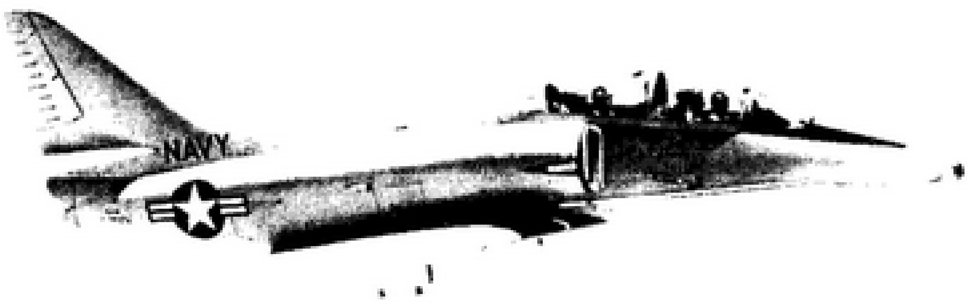
BASIC AND ALL CHANGES HAVE BEEN COLLATED TO MAKE THIS A COMPLETE PUBLICATION

NATOPS FLIGHT MANUAL
NAVY MODEL
TA-4F/TA-4J
AIRCRAFT



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COMMANDER, NAVAL AIR SYSTEMS COMMAND

0801LP0193110 NATEC ELECTRONIC MANUAL

1 AUGUST 1988
Change 1 — 1 September 1992

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

1 August 1988

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach toward improving combat readiness and achieving a substantial reduction in the aircraft accident rate. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The standardization program is not planned to stifle individual initiative, but rather to aid the commanding officer in increasing the unit's combat potential without reducing command prestige or responsibility.

2. This manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. In order to remain effective, NATOPS must be dynamic and stimulate rather than suppress individual thinking. Since aviation is a continuing, progressive profession, it is both desirable and necessary that new ideas and new techniques be expeditiously evaluated and incorporated if proven to be sound. To this end, commanding officers of aviation units are authorized to modify procedures contained herein, in accordance with the waiver provisions established by OPNAVINST 3710.7, for the purpose of assessing new ideas prior to initiating recommendations for permanent changes. This manual is prepared and kept current by the users in order to achieve maximum readiness and safety in the most efficient and economical manner. Should conflict exist between the training and operating procedures found in this manual and those found in other publications, this manual will govern.

3. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made and may be carried in naval aircraft for use therein. It is forbidden to make copies of this entire publication or major portions thereof without specific authority of the Chief of Naval Operations.

R.M. DUNLEAVY
Vice Admiral, USN
Assistant Chief of Naval Operations
(Air Warfare)

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RECORD OF CHANGES

Change No. and Date of Change	Date of Entry	Page Count Verified by (Signature)

INTERIM CHANGE SUMMARY

The following Interim Changes have been canceled or previously incorporated in this manual:

INTERIM CHANGE NUMBER(S)	REMARKS/PURPOSE
1 thru 74	Previously incorporated

The following Interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE
75	Loss of Thrust
76	Throttle Rigging/Throttle Linkage Failure
77	Secondary Indications of Fire
78	Pretakeoff Checklist (Step 25 Note)
79	Pretakeoff Checklist (Step 18 Caution) and Manual Fuel Control Checks
80	Oil Pressure Indicator/Oil Pressure Variation
81	Engine Fire
82	Advance Change Conference Items
83	External Pilot Chute Static Line Preflight

Interim Changes Outstanding - To be maintained by the custodian of this manual:

INTERIM CHANGE NUMBER	ORIGINATOR/DATE (or DATE/TIME GROUP)	PAGES AFFECTED	REMARKS/PURPOSE

PTAUZYUW RUENAAA8085 0112351-UUUU--RULSTGP.
ZNR UUUUU
P 112107Z JAN 99 ZYB PSN 916439M32
FM CNO WASHINGTON DC//N889//
TO ALL SKYHAWK AIRCRAFT ACTIVITIES//
INFO RUCTPOH/NAVOPMEDINST PENSACOLA FL//06//
RULSTGP/COMNAVWARDEVCOM DIV WASHINGTON DC//NATOPS//
BT
UNCLAS //N03711//
MSGID/GENADMIN/N889//
SUBJ/INTERIM CHANGE TO TA-4F AND TA-4J AIRCRAFT NATOPS FLIGHT MANUAL
//
REF/A/DOC/NAVAIR/01SEP92//
AMPN/NAVAIR 01-40AVD-1 (TA-4F/TA-4J NATOPS FLIGHT MANUAL) DTD 01AUG88
WITH CHG-1 01SEP92//
RMKS/1. THIS IS INTERIM CHANGE NUMBER 85 TO REF A (TA-4F/TA-4J NFM).
2. SUMMARY. ADDS WARNINGS AND INFORMATION ABOUT AIRCREW BODY WEIGHTS AND INJURY RISK INFORMATION INTO NFM. VERSION OF ESCAPAC SERIES I (A ROMAN NUMERAL) EJECTION SEAT IN THE TA-4F/TA-4J IS THE ESCAPAC SERIES IG-3 (PRONOUNCED 1G-3). REFERENCES TO ESCAPAC 1G-3 AND ESCAPAC IG-3 REFER TO THE SAME SEAT.
3. CHANGE REF A (TA-4F/TA-4J NFM) AS FOLLOWS:
PAGE 02 RUENAAA8085 UNCLAS
A. CHAPTER 2, PAGE I-2-35, PARAGRAPH 2.17 ESCAPAC 1G-3 EJECTION SEAT SYSTEM, AFTER FIRST PARAGRAPH WHICH BEGINS "THE AIRCRAFT IS...":
   (1) DELETE: N/A
   (2) ADD:

WARNING

REGARDLESS OF THE ESCAPAC IG-3 EJECTION SEAT LIMITATIONS, ANY PERSON WHOSE NUDE BODY WEIGHT IS BELOW 136 POUNDS OR ABOVE 213 POUNDS IS SUBJECT TO INCREASED RISK OF INJURY FROM EJECTION.

B. CHAPTER 14, PAGE V-14-39, PARAGRAPH 14.18 EJECTION, AFTER LAST PARAGRAPH WHICH BEGINS "USING THE ROCKET-CATAPULT SEAT,....":
   (1) DELETE: N/A
   (2) ADD:

WARNING

REGARDLESS OF THE ESCAPAC IG-3 EJECTION SEAT LIMITATIONS, ANY PERSON WHOSE NUDE BODY WEIGHT IS BELOW 136 POUNDS OR ABOVE 213 POUNDS IS SUBJECT TO INCREASED RISK OF INJURY FROM EJECTION.

GENERAL INJURY RISKS -

1. EJECTION SEAT STABILITY IS DIRECTLY RELATED TO OCCUPANT RESTRAINT. ALL OCCUPANTS SHOULD BE SECURELY RESTRAINED IN THE SEAT BY A PROPERLY FITTED TORSO HARNESS AND FULLY TIGHTENED LAP BELTS FOR OPTIMUM PERFORMANCE AND MINIMUM INJURY RISK.
2. INERTIA REEL PERFORMANCE MAY BE DEGRADED FOR OCCUPANTS OUTSIDE OF THE QUALIFIED WEIGHT RANGE. LIGHTER OCCUPANTS MAY BE INJURED DURING RETRACTION, AND BOTH LIGHT AND HEAVY OCCUPANTS MAY EXPERIENCE POOR EJECTION POSITIONS, RESULTING IN INCREASED RISK OF INJURY DURING EJECTION.

INJURY RISKS FOR AVIATORS WITH NUDE WEIGHTS LESS THAN 136 POUNDS -

1. THE CATAPULT WAS DESIGNED FOR THE EJECTION SEAT QUALIFIED WEIGHT RANGE. LIGHTER WEIGHT OCCUPANTS ARE SUBJECT TO A HIGHER RISK OF INJURY ON THE CATAPULT DUE TO GREATER ACCELERATIONS.

2. LIGHTER WEIGHT OCCUPANTS ARE AT RISK OF PARACHUTE ENTANGLEMENT AT LOW SPEEDS.
3. LIGHTER WEIGHT OCCUPANTS ARE AT A GREATER RISK OF INJURY DUE TO SEAT INSTABILITY BEFORE MAIN PARACHUTE DEPLOYMENT.

INJURY RISKS FOR AVIATORS WITH NUDE WEIGHTS GREATER THAN 213 POUNDS -

1. LARGER OCCUPANTS MAY NOT ATTAIN SUFFICIENT ALTITUDE FOR PARACHUTE FULL INFLATION IN ZERO-ZERO CASES OR AT EXTREMELY LOW ALTITUDES AND VELOCITIES.
2. LARGER OCCUPANTS ARE AT A GREATER RISK OF INJURY DURING PARACHUTE LANDING DUE TO HIGH DESCENT RATES.
3. LARGER OCCUPANTS MAY NOT ATTAIN SUFFICIENT ALTITUDE TO CLEAR THE AIRCRAFT'S TAIL STRUCTURE. //

BT

PTAUZYUW RUENAAA0821 1? 909-σUUU--RULSTGP.
ZNR UUUUU
P R 051704Z MAY 93 ZYB PSN 950533M25
FM CNO WASHINGTON DC//N889//
TO ALL SKYHAWK AIRCRAFT ACTIVITIES//
INFO RULSTGP/NAVTACSUPPACT WASHINGTON DC//60//
RHFJPOH/NAVAEROPMEDINST PENSACOLA FL//00MM//
BT
UNCLAS //N03711//
MSGID/GENADMIN/N889//
SUBJ/INTERIM CHANGES TO TA-4F/J AIRCRAFT NATOPS FLIGHT PUBLICATIONS//
REF/A/DOC/NAVAIR/01AUG88//
AMPN/REF A IS NAVAIR 01-40AVD-1 (TA-4F/J NATOPS FLIGHT MANUAL) DTD 01AUG88//
REF/B/DOC/NAVAIR/01AUG88//
AMPN/REF B IS NAVAIR 01-40AVD-1B (TA-4F/J NATOPS PILOT'S POCKET CHECKLIST) DTD 15JUL86 CHGD 01AUG88//
RMKS/1. THIS IS INTERIM CHANGE NUMBER 84 TO REF A (TA-4F/J NFM), AND INTERIM CHANGE NUMBER 33 TO REF B (TA-4F/J PPCL). THIS MSG INCREASES THE DISTANCE FOR LOWERING HOOK PRIOR TO ARRESTING GEAR DURING AN ABORTED TAKEOFF TO ENSURE THAT HOOK CATCHES PENDANT.
2. CHANGE REF A (TA-4F/J NFM) AS FOLLOWS:

A. PART III, CHAPTER 8, PARAGRAPH 8.9.3.6 LONG FIELD ARRESTMENTS, PAGE III-8-34 -
(1) DELETE FIRST SENTENCE OF SECOND PARAGRAPH, AS FOLLOWS:
LOWER THE HOOK 1,000 FEET PRIOR TO THE PENDANT TO PRECLUDE WEAKENING OF THE HOOK POINT.
(2) ADD: NA
B. PART V, CHAPTER 14, PARAGRAPH 14.3.8 ABORTING TAKEOFF, PAGE V-14-5 -
(1) DELETE "1,000 FEET" AND "IF APPLICABLE" IN STEP 4 OF PROCEDURE.
(2) ADD REPLACEMENTS "1,500 FEET" AND "IF REQUIRED" IN STEP 4 SO THAT STEP READS AS FOLLOWS:
(AST)4. HOOK DOWN (1,500 FEET PRIOR TO A-GEAR) IF REQUIRED.
(3) ADD NOTE TO FOLLOW STEP 4 WARNINGS AS FOLLOWS:
NOTE
PILOTS SHOULD ENSURE HOOK DOWN AT LEAST 1500 FEET PRIOR TO ARRESTING GEAR DURING HIGH SPEED ABORTS DUE TO HOOK TRAVEL TIME OF UP TO 5 SECONDS.
3. CHANGE REF B (TA-4F/J PPCL), PAGE 15, ABORT TAKEOFF PROCEDURE,

STEP 4 AS IN PARAGRAPHS 2.B(1) AND 2.B(2) ABOVE. //
BT
#0821
NNNN
DLVR:NAVTACSUPPACT WASHINGTON DC(1)...INFO
RTD:000-000/COPIES:

SUMMARY OF APPLICABLE TECHNICAL DIRECTIVES

Information relating to the following recent technical directives has been incorperated in this manual

CHANGE NUMBER	DESCRIPTION	DATE INC. IN MANUAL	VISUAL IDENTIFICATION

Information relating to the following recent technical directives will be incorporated in a future change

CHANGE NUMBER	DESCRIPTION	VISUAL IDENTIFICATION

GLOSSARY

A

A/A. Air-to-Air Ranging (Tacan)

a/ao. Ratio of speed of sound at altitude to speed of sound at sea level, ICAO standard day.

AAR. Aircraft accident report

ac. Alternating current

ACC. Air crew change

ACP. Aircraft communications procedures

ADCS. Air data computer set

ADF. Automatic direction finding

ADI. Attitude director indicator

ADIZ. Air defense identification zone

ADL. Armament datum line

AFC. Automatic frequency control

AFCS. Automatic flight control system

A/G. Air-to-Ground

AGC. Automatic gain control

AGL. Above ground level

AI. Airborne intercept

AJB. Airborne, electro-mechanical, bombing

AMCS. Airborne missile control system

AOA. Angle-of-Attack

AOJ. Acquisition on jam

AP. Autopilot

APC. Approach power compensator

APN. Airborne, radar, navigational aid

APQ. Airborne, radar, special purpose

AR. Air refueling

ARC. Airborne, radio, control

ARTC. Air route traffic control center

ASC. Aircraft service change

ASQ. Airborne, special type, combination of purposes

ASW. Anti-Submarine warfare

ATC. Air traffic control

AWW. Airborne, armament, control

B

BDHI. Bearing distance heading indicator

BINGO. Return fuel state

Bolter. Hook down, unintentional touch and go (missed wire)

BRC. Base recovery course

BRT. Bright

BST. Boresight

Buddy Store. In-flight refueling store

Buster. Full military power

C

°C Degrees Centigrade

CADC. Central air data computer

CAP. Combat air patrol

CARQUAL. Carrier qualifications

CAS. Calibrated airspeed

CAT. Catapult

CAT. Clear air turbulence

CATCC. Carrier air traffic control center

CCA. Carrier controlled approach

CG. Center of gravity

Charlie Time. Expected time over ramp

CIC. Combat information center

CIT. Compressor inlet temperature

CNI. Communication navigation identification

CO_2. Carbon dioxide

CONOLABS. Conventional ordnance low altitude bombing system

CORC. Conventional ordnance release computer

COT. Cockpit orientation trainer

cps. Cycles per second

CRAW. Carrier readiness attack wing

CSD. Constant speed drive

CSS. Control stick steering

CVA. Aircraft carrier (Attack)

CVS. Anti-Submarine carrier

cw. Continuous wave

D

DART. Ejection seat stabilization system

dc. Direct current

DCU. Douglas control unit

Dead Beat. Causing the object, when disturbed to return to its original position without oscillation.

Delta. Orbit pattern

Δ. Delta – change in (e.g., gross weight)

δ or P/P_0. Delta – ratio of static air pressure to ICAO standard sea level static air pressure

DF. Direction finding

DIRTY. Landing configuration

DIRTY-UP. Changing to landing configuration

DME. Distance measuring equipment

Dog Radial. An assigned radial on which to set up a holding pattern

DONUT. Optimum approach index

DR. Dead reckoning

≤ less than or equal to

E

EAC. Estimated approach clearance

EAS. Equivalent airspeed = CAS corrected for compressibility effect

EAT. Estimated approach time

EBC. External baggage container

ECCM. Electronic counter-countermeasure(s)

EGT. Exhaust gas temperature

EMERG. Emergency

EPI. Engine performance indicator

EPR. Engine pressure ratio

EXT. Exterior/external

F

°F Degrees Fahrenheit

FA. Flameout approach

FAM. Familiarization

FCLP. Field carrier landing practice

FL. Flight level

FLIP. Flight information publication

FMLP. Field mirror landing practice

Foxtrot Corpen. Fleet course

FPM. Feet per minute

FUS. Fuselage

FWD. Forward

G

g's. Gravity

GAL. Gallon

Gate. Maximum power

GCA. Ground control approach

GCBS. Ground control bombing system

GCI. Ground control intercept

gpm. Gallon per minute

GTC. Ground turbine compressor

H

Hangfire. A delay or failure of an article of ordnance after being triggered

HDG SEL. Heading selector switch

H or h. Altitude

Hg. Mercury

HI. High

HMI. Handbook of maintenance instructions

Hot Start. A start that exceeds normal starting temperatures

HYD. Hydraulic

I

IAS. Indicated airspeed

ICAO. International Civil Aviation Organization

IFF. Identification friend or foe

IFR. Instrument flight rules or In-flight refueling

ILS. Instrument landing system

IMN. Indicated Mach number

IMP. Imperial

INST. Instrument

INT. Interior

IP. Identification point

I/P. Identification of position

IR. Infrared

J

JANAP. Joint Army Navy Airforce Publication

JATO. Jet assist takeoff

JETT. Jettison

JP. Jet propulsion

Judy. Radar contact with target, taking over intercept

K

KCAS. Knots calibrated airspeed

KEAS. Knots equivalent airspeed

KIAS. Knots indicated airspeed

KTAS. Knots true airspeed

L

LABS. Low altitude bombing system

LAWS. Low altitude warning system

LDG GR. Landing gear

LE. Leading edge

LO. Low

Localizer. Azimuth only information

LOX. Liquid oxygen

lpm. Liters per minute

LSO. Landing signal officer (Paddles)

LTS. Lights

M

M. Mach number

MAC. Mean aerodynamic chord

MAN. Manual

MARSHAL. Carrier controlled approach holding

MAX. Maximum

MBR. Multiple bomb rack

Meatball. Glide slope image of mirror landing system

MER. Multiple ejector rack

MIL Military

MIM. Maintenance instruction manual

MIN. Minimum

MIN. Minute

Misfire. A permanent failure of an article of ordnance being triggered.

Mk. Mark

MLP. Mirror landing practice

MLS. Microwave Landing System

mm. Millimeter

MOD Modification

MRT. Military rated thrust

MSL Mean sea level

μ Coefficient of rolling friction

N

NAMO. Naval air maintenance organization

NAMT. Naval air maintenance training

NAMTD. Naval air maintenance training detachment

NATO. North Atlantic Treaty Organization

NATOPS. Naval air training and operating procedures standardization

NAVAIDS. Navigation aids

NAVPAC. Navigation package

nm. Nautical miles

NMPP. Nautical miles per pound

NTDS. Naval tactical data system

NWIP. Naval warfare information publication

NWIP. Naval warfare intercept procedures

NWP. Naval warfare publication

O

OAT. Outside air temperature

OBST. Obstruction

OFT. Operational flight trainer

OMNI. Omni directional range

P

P. Static atmospheric pressure at any altitude

P_o. Static atmospheric pressure at sea level ICAO standard day = 29.92 inches of mercury

PA. Power approach/precautionary approach

Paddles. Landing signal officer

PAR. Periodic aircraft rework

PAR. Precision approach radar

PC. Power control

Pigeons. Bearing and distance

PK. Pararaft kit

P/C. Plane captain

Platform. The 5,000 foot altitude level in a CCA.

PMBR. Practice multiple bomb rack

POGO. Return to last or assigned radio frequency

PPC. Power plants change

PPH. Pounds per hour

PPS. Pulses per seconds

prf. Pulse repetition frequency

PRIM. Primary

psi. Pounds per square inch

PTT. Press-to-test

Q

q. Dynamic pressure, psf

QT. Quart

R

Radar. Radio detection and ranging

RAT. RAM air turbine

RCR. Runway condition reading

RDO. Runway duty officer

RET. Retracted

rf. Radio frequency

RF. Reconnaissance – Fighter

ρ. Rho – density of atmosphere in slugs/foot at any altitude

ρ_o. Rho – density of atmosphere at sea level ICAO standard day = 0.002378 slugs per foot

RMI. Radio magnetic indicator

RNI. Reynolds number index

ROD. Rate of descent

rpm. Revolution per minute

S

SA. Situational awareness

SAR. Sea air rescue

SAR. Surveillance approach radar

SEC. Second

SEC. Secondary

S/B. Speedbrake

SID. Standard instrument departure

SIF. Selective identification feature

δ or ρ/ρ_o. Sigma – ratio of density of any altitude to density at sea level, ICAO standard day

SL. Sea level

SPD BRK. Speedbrake

SPEC. Specification

SRCH. Search

SRT. Standard rate turn

STA. Stuck throttle approach

Sta. Station

STAB AUG Stability augmentation

STBY. Standby

SYNC. Synchronize

T

T. Static absolute temperature at any altitude

T_o. Static absolute temperature at sea level ICAO standard day = 288.2° Kelvin.

Tacan. Tactical air navigation

TAS. True airspeed

T/C. Terrain clearance

TE. Trailing edge

TER. Triple ejector rack

θ or T/T_o. Theta – ratio of absolute temperature of any altitude to absolute temperature at sea level. ICAO standard day

TMN. True Mach number

TRA. Transfer

TRANS. Transfer

Trap. Arrested landing

U

UHF. Ultra high frequency

US. United States

V

V_c. Calibrated airspeed = IAS corrected for position error.

V_e. Equivalent airspeed = CAS corrected for compressibility effect

VFR. Visual flight rules

VHF. Very high frequency

V_i. Indicated airspeed = instrument reading corrected for instrument error

V_n. Velocity acceleration relationship

VORTAC. Very high frequency – Omni range and Tactical air navigation

Vs. Versus

W

W. With

W/O. Without

WST. Weapons system trainer

Y

Yellow Sheet. Naval aircraft discrepancy record

PREFACE

SCOPE

The NATOPS flight manual is issued by the authority of the Chief of Naval Operations and under the direction of Commander, Naval Air Systems Command in conjunction with the naval air training and operating procedures standardization (NATOPS) program. This manual contains information on all aircraft systems, performance data, and operating procedures required for safe and effective operations. However, it is not a substitute for sound judgment. Compound emergencies, available facilities, adverse weather or terrain, or considerations affecting the lives and property of others may require modification of the procedures contained herein. Read this manual from cover to cover. It's your responsibility to have a complete knowledge of its contents.

APPLICABLE PUBLICATIONS

The following applicable publications complement this manual:

NAVAIR 01-40AV-1T(A) Supplement

NAVAIR 01-40AV-1T Tactical Manual

NAVAIR 01-40AV-1TB Tactical Pocket Guide

NAVAIR 01-40AVD-1B Checklist

NAVAIR 01-40AVD-1F Functional Checkflight Checklist

HOW TO GET COPIES

One-Time Orders. If this publication is needed on a one-time basis (without future updates), order it from stock by sending an electronic DD 1348 requisition in accordance with NAVSUP Publication 2002D.

Automatic Distribution (With Updates). This publication and changes to it are automatically sent to activities that are established on the Automatic Distribution Requirements List (ADRL) maintained by the Naval Air Technical Services Facility (NAVAIR-TECHSERVAC), Philadelphia, PA. If there is a continuing need for this publication, each activity's Central Technical Publication Librarian must send a revised ADRL report on floppy disk to NAVAIRTECHSERVFAC. If an activity does not have a library, then send a letter to Commanding Officer NAVAIRTECHSERVFAC, Attn: Code 32, 700 Robbins Avenue, Philadelphia, PA 19111, requesting assignment of a distribution account number (if necessary) and automatic mailing of future issues of the publications needed.

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UPDATING THE MANUAL

To ensure that the manual contains the latest procedures and information, NATOPS review conferences are held in accordance with OPNAVINST 3710.7.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAVINST 3710.7.

Routine change recommendations are submitted directly to the model manager on OPNAV Form 3710/6

NATOPS/TACTICAL CHANGE RECOMMENDATION
OPNAV 3710/6 (4-90) S/N 0107-LF-009-7900

DATE ____________

TO BE FILLED IN BY ORIGINATOR AND FORWARDED TO MODEL MANAGER

FROM (originator)	Unit
TO (Model Manager)	Unit

Complete Name of Manual/Checklist	Revision Date	Change Date	Section/Chapter	Page	Paragraph

Recommendation (be specific)

CHECK IF CONTINUED ON BACK

Justification

Signature	Rank	Title

Address of Unit or Command

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FROM	DATE

TO

REFERENCE

(a) Your Change Recommendation Dated ____________

☐ Your change recommendation dated ____________ is acknowledged. It will be held for action of the review conference planned for ____________ to be held at ____________

☐ Your change recommendation is reclassified URGENT and forwarded for approval to ____________ ____________ by my DTG ____________ .

/S/____________ MODEL MANAGER | ____________ AIRCRAFT shown on the next page. The address of the Model Manager of this aircraft is:

Commanding Officer, VT-7
100 Fuller Road
Suite 270
Meridian, MS 39309-5401
Attn: NATOPS Evaluator

Change recommendations of an URGENT nature (safety of flight, etc.) should be submitted directly to the NATOPS advisory group member in the chain of command by priority message.

YOUR RESPONSIBILITY

NATOPS flight manuals are kept current through an active manual change program. Any corrections, additions, or constructive suggestions for improvement of its content should be submitted by routine or urgent change recommendation, as appropriate, at once.

NATOPS FLIGHT MANUAL INTERIM CHANGES

Flight manual interim changes are changes or corrections to the NATOPS flight manuals promulgated by CNO or NAVAIRSYSCOM. Interim changes are issued either as printed pages or as a naval message. The interim change summary page is provided as a record of all interim changes. Upon receipt of a change or revision, the custodian of the manual should check the updated interim change summary to ascertain that all outstanding interim changes have been either incorporated or canceled; those not incorporated shall be recorded as outstanding in the section provided.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, adjacent to the affected text, like the one printed next to this paragraph. The change symbol identifies the addition of either new information, a changed procedure, the correction of an error, or a rephrasing of the previous material.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "WARNINGs", "CAUTIONs", and "Notes" found throughout the manual.

WARNING

An operating procedure, practice, or condition, etc., that may result in injury or death if not carefully observed or followed.

CAUTION

An operating procedure, practice, or condition, etc., that may result in damage to equipment if not carefully observed or followed.

Note

An operating procedure, practice, or condition, etc., that is essential to emphasize.

WORDING

The concept of word usage and intended meaning that has been adhered to in preparing this Manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

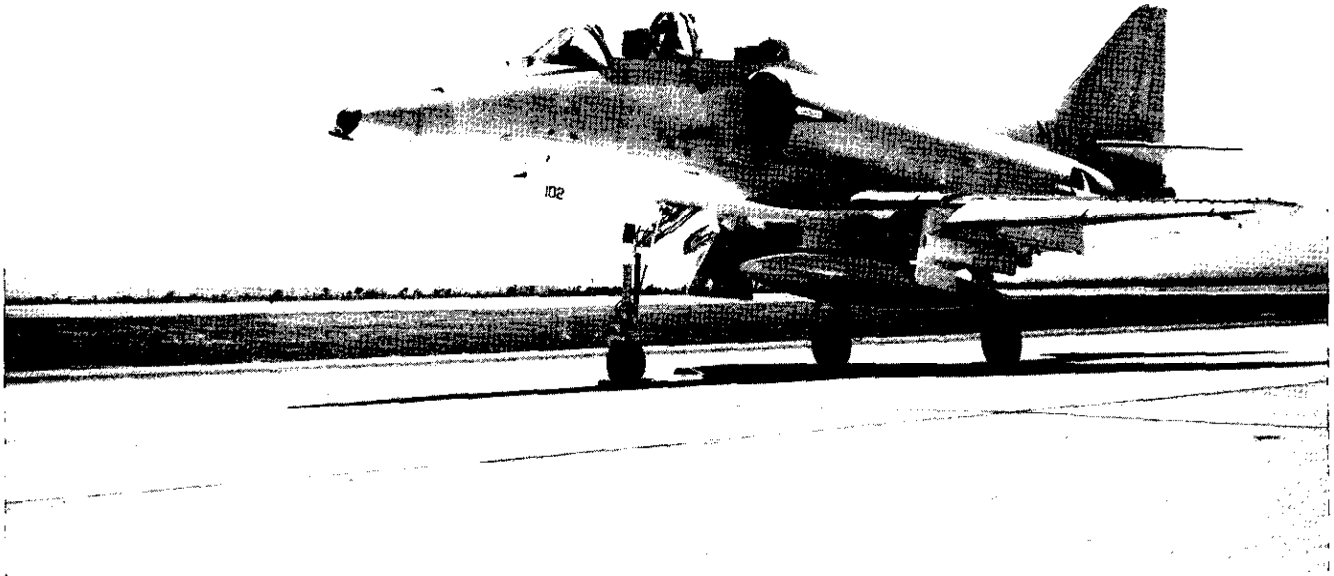
"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicated futurity, never to indicate any degree of requirement for application of a procedure.

"Land immediately" is self explanatory.

"Land as soon as possible" means land at the first site at which a safe landing can be made.

"Land as soon as practicable" means extended flight is not recommended. The landing site and duration of flight is at the discretion of the pilot in command.



TA-4F

TA-4J

TA1-295

Figure 1-0. TA-4F/J Models

PART I

Aircraft

CHAPTER 1

General Arrangement

1.1 DESCRIPTION

The Navy Model TA-4F/J Skyhawk (Figure 1-0) is a two-place, light-weight, high-performance aircraft with a modified delta-planform wing. The aircraft is powered by either a P&WA J52-P-6 (8,500 pounds sea level static thrust rating) or a P&WA J52-P-8 (9,300 pounds sea level static thrust rating) gas turbine engine and is manufactured by the Douglas Aircraft Company, Long Beach, California.

Note

All performance data is applicable to both TA-4F and TA-4J aircraft unless otherwise indicated. (i.e., (TA-4F)).

The TA-4F/J was designed as a training aircraft capable of operating from a carrier or shore base. The aircraft has two seats in tandem to train pilots in instruments and all other phases of naval operational flying.

The aircraft mounts two 20mm guns internally and carries a variety of external stores. Refer to NAVAIR 01-40AV-1T for External Stores Compatibility and Limitations. Aircraft weight data are given in Figure 20-1.

Figures 1-1 through 1-6 show the principal dimensions, major airframe components, aircraft general arrangements, cockpit arrangements, and main A-4 model differences. Cockpit instrument panels and consoles are shown in Figures FO-1 and FO-2.

1.2 COCKPITS

The following is a list of switches, instruments, and equipment not duplicated in the aft cockpit:

1. LABS timer (TA-4F)
2. LABS light
3. LAWS light
4. Radarscope (TA-4F)

Note

Aircraft incorporating A-4 AFC 355 include an aft cockpit radarscope.

5. GUN SIGHT OFF-BRT control knob
6. Radar PROFILE-PLAN switch (TA-4F)
7. Radar LONG-SHORT switch (TA-4F)
8. STATIONS READY-OFF-SHRIKE PAIR switches (TA-4F)
9. STATIONS READY-OFF switches (TA-4J)
10. MASTER armament OFF-ON switch
11. Function selector OFF-ROCKETS-GM UNARM-SPRAY TANK-LABS-BOMBS & GM ARM-CMPTR switch (TA-4F)
12. Function selector OFF-ROCKETS-BOMBS switch (TA-4J)
13. Bomb ARM selector NOSE & TAIL-OFF-TAIL switch
14. GUNS READY-SAFE switch
15. SHRIKE 1-2 switch and VOL knob (TA-4F)
16. TGT REJ switch (TA-4F)
17. Pilots advisory lights (TA-4F)
18. Ejection control selector valve
19. Data link control panel

20. Doppler control panel (TA-4F)

21. NAV computer ASN-41 (TA-4F)

22. FAA beacon APX-64

23. Radar control panel (TA-4F)

24. Compass control panel

25. AFCS control panel (location optional)

26. AFCS preflight test panel (location optional)

27. JATO JETTISON switch

28. JATO ARM-OFF switch

29. JATO PUSH-TO-FIRE switch

30. Throttle friction and lock control

31. APC control panel (TA-4F)

32. All exterior light switches

33. Air conditioning FWD and AFT OFF-ON switches

34. Air conditioning PRESS NORMAL-RAM switch

35. RAIN REMOVAL-OFF switch

36. UHF ANT LWR-UP switch (TA-4F)

37. REFUELING position of DROP TANKS switch

38. Emergency speedbrake control

39. Smoke abatement FUEL ADD-OFF switch (TA-4F)

40. Rain repellent switch

41. FUEL TRANS BYPASS switch (TA-4F).

1.3 DIMENSIONS

The principal three-point dimensions of the aircraft are as follows:

1. Length – 43 feet, 7 inches

2. Wing span – 27 feet, 6 inches

3. Height – 15 feet, 7 inches

4. Tail span – 11 feet, 4 inches.

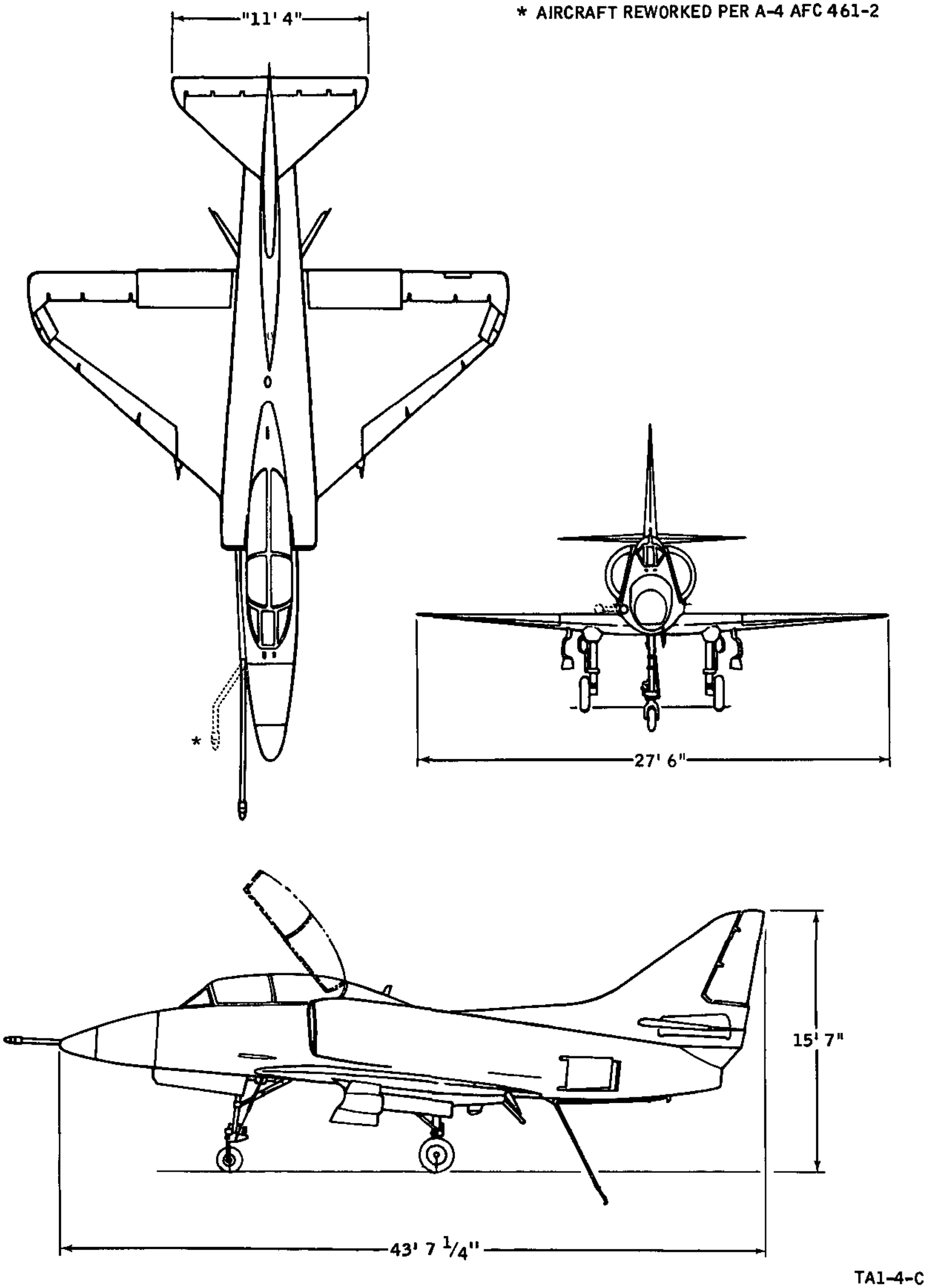


Figure 1-1. Principal Dimensions

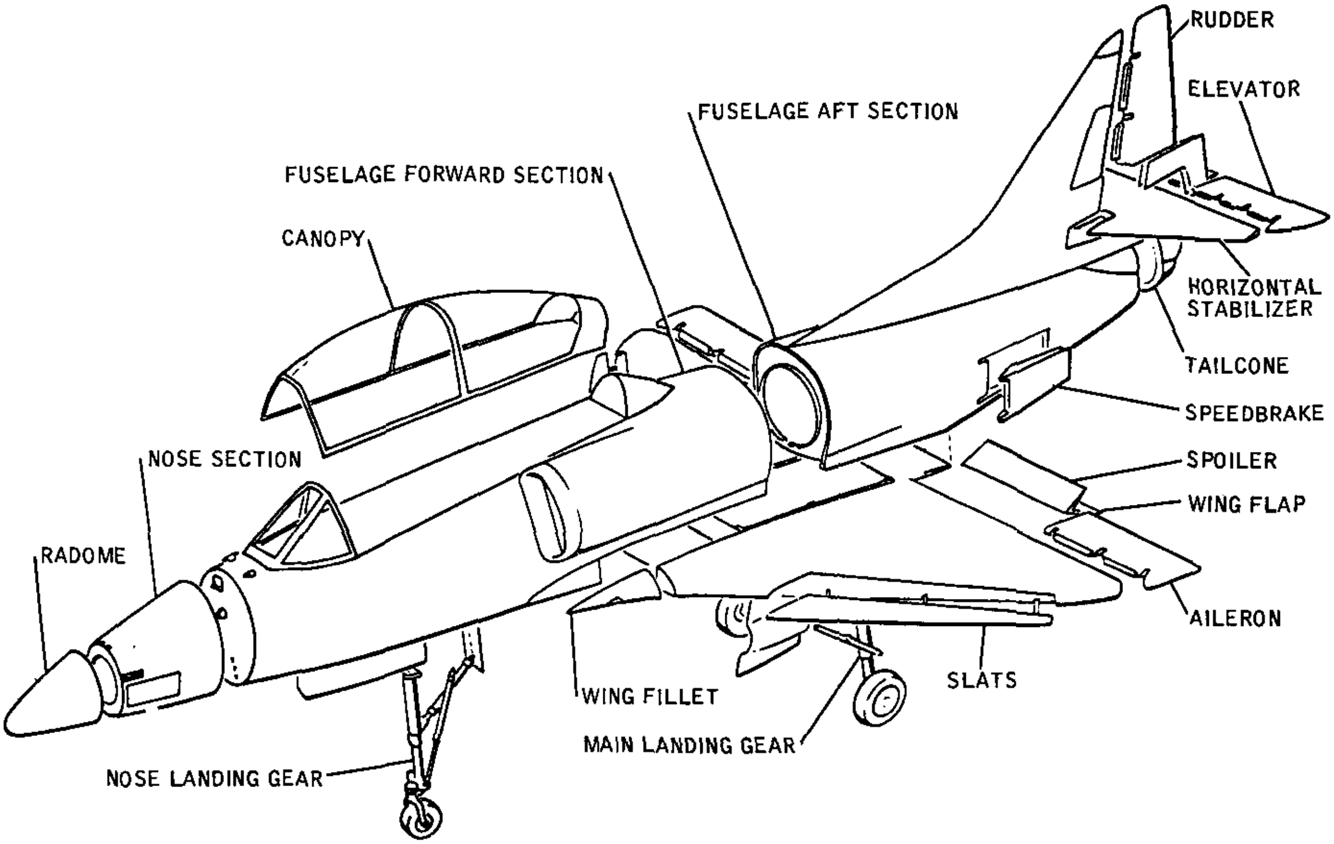
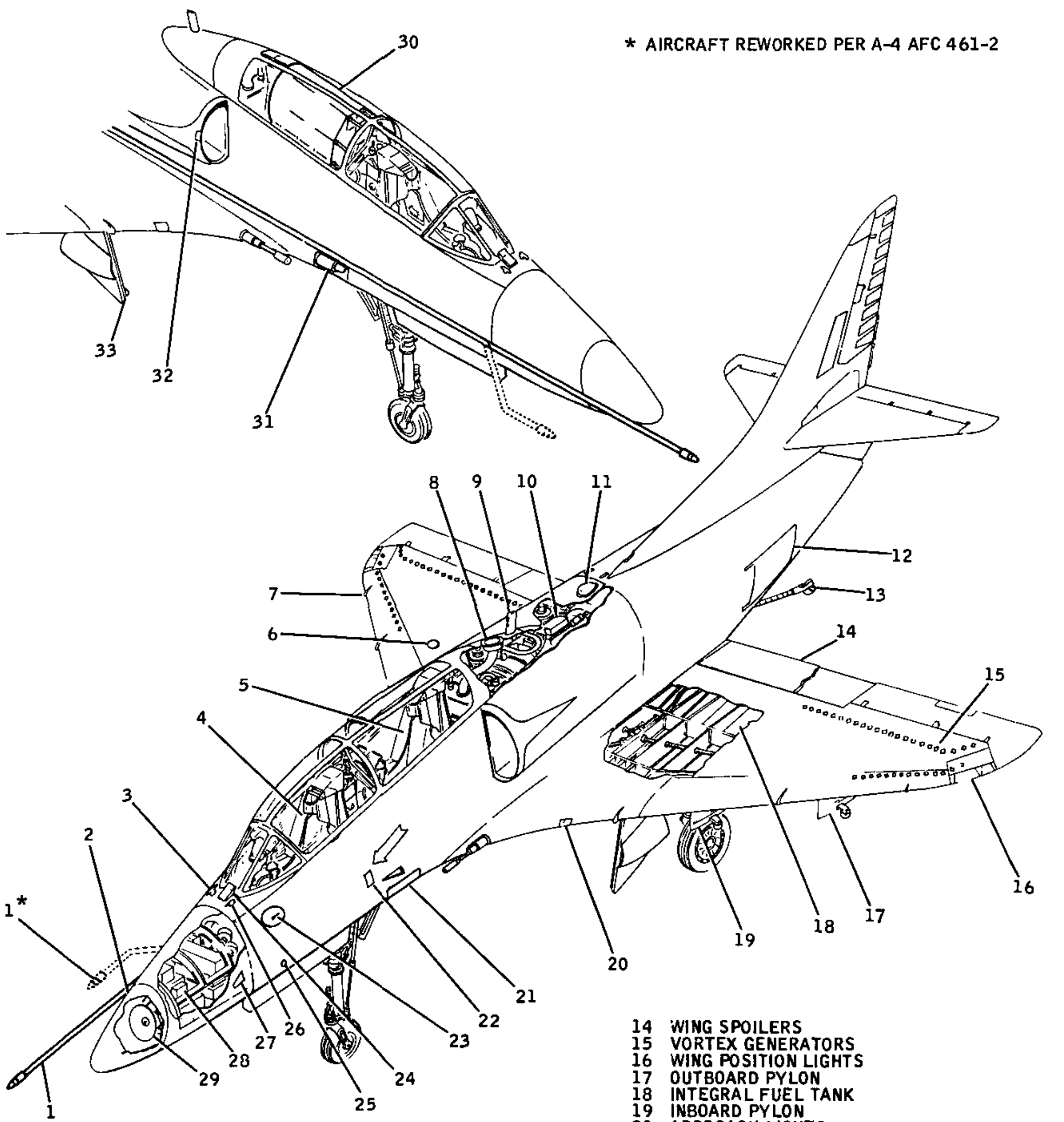


Figure 1-2. Airframe Major Components



1 AIR REFUELING PROBE
2 RADOME
3 TOTAL TEMPERATURE SENSOR
4 FORWARD COCKPIT
5 AFT COCKPIT
6 WING TANK FILLER CAP
7 BARRICADE ENGAGEMENT DETENTS
8 FUSELAGE FILLER CAP
9 UHF ANTENNA
10 OIL TANK
11 ANTICOLLISION LIGHT
12 SPEEDBRAKES
13 ARRESTING HOOK
14 WING SPOILERS
15 VORTEX GENERATORS
16 WING POSITION LIGHTS
17 OUTBOARD PYLON
18 INTEGRAL FUEL TANK
19 INBOARD PYLON
20 APPROACH LIGHTS
21 CANOPY EXTERNAL OPERATING CONTROLS
22 CANOPY EXTERNAL JETTISON HANDLE
23 ANGLE-OF-ATTACK VANE AND TRANSDUCER
24 RAIN REMOVAL NOZZLE
25 ENGINE BLEED STATIC PORT
26 PITOT TUBE
27 STATIC ORIFICE
28 ELECTRONICS PACKAGE
29 APG - 53 A RADAR TRANSMITTER AND RECEIVER GROUP (TA-4F)
30 PILOT INSTRUMENT TRAINING HOOD
31 EMERGENCY GENERATOR
32 AIR REFUELING PROBE LIGHT
33 TAXILIGHT

TA1-5-D

Figure 1-3. General Arrangement

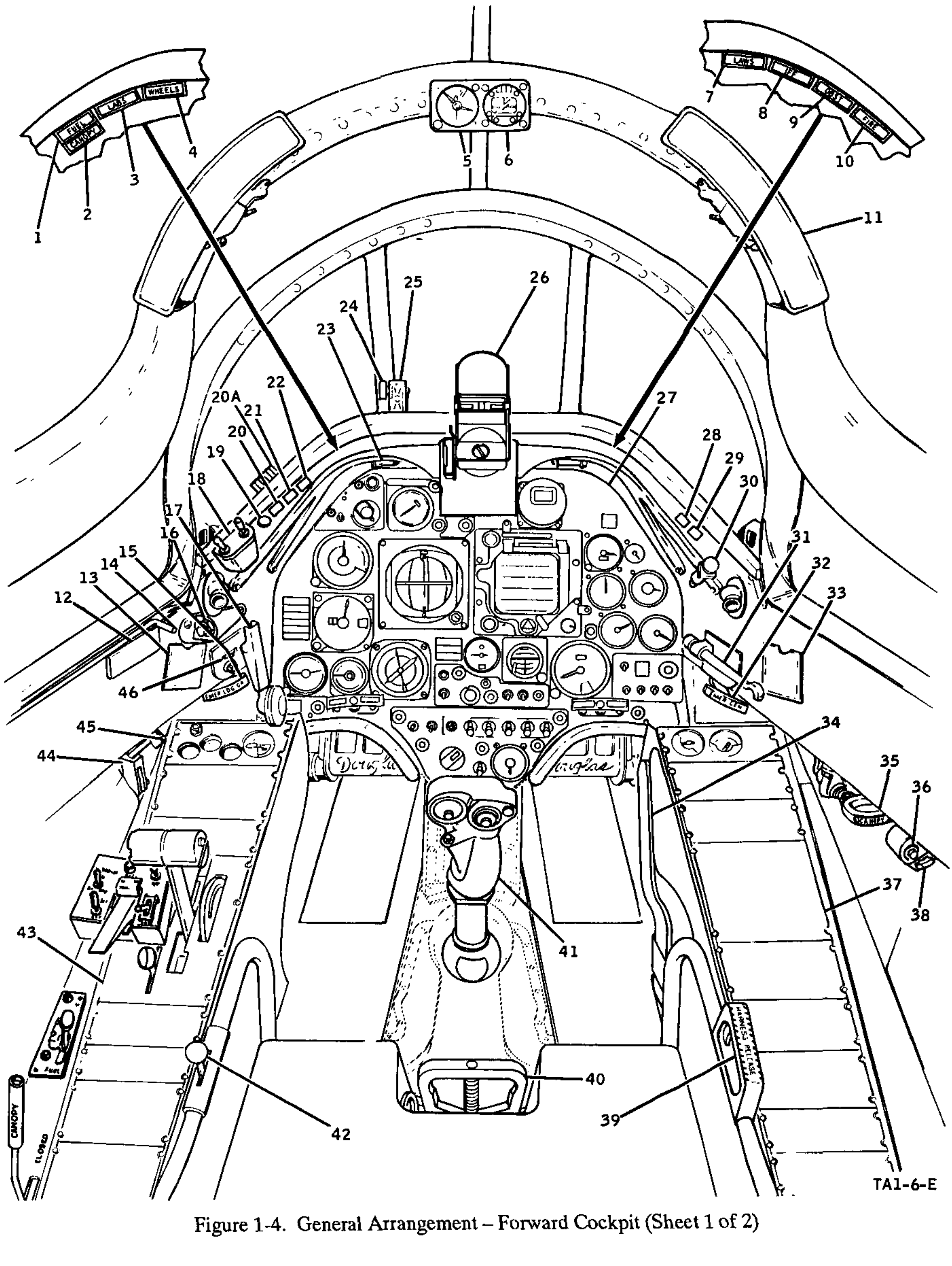


Figure 1-4. General Arrangement – Forward Cockpit (Sheet 1 of 2)

KEY TO FIGURE 1-4

1. FUEL WARNING LIGHT
2. CANOPY WARNING LIGHT
3. LABS LIGHT
4. WHEELS WARNING LIGHT
5. ELAPSED TIME CLOCK
6. STANDBY COMPASS
7. LAWS LIGHT
8. IFF CAUTION LIGHT
9. OBST WARNING LIGHT
10. FIRE WARNING LIGHT
11. REAR VIEW MIRROR
12. COMPASS DEVIATION CARD
13. COMPASS CO RECTION CARD
14. RIFLE-BOLT LOCKING HANDLE
15. EMERGENCY LANDING GEAR RELEASE HANDLE

*16. RAIN REPELLANT CONTROL BUTTON

17. LANDING GEAR CONTROL HANDLE
18. APPROACH POWER COMPENSATOR
19. LAWS WARNING LIGHT
20. LABS LIGHT

20A. DATA LINK ADVISORY LIGHTS (DISCRETE)

21. WHEELS WARNING LIGHT
22. FUEL WARNING LIGHT
23. COCKPIT FLOODLIGHTS
24. APPROACH POWER COMPENSATOR LIGHT
25. ANGLE-OF-ATTACK INDEXER
26. GUNSIGHT
27. INSTRUMENT PANEL (FIGURE FO-1)
28. FIRE WARNING LIGHT
29. OBST WARNING LIGHT
30. UTILITY FLOODLIGHT
31. ARRESTING HOOK HANDLE
32. EMERGENCY GENERATOR RELEASE HANDLE
33. STANDBY COMPASS DEVIATION CARD
34. CANOPY HAND PUMP HANDLE
35. CANOPY JETTISON HANDLE
36. WHITE FLOODLIGHTS CONTROL
37. RIGHT CONSOLE (FIGURE FO-1)
38. FUEL TRANS BYPASS SWITCH
39. EMERGENCY RESTRAINT RELEASE HANDLE
40. LOWER EJECTION HANDLE
41. CONTROL STICK
42. SHOULDER HARNESS LOCK LEVER
43. LEFT CONSOLE (FIGURE FO-1)
44. CATAPULT HANDGRIP
45. JATO FIRING BUTTON
46. DOWN LOCK RELEASE LATCH

*Rain repellant system no longer used.

Figure 1-4. General Arrangement – Forward Cockpit (Sheet 2 of 2)

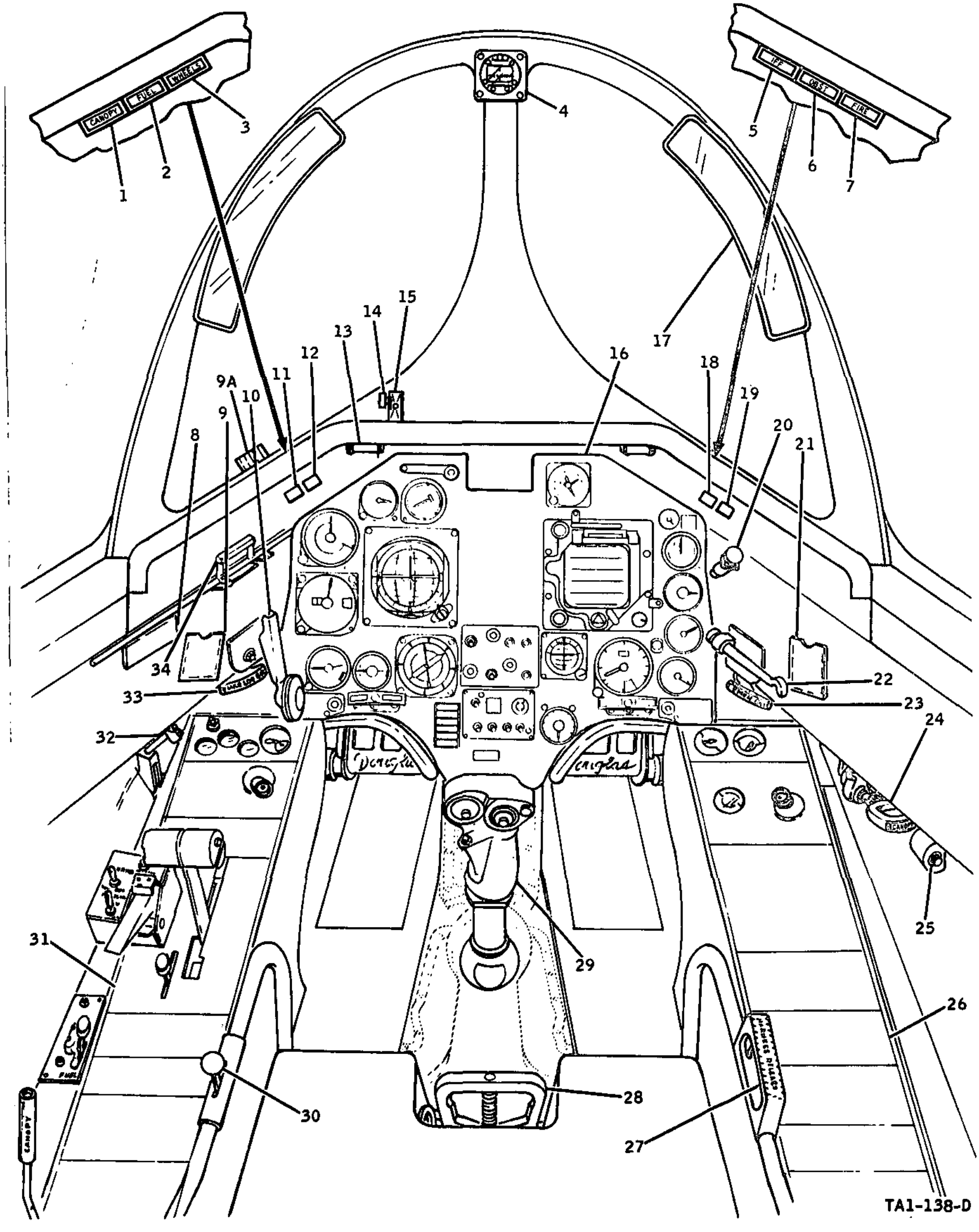


Figure 1-5. General Arrangement – Aft Cockpit (Sheet 1 of 2)

KEY TO FIGURE 1-5

1. CANOPY WARNING LIGHT
2. FUEL WARNING LIGHT
3. WHEELS WARNING LIGHT
4. STANDBY COMPASS
5. IFF CAUTION LIGHT
6. OBST WARNING LIGHT
7. FIRE WARNING LIGHT
8. COMPASS DEVIATION CARD
9. COMPASS CORRECTION CARD

9A. DATA LINK ADVISORY LIGHTS (DISCRETE)

10. LANDING GEAR CONTROL HANDLE
11. WHEELS WARNING LIGHT
12. FUEL WARNING LIGHT
13. COCKPIT FLOODLIGHTS
14. APPROACH POWER COMPENSATOR LIGHT
15. ANGLE-OF-ATTACK INDEXER
16. INSTRUMENT PANEL (FIGURE FO-2)
17. REAR VIEW MIRROR
18. FIRE WARNING LIGHT
19. OBST WARNING LIGHT
20. UTILITY FLOODLIGHTS
21. STANDBY COMPASS DEVIATION CARD
22. ARRESTING HOOK HANDLE
23. EMERGENCY GENERATOR RELEASE HANDLE
24. CANOPY JETTISON HANDLE
25. WHITE FLOODLIGHTS CONTROL
26. RIGHT CONSOLE (FIGURE FO-2)
27. EMERGENCY RESTRAINT RELEASE HANDLE
28. LOWER EJECTION HANDLE
29. CONTROL STICK
30. SHOULDER HARNESS LOCK LEVER
31. LEFT CONSOLE (FIGURE FO-2)
32. CATAPULT HAND GRIP
33. EMERGENCY LANDING GEAR RELEASE HANDLE
34. RIFLE-BOLT LOCKING HANDLE

Figure 1-5. General Arrangement – Aft Cockpit (Sheet 2 of 2)

	A-4E	A-4F	A-4M	TA-4F	TA-4J
ENGINE	J52-P-8	J52-P-8 J52-P-408	J52-P-408	J52-P-6 J52-P-8	J52-P-6B/C J52-P-8B
THRUST	8 500# 9,300#	9,300# 11,200#	11,200#	8,500# 9,300#	8,500#
FUSELAGE Fueling Probe Air Refueling Store Intake Ducts	YES YES SEPARATED	YES YES SEPARATED	YES YES SEPARATED	YES YES SEPARATED	YES YES SEPARATED
UPPER AVIONICS COMPARTMENT	SOME	YES	YES	NO	NO
AFCS	YES	YES	YES	YES	YES
RADAR	APG-53A	APG-53A	APG-53A (PROVISIONS ONLY)	APG-53A	APG-53A
VIDEO IP-936 AXQ	SOME	SOME	YES	SOME	NO
NAVIGATION COMPUTER	ASN-19A (EARLY A-4E) ASN-41	ASN-41	ASN-41 (PROVISIONS ONLY)	ASN-41	ASN-41
LABS	AJB-3 AJB-3A	AJB-3A	AJB-3A	AJB-3A	AJB-3A
CP-741/A	YES	YES	YES	YES	NO
OXYGEN SYSTEM	10 LITER	10 LITER	10 LITER	10 LITER	10 LITER
EXTENDABLE CONTROL STICK	NO	NO	NO	NO	NO
FUEL GAGING Fuselage Wing Drop Tanks	1 PROBE 6 PROBE YES	1 PROBE 6 PROBE YES	1 PROBE 6 PROBE YES	1 PROBE 6 PROBE YES	1 PROBE 6 PROBE YES
FUSELAGE FUEL CELL CAPACITY	1600 LB	1600 LB	1600 LB	700 LB	700 LB
ELEVATOR Boosted Powered	NO YES	NO YES	NO YES	NO YES	NO YES
AILERON POWER	TANDEM	TANDEM	TANDEM	TANDEM	TANDEM
STABILIZER TRIM 12 Degrees Noseup 1 Degree Nosedown 11 Degrees Noseup 1 Degree Nosedown 12-1 4 Degrees Noseup 1 Degree Nosedown	NO NO YES	NO NO YES	NO NO YES	NO NO YES	NO NO YES
BOMB RACKS	5	5	5	5	5
ROCKET EJECTION SEAT	ESCAPAC 1A-1 STENCEL MOD	ESCAPAC 1G-3	ESCAPAC 1G-3	ESCAPAC 1G-3	ESCAPAC 1G-3
NOSEWHEEL STEERING	NO	YES	YES	YES	YES
SPOILERS	YES	YES	YES	YES	YES
DRAG CHUTE	NO	NO	YES	NO	NO
COMMUNICATIONS	ARC-27A	ARC-51A ARR-69	ARC-51A	ARC-51A ARR-69 ARN/ARC-159(V5)	ARC-51A ARR-69 ARN/ARC-159(V5)
RADAR IDENTIFICATION (IFF)	APX-72(V)	APX-64(V)/ 72(V)	APX-72(V)	APX-64(V)/ 72(V)	APX-64(V)/ 72(V)
APC	YES	YES	PROVISIONS ONLY	YES	PROVISIONS ONLY
DOPPLER APN-153	SOME	YES	PROVISIONS ONLY	YES	YES
TACAN	ARN-21B (EARLY A-4E) ARN-52(V)	ARN-52(V)	ARN-52(V)/ 84	ARN-52(V)/ ARN-118(V)	ARN-52(V)/ ARN-118(V)
ADF	ARA-25	ARA-50	ARA-50	ARA-50	ARA-50

N9/92

Figure 1-6. Main Differences Table

CHAPTER 2

Systems

2.1 ENGINE

The P&WA J-52-P-8 (9,300 pounds sea level static thrust rating) or P-6 (8,500 pounds sea level static thrust rating) turbojet is a continuous-flow gas turbine engine consisting of a split 12-stage axial flow compressor, a unit can-annular combustion chamber, and a split 2-stage turbine. The engine has three major sections: the compressor section, the turbine section, and the accessory section.

The axial flow compressor consists of a five-stage low-pressure unit and a seven-stage high-pressure unit. The low-pressure unit is connected by a through shaft to the second-stage turbine rotor. The high-pressure unit is connected independently by a hollow shaft to the first-stage turbine rotor. The rpm of the high-pressure rotor (N_2) is governed by the engine fuel control; whereas, the low-pressure rotor rpm (N_1) is completely independent and is entirely a function of the pressure-drop across the turbines. The engine has nine combustion chambers numbered clockwise, with the No. 1 combustion chamber at the 12 o'clock position. The engine has two spark igniters: one in the No. 4 combustion chambers, and the other in the No. 7 combustion chamber.

The anti-icing air system, compressor airbleed system, internal airbleed system lubrication system, pressure oil system, scavenge oil system, oil breather system, fuel system, ignition system, and the fuel heater are also included as part of the engine.

On BuNo. 153663 and subsequent aircraft, a nameplate is installed on the forward instrument panel between the pressure ratio indicator and the tachometer identifying the type of engine installed in the aircraft.

2.1.1 Compressor Airbleed System. The compressor airbleed system vents low-pressure compressor unit air overboard as necessary to prevent overloading of the high-pressure compressor unit.

CAUTION

Covering or clogging of the engine bleed static port on the left side of the forward fuselage can cause compressor chugs and stalls and/or loss of thrust.

2.1.2 Ignition. The engine ignition system consists of two spark igniters, an ignition timer, and dual ignition units. The spark igniters are located in the two combustion chambers at the 4 and 8 o'clock positions. The J52-P6 engine includes a 20-joule and 4-joule ignition system, and the J52-P-8 engine includes a dual 20-joule system. For engine starting, the timer energizes the high power ignition unit which supplies electrical power to the 20-joule igniters for a 30- to 45-second firing cycle. When the engine-driven or emergency generator is operating, the 4-joule ignition unit of the J52-P-6 engine operates continuously, firing only the igniter that is located in the 8 o'clock position. The ignition switch, which energizes the ignition timer, is a momentary-contact limit switch that is actuated by movement of the throttle outboard from the OFF position.

Note

Even through the 4-joule system operates continuously, conditions of fuel-air mixture would have to be ideal to relight from this system.

2.1.3 Starter. The engine is started on the ground by a pneumatic starter driven by compressed air from a mobile gas turbine compressor (GTC). A suitable compressor package that can be carried externally on the centerline or inboard racks is available.

2.1.4 Engine Fuel System. The function of the fuel system is to supply and regulate the fuel to the combustion chambers at pressures and flows required by engine airflow at all operating altitudes and temperatures. The system has two major components: the engine fuel pump and the fuel control.

2.1.4.1 Fuel Pump. The engine fuel pump consists of a centrifugal boost stage and a high-pressure single gear stage. The boost impeller serves to increase pressure and eliminate pump cavitation in the gear stage. To filter the fuel, a replaceable 40-micron cartridge is located between the boost and gear stages. A filter bypass valve, in parallel with the filter, will bypass fuel if the filter becomes clogged. A manual drain valve is located on the bottom of the filter to drain off water. Excess fuel pressure will be relieved by a relief valve set at approximately 90 psi above maximum expected discharge pressure. A vapor return to the fuselage fuel cell is also part of the engine fuel pump.

2.1.4.2 Fuel Control. The engine fuel control is a hydromechanical control that senses inlet air temperature, burner pressure, high-pressure compressor speed (N_2), and throttle position. When the throttle setting is changed and while adjusting to a new steady-state fuel rate, the control schedules the fuel flow so that maximum acceleration and deceleration rates can be obtained with satisfactory engine operation. The control automatically regulates the fuel flow to maintain stable engine operation during all normal flight conditions and maneuvers, thus preventing compressor stalls, excessive temperatures, or flameouts. The fuel control has a manual system that is only pressure altitude and airspeed compensated. The engine fuel control operation may be changed from PRIMARY to MANUAL at all altitudes during flight. If airspeed, at the time of switchover, is above 225 KIAS, selection of MANUAL may be made at any throttle setting from IDLE to MILITARY. If airspeed is below 225 KIAS, rpm must be above 65 percent prior to switchover. The switchover to the manual fuel system may be accompanied by a minor surge in engine speed and EGT. Switchover from MANUAL to PRIMARY fuel control should be accomplished between 80- to 85-percent rpm. After a switchover to MANUAL, the throttle should be moved slowly and smoothly to the desired power setting while observing the engine operating limits shown in Chapter 4. It must be remembered that when operating on the manual fuel control system, all fuel metering to the engine is accomplished by direct movement of the throttle; therefore, all power changes must be made with care, not only to prevent overspeeding and extreme temperatures, but also to avoid a flameout from the possible inability of the engine to parallel (in speed) the rapidly changing fuel flow during quick accelerations and decelerations.

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8 engines with PPC 185 incorporated), a minimum in-flight engine rpm of 70 percent should be maintained to preclude possible flameout.

Note

Complete loss of electrical power precludes switching the fuel control from the position selected.

2.1.5 Engine Controls

2.1.5.1 Throttles. The two throttles, one in the forward cockpit and one in the aft cockpit, are located on the left console. They are mechanically linked in tandem to the engine fuel control unit and select engine thrust. The throttle linkage is connected to the Approach Power Compensating System at the aft throttle control.

The throttle in the forward cockpit has the following marked positions: OFF, IGN (ignition), IDLE, NORMAL, and MILITARY. The OFF position closes a fuel cutoff valve in the fuel control unit, stopping fuel flow to the engine fuel nozzles. The IGN position actuates the ignition timer when the throttle is moved outboard from the OFF position. The IDLE position is detented to prevent inadvertent movement of the throttle to the OFF position. The NORMAL position covers the operating range of the engine. Maximum thrust should be developed from the engine at MILITARY, but rpm will vary with ambient air temperature and airspeed. The radio ICS and speedbrake switches are on the inboard side of the throttle grip and the exterior lights switch is on the outboard side. The throttle friction wheel is on the panel inboard of the throttle. Rotate the friction wheel forward to increase friction on the throttle or aft to decrease the friction. The throttle friction mechanism incorporates a microswitch for the approach power compensator. The engine can be shut down with the throttle from the forward cockpit only.

CAUTION

While advancing the throttle from IDLE toward military power, any outward pressure may cause an inadvertent throttle hangup in the forward idle detent.

The throttle in the aft cockpit provides manual control of the linkage to the engine fuel control for selecting engine thrust. The aft cockpit throttle positions are labeled: OFF, IGN, IDLE, NORMAL, and MILITARY. The OFF position is labeled to indicate the position but does not shut down the engine. Engine shutdown may be accomplished in the rear cockpit by closing the manual fuel shutoff lever. The IGN position actuates the ignition timer when the throttle is moved outboard. The IDLE position is not detented and is used only to show the range between IDLE and NORMAL. The NORMAL position indicates the operating range of the engine. The radio ICS and speedbrake switches are on the inboard side of the throttle. The aft cockpit throttle does not have a throttle friction wheel and selection of the approach power compensator is not possible. There is a switch under the forward throttle that cuts off the radar altimeter and air data computer at shutdown to eliminate electrical power surge and avoid blowing fuses.

A catapult handgrip is located in each cockpit against the cockpit rail forward of the throttle. The catapult handgrip swivels into position and must be grasped along with the throttle to prevent possible retarding of the throttle during catapult launch or JATO takeoff. A JATO firing button is part of the catapult handgrip in the forward cockpit only.

2.1.5.2 Engine Control Panel. The engine control panel, in the forward cockpit, is located just aft of the throttle and contains all other controls necessary for operation of the engine. The following switches and switch positions are on the panel: the wing fuel DUMP, OFF, and EMER TRANS switch; the drop tanks OFF, PRESS, and FLIGHT REFUEL switch; the engine START, ABORT switch; the fuel control MANUAL, PRIMARY switch; and the manual fuel control warning light.

The aft cockpit engine control panel contains the same switches and switch positions as the engine control panel in the forward cockpit except the drop tanks switch has two positions of PRESS and OFF instead of three positions of OFF, PRESS, and FLIGHT REFUEL used on the engine control panel in the forward cockpit.

2.1.5.3 Fuel Control Switch. A two-position fuel control switch on the engine control panel is used to select the mode of operation of the engine fuel control unit. The automatic metering devices in the fuel control unit regulate the flow of fuel to the engine when the switch is in the PRIMARY position. The control compensates automatically only for variations in altitude and airspeed when the switch is in MANUAL.

2.1.5.4 Manual Fuel Control Warning Light. The manual fuel control warning light, located on the engine control panel, comes on when the fuel control has shifted to the manual mode of operation. The light indicates the position of the emergency transfer valve which directs the fuel to either the primary or manual fuel control system. The emergency transfer valve is kept in the manual fuel control position by spring load, until overcome by engine-driven fuel pump pressure, regardless of the position of the fuel control switch. Consequently, the light will be on during normal engine starts until fuel pressure within the control shifts the transfer valve to the PRIMARY position, normally at 5- to 10-percent rpm, but the light must be out by 25-percent rpm. The light will also come on shortly after engine shutdown indicating a shift to the manual mode upon loss of fuel pressure. Complete loss of electrical power precludes switching the fuel control from position selected.

2.1.5.5 Engine Starter Switch. Actuation of the starter is controlled by the engine starter switch on the engine control panel (Figures FO-1 and FO-2) and is labeled START-ABORT. When the switch is depressed to START, the starter air supply solenoid valve opens, allowing compressed air from the gas turbine compressor to rotate the starter. A holding relay retains the switch in the START position. When the engine speed reaches approximately 50-percent rpm, a centrifugal switch in the starter opens, allowing the engine starter switch to pop up, thus stopping the air supply to the starter. Manually pulling out the engine starter switch will also stop the starter air supply.

2.1.5.6 Low Fuel State Warning Light. The TA-4F/J aircraft has a low fuel state warning light system to warn the pilot of an impending low fuel condition. The warning light is located under the glareshield above the left center section of the instrument panel and comes on under either of the following conditions:

1. Internal fuel quantity has decreased below 1,100 pounds.

2. Fuselage tank quantity has dropped to 550 pounds and the indicator gauge has switched over to indicate only fuselage tank fuel. Illumination of the fuel transfer caution light will normally also be associated with this condition.

If these conditions do not exist when the low fuel warning light comes on, assume that only 550 pounds usable fuel remains and proceed with Fuel Transfer Failure Procedures outlined in Part V.

Note

- With fuselage tank float valve failure, the fuel transfer caution light may not come on.
- Aircraft reworked per A-4 AFC 384 have provisions for dimming the low FUEL warning light only from the aft cockpit instrument lights control. Pilots flying solo should check for proper setting during aircraft preflight.

2.1.5.7 Approach Power Compensator. The approach power compensator (APC) system is installed in aircraft reworked per A-4 AFC 399. The APC controls the fuel control and is designed to maintain the optimum angle of attack of 16.5 units resulting in an optimum approach speed on the glide slope and during normal maneuvers in the landing pattern at any landing gross weight. Major APC components are: the computer, amplifier, servo actuator, accelerometer, elevator potentiometer, angle-of-attack vane transducer, and the APC control panel.

The APC is designed to command throttle position between an approximate 70-percent rpm and an approximate military rated thrust (MRT) in response to angle of attack. The angle-of-attack signal is modified by normal acceleration and elevator control stick position. If the APC is engaged or operating when aircraft angles of attack are greater than or less than optimum, the APC will compensate by increasing or decreasing throttle position accordingly. At angles of attack greater than optimum, the APC will command an increasing throttle position until MRT (approximate) is attained or the angle of attack returns to optimum. Conversely, at angles of attack less than optimum, the APC will command a decreasing throttle position until 70-percent (approximate) rpm is attained or the angle of attack returns to optimum.

When the APC is in operation (power switch – ENGAGE), the system will disengage if any of the following occur:

1. Throttle friction is applied.

2. Throttle position is below 70-percent (approximate) rpm.

3. Weight is applied to the main landing gear.

Note

It is possible to manually hold the APC engaged and override the disengage features in steps 1, 2, and 3. However, this procedure is not recommended because the engage interlock safety circuits are bypassed.

4. An override force of 25 to 30 pounds is applied to the throttles.

5. Power switch is manually returned to STBY position.

2.1.5.7.1 APC Control Panel. The APC control is located outboard of the throttle on the left console. The control panel contains two 3-position switches: an APC power switch, and an air temperature switch.

2.1.5.7.2 APC Power Switch. The APC power switch labeled OFF, STBY, and ENGAGE controls electrical power to the APC system. When the switch is in the OFF position, the APC is deenergized. Placing the switch in STBY position energizes the APC but does not engage the system. After the power switch has been positioned in STBY for a minimum of 15 seconds and the status light (located on the AOA indexer) comes on, the APC will function when the power switch is placed in the ENGAGE position.

2.1.5.7.3 Air Temperature Switch. The air temperature switch, labeled HOT-STD-COLD provides a means of compensating for variations in thrust because of outside air temperature changes. The HOT position should be used for temperatures above 80 °F (27 °C). STD from 40 °F to 80 °F (5 °C to 27 °C), and COLD below 40 °F (5 °C).

2.1.5.7.4 APC Status Light. Status of the system is indicated to the pilot by the APC status light located in the AOA indexer above the instrument glareshield. The light comes on when the system is in standby and goes off when the APC is engaged. The light will come on when the system is disengaged and/or is returned to standby.

2.1.6 Engine Instruments

2.1.6.1 Exhaust Gas Temperature (EGT) Indicator. The exhaust gas temperature indicator (Figures FO-1 and FO-2), located on the instrument panels, indicates, in degrees centigrade, the temperature of the exhaust gases immediately downstream of the turbine assembly. The range of indications is from 0 °C to 1,000 °C.

Note

High rates of roll or positive and negative accelerations may cause the EGT indicator to give erroneous indications. However, upon return to stabilized flight, readings will return to normal.

2.1.6.2 Tachometer. A tachometer (Figures FO-1 and FO-2), located on the instrument panels, indicates the speed of the high-pressure compressor rotor (N_2) as a percentage of rpm: for J52-P-6 engines, 11,600 rpm is equal to 100 percent; for J52-P-8 engines, 12,052 rpm is equal to 100 percent. Both EGT indicator and tachometer operate independently of aircraft electrical power and function whenever the engine is running.

2.1.6.3 Pressure Ratio Indicator. A pressure ratio indicator (Figures FO-1 and FO-2) located on each of the instrument panels, indicates the ratio between the second-stage (N_1) turbine discharge pressure (P_{t7}) and the aircraft pitot air pressure (P_{to}). The instrument is calibrated from 1.2 to 3.4. A knob on the lower left-hand side of the instrument operates a counter dial and simultaneously moves an index along the perimeter of the dial. The knob is rotated to set the minimum acceptable takeoff pressure ratio on the counter dial. See Figure 8-6, Takeoff Pressure Ration chart, to determine the minimum acceptable takeoff pressure ratio. When the throttle is advanced to military power, the dial pointer should coincide with, or exceed, the setting of the index to indicate that minimum acceptable takeoff thrust is available and should be read at zero airspeed.

Note

Wind has a negligible effect on EPR readings.

2.1.6.4 Fuel Flowmeter. A fuel flowmeter indicator (Figures FO-1 and FO-2), located on each of the instrument panels, shows engine fuel consumption in pounds per hour. The portion of the dial between 300 and 5,000 pounds per hour is divided into 100-pound increments. Above 5,000 pounds per hour, the dial is marked into 1,000-pound increments. Flow rates between 0 and 300 pounds per hour will be indicated as 300 pounds per hour. The fuel flowmeter indicator does not measure engine thrust output.

2.1.7 Engine Operation. Control of the engine consists essentially of selecting throttle positions. If the engine is in trim, the fuel control will correctly schedule any thrust setting (operating condition) that the pilot selects with the throttle. Exhaust gas temperature (EGT) indicates how much effort the engine is making, rather than how much work the engine should be, or is, doing. EGT must never be used, therefore, as a basis for setting thrust except when it becomes necessary to reduce a throttle setting to avoid exceeding a temperature limit, or to cope with unstable operation.

The pilot must not only know and observe the engine operating limitations, he must also recognize relationships like those between operating temperatures and temperature limits. For example, although it is permissible for an engine to operate at the actual temperature limit corresponding to a selected thrust setting (operating condition), an engine that does so may have something wrong that caused it to run abnormally hot. It is the thrust setting, not the EGT indication, that determines the allowable time limit at a thrust level as specified in Chapter 4. That is, the time limit is 30 minutes because the thrust setting is military rated not because the EGT indication happens to be 650 °C (621 °C for P-6 engine). In fact, if the EGT indication is 650 °C (621 °C for P-6 engine) at military rated, the pilot should be concerned about a possible malfunction. Report, as an engine discrepancy, every instance of overtemperature, noting not only the peak temperature reached, but also the length of time that the EGT exceeded limits.

2.1.7.1 Starting. Engine exhaust gas temperature will not normally rise above 340 °C on ground start. Conditions may exist which will give rise to EGTs that may approach the maximum permissible temperature of 455 °C. Under these conditions, the EGT tendency will be a better indication of proper engine operation than will the actual value attained. Thus, a ground starting EGT of 400 °C and rising rapidly should concern a pilot more than a start where the EGT slowly peaks out at 450 °C. The cause of the start above 340 °C (extremely high ambient temperatures, starting a hot engine, high wind up the tail pipe, etc.) should always be determined, since start EGT may be indicative of some engine malfunction. Refer to Part V for abnormal starts.

2.1.7.2 Acceleration. The acceleration temperature limits for J52-P-6 and J52-P-8 engines are specified in Part I, Chapter 4. The limits apply to all accelerations whether the acceleration is from IDLE to MILITARY thrust or only a small change such as from 85- to 95-percent rpm. The limit for acceleration and maximum operating temperature for a J52-P-8 engine should be interpreted to mean that the EGT may rise to 680 °C during or immediately following the acceleration, but must decrease to 650 °C or less within 8 minutes after the engine reaches its speed. For J52-P-6 engines, the limit for acceleration and maximum operating temperature should be interpreted to mean that the EGT may rise to 660 °C during or immediately following the acceleration, but must decrease to 621 °C or less within 8 minutes after the engine reaches its speed.

2.1.7.3 Steady State Operation. Exhaust gas temperatures for normal rated should be thought of as the temperature which, if exceeded at approximately 3 percent less than MILITARY rpm, warns of a possible engine malfunction. The temperatures shown for military rated and normal rated are positive limits that cannot be exceeded without compromising the engine's service life. A normally functioning engine should operate somewhat below the EGT limits published for the several operating conditions. The IDLE EGT limit is intended only as a guide, and is not a firm operating limit. Specified temperature limits serve two purposes: They assure that an engine will always be operated at internal temperatures that will not shorten the service life expectancy of engine components and they enable the pilot to detect an engine fuel control system or instrumentation malfunction in time to take proper corrective action.

The length of time that an engine may be operated at each of the thrust settings (operating conditions) was established to conserve the life of the engine and to make the time between overhauls predictable.

An engine's service life "budget" has just so many hours of operation at high thrust. Whether these hours are used up quickly or are distributed throughout a normal, calculated period depends on how conscientiously the EGT and time limits are observed by the pilot.

The time limit for operation at military rated is specified not so much to permit a cooling period between intervals of operation at high thrust as it is to distribute the rate of blade creep uniformly throughout the engine's normal life. Nothing is gained, therefore, by reducing a high thrust setting only momentarily before repeating it just to be able to report that time limits were not violated.

In the high thrust range, an increase of only 5 °C may double the rate of turbine blade creep since just so much creep can be tolerated by each blade. The rate at which blade life is depleted depends on proper pilot technique. Unfortunately, no operational technique can reverse the effect of blade creep.

2.2 OIL SYSTEM

The engine lubrication system is a self-contained high-pressure system which supplies lubrication to the main engine bearings and to the accessory drives. Pressure oil delivered by the engine-driven oil pump is cooled by means of an oil cooler prior to entering the bearing compartments. The oil cooler is a heat exchanger employing the fuel flowing from the engine fuel control to the fuel nozzles as a coolant. A scavenge system returns oil withdrawn from the bearing compartments and the accessory drive gearbox to the oil tank. A breather system connects the individual bearing compartments and oil tank with the breather pressure relief valve. The breather pressure relief valve vents overboard on the starboard side of the aft fuselage. The maximum oil consumption is 0.28 gallon (approximately 1 quart) per hour.

2.2.1 Oil Pressure Indicator. The oil pressure indicator (Figures FO-1 and FO-2) on the instrument panel shows engine oil pressure. Normal oil pressure indication is between 40 and 50 psi. Minimum oil pressure for ground IDLE is 30 psi.

Note

- Maneuvers producing acceleration near zero g may cause a temporary loss of oil pressure. Absence of oil pressure for a maximum of 10 seconds is permissible.
- Oil pressure indications are available on emergency generator.

2.2.2 Oil Quantity Indicator/Switch. An oil quantity indicator/switch, labeled OIL LOW, is mounted in the upper right-hand side of the pilot instrument panel (Figures FO-1 and FO-2). The OIL LOW indicator light automatically comes on when the engine oil tank reaches a critically low engine oil level of 20 percent or less of capacity. Oil servicing is required if the OIL LOW light is not on but comes on when the switch is pressed. This indicates that the engine oil tank contains over 20 percent but less than 80 percent of capacity.

Pressing the master press-to-test switch causes the OIL LOW light to come on, verifying all of the system except the 80-percent sensing circuit. The 80-percent sensing circuit may be verified by pressing the oil quantity indicator/switch and the master press-to-test switch simultaneously, causing the OIL LOW light to come on.

Note

- After securing the engine, oil seeps past the high-pressure oil pump into the accessory gear case. For this reason, an oil quantity check should be made within 30 minutes after engine shutdown, or when the engine has run for 8 minutes or longer at 75-percent or higher rpm and the scavage pump has returned the oil to the tank. False indications may be obtained if the oil quantity check is made during taxi or takeoff because of engine acceleration disrupting the oil level.
- On BuNo. 152864 and subsequent aircraft, the oil quantity indicating system is factory installed. The system is installed on BuNo. 152846 to 152863 reworked per A-4 AFC 315.
- The oil quantity light may erroneously indicate low oil quantity momentarily during periods of takeoff acceleration. A decision to abort must be tempered by airspeed at the time of occurrence.

2.3 FUEL SYSTEM

The internal fuel supply is carried in two tanks, the integral wing tank and fuselage tank, containing a total of 679 U. S. gallons. These tanks can be serviced through two gravity fuel tank fillers or a single-point pressure fueling system. Three external drop tanks can be carried to increase the total fuel quantity to 1,679 U. S. gallons. Fuel is normally transferred from the drop tanks to the wing tank by bleed air tank pressurization and from the wing tank by a bleed air driven fuel transfer pump. Emergency wing fuel transfer may be accomplished by bleed air wing tank pressurization. All fuel is delivered to the fuselage tank, from which an electrically driven fuel boost pump delivers the fuel under pressure to the engine-driven fuel pump. A manual fuel shutoff control lever is provided in both cockpits. See Figure FO-3 for a schematic presentation of the fuel system.

2.3.1 Fuel Tanks

2.3.1.1 Internal Tanks. Internal tanks comprise an integral wing tank and a self-sealing type fuselage tank mounted between the aft cockpit and the engine bay. The fuselage tank contains the control valve for regulation of transfer fuel flow and the fuel boost pump which delivers fuel to the engine driven fuel pump.

Both fuel tanks are vented. The vent system exit is located aft of the right main landing gear strut and is designed to provide a small amount of RAM air pressure in the fuel vent system to reduce the amount of collapse of the self-sealing type fuselage tank when it is partially full. Both tanks incorporate provisions for gravity fueling, pressure fueling and defueling, and water and sediment drainage. For information concerning total and usable fuel capacities of each tank, see Figure 2-1.

2.3.1.2 External Tanks. Drop tanks may be carried either singly or in combination. The inboard and centerline external stores racks will accommodate either 150- or 300-gallon drop tanks. A 400-gallon drop tank may be accommodated on the centerline rack only. All drop tanks are vented and have provisions for gravity fueling, pressure fueling, and bleed air pressurization to effect fuel transfer to the integral wing tank at the option of the pilot. The drop tanks may be jettisoned in the same manner as other external stores.

2.3.2 Fuel Transfer

2.3.2.1 Wing Tank Transfer. The wing tank air-driven transfer pump, which utilizes engine compressor bleed air for power, operates when the engine is running. Since the pump operates continuously, a float valve placed in the fuselage tank stops the transfer of fuel when the fuselage tank is full, preventing transfer fuel from being pumped overboard through the fuel vent system. A fuel transfer failure caution light (ladder light) is located on the left side of the instrument panel and comes on when wing tank fuel transfer pressure drops below 2 (+1/4, -1/8) psi. A steady light, when engine rpm is above 70 percent, indicates possible fuel transfer pump failure or wing tank fuel depletion. Maneuvering flight may cause the pump to become temporarily unported, thereby inducing intermittent flashing of the fuel transfer caution light.

Note

- On aircraft reworked per A-4 AFC 404 (increased transfer pump inlet diameter), sufficient fuel transfer may occur at idle to turn off the FUEL TRANS light.
- Extended periods of idle operation on deck can cause fuselage cell fuel level to drop below 550 pounds and illuminate the low fuel light. If this occurs prior to takeoff, increase rpm to 70 percent to ensure adequate fuel transfer; when internal fuel returns to normal indication and low fuel light is OUT, continue with flight.

2.3.2.2 Drop Tank Transfer. Fuel transfer from the drop tanks to the integral wing tank or fuselage tank is accomplished by pressurizing the drop tanks. Placing the drop tanks transfer switch, on the engine control panel (Figures FO-1 and FO-2), in PRESS position opens a solenoid-operated air shutoff valve, which directs engine compressor bleed air to the drop tanks. Once the tanks are pressurized, the flow of fuel from the drop tanks to the wing tank is controlled by the dual float pilot valve in the wing tank, which stops the transfer of fuel when the wing tank is full or allows it to continue when space is available. If the wing is full and the fuselage tank is not (as in the case of wing tank transfer pump failure), drop tank fuel will flow directly to the fuselage tank. To discontinue fuel transfer from the drop tanks, place the drop tanks switch in OFF. This energizes the drop tank air shutoff valve, thereby closing the valve and stopping fuel transfer. The drop tank air shutoff valve is automatically opened, if electrical failure occurs, providing immediate and automatic transfer of drop tank fuel as wing tank space permits. To prevent drop tank pressurizing air from being exhausted overboard through the drop tank vent, each drop tank is equipped with a combination float and diaphragm vent shutoff valve. This valve acts to close the drop tank vent when the tank is full or pressurizing air is introduced. The maximum transfer rate from the drop tanks to the fuselage

FUEL QUANTITY DATA

GALLONS – POUNDS

TANKS	USABLE FUEL				UNUSABLE FUEL LEVEL FLIGHT	EXPANSION SPACE	TOTAL VOLUME
	GALLONS	POUNDS					
		JP-4	JP-5	JP-8			
INTEGRAL WING PRESSURE FUELING	560	3640	3808	3752	6	9	585
INTEGRAL WING GRAVITY FUELING	570	3705	3876	3819			
FUSELAGE PRESSURE FUELING	104	676	707	697	0	0	109
FUSELAGE GRAVITY FUELING	109	709	741	730			
LH WING (INBOARD WING RACK)							
150-GALLON DROP	147	956	1000	984	2	1	150
300-GALLON DROP	295	1918	2006	1976	4	1	300
CENTERLINE							
150-GALLON DROP	147	956	1000	984	2	1	150
300-GALLON DROP	295	1918	2006	1976	4	1	300
300-GALLON AIR REFUELING STORE	295	1918	2006	1976	4	1	300
400-GALLON DROP	396	2574	2693	2653	3	2	401
RH WING (INBOARD WING RACK)							
150-GALLON DROP	147	956	1000	984	2	1	150
300-GALLON DROP	295	1918	2006	1976	4	1	300

USABLE FUEL TOTALS

TANKS	PRESSURE FUELING	*POUNDS			GRAVITY FUELING	*POUNDS		
		JP-4	JP-5	JP-8		JP-4	JP-5	JP-8
FUSELAGE, WING	664	4316	4515	4449	679	4414	4617	4549
FUSELAGE, WING (150) CENTER DROP	811	5272	5515	5434	826	5369	5617	5534
FUSELAGE, WING (300) CENTER DROP	959	6234	6521	6425	974	6331	6623	6526
FUSELAGE, WING (300) AIR REFUELING STORE	959	6234	6521	6425	974	6331	6623	6526
FUSELAGE, WING, (400) CENTER DROP	1060	6890	7208	7102	1075	6988	7310	7203
FUSELAGE, WING, TWO (150) WING RACK DROP	958	6227	6514	6419	973	6325	6616	6519
FUSELAGE, WING, (150) CENTER, TWO (150) WING RACK DROP	1105	7183	7514	7404	1120	7280	7616	7504
FUSELAGE, WING, (300) CENTER, TWO (150) WING RACK DROP	1253	8145	8520	8395	1268	8242	8622	8496
FUSELAGE, WING, (400) CENTER, TWO (150) WING RACK DROP	1354	8801	9207	9072	1369	8899	9309	9172
FUSELAGE, WING, TWO (300) WING RACK DROP	1254	8151	8527	8402	1269	8249	8629	8502
FUSELAGE, WING, (150) CENTER, TWO (300) WING RACK DROP	1401	9107	9527	9387	1416	9204	9629	9487
FUSELAGE, WING, (300) CENTER, TWO (300) WING RACK DROP	1549	10069	10533	10378	1564	10166	10635	10479
FUSELAGE, WING, (400) CENTER, TWO (300) WING RACK DROP	1650	10725	11220	11055	1665	10823	11322	11156

NOTE

*Calculated for standard day conditions using: 6.5 LB/GAL for JP-4
6.8 LB/GAL for JP-5
6.7 LB/GAL for JP-8

Figure 2-1. Fuel Quantity Data

tank is 9,500 pph with two wing drop tanks, and 14,000 pph with three drop tanks installed.

CAUTION

- Drop tank fuel transfer shall not be selected during maneuvers that may result in departure from controlled flight or maneuvering flight resulting in high roll rates or negative g's. A momentary block of the pressure vent valve resulting from high roll rates or negative g's could cause overpressurization of the wing tank resulting in structural damage.

- For dual drop tank aircraft, drop tank transfer shall be deselected anytime drop tanks are empty prior to commencing any of the maneuvers listed as restrictions applicable to flight with the wing tank pressurized (see Chapter 4). Pressure entering the wing from the drop tanks, coupled with a blockage of the pressure vent valve, can overpressurize the wing resulting in an inadvertent fuel dump.

Note

- Unless the drop tank fueling switch in the engine aft compartment is in the OFF position, fuel transfer from the drop tanks is not possible in the air, except by extending the emergency generator.

- A noticeable thumping may be experience during the latter stages of drop tank transfer.

- Venting of fuel through the wing tank vent mast may occur in the latter stages of drop tank transfer. Placing the drop tank switch to OFF will stop the venting. Drop tanks should be repressurized only when the wing tank is not completely full.

2.3.2.3 Emergency Transfer. Emergency transfer of fuel from the wing tanks to the fuselage tank is possible. A WING FUEL switch located on the engine control panel (Figures FO-1 and FO-2) provides for the transfer of fuel by wing tank pressurization. Moving the switch to the EMER TRANS position closes the wing tank pressure and vent valves allowing engine compressor bleed air to pressurize the wing tank. Fuel is then transferred to the fuselage tank through the pressure fueling line. If normal transfer failure was caused by a failure of the transfer pump, emergency transfer fuel will also flow through the regular transfer line as well as the pressure fueling line to the fuselage tank.

CAUTION

- When the wing fuel switch is in EMER TRANS position, overpressurization of wing is possible if fuel covers fuel vent outlet in tank because of 6-psi static pressure imposed on wing during emergency transfer. This condition can exist during negative g flight or when aircraft is in nosedown attitude.

- Refer to Chapter 4 for limitations applicable to flight with the wing tank pressurized.

When centerline drop tank is installed, the following sequence should be used to prevent transfer of wing tank fuel to centerline drop tank when the wing tank is pressurized. First, transfer all drop tank fuel that will fill the wing tank and then flow directly to fuselage tank. Then while maintaining drop tank pressurization, initiate emergency transfer.

Air pressure in center drop tank will prevent flow of fuel from wing down into center tank, where it would be unavailable from immediate emergency transfer.

Note

- External fuel transfer may not be possible with the emergency fuel transfer switch activated.

- Emergency fuel transfer is available on emergency generator in aircraft reworked per A-4 AFC 586.

2.3.3 Fuel Consumption Effects on Aircraft Center of Gravity. Drop tank fuel consumption has the least effect on center of gravity movement. The center of gravity will move approximately 1-percent

MAC (mean aerodynamic chord) forward as the drop tank fuel goes from full to empty. Aircraft normal fuel scheduling maintains the fuselage tank at a 600 to 700 pounds level by transfer of first drop tank fuel and then wing tank fuel. Wing tank fuel consumption causes the center of gravity to move forward until the wing tank is empty. The center of gravity will move forward approximately 6-percent MAC as wing tank fuel goes from full to empty. The aircraft will be at its most forward center of gravity for a given configuration when only the fuselage tank is full. Fuselage tank fuel consumption causes the center of gravity to move aft. The center of gravity will move aft approximately 3-percent MAC as the fuselage tank fuel goes from normal fuselage fuel level to empty. See Figure 2-2.

2.3.3.1 Fuel Transfer Rates. Basis: Fuel lab tests using JP-5.

2.3.3.1.1 Normal Fuel Transfer.

1. Air Turbine Pump Fuel Transfer from Wing to Fuselage Tank.

ALT	MACH	Gallon-Pounds/Hr	
SL	V min	1,260	8,568
15,000	V min	1,200	8,160
25,000	V min	1,200	8,160
35,000	V min	1,080	7,344
SL	V max	2,880+	19,584+
15,000	V max	2,880	19,584
25,000	V max	2,400	16,320
35,000	V max	1,920	13,056

2. External Drop Stores to Internal Fuel Tanks

	Pounds/Hr
Wing drop tanks (2)	9,500
Centerline drop tank	5,500
Two wing/centerline drop tank combination	14,000

Note

Drop tank fuel transfer rates apply from SL to 40,000 feet for all flight except idle descent.

3. Wing Tank/Air Refueling Store

	Gallons-Pounds/Min	
Wing tank to air refueling store	80 to 100	544 to 680
Air refueling store to wing tank	14 to 18	95 to 122.4
Air refueling store to receiver aircraft	180	1,224

2.3.3.1.2 Emergency Fuel Transfer. Wing to fuselage tank.

Gallons-Pounds/Min	
21	142.8

2.3.3.1.3 Fuel Dump Rates. Wing tank and air refueling store.

	Gallons-Pounds/Min	
Wing tank	100+	680+
Air refueling store	100	680

2.3.3.2 Wing Tank Fuel Dump and Pressure Relief Valve. A fuel dump and pressure relief valve is installed in the wing tank to prevent overpressurization of the wing tank and allow wing tank fuel to be dumped overboard. The pressure relief function of the valve is designed to fully open the dump valve when pressure within the wing reaches 8.5 to 9.0 psi. When opened in this manner, the dump valve will not reset until pressure within the wing decreases to about 4 psi. Normal (pilot selected) function of the dump valve is accomplished by placing the wing tank fuel dump switch, located on the engine control panel (Figures FO-1 and FO-2), in the guarded DUMP position. This will allow wing fuel to flow by gravity out the dump mast, located on the right main landing gear

TYPICAL CG TRAVEL
GEAR AND FLAPS DOWN

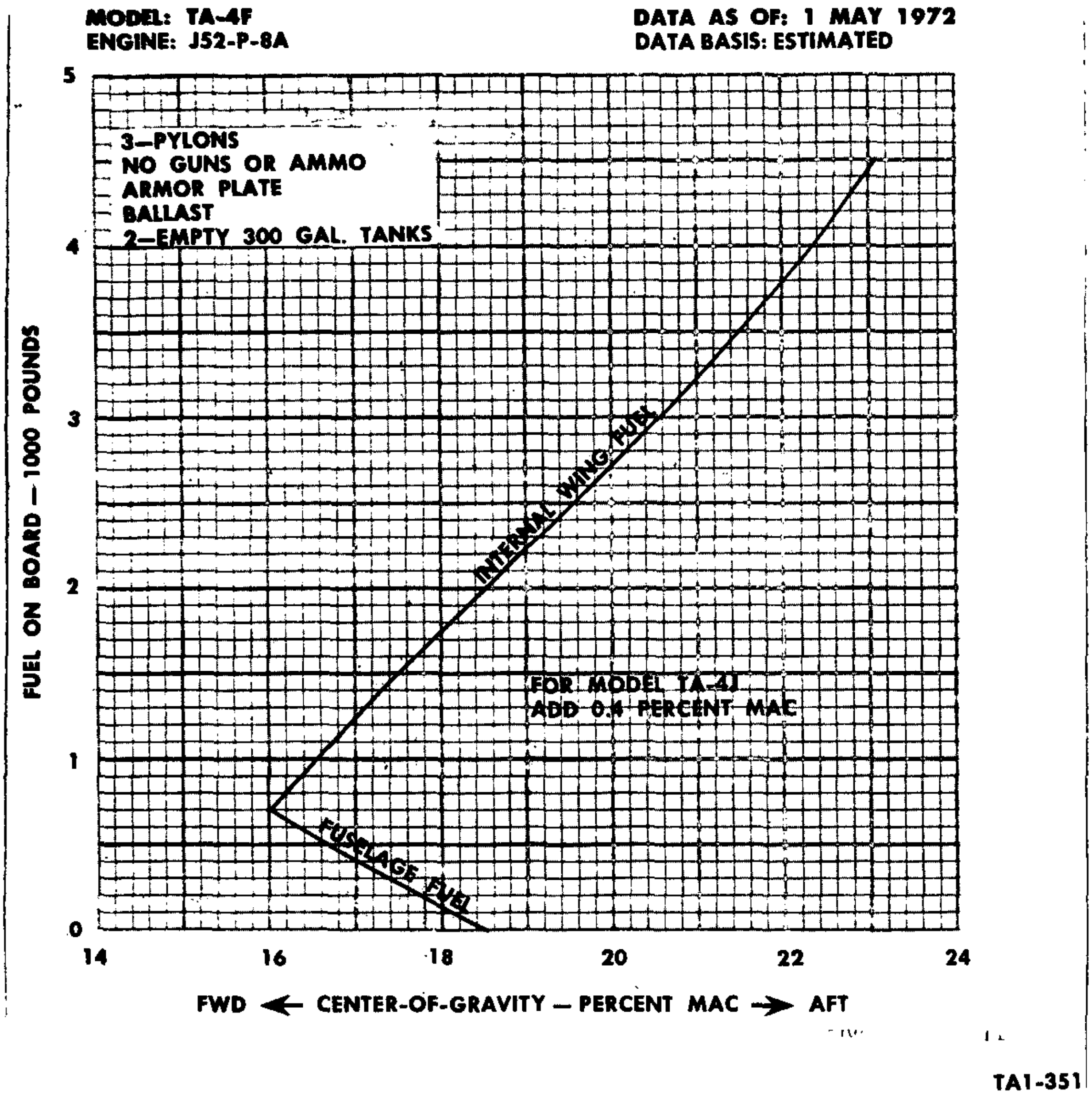


Figure 2-2. Typical CG Travel

fairing, at the rate of approximately 100 gallons per minute.

CAUTION

- Dumping fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted or descent is made below the freezing level.
- When operating the valve pneumatically (dump function) after each valve closure, a minimum of 2 minutes shall be allowed for all fuel drainage from the diaphragm cavity prior to reactivating dump switch; otherwise, damage to the diaphragm may result.

Note

- Maximum rate of wing fuel dumping may be accomplished by selecting EMER TRANS in one cockpit and DUMP in the other. This should not be done as a normal procedure, and if utilized in an emergency, both switches must be OFF prior to landing.
- While dumping wing tank fuel, monitor the fuel quantity indicator closely to preclude inadvertent dumping of fuel below the desired level.
- The WING FUEL switch must be in the OFF position during air refueling, hot refueling, or ground refueling with electrical power applied to the aircraft. This will prevent dumping of fuel overboard through the wing fuel dump valve.

2.3.3.3 Scupper Drain (Gang Drain). The mast, located aft of the aft fuselage lower access door, drains various aircraft and engine areas. Any fluids seen venting from this mast, other than on shutdown, may indicate a serious malfunction or leak and is cause for immediate landing and investigation.

Note

This mast should not be mistaken for the wing tank dump mast located aft of the right main gear.

2.3.3.4 Fuel Transfer Bypass Switch. On aircraft reworked per A-4 AFC 317, a FUEL TRANS BYPASS switch is installed in the forward cockpit on the underside of the white floodlight control cover. When the switch is placed in the BYPASS position during air refueling, fuel flows into the fuselage fuel tank only. The switch is normally used when the receiver aircraft has wing damage to prevent fuel from entering a damaged wing tank, thus averting a fuel loss/fire hazard condition.

Air refueling of the drop tanks and fuselage fuel tank (bypassing the wing tank) is possible by placing the DROP TANKS switch in the FLIGHT REFUEL position, in addition to placing the fuel transfer bypass switch in the FUEL TRANS BYPASS position.

If a wing tank is damaged, causing loss of fuel, any fuel remaining in the drop tanks can be transferred directly to the fuselage tank by activating the FUEL TRANS BYPASS switch and pressurizing the drop tanks. Indication of fuel transfer may take as long as 10 minutes if activated with 400 pounds of fuel or less remaining in each drop tank.

CAUTION

If drop tank transfer lines, which are routed through the wing tanks, are damaged, transfer of drop tank fuel or attempted air refueling of drop tanks would constitute a fire hazard.

Note

The fuel transfer bypass switch is operable on emergency generator power.

2.3.3.5 Fuel Boost Pump. An electrically driven fuel boost pump is submerged in the fuselage tank. The fuselage tank incorporates a standpipe that helps to keep the boost pump fuel inlet supplied with fuel at all aircraft attitudes, including diving and inverted flight for normal accelerations greater than ±0.5g and less than -0.5g.

Note

Normal accelerations between +0.5g and -0.5g can result in a loss of boost pump fuel transfer followed by engine flameout. Transient flight maneuvers only are permitted in this normal acceleration range where transient is defined as transition from one flight regime to another with no intermediate dwell time or stops.

Operation of the fuel boost pump is automatic whenever the aircraft electrical system is energized by the main generator, or by external power through the ground test switch. In the event of main generator failure, the fuel boost pump will be inoperative and will remain inoperative even though the emergency generator is deployed. (Refer to Part V, Fuel Boost Pump Failure.)

2.3.3.5.1 Fuel Boost Pressure Indicator. Loss of fuel boost pressure is indicated by a FUEL BOOST warning light located on the caution panel (ladder light), of the instrument panel (Figures FO-1 and FO-2). The warning light will come on whenever fuel boost pressure falls below 4 psi and will go off at 6 psi.

2.3.3.6 Manual Fuel Shutoff Control. The fuel system incorporates a manually operated (not interconnected) fuel shutoff control lever in both cockpits (Figures FO-1 and FO-2) located outboard of the left-hand console. This lever has two positions, NORMAL and EMER OFF. The EMER OFF position of the control stops all fuel flow from the aircraft fuel system to the engine fuel control system. A spring-loaded lift-type guard is provided to prevent inadvertent movement of the lever to EMER OFF.

Note

- To ensure complete fuel shutoff, the control lever must be moved fully aft into the EMER OFF detent.
- At shutdown the engine will continue to run at the same thrust level for approximately 1 (high power) to 3 (minimum required for level flight) seconds prior to engine shutdown.

2.3.4 Fuel Quantity Indicating System. The fuel quantity indicating system consists of capacitance-type fuel quantity probes, a fuel quantity indicator, a low-level switch, a fuel quantity test switch, a low fuel level warning light, and associated wiring. The wing tank contains six fuel quantity probes. Each external fuel tank and the fuselage tank contain one fuel quantity probe. The wing and fuselage probes are wired into the fuel quantity indicator that indicates the total quantity of fuel remaining in the internal tanks. A low fuel level warning light comes on when approximately 164 gallons (1,100 pounds) of fuel remains in the internal tanks. External fuel tanks quantity is checked by depressing and holding the external fuel button. Air refueling stores do not have fuel gauging provisions unless reworked by AYC 86. Air refueling stores incorporating AYC 86 will provide fuel quantity when the external fuel button is depressed and held, the same as for drop tanks. The effect of aircraft attitude on the relationship between indicated and actual total fuel quantity is shown in Figure 2-3.

2.3.4.1 Low Fuel State Warning Indicator. The fuselage tank contains a low-level switch (thermistor bead) located at the 82 gallon level. If the fuel supply in the fuselage tank falls below this level because of malfunction of the wing tank transfer system, or failure or mismanagement of the drop tank transfer system, the low-level switch causes the reading of any remaining wing-tank transfer fuel to be dropped out, indicating to the pilot that approximately 82 gallons (550 pounds) of usable fuselage fuel remains.

2.3.4.2 Fuel Quantity Indicator. The fuel quantity indicator (Figures FO-1 and FO-2), located on the instrument panel, indicates the total fuel available in pounds multiplied by 1,000. The range of indication is from 0 to 6,400 pounds. Indicated airspeed for most accurate fuel reading is 250 KIAS at approximately 80-percent rpm in level flight.

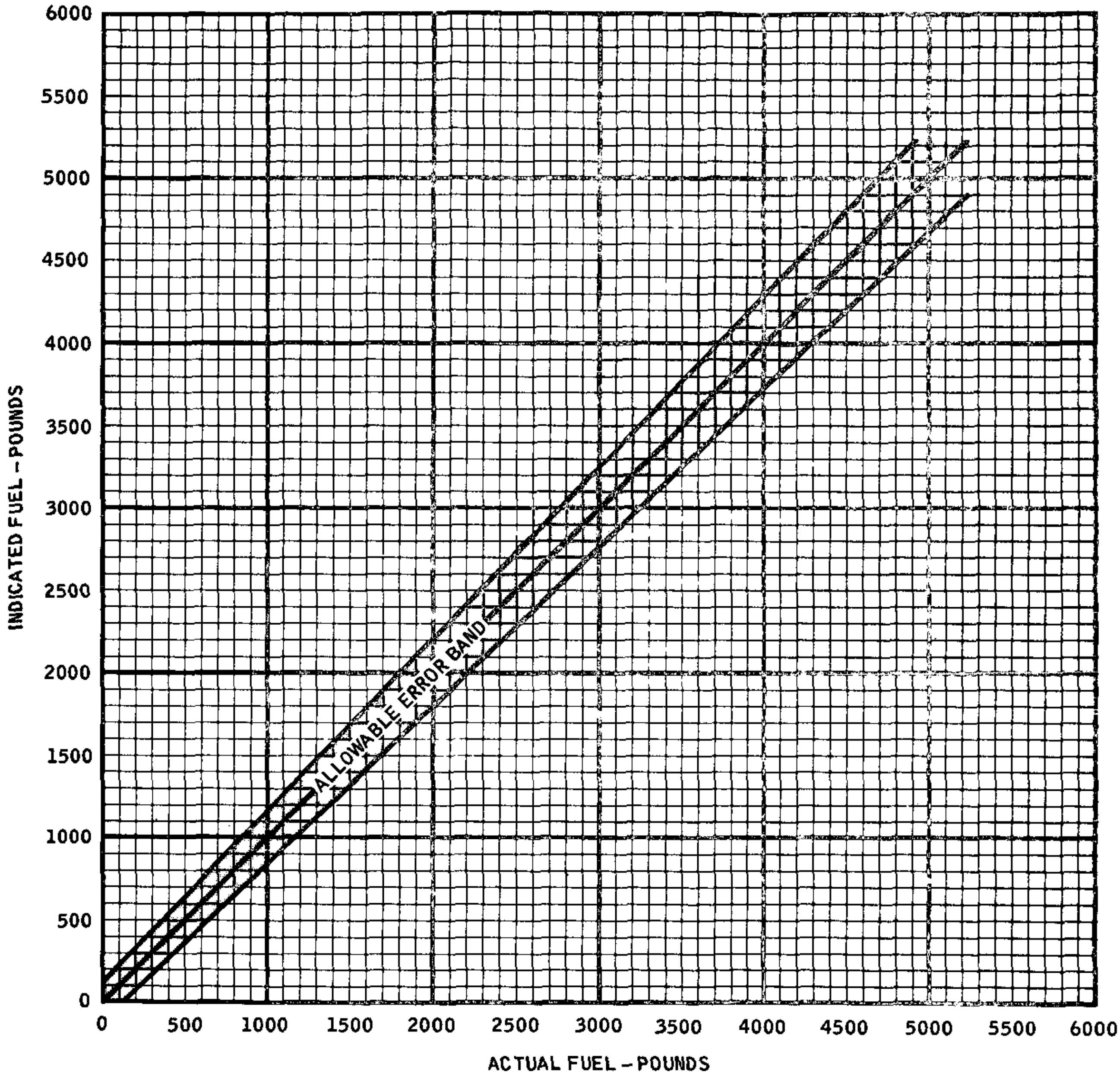
Note

- With failure of the transformer rectifier circuit, no dc power will be available to the fuel quantity control unit. As a result, the fuel quantity indicator will indicate only fuel available in the fuselage fuel cell (fuel available in the wing tank will not be included). This fuel indication will be approximately 650 pounds with the engine operating. As total usable fuel

When the fuselage tank indicated fuel quantity is at or below 600 pounds, and the aircraft attitude is between 4° noseup and 4° nosedown, indicated quantity can be considered to be actual quantity. The fuel low-level warning light is accurate in stable flight conditions when the aircraft attitude is between 8° noseup and 12° nosedown.

FUEL/ATTITUDE CALIBRATION

DATA AS OF: 1 OCTOBER 1959
DATA BASIS: CONTRACTOR'S CALIBRATION



REMARKS:

(1) ALLOWABLE ERROR BAND PER MIL-G-7940.

(2) JP-5 FUEL.

EXAMPLE:

ASSUME INDICATED FUEL IS 4000 POUNDS.

(1) READ ACROSS TO ALLOWABLE ERROR BAND.

(2) ACTUAL FUEL IS EQUAL TO 3700 POUNDS (MINIMUM) TO 4300 POUNDS (MAXIMUM).

TA1-281-B

Figure 2-3. Fuel/Attitude Calibration Chart becomes less than 650 pounds, the correct fuel quantity will be indicated.

- Maneuvering or accelerated flight causes erroneous fuel quantity indications.

The fuel quantity indicator gauge may be tested by the press-to-test button (Figures FO-1 and FO-2) on the instrument panel. When the test button is depressed, the fuel quantity indicator pointer will rotate in a counterclockwise direction. When the test button is released, the pointer will return to the original indication if all units of the fuel quantity measuring circuit are functioning properly.

2.3.4.3 Internal-External Fuel Switch. A pushbutton switch labeled INT-EXT is located on the instrument panel for checking external fuel load. The switch is spring loaded to the INT position. External quantity will be indicated when the switch is pushed to the EXT position and held until the indicator pointer stabilizes.

2.3.5 Single-Point Fueling and Defueling System. The pressure fueling system is designed to permit fueling at a rate of 200 gpm through a single-point pressure fueling receptacle, located at the trailing edge of the wing just inside the aft engine compartment access door. The system may be defueled through the same receptacle at a rate of approximately 100 gpm.

2.3.5.1 Pressure Fueling Switch Panel. The pressure fueling switch panel is located on the left side of the aft engine-access compartment just inside the access door. This panel has two switches: the check switch and the drop tank fueling switch. The check switch has three positions: PRIMARY OFF, FUELING ON, and SECONDARY OFF. The switch is used to test the operation of the dual float shutoff valves. The drop tank fueling switch has two positions: ON and OFF. The ON position of the drop tank fueling switch energizes the drop tanks solenoid pilot valves, permitting pressure fueling of the drop tanks.

2.3.5.2 Pressure Fueling. When the wing and fuselage tanks are being fueled, fuel pressure opens the fueling shutoff valve in each tank allowing fuel to enter the tank and to flow through the sensing lines to the dual float pilot valve. When the tank is filled, the floats close the pilot valve, causing pressure to increase behind the diaphragm of the shutoff valve and closes it. Each shutoff valve consists of a primary float, which is the pilot for the shutoff valve, and a secondary float, which is a standby for the shutoff valve. Moving the check switch to either the PRIMARY OFF or SECONDARY OFF position causes solenoids to raise the respective float valve to simulate the normal shutoff valve action at the maximum fuel capacity level. This check can be made only after the pressure fueling operation has begun.

CAUTION

When external electrical power is not available during pressure fueling of the aircraft, the functional tests of pressure fueling shutoff components cannot be performed. The wing and fuselage tank gravity filler caps must be removed during fueling to prevent possible damage to the internal fuel tanks structure.

To fuel the drop tanks by means of the pressure fueling system, it is necessary to plug in external electrical power. Placing the drop tank fueling switch on the pressure fueling switch panel in the ON position energizes the normally closed solenoid pilot valve, permitting fuel pressure to open the drop tanks shutoff valves and, subsequently, flow to the drop tanks. Under these conditions, fuel also flows through the sensing lines to the drop tanks solenoid pilot valves. As each drop tank is filled, a float switch in the tank rises, breaking the electrical circuit to the energized solenoid pilot valve, causing the pilot valve to close and pressure to build up behind the diaphragm of the shutoff valve, which then also closes, discontinuing the pressure fueling to that tank.

Note

Unless the drop tank fueling switch in the engine aft compartment is in the OFF position, fuel transfer from the drop tanks will not be possible in the air, except by extending the emergency generator.

When the air refueling store is installed instead of the centerline drop tank, the store is fueled through the pressure fueling receptacle on the store.

2.3.5.3 Pressure Defueling. To defuel the integral wing tank, it is necessary to connect the defueling hose to the pressure fueling receptacle. To defuel the fuselage tank, it is necessary to operate the manual override check valve between wing and fuselage tanks. When the defueling operation is begun, negative pressure in the pressure fueling shutoff valves will open the valves and allow the fuel to be removed. When either the fuselage or wing tank becomes empty, the defueling low level float valve opens, increasing the pressure behind the diaphragm of the shutoff valve, causing the valve to close. This prevents air from entering the defueling line and breaking the siphon when one tank empties ahead of the other.

To defuel the drop tanks through the pressure fueling system, it is necessary to connect a source of air pressure to the capped tee in the drop tanks pressurizing system, and first transfer the drop tanks fuel into the integral wing tank.

2.4 ELECTRICAL SYSTEM

Electrical power is normally supplied by a 10-kVA engine-driven generator, which furnishes 115/200-volt, 3-phase, 400-cycle, constant frequency ac power, and, through a transformer-rectifier, 28-vdc power. No dc generator or battery is provided. An additional transformer modifies generator power to 26-vac power for the operation of certain equipment. Eight busses serve to distribute power to the various electrical units. An airstream-operated emergency generator provides electrical power to essential equipment in the event of main generator or engine failure. External power can be used to energize the system through an external power receptacle located in the lower forward plating of the left-hand wing root. Operation of the electrical system is completely automatic, with the exception of the emergency generator, which must be activated by the pilot upon failure of the main generator. Refer to Part V for emergency of the electrical system, and see Figure FO-4 for a schematic presentation of normal and emergency electrical power distribution.

2.4.1 Main Generator. The generator is driven at a steady state of 8,000 rpm, over the entire operating range of the engine from idle to maximum power by the constant-speed drive unit. A test unit may be plugged into the receptacle on the fuse panel in the nosewheel well to ascertain that the generator is operating within prescribed limits.

On aircraft incorporating AFC 338, an underfrequency protector is connected between the output of the main generator and the voltage regulator to prevent the supply of low frequency power to electronic equipment during engine shutdown or constant-speed drive malfunction.

2.4.2 External Power Switch. The external power switch located in the leading edge of the left wing root disconnects the aft monitored bus from the main generator and connects it to the external power receptacle when the external position is selected to apply external power to the system. It is not possible to close the external power receptacle door when the switch is in the EXTERNAL position.

2.4.3 Retraction Release Switch System. The retraction release switch system has two positions, airborne and ground. The airborne position is obtained by extending the left main gear strut as aircraft becomes airborne. The ground position is obtained as the left main gear strut compresses on aircraft landing. If aircraft is airborne and retraction release switch system malfunctions to the ground position, operation of the following systems will be affected:

1. Landing gear lever safety solenoid inoperative, requiring manual movement of the serrated lever to place landing gear handle in the up position.

2. AFCS and STAB-AUG inoperative (will not engage).

3. Spoilers will open if armed, and the throttle is reduced below the 70 percent position.

4. APCS inoperative (will not engage).

5. Approach AOA lights, indexer lights, and transducer heat inoperative.

6. Radar altimeter inoperative.

If aircraft is on ground and retraction release switch malfunctions to airborne position, operation of the following systems will be affected:

1. STAB-AUG will not disengage on landing.

2. APCS will not disengage on landing.

3. Nosewheel steering inoperative (will not engage).

4. AOA transducer heat will not be removed on landing, and AOA lights will stay ON.

5. Spoilers will not operate.

2.4.4 Emergency Generator – RAM Air Turbine (RAT)

WARNING

Aircrew should use extreme caution when deploying handle. A palm-down method of grasping the emergency generator handle is recommended.

The emergency generator, rated at 1.7 kVA, is carried in a compartment in the lower right-hand side of the forward fuselage. When the generator is released into the airstream, a variable pitch propeller governs the speed of the generator at approximately 12,000 rpm to provide 400-Hz power to the primary and monitored primary bus.

2.4.4.1 Emergency Generator Bypass Switch. The emergency generator bypass switch labeled NORMAL-BYPASS is located on the right-hand console in both cockpits (Figure FO-1). If main generator power has been regained, the pilot can return to main generator operation by placing the emergency generator bypass switch in the BYPASS position. The front cockpit has a lever-lock switch while the rear cockpit has a solenoid-actuated switch which is spring loaded to the NORMAL position. As long as main generator power is available, either cockpit can select BYPASS and cannot be overridden by the other cockpit. The aft cockpit switch is solenoid held in the BYPASS position and will automatically revert to the NORMAL position if main generator power is lost. The front cockpit switch is a lift-to-lock toggle switch which must be manually moved from the BYPASS position.

2.4.4.2 Emergency Generator Release T-Handle. The emergency generator release T-handle (Figures 1-4 and 1-5) is located on the right side of the cockpit above the right console near the instrument panel and provides control for release of the emergency generator in the event of main generator failure. The emergency generator drops into the airstream when the handle is pulled, and the main generator is disconnected from the electrical system, while the primary and monitored primary bus are connected to the emergency generator. To obtain electrical power from the emergency generator, the bypass switch must be in the NORMAL position.

Note

If the emergency generator has been deployed with an operating main generator, main generator power will be regained during rollout as the emergency generator drops off the line.

Once the emergency generator is extended, it cannot be retracted to the normal stowed position, while in flight.

2.4.5 AC Power Distribution

2.4.5.1 Normal AC Power. Power from the main generator is sampled by a voltage regulator. The voltage regulator maintains a constant voltage output from the main generator by varying the current in the generator exciter field. The voltage-regulated power is directed through the INTERNAL position of the external power switch.

2.4.5.2 Emergency AC Power. Extending the emergency generator into the airstream breaks the main generator exciter field circuit, rendering the main generator inoperative, and transfers the primary bus and monitored primary bus from the aft monitored bus to the emergency generator. (See Figure FO-4.) If either the horizontal stabilizer manual override lever or the AMAC SYS EMER PWR switch is actuated while operating on emergency generator, the monitored primary bus will be lost as all emergency generator power is diverted to the primary bus. Upon releasing the manual override, or returning the AMAC SYS switch to the NORM position, power is again directed to the monitored primary bus.

CAUTION

Sufficient emergency generator power to operate essential equipment is assured at a minimum of 145 KIAS gear down and 165 KIAS gear up. Prolonged trim motor actuation below these speeds may cause complete failure of the emergency generator by demagnetizing the permanent magnet rotor.

Note

High g maneuvers, touch and go landings, and other evolutions with the emergency generator extended may overstress the emergency generator supports and are not recommended.

2.4.6 DC Power Distribution. The primary bus supplies 115/200-volt, 3-phase, 400-Hz ac power to a single transformer-rectifier, which converts the ac power to 28-vdc power.

2.4.6.1 Armament Bus. The armament bus receives dc power when the master armament switch is ON and the landing gear handle is UP. The armament bus is deenergized by an armament safety switch that is actuated when the landing gear handle is in the down position. This is a safety feature to prevent inadvertent firing of the guns or release of stores when the aircraft is on the ground or in the landing pattern with the wheels down.

2.4.6.2 Armament Safety Disable Switch. The armament safety disable switch is located on the outboard side of the right-hand wheelwell for ground testing of the armament circuit. When the master armament switch is ON and the armament safety disable switch is momentarily depressed, an armament safety disabling relay is closed, allowing power to energize the armament bus. The relay is held closed until the master armament switch is turned OFF, or electrical power is disconnected from the aircraft. When this occurs, the armament safety feature is automatically reinstated.

2.4.7 Fuse Panels. All electrical circuits, with the exception of the all-attitude indicating system, are protected by fuses in lieu of circuit breakers in order to save weight and provide better wire protection. The fuses are located on three panels: two in the nosewheel well, and the other in the forward engine compartment.

2.5 FIRE DETECTION SYSTEM

The fire detection system will indicate the existence of fire in the area surrounding the engine, tailpipe, and accessories section. If fire occurs in these locations, the FIRE warning light (Figures 1-4 and 1-5) under the glareshield will come on. The fire detection system will be checked in both cockpits when the master press-to-test switch is depressed (Figures FO-1 and FO-2). When the button is depressed, the FIRE warning light will come on indicating a properly functioning circuit. This system discriminates against short circuits and prevents lighting of the fire warning light by either the fire detection control unit or press-to-test button when a short exists.

2.6 HYDRAULIC SYSTEM

The hydraulic systems consist of the utility hydraulic system and the flight control hydraulic system, utilizing two self-pressurizing fluid reservoirs and two identical engine-driven variable displacement pumps. Both reservoirs are located in the upper right-hand side of the fuselage over the center of the wing, with the flight control system reservoir aft of the utility system reservoir. The hydraulic fluid capacity of the utility system reservoir is 1.25 gallons and the capacity of the flight control system is 0.30 gallon.

Each system operates normally under a pressure of 3,000 psi. Pressure relief valves in each system open at 3,650 psi to prevent damage to the lines and equipment, should the pump displacement compensator fail. Tandem power cylinders are used in the aileron, elevator and rudder power controls; one-half of each cylinder is operated by flight control system pressure, and the other half by utility system pressure. This arrangement allows power operation of the ailerons, elevator, and rudder at reduced hinge moments by either system in the event of failure of the other system.

The flight control hydraulic system powers only one-half of the aileron, elevator, and rudder tandem actuating cylinders. The utility hydraulic system, in addition to powering one-half of the aileron, elevator, and rudder tandem actuating cyclinders, also operates the landing gear, nosewheel steering, wing flaps, speedbrakes, wing spoilers, canopy, arresting hook, autopilot servos, and JATO jettison. Hydraulic pressure warning lights (Figures FO-1 and FO-2) are located in the cockpit for each system. Pressure gauges for both systems are installed in the right-hand wheelwell. No hydraulic pressure is available for ground operation unless the engine is running; however, there is a hand-operated hydraulic pump available for canopy operation without engine power. Normal hydraulic pressure is supplied to the flight control and the utility systems when the engine is running.

The engine-driven hydraulic pumps for the flight control and utility systems are of the constant pressure, variable displacement type. The rate of fluid flow through each system will vary (gallons per minute) with the operating speed of the associated pump. Flow restrictors, to regulate the maximum rate of flow, prevent the wing flaps, speedbrakes, and arresting hook from operating too fast when fluid flow is at its peak, yet do not affect the time of operation when flow is reduced at low engine speeds. As long as the engine is turning at IDLE rpm or greater, the hydraulically operated units will operate against the usual loads. However, at engine windmilling speeds, fluid flow is greatly reduced, and the time required for hydraulically operated units to respond fully is increased. See Figure FO-5 for a schematic diagram of the hydraulic system.

The loss of pressure in the utility hydraulic system or the flight control hydraulic system will be indicated by the individual system's warning light (ladder lights). Either the utility or flight control system can provide sufficient pressure for normal flight operations. Stiffening of the control stick may be noted at high speeds or during rapid control movements.

When operating on the utility hydraulic system alone, actuations of various units normally operated by utility pressure cause a temporary decrease in the effectiveness of the flight controls.

No means are available for the pilot to correct a hydraulic system failure. For action to be taken in the event of failure, refer to Part V.

2.7 FLIGHT CONTROL SYSTEM

The primary flight controls systems are tandem full power hydraulic systems with artificial feel supplied by bungee springs in parallel with the controls. Motion of the stick or rudder pedals is transmitted through linkage and cable systems to the control valve. The valve ports fluid to the power cylinder, which actuates the control surfaces. Each of the three flight control surfaces, the aileron, elevator, and the rudder, is a part of the tandem hydraulic system.

Aileron and rudder trim is obtained by repositioning the neutral force point of a load-feel bungee. Longitudinal trim is obtained by positioning the horizontal stabilizer.

If total hydraulic power failure occurs, the aileron and elevator power cylinders may be disconnected and control is maintained manually. The rudder system cannot be disconnected. With loss of hydraulic power, the rudder control valve ports the two cylinder ports together so that the rudder can be controlled manually through the manual bypass linkage.

Hydraulic servos, in parallel with the pilot operated controls, provide the aileron and elevator control forces required for automatic flight control. A load feel bungee is placed in series with the elevator servo to limit its force output for structural protection.

The rudder control system has a dual input electromechanical control valve so AFCS commands may be added to pilot commands. With the AFCS or STAB AUG engaged, the valve operates electrically. With AFCS and STAB AUG disengaged, the valve operates mechanically.

The aileron and rudder control surfaces have rotary viscous dampers to reduce surface buzz.

The rudder pedals are independently adjusted fore and aft by a lever located on the inboard side of each pedal.

CAUTION

Do not attempt maneuvers requiring high control forces (such as high-speed pullouts) when it is known beforehand that one or both systems are inoperative.

2.7.1 Aileron Control. Lateral movement of the control stick positions the aileron control valve so that hydraulic fluid at 3,000 psi is ported to the aileron power cylinder. The aileron power cylinder operates push-pull tubes to the ailerons, causing the latter to be deflected in the desired direction. Because the aileron power control is irreversible, there is no feedback to the pilot of airloads against the ailerons; therefore, artificial "feel" is provided by a spring bungee.

2.7.1.1 Aileron Trim System. An electrically powered aileron trim actuator is controlled by movement of the trim switch on the stick grip in either cockpit to LWD (left wing down) or RWD (right wing down). If both pilots attempt to trim at the same time, opposing aileron trim signals will stop trim movement regardless of the direction or sequence of actuation. The trim actuator moves the stick, power system linkages, and, consequently, the ailerons to the desired trim position by changing the neutral position of the aileron load feel and centering bungee. At the same time, the actuator positions a followup tab on the left aileron so that the aircraft remains approximately in trim whenever the power system is disconnected.

Note

The position of the followup tab has negligible effect on lateral trim during flight, utilizing either or both hydraulic power control systems.

If the hydraulic power system has been disconnected, continue to trim the ailerons in the same manner, except that now the tab is positioning the surfaces, and the aerodynamic forces on the ailerons will be felt through the manual control system. The "in-trim" angular position of the aileron tab will vary between individual aircraft because of manufacturing tolerances and is established by company test pilots prior to fleet delivery of each aircraft. Theoretically, this setting should not change during the service life of the aircraft unless some change is made to its aerodynamic configuration. For safety of flight, it is mandatory that the trim tab rigging, the in-trim position, and the trim tab movement (opposite of aileron) be verified after replacement or adjustment of the aileron, wing, or lateral trim system components. Failure to do so may result in uncontrollable rolling tendencies when the power system is disconnected. (Refer to Hydraulic Power Disconnect, paragraph 2.7.5.)

The stick trim actuator is inoperative when the emergency generator is in use. No indicator is provided to show the trim position of the ailerons and tab, but the control stick is displaced from center to a new NEUTRAL position as the trim tab and ailerons are moved from their faired positions by the trim actuator. The control stick should be centered for takeoff trim setting.

2.7.2 Elevator Control. Fore-and-aft movement of the control stick moves a pushrod attached to the elevator control valve, which ports hydraulic pressure to the elevator power control cylinder. The cylinder, through mechanical linkage, deflects the elevator surface as desired. The elevator power control system is aerodynamically irreversible; therefore, artificial feel is provided by a spring bungee. Forward and aft bobweights provide additional stick force cues under positive g-loads to aid in prevention of inadvertent aircraft overstress. This is accomplished by attachment of the bobweights to the mechanical linkage which connects the control stick to the elevator. When positive g-forces are applied, this bobweight arrangement tends to pull the control stick forward and increase the pull force required to attain the desired load factor. Under negative g-loads, this design will react to nosedown pitch accelerations in a manner which also causes the stick to move forward, thereby lightening the stick push force required. The elevators are not equipped with trim tabs, as longitudinal trim is provided by a movable horizontal stabilizer. A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflects downward while trimming nosedown. The elevator moves approximately 8° as the stabilizer travels from full-throw up to full-throw down. When elevator-hydraulic power is lost, the elevator-stabilizer linkage is ineffective. The elevators are interconnected with the operation of the speedbrakes to assist the pilot in overcoming trim changes resulting from speedbrake operation. A system of cables and springs attached to the left speedbrake actuates the control cables between the stick and the elevator control valve. When speedbrakes are opened, this system pulls the nosedown elevator cable, moving the stick forward and actuating the elevator to reduce noseup pitch. When the speedbrakes are closed, the stick moves aft to its original trimmed position, thus reducing nosedown pitch.

2.7.3 Horizontal Stabilizer Trim System. The entire surface of the horizontal stabilizer is moved by an electrically operated actuator to provide longitudinal trim. The actuator is controlled by forward and aft movement of the trim switch to NOSEDOWN or NOSEUP. The pilot first initiating horizontal stabilizer trim will control the direction of the horizontal stabilizer movement. Stabilizer travel is from 12-1/4° ±1/4° noseup to 1° nosedown. The position of the horizontal stabilizer is shown on the trim position indicator.

2.7.3.1 Manual Override Lever. A horizonal stabilizer manual override lever (Figure FO-1), on the left console outboard of the throttle, will operate the horizontal stabilizer if the trim switch becomes inoperative. The positions of the manual override lever correspond to those of the trim switch; and, as the switch is spring loaded to the center or OFF position, it must be moved to the full extent of its travel in either direction to operate the horizontal stabilizer. When the emergency generator is operating, the manual override lever is the only means of actuating the horizontal stabilizer.

CAUTION

Do not run the actuator against the stops during the preflight check. Use of the horizontal stabilizer manual override lever does not cut out the actuator motor when the horizontal stabilizer reaches full travel. Continued operation of the manual override lever in one direction, when the stabilizer is at the limit of travel, will burn out the actuator motor and cause complete loss of stabilizer control. In addition, this may result in structural damage to the horizontal stabilizer actuator and aft fuselage.

2.7.4 Rudder Control. The aircraft is equipped with a rudder system operating at a reduced hydraulic pressure of 1,150 psi. The rudder power control is operated by the flight control system and the utility system at the same reduced pressure. Movement of the rudder pedals mechanically positions the rudder electromechanical dual input servo valve. The valve ports hydraulic pressure to the rudder actuating cylinder as required. Since there is no feedback of airloads on the control surface of a hydraulic power system, a spring bungee is installed in the fin to center and restrain the control valve and rudder pedals, and to provide artificial feel.

2.7.4.1 Rudder Trim System. Directional trimming is accomplished by displacing the entire rudder surface as a result of repositioning the center or neutral point of the spring bungee through the action of an electrical motor controlled by the rudder trim control (Figures FO-1 and FO-2) on the left-hand console. If both pilots attempt to trim at the same time, opposing rudder trim signals will stop the trim movement regardless of the direction or sequence of actuation. Positions of the trim control are NOSE LEFT and NOSE RIGHT. Rudder trim position is shown on the trim position indicator. Trim is not available during emergency generator operation.

Note

Loss of rudder hydraulic power results in loss of rudder trim.

2.7.5 Hydraulic Power Disconnect. A manual flight control T-handle (Figures FO-1 and FO-2) on the lower right side of the instrument panel, in both cockpits, may be used to disconnect the elevator and aileron power cylinders from the flight controls in the event of complete hydraulic systems failure. After disconnect, stick forces are high, particularly for lateral deflections. At airspeed in excess of 300 KIAS, stick forces become extremely high.

CAUTION

Hold the T-handle while allowing handle to return to the stowed position. This procedure is to prevent handle striking an instrument.

Note

- The rudder has no hydraulic disconnect in the system.
- As long as (normal) electrical power is available, the aircraft can be trimmed. Trim the aircraft immediately if it should roll when the manual flight control handle is pulled, during an actual hydraulic system failure.
- Prior to performing a hydraulic power disconnect under controlled conditions, the emergency generator should first be extended and a functional check of the emergency trim override should be made. If the emergency trim functions properly on emergency generator, switch to BYPASS and continue with disconnect.

Note

If normal electrical power and utility hydraulic pressure is available after disconnect, the AFCS may be used to reduce stick forces.

On all TA-4F and TA-4J aircraft reworked per A-4 AFC 530, the elevator power mechanism disconnect linkage is changed to improve the connect/disconnect function and to eliminate partial disconnects. The lockspring and supporting ends are removed. The quadrant assembly is improved and with the locking pawl provides a positive locking feature in the latched position, that can be easily checked. An added torsion spring provides constant pressure on the hook and linkage in the unlatched position. The aft elevator power release cable assembly is replaced with two cables; the center elevator power release cable and the aft elevator power release cable. The center and aft power release cables have a disconnect just forward of the elevator power mechanism. Paint stripes on the disconnect hook and idler cranks provide a visual indication of power mechanism engagement when observed from the ground. (See Figure 2-4.)

2.7.6 Trim Position Indicators. The position of the rudder trim and the horizontal stabilizer are shown on the trim position indicators (Figures FO-1 and FO-2) at the forward end of the right-hand console. The rudder trim position indicator is graduated in 1° units to the left and right of 0. Total travel of the rudder trim position indicator represents 7° of rudder travel left and right of center. All even degree marks are numbered from 0 through 6.

The scale for horizontal stabilizer position is graduated in 1° units from down (DN) through UP. All even numbered degree marks are identified numerically.

2.8 LANDING GEAR SYSTEM

The tricycle landing gear is retracted and extended by utility hydraulic system pressure during normal operation. The main gear retracts up and forward and the wheels rotate to fit flush into the wheelwells in the wings. The nosegear also retracts up and forward. The nose strut telescopes to allow the nosewheel to fit into the nosewheel well. When retracted, the landing gear is held up by utility hydraulic pressure and in the case of hydraulic system failure, the gear rests on the landing gear doors which are held closed by mechanical latches. For emergency extension of the landing gear, the door latches are manually released by the pilot.

2.8.1 Landing Gear Handle. A landing gear control handle (Figures 1-4 and 1-5), located forward of the left cockpit rail in both cockpits controls normal operation of the landing gear system. The landing gear control handles have two positions, UP and DOWN, and are mechanically linked to the landing gear control valve.

A safety downlock solenoid (located only in the front cockpit) is actuated by depressing the latch lever guard on either gear handle, allowing the gear handle to be moved to the UP position.

CAUTION

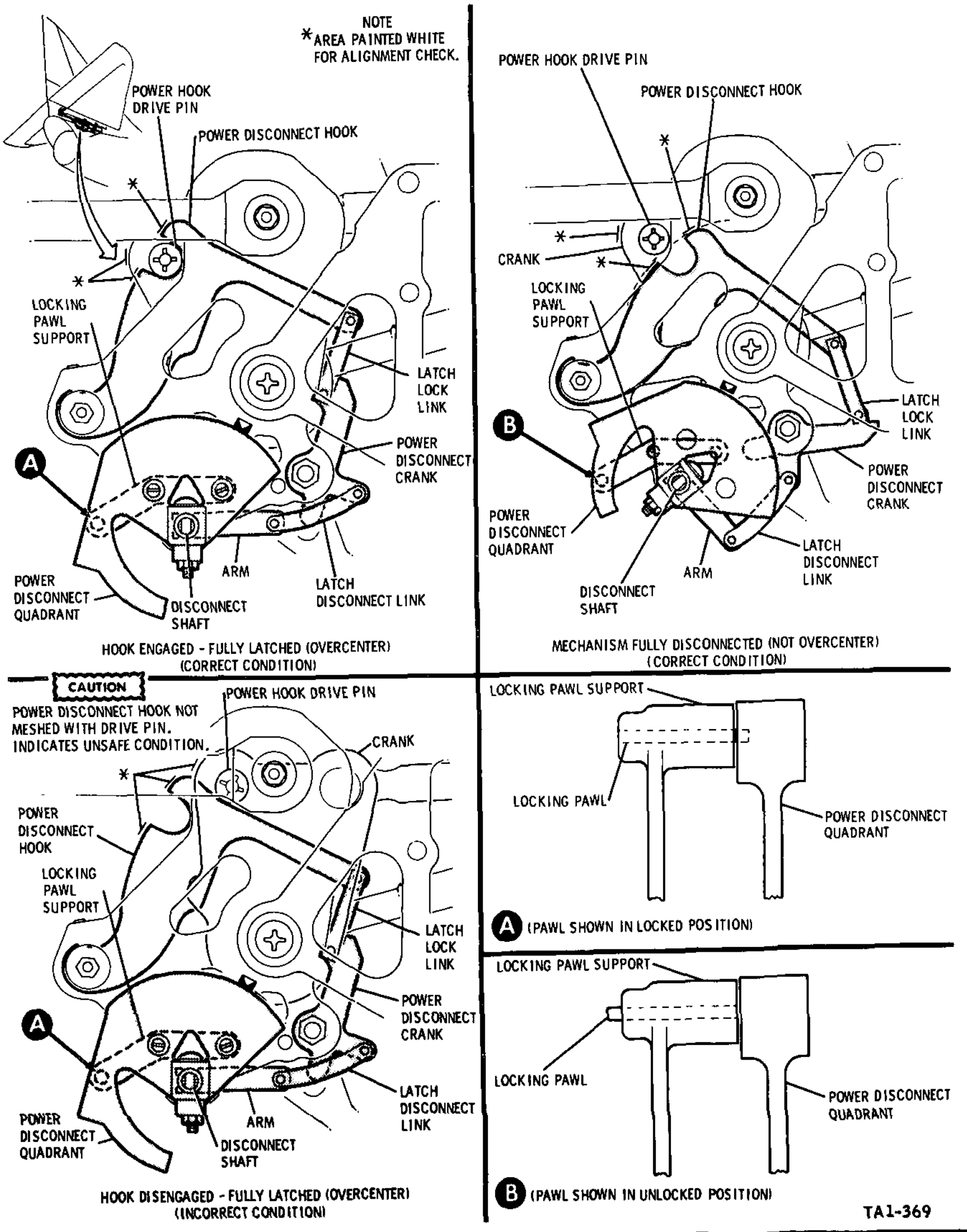
If the downlock release latch is not seated with the landing gear up and locked, inadvertent landing gear extension during accelerated maneuvers is possible.

Note

If electric power to the safety downlock solenoid fails, the downlock release latch (located in the front cockpit) (Figure 1-4), can be manually moved aft. The landing gear control handle can then be moved UP or DOWN to accomplish ground maintenance or airborne emergency gear-up or gear-down actuation.

A warning light in the wheel-shaped landing gear control handles will light when the handles are moved to either of their two positions. The light will remain on until the wheels are locked in either the up or down position. The position of the wheels is shown on the wheels and flaps position indicator on the left console. A flasher-type wheels warning light (Figures 1-4 and 1-5) to warn the pilot of a possible unsafe condition, is installed beneath the upper left side of the glareshield in each cockpit adjacent to the FUEL warning light. The WHEELS warning light flashes when the throttle is retarded below 91 to 96 percent, if the wing flap handle is not in the UP detent and the landing gear is up or unsafe.

The front cockpit landing gear handle has a safety lock in the DOWN position to prevent movement of either handle to the UP position when the aircraft is on the ground. This safety downlock is released by a solenoid that is energized when the left main landing



Effectivity: All TA-4F and TA-4J aircraft reworked per A-4 AFC 530.

Figure 2-4. Elevator Power Mechanism

gear strut extends during takeoff. The gear handle in either cockpit can be raised once this safety downlock is retracted. The serrated end of the downlock release latch, located adjacent to the front cockpit landing gear control handle, must be moved aft to override the safety downlock and enable raising the landing gear while on the ground.

Note

> If landing gear handle cannot be raised and angle-of-attack (AOA) indexer does not come on immediately after takeoff, a possible retraction release switch malfunction is indicated.

2.8.2 Emergency Landing Gear System. The landing gear may be lowered manually by use of the emergency landing gear release handle, located in both cockpits (Figures 1-4 and 1-5) in the event of utility hydraulic system failure. The emergency landing gear release handle is located on the left side of the cockpit above the left console. To use the emergency landing gear system, place the landing gear control handle DOWN and pull the emergency landing gear release handle. The landing gear doors unlatch, allowing the landing gear to drop into the airstream. The landing gear extends and locks by a combination of gravity and RAM air force.

CAUTION

> Damage may be sustained by the bulkhead brackets and the landing gear handle ratchet, if the landing gear handle is raised after the emergency landing gear release T-handle is pulled.

2.8.3 Wing Flaps. Split flaps are installed on the trailing edges of the wings. The flaps are hydraulically actuated by a single cylinder and are mechanically controlled from either cockpit by the wing flap handle (Figures FO-1 and FO-2) located on the left console outboard of the throttle. The wing flaps may be extended to 50° by moving the flap handle to DOWN, or stopped at any intermediate position by placing the flap handle at STOP. When UP is selected, the flaps will retract fully. The position of the flaps is shown on the flaps position indicator. A relief valve in the wing flap system allows the flaps to blow back and prevent structural damage when the airloads cause the hydraulic pressure within the actuating cylinder to exceed the pressure at which the relief valve opens. This automatic retraction will begin at approximately 230 KIAS.

Note

> The flaps will not return automatically to the extended position after blow back if the flap handle is in the STOP position.

2.8.4 Wheels and Flaps Position Indicators. The position of the landing gear and wing flaps is presented on the wheels and flaps position indicators (Figures FO-1 and FO-2) located on the left console. When the wheels are down and locked, the image of a wheel appears in a small window provided for each wheel on the instrument. When the landing gear is up and locked, the word UP appears in each window. During the period when the landing gear is transient, or when the wheels are not locked in position, diagonally striped signals are shown in the windows. The position of the wing flaps is shown in units with respect to the wing. Each unit corresponds to one-quarter of the total amount of extension possible. Labeled positions are UP, 1/2, and DOWN.

2.9 NOSEWHEEL STEERING

The nosewheel steering system consist of stick control buttons actuated from either cockpit, normal-emergency off steering switches, a solenoid-operated hydraulic shutoff valve located on the nose gear actuator, nosewheel steering actuator, and associated electrical components.

Steering may be engaged from either cockpit by actuation of the stick control button provided both NORM-EMER OFF steering switches are in the normal position, the landing gear is down, normal utility hydraulic pressure exists, normal electrical power exists, and weight is on the main landing gear. The nosewheel steering system is enabled electrically through the retraction release switch on the port main landing gear, and hydraulically from the GEAR DOWN pressure available through the nose gear actuator. Hydraulic pressure is supplied through the solenoid-operated hydraulic shutoff valve at 3,000 psi to the nosewheel steering actuator which is electrically commanded to hydraulically position the nosewheel left or right.

When nosewheel steering is engaged, the nosewheel position is a function of rudder pedal displacement. The degree of displacement is electrically transmitted to a servo on the nosewheel steering actuator, driving the nosewheel to a maximum of 45° to either side of center. Once the nosewheel is driven beyond 45° of center, it must be brought within 45° of center using differential braking before electrical and hydraulic control can be regained.

CAUTION

Activation of the nosewheel steering system is not recommended during landing/takeoff roll unless normal rudder/brake control is not effective. Less rudder is required to counteract crosswind or drift with nosewheel steering engaged. If nosewheel steering is engaged while the rudder is deflected to counteract crosswind or drift, the rudder pedal pressure should be decreased simultaneously with or immediately after engagement. If the same amount of rudder deflection is maintained after nosewheel steering is engaged, it will cause swerving and/or possible loss of directional control.

Any amount of left or right rudder trim will proportionally limit the nosewheel travel in the direction of rudder trim. This occurs as a result of repositioning the neutral or center point of the rudder bungee, which mechanically limits the amount of nosewheel steering direction available.

2.9.1 NORM-EMER OFF Steering Switches. These switches, located outboard of each throttle, allows the nosewheel steering system to be disabled electrically. In case of a malfunction or emergency, placing the NORM-EMER OFF steering switch in the EMER OFF position eliminates electrical power to the system. With normal utility hydraulic pressure available, the nosewheel steering system hydraulic pressure will be maintained to the hydraulic shutoff valve at 3,000 psi with the landing gear down.

WARNING

In the EMER OFF position the switch eliminates the ability to compensate for a hydraulically-induced nosewheel displacement.

On aircraft without AFC 626, with the arresting hook handle out of the up position and the NORM-EMER OFF steering switch in the NORM position, the nosewheel is electrically commanded and hydraulically centered.

WARNING

Because of the location of the activating switches, the centering function can become activated with the arresting hook handle slightly out of the full up position. The situation could be complicated by a nosewheel that is not rigged to true center, resulting in unexpected swerving during takeoff or landing roll.

Note

- Although the nosewheel is electrically and hydraulically centered with the arresting hook down and the NORM-EMER OFF switch in the NORM position, nosewheel steering is available by actuating the nosewheel steering stick button.
- On aircraft with AFC 626, the nosewheel steering is free castoring regardless of hook handle position provided the nosewheel steering stick button is not depressed.
- With the NORM-EMER OFF steering switch in the EMER OFF position and the arresting hook down, the nosewheel should caster freely.

2.10 WING SPOILERS

The spoilers are hydraulically actuated and electrically controlled by the spoiler ARM-OFF switch (Figures FO-1 and FO-2) located in both cockpits on the left console outboard of the throttle. Utility hydraulic pressure will extend the spoilers only when: (1) the ARM-OFF switch is positioned to ARM in either cockpit, (2) the left main landing gear oleo is compressed, and (3) the throttle position is below 70-percent rpm.

WARNING

- Spoilers operate rapidly and with great force. Be certain that all personnel are clear of area prior to spoiler actuation.
- After takeoff ensure the spoiler arm switch is OFF. An underserviced left strut compressed in the wheelwell or a malfunctioning retraction safety solenoid can cause an in-flight actuation of the spoilers when other actuation conditions are met. The spoilers should not be armed if the AOA indexer fails to light after lowering the landing gear. Arm the spoilers only after the aircraft is firmly on the runway. If armed spoilers are required, engine rpm must be maintained above 70 percent to preclude inadvertent spoiler actuation.

In-flight actuation of the spoilers is not likely because of the solenoid switch on the left landing gear which permits spoiler operation only when the weight of the aircraft is on the main landing gear strut. The spoilers will immediately dump to a faired position during a touch-and-go when the throttle position is advanced above 70-percent rpm. The spoilers are inoperative during use of emergency power.

Note

When spoilers are actuated during engine idle rpm ranges, the hydraulic pressure decreases, which may cause the utility system ladder light to flash momentarily.

2.11 SPEEDBRAKES

Two flush-mounted speedbrakes (Figure 1-2), one on each side of the fuselage, provide deceleration during flight. The speed brakes are hydraulically operated and electrically controlled from either cockpit by a three-position speedbrake switch located on the inboard side of the throttle grip (Figures FO-1 and FO-2). The switch is spring-loaded to the OFF position. Momentary operation of the switch in either cockpit to the OPEN or CLOSE position will cause the speedbrakes to open or close completely; intermediate positions cannot be selected. The pilot selecting speedbrakes open will control the speedbrake operation in the even of simultaneous operation of the speedbrake system.

The SPD BRK OPEN warning light, located on the caution panel (Figures FO-1 and FO-2) lights whenever the speedbrakes are in any position other than fully closed. A blowback feature allows the speedbrakes to begin closing when the airload against them causes the hydraulic pressure in the actuating cylinders to exceed the pressure at which the blowback relief valve opens (3,650 psi), thus preventing damage to the speedbrake system. The speedbrakes begin to blow back at an indicated airspeed of approximately 490 knots. The speedbrakes will not open fully above 440 KIAS.

Three flush-mounted JATO hooks are attached to each speedbrake for mounting a JATO bottle when required for assisted takeoffs.

Note

When JATO bottles are attached to the speedbrakes, an interlock in the speedbrake electrical circuit prevents the speedbrakes from opening when the speedbrake switch is actuated.

2.11.1 Speedbrake – Elevator Interconnect. Speedbrake-elevator interconnect springs minimize aircraft pitchup during speedbrake actuation by automatically providing nosedown elevator when the speedbrakes are opened.

2.11.2 Emergency Speedbrake Control. The aircraft is equipped with an emergency speedbrake solenoid valve override control. The emergency speedbrake control (Figure FO-1) is a push-pull knob located at the aft end of the left console in the forward cockpit only. The emergency speedbrake control will open or close the speedbrakes in the event of dc electrical failure or failure of one of the speedbrake control valve solenoids. The emergency speedbrake control knob is held in a NEUTRAL position by the action of a spring bungee and must be pulled up or pushed down to open or close the speedbrakes, respectively.

In the event of electrical failure, the speedbrakes may be opened or closed by momentary operation of the emergency speedbrake push-pull control knob.

Note

When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft, resulting in airframe damage.

2.12 WING SLATS

Aerodynamically controlled slats are installed on the leading edges of the wings to improve airflow characteristics over the wing surfaces at high angles of attack, primarily during approach and landing. The wing slats will open and close independently and automatically as the aerodynamic loading on them dictates. Because so many variables – airspeed, gross weight, and applied load factor – affect the operation of the wing slats, no fixed airspeeds can be established as the points at which the slats begin to open or close. In general, however, they begin to open at some airspeed below 200 knots, and are fully opened at stalling speed.

2.12.1 Barricade Engagement Detents. Three barricade engagement detents (Figure 1-3) are installed along each leading edge to ensure proper barricade engagement. Two of the detents are spaced evenly on each wing slat; the third is on the leading edge of the wing, inboard of the slat.

2.13 VORTEX GENERATORS

To help overcome buffet and random wing drop at high altitude, vortex generators, which are small metal vanes set at various fixed angles relative to the normal airflow, are installed along the span of the slats and on the upper surface of the wing.

2.14 ARRESTING HOOK

An externally mounted arresting hook (Figure 1-3) is installed on the lower aft fuselage. Retraction and extension of the hook are accomplished by a pneumatic-hydraulic holddown cylinder in the aft engine compartment. The holddown unit is essentially a reservoir which is divided into two chambers by a relief valve and orifice arrangement. The upper chamber is filled with hydraulic fluid to the full level and then charged with compressed air to 900 ±50 psi with the hook retracted. The lower chamber contains the actuating piston which is attached to the arresting hook. Utility hydraulic system pressure is applied to the lower side of the piston to effect retraction of the arresting hook, which is then held in the retracted position by a mechanical latch. Compressed air pressure and the weight of the arresting hook cause extension when the latch is released. With the arresting hook extended, the relief valve and orifice provide snubbing action to keep the hook on the deck during arrested landing by restricting the flow of nitrogen between the lower and upper chambers of the holddown unit when external forces tend to bounce the hook toward the retracted position.

2.14.1 Arresting Hook Control. An arresting hook handle in each cockpit on the right cockpit rail (Figures 1-4 and 1-5) controls the operation of the arresting hook. When the handle is moved to DOWN, the arresting hook is manually unlatched, allowing pressure from the holddown unit and gravity to extend the hook.

CAUTION

The arresting hook handle should be firmly placed into position, not flipped nor slammed.

A light in the hook handle will come on when the handle is moved to DOWN and will go off before the hook reaches the fully extended position. The UP position of the handle manually positions the arresting hook control valve so that utility hydraulic fluid at 3,000 psi flows into the lower part of the arresting hook holddown cylinder overriding the air pressure, causing the hook to be retracted and latched against the lower surface of the fuselage. The arresting hook system employs a "fail-safe" feature which allows the hook to be extended in the event of cable system failure or hydraulic pressure failure.

If the utility hydraulic pressure is lost, compressed air pressure and the weight of the arresting hook will enable the hook to extend when the hook handle is moved to the down position. However, the pilot cannot retract the arresting hook without hydraulic pressure.

If the arresting hook control cable should part, releasing the uplatch will allow the hook to move to the down position.

Note

- On aircraft reworked per A-4 AFC 429, placing the hook handle in the down position centers and hydraulically locks the nosewheel.
- On aircraft reworked per A-4 AFC 626, placing the hook handle out of the up position no longer centers and hydraulically locks the nosewheel.

2.15 WHEELBRAKES

Dual-disc, spot-type brakes are installed on the main landing gear. The brake system includes a separate hydraulic reservoir (Figure FO-5) located within the contoured area of the canopy aft of the rear cockpit. Toe pressure on the upper half of the rudder pedals actuates the master brake cylinders to provide the necessary hydraulic pressure for braking action.

Note

The wheelbrakes are a completely independent hydraulic system. The pilot should realize that he will have brakes even though he lands with complete hydraulic system failure.

2.16 COCKPIT ENCLOSURE

The cockpit enclosure consists of a fixed, three-piece windshield and a hinged "clamshell" canopy. The two windshield side panels are made of two stretched acrylic plies with a layer of vinyl between, and the center panel is constructed of alternating layers of glass and vinyl.

2.16.1 Canopy. The canopy (Figure 1-2), when closed and locked, provides a pressurized enclosure to ensure proper environmental conditions during flight. The canopy is hinged behind the aft cockpit and is attached to a hydraulic actuator located between the cockpits. Under normal operating conditions, the utility hydraulic system actuates the canopy. A hand pump is provided (Figures 1-4 and 1-5) to actuate the canopy when utility system pressure is not available.

WARNING

Prior to opening or closing the canopy, a positive ICS check will be made between pilots, stating CANOPY COMING OPEN/CLOSED.

CAUTION

- Prior to opening or closing the canopy, both pilots must ensure that all canopy contact areas are clear and that all loose gear has been stowed to preclude damage from foreign objects.
- Canopy must be fully closed with relative wind in excess of 60 knots.

2.16.2 Canopy Controls. Canopy controls consist of two cockpit canopy control handles, a cockpit canopy hand pump actuating handle, an external canopy control handle, and an external canopy hand pump actuating handle.

2.16.2.1 Cockpit Canopy Control Handles. The canopy control handles, located on the left console in both cockpits (Figures FO-1 and FO-2), are mechanically linked to the canopy operating mechanism. Each control handle is spring locked into a detent in each of two positions, LOCKED or UNLOCKED. With the handle in the UNLOCKED (rear) position, forward or aft movement of the handle controls hydraulic pressure to close or open the canopy. The speed of canopy movement varies with the amount of handle movement. An interlock prevents the handle from being moved to LOCKED before the canopy is fully closed. The canopy is mechanically stopped approximately 8 inches, at the actuator, before reaching the fully closed position. The canopy must be raised approximately 2 inches from the safety stop and may then be lowered to fully closed. When the canopy is fully closed, the handle can be moved to the LOCKED position. As the handle is moved to LOCKED, the latch hooks engage to hold the canopy in place. Safe locking is accomplished only after the handle has moved fully forward into the detent position.

CAUTION

If the control handle load does not drop off as the handle is moved to LOCKED, canopy rigging must be checked prior to flight.

Aircraft reworked per A-4 AFC 358 are equipped with a canopy latch lock indicator located on the forward end of the left cockpit rail. Figure 2-5 illustrates the position of the indicator (pin) when the canopy is unlocked and locked. The canopy latch lock indicator, installed on aircraft reworked per A-4 AFC 358 (Figure 2-5), is replaced by a backup "rifle-bolt" locking mechanism on aircraft reworked per A-4 AFC 419, Increment II. The rifle-bolt locking mechanism, located along the left-hand cockpit rail (Figure 2-5), ensures that the normal canopy locking system is secured in the closed and locked position. The canopy warning light is controlled by a relocated microswitch that will allow an indication of fully closed and locked (light goes out) only after the canopy is closed and locked, using normal canopy controls, and after the rifle-bolt locking mechanism is moved forward and rotated into its locked position (aft cockpit: handle horizontal; front cockpit: handle down).

Note

- The canopy control handles (on forward and aft), are spring-loaded into detents in the forward position only to prevent inadvertent unlocking.
- Aircraft equipped with AFC 551 have a canopy unlock warning tone that will sound if the canopy rifle bolt is not in the locking detent and the throttle is advanced above 70 percent.
- The canopy warning light is controlled by the microswitch under the front rifle bolt handle, and the canopy unlock warning tone is controlled by the microswitch under the aft rifle bolt handle.

Aircraft reworked per A-4 AFC 419 Increment I include a CANOPY unlock warning light (Figures 1-4 and 1-5) located under the left side of the glareshield in both cockpits. When the canopy is fully closed and locked, the warning light goes off, indicating that the canopy latch hooks are engaged to hold the canopy in place. On aircraft reworked per A-4 AFC 345, the CANOPY unlock warning light should come on when the master TEST switch is depressed.

TA-4J aircraft BuNo. 156892, 158073, and subsequent, and all TA-4 aircraft reworked per A-4 AFC 471 are equipped with a canopy operating system which has separate controls for raising and lowering the canopy, and locking the canopy. The control handles in aircraft so equipped are easily identified since the handles are only 5 inches long as opposed to 8-1/2 inches long in the previous system. The handles serve only to operate the canopy actuator valve, and are completely separate from the canopy latch bar mechanisms. The canopy handles operate in the same manner as the dual function control system in that the control handles are actuated aft to raise the canopy, and forward to close the canopy. The forward (to lower) position of the handle must be held forward to lower the canopy and is spring-loaded to the neutral (stop) position. After the canopy is lowered to the closed position, it is necessary to move the locking mechanism (rifle-bolt) to the forward position to extend the canopy latch locks to the locked position. The forward and down position of the rifle-bolt also allows

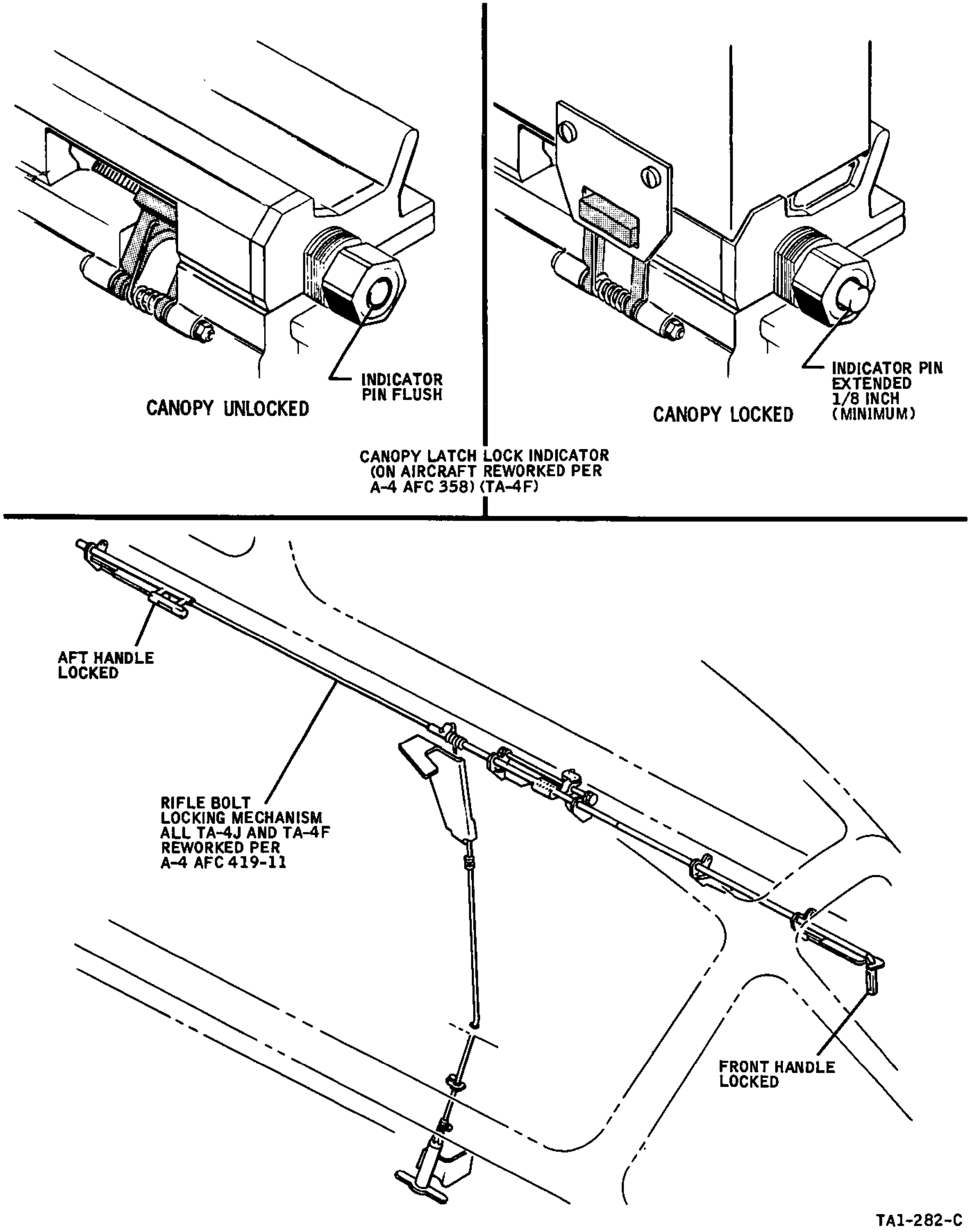


Figure 2-5. Canopy Locking and Indicator Mechanisms (Sheet 1 of 3)

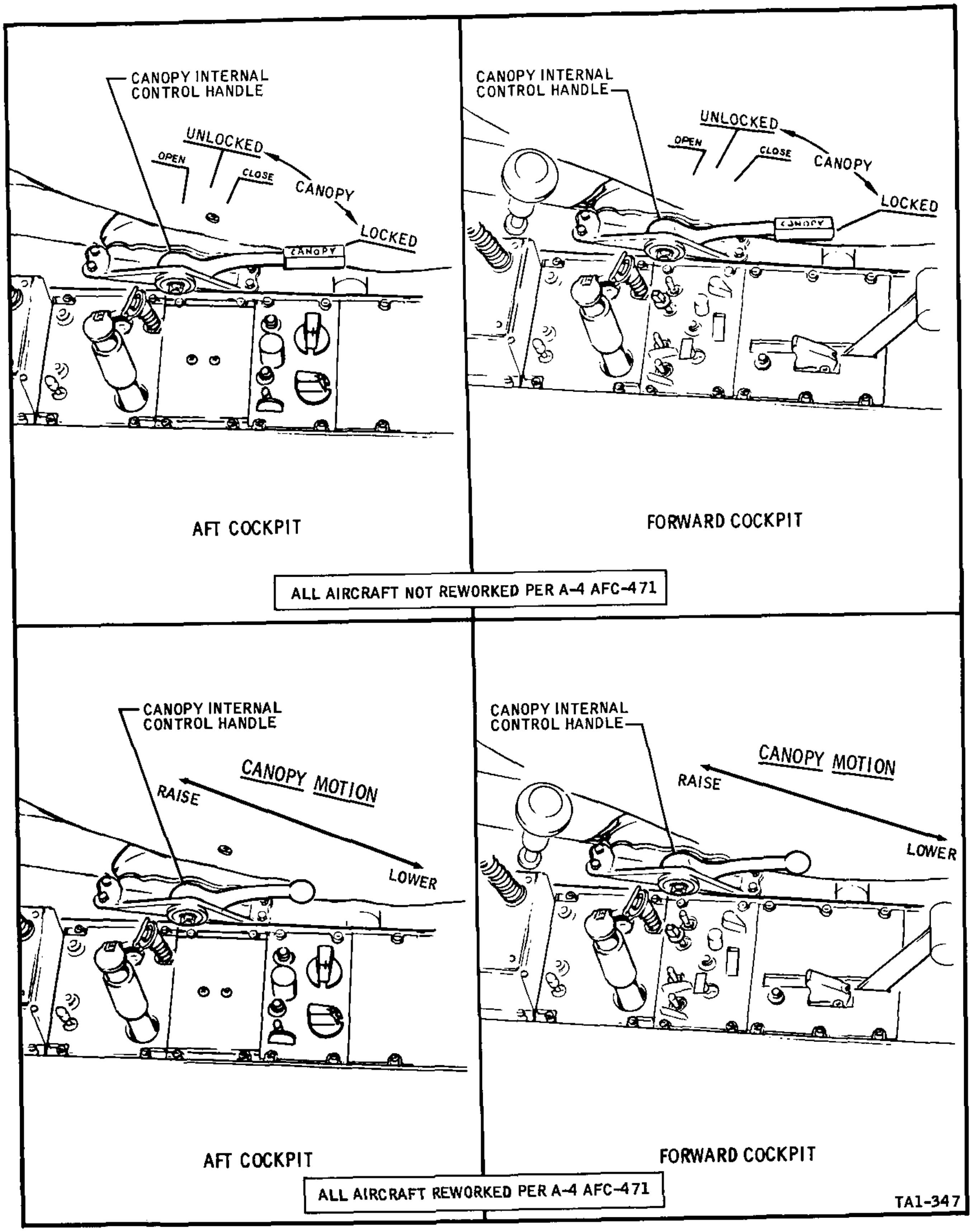
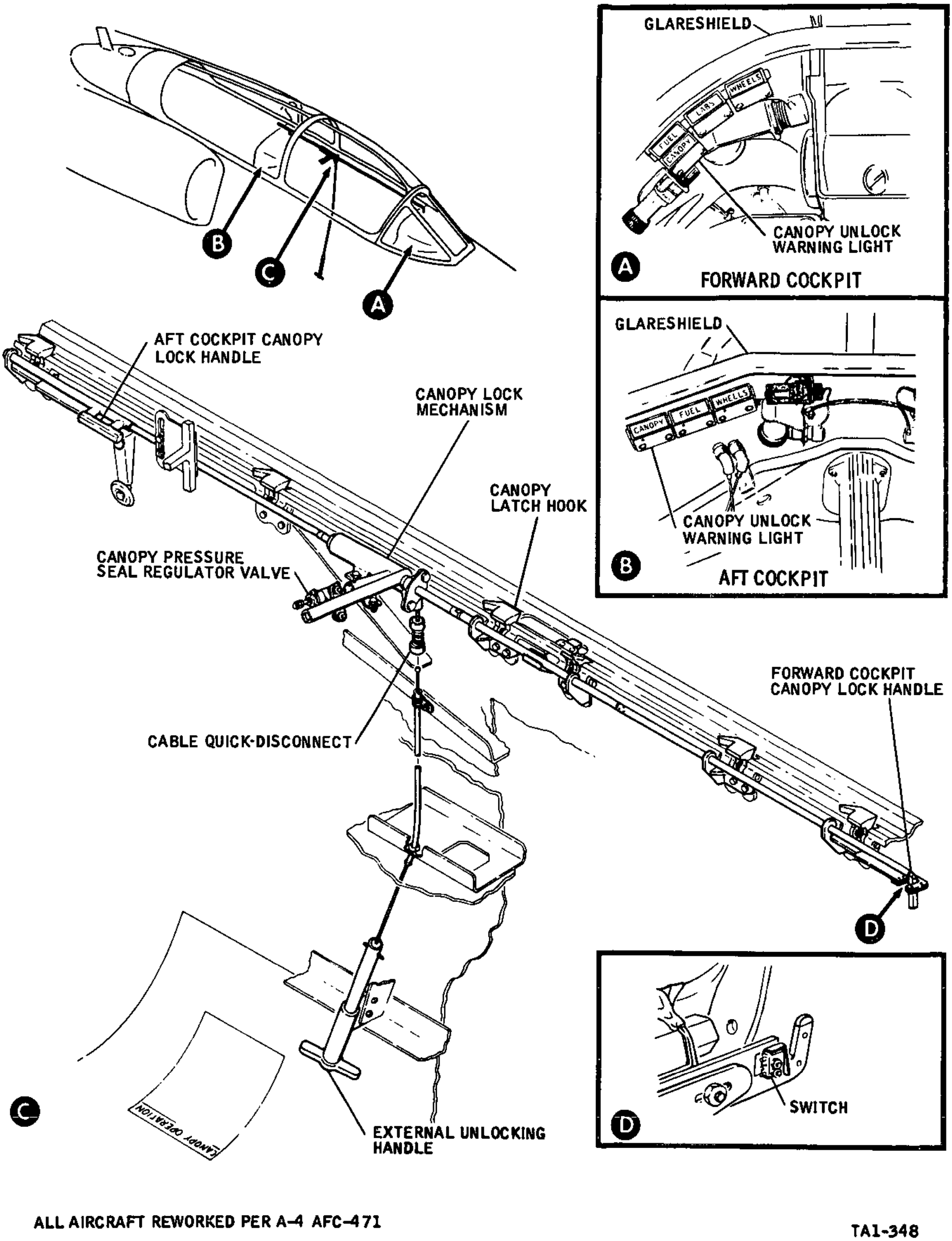


Figure 2-5. Canopy Locking and Indicator Mechanisms (Sheet 2 of 3)



ALL AIRCRAFT REWORKED PER A-4 AFC-471

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Figure 2-5. Canopy Locking and Indicator Mechanisms (Sheet 3 of 3)

the canopy seal to inflate and extinguishes the canopy warning light.

CAUTION

- Unless the canopy latch bar actuating assembly is in the forward, closed position, and the canopy warning light is out, the canopy is not secured to the aircraft and may be lost as airspeed increases to approximately 240 KIAS.
- In the event the aircraft becomes airborne without the rifle-bolt in the forward closed position, and airspeed is less than 240 KIAS, depressing the canopy control handle will apply normal utility hydraulic to the canopy actuating system but will not ensure that the canopy will remain with the aircraft.
- Airspeed must be decreased until the canopy can be locked or a landing can be effected.

2.16.2.2 Cockpit Canopy Handpump Handle. The canopy handpump actuating handle, located alongside the forward cockpit right console (Figure 1-4), is attached to hydraulic pumps that provide pressure to actuate the canopy when utility system pressure is not available. Approximately 50 single strokes of the pump handle are required to open the canopy.

Note

The canopy control handle must be used in conjunction with the hand pump in the same manner as with the utility hydraulic system.

2.16.2.3 External Canopy Control Handle. The external canopy control handle, located behind the canopy controls external access door on the left side of the fuselage forward of the wing (Figure 1-3), is mechanically connected to the cockpit canopy control handles. To operate the canopy, the handle must be pulled down to engage a control crank and then moved to and held in the position selected for canopy operation. To open the canopy, pull the handle down and outboard; to close the canopy, pull the handle down and push inboard. The external canopy control handle may be used with either handpump hydraulic pressure or utility hydraulic system pressure.

Note

Aircraft reworked per A-4 AFC 419-II are equipped with a rifle-bolt locking mechanism. To open the canopy externally, the canopy override (rifle-bolt) external latch handle must be pulled down and held approximately 3/4 inch while pulling the external canopy control handle down and outboard. The canopy may then be opened, using either utility hydraulic system pressure or handpump hydraulic pressure.

2.16.2.4 External Canopy Handpump Actuating Handle. The external canopy handpump actuating handle, located behind the canopy controls external access door on the left side of the fuselage forward of the wing (Figure 1-3), is connected with the cockpit canopy handpump actuating handle to provide hydraulic pressure for canopy operation when utility hydraulic system pressure is not available. To operate the handpump, pull the external actuating handle into the extended position and pump.

2.16.3 Interior Canopy Jettisoning

2.16.3.1 Canopy-Jettison Handle. The canopy may be jettisoned in any position from closed to fully open, by pulling the canopy-jettison handle above the right console in either cockpit (Figures 1-4 and 1-5). A pull of 20 to 35 pounds on the handle fires an initiator, which causes canopy latch thrusters to fire and unlock the canopy. After unlocking the canopy, excess gas from the thrusters fires the canopy remover which is located within the canopy actuator assembly. The remover forces the canopy open to rotate aft about the hinge points to jettison free of the aircraft. The handle will move approximately 1/2 inch and then fall free after the cartridge has been fired.

WARNING

The canopy control handles, unless reworked per A-4 AFC 471, will "snap" rearward as the canopy is jettisoned. Keep hand and arm clear of this area to avoid possible injury.

If the canopy fails to jettison ballistically by whatever means is employed, it must be aerodynamically removed. Normally, with airspeed above 120 knots, the canopy must be removed by unlocking the rifle bolt and moving the canopy control handle to the OPEN position (RAISE position with AFC 471 incorporated). If the canopy will not raise and is not jettisoned by this means, an increase in airspeed to 240 knots will be required to accomplish jettison.

Note

- The canopy control handle will not snap rearward if the canopy is jettisoned aerodynamically by use of the canopy control handle.
- During flight, if the canopy latches start to retract (airflow is noted around the canopy seal) or the canopy control handle is observed to move aft, immediately push the canopy control handle forward holding it until landing is made. Immediately slow aircraft below 200 knots.
- On aircraft reworked per AFC 593, the canopy actuator hydraulic locking feature only occurs after the canopy has physically left the aircraft. On aircraft without AFC 593 the canopy could be hydraulically locked on the aircraft if certain failures occurred in the jettison/ejection sequence.

2.16.3.2 Canopy-Jettison Safety Pins. To prevent the canopy remover cartridge from being inadvertently fired while on the ground, safety pins are provided for the canopy-jettison system and are connected by a red streamer stenciled REMOVE BEFORE FLIGHT.

2.16.4 Exterior Canopy Jettisoning. An emergency canopy-jettison handle (Figure 14-15) is located on each side of the fuselage, just forward of the wing root, for jettisoning of the canopy during rescue. The control handle, marked PULL CANOPY JETTISON, is installed in a recess behind a springloaded door, indicated by a RESCUE arrow. When the door is pushed in, the handle extends and may be grasped and pulled to fire the canopy actuator cartridge. The canopy will jettison regardless of position.

WARNING

Jettisoning the canopy arms the seat. Use extreme care when removing the pilot.

2.16.4.1 Underwater Canopy-Jettison Relief Valve. The aircraft is equipped with an underwater canopy-jettison relief valve which will allow water to flow into the cockpit after ditching. The relief valve is located on the cockpit floor below the canopy actuator cylinder.

The underwater canopy-jettison relief valve is a panel that is designed to open when the outside water pressure head is approximately 2 psi. The flow of water into the cockpit reduces the effective pressure head on the canopy.

The use of the canopy-jettison handle for quick exit from the cockpit is recommended in order to utilize the power of the canopy remover. The use of the canopy control handle and hand-operated hydraulic pump should be considered an alternative, or last resort, method of underwater canopy opening.

2.17 ESCAPAC 1G-3 EJECTION SEAT SYSTEM

The aircraft is equipped with two ESCAPAC 1G-3 ejection seats (Figure 2-7). The ESCAPAC 1G-3 utilizes rocket thrust to provide escape capability from zero speed and zero altitude throughout the entire aircraft flight profile except for unusual flight conditions such as inverted flight, steep angles of bank, or dives at low altitude. The seat accommodates a back-type parachute and a RSSK-8 series rigid seat survival kit and is designed to be compatible with an integrated torso harness.

An ejection seat control selector valve (Figure 2-6) is located in the forward cockpit on the bulkhead aft of the left console. The control valve has two positions, the selection of position normally being set prior to flight. When the lever on the valve is in the up position, the pilot in the forward cockpit can eject both seats, while the pilot in the aft cockpit can eject the aft

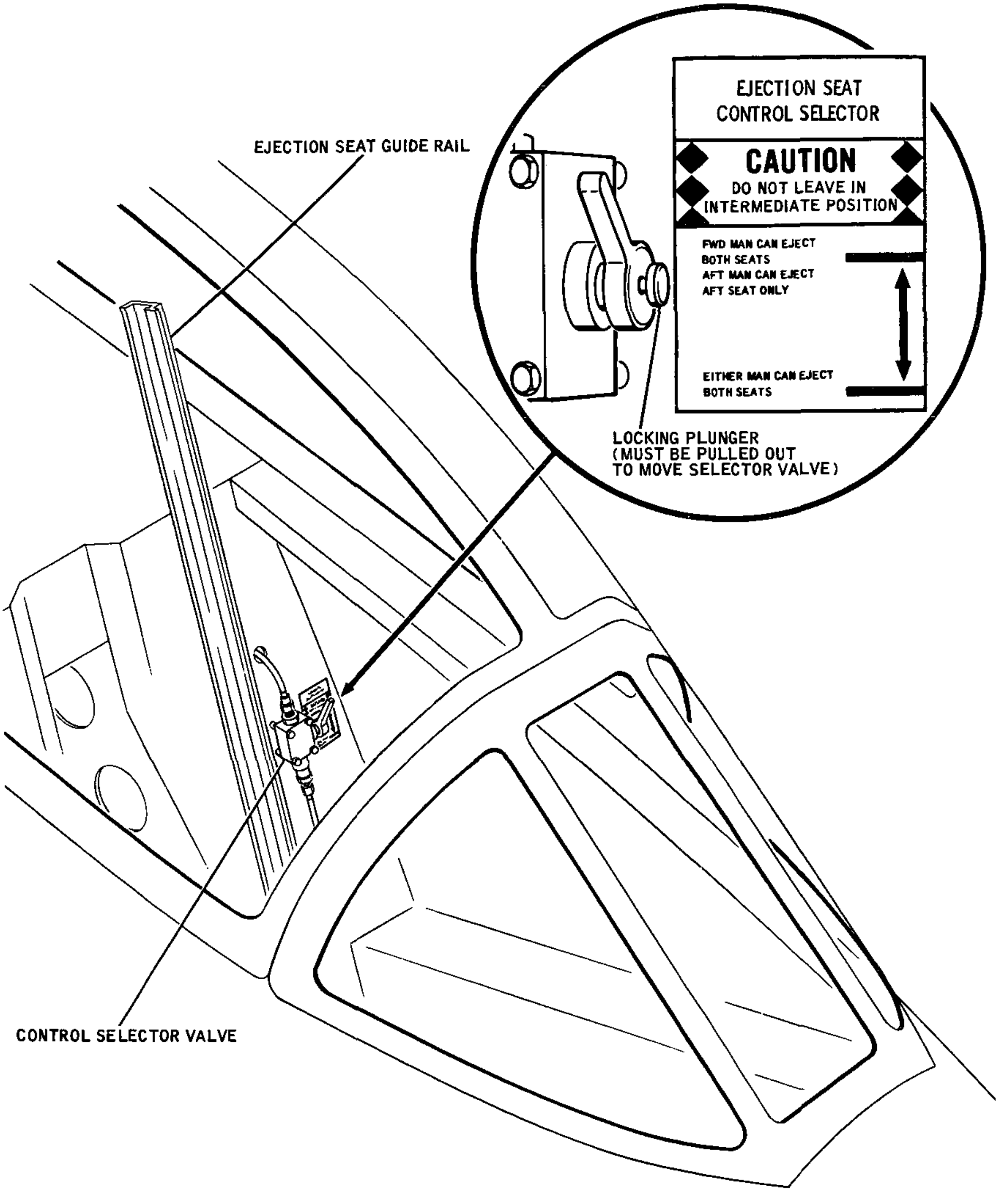
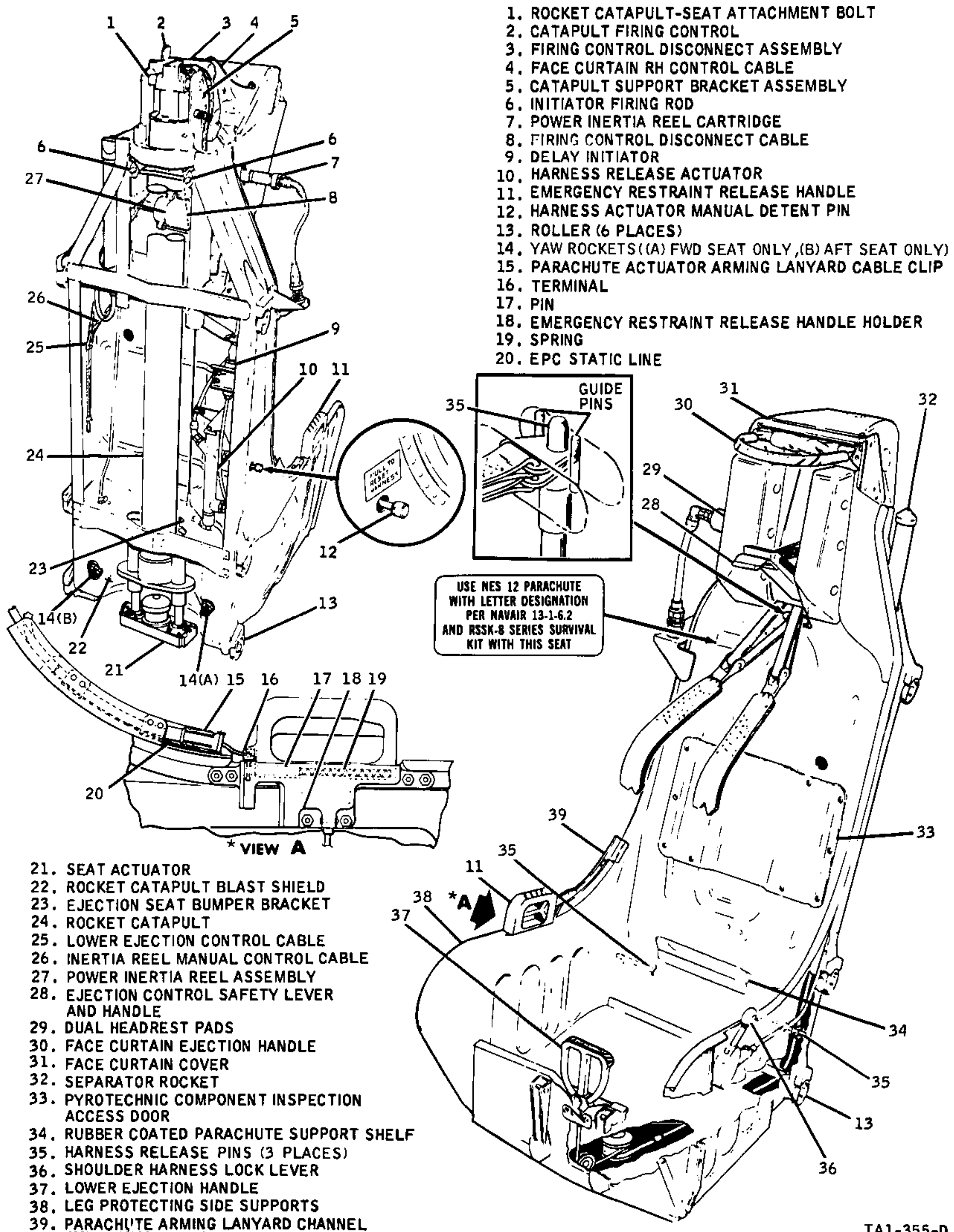


Figure 2-6. Ejection Seat Control Selector Valve



Reworked per ACC 285.

Figure 2-7. ESCAPAC 1G-3 Ejection Seat

seat only. When the lever is in the down position, both seats can be ejected, regardless of which pilot initiates the ejection sequence. The ejection sequence is started by pulling the face curtain over the helmet and past the face with both hands or by pulling the lower ejection handle on the seat between the pilot's legs. This fires the canopy remover cartridge, thereby jettisoning the canopy, and initiates the power retract mechanism on the inertia reel in both cockpits, pulling the occupants to proper sitting position for ejection. When the canopy is jettisoned, two hooks mounted on the aft portion of the canopy engage the two shackles of the canopy hook interlock assembly. As the canopy leaves the aircraft, the shackles are pulled and the attached cable, upon reaching full length, fires the interlock initiators.

When either or both initiators fire, the interlock behind each seat is removed enabling further travel of the ejection seat face curtain and/or the lower ejection handle(s), and subsequent rocket firing of either seat. The aft seat is ejected first to prevent blast injury from the forward seat. Normally, on initiation, the system ejects both seats automatically with the aft seat preceding the forward seat by 0.55 second. Each seat is ejected by the launch phase of the rocket catapult and propelled into a ballistic trajectory by the rocket motor. As each seat leaves the aircraft, the emergency oxygen cylinder and the emergency locator beacon are activated. The seat contacts a striker plate which trips the harness release actuator sear and fires the actuator after a 1 second delay. When the 1 second delay cartridge fires, the harness release actuator automatically releases the seatbelt, shoulder harness, and face curtain.

Refer to NAVAIR 01-40AVD-2-2.4 for detailed gas flow and schematic diagrams.

TA-4J aircraft BuNo. 158712, 159795, and subsequent are equipped with ESCAPAC 1G-3 ejection seats that incorporate a yaw thruster (Figure 2-7) to assure lateral separation of seats upon ejection. The yaw thruster ignites and burns for 0.1 second as each seat leaves the guide rails during ejection (Figure 14-8). Lateral seat separation is established as yaw thruster action rotates the aft seat to the portside of the longitudinal axis of the aircraft and the forward seat to the starboard side.

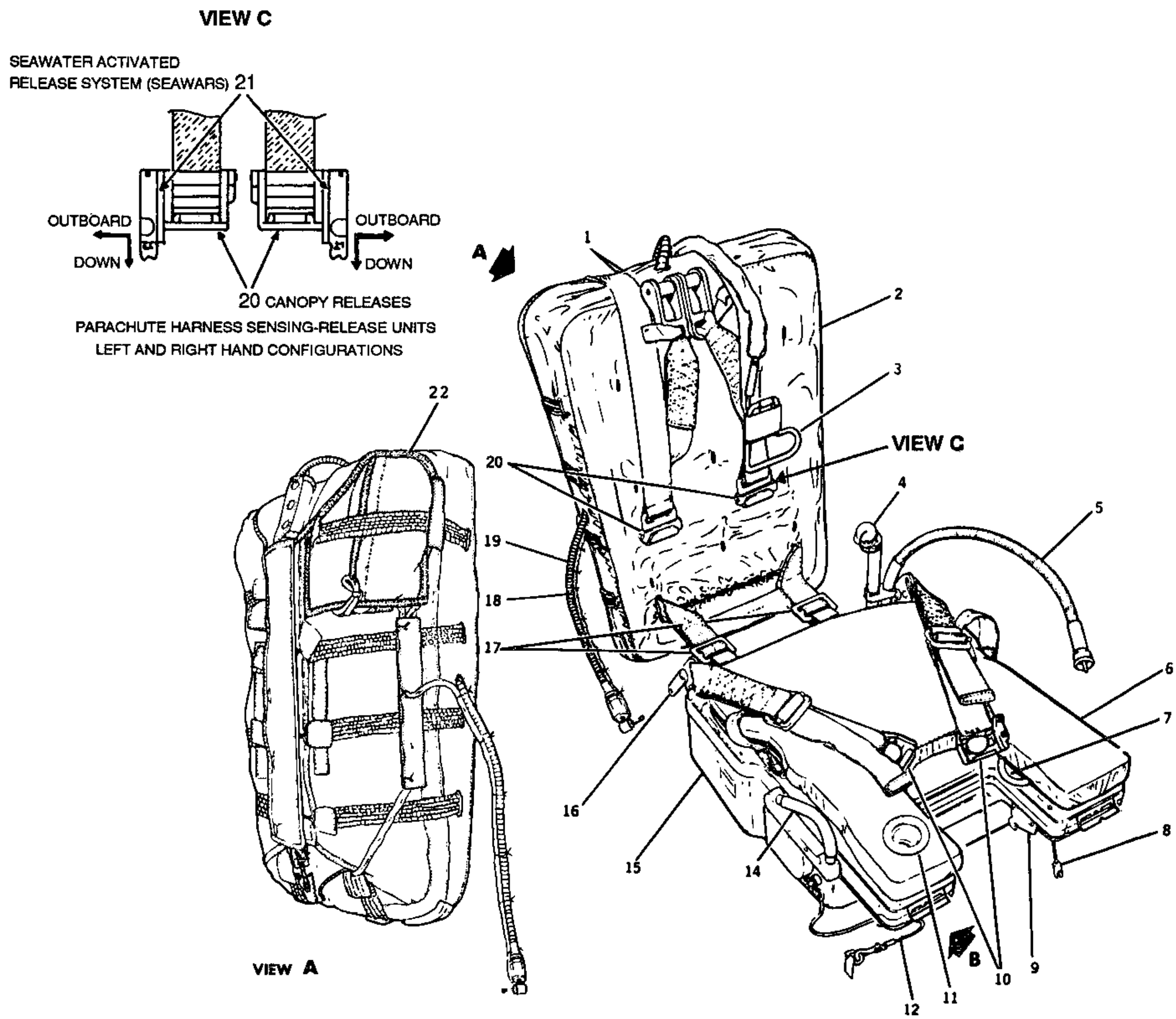
The ejection seat automatically provides positive seat separation by means of a man/seat separator rocket. The thrust of the rocket simultaneously separates and propels the seat away from the pilot, minimizing the probability of collision between the seat and the pilot or his parachute after man/seat separation.

The separator rocket is fired 0.52 second after start of the initial ejection sequence, forcibly separating the pilot from the seat. The barometric time-delay parachute actuator is armed when the pilot separates from the seat. This causes the ripcord pins to be pulled 0.75 second after pilot/seat separation, resulting in a fully inflated parachute canopy if ejection is below a preset altitude of 14,000 ±1,000 feet. At higher altitudes, an aneroid in the parachute release actuator delays opening of the parachute until the preset altitude of 14,000 ±1,000 feet plus 0.75 second delay is reached by freefall of the pilot.

An NES-12 semirigid contoured parachute pack contains a 28-foot flat circular parachute canopy with an automatic release actuator (opener), a tristage external pilot chute, and a ballistic spreading gun, canopy releases (Koch fittings), and SEAWARS. The parachute (opener) is armed at the time of seat/pilot separation. The opener is powered by a Mk 4, 0.75 second delay cartridge. An aneroid prevents parachute opener operation unless, or until, the crewman is below a preset altitude of 14,000 (±1,000) feet above sea level.

At the time of seat/pilot separation the external pilot chute (EPC) is deployed by a lanyard attached to the seat. The external pilot chute is a tristage design assuming various drag areas as a function of the airspeed/dynamic pressure at the time of chute filling. This is accomplished by breakaway attachments on the chute bridle. This feature provides a main parachute deployment force sufficient for fast deployment during a zero-zero ejection and yet precludes undesirably high loads during high-speed ejection conditions.

The external pilot chute is packed in a deployment pouch (Figure 2-8) stowed on the upper right aft corner of the parachute pack. When seat/pilot separation occurs, the relative motion between the seat and pilot arms the parachute actuator (opener) and extracts the external pilot chute from the deployment pouch. The external pilot chute helps orient the pilot to position facing his direction of travel and provides an effective drag force to immediately start deployment of the parachute canopy on release of the pack flaps by the actuator.



1. SHOULDER HARNESS ROLLER FITTINGS
2. NES-12 PARACHUTE
3. PARACHUTE RIPCORD
4. OXYGEN AND COMMUNICATION HOSE
5. OXYGEN AND COMMUNICATION HOSE (TO CONSOLE)
6. CUSHION
7. EMERGENCY OXYGEN (MANUAL) HANDLE (TUCKED UNDER PAD)
8. EMERGENCY OXYGEN LANYARD (AUTOMATIC)
9. SURVIVAL KIT HOOKS (2)
10. HIP HARNESS RELEASE FITTINGS
11. EMERGENCY OXYGEN PRESSURE GAGE
12. AN/URT-33 EMERGENCY RADIO BEACON AUTOMATIC ACTUATOR LANYARD
13. DELETED
14. MANUAL KIT RELEASE HANDLE
15. RSSK-8 SERIES SURVIVAL KIT
16. SURVIVAL KIT LUG (2)
17. NYLON HARNESS STRAPS
18. STATIC LINE (EPC)
19. PARACHUTE ARMING LANYARD
20. SHOULDER HARNESS FITTINGS (PARACHUTE RELEASE)
21. SEAWATER ACTIVATED RELEASE SYSTEM (SEAWARS)
22. EXTERNAL PILOT CHUTE (EPC)

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Figure 2-8. Parachute (Typical)

When the delay cartridge within the parachute actuator fires, the pack ripcord pins are pulled and the external pilot chute is released from the pack, allowing the pilot chute to deploy the main parachute canopy. As the main canopy is deployed, the cartridge within the ballistic spreading gun is fired by a static line just prior to line stretch. The resulting gas pressure propels slugs, that are attached to the skirt hem/suspension line junctions, outward to produce uniform, accelerated inflation of the canopy.

WARNING

- The pilot should check to ensure that the ballistic spreader gun safety pin is stowed in the safety pin pennant (red) on the forward side of the upper left hand parachute pack opening band. If ballistic spreader gun safety pin has not been removed, main canopy will not deploy.
- Automatic chute deployment will not occur if the pilot manually separates himself from the seat. The parachute ripcord must be pulled.

The RSSK-8 series rigid seat survival kit contains the emergency oxygen supply and survival equipment. Two hooks on the front of the survival kit must engage the two rollers on the forward edge of the seat. Hook engagement causes the survival kit to rotate straight forward out of the seat during seat/man separation.

During ejection the automatic actuation lanyard for the emergency oxygen system activates the reducer assembly. The pilot is then supplied emergency oxygen for descent. The radio beacon is also actuated by means of an automatic actuation lanyard upon seat ejection. The beacon will provide a continuous signal during descent.

After inflating the LPA, the pilot should pull the kit release handle for the kit. This unlocks the containers and the lower half falls away but remains attached to the dropline assembly. The liferaft, attached to the dropline, is automatically inflated.

Note

If the RSSK-8 release handle will not open the seat lid, an alternate method is available. Insert a mechanical pencil, pen, or knife point into one of the three inspection slots (located on each side and on the backside) and force the locking device toward the handle while pulling on the lid until it opens.

2.17.1 Functional Components

2.17.1.1 Harness-Release Actuator. The ESCAPAC 1G-3 ejection system, upon actuation of either ejection control, fires the canopy jettison, interlock release, and actuates the M99 rocket catapult initiator that is located on the bulkhead aft of the seat. The M99 rocket catapult initiator fires the rocket catapult and arms a Mk 11 delay initiator. After a set time delay the Mk 11 cartridge fires, initiating the M53 booster initiator which actuates a piston in the harness release actuator that performs three operations: rotates the bell-crank assembly to release the survival kit and emergency restraint harness, releases ejection controls from seat, and supplies bypass pressure to ignite the man/seat separator rocket. The piston rod is attached to the bellcrank by a clevis and pin.

As the piston is forced upward the clevis strikes the firing control disconnect assembly actuating the arm, releasing the ejection control handles from the seat. Actuation of the bellcrank, when rotated to the up position, retracts the shoulder harness disconnect cable to release the inertia reel straps, and retracts the survival kit retaining pins from the seat structure. As the piston nears the end of its upward travel, high-pressure gas is ported from the actuator cylinder to ignite the man/seat separator rocket.

On ESCAPAC 1G-3 ejection seats installed in TA-4J aircraft BuNo. 158712, 159795, and subsequent, the Mk 11 delay initiator and the M53 booster initiator are replaced with a 0.3 second delay initiator on the seat. When the M99 initiator fires the catapult and just as the propulsion rocket is fired, an output signal is produced that initiates the 0.3 second delay initiator. This actuates a piston in the harness release actuator that performs the three operations referred to above. In addition, seats in these aircraft incorporate yaw thrusters to reduce the probability of midair collision between the forward and aft seats during ejection.

2.17.1.2 Automatic Barometric Parachute Actuator. Parachutes are equipped with a barometrically controlled parachute actuator. The actuator is designed to deploy the parachute automatically at a predetermined altitude during ejection, if pilot incapacitation occurs. The 1G-3 actuator provides a 0.75-second parachute actuator delay before opening the parachute after reaching the preset altitude. When ejection is made below, at, or slightly above, the altitude for which the actuator is set, the delay allows the pilot to decelerate prior to parachute opening, thus reducing or eliminating pilot injury or parachute damage from opening shock. The delay also prevents the parachute from fouling on the seat when ejection is made at altitudes below that for which the actuator is set, where deployment would occur immediately upon separation from the seat. The automatic parachute actuator interferes in no way with the manual parachute ripcord release that may be pulled at any time to open the parachute.

An arming pin is inserted through the actuator mechanism to prevent inadvertent release of the parachute during normal operation when the aircraft descends through the altitude for which the actuator is set. The arming pin is anchored by the automatic parachute actuator arming lanyard to the harness-release handle. The barometric time-delay parachute actuator is armed when the pilot separates from the seat. If the automatic release mechanism fails to operate, and the emergency restraint release handle is used to free the pilot from the seat, automatic parachute deployment will not occur. The pilot must pull the parachute ripcord.

2.17.1.3 Parachute Harness Sensing Release Units (SEAWARS). This is a SEAWATER activated system that automatically releases the parachute from the crewmember. When the sensing – releasing units are immersed in sea water, cartridges are fired which allow the parachute risers to separate from the canopy releases (Koch fittings).

2.17.1.4 Seat Attachments. The pilot is held in the seat by attachments to the integrated torso harness. This torso harness incorporates within its structure, a seatbelt, shoulder straps, and a parachute harness, thus leaving the pilot with few of the usual encumbrances. The shoulder harness straps are sewn to the parachute risers and attach to the inertia reel straps. The loose ends of the parachute risers have quick-disconnect canopy releases (Koch fittings) that engage other fittings that extended from the front shoulders of the torso harness. Short seatbelts, which are sewn to the parachute harness on each side and attached to the seat structure at the aft corners of the seat bucket, are adjustable in length. The loose ends of the seatbelts have quick-action fittings which engage fittings protruding from the hip region of the torso harness.

2.17.1.5 Seat Controls

2.17.1.5.1 Seat Switch. The seat is electrically adjusted in the vertical plane by movement of the three-position seat switch located on the outboard right console (Figures FO-1 and FO-2) to either UP or DOWN, and is stopped at the desired position by releasing the spring-loaded switch to the center, or off position.

WARNING

- The ejection seat has mechanical stops incorporated to preclude raising the seat beyond ejection system initiation position. No electrical cutoffs exist. If the seat cannot be lowered after hitting the upper bumper stops, it should be assumed that the rivets are sheared and ejection is impossible.

- The aircraft shall not be flown until corrective maintenance action has been taken.

2.17.1.5.2 Shoulder Harness Lock Lever. The shoulder harness lock lever (Figure 2-7), on the left side of each seat bucket, locks the inertia reel drum to prevent playout of the webbing from the inertia reel. When the lock lever is in the LOCKED position, the shoulder harness will not extended and the pilot's freedom of movement is restricted. The UNLOCKED position allows the shoulder harness to extend or retract as the pilot moves about. The reel will lock automatically if the aircraft is subjected to a deceleration in excess of 2.5 ±0.5g along the thrust line. This safety feature helps to prevent injuries if the shoulder harness is not locked prior to an arrested landing or a crash. If the inertia reel fails to unlock while any load is being applied to the cable, relax the load and recycle the handle. The shoulder harness in each cockpit is automatically retracted and locked during ejection.

2.17.1.5.3 Emergency Restraint Release Handle. The emergency restraint release handle (Figure 2-7), labeled HARNESS-RELEASE, is mounted on the right side of the seat. A pin protrudes from the aft end of the handle, which extends aft through the edge of the ejection seat to anchor the arming lanyard of the barometric parachute opener. A spring-loaded latch, which is grasped with the emergency restraint release handle, retains the handle in the proper position and must be squeezed before the latter can be pulled. When the handle is pulled up the barometric parachute opener lanyard and the shoulder harness and seatbelt attachments are released from the seat, allowing the pilot to leave the cockpit with the parachute and pararaft kit still attached to the integrated torso harness.

On ESCAPAC 1G-3 ejection seats reworked per ACC 285, the seats are modified to ensure that the emergency restraint release handle makes positive connection of the parachute arming cable, and positive seating of the emergency restraint release handle in the emergency restraint release handle holder (Figure 2-7).

WARNING

- The emergency restraint release handle should not be pulled while the aircraft is airborne or until it comes to a complete stop after landing. Pulling the emergency restraint release handle releases the shoulder harness and lap belt end fittings, which cannot be reengaged in flight.
- Disconnect the barometric parachute opener arming lanyard from the emergency restraint release handle before removing the parachute from the seat. If this is not done, the arming pin will be pulled and the parachute will open.

2.17.1.5.4 Face Curtain. The face curtain screens the face from wind blast during ejection. The ejection seat face curtain handle (Figure 2-7) should be manually adjusted prior to engine start to establish a suitable handle position relative to the pilot's helmet. It serves as a control for ejecting the seat and aids in supporting and positioning the pilot during ejection. The face curtain, which is housed in the headrest structure with the handle protruding, is mechanically connected to the canopy jettison system and the seat catapult firing mechanism. When the face curtain is pulled downward, the first portion of travel jettisons the canopy and the last portion causes the seat to be ejected. The seat will not eject until the canopy is clear of the ejection path.

WARNING

Canopy jettisoning by means of partial face curtain extension should not be attempted except during the ejection sequence since no positive stops are provided to prevent seat ejection after the canopy has jettisoned.

2.17.1.5.5 Lower Ejection Handle. The lower ejection handle (Figure 2-7) is located on the forward side of the ejection seat between the pilot's legs. The handle is used to initiate the ejection sequence when use of the face curtain is not desireable or possible.

2.17.1.5.6 Ejection Control Safety Handle. The ejection control safety handle (headknocker), located between two rubber pads on the upper forward area of the seat assembly, functions as an ejection seat safety lock when in the down position. Locking is achieved by locking the firing control disconnect assembly and in turn, locking the face curtain and lower ejection handle. The headknocker is identified with a PULL OUT TO SAFETY EJECTION CONTROLS decal. Moving the headknocker to the down position extends a rod to block motion of a locking pin thus preventing travel of the firing control disconnect mechanism. The headknocker cannot be moved to the up position (unlocking the ejection mechanism) until a safety lock is manually depressed, disengaging the lock.

WARNING

- Headknocker shall not be lowered to preclude inadvertent ejection as head/neck would be in dangerous ejection position if ejection were initiated by other cockpit.
- The pilot in command shall ensure that both headknockers are in the same position at all times when both seats are occupied.

Note

- Pull safety lockpin streamer before depressing the safety lock.
- The safety lock is visible only when the headknocker is in the down position. The safety lock is identified from above with a black and yellow checkerboard decal, providing visual verification that ejection controls are secured in the locked (headknocker down) position.

2.17.1.6 Ejection Seat Stabilization System (DART). The ejection seat stabilization system counteracts the adverse effects of aerodynamics and seat system center-of-gravity variation. The system provides consistent and predictable trajectory during the rocket burning phase. The stabilization system is installed on the under side of the seat bucket and consists of two brake units, a deployable bridle arrangement, and four nylon draglines. Portions of the system lines are stowed in two fabric pouches mounted on the seat. The lines are routed through the brake units and through the eye of the bridle. At the eye, the remaining lengths of the system lines are gathered together and covered with a flame retardant sleeve. The covered section of line is stowed in a deployment pouch and the end is attached to the cockpit floor.

As the seat ejects, the slack line stowed in the deployment pouch pays out, and the bridle drops into position. At a preprogrammed distance, the system lines are pulled through the brake units, developing a preprogrammed force in the lines, and consequently, a moment around the system center of gravity which counteracts any adverse rotation of the seat.

2.17.1.7 Ejection Sequence. Refer to Part V for ejection sequence.

2.18 OXYGEN SYSTEM

Oxygen is supplied by a single 10-liter vacuum bottle liquid oxygen converter mounted in a vented compartment in the aft fuselage section. For servicing, the converter filler valve is reached through an access door on the right side of the fuselage. Evaporation loss is constant when the system is not in use, and this loss is used to pressurize the system. By venting any excess pressure overboard through relief valves, pressure is maintained at 70 ±5 psi. Venting pressure may increase to 100 ±10 psi when the liquid oxygen system is not being used.

2.18.1 Liquid Oxygen Quantity Indicator. A liquid oxygen quantity indicator is located on the instrument panel in the forward cockpit (Figure FO-1). In the aft cockpit the oxygen quantity indicator is located on the right console (Figure FO-2). The face of the indicator is graduated with markings of 10, 8, 6, 4, 2, and 0. The quantity indicator is electrically operated and has a small OFF window to show that the indicator is inaccurate when electrical power is lost. A red low-level warning light on the indicator face will light when the oxygen quantity falls below 1 liter. Depressing the TEST button (Figures FO-1 and FO-2) on the instrument panel tests the operation of the liquid oxygen quantity indicator causing the pointer to move counterclockwise. The low level warning light will come on when the pointer passes the 1-liter mark. When the TEST button is released, the pointer should return to its previous position. The two TEST buttons are interconnected and as the indicator in the aft cockpit is a repeater indicator, test from either cockpit should show on both indicators.

2.18.2 Controls and Equipment. A lift-type toggle switch is located on the aircrew services panel (Figure FO-1 and FO-2). When the switch is moved from OFF to OXY, oxygen is delivered from the supply system at a pressure of 70 psi to the oxygen receptacle located on the oxygen and anti-g panel on the left console. The pilot supply tube is plugged into the receptacle to allow the oxygen to flow to the oxygen chest regulator, just below the pilot face mask. The chest regulator reduces the 70-psi converter oxygen pressure and delivers 100-percent oxygen to the mask under a positive pressure of about 1-inch water pressure at all cabin altitudes below approximately 35,000 feet. At high cabin altitudes, the delivered pressure is automatically increased to allow the pilot adequate oxygen absorption.

WARNING

The type A-13A face mask used with this oxygen system must be properly fitted to the pilot's face. Relatively small leaks around a mask are cumulative in effect and result in considerable oxygen loss over long periods of operation.

2.18.3 Emergency Oxygen Supply. Emergency oxygen is contained in a U-shaped cylinder installed in each RSSK-8A-1 survival kit. The cylinder pressure gauge, visible through the upper surface of the forward right corner of the survival kit, should register 1,800 psi when the cylinder is full. A pressure reducer allows oxygen to flow at 60 psi through the supply tube to the oxygen regulator for delivery to the face mask. The duration of the emergency supply is approximately 4 to 20 minutes, depending upon the altitude (the higher the altitude, the longer the duration). If the pilot desires to use the emergency oxygen supply, he must pull the manual release handle (green O-ring) and turn off the normal oxygen supply from the console. This is necessary because the integral relief valve in the emergency oxygen supply will not deliver oxygen to the pilot mask until the output pressure of the LOX system falls below 50 ±10 psi (or is placed in the OFF position). The actuator assembly is attached to the manual release handle, or green ring, by a cable and to the cockpit floor through a quick-disconnect fitting by an emergency oxygen actuator. When the seat is ejected or the pilot, still attached to his survival kit, leaves the cockpit, the lanyard attached to the cockpit floor provides emergency oxygen actuation automatically.

Prior to flight, the following inspection should be made to ensure automatic supply of emergency oxygen during an emergency.

1. Check pressure gauge for adequate supply (1,800 psi).

2. Check that actuator lanyard is attached to the cockpit floor.

3. With the mask-to-survival kit hoses connected and the console supply shut off or disconnected, check that there is no oxygen flow to the mask.

2.18.4 Oxygen Duration. Figure 2-9 gives a tabulation of hours remaining for various altitude oxygen quantity combinations for the liquid oxygen supply system. It will be noted that although 100-percent oxygen is used at all times, duration is greater at high altitudes. The volume of oxygen increases in direct proportion to the decrease in atmospheric pressure as altitude increases; thus, while the volume of oxygen required by the pilot is approximately the same at any altitude, the oxygen delivered in reduced cockpit pressure is lower in density and less of the supply is required to satisfy the demand.

2.18.5 Normal Operation

2.18.5.1 Before Flight. Before each flight, the oxygen system and mask shall be checked for proper operation. Connect the oxygen supply tube to the connector on the seat cushion with the mask turned away from the face. Turn the oxygen switch ON. Listen for free flow of oxygen. Don the mask. Inhalation should be almost effortless if the regulator is delivering oxygen at a slight positive pressure. Exhalation should also be possible but will require some effort in order to close the inhalation valve.

2.18.5.2 During Flight. Oxygen quantity should be checked periodically during flight.

Note

Separation of the oxygen hose couplings will be immediately apparent as oxygen flow and radio communication will cease.

2.19 FLIGHT INSTRUMENTS

The airspeed indicator, vertical velocity indicator, and altimeter are connected to the pitot-static system. The attitude gyro, standby attitude gyro, bearing-distance-heading indicator (BDHI), angle-of-attack system, and radar altimeter are electrically operated. The accelerometer is independent of other systems in operation.

2.19.1 Airspeed Indicator. A combination airspeed indicator and Mach meter is mounted on the upper left corner of the instrument panels in the forward and aft cockpits (Figures FO-1 and FO-2). The airspeed portion of the dial is fixed in position and is calibrated from 80 to 650 knots. The Mach meter scale is a rotating disc, marked from 0.50 to 2.9, turning beneath the airspeed dial. Only a portion of the disc can be seen through a cutout in the airspeed dial. Airspeed and corresponding Mach number are indicated simultaneously by a single needle pointer. A movable index on the Mach number disc is used to set a Mach reference by depressing and turning a set knob on the lower left corner of the instrument case. On the edge of the airspeed dial is an airspeed index

LIQUID OXYGEN DURATION

10 LITER SYSTEM

DATA AS OF: 1 FEBRUARY 1962
DATA BASIS: SPECIFICATION MIL-1-19326 (WEPS)

HOURS REMAINING

CABIN PRESSURE ALTITUDE FEET	GAGE READING (LITERS)					
	10	8	6	4	2	1
40,000 UP ▶	60.6	48.5	36.4	24.2	12.0	4.8
35,000 ▶	37.0	29.6	22.2	14.8	7.4	3.6
30,000 ▶	27.2	21.8	16.4	10.8	5.4	2.8
25,000 ▶	20.4	16.4	12.4	8.2	4.0	2.0
20,000 ▶	16.0	12.8	9.6	6.4	3.2	1.6
15,000 ▶	12.8	10.2	7.6	5.2	2.6	1.2
10,000 ▶	10.0	8.0	6.0	4.0	2.0	1.0
5,000 ▶	8.4	6.6	5.0	3.2	1.6	0.8
SEA LEVEL ▶	7.0	5.6	4.2	2.8	1.4	0.6

REMARKS:

(1) BASED ON 800 LITERS OF GASEOUS OXYGEN PER LITER OF LIQUID OXYGEN.

(2) DATA ASSUME THE USE OF A PROPERLY FITTED MASK.

(3) DATA BASED ON SINGLE PILOT OPERATION DIVIDE BY TWO FOR DUAL PILOT OPERATION.

Figure 2-9. Liquid Oxygen Duration

pointer, which is adjustable through a range of 80 to 145 knots merely by turning the set knob.

2.19.2 Vertical Velocity Indicator. A vertical velocity indicator is located in the lower left-hand corner of each instrument panel (Figures FO-1 and FO-2). The indicator shows the rate of ascent or descent of the aircraft. The upper half of the indicator face is graduated in 500-foot units from 0 to 6,000 feet with 100-foot scale divisions from 0 to 1,000 feet. The upper half of the instrument indicates rate of climb in thousands of feet per minute. The lower half of the indicator face is identical to the upper half except that it indicates rate of descent. The vertical velocity indicator is connected to the static pressure system of the aircraft and measures the change in atmospheric pressure as the aircraft climbs or descends.

2.19.3 AAU-19/A Servo Altimeter. In aircraft reworked per A-4 AFC 329, the barometric altimeters have been replaced by AAU-19/A altimeters (Figures FO-1 and FO-2). The AAU-19/A counter-drum-pointer servo altimeter consists of a pressure altimeter combined with an ac powered servomechanism. Altitude is displayed in digital form by a 10,000 foot counter, a 1,000 foot counter, and a 100 foot drum. A single pointer also indicates hundreds of feet on a circular scale, with center graduations of 50 feet. Below 10,000 feet, a diagonal warning symbol appears on the 10,000 foot counter. A barometric pressure setting (baroset) knob is provided to insert barometric pressure in inches of Hg. The baroset knob has no effect on the digital output (Mode C) of the altitude computer that is always referenced to 29.92 inches of Hg. The altimeter has a reset (servo) mode and a standby (pressure) mode of operation, controlled by a spring-loaded self-centering mode switch placarded RESET and STBY. In the reset (servo) mode, the altimeter displays altitude, corrected for position error, from the synchro output of the altitude computer. In the standby mode, the altimeter displays altitude directly from the static system (uncorrected for position error) and operates as a standard pressure altimeter. A dc powered internal vibrator is automatically energized while in the standby mode to minimize friction in the display mechanism.

2.19.4 AAU-19/A Operating Characteristics. The counter drum-pointer display is designed so that the 100-foot drum and the pointer rotate continuously during altitude changes, while the 10,000 foot and 1,000 foot counters remain in a fixed position. When each 1,000-foot increment is completed, the counter(s) abruptly index to the next digit. However, when operating in the standby mode, there may be a noticeable pause or hesitation of the pointer caused by the additional friction and inertia loads involved in indexing the counter(s). The momentary pause is followed by a noticeable acceleration as the counter(s) change. The pause-and-accelerate behavior occurs in the 9 to 1 section of the scale and is more pronounced when the 10,000 foot counter changes. It is also more pronounced at high altitudes and high rates of ascent and descent. During normal rates of descent at low altitudes the effect is minimal.

Note

If the altimeter's internal vibrator is inoperative, the pause-and-accelerate effect may be exaggerated in the standby mode. If operating in the standby mode, be watchful for this behavior when the minimum approach altitude lies within the 8 to 2 sector of the scale, i.e., 800 to 1,200 feet, 1,800 to 2,200 feet, etc.

2.19.4.1 AAU-19/A Normal Operating Procedures. During poststart checks, conduct field elevation checks as follows:

1. Set local field altimeter with baroset knob. Indicated altitude should be published field elevation ±75 feet.

Note

During normal use of the baroset knob, if momentary locking of the barocounters is experienced, do not force the setting. Application of force may cause internal gear disengagement and result in excessive altitude errors in both reset and standby modes. If locking occurs, rotate the knob a full turn in the opposite direction and approach the setting again with caution.

2. Place reset/standby switch to RESET position for 1 to 3 seconds until reset flag appears. Indicated altitude should be published field elevation ±75 feet. In addition, the altitudes indicated in the RESET and STANDBY modes should be within ±75 feet of each other.

WARNING

The maximum allowable difference between the reset and standby modes during ground checks is 75 feet. If the difference exceeds 75 feet, the standby mode of operation should be used.

Note

The AAU-19/A altimeter will automatically switch from reset to standby operation in case of an electrical power interruption for longer than three seconds.

During STANDBY operation, it is possible for the transponder to continue to transmit altitude information (corrected for position error) on mode C, while the altimeter is displaying altitude uncorrected for position error.

2.19.5 AN/APN-141 Radar Altimeter Operating Characteristics. The AN/APN-141 radar altimeter is located on the lower right-hand part of each instrument panel (Figures FO-1 and FO-2). The altimeter employs the pulse radar technique to furnish accurate instantaneous altitude information to the pilot from 0- to 5,000-foot terrain clearance. Aircraft height is determined by measuring the elapsed transit time of a radar pulse which is converted directly to altitude in feet and is displayed on the cockpit indicator. The indicator dial face is marked in 10-foot increments up to 200 feet, 50-foot increments from 200 to 600 feet, 100-foot increments from 600 to 2,000 feet, and 500-foot increments from 2,000 to 5,000 feet. A control knob on the front of the indicator controls power to the indicator and is used for setting the low-limit indexer. It also provides for preflight and in flight test of the equipment with a push-to-test type control knob feature.

Note

This push-to-test operation should result in the needle moving from the masked portion of the indicator dial to 5 ±5 feet, with associated LAWS indications present if the indexer has been set and the needle rotates through the selected altitude.

Refer to low-altitude warning system (LAWS) for information on the low-limit indexer. An OFF flag on the indicator face will appear when signal strength becomes inadequate to provide reliable altitude information, when power to the system is lost, or when the system is turned OFF.

CAUTION

Leave the APN-141 radar altimeter in the OFF position until power is applied to the aircraft and return equipment to OFF before power is removed.

Note

At altitudes above 5,000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator dial. The pointer will resume normal operation if the aircraft descends below 5,000 feet.

The radar altimeter operates normally during 50° angles of climb or dive and 30° angles of bank right or left. Beyond these points, the indications on the radar altimeter become unreliable but will resume normal operation when the aircraft returns to normal flight.

2.19.6 AN/APN-194 Radar Altimeter Operating Characteristics. Aircraft reworked per AFC 555, Chapter 2 have the AN/APN-194 radar altimeter installed.

The AN/APN-194 radar altimeter system is a high resolution pulse radar that indicates absolute clearance over land or water from 0 to 5,000 feet. The absolute clearance is determined by measuring the elapsed transmit time of a radar pulse that is converted to altitude in feet. The system includes a receiver-transmitter, two identical antennas, and an indicator. The receiver-transmitter and the two antennas are located outboard under the left wing.

The radar altimeter indicator displays altitude, controls system power, and provides an adjustable low altitude warning function for visual- and aural-low altitude warning. System self-test is also initiated from the indicator.

The scale on the indicator is 0 to 5,000 feet. Scale graduations are as follows: 10-foot increments from 0 to 200 feet; 50-foot increments from 200 to 600 feet; 100-foot increments from 600 to 2,000 feet; 500-foot increments from 2,000 to 5,000 feet. A rotating pointer is read against the scale for altitude indications. An OFF flag on the face of the indicator appears when signal strength becomes inadequate for reliable altitude information, when power to the system is lost, or when the system is turned off.

Note

At altitudes above 5,000 feet terrain clearance, the OFF flag will appear and the pointer will move behind the masked portion of the indicator scale. The pointer will resume normal operation, and the OFF flag will disappear from view, when the aircraft descends below 5,000 feet terrain clearance.

A multipurpose control knob is located on the lower left corner of the indicator. When the knob is rotated to move the low-limit index marker to 0, power to the system is off and the OFF flag will appear. To apply power to the system, the knob is rotated to move the low-limit index marker to an altitude greater than 0. Approximately 2 minutes is required for system warmup. When system warmup is completed, the OFF flag disappears from view.

CAUTION

Leave AN/APN-194 radar altimeter system off until power is applied to aircraft, and return system to OFF before power is removed.

The control knob is also used to set the low-level index marker to a desired altitude for low altitude visual- and aural-warning. When the pointer moves below the altitude of the preset index marker the red low-limit warning light, located on the glareshield comes on, and an aural-warning tone is activated for 2 seconds at a 2-Hz repetition rate.

For preflight or in-flight self-test, the control knob is pushed in. To indicate satisfactory system operation, the indicator will read 100 (±10) feet, and the green self-test indicator light, located on the indicator face to the left and slightly below center, comes on.

The radar altimeter displays reliable indications with aircraft attitudes that do not exceed a 50° angle of climb or dive and a 30° angle of right- or left-bank. Beyond these parameters, radar altimeter indications become unreliable, but reliable indications will resume when the aircraft attitudes return within the parameters

2.19.7 Low-Altitude Warning System (LAWS). A low-altitude warning system consists of two forward cockpit warning lights (Figures 2-10 and FO-1) and an aural warning tone to both cockpits operated in conjunction with the AN/APN-141 or AN/APN-194 radar altimeter. The system is controlled from the forward cockpit. The aural warning tone to both cockpits is activated by the forward cockpit AN/APN-141 or AN/APN-194.

When the forward cockpit AN/APN-141 or AN/APN-194 indicator needle moves below the preset indexer altitude, the marker beacon light (forward cockpit only), the forward cockpit low-limit warning light, and the aural-warning tone to both cockpits are activated for 2 seconds.

The warning signal is an alternating 700 to 1,700 cps tone heard through the pilot headset at a 2-cps repetition rate. A reliability warning signal of the same frequency range (but with 8-cps repetition rate) is also provided. The reliability warning signal sounds for 2 seconds when the AN/APN-141or AN/APN-194 acquires or loses a lock on.

Note

The reliability warning signal feature is removed from aircraft reworked per A-4 AFC 423A.

The aft cockpit low limit warning light function is independent of the LAWS and forward cockpit AN/APN-141 or AN/APN-194 operation. However, if either indicator is turned on, both cockpit indicators will indicate the altitude of the aircraft.

2.19.8 AN/AJB-3A All-Attitude Indicator. An all-attitude indicator for the AN/AJB-3A system is located on each instrument panel (Figures FO-1 and FO-2). The indicator provides the pilot with a pictorial presentation of the aircraft's pitch, roll, heading, and turn-and-slip. Aircraft attitude reference signals are supplied to the indicator by electrical connection with the remove mounted master reference platform. Pitch, roll, and heading are shown by the orientation of the all-attitude indicator sphere with the miniature referenced aircraft attached to the instrument face. An electrically powered bank inclinometer and rate-of-turn pointer, under the sphere on the attitude director indicator, completes the indicator presentation. The horizon is shown as a white line dividing the top and bottom halves of the sphere. The upper half, symbolizing sky, is indicated by a light grey area above the horizon line; the lower half, symbolizing earth, is indicated by a dull black area below the horizon line. The sphere is graduated every 5° in azimuth around the horizon line and every 30° around the rest of the

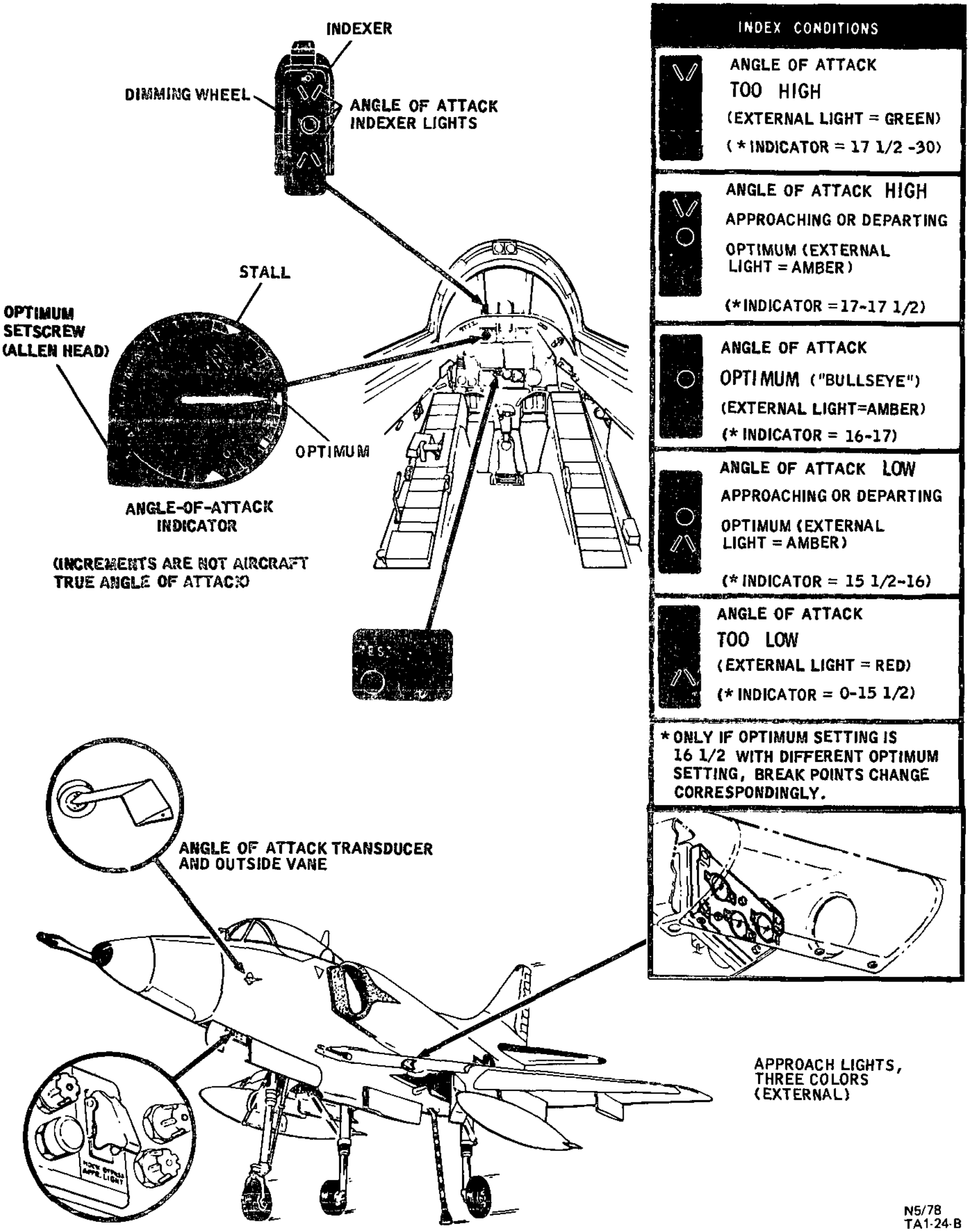


Figure 2-10. Angle of Attack – Approach Light System

sphere. The sphere is graduated every 10° of climb and dive. The sphere is free to move a full 360° in pitch, roll, or heading without obstruction. Roll indices are located on the top and bottom of the indicator.

Several indicating flags and pointers are incorporated in the instrument that are not used by this system. All flags and indicators are biased out of sight at the completion of the warmup period and should not reappear until the system is turned off. Only the horizontal and vertical director pointers, used in associated systems, are later brought into view. If the OFF flag does appear, a power failure in the system is indicated. A maximum of 90 seconds may be required for gyro erection and amplifier warmup.

WARNING

- Do not rely on indicator if OFF flag is visible.
- It is possible to receive erroneous indications on gyro indicator without OFF flag showing.

The turn-and-slip indicators are located below the sphere and are an integral part of the all-attitude indicator. A one-needle width deflection of the turn indicator will result in a standard rate, 2-minute, 360° turn. Full deflection (two-needle widths) results in a 1-minute, 360° turn. The turn indicator is electrically driven and will operate on emergency generator.

A pitch trim knob, located on the lower right corner of the indicator, with an index mark at its 10 o'clock position, controls the sphere pitch setting in relations to reference aircraft. Adjustment can be made from 10° noseup to 5° nosedown. The indicator is calibrated to display (at any pitch angle) the true aircraft attitude (armament datum line) in relation to the surface of the earth with pitch trim knob aligned to the index mark. It is recommended that the pitch trim knob always be aligned with the index mark before flight and be left in that position throughout the flight. This will enable the pilot to always know his true attitude in relation to the surface of the earth regardless of the maneuver performed.

2.19.8.1 Gyro Ground Test Switch. A gyro ground test switch is located in the left-hand side of the forward engine compartment. In the NORMAL position, maintenance and servicing requirements involving power application to the aircraft may be accomplished without energizing the AJB-3A system. Gyro damage will be prevented by allowing uninterrupted rundown subsequent to flight and preventing unnecessary brief turnups.

2.19.9 Bearing-Distance-Heading Indicator (BDHI). The ID-663 BDHI is located on the lower left center section of each instrument panel (Figures FO-1 and FO-2). The indicator displays magnetic heading by rotation of the compass card dial. Distance and relative/magnetic bearings, in relation to a ground or shipboard station, are also displayed by the instrument.

Magnetic heading information from the compass compensator adapter is provided to the rotating compass card which indicates magnetic heading in degrees. A fixed index at the top of the indicator denotes the reference heading of the aircraft.

A window in the indicator face, at the 3 o'clock position, shows a three-digit display, indicating distance in nautical miles for tacan operation. An OFF flag is displayed when distance information is not present.

Displayed on the face of the indicator are two pointers: the No. 1 pointer (a single-bar pointer for ARA-50 operation) and the No. 2 pointer (a double-bar pointer for OMNI or tacan). Both pointers will indicate relative and magnetic bearing information if the compass card is in synchronization.

Note

The No. 1 pointer will always indicate relative bearing from the aircraft. However, if the compass card is out of synchronization, the No. 2 pointer will "follow" the compass card and indicate magnetic bearing only.

2.19.10 Standby Attitude Indicator (TA-4F). A remote indicating standby attitude indicator is located on the lower right center section of the instrument panel (Figures FO-1 and FO-2). The indicator provides an alternate system for the all-weather instrumentation of the aircraft in the event of malfunction or failure of the all-attitude indicator. A fast erect switch is located on the indicator case to decrease the time required to erect the indicator. The fast erect switch has an erection rate of 30° per minute.

CAUTION

Do not operate the fast erect switch longer than 2 minutes continuously. Extended operation may damage the circuitry.

2.19.11 ID-1481/A Standby Attitude Indicator. A self-contained, ac-powered, standby attitude indicator is located on the lower-right-center section of the instrument panel (Figures FO-1 and FO-2). The indicator provides an independent attitude system in the event of a malfunction or failure of the AJB-3A all attitude indicator. The gyro has a caging knob located in the lower-right corner to allow manual gyro caging and also to control the aircraft reference symbol through a ±5° pitch range. The gyro can be locked in the caged position by pulling out the caging knob and rotating it clockwise. The caging knob will normally be pulled and held until the gyro stabilizes, approximately 60 seconds after engine start. The gyro will provide accurate attitude information within 3 minutes after ground caging. The indicator will normally show a 2° to 4° nosedown attitude on the ground depending on aircraft attitude because of installation and instrument effects. The indicator will show a 4° to 8° nosedown attitude when the aircraft is tensioned for catapult launch. Pulling the caging knob causes a red OFF flag to appear in the left side of the indicator. The OFF flag will also appear whenever electrical power is interrupted. The indicator will provide a usable attitude reference up to 9 minutes after a power failure even though the OFF flag is visible. The gyro automatically erects at a rate of 2.5° per minute when the aircraft attitude is between 1° and 15° noseup.

The indicator provides a reliable alternate attitude reference with the following characteristics: the horizon will indicate a pitch change of 2° to 4° nosedown with bank angles of 30°; exceeding the pitch limits of approximately 85° noseup or down can cause bank and pitch errors up to 10°. The indicator may be manually caged in flight, when bank and pitch errors in excess of 6° are observed, by pulling the caging knob with the aircraft in wings-level flight at a noseup attitude between 1° and 15°. A 6 minute stabilization period is required after caging for accurate attitude information.

CAUTION

Attempts to cage the gyro outside of wings-level and a 1° to 15° noseup attitude will prevent proper gyro stabilization.

If the standby attitude indicator is left uncaged when the aircraft is shutdown, the indicator may, during rundown, precess considerably out of the normal reference plane. An excessive amount of time for stabilization will then be required the next time power is applied to the aircraft. A minimum of 6 minutes stabilization time is required after caging before the indicator will provide accurate attitude information.

CAUTION

The ID-1481/A standby attitude indicator should not be locked while installed in the aircraft.

2.19.12 Accelerometer. An accelerometer with three indicating pointers is located in the lower left corner of each instrument panel. The accelerometer (Figures FO-1 and FO-2) registers and records positive and negative loads. One pointer moves in the direction of the g load being applied while the other two, one for positive g loads and one for negative g loads, follow the indicating pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions of the g's being applied providing a record of maximum g loads encountered. Depressing the push-to-reset knob, at the lower left corner of the instrument, allows the recording pointers to return to the normal 1-g position.

Note

Accelerometers may read as much as 1/2g low; possibly lower, if the pull-in rate is high.

2.19.13 Angle-of Attack System. The angle-of-attack system consists of an angle-of-attack vane-transducer unit, a three-colored external approach lights unit, an angle-of-attack indicator (each cockpit), and angle-of-attack indexer lights (each cockpit) with dimming wheels (Figure 2-10). The angle-of-attack vane extending outboard on the left side of the fuselage senses the attitude of the aircraft in relation to the relative wind and sends the angle-of-attack readings to the angle-of-attack indicator at the top left center of the instrument panels in the forward and aft cockpits. The angle-of-attack indicator consists of a single pointer on a dial graduated in units of 0 through 30 with an OFF window in the face of the dial. The dial face is adjustable with respect to the fixed reference index at the 3 o'clock position on the case. Angle-of-attack information from the angle-of-attack indicator goes to the angle-of-attack indexer light located on the left side of each glareshield, and also to the three colored external approach lights unit for the Landing Signal Officer (LSO). The angle-of-attack vane is electrically heated when weight is off the main landing gear. The angle-of-attack vane is not heated when operating on emergency generator with the landing gear extended.

2.19.13.1 Angle-of-Attack Indexer. The angle-of-attack indexer, located on the glareshield in the forward and aft cockpits, mounts three indexer lights. The indexer light indications are a chevron (v)showing too high angle of attack at the top, a donut (O) showing proper angle of attack in the center, and a chevron (ʌ) showing too low angle of attack at the bottom. Two intermediate conditions are also indicated by showing the (O) with the (v) or the (ʌ). See Figure 2-10 for INDEXER CONDITIONS with the corresponding color of the external approach light visible to the LSO. The angle-of-attack indexer lights show a green top chevron (v), a yellow middle circle (O), and a red lower chevron (ʌ), corresponding to similar external approach light displays. Dimming is automatically provided when the exterior lights are turned ON. Intensity is further adjustable by use of the indexer dimming control wheel. The press-to-test button, labeled TEST and located on the lower center section of each instrument panel, checks the lighting integrity of the indexer by lighting all three lights of the indexer when it is depressed.

2.19.13.2 Angle-of-Attack Indicator. The angle-of-attack (AOA) indicator registers units of angle of attack to the relative airstream, from 0 to 30 on the face of the dial. (The increments are not absolute angles of attack but are arbitrary indicated units grouped around the optimum.) An OFF flag becomes visible when ac power is lost. The dial is adjustable by means of an allen wrench receptacle at the lower left-hand corner of the indicator to set the optimum unit setting at 3 o'clock position. All switching is referenced to the 3 o'clock position regardless of dial setting. The recommended setting for landing approach is 16-1/2 units. The indicated units should be checked against the airspeed indicator reading during the approach on each flight. If the AOA indication of 16-1/2 units does not produce the proper IAS as computed from Figures 27-1 or 36-1, the pilot should check flap position indicator to ensure that the aircraft is in the proper configuration. The pilot should determine which instrument is providing correct information by observing the position of the wing slats. Slats should be approximately one-half extended at approach speed, gear and flaps down.

Four indices are positioned at various points around the dial. The main index represents the optimum angle of attack for approach to landing and is always placed in the 3 o'clock position. The stall index is set at 27 units, near the 12 o'clock position on the dial. The triangular-shaped cruise index (at 5:30 o'clock) and the square-shaped climb index (at 4:30 o'clock) are not used because of variations in climb and cruise angels of attack in A-4 aircraft.

The recommended 16-1/2 units for TA-4F/J aircraft is consistent with 17-1/2 units for A-4C, A-4E, and A-4F aircraft, and 19 units for A-4A/B aircraft. At these recommended approach units, for equal gross weights, the approach airspeed and attitude with respect to horizontal will be equal on all A-4 series aircraft.

The angle of attack can be used for cruise control in the event of failure of the airspeed system. Angle-of-attack indications are normally inadequate for use as a prime cruise control system, since small variations in angle of attack result in relatively large changes in airspeed at optimum cruise conditions. Sample angle-of-attack readings for this condition are as follows:

Condition	Angle-of-Attack Indicator Units
Maximum rate climb	4.5 to 9.0
Maximum range descent or maximum endurance at all altitudes	10.5
Cruise at 5,000 feet	6.6 to 7.0
Cruise at 35,000 feet	7.7 to 9.0
250-knot descent with speedbrakes extended	7.0*

Condition	Angle-of-Attack Indicator Units
* Gross weight of 14,000 pounds. Add/subtrtact 0.35 units for each increase/decrease of 1,000 pounds weight. Valid for all configurations.	

The above data are based on an aircraft configured with two 300-gallon external tanks. For a clean aircraft these angle-of-attack indicator units should be decreased 1.0 unit for the maximum endurance condition, and 0.6 unit for the cruise and rate-of-climb.

Note

When above speeds of 200 KIAS, an angle-of-attack error of 0.5 unit can be equal to an airspeed error of 25 KIAS or more.

2.19.13.3 External Approach Lights. The external approach lights unit, located in the leading edge of the left wing behind a transparent section, has three separate lights covered by red, amber, and green lenses. The corresponding angle-of-attack conditions are shown to the LSO as green for angle-of-attack too high, as amber for angle-of-attack optimum (or approaching or departing optimum), and as red for angle of attack too low.

The external approach lights unit shines brightly in the daytime and dims automatically at night when the master exterior lights switch is activated for night flying.

The indicator in the cockpits will be in operation during the entire flight to present angle-of-attack information. The transducer is also connected to the APG-53A radar system. The external approach lights, powered by the ac primary bus, operate automatically when the arresting hook is extended and the landing gear is down and locked with the port strut fully extended. All approach lights go off, upon landing, by means of a landing gear strut compress switch (squat switch). An approach light arresting hook bypass switch for field carrier landing practice with arresting hook retracted is provided in the nosewheel well.

Note

External approach lights are operated through a dc approach light relay. The primary dc bus that operates the approach light relay will be inoperative and external approach lights will be unavailable with a dc electrical failure. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator.

2.19.13.4 Approach Light Arresting Hook Bypass. A momentary contact toggle switch, labeled HOOK BYPASS, is located in the nosewheel well. This guarded switch is used to bypass the arresting hook circuit of the approach light system during field carrier landing practice. To provide approach lights during field landings without using the arresting hook, a ground crewman momentarily engages the HOOK BYPASS switch in the BYPASS position. The approach lights remain on as long as the landing gear is down and the landing gear struts are not compressed enough to actuate the struts compress switch (squat switch). Normal operation of the approach light circuit is reestablished by moving the arresting hook lever to the DOWN position, or interrupting electrical power to the approach light circuit.

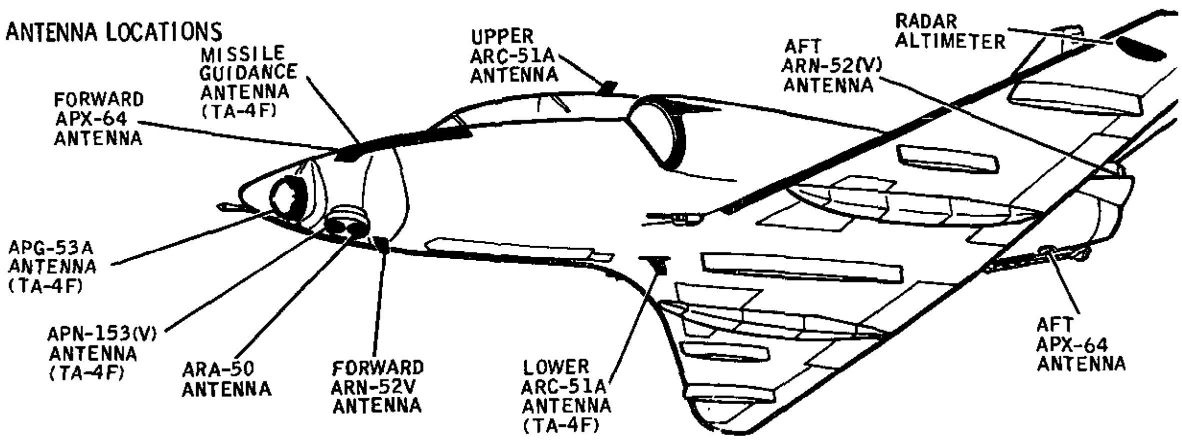
Note

- If "bounce drill" on the carrier is conducted using the approach light arresting hook bypass, extra precaution must be taken to ensure that the arresting hook is extended before an arrested landing.
- On aircraft reworked per A-4 AFC 595, the approach light will operate when the landing gear is down and locked and port strut is fully extended.

2.20 COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

All communications and associated electronic equipment is listed in the Table of Electronic Equipment (Figure 2-11). Major units of the ARC-51A or ARC-159(V5) UHF radio and the ARA-50 direction finder are located in the nose section of the aircraft. Also installed in the nose section is the ARN-52(V) or ARN-118(V) tacan radio.

2.20.1 Intercommunication System (ICS). The intercommunication system (ICS) provides communication between the forward and aft cockpits. The ICS is composed of dual installation of the following components: ICS amplifier console, ICS and radio control, MIC-ICS/UHF keying switch, personnel disconnect, and ICS filter. The ICS amplifier consoles are both installed in the aft cockpit righthand console.



AIRCRAFT INSTALLATIONS

TYPE	DESIGNATION	FUNCTION	RANGE	LOCATION OF CONTROLS
COMMUNICATION: *UHF RADIO* UHF RADIO AUXILIARY UHF RADIO SECURITY EQUIPMENT (A-4 AFC 343-III) (TA-4F)	AN/ARC-51A(V5) AN/ARC-159 ARR-69 JULIET 28	SHORT RANGE-TWO-WAY VOICE COMMUNICATION SHORT RANGE-TWO-WAY VOICE COMMUNICATION SHORT RANGE RECEIVER/ADF CLASSIFIED	LINE-OF-SIGHT LINE-OF-SIGHT	RIGHT CONSOLE RIGHT CONSOLE RIGHT CONSOLE RIGHT CONSOLE
NAVIGATION: UHF-ADF TACAN *TACAN*	ARA-50 ARN-52(V) *ARN-118(V)*	DIRECTIONAL HOMING PROVIDES BEARING AND DISTANCE TO A SELECTED STATION AND AIR-TO-AIR DISTANCE INFORMATION FROM ANOTHER AIRCRAFT	LINE-OF-SIGHT LINE-OF-SIGHT TO 300 MILES	RIGHT CONSOLE RIGHT CONSOLE
COURSE INDICATOR *(TA-4J)*	ID-249/ARN, ID-351/ARN, OR ID-387/ARN	INDICATES DEVIATION *FROM SELECTED COURSE*	LINE-OF-SIGHT	INSTRUMENT PANELS
NAVIGATION COMPUTER (TA-4F)	ASN-41	GREAT CIRCLE AND PLANAR NAVIGATION	OVER 300 MILES	RIGHT CONSOLE
DOPPLER RADAR *NAVIGATION (TA-4F)*	APN -153(V)	GROUNDSPEED AND DRIFT *ANGLE*	LINE-OF-SIGHT	RIGHT CONSOLE
DATA LINK	ASW -25A	FINAL APPROACH COURSE NAV	7 MILES	LEFT FRONT CONSOLE
IDENTIFICATION: IFF RADAR	APX-64	IDENTIFIES AS FRIENDLY	LINE-OF-SIGHT	RIGHT CONSOLE
TERRAIN CLEARANCE RADAR: (TA-4F) AIR-TO-GROUND *RECEIVE AND TRANSMIT*	APG-53A	AIRBORNE RADAR	LINE-OF-SIGHT	LEFT CONSOLE AND INSTRUMENT PANEL
RADAR ALTIMETER RADAR ALTIMETER	APN-141 APN-192	INDICATE HEIGHT ABOVE OBSTACLE	LINE-OF-SIGHT	INSTRUMENT PANEL
MISSILE MONITOR (TA-4F)	IP-936/AXQ - SEE TACTICAL MANUAL (NAVAIR 01-40AV-1T)	VIDEO PRESENTATION	LINE-OF-SIGHT	INSTRUMENT PANEL
WEAPONS DELIVERY: (WHEN CARRIED) (TA-4F) AIR-TO- GROUND MISSILE	SEE TACTICAL MANUAL (NAVAIR 01-40AV-1T)	GUIDED MISSILE	LINE-OF-SIGHT	LEFT CONSOLE AND CONTROL STICK
COMPASS CONTROLLER		ROTATES ALL-ATTITUDE INDICATOR AND ID-663 BDHI COURSE INDICATOR LATITUDE COMPENSATION	360° OF ROTATION 0° - 90° NORTH 0° - 90° SOUTH	RIGHT CONSOLE

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Figure 2-11. Electronic Equipment

One amplifier is wired to the forward cockpit and the other amplifier is wired to the aft cockpit. It is possible to switch amplifiers so either pilot can use either amplifier if one amplifier fails.

Note

> Use of the MIC-ICS/UHF keying switch, or MIC HOT/COLD switch in HOT position, for ICS communications may degrade normal UHF reception depending on the volume levels of the ICS/UHF volume control potentiometers.

2.20.1.1 Exterior Communications System. With incorporation of A-4 AFC 585 (external ICS jack), communication between the occupant of either seat and the ground crew is possible by placing the MIC-HOT/COLD switch in HOT position.

2.20.1.2 ICS and Radio Control Panel. The ICS and radio control panel is mounted on the instrument panel in each cockpit (Figures FO-1 and FO-2). The forward cockpit ICS and radio control panel is located in the lower right-hand section of the instrument panel (Figure FO-1). The aft cockpit ICS and radio control panel is located in the lower center section of the instrument panel (Figure FO-2). The ICS and radio control panel contains the following controls:

1. Communication/navigation radio control selector (RAD CONT)
2. Normal/alternate selector switch (HDST-NORM/ALT)
3. Microphone hot/cold switch (MIC HOT/COLD)
4. Main receiver on/off switch (MAIN REC/OFF)
5. Auxiliary receiver on/off switch (AUX REC/OFF)
6. Nav-Pac/tacan on/off switch (NAV-TAC/OFF)
7. ICS volume control (ICS)
8. MIC-ICS/UHF keying switch
9. Radio volume control (RAD)

2.20.1.2.1 Communication/Navigation Radio Control Selector. The communication/navigation radio control selector, labeled RAD CONT, is actuated by pressing the square control button. Lights in the square control button will turn on or off to indicate which cockpit has radio control. The words FWD or AFT imbedded in the square control button will light to indicate the transfer of control of the main receiver-transmitter and auxiliary receiver from one cockpit to the other.

2.20.1.2.2 Normal/Alternate Select Switch. The normal/alternate select switch, labeled HDST-NORM/ALT, has two positions. The NORM position indicates that the pilot is using the ICS amplifier console that is assigned to that cockpit. If the ICS amplifier console should fail, the switch can be placed in the ALT position and both pilots will be using the remaining ICS amplifier console.

2.20.1.2.3 Microphone-Hot/Cold Switch. The microphone hot/cold switch is a two-position toggle switch labeled MIC with HOT and COLD positions. When the switch is placed in the HOT position, the ICS relay is energized and intercommunication between cockpits is continuously available. Communication will continue to be available between cockpits until the microphone hot/cold switch is placed in the COLD position, or until the MIC radio switch on the throttle is keyed to the UHF (forward) position and overrides the ICS HOT position.

2.20.1.2.4 Main Receiver ON/OFF Switch. The main receiver on/off switch, labeled MAIN/REC/OFF, is a two-position switch used to switch on the audio from the main receiver and provide an interlock in the main transmitter keying circuit. In the MAIN-REC position, audio, sidetone, and transmitting capability are available to the pilot on the main receiver-transmitter. In the OFF position, the main receiver-transmitter cannot be keyed; the main receiver audio will not be heard in the pilot headset; and, if there is radio transmission from the other cockpit, the transmitting sidetone will not be heard by the pilot who is not transmitting.

2.20.1.2.5 Auxiliary Receiver ON/OFF Switch. The auxiliary receiver on/off switch, labeled AUX-REC/OFF, is a two-position switch. Audio signals from the auxiliary receiver are available when the switch is in the AUX-REC position. In the OFF position, the audio signals are grounded.

2.20.1.2.6 NAV-PAC/Tacan ON/OFF Switch. The Nav-Pac/tacan on/off switch, labeled NAV-

TAC/OFF, is a two-position switch. In the NAV-TAC position, audio signals are available from the ARN-52(V) (tacan) or ARN-159(V) radio navigation system. In the OFF position, the audio signals are grounded.

2.20.1.2.7 ICS Volume Control. The ICS volume control is part of a double potentiometer with an inner control knob and outer control ring that can be rotated independently. The potentiometer is labeled VOL and the outer control ring is labeled ICS. The ICS ring controls the volume received from the other cockpit. The radio volume control is the other part of the double potentiometer with the inner control knob labeled RAD. The inner RAD knob controls the volume of all audio signals except ICS and the radar altimeter warning tone.

2.20.1.2.8 MIC-ICS/UHF Keying Switch. The MIC-ICS/UHF keying switch is located on the right-hand end of the throttle control in each cockpit. The switch initiates microphone communication in the ICS or ARC-51A or ARC-159(V5) radio communication system. The switch is a two-position switch spring-loaded to the center or off position. The forward switch position is labeled UHF and the aft switch position is labeled ICS.

Note

- Dual flight should not be undertaken unless positive ICS communications are available between cockpits.
- If ARC-51 or ARC-159(V5) transmitter is energized, both primary- and auxiliary-receiver are inoperative and reception is not possible. If ARC-51 or ARC-159(V5) MIC button sticks, the only means of radio reception is to place ARC-51 or ARC-159(V5) to OFF and utilize CMD or GRD position of ARR-69.

2.20.2 Personnel Disconnect. The personnel disconnect consists of a quick-release socket that supplies the electrical and pneumatic connections for the pilot oxygen supply, microphone, and headset.

2.20.3 AN/ARC-51A UHF Radio Communication System. The ARC-51A UHF radio communication system provides radiotelephone voice communication. The voice communication can be between aircraft in flight, aircraft in flight to ships, or aircraft in flight to ground-based radio stations. The range is normally limited to line-of-sight installations or the horizon when airborne.

The system consists of the following components: an RT-753/ARC-51A radio receiver-transmitter, a C-6555/ARC-51A radio control set, and ID-1003/ARC standing wave ratio indicator, an HD-513/ARC electronic equipment air cooler, an ARC-51A junction box, an AB-U-1478 UHF communication (blade) antenna, an antenna coaxial relay, and a UHF antenna switch. Some components of the following systems or units are also used in the ARC-51A system: intercommunication system (ICS), the AM-3624/ARA-50 control amplifier/coaxial switch assembly, and the AS-909/ARA-48 ADF antenna.

The ARC-51A system can be controlled and various frequencies selected from either cockpit; however, control is possible from only one cockpit at a time. Control of the ARC-51A system is indicated by the square control button labeled RAD CONT. The square button is located on the ICS and radio control panel and is part of the ICS system. The ICS and radio control panel is located on the instrument panel in each cockpit. If the FWD light is visible in the square control button, the forward cockpit has control of the ARC-51A system. An AFT light, visible in the square control button, indicates AFT cockpit control. Either pilot can take control of the ARC-51A system by pressing the square control button. Neither pilot can prevent the other pilot from assuming control of the system.

The ARC-51A system is energized by placing the C-6555/ARC-51A radio control function selector switch (Figure FO-1) from OFF to T/R or T/R+G. The mode selector switch is placed in PRESET CHAN position if one of the 20 preset channels is to be used. If a frequency is desired that is not preset, the mode selector switch is placed in MAN, and the frequency is set manually by using the three manual select knobs. If the function selector switch has been set in T/R+G instead of T/R, the separate guard receiver will be monitored in addition to the other selected channel or frequency. The MAIN-REC/OFF switch (Figure FO-1) on the ICS and radio control panel must be placed in the MAIN-REC position before any signals can be sent or received on the ARC-51A system. Audio signals from the receiver are grounded when the switch is in the OFF position and an interlock prevents radio transmission.

The ARC-51A system uses three antennas, an ADF antenna for direction finding, and two blade antennas for normal communication work. One blade antenna is located on the upper fuselage just aft of the aft cockpit (Figure 1-3) and the other blade antenna is located on the access door to the aft refrigeration unit. The dual UHF antenna system is applicable to the TA-4F only. A two-position switch for antenna selection is located in the forward cockpit on the outboard forward right-hand console (Figure FO-1). The aft cockpit does not have an antenna selection switch.

2.20.3.1 C-6555/ARC-51A Radio Set Control Panel. The C-6555/ARC-51A radio set control panel provides remote control of the RT-743/ARC-51A radio receiver-transmitter. A separate control panel is located in each cockpit. The C-6555/ARC-51A control panel contains a frequency indicator, a channel indicator, a potentiometer, a memory drum; plus switches for function selection, mode selection and squelch disable. The mode selector switch has three positions: PRESET CHAN, MAN, and GD XMIT. The PRESET CHAN position permits selection of any one of 20 preset channels, with the selected channel number showing in the window above the PRESET CHAN knob. The hinged cover conceals the memory drum and has the numbers 1 through 20 listed on the cover. The 20 preset channel frequencies can be listed in the space provided after the numbers. The MAN position permits manual selection of channel frequencies, using the three switch knobs on the panel. The frequency selected will appear on the frequency indicator. In the GD XMIT position, the guard frequency is automatically selected on the main receiver for both reception and transmission in emergencies.

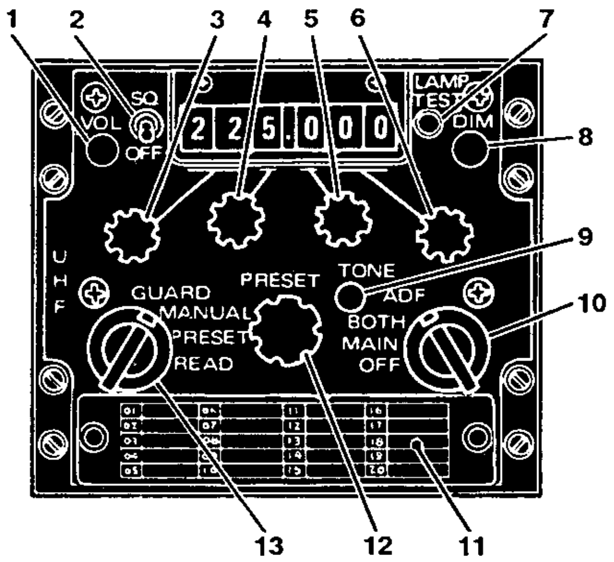
The function selector switch has four positions: OFF, T/R, T/R+G, and ADF. The AN/ARC-51A system is deenergized when the function selector switch is in the OFF position. The T/R position energizes the system and transmission and reception is possible after warmup. In the T/R+G position, the separate guard receiver can be monitored, in addition to the capability provided by the T/R position. The ADF is used for automatic direction finding (ADF). The SQ DISABLE switch has an ON and OFF position. In the OFF position, the main receiver squelch circuit operates in a normal manner. When the switch is in the ON position, the squelch circuit is disabled. The potentiometer, labeled VOL, is not used and has no effect on the system. The memory drum is under the hinged cover on which the 20 preset channel frequencies can be listed. The cover can be lifted and the preset channel frequencies changed to any frequency between 225.00 and 399.95 megacycles, in 0.05 steps. A small tool is provided under the cover to change frequencies.

2.20.4 ARC-159(V5) UHF Radio Communication System. The ARC-159(V5) UHF radio communication system (solid-state) is installed on aircraft reworked per AFC No. 621, Amendment No 2. The system provides 20 preset channels and up to 7,000 manually set channels of amplitude modulated voice communication. The system is also capable of automatic direction finder (ADF) and guard reception. Range of the ARC-159(V5) is normally limited to line-of-sight, or the horizon when airborne.

The ARC-159(V5) radio communication system includes a transceiver, UHF antenna, and two control boxes. Controls for operation and frequency selection are available in the forward and aft cockpits but control is effective in only one cockpit at any time. Control is indicated by lights in the square control button, labeled RAD CONT, on the RH wedge console in both cockpits. If the FWD light is on, control is in the forward cockpit. If the AFT light is on, control is in the aft cockpit. Control can be changed by depressing either control button without hindrance from the pilot in the other cockpit.

2.20.4.1 ARC-159(V5) UHF Radio Operation. The ARC-159(V5) UHF system is energized by placing the transceiver control function selector switch from OFF position to MAIN or BOTH. The mode selector switch is placed to PRESET if one of the 20 preset channels is to be used, and the PRESET knob rotated to the desired channel number. The channel number selected will appear on the indicator in the fourth- or fifth-digit position. The remaining readout positions will be blank. To identify the frequency, place the mode selector switch to READ position and the indicator readout will display the preset frequency for the channel selected. Manual selection of a frequency is accomplished by placing the mode selector switch in MANUAL position and rotating the four manual frequency selector knobs until the desired frequency appears on the indicator. If the function selector switch has been placed in the BOTH position instead of MAIN, the separate guard receiver will be monitored in addition to the other channel or frequency selected.

The volume of received audio signals is controlled by the volume (VOL) control on the ARC-159(V5)



1. VOLUME CONTROL
2. SQUELCH-OFF SWITCH
3. 100-MHz/10-MHz FREQUENCY SELECTOR SWITCH
4. 1-MHz FREQUENCY SELECTOR SWITCH
5. 0.1-MHz FREQUENCY SELECTOR SWITCH
6. 50-KHz/25-KHz FREQUENCY SELECTOR SWITCH
7. LAMP TEST PUSHBUTTON SWITCH
8. LIGHTING (DIM) POTENTIOMETER
9. TONE PUSHBUTTON SWITCH
10. FUNCTION SELECTOR SWITCH
11. PRESET FREQUENCIES CHART
12. PRESET CHANNEL SELECTOR
13. MODE SELECTOR SWITCH

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Figure 2-12. AN/ARC-159(V5) Operating Controls (Sheet 1 of 2)

transceiver control panel. The squelch circuit can be disabled by placing the squelch (SQ) switch in the OFF position, improving receiver sensitivity to weak signals.

The ARC-159(V5) UHF radio communication system is capable of transmitting and receiving on any one of 7,000 frequencies, spaced at 25-kilohertz intervals in the 225.000 to 399.750 megahertz UHF band. Any one of 20 preset channels may be preselected when the panel mode selector switch is in the PRESET position. Placing the mode selector switch in the MANUAL position transfers frequency selection to the four manual frequency selector knobs. Reading clockwise, the first knob controls the first two digits of the frequency in 10-megahertz steps from 22 to 39. The second knob provides steps of one megahertz from 0 through 9. The third knob provides steps of one-tenth megahertz, and the fourth knob provides steps of 25 kilohertz.

Placing the ARC-159(V5) selector switch in BOTH position monitors the audio from the guard receiver and the main UHF receiver simultaneously, unless transmitting.

The guard channel can be used for emergency transmission and reception by placing the mode selector switch in GUARD position. The transceiver automatically tunes to guard frequency and displays 243.0 megahertz on the indicator.

The ARC-159(V5) UHF system uses two antennas (Figure 2-12), an ADF antenna for direction finding, and a blade antenna for normal communication. The blade antenna is omnidirectional and is used for receiving and transmitting UHF communication signals.

Automatic direction finding (ADF) on received signals is accomplished by placing the ARC-159(V5) function selector switch in the ADF position.

ARC-159(V5) (UHF) TRANSCEIVER OPERATING CONTROLS AND FUNCTIONS

CONTROL	DESCRIPTION	FUNCTION
VOL	Potentiometer	Adjusts audio output level.
SQ-OFF	Toggle switch	Enables or disables main receiver squelch. Squelch is disabled in OFF position.
Frequency	Wafer switch and readout	Selects and indicates 100-MHz and 10-MHz frequency increments during manual operation.
Frequency	Wafer switch and readout	Selects and indicates 1-MHz frequency increment during manual operation.
Frequency	Wafer switch and readout	Selects and indicates 0.1-MHz frequency increments during manual operation.
Frequency	Wafer switch and readout	Selects and indicates 50-KHz and 25-KHz frequency increments during manual operation.
LAMP TEST	Momentary contact pushbutton switch	Illuminates readout when pressed.
DIM	Potentiometer	Adjusts light intensity of readout.
TONE	Momentary contact pushbutton switch	Keys transmitter and modulates transmitted signal with 1020-Hz tone.
Mode selector	Wafer switch	
GUARD		Tunes receiver-transmitter to guard frequency. Displays guard frequency on readout.
MANUAL		Permits manual selection of frequency. Selected frequency is displayed on readout.
PRESET		Permits selection of any of 20 preset channels. Displays selected channel number on readout in 4th and/or 5th digit position. Remaining 4 digits are blank.
READ		Identifies frequency on indicator readout by displaying preset frequency for channel selected.
Chart	Operating frequency chart	Provides semipermanent record of preset frequencies.
PRESET	Memory drum switch	Preset channel selector. Sets channel when mode selector is in PRESET or READ.
Function selector	Wafer switch	
OFF		Turns off power to receiver-transmitter.
MAIN		Selects normal receive and transmit operations. Transmitter is keyed by MIC switch or TONE button.
BOTH		Enables guard receiver in addition to functions described for MAIN.
ADF		Enables automatic direction-finding equipment. Main and guard receivers are enabled.

Figure 2-12. AN/ARC-159(V5) Operating Controls (Sheet 2 of 2)

Note

For ARC-159(V5) ADF operation, ensure that function selector switch on ARR-40 control panel of ARR-69 auxiliary UHF receiver system is not in ADF position. AUX REC ADF position automatically places the ARC-159(V5) transceiver in MAIN position.

ARC-159(V5) UHF transceiver operating controls and functions are presented in Figure 2-12.

2.20.5 Security Equipment (TA-4F). Aircraft reworked per A-4 AFC 343-III include security equipment (Juliet 28) which is supplementary to the UHF. The security equipment control panel is located on the right-hand console in the forward cockpit between the UHF and tacan control panels. Power for the security equipment is supplied by the 28-vdc primary bus (Figure FO-4). Any further description of the security equipment or its function is above the security classification of this manual.

2.20.6 UHF Antenna Switch (TA-4F). When installed, a two-position switch allows selection of either the upper or lower UHF antenna. In the event reception is marginal, selection of opposite antenna is recommended. On aircraft with one antenna (a configuration based on later studies), a switch is not installed.

2.20.7 AN/ARR-69 (UHF) Auxiliary Receiver System. The AN/ARR-69 (UHF) auxiliary receiver system is used alternately with the AN/ARC-51A/ AN/ARC-159(V5) (UHF) radio communication system, or simultaneously if one system is used for direction finding and the other for communication.

An interlock in the two systems gives the AN/ARR-69 system some control over the AN/ARC-51A or AN/ARC-159(V5) system. The AN/ARR-69 system operates in the frequency range of 265.2 to 284.2 megacycles. Twenty preset frequency channels plus guard channel (243.0 megacycles) are available within the frequency range. The C-1457/ARR-40 receiver control for the R-1286/ARR-69 auxiliary radio receiver is installed in each cockpit. Control is possible from each cockpit from only one cockpit at a time. Control is switched with the AN/ARC-51A or AN/ARC-159(V5).

2.20.7.1 C-1457/ARR-40 Receiver Control Panel. The C-1457/ARR-40 receiver control panel (Figure FO-1) is used as a remote control of the R-1286/ARR-69 auxiliary radio receiver. The C-1457/ARR-40 receiver control panel also exercises some control over the AN/ARC-51A or AN/ARC-159(V5) system. The function selector switch on the C-1457/ARR-40 receiver control panel is labeled AUX REC above the switch and MAIN T/R below the switch. The AUX REC switch positions are: OFF, ADF, CMD, and GRD. The MAIN T/R switch positions are: T/R, ADF, and ADF. When the switch is operated, the AUX REC and MAIN T/R positions change simultaneously. The relation between the AUX REC and MAIN T/R follows:

AUX REC Position	MAIN T/R Position
OFF	None
ADF	T/R
CMD	ADF
GRD	ADF

The AUX REC position must be in OFF, command (CMD), or guard (GRD) to give the MAIN T/R (AN/ARC-51A or AN/ARC-159(V5) system) ADF capability.

The C-1457/ARR-40 receiver control center dial, labeled AUX/CHAN, is marked to represent 20 preset channel frequencies. Guard frequency channel selection is provided on the function selector switch. To determine the preset channel corresponding to a given Navy/Marine UHF radio beacon, subtract 64 from the last two digits (whole number) of the frequency. Example: frequency 267.6 would be (67 - 64 = 3) on channel 3.

Two potentiometer-type controls are located on the right-hand side of the C-1457/ARR-40 receiver control panel. The volume is also controlled by the radio volume control on the ICS and radio control panel, located on each instrument panel. The control labeled SENS will control the sensitivity of the R-1286/ARR-69 auxiliary radio receiver. Rotating the SENS control in a clockwise direction will increase the sensitivity of the receiver.

2.21 AIMS TRANSPONDER SYSTEM

The AIMS transponder system is capable of automatically reporting coded identification and altitude signals in response to interrogations from surface (or airborne) stations so that the stations can establish aircraft identification, control air traffic, and maintain vertical separation. The system has five operating modes (1, 2, 3/A, C, and 4). Modes 1 and 2 are IFF modes, mode 3 (Civil mode A) and mode C (automatic altitude reporting) are primarily air traffic control modes and mode 4 is the secure (encrypted) IFF mode. (Mode 4 is not operational unless the system includes a KIT-1A TSEC transponder computer.)

2.21.1 AIMS Transponder System Components The basic AIMS transponder system components are:

1. C-6280A(P) transponder set control
2. APX-72 transponder
3. TS-1843/APX transponder test set
4. Antenna switching unit.

The AIMS altimetry in higher performance aircraft consist of:

1. CPU-66/A altitude computer
2. AAU-19/A servo altimeter

The following components provide the secure IFF function:

1. KIT-1A/TSEC transponder computer
2. IFF caution light
3. Landing gear interlock.

2.21.2 Transponder Test Set. The TS-1843/APX transponder test set provides the self-test and monitor functions for modes 1, 2, 3/A, and C. The transponder accomplishes the self-test functions, when actuated, by interrogating the transponder and monitoring the replies. The monitor function is accomplished, when selected, by monitoring the replies to external interrogations. The controls for the transponder are included on the C-6280 transponder set control.

2.21.3 C-6280A(P) Transponder Set Control. Most of the controls for the AIMS transponder system are included on the transponder set control (Figure 2-13). The REPLY light and the controls on the left side of the C-6280A(P) are concerned with mode 4. The test light and the remaining controls are associated with modes 1, 2, 3/A, and C; except that the master switch controls all modes of operation.

2.21.4 MASTER Switch. The master switch applies power to all of the AIMS transponder system components except the altimetry components. The switch is a five-position rotary switch placarded OFF, STBY, LOW, NORM, and EMER. The switch must be lifted over a detent to position to EMER or to OFF. STBY should be selected for 3 minutes prior to switching to LOW or NORM to allow the transponder to warm up. In the NORM position, the transponder system is operational at normal receiver sensitivity. In the LOW position, the system is operational, but the transponder receiver sensitivity is reduced. In the EMER position, the transponder transmits emergency replies to mode 1, 2, or 3/A interrogations. The mode 3/A emergency reply includes code 7700. When

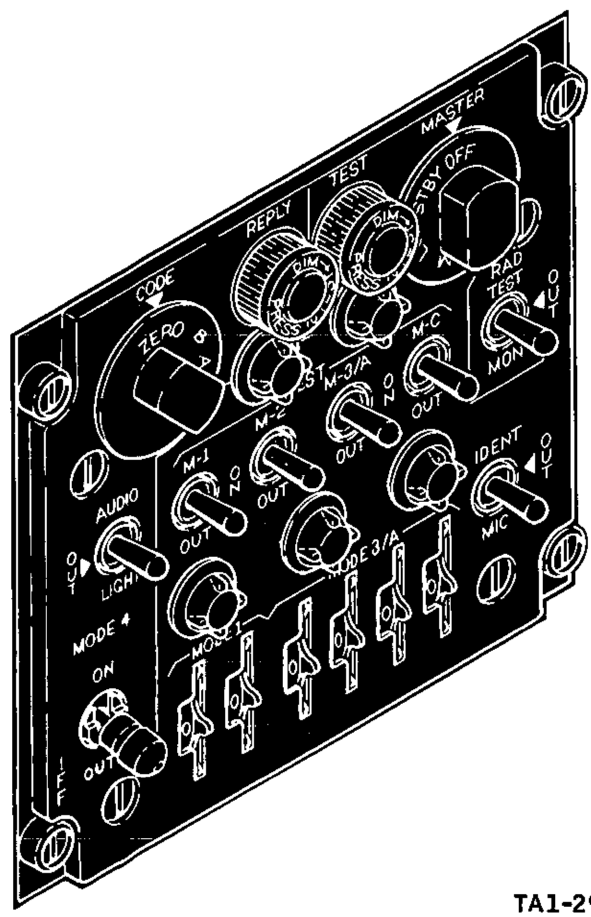

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Figure 2-13. C-6280A(P) Transponder Set Control

EMER is selected, mode 4 and mode C are enabled regardless of the position of the selector switches.

2.21.5 IDENT-OUT-MIC Switch. The IDENT-OUT-MIC switch is a three-position toggle switch. The spring-loaded IDENT position adds an identification of position pulse to mode 1, 2, and 3/A replies for a period fo 15 to 30 seconds. In the MIC position, the identification of position function is activated for 15 to 30 seconds each time the UHF microphone switch is pressed.

2.21.6 Mode 1, 2, and 3/A Code Selectors. The two mode 1 thumbwheel selector switches allow selection of 32 mode 1 codes and the four mode 3/A thumbwheel selectors allow selection of 4,096 mode 3/A codes. The mode 2 code selector switches are located on the transponder and cannot be changed by the pilot during flight.

2.21.7 Mode Switches. The four mode switches (M-1, M-2, M-3/A, and M-C) each have OUT, ON, and spring-loaded TEST positions.

The center ON position of each switch enables that mode. To test the transponder, press the mode switch of each mode to the TEST position.

TEST light on indicates proper operation of that mode. The MASTER switch must be set to NORM for the test function to operate. The mode switches of the modes not being tested should be OUT when testing on the ground to prevent unnecessary interference with nearby ground stations.

Note

> The TEST light may flash once as each mode switch is released from the TEST position, and as the RAD TEST-OUT-MON switch is moved. The TEST light flash in these instances, is a characteristic of the TS-1843 transponder test set and is of no significance.

2.21.8 RAD TEST-OUT-MON Switch. The MON position of the RAD TEST-OUT-MON switch is used to monitor the operation of the modes 1, 2, 3/A and C. When MON is selected, the TEST light will come one for 3 seconds each time an acceptable response is made to an interrogation on a selected mode.

The spring-loaded RAD TEST position is used for testing. This position enables a mode 3/A code reply to a TEST mode interrogation from a ramp test set. It also enables a mode 4 reply to a VERIFY 1 interrogation from a surface station or a ramp test set. A VERIFY 1 interrogation is a modified mode 4 interrogation used for testing.

2.21.9 Mode 4 Operation. Mode 4 operation is selected by placing the mode 4 toggle switch to ON, provided that the MASTER switch is in NORM or LOW. Placing the mode 4 switch to OUT disables mode 4.

The mode 4 CODE switch is placarded ZERO, B, A, and HOLD. The switch must be lifted over a detent to position to ZERO. The switch is spring-loaded to return from HOLD to the A-position. Position A selects the mode 4 code for the present code period and position B selects the mode 4 code for the succeeding code period. Both codes are mechanically inserted into the KIT-1A/TSEC transponder computer by a single insertion of the KIK-18/TSEC code changing key. The codes are mechanically held in the KIT-1A/TSEC transponder computer, regardless of the position of the MASTER switch or the status of aircraft power, until the first time the weight is off the landing gear. Thereafter, the mode 4 codes will automatically zero anytime the MASTER switch or the aircraft power is turned off. The code settings can be mechanically retained after the aircraft has landed (weight must be on the landing gear) by turning the CODE switch to HOLD and releasing it at least 15 seconds before the MASTER switch or aircraft power is turned off. The codes again will be held, regardless of the status of aircraft power or the MASTER switch, until the next time the landing gear is raised.

The mode 4 codes can be zeroed any time the aircraft power is on and the MASTER switch is not OFF by turning the CODE switch to ZERO.

An audio signal, the transponder set control REPLY light, and the IFF caution light are used to monitor mode 4 operation. The AUDIO-OUT-LIGHT switch controls the audio signal and the REPLY light, but not the IFF caution light. In the LIGHT position, the REPLY light comes on as mode 4 replies are transmitted. In the AUDIO position, an audio tone in the pilot headset indicates that valid mode 4 interrogations are being received and the REPLY light comes on if mode 4 replies are transmitted. In the OUT position, the audio indications and the REPLY light are inoperative and the REPLY light will not press-to-test.

2.21.10 IFF Caution Light. The IFF caution light, located on the glareshield (Figure 1-3), comes on to indicate that mode 4 is not operative. The light is operative when aircraft power is on and the MASTER switch is not OFF. However, the light will not operate if the KIT-1A/TSEC transponder computer is not installed in the aircraft. The IFF caution light comes on to indicate that (1) the mode 4 codes have zeroed, (2) the self-test function of the KIT-1A/TSEC transponder computer has detected a faulty computer, or (3) the transponder is not replying to proper mode 4 interrogations.

If the IFF caution light comes on, switch the MASTER switch to NORM (if in STBY) and ensure that the mode 4 toggle switch is ON. If the light remains on, employ operationally directed flight procedures for an inoperative mode 4 condition.

2.21.11 CPU-66/A Altitude Computer. The CPU-66/A altitude computer is a small air data computer consisting of an altitude sensor, airspeed sensor, electromechanical computing section, servo monitors, synchro outputs, and a digital encoder.

The CPU-66/A computer outputs are altitude information corrected for static position error. The synchronization output is supplied to the AAU-19/A altimeter(s) providing the pilot(s) with a corrected altitude indication. The digital output from the computer is applied to the transponder for transmission on mode C. The digital output is coded in increments of 100 feet and is referenced to 29.92 inches of Hg. The computer operates automatically when aircraft power is on, unless the circuit breakers are pulled. In case of an electrical failure in the computer, the AAU-19/A altimeters automatically switch to standby operation and the computer digital output circuit is disabled. In addition, the transponder test set mode C enabling circuit is opened preventing a GO test for mode C.

2.21.12 AAU-19/A Servo Altimeter. The AAU-19/A counter-drum-pointer servo altimeter consists of a pressure altimeter combined with an ac powered servomechanism. Altitude is displayed in digital form by a 10,000 foot counter, a 1,000 foot counter, and a 100-foot drum. A single pointer also indicates hundreds of feet on a circular scale, with center graduations of 50 feet. Below 10,000 feet, a diagonal warning symbol appears on the 10,000-foot counter. A barometric pressure setting (baroset) knob is provided to insert barometric pressure in inches of Hg. The baroset knob has no effect on the digital output (mode C) of the altitude computer that is always referenced to 29.92 inches of Hg. The altimeter has a reset (servo) mode and a standby (pressure) mode of operation, controlled by a spring-loaded self-centering mode switch placarded RESET and STBY. In the reset (servo) mode, the altimeter displays altitude, corrected for position error, from the synchronization output of the altitude computer. In the standby mode, the altimeter displays altitude directly from the static system and operates as a standard pressure altimeter. During standby operation, it is possible for the transponder to continue to transmit altitude information (corrected for position error) on mode C, while the altimeter is displaying altitude not corrected for position error.

2.22 NAVIGATION EQUIPMENT

2.22.1 Compass Controller. The controls for the compass system are located on the compass controller panel (Figure FO-1) located on the right console. The switch, marked SLAVED and FREE, permits selection of either function. A push-to-set-heading knob is used to rotate the ID-663 BDHI and the all-altitude indicator to any desired heading. This also may be used to synchronize the compass system with the magnetic flux valve. The rate of rotation is proportional to the amount of displacement of the set heading knob.

The PUSH TO SYNC button will do the synchronizing automatically. The compass synchronization needle is energized only when the system is operated as a slaved directional gyro. The synchronization indicator functions as a null indicator with heading information being obtained from either the BDHI or the all-attitude indicator.

If the average needle position is the centerline of the synchronization indicator when the system is operated in the SLAVED mode, the compass card is synchronized with the magnetic flux valve. Any small deviation from the null position will be slaved out in 1 to 3 minutes after the initial heading is set.

A compass card error of ±2° will peg the needle. If the synchronization needle stays pegged after prolonged straight and level flight (more than 5 minutes), a possible malfunction of the system is indicated.

During flight, the synchronization needle will oscillate about the null position because of the motion of the flux valve. This oscillation is normal and indicates that correct integration of inputs from the flux valve is being accomplished (as long as the average position of the synchronization needle is the null position).

The directional gyro will integrate or smooth out these oscillations on the BDHI compass card. To synchronize the compass proceed as follows: if the synchronization needle is left of center, clockwise rotation of the set heading control should move the synchronization needle from left to right and rotate the compass card clockwise; if the synchronization needle is right of center, counterclockwise rotation of the set heading control should move the needle from right to left and rotate the compass card counterclockwise. For fast centering of the synchronization needle, push the PUSH TO SYNC button and hold it until the needle is centered. To move the synchronization needle slowly, depress and turn the set heading knob left or right until the desired slew rate is achieved.

The latitude setting dial is used to control the apparent drift of the gyro when operating as a free gyro. This dial is marked for each 2° for 0 to 90. The dial should be set to the approximate latitude of the aircraft. If the latitude changes as the flight progresses, the dial should be reset to the new latitude.

2.22.1.1 Slaved Operation. When electrical power is initially applied to the system in the SLAVED mode, allow 100 seconds for warmup; then the auto synchronization cycle (approximately 12 seconds) will rotate the all-attitude indicator and the BDHI compass card to the aircraft magnetic heading.

The heading indicator should show the correct magnetic heading when the synchronization needle stabilizes.

2.22.1.2 Free Gyro Operation. To operate the system as a free gyro, allow 90 seconds for the system to warm up, then:

1. Place the SLAVED-FREE switch in FREE.

2. Rotate the latitude setting dial to the latitude of the aircraft.

3. Rotate the compass card of the BDHI to the desired heading by the use of the set heading knob.

Note

The compass synchronization needle nulls and is inoperative when the system is used as a free gyro.

2.22.2 Tacan Bearing-Distance Equipment. The AN/ARN-52(V) tacan airborne equipment operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot. Visual indication of magnetic bearing to a selected station is provided by the No. 2 pointer of the ID-663-BDHI (Figures FO-1 and FO-2), and distance information is indicated in the range window. Beacon identification tone signals are received through the regular headset.

2.22.2.1 Tacan Control Panel (ARN-52(V)). The control panel (Figure FO-1 and FO-2), is identified as TACAN and is located on the right console. Operating controls include the power switch with OFF, REC, T/R, and A/A positions, two channel selector knobs, and volume control. The REC and T/R positions give bearing information on the No. 2 needle of the ID-663-BDHI. In the T/R position, distance information in the range window of the instrument is also given. The A/A position gives air-to-air distance information between cooperative aircraft. Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the tacan installation to provide range indications between one aircraft and up to five others. Tacan displays normal range and azimuth information in the T/R mode and range information only in the A/A mode. (The azimuth indicator, No. 2 pointer, rotates continuously.)

If A/A operation is desired between two aircraft, the channels selected must be separated by exactly 63 channels; for example, No. 1 aircraft is set to channel 64. No. 2 aircraft is set at channel 1. Both aircraft must then select A/A mode on the tacan function switch with the range between aircraft displayed on the DME indicator. The maximum lock on range is 300 miles. However, because of the relative motion of the aircraft, the initial lock on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the tacan selector switch.

2.22.2.2 Operation of ARN-52(V). To operate the tacan radio, proceed as follows:

1. Power switch – REC

2. After 3 minutes, power switch – T/R

3. Channel selector switch – SET CHANNEL SELECTOR

4. Station identification code will be audible in headset only when the NAV-TAC switch on the ICS control panel is in the TAC position.

5. BDHI-NAV COMPUTER-TACAN -NAVPAC switch – TACAN position

6. Magnetic bearing to station will be indicated on the No. 2 pointer of the BDHI indicator.

7. For distance information, the power switch must be turned to T/R. Read slant range distance to the station in nautical miles in the range window.

2.22.2.3 Tacan Bearing-Distance System (ARN-118(V)). The ARN-118(V) TACAN bearing distance system is installed in aircraft reworked per AFC 602, Chapter 2. The system provides operational modes for indications of bearing and slant range up to 275 nm to a selected VORTAC facility, or to a surface or airborne tacan beacon. A mode is also provided for slant range distance indications to another similarly equipped aircraft, and if the other aircraft is equipped with bearing transmitting equipment, bearing indications to the other aircraft will be displayed. Serious problems such as 40° lock-on error, echo tracking, and long search cycles, are eliminated in the ARN-118(V) system. The elimination of these problems increases confidence in operation of the ARN-118(V) system and ensures accurate navigational information for determining flightpaths and approaches.

Note

A-4 aircraft are not presently equipped with bearing transmitting equipment.

The system provides a self-test of the system that is manually initiated by depressing a built-in-test switch located on the tacan control panel. The ARN-118(V) also contains an automatic self-test function that causes the system to be tested automatically when the tacan beacon is lost. The automatic self-test checks the system for proper operation to determine if the signal loss was because of a system malfunction. If there is a system malfunction, the TEST indicator on the tacan control panel lights at the end of the automatic self-test cycle.

Major components of the ARN-118(V) TACAN system include a receiver-transmitter unit with required accessories, two antennas (same antenna as ARN-84 and ARN-52), a tacan control panel, and a tacan antenna switch.

2.22.2.4 Tacan Control Panel (ARN-118(V)). The ARN-118(V) TACAN control panel (Figure 2-14) is located on the right console and is labeled TACAN. The control panel contains a mode selector control, two channel selector controls, a volume control, X-Y selector, a built-in-test switch, and a test indicator light.

The five-position, rotary function mode selector switch is marked with positions OFF, REC, T/R, A/A, and A/A T/R. The function of each position is as follows:

1. OFF – Power is not applied to tacan system.

2. RECEIVE MODE (REC) – Tacan system determines bearing from the aircraft to the selected tacan station. Bearing to the station is displayed on the BDHI by the No. 2 pointer. Station identification signal is received. No distance is calculated.

3. TRANSMIT AND RECEIVE MODE (T/R) – In addition to the functions of REC position, tacan system determines slant range from the aircraft to the selected tacan station. Distance to the station in nautical miles is displayed in the range window on the BDHI.

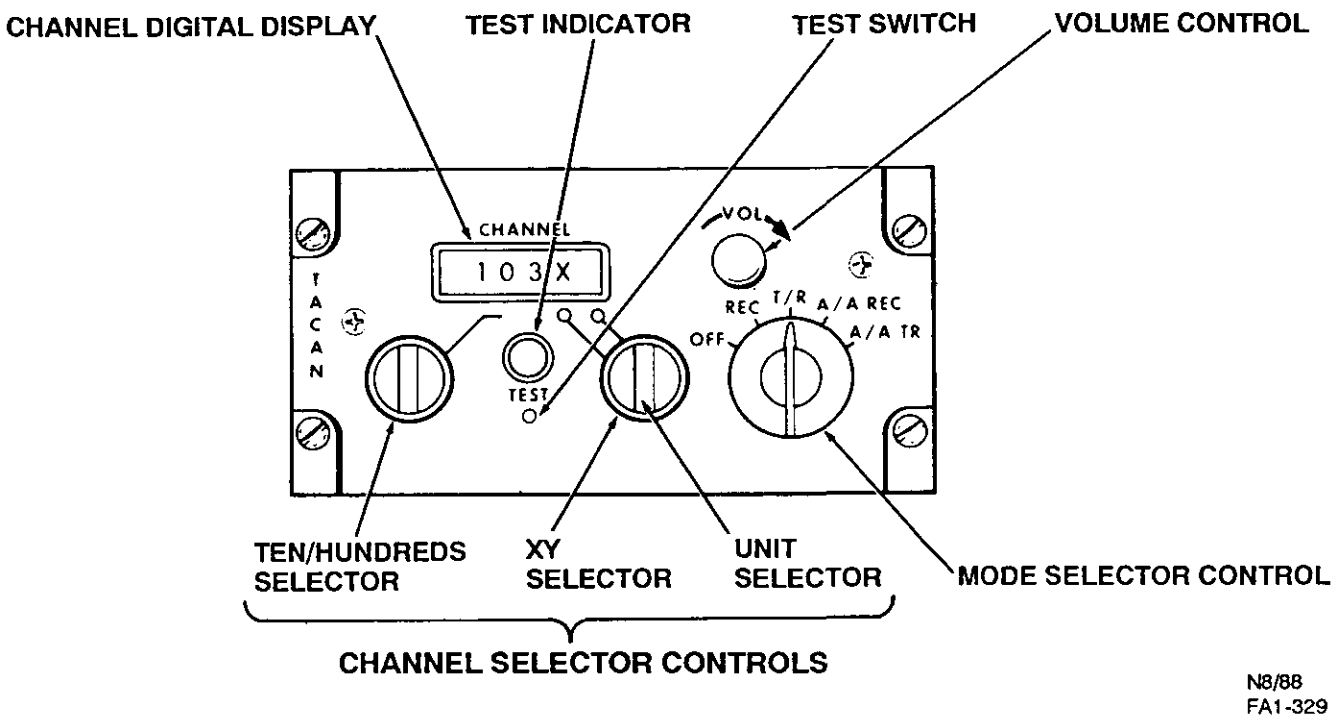


Figure 2-14. ARN-118(V) Tacan Control Panel

4. AIR-TO-AIR RECEIVE MODE (A/A REC) – Tacan system receives bearing information from a suitably-equipped, cooperating aircraft and calculates the relative bearing to the cooperating aircraft. No distance information is available.

5. AIR-TO-AIR TRANSMIT-RECEIVE MODE (A/A/T/R) – Tacan system receives both distance and bearing information from a suitably equipped, cooperating aircraft and calculates the slant-range distance and relative bearing of the aircraft. If the aircraft is not equipped with bearing transmitting capabilities, only distance information is received and slant-range distance to the aircraft is calculated.

Additional control switches located on the ARN-118(V) control panel are:

1. CHANNEL selectors – Selects desired tacan channel that is displayed in the CHANNEL digital display.

2. X-Y selector – Selects either X or Y channel. When X mode is selected, the basic 126 channels for tacan operation are provided. When Y mode is selected, an additional 126 channels are provided.

Note

At the present time only X type tacan stations are in operation. Selecting a Y station erroneously will result in an apparent tacan system failure with no azimuth or DME lock on.

3. Units selector – Selects units digit of desired channel.

4. Tens/hundreds selector – Selects tens and/or hundreds digit of desired channel.

5. CHANNEL digital display – Displays selected tacan channel.

6. VOL control – Varies level of audio identification signal.

7. TEST switch – Initiates system self-test.

8. TEST indicator – Lights when a malfunction occurs during MANUAL self-test or automatic self-test. Flashes at start of self-test cycle to check indicator lamp.

2.22.2.5 Preflight of the ARN-118(V). On all flights, perform the preflight check before takeoff to ensure that the ARN-118(V) tacan system is operating correctly and will provide accurate navigational information.

1. Set tacan control mode selector to T/R.

2. Wait 90 seconds for receiver-transmitter warmup.

3. Momentarily depress TACAN control TEST switch and at the same time observe BDHI and TACAN control for the following indications:

   a. Tacan control TEST indicator momentarily flashes, indicating that the indicator is operational.

   b. BDHI bearing pointer may slew to 270° for a nominal 7 seconds.

   Note

   The indications in step c occur for a nominal 15 seconds.

   c. BDHI DME window indication is 000.0 to 0.5, and bearing pointer indicates 180° (±3°). A distance indication of 300.0 is equal to negative 0.01 nm and a distance indication of 399.5 is equal to negative 0.5 nm. The 300.0 to 399.5 indications in the MILES window are not malfunctions, but an indication of negative distance.

   d. Observe tacan control TEST indicator. If indicator light comes on during the test and remains on, there is a malfunction in the ARN-118(V) system and all distance and bearing information should be disregarded until the malfunction is corrected.

In the A/A REC mode, the ARN-118(V) calculates the relative bearing to a suitably equipped, cooperating aircraft. Any number of aircraft can receive bearing information from one aircraft.

Note

- In all tacan systems there is the possibility of interference from IFF, transponder, and DME signals when operating in the air-to-air modes. To minimize the possibility of interference, it is recommended that Y channels be used and that channels 1 through 11, 58 through 74, and 121 through 126 be avoided.
- In A/A operation between two aircraft the channels must be separated by exactly 63 channels e.g., No. 1 aircraft is set to channel 29, No. 2 aircraft is set at channel 92. Both aircraft must then select A/A mode on the tacan function switch with the range between aircraft being displayed on the DME indicator.

2.22.2.6 Operation of Tacan System (ARN-118(V)). For normal tacan system operation proceed as follows:

1. X-Y selector – X.

2. Channel selector controls – SET.

3. Mode selector control – REC.

Note

When mode selector control is moved from the OFF position, a 90-second warmup period in REC position is required before selecting another mode.

4. After 90-second warmup, mode selector control – T/R.

5. Self test – PRESS.

6. Station identification signal will be audible in headset. Volume can be adjusted by using VOL control.

Note

When cochannel interference occurs in the T/R mode, one audio identification signal may be clear and readable while the second identification signal is garbled. The garbled identification signal alerts the pilot that range information is being received from one tacan beacon and an audio identification signal is being received from another tacan beacon. The garbled identification signal remains until both the distance information and a single clear audio identification signal are received from the same tacan beacon. When any garbled information is received, all information displayed is unreliable and should not be used.

7. BDHI NAV COMPUTER TACAN-NAVPAC switch - TACAN.

8. Magnetic bearing to station will be displayed on BDHI No. 2 pointer.

9. Slant range distance to station in nautical miles is displayed in range window on BDHI.

2.22.3 Tacan Antenna Switch. A three-position tacan antenna switch (Figures FO-1 and FO-2) is located on the outboard right console. The purpose of the switch is to enable the pilot to utilize the forward or aft antenna. The switch is labeled AUTO, FWD, and AFT. The AUTO position enables automatic selection of the antenna which permits station lock on to be achieved.

2.22.4 Course Indicator ID-249/ARN (TA-4J). The course indicator ID-249/ARN is installed on the instrument panels of both cockpits (Figures FO-1 and FO-2) in the TA-4J model aircraft only. The course indicator displays aircraft heading and position relative to a selected tacan course anytime the tacan power switch is set to REC or T/R and a signal of sufficient strength is being received. The course deviation indicators of both cockpits are slaved and indicate deviation from the course selected in the cockpit having tacan control.

When the course indicator is used to display tacan information, the desired course is set in the course selector window with the course set knob. The heading pointer, connected to the course set knob and the compass system, displays aircraft heading relative to the selected course. When the aircraft heading is the same as the course selected, the heading pointer indicates 0° heading deviation at top of the course indicator. The heading deviation scales, at the top and bottom of the course indicator, are scaled in 5° increments up to 45°.

The TO-FROM indicator shows whether the course selected, if intercepted and flown, will lead the aircraft to or from the station. When the aircraft passes a course from the station perpendicular to the selected course, the TO-FROM indicator changes.

Aircraft heading has no effect on the TO-FROM indications. The course deviation indicator or vertical pointer (CDI) displays aircraft position relative to the course selected. Turning until the heading pointer points toward the CDI will correct the aircraft toward the selected course or its reciprocal. The CDI will remain fully deflected until the aircraft is within 10° of the course selected in the course selector window.

The horizontal pointer is used to indicate vertical position relative to an instrument landing system (ILS) glide slope, and is not operative in the TA-4J.

2.22.5 Automatic Direction Finding Equipment. The ARA-50 (ADF) radio navigation system supplies automatic direction finding indication from received UHF radio signals. The ARA-50 system operates in conjunction with the ARC-51A (or ARC-159(V5)) (UHF) radio communication system, the ARR-69 (UHF) auxiliary receiver system, and the ID-663B/U bearing, distance, and heading indicator (BDHI). The signal is received by the ARA-50 from either the ARC-51A (or ARC-159(V5)) or the ARR-69 system and then the relative bearing to the transmitting UHF station is displayed by the No. 1 pointer of the BDHI.

Note

Excessive UHF-ADF bearing errors may result when stores are carried on center-line stations or when in landing configuration outbound.

The ADF operation is partially controlled by the C-1457/ARR-40 receiver control panel of the ARR-69 (UHF) auxiliary receiver system (Figure FO-1). The ARC-51 (or ARC-159(V5)) (UHF) radio communication system cannot be used in the ADF mode unless the C-1457/ARR-40 control is in the AUX REC/OFF, AUX REC/CMD, or AUX REC/GRD position. To use the ARR-69 auxiliary communication system in the ADF mode, place the C-1457/ARR-40 control in the AUX REC/ADF position.

2.22.5.1 Operation of the ARA-50 Radio Navigation System. The ARA-50 ADF equipment is energized when the aircraft electrical system is energized. Tune in a UHF station on either the ARC-51A (UHF) radio communication system or the ARR-69 (UHF) auxiliary receiver system, using the normal communication (blade) antenna. When the station signals are received in the headset, and the station is identified, the selected (ARC-51A/ARC-159(V5) or ARR-69) system control switch is placed in the ADF position. The received signal is switched from the blade antenna to the ADF antenna. The ADF antenna then rotates to the null point and the relative bearing is displayed by the No. 1 needle of the BDHI.

Note

When the emergency generator is extended, the ARN-52(V)/ARN-118, APX-64, ARA-50, ARC-51A/ARC-159(V5), AN/ARR-69, and the compass system are the only navigational aids available to the pilot. The ARN-52(V)/ARN-118(V) is inoperative when the landing gear is down.

2.22.6 AN/ASN-41 Navigational Computer System (TA-4F). The AN/ASN-41 navigation system will supply information to the pilot about his position, windspeed and direction, distance to destination, and bearing and ground track relative to true heading. The system can store two-target destinations without loss of primary data. The navigation system computes and provides outputs of great circle distance and bearing (relative to heading) to either of two selected targets. A great circle solution is employed for distances greater than 200 miles. A planar solution is employed for distances of less than 200 miles. Present position of the aircraft in latitude and longitude coordinates is continuously computed and displayed on the AN/ASN-41 control indicator (Figure 2-15). The magnetic heading ground track bearing to the target and distance-to-go is displayed on the BDHI. Three modes of operation are available for system operation: Doppler, memory, and air mass mode.

2.22.6.1 Doppler Mode. The system receives inputs of groundspeed, drift angle, true airspeed and magnetic heading to compute the groundspeed and airspeed vectors. The comparison of groundspeed and airspeed vectors provides a continuous solution of wind direction and windspeed.

2.22.6.2 Memory Mode. Whenever there is a temporary loss of Doppler information, this mode will automatically actuate the wind memory portion of the AN/ASN-41 computer. The computer retains the last value of wind vector computed and combines the vector with the current airspeed vector to form a new groundspeed.

2.22.6.3 Air Mass Mode. When the Doppler is completely inoperative, manually inserted wind settings are updated to combine with current airspeed to solve for groundspeed vector. When the AN/APN-153(V) Doppler radar navigation set is inoperative, turn set off. Manually insert wind settings on the AN/ASN-41 control box or compute the drift angle and groundspeed and set into the AN/APN-153 with the two push-to-set knobs on the AN/APN 153 control panel.

2.22.6.4 Navigation Computer Set Controls. The controls indicator panel, on the right console, contains the controls and display windows to indicate:

1. PRESENT POSITION – LATITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

2. PRESENT POSITION – LONGITUDE counter (in degrees and minutes) with a mechanical push-to-set knob.

3. DESTINATION – LATITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

4. DESTINATION – LONGITUDE counter (in degrees and minutes) with a mechanical and electrical set knob.

5. MAG VAR (magnetic variation) counter (in degrees and tenths of a degree) with a mechanical set knob.

6. WINDSPEED counter (0 to 300 knots) with a mechanical set knob.

7. WIND DIRECTION (in degrees) with a mechanical set knob.

8. SELECTOR SWITCH – The SELECTOR SWITCH on the control indicator (CONT IND) panel performs the following functions:

POSITION FUNCTION

1. OFF – The navigation computer system is deenergized. The destination and present position counters can be manually set in preparation for a mission.

2. STBY – Power is applied to the set. Destination one (D1) is displayed on the counters and is also stored in the computer memory circuit. Push-to-set

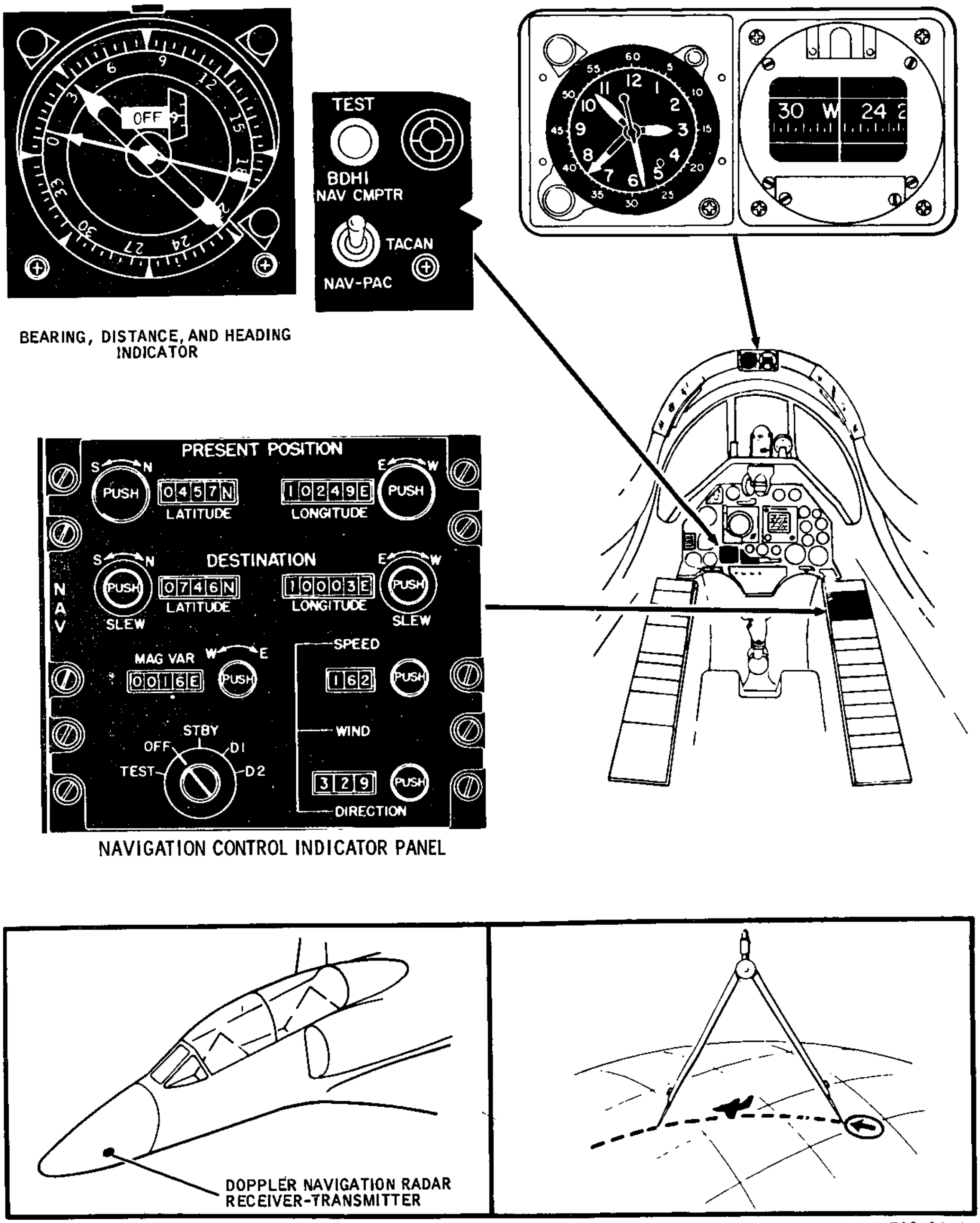


Figure 2-15. AN/ASN-41 Navigational Computer System – TA-4F

or slew knobs can be used to set up D1 in the standby position.

3. D1 (Destination) – This position supplies course and distance information for integration of present position counters on the first leg of the mission. This information can be changed to a new destination at any time using the slew knobs. When in D1 position, only the slew knobs are usable. The push-to-test knobs do not work.

4. D2 (Destination) – This position provides course and distance information for destination two (D2) on the second leg of the mission. Destination two (D2) can be updated by use of the slew knobs only.

5. TEST – This position inserts a presolved problem into the navigation computer whose solution is displayed by the control indicator counter and BDHI.

2.22.6.5 Operational Procedure

2.22.6.5.1 Prior to Flight

1. Rotate the AN/ASN-41 selector switch to TEST.

2. BDHI switch in NAV CMPTR position. WIND SPEED indicates 223.6 ±2.5 knots. WIND DIRECTION indicates 091 ±1-1/2°. LATITUDE PRESENT POSITION shows South integration. LONGITUDE PRESENT POSITION shows East integration. BDHI No. 2 pointer indicates 30 ±1°. BDHI No. 1 pointer indication depends on present position and destination data set in.

3. Rotate function switch to STBY.

Note

In the STBY position, power is applied to all circuits except the present position integrator.

4. Rotate function switch to D2. Using the electrical slew knobs, set in latitude and longitude destination counters to a destination. If destination is the starting point, insert present position coordinates.

5. Rotate function switch to STBY and set in D1 checkpoint or target latitude and longitude, using the push-to-set or slew knobs.

6. Set in latitude and longitude of present position on present position counters using push-to-set knobs.

7. Set in magnetic variation with push-to-set knob. Variation is in degrees and tenths of a degree.

8. Set in wind direction and velocity. Use climb winds.

9. Leave function switch in STBY.

Note

If the AN/APN-153(V) Doppler radar is to be used with AN/ASN-41, step 8 need not be set in. This function will be automatically computed by the Doppler.

10. Set function switch on Doppler control to STBY. Allow approximately 5-minute warmup. Place function switch in TEST. If the system is operating properly, it will lock on to the left signal within 1 minute. The memory light will go off, the groundspeed indicator will read 121 ±5 knots, and the drift angle indicator will show 0 ±2°.

Note

If Doppler test function step 10 is not acceptable, perform step 8 to complete the AN/ASN-41 operation.

2.22.6.5.2 Takeoff

1. Leave the function switch (Figure 2-15) in STBY if use of an airborne (AN/ASN-41) starting point is planned, and place function switch in D1 or D2 when passing over starting point. If using takeoff point as the starting point, place the AN/ASN-41 function switch in D1 or D2 immediately prior to takeoff roll.

Note

Minimum computer-operation airspeed for the AN/ASN-41 is 100 KIAS. A negligible error in computer readout will result until aircraft accelerates to 100 KIAS.

2. Place (AN/APN-153(V)) function switch in either LAND or SEA position depending on the terrain over which the aircraft is flying.

3. When Doppler operation locks on (memory light out), the computer will switch to Doppler mode and wind information will be automatically computed.

4. When the aircraft is over the starting point, place function switch (AN/ASN-41) in D1. The present position counters will start to integrate toward the primary target and the wind vector is computed and displayed.

5. To fly great circle route (shortest route) to target, adjust aircraft heading to align with the No. 1 pointer on BDHI. Ground track (drift angle) is displayed by the No. 2 pointer. The distance counter on the BDHI indicates ground range and slant range to target or destination. To fly to a selected destination (D1 or D2), align the No. 1 over the No. 2 pointer. Only in a no-drift condition will these pointers remain aligned at the 12 o'clock position on the BDHI. Example: with the No. 1 pointer at the 12 o'clock position and No. 2 pointer to the right of this position, a right drift would be indicated. This would require a turn to the left to realign the pointers. They would then be to the right of the 12 o'clock position when aligned.

6. New targets or checkpoints can be set up while airborne with the AN/ASN-41 operating. Destination 1 selection can be changed by selecting D1 with the function switch and setting the coordinates of the new checkpoint in the destination window with the slew knobs. D2 coordinates can be changed in the same manner.

The AN/ASN-41 can also be operated using D1 as the first target and D2 as the second target then placing the function switch back in D1 while en route to the second target, and setting a third target latitude and longitude in the destination window. Return the function switch to D2 to continue the flight to target two. When over target two, switch again to D1 for flight to target three.

Another way of using the AN/ASN-41 is to set the point of intended landing in D2 destination window and use D1 for all checkpoints. Upon arrival at a checkpoint, set latitude and longitude of next checkpoint in destination windows utilizing the slew knobs with the function switch left in D1 at all times until ready to proceed to point of intended landing when D2 is selected. This method provides instantaneous "bingo" information from any point on the route by shifting to the D2 position.

2.22.6.5.3 In Flight. Monitor the navigation system and if necessary update the following situations:

1. If the Doppler radar is off for a considerable time, the wind data can be manually updated, using the predicted wind information from the flight plan. To update the wind data in this case, it is necessary to turn the AN/APN-153 to OFF or STBY and update the wind data on the AN/ASN-41. Otherwise, it is necessary to compute the drift angle and groundspeed and insert them in the AN/APN-153 with the push-to-set switches on the AN/APN-153 control box to change wind data in the AN/ASN-41.

2. If present position counters are incorrect while flying over a known checkpoint, the counters can be updated.

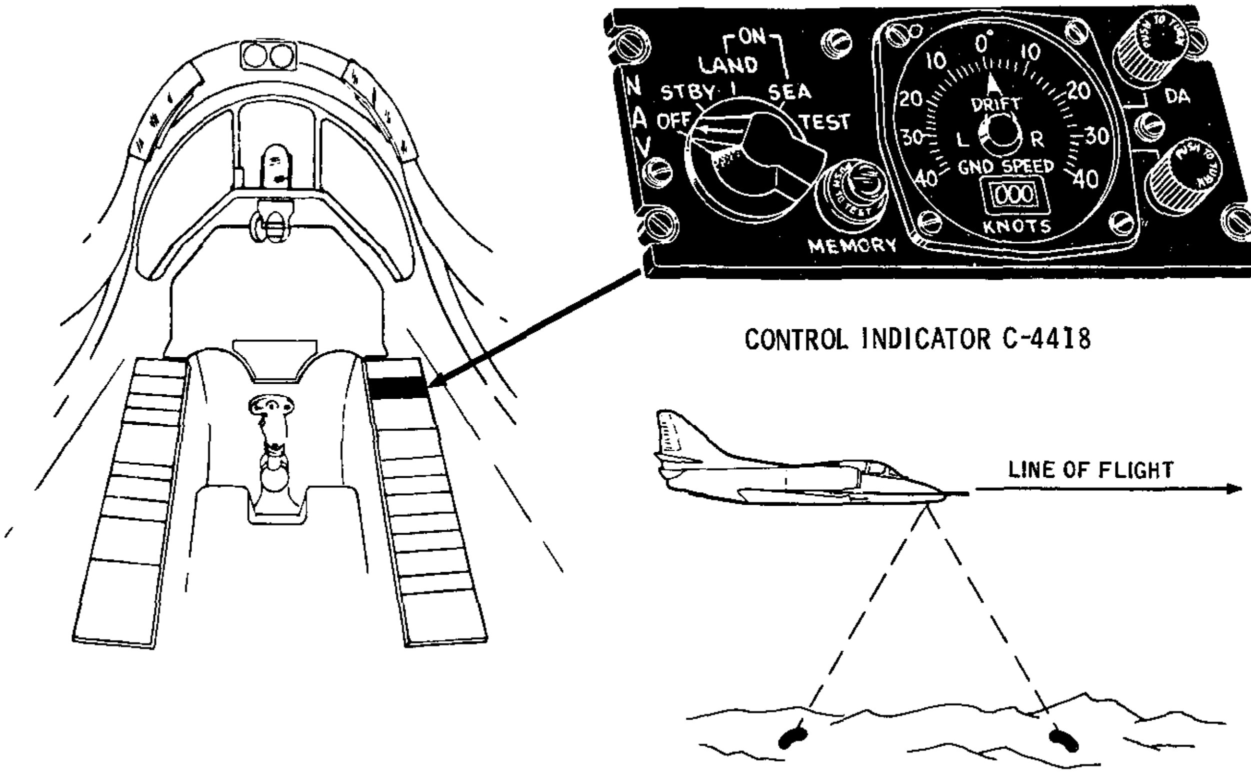
Note

The destination counters will always display the coordinate of the destination as selected by the function switch. Flexibility has been provided by permitting either destination to be changed at any time or as often as required for any specific mission.

3. Magnetic variation (MAG VAR) is to be updated as required throughout the flight.

2.22.7 AN/APN-153(V) Radar Navigation Set (Doppler) (TA-4F). The AN/APN-153(V) (Figure 2-16) is a miniaturized radar navigation set that uses the Doppler principle for continuous measurement of groundspeed and drift angle. The radar set transmits rf energy to the ground and measures the shift in frequency of the returned energy to determine aircraft groundspeed and, through use of a special beam, drift angle. The AN/APN-153(V) Doppler radar set is contained completely within the aircraft and does not depend on ground aids for navigation purposes. The radar set automatically acquires Doppler information and computes groundspeed and drift angle within approximately 1 minute after it is turned ON. The AN/APN-153(V) Doppler radar set operated in conjunction with the AN/ASN-41 computer provides navigation to and from preselected targets.

2.22.7.1 System Operation. The AN/APN-153(V) Doppler radar navigation set, controls, and indicators are on the C-4418/APN-153(V) control indicator panel, labeled NAV and located on the right



TA1-28-A

Figure 2-16. AN/APN-153(V) Radar Navigation Set (Doppler) – TA-4F

console (Figure FO-1). To operate the AN/APN-153(V) Doppler radar set, the selector switch must be placed ON in either the LAND or SEA position depending on the terrain over which the aircraft will be flying. In the SEA position, the scale factor calibration network is altered to compensate for the apparent increase in antenna looking angle when the aircraft is flying over water, thus providing proper groundspeed calibration. Circuits within the frequency tracker automatically sweep over the operating groundspeed range, seeking a usable return signal. When the reflected rf energy is of sufficient power to permit measurement of groundspeed and drift angle, then the set is switched to the normal mode of operation. Until this change takes place, the set is in the memory mode and the MEMORY light on the C-4418 control indicator panel is on. While the Doppler radar set is in the memory mode, the groundspeed and drift angle readings on the C-4418 control inidicator panel are the values computed when the Doppler radar set is in the normal mode. Drift angle and groundspeed push-to-turn control knobs are provided to enable the pilot to change groundspeed and drift angle when the Doppler radar set is in the memory mode. If a malfunction should occur in the Doppler radar set while it is connected to the AN/ASN-41 computer, the pilot can use the drift angle and groundspeed knobs to insert approximate drift angle and groundspeed value, to enable the computer to continue operating. In the LAND position, the preceding conditions can also be handled.

The system may go into the memory mode under any of the following conditions:

1. Selector switch is at STBY, transmitter will be off.

2. A 1-minute period after the system has been turned on and before a signal has been acquired.

3. During operation over smooth glassy seas.

4. During operation over extremely hilly terrain, where coherence may be lost despite broad antenna beams.

5. During periods when the aircraft is maneuvering beyond the antenna's limits of operation.

In the STBY position, all power except the modulator power required to drive the magnetron is applied to the AN/APN-153(V) Doppler radar set. This position is used when observing radar silence or when maintenance personnel wish to check the system. When the selector switch is on STBY, the system goes into memory mode and the amber MEMORY light comes on.

2.22.7.2 Prior to Flight.

1. Place selector switch in TEST position. After 5-minute warmup time, the memory light should be off, the groundspeed dial should read 121 ±5 knots, and the drift angle dial should read 0 ±2°.

2. Place selector switch in STBY.

2.22.7.3 Prior to Takeoff

1. Place selector switch in ON-LAND or ON-SEA position, depending upon the terrain to be flown over.

2.22.7.4 After Takeoff

1. Approximately 30 seconds after reaching an altitude of 40 feet, the memory lighting should go off.

2. After cruise altitude is attained, groundspeed and drift angle should be observed to read within ±50 knots and ±10° respectively for the known condition of flight.

Note

It may be necessary to use the push-to-set knob and set the Doppler to 150 knots after test and prior to takeoff.

3. Bank and turns are limited to 30° roll in right or left and/or to type of terrain being flown over. If the above limitations are exceeded, memory light will come on, indicating loss of tracking signal.

4. Climbing and descending maneuvers should be observed. High angle climbs and descents should be at approximately 25° pitch attitude, since 25° pitch angle is near the operating limits. The memory light may come on for periods of time, not to exceed 3 seconds.

5. At combat ceiling and at lowest mission altitude (not below 40 feet), the memory light should remain off, indicating Doppler signal lock on and tracking.

2.23 AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

Control of the automatic flight control system (AFCS) in the TA-4 aircraft is available in one cockpit only – it can be in either front or rear cockpit. The aircraft should be flown only from the cockpit that contains the AFCS control panel when the AFCS is engaged.

WARNING

The pilot in the cockpit without the control panel shall not attempt to control the aircraft with the AFCS engaged.

The pilot control stick in the cockpit without the AFCS control panel will resist any movement with the AFCS engaged, since the stick sensor is not energized. This does not prevent use of the primary control system since the stick can be moved by overpowering the AFCS. The system overpower forces are 15 pounds in pitch and 35 pounds in roll. If the system is overpowered in pitch, the AFCS automatic trim system will move the horizontal stabilizer in the opposite direction of stick movement and will keep it moving until the stick is released or until the stabilizer limit switches are actuated. The horizontal stabilizer moving in the opposite direction of stick pressure can cause violent maneuvers of the aircraft when stick pressure is released because of the out-of-trim condition.

The AFCS can be disengaged by either pilot by depressing the AP button on the pilot control stick regardless of position of the control panel. Therefore, if requirements exist for a pilot to control the aircraft from the cockpit without the AFCS control panel when the AFCS is engaged, it should be disengaged by depressing the AP button on the stick prior to applying stick forces.

2.23.1 Automatic Flight Control Panel. The control panel (Figure FO-1) is labeled AFCS and is located on the left-hand console in the forward cockpit. There are provisions in the aft cockpit for an AFCS control panel.

2.23.1.1 Standby Switch. Placing the standby switch in STANDBY provides electrical power to the AFCS for warmup and automatic control synchronization to prevent engage transients. This switch should be in STANDBY at least 90 seconds prior to engaging the stability augmentation switch or the AFCS main engage switch. When the switch is placed in the OFF position, all toggle switches on the panel return to the OFF position.

2.23.1.2 Engage Switch. Placing the engage switch in the ENGAGE position turns on the AFCS in one of the two modes: attitude hold or heading hold, depending on flight attitude. In addition, the pilot can select control stick steering, or altitude hold, and or preselect heading.

The engage switch may be placed in the OFF position at any time. The switch should not be placed in ENGAGE position until the standby switch has been in STANDBY position for 90 seconds.

The AFCS will not engage until the all-attitude indicator OFF flag disappears.

When this switch is placed in the OFF position, both the heading select switch and the altitude switch return to the OFF position. An abrupt lateral stick force of 40 pounds causes the aileron servo to bypass, which effectively disengages the AFCS lateral controls. The engage switch does not move from the ENGAGE position. Lateral control of the aircraft is then provided by the normal control system. To reengage the lateral servo, cycle the engage switch to the OFF position and then return to the ENGAGE position. This operation may be performed at any time.

Pressing the AFCS override button (AP) on the control stick causes the mode switches to move automatically to the OFF position. The AFCS can be reengaged by placing the engage switch in ENGAGE.

2.23.1.3 Heading Select Switch. Placing the heading select switch in the HDG SEL position starts the aircraft turning by the shortest route toward the heading selected on the heading select indicator by use of the SET knob. The heading select switch may be moved to the OFF position at any time. If placed in the OFF position prior to the completion of a turn, the aircraft will roll smoothly to a level attitude and maintain the compass heading indicated at that time. If the SET knob is used to change the heading on the indicator while the switch is in the HDG SEL position, the following can occur:

1. If the aircraft is in level flight, sudden SET knob movement will result in abrupt aircraft lateral movement. If the SET knob is moved very slowly, small heading changes can be made satisfactorily.

2. If the aircraft is already in a preselect heading turn, the SET knob may be moved at any rate if the new selected heading is in the same direction as the turn and is less than 180° away from the compass heading at the time of selection. Selection of a heading reciprocal to the present aircraft heading will cause the aircraft to reverse the turn abruptly.

The heading select switch will automatically move to the OFF position if the control stick steering mode is engaged.

Note

Pilot use of the SET knob within 5 seconds after placing the heading select switch in the OFF position will cause an abrupt roll transient.

Upon engaging the HDG SEL switch, the approximate pitch attitude will be maintained during the turn. If a level turn is desired, the altitude hold mode should be engaged by moving the altitude switch to ALT.

2.23.1.4 Altitude Hold Switch. Placing the altitude switch to the ALT position causes the aircraft to maintain the barometric altitude at actuation. If the mode is engaged in a climb or dive, the aircraft will return to the barometric altitude existing at the time of altitude hold engagement. Altitude hold cannot be engaged in climbs or descents in excess of 4,000 feet per minute. The mode cannot be engaged if any force is being applied to the control stick. The switch will move automatically to the OFF position whenever control stick steering mode is engaged.

2.23.1.5 Stability Augmentation Switch. Yaw damping action is provided when the engage switch is in the ENGAGE position or the stability augmentation switch is in the STAB AUG position.

2.23.1.6 Aileron Trim NORM-Emergency Switch. The aileron trim switch has two positions: NORM and EMERG. This switch is usually in the NORM position, but may be moved to the EMERG position to provide aileron trim after the AFCS is disengaged, if aileron trim is not available in NORM. Movement of this switch to the EMERG position also disengages and prevents reengagement of the AFCS, except stability augmentation, while in the EMERG position. The AFCS can be reengaged after returning the switch to the NORM position.

2.23.2 Preflight Test Panel. This panel is the AFCS test panel on the aft right-hand console, in the forward cockpit. The three indicators R, Y, and P, measure dc control current to the AFCS servos for roll, yaw, and pitch respectively. The 1-N-2 switch is provided to obtain two test conditions. The switch is spring loaded in the N (normal) position and must be held in either test position 1 or test position 2. All test procedures are covered in Preflight Procedure.

Note

The 1-N-2 switch must be in N position for normal AFCS operation.

2.23.3 Control Stick

2.23.3.1 Autopilot Override Button. The control stick has an AFCS override button labeled AP. Pressing this button in either cockpit immediately disengages the entire AFCS.

2.23.3.2 Sensor. The AFCS control panel may be installed in either cockpit. Control stick steering (CSS) is available only in the same cockpit as the AFCS control panel installation. The control stick in that cockpit has a force stick sensor that transmits signals of pilot-applied stick forces to the control stick steering of the AFCS.

2.23.3.3 Stick Trim Switch. The control stick trim switch button, which is used to trim the aircraft in roll and pitch during normal flight, is inoperative during all AFCS modes except control stick steering. During the control stick steering mode, the lateral trim signal causes a trimming adjustment within the autopilot and not within the aileron power control as in normal control system use. All pitch trim signals operate the horizontal stabilizer whether on control stick steering mode or normal flight controls.

Note

The control stick trim button should be used with normal technique when control stick steering mode is engaged. Transients are minimized during disengagement or reengagement of control stick steering if the aircraft is correctly trimmed at that time.

2.23.4 AFCS Modes. The modes of operation discussed in the following paragraphs provide automatic flight control.

2.23.4.1 Control Stick Steering (CSS) Mode. The CSS mode provides for longitudinal and lateral control of the aircraft through the AFCS by pilot movement of the stick as in normal flight. This mode is engaged regardless of other modes selected or in operation by applying a force on the control stick grip of 2 pounds or more. Preselect heading and altitude hold modes are disengaged by use of control stick steering and they must be reengaged to be used again. The AFCS reverts from control stick steering mode to either attitude hold or heading hold mode when pilot force on the control stick is reduced below 2 pounds. The aircraft is controllable in all attitudes in control stick steering throughout the AFCS flight envelope, which is 4 ±1/2 positive g, 1-1/2 ±1/2 negative g, and one-half aileron deflection left or right. If these limits are exceeded, the AFCS disengages. The AFCS will not switch out of control stick steering at bank angles exceeding 70° or pitch angles exceeding 60° noseup or nosedown unless limits of acceleration or aileron deflection are exceeded.

CAUTION

The control stick should not be released while in control stick steering if the pull or push force at the time exceeds 12 pounds because of large disengage transients. These transients are minimized if the aircraft is properly trimmed at the time of release.

2.23.4.2 Attitude Hold Mode. With an aircraft bank angle between 5° and 70° and a pitch angle less than 60° noseup or nosedown, the aircraft lateral and longitudinal attitude at time of engagement of the AFCS or reversion from the control stick steering mode will be maintained.

2.23.4.3 Heading Hold Mode. If the pitch angle is within 60° noseup or nosedown and the bank angle of the aircraft is less than 5° upon engagement of the AFCS or reversion from control stick steering mode, the aircraft will be rolled to a level attitude and the heading and pitch angles at that time will be maintained.

2.23.4.4 Preselect Heading Mode. Upon engagement of this mode after the heading has been preselected on the indicator, the aircraft will roll into a smooth turn to the preselected heading and then roll out on this heading. The turn will always be in the direction of the shortest route to the preselected heading. The bank angle will be maintained at 27° ±5° under all conditions.

Note

The fixed bank angle of 27° ±5° may cause the aircraft to buffet in an approach to stall if the preselect heading mode is selected below airspeeds ranging from 160 KIAS at 10,000 to 200 KIAS at 40,000 feet.

2.23.4.5 Stability Augmentation Mode. The stability augmentation mode provides rudder yaw damping action which is independent of pilot movement of the rudder pedals. The mode can be selected at any time without other AFCS functions. It is also in operation automatically during all other AFCS functions.

Note

The pilot must trim the aircraft directionally while using the AFCS in the same manner as he would when on the normal flight control system. If the aircraft is out of trim directionally, the following will occur:

1. A lateral engage transient will occur during change to the control stick steering mode.

2. The aircraft will be in a steady heading side slip in the heading hold mode.

2.23.4.6 Altitude Hold Mode. This mode may be engaged when the rate of change of altitude is less than 4,000 ±500 feet per minute. The aircraft will maintain the altitude at engagement. The aircraft automatically will pull out of its climb or dive and return to and maintain the engage altitude.

2.23.4.7 Ground Control Bombing Mode (TA-4F). Refer to NAVAIR 01-40AV-1T, A-4/TA-4 Tactical Manual, Ground Controlled Bombing System.

2.23.5 Automatic Safety Features. The automatic major safety features are incorporated in the AFCS are discussed in the following paragraphs.

2.23.5.1 Aircraft Structural Protection. The AFCS is automatically disengaged, and the engage switch is automatically moved to the OFF position when normal load factor approaches 4 ±1/2 positive g or 1-1/2 ±1/2 negative g, or when the aileron surface displacement exceeds 20°, one-half lateral stick displacement from neutral. Normal acceleration values are reduced to 3-1/2 ±1/2 positive g and 1 ±1/2 negative g when a centerline store is carried, except when operating in CSS mode. (Refer to control: Stick Steering Mode.)

Note

The system in response to hardover signals disengages the AFCS with negligible upset in either noseup or nosedown attitudes. The incremental load factors, as a result of hardover signal, will vary between 0 and 0.6g for airspeeds up to Mach 0.85. Elevator surface rates in excess of 20° per second disengage the AFCS with the same characteristics as hardover signals. For displacement rates of 5° to 20° per second at speeds in excess of 300 knots, structural limits are not exceeded. Altitude change from hardover to disconnect is less than 100 feet. This does not include the additional altitude necessary to recover to level flight.

2.23.5.2 AFCS Temporary Overpower. The AFCS can be overpowered temporarily laterally and longitudinally. Pilot application of 15 pounds longitudinal stick force will overpower the AFCS longitudinal control without affecting AFCS lateral or directional control. In the same manner a 35-pound lateral stick force will overpower the AFCS lateral control without affecting AFCS controls and will remain overpowered as long as the stick forces as noted are maintained.

Note

The only occasion to use the overpower feature will probably be to counteract a failure within the AFCS that would cause large deflection of the elevator or aileron. Unless prevented by the failure noted above, the AFCS will engage the control stick steering mode when the stick force is applied, and will disengage this mode when the stick force is reduced below 2 pounds.

2.23.5.3 AFCS Lateral Hydraulic Disengage. The lateral AFCS control can be disengaged by applying a sudden sharp force laterally to the control stick. This lateral disengagement allows the pilot to provide lateral control through the normal system but does not affect AFCS longitudinal control. AFCS lateral control may be reengaged by cycling the engage switch to OFF and then returning it to the ENGAGE position.

2.23.5.4 Control Stick Disengage. Pressing the AP button on either control stick will disconnect the AFCS electrically. The AFCS can be reengaged in the normal manner.

2.23.6 Preflight Procedure. The following preflight test procedure is recommended:

1. Landing gear handle – DOWN.

2. Engine rpm – IDLE.

3. All-attitude gear handle indicator power warning flag not visible.

4. Observe hydraulic power from movement of control surfaces and caution panel lights.

5. Standby switch – STANDBY.

6. Aileron trim emergency switch – NORM.

7. Stability augmentation switch – OFF.

8. Heading select switch – OFF.

9. Altitude switch – OFF.

10. Engage switch – OFF.

11. 1-N-2 switch – N.

12. Heading select counter and set knob – ANY PRESELECTED HEADING OR POSITION DESIRED.

Note

Two sets of preflight performance checks are provided here. The pilot should make the following four MANDATORY CHECKS before each flight when time is limited. If there is sufficient time available or after reworking or overhauling of the autopilot system, the COMPLETE PERFORMANCE CHECKS consisting of 17 items should be made.

2.23.6.1 Mandatory Checks. These four checks are made in test position 2 and with the engage switch in ENGAGE.

1. Move the stick right. At about half deflection, the autopilot should disengage and the engage switch will be seen to slip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the stick. Repeat the same check to the left. The results should be the same. This is the aileron limit switch check.

2. Move the trim button right. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the trim button. Repeat the same check to the left. The results should be the same. This is the load factor monitor limit switch check.

3. Move the stick aft (noseup) and move the horizontal stabilizer trim toward NOSEUP. The autopilot should disengage and the engage switch will be seen to flip to its OFF position. Recycle the engage switch to its ENGAGE position after centering the stick. Move the stick forward (nosedown) and move the horizontal stabilizer trim toward NOSEUP. The results should be the same. This is the trim monitor switch check.

4. Depress AP button. The autopilot should disengage and the engage switch will be seen to flip to its OFF position.

5. Place STANDBY-OFF switch in OFF. Leave the switch in OFF for takeoff.

The pilot will know from the above test that he has electrical power to the AFCS servos and that the safety circuits are operating.

Note

If all four AFCS mandatory checks are not satisfactorily completed, the AFCS STANDBY-OFF switch should be placed in the OFF position. STAB-AUG will not be available with the STANDBY-OFF switch in the OFF position.

2.23.6.1.1 Complete Performance Checks. It is recommended that these checks be made in the sequence given. There are 4 checks in TEST POSITION 1 and 13 checks in TEST POSITION 2. These 17 checks should be made if there is adequate time or after reworking or overhauling the autopilot system.

2.23.6.1.2 Test Position 1 Checks. Hold the spring-loaded 1-N-2 switch in test position 1 until the following four tests have been completed (AFCS is unsynchronized).

1. All three pointers (R, Y, and P) should deflect upward and remain positioned upward. This shows dc control current to the autopilot servos and indicates proper direction for surface movement.

2. Push on the right rudder pedal. The indicator needle in the Y (yaw) window should move from the upward position to a full down position. Sluggish rudder operation will be apparent, but is normal.

3. Actuate the engage switch to the ENGAGE position. It should not engage, because the AFCS should never engage while in an unsynchronized condition. If the switch does not flip back to the OFF position, report the trouble.

4. Actuate the stability augmentation switch to the STAB AUG position. It should remain engaged rather than flipping back to OFF. Return switch to OFF position when test is completed.

2.23.6.1.3 Test Position 2 Checks. Hold the spring-loaded 1-N-2 switch in test position 2 until the following thirteen tests have been completed (AFCS is still unsynchronized).

1. All three pointers (R, Y, and P) should again deflect upward and remain positioned upward.

2. Actuate the stability augmentation switch to the STAB-AUG position. It should engage, but the (Y) indicator for rudder should null (go to the center) because test position 2 closes the rudder loop. Leave the switch in the STAB AUG position for later checks.

3. Actuate the engage switch to the ENGAGE position. It should engage and the switch remain there because test position 2 allows engagement in the unsynchronized condition by bypassing the synchronizing monitors that normally protect the aircraft from engage transients (jumping). A small stick jump or movement normally accompanies engagement in test position 2.

4. With the engage switch in the ENGAGE position (as in step 3), the P and R indicators for pitch (elevator) and roll (aileron) should null (go to the center) because the pitch and roll loops have been closed in test position 2.

5. Move the control stick for roll and pitch. It should feel normal.

6. Move the control stick hard over to the right. The engage switch should flip to the OFF position but the stability augmentation switch should remain engaged because the aileron has reached a position greater than half-travel from faired, and the protection circuit has caused the AFCS system to disengage.

7. Move the engage switch back to ENGAGE position. Move the control stick hard over to the left. The results should be the same as in step 6.

8. Move the engage switch back to ENGAGE position. Move the trim button to the right for right aileron. The results should be the same as in steps 6 and 7 because test position 2 feeds a test signal into the structural protection circuit.

9. Move the engage switch back to ENGAGE position. Move the trim button to the left for left aileron. The results should be the same as in step 8.

10. Move the engage switch back to the ENGAGE position. Actuate the aileron trim emergency switch to the EMER position. The engage switch should flip to the OFF position, but the stability augmentation switch should remain in the STAB AUG position. The emergency trim switch is to be used only with the AFCS disengaged, and this switch interlocks the AFCS engage switch as a protective measure.

11. Return the aileron trim emergency switch to the NORM position, but do not move the engage switch to its ENGAGE position at this time. Engage the AFCS by actuating the engage switch to the ENGAGE position. Then move the stick aft and, while holding an aft force on the stick, operate the stick trim button to trim the aircraft noseup. The result should be that the autopilot disengages, the engage switch should flip to its OFF position and the stability augmentation switch should remain in its STAB AUG position. The test simulates the automatic trim circuit working improperly (making an out-of-trim condition worse).

12. With the switches left in the position resulting from the check of step 11, engage the AFCS, and make a similar test as in step 11, but push the stick forward and trim for a noseup condition. The results should be the same as in step 11.

13. Reengage the engage switch, then depress the AP button on the stickgrip. The ENGAGE switch and the stability augmentation switch should flip to their OFF positions. This emergency switch removes all AFCS authority from the aircraft control system. Turn standby switch to OFF. Leave switch off for takeoff.

WARNING

Takeoff trim should always be checked after completion of the AFCS preflight check. Positioning the AFCS test switch to test position 2 may change the trim setting.

2.23.7 Normal In-Flight Operation

2.23.7.1 To Engage Stability Augmentation

1. Standby switch – STANDBY.
2. Warmup period – 90 SECONDS.
3. Aileron trim emergency switch – NORM.
4. Heading select switch – OFF.
5. Altitude switch – OFF.
6. Engage switch – OFF.

CAUTION

Do not use the 1-N-2 switch while in flight.

7. 1-N-2 switch – N.
8. Stability augmentation switch – STAB AUG.

2.23.7.2 To Engage AFCS. Perform the above steps, then actuate the engage switch to the ENGAGE position.

Note

Engagement by use of the engage switch can be made without first using stability augmentation (STAB AUG). However, stability augmentation actuation is recommended first so that the pilot will have the stability augmentation mode after selecting OFF on the ENGAGE switch on the AFCS control panel.

2.23.7.3 To Disengage AFCS. The pilot may disengage the AFCS in the following ways:

1. Pressing either control stick AP button will disengage the AFCS.
2. Moving the standby switch to its OFF position.
3. Moving both the engage and the stability augmentation switches to their OFF position.

4. Depressing the PUSH TO SYNC button on the compass controller.

5. Moving the SET HDG switch on the compass controller.

6. Moving the aileron trim NORM/EMER switch to EMER position. In the event the switchover from automatic trim to manual trim malfunctions, or upon disengagement, the EMER position gives an additional switchover and will disengage the AFCS.

7. Moving the horizontal stabilizer manual override lever on the left-hand console will manually overcome malfunction of the automatic pitch trimmer.

Note

Up to 4 seconds of override lever actuation may be required before disengagement occurs.

8. Pulling the emergency generator release handle.

2.24 LIGHTING EQUIPMENT

2.24.1 Interior Lights. The interior lighting system, in both cockpits, includes all instrument and console lights, and cockpit floodlights. A light is mounted in each instrument lens (except the oil pressure gauge) to provide equal illumination over the entire face of the instrument. Two floodlights are mounted beneath the glareshield, in each cockpit, to provide auxiliary or emergency lighting of the instrument panels. In the forward cockpit, a white floodlight incorporating a red filter is mounted on the right-hand side of the gunsight support to provide lighting for the pilot kneeboard. In the aft cockpit, the kneeboard floodlight is mounted beneath the glareshield on the right-hand side. Six red floodlights are located in each cockpit to provide auxiliary or emergency console lighting. Four white floodlights are located in each cockpit to provide auxiliary cockpit lighting. The instrument and console lights also operate on emergency generator.

2.24.1.1 Interior Lights Control Panel. An interior lights (INT LTS) control panel is located in each cockpit on the right console (Figure 2-18, sheets 1 and 2). The two panels contain switches for the operation of all interior lights except the four, high-intensity, white floodlights. Two rotary switches, marked INST and CONSOLES, are rotated clockwise from OFF to turn on the instrument lights and console lights, respectively. Further rotation in a clockwise direction toward the BRIGHT position increases the intensity of the light.

Aircraft reworked per A-4 AFC 428 have three rotary switches marked PRIM INST, CONSOLES, and SEC INST (Figures FO-1 and FO-2). The three rotary switches afford individual control of the primary instrument, left- and right-hand console, and secondary instrument lighting. Turning the PRIM INST switch clockwise from OFF will turn on the altimeter (radar and barometric), airspeed, all-attitude, and BDHI indicator lights. Turning the CONSOLES and SEC INST switches clockwise from OFF will turn on the console lights and the secondary instrument lights, respectively. The brightest lighting will be reached at full clockwise rotation of any switch. The primary instruments can be adjusted to bright by pilot selection, while all other lighting is dimmed, resulting in a more compatible lighting environment for the pilot during night and/or combat missions.

Note

When the instrument lights switch (PRIM INST rotary switch, on the aircraft reworked per A-4 AFC 428) is in any position other than OFF, the ladder lights are dimmed for night operations and may not be visible in daylight.

A toggle switch, marked FLOOD, with three positions, BRIGHT, DIM, and MEDIUM, controls the intensity of the red floodlights after the CONSOLES switch is rotated from the OFF position. The pilot kneeboard floodlight has a separate intensity control on the case.

The four high intensity white floodlights in each cockpit, two for each instrument panel and one for each console, have a common control installed above the right-hand console on the fuselage skin, in each cockpit. Clockwise rotation of the control from the OFF position turns the floodlights on dimly and further clockwise rotation increases the intensity.

2.24.2 Exterior Lights. The exterior lights system includes position lights, fuselage wing lights, air refueling probe light, an approach light, and a taxi light. A semiflush white high intensity gas discharge and low intensity filament fuselage wing light is located under the leading edge of each wing. The aircraft has

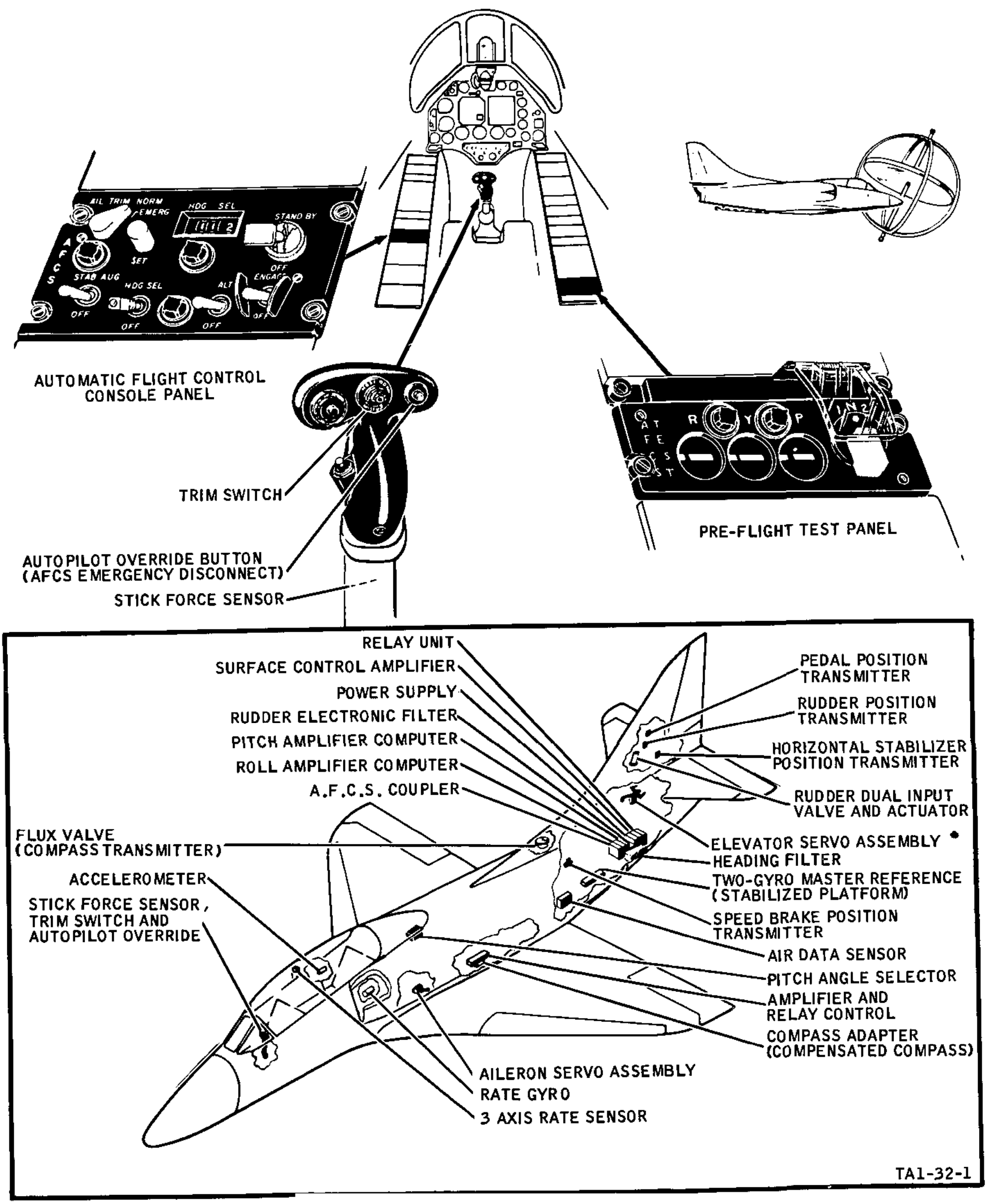
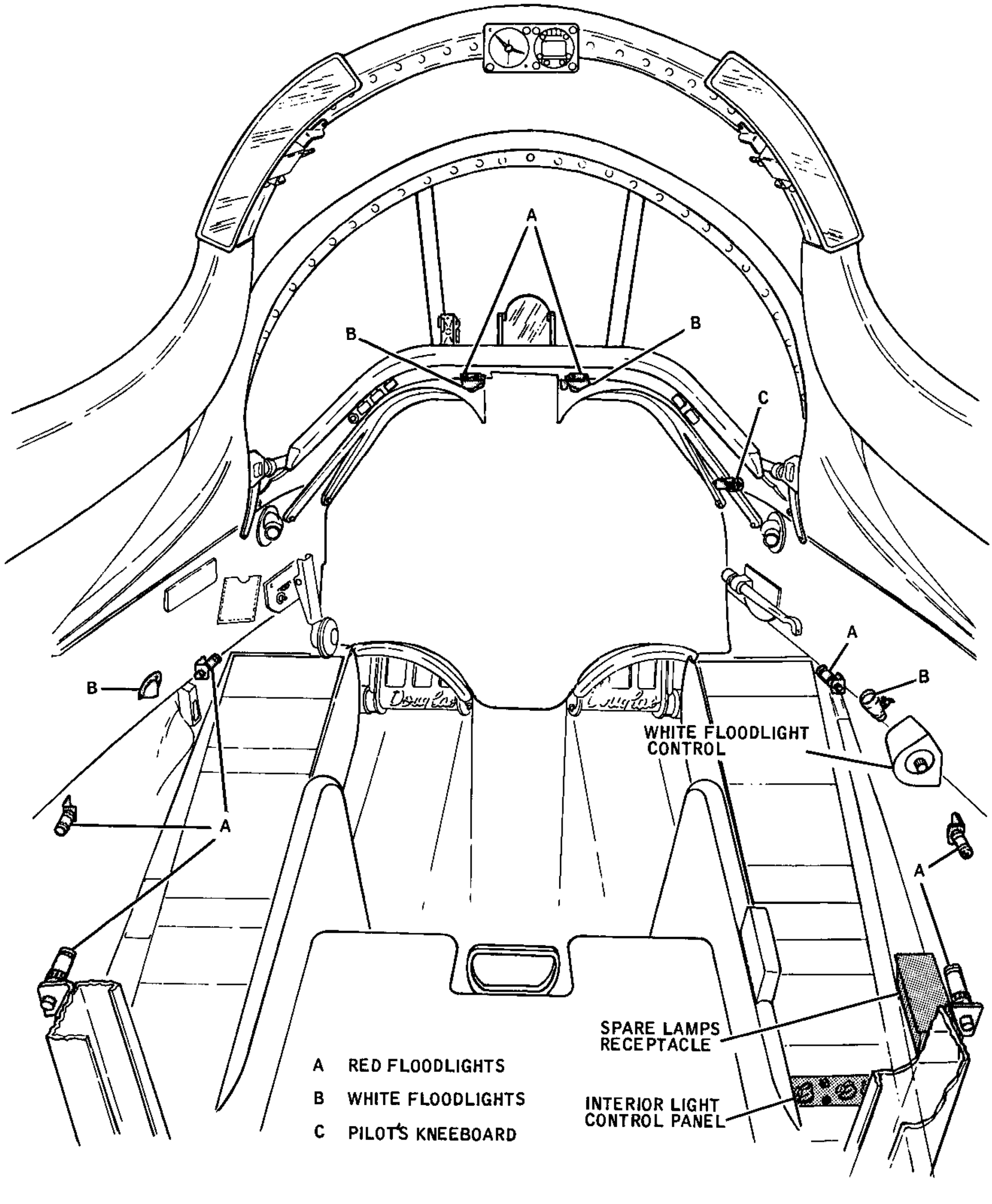


Figure 2-17. Automatic Flight Control System



FORWARD COCKPIT

TA1-33-1

Figure 2-18. Interior Lights – Forward Cockpit (Sheet 1 of 2)

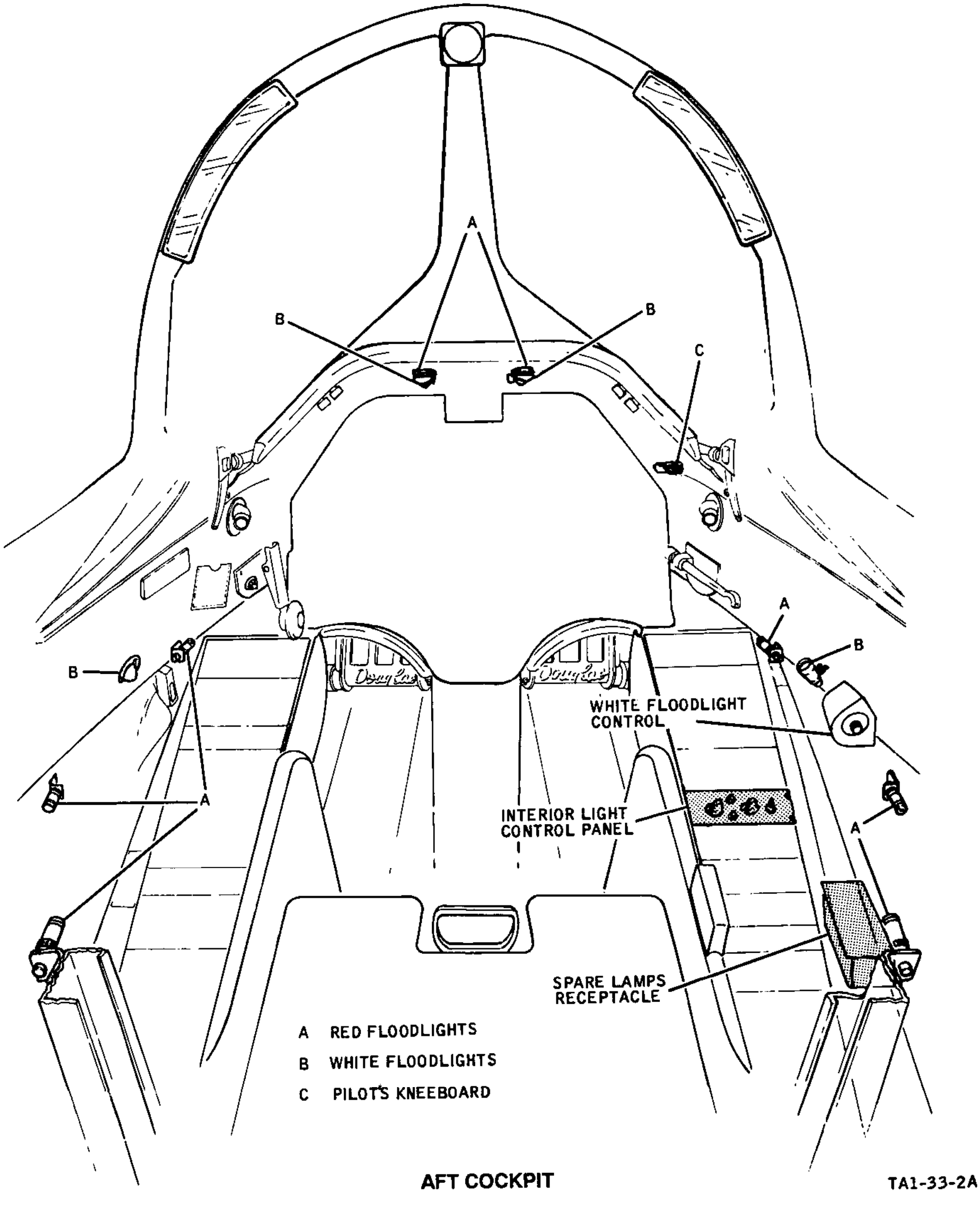


Figure 2-18. Interior Lights – Forward Cockpit (Sheet 2 of 2)

two flashing red anticollision beacons: one is mounted on top of the fuselage and the other on the left main landing gear strut fairing. The angle-of-attack approach lights are mounted in the leading edge of the left wing (Figure 2-19). The taxi light is installed on the right-hand main landing gear door. When the anticollision lights are turned on, the white fuselage lights are turned off automatically.

The air refueling probe light is located on the right-hand intake duct forward outboard lip Figure 2-19).

Wingtip, tail, and fuselage lights are actually double lights, as both filament and gas discharge types are provided. The BRT (bright) position directs power to the gas discharge lights; the DIM position directs power to the filament lights.

Note

The only exterior lights that will operate on emergency generator power are the approach lights.

2.24.2.1 Exterior Lights Control

2.24.2.1.1 Master Exterior Lights Switch. A master exterior lights switch (Figure 2-19), on the outboard side of the throttle grip in the forward cockpit, controls power to the wing, tail, and fuselage lights. The switch has a forward ON position, a center OFF position, and an aft FLASH position. The switch is spring loaded from the aft to the center position, providing a means of signaling with the exterior lights.

CAUTION

Application of external power or starting the aircraft with external lights ON/BRIGHT may cause failure of the lights. Allow 60 seconds for warmup after electrical power is applied to the aircraft.

2.24.2.1.2 Exterior Lights Control Panel. An exterior light control panel (Figure 2-19) on the outboard right console in the front cockpit contains switches for functional control of the exterior lights.

2.24.2.2 Approach Light Operation. The approach light circuit is controlled by a tailhook switch, a landing gear microswitch, and a manually operated tailhook bypass switch. When the master exterior lights switch on the throttle is ON, the approach lights are automatically dimmed for night operations. Approach lights will operate on emergency generator power.

2.25 AIR CONDITIONING AND PRESSURIZATION SYSTEM

A combination air conditioning and pressurization system heats, cools, ventilates, and pressurizes the cockpits. The system comprises two air cycle refrigeration units, a cockpit pressure regulator, two pressure relief valves, and temperature control components. See Figure 2-20 for a schematic of the air conditioning and pressurization system.

2.25.1 Air Conditioning. Hot high-pressure air is bled from the engine compressor section and is ducted either through or around a refrigeration unit, as governed by a cockpit temperature controller. Air passing through the refrigeration unit is directed through a heat exchanger and turbine, where it is expanded and cooled. The cooled air from the refrigeration unit is further mixed with hot air which has bypassed the unit and is delivered to the cockpits. The degree of mixing of the conditioned air is controlled automatically by an air temperature control valve, which maintains the cockpit inlet air at the temperature selected from the cockpit.

The air conditioning system is a delivered air temperature control system. Since the console control calls for a fixed temperature of the air as it enters the cockpit, the pilot must change the setting as cockpit heating and cooling loads change. Position of the temperature control knob is not an indicator for pilot comfort. Under certain flight conditions full cold will provide comfort; under other conditions, full hot may be required. The pilot, therefore, must adjust the control to maintain a comfortable cockpit.

2.25.2 Pressurization. When the air conditioning system is in normal operation, the air provided for heating, cooling, and ventilation is also used to pressurize the cockpit. The pressurization schedule (Figure 2-21) provides for cockpit pressure to equal atmospheric pressure from sea level to 8,000 feet altitude. The cockpit pressure at 8,000 feet is then maintained from an aircraft altitude of 8,000 feet to 17,000 feet. Above 17,000 feet, the cockpit pressure

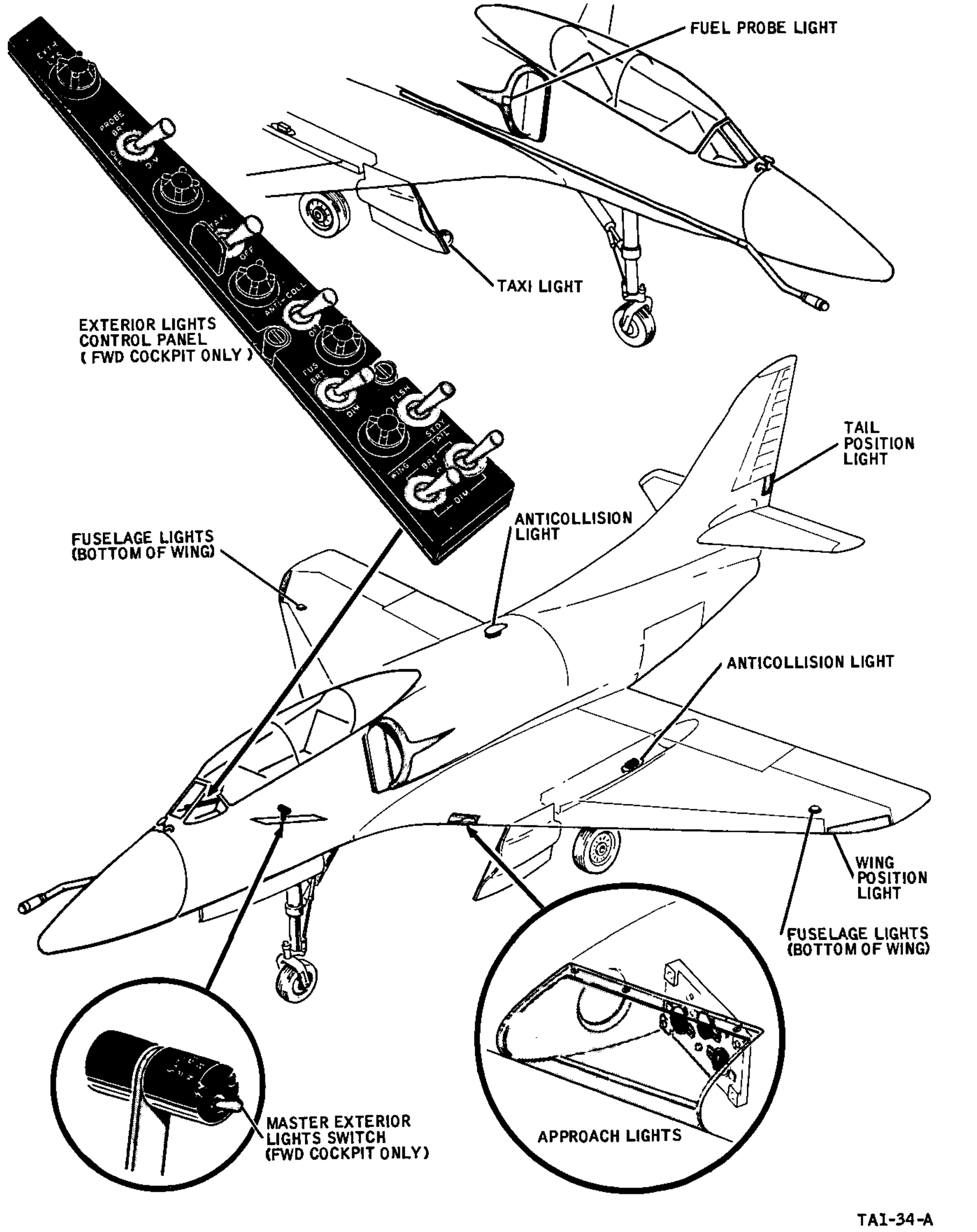
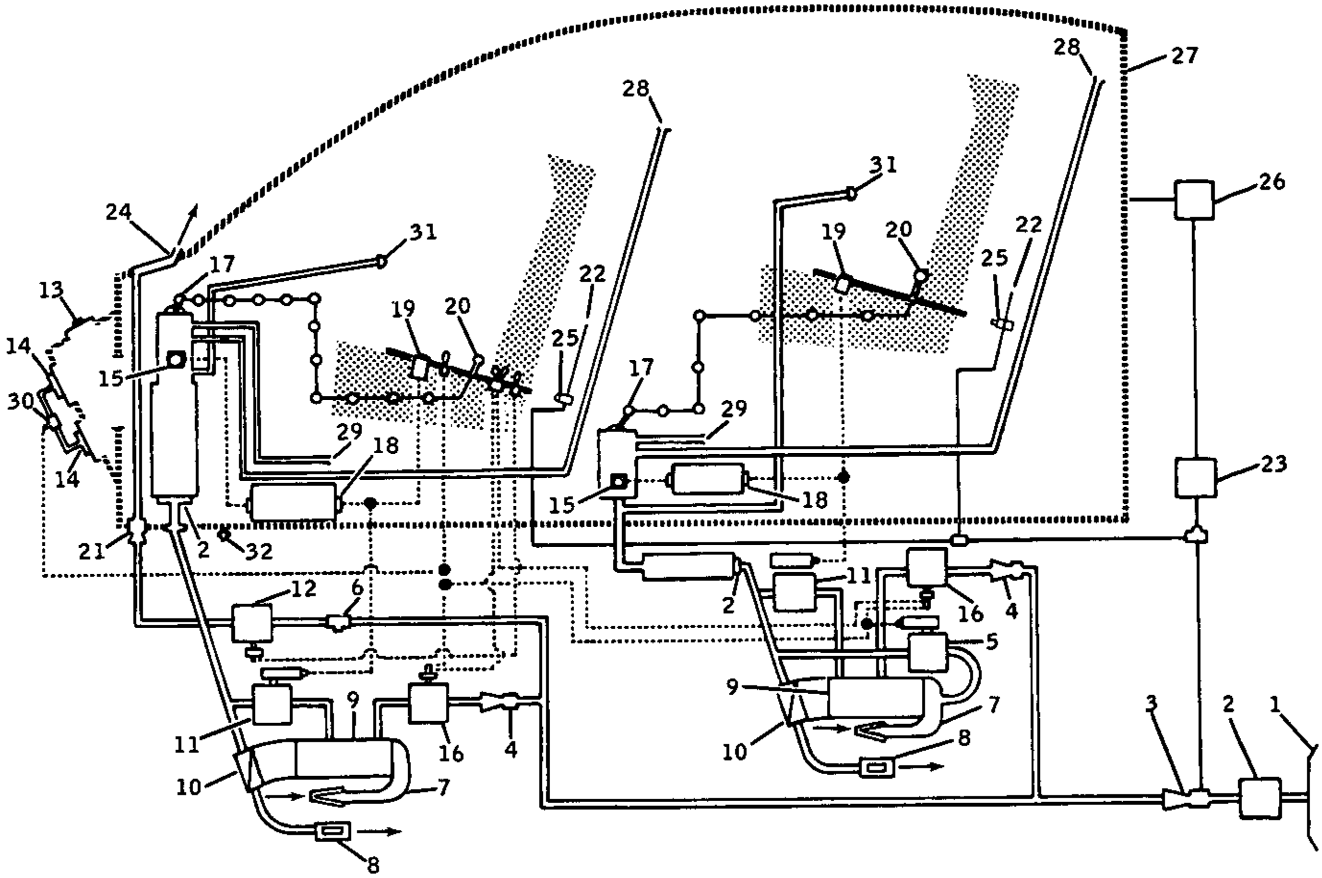
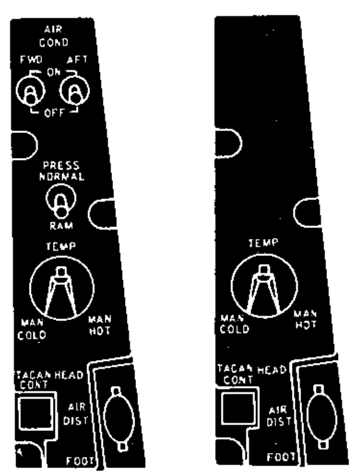


Figure 2-19. Exterior Lights



1. AIRCRAFT ENGINE COMPRESSOR
2. CHECK VALVE
3. VENTURI
4. VENTURI (REFRIGERATION UNIT)
5. RAM AIR SHUTOFF VALVE
6. GROUND TEST FITTING
7. INLET RAM AIR SCOOP
8. EXIT RAM AIR VENT
9. REFRIGERATION UNIT - HEAT EXCHANGER
10. REFRIGERATION UNIT TURBINE
11. AIR CONTROL VALVE
12. RAIN REMOVAL PRESSURE REGULATOR ON-OFF VALVE
13. PRESSURE REGULATOR VALVE
14. PRESSURE RELIEF VALVE
15. CABIN DUCT SENSING ELEMENT
16. BLEED AIR SHUTOFF VALVE
17. AIR PROPORTIONING VALVE
18. CABIN CONTROL UNIT
19. CABIN TEMPERATURE SELECTOR SWITCH
20. AIR PROPORTIONING VALVE CONTROL
21. RAIN REMOVAL JET PUMP
22. PRESSURE (ANTI-G) SUIT
23. ENCLOSURE SEAL AIR FILTER
24. RAIN REMOVAL NOZZLE
25. ANTIBLACKOUT (ANTI-G) VALVE
26. CANOPY SEAL PRESSURE CONTROL VALVE
27. CANOPY SEAL
28. HEAD AIR
29. FOOT AIR
30. SOLENOID BELLOWS RELIEF VALVE
31. EYEBALL DIFFUSER
32. PRESSURE GAGE CONNECTION



FWD COCKPIT AFT COCKPIT

AIR CONDITIONING PANEL

TA1-45-B

Figure 2-20. Air Conditioning and Pressurization System

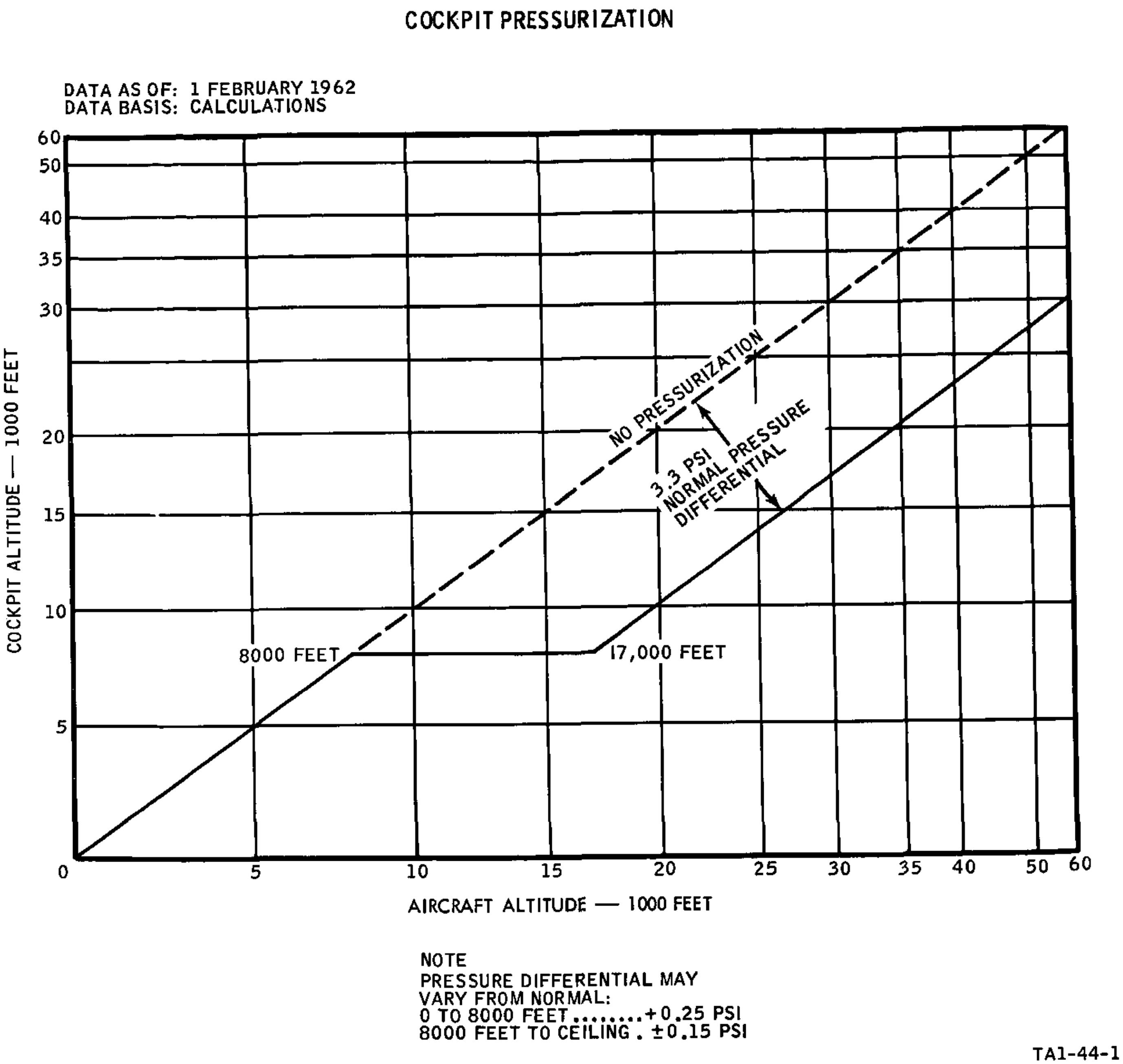


Figure 2-21. Cockpit Pressurization Chart

is maintained at 3.3 psi above the existing atmospheric pressure. Cockpit pressure is shown in terms of altitude by the cabin altimeter (Figure 2-20), located on the instrument panel of each cockpit.

To prevent excessive positive or negative pressure differentials because of possible malfunctioning of the pressure regulator, two pressure relief valves open at a positive pressure differential of 3.6 psi and at a negative differential pressure of 0.10 psi. The pressure relief valves incorporate an emergency feature that allows the valves to dump cockpit pressure when the cockpit pressurization switch in the forward cockpit is placed in the RAM position.

2.25.3 Air Conditioning Control Panel. The air conditioning control panel in the forward cockpit (Figure FO-1) is located outboard of the right-hand console. The panel contains two toggle switches, one for the forward cockpit and one for the aft cockpit, for the operation of the refrigeration unit shutoff valves, a two-position lever lock toggle switch for operation of the cabin pressurization system, and a rotary cabin temperature control knob. There is also an air distribution lever.

2.25.3.1 Air Conditioning Switches. The two air conditioning switches are located on the air conditioning control panel in the forward cockpit. The switches are marked FWD (OFF/ON) and AFT (OFF/ON). In the OFF position, no air will enter the cockpit. When the switch is in the ON position, air will enter the cockpit at temperature selected by the controlling selector switch. The pilot in the forward cockpit is responsible for the air conditioning, but not the temperature, of both cockpits.

2.25.3.2 Cockpit Pressure Switch. The cockpit pressure switch is located on the air conditioning panel in the forward cockpit. The switch is marked PRESS – NORMAL and RAM. When the NORMAL position is selected, and the canopy is closed, the cockpit is sealed and pressurized by engine compressor bleed air. Pressurization is automatically maintained at a predetermined schedule by the cockpit pressure regulator. The RAM position electrically opens the pressure relief valves to dump cockpit pressure and opens a motor-driven valve in the RAM air line allowing outside air to ventilate the cockpit. Selecting RAM also closes off engine bleed air to the air conditioning system.

2.25.3.3 Cockpit Temperature Control. The marked positions of the rotary cockpit temperature control are MAN COLD and MAN HOT. The control is functional whenever the cockpit pressurization switch is in the NORMAL position. In normal operation, the control is set in the arc (from 10 o'clock to 2 o'clock) between MAN COLD and MAN HOT which provides the desired cockpit temperature. In the event of a malfunction in the normal temperature control circuitry, manual temperature control is provided by rotating the temperature control past a detent to the MAN COLD or MAN HOT positions. These positions bypass the automatic temperature control circuitry and change the mixing of hot and refrigerated air in the selected direction as long as the control is held in position. The temperature control must be held in either position for at least 8 seconds to allow complete repositioning of the temperature control valve.

2.25.3.4 Air Distribution Control Lever. The air distribution control lever, labeled AIR DIST, has two marked positions: HEAD and FOOT. The lever operates to divert conditioned air to the position selected by the pilot. An AIR DIST control lever is located in each cockpit, outboard of the right-hand console (Figures FO-1 and FO -2).

2.25.4 Windshield Defrost. Defrosting the bullet resistant glass center panel and the side panels of the windshield is accomplished by electrical means. The system is energized when the main generator is operating or when external power is supplied. A transparent layer within the glass panels provide resistance for electrical heating, and a sensing element in the panels causes a heating controller to regulate automatically the temperature of the surface to maintain it between two predetermined limits. (Temperature limits revised after incorporation of A-4 AFC 392.)

Windshield panel defrosting also functions when the emergency generator is extended. With the emergency generator extended, a switch in the system automatically shuts off the heating element when the landing gear handle is moved to the DOWN position. To minimize fogging of the panels when the emergency generator is extended, delay lowering the landing gear as long as possible in the landing sequence.

2.25.5 Canopy Defrost. The air conditioning system is used to defrost the canopy. This is accomplished by placing the air distribution control lever (in both cockpits) in the HEAD position, adjusting the cockpit temperature control knob (in both cockpits) for higher temperature, and directing each eyeball diffuser upward toward the opposite side of the canopy. Outlet on diffusers must be rotated for maximum airflow.

2.25.6 Cockpit Fog and Snow Suppression. Small quantities of fog, light snow, or ice may appear at the air conditioning outlets. A screen is installed downstream of each refrigeration unit to prevent ice from being emitted from the distribution system. While this is a normal condition resulting from rapid cooling of air by the air conditioning units, an excessively large volume of fog which obstructs vision can occur under extreme conditions of high humidity and high ambient air temperatures at low altitude. This fog may be eliminated by adjusting the cockpit temperature control knob for higher cockpit temperature, or by adjusting the AIR DIST control lever, thereby dumping the fog and snow to the footwarmers. In some cases the ducting may have cooled to a point where fog will persist for a short time after the cockpit temperature has been increased. After the fog has been suppressed, a temperature setting should be selected that will provide the most comfortable temperature above the fogging point.

2.26 ANTIBLACKOUT SYSTEM

The antiblackout system utilizes high pressure engine bleed air. Air is directed through a line to a valve located under the anti-g oxygen panel on the left-hand console in each cockpit (Figures FO-1 and FO-2). As g-forces are increased, the valve will automatically increase the pressure in the suit. A pushbutton located at the top of the valve may be manually operated to test the system. If the valve has any tendency to stick or fails to return to the closed position, it should be replaced. On long flights, it is possible for the pilot to inflate the suit by depressing the button occasionally for body massage to lessen fatigue. The antiblackout suit connection plugs into a receptacle located on the panel.

Note

In the event of inadvertent g-suit hose disconnect, noticeable chattering in the valve may occur during accelerated flight.

2.27 ANTI-ICING SYSTEM

2.27.1 Engine. The engine anti-icing system is designed to prevent ice formation, and safe operation requires that the pilot anticipate the possibility of ice formation whenever these weather conditions exist.

Ice formation in the engine air inlet section is prevented by an integral power plant system that utilizes hot high-pressure bleed air from the compressor section. Air bled from both sides of the compressor discharge is piped forward through external lines and distributed through the inlet guide vanes from which it is ported into the engine inlet airstream.

2.27.2 Anti-Icing Control. Electrical control of the anti-icing system is accomplished by placing the anti-icing switch (Figure FO-1), located outboard on the right console, to ALL position. In this position, the switch directs power to the anti-icing valve and regulator on the system external lines. The switch also actuates the pitot tube heating element.

Note

Operation below approximately 75-percent rpm may not supply sufficient heat to keep the engine air inlet ducts clear of ice.

2.27.2.1 Pitot and Angle-of-Attack Vane. The pitot tube is electrically heated at all times when the anti-icing switch is in the ALL or PITOT position. The angle-of-attack vane is automatically heated when the aircraft is airborne and is independent of the anti-icing switch position.

2.28 RAIN REMOVAL SYSTEM

The rain removal system utilizes high-pressure engine bleed air to remove rain from the bullet resistant glass center panel of the windshield. Hot high-pressure bleed air is ducted to the rain removal automatic pressure regulating unit. The pressure regulating unit allows constant pressure air to be delivered to the jet pump unit. The jet pump unit mixes the hot bleed air with ambient air and delivers it to a nozzle which directs the high velocity hot air over the windshield surface. Electrical control of the system is maintained by the rain removal control panel. The rain removal system is inoperative on emergency generator.

2.28.1 Rain Removal Control Panel. The rain removal control panel, in the forward cockpit (Figure FO-1) has two switch positions labeled RAIN REMOVAL and OFF. When the switch is placed at the RAIN REMOVAL position, hot high-pressure air is directed over the windshield surface. The OFF position of the switch cuts off the air. In the event of electrical power failure, the valve in the pressure regulating unit automatically closes, shutting off the system.

2.28.2 Normal Operation

2.28.2.1 On the Ground. Rain removal airblast temperatures are a function of engine power setting. At IDLE power, airblast temperature is not sufficiently hot to cause damage to the windshield, and the system may be operated continuously. However, at MILITARY, the temperature becomes extremely hot, and the operation at high power settings is limited to a maximum of 3 minutes.

CAUTION

Exceeding the 3-minute limit could cause bubbling of the vinyl layers and cracking of the glass.

The pilot may check the rain removal system after engine starting by noting the warm airblast over the top of the windshield (engine power may have to be advanced to 78-percent rpm to feel the airblast). The rain removal switch should always be returned to the OFF position immediately after the preflight check to prevent inadvertent operation at high power settings and subsequent damage to the windshield. On takeoff, when the rain removal system may be required, the switch should be placed in RAIN REMOVAL just prior to the takeoff roll and secured when safely airborne.

2.28.2.2 In the Air. The rain removal system may be used for extended periods of time during approach and landing because of the lower power settings usually required for this phase of flight.

CAUTION

- The jet blast rain removal system was designed to operate during conditions of approach, landing, takeoff, waveoff, and taxi. Operation at conditions other than these is recommended only under extreme emergency flight conditions where forward visibility provided by this system is necessary. System operation at high altitude may cause cracks in the outer glass ply of the center windshield panel because of extreme thermal shock to the glass.
- During a waveoff when high power settings are required, the 3 minute limitation at military power applies.
- Activation of the rain removal system prior to entering precipitation may result in a cracked windshield.
- If rain removal switch is discovered to be in RAIN REMOVAL at altitude, if practicable, gradually reduce power, descent to lowest feasible altitude, and place the rain removal switch to OFF.

2.29 AIR REFUELING (TANKER) SYSTEM (TA-4F)

The air refueling system enables the aircraft to serve as a tanker for other aircraft. Fuel from the wing tank and the drop tanks may be transferred to the refueling store. All fuel in the tanker aircraft except that contained in the fuselage tank may be transferred to the receiver aircraft.

2.29.1 Air Refueling Store. The refueling store carried on the centerline rack contains a 300-gallon fuel cell, a constant-speed RAM air turbine-driven hydraulic pump, a hydraulically driven fuel pump, a hydraulically operated hose reel, and 50 feet of refueling hose with a drogue. The store is capable of transferring fuel to the receiver aircraft at approximately 180 gallons per minute. Provisions are made for dumping fuel overboard if necessary (Figure 13-2).

Air refueling stores reworked per Accessory Change No. 86 incorporate a fuel quantity probe within the store. Air refueling stores with this change will provide fuel quantity when the external fuel quantity switch is actuated, the same as the drop tanks.

The operational envelope of the store with the drogue extended is limited to 300 KIAS or 0.80 Mach, whichever is lower, at altitudes up to 35,000 feet. Refer to Part XI, Chapter 25, for the complete operational envelope and fuel available for transfer.

2.29.1.1 Air Refueling Store Lights. At the aft end of the refueling store are two lights, amber (left side) and green (right side). These lights are of use only to the receiver aircraft. The amber light comes on when the hose is extended, indicating that the receiver aircraft may now engage the drogue.

After engagement is accomplished, the receiver must move forward (3 to 6 feet) until the amber light goes off. Illumination of the green light indicates that fuel is actually flowing from the tanker to the receiver.

Air refueling stores incorporating Accessory Change No. 33 provide for illumination of the hose and drogue to facilitate night refueling operations. Lights added by this change consist of two white lights mounted in the aft section of the store for illumination of the hose and four white lights mounted in the drogue assembly. The hose lights come on when the drogue switch is placed in the EXT position and go off when the drogue switch is placed in the RET position. The drogue lights are furnished power by a small air-driven generator mounted in the drogue assembly and are on continuously while the drogue is extended into the airstream.

2.29.2 Air Refueling Control Panel. The refueling control panel, located in the forward cockpit on the left console, contains all the indicators and switches used to operate the system (except the drop tank pressurization switch). The system is designed so that any sequence of switch positioning is possible without causing damage or malfunction to the tanker store.

2.29.2.1 Drogue Position Indicator. The drogue position indicator has three possible indications: RET (retracted), EXT (extended), or TRA (transfer). The indication will be RET only when the drogue is fully retracted or during drogue extension. The indication will be EXT only when the drogue is fully extended and ready for receiver engagement. The indication will be TRA only when the hose and drogue have been engaged and approximately 4 feet of hose retracted onto the store reel and also during hose retraction until the drogue is fully retracted.

2.29.2.2 Gallons Delivered Counter. The gallons delivered counter registers the gallons of fuel transferred through the hose and drogue to the receiver in increments of 2 gallons. A reset knob is provided to reset counters to 0 when desired.

2.29.2.3 Refueling Master Switch. The refueling master switch has three positions: ON, OFF, and DUMP. When the refueling master switch is placed ON, it unlocks and unfeathers the air-driven propeller at the forward end of the refueling store. When placed in OFF, it feathers and locks the propeller. When the switch is placed in DUMP, an electrically operated fuel dump valve in the bottom of the refueling store opens to dump fuel. To place it in DUMP, first depress the spring-loaded lever guard, and then lift the switch from its spring-loaded safety position.

2.29.2.4 Store Dump Light. Control panels incorporating Accessory Change No. 1 provide for a store dump light. The store dump light will come on when fuel flows through the dump valve on the bottom of the store or when fuel flows from the store to the aircraft. When fuel flow ceases, either because of fuel depletion or because dump/transfer has been secured, the light will go off. A press-to-test feature for the bulb is incorporated, but is energized only when the SHIP-TANK switch is in FROM STORE position.

2.29.2.5 Drogue Switch. The drogue switch controls the hose and drogue positioning and is marked RET and EXT. When the refueling master switch is ON and the drogue switch is positioned at EXT, the hose will extend to trail position. Extension of the drogue energizes a bypass relay. This relay prevents feathering of the air turbine regardless of the position of the refueling master switch until the drogue is fully retracted. When the drogue switch is positioned at RET, the hose will retract.

Note

On air refueling stores incorporating Accessory Change No. 33, the drogue switch also controls the white lights in the aft section of the store that were provided for illumination of the hose.

2.29.2.6 Fuel Transfer Switch. The fuel transfer switch controls the flow of fuel after proper hookup is made. The switch must be at TRANS before fuel will transfer. Fuel flow will stop any time this switch is positioned at OFF. A holding relay is provided which causes the switch to remain in the TRANS position until store fuel is depleted or the pilot moves it to OFF.

2.29.2.7 Light Switch. The light switch determines the brightness of the amber and green lights at the aft end of the refueling store. The switch has two positions: BRT for daylight fueling, and DIM for night. With the switch in DIM, store lights will not be visible during daylight.

2.29.2.8 Ship-Tank Switch. The ship-tank switch has three positions: TO STORE, OFF, and FROM STORE. The TO STORE position permits fuel to flow from the wing tank to the refueling store. When the switch is placed in FROM STORE, fuel will flow under engine air pressurization from the air refueling store and drop tanks to the wing tank.

2.29.2.9 Hose Jettison Switch. The hose jettison switch is provided to cut and crimp the store hose in the event of store malfunction which precludes drogue retraction. The switch also removes all electrical power from the store controls except for the refueling master switch. The hose jettison switch must be kept in the forward OFF position at all times unless jettisoning of the hose and drogue is required during an in-flight emergency. To move the hose jettison switch to HOSE JETTISON, first hold back the spring-loaded channel guard, then lift the switch from its spring-loaded safety position. Be sure that this switch is in its forward OFF position before electrical power is applied. Once the HOSE JETTISON position is selected, do not return switch to its forward OFF position as the turbine will unfeather and cause the hose to be pulled from the guillotine crimper, spilling fuel in the store and creating a fire hazard.

2.29.2.10 Drop Tank Transfer During Air Refueling. To use the fuel in the drop tanks for air refueling, place the drop tank pressurizing switch in PRESS. This provides normal drop tank transfer to the wing where it may then be used for transfer to the store by means of the SHIP-TANK switch.

Note

> When the SHIP-TANK switch is in the FROM STORE position, fuel in the drop tanks will automatically be transferred to the wing regardless of the position of the drop tank transfer switch on the engine control panel.

2.29.3 Air Refueling (Receiver) System. During air refueling, fuel flows through the receiver aircraft's probe nozzle under pressure and is distributed to each tank in the same manner as it is through the pressure fueling receptacle.

2.30 JET-ASSISTED TAKEOFF SYSTEM

A two-bottle JATO system provides the aircraft with additional thrust during takeoff. A JATO bottle is mounted on each speedbrake. Each bottle is capable of producing 4,500 pounds of thrust for 5 seconds. The bottles are fired electrically and jettisoned hydraulically by utility system hydraulic pressure controlled through a solenoid-operated selector valve.

2.30.1 JATO Control Panel. The JATO control panel, located in the forward cockpit, outboard of the left-hand console (Figure FO-1), contains the following controls for arming and jettisoning the JATO bottles: the JATO arming switch, the JATO jettison switch, and the press-to-test type JATO arming caution light.

2.30.1.1 JATO Arming Switch. The JATO arming switch is a two-position lever-lock toggle switch labeled ARMED and OFF. To place the switch in the ARMED position, the spring loaded toggle lever must be lifted. This arms the JATO firing circuit by energizing the JATO firing button on the catapult handgrip and the jettison circuit to the jettison switch.

2.30.1.2 JATO Armed Indicator Light. A JATO armed indicator light on the control panel comes on when the arming switch is energized. The press-to-test feature of this light provides a means for preflight checking of JATO arming and firing circuit continuity.

2.30.1.3 JATO Jettison Switch. The JATO jettison switch on the control panel is a guarded, momentary-contact toggle switch, spring loaded to the SAFE position. In the JATO JETT position the switch energizes a solenoid-controlled hydraulic selector valve, which directs hydraulic pressure to the JATO mounting hook actuating cylinders. The mounting hooks are actuated to release both JATO bottles simultaneously.

Note

> An interlock in the speedbrake electrical circuit prevents normal operation of the speedbrakes with JATO bottles attached. Be sure the speedbrake switch on the throttle is in the CLOSED position prior to jettisoning the JATO bottles. Otherwise, upon release of the JATO bottles, the speedbrakes will open.

CAUTION

> When JATO bottles are installed, operation of the emergency speedbrake control will force the JATO bottles off the aircraft, resulting in airframe damage.

2.30.1.4 JATO Firing Button. The JATO firing button (Figure 1-4) located at the end of the catapult handgrip energizes a relay which completes the circuit to the firing mechanism. Refer to Part XI, Performance Data, for additional information on takeoff airspeeds with JATO and distances at which the JATO bottles are fired.

WARNING

To prevent possible JATO system accidents, the JATO arming switch in the cockpit shall be at OFF and a no-voltage test shall be made at the aircraft igniter terminals prior to attaching the JATO igniter leads to the bottles.

2.31 ARMOR PLATE INSTALLATION (TA-4F)

On aircraft reworked per A-4 AFC 406 armor plate is installed for the protection of both pilots (Figure 2-22). Increased aircraft weight with armor plate and ballast installed is 347 pounds.

CAUTION

Should the armor plating be removed for any reason, the ballast located on both sides of the aft fuselage must also be removed prior to flight.

2.32 MISCELLANEOUS EQUIPMENT

2.32.1 Antiexposure Suit Ventilation Control Panel. An antiexposure suit ventilation control panel is installed in both cockpits on the left-hand console (Figures FO-1 and FO-2) for use with Mk 5 antiexposure suit.

The control panel contains the EXPOSURE SUIT VENT and OFF toggle switch, a ventilation blower, and a quick-disconnect flexible hose for connection to the antiexposure suit. The suit hose disconnect coupling contains a butterfly valve to control the flow of ventilating air to the antiexposure suit or to close off the opening when the suit is not used.

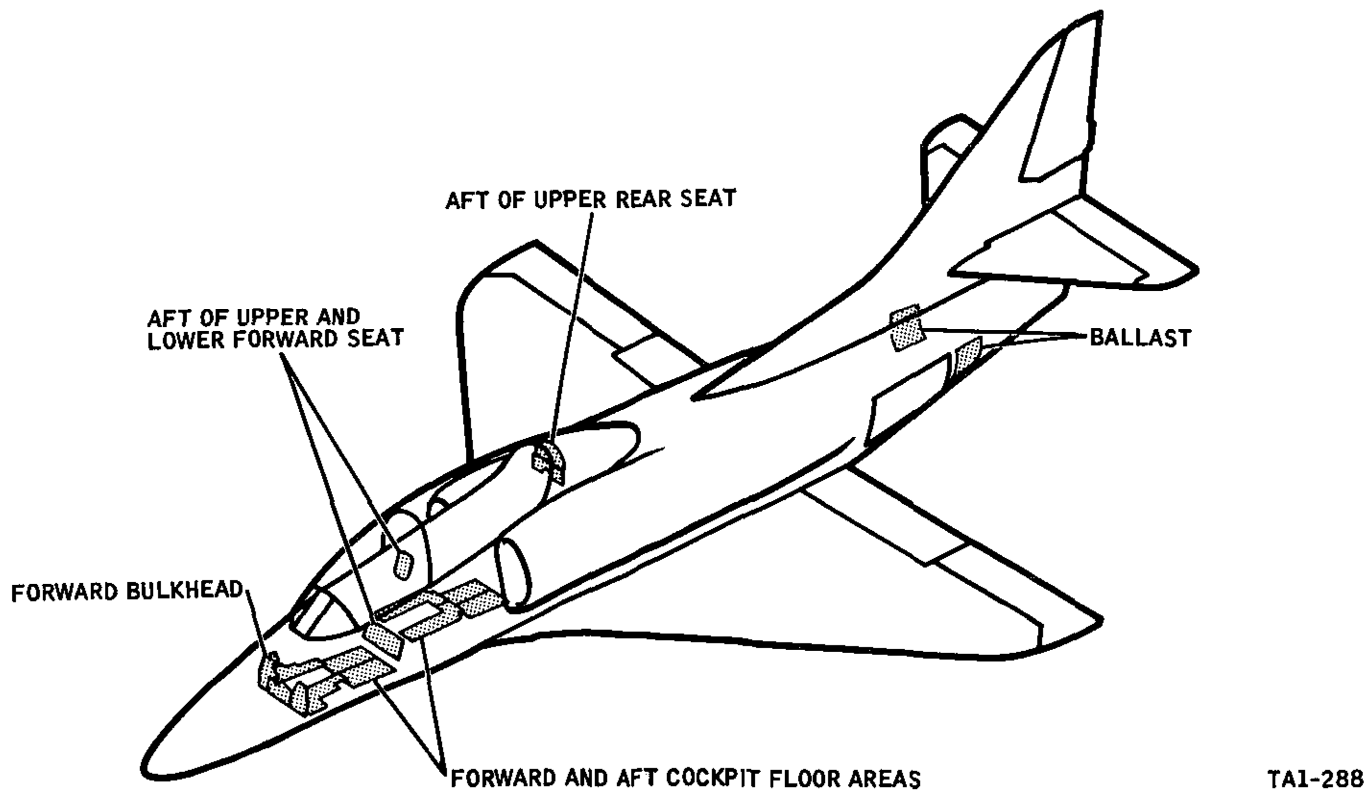


Figure 2-22. Armor Plate Installation

On aircraft reworked per A-4 AFC 387, the anti-exposure suit blower, blower control switch, and quick-disconnect hose are integral parts of the oxygen panel (Figures FO-1 and FO-2). The blower control switch has two positions: SUIT BLOWER and OFF.

2.32.2 Map Pocket. A map pocket is provided on the right side of the forward cockpit. A map case is located in the right console in the aft cockpit.

2.32.3 Spare Lamps Receptacle. Replacement lamps are contained in the SPARE LAMPS receptacle (Figures FO-1 and FO-2) outboard of the right-hand console in both cockpits.

2.32.4 Relief Container. The relief provisions for this aircraft consist of disposable plastic bags. The storage compartment for the bags is located on the left-hand side of the canted the bulkhead in both cockpits.

2.32.5 Rear View Mirrors. A rear-view mirror is installed on each side of the canopy bow, in both cockpits, and provides limited rearward vision during flight and taxi.

2.32.6 Elapsed Time Clock. The elapsed-time clock ABU-9/A (Figure 1-4) is the primary timepiece and elapsed-time indicator in the aircraft. Two elapsed time clocks are installed in the aircraft. One elapsed-time clock is installed in a mounting bracket assembly, that is attached to the canopy of the left side of the centerline in the forward cockpit. Another elapsed-time clock is installed in the upper right-hand section of the aft instrument panel. The ABU-9A elapsed time clock is integrally lighted by three 5-volt light bulbs. The elapsed-time clocks have an 8-day mechanical movement and four concentrically mounted pointers: hour, minute, second, and elapsed time.

2.32.7 External Baggage Container (CNU-188/A). The external baggage container, CNU-188/A, is a modified Aero-1D fuel tank. It contains two shelves, mounted center and aft. The container has two possible tail assemblies for carriage on the aircraft: a two-fin configuration and a bobtail configuration. See Figure 2-23 for CNU-188/A physical characteristics.

Adjustments for tightening or loosening baggage harness tiedown straps can be made only at the buckle end of each strap. Ensure that baggage is properly secured prior to closing and fastening CNU-188/A doors.

External baggage containers are authorized for multiple carriage combinations on stations 2, 3, and 4, provided asymmetric limitations are adhered to for takeoffs and landings.

2.33 EQUIPMENT/BAGGAGE STOWAGE

Equipment and/or baggage should normally be stowed in the nose compartment. If size or quantity of equipment/baggage necessitates further stowage area, the forward engine compartment (FEC) may be used.

WARNING

- Storage of unsecured parts or luggage in the FEC may result in control binding. Any material stored in the FEC must be secured. Abrupt maneuvering as experienced in air-to-air or air-to-ground training should be avoided when materials are carried in the FEC.
- Stowage of baggage in the rear engine compartment constitutes a fire hazard and is prohibited.

EXTERNAL BAGGAGE CONTAINER, CNU-188/A

PHYSICAL CHARACTERISTICS

	(BOBTAIL)	(TWO FIN)
Weight:		
Empty:	198 pounds	216 pounds
Full:	Shore Based Opns; 631 pounds Carrier or SATS Opns; 548 pounds	Shore Based Opns; 649 pounds Carrier or SATS Opns; 556 pounds

	(BOBTAIL)	(TWO FIN)
Dimensions:		
Length:	202 inches	227 inches
Diameter:	27 inches	27 inches

Capacity:
- Center Shelf: 200 pounds
- Aft Shelf: Shore Based Opns; 233 pounds; Carrier or SATS Opns; 150 pounds

SUSPENSION REQUIREMENTS

(30 inches) - AERO 7A
or
(14 inches) - AERO 20A

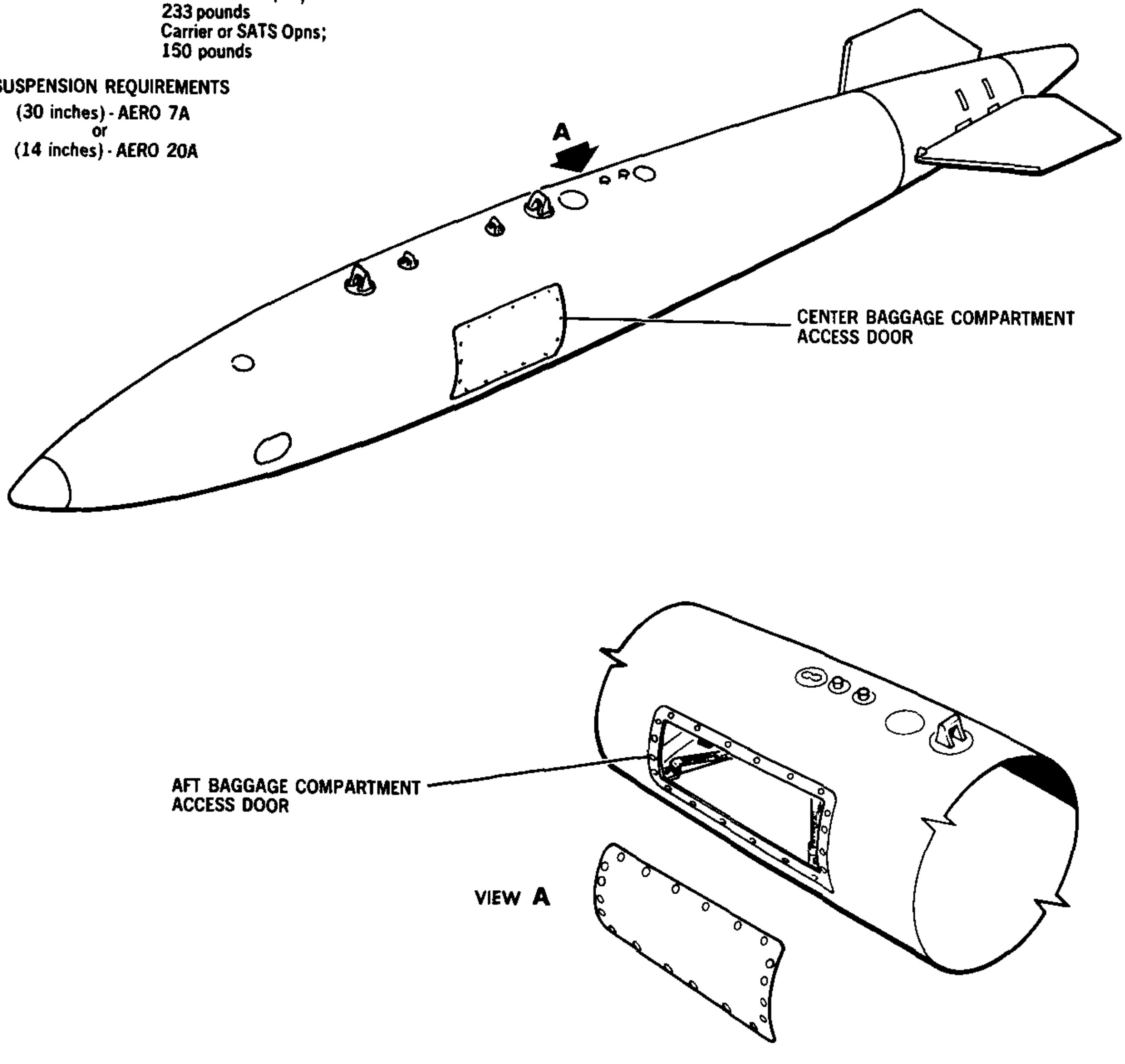


Figure 2-23. External Baggage Container (SNU-188/A)

CHAPTER 3

Aircraft Servicing

3.1 INTRODUCTION

Normally, the aircraft will be serviced by qualified maintenance personnel; however, navigation lights, diversions, weather alternates, and other operations may require the use of various bases. Therefore, the pilot must have a knowledge of aircraft servicing procedures (Figure 3-1) sufficient to accomplish normal aircraft servicing. Reference to the following procedures should be adequate to ensure proper servicing by transient maintenance personnel, under the supervision of the pilot.

Note

The flight manual is not intended to be a maintenance manual. For detailed maintenance information, refer to the appropriate section of the applicable NAVAIR 01-40AVD-2 series of maintenance instructions for the system desired.

3.2 FUEL SYSTEM SERVICING

The aircraft may be serviced with approved fuel (see Figure 3-1) by either the pressure fueling method or the gravity fueling method. The pressure fueling-defueling receptacle valve permits single-point pressure fueling (or defueling) of the aircraft. Individual filler ports are provided for gravity fueling the aircraft.

Note

Removal of JP-4 or JP-8 from the aircraft is not required before refueling with JP-5. If removal aboard ship is found necessary, it shall not be defueled into existing storage tanks containing JP-5.

3.2.1 Fuel Control Fuel Selector. The fuel grade selector on the engine fuel control should correspond to the grade of fuel being used. After JP-4 is introduced into the fuel system of the engine, the specific gravity switch on the fuel control will be set to JP-4. The setting will not be returned to JP-5 until after the first flight during which JP-5 has been used. When using a combined fuel load of JP-4 and JP-5 on the JP-4 setting, the pilot must monitor EGT to ensure that full throttle operation remains within the prescribed limits. Use the JP-5 setting on the control when using JP-8 fuel.

3.2.1.1 Adjustment. (See Figure 3-2). Open the left-hand engine access door and observe fuel selector adjustment valve located on the upper aft end of the fuel control. If the valve setting does not correspond to grade of fuel being added, adjust fuel control fuel selector as follows:

1. Remove retaining nut that secures locking bracket to retaining stud on housing.

2. Remove locking bracket from stud.

3. Invert locking bracket and insert over hexagon shaft.

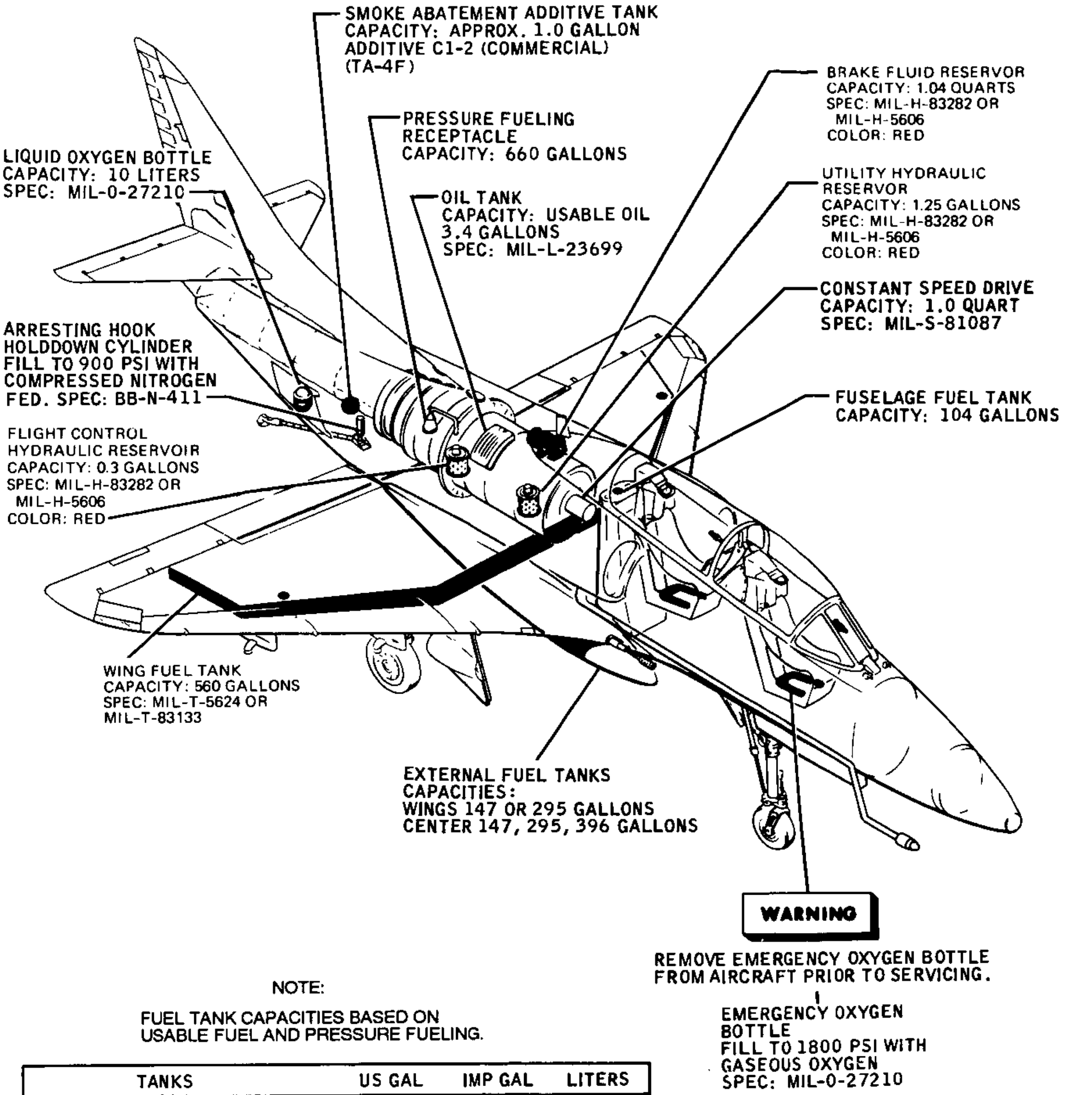
4. Using locking bracket as a wrench, rotate hexagon shaft until pointer on outside of valve is aligned with index for grade of fuel being added.

5. Replace locking bracket over hexagon shaft so that slotted end fits over retaining stud on housing.

6. Secure bracket to retaining stud with washer and nut.

7. Close left-hand engine access door.

3.2.2 Pressure Fueling. The preferred pressure fueling method requires the use of external ac power. This method will be used at all times when external ac power is available.



NOTE:

FUEL TANK CAPACITIES BASED ON
USABLE FUEL AND PRESSURE FUELING.

TANKS	US GAL	IMP GAL	LITERS
FUSELAGE FUEL CELL	104	83.3	369.8
WING INTEGRAL FUEL TANK	560	466.2	2119.6
EXTERNAL FUEL TANK, AERO 1C	147	122.3	556.3
EXTERNAL FUEL TANK, AERO 1D	295	245.6	1116.5
AIR REFUELING STORE	295	245.6	1116.5
EXTERNAL FUEL TANK, ATP-D1B	396	329.7	1498.8

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TA1-153-F

Figure 3-1. Servicing Diagram (Sheet 1 of 2)

TA-4/OA-4 Fuel Preference and Cross Reference Chart

	NATO Code	Fuel Type (Note 1)	U.S. Military		ASTM Commercial	
			Code	Specs	Code	Spec
Primary Fuel	F-44	High	JP-5	MIL-T-5624	None	
	F-40	Widecut	JP-4	MIL-T-5624	None	
	F-34	Kerosene	JP-8	MIL-T-83133	None	
Alternate Fuel (Note 2 and 3)	F-35	Kerosene	(JP-8)	MIL-T-83133	Jet A-1	ASTM D-1655
	None	Kerosene	None	None	Jet A	ASTM-D-1655
	None	Widecut	(JP-4)	None	Jet B	ASTM-D-1655
	F-43	High Flash	(JP-5)	None	None	

Notes:

1. The J52-P6 engine's fuel control must be adjusted to the type of fuel being used in order to maximize engine performance and efficiency. Kerosene and high flash kerosene fuels require the JP-5 setting while widecut fuels use the JP-4 setting. If changing from a kerosene type fuel to a widecut type, do not change setting until tanks are filled with a widecut fuel for a second time, then change setting to JP-4. If changing from a widecut fuel to kerosene, this fuel density adjustment to the fuel control should be made upon the initial fueling with a kerosene type fuel. It is not required to change density settings on cross-country flights.

2. Alternate fuels which are authorized for use by the J52-P6 engine do not contain Fuel System Icing Inhibitor (FSII), lubricity additives, or storage stability additives. Since these additives contribute to the aircraft's and engine's durability and maintainability, the primary fuels should be used in preference to alternate fuels.

3. These fuels which are shown in parentheses have physical and chemical properties which are essentially identical to those listed in the other columns except that they contain FSII, lubricity, and storage stability additives. They are included here for reference purposes.

CAUTION

JP-5 is the primary fuel used by the Navy and Marine Corps because of the increased safety afforded by its low volatility/high flash point. Any aircraft scheduled for immediate sea duty should be refueled with JP-5. An aircraft cannot be defueled into ships storage if the flash point of the fuel in its tanks is below 140 °F. After refueling with JP-4, it may take as many as three to five refuelings with JP-5 before fuel in an aircraft tank is above 140 °F.

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Figure 3-1. Servicing Diagram (Sheet 2 of 2)

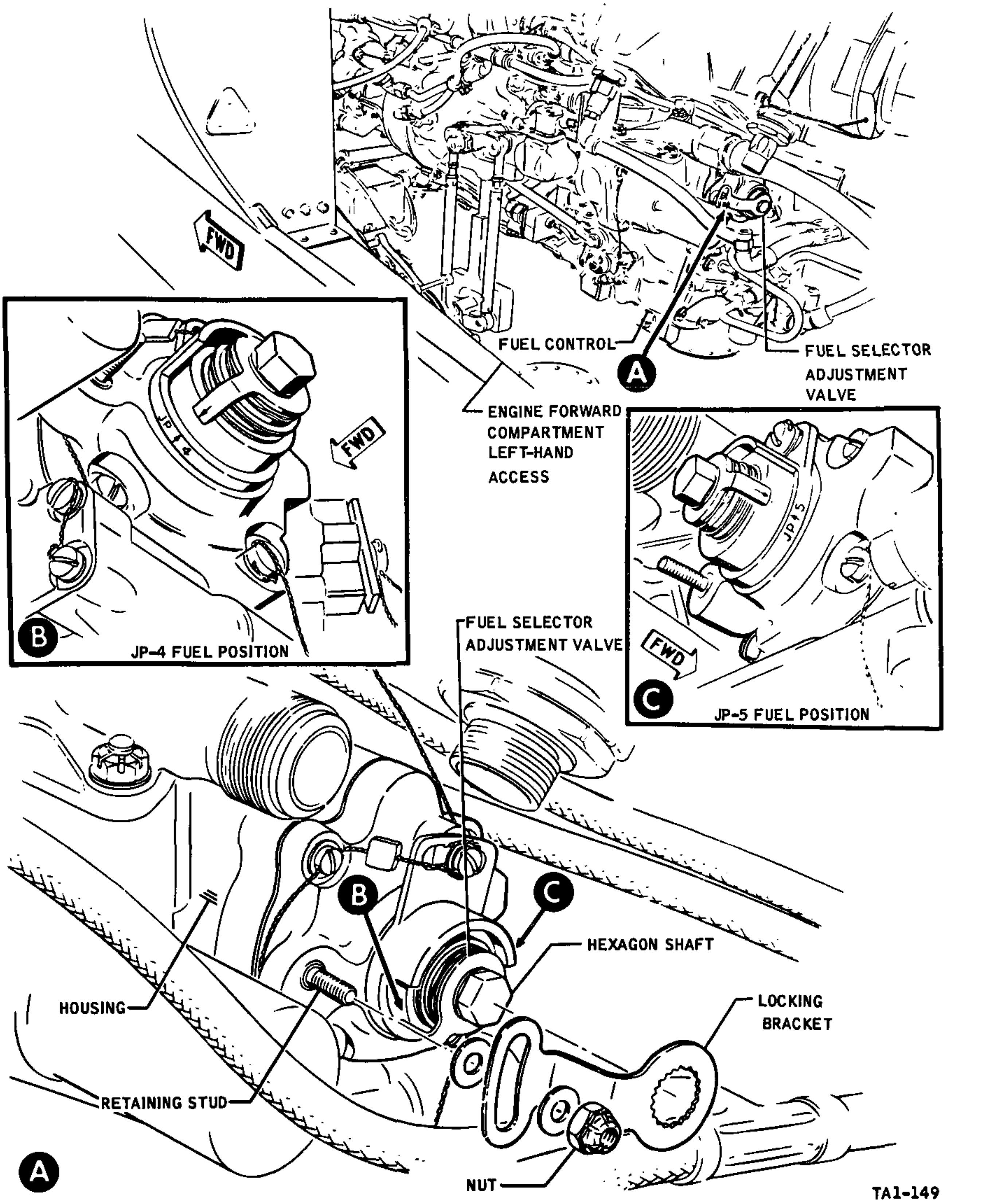


Figure 3-2. Fuel Control Fuel Selector Adjustment

If external ac power is not available, the alternate pressure fueling method will be used. When the alternate pressure fueling method is used, the external fuel tanks must be gravity fueled.

3.2.2.1 Pressure Fueling – Preferred Method. The preferred pressure fueling method requires the use of external ac power input and single-point fueling source. Perform the fueling operation in the following sequence.

WARNING

- Perform all fueling operations in a well-ventilated area.
- Stop all maintenance on aircraft during fueling operations.
- Ensure adequate grounding of aircraft and fueling equipment.
- Ensure that no aircraft radar is in operation within 100 feet of the fueling operation and that no electrical or electronic equipment is operating in the area.
- Ensure that adequate fire fighting equipment is in the immediate area of fueling operation.

Note

Aircraft must be on a level surface in a 4° noseup attitude to ensure maximum capacity fueling.

1. Ensure that WING FUEL DUMP/EMER TRANS switch located on left-hand console (in both cockpits) is in the OFF position.

2. Inspect fuel vent mast to ensure that it is not obstructed.

WARNING

Failure of air to exhaust through fuel vent mast during pressure fueling by the preferred method may result in rupture of wing integral fuel tank and/or fuselage fuel cell and possible injury to personnel.

3. If external fuel tanks are to be refueled, remove caps.

4. Open aft fuselage lower access door.

Note

When air refueling store or centerline 400-gallon fuel tank is installed on aircraft, aft fuselage lower access door must be removed to connect pressure fueling nozzle to pressure fueling-defueling adapter valve.

5. Remove cap from pressure fueling-defueling adapter valve, and connect pressure fueling nozzle to pressure fueling-defueling adapter valve. (See Figure 3-3.)

Note

When the nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

6. Ensure that CHECK SWITCH on fueling panel is in FUELING ON position.

7. Connect external ac power to aircraft. (Refer to External Power Application.)

WARNING

Proper connection of ac external power cable plug to aircraft external power receptacle must be made. Failure to insert plug completely into receptacle can result in presence of high voltage on aircraft metal surfaces.

8. Place external ac power switch in EXTERNAL position.

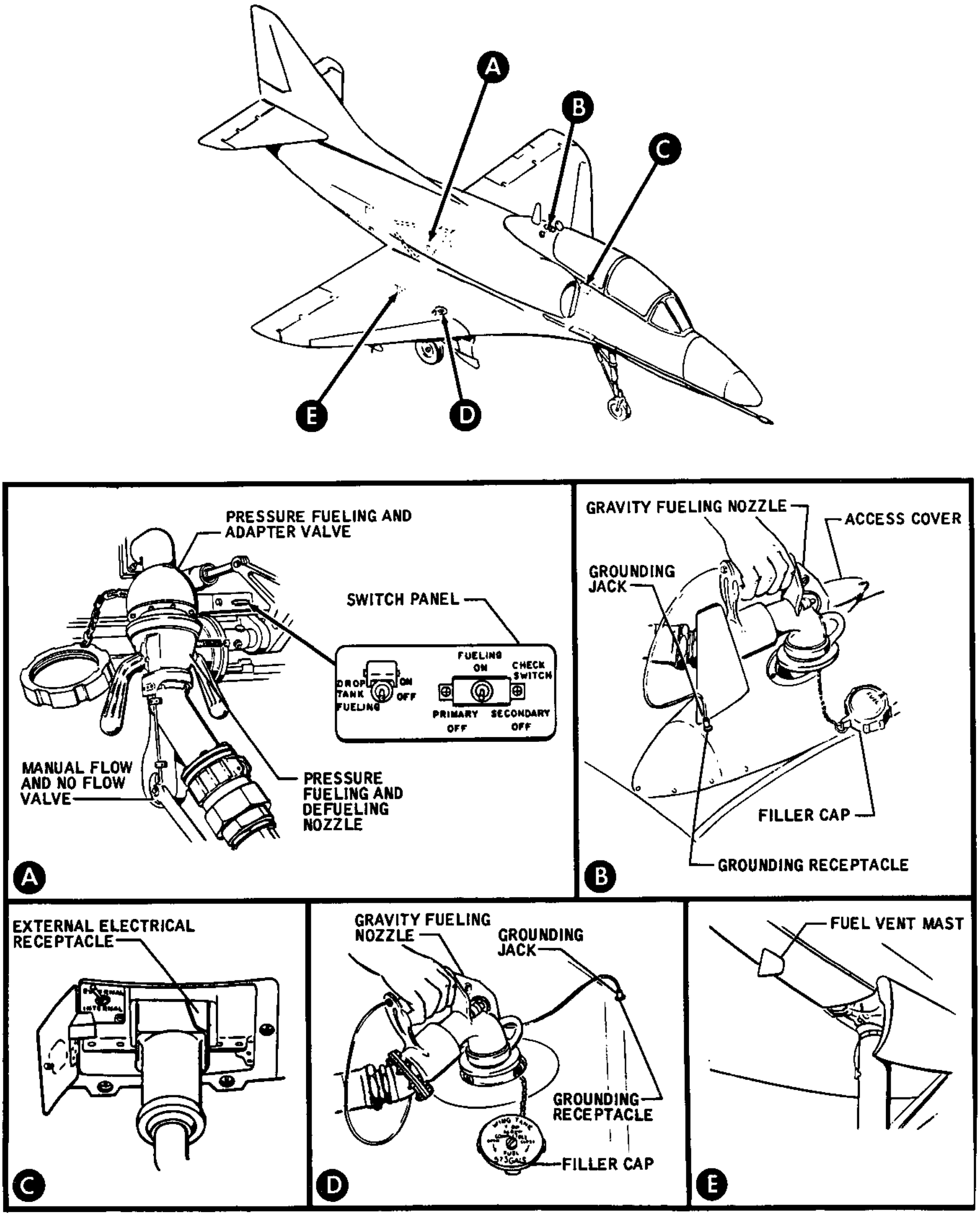


Figure 3-3. Aircraft Fueling

9. Start pressure fueling equipment and open manual flow and no-flow valve on pressure fueling nozzle.

WARNING

Removal of gravity filler caps while pressure fueling is being accomplished may result in injury to personnel.

CAUTION

To prevent damage to aircraft fuel system, maximum fueling pressure must not exceed 55 psi at any time.

10. Immediately after pressure fueling has started, test the fuel vent system for proper functioning by holding the hand beneath fuel vent mast. (See Figure 3-3).

WARNING

If air is not exhausting from fuel vent mast, stop pressure fueling immediately and investigate the fuel vent system. Failure to comply may result in damage to equipment and injury to personnel.

11. During the initial stage of pressure fueling, perform functional test of pressure fueling shutoff components in sequential order as shown in steps 12 through 16.

12. Place and hold CHECK SWITCH in PRIMARY OFF position. Fuel flow shall stop in 1 to 3 seconds.

CAUTION

If fuel flow does not stop in 1 to 3 seconds, stop fueling immediately and investigate cause.

Note

Because of fuel flow through pilot lines of float valves, a 2-gpm maximum flow (registered on pressure fuel meter) is permissible.

13. Return CHECK SWITCH to FUELING ON position. Fuel flow should start.

14. Place CHECK SWITCH in SECONDARY OFF position. Fuel flow shall stop in 1 to 3 seconds.

15. Return CHECK SWITCH to FUELING ON position. Fuel flow should start.

16. Upon satisfactory completion of functional test, continue pressure fueling of aircraft.

17. During pressure fueling, inspect for evidence of fuel leakage. Correct if required.

If partial aircraft internal fuel load with full external tanks is desired, proceed as follows, disregarding steps 21, 22, and 23:

18. Place and hold CHECK SWITCH in the PRIMARY or SECONDARY OFF position, and place DROP TANK FUELING switch in the ON position. Fuel flow should start into external tanks only.

19. When fuel flow stops, return CHECK SWITCH to the FUELING ON position and return DROP TANK FUELING switch to the OFF position.

CAUTION

If fuel flow does not shut off and overflows from an external fuel tank, stop fueling immediately and investigate the cause.

20. When internal quantity reaches desired amount, close manual flow and no-flow valve and shutdown pressure furling equipment.

If a full fuel load is desired, disregard steps 18, 19, and 20, and proceed as follows.

21. Place DROP TANK FUELING switch in the ON position. Fuel flow should commence to the external tanks.

22. After fuel flow has stopped (cell and tanks full), check fuel-delivered meter for indication of pressure fueling system internal leakage. Maximum leakage must not exceed 1 gpm.

23. Close manual flow and no-flow valve, and shut down pressure fueling equipment.

24. Place external ac power switch in INTERNAL position.

25. Disconnect external ac power from aircraft.

26. Disconnect pressure fueling nozzle from pressure fueling-defueling adapter valve and install cap.

27. Place DROP TANK FUELING switch in OFF position.

28. Close and secure aft fuselage lower access door, if applicable.

29. Replace external fuel tank caps, if removed.

3.2.3 Pressure Fueling – Alternate Method.

The pressure fueling alternate method must be used to fuel the aircraft when single-point fueling source is available and external ac power is not available. External fuel tanks cannot be fueled using alternate method. Perform the alternate method fueling operation in the following sequence.

WARNING

- Perform all fueling operations in a well-ventilated area.
- Stop all maintenance on aircraft during fueling operations.
- Ensure adequate grounding of aircraft and fueling equipment.
- Ensure that no aircraft radar is in operation within 100 feet of fueling operation and that no electrical or electronic equipment is operating in the area.
- Ensure that adequate fire fighting equipment is in the immediate area of fueling operation.

Note

Aircraft must be on a level surface in a 4° noseup attitude to ensure maximum capacity fueling.

1. Remove gravity filler caps from the fuselage fuel cell and the integral wing tank. Use any suitable means to prevent entry of foreign material into openings.

WARNING

Wing integral fuel tank and fuselage fuel cell gravity fuel filler caps must be removed prior to pressure fueling aircraft by the alternate method. As ac electrical power is not available, a malfunction of the fuel vent system or any shutoff valve could result in rupture of the wing integral fuel tank and/or fuselage fuel cell with damage to the aircraft and/or injury to personnel.

2. Inspect fuel vent mast to ensure that it is not obstructed.

3. Open aft fuselage lower access door.

Note

When air refueling store or centerline 400-gallon fuel tank is installed, aft fuselage lower access door must be removed to connect pressure fueling nozzle to pressure fueling-defueling adapter valve.

4. Remove cap from pressure fueling-defueling adapter valve and connect pressure fueling nozzle to valve. (See Figure 3-3.)

CAUTION

To prevent damage to aircraft fuel system, maximum fueling pressure must not exceed 55 psi at any time. One man shall be posted at manual flow and no-flow valve to stop fuel flow immediately if fuel flow does not stop when fuel tanks are full.

Note

When the nozzle is connected to the valve, the aircraft is grounded automatically through the connection and no further grounding of individual fuel tanks is necessary.

5. Start pressure fueling equipment and open manual flow and no-flow valve on pressure fueling nozzle.

6. During pressure fueling, inspect for evidence of fuel leakage. Correct if required.

7. After fuel flow has stopped (wing integral tank and fuselage fuel cell full), check fuel delivered meter for indication of pressure fueling system internal leakage. Maximum leakage must not exceed 1 gpm.

Note

If external fuel tanks are installed, they must be fueled by gravity method. (Refer to Gravity Fueling.)

8. Close manual flow and no-flow valve on fuel nozzle and shut down pressure fueling equipment.

9. Disconnect pressure fueling nozzle from fueling-defueling adapter valve and install valve cap.

10. Verify that DROP TANK FUELING switch is in the OFF position.

11. Close and secure aft fuselage lower access door, if applicable.

12. Install fuselage fuel cell gravity filler cap and secure access cover.

13. Install wing integral fuel tank filler caps.

3.2.4 Pressure Fueling Air Refueling Store (TA-4F). See Figure 3-4.

WARNING

- Perform fueling operations in a well-ventilated area.
- Stop all maintenance on aircraft during fueling operations.
- Ensure adequate grounding of aircraft and fueling equipment.
- Ensure that no aircraft radar is in operation within 100 feet of fueling operation and that no electrical or electronic equipment is operating in the area.
- Ensure that adequate fire fighting equipment is in the immediate area of fueling operation.

Note

- The following procedures also apply to fueling a 400-gallon external fuel tank.
- Aircraft must be in a 4° noseup attitude to ensure maximum capacity fueling.

1. Remove pressure fueling access cover from air refueling store and remove cap from fueling receptacle.

2. Connect pressure fueling nozzle to air refueling store fueling receptacle.

3. Start pressure fueling equipment and open manual flow and no-flow valve on fueling nozzle.

Note

Pressure fueling will stop automatically when air refueling store is full.

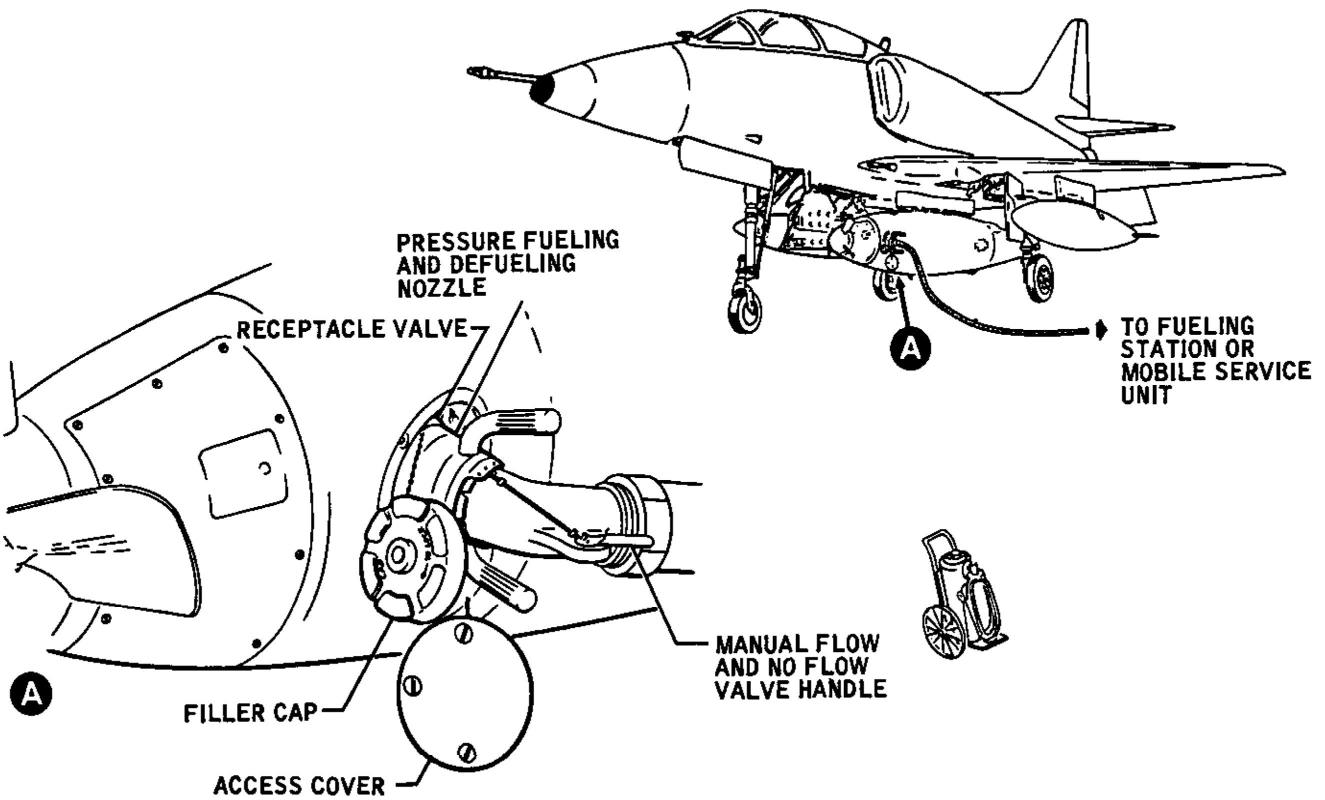


Figure 3-4. Pressure Fueling—Air Refueling Store—TA-4F

4. When air refueling store is full, close manual flow and no-flow valve on fueling nozzle and shut down pressure fueling equipment.

5. Disconnect fueling nozzle from air refueling store fueling receptacle.

6. Install cap on fueling receptacle.

7. Install and secure access cover on air refueling store.

3.3 HOT REFUELING

Refer to procedures in Part III, Chapter 10, for refueling of aircraft with the engine running.

3.4 GRAVITY FUELING

Gravity fueling must be used when pressure fueling equipment is not available. It must also be used to fuel external tanks when pressure fueling equipment is used without ac power.

WARNING

- Ground aircraft and fueling equipment during all fueling operations.
- Stop all maintenance on aircraft during fueling.
- Ensure that adequate firefighting equipment is available in immediate area.
- Make certain that proper fuel is used for refueling. (See Figure 3-1.)
- Do not connect external electrical power to aircraft when gravity fueling.
- Do not start fueling or defueling operations within 100 feet of aircraft operating with radar equipment.

3.4.1 Gravity Fueling Fuselage Fuel Cell. See Figure 3-5.

1. Open fuselage cell gravity filler access door; remove cap from gravity filler port.

2. Insert nozzle grounding jack in grounding receptacle directly aft and outboard of access door; insert refueling nozzle in gravity filler port.

3. Fill fuselage cell until fuel level is at bottom of gravity filler port neck.

CAUTION

Stop fueling when fuel comes out of the vent line.

4. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

5. Install gravity filler port cap and secure access door.

3.4.2 Gravity Fueling Wing Integral Fuel Tank. See Figure 3-6.

1. Remove wing integral fuel tank filler cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on wing nose.

CAUTION

Do not drop fueling nozzle in wing tank filler port because nozzle will damage lower surface of tank. Do not pull fueling hose over wing slats.

3. Insert refueling nozzle in gravity filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill wing fuel tank until fuel is at bottom of gravity filler port neck.

5. Remove refueling nozzle from gravity filler port; disconnect grounding jack from receptacle.

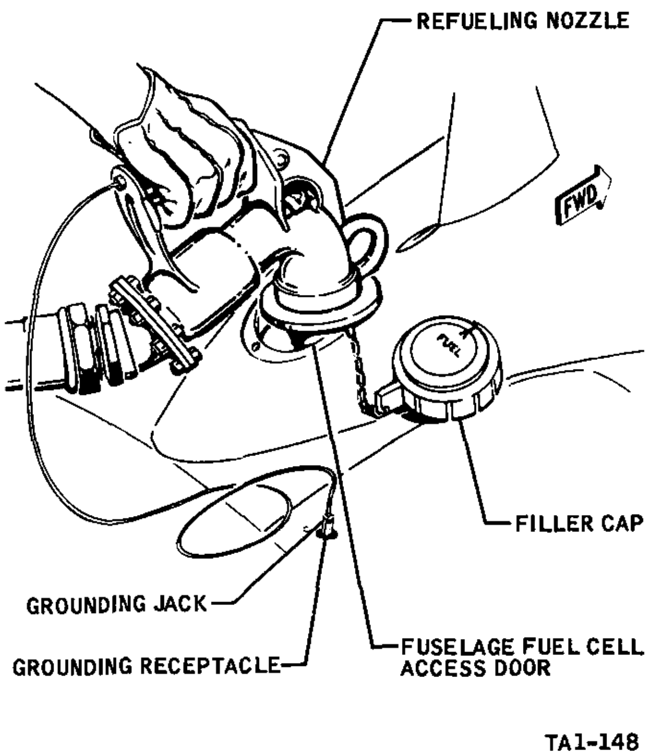


Figure 3-5. Gravity Fueling Fuselage Fuel Cell

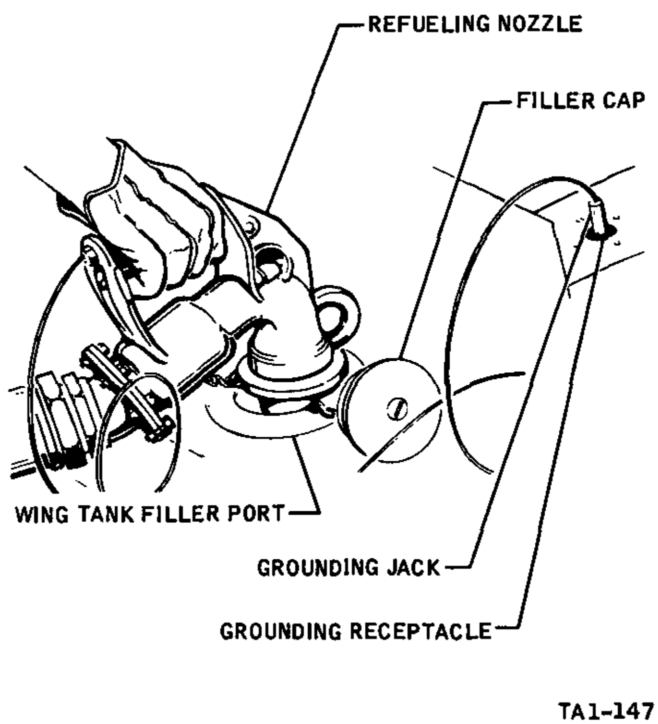


Figure 3-6. Gravity Fueling Wing Integral Tank

6. Install wing fuel tank gravity filler port cap and lock securely in place.

3.4.3 Gravity Fueling External Fuel Tank or Air Refueling Store. See Figure 3-7.

1. Remove tank or store filler cap.

2. Insert refueling nozzle grounding jack in grounding receptacle on left-hand side of external stores rack.

3. Insert refueling nozzle into filler port. Hold refueling nozzle in one hand and support refueling hose with other hand.

4. Fill tank or store until fuel level is approximately 1 inch below filler port to allow for thermal expansion.

5. Remove refueling nozzle from filler port; disconnect refueling nozzle grounding jack from receptacle.

6. Install tank or store filler cap.

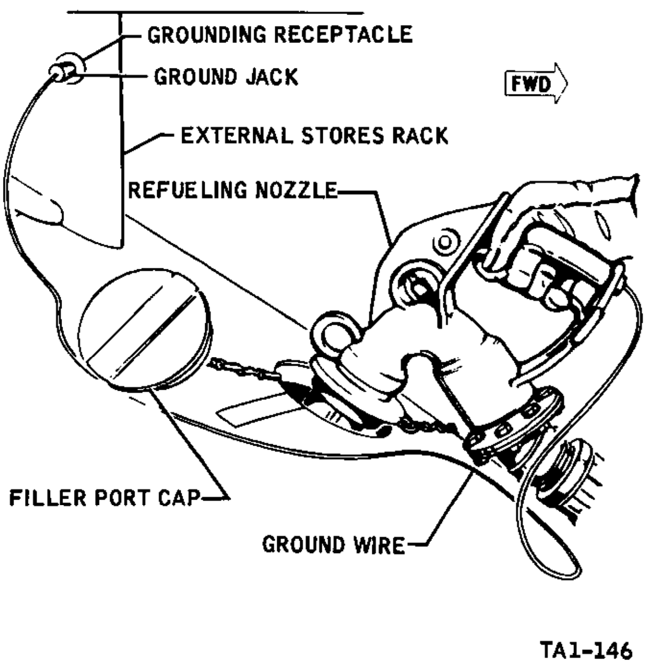


Figure 3-7. Gravity Fueling External Fuel Tank or Air Refueling Store

3.5 ENGINE OIL SYSTEM SERVICING

Servicing provisions are accessible through the engine forward compartment lower access doors.

The PON-5A pressure oiling unit is recommended for servicing the engine oil tank.

3.5.1 Engine Oil System Quantity Check. Checking or filling the engine oil system shall be accomplished at engine shutdown or not over 30 minutes after engine shutdown with external power.

Note

> When electrical power is applied to the aircraft several hours after shutdown, the oil quantity indicator light will come on. The oil drains from the engine into the gearbox. Engine operation will pump the oil back to the tank. Engine must be turned up 75 percent or more for 8 minutes to establish actual oil tank level.

1. Apply external power to aircraft (Figure 3-21).

2. Press MASTER PRESS-TO-TEST switch to ensure that indicator lights are operative, and release switch.

3. If oil level warning light remains on, system is below 20 percent remaining level. This indicates dangerously low oil state and engine oil tank must be serviced.

4. The warning light comes on when pressed if the oil level is below the 80 percent level. Service is required.

5. No light indicates sufficient engine oil supply.

6. Remove external electrical power from aircraft.

3.5.2 Engine Oil System Pressure Filling. See Figure 3-8.

1. Remove oil fill and oil overflow dust caps.

2. Connect pressure oiling unit hose to fill connection.

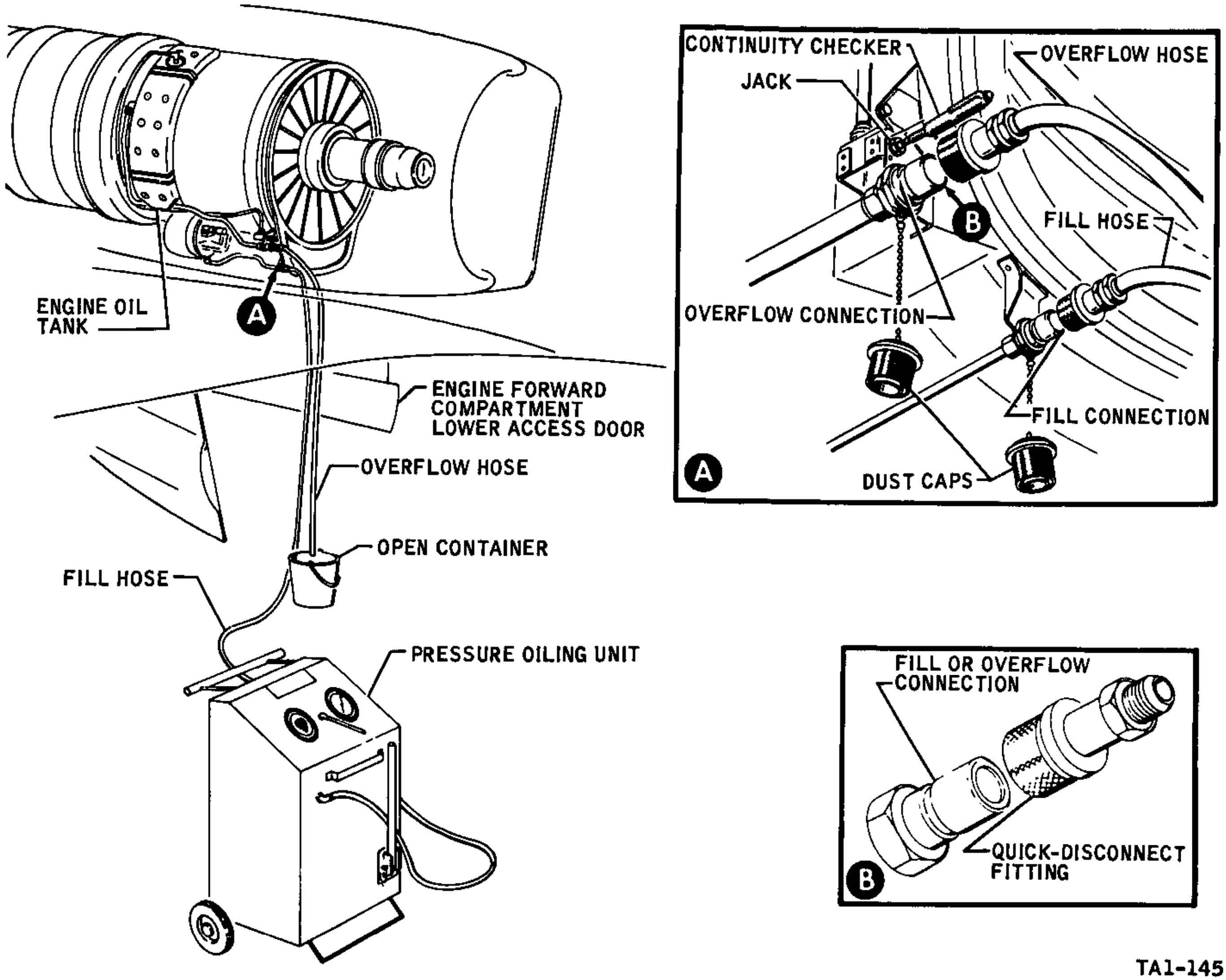


Figure 3-8. Engine Oil System Pressure Filling

3. Connect 3-foot hose with Roylyn 7776 3/4-inch (MS24475-2) quick-disconnect fitting to overflow connection.

Note

Overflow hose should be not more than 3 feet in length to prevent back pressure in bleed line.

4. Allow overflow hose to empty into open container.

5. Pump oil (MIL-L-23699) into tank until continuous stream of oil runs out overflow line.

3.6 CONSTANT-SPEED DRIVE (CSD) SERVICING

The constant-speed drive (Figure 3-9) is located on the forward end of the engine. It is mounted on an adapter bolted to the engine pad and secured by a V-band coupling. The drive unit and components should be inspected daily. Access to the constant-speed drive is through the engine forward compartment lower right-hand access door and the constant-speed drive outer and inner access doors. Servicing consists of inspecting for fluid level and adding fluid.

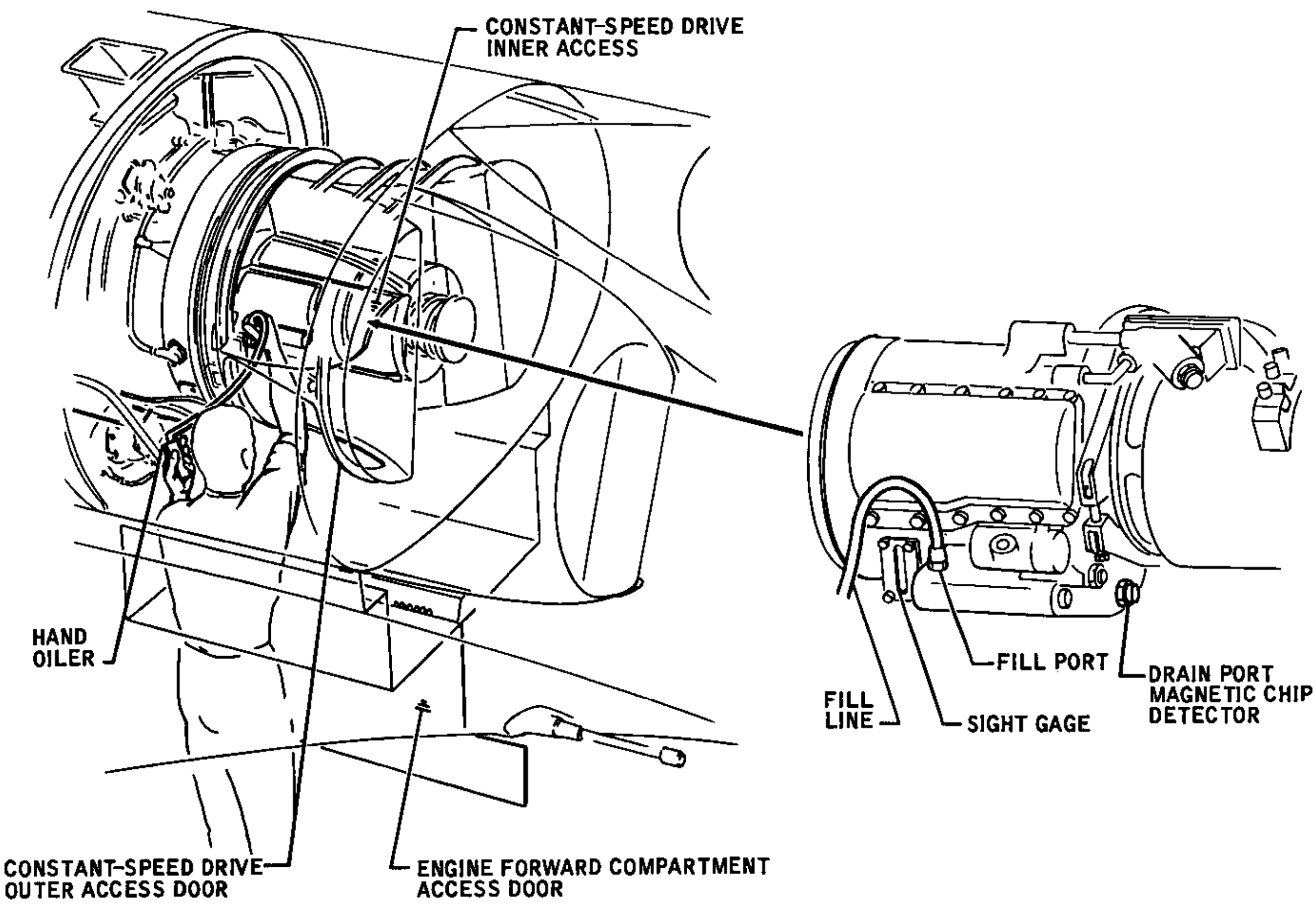


Figure 3-9. Constant-Speed Drive Filling

3.6.1 Daily Inspection. The following inspection should be made:

1. Open engine forward compartment right-hand access door and constant-speed drive outer and inner access doors.

2. Using a flashlight and an inspection mirror, inspect constant-speed drive for signs of fluid leakage.

3. Inspect fluid level on sight gauge.

3.6.2 Filling. See Figure 3-9.

1. Open engine forward compartment right-hand access door, and constant-speed drive outer and inner doors.

2. Remove lockwire and filler plug located at top right-hand side of sump.

CAUTION

Use only MIL-S-81087A, Type 1 fluid. Mixing or the use of other than an approved fluid will cause constant-speed drive failure.

3. Add fluid (MIL-S-81087A, Type 1) until fluid level is at FULL mark on sight gauge.

Note

The capacity of the constant-speed drive is 1 quart.

4. Replace filler plug and secure with lockwire.

5. Close access doors.

3.7 HYDRAULIC SYSTEM SERVICING

The utility hydraulic system and the flight control hydraulic system are serviced separately.

3.7.1 Utility Hydraulic System Filling. See Figure 3-10.

1. Open engine forward compartment access doors and utility hydraulic reservoir access door.

2. Remove dust caps and connect source of hydraulic fluid to FILL quick-disconnect on right-hand side of engine compartment. (See Figure 3-11.)

3. Remove utility hydraulic bleed line from retaining clips, pass free end of line through utility hydraulic reservoir access door, and place end in suitable container on wing to receive any possible overflow of fluid when bleeding.

4. Fill reservoir until piston registers FULL on sight gauge. (Gauge is viewed through utility hydraulic reservoir access door.) (See Figure 3-12.)

CAUTION

Do not allow pressure applied to FILL port to exceed 65 psi.

5. Depress manual bleed valve until sight gauge is free of air bubbles. (See Figure 3-13.)

6. Disconnect external supply source when reservoir has been filled and bled.

7. Install dust cap on FILL quick-disconnect.

8. Reinstall overflow line in retaining clips.

9. Close engine forward compartment access doors and utility hydraulic reservoir access door.

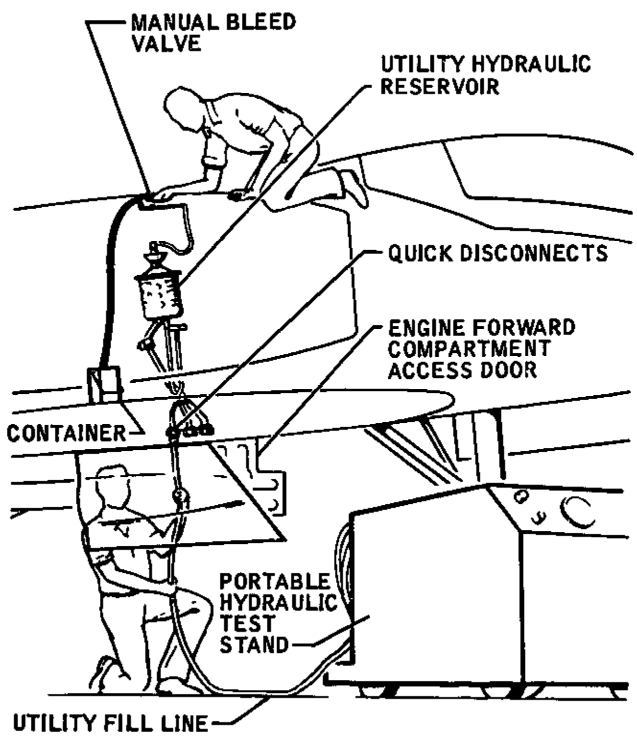


Figure 3-10. Utility Hydraulic System Filling

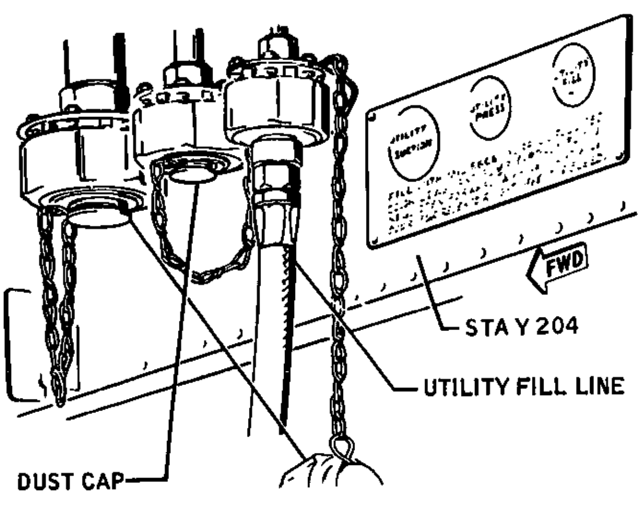


Figure 3-11. Utility Hydraulic Quick-Disconnect

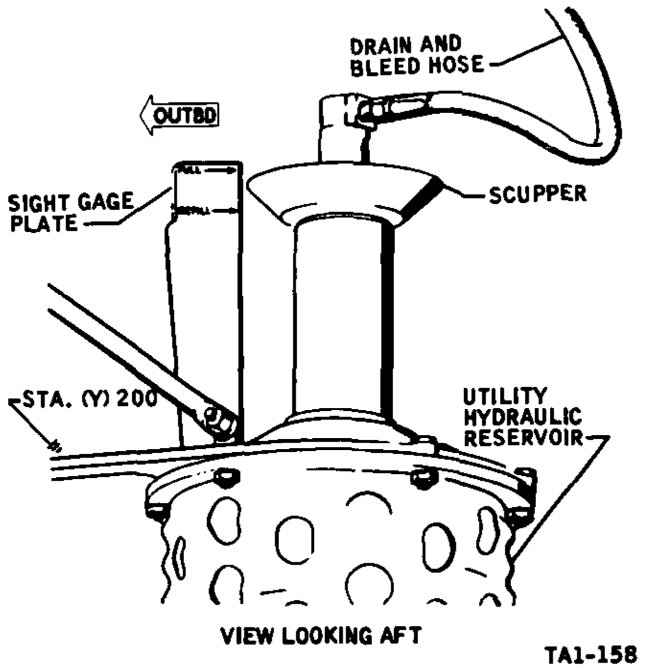


Figure 3-12. Utility Hydraulic Reservoir Sight Gauge

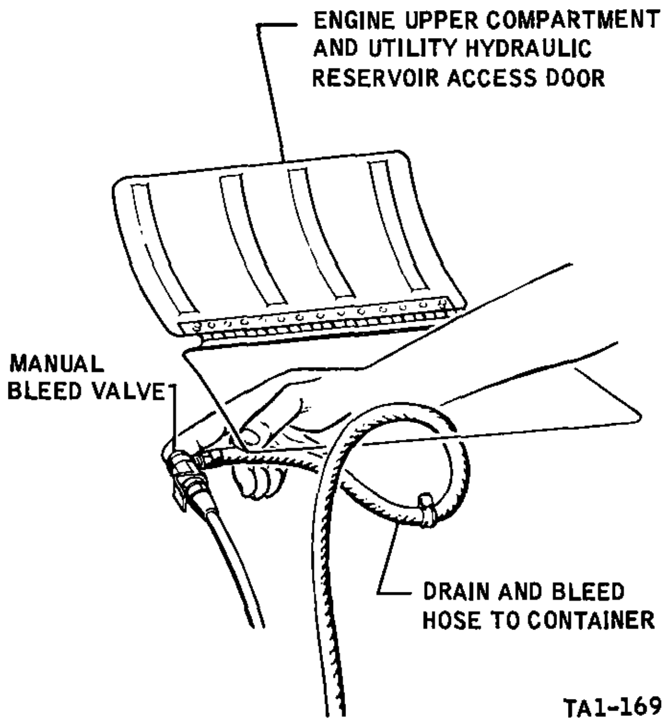


Figure 3-13. Utility Hydraulic Manual Bleed Valve

3.7.1.1 Flight Control Hydraulic System Filling. See Figure 3-14.

1. *Open engine control access door and flight control hydraulic reservoir access door.*

2. Remove dust cap and connect source of hydraulic fluid supply to FILL quick-disconnect (Figure 3-15).

3. Remove flight control hydraulic bleed line from retaining clip, pass free end of line through flight control hydraulic reservoir access door, and place free end in suitable container on wing to receive any possible overflow of fluid when bleeding. (See Figure 3-16.)

4. Fill reservoir until piston registers full on sight gauge. (Gauge is viewed through flight control hydraulic reservoir access door.) (See Figure 3-17.)

WARNING

Do not allow pressure applied to FILL port to exceed 100 psi.

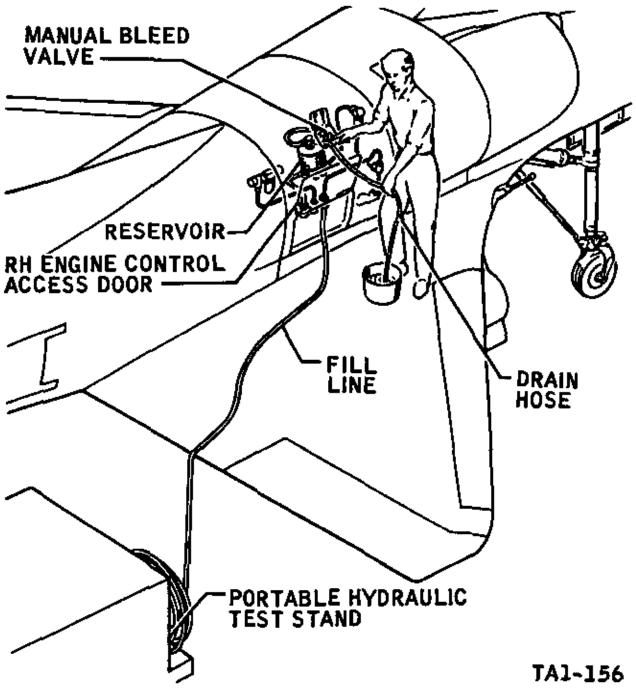


Figure 3-14. Flight Control Hydraulic System Filling

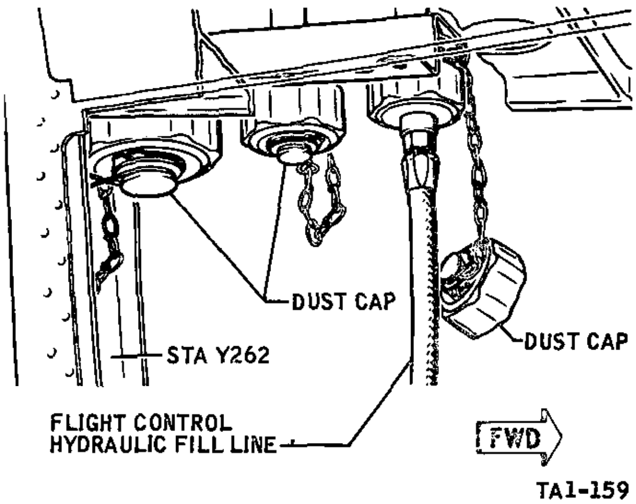


Figure 3-15. Flight Control Hydraulic
Quick-Disconnect Panel

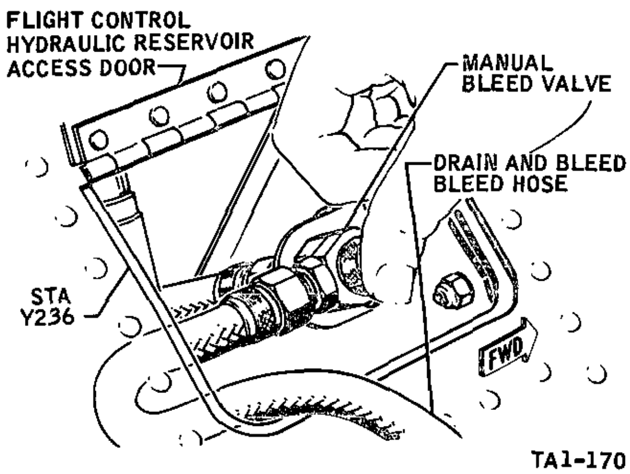


Figure 3-16. Flight Control Hydraulic
Manual Bleed Valve

5. Depress manual bleed valve until sight gauge is free of air bubbles.

6. Disconnect external supply source when reservoir has been filled and bled.

7. Install dust cap.

8. Install bleed line in retaining clamps; secure engine fuel control and flight control hydraulic reservoir doors.

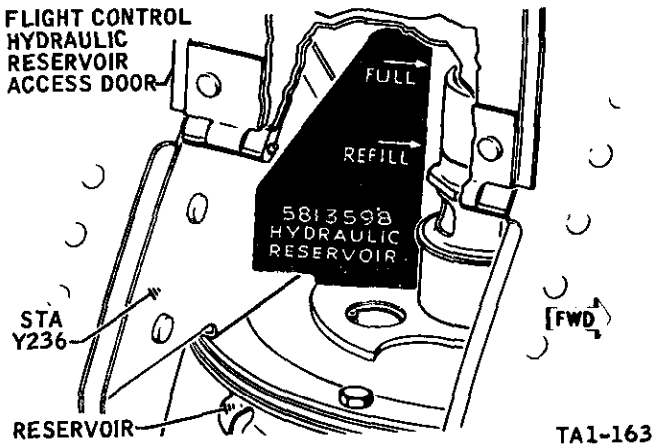


Figure 3-17. Flight Control Hydraulic
Reservoir Sight Gage

3.7.2 Brake Reservoir Servicing.

See Figure 3-18.

1. Remove brake reservoir fairing from canopy hinge area.

2. Remove filler plug from brake reservoir.

3. Insert filler nozzle of hydraulic servicing tank into reservoir filler port.

4. Fill reservoir with hydraulic fluid until gauge indicates full.

Note

When sight gauge indicates that reservoir is full, do not add more fluid. If reservoir is filled to level of port, excess fluid will be vented overboard during flight maneuvers.

5. Install reservoir filler plug.

Note

Clean any spilled hydraulic fluid by wiping area with cloth moistened in naphtha.

6. Check brakes and bleed if necessary. (Refer to Maintenance Instruction Manual, NAVAIR 01-40AVD-2-2.2.)

Note

If brakes are bled, reservice reservoir as necessary.

HYDRAULIC FLUID MIL-H-5606 or MIL-H-83282			
	US QTS	IMP QTS	LITERS
OIL LEVEL WHEN FULL	1.04	0.86	0.983

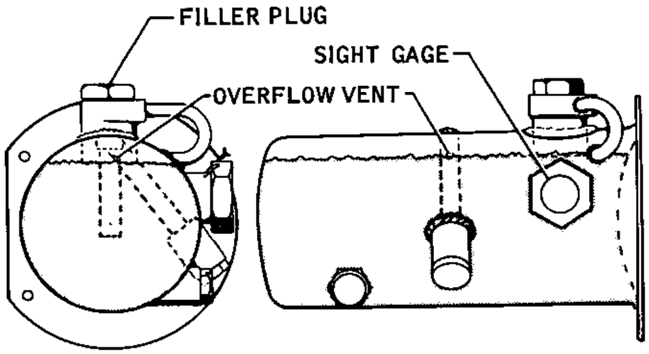


Figure 3-18. Brake Reservoir Servicing

7. Install brake reservoir fairing.

HYDRAULIC FLUID MIL-H-5606 or MIL-H-83282			
	US QTS	IMP QTS	LITERS
OIL LEVEL WHEN FULL	1.04	0.86	0.983

3.8 LIQUID OXYGEN SYSTEM SERVICING

Servicing of the 10-liter liquid oxygen system (Figure 3-19) is accomplished by means of a portable external source. Liquid oxygen from an insulated servicing trailer is transferred under pressure to the aircraft system. Because of the nature of liquid oxygen no external pressure source is required, as evaporation builds up sufficient pressure within the servicing trailer to complete the operation.

3.8.1 Filling Converter

1. Make certain oxygen switch in cockpit is in OFF position.

2. Open liquid oxygen compartment access door.

3. Remove filler valve cap from filler valve.

4. Purge filler hose on servicing trailer until oxygen flows in steady uninterrupted stream.

5. Connect filler hose immediately to converter filler valve and commence filling.

Note

Any prolonged delay in connecting filler hose may allow liquid oxygen in hose to change to gaseous oxygen. Pressure in servicing trailer should be between 45 to 50 psi.

6. When liquid oxygen flows from overflow vent port in steady stream, close fill drain valve on servicing trailer; disconnect filler hose from filler valve which will automatically return converter to BUILDUP position.

WARNING

Warn all personnel working on aircraft and in area to remain clear of liquid oxygen overflow. (See Figure 3-20.)

Note

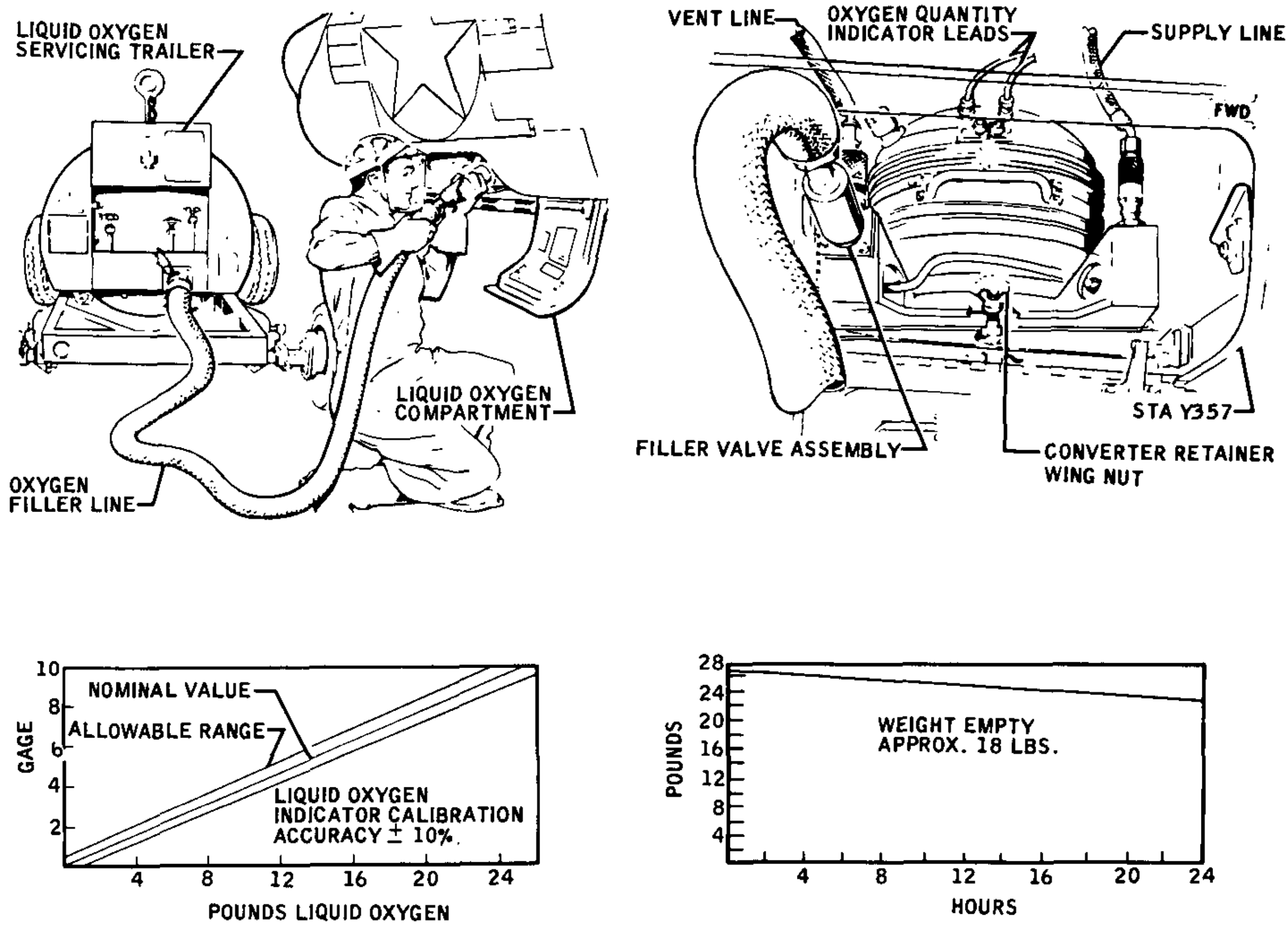
If the converter filler valve freezes during filling, remove filler hose and install filler valve cap. Recheck filler valve after approximately 10 minutes.

7. Relieve pressure in servicing trailer filler hose by engaging filler nozzle in purging device on trailer.

8. Install dust cap on filler valve.

Note

Prior to installing filler valve dust cap, inspect cap closely for evidence of water. If water or moisture is noted, dry thoroughly with compressed air because water in cap may freeze in filler valve.



SERVICING TRAILER VALVES							
VALVE IDENTIFICATION			FUNCTIONS				
LETTER	COLOR	VALVE NAME	FILLING	PRESSURE BUILD-UP	TRANSFER	VACUUM PUMPING	LIQUID STORAGE
A	YELLOW	VACUUM	CLOSED	CLOSED	CLOSED	OPEN	CLOSED
B	BLACK	CAPACITY GAGE	OPEN	OPEN	OPEN	OPEN	OPEN
C	BLUE	FILL-DRAIN	OPEN	CLOSED	OPEN	CLOSED	CLOSED
D	WHITE	PRESSURE BUILD-UP	CLOSED	OPEN	CLOSED*	CLOSED	CLOSED
E	RED	VENT	OPEN	CLOSED	CLOSED	OPEN	OPEN

* WHEN THE PRESSURE FALLS BELOW TRANSFER PRESSURE IT WILL BE NECESSARY TO OPEN VALVE D UNTIL DESIRED PRESSURE IS OBTAINED.

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Figure 3-19. Liquid Oxygen System Servicing

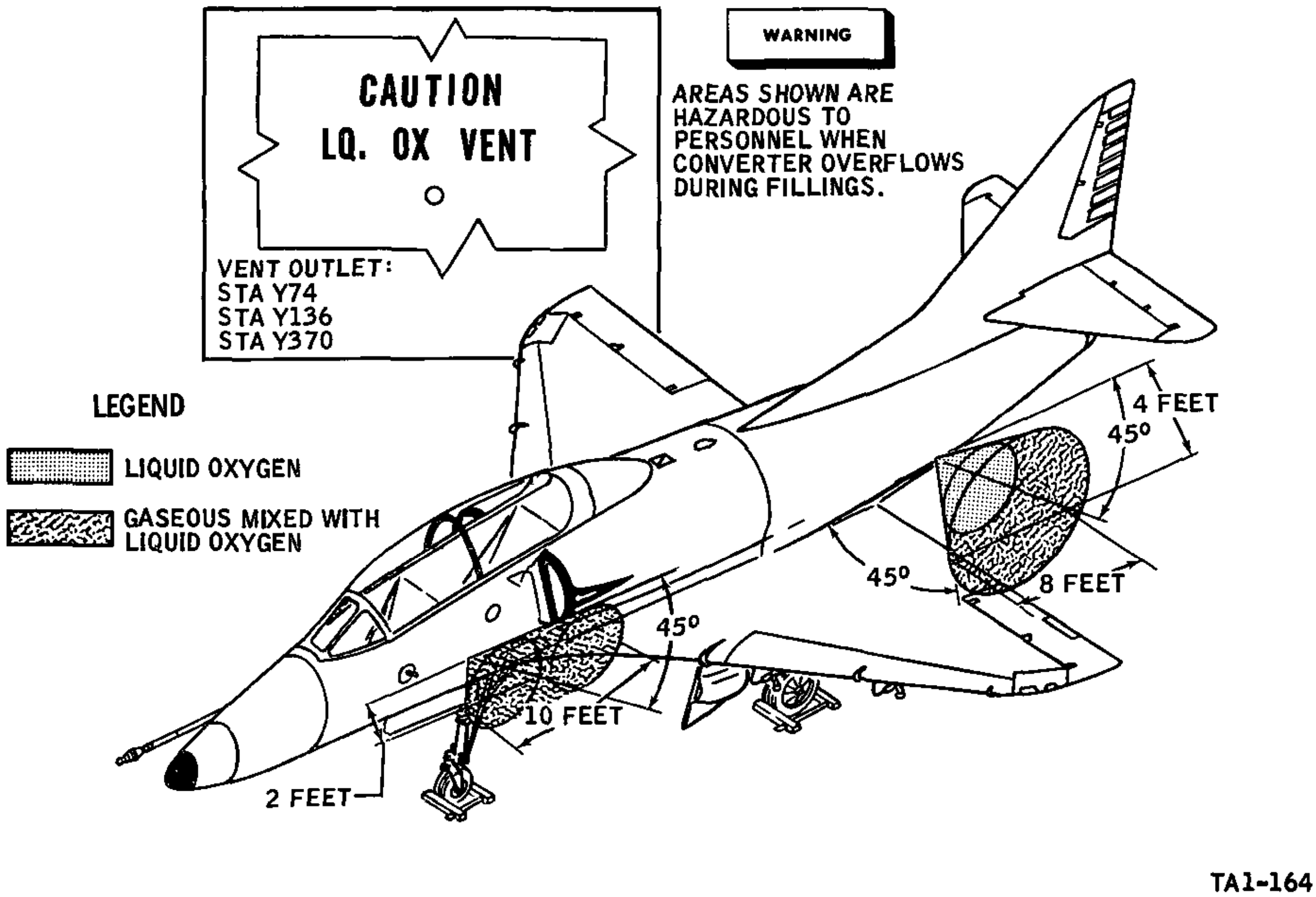


Figure 3-20. Liquid Oxygen Handling Precautions

9. Install dust cap on filler hose nozzle.

10. Secure liquid oxygen compartment door.

3.9 EXTERNAL POWER APPLICATION

Two methods of applying ac external electrical power to the aircraft are available. The primary or standard method utilizes an ac mobile electric power plant (NC-5 or equivalent) (Figure 3-21). The second method enables a ground crewman to apply ac power, dc power, and starter air through the engine starter access door for pilot-controlled starts, utilizing the aircraft ground start disconnect cable. This method will supply electrical power only to the START/ ABORT switch and engine ignition system.

3.9.1 Starting Requirements. A high-pressure air supply to the air turbine starter (installed in the aircraft) and external electrical power are required for starting. Approved starting equipment is as follows:

AIR STARTER UNITS	
USN	USAF
GTC-85	MA-1
MA-1E	MA-1A
*WELLS Air Start System	MA-1TA
	MA-2
	MD-1A
	MD-2A
	MD-3B
*Set to low pressure ratio.	

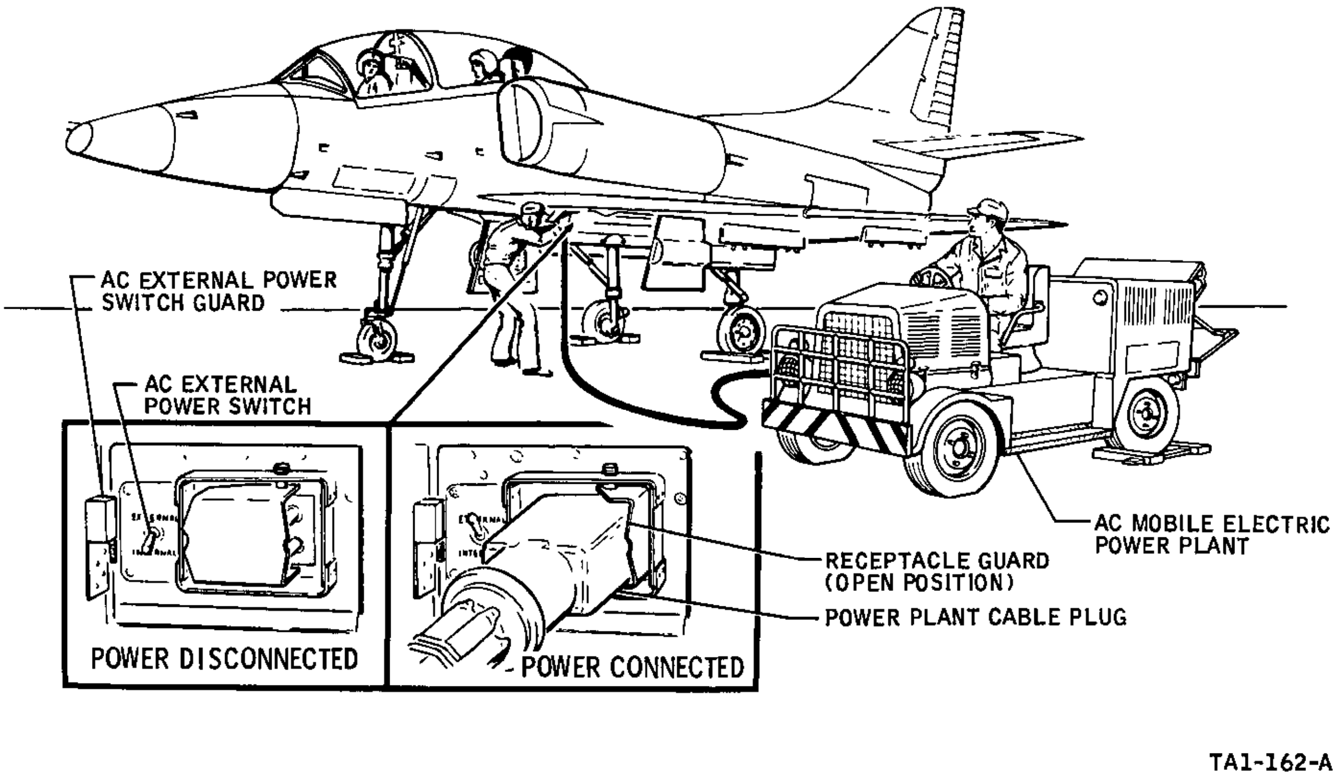


Figure 3-21. External Power Application

ELECTRICAL POWER UNITS		
USN	USAF	RCAF
NC-5	B-10	CAN-C
NC-6	B-10A	
NC-6A	B-10B	
NC-7	MD-3	
NC-8		
NC-10		
NC-12		

COMBINATION ELECTRICAL/AIR STARTER UNITS	
USN	USAF
*RCPP/RCPT/NCPP-105	MA-2MP
	MA-3MP
	M32A-60
	*MD-3A
*Set to low pressure ratio.	

A source of 115-vac power is required for ignition; 28-vdc power is required if a cockpit controlled start is desired. Ac power can be provided through the external power receptacle (Figure 3-21) or through the aircraft ground start disconnect (Figure 3-22).

Dc power (for cockpit controlled start) can be supplied only through the aircraft ground start disconnect.

Note

If 28-vdc power is not available, a ground start must be accomplished.

3.10 FORWARD TOWING PROVISIONS

For forward towing (Figure 3-23), either a standard tow bar or an adjustable tow bar may be attached to the nosewheel axle. Ensure that main and nose landing gear lockpins are installed before towing aircraft. Standard hand signals shall be utilized to relay instructions to personnel towing aircraft.

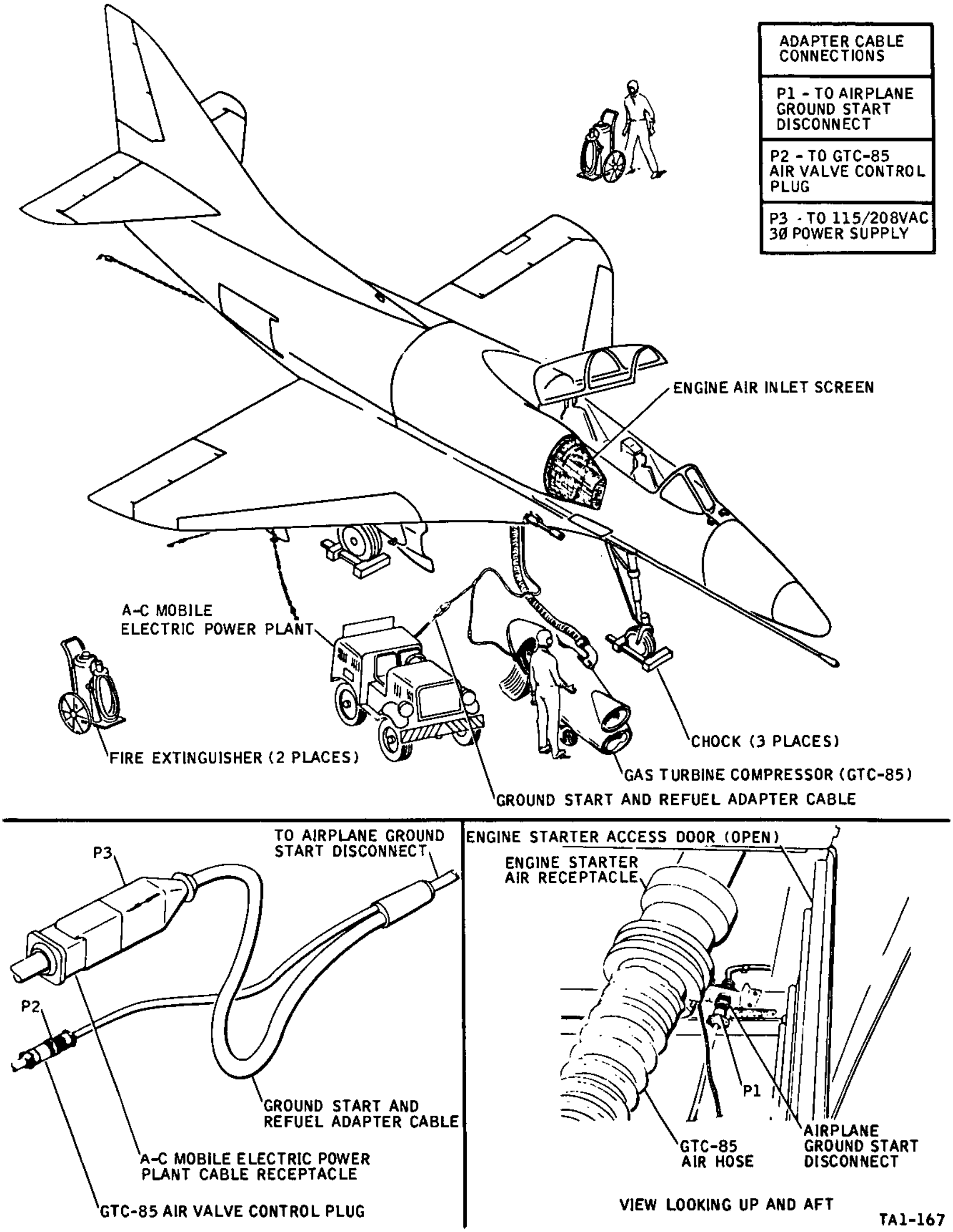


Figure 3-22. Engine Ground Starting Preliminary Preparations

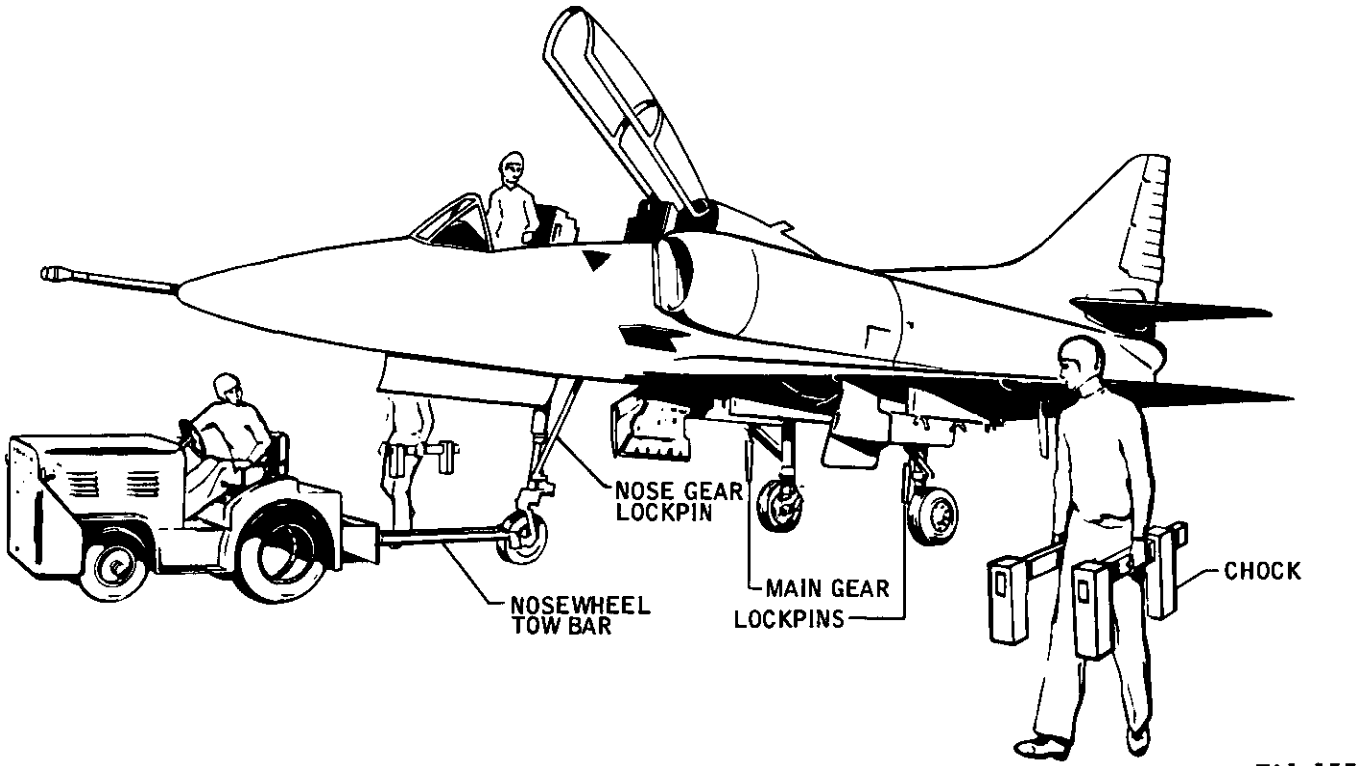


Figure 3-23. Forward Towing

CAUTION

- Towing of aircraft with engine and tail section removed is not recommended. If aircraft forward section must be moved, defuel fuselage fuel cell to improve turning stability, and ensure that enough personnel are available to prevent overturn.
- If aircraft is towed with canopy open, make certain canopy internal control handle is in unlocked position, as bouncing of canopy, with control handle locked, can cause fracture of canopy hinge structure. Do not tow aircraft without qualified plane captain in cockpit.
- Do not exceed speed of 10 miles per hour while towing along straight path or 5 miles per hour while turning. Do not make sudden stops.

When high winds prevail, chain tiedown assemblies shall be used to secure aircraft immediately when parked.

3.10.1 Towing Safety Precautions. Towing the aircraft safely requires the undivided attention of all personnel concerned. Ensuing text defines limitations that should not be exceeded and procedures that should be followed for maximum safety.

3.10.2 Towing With Asymmetrical Loads. Asymmetrical loading of the aircraft imposes certain limitations on towing. Figure 3-24 shows speeds recommended for towing the aircraft with or without the fuselage aft section attached, and with asymmetrical loads at wing stations X75 and X113.

CAUTION

Turns of less than 10-foot radius shall not be made.

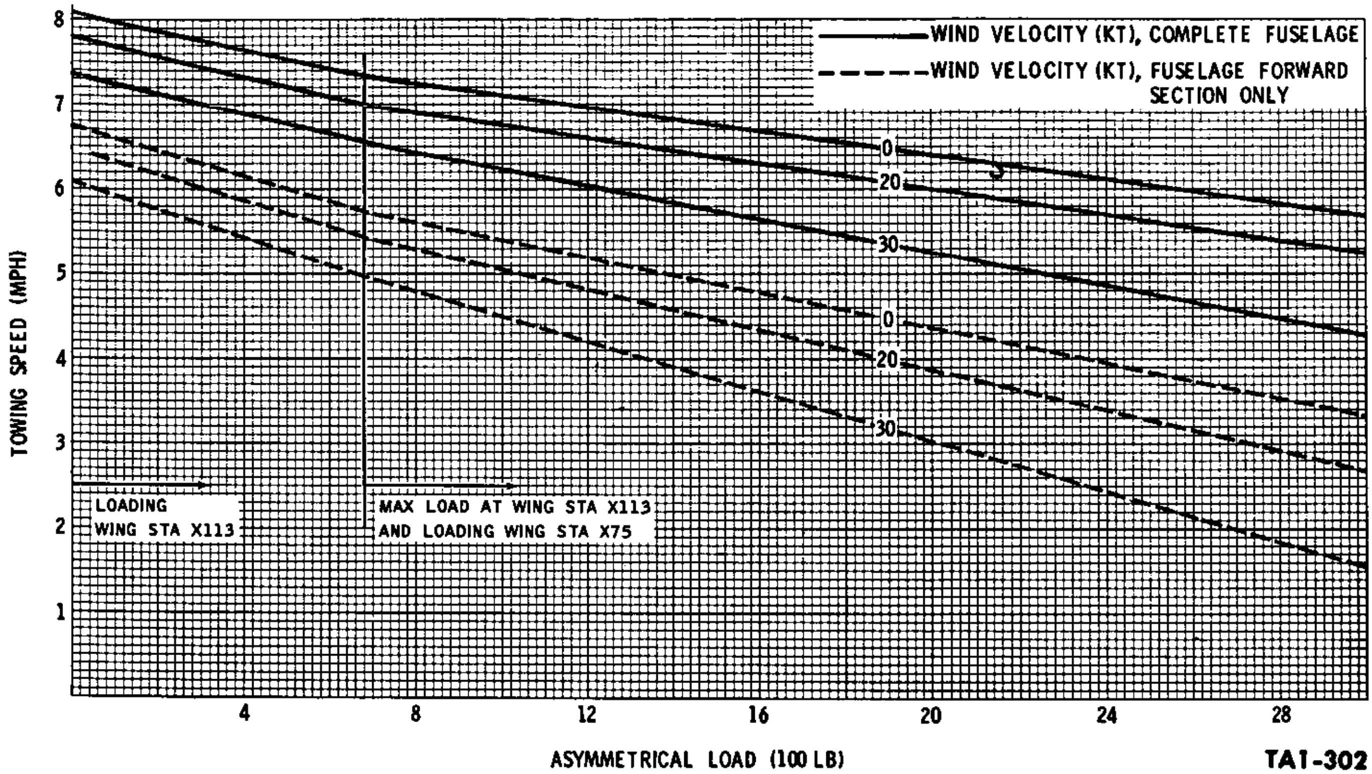


Figure 3-24. Towing Speeds for Asymmetrical Loadings

3.11 TIEDOWN PROVISIONS

The aircraft can be secured to the ground, flight deck, or hangar deck with chain assemblies attached to tiedown rings on the nose gear, on each main gear, and on each side of the wing lower surface. The nose gear shock strut is provided with two tiedown rings, one on each side. Recommended procedures for normal and heavy weather conditions are contained in subsequent paragraphs.

3.11.1 Ground Tiedown in Normal Weather. See Figure 3-25.

1. Install landing gear lockpins.

2. Align nosewheel fore and aft; secure nose and main gear wheels, fore and aft, with chocks.

CAUTION

Minimum and maximum angles of tiedown chain in relation to aircraft and ground or deck must be strictly adhered to.

Note

Use adjustable chocks if available.

3. Attach chain assemblies to tiedown points indicated for normal weather tiedown and tighten chains.

4. Make certain throttle lever is in OFF position and tighten THROTTLE FRICTION AND LOCK CONTROL.

5. Close canopy.

6. Install cockpit enclosure cover.

7. Install pitot and temperature probe covers.

8. Install manifold exhaust cover.

9. Install aft compartment cooling duct plugs.

10. Install aileron gust lock.

11. Install wing slat locks.

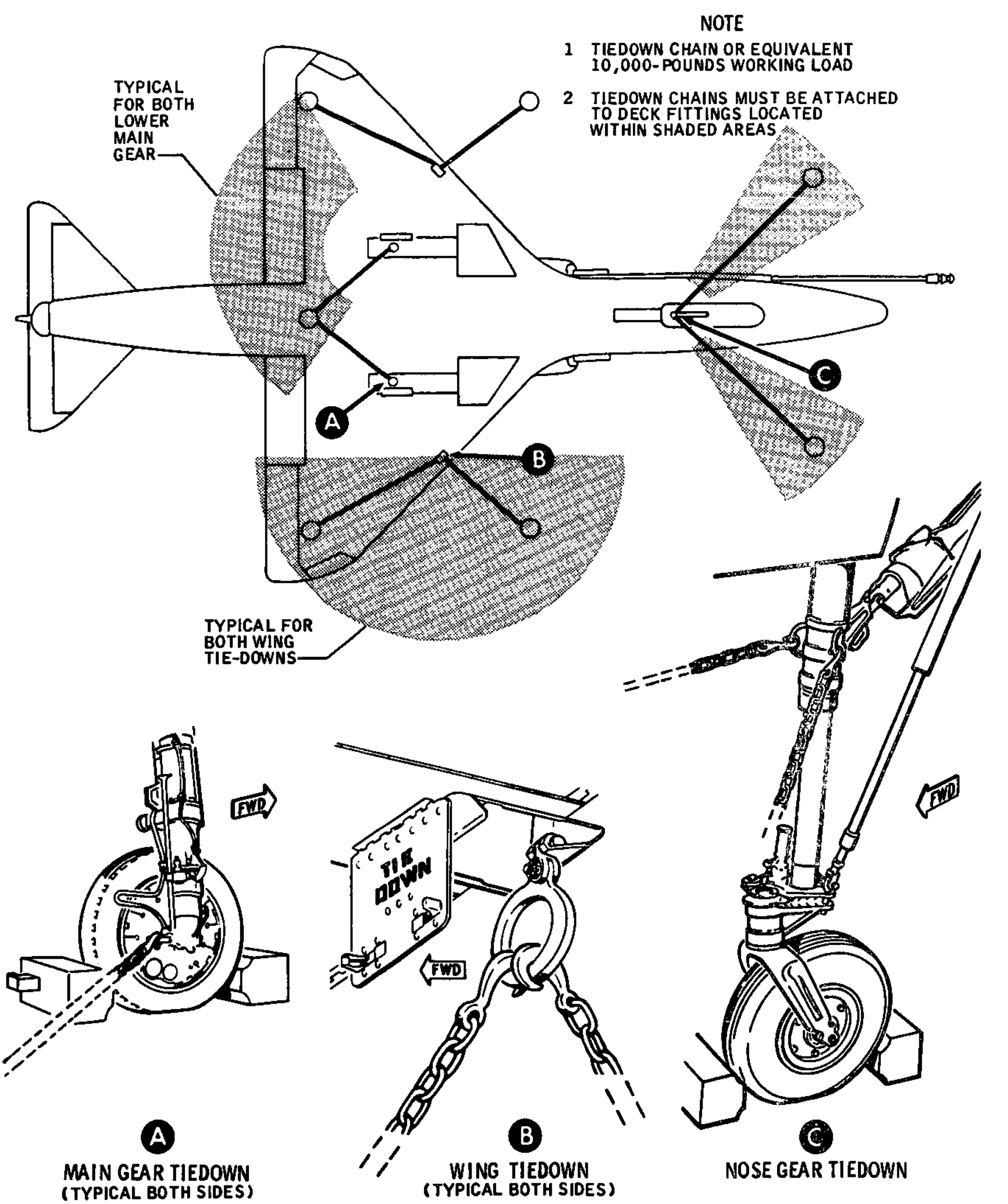


Figure 3-25. Normal Weather Tiedown

12. Install engine air inlet covers.

13. Install angle-of-attack vane guard.

14. Install nose compartment cooling duct plugs.

15. Install air conditioning RAM air duct plugs.

16. Install engine exhaust cover.

17. Remove entrance ladder, if installed.

3.11.2 Ground Tiedown in Heavy Weather. See Figure 3-26.

Note

The aircraft should be moved into hangar or flown out of storm area if possible.

1. Spot aircraft pointing into direction of maximum expected winds.

2. Remove all armament stores from aircraft.

3. Fuel aircraft to maximum weight.

4. Chock nosewheel and main gear wheels with adjustable chocks.

5. Install tiedown chains as shown in Figure 3-26 with aircraft in maximum gross weight configuration exceeding 15,600 pounds.

6. Ensure throttle is off and tighten throttle friction and lock control.

7. Install damage prevention equipment as listed in steps 5 through 17 under procedures for ground tiedown in normal weather.

3.12 DANGER AREAS

During ground operations certain hazardous areas exist. These areas are shown in Figure 3-30.

3.13 TURNING RADII

For turning radii of the aircraft, see Figure 3-31.

3.13.1 Wheel Removal and Installation Procedures for TA-4 Aircraft

1. Removal (Figure 3-27).

a. Install landing gear lockpins.

b. Chock wheel/tire not to be changed.

c. Place hydraulic axle jack (cap - 5 tons) in position below jack pad on gear strut to be jacked.

d. Operate jack slowly until tire is no more than 2 inches from deck.

e. Remove valve cap, deflate tire, then remove valve core.

f. At wheel axle, remove snapring and dust cap.

g. Remove axle nut retaining spring.

h. Remove axle nut using proper nut wrench.

Note

Have man in cockpit depress and hold corresponding brake pedal while removing and installing wheel. This will eliminate the need for realigning the keys in the wheel with the keyways in the brake disc.

i. Remove washer and slide wheel/tire from axle.

j. Inspect axle and brake assembly for damage, wear, and security.

k. Make certain collar is flush against axle flange before installing wheel/tire.

2. Installation (Figure 3-28).

a. Make sure axle is clean and wheel bearings are properly greased (MIL-G-81322).

b. Install wheel/tire assembly on axle while brake is applied, engaging keys on inner wheel with keyways in disc(s).

c. Install washer and axle nut; fingertight.

NOTE

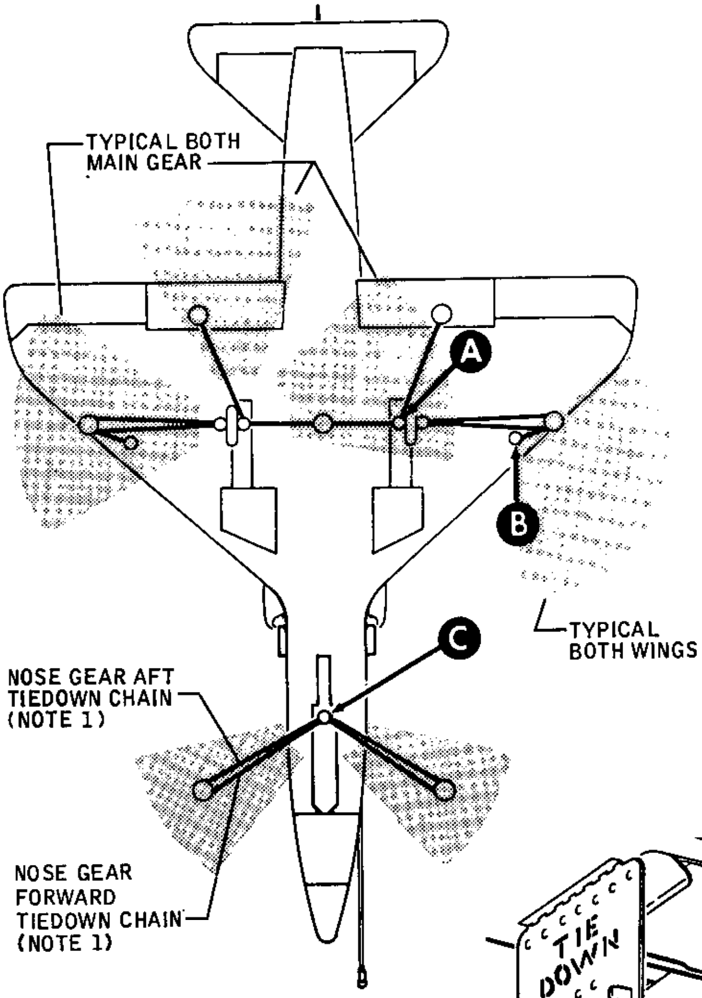
1 NOSE GEAR FORWARD TIEDOWN CHAINS NOT REQUIRED WHEN GROSS WEIGHT IS LESS THAN 15,600 POUNDS AND AIRCRAFT IS SPOTTED IN FORE AND AFT DIRECTION ON CARRIER.

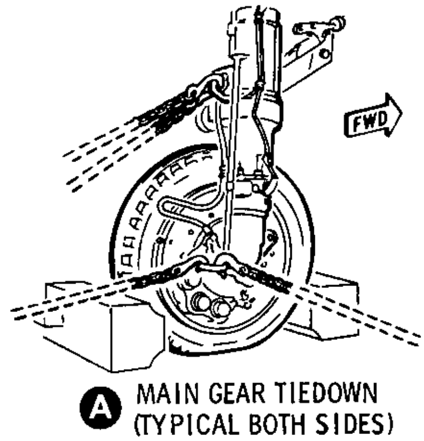
2 MAXIMUM CARRIER GROSS WEIGHT 20,600 POUNDS FOR MODERATE WEATHER TIEDOWN.

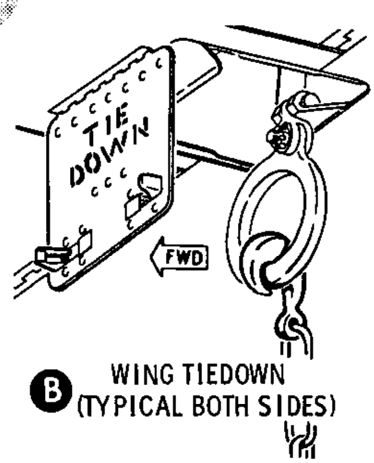
3 MAXIMUM CARRIER GROSS WEIGHT 15,600 POUNDS FOR HEAVY WEATHER TIEDOWN.

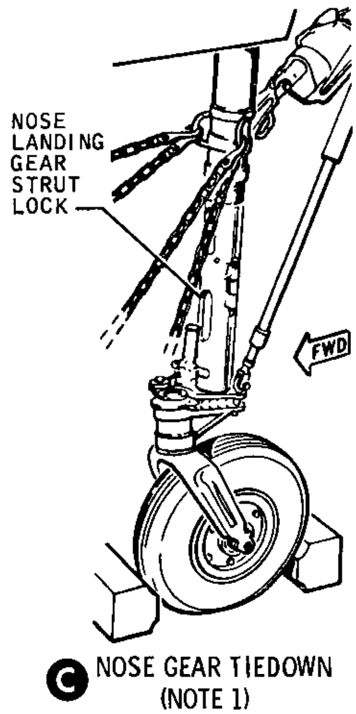
4 TIEDOWN CHAIN OR EQUIVALENT 10,000 POUND WORKING LOAD.

5 TIEDOWN CHAINS MUST BE ATTACHED TO DECK FITTINGS LOCATED WITHIN SHADED AREAS.









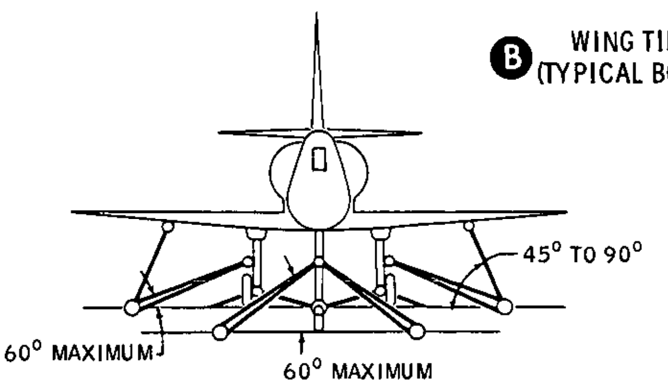


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Figure 3-26. Heavy Weather Tiedown

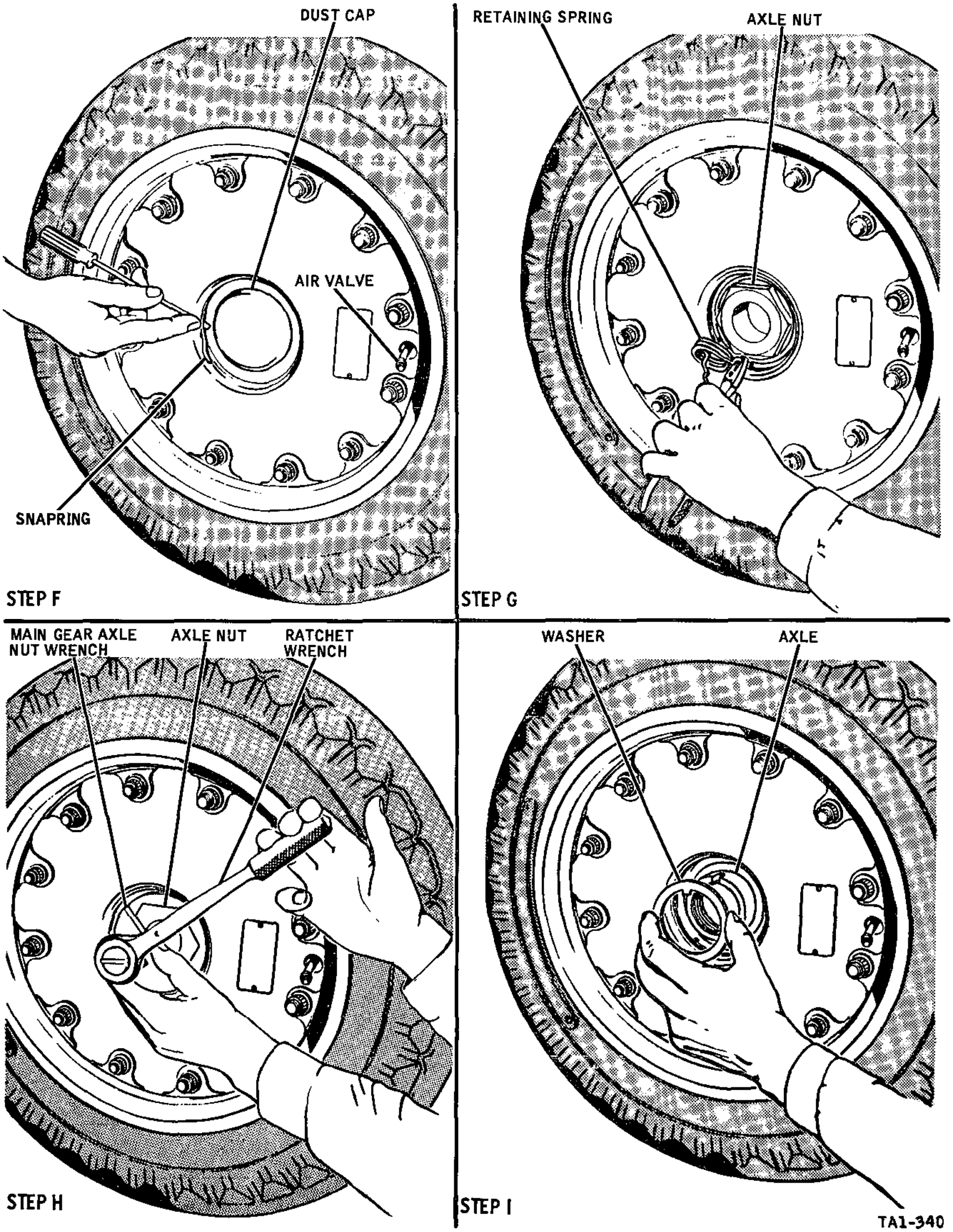


Figure 3-27. Main Gear Wheel – Removal

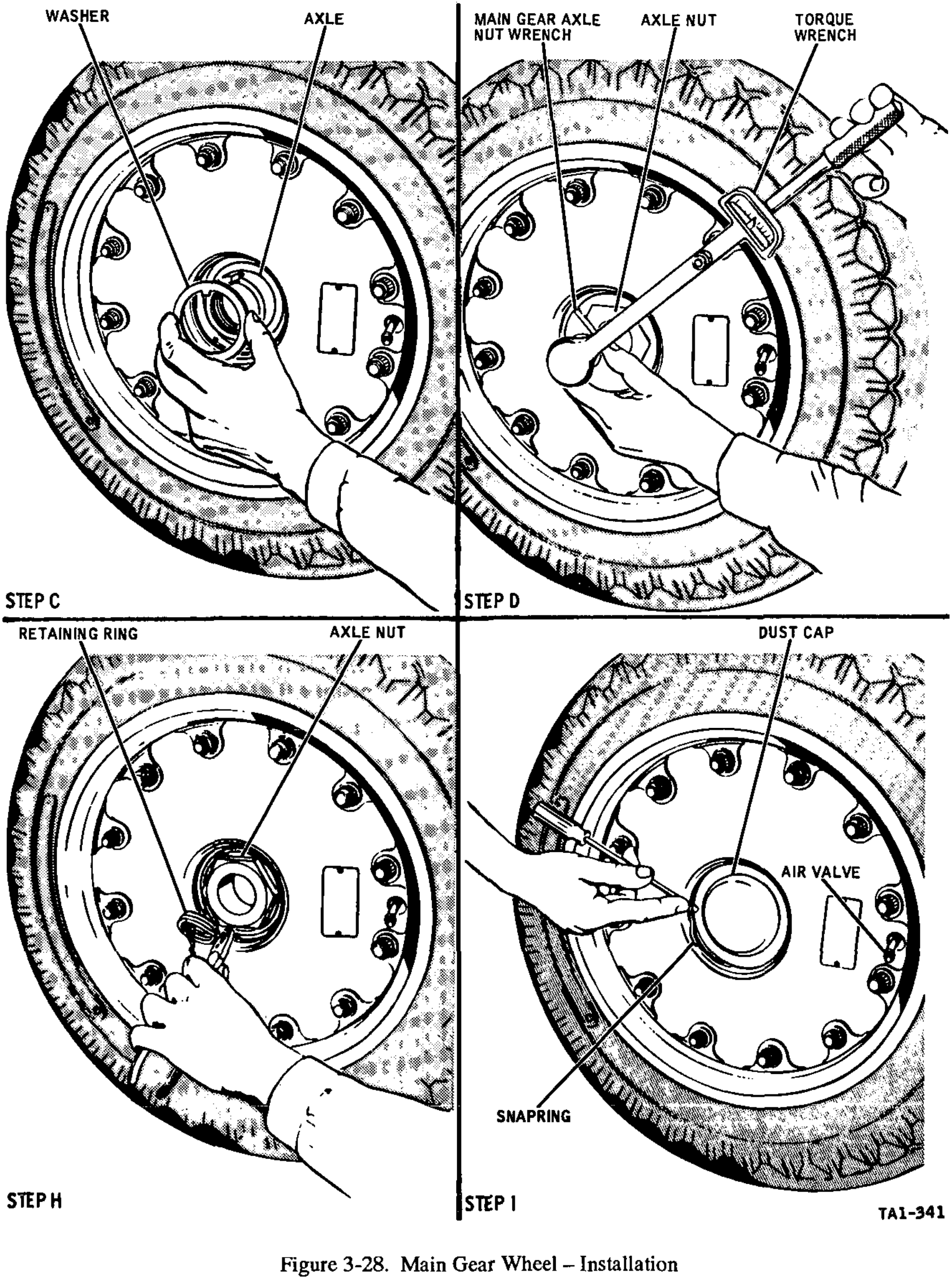


Figure 3-28. Main Gear Wheel – Installation

d. Tighten axle nut to 50 foot-pounds torque, using special axle nut wrench (hex 2-1/2 inches across flats) and torque wrench.

e. Turn wheel one or more revolutions in normal roll direction.

f. Back off axle nut until free.

g. Retighten nut until first lineup of locking holes and slots in axle, using 2 to 15 foot-pounds torque.

h. Install axle nut retaining spring with earlocks in either the 5/11 o'clock or 7/1 o'clock position. Important, as improper installation could result in loss of wheel.

i. Install dust cover and snapring.

j. Inflate tire to proper pressure as shown on chart plate attached to landing gear door (Figure 3-29).

Note

The only main tire size compatible with the aircraft is 24 X 5.5. Service tire with dry nitrogen only.

k. Lower aircraft slowly.

l. Remove as appropriate lockpins and/or chocks.

Note

One man can remove and install the wheel assembly, however care must be taken to ensure that the brake discs do not fall, and damage the axle when the wheel is removed.

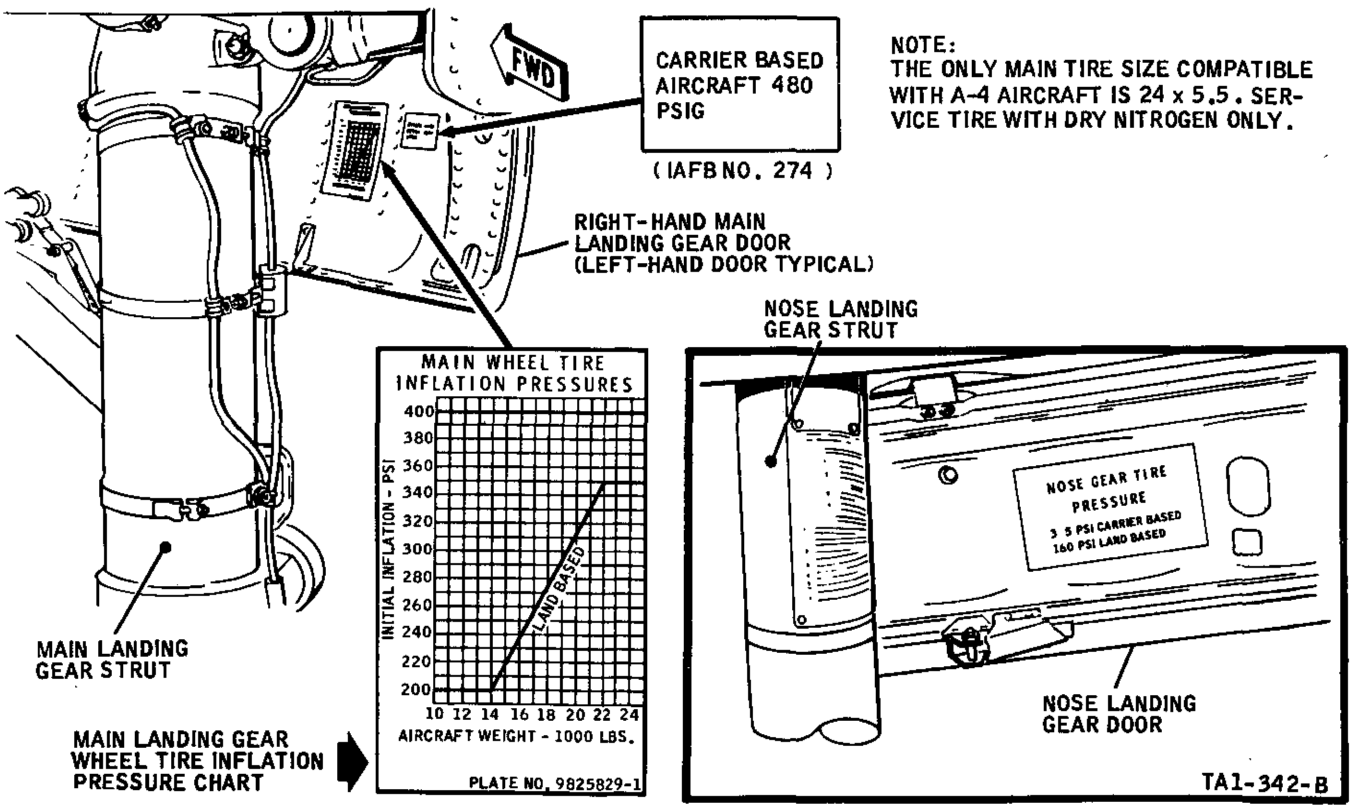


Figure 3-29. Main Gear and Nose Gear Tire Pressures

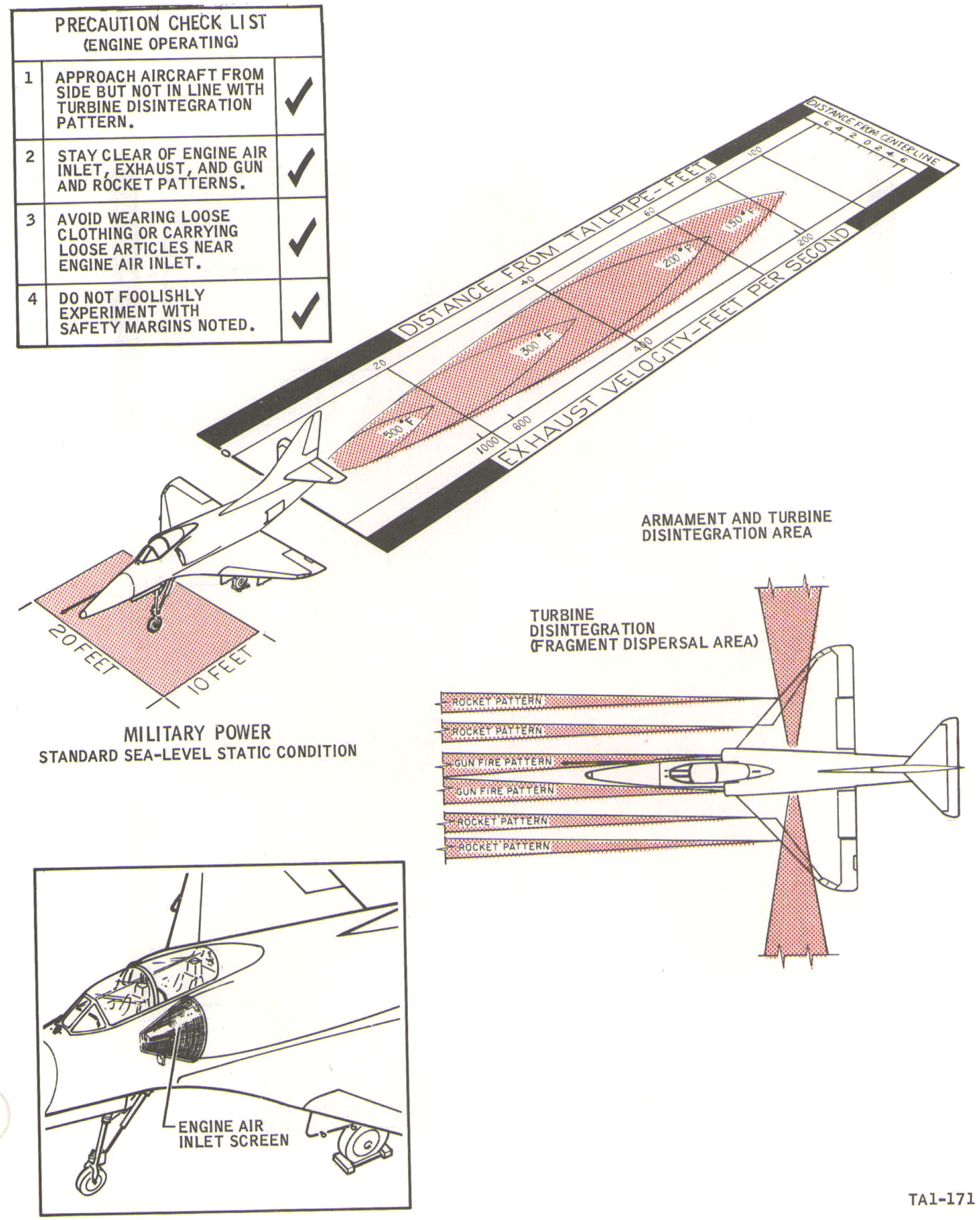


Figure 3-30. Danger Areas (Sheet 1 of 3)

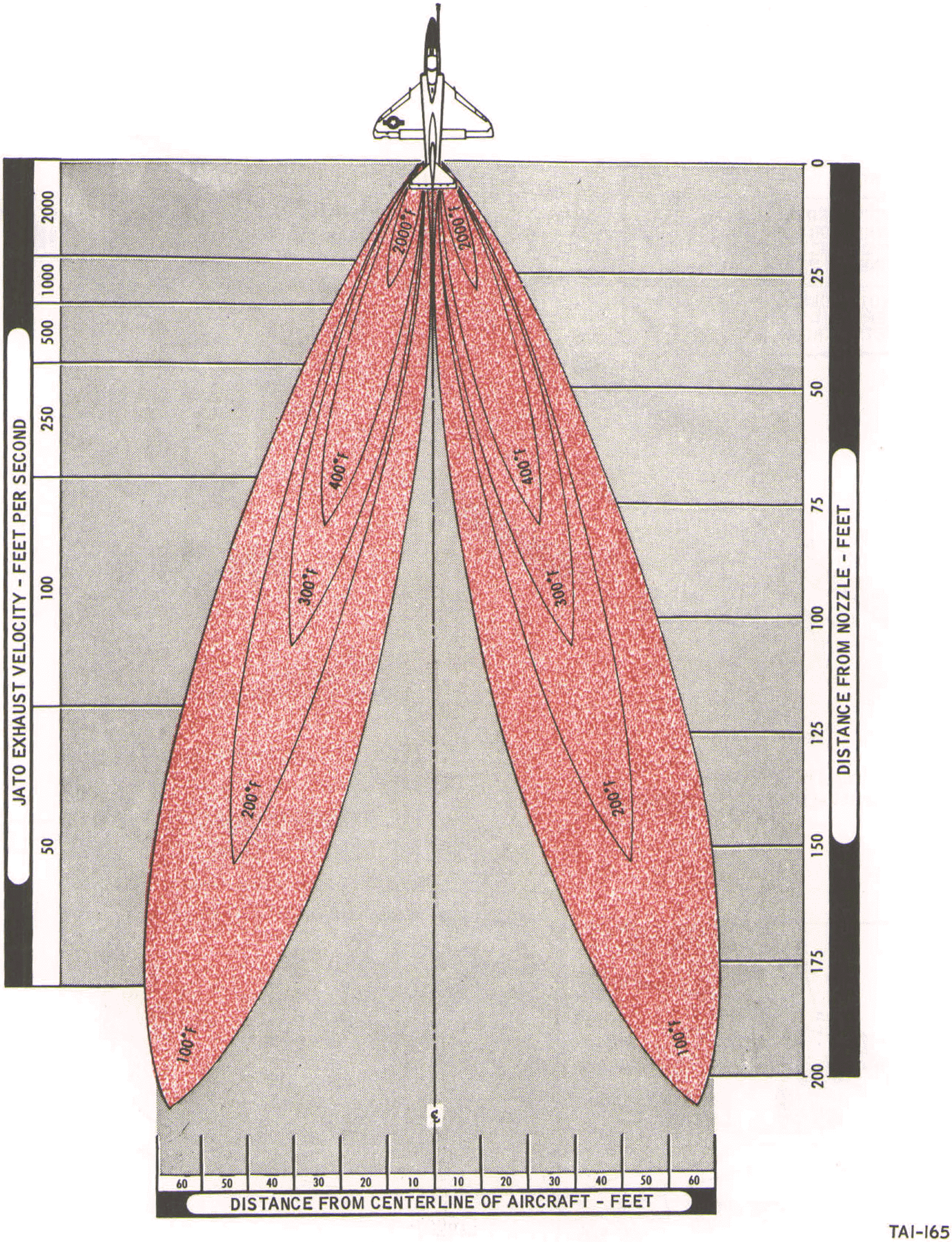


Figure 3-30. Danger Areas (Sheet 2 of 3)

ENGINE TRIM OPERATION

1 ENGINE POWER SETTING AT MILITARY WITH NO SOUND SUPPRESSORS.

2 ZONES ARE BASED ON A FIFTEEN MINUTE EXPOSURE FOR AN EIGHT HOUR PERIOD.

DANGER AREA	DATA
ZONE 1	EARMUFFS OR EARPLUGS MUST BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 2	EARMUFFS AND EARPLUGS MUST BE WORN WHEN WORKING WITHIN THIS AREA.
ZONE 3	CRITERIA FOR FIFTEEN MINUTE EXPOSURE EXCEEDED. PERSONNEL SHOULD NOT ENTER EXCEPT FOR VERY SHORT DURATION.

WARNING

1 EAR PROTECTION MUST BE PROPERLY FITTED TO PERSONNEL.

2 DURING ENGINE OPERATION AT IDLE POWER, EARMUFFS OR EARPLUGS ARE REQUIRED FOR PERSONNEL WITHIN 100 FEET OF OF AIRCRAFT.

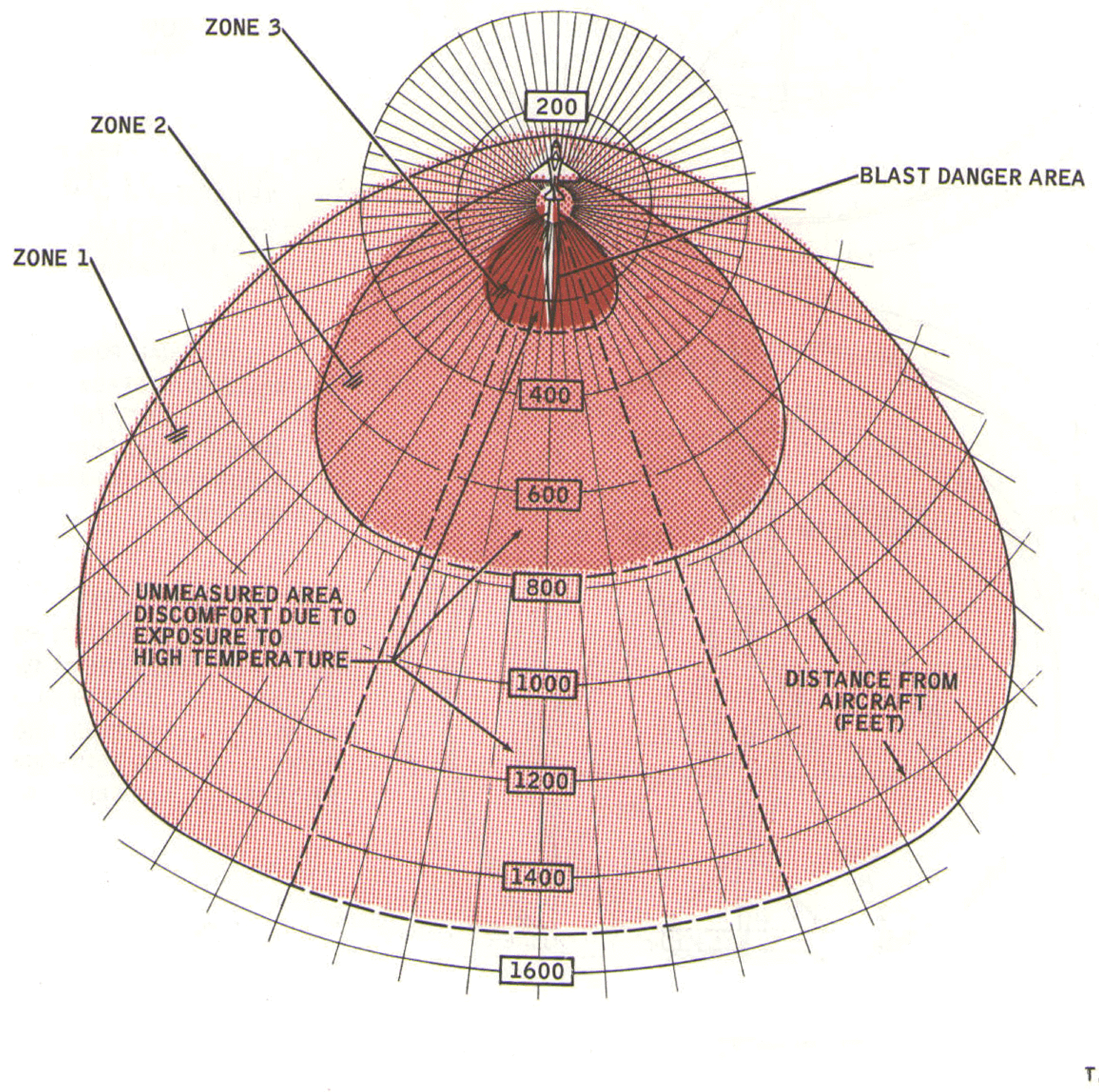
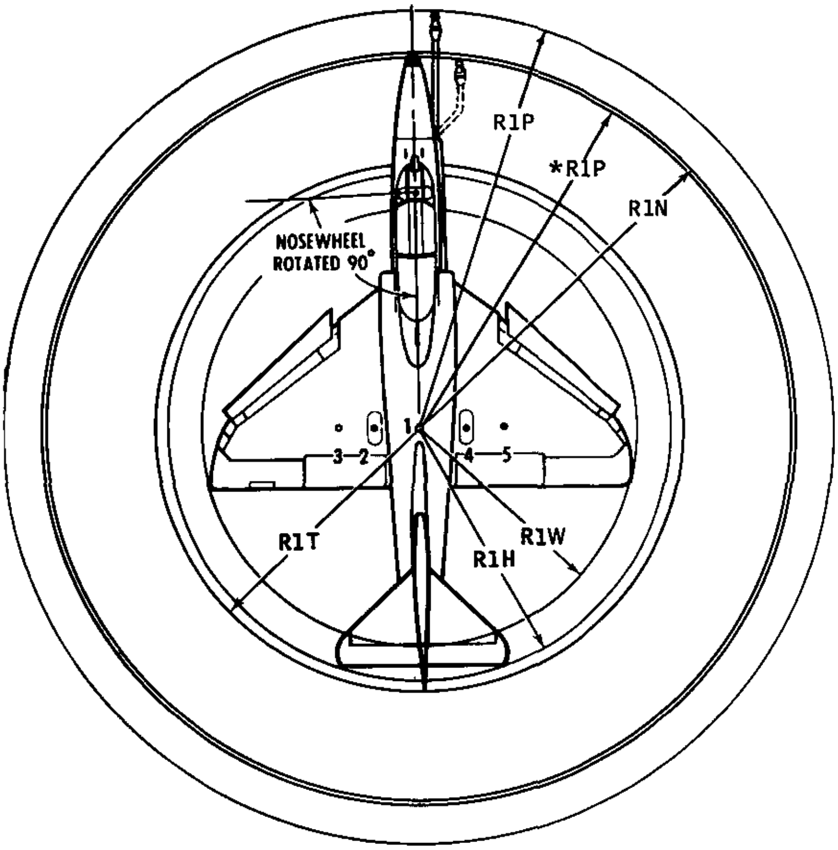


Figure 3-30. Danger Areas (Sheet 3 of 3)



NOTE:

1. RADII DISTANCES COMPUTED ON 15,750 POUNDS GROSS WEIGHT.

*2. BENT PROBE RADIUS.

PIVOT POINT 1

R1 TO H . . . . . . 18 FEET 7 INCHES
R1 TO N . . . . . . 24 FEET 5 INCHES
R1 TO P . . . . . . 27 FEET 5 INCHES
*R1 TO P . . . . . . 23 FEET 10 INCHES
R1 TO T . . . . . . 18 FEET 9 INCHES
R1 TO W . . . . . . 14 FEET 11 INCHES

CODE
R - RADIUS

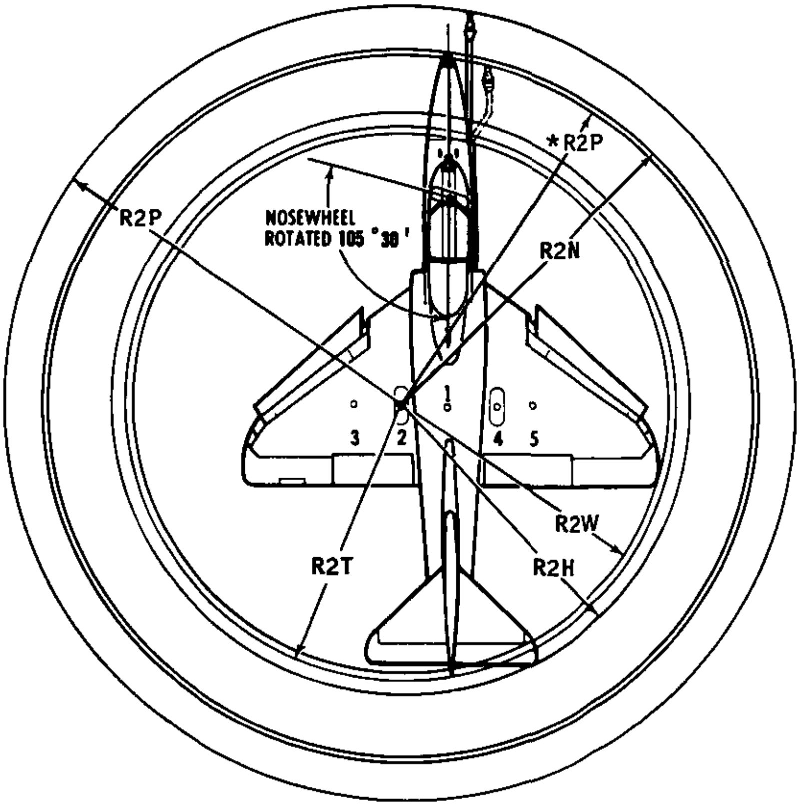
PIVOT POINT

1 = AIRCRAFT CENTERLINE AT INTERSECTION WITH LINE THROUGH MAIN GEAR AXLES

2 = 46.75 INCHES LEFT OF CENTERLINE IN LINE WITH MAIN GEAR AXLE.

TERMINAL POINT

H = HORIZONTAL STABILIZER TIP
N = NOSE (RADOME) TIP
P = AIR REFUELING PROBE TIP
T = RUDDER TRAILING EDGE
W = WING TIP



PIVOT POINT 2

R2 TO H . . . . . . 20 FEET 1 INCH
R2 TO N . . . . . . 24 FEET 9 INCHES
R2 TO P . . . . . . 27 FEET 11 INCHES
*R2 TO P . . . . . . 24 FEET 7 INCHES
R2 TO T . . . . . . 19 FEET 2 INCHES
R2 TO W . . . . . . 18 FEET 7 INCHES

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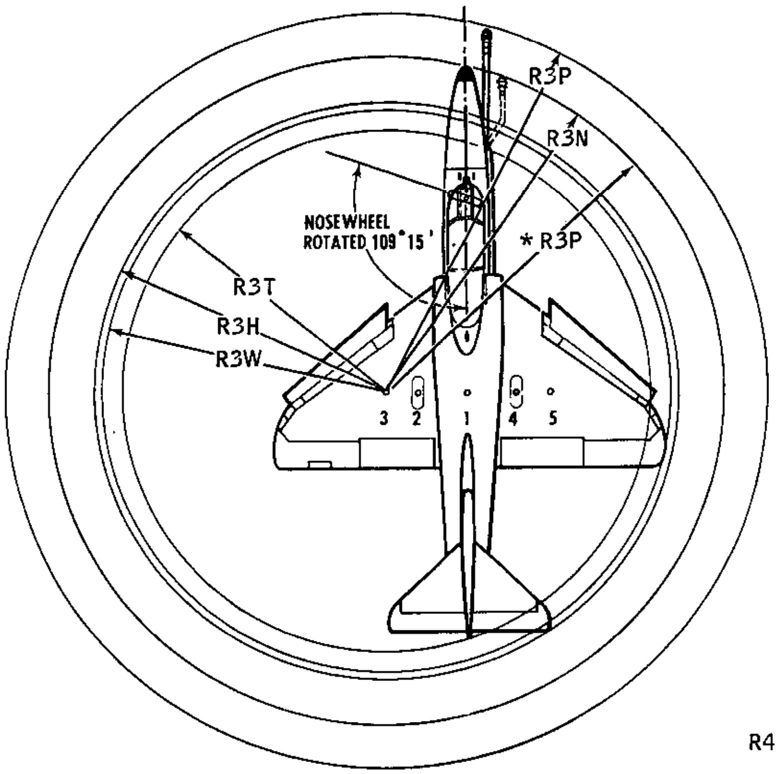
Figure 3-31. Minimum Turning Radii (Sheet 1 of 2)



CODE
R - RADIUS

PIVOT POINT

3 = 58.75 INCHES LEFT OF CENTER LINE IN LINE WITH MAIN GEAR AXLE

4 = 46.75 INCHES RIGHT OF CENTER LINE IN LINE WITH MAIN GEAR AXLE

5 = 58.75 INCHES RIGHT OF CENTER LINE IN LINE WITH MAIN GEAR AXLE

TERMINAL POINT

H = HORIZONTAL STABILIZER TIP

N = NOSE (RADOME) TIP

P = AIR REFUELING PROBE TIP

T = RUDDER TRAILING EDGE

W = WING TIP

PIVOT POINT 3

R3 TO H . . . . . . 20 FEET 7 INCHES
R3 TO N . . . . . . 24 FEET 11 INCHES
R3 TO P . . . . . . 28 FEET 1 INCH
*R3 TO P . . . . . . 24 FEET 11 INCHES
R3 TO T . . . . . . 19 FEET 5 INCHES
R3 TO W . . . . . . 19 FEET 7 INCHES

PIVOT POINTS 4 AND 5

R4P = 27 FEET 4 INCHES   R5P = 27 FEET 5 INCHES

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Figure 3-31. Minimum Turning Radii (Sheet 2 of 2)

CHAPTER 4

Operating Limitations

4.1 INTRODUCTION

This section contains important operating limitations that shall be observed during normal operation of the aircraft. Refer to the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T, for additional limitations.

Note

All performance data is applicable to both TA-4F and TA-4J aircraft unless otherwise indicated, (i.e., TA-4F).

4.2 ENGINE LIMITATIONS

Restrictions to be observed in the operation of the engines are based upon the use of fuel as follows:

	Approved Fuel	
	Ashore	Afloat
Recommended	JP-5	JP-5
Alternates	JP-4 JP-8	

4.2.1 Engine Operating Limits

4.2.1.1 Exhaust Gas Temperature and Engine Speed. Engine limitations are based on combinations of engine speeds and exhaust gas temperatures, with a maximum allowable engine speed under any condition of 102.6 percent (11,900 rpm) for J52-P-6 engines, or 102.9 percent (12,400 rpm) for J52-P-8 engines. Mechanical speed limits of 102.6 percent (P-6) and 102.9 percent (P-8) are overspeed limits and are not to be exceeded.

4.2.2 Start Duty Cycle Starter Limitations. The starter does not have a cooling system and will overheat if run continuously for too long a period, or if insufficient time is allowed for cooling between starting evolutions. The following duty cycles must not be exceeded.

4.2.2.1 AiResearch Starter. Five consecutive starts, none of which exceeds 1-minute duration; three 1-minute cranking cycles during a 1-hour period, with a minimum rest period of 10 minutes between each cycle; a 2-minute continuous cranking cycle is permissible for depreservation or preservation purposes if starter is initially at ambient temperature.

4.2.2.2 Bendix Starter. Two 1-minute continuous operations with a minimum rest period of 10 minutes between the two; a rest period of 15 minutes must follow the second period before the evolution may be repeated.

4.2.2.3 Starting Temperatures. If engine exhaust gas temperature (EGT) exceeds 455 °C five times, or reaches 531 °C for one period of 5 seconds or more, engine must be subjected to an overtemperature inspection. Any EGT exceeding 565 °C for any period of time will require a teardown inspection of all hot section parts.

Operating Condition	Maximum EGT °C	Maximum Percent RPM	Time Limit
Starting limits	455	(Start to idle)	2 minutes
Idle	340	Idle	
Acceleration J52-P-6 J52-P-8 (TA-4F)	 660 680	 Military Military	 8 minutes 8 minutes
Normal J52-P-6 J52-P-8 (TA-4F)	 602 595	 Military minus 3 percent Military minus 3 percent	
Military J52-P-6 J52-P-8 (TA-4F)	 621 650	 Military Military	 30 minutes 30 minutes

The IDLE temperature of 340 °C is not a limit but is given as a guide to indicate the temperatures which, if exceeded, may signify an engine malfunction. The military operating time of 30 minutes is not intended as a limit, but as a guide to prolong engine life. Engine life deteriorates more rapidly by cycling the engine from miliary power to a lower power setting for short periods than by operating the engine at military power for 30 minutes or more. Following acceleration, EGT may overshoot the stabilized value for a given throttle setting, and require some time to decrease to that value. After "peaking," EGT will decrease quite rapidly at first; then decrease slowly as it approaches the stabilized value. EGT should not stabilize at any point above the maximum steady-state value. The above limits for acceleration and temperatures should be interpreted to mean that the EGT for J52-P-6 engines may go to 660 °C during acceleration but must decrease to 621 °C or less within 8 minutes after acceleration; EGT for J52-P-8 engines may go to 680 °C during acceleration but must decrease to 650 °C or less within 8 minutes after acceleration. In normal operation EGT overshoot rarely occurs.

4.2.2.4 Engine Speed. RPM varies between engines at MILITARY thrust. For each engine, the specific rpm required to produce MILITARY thrust under standard day conditions is placarded on the engine data plate. Most engines will fall in the range of 97 to 100 percent. The pilot should therefore expect to see tachometer rpm indicate in this range at full throttle. The rpm at MILITARY thrust also varies noticeably with changes in inlet temperature. The amount of variation from data plate rpm depends on the type fuel control installed but is approximately +1 to -2 percent for extreme conditions of hot and cold respectively. (See Figure 4-1.) The 30-minute time limit at MILITARY thrust is a power level limit as well as a temperature limit; that is a particular engine which develops MILITARY thrust at an exhaust gas temperature of 540 °C is still limited to 30 minutes at this power even though it is below the MILITARY operating temperature limit.

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8 engines with PPC 185 incorporated), a minimum in flight engine rpm of 70 percent should be maintained to preclude possible flameout.

Note

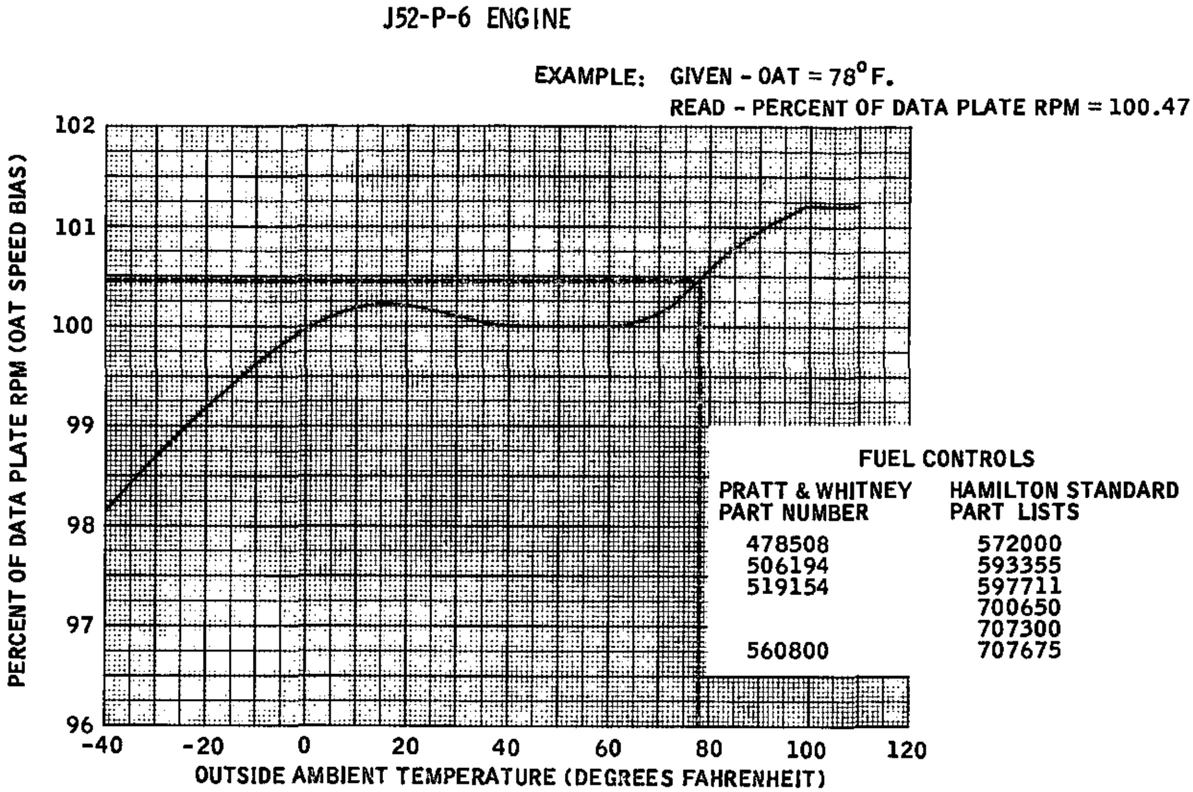
Engine compressor stalls may be induced above 30,000 feet in heavy airframe buffet at high angles of attack.

4.2.3 Oil Pressure Variation. The oil pressure indication at IDLE RPM should be normal (40 to 50 psi); however a minimum of 30 psi for ground operation is acceptable. If the indication is less than 30 psi at 60-percent rpm, shut down the engine to determine the reason for the lack of, or low, oil pressure.

CAUTION

- Even though certain maneuvers normally cause momentary loss of oil pressure, maximum operating time with oil pressure indicating less than 40 psi in flight is 1 minute. If recovery of oil pressure is not accomplished in 1 minute, flight should be terminated as soon as practicable.

- Maneuvers producing acceleration near zero g may cause complete loss of oil pressure temporarily. Absence of oil pressure for maximum of 10 seconds is permissible.



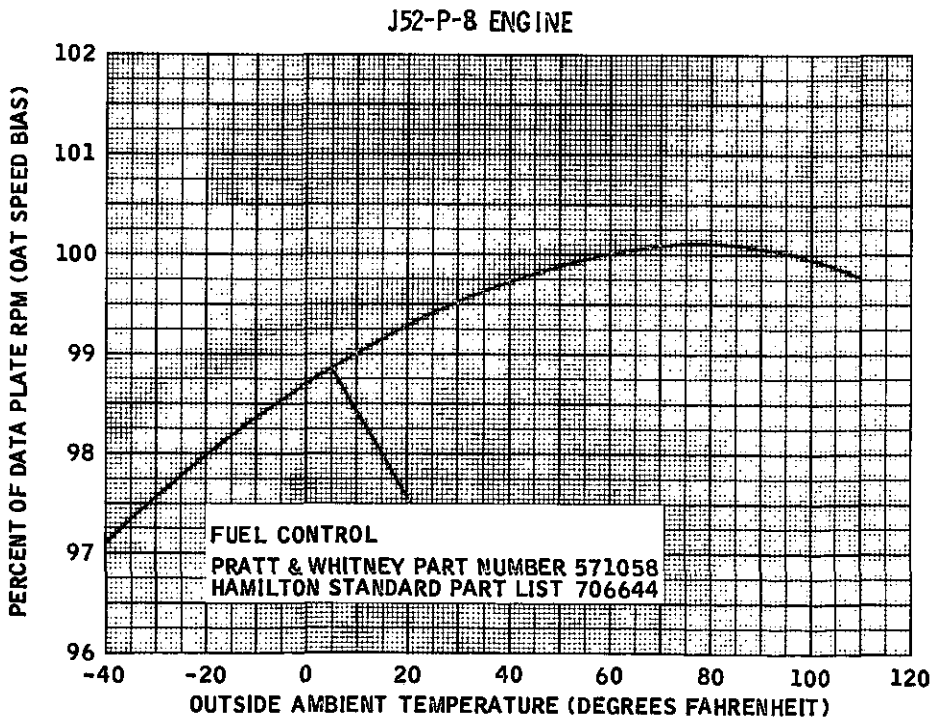


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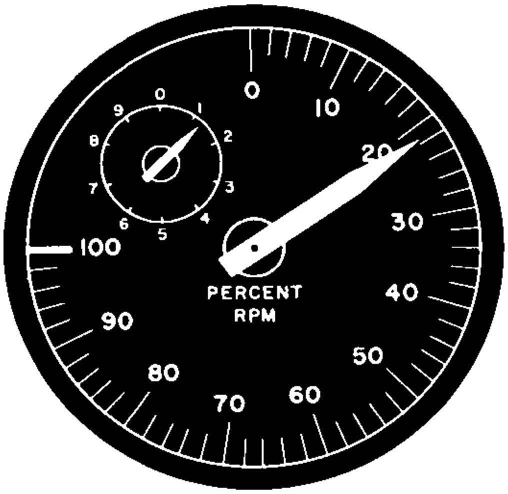
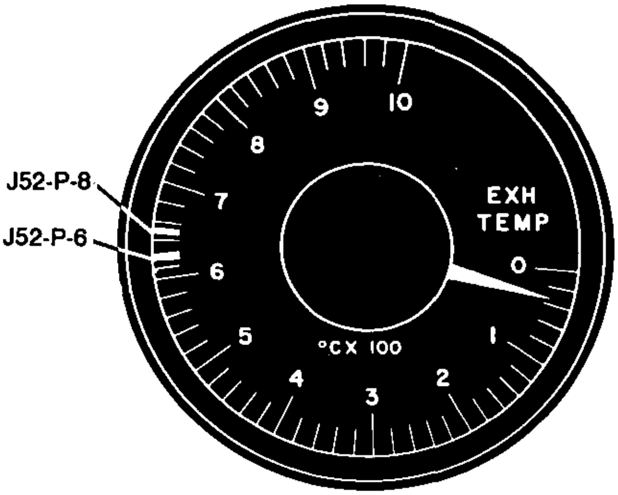
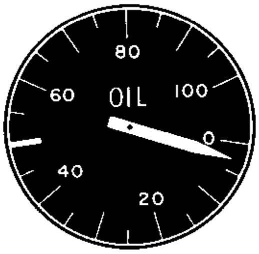
Figure 4-1. Military RPM Curve for Sea Level Static Condition



TACHOMETER



EXHAUST GAS TEMPERATURE



OIL PRESSURE

OIL QUANTITY
INDICATOR/SWITCH

ENGINE PERFORMANCE		
	ENGINE	
	J52-P-6	J52-P-8
MAXIMUM STABILIZED RPM (30 MINUTES)	MILITARY	MILITARY
MAXIMUM STABILIZED TEMPERATURE (30 MINUTES)	621°C	650°C
MAXIMUM ALLOWABLE OIL PRESSURE	50 PSI	50 PSI
MINIMUM ALLOWABLE OIL PRESSURE- INFLIGHT GROUND- IDLE	 40 PSI 30 PSI	 40 PSI 30 PSI

N9/92
TAI-201-B

Figure 4-2. Engine Instruments

CAUTION

Oil pressure above 50 psi can cause failure of internal engine oil seals and result in loss of oil to the engine. At the first indication of oil pressure above 50 psi, reduce engine rpm to the minimum necessary for flight in an attempt to reduce oil pressure to acceptable levels. Check oil quantity frequently for early indications of oil loss. If the 20 percent oil light illuminates, set the engine rpm at 86 to 88 percent and proceed with the procedures for low oil quantity. Prepare for landing at the nearest suitable field at the first indication of high oil pressure.

Note

During starting and initial runup, the maximum allowable oil pressure is 50 psi.

4.3 MANEUVERS

The following manuevers are prohibited:

1. Negative g flight in excess of 10 seconds because of resulting oil starvation.

2. Intentional spins.

3. Aileron rolls:

   a. That exceed 360° of roll.

   b. That exceed one-half stick deflection with fuel in external fuel tanks. Above 20,000 feet, full stick deflection may be used for rolls up to 180°.

4. Maximum permissible change in angle of bank during rolling pullouts or rolling pushovers is 180°.

5. Intentional decelerations to zero airspeed at pitch attitudes of 90° to 100° nose-high.

6. Normal accelerations between +0.5 and -0.5g, except transient, where transient is defined as transition from one flight regime to another with no intermediate dwell time or stops.

WARNING

Normal accelerations between +0.5g and -0.5g may result in a loss of boost pump fuel transfer followed by engine flameout. Transient flight maneuvers only are permitted in this normal acceleration range.

CAUTION

Drop tank fuel transfer shall not be selected during maneuvers that may result in a departure from controlled flight, or maneuvering flight resulting in high roll rates and negative g's. Additionally, for dual drop tank aircraft, drop tank fuel transfer shall not be selected during any maneuvering flight when the tanks are empty because of the possibility of uncommanded fuel dump.

4.4 AIRSPEED LIMITATIONS

The maximum permissible indicated airspeeds in smooth or moderately turbulent air are as follows:

1. With no external stores and with landing gear, flaps, and hook retracted - As shown in Figure 4-4.

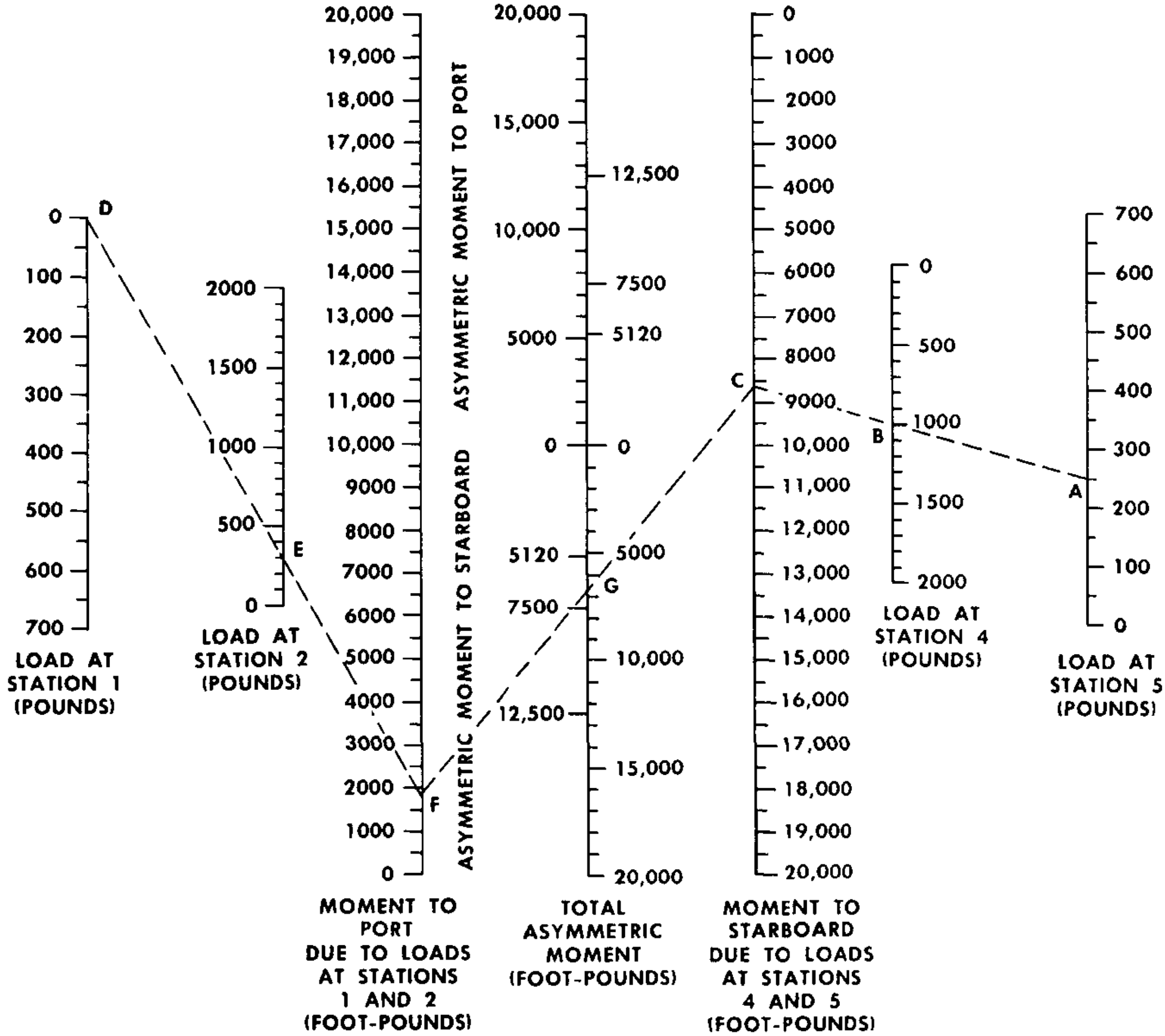
2. With 300-gallon external fuel tanks and with landing gear, flaps, and hook retracted - 575 KIAS or Mach 0.90, whichever is lower.

3. With external baggage container installed, loaded or empty - 525 KIAS or Mach 0.80, whichever is lower.

Note

For other external store limitations/loadings, refer to the Tactical Manual, NAVAIR 01-40AV-1T.

ASYMMETRIC WING STATION LOAD LIMITATION NOMOGRAM



TO USE THE NOMOGRAM CONNECT THE KNOWN LOADS ON STATIONS 1 AND 2 (FOR MODELS A-4 B/C STATION 5 AND 1 LOADS ARE ZERO) WITH AN EXTENDED STRAIGHT LINE. READ THE MOMENT TO PORT DUE TO LOADS AT STATIONS 1 AND 2. REPEAT THIS PROCEDURE FOR STATIONS 4 AND 5 TO FIND STARBOARD MOMENT. CONNECT THE STARBOARD MOMENT AND PORT MOMENT WITH A STRAIGHT LINE. READ TOTAL ASYMMETRIC MOMENT AT THE INTERSECTION OF THE CONNECTING LINE AND THE TOTAL ASYMMETRIC MOMENT SCALE. IF THE TOTAL ASYMMETRIC MOMENT IS LESS THAN THAT ALLOWED FOR A GIVEN OPERATION THE LOADING IS SATISFACTORY.

LIMITATIONS:

FIELD LANDINGS ....12,500 FT-LB

FIELD TAKEOFFS
OR CARRIER LANDINGS .. ..7500 FT-LB

CARRIER CATAPULT ....5120 FT-LB

EXAMPLE:

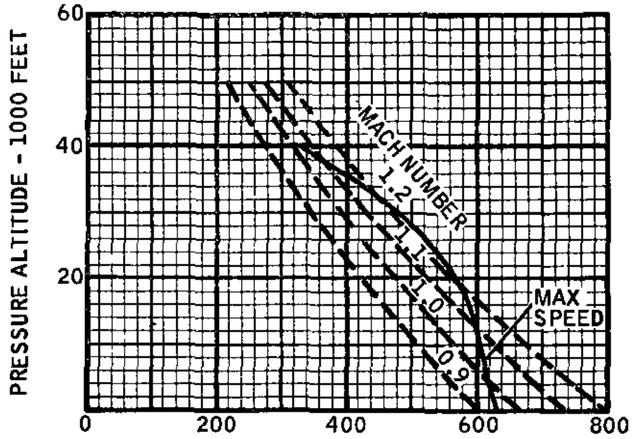
A LOAD AT STATION 5 ....250 LB
B LOAD AT STATION 4 ....1000 LB
C MOMENT TO STARBOARD ...8620 FT-LB
D LOAD AT STATION 1 ....0 LB
E LOAD AT STATION 2 ....300 LB
F MOMENT TO PORT ....1875 FT-LB
G TOTAL ASYMMETRICAL
MOMENT ....6745 FT-LB

TA1-197-B

Figure 4-3. Asymmetric Wing Station Load Limitation Nomogram

AIRSPEED LIMITATIONS

MODEL: TA-4F/TA-4J DATA BASIS: FLIGHT TEST



TA1-195-C

Figure 4-4. Airspeed Limitations

4. With landing gear and/or flaps extended (except in an emergency) to lock gear down – 225 KIAS (with zero yaw) 170 KIAS (with unrestricted yaw).

CAUTION

Do not exceed 240 KIAS with flaps extended, unless there is indication of flap blowback. This precaution is to prevent structural damage if the blowback relief valve is not operating.

5. (TA-4F) For air refueling from A-4 tanker and for buddy store hose extensions – 300 KIAS or Mach 0.80, whichever is lower.

a. For buddy store hose retraction – 250 KIAS.

b. Carriage – 500 KIAS or Mach 0.80, whichever is lower.

6. With flight controls disconnected:

a. With asymmetrical loading – 200 KIAS.

b. With symmetrical loading – 300 KIAS or Mach 0.80, whichever is lower.

7. With emergency generator extended – 500 KIAS or Mach 0.91, whichever is lower.

8. Insofar as practicable, utilize strafing speeds of – 350 to 450 KIAS.

4.5 CENTER-OF-GRAVITY LIMITATIONS

Refer to Weight and Balance Handbook, NAVAIR 01-1B-40, for operating limitations.

4.6 GROSS WEIGHT LIMITATIONS

The maximum recommended gross weights are as follows:

1. Field takeoff – 24,500 pounds.

2. Field landing (minimum rate of descent) – 16,000 pounds.

3. Field landing (other than minimum rate of descent), FCLP, and field arrestments – 14,500 pounds.

4. Catapulting–24,500 pounds.

Note

When using C-11, C-11-1 catapult, maximum takeoff weight is 23,500 pounds.

5. Carrier landing, and carrier arrestment – 14,500 pounds.

6. Barricade engagement – 14,500 pounds.

At gross weights in excess of 14,500 pounds, only minimum rate of descent field landings are recommended. Field landings at gross weights in excess of 16,000 pounds should be attempted only in an emergency. Refer to Part V, Landing at High Gross Weights.

CAUTION

All external fuel tanks must be empty prior to arrested landings.

CAUTION

- Barricade engagements may be made with stores such as empty tanks, empty rocket packs, or other lightweight inert stores, but, if torn loose, these stores may present a hazard to flight-deck personnel. Barricade engagements are not permitted with stores other than mentioned above. It is recommended that barricade engagements be made with minimum fuel. Refer to the appropriate recovery bulletin for permissible arresting gear engaging speeds.
- At high gross weights, engaging speeds should be held to a minimum to prevent structural damage to the aircraft.
- Additional catapulting gross weight limitations as imposed by increased ambient temperatures and the resultant reduction in engine thrust are extremely critical when operating with stores on the multiple bomb racks in a FULL FLAP or HALF FLAP configuration. Refer to applicable Aircraft Launching Bulletin for more detailed information.
- Barrier engagements are not recommended.

Compatibility of the aircraft with this type of gear has not been flight tested, but engineering analysis has resulted in the following recommended procedures:

1. Planned use, such as a long field arrestment, is recommended only when no other type of arresting gear is available. Do not engage with fuel in the drop tanks.

2. Emergency use, such as takeoff abort, would probably be unavoidable because system is normally rigged. However, hook should be lowered to increase probability of arrestment.

4.7 MISCELLANEOUS LIMITATIONS

Shipboard catapult shots with partial fuel loading in external drop tanks is prohibited.

The external baggage container (EBC) may be carried, loaded or empty, within the limits of flight for full 300-gallon tanks except as modified by the following restrictions:

1. Airspeed limitation is 525 KIAS or Mach 0.80, whichever is lower.

2. Normal acceleration limitations are negative 1.0 to positive 3.0g's.

3. Flight controls, propulsion controls, or other systems shall not be moved or operated so as to result in rapid or abrupt aircraft responses.

4. Side slipping or skidding shall be avoided.

5. Angle of bank shall not exceed 60°.

6. Jettison in emergency only, in 1.0g level flight at maximum of 475 KIAS/0.80 IMN.

7. **Do not exceed 19 units AOA in an asymmetrical slat condition.**

4.8 ASYMMETRIC LOAD LIMITATIONS

1. Asymmetrical store loadings up to 7,500 foot-pounds of static moment on either wing are permitted for field takeoffs and carrier landings. Asymmetric load at outboard rack times 9.48 plus asymmetric load at inboard rack times 6.25 must not exceed 7,500 foot-pounds.

2. Crosswind catapult launches with asymmetric loads are prohibited. Bow catapult launches are permitted with external store loadings up to 5,120 foot-pounds asymmetric moment. A lateral control input will be required to maintain wings level as the aircraft leaves the bow. Directional trim of two units away from the more heavily loaded wing is required.

3. Waist catapult launches with asymmetric loads are prohibited.

4. Carrier landings with a crosswind component from the unloaded or light wing side are not recommended.

5. Flared field landings are permitted with an asymmetric store loading up to 12,500 foot-pounds. The minimum approach speed is 115 knots with up

to 7,500 foot-pounds asymmetric moment, varying linearly to 130 knots at 12,500 foot-pounds. For rapid computation of allowable asymmetric loading, refer to Figure 4-3.

4.9 AUTOMATIC FLIGHT CONTROL SYSTEM LIMITATIONS

At altitudes of 7,500 feet and above, operation of the AFCS is unrestricted throughout the speed range of the aircraft (Figure 4-7).

The automatic flight control system may be engaged below 7,500 feet except for the following conditions:

1. During takeoff and landing.

2. Between 1,000 and 7,500-foot terrain clearance, with airspeed below 300 knots, AFCS operation requires the hands on the control stick. Above 300 knots, operation is unrestricted.

3. Below 1,000-foot terrain clearance, to 200-foot terrain clearance, AFCS operation is restricted to hands on the control stick and a maximum airspeed of 500 knots.

4. The AFCS shall not be engaged below 200-foot terrain clearance.

4.9.1 AFCS Performance and Power Limitations. The attitude hold, preselect heading, and altitude hold modes all operate within the 60° pitch and 70° roll angle limits of the AFCS. It must be realized that within these limits each mode is further limited by the attitude, gross weight, and power performance of the basic airframe.

4.10 ACCELERATION LIMITATIONS

Accelerations at which moderate buffeting occurs shall not be exceeded (Figure 4-5). Otherwise, the maximum permissible accelerations for flight are as shown on Figure 4-6. As gross weight increases above 12,500 pounds, maximum permissible accelerations decrease as shown in Figure 4-6. During conditions of moderate turbulence, avoid deliberate accelerations in excess of those permitted as shown in Figure 4-6 to minimize the probability of overstressing gust and maneuvering loads. Transonic pitchup can occur during speed reductions in the transonic region. Buffet onset and flight strength limits at low altitude combat conditions are shown in Part XI, Chapter 28.

CAUTION

To minimize the probability of exceeding the maximum permissible load factor because of the combined effects of maneuvering load factor and transonic pitchup, the following procedure is recommended:

1. Below 15,000 feet, at speeds in excess of 0.94 IMN, avoid deliberate accelerations in excess of +4g.

2. Above 15,000 feet, avoid deliberate accelerations that exceed buffet onset.

4.11 PRESSURIZED WING TANK LIMITATIONS

The following is a summary of the restrictions applicable to flight with the wing tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS

2. No catapulting

3. No landings

4. Coordinated turns only

5. Aircraft load factor limits +0.1 to +2.0

6. No air refueling

7. No nosedown attitudes

8. 45° bank maximum.

4.12 TIRE SPEED LIMITATIONS

A maximum of 175 knots groundspeed is imposed upon the aircraft during ground operations because of structural limits of the tires. The limit is depicted in the takeoff charts by broken lines for various pressure altitudes.

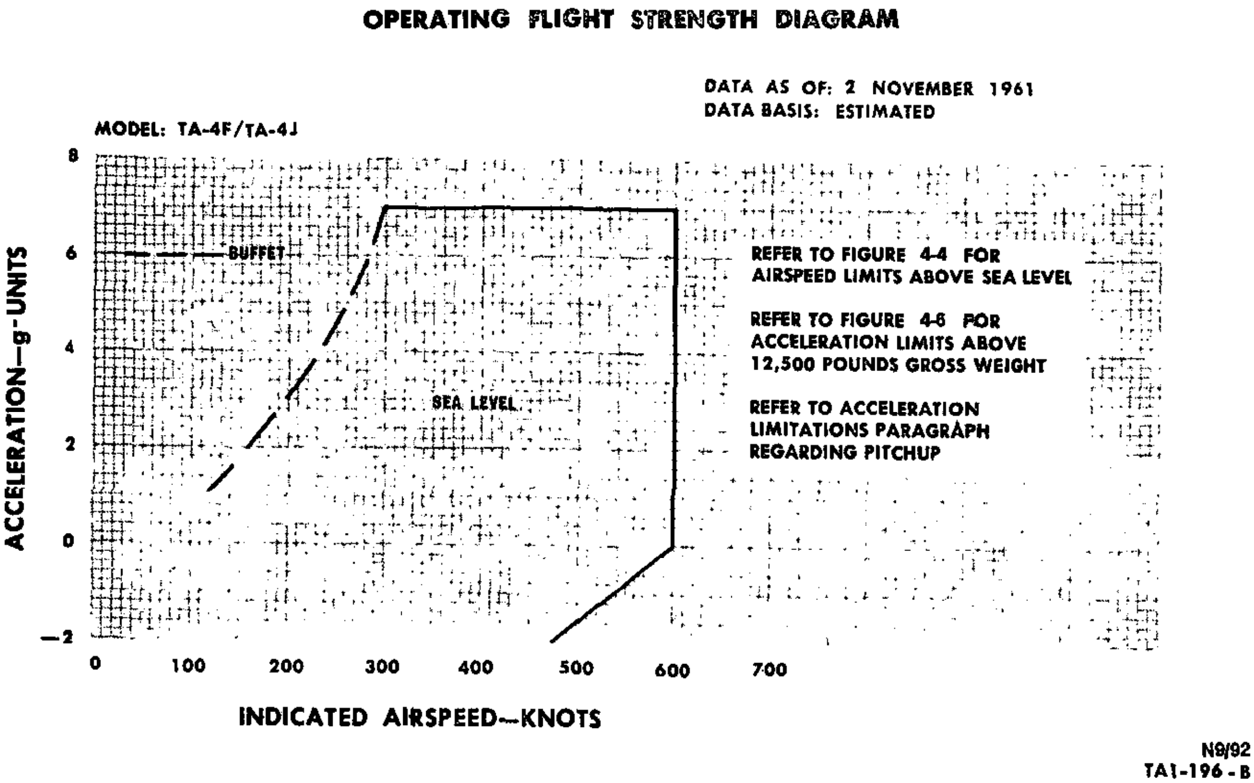


Figure 4-5. Operating Flight Strength Diagram

ACCELERATION LIMITS VS GROSS WEIGHT

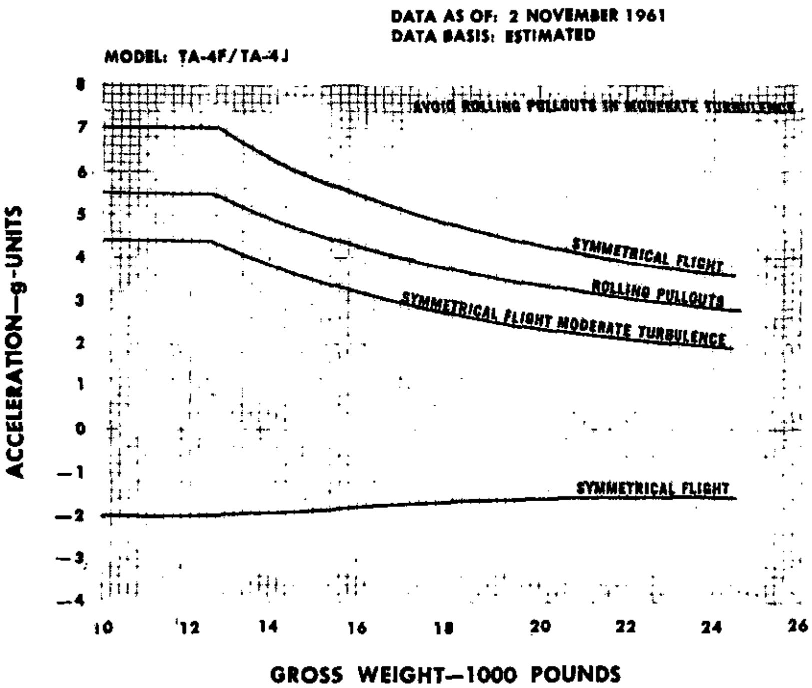


Figure 4-6. Acceleration Limits Versus Gross Weight

AFCS SPEED ENVELOPE
GROSS WEIGHT = 14,721 POUNDS
CG @ 20.9 MAC

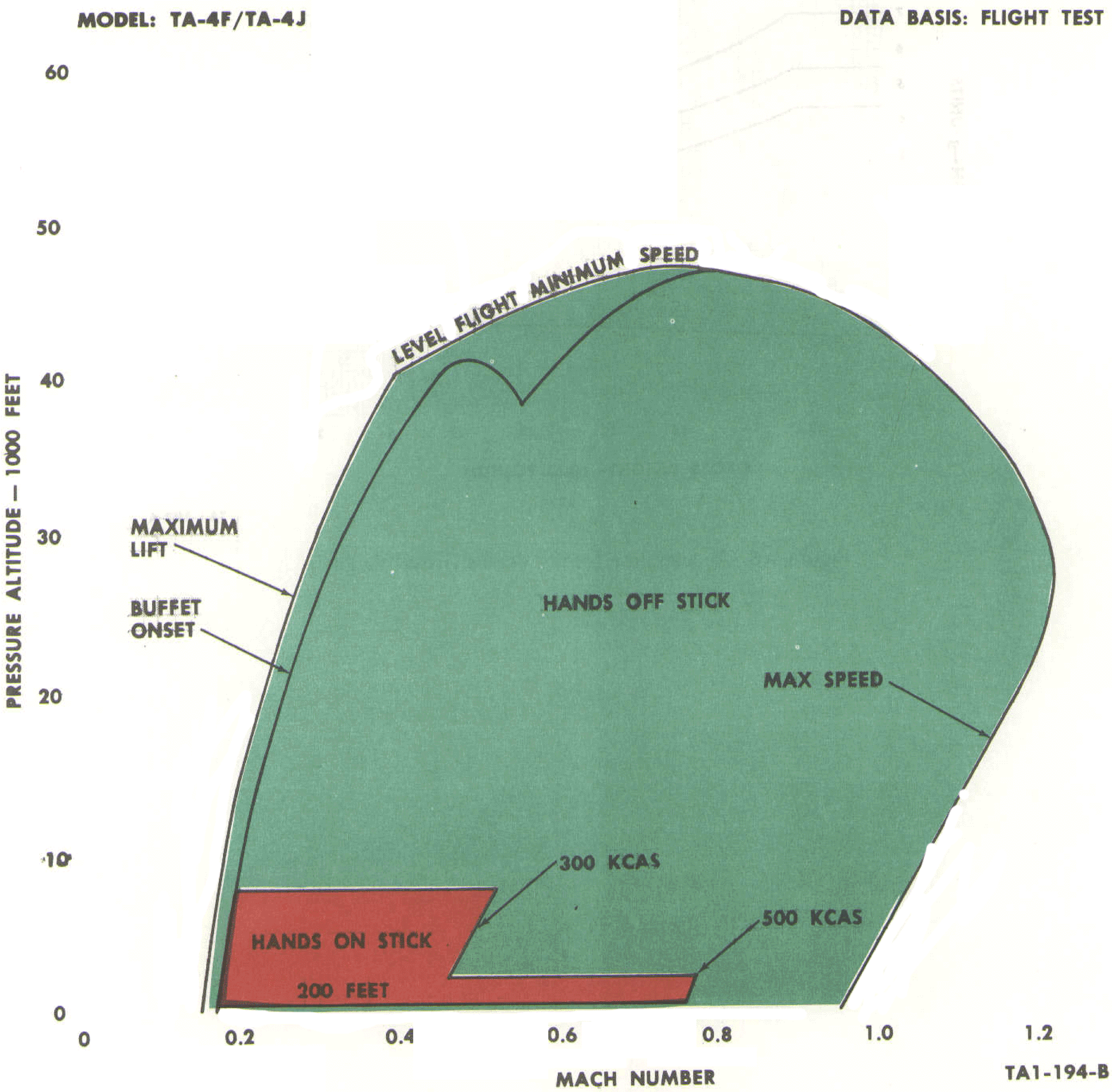


Figure 4-7. AFCS Speed Envelope

PART II

Indoctrination

Chapter 5 — Indoctrination

CHAPTER 5

Indoctrination

5.1 INTRODUCTION

This section establishes minimum requirements for training, initial qualification, and currency in specified areas. Subsequent sections provide the operational information considered necessary to ensure safe and efficient operation of A-4/TA-4 aircraft, when used in conjunction with the Naval Warfare Publications series. Unit commanders are authorized to waive, in writing to the individual affected, flight hour minimums and/or OFT/WST training requirements where recent experience in similar models warrants.

It is important th adequate preparation and guidance are available to pilots for initial and subsequent flights, so that they attain and maintain a reasonable degree of proficiency in the operation of A-4/TA-4 aircraft. Too often, under pressure of operational commitments, this groundwork is abbreviated or deleted. This can result only in a deterioration of individual and unit effectiveness. For this reason, commanding officers must continuously ensure adherence to these basic criteria whenever possible. Procedures for requesting waivers from the provisions of this section are contained in OPNAVINST 3710.7.

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadrons are governed by OPNAVINST 3710.7.

Training requirements and indoctrination for Advanced Training Command units will closely conform where feasible to the manual and OPNAVINST 3710.7. For the specialized mission of flight training in the TA-4J, CNATRA provides supplementary instruction to this section for both flight and ground syllabi.

5.2 GROUND TRAINING

Ground training should be continuous throughout the career of the A-4/TA-4 aircraft pilot. The overall syllabus will vary according to local conditions, facilities, directives from higher authority, and the unit commander's estimation of squadron readiness. However, there are certain specific requirements that must be met to ensure that the pilot is properly indoctrinated and briefed prior to flight.

5.2.1 Ground Training Requirements. Ground training and other related requirements for all pilots prior to familiarization flights in A-4/TA-4 aircraft are as follows:

Note

Currently qualified A-4/TA-4 pilots need comply with only those portions of items 3, 4, and 6 that pertain to differences in new model.

1. Current medical clearance.

2. Aviation physiological training as set forth in OPNAVINST 3710.7.

3. NAMO Pilot Familiarization course (if available) or equivalent lectures by RCVW, operating A-4/TA-4 squadron, or other qualified personnel.

4. Lectures from RCVW, operating A-4/TA-4 squadron, or other qualified personnel on the following subjects:

   a. Aircraft preflight, ground handling, hand signals, and normal flight procedures

   b. Flight characteristics (including stalls and spins) and operating limitations

   c. Use of safety and survival equipment and related procedures

   d. Cockpit troubleshooting procedures

   e. Emergency procedures

f. Past aircraft accidents as an aid in preventing future accidents of like nature

g. Local course rules, flying area, instrument procedures, and SAR facilities.

5. Blindfold cockpit check.

6. Minimum of 2 hours of flight and emergency procedures simulation in the OFT/WST within the 2-week period prior to the first familiarization flight. If OFT/WST is not available, a comprehensive oral and/or written examination on emergency procedures must be substituted.

7. Practice dry-run ejection accomplished in the ESCAPAC ejection seat in complete flight gear, utilizing both primary and alternate ejection handles.

8. Satisfactory completion of examinations on A-4/TA-4 aircraft operating limits, normal and emergency procedures, course rules, and aircraft systems.

9. Supervised aircraft preflight utilizing Daily Maintenance Requirement Cards, engine start, poststart checks using plane captain's signals, taxi, and securing engine.

10. Aviator's required reading pertinent to flight.

5.2.2 Ground Training Subjects. The following subjects should be included in the normal A-4/TA-4 squadron's ground training syllabus.

5.2.2.1 Technical Training

1. NATOPS Flight Manual
2. Auxiliary equipment
3. Flight safety equipment.

5.2.2.2 Mission Training

1. Bombing and rocket theory and pipper control
2. Glide bombing, rocket, and missile procedures
3. Strafing procedures
4. LABS equipment
5. LABS/laydown delivery
6. Patterns and procedures for local targets
7. Close air support and GCBS procedures
8. Pertinent publications in the NWP and NWIP series
9. Special weapons
10. Aviation ordnance
11. Weapons loading
12. High and low altitude navigation
13. Radar and navigational computer operating procedures
14. Aerial refueling
15. Night flying
16. FCLP and carrier procedures.

5.2.2.3 Instrument Training

1. Instrument flight (genera'`
2. REST computer
3. Handheld computer
4. Local climbout and penetration
5. GCA/CCA
6. Special equipment.

5.2.2.4 Flight Safety

1. MIR/hazard report reviews.

2. Aircraft emergencies: practiced whenever possible in the OFT/WST. Where such a trainer is available, its use is mandatory during familiarization, and annually thereafter. In addition, a refresher

hop or an oral or written review of emergency procedures is required after any layoff from flying in excess of 4 weeks.

3. Use of barricade/emergency field arresting gear.

5.2.2.5 Intelligence

1. Mission planning material

2. Orders of battle

3. Aircraft and ship recognition

4. Escape and evasion

5. Authentication procedures.

5.2.2.6 Survival

1. Physiological and medical aspects

2. First aid

3. Survival on land/sea

4. Pilot rescue techniques.

5.3 FLIGHT QUALIFICATIONS

Minimum requirements for qualification are set forth for each phase of flight. Minimum requirements for currency are set forth in OPNAVINST 3710.7.

Command prerogative should be exercised to increase minimums when desired. Unit commanders are authorized to waive, in writing to the individual, these minimum requirements and/or OFT/WST training where recent experience in similar models warrants.

Note

Requirements listed for flight qualifications must be First Pilot time.

5.3.1 Familiarization

1. Completion of the minimum ground training requirements prescribed earlier in this manual is required prior to flight.

2. Familiarization flights will be conducted in accordance with Part IV, Chapter 13.

3. Initial checkout flights will consist of a minimum of 5 hours.

5.3.2 Instruments. Minimum requirements prior to actual instrument flight are as follows:

1. Ten hours in A-4/TA-4 aircraft in the last 6 months.

2. At least one A-4/TA-4 flight in the last 30 days.

3. Current instrument card.

4. Demonstration of instrument proficiency in assigned model.

5.3.3 Weapons and Mission Training. Prerequisites for weapons and mission training are as follows:

1. Completion of appropriate ground training requirements.

2. Minimum of 10 hours in A-4/TA-4, of which 5 hours must be within preceding 6 months.

3. For weapons delivery or mission training requiring a high-speed, low-level run-in, a minimum of 15 hours in A-4/TA-4 aircraft within preceding 6 months, of which 5 hours must be in model being flown.

4. Basic qualifications and currency requirements for various missions and weapons deliveries are set forth in OPNAVINST 03740.8.

Minimum requirements prior to night weapons training are as follows:

1. Same as night-flying minimum, except 50 hours in A-4/TA-4 aircraft, and 10 hours in the last 30 days.

2. Day-proficiency in type delivery in model being flown.

3. Familiar with target area and procedures.

4. Five hours night time in A-4/TA-4, of which one flight in model being flown must be within preceding 30 days.

Note

Ten hours during last 30 days may be waived for high altitude horizontal bombing.

5.3.4 Air Combat Training. Prerequisites for air combat training are:

1. Completion of appropriate training set forth in preceding familiarization and instruments sections.

2. Minimum of 20 hours in A-4/TA-4 of which 10 hours must be within the preceding 3 months in model being flown.

5.3.5 Night Flying. Minimum requirements prior to night flights are as follows:

1. Current instrument card

2. Ten hours in A-4/TA-4 within the last 3 months.

5.3.6 FCLP and Carrier Qualification. For day and night FCLP qualification, the exact number of FCLP periods required depends on the experience and ability of the individual pilot, and will be determined by the unit commander.

If any of the following requirements are contradictory to the LSO NATOPS Manual, the LSO NATOPS Manual will take priority.

Minimum requirements prior to day FCLP are as follows:

1. Ten hours in A-4/TA-4 aircraft and one flight in the last 30 days

2. Familiarity with the slow-flight characteristics of the aircraft

3. Proficiency in instrument flying in assigned model

4. Proper briefing in day FCLP procedures.

Minimum requirements prior to night FCLP are as follows:

1. Demonstration of proficiency in day FCLP

2. Five hours night time in the A-4/TA-4

3. One A-4/TA-4 flight in the last 10 days; otherwise one day flight will be required prior to the night FMLP period

4. Proficient in instrument flying in assigned model

5. Proper briefing in night FCLP procedures.

Minimum requirements prior to day carrier qualification are as follows:

1. Certification by unit commander as day field-carrier-landing qualified in model to be flown.

2. Fifty hours in A-4/TA-4 aircraft.

3. Proper briefing in carrier landing, catapult, and deck procedures.

Minimum day qualifications are as follows:

1. Two touch-and-go landings

2. Ten arrested landings

3. Two day CCA approaches from marshal point.

Minimum requirements prior to night carrier qualifications are as follows:

1. Current day-carrier qualification in the model to be flown

2. Ten hours night time within the last 6 months

3. Certification by unit commander as night field-carrier-landing qualified in model to be flown

4. Proper briefing in night carrier landing, catapult, and deck procedures

5. A minimum of two satisfactory arrested landings shall be completed during the daylight hours preceding night qualification landings.

PART III

Normal Procedures

Minimum night qualifications are as follows:

1. Six night arrested landings

2. Two night CCA approaches from marshal point (to be conducted only after satisfactory completion of day CCA qualification).

For maintaining carrier qualifications, qualification is considered current for 6 months after the date of the last carrier landing in type. Refresher requirements to requalify are as follows:

1. Six to twelve months: four day and two night arrested landings

2. Over 12 months: initial requirements, both day and night.

5.3.7 Cross-Country Flight. Minimum requirements prior to cross-country flight are as follows:

1. Current instrument card

2. Fifteen hours in A-4/TA-4 to include 3 hours instrument time

3. Flight packet, which includes security, accounting, servicing data, and accident forms

4. Familiarity with aircraft servicing.

5.4 PERSONAL FLYING EQUIPMENT REQUIREMENTS

The applicable flying equipment delineated in OPNAVINST 3710.7 shall be carried/worn on every flight. In addition, the following items not delineated in OPNAVINST 3710.7 are also considered required flying equipment:

1. Integrated torso harness

2. Approved light

3. Shroud cutter

4. Other survival equipment appropriate to the climate, or required by unusual conditions that may be peculiar to the area

5. Survival transceiver, if available.

All survival equipment will be secured in such a manner that it is easily accessible and will not be lost during ejection or upon landing.

CHAPTER 6

Briefing/Debriefing

6.1 BRIEFING

Briefings will be conducted using a prepared briefing guide and the appropriate mission card. The briefing shall cover those items pertinent to the specific mission assigned. Any format that is complete, concise, and orderly and that can be readily used by the instructor pilot as a briefing guide is suitable. Each pilot will maintain a knee pad and record all data necessary to successively assume the lead and complete the assigned mission. This, however, does not relieve the instructor pilot of the responsibility for all pilots in the operation and conduct of the flight.

6.1.1 General. The briefing guide will include the following items, where applicable:

1. Aircraft assigned, call signs, event number, and deck spot.
2. Succession to lead.
3. Fuel load, stores, and aircraft gross weight.
4. Engine start, taxi, and takeoff times.
5. Rendezvous instructions, takeoff distance and speed, line and refusal speeds, consideration of arresting gear, and location.
6. Mission
   a. Primary
   b. Secondary
   c. Operating area/target
   d. Control agency
   e. Time on station or over target.
7. Navigation and flight planning
   a. Duty runway/predicted Foxtrot Corpen for launch and recover, and position in the force
   b. Climbout
   c. Operating area procedures and restricted areas
   d. Mission plan, including fuel/oxygen management and PIM
   e. Bingo (minimum fuel)/emergency fuel
   f. Marshal/holding (normal and emergency)
   g. Penetration procedures and minimums
   h. Ship/field approach and runway lighting
   i. GCA/CCA procedures and minimums, missed approach
   j. Recovery: course rules, pattern, breakup, landing, waveoff
   k. Divert and emergency fields/ready deck.
8. Communications
   a. Frequencies
   b. Controlling agencies
   c. Radio procedures and discipline
   d. ADIZ procedures
   e. IFF/SIF
   f. Navigational aids

g. Hand/light signals

h. Shift of aircraft control shall be accomplished with positive ICS call.

9. Weapons

a. Loading

b. Arming

c. Special routes because of ordnance aboard

d. Pattern

e. Armament switches

f. Aiming point/sector setting

g. Run-in/entry airspeed

h. Minimum release/pullout altitudes

i. Duds, hung ordnance procedures, dearming, jettison area

j. Safety

k. G versus gross weight.

10. Weather

a. Local area, en route, and destination (existing and forecast)

b. Weather at alternate/divert fields

c. Winds, jet stream, temperature, and contrail band width.

11. Emergencies

a. Takeoff aborts

b. Radio failure

c. Loss of NAVAIDS

d. Loss of visual contact with flight

e. Lost plane procedures

f. Downed pilot and SAR

g. Aircraft emergency procedures and system failures

h. Ejection procedures.

12. Air intelligence and special instructions

a. Friendly/enemy force disposition

b. Current situation

c. Targets

d. Safety precautions

e. Reports and authentication

f. Escape and evasion.

13. Safety Precautions.

6.2 DEBRIEFING

Each flight shall be followed with a thorough debriefing by the instructor pilot as soon as practical. All phases of the flight shall be covered, paying particular attention to those areas where difficulty was encountered and to the effectiveness of any tactics employed or weapons expended. To derive maximum benefit, constructive criticism and suggested improvements as to doctrine, tactics, and techniques should be given and received with the frankness, purpose, and spirit of improving the proficiency of the unit, as well as that of the individual pilot. When appropriate, it should include the individual debriefing of each pilot by the LSO.

CHAPTER 7

Mission Planning

7.1 MISSION PLANNING

The training objective is the orderly development of pilot techniques in preflight planning, climbout, high-altitude navigation and cruise control, air refueling, low-level navigation, and high-speed approaches to the delivery maneuver. The specifics of these deliveries are set forth in the A-4/TA-4 Tactical Manual NAVAIR 01-40AV-1T. Mission turn radii charts are located in Part XI, Chapter 9 and Chapter 37.

A mission planning sample, Part XI, Chapter 29, is provided to assist the pilot in becoming familiar with the use of the performance section and to enable him to perform the assigned mission at the optimum conditions within the aircraft flight envelope.

CHAPTER 8

Shore-Based Procedures

8.1 PRIOR TO FLIGHT

8.1.1 Preflight Checklist

8.1.1.1 Exterior Inspection. Consult the aircraft inspection and acceptance record to determine the status of the aircraft, that it has been fully serviced with fuel, oil, liquid oxygen, compressed air, and hydraulic fluid. Inspect the exterior of the aircraft, proceeding as shown in Figure 8-1.

8.1.1.2 Forward Fuselage (A)

1. External canopy control handle - STOWED: ACCESS DOOR CLOSED.

Note

Ensure trigger latch (releasing mechanism of primary latch) on all access doors is installed so that the PUSH portion is FWD and spring tension within the trigger latch is adequate to ensure positive locking action.

2. Static pressure vents (2 vents left side) - CLEAR.
3. Engine bleed static port (left side) - CLEAR.
4. Angle-of-attack vane - CONDITION.
5. Air-conditioning intake and exhaust ducts - CLEAR.
6. Nose compartment panels - CONDITION, SECURITY.
7. Nose compartment cooling air inlet - CLEAR.
8. Air refueling probe cover - REMOVED.
9. Static pressure vent (right side) - CLEAR.
10. Controls access panel (right side) - SECURE.
11. Nosewheel well door - CONDITION, SECURITY.
12. Air-conditioning ground test plug (nosewheel well) - SECURITY.
13. Emergency landing gear release ratchet properly oriented - TEETH OUTBOARD.

CAUTION

Improper positioning of the emergency landing gear release ratchet may cause damage to the bulkhead brackets when the landing gear handle is raised, possibly resulting in a hung gear.

14. Downlock and microswitch (nosewheel wheel) - CONDITION.
15. Pitot drain line covers (nosewheel well) - SECURITY.
16. Nosegear strut - EXTENSION, NO LEAKAGE.
17. Nosewheel spindle nut - SECURITY.
18. Nosewheel steering wire bundle - CONDITION.
19. Nosewheel tire - CONDITION.
20. Nosegear downlock pin - INSERTED.
21. Nosegear actuator - CONDITION.
22. Emergency generator - RETRACTED, SECURE.
23. External canopy jettison handle (both sides) - STOWED, ACCESS DOORS CLOSED.
24. Gun flash suppressors and guns - SECURE.
25. Forward engine compartment - CONDITION AND SECURITY.

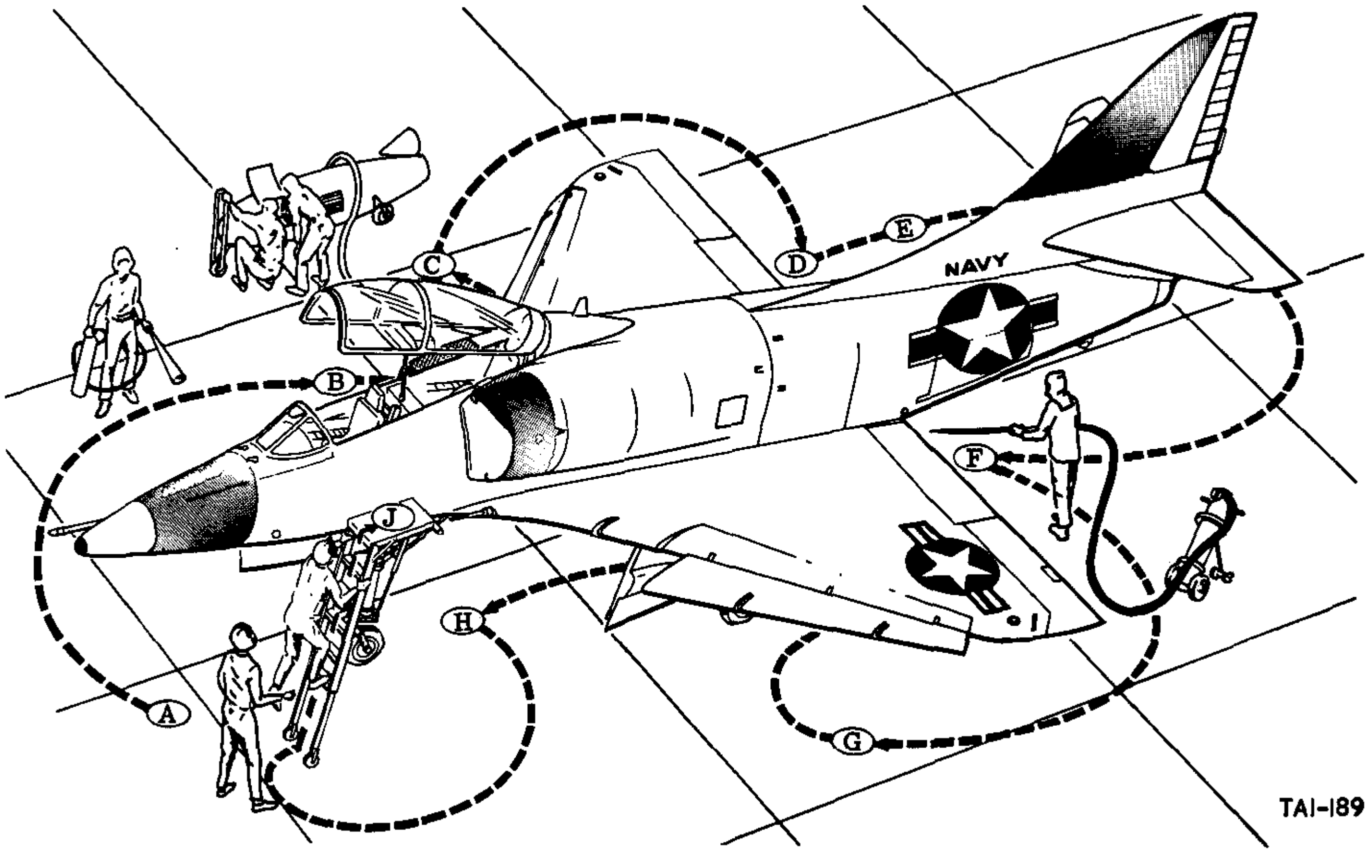


Figure 8-1. Exterior Inspection

26. Guncharger pneumatic pressure gauge - CHECK.

27. Gearcase oil drain line cap - SECURED AND LOCKWIRED.

28. Aileron power package - CHECK ALIGNING MARKS.

29. AJB-3A GND TEST switch - NORMAL.

30. Fuel boost cutout switch - NORMAL.

31. CSD/generator door - CONDITION, SECURITY.

CAUTION

CSD/generator door can appear to be falsely latched. Aircrew should check latches by physically grabbing and tugging to ensure proper security of latches.

8.1.1.3 Right-Hand Wheelwell (B)

1. Main wheelwell doors - CONDITION, SECURITY.
2. Taxilight - SECURITY.
3. Gun pneumatic pressure gauge - CHECK.
4. Armament safety disable switch - SAFE.
5. Downlock and microswitch - CONDITION
6. Catapult hook - PRELOAD, SECURITY.
7. Main gear downlock pin - INSERTED.
8. Main wheel strut - EXTENSION, NO LEAKAGE.
9. Main wheel tire - CONDITION.
10. Brakes - CONDITION, NO LEAKAGE.
11. Main landing gear actuator - CONDITION.

12. Fuel system vent - CLEAR.

8.1.1.4 Right-Hand Wing (C)

1. General condition - WRINKLES, CRACKS, LOOSE RIVETS; FUEL DEPOSITS.

2. Wing rack stores - SECURE.

3. Drop tank - REMOVE FILLER CAP, VISUALLY DETERMINE LOADING, REPLACE FILLER CAP.

4. Wing slat.

WARNING

Operate each slat by hand to make certain that each extends and retracts with negligible effort and without binding. Binding which causes asymmetric slat extension requires excessive lateral control deflection to maintain wings level after catapulting or during accelerated stalls and landing approaches.

a. Slat tracks and rollers should be free of grease and dirt.

b. Inspect slat track attach points for condition/security.

c. Push on the middle of the slat to check for smooth tracking upward. All points of the slat should contact the wing simultaneously. Check for upper and lower trailing edge gap uniformity.

d. Release the slat slowly, checking for smooth downward travel. All slat tracks should bottom-out evenly.

e. Grasp leading edge of slat and check for excessive lateral movement.

f. Grasp underside of leading edge and lift up with forward tension to check for excessive vertical movement.

5. Position and fuselage wing lights - CONDITION.

6. Aileron and wing flap - CONDITION, BONDING.

7. Spoiler - CONDITION, BONDING.

8.1.1.5 Over-Wing Preflight (D)

1. CSD - ACCESS DOOR CLOSED.

2. Utility hydraulics - CHECK, SECURE.

3. Flight control hydraulics - CHECK, SECURE.

4. Starboard engine compartment - CONDITION, SECURITY.

5. Wing tank filler cap - SECURE.

6. Port engine compartment - CHECK POWER CONTROL CRANK RETAINING NUT FOR PROPER INSTALLATION WITH CRANK TEETH PROPERLY ENGAGED AND COTTER PIN INSTALLED. CHECK REMAINDER OF ENGINE COMPARTMENT FOR CONDITION AND SECURITY.

7. Fuselage tank filler cap - SECURE.

WARNING

Failure to ensure secure placement of fuselage tank filler cap may result in fuel fire and/or explosion and/or fuel starvation.

8.1.1.6 Aft Fuselage and Tail Section (E)

1. All access doors - CLOSED.

2. Speedbrake - CONDITION, SECURITY.

3. LOX compartment - CONDITION, SECURITY.

4. Tailpipe cover - REMOVED.

5. Tailpipe - CRACKS, WRINKLES, BURNS, FUEL DEPOSITS.

6. Taillight - CONDITION.

7. Rudder, elevator, and horizontal stabilizer - CONDITION, BONDING.

8. Speedbrake - CONDITION, SECURITY.

9. Arresting hook - RETRACTED AND LOCKED; CONDITION.

10. Tension bar retainer - CONDITION.

11. Arresting hook holddown cylinder pressure gauge - 900 ±50 PSI.

12. Aft engine compartment - CONDITION, SECURITY.

13. Flap actuator - CONDITION.

14. Drop tank fueling switch - OFF.

15. Engine fuel drain lines (aft engine compartment) - CONNECTED.

WARNING

Do not pull any cable in the aft engine compartment. Inadvertent full or partial elevator disconnect or lowering of the arresting hook may result.

16. Elevator power disconnect hook and power hook drive pin (aircraft reworked per A-4 AFC 530) - ENGAGED.

17. Pitot drain line covers (aft engine compartment on aircraft reworked per AFC 565) - SECURE.

8.1.1.7 Left-Hand Wing (F)

1. Wing - WRINKLES, CRACKS, LOOSE RIVETS; FUEL DEPOSITS.

2. Wing flap and aileron - CONDITION, BONDING.

3. Aileron tab - CONDITION.

4. Spoiler - CONDITION, BONDING.

5. Position and fuselage wing lights - CONDITION.

6. Wing slat.

a. Slat tracks and rollers should be free of grease and dirt.

b. Inspect slat track attach points for condition/security.

c. Push on the middle of the slat to check for smooth tracking upward. All points of the slat should contact the wing simultaneously. Check for upper and lower trailing edge gap uniformity.

d. Release the slat slowly, checking for smooth downward travel. All slat tracks should bottom-out evenly.

e. Grasp leading edge of slat and check for excessive lateral movement.

f. Grasp underside of leading edge and lift up with forward tension to check for excessive vertical movement.

7. Wing rack stores - SECURE.

8. Drop tank - REMOVE FILLERCAP; VISUALLY DETERMINE LOADING; REPLACE FILLERCAP.

9. Approach lights and cover - CONDITION.

8.1.1.8 Left-Hand Wheelwell (G)

1. Main gear doors - CONDITION, SECURITY.

2. Downlock and microswitch - CONDITION.

3. Catapult hook - PRELOAD, SECURITY.

4. Main gear downlock pin - INSERTED.

5. Main wheel strut - EXTENSION NO LEAKAGE.

6. Main wheel tire - CONDITION.

7. Brakes - CONDITION.

8. Main landing gear actuator - CONDITION.

9. Retraction release switch - CONDITION.

8.1.1.9 Center Fuselage Underside (H)

1. Fuselage rack store - SECURE.

2. Centerline fuel tank - REMOVE FILLERCAP; DETERMINE LOADING; REPLACE FILLERCAP.

3. Centerline external baggage container (if installed) - SECURE; CHECK BAGGAGE TIEDOWN; DOORS SECURED.

4. Forward engine and accessory section access doors - CLOSED.

5. Link and case ejection chutes - CLEAR.

8.1.1.10 Cockpit Area (J) (Figures 8-2 and 8-4)

1. External canopy jettison handle - STOWED; ACCESS DOOR CLOSED.

2. Control access panel - SECURE.

3. Angle-of-attack vane - CONDITION, FREE MOVEMENT.

4. Engine intake plugs - REMOVED.

5. Intake ducts - FREE OF FOREIGN OBJECTS.

6. Canopy cover - REMOVED.

7. Fuselage tank filler cap - SECURE.

8. Pitot tube cover - REMOVED.

9. Total temperature sensor cover - REMOVED.

10. Canopy - UNDAMAGED.

8.1.2 Before Starting Engine. Make certain that the areas forward and aft of the aircraft are clear of personnel and loose objects. See Figure 3-30 for danger areas. Make certain that firefighting equipment is available and manned and that the boarding ladder is removed.

8.1.3 Starting Engine. An electrical power supply of 115 vac, and a source of starter air are required for starting the engine on the ground. The three methods of starting the engine are pilot-controlled starts, modified pilot-controlled starts, and ground-controlled starts.

8.1.3.1 Pilot-Controlled Starts. A pilot-controlled start requires a source of 3-phase, 400-cps, 115/200-vac power, and an air start unit modified to provide 28-vdc and 115-vac, single-phase electrical power.

Pilot-controlled starts should be made whenever possible to avoid starter motor overspeed. The time delay inherent in initiating or shutting off the starter air supply, when using hand signals, makes the ground-controlled start less desirable.

WARNING

Starter motor overspeed can be severe enough to cause starter motor damage or failure, with a resultant hazard to personnel and equipment.

To provide automatic air supply shutoff at the correct starter cutout speed, the aircraft starter circuit receptacle must be connected electrically to the gas turbine power unit prior to starting attempts. The ground air supply shuts off automatically at approximately 50-percent engine rpm unless a malfunction occurs, in which case the air supply must be shut off manually by pulling up on the engine starter switch. The engine should be started in the following manner:

1. External power - CONNECT.

2. ICS - CHECK.

3. Master press-to-test - CHECK.

4. Throttle - OFF.

5. Engine starter switch - DEPRESS TO START.

6. Five-percent rpm, throttle - IGN.

7. Fifteen-percent rpm, throttle - IDLE.

Lightoff should occur within 20 seconds after moving the throttle outboard to start the ignition cycle. Lightoff will be indicated by a rise in EGT after the throttle is moved to the IDLE position. Normally, the engine should be stabilized at IDLE rpm within 45 seconds after depressing the engine starting button.

8. Disconnect power.

8.1.3.2 Modified Pilot-Controlled Start. A modified pilot-controlled start may be made whenever a separate source of 3-phase, 400 cps electrical power is unavailable, and the air start unit has been modified to provide 28-vdc and 115-vac, single-phase electrical power.

Note

No aircraft instrument except the tachometer and the exhaust gas temperature indicators are operable during the start cycle until the generator comes on the line.

	Forward Cockpit	Aft Cockpit	
		Dual	Solo
1. Ejection seat control safety handle (headknocker)	Down	*	*
2. Ejection seat control safety handle safety pin (1)	Removed	*	*
3. Seat firing control mechanism initiator safety pins (2 each seat)	Removed	*	*
4. Initiator firing rods	Condition/security	*	*
5. Canopy-seat interlock initiator safety pins (2)	Removed	*	*
6. Canopy interlock (observe through sight in control box housing)	Engaged	*	
7. Face curtain and lower ejection handle firing control cables	Engaged	*	
8. Ejection seat firing control release fitting and firing control housing surfaces	Mated	*	
9. Face curtain	Stowed	*	*
10. Shoulder harness lockpin	Secure	*	
11. Shoulder harness inertial reel	Operable	*	
12. Parachute ripcord handle	Secure	*	
13. SEAWARS	Condition/position	*	
14. Canopy releases (Koch fittings)	Condition	*	*
15. Parachute pack	Closed/condition	*	
16. Spreader gun safety pin	Stowed	*	
WARNING If ballistic spreader gun safety pin has not been removed, main parachute canopy will not deploy.			
17. Delay initiator quick disconnect	Secure	*	
18. Ejection seat control selector lever	As desired		
19. Lapbelt and lapbelt lockpins (2)	Secure	*	
20. Emergency oxygen lanyard	Connected	*	
21. Dart system lanyard	Connected	*	
22. Emergency beacon lanyard	Connected	*	
23. Lower ejection handle	Stowed	*	
24. Emergency oxygen bottle	1,800 PSI (70 °F)	*	
25. Seat kit release handles	Stowed	*	

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Figure 8-2. Interior Inspection (Before Entering Cockpit) (Sheet 1 of 2)

	Forward Cockpit	Aft Cockpit	
		Dual	Solo
26. Emergency restraint release handle/parachute arming cable. **Note** Ensure parachute arming cable is in retaining clips and cable ball stop is in emergency restraint release handle holder (push down on emergency restraint release handle).	Connected and stowed		
27. External pilot chute static line **WARNING** Single or multiple wraps of nylon external pilot chute static line around the parachute arming cable housing can result in delayed operation of the parachute. **Note** Ensure that parachute external pilot chute static line is routed underneath parachute arming cable housing for its entire length. Parachute arming cable housing is stowed in retainer on right side of seat and not routed beneath parachute pack opening bands.	Routed under arming cable for its entire length		
28. Power inertia reel hose quick disconnect	Secure		

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Figure 8-2. Interior Inspection (Before Entering Cockpit) (Sheet 2 of 2)

To provide automatic air supply shutoff at the correct starter cutout speed, the aircraft starter circuit receptacle must be connected electrically to the gas turbine power unit prior to starting attempts. The ground air supply shuts off automatically at approximately 50-percent engine rpm unless a malfunction occurs, in which case the air supply must be shut off manually by the pilot by pulling up on the engine starter switch. The engine should be started in the following manner:

1. Igniter power - CONNECT.
2. Throttle - OFF.
3. Engine starter switch - DEPRESS TO START.
4. Five-percent rpm throttle - IGN.
5. Fifteen-percent rpm throttle - IDLE.

Lightoff should occur within 20 seconds after moving throttle outboard to start ignition cycle. Lightoff will be indicated by rise in EGT after throttle is moved to IDLE position. Normally, engine should be stabilized at IDLE rpm within 45 seconds after depressing engine starter button.

6. Disconnect power.

8.1.3.3 Ground-Controlled Starts. In most cases, pilot-controlled starts are not possible and the following procedure must be used:

1. Pilot holds one finger vertically - P/C CONNECTS EXTERNAL POWER AND STARTS GTC.
2. ICS - CHECK.
3. Master press-to-test - CHECK.
4. Throttle - OFF.

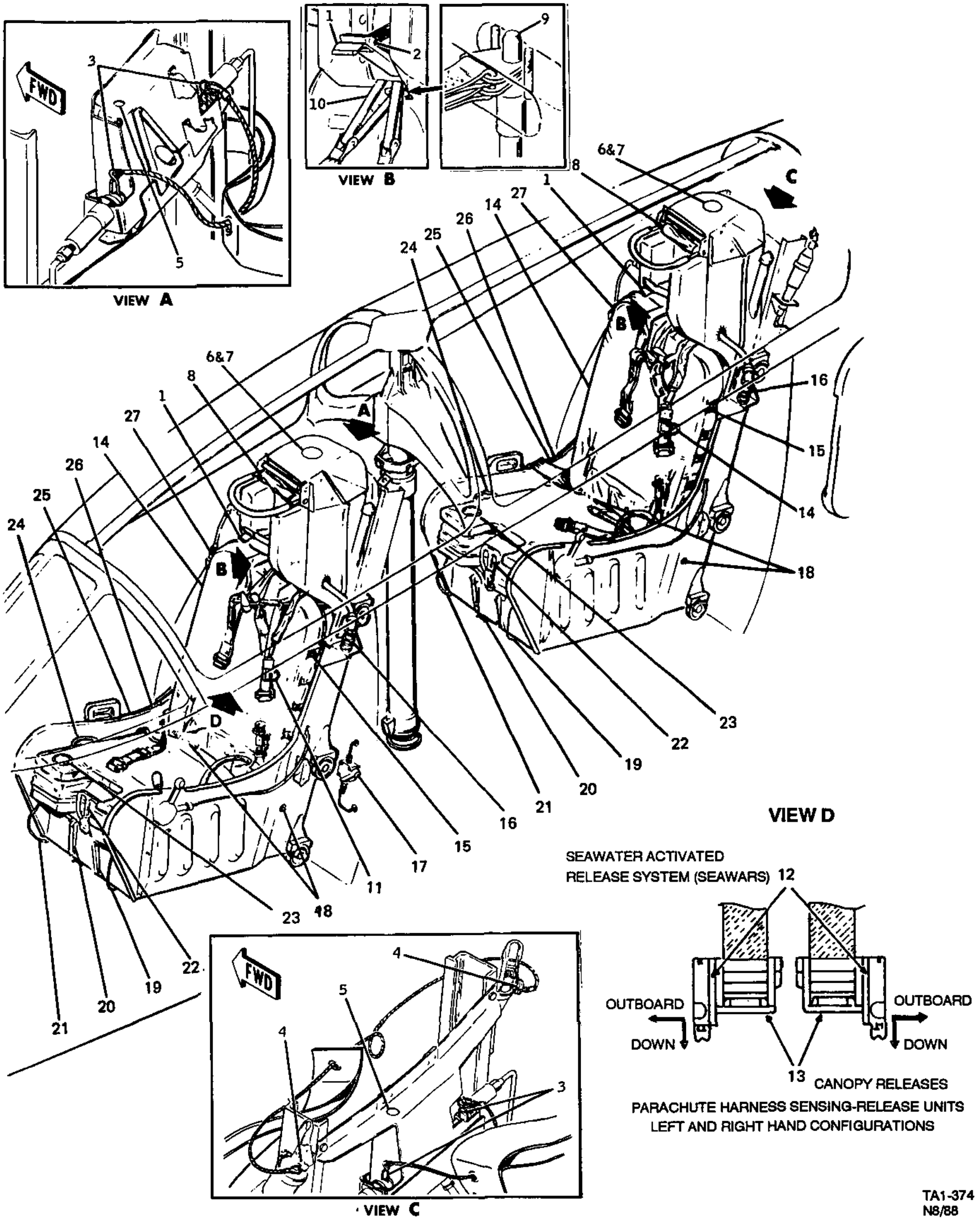


Figure 8-3. 1-G3 Ejection Seat Preflight

Interior Inspection (After Entering Cockpit)

	FORWARD COCKPIT	AFT COCKPIT	
		DUAL	SOLO
1. Emergency speedbrake knob	NEUTRAL		
2. Suit blower/exposure suit vent	OFF	*	
3. Antiblackout (anti-g) suit, oxygen and radio communications connections	CONNECTED	*	
4. Oxygen switch	ON, CHECK FLOW, THEN OFF	*	OFF
5. AFCS standby switch	OFF		
6. AFCS aileron trim switch	NORM		
7. Radar function selector switch (if installed)	OFF		
8. Manual fuel shutoff control lever	CYCLE/NORMAL (GUARD DOWN)	*	*
9. Smoke abatement switch	OFF		
10. Emergency fuel transfer switch	OFF	*	*
11. Drop tanks switch	OFF	*	*
12. Engine start switch	UP	*	*
13. Fuel control switch	PRIMARY	*	*
14. Rudder trim control switch	NEUTRAL	*	
15. Horizontal stabilizer manual override	NEUTRAL	*	
16. Throttle	OFF		
17. Speedbrake switch	CLOSED	*	
18. Master exterior lights switch	OFF		
19. Throttle friction	OFF		
20. JATO jettison switch	SAFE		
21. Flap handle	UP	*	
22. Spoiler switch	OFF	*	*
23. Nosewheel steering switch	NORM	*	*
24. JATO arming switch	OFF		
25. Catapult handgrip	STOWED	*	*
26. Landing gear handle	DOWN	*	*
27. Emergency landing gear handle	STOWED	*	*
28. Emergency bomb release handle	STOWED	*	*
29. Vertical velocity indicator	0	*	

Figure 8-4. Interior Inspection (After Entering Cockpit) (Sheet 1 of 3)

Interior Inspection (After Entering Cockpit-Continued)

	FORWARD COCKPIT	AFT COCKPIT	
		DUAL	SOLO
30. Altimeter	SET	*	
31. AJB-3 all-attitude indicator pitch trim adjustment knob	SET	*	
32. Airspeed indicator	0, SET	*	
33. Gunsight brightness control	OFF		
34. Accelerometer	PUSH TO RESET	*	
35. APC standby switch	OFF		
36. APC temperature switch	STD		
37. Data link power switch	OFF		
38. Gunsight	SET, LOCK		
39. Standby attitude indicator	UNLOCKED/SET	*	UNLOCK
40. BDHI function selector switch	AS DESIRED	*	
41. Stores emergency jettison select switch	AS DESIRED	*	
42. All armament switches	OFF		
43. Radar altimeter	OFF	*	*
44. Manual flight control handle	STOWED	*	*
45. ICS radio control panel switches	AS DESIRED	*	*
46. Emergency generator release handle	STOWED	*	*
47. Arresting hook handle	UP	*	*
48. Canopy jettison handle	STOWED/PIN REMOVED	*	
49. Fuel transfer bypass switch	NORM		
50. White floodlight control	AS DESIRED	*	OFF
51. Doppler radar function selector switch (TA-4F)	OFF		
52. Navigation computer (TA-4F)	SET UP/OFF		
53. UHF function selector switch	OFF	*	*
54. IFF master switch	OFF		
55. TACAN function selector switch	OFF	*	*
56. Radar function selector switch (if installed)	OFF		
57. Compass control panel	SLAVED, LATITUDE SET		

Figure 8-4. Interior Inspection (After Entering Cockpit) (Sheet 2 of 3)

Interior Inspection (After Entering Cockpit-Continued)

	FORWARD COCKPIT	AFT COCKPIT	
		DUAL	SOLO
58. UHF auxiliary receiver functional selector switch	OFF	*	*
59. Interior light switches	AS DESIRED	*	OFF
60. Spare lamps container	ADEQUATE SUPPLY AND LID CLOSED	*	
61. UHF antenna switch (TA-4F)	UP	*	*
62. TACAN antenna switch	AUTO	*	
63. Rain removal switch	OFF		
64. Anti-icing switch	OFF	*	*
65. Emergency generator bypass switch	NORMAL	*	*
66. Air distribution control lever	AS DESIRED	*	HEAD
67. Temperature control knob	AS DESIRED	*	MEDIUM RANGE
68. Cabin pressurization switch	NORMAL		
69. Air conditioning OFF/ON switches	AS DESIRED		
70. External light switches	AS DESIRED		
71. Anticollision light	ON		

Figure 8-4. Interior Inspection (After Entering Cockpit) (Sheet 3 of 3)

After plane captain signals that GTC is up to speed:

5. Two fingers held vertically – P/C OPEN GTC AIR VALVE.

6. Five-percent rpm, throttle – IGN.

7. Fifteen-percent rpm, throttle – IDLE.

Lightoff should occur within 20 seconds after moving throttle outboard to start ignition cycle and will be indicated by rise in EGT after throttle is moved to IDLE position. Normally engine should be stabilized at IDLE rpm within 45 seconds after P/C opens GTC valve.

8. Forty-five-percent rpm, three fingers held vertically - P/C CLOSE GTC AIR VALVE AND REMOVE STARTER AIR HOSE.

9. Stabilized idle rpm, pilot holds four fingers vertically – P/C SELECTS INTERNAL ELECTRICAL POWER, SECURES POWER UNIT, REMOVES ELECTRICAL CABLE, SECURES ACCESS PANEL.

Note

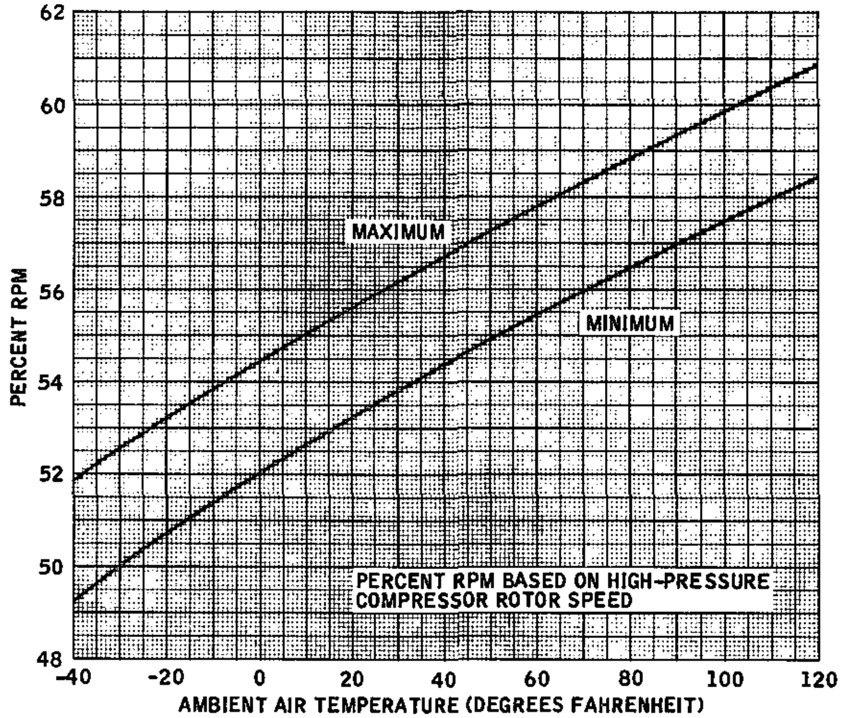
Engine idle check curves (Figure 8-5) apply to J52-P-6 and J52-P-8 engines.

8.1.3.4 After Engine Lightoff. If lightoff is satisfactory and engine speed is stabilized with the throttle at IDLE, using either of the above methods, check the following.

ENGINE IDLE CHECK CURVE - J52-P-6

MODEL: TA-4F/TA-4J

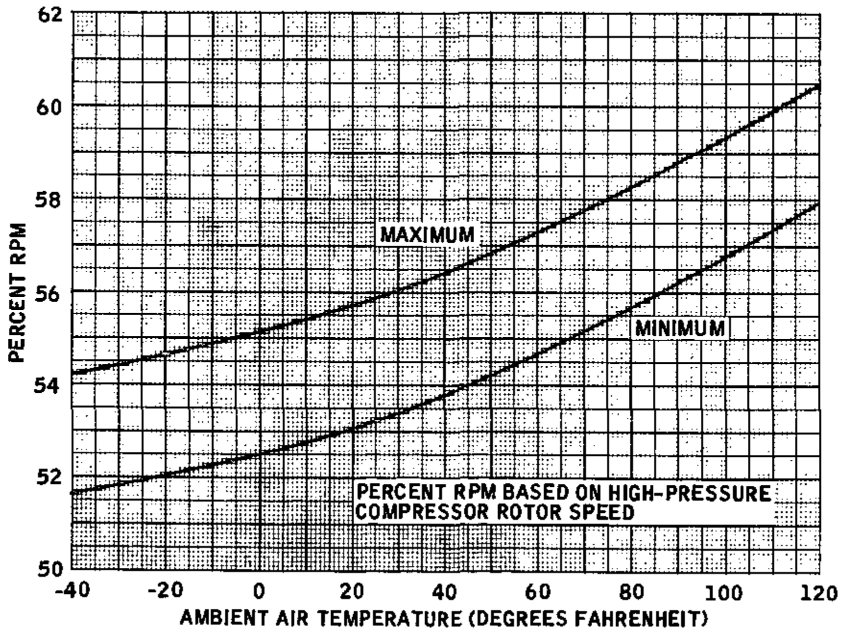
DATA AS OF: 9 September 1966
DATA BASIS: Contractors Trim Curve



ENGINE IDLE CHECK CURVE - J52-P-8

MODEL: TA-4F

DATA AS OF: 9 September 1966
DATA BASIS: Contractors Trim Curve



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TA1-210-B

Figure 8-5. Engine Idle Check Curve

1. RPM – IDLE. (Check for acceptable rpm as defined in Figure 8-5.)

CAUTION

Operation of the engine below minimum acceptable rpm for ambient temperature may result in adverse acceleration characteristics from idle rpm. If deviation is great enough, particularly at cold temperatures, rpm may be low enough in underspeed condition and damage CSD.

Note

Engine idle check curves (Figure 8-5) apply to J52-P-6 and J52-P-8 engines.

2. EGT – 200 °C TO 340 °C.

Note

At IDLE RPM, temperature pointer will normally stabilize at position below maximum indicated. The 340 °C temperature is not a limit but a guide to indicate EGT which, if exceeded, may signify an engine malfunction.

3. Fuel boost – LIGHT OUT.

4. Oil pressure - 30 to 50 PSI.

Note

If oil pressure reads low (below 30 psi) at IDLE RPM, increase rpm slightly to 60 percent. If normal pressure is not indicated at this higher rpm, shut down engine and determine reason for lack of, or low oil pressure indication.

5. Oil quantity indicator/switch – LIGHT OUT.

Note

- Because of oil system drainage or low ambient temperature, the 20 percent oil light may come on at start. If oil pressure is within limits, engine operation for 12 minutes at idle rpm will scavenge, aerate, and heat oil.
- The 80 percent oil light may come on when depressed because of the same conditions. With acceptable oil pressure, engine operation at 75 percent rpm for 8 minutes will completely scavenge, aerate, and heat oil.

6. Aft throttle – CHECK RIGGING.

Note

With front cockpit throttle at IDLE, moderate aft pressure should be applied to rear cockpit throttle. An rpm drop in excess of 2 percent indicates improper throttle rigging and aircraft should not be flown.

8.1.3.5 Chugs and Stalls. If chugging is encountered during an acceleration, there will be a momentary rpm hesitation without an exhaust temperature rise. Engine stall may or may not be accompanied by chugging. If a stall does occur, the rpm will hang up or decrease and the exhaust gas temperature will rise. Should either a chug or a stall occur, shut down the engine and investigate.

8.1.4 Engine Ground Operation. No warmup period is necessary. Always use the minimum rpm deemed necessary to minimize the possibility of damage from foreign objects.

CAUTION

During ground operations with the canopy open, keep loose articles in the cockpit at absolute minimum.

CAUTION

- Do not carry articles in the external shoulder pockets of the flight suit.
- Do not set objects on instrument shroud in rear cockpit.
- Use extreme caution if necessary to pass objects to or from ground crewmen with engine operating. This practice has proved dangerous in causing ingestion of foreign objects into the engine and subsequent damage to blading.
- Do not enter/exit the cockpit from either crew position unless intake screens are installed.

8.1.4.1 Equipment Warmup Time. Warmup times for the listed electronic equipment are as follows:

Item	Warmup
ARC-51A	3 minutes
ARR-69	3 minutes
ARA-50	3 minutes
ARN-52(V)	3 minutes
ARN-118(V)	90 seconds
PX-64	3 minutes
ASN-41(TA-4F)	2 minutes
APN-141	1 minute
APN-194	3 minutes
AJB-3A	90 ±10 seconds
AFCS	90 seconds
APG-53A(TA-4F)	3 minutes
APN-153(V)(TA-4F)	5 minutes
ID-1481/A(TA-4J)	3 minutes
ASW-25A	10 seconds
ARC-159(V5)	None

8.1.5 Poststart Checklist. After engine start with internal electrical power:

1. ICS – CHECK.
2. Headknocker(s) – AS DESIRED.

The pilot in command shall ensure that both headknockers are in the same position at all times when both seats are occupied.

3. Rain removal – CHECK FOR FLOW, THEN OFF.

Note

Power settings above 70 percent may be required to activate system.

4. Canopy – AS DESIRED.
5. Master press-to-test – CHECK LIGHTS (LADDER CAUTION, CANOPY, FUEL, LABS, WHEELS, APC, ANGLE-OF-ATTACK INDEXER, LAWS, IFF, FIRE, OIL QUANTITY AND CIRCUIT, RADAR ALTIMETER AND ARMAMENT).
6. Anti-g suit valve – CHECK OPERATION.

Note

No airflow may indicate bleed air leak.

7. AFCS (if applicable) – STANDBY.
8. Fuel quantity – CHECK INT/EXT READINGS.
9. LOX quantity – NOTE.
10. Radar altimeter – ON/SET.
11. Doppler (TA-4F) – STBY.
12. NAV CMPT (TA-4F) – STBY.
13. UHF function switch – T/R + G.
14. IFF master switch – STBY.
15. Tacan switch Doppler (TA-4F) – REC.

16. AUX REC Doppler (TA-4F) – ADF.

17. Compass controller panel – SET.

18. Seat(s) – CHECK OPERATION/SET.

19. AFCS (if applicable) – RUN CHECKS, THEN OFF.

WARNING

Do not operate any hydraulically operated equipment unless acknowledgement is received from plane captain.

Plane Captain Checks (See Figure 16-1 for signals)

20. Hydraulic pressure – 3,000 PSI.

21. All flight controls – FREE, FULL TRAVEL AND PROPER MOVEMENT.

22. Drop tank pressure – PRESS.

CAUTION

If any jamming or restriction is encountered, no effort should be made to free the controls by force. Instead, a light pressure should be maintained on the restriction while maintenance personnel investigate. Once investigation has begun, controls should only be moved when directed by the maintenance supervisor.

23. Flaps – FULL DOWN.

a. Speedbrakes – OPEN.

b. Hook – DOWN.

c. Spoilers – ARM/CHECK OPERATION.

d. Rudder pedals – MOMENTARILY DEFLECT.

Note

Both crewmembers should hold both hands up while plane captain is checking hydraulic system components.

24. Flaps – UP, THEN SET 1/2.

a. Speedbrakes – CLOSED.

b. Hook – UP.

c. Spoilers – DEARM.

25. Rudder trim – CHECK AND SET AT ZERO.

26. Horizontal stabilizer trim and manual override lever – CHECK OPERATION AND INDICATIONS.

27. Horizontal stabilizer trim – SET.

28. Aileron - STICK CENTERED, AILERONS SYMMETRICAL, TAB FAIRED ±11/32 INCH. CHECK BOTH RIGHT AND LEFT TRIM.

29. Emergency transfer – ON.

30. Fuel transfer light – OFF.

31. Emergency transfer – OFF.

Note

- This emergency transfer check may be done at idle power. In J52-P-6 equipped aircraft, idle power check may allow use of FUEL TRANS caution light (going off and on) as a secondary indication of wing cell pressurization and depressurization.
- Fuel stores on center station should be pressurized before checking emergency transfer system to prevent inadvertent dumping from store vent outlet.

32. Drop tank pressure – OFF.

33. Pins – PLANE CAPTAIN PULL AND STOW.

34. AJB-3 – ERECT, OFF FLAG NOT VISIBLE.

35. Oil quantity – CHECK.

36. Standby gyro – ERECT.

37. Altimeter – CHECKED AND SET.

38. EPR – SET.

Note

Prior to takeoff it is recommended that a final line inspection be made to ensure security of panels, removal of pins, no leaks, and for partial/full manual flight control disconnect.

8.1.5.1 Taxi. When ready to taxi, signal the plane captain to remove chocks. Advance throttle to about 70 percent before releasing the brakes. Release brakes and, when the desired taxi speed is reached, retard throttle to IDLE. Use caution in confined or restricted areas.

Note

- With spoiler switch in ARMED position, spoilers will be open as long as throttle position is below 70 percent setting.
- It is recommended that all taxiing be accomplished with canopy closed to prevent undue stress on hinges. If, however, pilot heat fatigue becomes a problem, taxiing may be done with the canopy on the stops (in the mousetrap position).
- Extended periods of idle operation on deck can cause fuselage cell fuel level to drop below 550 pounds and illuminate the low fuel light. If this occurs prior to takeoff, increase rpm to 70 percent to ensure adequate fuel transfer; when internal fuel returns to normal indication and low fuel light is OUT, continue with flight.

Check nosewheel steering system for proper operation during taxi as follows:

1. With nosewheel steering engaged, check responsiveness of the system left and right to ensure that the nosewheel is driven accurately in conjunction with rudder pedal displacement.

2. While taxiing straight ahead, disengage nosewheel steering and note any tendency to turn. Taxi in this condition for a sufficient distance to determine that the true tendency has been demonstrated. A steady, slight turn is not a major malfunction and is probably indicative of mismatched main strut extension, misalignment of nosewheel center, or a moderate x-wind component.

3. While taxiing straight ahead with nosewheel steering not engaged, attempt to turn aircraft slightly left and right using differential braking. If the aircraft fails to respond or is hard to turn, the hydraulic centering feature in the tail hook handle may have been inadvertently activated.

WARNING

Failure of any of the nosewheel steering checkout procedures may result in loss of directional control during takeoff or landing, and the system should be checked by maintenance personnel prior to flight.

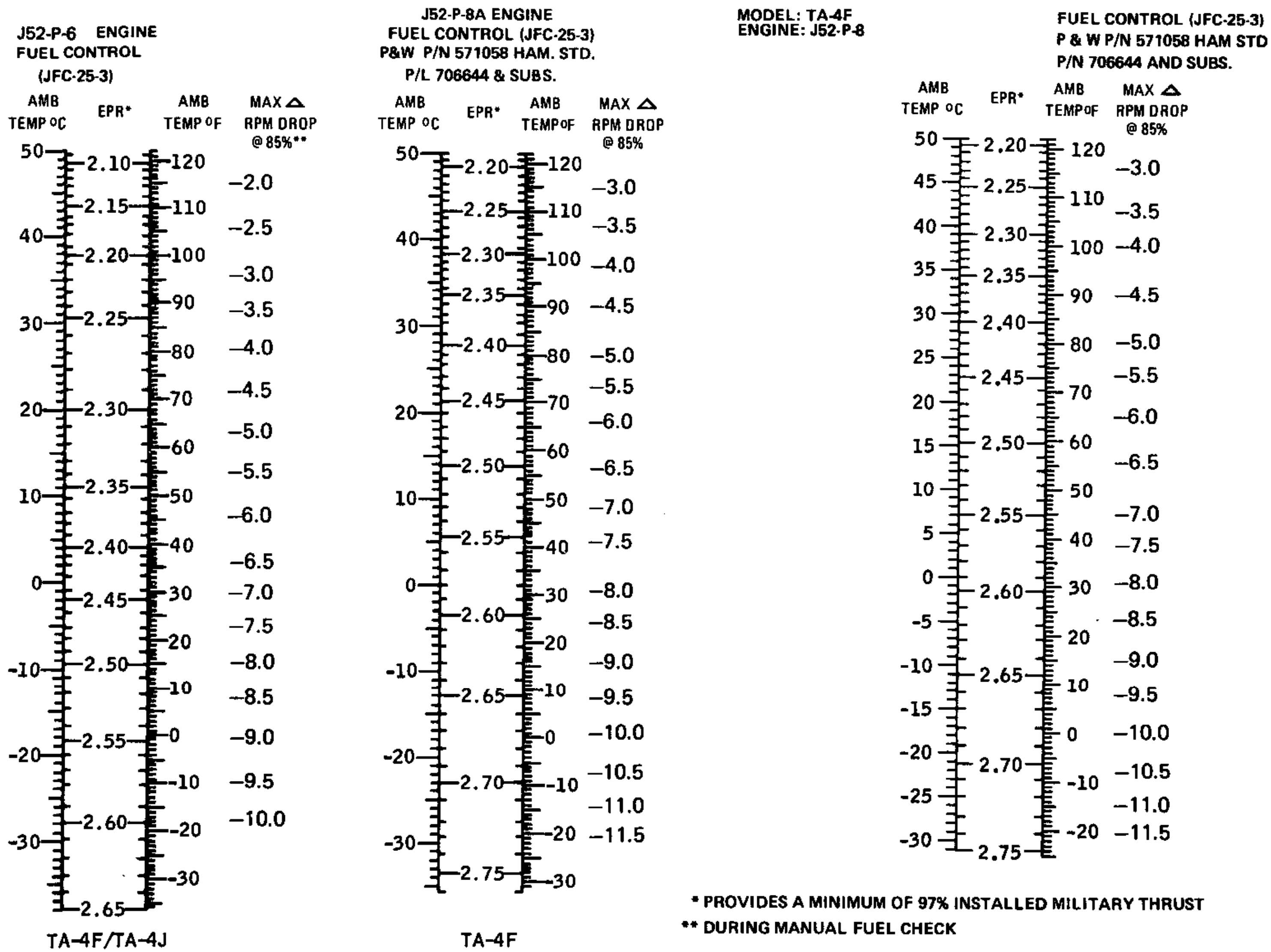
Note

AFC 626 deletes the hookdown nosewheel centering feature.

Maintain directional control using nosewheel steering and brakes, as necessary.

To avoid foreign object damage to engines, pilot shall maintain a minimum taxi interval of 200 feet, or taxi in close formation with wingtip clearance and intakes clear of leader's exhaust. While taxiing, determine that nose strut is not overinflated by observing that nose strut will compress when brakes are applied firmly. Check standby compass swinging free and adequate fluid level; turn indicator deflecting normally. The oxygen mask should be donned while taxiing when the canopy is closed and the pressurization is on.

8.1.6 Pretakeoff Checklist. Referring to the TAKEOFF checklist (Figure 8-7), check the following:



* PROVIDES A MINIMUM OF 97% INSTALLED MILITARY THRUST
** DURING MANUAL FUEL CHECK

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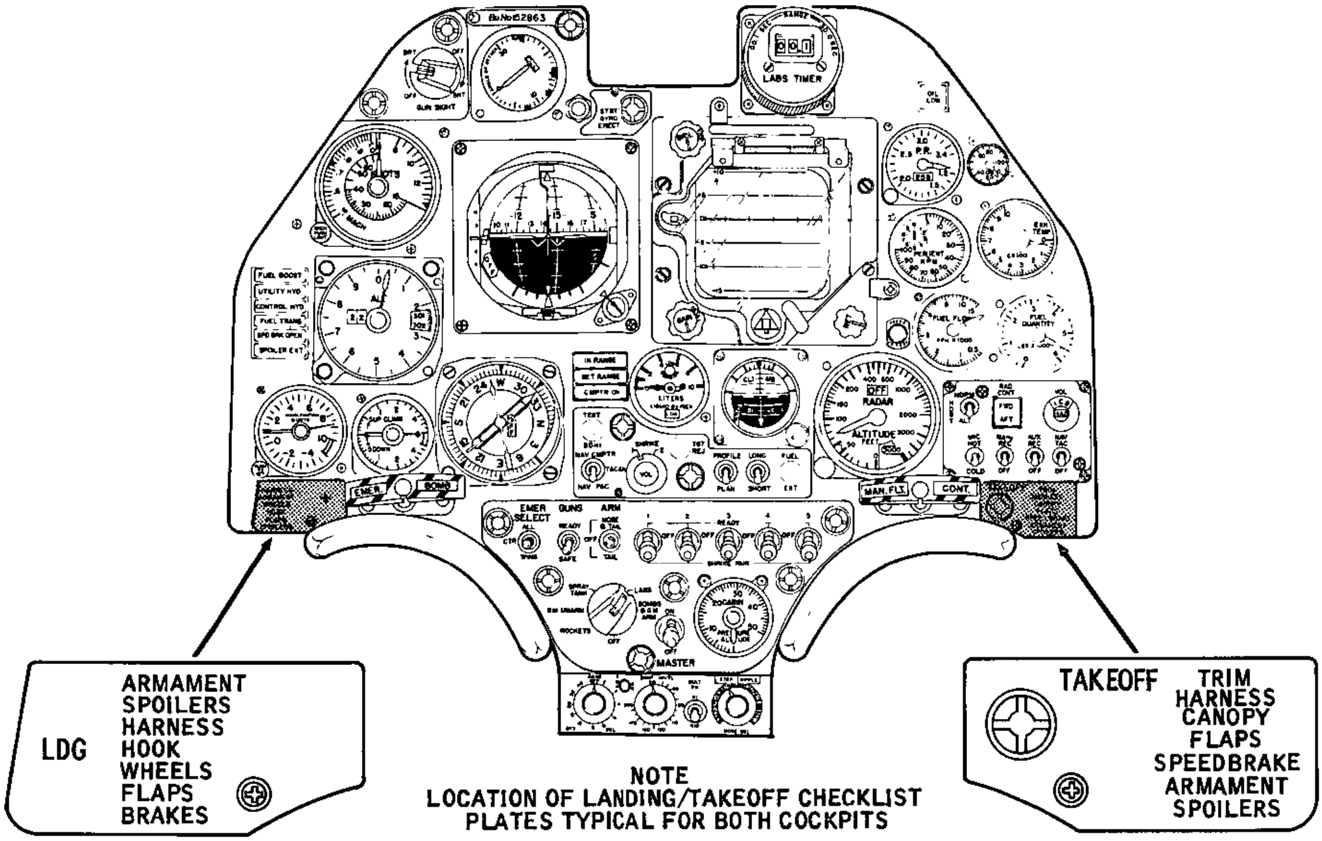
Figure 8-6. Takeoff Pressure Ratio Chart

N8/92



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A-4 AFC 430

TA1-190-A

Figure 8-7. Takeoff and Landing Checklist

1. Trim

a. Rudder – 0°

b. Horizontal stabilizer – 8° UP

Note

A minimum noseup trim setting of 6° is permissible at gross weights less than 18,000 pounds.

c. Aileron – STICK CENTERED, TAB FAIRED ±11/32 INCH.

2. Harness – SHOULDER HARNESS LOCKED.

3. Canopy

a. Prior to closing – ACKNOWLEDGEMENT FORE AND AFT COCKPITS (Aircraft not reworked per A-4 AFC 419) PHYSICALLY AND VISUALLY CHECK LOCK INDICATOR PIN FLUSH.

b. While locking – ENSURE DETENT ACTION IS PRESENT ON CONTROL HANDLE (HANDLE WILL SPRING FORWARD).

c. Control handle load check – PULL HANDLE AFT TO CHECK FOR INCREASE IN HANDLE LOAD, THEN MOVE FULL FWD, ENSURE NORMAL HANDLE LOADS.

d. After closed and locked (Aircraft not reworked per A-4 AFC 419) – PHYSICALLY AND VISUALLY CHECK LOCK INDICATOR PIN PROTRUDES 1/8 INCH (MINIMUM). LATCH HOOKS PROTRUDE INTO STRIKER PLATES.

e. After closed and locked (Aircraft reworked per A-4 AFC 419) – LOCK RIFLE BOLT AND CHECK CANOPY UNLOCK WARNING LIGHT – OFF.

f. After closed (Aircraft reworked per A-4 AFC 471) – RIFLE BOLT IN LOCK DETENT, CANOPY WARNING LIGHT OUT.

g. Check – OXYGEN/ANTI-G HOSES CLEAR OF CANOPY HANDLE.

4. Flaps – SET AT 1/2.

5. Speedbrakes – CLOSED.

6. Armament – ALL SWITCHES OFF. EMERGENCY SELECTOR SWITCH APPROPRIATE SETTING.

7. Spoilers – ARMED (SHORE-BASED OPERATIONS).

Additionally, the following items should be checked *prior to taking the runway:*

8. Ejection selector – VERIFY POSITION (DUAL).

9. AFCS – OFF.

10. Emergency transfer – OFF.

11. Nosewheel steering – NORMAL.

12. Oil quantity – CHECK.

13. Cabin temperature – 12 O'CLOCK.

Note

It is recommended all defrost air be diverted to foot warmer. Direct eyeball diffusers away from face.

14. Anti-ice – AS REQUIRED.

15. Headknocker – UP.

16. Controls – FREE.

17. Engine idle rpm – NOTE.

Before takeoff, complete the following checks:

18. Throttle – 85-PERCENT RPM.

CAUTION

During 85-percent engine runup checks, aircrew noting visible smoke exiting engine manifold bleed outlet shall abort the mission immediately. Visible smoke (as opposed to clear exhaust) may be indicative of engine bearing failure and subsequent engine failure.

19. Fuel control – MANUAL.

20. Fuel control light – ON.

21. Fuel flow/EPR – *FLUCTUATION.*

22. RPM – DROP WITHIN LIMITS.

23. Fuel control – PRIMARY.

24. Fuel control light – OFF.

25. Throttle – REDUCE QUICKLY TO IDLE.

Note

RPM should return to the previously noted idle rpm in the decreasing direction only. If rpm decreases more than 1 percent below previously noted idle rpm and then abruptly increases to idle, or if rpm hangs up while decreasing and then abruptly increases without throttle movement, the fuel control has malfunctioned and shall be rejected. An abrupt increase in rpm may be accompanied by a sharp increase in fuel flow and an audible engine acceleration.

26. Throttle – 85-PERCENT RPM.

27. Throttle – REDUCE QUICKLY TO IDLE.

Note

One occurrence of fuel control hangup is a downing discrepancy and the aircraft shall not be flown.

28. All caution lights - OFF.

29. Engine instruments - NORMAL.

30. ICS - AS REQUIRED.

Upon completion of the pretakeoff checklist and after receipt of clearance from the tower, the aircraft will line up on the runway. Each pilot should check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, no fuel or hydraulic leaks, and ejection seat control safety handle up. Half-flaps should be used for takeoff during normal shore-based operations. Each pilot shall indicate his readiness for takeoff by giving a "thumbs-up" up the line.

See Figure 8-8 for typical takeoff diagram.

Note

The amount of nose gear strut extension has no significant effect on liftoff speed, control forces, or trim position required. Refer to Part XI for additional information on takeoff airspeed and ground roll distance.

As the engine accelerates through 90 percent, release brakes to prevent skidding the tires. Ensure that acceleration is within acceptable limits and that engine accelerates smoothly. When engine stabilizes initially, check for minimum takeoff pressure ratio (EPR), EGT, and rpm.

Note

Wind has a negligible effect on EPR readings.

Use brakes to maintain directional control until rudder becomes effective (about 70 knots).

WARNING

Because of possibility of uncommanded hydraulic inputs, which can result in unexpected swerving and loss of control when the nosewheel steering button is released, nosewheel steering should not be used during takeoff roll unless an emergency dictates otherwise.

On rough runways, nosewheel bounce may be experienced. Apply forward stick as necessary to maintain nosewheel on the deck. Check the predicted line speed at selected distance marker. This checkpoint should be selected so as to allow normal braking technique to stop the aircraft on the runway remaining. At 10 knots prior to predicted takeoff speed, raise the nose to a takeoff attitude and allow aircraft to fly itself off the deck. After comfortably airborne, retract landing gear and apply brakes momentarily to stop main gear tire rotation before wheel enters wheelwell. Raise the flaps at 170 KIAS or above. Place spoiler switch in OFF position after getting comfortably airborne.

For a single takeoff, the centerline of the runway should be used as a directional guide.

During formation takeoff (maximum of two aircraft), the leader should take position on the downwind side of the runway. Lateral separation shall be ensured to minimize danger of collision should a lead aircraft blow a tire or abort. For formation takeoffs with two sections, one section shall be airborne before the next section commences takeoff run. Formation takeoffs are not permitted with dissimilar-type aircraft nor with a crosswind component in excess of 8 knots.

Where individual takeoffs are made with a flight of two or more aircraft, the flight leader shall take position on the downwind side of the runway. Each pilot shall, after lineup on the runway, check adjacent aircraft for correct trim settings, flap position, canopy closed, speedbrakes closed, spoilers closed, no fuel or hydraulic leaks, and ejection seat control safety handle up. Each pilot shall indicate his readiness for takeoff by giving a thumbs-up up the line. The second aircraft shall commence takeoff run not less than 10 seconds behind the first aircraft. The pilot will inform the tower immediately by radio if takeoff is aborted.

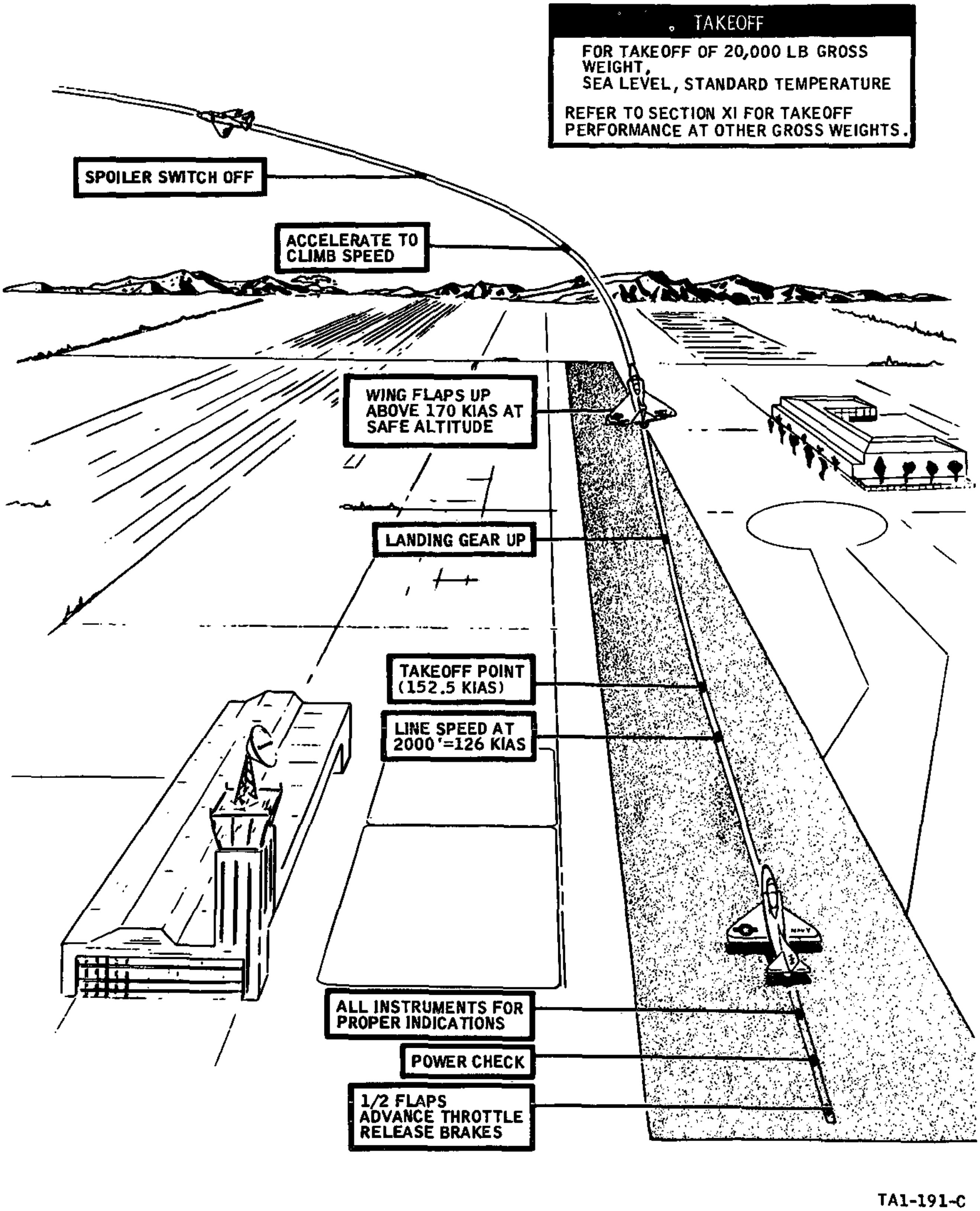

Figure 8-8. Takeoff Diagram

If strong crosswinds exist, take off along upwind side of runway and apply forward stick as necessary to hold nosewheel on deck until computed takeoff speed is reached. Deflect stick into wind as necessary to maintain lateral control. Use brakes to maintain directional control until rudder becomes effective (about 70 KIAS). It is recommended that the spoilers be armed prior to releasing the brakes so they will be immediately available in the event of a takeoff abort.

CAUTION

- Excessive forward stick pressure may cause a blown nose tire during takeoff run.
- With spoilers, takeoff is not recommended when the crosswind component is in excess of 25 knots. Without spoilers, takeoff is not recommended when the crosswind component is in excess of 15 knots.

Note

Almost constant trimming of the horizontal stabilizer will be necessary after takeoff during the period of acceleration to best climbing speed.

Be prepared for the possibility of unusual noise or vibration during the first minute after takeoff, caused by an unbalanced nosewheel tire. An unbalanced nosewheel tire creates a strong vertical vibration of decreasing frequency which can be sensed to emanate from the nose section. *DO NOT* assume that this is the case if unusual noises occur after takeoff. Do analyze engine instruments and feel of aircraft. Be prepared to take action until noise/vibration ceases as indicated above.

8.2 WET RUNWAY TAKEOFF

Takeoffs on wet runways when crosswinds exist must be undertaken with extreme caution. Directional control can be lost at suprisingly low speeds early in the takeoff roll. A-4/TA-4 aircraft tend to turn away from a crosswind when normal tire friction exists because of the large side area forward of the main landing gear about which the aircraft turns. However, as the aircraft accelerates through the speed region where the aerodynamic surfaces become effective (about 60 to 80 KIAS), standing water, runway paint, or rubber deposits may reduce tire friction to a point where the aircraft will "weather-cock" into the wind. If standing water is patchy, the aircraft may alternately turn into the wind, then away from it as tire friction decreases then increases. Directional control difficulties will be aggravated in strong or gusty crosswinds because the spoilers will be closed. Excessive control inputs by the pilot may induce swerving that may further aggravate the condition. Once a drift has begun on a slippery surface, it will be extremely difficult to stop. Runway width may be insufficient to keep the aircraft from going off the side. If takeoff must be accomplished on a wet runway during crosswind conditions, follow the procedures in this section, being careful not to overcorrect for any drifting or skidding.

8.2.1 Minimum Run Takeoff. Minimum distance takeoff technique of nosewheel liftoff and full noseup trim result in only a very minor improvement in takeoff distance (approximately 200 feet at all gross weights tested) and no improvement in 50 foot obstacle clearance distance. If takeoff distance is predicted to be marginal, strong consideration should be given to reducing gross weight as a means of assuring adequate takeoff and 50 foot obstacle distances.

To accomplish a minimum run takeoff, full noseup trim and half-flaps should be employed. Use of full-flaps delays nosewheel liftoff. After brake release, as the aircraft accelerates down the runway, a generous amount of aft stick should be used to effect nosewheel liftoff. Full aft stick deflection may result in an inadvertent trim input because of interference with pilot survival equipment. During aircraft liftoff (about 10 KIAS less than normal), a noseup rotation of the aircraft will occur, which will require an immediate reduction in aft stick pressure to control. As the aircraft accelerates to climbing speed after takeoff, almost constant retrimming of the stabilizer will be necessary. The noseup rotation of the aircraft at takeoff is reduced in abruptness and severity by an increase in gross weight or by use of less aircraft noseup trim. However, if less than full-noseup trim or less than full aft stick is employed, minimum nosewheel liftoff speed will be increased.

8.3 IN FLIGHT

Note

Below 2,500-feet AGL, HOT-MIC shall always be selected unless the HOT-MIC would significantly detract from the safety or mission effectiveness of the flight.

Refer to Part IV.

8.4 BRAKING TECHNIQUES

Brake pedals should be pumped while on final approach to ensure a firm brake pedal after touchdown. As a general technique, a steady pedal pressure should be applied and maintained during landing rollout. Brake pedals should be released and reapplied only as necessary in order to hold firm pedal pressure and position.

CAUTION

The improved capacity of the dual disc brakes makes it possible to lock the wheel brakes at any speed, causing a tire to blow.

Proper braking technique for a minimum distance landing roll requires moderate brake pedal pressure, without skidding tires, as soon as aircraft weight is firmly on the main wheels. Brake pressure must then be increased as the aircraft decelerates because aircraft weight on the tires increases as wing lift decreases, assisting braking effort.

The wing lift spoilers, when extended with full flaps, reduces wing lift by almost 84 percent and minimizes aircraft weight change on the tires as the aircraft decelerates. Brakes may be applied, as soon as the spoilers are extended, with moderately heavy pressure that will be slightly increased as the aircraft speed decreases.

Note

The maximum braking technique will not be used for normal field landings where adequate runway exists for allowing the aircraft to decelerate below 80 KIAS before applying brakes.

8.5 LANDING

The flight shall normally approach the breakup point in echelon, parade formation, at 250 to 300 knots. A 3- to 5-second break will provide an adequate downwind interval. Immediately after the break, extend speedbrakes and retard throttle to 70 percent. Speedbrakes will normally remain extended throughout approach and landing. Speedbrakes increase the stalling speed approximately 1 knot. If the AOA indication of 16-1/2 units does not produce the proper IAS as computed from Figure 27-1, the pilot should check flap position indicator to ensure that the aircraft is in the proper configuration. The pilot should determine which instrument is providing correct information by observing the position of the wing slats. Slats should be approximately one-half extended at approach speed, gear and flaps down.

WARNING

If the AOA indexers are not lighted, do not arm the spoilers until the aircraft is firmly on the runway.

As the aircraft decelerates to 225 knots or less, lower the landing gear and extend full flaps. As the airspeed decreases to 170 knots, readjust power to maintain desired pattern airspeed commensurate with gross weight. Complete the landing checklist (Figure 8-7) and check wheel brakes prior to reaching the 180° position.

1. Armament - ALL SWITCHES OFF/SAFE.
2. Spoilers - ARMED (ashore)/OFF (shipboard).
3. Harness - LOCKED.
4. Hook - AS REQUIRED.
5. Wheels - DOWN.
6. Flaps - FULL DOWN.
7. Brakes - CHECK FIRM/SPEEDBRAKES OUT.
8. Taxi light - AS REQUIRED.

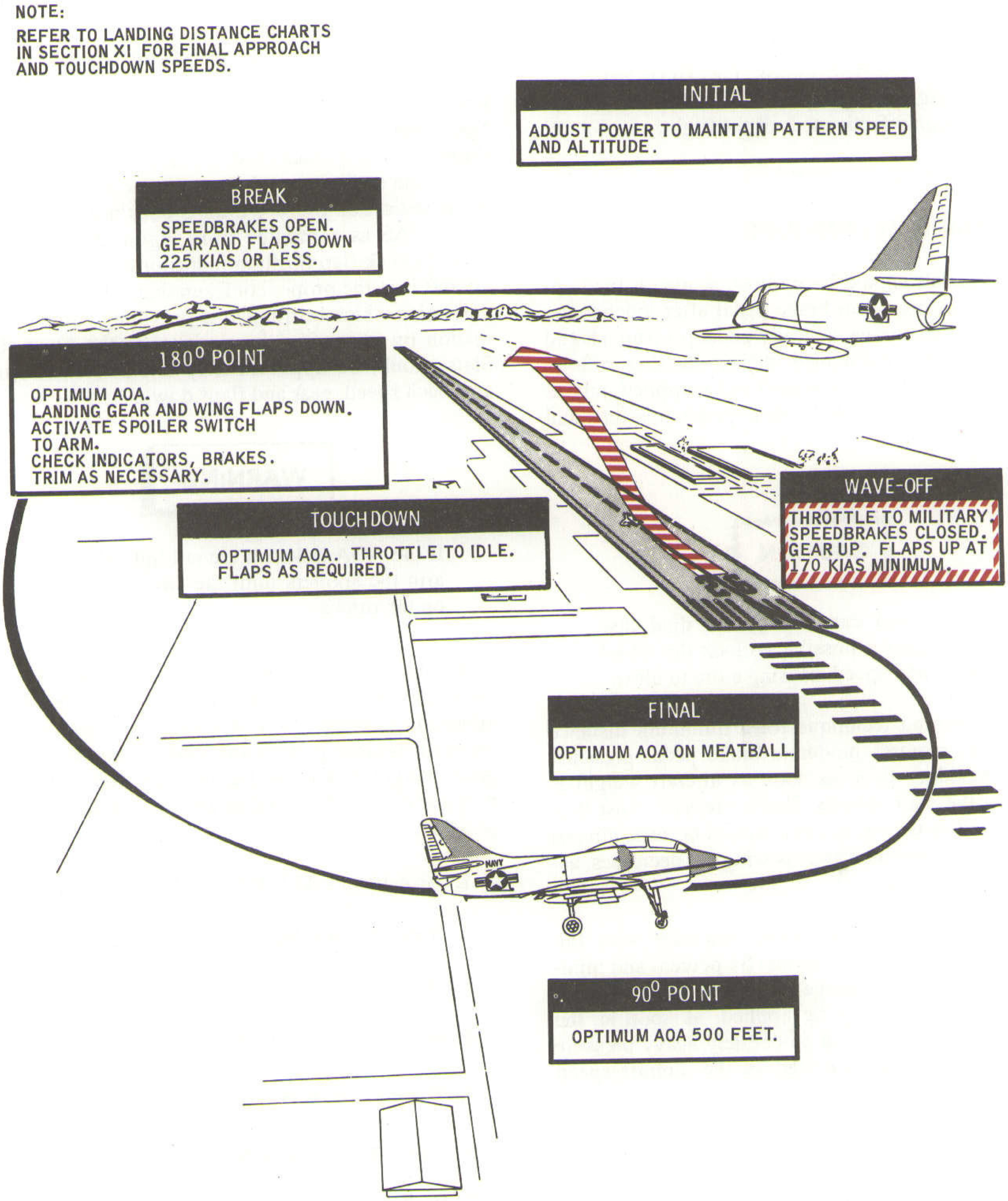

Figure 8-9. Landing and Waveoff Patterns

The Landing Checklist shall be completed prior to landing.

Cross-check airspeed with AOA indexer indication. At a gross weight of 14,000 pounds, recommended approach speed is 125 KIAS at the abeam position (Figure 8-9). Optimum AOA indication is 16-1/2 units.

Note

For each 1,000-pound increase over 14,000 pounds, optimum approach speed (determined by the AOA indexer) increases approximately 5 knots.

If a discrepancy between indexer and airspeed exists, recheck landing configuration and gross weight, and approach at recommended airspeed. Report error in AOA calibration.

Begin the turn into the base leg at a point slightly downwind of the landing end of the runway in order to have adequate straightaway for corrections on final. Optimum angle-of-attack approaches to touchdown will be made. Where a mirror is available, its use is recommended. Attempt to control meatball, lineup, and angle-of-attack/airspeed as precisely as for a carrier approach in order to maintain proficiency in this technique.

Upon touchdown, the following technique is recommended:

1. Power to idle (spoilers open).

2. Flaps as required by landing conditions.

3. After touchdown, apply full-forward stick deflected into the wind as necessary to maintain a wings level attitude. Apply rudder as required to maintain directional control.

4. Use brakes as necessary.

5. As rudders become ineffective, use brakes for directional control; use nosewheel steering only if necessary.

Prior to turning off the runway, aircraft speed must be slowed to about walking speed.

Note

A "roll and go" or go-around may be executed on a standard day with a minimum of 4,000 feet remaining and 80 KIAS. Procedures are the same as for a waveoff. Local conditions may allow a delay in initiation but must be approached with caution.

8.5.1 Crosswind. Crosswind landings are not recommended with a 90° crosswind component in excess of 25 knots. During the approach, maintain wing down into the wind and opposite rudder as required to maintain lineup. At touchdown, the aircraft alignment should be straight down the runway with no drift. After touchdown, under crosswind components of 25 knots or less, the aircraft can be easily controlled directionally by applying aileron into the wind and using wheelbrakes as required. Nosewheel steering may be used when rudder becomes ineffective. If the upwind wing is allowed to rise, the nose of the aircraft will tend to track toward the downwind side rather than weather-cocking into the wind as is normally expected. If strong crosswinds exist, land on the upwind side of the runway.

CAUTION

Maximum recommended crosswind component is 15 knots at 90° when spoilers are unavailable (loss of utility hydraulic pressure, on emergency generator power, etc).

The following procedure is recommended immediately after touchdown:

1. Reduce power to IDLE.

2. Maintain stick deflection into the wind as required and allow nose of aircraft to fall through.

When nosewheel is on deck, apply full-forward stick deflected into the wind as required to maintain a wings level attitude.

3. Raise the flaps to further reduce wing lift.

4. Extend speed brakes, if not already extended, to shorten landing roll.

5. Use wheelbrakes as necessary, but do not skid the tires.

6. Below 60 knots, nosewheel steering may be used for directional control.

Note

Ensure that rudder is centered prior to engagement of nosewheel steering.

During a crosswind landing with the power boost disconnected, increased control stick pressures and reduced control sensitivity make the landing extremely hazardous. If the crosswind component exceeds 8 knots, it is recommended that the field arresting gear be used.

CAUTION

At high values of 90° crosswind component (20 to 25 knots), wind gusts become more prevalent. Pay close attention to lateral control, particularly when landing with asymmetric store loadings.

Note

With any asymmetrical load, the maximum permissible crosswind component under the loaded or heavy wing is 15 knots without spoilers and 25 knots with spoilers open.

8.5.2 Minimum Distance. To accomplish a minimum rollout distance landing, the following procedure is recommended:

1. Maintain optimum angle-of-attack during approach.

2. Upon touchdown, let the nose fall through, and use full forward stick.

3. Leave the flaps fully extended unless there is excessive crosswind.

4. Apply moderately heavy braking immediately after the nosewheel is on the runway.

5. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

6. If circumstances dictate, the landing roll may be further reduced by shutting down the engine at approximately 80 KIAS.

Note

Spoilers will close at engine shutdown.

8.5.2.1 Landing on a Wet Runway/Hydroplaning. The following procedures should be used when landing on a wet runway:

1. Use of short field arresting gear should be considered, if available.

2. Land on longest available runway that is acceptable to aircraft crosswind and arresting gear limitations.

3. Land no faster than optimum approach speed. Dump/burn down as much as practicable to reduce optimum approach speed and minimize stopping distance.

4. Land on end of runway utilizing FCLP type landing. Do not flare.

5. Deploy spoilers upon touchdown and use rudder as necessary to track straight down runway until below rudder effectiveness speed, at which time brakes and nosewheel steering may be used.

Note

Nosewheel steering must be used judiciously to prevent nosewheel skidding.

6. Because of the decreased friction-coefficient, braking technique must be modified to prevent locking the wheels, which further decreases braking effectiveness. Apply light braking. If a skid is felt, the pilot must release the brakes and resume light braking when the track straightens out.

7. If abort gear is not available and there is doubt that the aircraft can be stopped on the runway, either:

   a. Waveoff if adequate runway remains, or,

   b. Secure the engine as airspeed decreases below 80 KIAS, with the aircraft under control.

8. Be prepared to drop the hook and take the abort gear, if necessary.

WARNING

In the event of a hookskip during a short field arrestment, consideration should be given to getting airborne for aircraft without AFC 626 incorporated. With the hook down, the nosewheel is electrically and hydraulically centered and will not caster freely. This may require excessive control inputs to correct for possible alignment drifts inherent in the system. This situation may also develop if hook is lowered too soon prior to mid/long field abort gear.

8.5.2.2 Landing on an Ice-Covered Runway. If it is not feasible to divert to a field with better landing conditions, use the following techniques:

1. Make a short field arrestment if possible.

If unable to make a short field arrestment:

2. Land no faster than optimum approach speed. Burn/dump fuel to reduce optimum approach speed and minimize stopping distance.

3. Touch down so as to utilize all available runway.

4. Use rudder as necessary to track straight down the runway until below rudder effectiveness speed, at which time nosewheel steering may be used.

Note

Nosewheel steering must be used judiciously to prevent the nosewheel from skidding. In severe ice conditions, the nosewheel steering may not be effective.

5. Because of the decreased friction coefficient, braking technique must be modified to prevent wheel locking, which further decreases braking effectiveness. Apply light braking evenly and cautiously. If a skid is felt, release the brakes and resume light braking when the track straightens out.

6. If abort gear is not available and there is any doubt as to being able to stop on the runway, secure the engine as the airspeed decreases below 80 KIAS if the aircraft is under control directionally. If directional control problems exist and adequate runway remains – waveoff.

7. Be prepared to drop the hook and use the abort gear if airspeed is not down to a safe taxi speed prior to reaching the abort gear.

WARNING

In the event of a hookskip during a short field arrestment, consideration should be given to getting airborne for aircraft without AFC 626 incorporated. With the hook down, the nosewheel is electrically and hydraulically centered and will not caster freely. This may require excessive control inputs to correct for possible alignment drifts inherent in the system. This situation may also develop if hook is lowered too soon prior to mid/long field abort gear.

Note

If more than one aircraft is in the flight, maintain adequate fuel reserve for the runway to be cleared and abort gear rerigged in case the preceding aircraft had to shutdown or use the abort gear.

The above procedures may be modified as necessary to allow for conditions of less severity than a completely ice-covered runway.

8.5.3 Securing Engine. The following steps will be performed prior to shutdown:

1. Flaps - AS REQUIRED.
2. Speedbrakes - IN.
3. Spoilers - CLOSED.
4. Horizontal stabilizer trim - AS REQUIRED.
5. DROP TANKS switch - OFF.
6. Radios and all electrical equipment - OFF.
7. Gear pins, ordnance pins, and chocks - IN PLACE.
8. Headknockers - DOWN.
9. Check oil level by depressing OIL LOW indicator/switch if installed. If light comes on, oil level is below 80 percent and must be serviced.

Note

For engine cooling purposes, whenever the engine has been operated above approximately 85 percent for a period exceeding 1 minute, the engine should be operated at idle for a period of at least 3 minutes just prior to shutdown.

10. Clear air conditioning system of condensation after each flight by turning the temperature control to full hot and depressing the anti-g suit valve until warm air is expelled.

11. INT/EXT - EXT (plane captain).

Note

With A-4 AFC 338 over/underfrequency protector installed, step 11 need not be performed.

12. With engine stabilized at IDLE, throttle - OFF.

13. Oxygen - OFF.

14. Canopy - OPEN.

CAUTION

Do not commence opening canopy (ambient cockpit temperature permitting) until engine is below 40-percent rpm. Above 40 percent, loose equipment lost inadvertently from the cockpit area will likely be ingested by the engine.

15. Canopy jettison initiator/headknocker safety pins - INSTALLED.

16. Boarding ladder when engine rpm is less than 10 percent – IN PLACE.

8.6 FIELD CARRIER LANDING PRACTICE

8.6.1 Pattern-Entry Procedure

8.6.1.1 Individual Entry. Call the tower for entry to the FCLP pattern. Request 800-foot break altitude. Otherwise, follow the normal field entry procedures into the break. When cleared to break and the proper interval of the aircraft downwind is assured, roll into a 45° banked turn.

Reduce power to 70 percent and extend speedbrakes. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not be desireable at high gross weights (in excess of 13,000 pounds) when configured with high drag stores; i.e., buddy store, MBRs, etc., because of the high thrust required during the approach. At 225 knots, lower gear and full flaps. Adjust angle of bank to provide correct distance abeam (1-1/4 miles). Descend to 600 AGL on the downwind leg. Pilots shall crosscheck airspeed against angle-of-attack indexer to ensure calibration of indexer prior to turning off the 180° position.

8.6.1.2 Formation Entry. The leader of the formation will enter the break as described above for single-plane entry. When cleared to break, the leader will give the breakup signal and execute a break by rolling into a 45° banked turn. The remaining aircraft in the formation will take a 10-second break interval.

8.6.2 Pattern

8.6.2.1 Downwind. Maintain 600 feet above the terrain at a comfortable airspeed, but no faster than 150 knots. Complete landing checklist.

8.6.2.2 180° Position. Altitude should be 600 feet above the terrain. Plan to lose sufficient airspeed on the downwind leg to arrive at the 180° position at the optimum angle-of-attack or approach speed. The approach airspeed will vary with wind conditions, but 1-1/4 miles abeam is a normal position. The turn from the 180° position will be delayed so as to intercept the glide slope, wings level at 350- to 375-feet AGL.

8.6.2.3 90° Position. Altitude should be 450- to 500-feet AGL, with the aircraft at optimum angle-of-attack/airspeed.

8.6.2.4 45° Position. Altitude should be 375- to 400-feet AGL and the pilot will begin his transition to the "meatball."

8.6.2.5 Final. When the meatball appears in the center of the mirror, it will be necessary to reduce power slightly and ease the nose over, maintaining optimum angle-of-attack/airspeed. Proper glide slope and approach speed are maintained by keeping the meatball centered by coordinated adjustments of power for altitude corrections, and of attitude for airspeed corrections.

Once the meatball is sighted, the approach should be monitored by cross-checking MEATBALL, LINEUP, ANGLE-OF-ATTACK INEXER/ AIRSPEED. Make necessary corrections immediately but smoothly.

8.6.2.6 Landing. Keep the aircraft on the glide slope and centerline. Keep the meatball centered until touchdown. Do not flare. Upon touchdown, add full power and retract speedbrakes immediately. Climb straight ahead until reaching at least 300 feet and 150 knots. Turn downwind when the aircraft ahead is approximately in the 10 o'clock position on the downwind leg. Do not exceed 150 knots in the pattern. About 30° angle of bank turning downwind should establish the correct distance abeam. Extend speedbrakes on the downwind leg prior to reaching the 180° position.

8.6.2.7 Waveoff. To execute a waveoff, immediately add full power, retract speedbrakes, and transition to a climbing attitude to prevent further loss of altitude. Make all waveoffs directly down the runway, until at least 300 feet of altitude and 150 knots are attained.

8.7 NIGHT FLYING

8.7.1 Flight Procedures. See Part IV.

8.8 NIGHT LIGHTING DOCTRINE FOR SHORE-BASED OPERATIONS

8.8.1 Line Area. Prior to start, turn wing and tail lights to STDY/DIM, anticollision light ON, all others OFF. This is the minimum lighting condition that should be used whenever the engine is running. Turn the master exterior lights switch ON, so that when the engine starts the exterior lights will come on. Perform customary poststart checks, including exterior lights check. Signal the plane captain when ready to taxi by flashing the exterior lights. Taxi in the line area with anticollision lights ON and remaining navigational lights DIM.

8.8.2 Taxiing. Once clear of the line area, turn lights to BRT/STDY, except when the use of such lights adversely affects ground operations. The taxi light should be utilized whenever the field lighting is insufficient for safe ground operation. Discretion is required, however, since night vision may be impaired.

WARNING

Utilization of the taxi light while airborne may destroy night vision and cause disorientation.

8.8.3 Takeoff. For single-plane takeoff, all lights will normally be BRT/STDY with anticollision light on, unless otherwise specified in local operating regulations. For a section takeoff, the leader will turn his lights DIM/STDY when in position on the runway, while the wingman will have his lights on BRT/STDY. After turnup to 90 percent, the wingman will indicate his readiness to go by turning on his anticollision light. The leader will signal "Brake release and adding power" by blinking his exterior lights.

8.8.3.1 Operating Clear of Traffic Pattern. For single-aircraft flights, once clear of the pattern, lights will be BRT/STDY with anticollision lights on.

When joining in formation, the following procedures will be utilized: As each pilot calls ABOARD (when he is in such a position that dimming the lights of the aircraft ahead will not affect his rendezvous), the pilot ahead will turn his fuselage and anticollision lights OFF and other lights DIM/STDY (fuselage light intensity as briefed or as desired by wingman). Normal lighting for aircraft in formation other than the last aircraft will be wing and tail DIM and all other lights OFF. As each aircraft breaks for rendezvous practice, the pilot will turn all lights to BRT/STDY and anticollision light on.

For night section penetrations, the leader will have fuselage and anticollision lights OFF and remaining lights on DIM/STDY. The wingman will leave all lights BRT/STDY and anticollision lights ON, if a VFR letdown is to be made. However, at any time that instrument conditions will be encountered, the wingman will turn all lights to BRT/STDY and anticollision lights OFF prior to entry into the clouds.

8.8.3.2 Landing Pattern. When returning to the base for normal breakup and landing, the lights will be at DIM/STDY, except the last aircraft will be at BRT/STDY with anticollision light on. The break will be signaled by each pilot blinking the exterior lights, just before break. Normally a 5- to 7-second interval will be used. All lights will be turned to BRT/STDY and anticollision light on, when well clear of the formation. Lights remain on BRT/STDY and anticollision on, for as long as aircraft remain in traffic pattern or unless otherwise directed by the tower or LSO. Single aircraft entering the break will have lights on BRT/STDY and anticollision lights on.

8.9 SPECIAL PROCEDURES

8.9.1 Tacan Failure

8.9.1.1 Loss of Bearing. When bearing information is lost, any of the following may be used (listed in order of preference):

1. Select alternate antenna position.

2. ARA-50 homing feature.

3. UHF-DF steer.

4. Mileage indication may be used to find the station as follows:

   a. Identify the station.

   b. Turn as necessary to stop mileage and establish an arc from the station.

   c. Note the RMI heading at the wing tip which is thought to be in the direction of the station.

   d. Turn left or right toward the noted heading.

   e. If mileage increases, turn to the reciprocal heading. Otherwise, continue inbound to half the initial distance and repeat the previous three steps until the DME reading is 20 miles or less. Then continue inbound on the predetermined heading. Observe the station passage and range when the distance begins to increase.

5. For TA-4J with ID-249/ARN course indicator – With BDHI or No. 2 pointer failure, the ID-249 may remain operative and may be used for orientation or navigation.

8.9.1.2 Loss of DME

1. Select alternate antenna position.

2. To determine the range, turn 30° off the inbound heading to the station until a bearing change of 10° from the original bearing is accomplished. Note the time required. Turn to place the station on the nose again. Time to the station is approximately three times that required to change the bearing 10°.

8.9.1.3 Ground Station Interference. This is recognized by an erroneous lock on by the No. 2 pointer, by erroneous mileage, and by garbled identification. Use DR until free of interference from the undesired station or select other means of navigating.

8.9.1.4 Other Tacan Malfunctions. Tube failure of improper adjustment may cause a 40° error in lock on in either direction from the correct bearing. ID-663 malfunctioning may cause errors in lock on in multiples of 40° in either direction from the correct bearing. Detection of these discrepancies may be accomplished by observing the rapid drift of the No. 2 pointer 40° from its previously stabilized position or by observing that the rate of closure on the DME is less than normal with the No. 2 pointer on the nose of the aircraft.

1. Change channels so as to unlock the No. 2 pointer, then return to the proper channel in an attempt to get a proper lock on.

2. Take a heading 40° more or less than indicated by the No. 2 pointer and fly to the station, observing DME closure rate.

3. Use ARA-50, ARR-69, or UHF-DF facility, if available.

8.9.2 Compass System Failure. If the compass system will not remain in SYNC during the slaved operation, switch to FREE DG and set correct north or south latitude in on the compass controller. Set heading to match the standby magnetic compass. If the compass card fails or is unreadable because of spinning, use the standby compass. Note the magnetic deviation on the deviation card when using the standby compass as deviation errors of up to 10° are possible.

8.9.3 Landing Emergencies

8.9.3.1 No-Radio Pattern Entry and Landing (VFR)

8.9.3.1.1 Day. Determine the duty runway by observing traffic or the tetrahedron. Enter the break, maintaining a vigilant lookout for other aircraft. Rock the wings slowly (about 20° bank) until over midfield. Make a standard break to the downwind. Double-check gear down at the abeam position. During the approach, periodically check the tower for a light signal while intermittently flashing the taxilight. If a red light or no light is received, waveoff (fuel permitting) and enter downwind. Do not raise the landing gear unless departing the pattern. Be alert for aircraft breaking above. Airfields with dual runways should attempt to designate either the left or right side for no-radio landings.

8.9.3.1.2 Section of Aircraft. The no-radio approach may be straight-in or by entry into the break. Aircraft with radio failure will fly on the starboard wing (port wing if the field has a right-hand pattern). If entering the break, the no-radio aircraft will break with the leader. The standard signal for speedbrakes will be given by the leader to slow to 220 KIAS. When airspeed is below 220 KIAS, the standard signal for gear down will be passed and both aircraft will lower gear and flaps. Aircraft will continue into the groove in section. When the leader has the ship/runway in sight and the no-radio aircraft has been cleared to land, the leader will point to the ship/runway and detach the wingman by blowing a kiss and pointing to wingman. The leader will then level off, obtain lateral separation, and parallel the final bearing/runway heading until the wingman is safely on deck. In the event of a waveoff or bolter, the wingman will rejoin the leader and the procedure will be repeated.

8.9.3.1.3 Night. In the event of radio failure with the external lights operative, follow the day procedures.

When complete electrical power is lost at night, the only course of action open to the pilot, short of ejection, is to maintain an extremely vigilant lookout, and observe traffic or the tetrahedron to locate the duty runway. If landing traffic cannot be observed on the runway, to ascertain that the runway is clear, attempt to alert the tower, prior to landing, by making a low pass parallel to the lighted runway, close aboard the tower, jazzing the throttle. Land, if possible, when the pattern is clear of traffic.

8.9.3.2 Night (or IFR). The leader (or aircraft with good radio) obtains marshal (shipboard) or approach clearance (shore-based) and leads the no-radio aircraft to meatball.

See Figure 16-10 for light signals. Aboard ship, hook will be lowered prior to departing marshal. Bolter and waveoff are same as for day.

8.9.3.3 Landing at High Gross Weights. Occasionally, the problem will arise of landing at a gross weight in excess of the recommended maximum, because of emergencies, fuel-transfer problems, etc. Ashore, the problem is simply one of stopping, since the sink-speed at touchdown can be minimized, and the stopping distance may be reduced by increasing braking, securing the engine, and/or using the arresting gear.

A flat approach using optimum AOA will be maintained to avoid high rates of descent and excessive airspeed. Final approach speed is critical and, once the runway is definitely made, power and attitude should be adjusted to touchdown with a minimum rate of descent.

Aboard ship, if it is necessary to make a heavy landing, the most important consideration is to keep the sink-speed to a minimum. If time permits, the mirror should be changed to a 3.5° glide slope in accordance with the recovery bulletins. Diving for the deck would be very bad procedure. The angle-of-attack indexer will show the best approach speed for the weight, and should not be exceeded. If the downwind-leg angle-of-attack check results in a high airspeed, it is best to fly the high airspeed rather than conclude that the angle-of-attack system is in error. There may be fuel in the tanks or in the buddy store, or there may be hung ordnance of which the pilot is not aware. If a gross discrepancy exists, inform the LSO, who can tell by the aircraft attitude and the SPN-12 reading which instrument is correct. Another important point is to land wings-level and on the centerline. A late-lineup correction may result in a collapsed landing gear. Landings in excess of the maximum gross weight recommended in Part I, Chapter 4, or the applicable recovery bulletin, should be made only in an emergency, as the structural limits of the landing gear or arresting hook may be exceeded.

8.9.3.4 Landing–Use of Field Arresting Gear. Many types and modifications of field arresting gear are in service, all of which differ in maximum permissible engaging speed, maximum off-center engagement limit, etc. (Refer to Figure 8-10.)

All field arresting gear possess a pendant and a braking device (i.e., hydraulic brake, rotary drum brake, water squeeze, or heavy chain). Depending primarily on the braking device, the device may be bidirectional or unidirectional.

WARNING

Engagement of unidirectional arresting gear in the wrong direction may cause severe aircraft damage. Engagement of chain drag gear in the wrong direction poses an additional threat to men and *equipment in the area.*

Field arresting gear is classified according to location on the runway.

1. Short field gear – Located 1,500 to 2,500 feet from the approach end.

2. Midfield gear – Located near halfway point of runway. Usually requires prior notification to rig for arrestment in direction desired.

3. Abort gear – Located 1,500 to 2,500 feet short of upwind end of duty runway and usually will be rigged for immediate use.

4. Overrun gear – Located shortly past upwind end of duty runway. Usually will be rigged for immediate use.

5. Jet barriers – At many bases a cable or new barrier is placed in the overrun and usually rigged.

CAUTION

Use of the field jet barrier is not recommended. Compatibility with the A-4/TA-4 has not been determined.

Location and capability of field arresting gear is of paramount importance to the pilot. Capability is delineated in Figure 8-10. Location is contained in the FLIP En Route Supplement and other publications.

WARNING

- The decision to abort should not be delayed because of the known existence of available arresting gear, but shall be based on the nature of the emergency.
- If off center conditions are encountered approaching the arresting gear, do not attempt to regain the runway centerline; engage the arresting gear parallel to the runway centerline.

Upon determination that an arrested landing is to be made, determine the type of arrestment to be made, the aircraft ETA at the field, and any special requirements. Advise the tower of the decisions made as soon as possible to facilitate preparation of the runway and crash crew set up equipment. Use of a radio-equipped LSO/RDO for all fly-in engagements is recommended.

Engagement of field arresting gear should be made at minimum speed practicable, on centerline, paralleling runway centerline. Engagement should be accomplished with feet off the brakes, harness locked, and all three wheels on the ground. Brakes should be applied after the aircraft stops to avoid two blocking the arresting gear at idle power. If the field arresting gear is to be used at night, the pendant should be illuminated and use of the taxi light is recommended.

8.9.3.5 Short Field Arrestments. The short field arrestment provides minimum rollout and minimum directional control problems while retaining waveoff capability if the pendant is missed. Short or midfield gear should be utilized when available.

Plan the approach to touchdown just short of the gear, on centerline at optimum airspeed.

Upon touchdown, maintain approach power until engagement is effected. When the hook is positively engaged, retard throttle to idle, or secure the engine as indicated.

WARNING

In the event of a hookskip during a short field arrestment, consideration should be given to getting airborne for aircraft without AFC 626 incorporated. With the hook down, the nosewheel is electrically and hydraulically centered and will not caster freely. This may require excessive control inputs to correct for possible alignment drifts inherent in the system.

Type of Arresting Gear	Maximum Engaging Speed (Knots)			Maximum Offcenter Engagement (Feet)
	Short Field Landing Gross Weight Up to 14,500 Pounds (d,e)	Long Field Landing Gross Weight 14,600 - 16,000 Pounds (f)	Aborted Takeoff Gross Weight 16,100 - 24,500 Pounds (h)	
E-15 (200-Foot Span)	150(b)	150(a)	144(a)	20
E-15 (300-Foot Span)	176(b)	180(c)	174(a)	40
E-27	159(b)	171(c)	163(c)	20
E-28	160(b)	159(a)	150(a)	40
E-28(i)	155(b)	155(a,b)	146(a)	40
M-21	151(a)	151(a)	144(a)	10
BAK-9	160(c)	160(c)	160(c)	30
BAK-12(k)	160(c)	160(c)	160(c)	50
Dual BAK-12(l)	119(b)	133(a)	133(a)	30

NOTES:
(a) Maximum engaging speed limited by aircraft arresting hook strength.
(b) Maximum engaging speed limited by aircraft limit horizontal drag load factor (mass item limit "g").
(c) Maximum engaging speed limited by arresting gear capacity.
(d) Maximum of 3.0-degree glide slope.
(e) Consult appropriate section for recommended approach speed.
(f) Flared or minimum rate of descent landing.
(g) Offcenter engagement may not exceed 25 percent of the runway span.
(h) Data provided in the aborted takeoff column may be used for emergency high gross weight arrestments.
(i) Only for the E-28 systems at Keflavik, Bermuda, and Wallops Flight Center with 920-foot tapes.
(j) Before making an arrestment, the pilot must check with the air station to confirm his maximum engaging speed because of a possible installation with less than minimum required rated chain length.
(k) Standard BAK-12 limits are based on 150-foot span, 1 inch crossdeck pendant, 40,000-pound weight setting, and 950-foot runout. No information available regarding applicability to other configurations.
(l) Dual BAK-12 limits are based on 225-foot span, 1-1/4-inch crossdeck pendant, 50,000-pound weight setting, and 1,200-foot runout. No information available regarding applicability to other configurations.

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Figure 8-10. Emergency Field Arrestment Data

8.9.3.6 Long Field Arrestments. The long field arrestment is used for stopping the aircraft when the runway remaining is insufficient and when directional control is not a problem. Long field arrestments should always be considered on icy or wet runways, aborted takeoffs, or loss of brakes during landing rollout. Inform the tower as soon as possible that a long field arrestment is to be made.

Lower the hook 1,000 feet prior to the pendant to preclude weakening of the hook point. Engagement should be accomplished on centerline, at minimum airspeed, parallel to runway heading. Shutdown of the engine may be accomplished at 80 knots.

WARNING

Without AFC 626 incorporated, with the hook down, the nosewheel is electrically and hydraulically centered and will not caster freely. This may require excessive control inputs to correct for possible alignment drifts inherent in the system.

8.9.3.7 Aborted Takeoff. When an aircraft takeoff must be aborted, a roll-in engagement of all arresting gear is recommended to prevent overrun. The aircraft is cleared up to maximum takeoff gross weight specified in Figure 8-10. Also, the data provided in the Long Field Landing column may be used for lightweight, aborted takeoff, where applicable.

Note

The taxi light may be of use in locating arresting/abort gear at night.

8.9.3.8 Field Barrier. At many Air Force bases and some USN/USMC fields, there is some form of jet barrier, usually a Davis type. Compatibility of the A-4 aircraft with this type of gear has not been flight tested, but engineering analysis has resulted in the following recommended procedures:

1. Planned use, such as long field arrestment, is recommended only when no other type of arresting gear is available. Do not engage with fuel in drop tanks.

2. Emergency use, such as takeoff abort, would probably be unavoidable because system is normally rigged. However, hook should be lowered to increase probability of arrestment.

8.9.3.9 Carrier Barricade Engagement. The barricade will be used when a normal arrestment is not feasible. Refer to Part I, Chapter 4, for the maximum aircraft gross weight for barricade engagement and the applicable recovery bulletin for maximum allowable engaging speed and emergency mirror/lens settings. Such stores as empty tanks, empty rocket-packs, or other lightweight inert stores will not interfere with barricade engagement; but, if torn loose, they may present a hazard to flight deck personnel. Fly a normal approach: on speed, on meatball, on centerline. Do not dive for the deck or engage the barricade while in flight. Anticipate the loss of the meatball for a short period late in the approach, as the barricade stanchions may obscure the mirror.

Approach light indications will not be available to the LSO with the landing gear retracted nor will indexer indications be available for the pilot.

8.9.4 Flaps–Up Takeoff. Half flaps are recommended for all field takeoffs on the models TA-4F/TA-4J aircraft. However, in the case of flap malfunction or the inadvertent leaving of the flaps in the up position, it is possible to safely complete the takeoff, provided the flaps-up takeoff speed does not exceed the safe tire limit of 175 knots groundspeed.

A flaps-up takeoff may be accomplished by increasing the half-flaps takeoff speed (Figures 21-1 and 30-1) from 7 knots at 18,000 pounds to 9 knots at 24,500 pounds. This increase in takeoff speed results in an increase in ground run distance over that shown in Figures 21-1 and 30-1 of from 200 to 400 feet, respectively.

Caution must be exercised when attempting a flaps-up takeoff in order that the safe tire speed limit of 175 knots groundspeed is not exceeded. This restriction is, in effect, a limit on the maximum weight at which a flaps-up takeoff may be safely completed. This maximum weight is that weight at which the flaps-up takeoff speed is 175 knots groundspeed.

8.9.5 Maximum Braking Procedure. When the nosewheel is firmly on the runway and excessive crosswind does not exist, moderately heavy braking should be applied immediately. Steady braking (no brake pedal pumping) should be maintained throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases. If pedal pressure is lost, pump brake momentarily in an attempt to regain pressure.

If excessive crosswind exists, apply full aileron deflection into the wind concurrent with full forward stick. Apply opposite rudder, as required, to maintain straight tracking down the runway. Braking can then be applied as described above if the wings are level. If the wings are not level, brake pedal pressure on the up-wing side should be reduced to prevent tire blowout. External stores on the aircraft help stabilize the aircraft in crosswind conditions and allow heavier braking than a clean configuration aircraft.

8.10 LOST/DOWNED PLANE PROCEDURES

8.10.1 Lost Plane Procedures. If unable to orient yourself, either using available NAVAIDs or visually, proceed as follows:

8.10.1.1 With Radio

1. Admit being lost.

2. If at low altitude, climb to increase endurance and communications/radar-detection range.

3. Conserve fuel by flying at maximum endurance airspeed until oriented.

4. Squawk EMERGENCY IFF codes.

5. Switch to GUARD channel, 243.0 mc.

6. Broadcast word PAN or MAYDAY three times, as appropriate.

7. Transmit type of aircraft, estimated position, course, speed, altitude, and fuel supply in minutes.

8. State difficulty.

9. State assistance desired or intentions.

10. Transmit for DF steer as requested.

11. Once in contact with radio facility, make broadcast that you are in contact with ________ and ask all others to remain SILENT unless called. Do not shift frequency or ground stations unless necessary.

12. Comply with instructions given.

13. When oriented and decision is made as to destination, use maximum-range airspeed to get there.

8.10.1.2 With Receiver Only

1. Use preceding steps, if applicable.

2. Monitor the GUARD channel and comply with instructions given by responding station.

8.10.1.3 Without Radio. Refer to FLIP planning document.

8.10.2 Downed Plane Procedures

8.10.2.1 Single Aircraft. If the situation permits, prior to ejection, crash landing, or ditching, make every effort to switch IFF codes to EMERGENCY settings and send a MAYDAY message on the GUARD channel. Conditions existing after abandoning the aircraft will dictate whether to remain near the scene of the crash or attempt to find assistance.

AIRCRAFT: TA-4F/J

ARRESTING GEAR RATING	SHORT FIELD LANDING UP TO 14,500 POUNDS				LONG FIELD LANDING UP TO 16,000 POUNDS				ABORTED TAKEOFF 16,100 – 24,500 POUNDS			
	STANDARD CHAIN		HEAVY CHAIN		STANDARD CHAIN		HEAVY CHAIN		STANDARD CHAIN		HEAVY CHAIN	
	E-5 E-5-2	E-5-1 E-5-3	E-5 E-5-2	E-5-1 E-5-3	E-5 E-5-2	E-5-1 E-5-3	E-5 E-5-2	E-5-1 E-5-3	E-5 E-5-2	E-5-1 E-5-3	E-5 E-5-2	E-5-1 E-5-3
COL 1	COL 2	COL 3	COL 4	COL 5	COL 6	COL 7	COL 8	COL 9	COL 10	COL 11	COL 12	COL 13
300-349	80(D)	80(D)	75(D)	75(D)	76(D)	76(D)	71(D)	71(D)	60(D)	60(D)	58(D)	58(D)
350-399	89(D)	89(D)	88(D)	88(D)	85(D)	85(D)	84(D)	84(D)	68(D)	68(D)	68(D)	68(D)
400-449	97(D)	97(D)	102(D)	102(D)	93(D)	93(D)	97(D)	97(D)	75(D)	75(D)	79(D)	79(D)
450-499	106(D)	106(D)	115(D)	115(D)	101(D)	101(D)	110(D)	110(D)	83(D)	83(D)	89(D)	89(D)
500-549	114(D)	114(D)	129(D)	129(D)	109(D)	109(D)	123(D)	123(D)	91(D)	91(D)	100(D)	100(D)
500-599	121(D)	121(D)	143(D)	143(D)	117(D)	117(D)	137(D)	137(D)	98(D)	98(D)	111(D)	111(D)
600-649	129(D)	129(D)	148(B)	148(B)	124(D)	124(D)	148(B)	148(B)	106(D)	106(D)	122(D)	122(D)
650-699	136(D)	136(D)	148(B)	148(B)	132(D)	132(D)	148(B)	148(B)	113(D)	113(D)	134(D)	134(D)
700-749	144(D)	144(D)	148(B)	148(B)	139(D)	139(D)	148(B)	148(B)	120(D)	120(D)	145(D)	145(D)
750-799	149(B)	149(B)	148(B)	148(B)	147(D)	148(B)	148(B)	148(D)	128(D)	128(D)	150(D)	157(D)
800-849	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	135(D)	135(D)	150(D)	163(A)
850-899	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	142(D)	142(D)	150(D)	163(A)
900-949	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	149(D)	149(D)	150(D)	163(A)
950-999	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	150(D)	156(D)	150(D)	163(A)
1000-1049	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	150(D)	163(D)	150(D)	163(A)
1050-1099	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	150(D)	165(D)	150(D)	163(A)
1100	149(B)	149(B)	148(B)	148(B)	149(B)	149(B)	148(B)	148(B)	150(D)	165(D)	150(D)	163(A)

The following notes apply to Figure 3-7.

(A) Maximum engaging speed limited by aircraft arresting-hook strength.

(B) Maximum engaging speed limited by aircraft limit horizontal-drag load factor (mass item limit "G").

(C) Maximum engaging speed limited by aircraft landing gear strength.

(D) Maximum engaging speed limited by arresting gear capacity. This arresting gear capacity is defined as either:

(1) A pendant dynamic tension limit caused by a 150-knot engagement into the E-5 or E-5 Mod 2 Arresting Gear or by a 165-knot engagement into the E-5 Mod 1 of E-5 Mod 3 Arresting Gear.

(2) The maximum energy dissipation capacity of 1,100 feet of rated chain.

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Figure 8-11. Emergency Speed Limits for E-5 Emergency Arresting Gear

CHAPTER 9

Carrier-Based Procedures

9.1 GENERAL

The CV NATOPS Manual and the LSO NATOPS Manual are the governing publications for carrier-landing operations. Pilots are responsible for being familiar with the contents of these manuals prior to commencing carrier operations.

9.2 DAY OPERATIONS

9.2.1 Preflight. Preflight, start, and poststart checks shall be accomplished in accordance with Part III, Chapter 8, with the following additions:

1. Record the expected gross weight of the aircraft for catapult launch in the designated area.

2. Ensure that the tension-bar retainer clip is installed securely and is in good condition.

3. Note the relationship of arresting hook to deck edge. Do not lower hook during poststart checks unless hook point will drop on the flight deck.

9.2.2 Poststart

1. Engines will normally be started 10 to 15 minutes prior to launch, and the customary functional checks will be performed.

2. The canopy shall be fully closed and locked.

3. Place emergency jettison select switch in appropriate position prior to launch.

9.2.3 TAXI

WARNING

Spoilers shall be dearmed during shipboard operations because of potential hazard to flight deck personnel.

1. Taxiing aboard ship is generally similar to that on land, with some variation of power required because of increased wind and turbulence and decreased braking effectiveness because of higher tire pressures. Particular attention should be given to keeping speed under control.

2. While taxiing with appreciable wind over the deck, pilots should avoid attempts to turn large angles to the relative wind or to the jet blast of another aircraft. However, *it is imperative that the* director's signals be followed closely at all times.

3. Under high wind conditions, directional control is sometimes difficult. Primary control for taxiing will be nosewheel steering augmented by brakes. If the nosewheel cocks, add throttle to 70 to 80 percent and use rapid intermittent brake to bounce the nose strut, while moving slowly forward. This should decrease the weight on the nosewheel long enough for it to swivel in the desired direction. If this procedure is not effective, hold brakes, retard throttle to IDLE, and signal for a tillerbar. Normally, under heavy crosswind conditions, a tillerbar and wing walkers should be provided.

WARNING

When the tillerbar is being used, apply both brakes simultaneously with equal pressure. Using brakes singly can injure the tillerbar man. Do not use nosewheel steering while tillerbar is on aircraft.

9.2.4 Catapult Launches. Proper positioning on the catapult is easily accomplished by maintaining a slight amount of excess power and using the brakes to control speed. The pilot must anticipate the initial "hold" immediately after the nosewheel drops over the shuttle, followed by a "come ahead" as the holdback unit is placed on the tension bar. After the nosewheel drops over the shuttle, the pilot must move ahead very slowly to prevent overstressing the tension bar. Upon receipt of the "release brakes" signal from the catapult director, release brakes, and immediately increase power to MILITARY. Observe acceleration time and allow engine to stabilize.

Note

Wind has a negligible effect on EPR readings.

Recheck the attitude gyro, RMI, engine instruments, trim indicators, flap setting, and receive acknowledgement from aft cockpit "Ready to go." Ensure drop tank switch is in pressure position if external fuel carried and ensure emergency wing transfer switch is off. If air refueling store is carried, the ship tank switch must also be off. Ensure a firm grip on the throttle and catapult handgrip, place your head against the headrest, salute, and wait. Normally, the catapult will fire 3 seconds after the catapult officer gives the fire signal.

9.2.4.1 Technique. Prior to launch, select the optimum trim setting for the anticipated endspeed and aircraft loading. The recommended technique is to grasp the stick lightly, allowing it to move aft during the power stroke and return to the trimmed position at shuttle release. The pilot must avoid any large longitudinal control movements as the aircraft becomes airborne, yet be prepared to make minor attitude corrections as necessary and correct any aircraft wing drop that may occur. When safely airborne after the catapult launch, adjust attitude as necessary for climbout; normally, this will be about 12° to 14° noseup on the attitude gyro.

An initial attitude of approximately 12° noseup is recommended. Cross-check angle-of-attack, airspeed, and other appropriate instruments. Do not rely solely upon one instrument. Ensure that a positive rate of climb is obtained. Retract flaps at 170 KIAS minimum.

1. Optimum Trim Settings

   a. Rudder – 0°

   b. Aileron – FAIRED

   c. Horizontal Stabilizer:

      (1) Basic trim with full flaps – 6°

      (2) Basic trim with half flaps – 6°.

Note

- Basic trim setting is based on internal fuel. For full flaps, increase setting by 1.0 unit for each 1,000 pounds less than full internal fuel. With half flaps, increase setting by 0.5 units for each 1,000 pounds less than full internal fuel.
- Basic trim setting is based on 15 knots excess airspeed. Increase setting by 1.0 unit for each 6 knots reduction in excess airspeed. Decrease setting by 1.0 unit for each 6 knots increase in excess airspeed.
- Trim settings are independent of external loading conditions.

2. Trim Settings for Asymmetrical Loadings. Asymmetrical bow catapult launches with up to 5,120 foot-pounds of static moment are permitted. The following trim and control inputs are required at the different wind conditions.

   a. Allowable crosswind – ZERO

   b. Required end airspeed above minimum – 9 KNOTS AND ABOVE

   c. Rudder trim units (away from loaded wing) – 2

   d. Aileron – FAIRED.

Note

Approximately one-fourth lateral stick deflection is required to maintain wings level after leaving the bow.

9.2.4.2 Aircraft or Catapult Malfunction. If, after established at MILITARY POWER, the pilot determines that the aircraft is down, he so indicates to the catapult officer by SHAKING HIS HEAD FROM SIDE TO SIDE. *NEVER* raise the hand into the catapult officer's view to give a thumbs-down signal. It is possible that the catapult officer may construe the signal to be a salute and fire the catapult. When the catapult officer observes the NO-GO signal, he should immediately give a suspend signal. If his response is not immediate, call on land/launch frequency, "Suspend, suspend." Remain ready for the catapult to fire until the catapult officer steps in front of the aircraft and gives the THROTTLE BACK signal. At that time reduce power to idle and comply with further directions.

9.2.5 Landing Pattern. Under VFR conditions, the formation shall approach the breakup position in right echelon, close aboard the carrier on the starboard side, parallel to the base recovery course (BRC) at 800 feet and 250 knots. A minimum straight-in of 3 miles is desired for VFR entry to the break. Aircraft shall be in parade formation with hooks down. Breakup should commence when past the bow and adequate interval on downwind traffic is assured. Normally, a 17-second break interval will establish a 35-second ramp interval. Close adherence to pattern details by all pilots is required for uniform landing intervals. The pattern given in Figure 9-1 is recommended. Each pilot shall have the landing checklist completed, be at optimum AOA/approach speed, and have the wheel brakes checked by the 180° position. Speedbrakes will normally remain out throughout the approach and landing. Use of speedbrakes may not be desirable at high gross weights (in excess of 14,000 pounds) when configured with high drag stores; i.e., buddy store, MERs, etc., because of the high thrust required during the approach.

9.2.6 Waveoff. To execute a waveoff, immediately add full power, retract speedbrakes, and smoothly adjust nose of aircraft to maintain optimum angle of attack. Make all waveoffs straight up the angled deck.

CAUTION

- Rotation of the aircraft to an exaggerated nose high attitude on a waveoff lowers the arresting hook beyond its normal reach and can result in an in-flight engagement. The resulting arrestment can cause damage to the aircraft. Overrotation on a waveoff can place the aircraft on the back side of the power required curve, where sufficient power is not available to stop the descent.
- While advancing the throttle from idle toward military power, any outward pressure may cause an inadvertent throttle hangup in the forward idle detent.

9.2.7 Arrested Landing and Exit From the Landing Area. Upon touchdown, advance the throttle to MILITARY, retract the speedbrakes, and apply full aft stick. After arrestment is assured, retard the throttle to IDLE and raise the hook and flaps. The aircraft should be allowed to roll back a short distance after arrestment to permit the hook to disengage from the pendant. Hold both brakes when signaled by the director, apply power (about 70 percent), and engage nosewheel steering, in anticipation of the come-ahead signal, unless pullback is indicated by the director. If pullback is directed, retard the throttle to IDLE, release brakes, and allow the aircraft to be pulled back until a brake signal is received. Then, apply brakes judiciously to prevent the aircraft from tipping or rocking back. Anticipate the come-ahead signal by adding power to approximately 70 percent.

CAUTION

Cross the foul line and follow the director's signals. The usual wind over the deck will give a substantial crosswind component while taxiing on the flight deck. Wing walkers should be provided to assist in leaving the landing area when there is a severe crosswind or wind over the deck exceeding 40 knots. Be extremely careful in using power and brakes when water, oil, or hydraulic fluid spillage is on the flight deck.

9.2.8 Postlanding Procedures. While the aircraft is taxiing, the canopy should remain closed and the pilot shall keep his helmet and oxygen mask on. Prior to shutdown, he will open the canopy. If the aircraft is towed or pushed, he shall keep speed slow and under control, and, as noise level is normally high, he must remain alert for either hand or whistle signals from aircraft handling personnel. Whenever the plane director is not in sight, STOP: Do not release brakes until the aircraft has at least an initial three-point tiedown. Plane captains shall not install the access ladder until this has been accomplished.

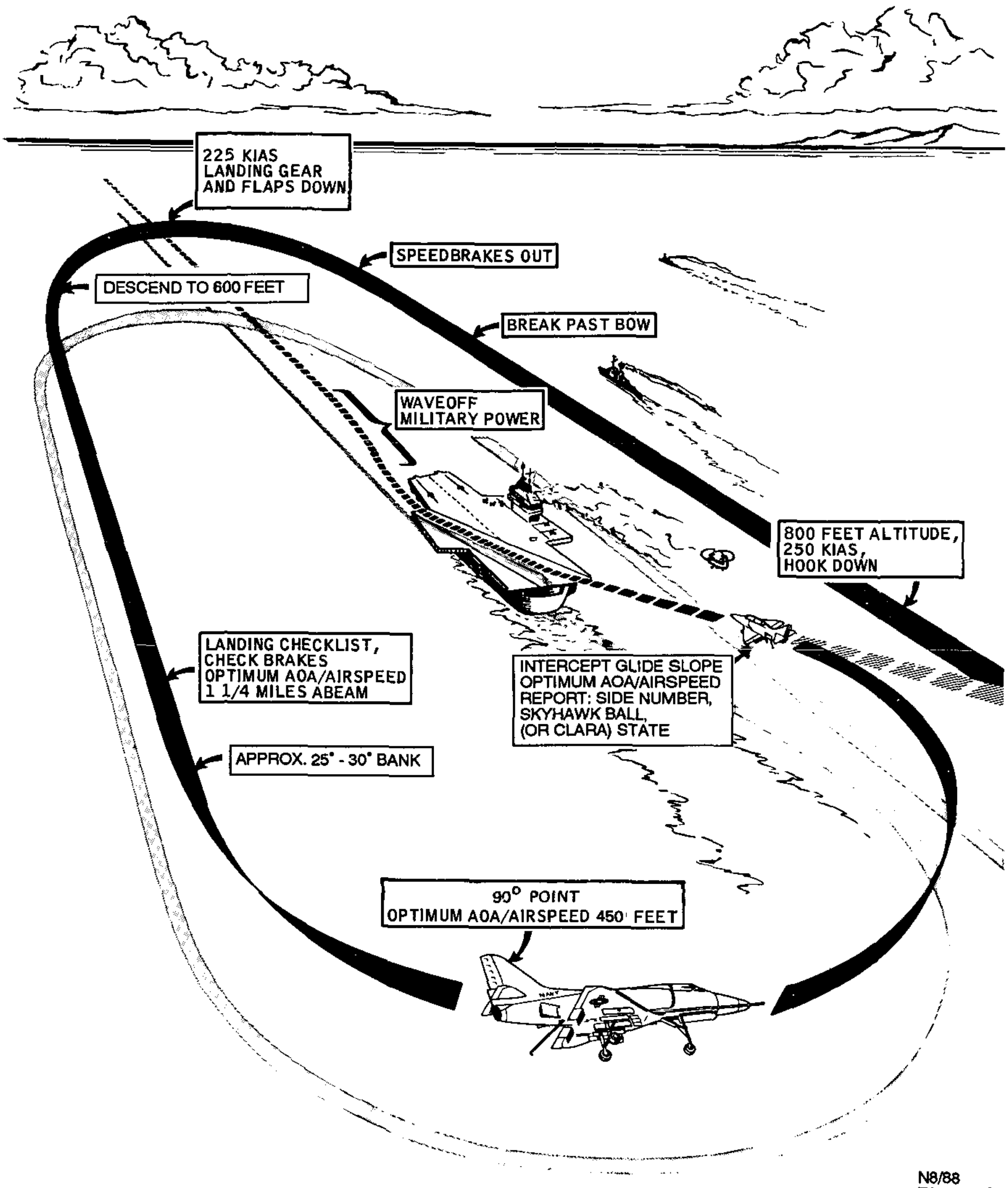

Figure 9-1. Typical Carrier Landing Pattern

9.3 NIGHT OPERATIONS (TA-4F)

9.3.1 Flight Deck

9.3.1.1 Preflight. External preflight will be made using a red-lens flashlight. In addition to normal cockpit preflight, ensure that external light switches are properly positioned for poststart exterior lights check. The master exterior lights switch, anticollision light switch, and the taxilight switch should always be in the OFF position prior to start. Wing and taillights should be set to BRT/STDY position for the poststart checks. Instrument lights and console lights control should be turned on. Direct cockpit emergency floodlights on instrument panel and kneeboard light as desired.

9.3.1.2 Poststart. Adjust cockpit lights intensity to desired level. After normal system checks are completed, perform exterior lights check. Move the master exterior lights switch to ON momentarily. Upon completion of exterior lights check, place master exterior lights switch in the OFF position.

9.3.1.3 Taxi. Slow and careful handling of aircraft by both plane directors and pilots is mandatory. If the pilot has any doubt as to the plane director's signals; *STOP*!

9.3.1.4 Catapult Launches. The difficulty of "getting on" the catapult at night is increased by the fact that it is difficult for the pilot to determine his speed. The pilot must rely upon, and follow closely, the directions of the plane director. As the aircraft approaches the catapult, the plane director should position himself forward and remain stationary to give the pilot a visual reference for controlling taxi speed as the aircraft approaches the shuttle.

Upon receiving the signal from the catapult director, release brakes. Immediately increase power to MILITARY in anticipation of the turnup signal from the launching officer.

Note

> Wind has a negligible effect on EPR readings.

When satisfied that the aircraft is ready for launch, the pilot so signifies by placing the master exterior lights switch to the ON position. The pilot must be prepared to establish a wings level, climbing attitude on instruments. An initial attitude of approximately 12° noseup is recommended. Ensure that a positive rate of climb is obtained. Retract flaps at 170 KIAS or above. During night launches, do not make clearing turns. At 2,500 feet or higher, adjust exterior lights as briefed.

9.3.1.5 Aircraft or Catapult Malfunction. The pilot's NO-GO signal for night catapult launch consists of not turning his exterior lights ON. The pilot should call on land/launch frequency, Suspend, suspend. Maintain MILITARY power until the catapult officer gives the throttle-back signal. *DO NOT* turn exterior lights ON unless completely ready to be launched.

9.3.2 Landing Pattern. Night and instrument recoveries normally will be made using TACAN/CCA approaches in accordance with the CV NATOPS Manual.

9.3.2.1 Arrested Landing and Exit From the Landing Area. The LSO will normally take control when the aircraft is approximately 1 mile from the ramp. The pilot should have exterior lights set in accordance with Air Wing doctrine. Following arrestment, immediately place master exterior lights switch in OFF. Taxi out of the landing area slowly. Do not stare fixedly at the plane director's wands but use them as the center of the scan pattern.

9.4 CARRIER CONTROLLED APPROACH (CCA)

9.4.1 General. The pattern procedures and terms used for carrier-controlled approaches shall be in accordance with the CV NATOPS Manual.

9.4.1.1 Procedures. A CCA approach is similar to a straight-in jet penetration. Lower the hook entering the holding pattern and maintain maximum endurance airspeed. Single aircraft must leave the marshal point at EAT. If the flight consists of two or more aircraft, the flight leader normally should plan to be in holding at the marshal point in time to make a half standard-rate, 180° left turn, breakoff from the flight, and return to the marshal point at his EAT. Subsequent aircraft in the flight break at 30-second intervals. As each pilot reaches the marshal point, he commences his letdown at 250 KIAS, 4,000 FPM rate of descent, speedbrakes OUT, and about 80- to 82-percent rpm. At 5,000 feet (platform), the rate of descent is reduced to 2,000 FPM, although penetration speed is maintained at 250 KIAS to the 10-mile gate. At this point, transition to 150 KIAS by retarding the throttle to 70 percent. Extend speedbrakes and drop wheels and flaps as airspeed drops below 225 KIAS. Retract speedbrakes and adjust power to maintain 150 KIAS. Aircraft shall be in landing configuration prior to reaching the 6-mile gate. Unless otherwise directed, maintain 1,200 feet and optimum approach speed until directed to commence descent at about 2-3/4 miles. Then, extend speedbrakes and maintain optimum AOA/airspeed.

After transition is made to landing configuration, all turns should be standard rate. Do not exceed 30° bank at any time. Do not exceed 15° bank below 600 feet on final approach.

9.4.1.2 Section CCA. A section CCA may be necessary if a failure occurs affecting navigation aids, communications equipment, or certain other aircraft systems. Normally, the aircraft experiencing the difficulty will fly the starboard wing position during the approach. The lead aircraft should fly a slightly faster approach (about 10 knots above optimum AOA/airspeed) to afford the wingman some comfort and latitude in power control. If leading a dissimilar type aircraft, comply with Air Wing doctrine. The section leader will detach the wingman when the meatball is sighted and continue straight ahead, offsetting as necessary to the left to determine if the wingman lands successfully. He shall commence a slow descent to not lower than 300 feet altitude and adjust exterior lights in accordance with Air Wing doctrine to provide the wingman with a visual reference and leader should he bolter or waveoff. The wingman should not detach unless he has the meatball in sight. Necessary visual signals are contained in Figure 16-11.

9.4.1.3 Waveoff Bolter Pattern. Waveoff will be straight up the angled deck, when given close-in. Pilots must bear in mind that during a late waveoff, an in-flight engagement is possible, therefore the aircraft must be lined up with the centerline to reduce the possibility of aircraft damage. In the event of a bolter, apply MILITARY power, retract the speedbrakes, and apply full aft stick to attain the proper takeoff attitude.

After a waveoff or a bolter, establish a positive climb and maintain the approach final bearing. DO NOT CROSS THE BOW while flying upwind. Be alert for other aircraft launching from the catapult or entering the pattern from the break. The aircraft ahead will have priority for the turn downwind. If in doubt, use the radio. A waveoff to the right will be made when overshooting the landing line to the extreme. When waving off to the right, remain well clear of the plane guard helicopter.

9.4.2 Carrier Emergency Signals. See CV NATOPS Manual for emergency signals from carrier to aircraft.

CHAPTER 10

Hot Refueling Procedures

10.1 HOT REFUELING PROCEDURES

The following procedures shall be strictly adhered to by pilots and ground personnel when refueling aircraft with the engine running.

Note

A-4 aircraft will be hot refueled through the probe only.

10.1.1 Prior to Entering the Pits

1. The pilot will secure all electrical and electronic gear not required for refueling operations.

2. The plane captain shall check for hot brakes. If the aircraft has hot brakes, the plane captain shall direct it away from the pits.

3. All ordnance shall be removed or dearmed in accordance with local regulations. This includes practice bombs with smoke charges installed.

4. Fueling personnel shall check the fuel pits for loose objects which could be ingested into engine.

5. The aircraft will be taxied into the fuel pits under the guidance of a qualified plane director.

10.1.2 Prior to Refueling

1. The aircraft will be chocked.

2. The plane captain shall attach grounding wire to aircraft before any other connections are made.

3. The pilot will close and lock the canopy and select RAM air. The radio will be set on ground control or, if aboard ship, other appropriate frequency.

4. Drop tank pressurization switch shall be placed in OFF position.

5. Ensure that FUEL TRANSFER BYPASS switch (A-4 AFC 317) is in the OFF position.

CAUTION

Ensure that fuel dump switch is in OFF position prior to refueling.

6. The work stand will be positioned in front of inflight refueling probe and wheels will be locked.

7. The nozzle operator shall attach nozzle adapter to the probe.

8. The pilot will signal to fuel pit coordinator when he is ready for commencement of fueling by thumbs-up signal in daytime, and by thumbs-up illuminated by flashlight at night.

10.1.3 After Commencement of Refueling

WARNING

The plane captain shall visually check drop tanks upon completion of hot refueling to ensure that tanks are either completely full or completely empty. This procedure applies whether the drop tank fueling switch has been placed in the ON or OFF position during refueling. In all hot refueling operations the pilot shall check his external fuel gauge to ensure the proper fuel load after completion of refueling.

1. Nozzle operator will slowly open valve and check for fuel leaks until the valve is fully open.

2. Immediately upon commencement of fueling, the plane captain will conduct the primary and secondary valve checks in accordance with the Maintenance Instruction Manual, NAVAIR 01-40AVD-2-4.1. If this check is not satisfactory, the refueling operation shall be secured immediately.

3. If the drop tanks are to be filled, either the plane captain will place the DROP TANK FUELING switch in the ON position, or the pilot will place the DROP TANK pressurization switch to the FLIGHT REFUEL position.

Note

When refueling ashore, gravity fueling methods must be used for partial drop tank loads.

4. Appropriately assigned personnel shall monitor vent mast on wing to ensure that it is not obstructed.

WARNING

If pressure cannot be felt coming from the vent mast, the refueling operation shall be secured immediately.

5. The pilot will signal the pit coordinator by a cut signal in the daytime and by flashlight at night when refueling is completed. The pit coordinator will signal the nozzle operator and pit operator. The nozzle operator will close the valve on the nozzle but will not remove the probe adapter until the pit operator has evacuated all fuel from the hose.

Note

The rotating beacon will be used as an emergency fuel cutoff signal at night.

6. The ground wire shall be detached after all other refueling equipment is removed.

7. A qualified plane director will direct the aircraft out of the pits.

CHAPTER 11

Functional Checkflight Procedures

11.1 GENERAL

11.1.1 Checkpilots. The most important single factor in getting good checkflights on the aircraft is to pick experienced, conscientious check pilots. Commanding officers shall designate, in writing, those pilots within their command who are currently eligible to perform this duty.

11.1.2 Checkflights and Forms. Checkflights shall be performed when directed by, and in accordance with, the directions of NAVAIRSYSCOM, Type Commanders, or other appropriate authority. Functional flight check requirements and applicable minimums are described below. Functional checkfight checklists are promulgated separately.

11.2 FUNCTIONAL CHECKFLIGHT REQUIREMENTS

The functional checkflight shall be performed after the completion of the calendar maintenance requirements using the applicable Functional Checkflight Checklist. This section contains a detailed description of the checkflight requirements, sequenced in the order in which they will be performed. Checkflight personnel shall familiarize themselves with these requirements prior to the flight. NATOPS procedures shall apply during the entire checkflight.

11.3 CONDITIONS REQUIRING FUNCTIONAL CHECKFLIGHTS

Checkflights are required under the following conditions (after the necessary ground check and prior to release of the aircraft for operational use):

1. Completion of aircraft rework, aircraft acceptance inspection or annually as required by OPNAVINST 4790 (required checkflight items are prefixed A).

2. Reinstallation of engine or reinstallation of fuel system components (required checkflight items are prefixed B).

Note

When tail section removal for engine change or inspection where flight control surfaces and rigging are not adjusted or otherwise worked on, the requirement for flight control disconnect may be satisfied by maintenance ground check.

3. When fixed flight surfaces have been installed, movable flight control surfaces replaced or removed for major repairs or rigged. When primary control cables, rods, or tubes have been replaced or rigged; or when control system components have been adjusted and where improper adjustment or installation could adversely affect flight characteristics or result in loss of aircraft control. This *profile is a composite profile for a multitude of aircraft* systems. Individual steps may be omitted based on the nature of the maintenance action performed if that individual system is not affected (i.e., a manual flight control hydraulic disconnect is not required for a slat replacement or rudder power pack assembly replacement and vice versa; a slat check is not required for an aileron replacement which requires a manual flight disconnect) (recommended checkflight items are prefixed C).

Note

- The requirement for a checkflight, under circumstances other than those specified in the preceding, is a determination to be made by the Maintenance Officer and will be based on the scope of the work accomplished and its effect on safety or reliability of operation.
- Local commands shall set minimums for check requirements for profiles A through C, using the minimums as set forth in the preceding as a guideline.

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11.4 CHECKFLIGHT PROCEDURES

Note

For preflight, starting and pretaxi procedures refer to Part III.

11.4.1 Poststart Checks

A B C

1. Normal poststart and plane captain checks and rigging check.

Note

Check standby attitude indicator and AJB-3A maximum warmup times immediately after start.

a. Wing Spoilers – Normal operation (ARM position). (Actuation should occur with landing gear struts compressed, and throttle below 70-percent position.)

b. Normal trim (see trim control check below).

c. Horizontal stabilizer override lever – Overrides the stick trim button in both directions.

11.4.1.1 Normal Trim Control Check. After start, when all systems normally required for flight are functioning on aircraft power, the normal trim control checks of the elevator, rudder, and ailerons should be performed to ensure proper operation. During the actuation of these trim systems, the pilot should be assisted by ground personnel, using predetermined signals to ensure correlation between trim settings and cockpit trim indicators.

WARNING

Ensure that aileron followup tab moves opposite to the left aileron (i.e., the tab must move up when the aileron is trimmed down and vice versa). If the tab moves in the same direction as the left aileron as it is trimmed, it is rigged improperly and the aileron trim will function normally until hydraulic disconnect, after which the trim will operate in reverse thus causing increased rate of roll and possible out of control situation if lateral trim is utilized.

11.4.1.2 Maximum Aileron Followup Tab Deflection and Initial Rigging Condition. Prior to performing a functional checkflight disconnect, the pilot must receive an indepth briefing from the maintenance department and quality assurance personnel concerning the nature of the maintenance action which has resulted in the requirement for the functional disconnect of the manual flight control systems. The pilot should be briefed regarding the nature of maintenance action, corrective action taken, previous rate of rolls of the aircraft, and aircraft trim settings for the followup tab as applicable. A proper briefing will provide the pilot with the information required to conduct the initial ground control and rigging checks.

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11.4.1.3 Preflight Rigging Check. Based on the maintenance briefing conducted prior to flight, the pilot should expect certain conditions to exist during initial preflight of the aircraft and initial rigging checks. Two situations exist:

11.4.1.3.1 Aircraft Mechanical Zero Condition. Initial rigging check with ailerons and trim tab settings at zero. This situation will exist following the replacement of either aileron, with a new or reworked aileron, structural repair to the aft spar or outboard portion of the wing tip, and such other times as determined by maintenance. Under these circumstances with normal hydraulic and electrical power, the ailerons will both be symmetrical with stick centered, the aileron followup trim tab will be flush with the trailing edge of the left aileron, and the aileron trim drum alignment notch will be at the 9 o'clock position to the drum with equal wraps of the trim cable around the drum. All throws and operations are set at zero position.

The following procedures are then accomplished to ensure proper rig.

1. Trim the ailerons full left wing down, observing that the right aileron moves down, the left aileron moves up, and the aileron followup tab moves down. Trim fully in the other direction and check for opposite movement. Assisted by ground personnel, trim both ailerons symmetrically (i.e., both above or below an equal amount relative to the wing).

2. Check the aileron followup tab to ensure it is flush with the trailing edge of the left aileron when the ailerons are trimmed symmetrically with the wing.

3. Ground personnel check to ensure the aileron trim drum alignment notch is at the 9 o'clock position in the left wheelwell.

4. Check control stick for centering (vertical) when ailerons are trimmed symmetrically with the wings.

5. Actuate all controls for maximum deflection and check for ease of movement to ensure that all systems are connected and functioning normally.

11.4.1.3.2 Other Than Aircraft Mechanical Zero. A second condition exists when an initial rate of roll check has been performed and a rate of roll correction has been applied to the aircraft. Example: With aircraft mechanical zero conditions set, the aircraft had a 12° per second rate of roll left wing down at 300 KIAS. The proper maintenance corrective action is to adjust the aileron tab one-half turn out and two serrations counterclockwise on trim drum. This action results in a displacement of the aileron trim tab from the flush position of approximately 2.15° up from being flush with the aileron. In general, a left rate of roll correction will result in the trim tab appearing to be moved up from flush position while a right rate of roll correction will result in the trim tab appearing to be moved down from the flush position.

The following procedures are then accomplished in the same manner as for initial conditions except the pilot would expect to see the followup tab deflected in the direction indicated above.

1. Trim the ailerons full left wing down, observing that the right aileron moves down, the left aileron moves up, and the aileron followup tab moves down. Trim fully in the other direction and check for opposite movement. Assisted by ground personnel, trim both ailerons symmetrically (i.e., both above or below an equal amount relative to the wing).

2. Check the aileron followup tab for not more than 5° (11/32 inch) deflection when the ailerons are trimmed symmetrically. (In this example, 2.15° up.) The pilot should actuate the

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system on the ground and visually check that the 5° up or 5° down limit from the faired with the ailerons position is not violated. Activation of the trim system to 5° up and 5° down limit (approximately 11/32 inch) will allow the pilot to visually calibrate the relative position of the trim tab. This check will aid in the pilot's subsequent in-flight check that the tab is within the 5° limits. Five degrees tab deflection from the faired position is difficult to determine visually, therefore, ground personnel should be briefed as to what is required and should use a means of measuring to definitely establish these settings.

3. Check control stick for centering (vertical) when ailerons are trimmed symmetrically with wings.

4. Actuate all controls for maximum deflection and check for ease of movement to ensure that all systems are connected and functioning normally.

WARNING

If control system does not meet requirements of above checks, aircraft is out of rig and requires correction prior to flight.

Note

Because of the maintenance action required to correct a previous rate of roll, the alignment notch on the trim drum will not normally be at the 9 o'clock position to the trim drum.

11.4.1.3.3 Logbook and Maintenance Reports. In our example, the second rate of roll check resulted in a 1° right wing down rate of roll. The correction is entered in the aircraft logbook as "Rate of roll 1° right wing down. Followup tab set at one-half turn out with two serrations counterclockwise on the trim drum and is reflected by a 2.15° up tab trim tab deflection." This is referred to as the aircraft logbook neutral settings.

1. Aircraft Logbook Neutral – This aircraft logbook neutral is valid only for the installed sets of ailerons on the aircraft. It is designed to provide a reference point which will allow removal of the ailerons to accomplish or facilitate such other maintenance as is required. Upon reinstallation of the original set of ailerons, provided no repair or modification has been made on either aileron, the logbook neutral settings are utilized to ensure proper tab setting and rerigging is maintained. Any replacement, repair, or other maintenance action which will affect the contour of the ailerons, such as replacement of either the left or right aileron or repair to either aileron, invalidates this logbook neutral setting for the aircraft. The aircraft must then be rerigged to the

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initial mechanical zero conditions in accordance with existing maintenance manuals prior to conducting a hydraulic disconnect.

WARNING

Logbook neutral tab setting deflections are only valid for the installed set of ailerons. Any rework to flight control surfaces, replacement of ailerons, either left or right, invalidates this setting. Use of the logbook neutral setting following replacement of either aileron may result in an out-of-control flight situation upon manual disconnect.

A 2. Elapsed Time Clock – CHECK.

a. Normal and elapsed time functions operate properly.

A 3. Standby Compass – CHECK.

a. Heading error ±3.0° of BDHI after magnetic deviation compensation.

b. Check fluid level.

A 4. Gunsight – CHECK.

a. Rheostats on both sides of gunsight ON-OFF control knob are operative.

b. Check DAY-NIGHT switch for proper operation.

c. Rotate MIL drum to 270 MILS, while checking for smooth operation/slippage.

d. Perform gunsight check described in NAVAIR 01-40AV-1T and record MIL error.

A 5. Airspeed and Mach – CHECK.

a. Indices movable.

A 6. Pressure Altimeter – CHECK.

a. RESET and STANDBY modes in accordance with Part I, Chapter 2.

A 7. Vertical Velocity Indicator – CHECK.

a. Needle indicates 0 ±100-feet per minute.

A 8. AJB-3A All-Attitude Indicating System (AAI) – CHECK.

a. Vertical Gyro (Gyro Erection)

(1) Off flag disappears within 90 ±10 seconds.

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(2) Roll attitude ±2° aircraft attitude in 3 minutes.

(3) Pitch attitude ±2° aircraft attitude in 3 minutes.

b. Indicator Display (Attitude)

(1) Pitch trim knob rotation (clockwise for dive, counterclockwise for climb) 10° minimum dive. Minimum climb 5° (from 0 dot).

c. Directional Gyro (Gyro Erection)

(1) Off flag disappears within 90 ±10 seconds after flag drops.

(2) Automatic synchronization 12 ±3 seconds after flag drops.

(3) Synchronization needle accuracy within 3/4 scale.

(4) Slow slave 1.5° ±0.5° per minute.

(5) Synchronization needle accuracy after 3 minutes within 1/4 scale of zero. (May oscillate about this point.)

d. Indicator Display (Heading Accuracy)

(1) AAI within 3.5° of ID-663 BDHI indication.

(2) BDHI within ±3.0° of actual magnetic heading.

e. Slew Knob Operation (Push to Turn)

(1) On clockwise, synchronization needle displaces to the right. AAI and BDHI increase heading.

(2) On counterclockwise, synchronization needle displaces to the left. AAI and BDHI decreases heading.

A 9. Standby Attitude System – CHECK.

a. TA-4F (Forward and Aft Cockpit Operation)

(1) Gyro Erection

(a) Off flag drops within 75 seconds maximum.

(b) Roll attitude ±2.0° of aircraft attitude within 3 minutes.

(c) Pitch attitude ±2.0° of aircraft attitude within 3 minutes.

(d) Maximum difference between indicators 2° in roll or pitch.

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(2) Indicator Display

(a) Pitch trim knob rotation (clockwise for dive, counterclockwise for climb) 10° to 20° dive, 5° to 10° climb (from 0 dot).

b. TA-4J (ID-1481) (Preflight) (Forward and Aft Cockpit Operation)

(1) Gyro Erection

(a) The OFF flag disappears when power is applied and gyro is not in the locked or caged position.

(b) Roll attitude ±0.5° to true vertical in 3 minutes.

(c) Pitch attitude will be to true vertical, and will indicate incline relationship to same.

(d) Difference over 1° is result of mounting error.

(2) Indicator Display

(a) Pitch trim knob rotation (clockwise for dive, counterclockwise for climb) 5° dive, 5° climb (from 0 dot).

(b) Knob is pulled to cage the erection system, and locked only if turned fully clockwise to detent position.

A B — 10. Pressure Ratio Indicator – CHECK.

a. Index and counter should move smoothly when setting knob is rotated. Index should agree with counter.

A B — 11. Fuel Quantity Indicator – CHECK.

a. Pointer rotates smoothly counterclockwise when master press-to-test is pressed.

b. Quantity displayed corresponds to actual fuel on board.

c. External fuel quantity indication is accurate when button is pressed.

A — 12. Liquid Oxygen Gauge – CHECK.

a. Off flag is not visible with electrical power to gauge.

b. Quantity indication corresponds to known quantity (if system recently serviced).

c. Pointer rotates smoothly counterclockwise when master press-to-test is pressed, and warning light operates when indication is 0 to 1 liter.

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A	13. Cabin Altimeter – CHECK.
	a. Sea Level ±200 feet.
	b. 5,000 feet elevation ±300 feet.
A	14. APN-153 Doppler Radar Navigation Set (TA-4F) – CHECK.
	a. Test position (5-minute warmup).
	(1) Memory light (extinguished).
	(2) Groundspeed (121 ±5.0 knots).
	(3) Drift angle (0° ±2.0°).
A	15. ASN-41 Navigation Computer Set (TA-4F) – CHECK.
	a. Check position in test mode. (Allow 2-minute warmup.)
	(1) Windspeed (223.6 ±1.5 knots).
	(2) Wind direction (90.5° ±1.5°).
	(3) Present position counters integrate south and east.
A B	16. Rain Removal – CHECK.
	a. Perform rain removal check in accordance with Part I, Chapter 2.
A	17. Canopy Locking Feature – CHECK.
	a. TA-4F/J reworked A-4 AFC 419-II:
	(1) Check that with rifle bolt forward and locked, canopy light out, and all latches seated.
	(2) With pressurization switches on, ensure canopy seal inflated.
	b. TA-4J reworked per A-4 AFC 471:
	(1) Check with canopy fully down and rifle bolt aft; no latches seated and with all pressurization switches on, canopy seal not inflated.
	(2) Check with rifle bolt forward, canopy latches seated.
	(3) Check with rifle bolt forward and locked, canopy light off, and canopy seal inflated.
A	18. Automatic Flight Control System – CHECK.
	a. Perform complete preflight checks in accordance with Part I, Chapter 2.

PROFILE

11.4.2 Taxi Checks

A 19. Brakes – CHECK.

a. Brake pedal travel 1-1/2 inches maximum prior to braking action.

b. Power check 85 percent and under, no aircraft forward movement. Spongy, chattering, fading, or dragging brake unacceptable.

A 20. Nosewheel Steering – CHECK.

a. Engage (Emergency control switch in NORMAL position, and steering control switch depressed.)

(1) Transients (Directional transients from tracking during taxi, landing, or takeoff roll not acceptable.)

(2) Pedal deflection (Verify that aircraft tracks in direction of applied rudder.)

(3) Nosewheel deflection (Verify that aircraft tracks in direction of applied rudder when arresting hook is lowered.)

b. Disengage (Control switch released.)

(1) Castering (Aircraft should track smoothly in direction of applied braking.)

(2) Nosewheel deflection (With pedal deflected, nosewheel should return to center when arresting hook is lowered.)

c. Emergency OFF

(1) EMER OFF position (Nosewheel steering should disengage when steering switch is placed in EMER OFF position.)

A 21. Turn-and-Slip Indicator – CHECK.

a. Check turn needle operation while taxiing.

b. Check ball movement while taxiing.

A 22. BDHI/AJB-3 – CHECK.

a. Check for freedom of movement.

b. BDHI heading within 3° of actual magnetic heading.

A 23. ARN-52/ARN-118 TACAN – CHECK.

a. Check bearing accuracy ±1.0° from designated point on airfield.

b. Check DME operation.

PROFILE	
A	24. ID-249 Course Indicator – CHECK.
	a. Check OFF, TO, and FROM indicators.
	b. Check for azimuth agreement between tacan and course indicator.
	c. Check course indicator number window for proper operation.
A	25. ARR-69 UHF/ADF – CHECK.
	a. Allow 3-minute warmup.
	b. Check bearing accuracy from designated point on airfield.

11.4.3 Pretakeoff Checks

PROFILE	
A B C	26. Takeoff Checklist.
	a. Perform takeoff checklist in accordance with this manual.
A B	27. Manual Fuel Control Checks.
	a. Note idle rpm.
	b. Switch to manual fuel control at 65-percent rpm.
	c. Occurrence of compressor stall unacceptable.
	d. Reduce power to idle.

CAUTION

- Do not allow engine to decelerate below 51 percent to prevent flameout.
- If engine rpm decays below idle while performing the manual fuel control checks, immediately secure engine. Attempts to advance the throttle when the engine rpm has decayed below normal idle limits will most probably result in an engine stall with a resultant engine overtemp unless the engine is immediately secured.

e. Switch back to PRIMARY at 80- to 85-percent rpm. Manual fuel control warning light should go off. If compressor stall occurs, return to MANUAL and position throttle to 78-percent rpm. Return throttle to IDLE, and while engine is decelerating, attempt another changeover. Occurrence of compressor stall is unacceptable.

f. Reduce throttle quickly to idle.

g. Note idle rpm.

h. Set engine rpm 85 percent.

PROFILE

CAUTION

During 85-percent engine runup checks, aircrew noting visible smoke exiting engine manifold bleed outlet shall abort the mission immediately. Visible smoke (as opposed to clear exhaust) may be indicative of engine bearing failure and subsequent engine failure.

i. Reduce throttle quickly to idle (P-6).

j. Note rpm hangup/abrupt increase (P-6).

Note

One occurrence of fuel control hangup is a downing discrepancy and the aircraft shall not be flown.

A B — 28. Anti-Icing System Check

a. Ensure aft cockpit engine anti-icing switch OFF.

b. At a stabilized rpm above 80 percent, activate forward cockpit anti-icing switch to ALL, and observe slight drop in EPR.

c. Turn anti-icing switch to OFF, and observe slight rise in EPR.

d. Cycle RAM air to RAM and back to normal. Check for securing of air conditioning system and pressurization.

e. Reduce power to IDLE.

f. Reduce throttle quickly to idle (P-6).

g. Note idle rpm (P-6).

h. Set engine rpm 85 (P-6).

i. Reduce throttle quickly to idle (P-6).

j. Note rpm hangup/abrupt increase (P-6).

Note

One occurrence of fuel control hangup is a downing discrepancy and the aircraft shall not be flown.

11.4.4 Takeoff

A B — 29. Engine Acceleration From Idle Check

Note

For individual engine limitations refer to Part I, Chapter 4 of this manual.

PROFILE

a. Jam Acceleration Check (13 seconds maximum) - RECORD (idle to military rpm).

b. EPR - CHECK at or above minimum.

c. At liftoff

(1) RPM - RECORD.

(2) EGT - RECORD.

(3) Fuel flow - RECORD.

(4) Oil pressure - RECORD.

11.4.5 Climb

Note

For purposes of Functional Checkflights, a climb schedule of 300 KIAS to 0.72 IMN is recommended.

A B 30. Climbing through 16,000 feet:

a. RPM - RECORD.

b. EGT - RECORD.

c. Fuel flow - RECORD.

d. Oil Pressure - RECORD.

e. Pressurization - RECORD (8,000 ± 1,000 feet).

A B 31. Climbing through 26,000 feet:

a. RPM - RECORD.

b. EGT - RECORD.

c. Fuel flow - RECORD.

d. Oil pressure - RECORD.

e. Pressurization - RECORD (14,000 + 1,300, -1,800 feet).

11.4.6 Level at 36,000 Feet

A B 32. Airspeed/Mach - RECORD (Indication of 237 ± 5 KIAS at 0.72 IMN.)

A B 33. Military

a. RPM - RECORD.

b. EGT - RECORD.

PROFILE

c. Fuel Flow - RECORD.

d. Oil Pressure - RECORD.

A B — 34. Idle (180 KIAS minimum)

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8 engine with PPC 185 incorporated) a minimum in-flight rpm of 70 percent should be maintained to preclude possible flameout.

a. RPM - RECORD.

b. EGT - RECORD.

c. Fuel flow - RECORD.

d. Oil pressure - RECORD.

e. Pressurization - RECORD (20,000 + 1,600, - 2,600 feet).

A B — 35. Jam Acceleration Check (20 seconds maximum)

11.4.7 Descending to 15,000 Feet

A C — 36. Flight Control Check

a. Noseover to obtain 0.90 IMN and check flight controls for proper response. Observe flight manual restrictions shown in Part I, Chapter 4.

CAUTION

Do not exceed 0.90 IMN with external tanks installed.

A B — 37. Anti-G System - CHECK.

a. Perform anti-g preflight check in accordance with Part I, Chapter 2.

A — 38. Accelerometer - CHECK.

a. Proper functioning and recording while pulling positive and negative g's.

11.4.8 Level at 15,000 Feet

A C — 39. Speedbrakes - CHECK.

a. Check in 1.0g-flight at 400 KIAS.

PROFILE

(1) Open (3 seconds maximum).

(2) Close (3 seconds maximum).

(3) Pitch (Open +1.0g maximum; close - 0.5g maximum).

(4) Yaw (1/2 ball).

(5) Roll (5° per second maximum).

A 40. AJB-3A All Attitude Indicator (AAI) – CHECK.

a. Vertical Gyro

(1) Precession after 180°, 4-minute turn, ±3.0° in roll or pitch.

(2) Gyro erection (slow erection rate 0.8° to 1.8° per minute) to within ±2.0° in roll or pitch.

(3) Indicator jitter and/or hangup ±0.5°.

b. Directional Gyro

(1) Fly cardinal headings by reference to the BDHI. Push to synchronization. Synchronization needle oscillations allowed about midposition. Record correspondent headings from AJB-3A (tolerance ±4°) and wet compass (tolerance ±3° after magnetic deviation compensation) heading.

(2) After 360°, 4-minute turn, press synchronization button to check precession. A 2.0° heading error is acceptable.

A 41. Standby Attitude Indicator – CHECK.

a. TA-4F

(1) Vertical Gyro

(a) Precession after takeoff turns ± 4.0° roll.

(b) Precession after 180°, 4-minute turn (from indication at start of turn); ± 3.0° in pitch or roll.

(c) Erection Time

– Normal 1.5° to 2.5° per minute.

– Manual (do not hold erection switch over 120 seconds maximum) not less than 0.5° per second.

(2) Indicators

(a) Jitter and/or hangup ±1.0° maximum.

PROFILE

(b) Attitudes over 82° in pitch will result in 180° roll indication.

(c) Difference between AAI and standby ±3.0° maximum.

Note

Check should be made upon returning to same airspeed and attitude as original setting.

(d) Maximum difference between indicators 2° after normal erection.

b. TA-4J (ID-1481)

(1) Indicator Operation

(a) Maximum climb indication 92°.

(b) Maximum dive indication 78°.

(c) Precession after turn, reasonable agreement with AAI.

(d) Pitch indications 3° to 4° below AAI.

(e) Gyro fail switch on, OFF flag appears on aft indicator and gyro is inoperative.

A — 42. ARC-51 or ARC-159/ADF Function – CHECK.

a. Reading error ±5.0° off the nose sector and within 20° all other sectors.

b. Hunting error ±1.0°.

A — 43. ARR-69 ADF/CMD Functions – CHECK.

a. System must be operative on all channels. Check as many as possible during the flight.

b. Sensitivity control is operative.

c. Volume control is operative.

d. Operational range is 100 nm minimum.

A — 44. APX-64/APX-72 IFF – CHECK.

a. Check identification modes with available interrogating stations.

b. Check emergency feature.

A — 45. ARN-52 or ARN-118 Tacan – CHECK (with antenna in AUTO position).

a. Operational range 150 to 300 nm.

b. Check as many channels as possible.

PROFILE

c. No flag showing when range indication is operating.

d. Volume control operative.

e. Auto antenna lock on 9 seconds maximum, with usable signal.

f. Air-to-air mode, range lock on with cooperating aircraft or station.

g. ID-249/ARN Course Indicator (TA-4J):

(1) Check OFF, TO, and FROM indicators.

(2) Check for azimuth agreement between tacan and course indicator.

(3) Check course indicator number window for proper indication.

A 46. APN-153 Doppler – CHECK.

a. Level Flight

(1) Takeoff (within 30 seconds after minimum altitude of 40 feet, memory light should go off, indicating system tracking.)

b. Cruise Altitude

(1) ON-LAND position (observe groundspeed and drift angle to be corrected within ±50 knots and ±10°, respectively for known conditions of flight.)

(2) ON-SEA position (observe slight increase in groundspeed indication from ON-LAND position.)

(3) Memory Light (should not be on for periods longer than 30 seconds.)

c. Maneuvers

(1) Banked Turns (groundspeed and drift angles shall track in bank angles of approximately 30°.)

(2) Climbing and descending (groundspeed and drift angles up to 25° attitude. Memory light should not be on for periods longer than 30 seconds.)

d. Doppler Radar Navigation System

(1) Wind direction and speed (displayed).

A 47. ASN-41 Navigation Computer Set – CHECK.

a. Bearing error (2.0° maximum).

b. Range error:

(1) 0 to 195 miles (1 mile, or 1 percent distance traveled).

PROFILE

(2) 195 to 2,000 miles (5 miles, plus 1 percent distance traveled).

Note

Tolerances for subitems a and b are for zero wind conditions.

A B

48. Drop Tank Transfer – CHECK.

a. Ensure all external fuel tanks transfer properly.

b. Ensure all external fuel quantity can be monitored.

A B

49. Jam Acceleration Check (180 KIAS minimum).

a. Idle:

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8B or J52-P-8A engines with PPC 185 incorporated) a minimum in-flight rpm of 70 percent should be maintained to preclude possible flameout.

(1) RPM – RECORD.

(2) EGT – RECORD.

(3) Fuel flow – RECORD.

(4) Oil pressure – RECORD.

(5) Pressurization – RECORD (8,000 ±1,000 feet).

b. Jam Acceleration Check (20 seconds maximum) (IDLE to MILITARY) – RECORD.

c. Military – RECORD.

(1) RPM – RECORD.

(2) EGT – RECORD.

(3) Fuel flow – RECORD.

(4) Oil pressure – RECORD.

A C

50. Slow Flight Check

a. Landing Gear – CHECK.

(1) Gear down (5 to 11 seconds).

PROFILE

b. Wing Slats – CHECK.

(1) Slats should commence opening at some airspeed below 200 KIAS (usually 160 to 180 KIAS). One-half open at optimum AOA, and are fully open at stalling speed.

c. Landing Flaps – CHECK.

(1) Flaps down 10 seconds maximum (160 KIAS and under).

d. Angle-of-Attack System – CHECK.

(1) Check AOA system for proper operation.

(2) All indexer lights come on when press-to-test button is pressed.

(3) Record fuel weight and airspeed at optimum AOA. See Figure 27-1 for airspeed/AOA relationship.

e. Landing Gear – CHECK.

(1) Gear up 14 seconds maximum (210 KIAS).

f. Flap blowback – CHECK.

(1) Indication of blowback should occur at approximately 230 KIAS. Maximum permissible speed without flap blowback indication is 240 KIAS.

g. Wheels Warning Light – CHECK.

(1) The wheels warning light flashes when throttle is retarded below 91 to 96 percent; if the wing flap handle is not in the UP detent and the landing gear is up or unsafe.

h. Landing Flaps – CHECK.

(1) Flaps up 7 seconds maximum (160 KIAS and under).

A 51. Automatic Flight Control System (AFCS) – CHECK.

a. Turn AFCS to STBY position 90 seconds prior to engagement.

(1) Stability Augmentation – CHECK.

(a) Engage – No aircraft upset (rudder thump acceptable).

(b) False rudder (no apparent oscillation remaining after 2 cycles).

(c) Disengage (no aircraft upset, rudder thump acceptable).

(2) AFCS Engage and Disengage Transients – CHECK.

(a) Trimmed straight and level flight ±0.5° bank upset. No pitch upset.

PROFILE

(b) Trimmed flight not straight and level (bank angle less than 70°, ±2.0° bank upset. Pitch angle less than 60°, ±0.5g-pitch upset.)

(3) Heading Hold Mode – CHECK.

(a) Will not engage (no force on control stick). Bank angle over 7.0° (All-Attitude Indicator reading).

(b) Must engage (no force on control stick). Bank angle under 3.0° (All-Attitude Indicator reading).

(c) Upon engagement (will seek and hold engage heading ±1.0°).

(4) Attitude Hold Mode – CHECK.

(a) Holds established pitch angle (within 60° noseup to 60° nosedown) (±1.0°).

(b) Holds established bank angle (within 5° to 70° left or right) (±2.0°).

(5) Preselect Heading Mode – CHECK.

(a) Upon engagement (aircraft should turn in the direction for smallest heading change).

(b) During turn (bank angle 27° ±5.0° established bank, and pitch angles remain constant ±2.0°).

(c) During rollout (rollout completed to selected heading within 20 seconds and bank angle ever decreasing).

(d) Following rollout (established heading should be ±1.0° of preselected heading).

(e) Disengage preselect heading switch during turn (aircraft returns to approximately wing-level flight within 20 seconds).

(f) Maximum rate of roll at any time while on preselect heading mode (40° per second).

(6) Attitude Hold Mode – CHECK.

(a) Steady state climb or dive over 4,500 FPM (will not engage).

(b) Steady state climb or dive under 3,500 FPM (must engage).

(c) Damping upon engagement during climb or dive (1- to 1/10-cycle amplitude).

(d) Load factor during damping (±0.5g from steady state load factor at engagement).

(e) Residual oscillation (level flight ±25 feet or ±5 percent of altitude with maximum frequency of 3 cpm).

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(7) Control Stick Steering (CSS) Mode – CHECK.

Note

Force measurements are given as a guide in making qualitative estimates only.

(a) CSS breakout force – Long/Latl (2 ±0.5 pounds).

(b) CSS stick force.

- Longitudinal (50 to 120 percent of normal system forces).
- Lateral (80 to 120 percent of normal forces).

(c) Feedback (qualitative evaluation).

Note

Feedback is defined as a lateral oscillation of the control stick, 1 to 3 cps, that the pilot feels and sees while maneuvering the aircraft in the lateral direction in the CSS mode. This does not include any transients caused by CSS engagement or disengagement (CSS Break-in or Breakout).

(8) Residual oscillations – CHECK.

(a) With hands off control stick and while using heading hold, preselect heading or attitude hold modes (±0.5° lateral at approximately 2 to 4 cps. No pitch oscillation).

(b) Because of external lights (flashing) (±0.75° lateral at approximately 1 cps. No pitch oscillation. Resultant stick motion acceptable.)

(9) Automatic Pitch Trim – CHECK.

(a) Time lag for trim operation after new attitude is established, and period between operations is 5 ±2 seconds (no transients).

(10) Longitudinal structural protection – CHECK.

(a) Windup turn on CSS mode without centerline store (disengage 4 ±0.5g); with centerline store (disengage 3.5 ±0.5g).

(b) Attitude hold mode (disengage +3.5 ±0.5g) (-1.0 ±0.5g).

(11) Lateral structural protection (AFCS lateral control approximately 1/2-stick throw, or 40-pounds stick force).

(12) Speedbrake compensation – CHECK.

(a) With AFCS engaged, open speedbrakes (±0.5g maximum pitch).

(b) With AFCS engaged, close speedbrakes (±0.5g maximum pitch).

PROFILE
A

52. Bombing system (TA-4F) – CHECK.

a. Switches

(1) Function select – LABS.

(2) Stations select switches – OFF.

(3) Master armament switch – ON.

(4) Attack mode – LOFT for 52b and 52d (7); O/S for 52c and 52d (8).

b. LABS Timer

(1) Set timer for 2.0 seconds and press bomb pickle – 1.0-second warning, tone and light.

(2) Timer rundown – Pull up tone and light.

c. G-Programmer

(1) Press bomb pickle – LABS light on. Vertical pointer and G-programmer center.

(2) Pullup – G-programmer schedules 4.0g in 2.0 seconds.

d. All-Attitude Indicator

(1) Pitch – Pitch trim removed.

(2) Azimuth – Locks on AAI.

(3) Roll – Displays roll/yaw.

(4) Vertical pointer – Displays roll/yaw.

(5) Yaw/roll ratio – 2.5 to 3.5:1.

(6) Yaw cancel – 15° ±5° yaw.

(7) Low angle release – Occurs at RA1 LSS.

(8) High angle release – Occurs at RA2 LSS.

(9) Reversion to all attitude mode – Occurs at release and cancel.

(10) Verticality error upon completion – ±1.0° roll; ±2.0° pitch.

(11) Heading error upon completion – Reciprocal heading; ±2.0° azimuth.

PROFILE	
	11.4.9 Descending to 6,000 Feet
A	53. Vertical Velocity Indicator (VVI) – CHECK.
	a. ±300 FPM during 2,000 FPM climb or descent.
	11.4.10 6,000 Feet and Below
A B	54. Carrier Check
	a. 6,000 feet at 150 KIAS, approximately 75-percent rpm with gear and flaps down.
	(1) Jam acceleration check (5 seconds maximum) – RECORD.
A	55. AN/APN-141 Radar Altimeter – CHECK.
	a. Crosscheck with pressure altimeter for approximate correlation.
	b. Dropout should not occur at pitch angle less than 50°, or bank angle less than 30°.
	c. Operation
	(1) Above 6,000 feet (pointer remains behind mask). (Off flag is in view.)
	(2) Below 5,000 feet (smooth tracking of terrain clearance without flicker of off flag).
	(3) Warning light (on when aircraft is below present terrain clearance altitude ±10 feet or 10 percent, whichever is greater).
	(4) Self-test (press control knob and indicator reads 5 +5 to 10 feet.)
	11.4.11 Climbing to 15,000 Feet
A B	56. Fuel Dump – CHECK.
	WARNING
	Dumping wing fuel above the freezing level may result in the dump valve freezing open. Fuel dump will then continue until the wing tank fuel is depleted, or descent is made below the freezing level.
	a. Turn on Fuel Dump
	(1) Note drop in internal fuel quantity, and slight buffet from fuel leaving the dump mast.
	b. Secure fuel dump.
	Fuel quantity should stabilize and the slight buffeting cease.

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11.4.12 Level at 15,000 Feet AGL ±2,500 Feet

A C

57. Proper Slat Operation – CHECK.

a. At 250 KIAS

(1) Trim aircraft directionally to center the ball.

(2) Perform constant airspeed left and right turns while steadily increasing g.

(a) Slat extension (12 to 14 units AOA).

(b) Maximum allowable AOA split between left and right slat opening (less than 1 unit).

(c) If slat performance satisfactory – proceed to 300 KIAS.

b. At 300 KIAS

(1) Repeat the check.

(a) Slat extension (13 to 16 units AOA).

(b) Maximum allowable AOA split between left and right slat opening (less than 1 unit).

(c) Maximum bank angle change because of asymmetric slat extension - ±20°.

A C

58. Trim – CHECK.

a. At 300 KIAS, trim aircraft for handsoff, straight-and-level flight (2,000 to 4,000 pounds fuel load recommended – CHECK.

(1) Rudder trim indication – RECORD (0 ±1.0°).

(2) Elevator trim indication – RECORD (1° ±1/2° noseup without wing drop tanks, or 1/2° ±1/2° noseup with wing drop tanks).

b. Aileron power configuration – CHECK.

(1) Breakout force – 3.8 pounds maximum.

(2) Control stick free play – 1/8 inch maximum.

c. Elevator power configuration – CHECK.

(1) Breakout force – 3.8 pounds maximum.

(2) Control stick free play – 3/8 inch maximum.

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d. Rudder System – CHECK.

(1) Breakout force – 7 to 13 pounds.

(2) Control free play – 1/4 inch maximum.

Note

Force measurements are given for guidance in making qualitative estimates only.

A C

59. Emergency Generator – CHECK.

a. Initial condition (aircraft dirty, 150 KIAS, UHF on unused frequency, all lights and avionics equipment on except AFCS, radar, and horizontal trim. Drop out emergency generator.)

b. Reduce power to idle, keeping UHF keyed (slow aircraft to 120 KIAS, side tone should not fade out).

Note

Lights should fail and warning flags should appear almost simultaneously with UHF fadeout. Large airspeed spreads between events may indicate marginal systems.

c. At 145 KIAS, operate horizontal stabilizer manual override lever to ensure trim in both directions.

d. Check emergency speedbrake operation.

e. With emergency generator deployed, attempt to trim the aircraft. Normal aircraft trim system should be inoperative.

WARNING

With emergency generator deployed and the generator bypass-normal switch in the NORMAL position, normal aircraft trim should not be available. If normal trim operation occurs, a failure has occurred which negates the ability of the emergency generator to act as a limiting device in the event of a runaway trim condition. The manual flight disconnect should not be performed if this condition exists.

f. Check generator bypass switch operation. Normal generator operation should be regained.

g. Check that normal trim functioning is regained.

PROFILE

A C

60. Flight Control Disconnect

a. This procedure is designed to be performed in conjunction with the normal flight check procedure. Items repeated that are part of the normal procedure are those that are exceedingly important in the proper performance of this check or those where additional checks are necessary that would not be performed in the normal flight check procedure.

11.4.12.1 Airborne Test Procedure. While other flight control surfaces generally affect the aircraft rates of roll, the primary factor determining the rate of roll an aircraft will experience is the effect of the aerodynamic forces on the ailerons following disconnect from the hydraulic boost system. Until the moment of disconnect, the aircraft roll tendencies are corrected by the hydraulic boost system and trim system. Upon disconnect, the ailerons will seek their aerodynamic neutral positions which will be reflected to the pilot through the transmission of stick forces through the mechanical cable system and a tendency of the aircraft to roll in either direction. The resulting rolling moment may be caused by either one or both of the ailerons.

11.4.12.2 Aircraft Configuration. It is mandatory that the aircraft be symmetrically configured during a maintenance disconnect. Installation of either a single, centerline drop tank, or two station wing tanks is permissible if operating conditions or local procedures dictate their use. However, all external fuel must be empty prior to disconnect. Under no circumstance will the disconnect be performed with an asymmetrical wing loading.

WARNING

A manual disconnect under asymmetrical wing loading or with fuel trapped in external drop tanks may result in an out-of-limit rate of roll following disconnect.

11.4.12.3 Aircraft Fuel Loading. Depending on local operating requirements, aircraft disconnects should be performed with the wing tank as near empty as practical to preclude the possibility of fuel displacement to a descending wing and a resultant increase rate of roll. An initial maximum condition of 2,000 pounds of fuel is recommended for uniformity between checkflights; however, if higher fuel loads are required because of local operation restrictions, a rate of roll check can be safely performed provided symmetrical wing loading is maintained.

11.4.12.4 Wind Conditions at Landing Field. A crosswind component of 8 knots is the considered maximum for a safe disconnect landing. The disconnect check will not be performed if a stronger component exists. When contacting the tower or ground control, the pilot should request the wind in degrees magnetic, velocity, and other pertinent information such as forecast wind shift, duty runway or into-wind runway availability, and gusts. It should always be anticipated that disconnecting will result in reduced control of the aircraft and if any condition exists that would further complicate the landing, the check should not be performed. In particular, the test should not be conducted if there is a possibility of encountering gusty wind conditions on landing. After contact with the tower has been established and the duty runway has been determined, proceed as follows.

11.4.12.5 Test Procedure. Prior to performing hydraulic power disconnect under controlled conditions, the emergency generator should first be extended and functional check of emergency

PROFILE

trim override should be made. If emergency trim functions properly on emergency generator, switch to BYPASS and continue with disconnect.

WARNING

- Do not attempt a manual flight control disconnect while operating on the emergency generator unless an emergency condition exists.
- Do not attempt a manual flight control disconnect if the emergency generator is inoperative.
- Do not attempt a manual flight control disconnect if normal trim operations are not regained following the emergency generator check and the BYPASS position is selected.

1. Establish altitude of 15,000-feet AGL or above, with minimum amount of fuel in the wing. Fifteen thousand feet is established as minimum safe altitude for performing check.

2. Trim for hands-off, straight-and-level flight at 300 KIAS. Note rudder and elevator settings.

3. Visually check followup tab for 5° maximum deflection from faired with aileron (port aileron). Five degrees deflection of followup tab from faired with aileron is approximately 11/32 inch, and may be determined during normal preflight check as outlined previously. This 5° limit applies to all present models of aircraft. If followup tab is deflected more than 5° when aircraft is trimmed for hands-off, straight-and-level flight at 300 KIAS, hydraulic systems should not be disconnected, as excessive rate of roll will probably occur.

4. Slow to 200 KIAS – Do not retrim aircraft during deceleration. Deceleration to 200 KIAS for the actual disconnect is for safety in the event an excessive rate of roll occurs. The aircraft is more controllable at slower speeds and there is less chance of overstressing the aircraft if an erratic condition occurs. Deceleration should be accomplished without use of speedbrakes. Speedbrakes are directly connected to elevator control and possible trim change may occur because of extension and retraction. Slowing to 200 knots should be accomplished with a slightly noseup attitude climb of no more than 5° to 10° until 200 knots is reached. With the aircraft nose slightly above the horizon, release of the stick, and the pulling of the manual flight control handle gives the pilot an increased response time and controllability of the aircraft once disconnected. This slightly nose-high attitude will compensate for the nose pitch down associated with the moment of disconnect. A slightly nose-high attitude will have negligible affect on the aircraft handling or resulting rate of roll provided a wings level attitude is maintained.

5. Pull power disconnect handle – The power boost disconnect should be pulled smartly to ensure proper disconnect. Pulling the handle slowly may result in partial disconnect that could cause hazardous flight condition or erratic rate of roll. Ensure that there is no pressure on control stick when handle is pulled. Normally the disconnect cable will extend approximately 12 inches for complete disconnect and two slight jolts will be felt, evidencing disconnect of aileron and elevator hydraulic systems in that order. Once again, it is emphasized that boost disconnect

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handle should be pulled smartly, and no hesitation between each system disconnect should be attempted.

CAUTION

Hold T-handle while allowing handle to return to stowed position. This procedure is to prevent the handle from striking an instrument.

11.4.12.6 Stick Forces. Stick forces following disconnect may be quite high. However, pilots should be aware that stick forces observed may not correspond to the resulting rate of roll. If heavy lateral stick forces are present the rate of roll should be conducted at an airspeed other than 300 knots. After disconnect, no trim should be used if the aircraft is controllable. If an excessive rate of roll or pitch condition exists at the present speed and the pilot considers that the aircraft may become uncontrollable at higher airspeed, no attempt should be made to perform the rate of roll check at a higher airspeed. In this condition, if the pilot feels able to control the rate of roll at 200 KIAS, the check may be performed the same as for the 300 KIAS check, but the angle of bank should not be allowed to exceed 30°. Prior to conducting a rate of roll at an airspeed of less than 300 knots the pilot must reduce the nose pitch down tendency in order to get an accurate rate of roll. Although not as desirable as if performed at 300 KIAS, this rate of roll will enable ground personnel to make some corrective adjustment. In this case, after the rate of roll has been recorded, the aircraft should be slow-flighted in the landing configuration and retrimmed as necessary for a safe landing. Speeds in excess of 200 KIAS should not be used for the remainder of the flight.

If the aircraft becomes uncontrollable after disconnect at 200 KIAS, an emergency condition exists and the check should be abandoned. Trim should be used immediately in an attempt to stop the roll and regain control; the throttle should be retarded to idle to reduce airspeed.

11.4.12.7 Aircraft Nose Pitch Tendencies. With the aircraft trimmed for 300 KIAS, the aircraft will, upon disconnect at 200 knots, want to pitch nose down seeking the 300 KIAS trim setting. As the aircraft airspeed is increased, the nose down pitch tendency will normally decrease.

At 300 KIAS the aircraft may exhibit either a slight noseup or slight nosedown pitch or no pitch at all. The slight noseup or no pitch situation has no effect on the resulting rate of roll. A nosedown pitch, if excessive, will result in an increasing aircraft airspeed and accentuated rolling moment.

WARNING

An excessive nosedown pitch if not corrected by the pilot will result in an increasing airspeed and accentuate rate of roll. If allowed to progress or if airspeed is allowed to build over 325 knots, control of the aircraft may be lost. Do not allow the aircraft to exceed 15° nose low.

PROFILE

CAUTION

In the case of excess nosedown pitch, it should be remembered that use of the speedbrakes may cause an increased nosedown tendency because of the design of the system.

Note

Although no limit has been established to the nosedown or noseup pitch movement, generally, 1° per second nose pitch down is acceptable. If a nose pitch up or nose pitch down is greater than 1° per second, the direction and rate of pitch should be noted and recorded for maintenance to take corrective action.

11.4.12.8 Use of Rudder in Controlling Rolling Moment. Momentary use of rudder controls to control or stop a rolling moment is optional, however, once rudder is utilized to correct a rolling moment, the resulting rate of roll may be suspect. The preferred method is to stop the rate of roll with the aileron. If heavy stick forces are present, then conduct the rate of roll at a lower airspeed vice 300 KIAS.

WARNING

An extensive use of rudder to maintain either level flight or to stop a rolling moment prior to checking rate of roll may result in an asymmetrical fuel loading of the wing if wing fuel is present. Asymmetrical loading of wing will accentuate the rate of roll and may result in excess rate of roll.

1. Accelerating to 300 KIAS. Under normal conditions, the rate of roll check should be performed at 300 KIAS since aircraft was trimmed for handsoff, straight-and-level flight at this speed. During acceleration, straight-and-level flight should be maintained without use of trim systems since this will destroy conditions for proper rate of roll check. If, however, control forces in either roll or pitch become so severe during acceleration that control of aircraft is doubtful, the rate of roll check should be immediately discontinued or performed at a lower airspeed as previously discussed.

WARNING

Do not allow the aircraft to exceed 60° of bank. An angle of bank in excess of 60° may allow the aircraft to Fall Through, which will cause the angle of bank to increase rapidly and in the case of an excessive rate of roll may cause the aircraft to become uncontrollable before corrective action can be taken.

2. At 300 KIAS record the rate of roll. When stabilized at 300 KIAS, wings level, release the stick (zero lateral stick force). Time the rate of roll by means of elapsed time clock and reference the gyro horizon.

PROFILE

After timing the rate of roll return the aircraft to wings level attitude without use of trim if possible and repeat the check to ensure an accurate rate of roll recordings. Five degrees per second, maximum allowable rate of roll, is very slow, and error in timing is possible during initial attempt.

3. Retrim for handsoff, straight-and-level flight at 300 KIAS. After determining direction and rate of roll, aircraft should be returned to straight-and-level flight, and retrimmed to maintain this condition.

4. After aircraft has been retrimmed at 300 KIAS, note and record deflection angle of followup tab and ailerons. Decelerate and perform simulated landing approach. In decelerating prior to performing simulated approach, use should be made of all systems that may be needed in actual landing (speedbrakes, landing gear, flaps) to determine any adverse effects they might have on control of aircraft.

5. Prior to landing, stability augmentation switch on AFCS control panel (if available) should be placed in STAB AUG position, and spoiler switch should be placed in ARM position.

6. Upon completion of flight, a notation should be made on Discrepancy Report that hydraulic system was disconnected, direction and rate of roll, if any, and any adverse flight conditions resulting from disconnect. This information and any other pertinent remarks which would aid other pilots or maintenance personnel in the future should be entered in aircraft log book.

CAUTION

Safety is of primary importance throughout the entire disconnect check. If any condition is present which may result in an excessive rate of roll or if aileron trim is necessary after disconnect or during landing for any reason, the pilot should not hesitate to utilize trim or terminate the hydraulic disconnect check.

11.4.12.9 Landing Considerations and Aircraft Handling. While on the manual flight controls, aircraft flight control response is markedly reduced, use of trim and coordinated turns will result in an easily controllable aircraft. Because of the reduced lateral response and a delay in response to flight control input, a slightly fast approach to touchdown is recommended to preclude the aircraft from getting an in close and slow rolling moment.

A B — 61. Low Fuel Level Warning – CHECK.

a. Lights should come on at approximately 1,100 pounds fuel remaining with aircraft in level flight attitude.

11.4.13 Landing – Make Straight-in Approach

A B C — 62. Brake Operation – CHECK.

A B C — 63. Ground Handling – CHECK.

PROFILE

11.4.14 After Landing

A — 64. Oxygen Consumption - CHECK.

A B — 65. Engine Oil Quantity - CHECK.

A B — 66. Secure engine from IDLE rpm using MANUAL FUEL SHUTOFF. Record time from operating MANUAL FUEL SHUTOFF to actual engine shutdown (approximately 15 to 30 seconds).

Note

Shutdown should be initiated by using the manual fuel shutoff. As the engine unwinds through idle, the throttles should be brought to OFF to prevent possible cavitation of fuel pump and lines.

A — 67. ID-1481 Standby Attitude Indicator (TA-4J) - CHECK.

a. Inoperative after 9 minutes. Less than 6° error for maximum of 9 minutes after power off.

A C — 68. Generator Bypass Switch - NORMAL.

PART IV

Flight Characteristics

CHAPTER 12

Flight Characteristics

12.1 INTRODUCTION

The flight characteristics of the aircraft as described in this section are based, whenever possible, on actual flight test information. In some instances, the results of extensive wind tunnel tests and data from flight tests of similar aircraft are used. Although additional information will be submitted periodically in the form of changes to this handbook, the latest service directives and technical orders concerning this aircraft should be consulted regularly to keep abreast of pertinent information.

Calculations and flight testing indicate that the flight characteristics of the TA-4F/J are the same as for the A-4E aircraft.

The aircraft has the excellent slow flying characteristics usually found in aircraft designed for carrier operations. Positive stability in the power approach configuration (landing gear and flaps down) results in a return to the trimmed condition when disturbed by turbulence or pilot induced displacement.

12.2 FLIGHT CONTROLS

12.2.1 Ailerons. Aileron control forces are light at all subsonic speeds when the aileron power system is operative.

In the transonic region and above, the air loads on the ailerons become large enough to require the total output of the power control system to deflect the ailerons beyond a certain point.

On manual control, the available rate of roll is markedly reduced at all speeds. Adequate lateral control can be maintained if the speed is reduced below Mach 0.80 or 300 knots, whichever is lower, where a maximum rate of roll of approximately 10° per second is available at sea level. This increases to 40° per second at 40,000 feet. (Refer to Part I, Chapter 2, Hydraulic Power Disconnect, for further information on aileron power disconnect.)

12.2.2 Elevators. The powered elevator provides good control at all speeds. (See Figure 12-1, for a powered elevator stick forces diagram.) A bungee is installed in the elevator control system to provide longitudinal load feel. The bungee is linked to the horizontal stabilizer so that the elevator deflects upward (stick moves aft) while trimming noseup and deflects downward while trimming nosedown. The elevator moves approximately 8° as the stabilizer travels from full-throw up to full-throw down.

With the elevator power control system inoperative or disconnected, elevator stick forces will be increased, but for flight at subsonic speeds, adequate control will be available. On manual control, no more than 1.8g can be obtained with the application of 120 pounds of stick force at Mach 0.96 at any altitude. As Mach number is increased, the maneuverability is further decreased. At Mach numbers less than 0.85 and altitudes below 5,000 feet, a load factor of 2.7g can be attained with 120 pounds of stick force. Above 5,000 feet, and below Mach 0.85, maneuverability is increased and is limited by buffet or accelerated stall.

12.2.3 Rudder. The rudder power system provides good rudder control at all airspeeds. In the event of hydraulic failure, rudder pedal forces will increase with airspeeds, but very little effort is required at approach and landing speeds. There is no rudder trim available with hydraulic failure.

12.2.4 Trim Surfaces. The trimming surfaces are capable of reducing stick forces to zero for all stabilized level flight conditions. The horizontal stabilizer will require almost constant repositioning during rapid acceleration and deceleration during takeoff and the approach to landing.

Retrimming of the rudder will not be necessary except when asymmetrical drag configurations are

STICK FORCES

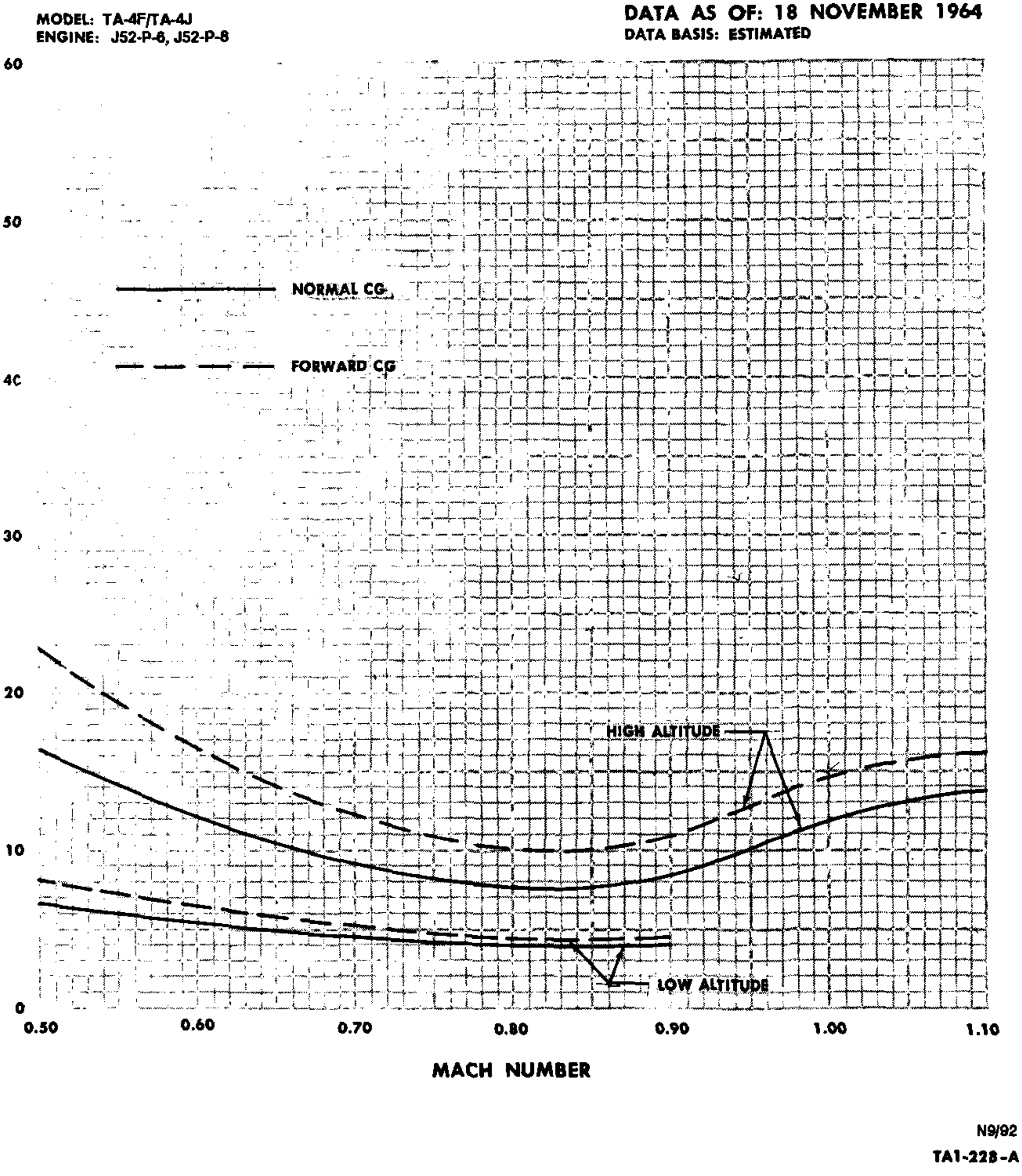


Figure 12-1. Stick Forces

encountered, as would occur if two large stores were being carried on the wing racks and one was dropped.

When the aircraft is laterally retrimmed, the aileron trim system actuator relocates the neutral position of the control stick through the aileron power control system. If the power control system fails or is disconnected, the followup tab provides sufficient trim for all flight conditions as long as electrical power is supplied.

12.2.5 Slats. Each wing is equipped with a 2/3 span, aerodynamically controlled, independently operated slat. Wing slats were incorporated in the TA-4 aircraft design to improve slow flight airflow characteristics and reduce landing airspeeds for carrier operations. Since the slats are not interconnected, one slat may open in advance of the other. Good mechanical rigging of the slat is essential to proper operation since aeroelastic effects of wing bending and twisting under high g-loads will likely cause binding of any misadjusted slat.

12.2.6 Wing Flaps and Landing Gear. Lowering the wing flaps or landing gear causes a nosedown trim change, while a noseup trim change results from raising either or both. The trim changes are slight and are overcome easily through use of the control surfaces or by retrimming.

12.2.7 Speedbrakes. *Operation of the speedbrakes* results in changes in trim characterized by a noseup pitch when opened and a nosedown pitch when closed. To counter this characteristic, a speedbrake-elevator interconnect is installed which physically displaces the elevator when the speedbrakes are operated. This interconnect mechanism pulls the control stick forward when the speedbrakes are opened, and returns the stick to its original position when the speedbrakes are closed, thus decreasing the noseup and nosedown pitching. Some trim change will occur when the speedbrakes are operated. The degree of this trim change will be a function of airspeed. For further information on use of the speedbrakes, refer to Diving.

12.3 TAKEOFF AND LANDING CHARACTERISTICS

12.3.1 Takeoff. Takeoff characteristics differ slightly from previous A-4 aircraft and are distinguished by nose heaviness requiring increased noseup stabilizer trim. To obtain liftoff at predicted takeoff speed, full aft stick is required approximately 10 knots prior to predicted takeoff speed. As the aircraft rotates, apply forward stick to maintain takeoff attitude and allow aircraft to fly itself off the deck.

12.3.2 Landing. Approach and landing characteristics are essentially as exhibited by previous A-4 aircraft. At optimum approach angle of attack, increased noseup stabilizer trim is required. Landing rollout characteristics are improved with spoiler deflection and significantly improved in crosswind conditions through the combined spoiler effects of reduced lift, increased deceleration, and reduced weathercocking tendencies.

12.4 LEVEL FLIGHT CHARACTERISTICS

12.4.1 Slow Flight. Control is good during slow flight at approach and landing speeds; however, a lateral-directional oscillation is present in rough air.

12.4.2 Cruising. Level flight cruising characteristics are normal and satisfactory trim and control forces are available. At high altitudes and cruising airspeeds, a lateral-directional oscillation occurs in rough air, which may be counteracted by application of control surfaces. Longitudinal stability is weak to neutral at increasing aft center of gravity positions.

12.5 TRANSONIC MACH CHARACTERISTICS

At airspeeds up to Mach 0.85 no unusual tendencies are apparent and stick forces are low to moderate. A mild nosedown trim change occurs at Mach 0.85 and increases slightly up to Mach 0.98. This trim change can be countered by applying small increments of noseup stabilizer trim (Refer to paragraph on 12.5.3). At Mach 1.02, a very slight noseup tendency appears, and increases gradually up to the maximum permissible speed. Care must be exercised to avoid exceeding the maximum limits. The aircraft is also predictably sensitive to longitudinal control and trim inputs. Up to Mach 0.90 the maneuvering stick forces are normal and control is good, but above Mach 0.90, elevator effectiveness drops appreciably. An increase in stick deflection and therefore an increase in stick force will be required to achieve comparable load factors (Figure 12-1). Lateral-directional oscillations will be more noticeable in this flight regime if stability augmentation is not engaged. Transonic flight should be conducted with STAB AUG on.

12.5.1 Transonic Pitchup. During accelerated recoveries from dives at supersonic speeds, a marked pitchup, proportional to existing normal load factor, will occur at approximately 0.95 IMN. This increase in load factor is partially because of a marked increase in elevator effectiveness when decelerating through 0.95 IMN. After the initial abrupt increase in load factor or pitchup, the load factor will continue to build up at a slower rate as Mach number is decreased below 0.95 IMN, unless the pilot relaxes aft pressure on the stick.

In the critical aft cg condition, it is possible to develop the following load factors at supersonic speeds, maintaining constant stick forces as speed drops off to 0.85 IMN without exceeding limit load factor in the ensuing pitchup:

1. 10,000 feet – 3.8g.

2. 20,000 feet – 3.5g.

3. 30,000 feet – 3.2g.

The pitchup severity depends on the initial load factor or stick position, being most severe for full aft stick. At altitudes above 15,000 feet, and at high load factors, aircraft buffet will be encountered above 0.95 to 0.98 IMN. This buffet should be heeded as a warning to relax aft stick pressure. If corrective action is applied by promptly relaxing the aft stick pressure, the pitchup can be appreciable lessened.

CAUTION

When using load factors in excess of those listed above for supersonic dive recoveries, relax aft stick pressure promptly, either upon encountering the initial sharp pitchup at about 0.95 IMN or on encountering aircraft buffet. Note that at altitudes below 15,000 feet aircraft buffet does not occur prior to pitchup.

Transonic pitchup during a speed reduction in the region where a marked increase in elevator effectiveness occurs can be appreciably decreased or eliminated entirely by reducing aft stick force as Mach reaches 0.98.

12.5.2 Transonic Maneuvering. Pullouts or accelerated maneuvers in the transonic range are characterized by abrupt random wing drop accompanied by general aircraft buffet. Large changes in bank angle may require momentary relaxation of load factor in order to level the wings and continue the pullout. The magnitude of the wing drop and intensity of the buffeting is generally proportional to the load factor developed.

12.5.3 Diving. The diving characteristics of the aircraft are normal except when steep dives are conducted in clean configurations from high altitudes where airspeeds increase into the supersonic range. Under these conditions, the elevator effectiveness will be reduced and the aircraft basic stability will become high, limiting the g available even with full aft stick.

Dive recovery nomographs are provided in Figure 12-5. Figure 12-5, sheet 1 shows the altitude loss after the load factor is applied and sheet 2 shows the altitude lost during pilot reaction time. The above two values must be added to determine the total loss in altitude from initiation of the dive recovery to level flight. The altitude loss given is for a constant airspeed pullout. Flight tests have shown actual altitude loss to be 1,000 feet to 2,000 feet greater than computed values because of aircraft acceleration at high power settings or steep dive angles.

WARNING

Figure 12-5 does not consider buffet onset or structural limits. See maneuverability chart, Figure 12-4.

The accelerometer should be referred to immediately upon initiating a pullout from a supersonic dive to ensure that enough load factor is being developed to recover.

Note

- If difficulty is experienced in recovering from dive, speedbrakes should be opened immediately and throttle retarded in an effort to reduce airspeed and limit altitude loss in recovery maneuver.

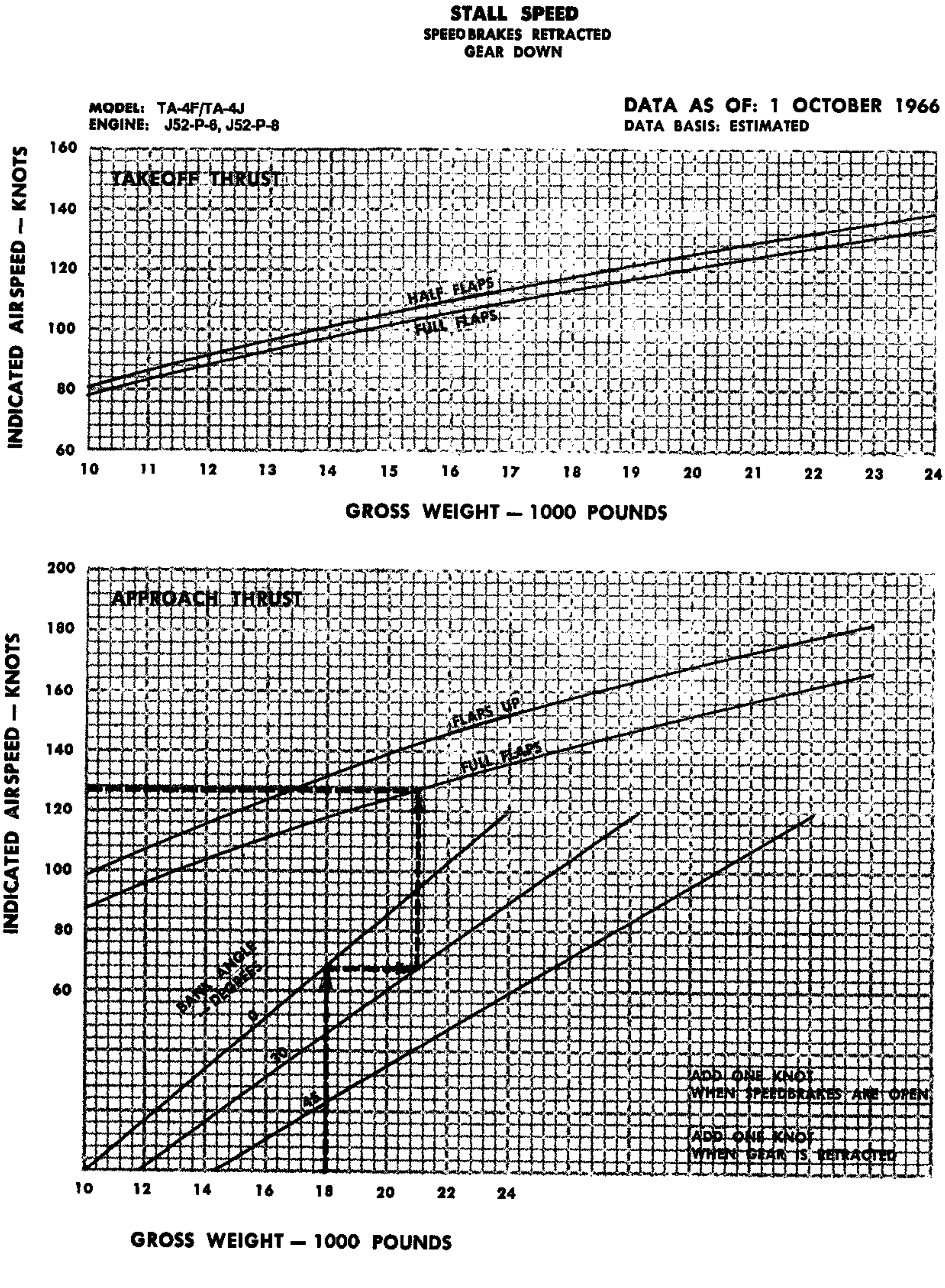


Figure 12-2. Stall Speeds

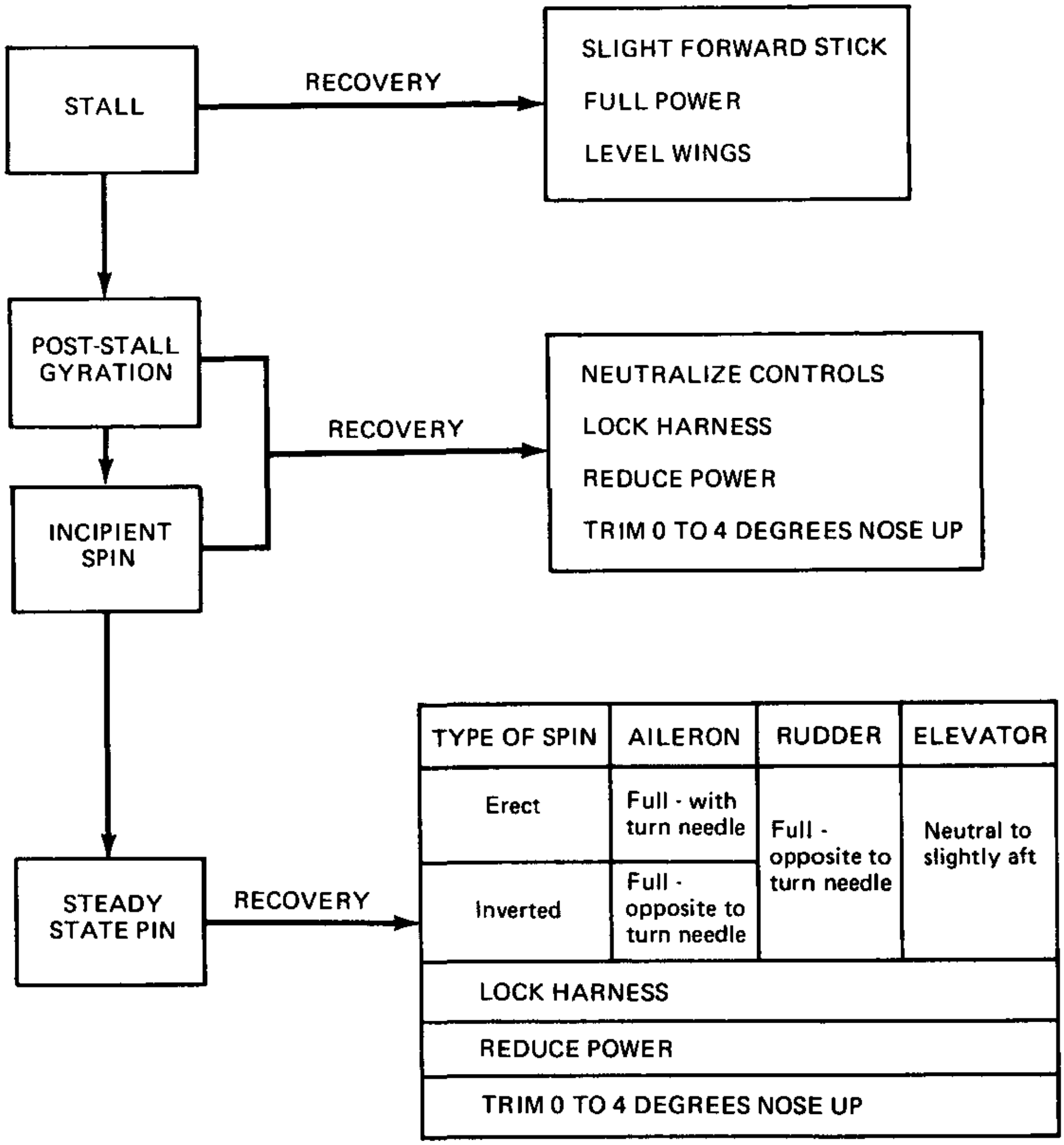


Figure 12-3. High AOA/Out-of-Control Flight Recovery Summary

- Maximum speed for fully effective opening of speedbrakes is 440 KIAS. Speedbrakes are partially effective up to maximum speed capabilities of the aircraft; however, a slow uncommanded roll may occur at airspeeds above 400 KIAS because of asymmetric speedbrake extension. The roll is easily countered by small lateral inputs.

If the elevator power system should fail during a supersonic dive, the stick force required for recovery will be so high as to prohibit normal recovery procedures. Use of aircraft noseup stabilizer trim will then become mandatory to effect recovery.

CAUTION

Do not use the horizontal stabilizer as a dive recovery device except in an emergency. A pitchup will occur as the airspeed drops below approximately Mach 0.94, increasing the chance of structural overstress.

If the speedbrakes are used before entering the dive, airspeeds will be limited to lower values where the increase in stick forces will not be severe.

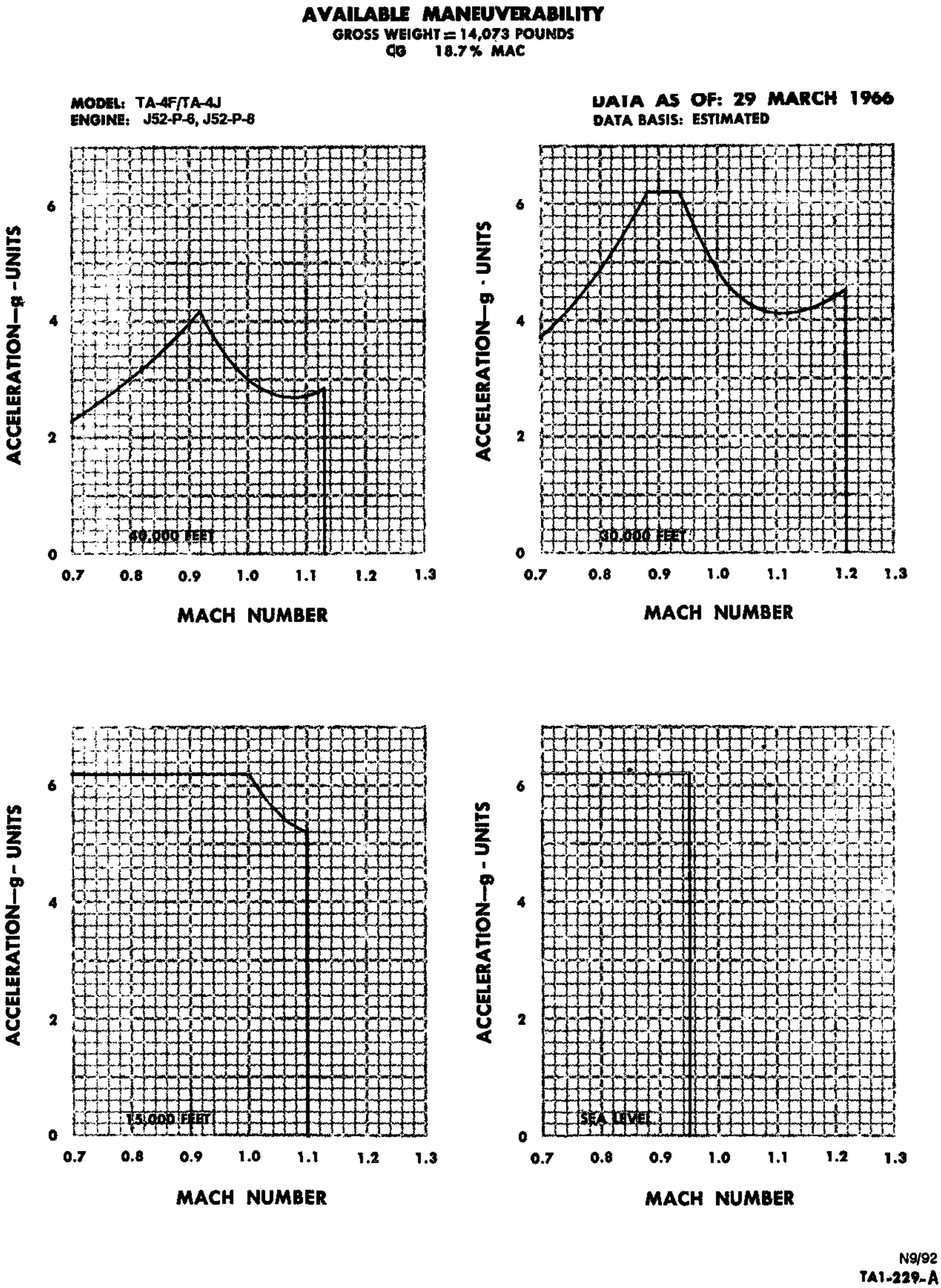
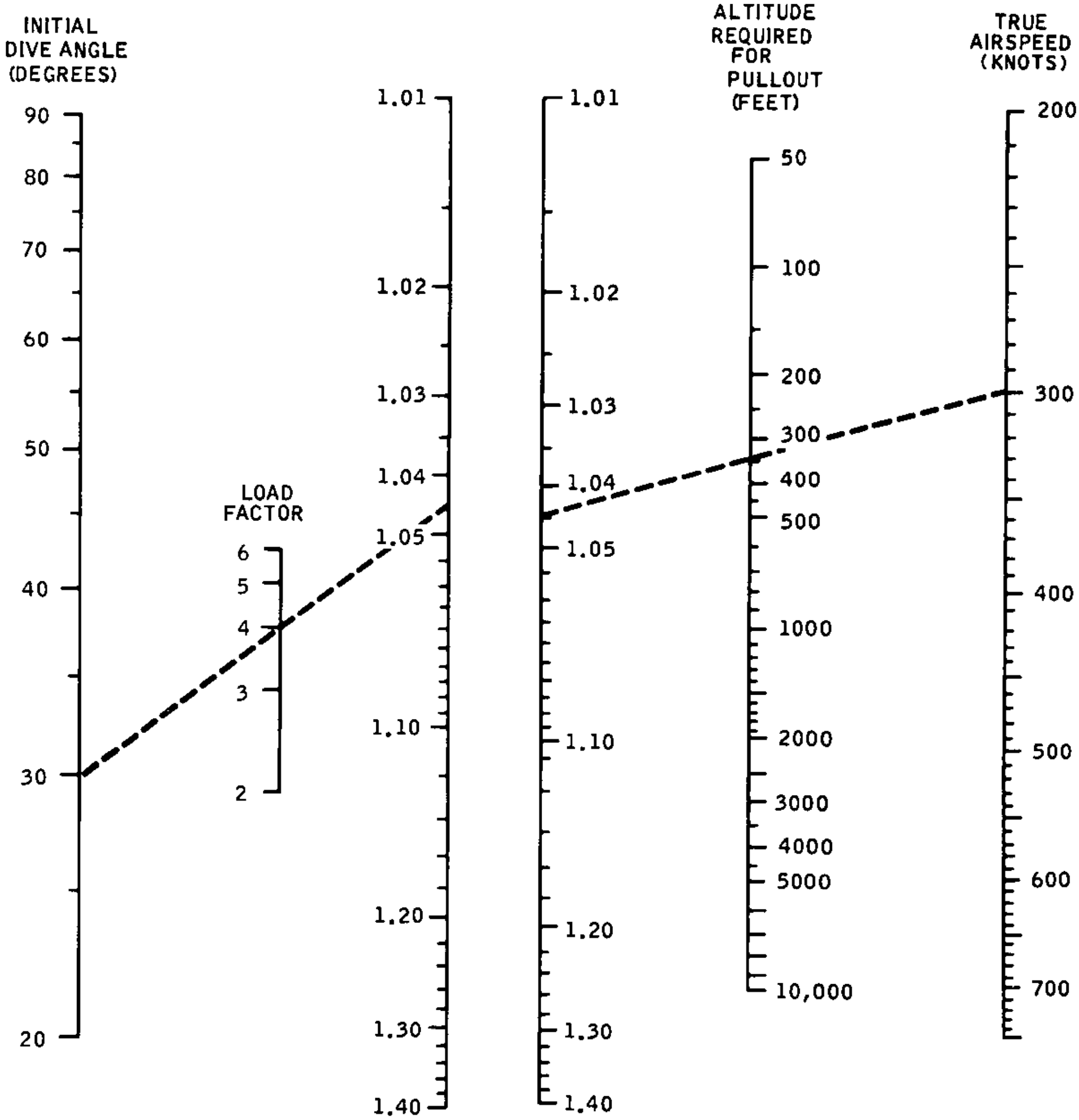


Figure 12-4. Available Maneuverability

DIVE RECOVERY
ALTITUDE LOSS DURING CONSTANT G PULLOUT



NOTE:

$$\Delta h = 0.08856\, V_T^2 \ln\left(\frac{n - \cos\gamma}{n - 1}\right)$$

Δh = ALTITUDE LOST (ft)
V_T = TRUE AIRSPEED (kn)
n = NORMAL LOAD FACTOR
γ = FLIGHT PATH ANGLE

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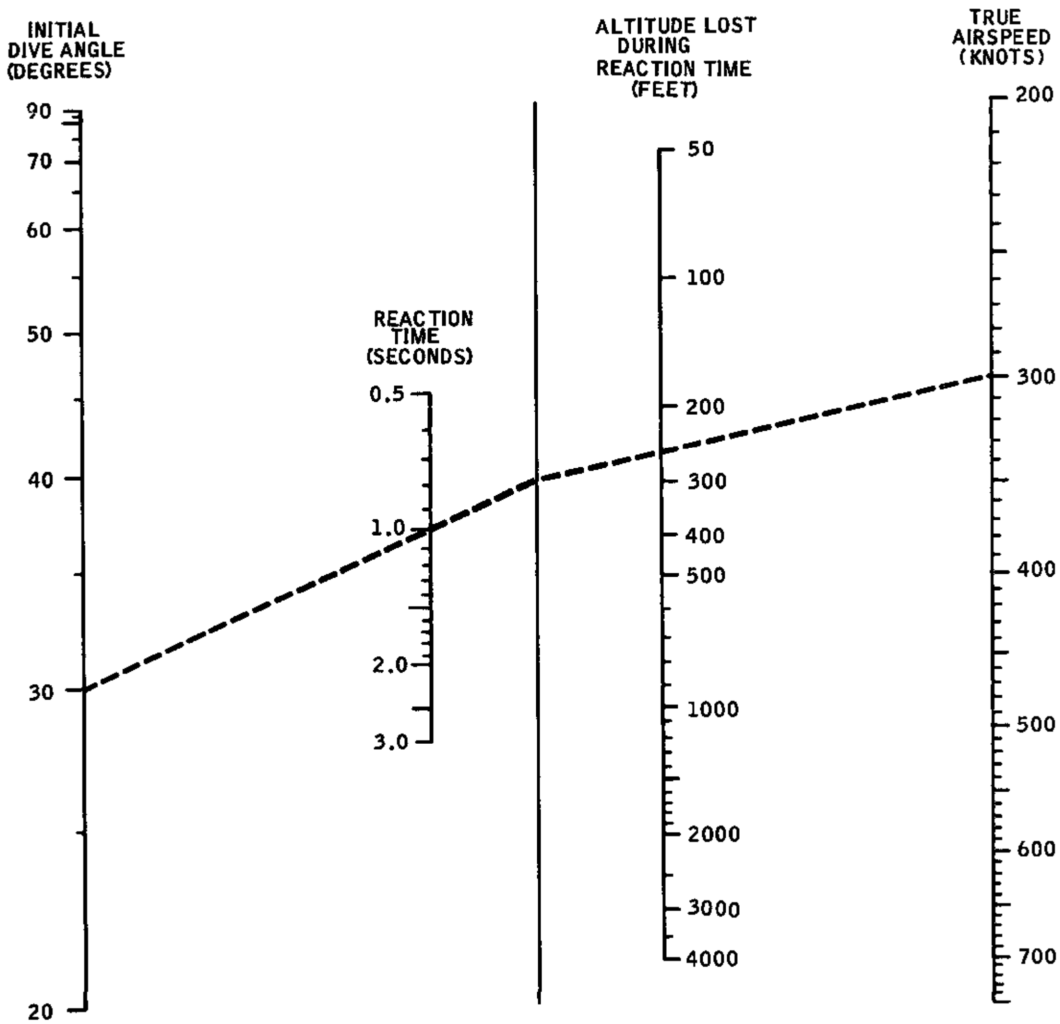
Figure 12-5. Dive Recovery Chart (Sheet 1 of 2)

DIVE RECOVERY
ALTITUDE LOSS DURING PILOT REACTION TIME



NOTE:

$\Delta h = 1.689\ V_T \times \Delta T\ \mathrm{SIN}\ \gamma$

Δh = ALTITUDE LOST (ft)
V_T = TRUE AIRSPEED (kn)
ΔT = REACTION TIME (sec.)
γ = FLIGHT PATH ANGLE (deg)

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Figure 12-5. Dive Recovery Chart (Sheet 2 of 2)

Note

The speedbrakes will begin to blowback at approximately 490 KIAS.

12.5.4 Flight with Power Control Disconnected. Power control disconnect above 300 KIAS or 0.80 IMN should be avoided if at all possible. Reduce thrust and open speedbrakes to decrease Mach to this value before disconnecting. Trim aircraft laterally prior to disconnect, if possible. The aircraft is subject to strong wing-dropping tendencies above 0.90 IMN, with the boost disconnected. Available rate of roll with maximum pilot effort in this speed range may be insufficient to overcome wing dropping tendencies. Although the aileron tab retains some effectiveness, the slow speed of operation of this tab makes it difficult to keep up with the random wing dropping. Wing dropping tendency disappears as airspeed is reduced to 0.85 IMN, and available roll rate from pilot input forces increases, making the aircraft once more controllable. (Refer to Part I, Chapter 2, Hydraulic Power Disconnect.)

12.6 FLIGHT WITH EXTERNAL STORES

Flight characteristics with external stores aboard are satisfactory. Adequate control is available to hold the wings level during landing with an asymmetrical loading up to 7,500 foot-pounds static moment on either wing. Wing heaviness or random wing drop may be encountered at medium altitudes (20,000 to 25,000 feet) and high subsonic speeds (between 0.94 and 1.0 IMN) when carrying certain stores, or in braked dives.

With various aft store loadings on the multiple bomb racks, the cg will shift aft. In the event that the aft bombs fail to release because of a rack malfunction, the cg may exceed the permissible aft limit. As the cg moves aft, the longitudinal stick forces become very light during low fuel state operation, and particularly in the landing configuration. If stick forces are so light and control sensitivity so great that landing may be extremely hazardous, the pilot should jettison the multiple bomb racks. (Refer to the Weight and Balance Handbook. AN 01-1B-40, for permissible cg limits.)

With asymmetric loadings, simple elevator control displacement induces roll as well as pitch. With control hydraulic power on, aileron control is sufficient to counteract roll induced by elevator control displacement. With hydraulic power off, at speeds above 200 KIAS, the roll induced by elevator displacement cannot be adequately controlled because of high lateral stick forces and low lateral control response. Accordingly, with hydraulic power off, longitudinal control should be minimized and airspeed should not exceed 200 KIAS with asymmetrical loadings. (Refer to Part I, Chapter 2, Hydraulic Power Disconnect.)

With asymmetric store loadings, the following recommendations are made:

1. That a straight-in approach should be made with a known or suspected asymmetrical load. Increased wing drop may be experienced if a break is made into the heavy wing. This condition greatly decreases available deflection for lateral attitude control as the aircraft transitions from break airspeed to landing pattern airspeed.

2. That the minimum approach speed be 115 knots with up to 7,500 foot-pounds of asymmetric moment, varying linearly thereafter to 130 knots at 12,500 foot-pounds. Normal approach angle of attack should be maintained so long as the resulting airspeed does not become less than this minimum. On manual control with asymmetric moments up to 7,500 foot-pounds, the initial approach speed should be a minimum of 140 knots with a minimum final approach and touchdown speed of 125 knots. Landings on manual control with asymmetric moments greater than 7,500 foot-pounds are not recommended. When landing with 7,500 to 12,500 foot-pounds of asymmetric loading, a minimum rate of descent landing is recommended.

3. That crosswind landings be made upwind or downwind, whichever is required to put the crosswind component under the heavy or loaded wing providing other factors such as runway length and gross weight are considered.

12.7 MANEUVERING FLIGHT

Premaneuvering checklist:

1. Koch fittings – ATTACHED AND SECURE

2. Lap restraints – TIGHT

3. Loose gear – STOWED

4. Drop tank pressurization – OFF

5. Anti-g suit – CHECK FOR PROPER OPERATION

6. Slat check – COMPLETE

7. Thunderstorm lights – AS DESIRED.

Available maneuverability is shown graphically in Figure 12-4. Longitudinal and lateral maneuvering characteristics are normal throughout the level flight speed range of the aircraft, however, flight characteristics in the following maneuvers should be noted.

12.7.1 Roll Characteristics

12.7.1.1 Aileron Rolls. During and upon termination of high rate aileron rolls (above 200° per second) in the high speed, low altitude regime, abrupt pitchdown will be noted. This pitchdown, though uncomfortable, is structurally safe and aircraft structural limits will not be exceeded provided 360° of roll are not exceeded.

CAUTION

When executing high rate, low altitude rolls (greater than 3/4 lateral stick input), apply recovery controls after completing 180° of roll to prevent exceeding 360° of roll.

12.7.1.2 Rolling Pullouts. High sideslip angles and a pitchup tendency occur in rolling pullouts in which high roll rates are developed. At high altitudes, the pitchup tendency increases the likelihood of inadvertent stall and spin. At low altitudes, sideslip angles are reduced but the pitchup tendency is considerably stronger. The normal load factor should be monitored during rapid rolling pullouts at low altitude, and, if an increase in the normal load factor is noted, the stick should be eased forward.

12.7.1.3 Rolling Pushovers. During recoveries from high rate rolling pushovers in the high and medium speed, low altitude regime, a marked pitchdown will be noted. The pitching tendency is a result of inertia coupling and is not noticeable in normal rolling pushovers with a moderate roll rate. If bank angle changes are limited to 180° or less, the pitchdown will not become excessive regardless of the lateral stick deflection used during the maneuver.

CAUTION

The pitchdown, described above, can exceed the structural limits of the aircraft. A marked nosedown pitching moment may occur during or upon recovery from a high rate rolling pushover which can generate a negative normal load factor in excess of the structural design limit of the aircraft.

12.8 DIRECTIONAL STABILITY

Directional stability is dependent on the relation of vertical tail size and its displacement from the aircraft center of gravity as compared to the area of the fuselage forward of the center of gravity. Various modifications of A-4 series aircraft have added considerable fuselage and canopy area forward of the aircraft center of gravity without any corresponding resizing of the vertical tail. Although the TA-4J exhibits adequate directional stability throughout the normal flight envelope, high sideslip angles and yaw rates can easily develop during departures as the airspeed decreases below 100 KIAS.

12.9 HIGH ANGLE-OF-ATTACK CHARACTERISTICS

12.9.1 Adverse Yaw. The A-4 series aircraft are equipped with relatively large ailerons in order to provide sufficient roll control at landing and takeoff speeds. Deflection of the ailerons will generate a yawing moment opposite to the direction of roll (i.e., right roll, left yaw). This characteristic is conventionally termed adverse yaw and will not be particularly noticeable or objectionable to the pilot throughout the normal operating envelope of the aircraft. Flight test results have indicated that lateral inputs after a departure from a low airspeed, high angle-of-attack maneuver can generate excessive adverse yaw that may result in roll rates as high as 130° per second and yaw rates as high as 40° per second. The pilot must hold and visually verify neutral lateral stick positioning after entering this phase of flight from these conditions.

12.9.2 High Angle-of-Attack Pitchup. During flight with aft center of gravity locations (aft of approximately 24-percent MAC), high angle-of-attack pitchup may be encountered when applying load factor. This pitchup is normally preceded by buffet onset and a buildup of buffet intensity. The pitchup manifests itself by a rapid increase in load factor with no change in stick position. At altitudes above 30,000 feet, the aircraft limit load factor will not be exceeded if pitchup is encountered. At altitudes below 15,000 feet and speeds above 0.80 Mach, adherence to the load factor limit will preclude the aircraft from encountering pitchup. Between 0.50 and 0.80 Mach number with a center of gravity aft of approximately 24 percent, it is possible to attain pitchup when maneuvering near limit load factor. At intermediate altitudes of 15,000 to 30,000 feet, the pitchup can result in exceeding the limit load factor. Even though the elevator effectiveness is reduced under these conditions, the severity of the pitchup can be controlled by partial forward stick movement. The onset and buildup in intensity of buffet cues serve as a warning that the pitchup boundary is being approached.

Pitchup does not occur below Mach 0.40 and, therefore, does not present a landing or low speed problem. The probability of encountering high angle-of-attack pitchup can be minimized by limiting pullups to buffet onset when operating with loadings where the center of gravity is aft of approximately 24-percent MAC. (Refer to center of gravity loading charts.)

CAUTION

Full forward stick should not be used to recover from a high angle-of-attack pitchup, as excessive negative load factors may occur.

12.9.3 Normal Stalls. The 1.0g stall is characterized by a mild nosedown pitch accompanied by small lateral and directional oscillations at approximately 24 units AOA. Full power will decrease the magnitude of the pitch break. Warning cues during the approach to the stall are in the form of light airframe buffeting which steadily increases as the stall is approached. At stall, the wing slats will be fully extended and ailerons remain effective. Full aft stick is required to stall the aircraft when pitch trim is less than 4° noseup. Because of limited elevator effectiveness, the aircraft will not stall inverted. The aircraft exhibits no tendency to depart controlled flight during the stall. Stall speeds are shown in Figure 12-2.

12.9.4 Accelerated Stalls. The accelerated stall is characterized by heavy airframe buffet, small longitudinal and lateral-directional oscillations, and full aft stick. Adherence to the aircraft structural limitations will preclude load factors which will result in accelerated stalls with the slats up. During flight tests, the slats always opened prior to achieving a stall condition. Above 0.7 Mach and at limit load factor with slats up, the aircraft controls were fully effective in all axes although heavy airframe buffet was experienced.

12.9.5 Stall Recovery. In the case of normal stalls, the conventional technique of decreasing angle of attack by moderate forward stick displacement, simultaneous full power addition, and leveling the wings should be used for stall recovery. Optimum angle of attack is recommended for nose-low recoveries. Recovery from accelerated stalls is easily accomplished by relaxing aft stick.

12.10 NOSE-HIGH, LOW AIRSPEED MANEUVERS

12.10.1 Nose-High, Low Airspeed Characteristics. During maneuvering flight, nose-high, low airspeed conditions may be encountered that necessitate termination of the maneuver and recovery to the normal flight regime. This flight condition should be considered as a period of increased spin susceptibility because of low directional stability; therefore, the aircraft should be maneuvered with caution.

WARNING

Intentional maneuvers to 90° to 100° nose high, zero airspeed conditions shall not be performed in the TA-4 aircraft because of the possibility of inadvertent inverted spin entry.

Flight tests have shown that lateral stick inputs of less than 1 inch have resulted in inverted spin entry from the 90° to 100° nose-high attitude with fuel remaining in the external drop tanks, or stores loaded. Loss of external stores and racks and structural damage to the aircraft may result should an inverted spin occur.

In most instances, the aircraft will pitch to a nosedown attitude and undergo a few random roll and yaw oscillations at low airspeed. During the nosedown pitch, the nose may pass through the vertical, nose-down position in a pendulum fashion, momentarily attaining an inverted attitude, before stabilizing in a near vertical nose-low dive with rapidly increasing airspeed.

12.10.2 Nose-High Low Airspeed Recovery. Recoveries from such conditions with airspeed above 100 KIAS are most effectively accomplished by attempting to maneuver the aircraft under positive g to the nearest horizon. Below 100 KIAS, the pilot must accept the aircraft attitude and initiate the procedures for out-of-control flight.

Minor engine compressor stalls during the post-stall gyrations may occur as rapid staccato banging. When they occur, they should serve as an added warning to neutralize controls and retard the throttle to below 80-percent rpm.

CAUTION

While the aircraft normally recovers all zero/low airspeed conditions if the controls are held neutral, it may occasionally enter a nose-low roll with increasing airspeed. When this occurs opposite aileron and rudder may be required to stop the roll.

12.11 OUT-OF-CONTROL FLIGHT

12.11.1 Introduction. Out-of-control flight, in general, can be divided into three phases (see Figure 12-3):

1. Departure - Post-Stall Gyration. When the aircraft, as a result of a stall or other phenomenon, such as asymmetric slat extension, leaves the region of normal flight and actuation of the regular flight controls does not result in the normal aircraft response.

2. Incipient Spins - That phase of a spin, after the post-stall gyration, when the aircraft is pitching, rolling, and yawing in a spin-like motion, but prior to the time when a steady state spin has developed.

3. Steady State Spin - The phase of a spin when the aerodynamic and inertia forces have reached a balance and the aircraft's pitching, rolling, and yawing motions are repeating in cyclic fashion. The yaw rate is sustained, and angle of attack is above stall in either a positive or negative direction.

12.11.2 Departure (Post-Stall Gyrations)

12.11.2.1 Characteristics. The A-4 series aircraft are not departure-prone; however, departures from controlled flight can occur as a result of nose-high, low airspeed conditions or asymmetric slat extension during accelerated stalls. Departures resulting from nose-high, low airspeed conditions are initially characterized by large uncommanded nosedown pitch rates (up to 70° per second), and followed by random post-stall gyrations in roll and yaw. Because of the reduced directional stability, the TA-4 aircraft is more susceptible to inadvertent spin entry than the A-4 after departure from a 90° to 100° noseup attitude when allowed to decelerate to zero or near zero airspeed. Lateral or longitudinal control inputs aggravate aircraft motion and can result in large yaw excursions, prolonging the out-of-control flight condition.

The pilot must accept the random roll and yaw oscillations associated with the out-of-control flight condition. Intentional and/or inadvertent control inputs will increase the magnitude of roll and yaw excursions, prolonging the post-stall gyration, and could result in spin entry.

In some instances, post-stall gyrations can exhibit high roll rates at zero or negative load factor and can be easily confused with an inverted spin. In this case, the angle of attack will oscillate as the airspeed continually increases.

Note

The aircraft is not spinning if the airspeed increases through 200 KIAS.

12.11.2.2 Recovery. Following a departure, neutralizing all flight controls will facilitate recovery during the post-stall gyration or incipient spin phase. In fact, application of spin recovery controls during these phases will increase the probability of spin entry. Therefore, following a departure, maintain neutral controls during the post-stall gyration, monitor the angle-of-attack, airspeed, and altitude, and commence dive recovery as airspeed increases through 200 KIAS. If residual rolling motions exist at or above 200 KIAS, stop the roll with aileron prior to commencing dive recovery. Observe the slat operation and position to ensure that they are functioning properly.

Large airflow distortions during a spin increase the probability of compressor stalls. The higher the power setting, the greater the potential for severe compressor stall. Therefore, power should be reduced below 80-percent rpm following a departure.

Once the aircraft has departed from controlled flight, whether entered from 1.0g or accelerated flight, comply with out-of-control flight procedures.

WARNING

- The rudder and ailerons should be neutralized immediately upon departure from controlled flight. The longitudinal control should be positioned and visually verified slightly aft of the neutral position. The use of both hands is recommended in properly positioning the control stick.
- A stabilizer trim setting greater than 6° noseup or less than zero is the same as intentionally holding aft or forward stick during the post-stall gyrations. The slightly aft stick position for recovery is dependent upon proper setting of the stabilizer trim. Failure to set pitch trim between 0° and 4° aircraft noseup can delay or prevent recovery.

CAUTION

During the post-stall gyrations associated with the controls neutral recovery, the pilot is in a zero or negative load factor condition and the motions often appear similar to those experienced in an inverted spin. Do not apply spin recovery controls unless a spin is confirmed by a sustained yaw rate with low airspeed and a pegged angle of attack.

12.11.3 Spins

12.11.3.1 General. The results of the Navy spin evaluation of the TA-4F are used for the following discussion, and are considered applicable to all A-4/TA-4 models.

The first step in any out-of-control situation is to neutralize all controls, assess the aircraft's motion, and determine if the aircraft has entered a spin.

Note

Do not apply spin recovery controls until the spin mode and direction have been positively identified. Recovery has been achieved on occasion while maintaining neutral controls.

In a fully developed spin, the rotation rate varies from 4 to 14 seconds per turn with an altitude loss of 2,000 to 7,000 feet per turn. Rate of descent will vary from 20,000 to 35,000 FPM.

With proper recovery controls maintained, recovery from a fully developed spin may require up to three turns if erect and up to four turns if inverted. The ailerons are the most powerful recovery control and must be applied properly to recover from any spin.

Neutralize controls as the rotation stops. Allow the airspeed to build up to 200 KIAS prior to starting the dive pullout. Altitude loss can be minimized by applying g as necessary to maintain airspeed at about 230 knots and angle of attack at 18 to 20 units. An altitude loss of 4,000 to 5,000 feet will occur during the pullout. A minimum altitude of 10,000 feet above the terrain is recommended to terminate spin recovery attempts if still spinning.

WARNING

If spin occurs below 10,000-feet AGL and neutralization of flight controls does not result in prompt recovery, EJECT. Recovery from a fully developed spin below 10,000 feet is considered doubtful since 4,000 to 5,000 feet may be needed to stop the spin and an additional, 4,000 to 5,000 feet are required to pull out. Recovery from a departure may be accomplished with altitude losses varying from 0 to 7,000 feet depending on entry conditions and pitch attitude on recovery.

12.11.3.2 Upright Spin Characteristics. The aircraft is very resistant to erect spin entry and generally requires pro-spin controls to be applied and maintained.

The most common erect spin is the steep oscillatory spin in which a 360° roll occurs during the first one or two turns. Roll and pitch oscillations occur continually after the first turn and varies ±70° in roll angle and 0° to 70° nosedown. There are frequent hesitations in spin rotation and the aircraft sometimes turns in a direction opposite to rudder deflection. No sustained yaw rate develops, airspeed usually increases as the spin continues, and angle of attack varies from 20 to 30 units.

Less frequently, relatively flat, erect spins have occurred, sometimes developing after several steep turns as described in the preceding text. Aircraft roll oscillations vary between 20° left and 20° right wing down. Airspeed fluctuates between 50 and 150 knots but does not increase as the spin progresses. The angle of attack will be pegged at 30 units. There is no hesitation in spin rotation, which is fast: 3 to 4 seconds per turn with an altitude loss of 1,200 to 1,500 feet per turn. Recovery from this spin mode will be slower than from the previously described erect steep oscillatory mode.

Erect spins entered from an accelerated stall have the same characteristics as those entered from 1.0g flight, except that more violent snap-roll type maneuvers occur during the first two or three turns.

12.11.3.3 Upright Spin Recovery. The recovery controls for an erect spin are full rudder against the spin (opposite direction of the turn needle), full aileron with the spin (same direction as turn needle), and longitudinal stick position from neutral to slightly aft. The ailerons are the primary recovery control and aircraft response will occur in the form of roll in the direction of the applied aileron. When spin rotation stops, neutralize all controls. The aircraft will be in a nosedown attitude.

Large noseup stabilizer trim settings have sometimes impeded the recovery from erect spins. In addition, noseup trim settings to more than 6° may cause the aircraft to enter an accelerated stall on recovery. Longitudinal trim setting should be checked and the stabilizer retrimmed 0° to 4° aircraft noseup after departing controlled flight and while maintaining neutral controls.

12.11.3.4 Inverted Spin Characteristics and Types. The inverted spin is oscillatory and extremely disorienting. Pitch attitude varies from the horizon to full 90° down, and roll oscillations are erratic. The angle of attack indicator is near zero units, and airspeed fluctuates between 50 and 150 knots. The aircraft sometimes executes 360° rolls while spinning inverted, and occasionally rolls to an erect position, pauses momentarily, and then continues inverted. During these rolls to the erect position, the angle of attack will oscillate through the full scale of the indicator, the turn needle will reverse as yaw rate changes direction, and g will become momentarily positive. Spins which exhibit this characteristic are referred to as the hesitant inverted mode. The spin rate is fast: 3 to 4 seconds per turn with altitude loss of 800 to 1,200 feet per turn. Negative load factors of over -2.5g have been experienced during inverted spins. High lateral accelerations caused by the high roll rates add to the overall disorientation of this flight condition.

12.11.3.5 Inverted Spin Recovery. The recovery controls for an inverted spin are full aileron and full rudder against the spin (opposite direction of the turn needle). Longitudinal stick position must be neutral or slightly aft. Forward stick impedes recovery. Spin direction in the hesitant inverted mode must be determined during the inverted portion of the spin rather than during the random upright condition. The pilot may sense that the aircraft is in the recovery phase; however, because of low sideforce cues, it is impossible to determine the magnitude of any existing yaw rate. Neutralizing flight controls at this point will likely allow the aircraft to reenter the spin. The surest indication of recovery from this spin mode is an increase in airspeed above 200 KIAS. A relatively high rate residual roll may occur during recovery which will stop upon neutralizing the controls.

WARNING

- During inverted spins, the control stick will float forward if released because of the flight control system bobweight arrangement. Forward stick will impede or even prevent recovery. To ensure that the stick is neutral, it is necessary to visually verify the control stick position to a cockpit reference point, and both hands should be used to properly position the stick. Normal stick force cues are not valid and the pilot/stick relationship will not be the same because of negative g encountered in inverted spins. Up to 20 pounds of stick pull force may be required to keep the stick centered during inverted spin recovery.

- The pilot restraint system in the A-4/TA-4 aircraft offers poor restraint under the zero and negative g's associated with inverted spins. When hanging in the shoulder straps or pressed up against the canopy, the pilot loses normal reference cues for proper positioning of the recovery controls.

12.12 SLAT OPERATING CHARACTERISTICS

12.12.1 Normal Operations. Under positive g flight conditions, the slats will initially extend in the 12 to 16-unit angle-of-attack range. In 1.0g flight, the slats will begin to extend below 200 KIAS. Flight tests have shown that even with properly adjusted slats initial opening may occur as slow as 170 KIAS. The slats may open at slightly different airspeeds or angles of attack which will present no control problems. During accelerated flight, the mild buffet cues present prior to slat extension will disappear upon initial slat opening. A light buffet will resume at an AOA approximately 2 to 3 units above that required for initial slat extension. Slat opening characteristics are affected by aircraft external configuration. Flight tests have shown that in accelerated flight conditions with empty wing stations, the slats will open more abruptly and extend at a slightly higher AOA (i.e., approximately 0.5 to 1.0 unit higher) than when the AERO-1D external fuel tanks are carried on stations 2 and 4. No objectionable handling qualities developed as a result of these configuration differences.

WARNING

Satisfactory operation of slats should always be verified as described in Part III, Chapter 11 prior to maneuvering flight. All maneuvering (accelerated flight) phases shall be discontinued if acceptable slat performance is not achieved.

12.12.2 Asymmetric Slat Characteristics. During maneuvering flight, slat extension asymmetry frequently occurs as a result of slat track binding because of the aeroelastic bending and twisting effects of the wing and/or sideslip excursions resulting from uncoordinated flight. Sideslip will subject each slat to a different angle of attack. Flight tests have shown that sideslip angles greater than 1° (i.e., one ball width out of trim) cause 1 unit AOA difference in slat deployment up to 300 KIAS and 2 units AOA at higher airspeeds. As defined in Part III, 1 unit AOA difference in slat deployment results in unacceptable operational performance.

The A-4 series aircraft exhibits three asymmetrical slat conditions:

1. Poor modulation of either or both slats after deployment.

2. Slat fully locked out (normal operating opposite slat).

3. Slat fully locked in (normal operating opposite slat).

The first condition is extremely common during maneuvering flight and is characterized by the slats failing to move smoothly and in unison over the full range of travel. Handling qualities ranging from mildly objectionable wing rocks to abrupt lateral/directional loss of control can occur. The amount of slat asymmetry, not AOA, is the limiting factor in asymmetric slat controllability. Loss of control occurs when the difference in slat positioning approaches 2/3 of full travel (differential of approximately 6 inches out of 9 inches available travel). AOA at the critical slat differential will vary from 19 to 24 units, depending on stuck slat positioning and flight conditions of the maneuver.

Flight tests have shown that the aircraft is fully controllable up to 425 KIAS in condition two. In unaccelerated flight, the aircraft exhibited a roll into the extended slat which can be controlled with small opposing lateral control inputs. The amount of required lateral control decreases as load factor is increased. So long as the second slat operates on schedule, no other abnormal handling qualities exist.

Condition three is the most serious asymmetrical slat condition and can result in out-of-control flight. The aircraft is controllable in both unaccelerated and accelerated flight up to 19 units AOA. When 19 units AOA was exceeded during flight tests, a very abrupt lateral-directional loss of control occurred. Rapid full aileron inputs into the extending slat to counterroll rates that were in excess of 140° per second resulted in severe rates in excess of 30° per second within the first 90° of turn. In general, the severity of the departure is directly dependent on gross weight, altitude, airspeed, and load factor. Immediate neutralization of controls and reduction AOA will aid recovery, however, the pilot may have difficulty finding the neutral position because of the violence of post-stall gyrations. In a benign departure, prompt recovery may be realized with less than 100° angle of bank change. In extreme departures violent post-stall gyrations will result and up to 5,000 feet may be required for recovery. Particular consideration should be given to maneuvering flight over areas of high elevation, because of resultant lack of available recovery altitude.

WARNING

Attempts to counter the abrupt roll-off of large asymmetric slat extension with aileron and rudder could reinforce departure nose slice, and may result in rapid, dynamic departure, and possible spin entry.

2.13 AERODYNAMIC LOCKOUT

Because of the large angle between the plane of the slat chordline relative to the wing chordline, the slat can develop large negative angles of attack if fully extended at airspeeds above 200 KIAS. This can occur during pushovers or extended inverted flight and will result in the slats remaining fully extended because of high drag forces. This aerodynamic lockout of the slats can be overcome by slowing the aircraft, thereby reducing the negative AOA and drag force. Slats should retract at approximately 200 KIAS. No degradation in flying qualities will result from this phenomenon, and the aircraft is fully controllable even if one slat is fully extended and the other is retracted so long as the AOA is maintained below 19 units.

CAUTION

Slat retraction at high speed may cause damage to the slat and/or leading edge of the wing.

12.14 UNUSUAL ATTITUDE RECOVERY WITH ASYMMETRIC SLATS

12.14.1 Nose-High, Low Airspeed. If an asymmetric slat extension occurs in the 90° to 100° nose-high attitude, maintain 16 to 18 units AOA and maneuver the aircraft out of the vertical attitude. If airspeed decreases below 100 KIAS, neutralize controls when pitch attitude is beyond the 90° to 100° nose-high cone and allow the nose to pitch through the horizon and airspeed to increase above 200 KIAS prior to applying recovery controls. If one slat remains extended during the recovery, the slow roll into the slat can be easily controlled with a small lateral control input above 100 KIAS.

12.14.2 Nose-Low, Increasing Airspeed. Recover to level flight when airspeed increases above 200 KIAS. Any g level can be used to recover from a dive with an asymmetrical slat configuration so long as 19 units AOA is not exceeded. A 16- to 18-unit AOA or 3g to 4g (whichever is achieved first) recovery is recommended and provides a satisfactory tradeoff between aircraft controllability and altitude loss.

12.15 AVAILABLE MANEUVERABILITY

For available maneuverability of the TA-4F/J, see Figure 12-4.

12.16 FLIGHT CHARACTERISTICS ON AFCS

The AFCS (autopilot) is described in detail in Part I, Chapter 2. When flying hands off, the aircraft is completely stable about all three axes, with no tendency to oscillate. See Part I, Chapter 4, for airspeed limitations while operating on AFCS. Certain flight characteristics of the AFCS are inherent in its detail design and constitute normal performance. Flight characteristics which are evident to the pilot are discussed in the following paragraphs.

12.16.1 Wing Down Phenomena on Heading Hold. There are particular circumstances which may result in temporary wing down condition while on heading hold. Asymmetric loading, directional trim, and platform gyro precession result in temporary wing down conditions.

Asymmetric loading causes the aircraft to be directionally out of trim and to fly wing down. Lateral and directional trim is available to the pilot and he should trim when necessary. On AFCS, directional trim is available at all times. Lateral and pitch trim is available in the control stick steering mode. If the pilot does not trim directionally, the aircraft will maintain a constant skid at a banked attitude. Speed changes result in changes in directional trim. On AFCS flight, just as in normal flight, the pilot should trim the aircraft as necessary.

12.16.2 Rollback on Roll Attitude Hold. Control stick steering switching levels and pilot technique in conjunction with the ability of the AFCS to synchronize changes in roll attitude will determine the amount of rollback obtained on roll attitude hold. On establishing a bank angle, some pilots prefer to release the stick before the rolling rate decays to zero. In this event, the roll synchronizer will lock on the roll reference at the time the force on the stick passes below 2 pounds. The aircraft overshoot and rollback can be as much as 5° to the AFCS reference. If the pilot elects to hold the desired bank angle in control stick steering for 1 or 2 seconds, no rollback will occur. Both techniques may be used. Obtaining roll attitude accuracy will require use of the latter technique.

12.16.3 Control Stick Steering Feel. The flight characteristics when on "control stick steering" mode are the same as for the basic aircraft except that the control stick experiences a change in feel which is the result of rate feedback and mode switching.

When on control stick steering, the stick is referenced to the rate gyros and as rate is developed, a very small amplitude, low frequency stick motion or feel results. Slight stick transients caused by the automatic return to the heading hold mode occur when making small bank angle or heading changes. These transients will be observed whenever the stick force varies above or below the 2-pound level and the aircraft is at a bank angle of less than 5°. Such transients are normal and result from the design characteristics of the heading hold mode.

12.16.3.1 Pitch. On control stick steering mode, forces are provided by electrical signals from the accelerometer, pitch rate gyro, and elevator deflection. The resulting electrical feel is slightly lower than that of the normal power control. There is less variation in stick force per g over the flight regime. The breakout force on control stick steering mode has been reduced to 2 pounds, as compared with 3 pounds on normal power control.

12.16.3.2 Roll. Aileron control forces in the control stick steering mode are slightly lower than normal power control forces. Breakout forces are 2 pounds and 3 pounds, respectively.

12.16.3.3 Yaw. The rudder control forces and breakout forces are identical in both modes.

12.16.4 Control Stick Steering Engage Transients During Auto Trim. The AFCS is equipped with automatic pitch trim which operates within 4 to 6 seconds after establishing a new flight condition. If the pilot should elect to go back on control stick steering before the automatic trim system has stabilized, he may encounter a control stick steering engage transient. This is normal and will not occur if the pilot remains out of the CSS mode longer than 6 seconds.

12.16.5 Hesitation or Loss of Rolling Rate On Preselect Heading Roll In. During the preselect heading roll in, a slight hesitation or loss of rolling rate may occur at approximately 20° of banked attitude. This is a normal phenomenon which is not detrimental to the performance of these circuits.

12.16.6 Preselect Heading "STEPPY" Roll Out. During the preselect heading rollout a tendency to roll out in steps or hesitations has been observed. These steps are the result of choosing the optimum gain ratio between heading and roll attitude. The optimum heading to bank ratio is a compromise between a smooth rollout and a short rollout time.

12.16.7 Sensitive Regions of Preselect Heading. Abrupt roll transients will occur on preselect reading if the SET knob is adjusted to command a turn in a direction opposite to the turn being made. The same phenomenon will occur if a heading change greater than 180° to the present aircraft heading is commanded while the aircraft is stabilized in the preselect heading turn. The preselect heading mode is designed to take the shortest path to the selected heading. If the aircraft is stabilized in a bank for a left turn and a right turn is commanded, the aircraft will immediately roll the opposite direction at maximum rate. Such preselect heading commands should not be initiated while stabilized in a turn.

12.16.8 Longitudinal Stick Motion During Automatic Trim. Automatic trim or trim transfer is provided when the pilot relief modes of the AFCS are in use. When the automatic trimming occurs, the stick is observed to move longitudinally. This movement arises from two sources. These are the geared elevator effect and relief of trim. The elevator is mechanically geared to the stabilizer so that any motion of the stabilizer will result in a motion of the elevator. The elevator motion is always in a direction to increase the camber of the horizontal tail. Trim relief occurs when the elevator is no longer holding the aircraft in trim and the elevator is returned to the zero position. The stabilizer now maintains aircraft trim. In event of a maneuver such as prolonged high g turns in attitude hold, automatic trim of the horizontal stabilizer will result in 2° to 3° noseup stabilizer. As speed decreases additional noseup stabilizer is required. At this time, if reversion to level attitude hold is desired, a force up to 15 pounds may be required on the stick, and if released, will cause pitchup. This stick force must be trimmed out on AFCS to approximately zero force prior to releasing stick.

12.17 APPROACH POWER COMPENSATOR (TA-4F)

2.17.1 Normal Procedures Before Landing. Perform the following checks and actions:

1. Complete landing checklist.
2. Throttle friction - OFF.
3. Temperature switch - SET.
4. APC power switch - STANDBY (observe APC light is on).
5. APC power switch - ENGAGE (observe APC light is off).

WARNING

Do not engage APC with fuel control in MANUAL. Automatic throttle movements associated with APC operation are rapid and could result in compressor stall or flameout.

6. Throttle - Observe movement.
7. Angle-of-attack/airspeed - Crosscheck.

12.17.2 Normal Procedures After Landing. Perform the following checks and actions:

1. Throttle - Reposition as required.
2. APC light - ILLUMINATED.
3. APC power switch - Check for STANDBY position.

12.17.3 APC Technique. The technique required for an APC approach differs from a manual approach in that all glide slope corrections are made by changing aircraft attitude. Since this technique violates the basic rule that altitude is primarily controlled by throttle, practice is required to develop proper control habit coordination necessary to use APC.

Smooth attitude control is essential for the satisfactory performance of the APC. Large, abrupt attitude changes result in excessive thrust changes. Close-in corrections are very critical. A large attitude correction for a high close-in condition produces an excessive power reduction and can easily result in a hard landing. If a high close-in situation develops, the recommended procedure is to stop meatball action and not attempt to recenter the meatball. A low close-in condition is very difficult to safely correct with APC and usually results in an over-the-top bolter. The recommended procedure for a low close-in condition is to override the APC and complete the pass manually. Throughout the approach, the pilot should keep his hand lightly on the throttle in case it becomes necessary to manually override the APC.

CHAPTER 13

Flight Procedures

13.1 FLIGHT PROCEDURES

13.1.1 General. The basic flight procedures contained in this section are for guidance. Where amplification is desired, refer to the appropriate Naval Warfare Publication.

CNATRA provides supplementary instruction and syllabi to fulfill training command requirements.

13.2 TRANSITION AND FAMILIARIZATION

13.2.1 Requirements. Transition and familiarization will be accomplished in accordance with the requirements outlined in Part II. This training will be conducted in the replacement air wing or in the squadron, as directed by the appropriate commander.

Familiarization flights should be designed to acquaint the pilot with the flight characteristics of the TA-4F/J while it is flown at various attitudes, altitudes, and configurations.

13.2.2 Procedures. The following procedures shall be followed for the first familiarization flight, in addition to those required for other flights.

13.2.2.1 Before Flight. The instructor pilot shall accompany the FAM pilot during his preflight inspection and start.

13.2.2.2 During Flight. Perform those prebriefed maneuvers which will give a general feel of the airdraft, both in the clean and dirty configuration. Stalls and confidence maneuvers will be practiced in designated areas and at altitudes which will ensure straight and level flight above 10,000-feet AGL upon completion. It is recommended that familiarization flights include a landing with the flight controls disconnected using disconnect procedures set forth in Part III, Functional Checkflight Procedures.

13.2.2.3 Return to Field and Landings. The return to field and landings on the first two FAM flights will be monitored by an instructor pilot qualified in the TA-4F/J.

13.2.3 Weather Considerations. All solo familiarization flights will be conducted under conditions which will permit climb and descent in VFR conditions and permit visual contact with the ground at all times.

13.3 NORMAL FLIGHT

13.3.1 Cruise Control. General cruise-control techniques are found in the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T. Specific cruise-control data are contained in Part XI, Performance Data. Additional comments and suggestions follow.

13.3.1.1 Climb. Acceleration to initial climb speed should be effected prior to passing through 1,000 feet.

Use the airspeeds recommended in the performance data charts to obtain the best rate of climb; however, speeds may be varied 10 knots above or below those stipulated without appreciably affecting climb performance. Maintain MILITARY rpm throughout the climb for best results, observing at all times the engine rpm, exhaust gas temperature, and time limitations as set forth in Part XI.

13.3.1.2 Cruise. Shortly after leveling at altitude and establishing cruising speed, the pilot should note the fuel used in the climb and check actual fuel flow against the planned consumption rate. The transfer from the external tanks should be commenced. Each pilot should develop his ability to judge distances on the ground from his position and altitude. This sense of distance is quite necessary for accurate navigation at high altitude. Landmarks at considerable distances from the desired track may frequently be used.

13.3.1.3 Descent. Descents may be made very rapidly by using IDLE power and speedbrakes.

For a maximum range descent, throttle back to IDLE and maintain the gliding speeds recommended in Part XI.

Prior to descent, adjust cabin temperature in both cockpits and defrost air, in forward cockpit, as necessary to prevent windshield frost.

CAUTION

For aircraft with reduced smoke engines installed (J52-P-8 engines with PPC 185 incorporated), a minimum in-flight engine rpm of 70 percent should be maintained to preclude possible flameout.

13.4 MINIMUM FUEL

Minimum fuel for final landing shall be as defined in OPNAV 3710.7. In no case shall this state be less than that required for 800 pounds fuel remaining after final landing.

13.5 FORMATION AND TACTICS

Procedures for specific maneuvers are promulgated in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T). The following instructions apply to A-4/TA-4 aircraft as general basic maneuvers.

13.5.1 Rendezvous

13.5.1.1 Turning Rendezvous. The turning rendezvous is made at 250 KIAS (unless otherwise briefed). When all aircraft are in a loose trail position, the leader commences a 25° to 30° bank turn. Each member of the flight waits until the lead aircraft passes 30° off his nose (out of the bullet-resistant windshield) and then rolls into a 45° bank turn, moving toward the inside of the leader's turn. After the leader passes back through the 12 o'clock position, the bank angle should be decreased slightly to avoid an excessive heading change. Wingmen may add enough power to gain a 10- to 15- knot speed advantage to expedite the rendezvous. As the rendezvous bearing is attained (35° to 40° aft of abeam), adjust the bank angle to maintain this bearing. As the aircraft closes on the leader and his aircraft becomes more defined, the leading edge of his wing should be utilized as the correct bearing, and power should be readjusted to control the closure rate. The wingman should join on the inside of the leader and then cross under to a normal wing position on the opposite side. This rendezvous may be accomplished either in level flight or with the leader in a stabilized climb.

13.5.1.2 Tacan-Circling Rendezvous. A tacan-circling rendezvous is used when aircraft are separated by extended or indefinite distances or time intervals. The pattern will be a port orbit tangent to the designated tacan radial, at a specified distance and altitude. Normally, each pilot flys outbound on the assigned radial, maintaining the briefed climb schedule and cruise speed. Upon reaching the joinup circle, each pilot commences a 250 KIAS (unless otherwise briefed) port orbit using 30° of bank until visual contact is made with the flight leader. At this time, the pilot plans a turn to cut across the circle, making sure that he is not cutting another aircraft out, and intercepts the rendezvous bearing. He then proceeds with a normal rendezvous and if necessary, request the leader's position. The leader will then state his position in the orbit pattern using the numbers 1, 2, 3, and 4 corresponding respectively to the orbit point, 90°, 180°, and 270° as shown in Figure 13-1. If tacan is not available, this same procedure may be accomplished by establishing the orbit point passing over a geographical point on a base heading. UHF/ADF may be useful in picking up the leader.

13.5.1.3 Running Rendezvous. A running rendezvous is effected by closing on the leader from the rear on a prebriefed radial or heading. This rendezvous is usually utilized in a climb-on-course situation and should be accomplished with the leader maintaining 250 KIAS and 90-percent rpm (unless otherwise briefed). If it is effected in level flight, the leader will maintain 250 KIAS (unless otherwise briefed) at a prebriefed or designated altitude. This, being the most dangerous type of rendezvous because of lack of adequate depth perception and sense of closure rate by the pilot joining, requires strict compliance with proper procedures. The joining aircraft will utilize no more than a 100 KIAS closure rate. A 6 o'clock approach will not be maintained closer than 1-1/2 miles from the leader. At a minimum of 1-1/2 miles, the

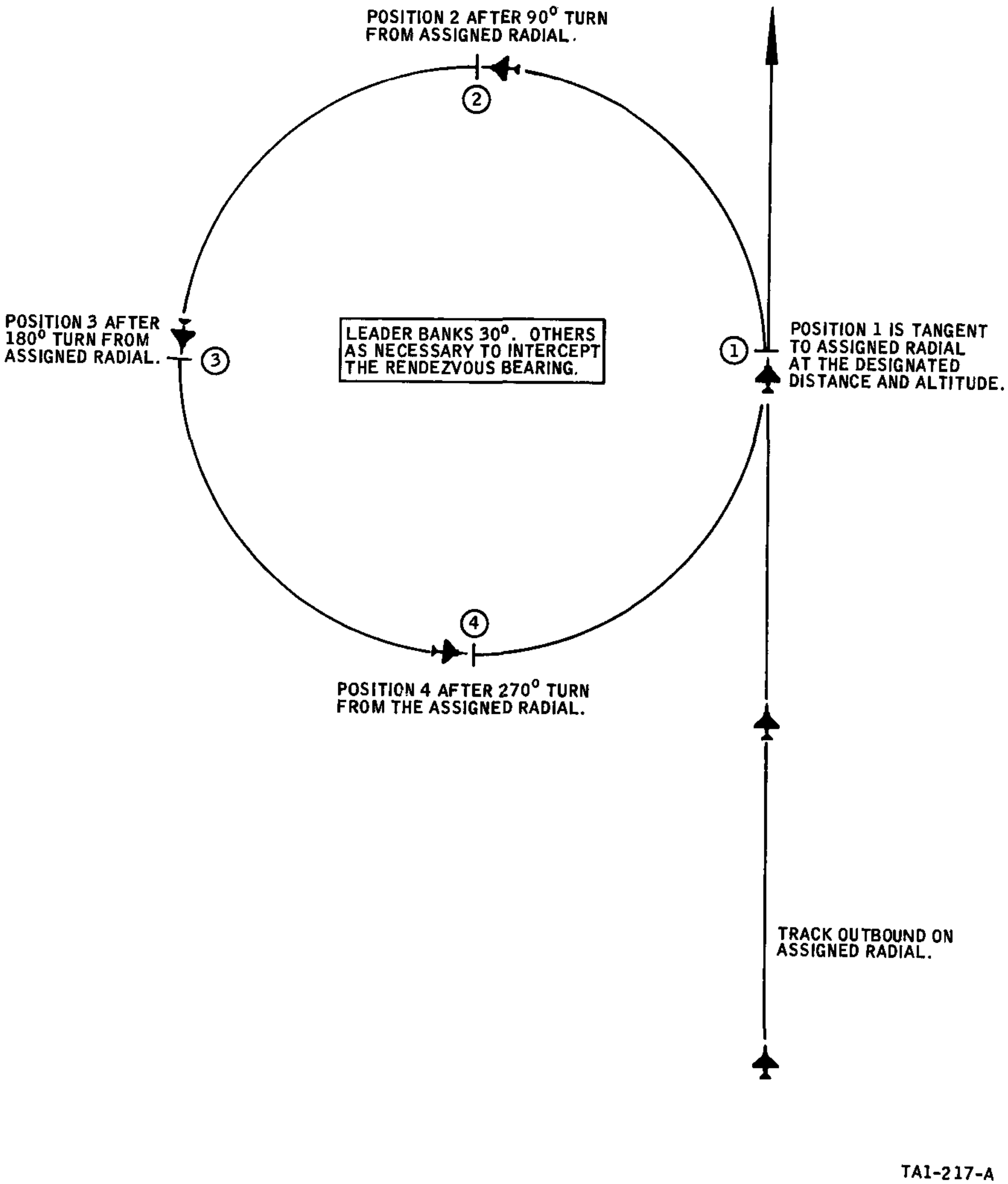


Figure13-1. Tacan-Circling Rendezvous

joining aircraft will move out to a 5 or 7 o'clock position from the leader and establish a course parallel to the leader. This course will be maintained until the joining aircraft arrives at a position abeam and has matched the leader's airspeed. The wingman will then slide laterally to the normal wing position. The use of the A/A (air-to-air) mode of the tacan and the UHF/ADF for rendezvous during periods of darkness or reduced visibility enhances safety immeasurably and should be utilized if possible.

13.5.1.4 UHF/ADF Running Rendezvous. The UHF/ADF rendezvous is useful for joining aircraft under all conditions, and particularly during a straight-course running rendezvous. When used in conjunction with the A/A mode of the tacan rendezvous, ability and safety are greatly enhanced. The procedure to be used for the latter is as follows:

1. Trailing aircraft select ADF position on the UHF control.

2. The flight leader will transmit a short count every minute, and when climbing, include the passing altitude.

3. Trailing aircraft will position themselves so that as the leader transmits the short counts, the No. 1 needle points 5° left or right of the nose position. The No. 2 aircraft will hold the leader to his left, No. 3 to his right, etc.

4. As the trailing aircraft approach the flight leader, they will turn to keep him 5° (left or right respectively) off the nose position. The amount of turn required to maintain the leader in this position will increase as the separation is reduced. Continue until visual sighting is obtained.

5. Slight altitude separation may be warranted.

13.5.1.5 Tacan Ranging (A/A)

Note

When operating the tacan in the A/A mode, distance to the origin of the strongest signal received will be transmitted to as many as five aircraft. This signal is not necessarily the distance to the nearest aircraft.

Air-to-air (A/A) ranging requires cooperating aircraft to be within line of sight distance. This mode enables the tacan installation to provide range indications between one aircraft and up to five others. Tacan displays normal range and azimuth information in the T/R mode and range information only in the A/A mode (the azimuth indicator, No. 2 needle, rotates continuously).

If A/A operation is desired between two aircraft the channels selected must be separated by exactly 63 channels, i.e., No. 1 aircraft set to channel 64, No. 2 aircraft is set at channel 1. Both aircraft must then select A/A on the tacan function switch with the range between aircraft being displayed on the DME indicator. The maximum lock on range is 198 miles. However, because of the relative motion of the aircraft, the initial lock on range will usually be less.

If A/A operation is desired between one lead aircraft and five others, the channel selected by the lead aircraft may be 64, for example. The other five aircraft must be separated by exactly 63 channels, and would be on channel 1. The A/A mode must then be selected on the tacan selector switch.

13.5.1.6 ARA-50 Circling Rendezvous. If a circling rendezvous is to be made, the flight leader will maintain prebriefed airspeed, 30° of bank, a specific altitude, and broadcast a short count and heading every minute. The trailing aircraft will correct head ing to keep the No. 1 needle on the nose when the leader transmits. From the change in azimuth of the No. 1 needle between short counts, approaching aircraft will be able to determine their proximity to the lead aircraft. Approaching the flight leader, the needle will change more degrees in azimuth between counts, requiring larger corrections to keep the leader on the nose. At this time, the leader can probably be detected visually and a standard rendezvous completed.

13.5.1.7 Low-Visibility Rendezvous/Rendezvous on Different Model Aircraft. This type of rendezvous should be performed in emergency situations only when directed by higher authority or when the urgency of the mission dictates. The rendezvousing aircraft should be flown at a safe maneuvering airspeed. The initial procedures will be as previously described for standard rendezvous. However, the latter stages should be modified as outlined below.

1. Establish radio contact, if possible, and deter mine indicated airspeed and intended flightpath of the aircraft to be joined.

2. Place all lights on BRIGHT and FLASHING (if applicable).

3. Rendezvous about 1,000 feet out, slightly aft of abeam (4 or 8 o'clock) the lead aircraft.

4. Cautiously close, while assuring constant nose-to-tail clearance. Maintain a constant relative bearing. Changes in relative bearing will cause foreshortening or lengthening of the aircraft fuselage and make determination of closure rate difficult.

5. A rendezvous on a different model aircraft and/or in low-visibility conditions is extremely conducive to vertigo. A high degree of caution and good judgment must be exercised throughout the rendezvous. At no time should a rapid-closing situation be allowed to develop.

13.5.1.8 Safety Rules for Rendezvous

1. During all rendezvous, safety shall be the prime consideration.

2. Keep all aircraft ahead constantly in view and join in order.

3. During rendezvous, only enough stepdown should be used to ensure vertical clearance on the aircraft ahead.

4. When necessary a wingman should abort the rendezvous by leveling his wings, sighting all aircraft ahead, and flying underneath them to the outside of the formation. He should then remain on the outside until all other aircraft have joined.

5. To avoid overshooting, all relative motion should be stopped when joining on an inside wing position. A crossunder to the outside may then be made.

6. During a running rendezvous, use caution in the final stage of joinup, as relative motion is difficult to discern when approaching from astern.

13.5.2 Formation

13.5.2.1 Section Takeoff. The leader will position his aircraft on the downwind side of the runway. Section takeoffs will not be performed with dissimilar type aircraft nor with a crosswind component in excess of 8 knots. Aircraft will line up on a parade bearing with enough lateral clearance to provide separation between aircraft in case the leader experiences a blown tire or is required to abort on takeoff. When the section is in position, the flight leader will give a turnup signal and both pilots will turn up to 85-percent rpm. All final checks will then be made before takeoff and each pilot will check the other's aircraft visually for leaks, trim settings, canopy closed, and flap setting. A raised hand will be signaled by each pilot when this is accomplished and he is ready for takeoff. The leader will then drop his hand smartly out of view at brake release for commencement of takeoff run. Power will then smoothly be advanced to MILITARY and then reduced approximately 3-percent rpm by the leader. The wingman will adjust his power to maintain relative position. When the section is comfortably airborne, the leader will give a headnod and raise the gear. After the gear is up, the flaps will be raised automatically (170 KIAS minimum). As soon as the wingman is comfortably airborne, he may slide to a proper parade position.

Note

For section takeoffs, 6° noseup trim is permissible.

13.5.2.1 Parade Formation. This formation will normally be employed when operating within the airport control zone or in conditions of low visibility and/or darkness. The flight leader is very restricted and must be smooth. It is recommended that all power changes, climbs, glides, and turns be signaled by the leader. Speedbrake and gear signals are mandatory. Sliding turns by the wingmen are not permitted.

Note

Sighting along the leader's wing leading edge/or the parade bearing may be preferable during periods of prolonged formation flying, IFR, or night time.

13.5.2.1.1 Section. Bearing is determined by lining up the wingtip light (bright) with the break in the fuselage. Stepdown of about 5 feet is achieved by flying level with the leader's wing. The 5 feet of wingtip lateral clearance is achieved by estimating a 20-foot clearance from the wingman cockpit to the leader's wingtip.

13.5.2.1.2 Four Plane Division (Fingertip Four). No. 3 aircraft flies identical position on leader as No. 2. A check for both aircraft being in position is to line up the tips of opposite wingman's drop tanks. No. 4 lines up canopies of No. 1 and No. 3.

13.5.2.1.3 Echelon. All aircraft are on the same side of the leader. No. 3 and No. 4 line up canopies with No. 2 and leader to maintain position. No. 2 must fly with increased stepdown (eye level with the centerline of the drop tanks).

13.5.2.1.4 Crossunders. Upon receipt of the crossunder signal, the wingman will acknowledge and commence an arcing crossunder by reducing power, dropping nose, and sliding aft to clear the leader's tailpipe and jet wash. As the nose passes below and aft of the leader's tail, smoothly add power and complete the crossunder by sliding up and forward to the proper wing position. A section crossunder is similar with the wingman passing directly aft of the section leader as the section leader passes directly aft of the division leader. The section leader must ensure that his wingman receives the crossunder signal.

13.5.2.2 Free Cruise Formation. The free cruise formation provides better lookout capabilities and maximum freedom of movement for the leader and other members of the element.

13.5.2.2.1 Section. The bearing is about 35° to 40° aft of abeam the leader (a bearing generating from the leading edge of the leader's wing). The wingman's distance out on bearing may vary between 50 to 100 feet depending upon the mission. This will always provide for a minimum of 10 feet of nose-to-tail clearance when crossing under. The wingman will maintain position primarily by sliding to the inside of the leader's turns with a minimum of throttle movement. He should not cruise in the leader's 6 o'clock position during turns but remain on the inside of the turn on bearing. The leader cannot see the wingman while in a 6 o'clock position, and no signals can be passed while in this position.

13.5.2.2.2 Division. The bearing of the section leader from the leader is same as that of the wingman. The section leader maintains adequate distance on bearing to give him a minimum of 10 feet of nose-to-tail clearance from No. 2 aircraft when sliding laterally. All members of the element should maintain proper nose-to-tail distance and remain on bearing as much as possible to enable the leader to pass signals at any time and know where element members are at all times. (No. 4 aircraft receives signals from the section leader.)

13.5.2.2.3 Tail Chase. This formation is to be used as a confidence builder and as a practical application of relative motion. As such, it will only be flown when specifically briefed.

Position for all aircraft is 10 feet nose-to-tail clearance with sufficient stepdown to avoid the jet wash of the preceding aircraft. The tail-on view of the aircraft should be such that the tailpipe is placed on top of the canopy bow and used as a wing position indicator. Power setting used by the leader should be commensurate with the maneuver to be performed and be considerate for the number of aircraft in the formation. Others in the flight should keep in mind that since the leader decelerates first on the climb, a power reduction will probably be necessary initially, and on dives, a throttle increase because of his accelerating first.

13.6 AIR REFUELING (AIR REFUELING STORE)

Note

Refer to NATOPS Air Refueling Manual (NAVAIR 00-80T-110) for information regarding other tanker platforms.

13.6.1 Before Takeoff

1. Refueling master switch - OFF.
2. Gallons delivered indicator set to - 000.
3. Drogue position switch - RET.
4. Fuel transfer switch - OFF.
5. Hose jettison switch - OFF (FORWARD).
6. Light switch - BRT (DAY) DIM (NIGHT).
7. Ship-tank switch - OFF.
8. Ship-tank switch - FROM STORE.
9. Dump light - TEST.

Note

If there is fuel in the store, the light should come on. If there is no fuel in the store, press the press-to-test light to ensure bulb functions.

10. Ship-tank switch – OFF.

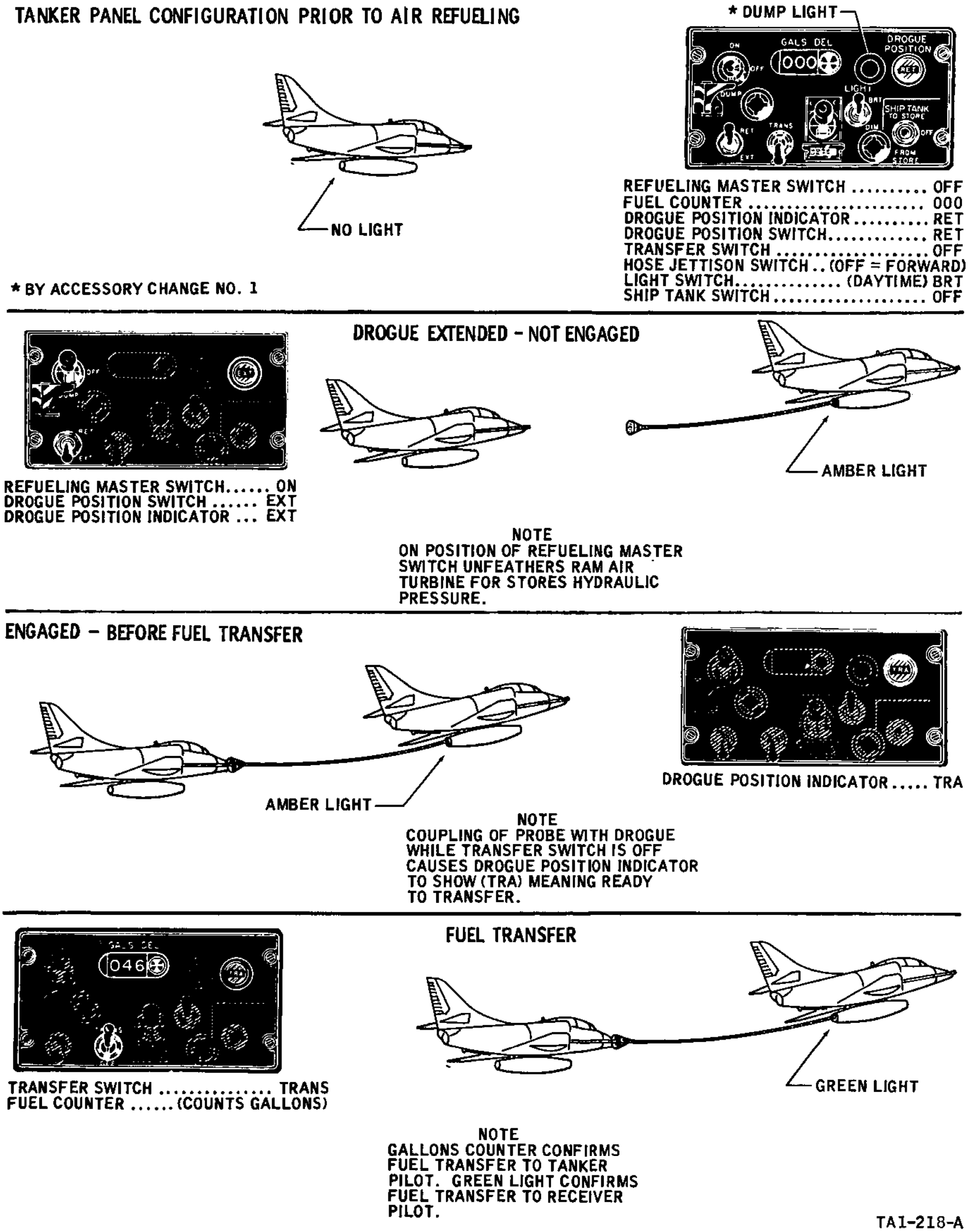
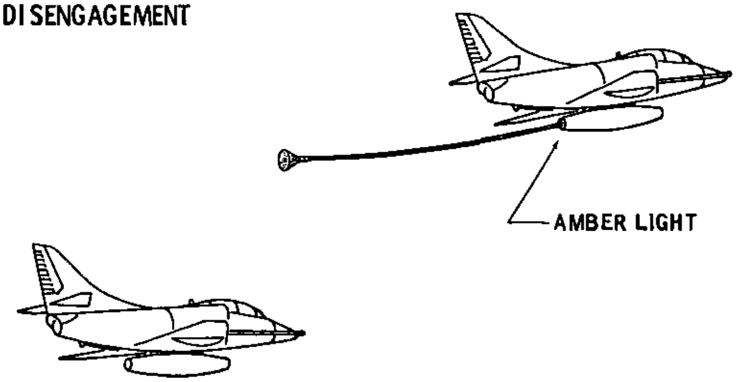


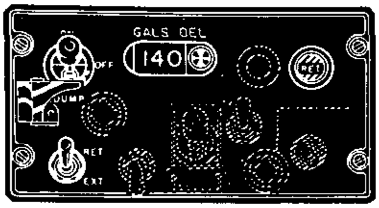
Figure13-2. Tanker Operation—Air Refueling—TA-4F (Sheet 1 of 2)

DISENGAGEMENT



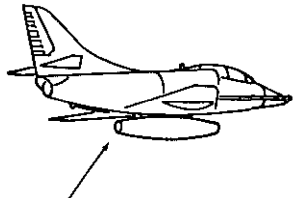
REFUELING MASTER SWITCH..... ON
TRANSFER SWITCH............ OFF
DROGUE POSITION INDICATOR .. EXT

DROGUE RETRACT

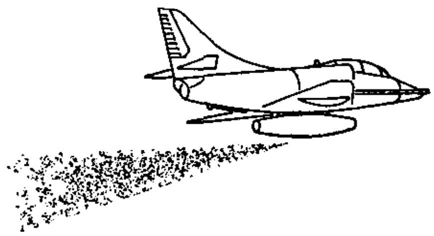


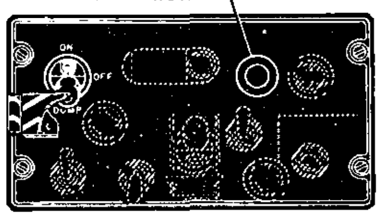
REFUELING MASTER SWITCH..... ON
DROGUE POSITION SWITCH...... RET
DROGUE POSITION INDICATOR... RET

AFTER DROGUE RETRACT
REFUELING MASTER SWITCH.... OFF



FUEL DUMP



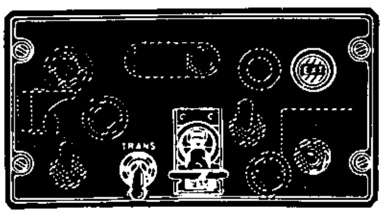


REFUELING MASTER SWITCH.....DUMP
(ALL OTHER SWITCHES SAME AS
NORMAL PANEL CONFIGURATION)

NOTE
FUEL DUMPING SHOULD ALWAYS BE DONE
PRIOR TO ANY ARRESTED LANDING
EITHER AFLOAT OR ASHORE.

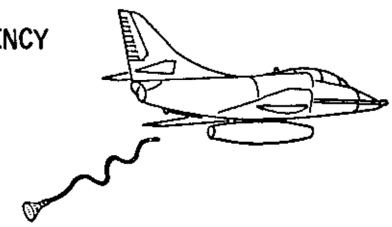
* BY ACCESSORY CHANGE NO. 1

HOSE AND DROGUE JETTISON-EMERGENCY



HOSE JETTISON SWITCH HOSE JETTISON
TRANSFER SWITCH .... OFF
REFUELING MASTER SWITCH ... (CONDITION)
DROGUE POSITION SWITCH ..... (CONDITION)
DROGUE POSITION INDICATOR........... EXT

NOTE
5 TO 20 SECOND TIME DELAY
IS A SAFETY FEATURE.



NOTE
JETTISONING CUTS OFF ALL STORE
POWER EXCEPT POWER TO SHIP TANK
SWITCH AND TO DUMP FUEL. THEREFORE,
FUEL DUMP IS POSSIBLE AFTER
JETTISONING.

WARNING

DO NOT MOVE HOSE JETTISON
SWITCH FROM HOSE JETTISON
POSITION AFTER JETTISONING.

TA1-219-A

Figure13-2. Tanker Operation—Air Refueling—TA-4F (Sheet 2 of 2)

13.6.2 Drogue Extension

1. Refueling master switch – ON.

2. Drogue switch – EXT.

Note

Be prepared for small trim changes as the drogue is extended.

3. Drogue position will read – EXT, WHEN DROGUE REACHES FULL TRAIL POSITION.

4. Ship-tank switch – TO STORE, FOR OVER 300-GALLON TRANSFER.

13.6.3 Normal Operation. When the amber light on the tanker refueling store is illuminated, the aircraft to be fueled maneuvers into position for probe-drogue engagement. After the probe is engaged in the drogue the receiving aircraft must move forward (4 to 6 feet in relation to the tanker) until the store amber light goes off. As long as the two aircraft maintain this relationship, fuel transfer may be made. Actual refueling will be indicated by the illumination of a green light on the store. Fuel flow through the probe to the wing and fuselage tanks is automatic.

If the drop tanks are to be fueled, the drop tanks switch must be positioned at FLIGHT REFUEL. Fuel flow will then be through the probe to the drop tanks, wing tank, and fuselage tank simultaneously.

CAUTION

On all receiver aircraft that have the Air Refueling Store Control Panel installed in the left-hand console, ensure that the SHIP-TANK switch is in the OFF position before engaging in air refueling. Ensure that the EMERGENCY WING TANK TRANSFER switch is in the OFF position before engaging in air refueling.

13.6.3.1 Stopping Fuel Transfer. To halt fuel transfer to the receiver at any time; turn fuel transfer switch to OFF.

Note

Refueling cannot be stopped by placing the refueling master switch in the OFF position. Refueling will stop if the receiver aircraft backs off enough for the amber light to come on or if the probe disengages. In either case, the drogue position indicator window will change from TRA to EXT.

To halt fuel transfer to the store, turn SHIP-TANK switch to OFF.

13.6.3.2 Drogue Retraction

1. Fuel transfer switch – OFF.

2. Airspeed – 250 KIAS or less.

3. Drogue switch – RET.

Note

If the drogue cannot be fully retracted at about 250 KIAS, reducing airspeed to 230 knots or less should permit full retraction.

4. When drogue position indicator reads RET, place the refueling master switch to OFF.

Note

The refueling master switch may be moved to OFF at any time after the drogue has extended. In this case the tanker store propeller will feather automatically only after the drogue has returned to the retracted position.

13.6.3.3 Transfer From Store to Wing. If it is desired to transfer fuel from the refueling store to the wing tank, place the SHIP TANK switch to FROM STORE. This will cause both drop tank air shutoff valves and the refueling store shutoff valve to open, allowing all external tanks to be air pressurized by the engine. Fuel will then flow from the drop tanks and the refueling store to the wing tank. Transfer of fuel from the store to the wing tank is very slow but will transfer fuel at about the rate that fuel is burned unless high power settings are used. While fuel is flowing from the store to the wing, the dump light will be on.

Note

If transfer of fuel from the drop tanks cannot be stopped by placing the drop tank pressurization switch on the engine control panel to OFF, check to see that the ship tank switch on the air refueling control panel is in the OFF position. If this switch is in the FROM STORE position, transfer from the drop tanks and refueling store is automatic and pressurization will be continuous unless the ship tank switch is placed at OFF.

13.6.3.4 Dumping Fuel. An electrically operated fuel dump valve is located on the bottom of the refueling store. To dump fuel, first depress the spring-loaded level guard assembly, then raise the master switch from the spring-loaded safety position and position at DUMP. While fuel is actually dumping, the dump light will be on.

CAUTION

On rare occasions, fuel dumped from the store may reenter and accumulate in the aft section of the store and may create a fire hazard if the store is operated after dumping.

13.6.3.5 Before Landing

1. Refueling master switch – OFF.
2. Drogue position indicator – RET.
3. Drogue switch – RET.
4. Fuel transfer switch – OFF.
5. Hose jettison switch – OFF (FORWARD).
6. Ship-tank switch – OFF.
7. Drop tanks switch – OFF.

Note

If practicable, open store dump valve prior to any arrested landing to ensure the store is empty. Ensure dump valve is closed prior to landing.

13.6.4 Jettisoning the Refueling Store. The air refueling store may be jettisoned electrically in the same manner as other droppable external stores. (Refer to Part VIII, Weapons System.)

13.6.5 Emergency Operation. Refer to Part V, Emergency Procedures.

13.6.6 Tanker Safety Precautions

CAUTION

- Be sure that the ship-tank switch is OFF during catapulting and arrested landings. The integral wing tank pressure increases to 6 psi above ambient when the ship-tank switch is in the TO STORE position. The addition of the 6-psi static pressure to the accelerations induced by catapulting and arresting would impose severe loads on the tank surfaces.
- When the ship-tank switch is in the TO STORE position, overpressurization of the wing tank is possible if fuel covers the fuel vent outlet in the tank. This condition will exist during negative-g operation, and when the aircraft is in a nosedown attitude.

The following is a summary of the restrictions applicable to flight with the integral wing fuel tank pressurized:

1. Aircraft velocity not to exceed 400 KIAS.
2. No catapulting.
3. No landings.
4. Coordinated turns only.
5. Aircraft load factor limits N_Z = +0.1 to +2.0.
6. No air refueling.
7. No nosedown attitudes.

8. Angle of bank shall not exceed 45°.

CAUTION

- Do not start the turbine or extend or retract the drogue when over populated areas or when other aircraft are close abeam or behind.
- Do not extend the drogue after it has been retracted when a hydraulic leak has been observed.
- Do not extend the drogue if there is any evidence of a possible electrical failure.
- Do not energize the turbine after dumping fuel unless failure to provide fuel will place another aircraft in jeopardy.
- Do not actuate the speedbrakes during any part of the refueling operation.
- Once the hose jettison switch is actuated to its HOSE JETTISON position for emergency jettisoning in flight, it shall not be moved back to its OFF position. Inadvertent cycling of this switch will cause internal damage to the store and may create a fire hazard.

13.6.7 Store Limits. The following limitations apply to the store:

1. Maximum speed for unfeathering is 300 KIAS: for extension of the drogue and refueling, it is 300 KIAS or .80 IMN. The recommended unfeathering and extension speed for training is 250 KIAS or less.

2. Maximum speed for drogue retraction is 250 KIAS. (If the drogue will not retract fully at 250 KIAS, slow to 230 KIAS or less and recycle drogue.)

3. Conduct refueling operations in straight and level flight whenever possible and, if possible, do not select TO STORE until 50 gallons of fuel has been delivered to the receiver.

13.6.8 Pilot Technique

Air refueling engagements can be accomplished at any altitude within a wide range of airspeed. Successful engagements have been made between sea level and 32,000 feet at airspeeds between 190 and 300 KIAS. The optimum airspeed for engagement is approximately 230 KIAS. Use of optimum airspeed will assist the receiver in escaping heavy buffeting caused by the tanker slipstream and jet exhaust.

Closure rates above 5 knots may induce hose whip.

If hose whipping or kinking occurs during normal receiver hookup, disengagement should be made immediately and the store inspected for hose tension regulator malfunction.

Thermal turbulence from the deck may be annoying for hookups at very low altitudes because of oscillatory drogue motion.

The receiver should start the engagement approach from behind and below the tanker. The receiver's flightpath prior to engagement should follow the angle of the trailing drogue hose, using the drogue only as a target reference during the final 3 or 4 feet prior to contact. The receiver pilot will notice increased pitch sensitivity at this point. A slight throttle advance may be necessary to maintain a definite closing rate during the final 3 feet. To facilitate engagement at night, an air refueling probe light is mounted in the outboard leading edge of the right airscoop and is controlled by a switch located on the wedge outboard of the right-hand console. Air refueling stores incorporating Accessory Change No. 33 have white lights installed in the aft section of the store and the drogue assembly to facilitate night refueling operations.

After engaging, the receiver aircraft must move forward so that a minimum of 4 feet of hose takeup occurs, starting the fuel transfer. The store hose is striped each 2 feet for the last 20 feet to be unreeled. The receiver refers to these strips to assist in maintaining a stable distance from the tanker during refueling. It is never necessary to close to a point where the stripes are not visible. The receiver should be flown so that the hose is centered laterally and maintained just above the lower centerline lip of the store's trailing edge, but not riding on or touching the lower lip. This optimum position is approximately 2 feet below the drogue's normal trailing position. This position is the most comfortable position for the receiver to avoid severe buffeting. Once the engagement has been accomplished, it is not difficult to fly the receiver dead astern with a 2-foot lateral tolerance, even in rough air or in turns up to 30° bank angle.

Mild buffeting will be felt by the receiver, but it should not be uncomfortable. Occasional mild fuel sprays of short duration may hit the receiver, but the only adverse result is possibly a greasy film on the windshield. Disconnecting is accomplished by the tanker holding constant power while the receiver retards throttle. The hose reel will unwind the takeup until it reaches the end of the hose travel and the receiver will break free.

WARNING

Do not engage, or remain engaged to, a steadily leaking drogue. The leaking fuel will be ingested into the engine and may ignite and explode. The small amount of fuel that is leaking momentarily during plug-in and disengagement is not considered dangerous.

13.6.9 Flight Procedures – Refueling Training and Refresher. Refueling training should be accomplished at various altitudes in accordance with current directives.

13.6.9.1 Prior to Refueling

1. After rendezvous has been effected, the flight leader of the receiver aircraft will position his flight in loose echelon away from the tanker on the side opposite the tanker escort, if assigned. The flight leader will then pass the lead to the tanker pilot if applicable.

The flight leader's position will be abeam the tanker with at least 200 feet separation in case a store turbine blade flies off during unfeathering.

2. When the flight is in position, the leader of the receiver aircraft or tanker escort (if assigned) will signal the tanker to unfeather (1-finger turnup signal).

3. The tanker will unfeather, ensuring airspeed is 250 KIAS or less.

4. The flight leader (or tanker escort) will indicate by a thumbs-up or down whether or not the turbine unfeathered. If the turbine does not unfeather, the tanker will secure store and not make further attempts to unfeather, unless failure to provide fuel would place receiver aircraft in jeopardy.

5. If the turbine unfeathers on the first attempt, the tanker responds to the thumbs-up signal of the flight leader (or escort) by extending the drogue.

6. As the drogue extends, the flight should fall back so that leader is abeam and level with the drogue, with about 100 feet lateral separation. Drogue extension will slow tanker speed. The tanker should adjust power to maintain desired refueling speed. 230 KIAS is recommended; however, plug-ins may be made anywhere in the store operational envelope of 200 to 300 KIAS. All aircraft will remain clear of the area directly behind the drogue during extension or retraction, in the event the hose and drogue separate from the store. If drogue extension is not snubbed as it approaches the fully extended position, do not attempt plug-ins.

7. The tanker pilot, as leader of the refueling formation, has the primary responsibility for maintaining a good lookout for other aircraft, although other members of the flight are responsible for assisting to the maximum extent possible.

8. Any evidence of a hydraulic leak from the buddy store during refueling operations should immediately be reported to the tanker pilot and the store secured.

9. Do not turn pressurization to RAM while inflight refueling. If fuel is ingested into the engine

from a leaking drogue, it may appear in the cockpit as white smoke. Immediately disengage if smoke appears in the cockpit.

10. If tanker escort is assigned, the escort pilot will fly a close parade position on the tanker throughout the evolution (except during moment of unfeathering turbine) and inform tanker when the dumping has been completed. The escort will watch for store malfunctions and provide assistance in case of tanker radio failure. Tanker escort, when assigned, will give any necessary signals for actuation of turbine and drogue. The escort will not take part in the refueling sequence when another formation is refueling.

13.6.9.2 Refueling

1. The leader should detach and move into a position 20 feet behind and below the drogue, on a plane with the trailing hose, to minimize turbulence from the tanker's wake. Call, "_____, lining up," before sliding into position behind the tanker. Observe amber light on tanker store, indicating store may be engaged. If light is not on, use caution during engagement, as hose tensioning and reel-in may be inoperative. The most likely cause, however, is a burned-out bulb. Trim the aircraft slightly nosedown to remove any slop from the elevator control system, and move forward and up the hose reference until the tip of the probe is 5 to 10 feet directly behind the drogue. Pause here long enough to get stabilized, then add enough power to close and engage the drogue at a closure speed of about 3 knots. Either the tanker or the probe and drogue may be used as the primary visual reference; however, both must be perceived to make consistent and safe engagements. Closing speeds in excess of 5 knots may cause hose-whip, with ensuing damage to probe, hose and drogue, or both. Also, if misaligned at high closure speeds, damage to radome, nose section, pitot tube, or canopy may occur. If the drogue is missed, stay below the drogue and back straight out until the drogue is in sight. Avoid looking up too high for the drogue as the pilot may unconsciously pull back on the stick and climb into the drogue. Instead, use the tanker as a reference until safely aft of the drogue.

2. After engaging the drogue, continue to push in the hose until the amber light is out, and then call, "_____, contact". The last 20 feet of hose to unreel from the store has a white stripe every 2 feet. At least two stripes must be pushed into the store before the transfer will occur. Do not fly so close that no stripes are visible. Maintain a position so that if some opening between the tanker and the receiver occurs, the transfer will not be interrupted. This position should also be along the general reference of the hose before plug-in and will keep the nose centered slightly above the lip of the aft end of the store.

CAUTION

> To preclude possible engine flameout and/or explosion, the following procedures should be used during receiver hookup. After the receiver pilot has made hookup, the tanker pilot will place the transfer switch momentarily to the transfer position and transfer 2 to 4 gallons to test for proper probe/drogue coupling. If no transmissions are heard from the receiver or the receiver does not disengage, reinitiate transfer. Excessive fuel on the windscreen, smoke or mist in the cockpit, and rising EGT are indications of possible impending engine explosion because of fuel ingestion in the engine intakes. If excessive fuel leakage is noted, the receiver pilot should notify the tanker operator immediately, retard throttle to idle, and disengage from the tanker. If the IFR probe valve continues to leak excessive fuel after disengagement, full right rudder should be applied until the valve has fully closed. This will tend to cause the fuel to flow outboard of the engine intake ducts. Do not attempt further plug-ins unless low fuel state so dictates. Inspect the probe and drogue for malfunction after landing.

3. Breakaway is accomplished by the receiver reducing power in order to open from the tanker at about 3 knots. Back straight away and down, following the line of the trailing hose. Stay behind the drogue until all members of the flight are sighted. To facilitate this, it is necessary that all members of the flight properly maintain their position in echelon. When the receiver aircraft is clear of the area behind the hose and drogue, call, "____, clear".

4. After breaking away, the leader will move to the opposite side of the tanker, where he will supervise

the refueling, giving help as necessary. After the leader is clear of the drogue, the No. 2 man in the flight will move into position and make his plug-in. He will then disengage and join the leader in loose, outside echelon, as before. Each member in turn will make plug-ins and upon completion will move to the next position on the leader.

13.6.9.3 After Refueling

1. When all members of the flight have successfully completed the hookups and are clear of the drogue, the flight leader will signal to secure the store by moving the flight forward in echelon until the leader is again abeam the tanker, with at least a 200-foot separation. When the tanker pilot observes the entire flight (and escort) in this position, he will retract the drogue and feather the air turbine. The flight leader (escort, if assigned) will indicate that the turbine is feathered by giving a thumbs-up.

2. Upon completion of refueling, the flight leader should resume lead of his flight, breaking away from the tanker in an easy turn until well clear. The tanker maintains straight and level flight until adequate separation from the receiver aircraft is assured. To ensure safe separation, an altitude differential should be maintained.

13.6.10 Mission Refueling. The range and fuel specifics or mission refueling are covered in Part XI, Chapter 25, and in the A-4/TA-4 Tactical Manual (NAVAIR 01-40AV-1T (A)).

13.7 NIGHT FLYING PROCEDURES

Night flying procedures are identical to day procedures with the exceptions given below. Night lighting doctrine is contained in Part III.

13.7.1 Night Rendezvous. Rendezvous at night are similar to daytime, except that in the final portion the pilot should try to close to a position slightly astern rather than directly toward to aircraft ahead. Pilots must be sure not to carry excess airspeed in the rendezvous. The leader must maintain a constant airspeed and altitude.

Whenever it is necessary for a pilot to go to the outside of the rendezvous, he will report this to the flight leader. Stay on the outside of the rendezvous until the remaining members of the flight have rendezvoused and then add power as necessary to join up. Pilots joining from astern will move out to the side in order to enhance their judgment of closure rates, as well as to ensure safe clearance.

13.7.2 Night Formation. It is important to main tain the correct bearing so that the wingman can be seen by the leader. Ensure that wingtip clearance is maintained at all times.

The pilot should not fly so close that he feels uncomfortable. Avoid staring at the aircraft ahead and getting fixation on its lights. Turns will be made as in instrument conditions, by rolling around the leader's axis.

Where no light signal exists for a certain maneuver, the radio should be used. Speedbrake signals may be given on the radio by transmitting flight, speedbrakes - now. Channel changes will be given on the radio and should be acknowledged before and after making the shift.

13.7.3 Night Refueling (TA-4F). Night refueling is performed in essentially the same manner as during the day. The tanker should have all lights on BRT an STDY, except the anticollision lights. The buddy store lights should be on DIM. The tanker lights illuminate enough of the tanker and the drogue to allow the receiver pilot sufficient light for the approach lineup. The receiver pilot should request adjustment of the tanker lights to meet his requirements.

Note

> The white lights added by Accessory Change No. 33 which illuminate the hose immediately aft of the store, come on when the drogue position switch is placed in the EXT position and go off when the switch is placed in the RET position. The four white lights on the drogue assembly are furnished power by an air-driven generator and come on whenever the drogue is extended into the airstream. The LIGHTS BRT/DIM switch on the air refueling store control panel affects only the intensity of the amber and green lights.

Take up an initial position on the tanker and use the same procedures described in this section for day refu eling. When in position aft of the drogue, correct altitude can be determined by the receiver pilot sensing the tanker's jet-wash on his vertical stabilizer. The receiver-aircraft lights should be on BRT and STDY. The receiver's probe light and/or fuselage light will provide sufficient illumination to see the drogue from 10 to 20 feet aft. The tendency in night air-refueling is to start the approach too far aft. This make it very difficult to judge relative motion and usually results in a high closure rate.

PART V

Emergency Procedures

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CHAPTER 14

Emergency Procedures

14.1 GENERAL

Items marked with an asterisk (*) are considered critical memory items which the pilot must be able to perform without reference to this manual or a pocket checklist.

This section contains the specific step-by-step procedures to be used for all emergencies likely to be encountered in the aircraft. Use it as the primary guide for studying remedial procedures for various emergencies. The information contained in other sections of this manual must be used to provide additional knowledge of systems operation and malfunctions.

In general, the emergencies a pilot will encounter fall into one of four categories: ground emergencies, takeoff emergencies, in-flight emergencies, and landing emergencies. It is likely that most emergencies will require some deviation from the procedure set forth for a simple failure, because of varied conditions: i.e., compounded emergencies, facilities available, weather factors. Consequently, thoughtful analysis of each situation is necessary, and the selection of the course of action to be taken rests with the pilot.

14.2 GROUND EMERGENCIES

14.2.1 Abnormal Starts

14.2.1.1 Hot/Hung/Wet Start

*1. Throttle – OFF.

*2. Engine – WINDMILL.

14.2.1.2 Hot Start. A hot start is a start during which the engine exhaust gas temperature (EGT) exceeds 455 °C. If the starting limit seems likely to be exceeded, proceed with the above procedures.

CAUTION

If engine EGT exceeds 455 °C five times, or reaches 531 °C to 565 °C. for one period of 5 seconds or more, engine must be subjected to an overtemperature inspection. An EGT exceeding 565 °C for any period of time will require a teardown inspection of all hot section parts.

Note

Log duration and peak temperature for each start during which EGT exceeds 455 °C.

14.2.1.3 Hung Start. A hung start condition exists when engine appears to lightoff normally, rpm stabilizes at some point below idle (usually 40 to 45 percent), and EGT continues to rise toward maximum temperature limits. Before attempting another start, determine that the compressor/turbine components are turning freely. If the second start attempt results in a hung start, no more starts shall be attempted until a thorough investigation has been made to determine the cause.

14.2.1.4 Wet Start. A wet start occurs when engine ignition is not obtained (no EGT rise) within 20 seconds and fuel vapor will emit from tailpipe.

CAUTION

Upon experiencing a wet start, determine that no residual fuel remains in the combustion chamber or tailpipe before attempting another start. If residual fuel is evident and a period of time has elapsed, a close inspection must be made to ensure that no fuel has seeped under tailpipe heat blanket before restart is attempted.

Note

After wet starts, retard the throttle to the OFF position being careful not to actuate the igniters.

14.2.1.5 False Start. A false start occurs when the engine lights off normally and EGT remains in limits, but the rpm remains at some rpm below idle for 120 seconds or more. If a false start occurs:

*1. Throttle – OFF.

*2. External air – SECURE.

3. Investigate prior to restart.

14.2.2 Engine Fire During Start/Shutdown

*1. Throttle – OFF.

*2. Manual fuel shutoff – EMERG OFF.

*3. Windmill engine .

If fire persists:

4. Abandon aircraft.

14.2.3 Wing or Accessory Section Fire

*1. Throttle – OFF.

*2. Manual fuel shutoff – EMERG OFF.

*3. Secure – starting air and electrical power.

4. Abandon aircraft.

14.2.4 Brake Failure During Taxi

*1. Nosewheel steering – ENGAGED.

*2. Hook – DOWN.

3. Brakes - PUMP VIGOROUSLY (in attempt to recover partial brake pressure).

4. Throttle - OFF (if required).

5. Landing gear - RETRACT ONLY AS A LAST RESORT TO STOP AIRCRAFT.

Note

The landing gear handle safety-solenoid must be actuated manually to move handle to UP position.

14.2.5 Hot Brakes. When excessive braking has occurred (such as after an aborted takeoff), or hot brakes are suspected, notify the tower to alert the crash crew and to inform other personnel to stand clear. A dragging brake will also produce excessive heat at the wheel. In each case, the amount of heat will vary. A badly dragging brake (indicated by necessity of rpm in excess of IDLE to maintain taxi speed) could raise wheel temperatures to a point where a normal takeoff would heat the wheel enough to produce an explosive failure.

1. Taxi the aircraft so that the wheel axle points toward a clear area.

2. Allow a minimum of 45 minutes for brakes to cool prior to moving.

3. If operational necessity requires takeoff, leave the landing gear extended at least 3 minutes.

14.2.6 Nosewheel Steering Malfunction. Nosewheel steering should not be utilized for takeoff, unless directional control is lost. If a nosewheel steering malfunction is suspected:

1. Ensure nosewheel steering switch is in NORM position.

2. Center rudder pedals.

3. Actuate stick control button in an attempt to maintain directional control.

If depressing stick control button is ineffective:

1. Release stick control button.

2. Maintain directional control by rudder and brakes.

3. Place nosewheel steering switch to EMERG OFF.

14.3 TAKEOFF EMERGENCIES

14.3.1 Engine Failure During Takeoff Roll

*1. Abort (see abort procedures).

14.3.2 Engine Failure During Catapulting

*1. EJECT.

2. If unable to eject, follow Ditching procedures.

14.3.3 Catapult Emergencies. Should a PREMATURE HOLD-BACK SEPARATION, BRIDLE FAILURE, CATAPULT HOOK FAILURE, or other emergency of this type occur, the following procedure is recommended:

*1. Throttle – OFF.

*2. Brakes – FULL APPLICATION.

If aircraft cannot be stopped, prior to leaving flight deck:

*3. EJECT.

14.3.4 Nose Pitchup on Takeoff. Nose pitchup on takeoff may be because of either runaway noseup trim or a partial disconnect of the elevator power system. The pilot must react successfully to the immediate problem of nose pitchup to maintain control of the aircraft and provide time for determination of the exact nature of the malfunction. Limited forward stick travel, in case of partial disconnect, and limited elevator effectiveness, in case of runaway noseup trim, may cause excessive nose pitchup as the aircraft accelerates through 170 KIAS and the flaps are raised.

WARNING

Should the angle of attack approach a stall, altitude loss and sink rate may develop and thereby preclude a safe ejection.

Note

The pitch trim position indicator should be used to help distinguish between a partial disconnect and runaway noseup trim.

14.3.4.1 Runaway Noseup Trim/Nose Pitchup on Takeoff

14.3.4.1.1 Below Refusal Speed

*1. Abort (see abort procedures).

14.3.4.1.2 Above Refusal Speed

*1. Flaps – DOWN.

*2. Trim override – NOSEDOWN.

*3. Stores – JETTISON (IF REQUIRED).

*4. RAT – OUT (IF REQUIRED).

5. Burn down and land.

14.3.5 Runaway Nosedown Trim

14.3.5.1 Below Refusal Speed

*1. Abort (see abort procedures).

14.3.5.2 Above Refusal Speed

*1. Flaps – UP.

*2. Trim override – NOSEUP.

*3. Stores – JETTISON (IF REQUIRED).

*4. RAT – OUT (IF REQUIRED).

WARNING

If unable to rotate the nose to a takeoff attitude 5 knots below the predicted takeoff airspeed, the pilot must decide whether to abort, apply corrective noseup trim (using the manual override), or eject. Ejection before leaving the runway surface at very high speed is recommended.

Note

Raising the flaps will change the angle of attack of the wing slightly and increase the probability of achieving enough rotation to become airborne.

14.3.6 Inadvertent Full Flight Control Disconnect. If a flight control disconnect has occurred, greater than normal stick forces will be required to counteract the positive pitching moment at takeoff. Leave flaps down to reduce trim changes and use longitudinal trim, as required, to control the aircraft. Do not let angle of attack get too high. Comply with the procedures for a flight control disconnect.

14.3.7 Partial Disconnect of Elevator Power System. With hydraulic power, a partially latched condition of the elevator hydraulic power mechanism will not be detectable from stick response prior to flight. Air loads on the elevator can cause partial disengagement of the elevator power cylinder at or shortly after takeoff.

Note

- On all aircraft reworked per A-4 AFC 530, the elevator power mechanism disconnect linkage is changed to improve the connect/disconnect function and to eliminate partial disconnects.
- With a partial elevator power disconnected, the aircraft will be flyable, but full forward elevator control is not available.

If partial disconnect occurs:

*1. Position the flaps to full down.

*2. Adjust power to maintain a safe flying speed.

*3. Elevator trim – FULL NOSEDOWN.

WARNING

Pulling the manual flight control T-handle with a forward force on the stick will prevent complete shifting of the elevator power mechanism to the manual flight control mode.

4. If full nosedown trim does not result in sufficient forward stick authority, climb to safe altitude, reduce force on control stick, and disconnect hydraulic power.

CAUTION

The flight control hydraulic power system should not be disconnected with a hydraulic system functioning if the flight controls appear to be jammed or malfunctioning in some other manner than the partial elevator power system disconnect described.

14.3.8 Aborting Takeoff. There are many circumstances that may require aborting a takeoff. Some of these circumstances are unacceptable engine acceleration check, less than normal takeoff EPR/EGT/RPM, illumination of fire-warning light, runaway nosedown trim, loss of oil pressure, fuel-transfer light ON, smoke in the cockpit, abnormally slow aircraft acceleration to takeoff speed, blown tire, dragging brake, nosewheel steering malfunction, uncommanded swerving, and loss of canopy. Early detection of an aircraft malfunction during takeoff roll is of primary importance. The decision to abort or continue takeoff must be based on the nature of the malfunction, aircraft speed, runway remaining, and whether or not the aircraft can become airborne prior to leaving the runway. To successfully carry out an abortive takeoff, the pilot must be aware of the location of airfield facilities which may be at his disposal. Effects of wind component must be considered.

A takeoff abort shall be accomplished by use of arresting gear when available, unless it is certain the aircraft will be stopped or slowed to taxi speed by normal braking on the runway remaining. The procedures for takeoff abort are considered relative to takeoff refusal speed.

*1. Throttle – IDLE.

Note

In all TA-4 aircraft, best deceleration will occur by placing the throttle to IDLE until below 80 KIAS and then by placing the throttle to OFF.

*2. Speedbrakes – OPEN.

*3. Brakes – AS REQUIRED.

Note

Do not blow the tires. Maximum braking is required at takeoff refusal speed. For maximum braking, apply forward stick followed immediately by moderately heavy application of brake pedal pressure. Maintain steady braking throughout the rollout to a stop or desired taxi speed, increasing brake pedal pressure as the rollout speed decreases.

*4. Hook down (1,000 feet prior to A-gear) if applicable.

WARNING

- Without AFC 626 incorporated with the hook down, the nosewheel is electrically and hydraulically centered and will not caster freely. This may require excessive control inputs to correct for possible alignment drifts inherent in the system.
- If off-center just prior to engaging arresting gear, do not attempt to go for center of runway. Continue straight ahead parallel to runway centerline.

*5. Spoilers – CHECK UP.

6. Stick forward.

7. Flaps as set.

8. Nosewheel steering may be used to keep aircraft lined up with runway centerline or return aircraft to centerline. If aircraft engine is secured, nosewheel steering will become immediately inoperative because of loss of electrical power. Ensure rudder pedals are centered prior to engaging nosewheel steering to prevent swerving or loss of aircraft.

9. Simultaneously with above steps, broadcast "(Identification) aborting takeoff," to warn following aircraft and tower.

Note

If aborting after exceeding takeoff refusal speed where abort gear is not available or if the hook skips the arresting gear, decide whether to eject or remain with the aircraft. The decision to eject if the aircraft is leaving the runway or overrun must be made with consideration to speed and the nature of the surface onto which the aircraft will go.

14.3.8.1 Jettison of Stores. Stores may be jettisoned using either main or emergency generator power.

1. Station select switch – SELECT.
2. Emergency bomb release handle – PULL.

CAUTION

Avoid contacting the landing gear handle when using the emergency bomb release handle. Landing gear handle malfunction may result in inadvertent lowering or raising of the landing gear.

14.3.8.2 Blown Tire on Takeoff. Abort, if feasible; however, if unable to abort:

1. Leave gear down. If operational necessity dictates, leave gear down for 3 minutes prior to raising.
2. Obtain visual check.
3. Land as soon as practicable (recommend short field arrestment).

14.3.9 Aborting a Section Takeoff. To avoid a collision in a section by an aircraft aborting a takeoff requires aircraft separation prior to extending the hook and aligning the aircraft on the runway centerline for the engagement of the arresting gear.

14.3.10 JATO Bottles Failure. If the JATO bottles fail to fire, either continue the takeoff or abort as determined from the takeoff charts in Part XI. If the JATO bottles cannot be jettisoned after takeoff, continue mission if operational situation warrants, or dump down below maximum permissible landing gross weight and land.

14.3.11 Retraction Safety Solenoid Inoperative. To raise the gear with the retraction safety solenoid inoperative:

1. Obtain visual check of main landing gear mounts to ensure proper strut extension.

CAUTION

The retraction safety solenoid may fail to function if the port main mount is not fully extended. If an attempt is made to raise landing gear when this occurs, the tire and wheel assembly may hang up, resulting in a wheels-up-landing. Retraction safety solenoid failure may also result from dc converter failure, or microswitch malfunction.

2. Depress landing gear control handle guard and rotate gear handle toward UP position.

CAUTION

If circuit power to retraction safety solenoid has failed, pilots should not attempt to force the landing gear handle UP. The forward cockpit pilot must first manually move downlock release latch (Figure 1-4) to the aft position. (Aft cockpit pilot will have to request such action.) The landing gear control handle can then be moved to UP.

3. Move downlock release latch (Figure 1-4) aft and simultaneously raise gear handle to full UP position.

14.3.12 Unsafe Gear-Up Indication. Nose or main gear unsafe or down, gear handle up:

1. Maintain 225 KIAS or less.

2. Obtain visual check. If gear up and door is flush, cycle gear in an attempt to get an up indication. Continue mission if gear indicates up.

If unable to get visual check or if visual check indicates that gear is not fully retracted or that wheel door is not fully closed, proceed as follows:

3. Lower gear (do not cycle).

4. Dump excess fuel.

5. Land as soon as practicable.

14.4 IN-FLIGHT EMERGENCIES

14.4.1 Out-Of-Control Flight

*1. Controls – NEUTRALIZE (neutral to slightly aft).

*2. Harness – LOCKED.

*3. Throttle – BELOW 80 PERCENT.

*4. Trim – 0° TO 4° NOSEUP.

*5. Flaps/speedbrakes – UP/IN.

*6. Slats – CHECK.

*7. If out of control below 10,000-feet AGL – EJECT.

CAUTION

The first step in any spin recovery is to neutralize the controls and determine if the aircraft is really spinning. Do not be hasty in applying recovery controls; the spin is likely to stop while maintaining the controls neutral.

Random yaw and roll oscillations associated with out-of-control flight must be accepted. Intentional or inadvertent control inputs will increase roll and yaw, prolonging the loss of control and significantly increase the possibility of spin entry.

If controlled flight is not regained, check cockpit instruments for spin indications of:

1. Angle of attack – 30 units (upright)/0 units (inverted).

2. Low airspeed – 50 to 150 KIAS.

3. Pegged turn needle – indicates direction of spin.

14.4.2 Upright Spin Recovery

*1. Aileron – FULL INTO turn needle.

*2. Rudder – FULL OPPOSITE turn needle.

*3. Stick – NEUTRAL to slightly aft.

CAUTION

Spin recovery controls must be applied smoothly.

*4. Controls – NEUTRALIZE when rotation stops.

*5. 200 KIAS utilize 18 to 20 unit pullout.

*6. If out of control passing 10,000-feet AGL – EJECT.

WARNING

Ejection should not be delayed because of the extremely high rates of descent (22,000 to 35,000 FPM).

14.4.3 Inverted Spin Recovery

*1. Aileron – FULL OPPOSITE turn needle.

*2. Rudder – FULL OPPOSITE turn needle.

*3. Stick – neutral to slightly aft.

CAUTION

- Location of stick neutral point may be extremely difficult to determine since up to 20 pounds of stick pull force may be required to keep the stick centered during inverted spin recovery. The pilot should determine a cockpit reference point for neutral stick positioning prior to flight.

- Spin recovery controls must be applied smoothly.

*4. Controls – NEUTRALIZE passing 200 KIAS.

CAUTION

It is imperative that the pilot maintain anti-spin controls as the aircraft rolls upright during the hesitant inverted mode. It may appear that the aircraft is recovering from the spin; however, increasing airspeed is the surest indication that recovery is effected and that the aircraft will not reenter the spin.

*5. 200 KIAS utilize 18 to 20 unit pullout.

*6. If out of control passing 10,000-feet AGL – EJECT.

14.4.3.1 Asymmetric Slat Deployment. Expect a roll away from the extended slat:

1. Relax g (slat should retract).

2. Use rudder and aileron to counter roll.

Note

Abrupt, large aileron inputs to counter roll can induce adverse yaw and increases spin susceptibility.

14.4.3.2 Slat Lockout. If one or both slats stick in the extended position:

1. Relax g.

2. If slat(s) remain extended, slow to 200 to 250 KIAS; slat(s) should retract and function normally.

3. If necessary, induce small pitch oscillations to retract slat(s).

4. If slat(s) will not retract, remain below 200 KIAS, and land as soon as practicable.

WARNING

Be prepared to counter uncommanded roll with rudder/aileron if one slat suddenly functions normally during approach.

14.4.4 Engine Malfunctions

14.4.4.1 Chugs/Stalls

*1. Reduce power.

If stalls continue:

2. Decrease angle of attack (if possible).

3. Increase airspeed (if possible).

If icing suspected:

4. Descend below freezing level.

5. Anti-ice – ALL

If icing not suspected:

6. Fuel control – MANUAL.

If stalls continue:

7. Throttle – OFF.

8. Refer to airstart procedures.

If stalls clear:

9. Check for adverse symptoms.

10. Land as soon as practicable.

14.4.4.2 RPM/EGT Malfunctions. Fluctuating rpm not corresponding to similar indication of fuel flow, EPR, or EGT should be assumed to be a faulty tachometer system. Use airspeed and throttle position for power reference if rpm is unreadable. If fuel flow or EGT is also fluctuating, assume a PRIMARY fuel control malfunction and shift to MANUAL.

Fuel flowmeter, EGT, or EPR fluctuations should be treated similarly; unless engine performance is determined to be erratic from more than one source, assume an instrument error. Otherwise shift to MANUAL fuel control.

14.4.4.3 Engine Overtemping. During climbs or sustained operations at MILITARY power, minor engine overtemping (5 °C or less) may occur. This overtemping should be controlled by reducing rpm slightly to maintain EGT within limits. If overtemping recurs at the reduced rpm or is in excess of 5 °C, land at the nearest suitable landing facility as soon as possible unless other action is indicated.

14.4.4.4 Fuel-Boost Pump Failure. With an inoperative boost pump, gravity flow of fuel to the engine-driven fuel pump provides an adequate supply of fuel for all power conditions up to 6,000 feet, and for continued operation at reduced rpm at higher altitudes.

Note

There have been repeated instances of successful full power operation at 35,000 feet.

If boost pump fails:

1. Throttle – Minimum required.

2. Avoid zero g, negative g, or inverted flight.

3. Ensure positive g loading during speedbrake operation.

4. Land as soon as practicable.

14.4.4.5 Throttle Linkage Failure. No provisions are incorporated for automatic positioning of the fuel control if throttle linkage failure occurs. The engine may accelerate to MILITARY, remain as is, retard to IDLE, or flameout. Once it is determined that a throttle linkage failure exists, continued flight is not advisable. No further throttle manipulation should be attempted. The stuck throttle approach (STA) or the precautionary approach (PA) should be flown depending upon the thrust level established.

If a throttle linkage failure occurs:

1. Do not manipulate throttle.

2. Determine thrust available; be alert for slow rpm decay.

3. Land as soon as possible.

WARNING

If throttle linkage is disconnected, fuel control may drift to the OFF position, causing the engine to flame out.

Note

APC may regain control of throttle if throttle linkage failure occurs.

4. Fly PA or STA; maintain 180 KIAS minimum.

When safe landing is assured:

5. Manual fuel shutoff control — OFF.

14.4.4.6 Fuel Control Malfunctions. A malfunction of the fuel control unit may result in fluctuating rpm and exhaust temperature, a sudden drop on the fuel flow indicator, or a complete loss of power. When any of these occur, proceed as follows:

1. Throttle – MATCH WITH RPM.
2. Fuel control switch – MANUAL.

Note

Rpm must be above 65 percent if airspeed is below 225 KIAS before switching to MANUAL to prevent possible compressor stall when switching.

3. Advance the throttle slowly and smoothly to the desired power setting.

CAUTION

Do not reset fuel control to PRIMARY after airstart unless flameout is known to have been caused by reasons other than engine fuel system malfunction. Operate throttle cautiously so as not to exceed rpm and temperature limitations when operating in MANUAL. If the shift from MANUAL to PRIMARY is made, perform the shift between 80- to 85-percent rpm in order to minimize the risk of flameout.

14.4.4.7 Engine-Driven Fuel Pump. When the engine-driven fuel pump fails, a flameout will occur, and no relight is possible.

14.4.5 Oil System Malfunctions

14.4.5.1 High Oil Pressure (Over 50 psi)

1. Throttle – Reduce as necessary. Land as soon as practicable.
2. Monitor oil quantity.
3. If 20 percent oil light illuminates, follow low oil quantity procedures.

WARNING

Oil pressure above 50 psi can cause failure of the internal oil seals and result in loss of oil to the engine.

14.4.5.2 Low Oil Quantity/Pressure

1. RPM – 86 to 88 percent.
2. Land as soon as possible.
3. Follow precautionary approach procedures.
4. After landing – SECURE engine.

Note

- Maneuvers producing acceleration near zero g may cause a temporary loss of oil pressure. Absence of oil pressure is permissible for a maximum of 10 seconds.
- Electrical power failure causes the oil pressure gauge to be inoperative. Deploying the emergency generator should rectify this condition.
- Increased engine friction may prevent the engine from accelerating once the throttle has been retarded.
- With a bearing failure, operation at very low power settings may hasten engine seizure.

14.5 ENGINE FAILURE

14.5.1 Impending Engine Failure. Symptoms of imminent engine failure, singly or in combination, are:

1. Loss of thrust, not because of throttle movement or icing.
2. Fluctuating rpm, EGT, and EPR not eliminated by shifting to MANUAL fuel control.
3. Abnormally high EGT in relation to engine rpm.

4. Oil pressure dropping or less than 40 psi.

5. Abnormal vibration or loud or explosive sounds apparently emanating from the engine.

If any of the above symptoms appear, gradually adjust power to the minimum rpm consistent with the requirements of level flight, and land as soon as possible, executing a precautionary approach, at the nearest suitable landing facility.

14.5.2 Procedure on Encountering Engine Failure

14.5.2.1 Loss of Thrust/Flameout

*1. Zoom climb (if below 1,500-feet AGL and 250 knots – EJECT).

*2. Stores – JETTISON (if required).

*3. Throttle – RETARD.

*4. Fuel control – MANUAL FUEL.

Note

Selecting manual fuel prior to loss of electrical power may prevent flameout.

If flameout occurs:

*5. Perform airstart.

14.5.2.2 Airstart. See Figure 14-1.

*1. RAT - OUT (ensure emergency generator bypass switch - NORMAL).

*2. Throttle - OFF (ensure fuel control - MANUAL).

WARNING

If fire is present or existed prior to shutdown do not attempt to restart engine.

If no fire exists, proceed with airstart as follows:

Note

- Successful airstarts can be obtained at any airspeed and altitude combination within the envelope prescribed in Figure 14-1.
- Unless fuel control malfunction exists, airstarts may be made with PRIMARY fuel control selected.
- Avoid negative g flight to prevent air being trapped in the engine-driven fuel pump inlet and to minimize fire hazard.
- In J52-P-8 engines, metering of fuel below 250 KIAS in manual fuel control is required.

*3. Establish 250 KIAS glide.

*4. Throttle – IGN, THEN IDLE.

CAUTION

If relight was made in manual fuel control, do not reset fuel control to primary after airstart. Operate throttle cautiously to avoid exceeding rpm and temperature limitations.

Note

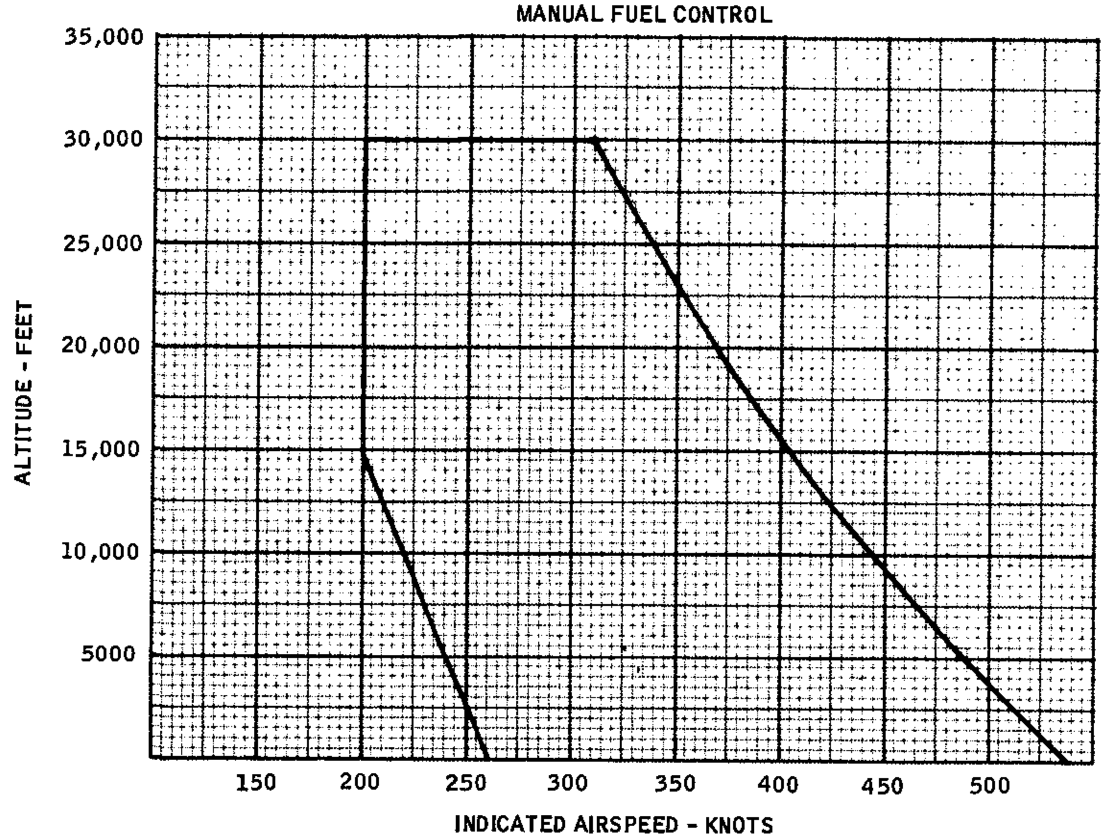
- Absence of fuel flow after moving the throttle from the OFF position is an indication that airstart is impossible.
- For best relight capabilities descend below 30,000 feet. Allow 30 seconds (JP-4) or 45 seconds (JP-5). Optimum relight range of fuel flow is 500 to 850 pph. JP-4 lights more readily at lower part of fuel flow range, JP-5 at higher part.

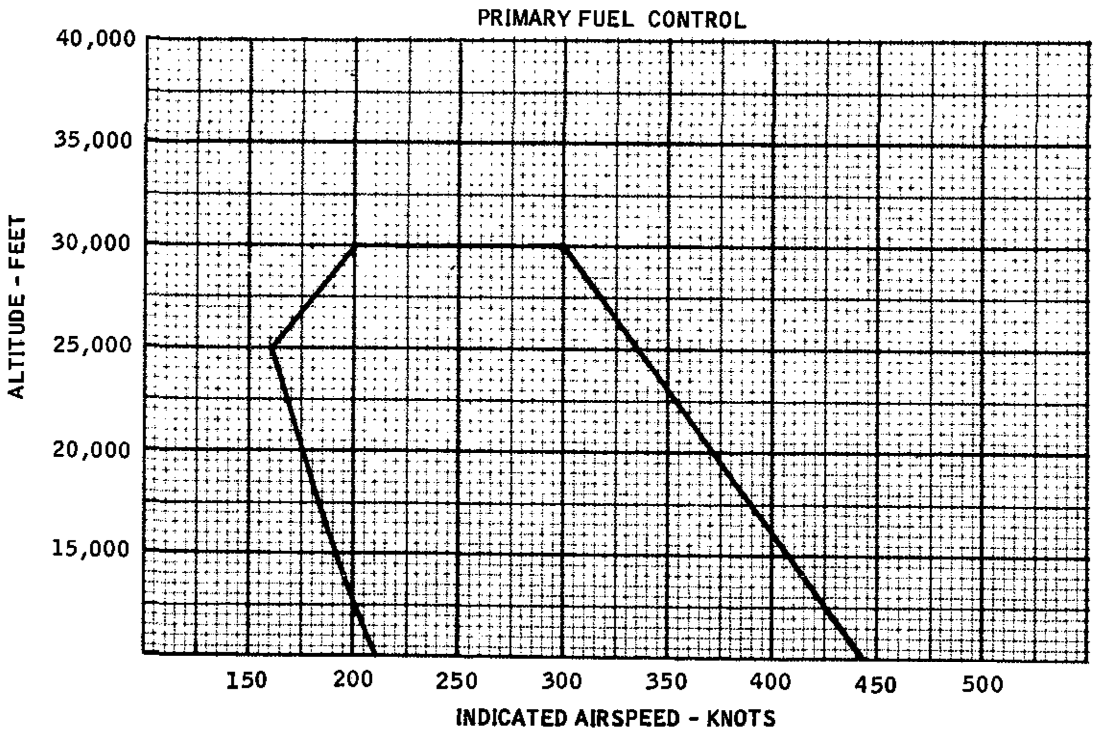
*5. Repeat procedure if no relight within 45 seconds.

FLIGHT RELIGHT REGIONS

MODEL: TA-4F/TA-4J

ENGINE J52-P-6A





TA1-116-E

Figure 14-1. Flight Relight Regions (Sheet 1 of 2)

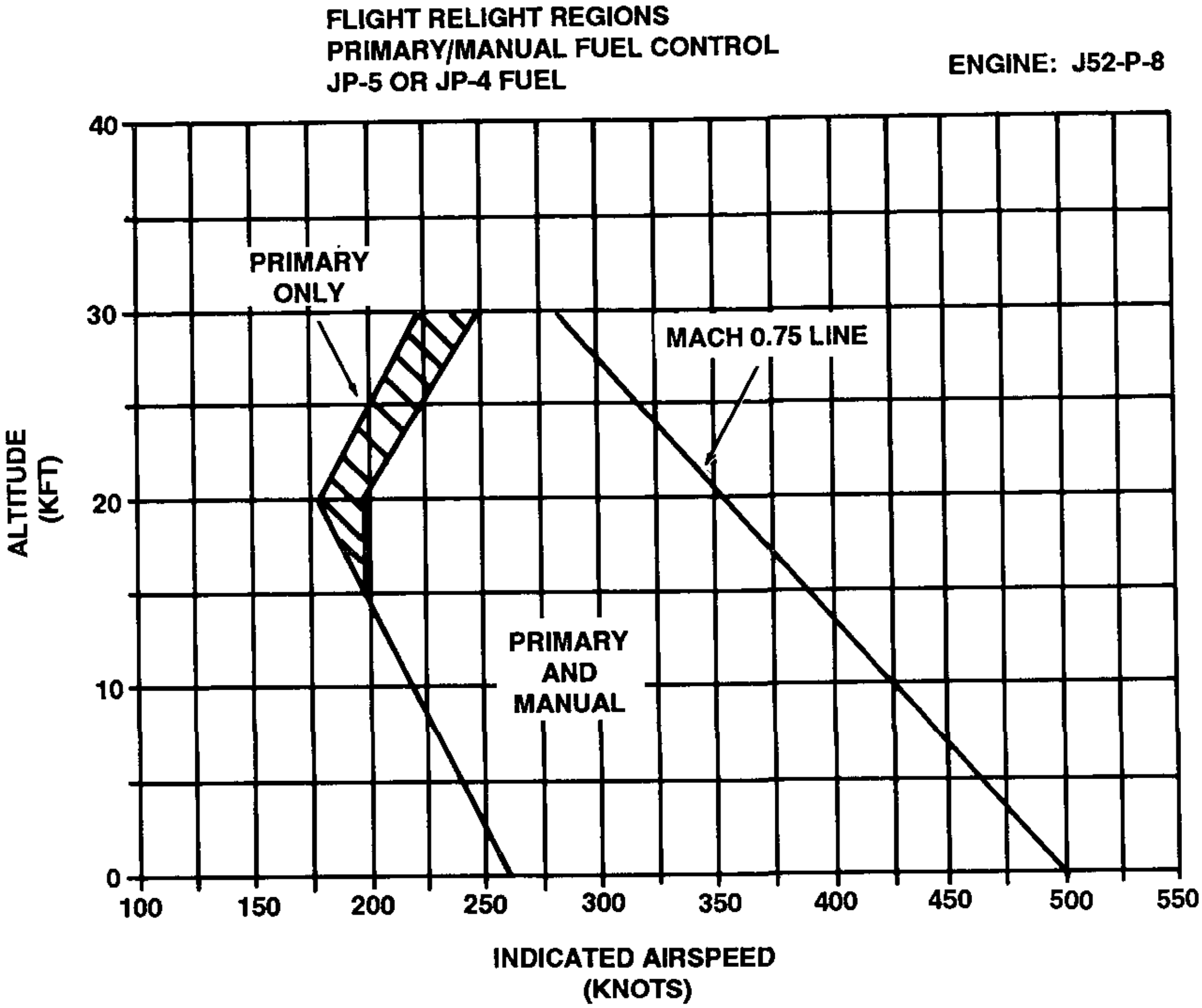


Figure 14-1. Flight Relight Regions (Sheet 2 of 2)

14.5.2.3 Maximum Glide Engine Windmilling – Emergency Generator Extended. The recommended speed for maximum gliding range is approximately 200 KIAS for gross weights up to 14,000 pounds, clean configuration, and altitudes up to 45,000 feet. See Figure 14-2 for approximate gliding ranges from various altitudes. For each 1,000-pound increase over 14,000 pounds, increase airspeed by 5 knots. The maximum gliding range angle of attack is 9.5 units without stores and 10.5 units with wing stores.

14.6 FIRE

14.6.1 Engine Fire. Because the engine is within the closed fuselage, engine fires are not usually directly observable, but must be confirmed from indications that accompany their presence. There are a number of indications, some more reliable than others, that may be used to determine the existence of an engine fire. The sight of fire/smoke issuing from the engine/engine compartment is the direct indication that an engine fire exists. Illumination of the FIRE warning light is the primary indication that a fire may be present within the engine compartment.

14.6.1.1 Secondary Indications. Secondary indications are indications that are closely associated with an engine fire. These conditions by themselves are not conclusive, but, in conjunction with a FIRE warning light, may be used to conclude with a high degree of probability that a fire is present. In addition to fire/smoke issuing from the engine/engine compartment, an acutal fire will almost always be accompanied by one or more of the following secondary indications:

1. Scorched or pungent odor in LOX system.

2. Flickering or steady ladder lights, stiffening in elevator or aileron control pressures, partial or complete loss of one or more flight controls, and/or abnormal flap indications.

3. Explosion or unusual vibration.

4. Rising EGT and decreasing rpm; excessive EGT.

14.6.1.2 Other Indications. Grinding engine noises accompanied by abnormal oil pressure or illumination of the OIL LOW (20 percent) indicator light are not only symptomatic of impending engine failure but also are associated with conditons that may culminate in an engine fire.

14.6.1.3 Fire Warning Light and Fire Detection Circuit. The FIRE warning light is the only cockpit indicator for the engine fire warning system. One of six possible conditions may exist for the FIRE warning indicator light and fire detection circuitry:

1. The light is on and circuitry tests and operates properly.

2. The light is on, but the circuitry is shorted and does not test and operate properly.

3. The light is off and the circuitry tests good and operates properly.

4. The light is off and the circuitry tests good, but does not operate properly.

5. The light is burned out.

6. The light is off and circuitry is damaged/inoperative.

In the first case, a fire is present. In the second case, the circuit has shorted and the light remains on whether or not there is a fire. Although the control unit logic is designed to prevent this condition, some occurrences of the second case have occurred. Because the cockpit indication is the same for both cases, existence of a fire cannot be confirmed solely from the FIRE warning light; additional indications are required to confirm the presence of an engine fire. There have been far fewer instances of the light being illuminated by shorted fire warning circuitry than by an engine fire. The third case is the normal condition of the system; however, the same conditions will be met when a fire is present that the fire detection system cannot detect, as listed below. The fourth case, ineffective sensing, has occurred on at least one occasion when the engine sensors were inadvertently coated with paint. The fifth case, lamp filament failure, may be confirmed by pressing the MASTER PRESS TO TEST button provided that the circuitry or control units are not malfunctioning. The sixth case occurs either following an explosion/engine fire or when other damage/extreme wear has been sustained. If the FIRE warning light was not on prior to the circuitry being discovered inoperative, failure has probably been caused by damage unrelated to fire or by extreme wear. If the FIRE warning light was on and then goes out, fire damage should immediately be suspected. The lamp and circuitry should be immediately checked to determine their continued reliability (1) whenever the lamp extinguishes under circumstances when fire may exist or have been present, or (2) when an engine fire is suspected and the light has not illuminated. In addition to those that occur when the fire detection light/circuit is inoperative or malfunctioning, there are some fires that the fire warning system will not detect. These include the following:

1. Fires that occur inside the engine

2. Fires outside the engine compartemnt or tailpipe sections

3. Engine fires that occur when the emergency generator (RAT) is extended and active and the horizontal stabilizer is actuated.

14.6.1.4 Certainty of Engine Fire. Illumination of the FIRE warning light is usually the first indication of a fire or an overheat condition in the engine compartment or tailpipe section. The pilot should be alert for corroborating evidence that a fire actually exists before executing any drastic emergency procedure based on illumination of the FIRE warning light since it is possible to have false indications for the FIRE warning light. Whenever possible, the aircraft should be visually checked for signs of fire by the pilot, wingman, tower operator, or other person to confirm the validity of the warning light and/or any other fire indication. If no one is available to observe the source directly, the pilot should turn the aircraft and observe the flightpath for smoke.

The steps to be followed whenever an engine fire is suspected depend on the indications present and the degree of certainty of fire. An engine fire is certain only when fire/smoke has been seen issuing from the engine/engine compartment. An engine fire is probable when the FIRE warning light is illuminated and one or more secondary indications of an engine fire are present. An engine fire is possible whenever grinding engine noises are present and accompanied by abnormal oil pressure and illumination of the LOW OIL (20 percent) indicator light. These symptoms do not necessarily indicate the presence of an engine fire; however, when these are encountered, the aircraft should be continuously monitored for signs of an engine fire.

14.6.1.5 Engine Fire in Flight. When signs of an in-flight engine fire are encountered, proceed as follows:

*1. If engine fire is confirmed visually - EJECT.

*2. If engine fire is not confirmed visually: throttle - MINIMUM REQUIRED FOR FLIGHT.

*3. If fire warning light and secondary indications are present - EJECT.

Note

Attempt visual confirmation of fire whenever possible.

4. Master press to test - DEPRESS.

Note

- Under some circumstances (e.g., painted sensor), the fire detection system has not sensed fire conditions even though the system tested properly.
- Failure of the FIRE light to function properly during press to test after signs of an in-flight engine fire have been encountered is cause for extreme diligence in monitoring for other indications of fire.

5. If at any time during flight, the FIRE warning light is on, secondary indications are present, or engine fire is suspected; monitor aircraft for fire and land as soon as possible.

14.6.1.6 Delayed Ejection With Engine Fire. Although any delay in ejecting when an engine fire is present will increase the risk to pilot safety, there are some circumstances when the pilot may decide to delay ejection. Such a decision normally results from consideration involving aircraft altitude, attitude, airspeed, and intensity; the severity of the fire/ indications; weather; and/or the chances for improving the rescue/survival environment by gliding toward land or ship. The pilot must decide when to eject. If ejection is indicated and a decision has been made to delay eject:

*1. Throttle - OFF.

*2. Manual fuel shutoff - OFF.

*3. RAT - EXTEND.

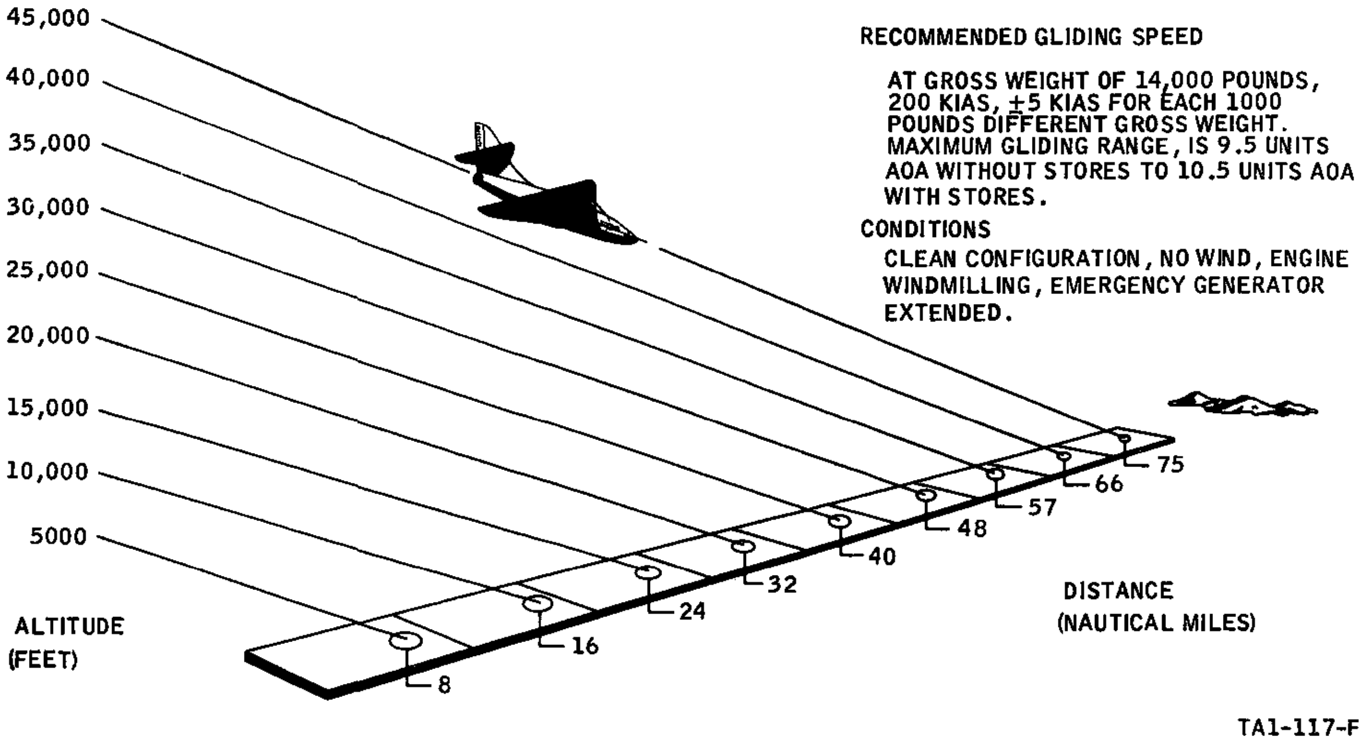


Figure 14-2. Maximum Glide

WARNING

Do not attempt engine restart when the engine fire is extinguished by cutting off fuel supply to the engine, as evidenced by the FIRE warning light going out and the disappearance of fire indications. Doing so may result in an explosion and/or reignition of engine fire.

14.6.2 Bleed Air Ducting Failure. Bleed air is obtained from the 7th stage of the N2 high pressure compressor unit. This air is extremely hot and if a leak develops in the ducting system, the air may ignite or cause severe heat damage ot materials adjacent to the leak. Cockpit indications of duct failure are very similar to those of the in-flight engine fire. Determination of whether the problem is one caused by the engine or by ducting failure is difficult. If the problem is being caused by a bleed air system failure, a reduction in engine power will reduce the flow of bleed air. A fire warning light caused by bleed air leakage can usually be elminated by a reduction in power. Every indication must be weighed in evaluating the cause, including external observation by a wingman. Immediate evaluation is of the utmost importance.

If it is determined that bleed air is the source of trouble:

1. Use minimum power consistent with safe flight.

2. Continue checking for consistent with safe flight.

3. Land as soon as possible.

14.6.3 Wing Fire. A fire in the wing could be caused by either fuel leakage or defective electrical wiring.

*1. Combustible stores - JETTISON.

*2. RAT - OUT.

*3. If fire persists - EJECT.

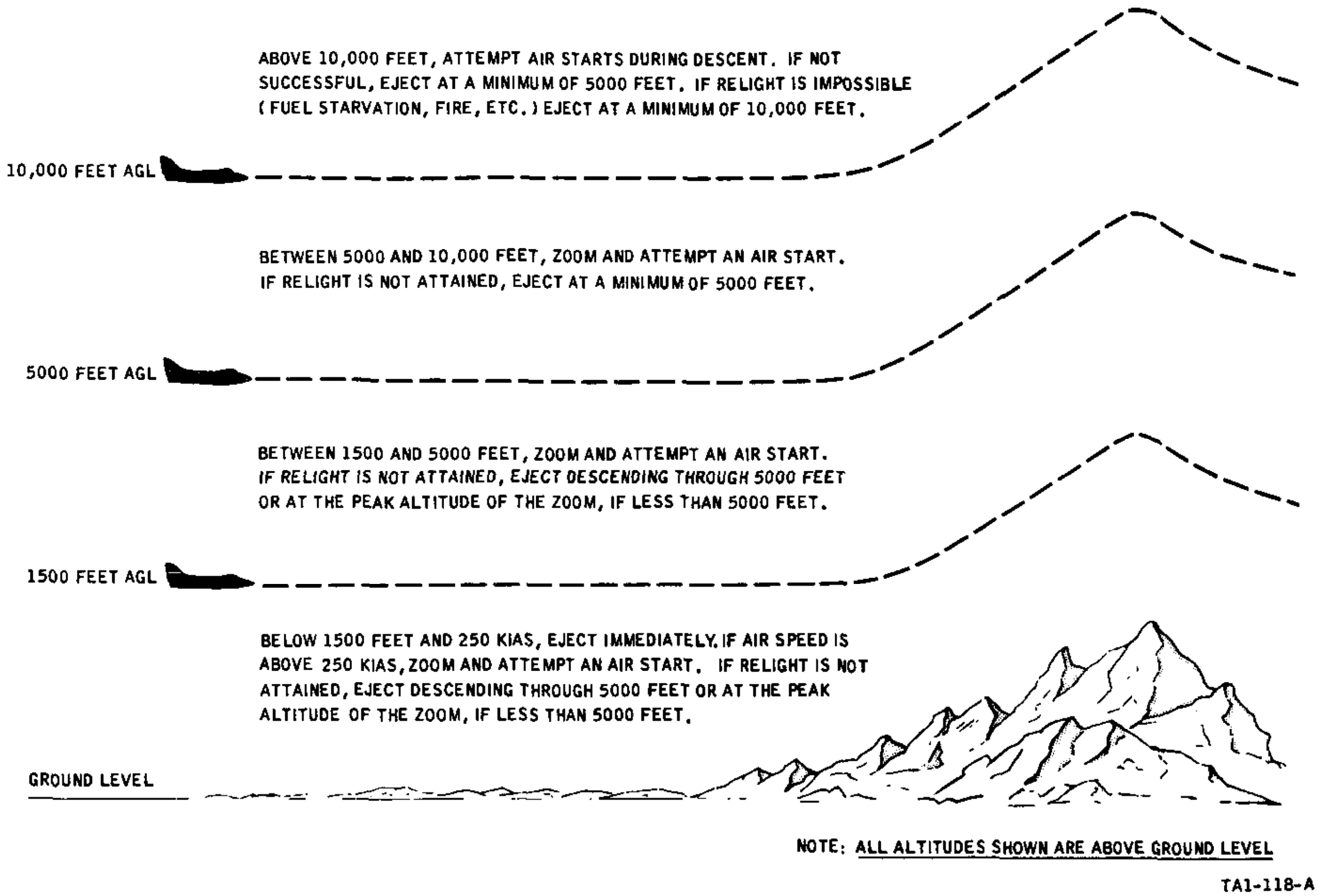


Figure 14-3. Summary of Flameout Action

14.6.4 Electrical Fire. When a fire seems to be electrical in origin, proceed as follows:

*1. Extend emergency generator.

*2. *If fire persists, turn off all electrical equipment.*

3. If fire is extinguished, turn ON only necessary equipment, one at a time. If offending circuit is again energized, secure it.

4. If fire cannot be extinguished in this manner, pilot must decide whether to land as soon as possible or EJECT.

5. If landing is made, take short field arresting gear if available. Secure engine upon coming to a stop.

CAUTION

After landing with the emergency generator deployed, an operating main generator will again take the load. An electrical fire previously extinguished by deploying the emergency generator will probably reignite unless the engine is shut down after coming to a stop.

14.6.5 Smoke or Fumes. There are several sources of smoke or irritating fumes in the cockpit. These sources are as follows:

1. Air conditioning system.

2. Bleed-air line may not be connected to g-suit valve, or there may be improper assembly of valve.

3. Torn canopy seal.

4. Electrical fire in cockpit.

Selection of RAM on the cabin-pressure switch will correct only the smoke or fumes from the air conditioning system.

14.6.5.1 Elimination of Smoke or Fumes

*1. Temperature control – INCREASE AS REQUIRED.

Note

Use of full manual hot may generate smoke or fumes.

*2. Select RAM.

3. If smoke or fumes are not eliminated, lift oxygen mask for a cautious smell. Do not inhale deeply because of possible presence of oil fumes that are highly toxic.

4. If odor smells like burning or hot electrical insulation, proceed as in Electrical Fire.

5. If it is determined that smoke or fumes are not electrical in origin, be alert for other evidence of fire. (Refer to Fire.)

6. If smoke or fumes cannot be eliminated and so limit vision that safe landing could not be made, or if accompanied by excessive cockpit temperatures, jettison canopy.

WARNING

Slow aircraft as much as possible prior to jettisoning canopy. With the canopy removed from the aircraft the rear seat occupant is susceptible to inadvertent ejection.

7. Land as soon as possible.

14.7 STRUCTURAL FAILURE OR DAMAGE

Loss of structural integrity may result from midair collision, exceeding structural limits, bird strikes, etc. The following procedure generally applies:

1. Reduce airspeed as much as practicable. If at low altitude, zoom to convert airspeed to altitude.

2. Determine whether adequate control of aircraft is available for continued flight. If not, eject.

3. If able to control aircraft, climb to minimum recommended ejection altitude, 10,000 feet or higher, at reduced airspeed to prevent further damage.

4. Operate engine at minimum setting required to maintain level flight or slow climb if it is suspected that foreign objects may have entered engine.

5. Whenever possible, obtain visual inspection by another aircraft to assist in evaluating damage sustained.

6. Examine slow flight characteristics of aircraft in landing configuration at 10,000 feet, or above, prior to attempting landing. Don't stall. Lower flaps in increments to determine if split flap condition exists.

7. Land at nearest suitable facility, using precautionary approach, modified as necessary, unless damage is determined to be negligible. If a bird has been ingested into engine, even though there is no visible damage or indications of engine malfunctions, prompt landing should be made, since possibility exists that engine may seize. Assume that the bird has been ingested if it strikes sides of fuselage forward of engine-intake ducts.

14.8 SYSTEMS FAILURES

14.8.1 Hydraulic Systems Failure. Illumination of either the utility or the flight control hydraulic system warning light indicates a loss of pressure to one or the other of the tandem hydraulic systems. Illumination of both UTIL HYD and CONT HYD warning lights and a stiffening of the controls indicates a complete hydraulic failure.

Note

The manual flight control handle should not be pulled unless both the flight control and utility systems have failed.

No means are available to the pilot to restore hydraulic system pressure.

When operating on utility system alone, actuations of various units normally operated by utility system pressure, will cause a temporary decrease in the effectiveness of the flight controls.

WARNING

- If a hydraulic system is lost in flight, be alert for evidence of fire, as the possibility exists of an engine section fire.
- Do not attempt maneuvers requiring high control forces (such as high-speed pullouts) when it is known beforehand that one or both hydraulic systems are inoperative.

14.8.1.1 Complete Hydraulic Failure. In the event of a complete hydraulic system failure, the following procedure should be followed for flight control disconnect:

1. Reduce airspeed to 200 KIAS, if possible. Lateral control forces are high on manual control except at low speeds.

2. Trim aircraft laterally.

Note

As long as (normal) electrical power is available, the aircraft can be trimmed.

3. Manual flight control handle – PULL.

Note

To ensure complete hydraulic power disconnect, relax stick pressure while pulling the manual flight control (MAN FLT CONT) handle.

4. Trim immediately, if necessary.

5. Terminate flight as soon as practicable.

6. When crosswind component exceeds 8 knots, make arrested landing. Arrested landing is also recommended to minimize fire hazard because of possible hydraulic leak.

Note

Emergency extension of the landing gear and a no-flaps approach and landing will be required. Spoilers and nosewheel steering will be inoperative. Landing gear safety pins should be installed as soon as possible after landing.

When a hydraulic power disconnect is made with asymmetric wing or store loadings, the following recommendations are made:

1. Speed less than 200 KIAS prior to disconnect if possible.

2. After disconnect, avoid excessive longitudinal stick motion.

3. Plan approach to ensure that crosswind component is under heavier wing if possible.

4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control speed is 115 KIAS with hydraulic power failure and up to 7,500 foot-pound asymmetric load.

Note

In case of excessive nose pitchdown, the use of speedbrakes may cause increased nosedown tendency because of the design of the speedbrake system.

The manual flight control handle should be pulled fully out (about 1 foot) with a rapid and positive motion. This action will assure a clean disconnect and will aid in preventing a tendency for the aircraft to roll as the switch to manual control is made. The manual flight control mechanism cannot be reset in flight once it has been disengaged.

If for any reason, the manual flight control handle is pulled while hydraulic pressure is still available, a metallic thud will be heard when the stick is moved. This sound, caused when hydraulic pressure slams the piston against the end of the cylinder, is normal for the system under the above conditions, and should not be a cause for alarm.

Note

- When a disconnect has been made and utility hydraulic system pressure is available, it is possible to engage and utilize the AFCS to reduce stick forces. The spoilers may also be used for landing.
- The tandem rudder actuator is not disconnected by the flight control disconnect handle and high rudder forces can be expected.

14.8.2 Electrical Systems Failure

14.8.2.1 CSD/Main Generator Failure. Partial or complete failure of the main generator to provide the aircraft with the required output may be caused by generator constant-speed drive failure, blown fuses(s), and other mechanical or electrical discrepancies. Partial failure may result in a loss of one or more phases of ac or reduced or fluctuating frequency or voltage, and may be impossible to detect from cockpit indications. The most likely signs of a partial failure will be tacan unlocking and spinning, loss of air conditioning, erroneous attitude presentation on the all-attitude indicator with or without an OFF warning flag indication, or abnormally slow trim motor speed.

CAUTION

A CSD failure which occurred from an overspeed condition may lead to the disintegration of the CSD. Parts of the CSD may penetrate through the cooling air inlet duct door resulting in ingestion into the engine. Pilots should closely monitor engine performance for erratic indications after an electrical failure.

Tacan breaking lock on, variation of instrument light intensity, sluggish or unstable gyro action, and variations in UHF background noise when associated with throttle reductions are indications of impending generator-driven transmission failure. Under this condition, continued throttle manipulation can induce various fuse failures, including dc converter fuse failure. It is recommended that throttle manipulation be reduced to the minimum. If symptoms then persist, deploying the emergency generator will prevent loss of power as long as airspeed is kept at or above 145 KIAS.

If the main generator should fail completely, all electrical equipment will be rendered inoperative immediately. The most easily recognizable indications of complete main generator failure occur simultaneously, as follows:

1. Landing gear indicators – UNSAFE.
2. Flap position indicator – OFF.
3. All attitude gyro indicator – OFF FLAG VISIBLE.
4. Trim position indicators – OFF SCALE.
5. UHF/TACAN – INOPERATIVE.
6. Exterior/interior lights – INOPERATIVE.

When a main generator failure is known or suspected:

1. RAT – OUT.

Note

- Airspeed should be below 500 KIAS or 0.91 IMN.
- Above 25,000 feet, throttle should be at 90 percent or less.
- Emergency generator bypass switch should be in NORMAL position.
- External approach lights are operated through a dc approach light relay. The primary dc bus that operates the approach light relay will be inoperative and external approach lights will be unavailable with a dc electrical failure. If a dc fuse is the problem, dc power may be regained by dropping the emergency generator.

2. Maintain at least 145 knots as long as power to horizontal stabilizer is required.

3. Advise tower that radio will be lost during rollout.

4. The following systems will be inoperative:

   a. Radar altimeter

   b. Fuel boost

   c. Engine pressure ratio indicator

   d. Aileron bungee heater blanket

   e. Side panel windshield heater

   f. Seat adjust

   g. Instrument panel vibrators

   h. Rain removal

   i. White floodlights

   j. Antiexposure suit ventilation blower

   k. Exterior lights.

Note

Emergency generator power to operate the tacan, the angle-of-attack vane heater, and the nesa glass heater will not be available when the landing gear is down. Power may be restored by first retracting the wheels and then recycling the emergency generator bypass switch.

14.8.2.2 DC Converter Failure. Failure of the dc converter is indicated when dc powered equipment malfunctions at the same time that ac equipment functions normally. The same indications will be present with an open dc power fuse. If the malfunction is an open dc fuse, deploying the emergency generator will restore dc power. If deploying the emergency generator does not restore dc power, a converter failure is confirmed and full ac power may be regained by selecting emergency generator BYPASS position.

The following items will be inoperative on the main generator when the dc converter has failed:

1. ICS radio transmission and reception
2. Control and utility hydraulic warning lights
3. Fuel boost lights and transfer warning lights
4. Approach lights
5. Fuel low warning lights
6. Hook bypass
7. AJB-3
8. Standby attitude system disable
9. Trim position indicators
10. ADF
11. All armament circuits (except emergency jettison)
12. Spoilers
13. Nosewheel steering
14. Speedbrakes (manual override available)
15. Aileron and rudder trim
16. AFCS
17. APC
18. Counting accelerometer
19. Rain repellant
20. LAWS
21. Test circuit for all warning lights
22. Wheel and flap indicators
23. JATO jettison
24. Landing gear solenoid
25. Emergency wing fuel transfer
26. Air conditioning
    a. Cannot be turned off

b. Relief valve cannot be opened

c. RAM air valve can be opened

27. 20 joule ignition

28. Tacan

29. Oil level

30. IFF

31. Wing fuel sensors (fuel quantity will indicate fuselage fuel only)

The following items will remain operative on either the main or emergency generator:

1. EGT

2. Tachometer

3. Oil pressure

4. Fuel flow indicator

5. Fire warning (minus test circuit)

6. Center panel windshield heater

7. Fuel control

8. Stabilizer trim (with override only)

9. Fuel quantity indicator (fuselage fuel only)

10. Instrument lights

11. Emergency jettison

12. Anti-icing and pitot heat

13. LOX quantity gauge

14. Servoed altimeter

15. Four joule ignition system.

If the emergency generator is deployed, the main generator can be regained by placing the switch in the forward cockpit in BYPASS. This cannot be accomplished in the aft cockpit, as this switch requires dc power to hold it in BYPASS.

14.8.2.3 Exterior Lights Failure. If exterior lighting is lost:

1. Maintain a sharp lookout to prevent collision with other aircraft.

2. Join another aircraft, if possible.

3. Request radar control for assistance if unable to join another aircraft.

14.8.2.4 Interior Lights Failure. If interior lighting is lost, use the cockpit emergency floodlights or a flashlight to illuminate the instruments or the console.

14.8.3 Flight Controls Systems Failure

14.8.3.1 Restricted Forward Stick Travel. An aircraft noseup out-of-trim condition, because of up elevator and restricted forward stick travel, may be caused by an uninitiated disconnect of elevator hydraulic power. The attitude problem may be alleviated by low airspeed, nosedown trim, extended flaps and landing gear, and all available forward stick. To restore full stick travel, follow the procedure for complete hydraulic failure. If the condition persists, relax pressure on the stick(s) while pulling the manual flight control handle again.

14.8.3.2 Horizontal Stabilizer Actuator Failure. If the stabilizer actuator should fail while the aircraft is trimmed for high-speed flight, a landing can be accomplished by flying the aircraft onto the runway with the flaps retracted, at an airspeed which assures adequate control. Landing with the flaps retracted is recommended because of the nosedown trim change which occurs when the flaps are extended. Since the inoperative stabilizer cannot be moved to correct for the trim change, the elevator would have to be employed, in effect reducing the amount of elevator travel remaining to accomplish the landing.

Maximum elevator effectiveness is achieved at aft cg conditions. Maximum aft cg on landing occurs at fuel weights corresponding to maximum landing weight with no external stores. Landing should be accomplished at an airspeed sufficient to ensure two inches backstick movement. See Figure 2-2 for typical cg travel.

14.8.3.3 Runaway Stabilizer Trim During Flight

*1. RAT – OUT .

2. Remain on hydraulic power control system.

3. If unable to retrim and trim is stuck at or near full noseup position:

a. Reduce speed

b. Lower flaps.

Note

If runaway trim occurs at high airspeed, aircraft g loading will rapidly increase as the trim approaches full noseup. If control stick is not restrained it may move fully forward because of effect of bobweight.

14.8.3.4 Normal Aileron Trim Failure. If aileron trim fails to respond while attempting normal corrective trim, do not attempt to check the trim circuit by operating the trim switch in the opposite direction. This will make the out-of-trim condition worse.

14.8.3.5 Aileron Trim Runaway

*1. RAT – OUT.

2. Remain on hydraulic power-control system.

3. Burn down and land.

With trim jammed at maximum deflections in either direction, forces required to return stick to neutral will be moderate.

WARNING

Do NOT disconnect flight control system.

At high speeds on manual control, lateral forces will be uncontrollable if aileron trim has runaway.

14.8.3.6 Rudder Trim Runaway

*1. RAT – OUT.

2. Remain on hydraulic power – control system.

3. Burn down and land.

Force required to return rudder to neutral will be moderate.

14.8.3.7 AFCS Malfunction. In the event flight controls operate in an erratic manner, such as uncontrolled lateral or pitch oscillations, or a hard over condition occurs, whether operating with AFCS in STANDBY or OFF, proceed as follows:

1. Depress the autopilot override button on the control stick.

WARNING

The pilot in either cockpit shall not attempt to control the aircraft with the AFCS engaged unless the AFCS control panel is installed in the same cockpit as the controlling pilot.

2. If normal control is not restored and AFCS standby switch is in STANDBY, turn switch OFF.

3. If this does not restore normal conditions, deploy the emergency generator.

4. If normal aileron trim is not restored upon disengagement of the AFCS, move the AFCS aileron trim NORM/EMER switch to EMER position. This should restore normal operation.

Note

Do not actuate the flight control power disconnect to rectify and AFCS malfunction.

14.8.3.8 Binding Flight Controls

1. *DO NOT* disconnect flight controls.

2. Strike stick smartly, attempt to free control.

3. If unable to free control, fly with trim tabs, rudder, and flaps.

4. If aircraft becomes uncontrollable – EJECT.

14.8.4 Spoilers Deploy in Flight. If spoilers deploy in flight, proceed as follows in attempting to close them:

*1. Throttle – MIL.

Note

Potential in-flight deployment when the power is reduced below 70 percent with the spoilers armed may be indicated by unlighted AOA indexers with the landing gear down.

*2. Spoiler switch - OFF.

If spoilers remain up:

*3. RAT – OUT.

4. If none of the above procedures succeed in closing the spoilers, slow flight the aircraft at 5,000-feet AGL, or above, to check landing characteristics.

5. Use full flaps with gear down.

6. Keep speedbrakes closed.

7. Expect excessive approach speed.

8. Use arresting gear where practical.

14.8.5 Speedbrake Failure. If speedbrake control valve solenoid or dc-electrical failure occurs, operate speedbrakes as follows:

1. Speedbrake switch – OPEN OR CLOSE, AS REQUIRED.

2. Emergency speedbrake knob – PULL TO OPEN OR PUSH TO CLOSE, AS REQUIRED.

The emergency speedbrake control may be used to override the electrical signal, but the handle must be held in the desired position. In case of hydraulic and electrical failures when the speedbrakes are open, they may be closed to the trail position by momentary actuation of the manual control.

14.8.6 Fuel System Failure

14.8.6.1 Fuel Quantity Indicator Failure. If the indicator needle will not move or if it continuously rotates, manage the fuel, using the flowmeter and the best estimate of fuel remaining. If in company with other aircraft, and the initial fuel load and the mission performed have been identical, the fuel remaining will usually be within a few hundred pounds of that of the accompanying aircraft. Land as soon as practicable, in either case.

Note

Low fuel warning light will continue to provide indication of a low fuel warning state.

14.8.6.2 Fuel Transfer Failure. The initial indication of fuel transfer pump failure will be when the FUEL TRANS caution light comes on. When the FUEL TRANS caution light remains on, assume that the usable fuel remaining is either 650 pounds or the indicated fuel quantity (whichever is less) and land as soon as possible.

Note

- The FUEL TRANS caution light may come on during maneuvering flight or if the engine rpm is approximately 70 percent or below.
- The FUEL TRANS caution light will come on if the wing fuel is depleted.

When the fuel remaining in the fuselage tank falls below approximately 550 pounds (the level at which the wing tank capacitance units are removed from the indicating circuit), there will be an abrupt drop in fuel quantity indication to a reading corresponding to the fuel remaining in the fuselage tank. When the wing tank transfer pump fails, only the fuel remaining in the fuselage fuel tank will be available. However, if the external fuel tanks contain fuel and are pressurized, fuel will flow to the wing tank until it is full and then will flow directly to the fuselage cell until drop tank fuel is exhausted. In aircraft reworked per A-4 AFC 317, the drop tank fuel may be transferred directly to the fuselage cell without first filling the wing tank by moving the FUEL TRANS BYPASS switch to the BYPASS position.

When drop tank fuel has been exhausted in aircraft reworked per A-4 AFC 209, move the emergency transfer switch to EMER TRANS. This will pressurize the wing tank, forcing fuel to the fuselage cell through the path of least resistance (air refueling plumbing and/or normal fuel lines between the transfer pump and fuselage cell).

With external fuel available and tanks pressurized, a drop off in indicated fuel quantity to 550 pounds is an indication that drop tank transfer is probably inoperative or inadequate. Selection of emergency transfer should be accomplished to ensure maintenance of adequate fuselage fuel quantity.

With a centerline drop tank installed, move the DROP TANKS switch to the PRESS position to prevent wing fuel from flowing into centerline tank when emergency transfer system is activated.

With an air-refueling store installed, move the ship-tank switch on refueling control panel to the FROM STORE position to prevent wing fuel from flowing into store when emergency transfer system is activated.

With the emergency transfer switch in EMER TRANS position, a static pressure of 6 psi is imposed in wing tank. Inadvertent dumping of wing tank fuel may occur through a pressure relief and dump valve if the wing tank is overfilled or wing tank vent becomes blocked with fuel. Inadvertent dumping of fuel will be apparent from a rapid drop in fuel quantity indication (about 700 pounds per minute). It may be necessary to turn off the emergency transfer switch temporarily to permit a decay of wing pressurization and the dump valve to reseat. This uncommanded dumping of wing fuel may also be caused by overpressurization of the wing tank because of drop tank transfer bleed air entering the wing.

If the fuselage tank float valve sticks in the closed position, the FUEL TRANS caution light will not normally come on; however, indication of a failure will be an abrupt drop in fuel quantity to approximately 550 pounds (the reading corresponding to the fuel remaining in the fuselage tank), and the low fuel warning light should come on. If there is fuel in the external tanks and they are pressurized, this will not normally occur until external fuel is depleted as it will continue to transfer to the fuselage tank through air refueling plumbing. Whenever the fuel quantity drops unexpectedly to 550 pounds, whether or not the FUEL TRANS caution light is on, proceed as follows:

1. Ensure that DROP TANKS transfer switch is in PRESS.

2. Emer trans/wing dump – OFF.

3. Wing bypass – NORMAL.

4. The float valve may be unseated by rapid oscillation of the control stick within the structural limits of the aircraft. If this action unseats the valve, landing at the nearest suitable facility is still recommended as there is a possibility that the valve will stick again.

5. If the above action is not practicable or is unsuccessful, place the emergency transfer switch in EMER TRANS.

6. Land as soon as possible.

Note

Emergency transfer is available on emergency generator in aircraft reworked per A-4 AFC 586. Wing transfer bypass and fuel dump are also available on emergency generator.

14.8.6.3 Drop Tank Transfer Failure. If fuel transfer from *all* drop tanks is abnormally slow or fails during flight, the pilot should proceed as follows:

1. Ensure that DROP TRANS is in PRESS.

2. Ensure that EMER TRANS is OFF and FUEL TRANS BYPASS (AFC 317) is in NORMAL.

If after ensuring proper placement of the above switches, drop tank transfer still does not occur:

3. Deploy emergency generator.

Note

Unless the drop tank fueling switch in the aft engine compartment is placed in the OFF position after refueling the drop tanks and prior to becoming airborne, drop tank fuel transfer will not occur unless the emergency generator is deployed.

When drop tank transfer is complete, place emergency generator switch in BYPASS. If deploying emergency generator does not accomplish transfer:

4. Ashore – Ensure aircraft weight for landing does not exceed maximum limits. Effect minimum descent landing.

5. Ship – Jettison drop tanks prior to landing.

Note

If it is apparent that one drop tank is not transferring while others are functioning normally, the fuel contained in the failed tank should be considered unusable. No airborne remedial action is available. For landing refer to: Landing With An Asymmetric Load.

14.8.6.4 Fuel Leak

14.8.6.4.1 Fuel Leak From Fuselage Area. Possible sources of a fuel leak from the fuselage area are fuel control, fuel heater, (fuel pump, oil cooler, and fuel manifolds. A fuel leak from these areas may not be detected by cockpit engine instruments and fire or engine flameout can occur.

If a wingman verifies a fuel leak from the fuselage area, proceed as follows:

1. Throttle - MINIMUM REQUIRED FOR FLIGHT.

2. Land as soon as possible utilizing a precautionary approach.

3. Be alert for fire.

4. Closely monitor engine instruments.

14.8.6.4.2 Fuel Leaking From Wing Tank. If fuel is leaking from wing tank, proceed as follows:

1. Ensure EMER TRANS and DROP TANK PRESS switches are off.

2. While wing fuel remains, proceed at highest possible speed to nearest divert field. If distance warrants, a bingo profile should be flown modifying (increasing) airspeed as feasible.

3. Once wing fuel is depleted, continue flight maximum range cruise. Intercept bingo profile for final descent.

If fuel remains in drop tanks, aircraft equipped with AFC 317 may obtain remaining drop tank fuel as follows:

4. Activate the fuel transfer BYPASS switch.

5. Place drop tank pressurization switch to PRESS position.

14.8.6.4.3 Fuel Leaking From Fuselage Fuel Tank

WARNING

Fuel leaking from fuselage fuel tank has resulted in explosion. Ejection should be considered depending on severity of fuel leak.

If flight is continued proceed as follows:

1. Land as soon as possible.

If fuel quantity drops to 550 pounds:

2. Emergency transfer - CYCLE TO MAINTAIN QUANTITY AT 550 POUNDS.

Note

Leaving emergency transfer on may result in accelerated fuel loss.

14.8.7 Uncommanded Fuel Dumping. Uncommanded fuel dumping may occur because of overpressurization of the wing fuel cell (greater than 8.5 to 9.0 psi) which can be caused by either blocking the P&V valve with fuel while EMER TRANS is selected or by drop tank transfer bleed air which can enter the wing when external tanks are empty but pressurization remains on. If the dump valve is opened in this manner, it will not close until pressure in the wing decreases to about 4 psi. Whenever uncommanded fuel dumping is experienced, or if fuel dumping does not stop when deselected, proceed as follows:

1. Ensure EMER TRANS and DROP TANK PRESS switches are OFF.

2. While wing fuel remains, proceed at highest feasible speed to nearest suitable field. If distance warrants, a bingo profile should be flown modifying (increasing) airspeed as feasible while wing fuel remains.

3. When established toward divert field, turn DUMP switch ON for 10 to 20 seconds in an attempt to clear dump valve, then turn OFF.

4. Once wing fuel is depleted, continue flight at Max Range Cruise. Intercept bingo profile for final descent.

Note

A nose low, left wing down sideslip, that shifts fuel away from the dump valve, may reduce wing tank pressure, allowing valve to reseat if dump was commenced because of pressure relief function of valve.

If dump continues and fuel remains in external drop tanks, aircraft equipped with AFC 317 may obtain remaining drop tank fuel as follows:

5. Activate the fuel transfer BYPASS switch.

6. Place drop tank pressurization switch to PRESS position.

14.8.8 Oxygen System/Mask Failure. If no oxygen is available because of system depletion or failure, or if mask malfunctioning or contaminated oxygen is suspected, proceed as follows:

1. Turn oxygen switch OFF and pull green ring. Descend rapidly to cabin altitude of 10,000 feet or below.

2. Remove mask if unable to breathe or when bailout oxygen is depleted.

3. If fuel remaining permits, descend to 10,000 feet pressure altitude or lower and select RAM air.

4. Land as soon as practicable.

14.8.9 Pitot-Static System Failure. When airspeed indications are lost or suspected to be erroneous, the altimeter and vertical velocity indications will probably be similarly affected. Turning the pitot heat ON should promptly restore normal operation, if the malfunction was because of pitot-tube icing. If it is apparent that icing is not the cause, place the cockpit-pressurization switch in RAM and break the glass from the vertical velocity indicator with a sharp instrument. This may restore operation by providing a source of static pressure, but instrument readings will not be accurate. There will be a pronounced lag, and the vertical velocity indications will be reversed. Use the cabin altimeters as a rough cross-check on altitude.

14.8.10 Air-Conditioning Temperature Control Failure. Occasionally, malfunctions will occur that cause the air-conditioning system to provide either full-hot or full-cold air to the cockpit. Manual positions are provided for the temperature control knob with which the pilot can select a desired temperature level. If the manual temperature is inoperative and the pilot becomes uncomfortably hot or cold, the NORMAL/RAM switch should be placed in RAM. If it is not practical to operate in RAM, adjust the air distribution lever and eyeball diffusers to minimize airflow. Use minimum rpm required for flight. Changing altitude should extend the period the adverse temperature can be endured. Land before debilitating effects reduce the pilot's capability to do so safely. As a last resort, if the cockpit temperature is unbearable and the pilot is unable to switch to RAM operation, the canopy should be jettisoned.

14.9 LOSS OF CANOPY

If the canopy is lost at speeds below 200 KIAS, both occupants will be uncomfortable; however, no immediate windblast hazard exists. At speeds in excess of 200 KIAS, windblast will be the primary problem. The front seat pilot will be able to effectively screen himself from the wind by leaning forward and will have no difficulty in controlling the aircraft. The rear seat occupant will experience severe physical buffeting because of the force of the wind. The harshness of the buffeting cannot be overemphasized as the rear seat occupant will be at least partially incapacitated. The windblast forces will be severe throughout the rear cockpit, making it difficult if not impossible for the occupant to move his hands without having them forced into the outside airstream. There is a strong probability that at speeds above 200 KIAS his oxygen mask may be forced up covering his eyes.

The aft edge of the rear cockpit instrument panel covering may work loose as the canopy is lost or shortly thereafter. When loose, it will probably flip forward against the rear of the front seat preventing the rear seat occupant from observing the pilot. UHF and ICS communications will be satisfactory from the front cockpit, but the aft seat occupant will be unable to communicate at speeds in excess of 200 KIAS. It is likely that the windblast will cause the rear seat radio cords to become disconnected. If the radio cords should stay connected, the rear seat occupant still should not attempt to key the mike at high speeds since any movement may result in his hand being forced into the airstream.

It is unlikely that windblast alone will pull the rear seat face curtain if the face curtain handle is properly seated. However, if the handle is slightly dislodged, it is possible that at speeds above 220 KIAS the windblast will pull the face curtain and fire the seat. At speeds in excess of 250 KIAS, it is probable that ejection seat firing will occur as the result of windblast forces on the face curtain when the face curtain handle is partially dislodged.

Although windblast is the most immediate problem, low ambient temperatures at altitude will also present a serious hazard. The effect of the ambient conditions on the occupants will depend on airspeed, outside air temperature, and the type of flight clothing being worn. Unless the aircraft is at low altitude, below 5,000 feet, detrimental effects because of ambient conditions will probably be apparent shortly after the canopy is lost.

14.9.1 Procedure Following Loss of Canopy. If the canopy separates from the aircraft while airborne the pilot in the front cockpit will retain or immediately assume control of the aircraft. When assuming control, the front seat pilot will signal by emphatically shaking the control stick and transmitting I HAVE IT on the ICS. The aft seat occupant shall not attempt to acknowledge unless sure that he can do so safely. The rear seat pilot shall position himself for possible ejection.

WARNING

The aft seat occupant should not take any action that might cause his hands to be caught in the windstream. It is likely that his arm flailing in the windstream will hit the face curtain handle causing partial dislodgement of the handle thereby increasing the possibility of inadvertent ejection.

The pilot will immediately reduce airspeed to the minimum acceptable, 200 KIAS maximum. If ambient conditions dictate, descend to a warmer altitude. Make an immediate landing if the physical condition of the aft seat occupant or surface temperatures are critical factors. If circumstances permit, slow flight the aircraft to determine the effect of possible structural

damage. Dump fuel to reduce gross weight prior to landing.

WARNING

Airstream forces on the aft seat occupant will be severe. At speeds in excess of 200 KIAS, the aft occupant will probably be incapacitated. It is imperative that the airspeed be reduced as much as possible prior to descending.

Forward cockpit UHF and ICS reception and transmission will be readable at any airspeed. The front seat pilot should attempt to establish ICS contact will the rear seat occupant as soon as the airspeed is below 200 KIAS.

14.10 AIR REFUELING STORE FAILURE (TA-4F)

14.10.1 Hose Jettison. Hose jettison may be desirable when store hydraulic pressure is lost or when an electrical malfunction occurs which prevents retraction of the drogue. When hose jettison is elected, proceed as follows:

1. Reduce airspeed to 250 KIAS or less.

2. Hold back spring-loaded channel guard, lift hose jettison switch, and move to JETTISON (aft) position.

Note

A 5- to 20-second time delay will occur prior to the hose jettisoning.

3. Do not change position of hose jettison switch after jettisoning hose and drogue.

If hose jettison is accomplished at speeds in excess of 250 KIAS, excessive tension on the hose because of hose stretching may pull the hose from the crimper after the guillotine is fired. Hose jettison is possible on emergency generator operation. Fuel dumping from the store is not possible when operating on the emergency generator. Fuel transfers automatically to the wing fuel tank when normal electrical power is lost or when operating on emergency generator.

14.10.1.1 Electrical Failure. Should the main generator or store electrical system fail with the drogue extended, transfer to the receiver aircraft will terminate automatically. Automatic transfer to the wing fuel tank of all external fuel will commence with deployment of the emergency generator.

On emergency generator, the drogue cannot be retracted and any remaining fuel in the store cannot be dumped. Hose jettison is available on emergency generator.

If failure occurs that prevents retraction of the drogue, proceed as follows:

1. Ashore – Jettisoning hose and drogue is necessary only if indicated by other considerations, such as field arrestment required, decreased drag necessary for safe return, etc.

2. Carrier-based – Jettison hose and drogue, if possible, before landing. Make normal approach. Advise ship of condition so that flight deck personnel can be warned.

14.10.1.2 Store Hydraulic Failure. Any evidence of a hydraulic leak observed during refueling operation should immediately be reported to the tanker pilot and the store secured.

14.10.1.3 Drogue and Coupling Lost and/or Hose Severed (Other Than Hose-Cutter Severance). Should the basket or hose be lost, the remaining hose will automatically retract because of the loss of the drag created by the basket. This is accomplished by the 200-pound force continually applied by the hose reel assembly. The following procedure is recommended:

1. Place drogue position switch in RET.

2. Deploy emergency generator.

3. Place refueling master switch in OFF.

4. Select emergency generator bypass to remain on main generator.

Note

The store may be dumped, but the refueling master switch shall not be placed in ON.

The preceding procedure is recommended to reduce fire hazard created by actuation of hose jettison. A secondary procedure is as follows:

1. Place drogue position switch in RET.

2. Place hose jettison switch in JETTISON and leave in this position until after engine shutdown.

14.10.1.3.1 Loss of Store Feathering Control

1. If unable to feather the store air turbine after drogue retraction, check drogue position indicator. If drogue indicates RET, observe limiting airspeed of 300 KIAS or 0.80 IMN for remainder of flight. No adverse effects should be expected. If the drogue position indicates TRA but drogue is reported to be retracted, slow to 230 KIAS and recycle drogue in an attempt to obtain a RET indication. If not successful, slow to 200 KIAS or 0.80 IMN for the remainder of the flight. No adverse effects should be expected except, after a shore-based landing, drogue will probably trail out and sustain damage. Shipboard, make a normal approach. Advise ship of possible necessity to tie up or carry drogue as aircraft is taxied from landing area.

2. With the store unfeathered and the drogue indicating EXT or TRA, the drag index is greatly increased. If fuel consumption is critical, consider jettisoning the hose and drogue to reduce drag.

14.11 FLAMEOUT APPROACHES

If it is impossible to eject/abandon aircraft, a flameout approach and landing may be attempted utilizing the procedures depicted in Figure 14-4. Simulated flameout approaches are prohibited.

14.12 FLIGHT CHARACTERISTICS WITH ENGINE FAILURE

14.12.1 Adequacy of Flight Controls. At the recommended airspeeds, the windmilling engine provides adequate hydraulic pressure for excellent controllability with the normal flight control system during flameout approach and landing. During landing rollout, lateral control is retained down to approximately 40 KIAS. With full elevator deflection (not normally required) or manual speedbrake extension at touchdown, normal flight controls become very stiff at approximately 80 KIAS. The manual flight control system must be selected in the event of engine seizure and provides adequate controllability, but the rapid control response required for high crosswind landing is lost.

14.12.1.1 Speedbrake Actuation. Manual speedbrake retraction requires less than 2 seconds and causes no adverse trim changes.

14.12.1.2 Canopy and Windshield Frosting. Depending on atmospheric conditions and the altitude at which flameout occurs, some frosting of canopy and windshield can be expected. The majority of frosting will occur on the canopy, with some accumulation on the windshield side panels. The center windshield panel is electrically heated by the emergency generator when the landing gear is retracted and will remain clear during the flameout glide.

Note

Rate of descent data with a seized engine are listed below for the Model TA-4F/TA-4J aircraft configured with 5 pylons, guns, and two 300-gallon external fuel tanks with gear down, speedbrakes closed, and flaps up. These data are presented for an aircraft weight of 14,000 pounds and a speed of 180 KIAS. For weights greater than 14,000 pounds, add 5 knots airspeed and 100 FPM for each 1,000-pound increase.

Pressure Altitude Feet	Rate of Descent FPM
20,000	4,850
15,000	4,470
10,000	4,160
5,000	3,870
0	3,610

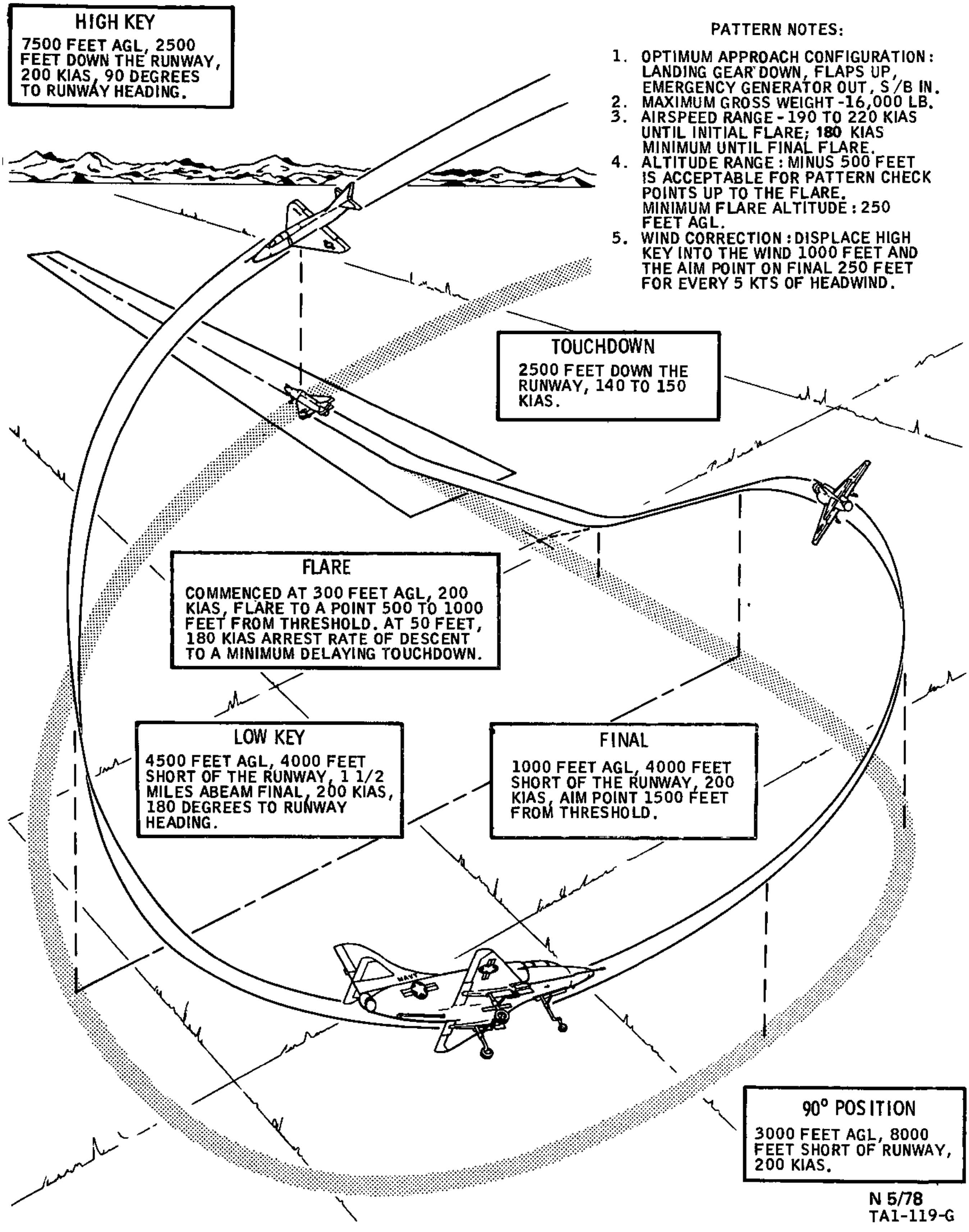


Figure 14-4. Flameout Approach

14.13 PRECAUTIONARY APPROACH (PA)

The precautionary approach (PA) is depicted in Figure 14-5. It may be used whenever circumstances make it desirable; such as loss of oil pressure or other engine difficulties which make it undesirable to reduce rpm. The variations in pattern-entry and altitude allow a wide margin of flexibility. A preferred field for a PA is one with a minimum of 8,000 feet of hard-surfaced runway. Select a field with crash equipment and arresting gear, if practicable.

14.13.1 Entry. Approaches to the field for a PA are divided into upwind-or downwind categories. If upwind of the landing runway, plan to pass through a normal left or right base at 2,000-feet AGL, executing a 180° approach, slightly deeper than a normal flightpath on the final. If downwind of the landing-runway, plan a modified straight-in approach to intercept the depicted flightpath.

14.13.2 Straight-in Approach. If a straight-in PA is selected, the initial point is 3,000-feet AGL at 4-1/2 miles from the touchdown point. However, the pilot may choose to intercept the depicted flightpath at the desired point in landing configuration–gear down, flaps down, speedbrakes as necessary. Have the aircraft "dirty" by 1-1/2 miles from touchdown, if possible. Turn the gunsight ON and set 110 MILS. At the initial point (or wherever the PA flightpath is intercepted), set the pipper on or alongside the touchdown point (1,000 feet down the runway from the approach end). Hold it there and drive downhill. Use speedbrakes as necessary to maintain 180 KIAS minimum. The rate of descent will be 1,800 to 2,200 FPM, depending on the wind.

14.13.3 Final Approach and Landing. An ejection attempt at low altitude in this approach leaves little margin for error. If ejection is decided upon, reduce the descent rate as much as possible and attempt to eject while wings are level. Do not descend below 200-feet AGL until 1,000 feet from the end of the runway. This final checkpoint is the first point in the PA from which a safe landing on the runway can be made if the engine fails.

Just short of the end of the runway, reduce power as necessary, flare to reduce rate of descent, dissipate airspeed, and land.

WARNING

Do not reduce power below 70 percent with the spoilers armed unless the AOA indexers are lighted.

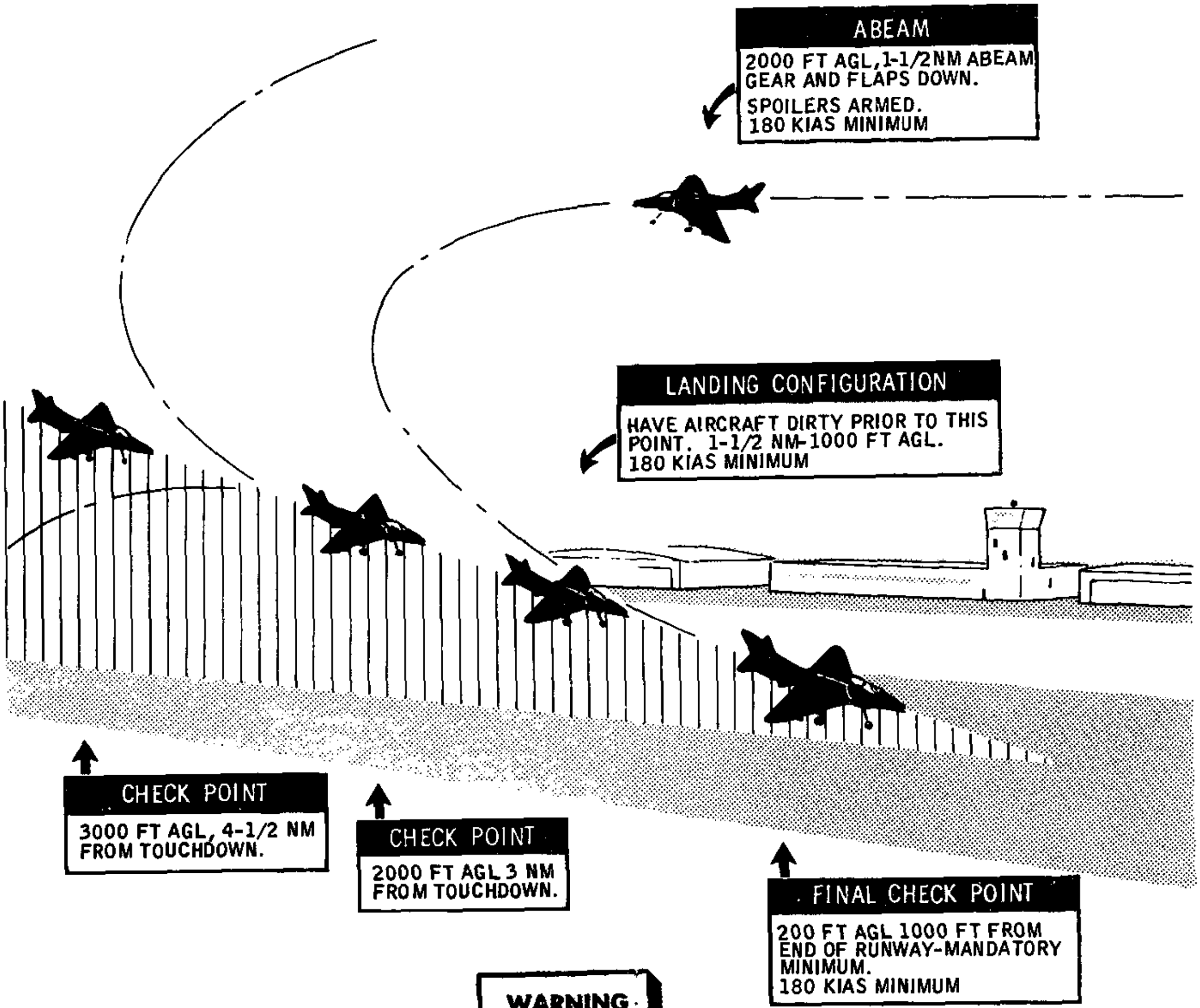
14.13.4 Practice PAs. Practice PAs are conducted as above. If practiced in an airport control-zone, they will be conducted only when there is positive control of traffic. Because of the higher than normal sink-rate used in making this approach, pilots are cautioned that significant power reduction should not be made during practice approaches until the sink-rate has been reduced to a normal rate by flaring as the touchdown point is approached. It is recommended that initial practice PAs be made with an instructor pilot, or be monitored by a chase pilot or by a qualified A-4 pilot or LSO on the end of the runway with two-way radio communications. Always wave off if the sink-rate gets out of control.

14.14 STUCK THROTTLE APPROACH (STA)

The stuck throttle approach (Figure 14-6) should be used whenever circumstances exist where it is impossible to change engine rpm. The aircraft will be configured using a combination of gear, flaps, and speedbrakes to reduce the approach airspeed as much as possible to the minimum airspeed of 180 KIAS. The approach airspeed corresponds to an altitude on a 3-1/2° glide slope where shutdown of the engine using the emergency fuel shutoff lever will allow a safe landing from a decelerating approach. An 8,000-foot runway with arresting gear available is the minimum recommended.

14.14.1 Entry Procedures. The primary concern, once it has been determined that a stuck throttle condition exists, is whether or not there is sufficient power available to maintain level flight. At intermediate thrust levels sufficient power for level flight may be marginal. With a stuck throttle condition near these rpm ranges, the aircraft should be flown toward the nearest suitable airfield for possible entry into the STA pattern. At about 10,000-feet AGL perform a transition to 180 KIAS, gear and flaps up and speedbrakes in, to determine whether or not there is

ENGINE SEIZURE WHILE PERFORMING A PRECAUTIONARY APPROACH WILL RESULT IN LOSS OF NORMAL FLIGHT CONTROLS. A PULL-UP TO REDUCE RATE OF DESCENT MAY NOT BE POSSIBLE.



WARNING

ENGINE SEIZURE WHILE PERFORMING A PA WILL RESULT IN LOSS OF NORMAL FLIGHT CONTROLS. A PULL-UP TO REDUCE RATE OF DESCENT MAY NOT BE POSSIBLE.

NOTE

THE STRAIGHT-IN FLIGHT PATH MAY BE INTERCEPTED AT THE MOST CONVENIENT POINT PRIOR TO THE FINAL CHECK POINT. THE CHECK POINTS ARE GUIDELINES ONLY.

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TA1-121-C

Figure 14-5. Precautionary Approach

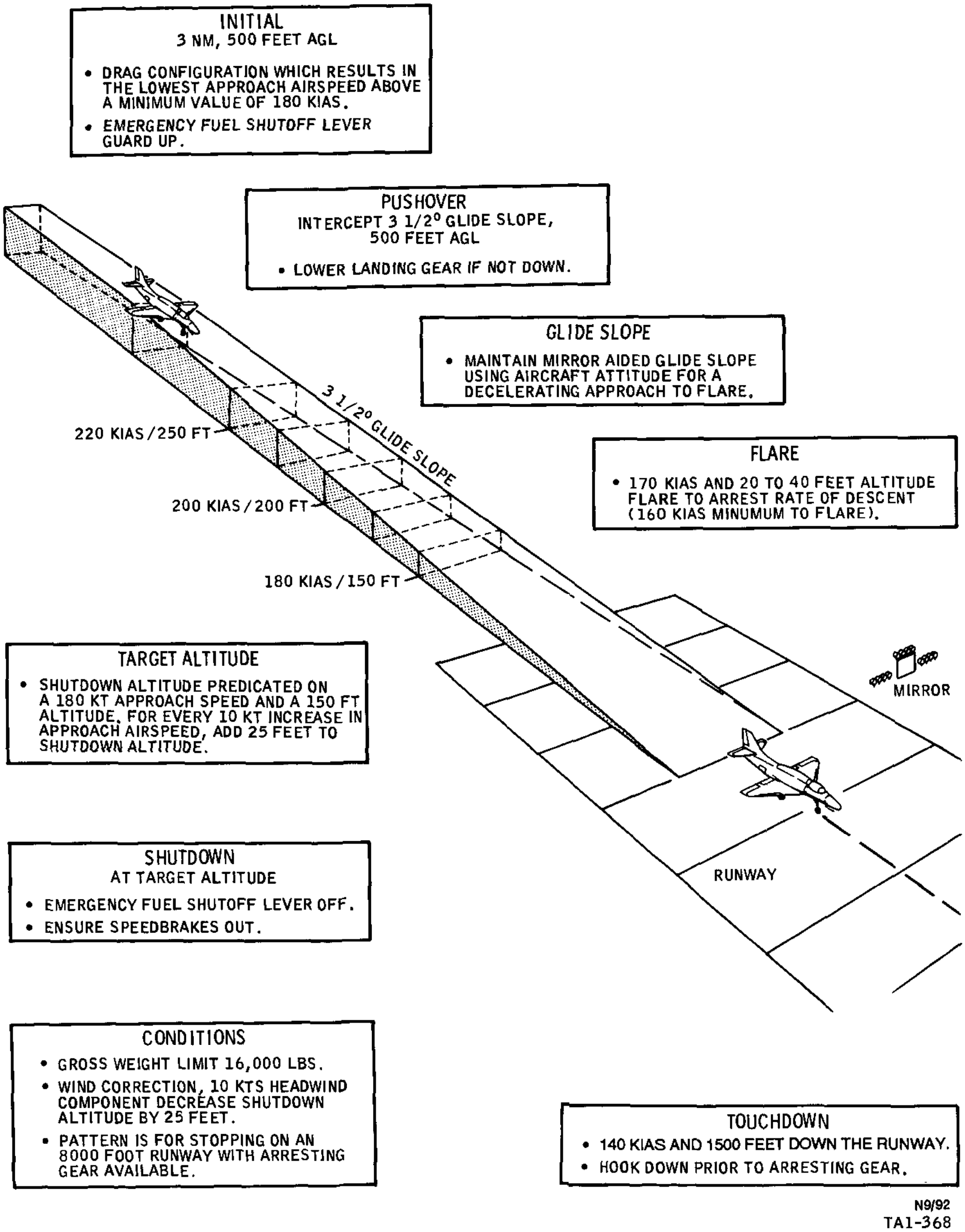

Figure 14-6. Stuck Throttle Approach (Power for Level Flight)

sufficient power for level flight. If, at 180 KIAS, steady state level flight cannot be maintained, there may be insufficient power to fly the STA and a decision must be made to enter the PA pattern or eject. If level flight or a rate of climb is maintained at 180 KIAS, sufficient power is available for safe execution of the STA and a controlled descent should be made toward the STA initial point.

14.14.2 Initial Point; Power Available for Level Flight. The initial point is a position approximately 3 nm, 500-feet AGL from the approach end of the runway on an extended centerline. The aircraft should be flown to arrive at the initial with the configuration adjusted to maintain at least a minimum approach airspeed of 180 KIAS. The flaps should be considered as a purely drag producing device. The STA can be safely flown with the flaps up. At high thrust levels, even with gear and flaps down, speedbrakes extended, airspeeds up to and exceeding 225 KIAS can be expected. With the engine rpm stuck in the lower acceptable STA rpm ranges, a clean configuration will be required (gear and flaps up, speedbrakes in) in order to maintain a minimum pattern airspeed of 180 KIAS. Once the approach configuration and a corresponding steady state airspeed has been determined, this airspeed should be maintained until engine shutdown by manipulation of the speedbrakes. At high thrust levels where approach airspeeds exceed 220 KIAS, full flaps and speedbrakes are required throughout the entire STA. Engine shutdown will be accomplished through the use of the emergency fuel shutoff lever. In order that there is no delay at engine shutdown, the guard on the emergency fuel shutoff lever should be raised at the initial point and rechecked clear prior to glide slope interception.

14.14.3 Glide Slope Interception. The glide slope is intercepted and a descent commenced when the meatball appears in the runway mirror or lens. The glide slope is maintained by varying aircraft attitude and the speedbrakes are modulated as necessary to maintain approach airspeed or left open to minimize buildup over 220 KIAS. If a mirror is not available, assistance for glide slope determination can be obtained by use of precision approach radar or an LSO stationed on the runway. Pilot estimation of a 3-1/2° glide slope can successfully be used for a STA. Upon commencing the descent on the glide slope, the landing gear is lowered if held because of minimum power considerations. If conditions dictate, a waveoff can be commenced any time prior to engine shutdown. At lower thrust levels, waveoff capability may be marginal and/or nonexistent if the landing gear is not retracted and/or the airspeed is allowed to decrease below 180 KIAS prior to engine shutdown.

14.14.4 Engine Shutdown, Final Approach and Landing. The most critical and demanding phase of the STA is from engine shutdown to final landing. The engine shutdown point on the 3-1/2° glide slope is determined by the following; for an approach airspeed of 180 KIAS, shut down the engine at 150-feet AGL using the emergency fuel shutoff lever and correct for every +10 knot increment in airspeed by adding 25 feet to the shutdown altitude; i.e., for an approach airspeed of 200 KIAS-shutdown at 200-feet AGL, for 220 KIAS to 250-feet AGL, etc. The radar altimeter should be used if available because of accuracy considerations but the standard barometric altimeter is acceptable.

CAUTION

Every effort should be made to ensure that the emergency fuel shutoff lever is actually in the off-detent. If it is not, the engine may not shut down or shutdown times may increase considerably and possibly prevent a safe landing.

At shutdown the engine will continue to run at the same thrust level for approximately 1 (high power) to 3 (minimum required for level flight) seconds prior to engine shutdown. The speedbrakes should be extended if not already out at this time. The glide slope should be maintained by changing aircraft attitude resulting in a decelerating approach. At 20- to 40-feet AGL, 170 KIAS, a flare is gradually commenced to hold the aircraft off the runway delaying touchdown until 140 KIAS and approximately 1,500 feet down the runway. A minimum airspeed of 160 KIAS should be maintained until flare is commenced. At touchdown, utilize proper braking technique with consideration given to a possible long field arrestment.

Note

Engine rpm usually deteriorates at a rate which results in the generator dropping off the line approximately at touchdown. The use of the emergency generator is not recommended because actuation of speedbrakes by emergency means will be required.

14.14.5 STA; Insufficient Power Available for Level Flight. If insufficient power for level flight exists with a stuck throttle condition, an attempt can be made to land the aircraft safely by entering the PA pattern. The PA pattern can be successfully flown using only speedbrakes and angle of bank variations to compensate for engine thrust. The engine should be shut down using the emergency fuel shutoff lever when a runway landing is assured, but prior to the flare if possible.

14.14.6 Additional Considerations

14.14.6.1 Wind Effects. To correct for headwind, reduce shutdown altitude by 25 feet for every 10 knots of headwind. A STA should not be attempted when the crosswind component exceeds the specified NATOPS limitation for a nonspoiler crosswind landing. Normal hydraulic flight control is adequate down to approximately 50 KIAS. The use of manual flight control is not recommended.

14.14.6.2 High Power Approaches. For high power stuck throttle conditions the speedbrakes, g loading and/or a climbing attitude will be necessary to reduce the airspeed below 225 KIAS in order to lower the landing gear and flaps. Angle of bank can then be used in a spiraling descent, maintaining the airspeed below 225 KIAS, to arrive in the vicinity of the initial point. However, approach airspeeds up to 240 KIAS can be expected at high thrust levels.

14.14.6.3 Optimum Fuel Control Mode. Tests have shown that there is an advantage to switching fuel control mode from the primary to manual at both high and low thrust levels. For high power stuck throttle conditions a significant reduction in thrust can be realized. At low power a slight increase in thrust is likely, and at intermediate levels the effect can be either a rise or loss of thrust. Because of the effects of ambient conditions the optimum fuel control mode will be that which provides a thrust level nearer to normal approach power.

14.14.6.4 Approach Simulation. Simulated engine shutdown may be accomplished by retarding the throttle to idle utilizing the following time delays:

Approach Airspeed (KIAS)	Time Delay (Seconds)
180	3
190	2
200 or greater	1

14.15 LANDING WITH LANDING GEAR MALFUNCTIONS

Figure 14-7 furnishes course of action guidance for emergency landings with landing gear malfunctions. These are recommendations only and are based on experience and statistical data available to date. It is recognized that sea, deck, weather, operational and pilot considerations may indicate different actions. The general considerations that follow are pertinent.

14.15.1 Field Arrestments. Always request the assistance of an LSO. When the arrestment is to be made at night, have the position of the arresting gear illuminated. Do not land wheels-down in abort type gear unless enough runway remains for runout. Normally, 1,500 feet should be adequate.

14.16 LANDING – OTHER FAILURES

14.16.1 No Utility Hydraulic Pressure. Intermittent illumination of the utility system ladder light will usually warn the pilot of the impending loss of utility system pressure prior to the complete loss of pressure. When this is observed and it is practical to do so, slow the aircraft and lower the landing gear and flaps, placing the flap selector in the STOP (center) position after extension. Return to base and land. Be prepared to disconnect the flight control power mechanisms in the event the flight control hydraulic system should also fail. (Refer to Hydraulic Systems Failure.)

If it is not practical to dirty-up because of fuel considerations, slow to 300 KIAS or below. Return to base or an alternate field. Lower the wheels, using the emergency landing gear extension procedure set forth in this section. Spoilers will not be available, nor will wing flaps and speedbrakes unless extended and locked prior to utility system failure. Nosewheel steering control switch should be placed in the EMER OFF position. Landing gear safety pins should be installed as soon as possible after landing.

Because the wheel brakes are completely independent of the aircraft's hydraulic system, the pilot should

BASIS: NADC

FINAL CONFIGURATION	CARRIER		FIELD Arresting gear available			FIELD No arresting gear	
	Land or Eject?	Notes	Land or Eject?	A/G Used?	Notes	Land or Eject?	Notes
All gear up	LAND	1	LAND	No	3, 4	LAND	3
Nose gear up	LAND	1, 2	LAND	Yes	5	LAND	7
Stub nose gear	LAND	1	LAND	Yes	5	EJECT	
One main gear up	LAND	1	EJECT	No	6	EJECT	
Stub main gear	LAND	1	EJECT	No		EJECT	
One main gear up; nose gear up	EJECT		EJECT	No		EJECT	
Both main gear up	EJECT		LAND	Yes	8	LAND	8

GENERAL

Whenever any landing gear is damaged or not down and locked, but all gear can still be retracted, retract the gear and divert ashore if feasible. Retain and land on empty tank/tanks, empty rocket packs, or other light weight inert stores, with exception of the air refueling store. Jettison the drop tanks, if they cannot be emptied. Prior to landing with any of the above malfunctions, except nose gear up and stub nose gear, burn down to 600 pounds or less fuel remaining to ensure that the wing fuel is expended and the fire hazard minimized. LSO control is advisable on any normal approach.

Notes:

1. Crossdeck pendant configuration shall be per current recovery bulletins.
2. If time considerations preclude removal of crossdeck pendants, land with hook up to prevent severe nosedown rotation, should arrestment occur prior to barricade engagement.
3. Ensure crossdeck pendants are removed from runway. Make flat approach at normal approach speed. Touch down lightly, with low sink rate. If 10 knots or more of crosswind component exists it may be desirable to use arresting gear where available.
4. Alternate method: Use arresting gear. Wave off if wire is missed.
5. **Make short field arrestment from flat approach at optimum angle of attack plus 10 knots with flaps down and 1,500 pounds of fuel. At touchdown, do not retard throttle. Hold nose up until arrestment. Wave off if wire is missed.**
6. **An alternative to ejection for this condition is to land in approach similar to that in Note 5, except burn down to 600 pounds of fuel and make touchdown point immediately prior to arresting gear. Grease this one on holding wings level with lateral stick as long as possible. An LSO is probably a necessity for this situation unless gear location is prominently marked.**
7. Make flat approach at normal approach speed. Trim full NOSEUP approaching touchdown. At touchdown, secure engine. Lower nose slowly before elevator effectiveness is lost.
8. Ejection mandatory without two drop tanks installed.

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Figure 14-7. Guide to Emergency Landings with Landing Gear Malfunctions realize that he will have brakes even though he makes a field landing with complete hydraulic failure. Should the pilot have a complete hydraulic failure, he can also extend his arresting hook. Compressed air pressure and the weight of the arresting hook cause extension when the arresting hook handle is moved to the DOWN position. However, the pilot cannot retract the arresting hook without hydraulic pressure.

The arresting hook should not be extended in flight unless a short field arrestment is planned. If a long field arrestment becomes necessary, lower the hook 1,000 feet prior to the gear to preclude dragging the hook on the runway, which may damage the hook to an unusable extent.

An arrested landing is recommended whenever possible, to minimize fire hazard because of a possible hydraulic leak. The engine should be secured immediately.

Note

If an arrested landing is not available, an increased landing roll of approximately 100 percent can be expected in a no flap, no speedbrake, no spoiler configuration.

14.16.2 Emergency Landing Gear Extension. Utility hydraulic system failure will necessitate lowering the landing gear with the emergency release system as follows:

1. Airspeed – 225 KIAS OR LESS.

2. Emergency jettison selector switch front cockpit – SELECT TO EMPTY STATION.

WARNING

Failure to position emergency select jettison switch to an empty station may result in inadvertent jettison of external stores. Avoid populated areas.

3. Landing gear handle – DOWN.

CAUTION

If circuit power to retraction safety solenoid has failed, pilots should not attempt to force landing gear handle DOWN. The forward cockpit pilot must first manually move downlock release latch (Figure 1-4) to the aft position. (Aft cockpit pilot will request each action.) The landing gear control handle can then be moved to DOWN.

4. Front cockpit emergency landing gear release handle – PULL.

CAUTION

Damage may be sustained by the bulkhead brackets and the landing gear handle ratchet if the landing gear handle is raised after the emergency landing gear release T-handle is pulled.

Note

Because of the proximity of rear cockpit cable routing to jettison circuits, front cockpit emergency landing gear handle should be used.

5. If landing gear fails to extend – APPLY MODERATE NEGATIVE G LOADING FOR 2 TO 3 SECONDS ; GET VISUAL CHECK.

6. If landing gear still does not extend fully down and lock, increase airspeed to 350 KIAS maximum and apply positive loading in attempt to get gear down indication. After lowering the landing gear by the emergency release system, the gear handle should be left in the DOWN position until the ratchet in the emergency system has been reset and cavitation in the gear down hydraulic pressure line has been eliminated by the application of hydraulic power. This procedure should be followed to prevent a failure of the ratchet and damage caused by

premature closing of the gear doors. However, if utility system pressure is available and circumstances warrant, the landing gear can be raised by means of the landing gear handle.

14.16.3 Unsafe Gear Down Indications. The most likely causes of failure of the landing gear to indicate DOWN after completion of the gear extension cycle are: faulty microswitches, sticking gear position indicator, utility system hydraulic failure, hung gear because of improper strut servicing, or failure of the main landing gear actuating cylinder. If all gears remain UNSAFE or UP with the gear handle down, the utility hydraulic system has most likely failed. Use the emergency landing gear extension procedure outlined above.

14.16.3.1. Main Gear Unsafe, Gear Handle Down

1. Maintain 225 KIAS or less.

CAUTION

Do not cycle the landing gear if extension of the landing gear is accompanied by an abnormal thump and subsequent loss of utility hydraulic pressure. Suspect a main landing gear trunnion failure. Attempt to obtain a visual check to confirm trunnion failure and perform steps 7 and 8 below.

2. If gear is determined to be UNSAFE, cycle gear in attempt to obtain DOWN indication. As soon as gear indicates DOWN, cease cycling. Nose gear extension may require as much as two minutes because of back pressure in return line if cause is broken nut in main landing gear actuating cylinder.

CAUTION

If all three gears indicate unsafe with gear handle down and normal utility hydraulic pressure, cycling of the landing gear could result in damage to the gear doors or possibly a hung gear because of improper sequencing of the landing gear system.

3. Unsafe gear down indication may be result of malfunctioning microswitch within gear indicating system. Without visual check, pilot will not be able to determine whether switch has malfunctioned or landing gear is actually unsafe. If cause of unsafe indication is microswitch, application of positive-g may force faulty switch to seat and produce safe indication.

4. If practicable, and if gear remains UNSAFE, obtain visual check from another aircraft or from qualified ground personnel to determine if cause is faulty indication or that gear is actually not down and locked. For in-flight checking of main gear in the down-and-locked position, high visibility fluorescent red-orange paint stripe is applied to inboard side of main gear drag link in two places. When these stripes are lined up, gear is down and locked. A more positive check that main gear is down and locked is observing that overcenter lever at midpoint of drag links is positioned forward and parallel to lower surface of wing. Nose gear should be checked down and locked by visually sighting through ground safety pin hole.

5. Occasionally, main landing gear will hang up in wheelwell because of improper strut servicing or brake lines catching on obstacles in well. If visual check indicates that this problem exists, or with no visual check available and above procedures have not produced SAFE indication, proceed as follows: Raise gear handle; with all gear up, apply and maintain negative-g, extend speedbrakes and lower gear. This procedure is normally effective in dislodging hung main gear.

6. If visual check reveals that one or more landing gear doors or strut doors remain closed, proceed as in paragraph entitled, Emergency Landing Gear Extension. If all landing gear and strut doors are open, do not use emergency landing gear release unless visual check is unavailable and previously employed procedures have failed to produce safe indication. Use of emergency landing gear release simply unlatches doors.

7. If landing gear does not indicate down-and-locked with gear doors open and landing gear extended, slowly increase airspeed to maximum of 350 KIAS and apply positive-g to obtain down-and-locked indication. Particular attention must be made to keep aircraft in balanced flight.

8. If landing gear indicates UNSAFE but is visually checked down-and-locked, make short field arrestment if available. If arresting gear is not available, make normal landing. To ensure that gear not down-and-locked, or if gear indicates UNSAFE and no visual check is practicable, attempt to raise all gear if utility hydraulic pressure is available. Refer to Figure 14-7, Guide to Emergency Landings with Landing Gear Malfunctions.

14.16.3.2. Nose Gear Unsafe, Gear Handle Down. Procedures used to obtain safe nose gear DOWN are the same as those outlined for Main Gear Unsafe except for procedures contained in step 5. Procedures to be used in the event of a Hung Nose Gear follow:

1. Occasionally, nose landing gear will hang up in wheelwell because of improper servicing or broken shrink linkage. If visual check indicates that this problem exists or with no visual check available and above procedures have not produced SAFE indication, proceed as follows: Raise gear handle; with all gear up, apply and maintain positive-g and lower gear. This procedure is normally effective in dislodging hung nose gear.

14.16.4 Landing – No Flaps. When unable to extend the flaps for landing, fly optimum angle of attack (optimum AOA is 16 to 19 KIAS above full flap approach speed). Fly slightly wider pattern about 1-1/2 miles abeam. For shipboard recovery, observe the maximum engaging speed.

14.16.5 Landing – No Speedbrakes. Utilize the standard pattern entry, approach, and landing when making a no-speedbrakes approach. The airspeed will be more sensitive to changes in the nose position. In the event of a waveoff, acceleration time to 100 percent will be slightly longer, but the overall difference from a speedbrake pass is negligible.

14.16.6 Landing – Stuck Slat. Fly optimum angle of attack. If angle of attack is not available, add 10 knots to the normal approach speed. Trim out any adverse lateral control pressures. Be alert to apply prompt correction, should the slat extend during the approach. Aboard ship, observe the maximum engaging speed.

14.16.7 Landing – Spoiler Malfunction on Landing Roll. The spoilers are not interconnected; therefore, there is a remote possibility that only one spoiler will be activated if a spoiler malfunction occurs. The pilot will notice an immediate swerving tendency that may be controlled by application of corrective rudder, ailerons, and braking. However, if feasible, the throttle should be advanced to military, a go-around effected, and landing accomplished with the spoilers dearmed. If a go-around is not feasible, place the spoiler switch to OFF.

14.16.8 Landing With an Asymmetric Load. With asymmetric loads landing should be made upwind or downwind, whichever is required to put the crosswind component under the heavy wing, providing other factors are considered, such as runway length and gross weight, and that the rollout will be shortened appreciably by securing the engine. Make a long straight-in approach. Execute a steady heading sideslip (wing down, opposite rudder) during approach. The minimum approach speed is 115 knots with up to 7,500 foot-pounds of asymmetric moment varying linearly thereafter to 130 knots at 12,500 pounds. Normal angle of attack should be maintained as long as the resulting airspeed does not become less than the minimum. With asymmetric loading, the maximum 90° crosswind component under the loaded or heavy wing is 15 knots without spoilers, and 25 knots with spoilers up. Landing with any amount of crosswind under the unloaded or light wing is not recommended because of a considerable reduction in control capability and possible unsafe characteristics during rollout.

14.16.9 Landing – Manual Flight Control (Hydraulic Power Disconnected). With the hydraulic power disconnected from the flight controls and all other systems operative, a modified approach with a long straightaway should be utilized. If the utility hydraulic system is inoperative, modify the approach as specified for landing with no flaps.

Maximum recommended crosswind component for landing is 8 knots. Above 8 knots, an arrested landing is recommended.

14.16.10 Landing – Manual Flight Control – Asymmetric Loading (Hydraulic Power Disconnected). Hydraulic power disconnects should not be performed with asymmetric loadings. If an actual hydraulic power disconnect must be made with asymmetric wing or store loadings, the following is recommended.

1. Speed must be reduced to less than 200 KIAS prior to disconnecting.

2. After disconnect, excessive longitudinal stick motions must be avoided.

3. Crosswind landings must be made upwind or downwind, whichever is required to put crosswind component under heavy or loaded wing.

4. Recommended approach airspeed is 140 KIAS with minimum final approach and touchdown airspeed of 125 KIAS. Minimum recommended lateral control airspeed is 115 KIAS with hydraulic power failure and up to 7,500 foot-pounds asymmetric moment.

14.16.11 Landing – No Airspeed Indication. Landing with the airspeed indicator inoperative can be accomplished safely. The angle-of-attack indicator/indexer should provide the pilot with a safe landing approach attitude reference. The wing slats, when halfway out with gear and flaps down, will also serve to indicate a safe landing approach speed.

14.16.12 Landing With Runaway Nosedown Trim. If a landing must be made with full NOSEDOWN trim that cannot be corrected by use of the horizontal-stabilizer MANUAL OVERRIDE, proceed as follows:

1. Prepare to land as soon as fuel has burned down to maximum allowable landing weight or as soon there after as possible to have the maximum aft cg condition for landing. (See Figure 2-2.)

2. At a safe altitude, place the aircraft in landing configuration. Wing flaps should not be extended.

3. Cautiously reduce airspeed to a reasonable approach speed commensurate with the runway length available for stopping. The airspeed selected should also provide 2 inches of additional backstick for use if gusts or turbulence cause a nosedown pitch during the approach. Landing may be made as soon as the above conditions are met. (Extending the flaps will reduce the amount of backstick available.)

WARNING

A carrier landing should not be attempted with full nosedown trim, because of marginal longitudinal control.

14.16.13 Landing With Runaway Noseup Trim. Make a normal approach and landing with full flaps. A moderate amount of forward stick pressure will be required at normal approach speeds.

14.16.14 Landing – Known Brake Failure. Landing with one or both brakes inoperative should be treated as follows. If arresting gear is available, make a short field arrestment, preferably into the midfield gear. Be prepared to waveoff if the arresting gear is missed. If arresting gear is not available, consideration should be given to landing on the longest runway available, winds permitting, aerodynamically braking until rudder effectiveness is lost, then utilizing nosewheel steering, if available, for directional control. If one brake is available the aircraft can be stopped on the runway utilizing judicious braking and nosewheel steering. If winds are not favorable, or runway conditions do not permit, or nosewheel steering and/or spoilers are not available, landing wheels-up on tanks, racks, or other inert external stores is recommended.

14.16.15 Landing – Brake Failure After Touchdown. When a brake failure occurs after touchdown, waveoff if possible and proceed as described under Landing – Known Brake Failure. If unable to waveoff and arresting gear is available, maintain directional control with rudder and make an arrested landing. Prudent use of nosewheel steering may be desirable at slower airspeeds. The aircraft should be straight on centerline at least 1,000 feet prior to the arresting gear when the hook is lowered. The nosewheel will center and lock as the hook is lowered except for aircraft reworked per A-4 AFC 421, steering effectiveness of the brakes and rudder will be reduced. If the aircraft is not going to remain on the runway when waveoff is not feasible and arresting gear is not available, a decision to jettison inflammable stores, retract landing gear, and shutdown of the engine must be made. Ejection is another feasible alternative.

14.16.16 Landing – Nosewheel Steering Malfunction. If directional control is lost immediately after landing despite corrective inputs, an immediate takeoff is recommended. If the decision is made to continue the landing rollout and a nosewheel steering malfunction is suspected:

1. Maintain corrective control inputs.

2. Actuate stick control button in an attempt to maintain directional control.

CAUTION

Less rudder deflection is required to counteract crosswind or drift with nosewheel steering engaged. Rudder pedal pressure should be decreased simultaneously with, or immediately after, engaging nosewheel steering if rudder is deflected to counteract crosswind or drift. If the same amount of rudder deflection is maintained after nosewheel steering is engaged, it could cause swerving or loss of control.

If depressing stick control button is ineffective:

1. Release stick control button.

2. Maintain directional control by rudder and brakes.

3. Nosewheel steering switch – EMER OFF.

4. Arresting hook down 1,000 feet prior to arresting gear (if necessary).

14.16.17 Landing With a Blown Main Tire. Little difficulty should be experienced in landing with a blown main tire. If it is known prior to landing that the tire is blown, a short field arrestment is recommended. In crosswind conditions, always use the arresting gear, if available. Land on the left, right or center of the runway; depending on crosswind and which tire is blown. For instance, with the left tire blown, a crosswind from the right, and no arresting gear available, land on the right side of the runway to provide the maximum distance for arcing to the left. In this case, both wind effect and the increased drag of the blown tire are additive, tending to drift the aircraft across the runway to the left. If the tire blows during normal landing rollout, use full rudder, if necessary, and brakes as required to maintain directional control. Usually, a blown tire will not even be noticeable until 80 knots or less. If the stopping distance appears marginal, secure the engine. If the use of abort or overrun gear becomes apparent, drop the hook 1,000 feet prior to engagement. More braking effectiveness can be obtained from a good tire than a blown one; consequently, it is poor technique to intentionally blow the good tire. Nosewheel steering may be used below 60 knots to maintain directional control.

14.16.18 Landing With a Blown Nose Tire. When landing with a blown nose tire, a short field arrestment is recommended. Obtain a positive hook down check with tower or the LSO. Make practice passes if fuel is available but land at maximum allowable gross weight or as soon as possible thereafter to have maximum aft cg condition for landing. Make a flat approach at normal approach speed. Trim full NOSEUP just prior to touchdown. Touch down with minimum sink-rate and hold the nose off until passing over the wires. Do not retard the throttle below approach power setting until the arrestment is felt. Waveoff if the wires are missed. If there is no arresting gear available, fly the same type of approach, on touchdown lower the nose slowly to the runway before elevator effectiveness is lost, and secure the engine at approximately 80 knots. Little difficulty should be experienced with this landing, with or without arresting gear available.

14.17 FORCED LANDINGS

14.17.1 Landing on Unprepared Surfaces. Landing on unprepared terrain is extremely hazardous. Provided that sufficient altitude is available, ejection is preferable to attempting an emergency landing on any surface other than a runway. When power is available, more deliberation can usually be given to evaluating the many variables affecting a safe emergency landing, such as direction and speed of the wind, and the type of surface or terrain on which the landing is to be made. On areas other than prepared runways and surfaces of known adequate hardness, the landing should always be made with the wheels retracted. If the nature of the emergency is such that all wheels will not fully extend, the landing gear should be left in the retracted position. Prior to any wheels-up landing on unprepared surfaces all external stores should be jettisoned, except empty drop tanks and lightweight inert stores which help absorb the force of the landing. The oxygen mask should be left on during crash landings, and a decision to jettison or retain the canopy made prior to impact. Remain braced until the shocks stop. Use the normal approach speeds throughout the landing pattern and attempt to touchdown at, or slightly above, the normal landing speed.

14.18 EJECTION

Ejection may be necessary as a result of fire, engine failure, structural failure, midair collision, or when the aircraft becomes uncontrollable. In each case, the pilot must decide when to eject using the following as a guide.

1. Ejection is mandatory under the following conditions, except when unusual circumstances clearly indicate to the pilot that the cause of safety to himself and others will be better served by a flameout approach than by ejection.

   a. Serious, uncontrolled fire.

   b. If the aircraft is in uncontrolled flight at 10,000-feet AGL or below.

   c. When engine flameout occurs below 1,500-feet AGL and 250 KIAS.

   d. If repeated relight attempts are not successful between 30,000 and 10,000 feet, eject by 10,000-feet AGL.

   e. If still on first or second relight attempt when passing through 10,000-feet AGL and it appears that a relight is likely, airstart attempt may be continued to a minimum of 5,000-feet AGL.

   f. Certain landing gear configurations. (See Figure 14-7.)

2. If the engine flames out below 10,000-feet AGL, zoom to convert excess airspeed to altitude. Attempt an air start as time permits. If the peak altitude is 5,000-feet AGL and the air start attempt is not successful, eject no lower than 5,000-feet AGL. If the peak altitude is below 5,000-feet AGL and an air start attempt is made during the zoom and there is no evidence of a relight, eject at the peak altitude. If no air start attempt is made, eject at the peak altitude.

3. If the decision to eject is made at high altitude, it is recommended that the pilot eject at minimum of 10,000-feet AGL, or higher, if conditions so indicate. (See Figure 14-3.)

Using the rocket-catapult seat, ejection may be accomplished on the ground at zero airspeed and above, and at all other altitude and airspeeds within the flight range of the aircraft (Figures 14-8 through 14-10), except for abnormal flight conditions of steep angles of bank (or inverted flight and high rates of descent at very low altitudes). For all practical purposes, in predicting minimum terrain clearance altitude (Figure 14-11) from the charts, dive angle and angle-of-bank chart altitudes are additive up to a 60° dive. In dives steeper than this, bank angle is negligible. The possibility of injury to shoulders and hips from flailing and windblast damage to personal gear, and possible injury from parachute opening shock, makes it imperative that the airspeed be reduced to 350 KIAS or less prior to ejection, whenever possible. Inverted and severe yaw positions should be corrected, if feasible, prior to ejection and every attempt made to reduce speed.

14.18.1 Ejection Preparation. An ejection seat control selector valve (Figure 14-12) is located in the forward cockpit on the bulkhead aft of the left console.

Ejection sequence will be determined by pilot in command.

CAUTION

Do not leave ejection seat control selector in the intermediate position.

Note

ESCAPAC IG-3 ejection seat performance data (Figures 14-9 through 14-11) is based on a rocket angle of 57.0°.

See Figure 14-14 for ejection procedures.

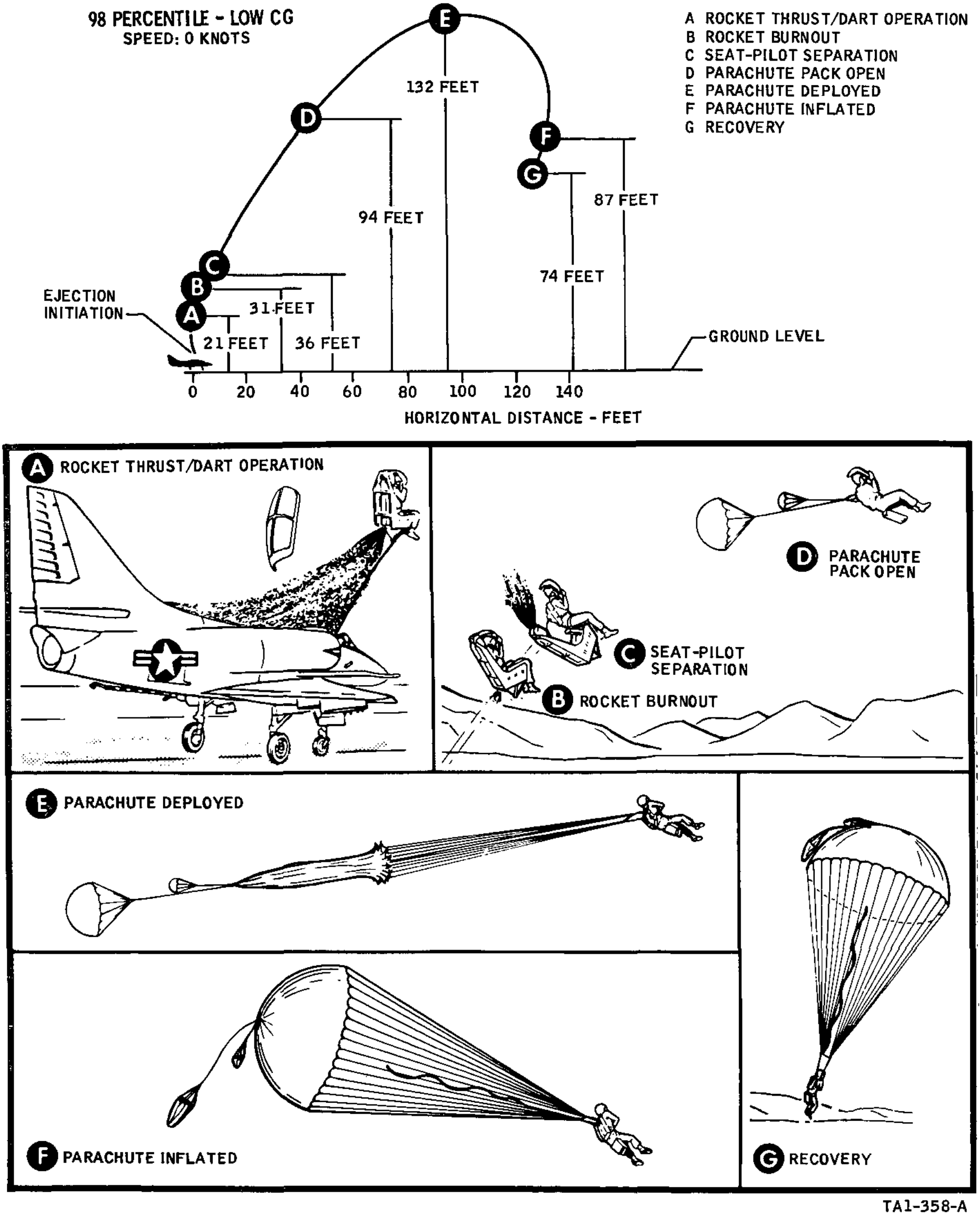

Figure 14-8. Ground Level Ejection—ESCAPAC 1G-3 Ejection Seat

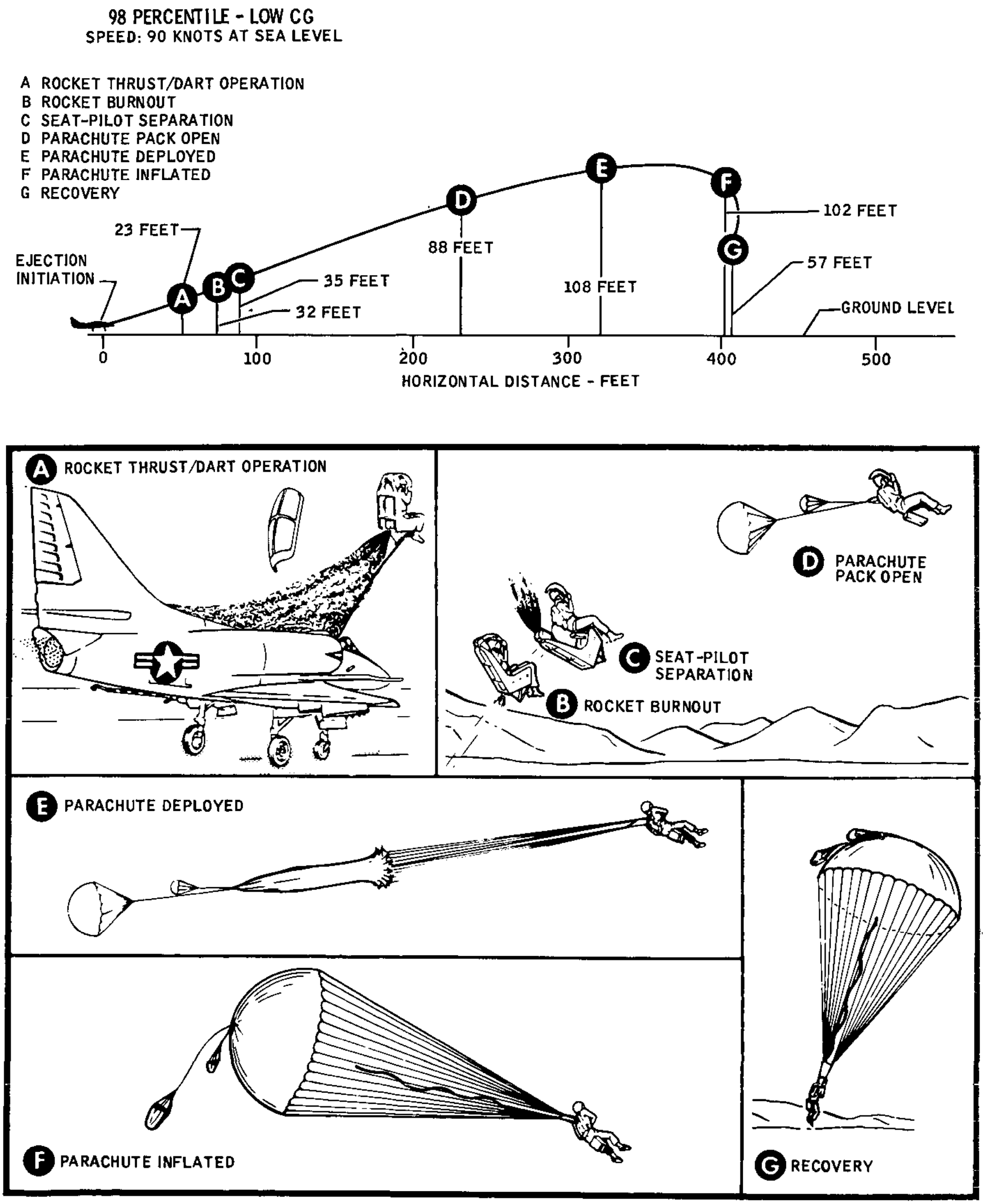

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Figure 14-9. Low Speed Ejection—ESCAPAC 1G-3 Ejection Seat

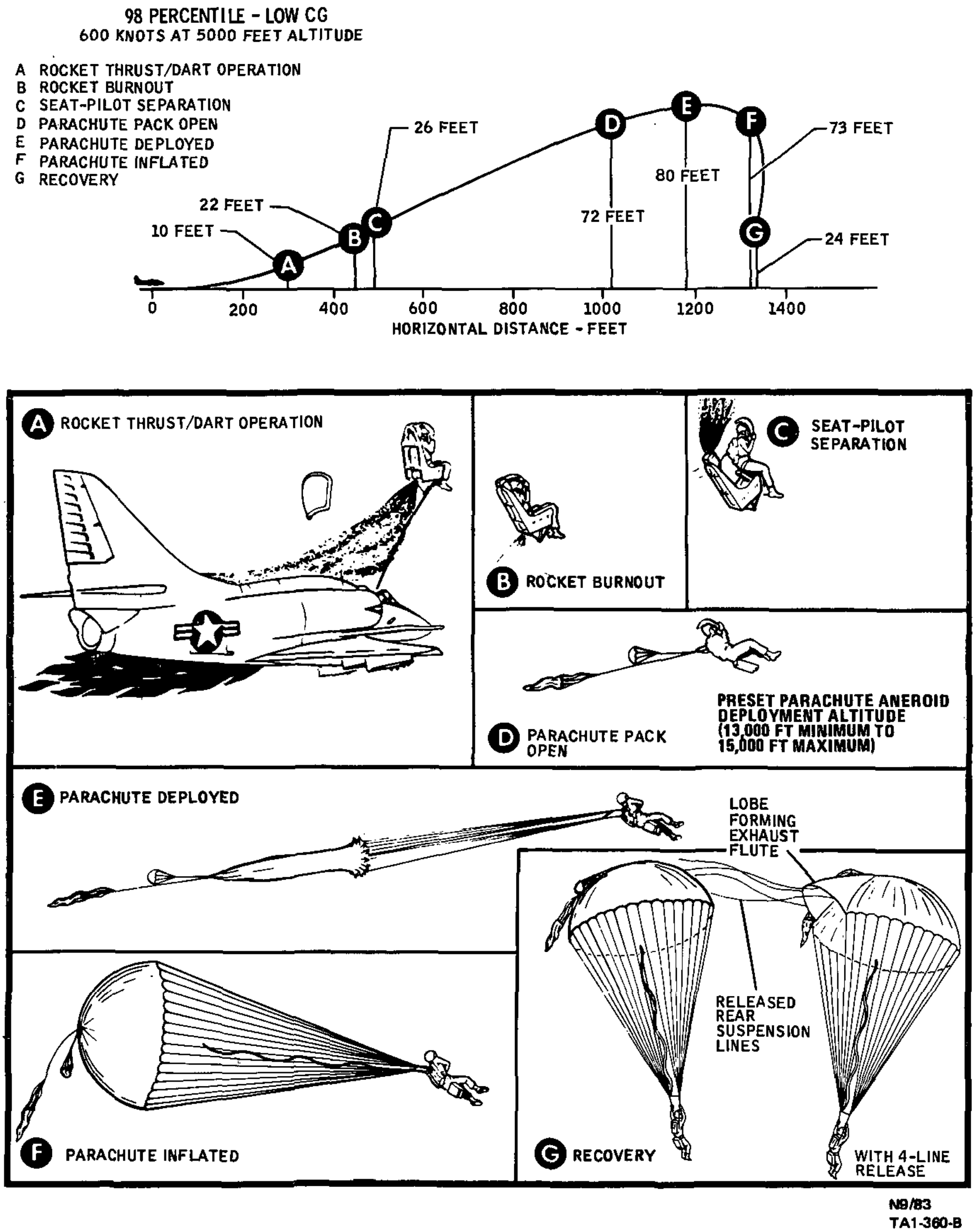
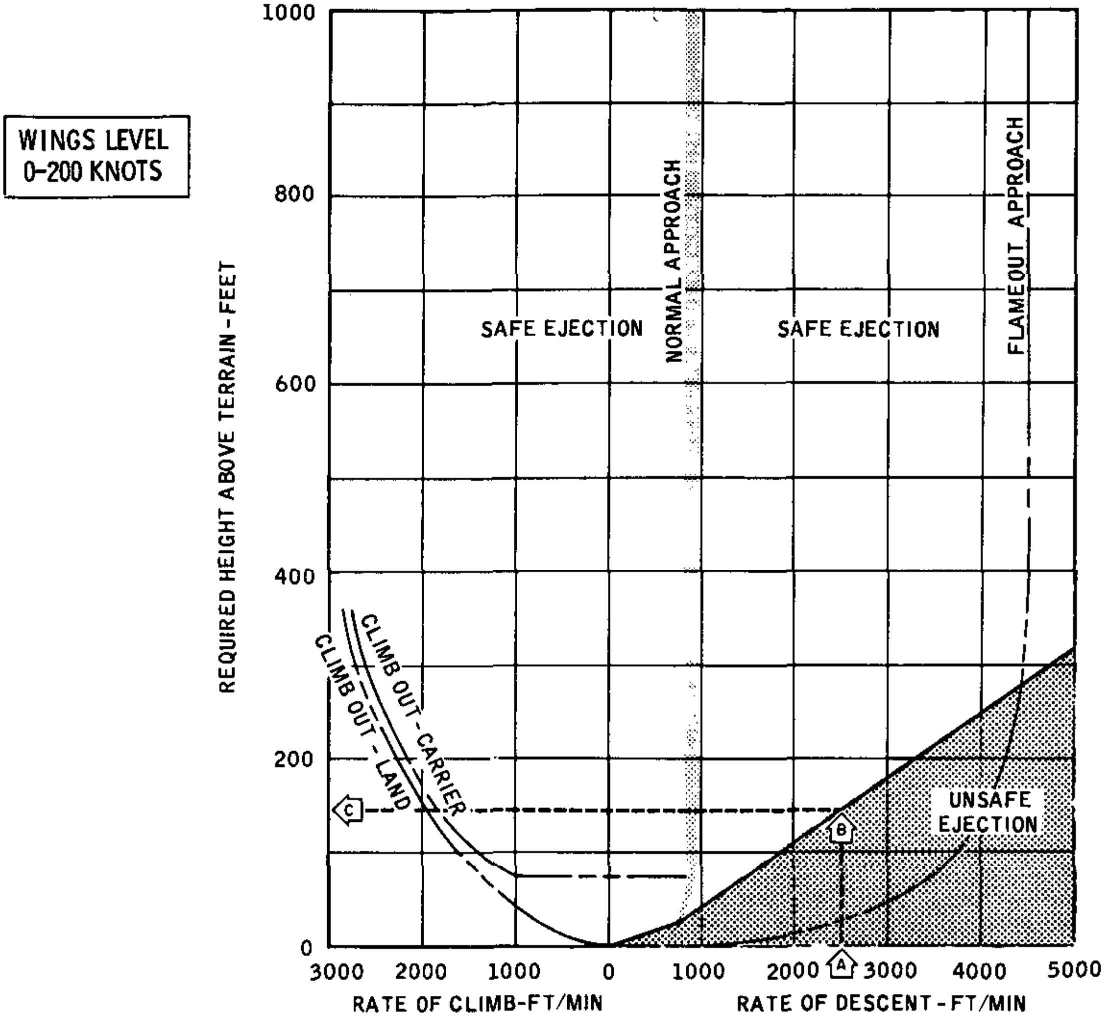


Figure 14-10. High Speed Ejection—ESCAPAC 1G-3 Ejection Seat

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1G-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Aircraft pitch $\pm 15^{\circ}$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 Percentile crewman - low cg.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

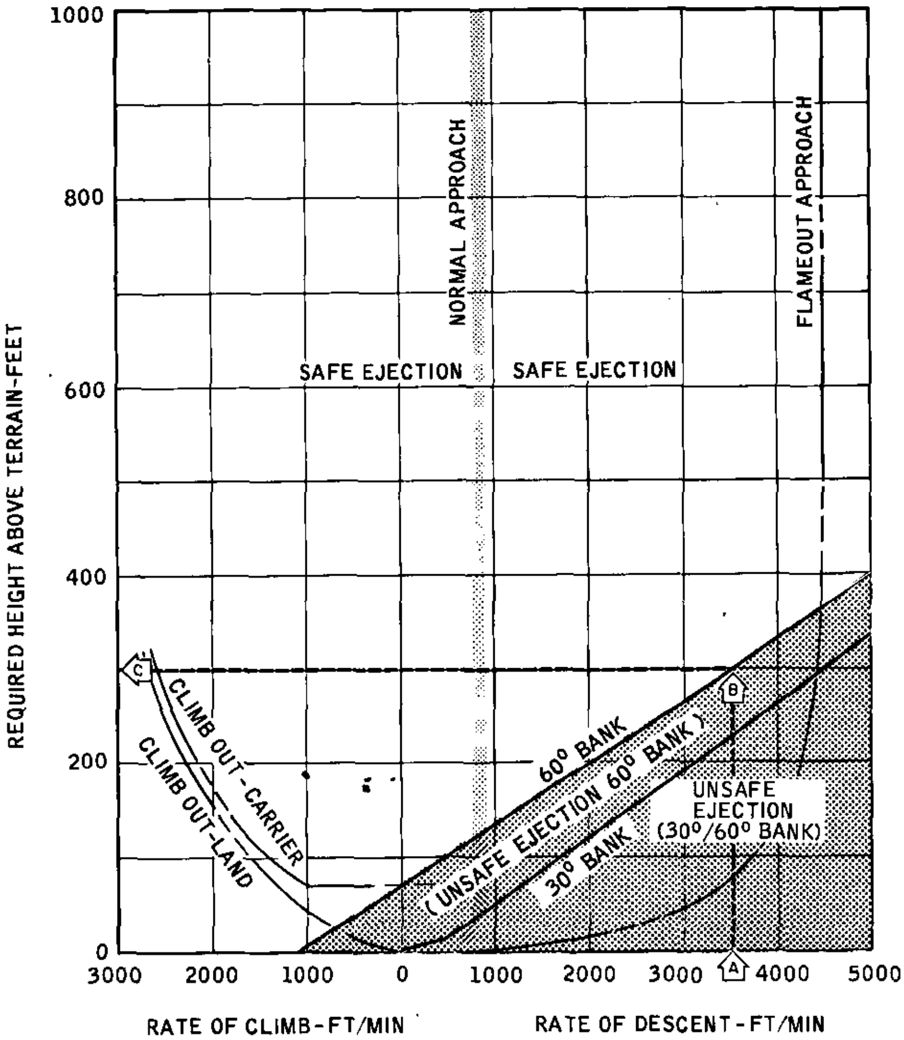
To find minimum height above terrain for safe ejection at a rate of descent of 2500 ft/min:

1. Enter chart at 2500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 145 feet minimum height above terrain. (C)

DATA AS OF: 15 October 1973
DATA BASIS: Computer Calculations

TA1-361-A

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 1 of 6)



REMARKS:

1. *Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only.* Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute *deployment.*
   d. 98 percentile crewman - low cg.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 15 October 1973

DATA BASIS: Computer Calculations

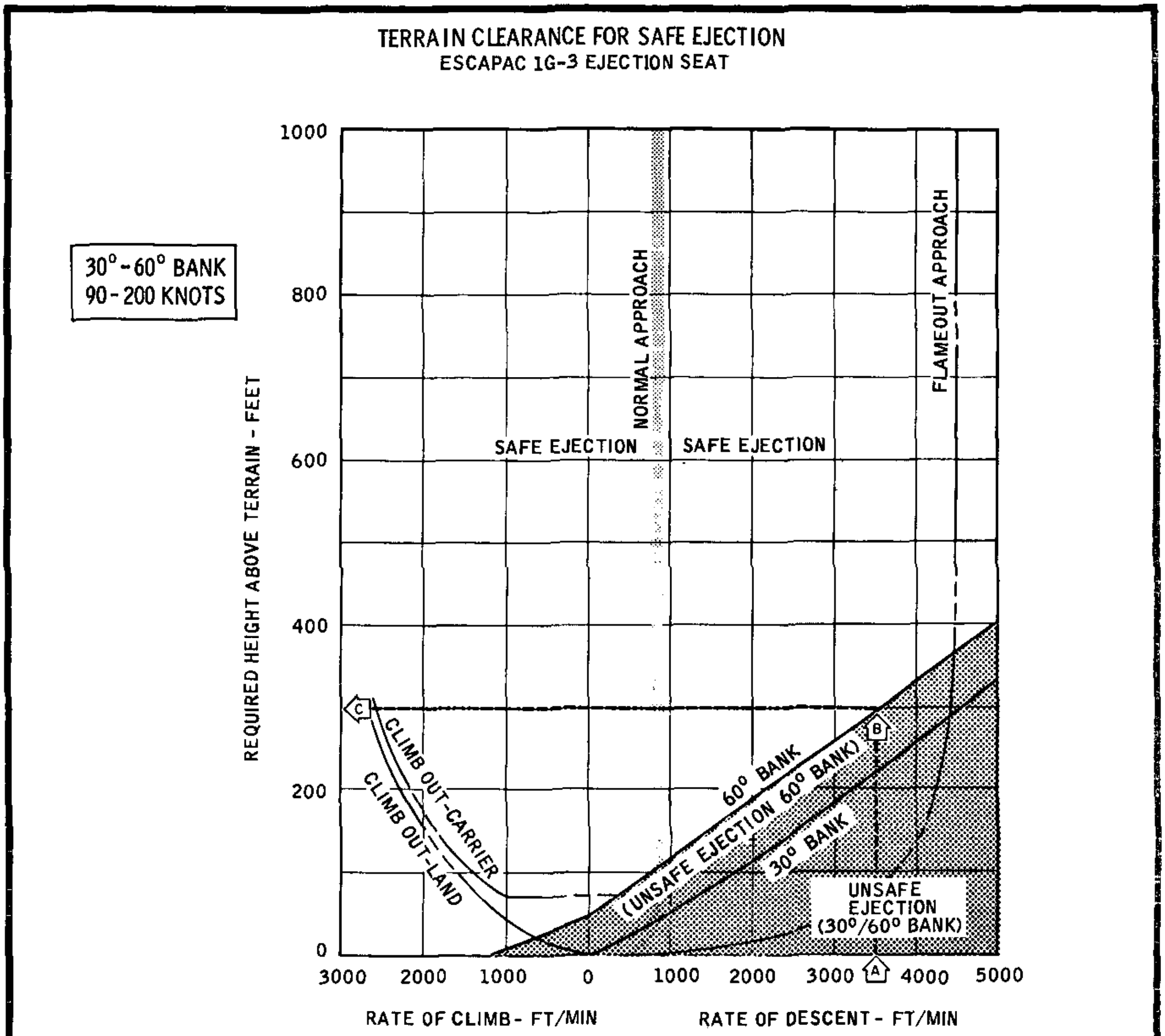
EXAMPLE:

To find minimum height above terrain for safe ejection at a **rate of descent of 3500 ft/min and a bank angle of 60°:**

1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 300 feet minimum height above terrain. (C)

TA1-362-A

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 2 of 6)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewman-low cg.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

DATA AS OF: 15 October 1973
DATA BASIS: Computer Calculations.

EXAMPLE:

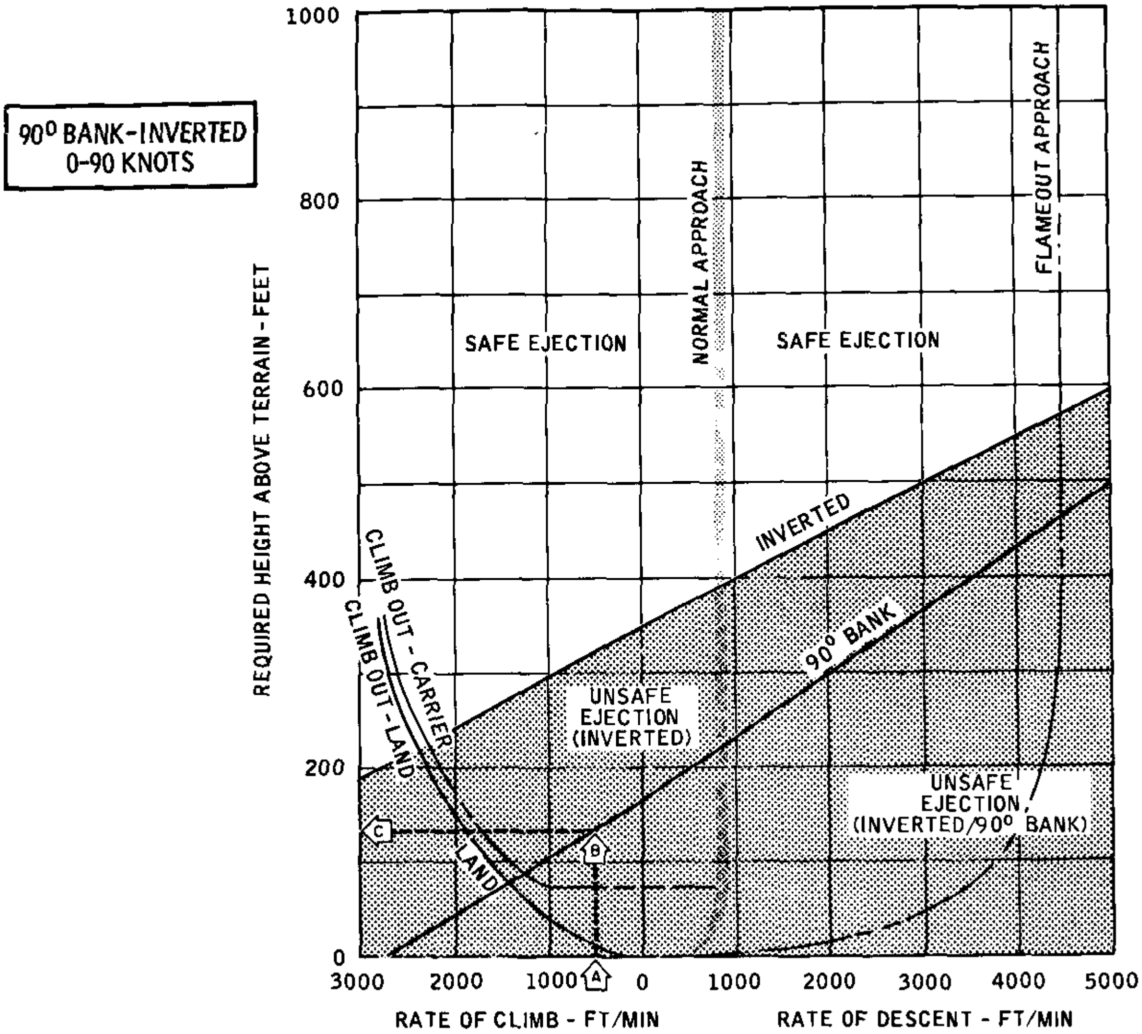
To find minimum height above terrain for safe ejection at a rate of descent of 3500 ft/min and a bank angle of 60°:

1. Enter chart at 3500 ft/min rate of descent. (A)
2. Follow vertically upward to ejection capability curve for 60° bank. (B)
3. Read horizontally 300 feet minimum height above terrain. (C)

TA1-363-A

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 3 of 6)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1G-3 EJECTION SEAT



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flameout Approach are typical curves shown for reference only. Do not use curves to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewmen - high cg.
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

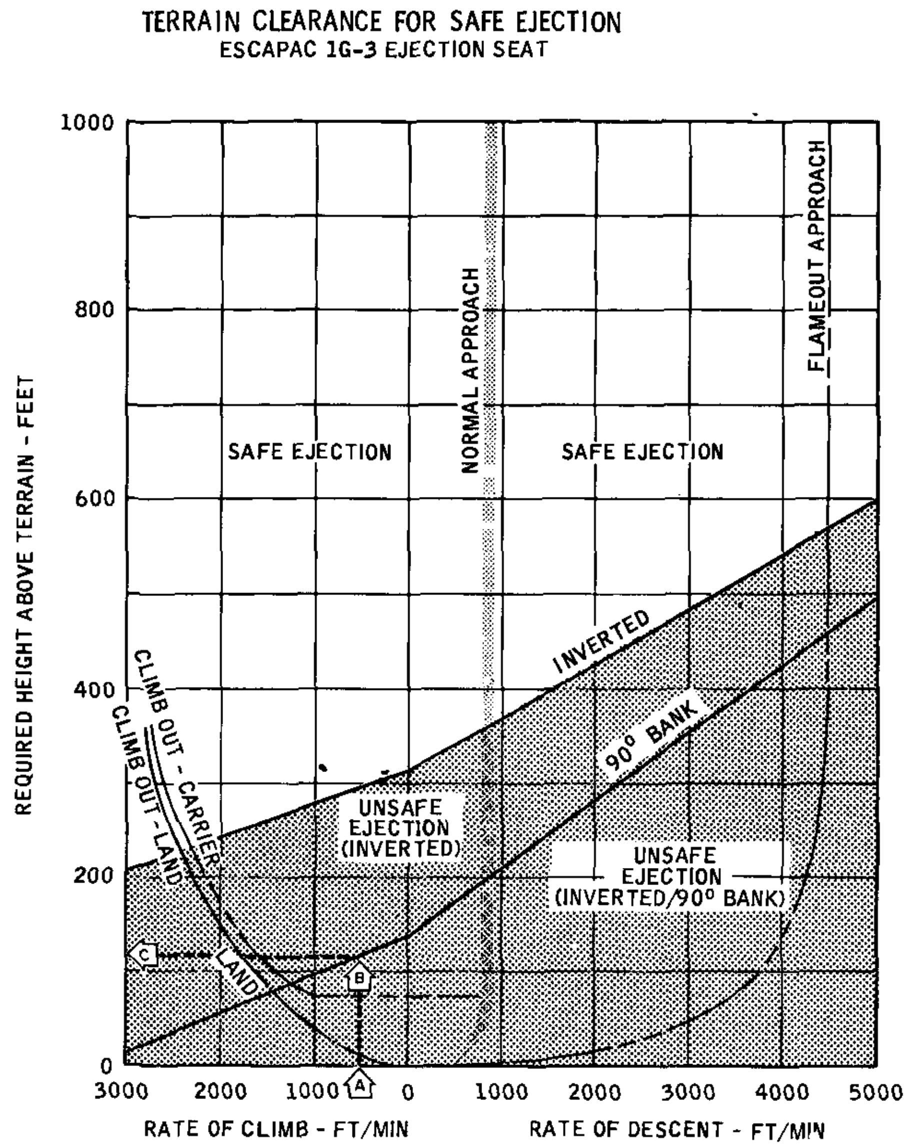
To find minimum height above terrain for safe ejection at a **rate of climb of 1500 ft/min and a bank angle of 90°**:

1. Enter chart at 1500 ft/min rate of climb. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 130 feet minimum height above terrain. (C)

DATA AS OF: 15 October 1973
DATA BASIS: Computer Calculations

TA1-364-A

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 4 of 6)



REMARKS:

1. Curves labeled Climb Out, Normal Approach, and Flame-out Approach are typical curves shown for reference only. Do not use them to read height for safe ejection.
2. Ejection capability curve (Safe-Unsafe Ejection region boundary) is based on:
   a. 2-second pilot reaction time (except climbing cases).
   b. Aircraft pitch $\pm 15^\circ$ for conditions shown.
   c. Nominal parachute opening delay time and parachute deployment.
   d. 98 percentile crewman - high cg
3. These curves are based on the best data available at time of publication, and are valid only for conditions indicated.

EXAMPLE:

To find minimum height above terrain for safe ejection at a **rate of climb of 500 ft/min and a bank angle of 90°**:

1. Enter chart at 500 ft/min rate of climb. (A)
2. Follow vertically upward to ejection capability curve. (B)
3. Read horizontally 115 feet minimum height above terrain. (C)

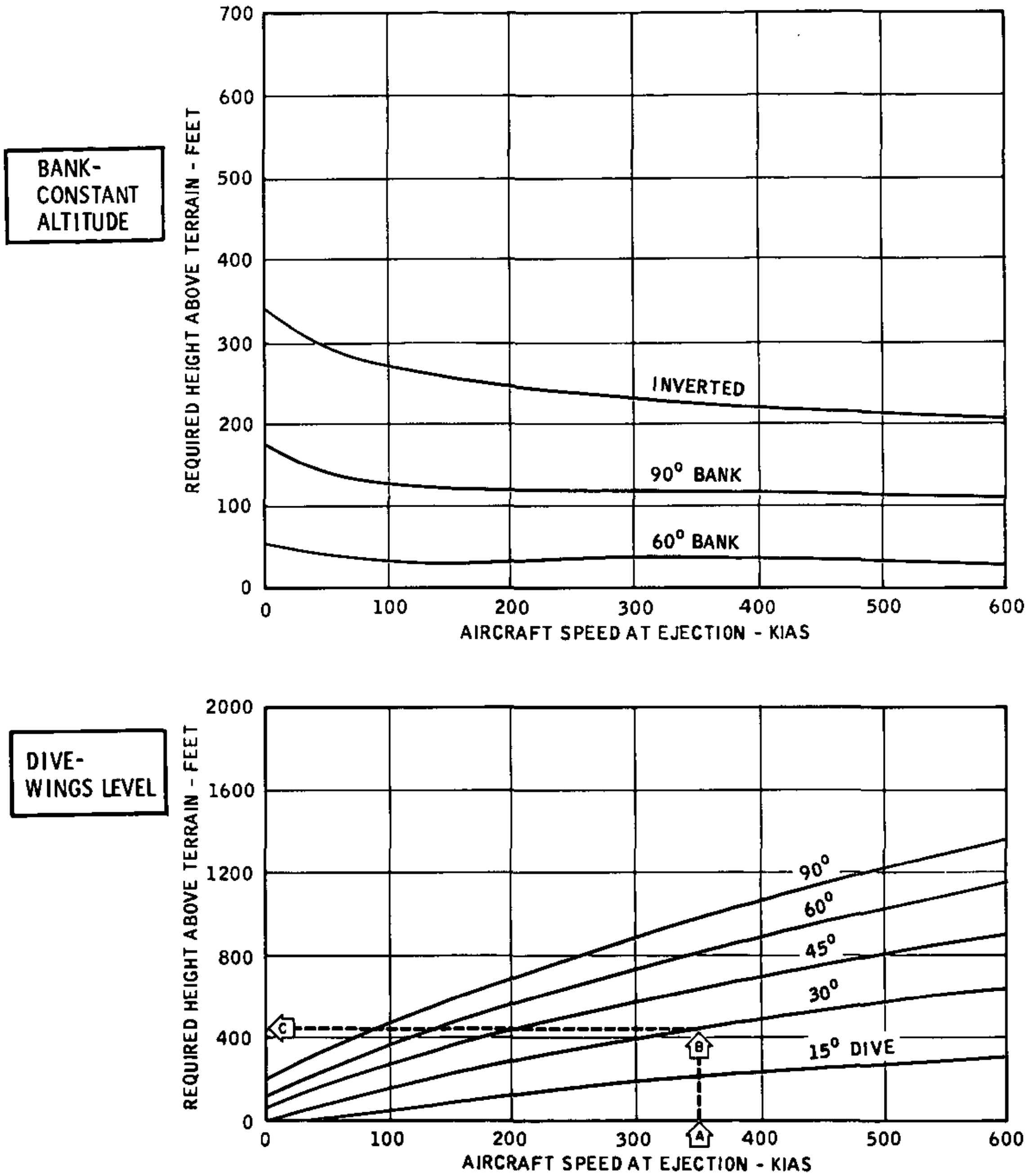
DATA AS OF: 15 October 1973

DATA BASIS: Computer Calculations

TA1-365-A

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 5 of 6)

TERRAIN CLEARANCE FOR SAFE EJECTION
ESCAPAC 1G-3 EJECTION SEAT



REMARKS:

1. These curves do not include pilot's reaction time.
2. Ejection capability curve is based on 98 percentile crewman low cg except for the inverted case a high cg is used.
3. These curves are based on the best data available at time of publication and are valid only for conditions indicated.

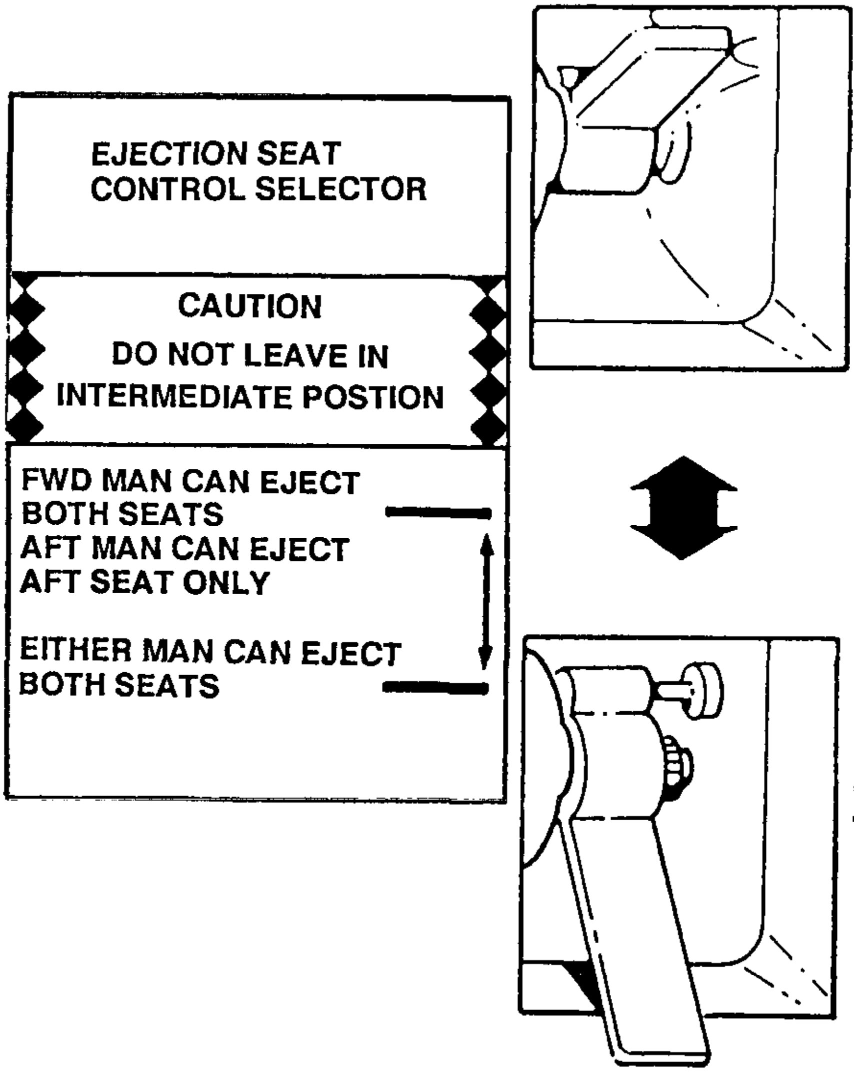
EXAMPLE:

1. Enter dive (wings level) chart at 350 KIAS. (A)
2. Follow vertically upward to 30° dive curve. (B)
3. Read horizontally 450 feet minimum height above terrain. (C)

DATA AS OF: 15 October 1973
DATA BASIS: Computer Calculations

TA1-366

Figure 14-11. Terrain Clearance for Safe Ejection—ESCAPAC 1G-3 Ejection Seat (Sheet 6 of 6)



UP - THE PILOT IN THE FORWARD COCKPIT CAN EJECT BOTH SEATS, WHILE THE PILOT IN THE AFT COCKPIT CAN EJECT THE AFT SEAT ONLY.

DOWN - BOTH SEATS CAN BE EJECTED REGARDLESS OF WHICH PILOT INITIATES THE EJECTION SEQUENCE.

Figure 14-12. Ejection Seat Control Selector

N8/88

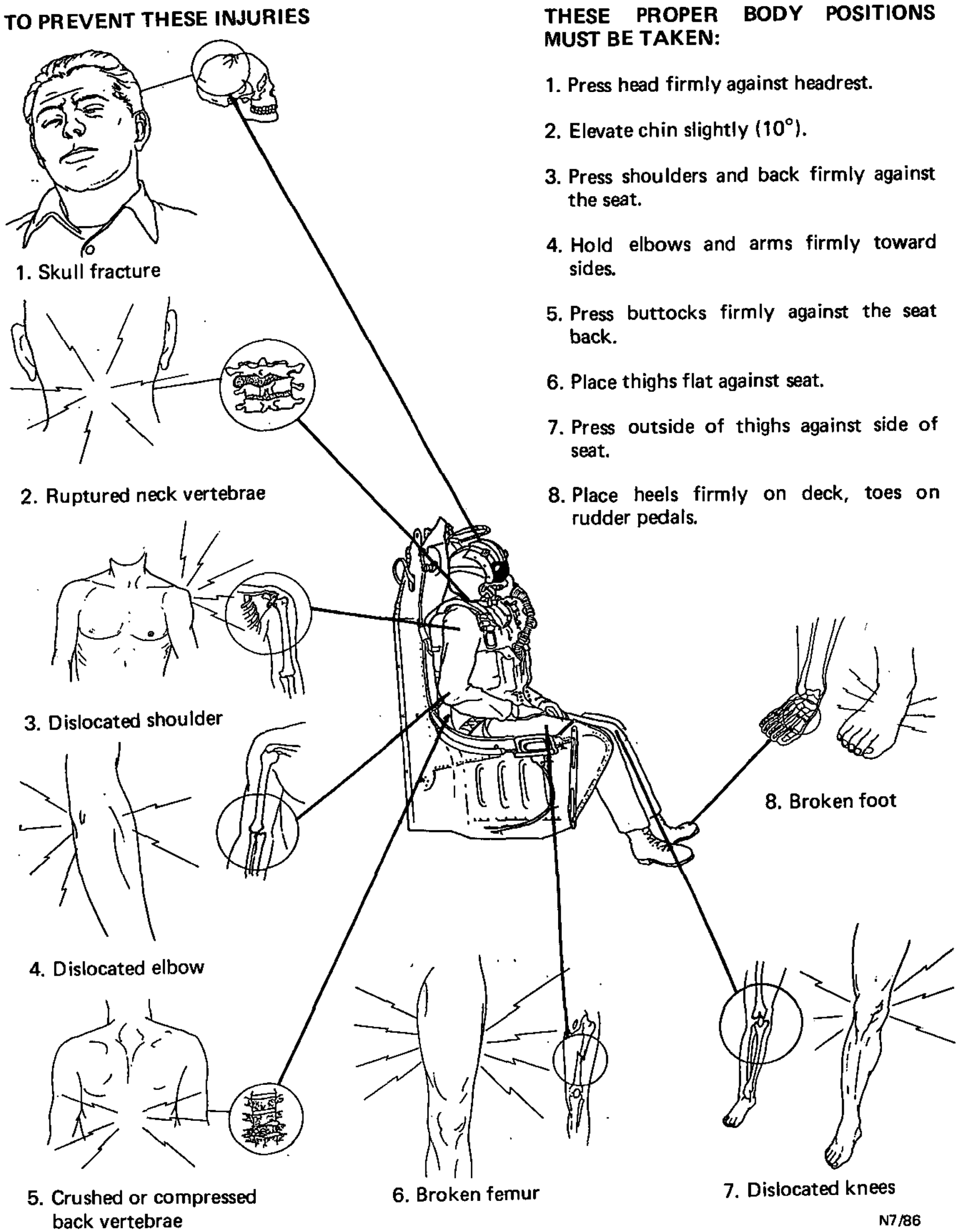


Figure 14-13. Ejection Injuries and Body Positioning

EJECTION PREPARATION

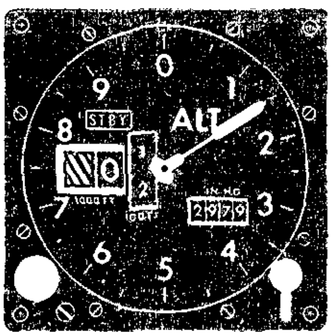
IMMEDIATE EJECTION

Usually, the pilot will have time enough to accomplish several things to prepare himself for a successful ejection prior to pulling the face curtain. However, when the emergency condition requiring ejection is such that ejection must be made without hesitation, simply grasp the face curtain handle (or lower ejection handle) and pull forcefully to the fullest extent until seat ejects.

CONTROLLED EJECTION

Time permitting, do the following:

1. Alert crew member.
2. Throttle – IDLE.
3. Reduce air speed to 350 KIAS or less.
4. Seat – OPTIMUM POSITION.
5. Emergency generator – AS REQUIRED.
6. IFF – EMERGENCY.
7. Transmit MAYDAY position report.
8. Shoulder harness lock lever – LOCKED.
9. Visor – DOWN.
10. Air-conditioning switch – RAM.
11. Leave feet on rudder pedals.
12. Check altimeter.



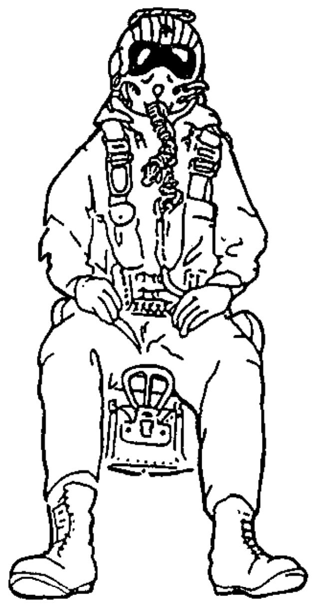
WARNING

Do not secure engine. Unsuccessful seat activation may require continued flight to allow alternate egress method.

13. Assume proper ejection body position.

Note

Proper body positioning is a critical factor in preventing ejection injuries.



ⓐ Lap and shoulder belts tightened.
ⓑ Visor down.
ⓒ Helmet secured.
ⓓ Oxygen mask tightened.

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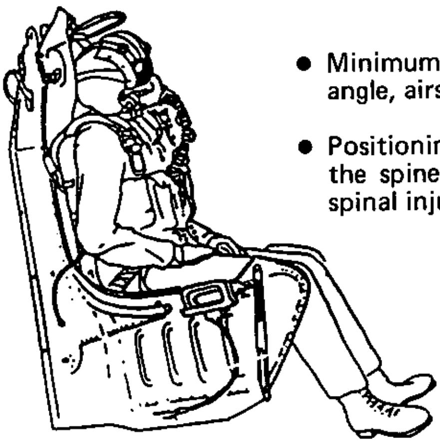
Figure 14-14. Ejection Procedures (Sheet 1 of 26)

EJECTION PREPARATION (Concl.)

WARNING



- Minimum ejection altitudes are dependent upon dive angle, airspeed, and angle of bank.
- Positioning the legs aft prior to ejection will cause the spine to flex and will increase the possibility of spinal injury.

ⓐ Head pressed back against headrest.

ⓑ Chin slightly elevated (10 degrees up).

ⓒ Back straight.

ⓓ Hips against seat back.

ⓔ Thighs flat on seat survival kit.

ⓕ Feet on rudder pedals, heels on deck.

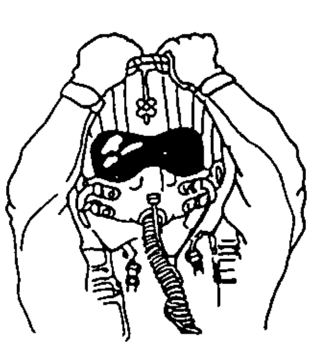
⓮ Initiate ejection.

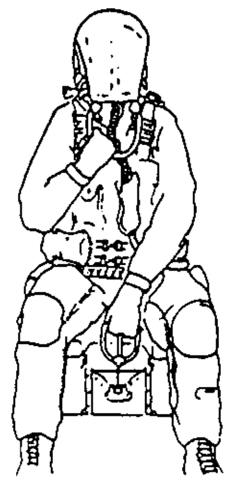
EJECTION INITIATION

FACE CURTAIN

Note

If face curtain handle is pulled very fast, the canopy interlock unit may cause a pause or stop and the force of the pull on the face curtain may not be sufficient to effect catapult firing. It may then be necessary to jerk as hard as possible on the face curtain to obtain sufficient pull force to fire.





❶ Grip upper handle, palms toward body using "thumbs around handle" grip. Keep elbows as close together as possible.

❷ Pull curtain sharply over head and into chest. Ensure pulling handle to end of travel.

❸ If seat fails to eject after pulling face curtain handle, continue to hold face curtain with one hand while grasping the lower ejection handle with the other hand and pull up firmly.

Figure 14-14. Ejection Procedures (Sheet 2 of 26)

EJECTION INITIATION (Cont.)

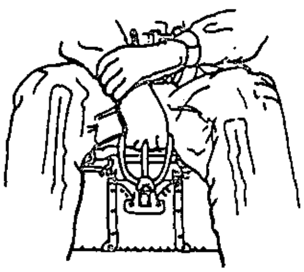
If seat still does not fire, release face curtain and apply a strong steady pull on lower ejection handle.

LOWER HANDLE

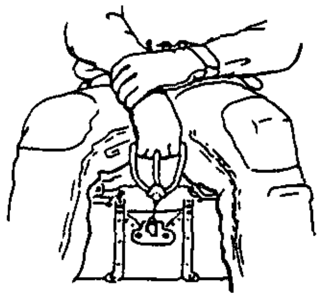
The recommended method for ejection initiation using the lower ejection handle is the single-hand grip depicted below.

Note

- During any combined low altitude/low airspeed conditions, as in the landing pattern or immediately after launch, the use of the lower ejection handle should be considered the primary means of ejection. Continue to fly the aircraft with the right hand, keeping wings level and maintaining altitude or the lowest possible sink rate while initiating ejection sequence with the left hand.
- Actuation by lower ejection handle may require between 85 to 100 pounds of pull.



1. Grip handle with strong hand, palms inward. Grip wrist of strong hand with other hand, palms toward body and elbows close to body.



2. Pull handle sharply up and toward abdomen, keeping elbows in. Ensure pulling handle to end of travel.

Note

. If pulling the face curtain (or lower ejection handle) fails to jettison the canopy, substitute the following emergency procedures:

a. Retain a firm grip on face curtain (or lower ejection handle) with one hand, but do not pull it farther out. Hold elbows inboard.

b. Pull canopy-jettison handle firmly. Handle is located on right side of cockpit.

c. After the canopy leaves, continue pulling face curtain (or lower ejection handle) with both hands.

d. If the canopy still remains, as a last resort it may be removed by the force of the airstream by moving and holding canopy control handle in the OPEN position if airspeed is above 120 KIAS. If canopy control handle is placed in the UNLOCKED position (not held in OPEN position), airspeed must be at least 240 KIAS. Retain face curtain (or lower ejection handle) with one hand during this procedure.

Figure 14-14. Ejection Procedures (Sheet 3 of 26)

EJECTION INITIATION (Concl.)

If ejection occurs above the preset barostat altitude, the parachute will not deploy automatically *until after expiration of the time delay cartridge initiated at the preset barostat altitude* (14,000 ± 1000 feet). If ejection occurs below the preset altitude and the automatic barometric ripcord actuator seems not to function, open the parachute with the parachute ripcord when clear of the seat. The parachute ripcord overrides the barometric release. If high-altitude ejection is made, free-fall to approximately 14,000 feet before opening the parachute. If the parachute must be opened manually after a high-speed ejection, wait at least 4 seconds after ejection to permit speed to reduce.

After face curtain or lower handle is pulled:

(a) Canopy jettisons.

(b) The power retract mechanism on the inertia reel in both cockpits activates, pulling the occupant to proper sitting position for ejection.

(c) Seats eject individually, with the aft seat ejecting first to prevent blast injury from the forward seat. The aft seat precedes the forward seat by 0.55 second.

(d) *During ejection the automatic actuation lanyard for the emergency oxygen system activates the* reducer assembly. The pilot is then supplied emergency oxygen for descent. The radio beacon is also actuated by means of an actuation lanyard upon seat ejection. The beacon will provide a continuous signal during descent.

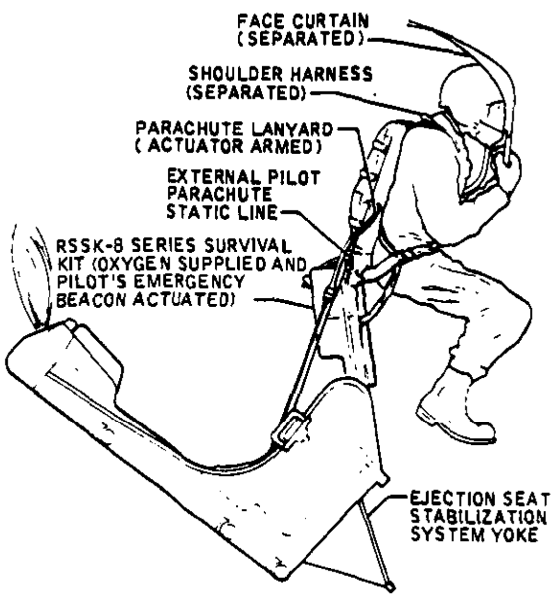
Note

For details of ejection seat mechanical operation, see Part I.

AUTOMATIC SEAT/MAN SEPARATION

The ejection seat automatically provides positive seat separation by means of a seat/man separator rocket. The thrust of the rocket simultaneously separates and propels the seat away from the pilot, minimizing the probability of collision between the seat and the pilot or his parachute after seat/man separation.

A separator rocket is fired 0.52 *second after start of the* initial ejection sequence, forcibly separating the pilot from the seat. The barometric time-delay parachute actuator is armed when the pilot separates from the seat. This causes the ripcord pins to be pulled 0.75 second after seat/pilot separation, resulting in a fully inflated parachute, if below 14,000 ± 1000 feet. If above barometric opening altitude, *the pilot must free-fall, less the seat, to the barometric* opening altitude before automatic parachute deployment will occur.



SEAT-PILOT SEPARATION N8/88

Figure 14-14. Ejection Procedures (Sheet 4 of 26)

AUTOMATIC SEAT/MAN SEPARATION (Concl.)

WARNING

During the ejection, if either the harness release or automatic barometric parachute actuator cartridge fails to function properly, automatic seat separation and/or parachute deployment may not occur. Therefore, during any low-altitude ejection, the pilot should attempt to "beat the seat" by manually pulling the emergency restraint release handle and then the parachute ripcord immediately after ejection.

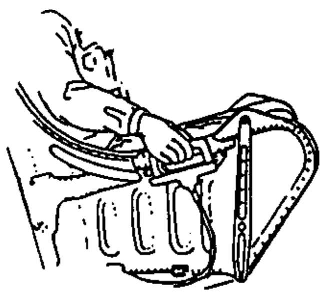
Note

TA-4J aircraft BuNo. 158712, 159795, and subsequent, are equipped with ESCAPAC 1G-3 ejection seats that incorporate a yaw thruster (figure 1-12) to assure lateral separation of seats upon ejection. The yaw thruster ignites and burns for 0.1 second as each seat leaves the guide rails during ejection. Lateral seat separation is established as yaw thruster action rotates the aft seat to the portside of the longitudinal axis of the aircraft and the forward seat to the starboard side during the main rocket propulsion stage.

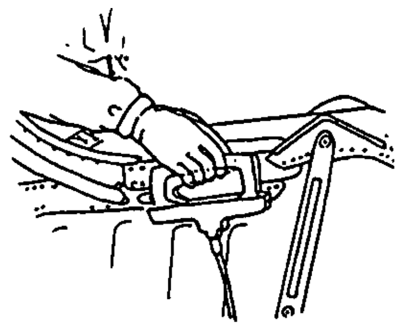
If after ejection from the aircraft, automatic seat/man separation has not occurred, manual seat/man separation procedures must be performed.

MANUAL SEAT/MAN SEPARATION

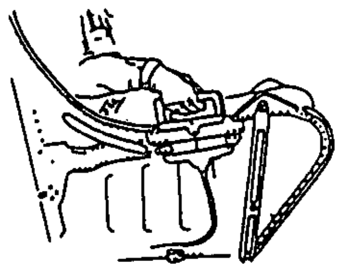
Perform the following procedures to effect seat/man separation:



1. Locate handle on right side of ejection seat.



2. Squeeze emergency restraint release handle trigger.



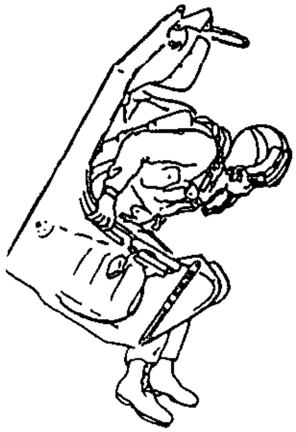
3. Pull handle straight up maximum distance.

WARNING

Automatic chute deployment will not occur if the pilot manually separates from the seat. The parachute ripcord must be pulled.

Figure 14-14. Ejection Procedures (Sheet 5 of 26)

MANUAL SEAT/MAN SEPARATION (Concl.)



4. Lean forward to clear the parachute from back of seat and push clear of seat.

5. Left hand – Grasp left riser above parachute ripcord.

6. Right hand – Grip parachute ripcord handle and pull downward to right side of body.

MANUAL BAILOUT

Even under the most favorable circumstances (level flight, slow air speeds, and optimum altitude), manual bailout from high performance aircraft is extremely hazardous and is considered a last resort method of escape. However, if the seat cannot be ejected and ditching is not feasible, the following bailout procedures are suggested:

WARNING

- If over 14,000 ± 1000 feet and bailout is required, freefall to below 14,000 feet since parachute opening shock increases with altitude. As a rule of thumb, 5 seconds are required to freefall 1000 feet.
- Manual bailout is not recommended below 2000 feet.

1. Pull green ring on seat pan for emergency oxygen.
2. Disconnect console oxygen and antiblackout hose.
3. Select RAM air.
4. Jettison canopy.
5. Pull emergency restraint release handle.
6. Lean forward to clear parachute past headrest.
7. Trim aircraft nose down.
8. Apply back pressure to stick.
9. Position arms against body and let stick snap forward.
10. When clear of aircraft and below approximately 14,000 feet, pull parachute ripcord.
11. As time permits, perform post-ejection procedures.

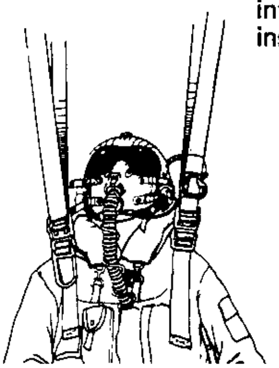
Figure 14-14. Ejection Procedures (Sheet 6 of 26)

POST-EJECTION PROCEDURES

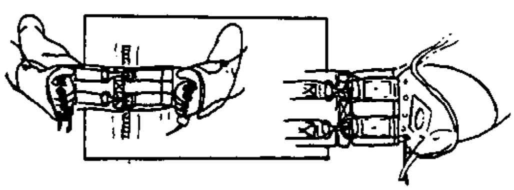
LPU INFLATION

WARNING

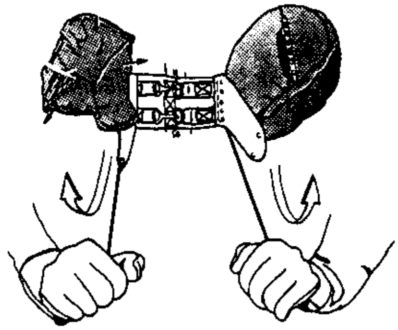
Although the FLU-8 automatic inflation device is designed to inflate the LPU upon water contact, manual inflation remains the primary mode of operation. Automatic actuation is intended for disabled or unconscious survivors or if there is insufficient time to manually activate the LPU.



1 Immediately following opening shock, check condition of parachute. If there is no damage/ malfunction. . . . .



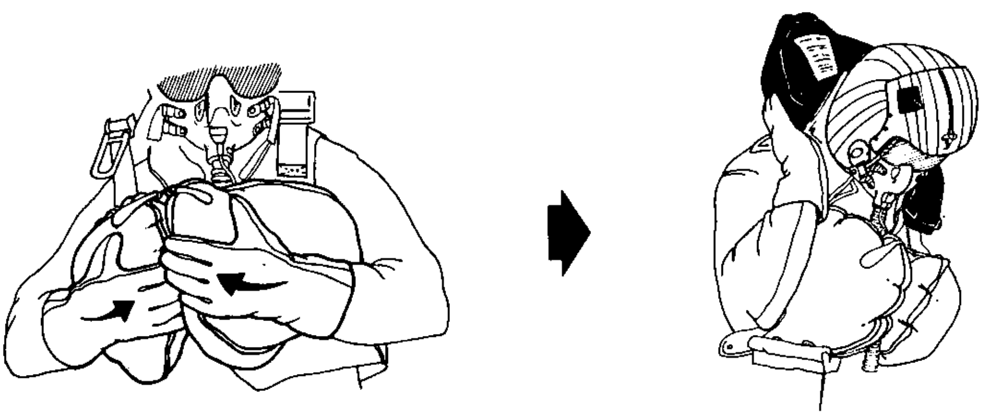
2 Locate beaded handles on LPU.



3 Pull beaded handles down and straight out to inflate. If beaded handle inflation fails, use oral inflation tube.

Note

The procedures outlined apply to overland or overwater ejections. However, inflation of the LPU may be undesirable overland.

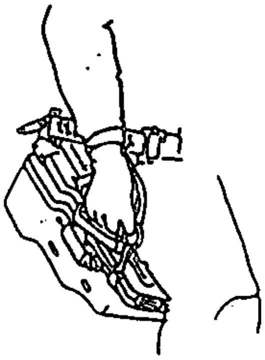


4 Squeeze LPU waist lobes together to help release velcro on collar lobe or manually release velcro on collar, if necessary, to achieve complete collar lobe inflation.

Figure 14-14. Ejection Procedures (Sheet 7 of 26)

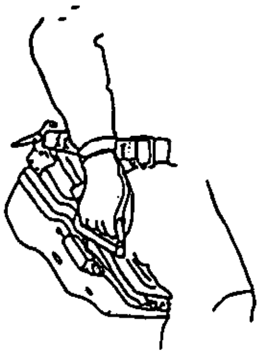
SEAT KIT DEPLOYMENT (Cont.)

WITHOUT ACC 377



9 Pull upwards on kit strap release handle with forefinger of right hand, while at the same time, pulling upward on seat kit release handle with the other three fingers.

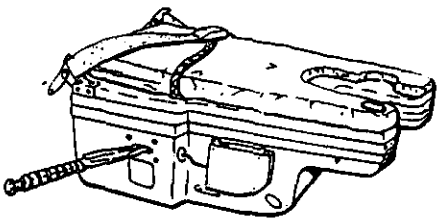
WITH ACC 377



9 Pull upwards on seat kit release handle.

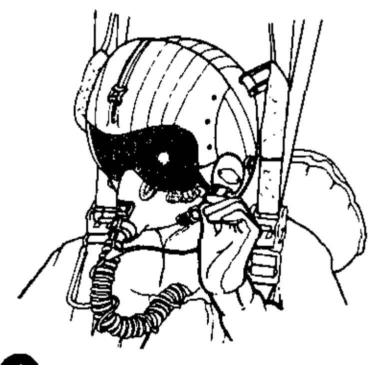
Note

If the RSSK-8 release handle will not open the seat lid, an alternate method is available. Insert a mechanical pencil, pen, or knife point into one of the three inspection slots (located on each side and on the backside) and force the locking device toward the handle while pulling on the lid until it opens.



INJURED ARM PROCEDURES

In the event of an injured right arm, and seat kit deployment is desired, the following procedures must be accomplished.



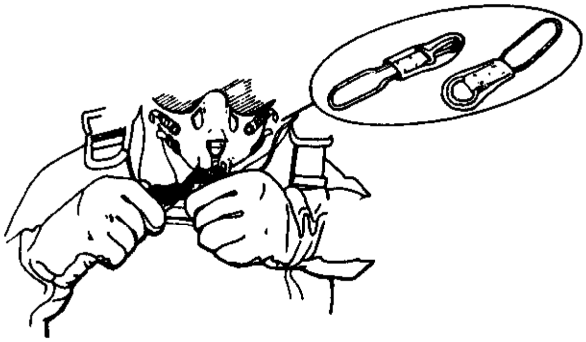
1 Release oxygen mask from helmet.

2 Disconnect lower oxygen hose from seat kit.

Figure 14-14. Ejection Procedures (Sheet 8 of 26)

POST-EJECTION PROCEDURES (Concl.)

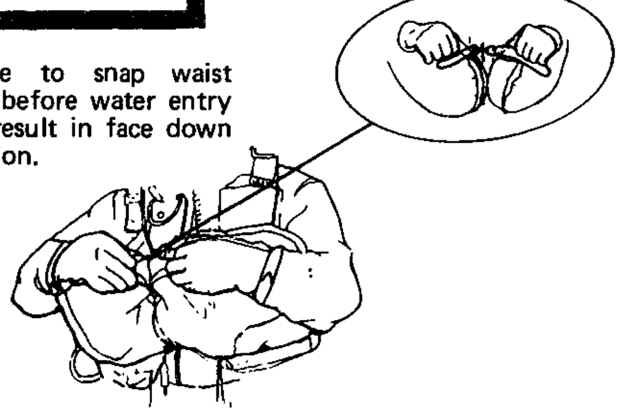
OPTIONAL PROCEDURE:



5 Remove chaffing material (when required) from waist lobe snaps.

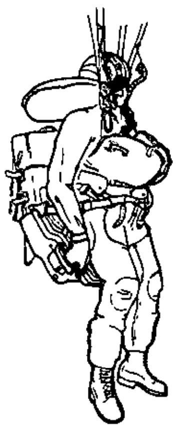
WARNING

Failure to snap waist lobes before water entry may result in face down flotation.



6 Snap waist lobes together.

SEAT KIT DEPLOYMENT



WITHOUT ACC 377

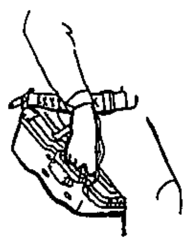
WARNING

Deploying seat kit is not recommended over land.

WITH ACC 377

7 After inflating LPU, prepare to deploy seat kit.

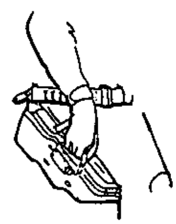
7 After inflating LPU, prepare to deploy seat kit.



8 With right hand, locate seat kit release handle and kit strap release handle on right side of seat kit.

WARNING

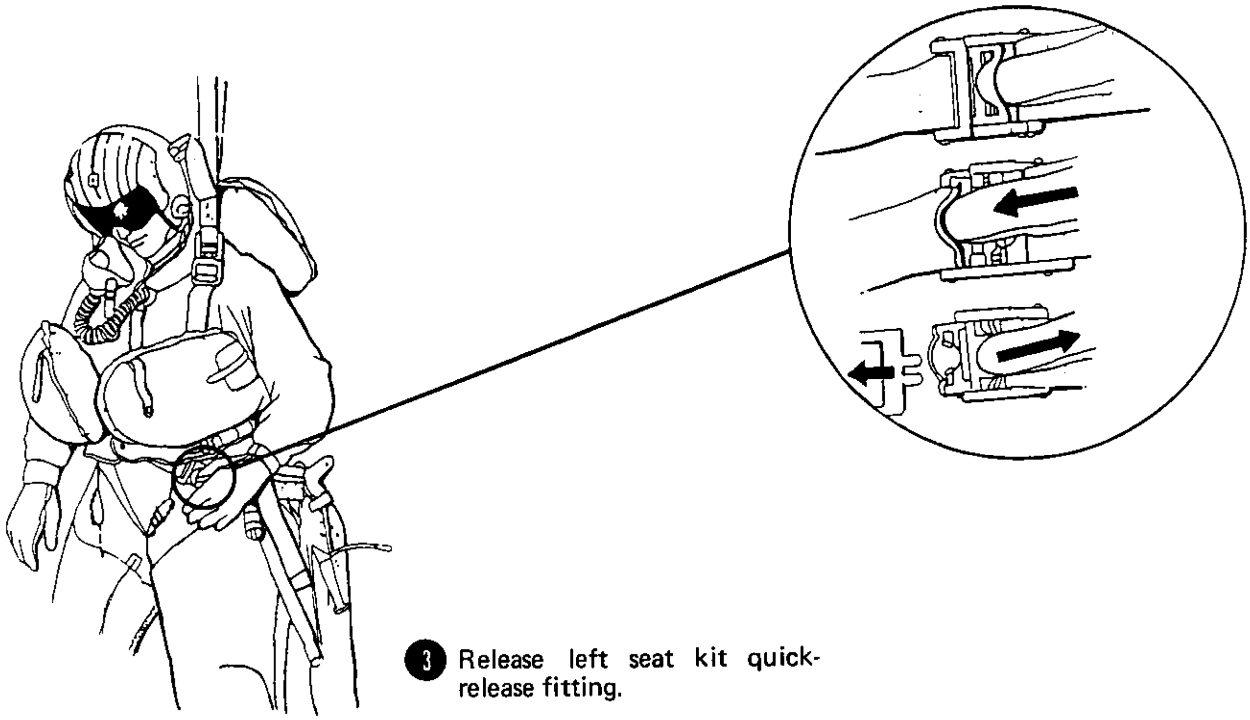
Unless kit strap release handle is pulled simultaneously with or before seat kit release handle (without ACC 377), the survival kit will not deploy beneath the pilot during descent, resulting in a hazardous landing.



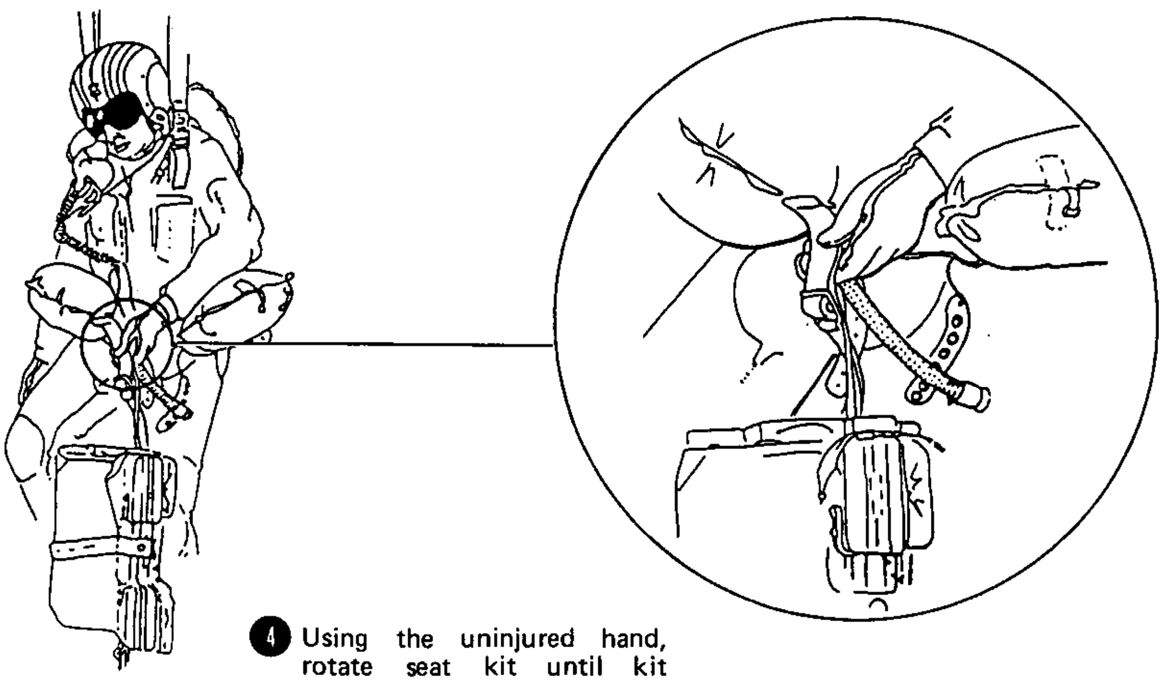
8 With right hand, locate release handle on right side of seat kit.

Figure 14-14. Ejection Procedures (Sheet 9 of 26)

SEAT KIT DEPLOYMENT (Cont.)



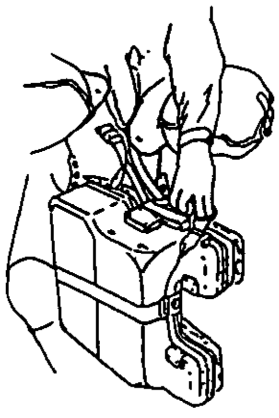
3 Release left seat kit quick-release fitting.



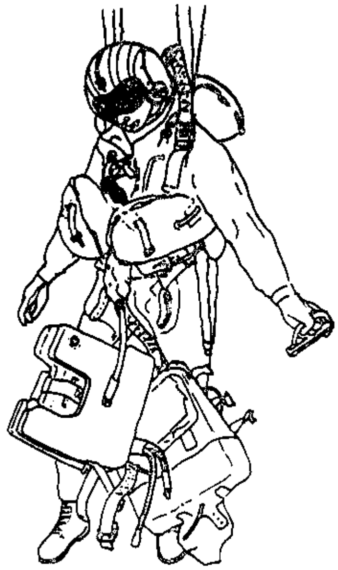
4 Using the uninjured hand, rotate seat kit until kit release handle can be reached.

Figure 14-14. Ejection Procedures (Sheet 10 of 26)

SEAT KIT DEPLOYMENT(Concl.)



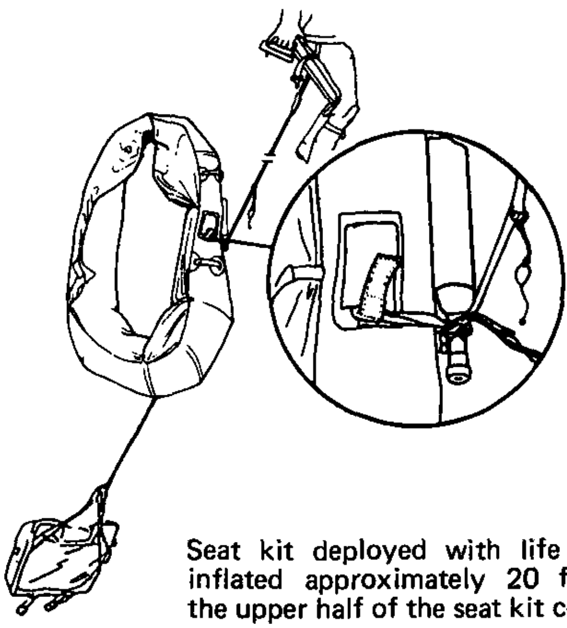
5 Use legs to position and hold seat kit.



6 Pull seat kit release handle until it is completely free. Allow lower portion of seat kit to fall free.

Note

If survival kit is deployed after water entry, a snatch pull on the dropline near the CO_2 bottle is required to inflate life raft.



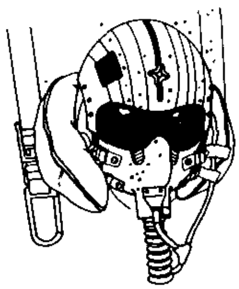
Seat kit deployed with life raft fully inflated approximately 20 feet below the upper half of the seat kit container.

Figure 14-14. Ejection Procedures (Sheet 11 of 26)

OPTIONS

If time and altitude permit or rescue is not imminent, the following options for the oxygen mask, visor, gloves, and parachute four-line release may be considered.

Remove oxygen mask. Oxygen mask/ hose assembly may be disconnected from seat kit and discarded, if desired.



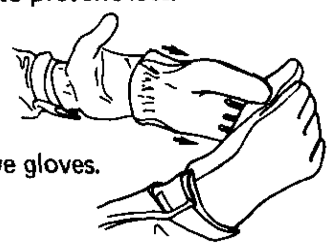
Note

The A-13A or MBU series oxygen mask and miniature regulator provide underwater breathing capability and should be retained in low-level overwater ejections.

Raise visor.

Note

- Removal of gloves may facilitate subsequent release of parachute release fittings.
- Stow gloves in a secure place to prevent loss.



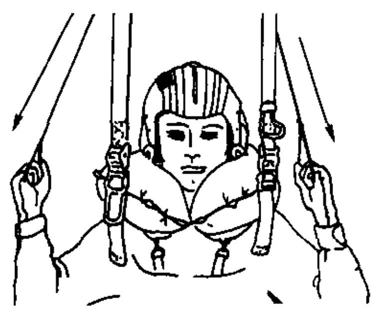
Remove gloves.

WARNING

- Carefully inspect parachute and suspension lines prior to using the four-line release system. If any parachute damage or broken suspension lines are evident, do NOT use the four-line release.
- Do NOT use the four-line release at night because parachute damage may be difficult to determine.

Note

Four suspension lines release from their connector links and a lobe forms at the center rear of the parachute creating a controlled channel for air escape.



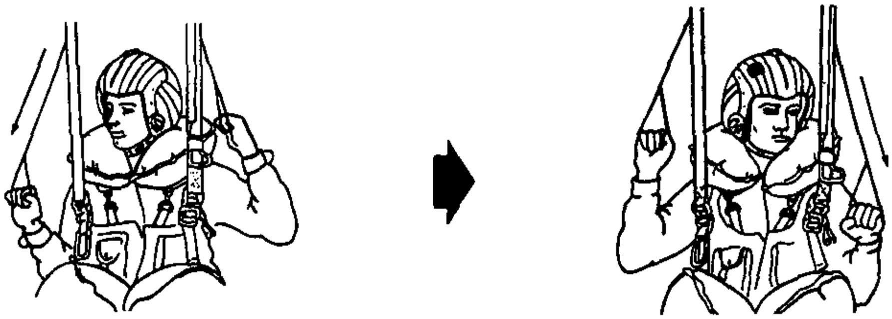
Activate the four-line release system by locating parachute control lanyards on inside of rear risers and pull down sharply.

Figure 14-14. Ejection Procedures (Sheet 12 of 26)

OPTIONS (Concl.)

Note

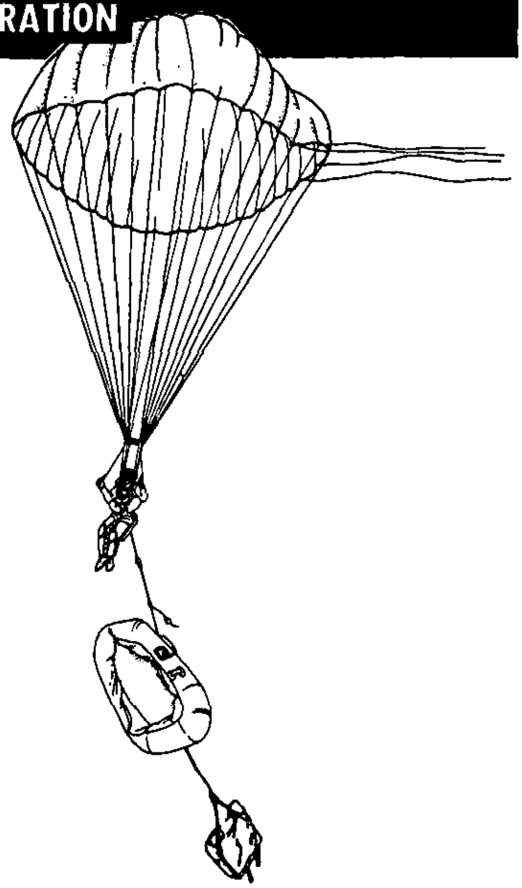
- In case of an injured arm, it is safe to activate only one side of the four-line release system. The parachute will turn into the direction of the side activated.
- A 180° turn can be accomplished in about 20 seconds.



Pull down on right lanyard to steer right.

Pull down on left lanyard to steer left

LANDING PREPARATION



N8/88

OVERWATER

Try to determine the wind direction at the surface using white caps, smoke from wreckage, or known surface winds in the vicinity. Winds at the surface may be quite different from those encountered at altitude. When nearing the surface, maneuver the parachute so that you are facing into the wind, then assume the proper body position for landing.

1. Feet together.
2. Knees slightly bent.
3. Toes pointed slightly downward.
4. Eyes on the horizon.
5. Firmly grasp parachute release fittings.
6. Tuck elbows in prior to water entry.

WARNING

SEAWARS does not operate in freshwater. Manual canopy release (KOCH fittings) is mandatory upon water entry.

Note

If you eject over seawater, SEAWARS will release the parachute canopy within 2 seconds upon seawater entry. However, if a malfunction occurs you should be prepared to manually unlock each canopy release (KOCH fittings) immediately.

Figure 14-14. Ejection Procedures (Sheet 13 of 26)

LANDING PREPARATION (CONT)

OVER LAND

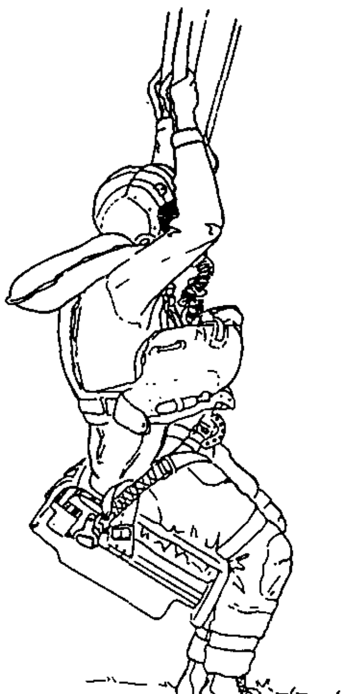
Perform the same procedures as for over water, but with the following exceptions:

1. Visor – Down.
2. Gloves – On.
3. Do NOT deploy seat kit.

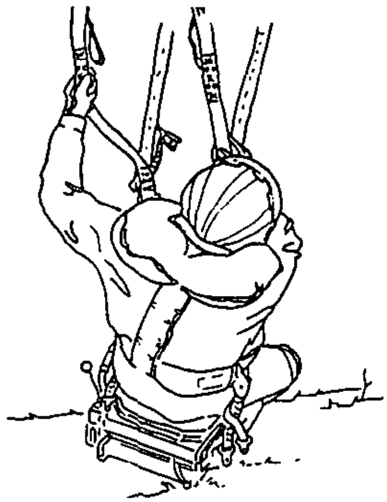
PARACHUTE LANDING FALL (PLF) PROCEDURES

Upon toes touching ground surface:

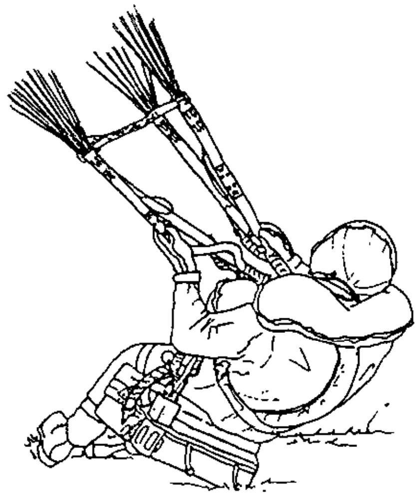
1. Arch side of body in direction of fall.
2. Contact ground at five points of body:



a. Balls of feet.



b. Roll to sides of calves.

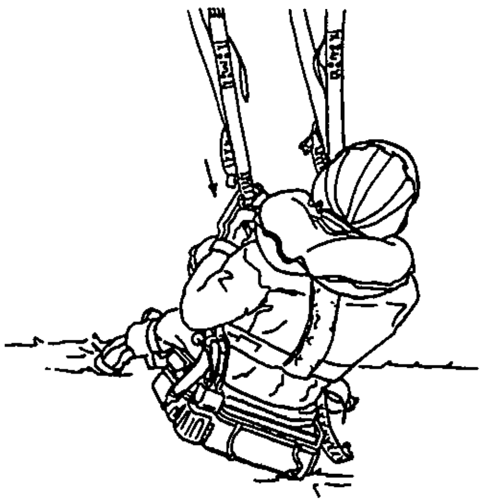


c. Roll to thighs.

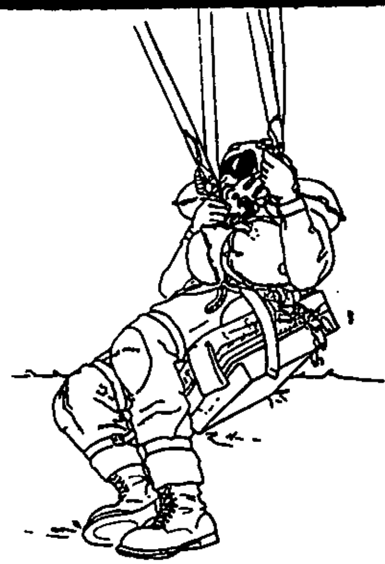
N7/86

Figure 14-14. Ejection Procedures (Sheet 14 of 26)

LANDING PREPARATION (CONT)



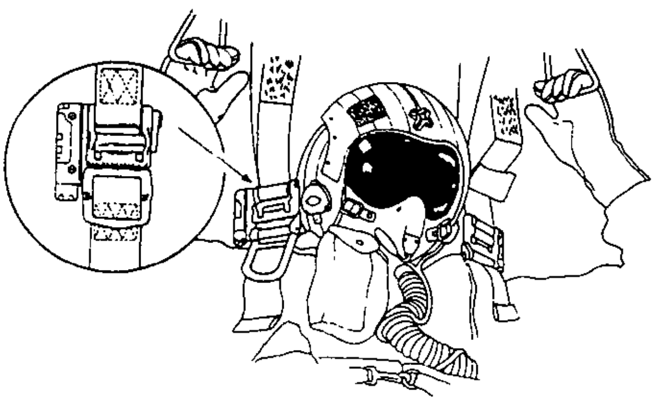
d. Roll to buttocks.



e. Roll to shoulders.

Release parachute fittings.

PARACHUTE FITTING RELEASE



Note

SEAWATER ACTIVATED PARACHUTE RELEASE SYSTEM (SEAWARS). If SEAWARS is installed on the parachute risers, it will automatically release the parachute from the harness upon immersion in seawater. This will help prevent entaglement and/or dragging injured survivor. SEAWARS does not interfere with the manual operation of the parachute release fittings. Manual operation remains the primary mode of release with SEAWARS intended as a backup system.

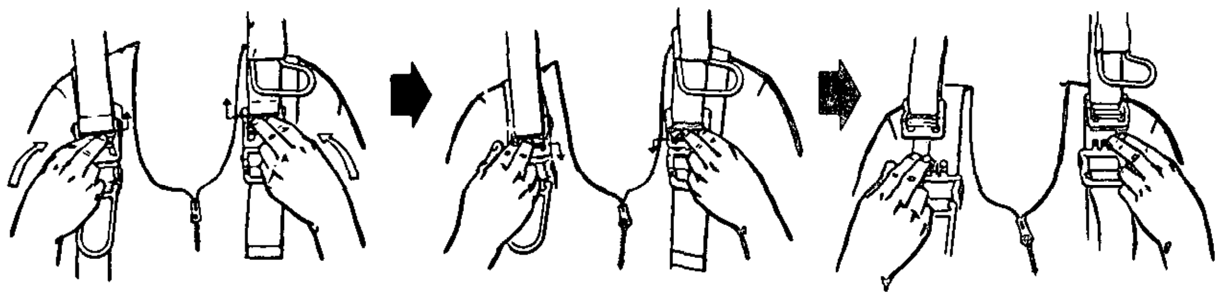
N7/86

Figure 14-14. Ejection Procedures (Sheet 15 of 26)

LANDING PREPARATION (Concl.)

WARNING

- If a parachute landing is made into the water or a high wind prevents normal spilling of parachute canopy, disconnect both quick-release fittings that attach risers to torso-harness suit, thus jettisoning parachute canopy.
- Do not disconnect quick-release fittings until after contact with ground or water.



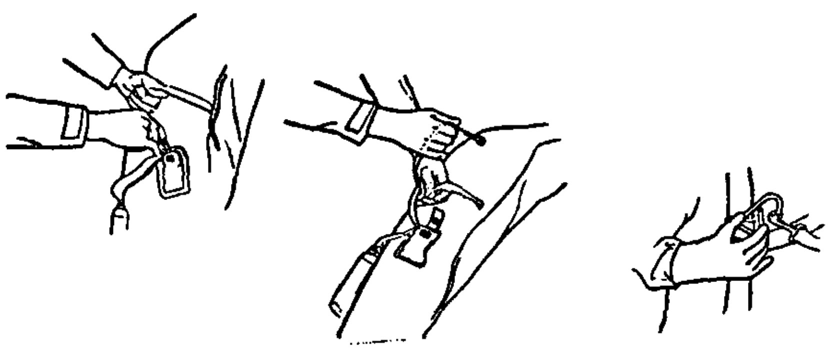
1. Push up on quick-release locking lever cover
2. Pull down on quick-release locking lever.
3. Parachute released.

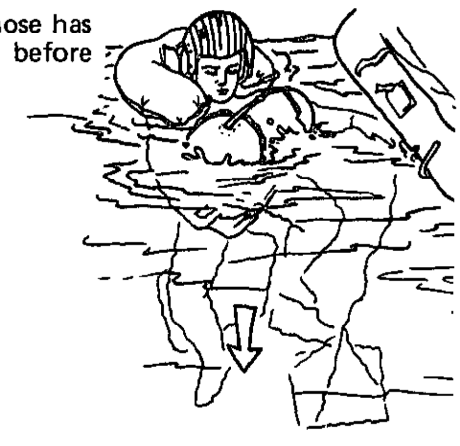
RAFT BOARDING

When clear of parachute canopy, retrieve LR-1 life raft by locating dropline and pulling raft to you.

Note

Ensure that raft retaining lanyard is securely attached and oxygen hose has been disconnected from seat kit (if not previously accomplished) before releasing upper half of seat kit.





1. Locate and remove raft retaining lanyard from its pocket just above CO_2 cylinder.
2. Attach snaphook to gated helo lift D-ring.
3. Locate quick-release fitting and release upper half of seat kit.

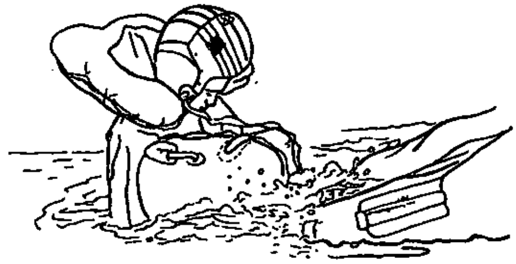
Figure 14-14. Ejection Procedures (Sheet 16 of 26)

RAFT BOARDING (Cont.)

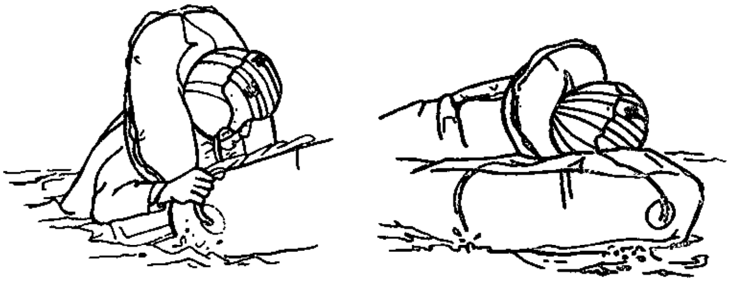
WARNING

Ensure that no sharp edges contact the life raft.

4 Bring raft around for entry into smaller end (stern).

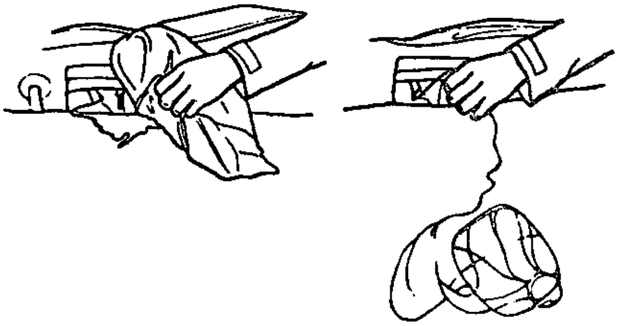


5 Grasp stern and forcibly push under LPU waist lobes.

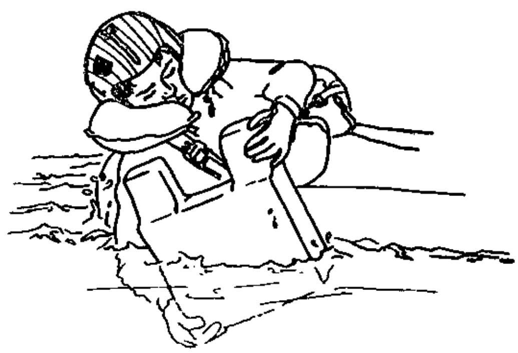


6 Using boarding handles, pull into raft and turn toward a seated position.

7 Move into a comfortable and well balanced position.



8 If sea anchor has not deployed, locate it on left side and deploy it.



9 Retrieve lower half of kit.

Figure 14-14. Ejection Procedures (Sheet 17 of 26)

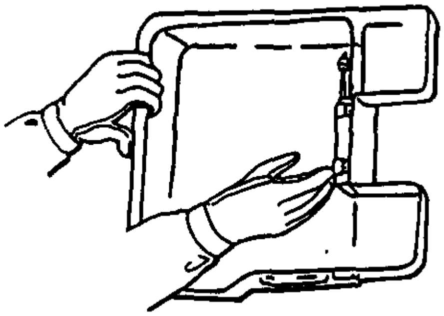
RAFT BOARDING (Concl.)

WARNING

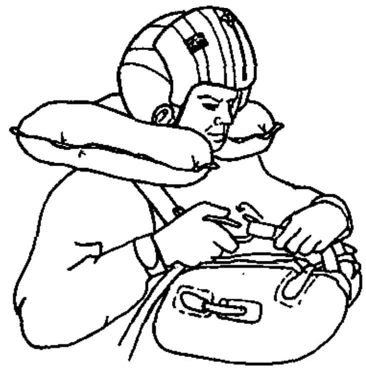
The URT-33A is not tied and once removed from seat pan, care must be taken to prevent its loss.

Note

The URT-33A has a retrieval lanyard secured to it with rubber bands. Secure lanyard to a suitable place on survival equipment; then remove URT-33A from its bracket.



10 Locate and retrieve AN/URT-33A from lower portion of seat kit.



11 Immediately secure equipment container to gated helo hoist D-ring.

SIGNALING DEVICES

The following information describes the use of signaling devices while in the life raft and is not intended to prescribe any given order of priority which would be dictated by the immediate situation of the survivor.

MK79 MOD 0 ILLUMINATION SIGNAL KIT

WARNING

Prior to securing cartridge into pencil-type launcher, ensure launcher is in cocked position.

Note

The Mk 79 Mod 0 Illumination Signal Kit uses a pencil-type launcher and cartridge flare.

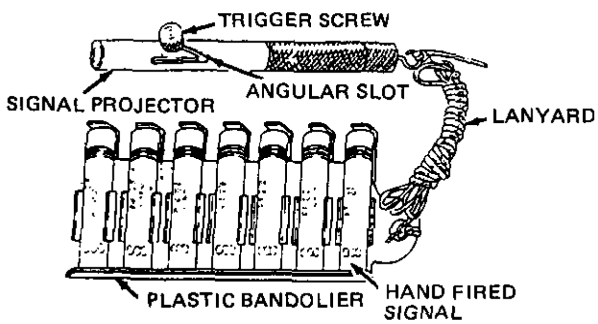


Figure 14-14. Ejection Procedures (Sheet 18 of 26)

SIGNALING DEVICES (Cont.)

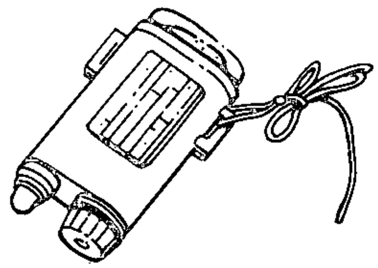
1 Screw cartridge flare into launcher while keeping flare pointed in a safe direction.

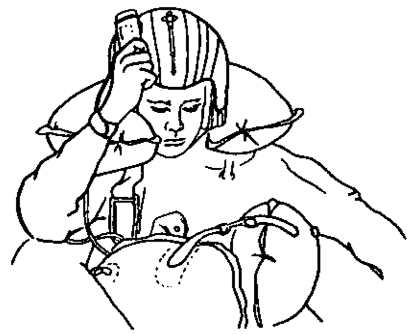
2 Hold launcher directly overhead. Pull back on trigger and release. The flare has a minimum 4-1/2 second duration and can be launched to about 200 feet.

SDU-5/E DISTRESS MARKER LIGHT

Note

SDU-5/E is actuated by pressing button on bottom of light. Emits 360° beam of light which flashes at a rate of 40-60 flashes per minute for approximately 12 hours.





SDU-5/E Distress Marker Light can be attached to the helmet by mating hook and pile (velcro) tape. This frees the hands for using other signaling devices while allowing light to flash up into the sky and reflect off the helmet.

EMERGENCY SIGNALING MIRROR

1. Place lanyard over head and around neck.
2. Reflect sunlight onto nearby surface (raft, hand, etc.)
3. Slowly bring mirror up to eye level and look through sighting hole. You will see a bright spot: the aim indicator.
4. Hold mirror close to eye, slowly turn and manipulate so that bright light is on target.
5. Even if there are no aircraft or ships in sight, continue to sweep horizon. Mirror flashes can be seen for many miles, even in hazy weather.

Note

Mirror flashes reflect light with a brilliancy of up to 8 million candle power, and with a range of 45-50 miles with search aircraft at 5000 feet on a clear day.

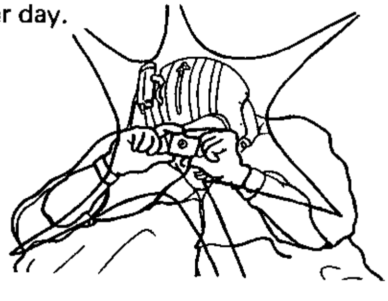


Figure 14-14. Ejection Procedures (Sheet 19 of 26)

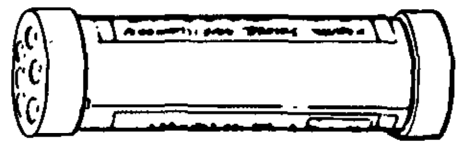
SIGNALING DEVICES (Cont.)

MK-13 MOD 0 MARINE SMOKE AND ILLUMINATION SIGNAL

The *Mk 13 Mod 0 Marine Smoke and Illumination Signal* is used to attract the attention of SAR aircraft and to give wind drift direction.

WARNING

Mk 13 Mod 0 signal may reach a temperature that is uncomfortable to handle after ignition. Use of gloves is suggested.



Note

- *Flare incorporating paper vice plastic end caps have no protrusions on cap.*
- *Flare burns approximately 20 seconds with approximately 3,000 candle power.*

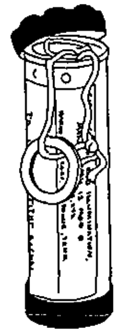
IDENTIFICATION:

Night

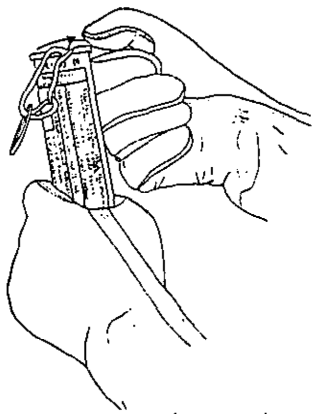
- Red cap.
- Protrusions on cap.
- Metal washer attached to lanyard.

Day

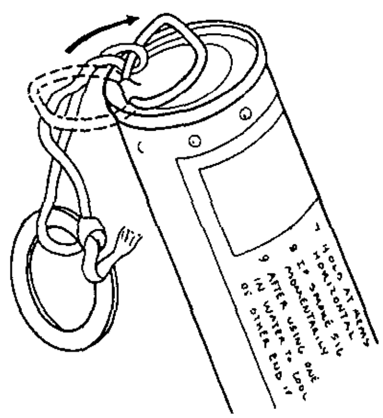
- Orange cap.
- No protrusions on cap.



1. To use Mk13 remove cap from desired end.



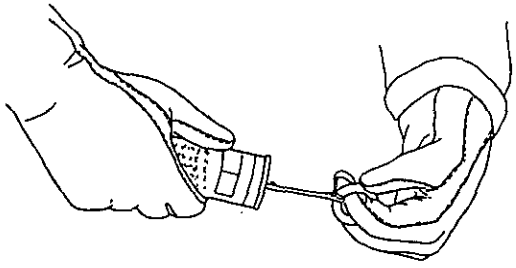
2. Pull flip ring over rim to break lead seal. If seal doesn't break, push ring until it bends against case.



3. Flip bent ring back to original position and use as a lever to break seal.

Figure 14-14. Ejection Procedures (Sheet 20 of 26)

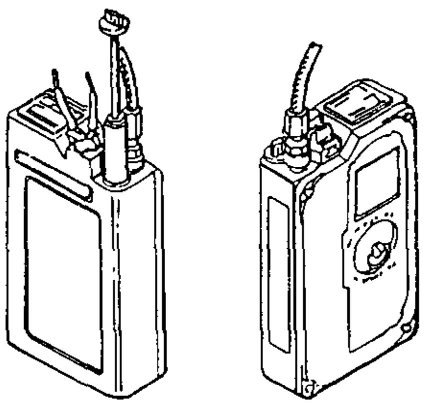
SIGNALING DEVICES (Concl.)



4 Ignite signal by a quick pull on the ring.

5 The ignited Mk 13 Mod 0 must be held at arms length, down wind, no more than shoulder high and over side of life raft to prevent damage to raft from hot residue.

AN/URT-33A RADIO BEACON SET



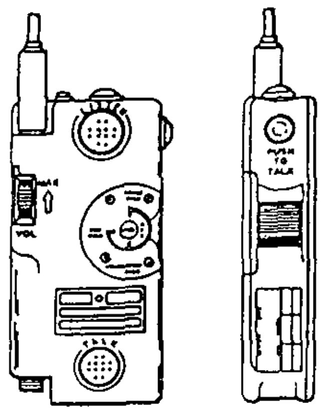
FRONT REAR

The AN/URT-33A radio automatically transmits a swept tone signal on 243.0 MHz when the ejection seat leaves the floor of the aircraft.

Note

- The AN/URT-33A must be turned off when using the PRC-90 on 243.0 MHz to prevent interference. When word "on" is visible, the radio is on.
- Do not point antenna directly at receiving aircraft.

AN/PRC-90 RADIO SET



FRONT RIGHT

The AN/PRC-90 radio set is a dual channel transmitter/receiver survival radio capable of transmitting (voice mode) up to 60 nm (line of sight, depending on receiving aircraft's altitude). It operates on guard (243.0 MHz) or a SAR primary operating frequency (282.8 MHz) with a mode for swept tone signal on 243.0 MHz only. Transmission of the beacon or code can be up to 80 nm.

Note

- Do not point antenna at receiving aircraft.
- Radio is equipped with external earphone to assist in avoiding enemy detection or for use in the event of aircraft radio failure.

Figure 14-14. Ejection Procedures (Sheet 21 of 26)

RESCUE

When the recovery aircraft is ready to effect rescue:

1. Stow or discard loose gear and roll out of raft on the right side (side with CO_2 cylinder).

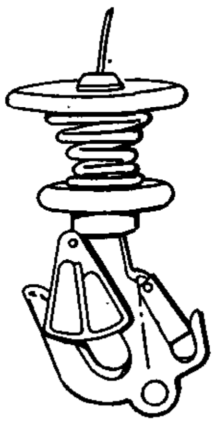
2. Swim away from raft. Ensure that helmet visor has been lowered.

3. Remove raft retention lanyard after rescue device has been lowered.

Procedures for use of the rescue hook:

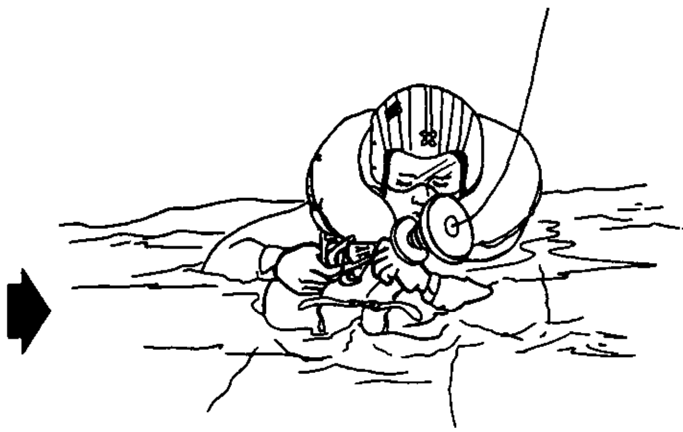
WARNING

- To allow discharge of static electricity and prevent electrical shock, do NOT touch helo-hoist cable or rescue device until is has made contact with water/ground.
- To avoid severe injury, keep hands clear of D-ring and rescue hook after hooking up.



Note

The helo rescue hook has a small and large hook. The large hook is the primary hook for hoisting personnel.



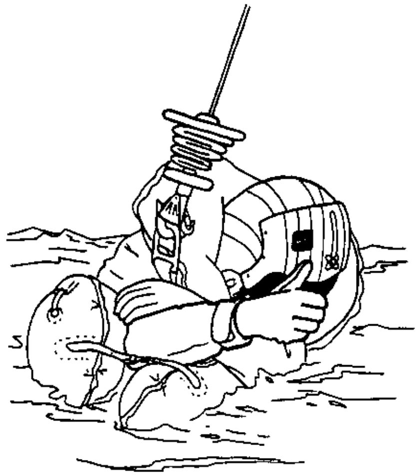
Attach large hook to gated D-ring.

Figure 14-14. Ejection Procedures (Sheet 22 of 26)

RESCUE (Cont.)

WARNING

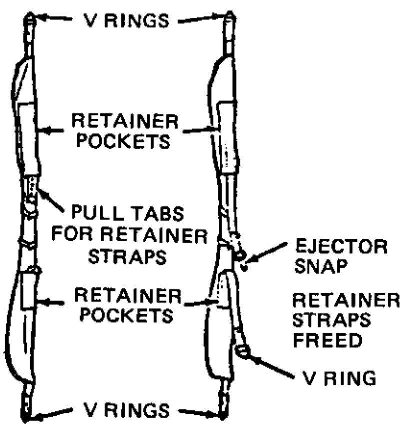
Under no circumstances should survivors attempt to assist their entrance into the helicopter or move from the rescue device until helicopter aircrewman assists them to a seat in the aircraft.



5 Cross arms in front of chest and place head down and to the left. Give thumbs up signal to helo-hoist operator.

6 Position of aircrewman during helo-hoist. Upon clearing ground/water, cross feet.

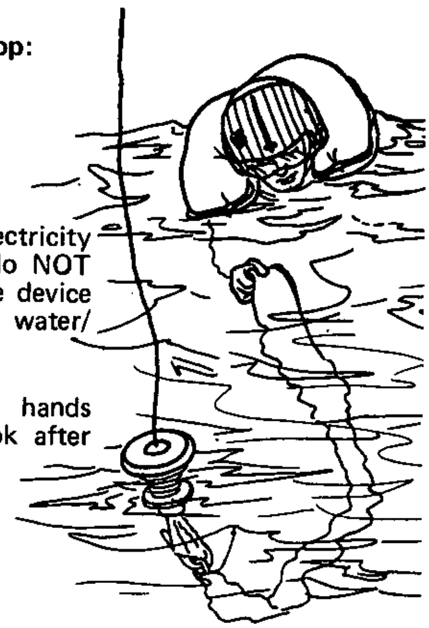
Procedures for use of the Rescue Strop:



Rescue strop (designed to accommodate one survivor at a time).

WARNING

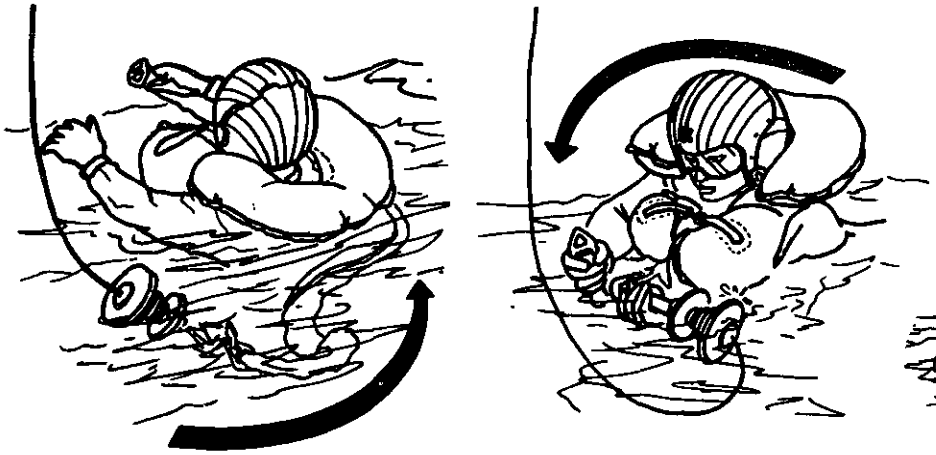
- To allow discharge of static electricity and prevent electrical shock, do NOT touch helo-hoist cable or rescue device until it has made contact with water/ ground.
- To avoid severe injury, keep hands clear of D-ring and rescue hook after hooking up.



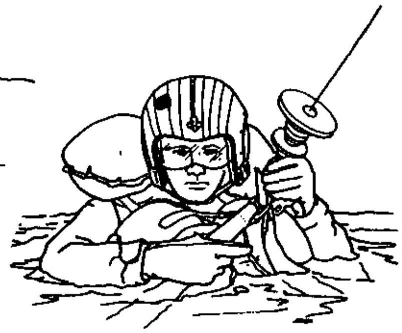
1 Grasp free end of rescue strop.

Figure 14-14. Ejection Procedures (Sheet 23 of 26)

RESCUE (Cont.)



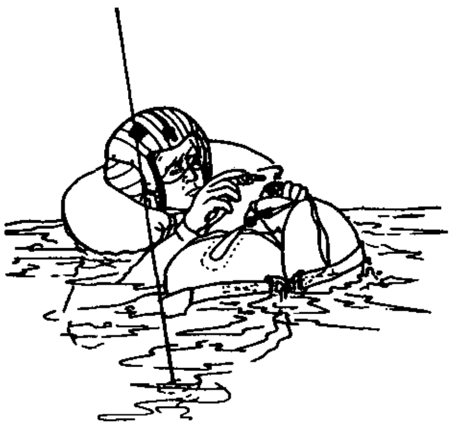
2 Swim in a circle toward rescue hook completely encircling body with rescue strop.



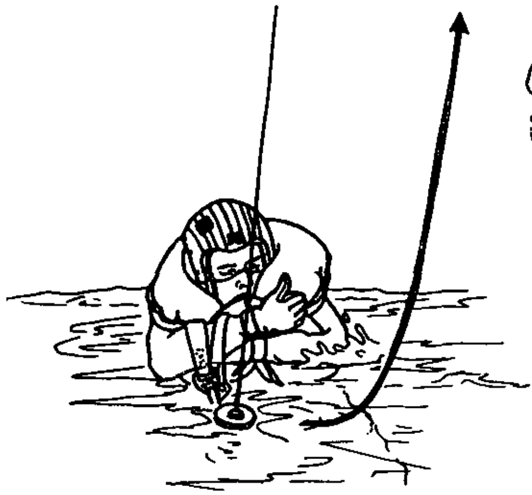
3 Attach free end of strop to large hook.

WARNING

- Under no circumstances should survivors attempt to assist their entrance into helicopter or move from rescue device until helicopter aircrewman assists them to a seat in the aircraft.



4 Pull both retainer straps free and connect ejector snap to V-ring of other retainer strap. Pull tight.

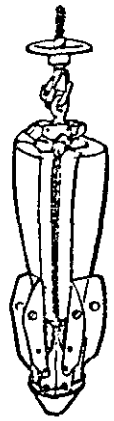


5 Ensure rescue strop is above LPU waist lobes and high on back. Wrap arms around strop and place hands in armpits. Keep head down and give thumbs up signal to helo-hoist operator.

6 Position of aircrewman during hoist. Upon clearing water, cross feet.

Figure 14-14. Ejection Procedures (Sheet 24 of 26)

RESCUE (Cont.)

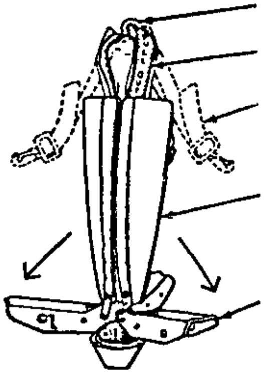


Forest penetrator with flotation collar and seats retracted (safety straps omitted to show connection of rescue hook to eyebolt).

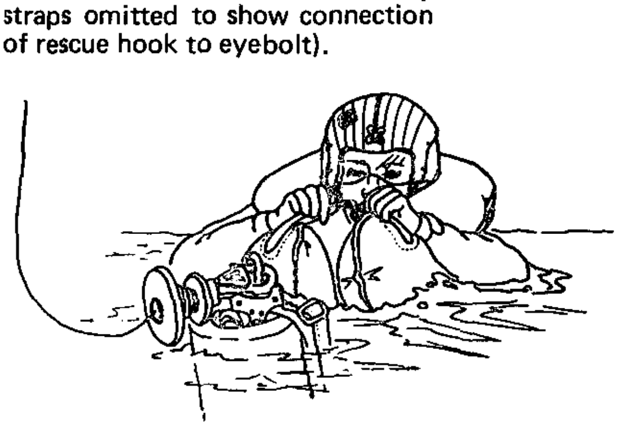
Procedures For Use of the Forest Penetrator

WARNING

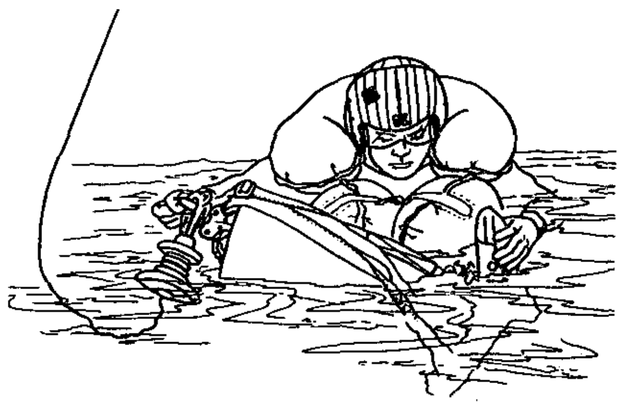
- To allow discharge of static electricity and prevent electrical shock, do NOT touch helo-hoist cable or rescue device until it has made contact with water/ground.
- To avoid severe injury, keep hands clear of D-ring and rescue hook after hooking up.



Forest penetrator with flotation collar and seats extended.

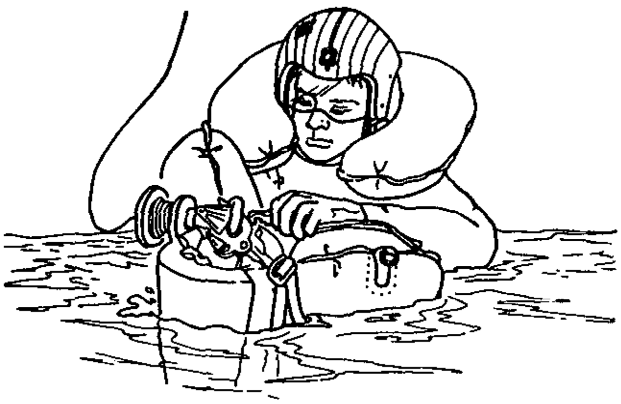


1. Unsnap LPU waist lobes.



2. Extend only one seat on forest penetrator.

3. Sit on seat facing flotation collar. Using elbows, separate LPU waist lobes and pull shaft of penetrator close to chest.



4. Pass safety strap under arm, around back, and under other arm. Connect safety strap and tighten.

Figure 14-14. Ejection Procedures (Sheet 25 of 26)

RESCUE (Concl.)

WARNING

Under no circumstances should survivors attempt to assist their entrance into helicopter or move from rescue device until helicopter aircrewman assists them to a seat in the aircraft.

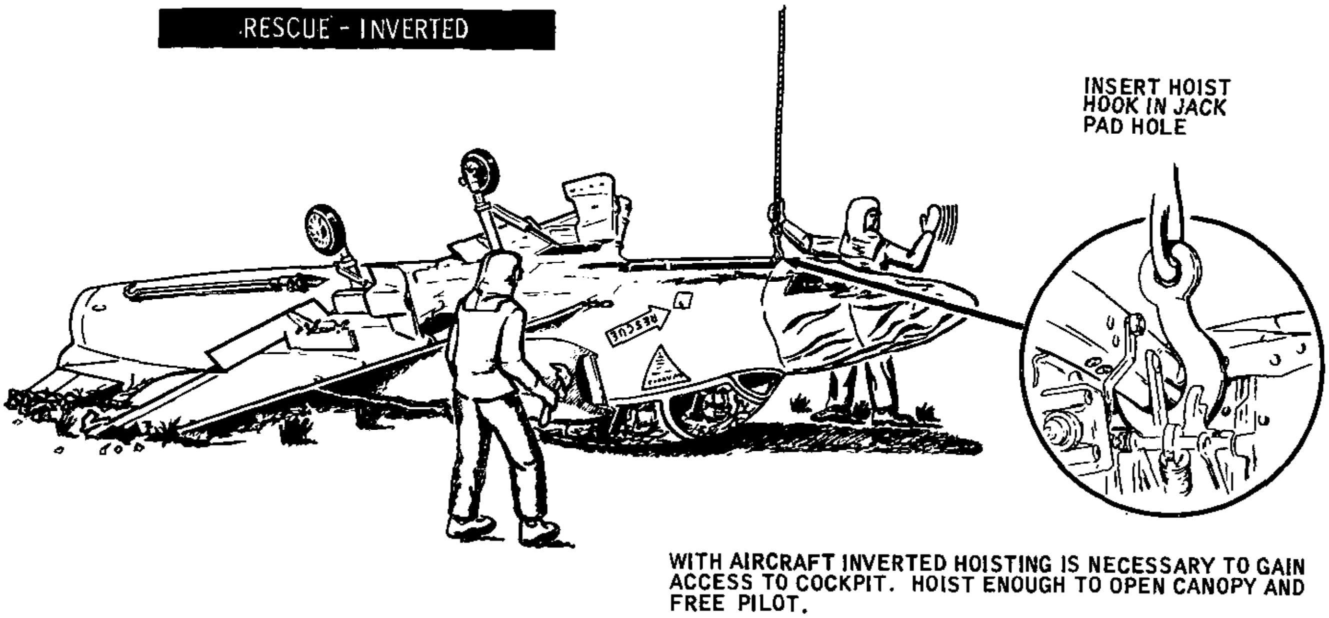
5 Turn head down and to the left; give thumbs up signal to helo-hoist operator.

6 Position of aircrewman during hoist. Upon clearing water, cross feet.

WARNING

- Ejection at low altitude allows only a matter of seconds to prepare for landing. Over water, inflation of the LPU is the most important step to be accomplished. Release of the parachute quick-release fittings as the feet contact the water is the second most important step to prevent entanglement in the parachute shroud lines.
- When ejection is in the immediate vicinity of the carrier, parachute entanglement combined with wake and associated turbulence can rapidly pull a survivor under. The deployed seat survival kit may contribute to shroud line entanglement. The survivor must be prepared to cut shroud lines that are dragging him down.
- The crashed aircraft may release large quantities of jet fuel and fumes which could hamper breathing and create a fire hazard if smoke or flare marker is present. The emergency oxygen system may be invaluable in this case and discarding the seat pan would terminate its use. However, totally discarding the seat pan may be appropriate after considering weather, sea conditions, and rescue potential.
- The variety and complexity of conditions encountered during the "time critical" movements following a low altitude overwater ejection make it impossible to formulate procedures to cover every contingency.

Figure 14-14. Ejection Procedures (Sheet 26 of 26)



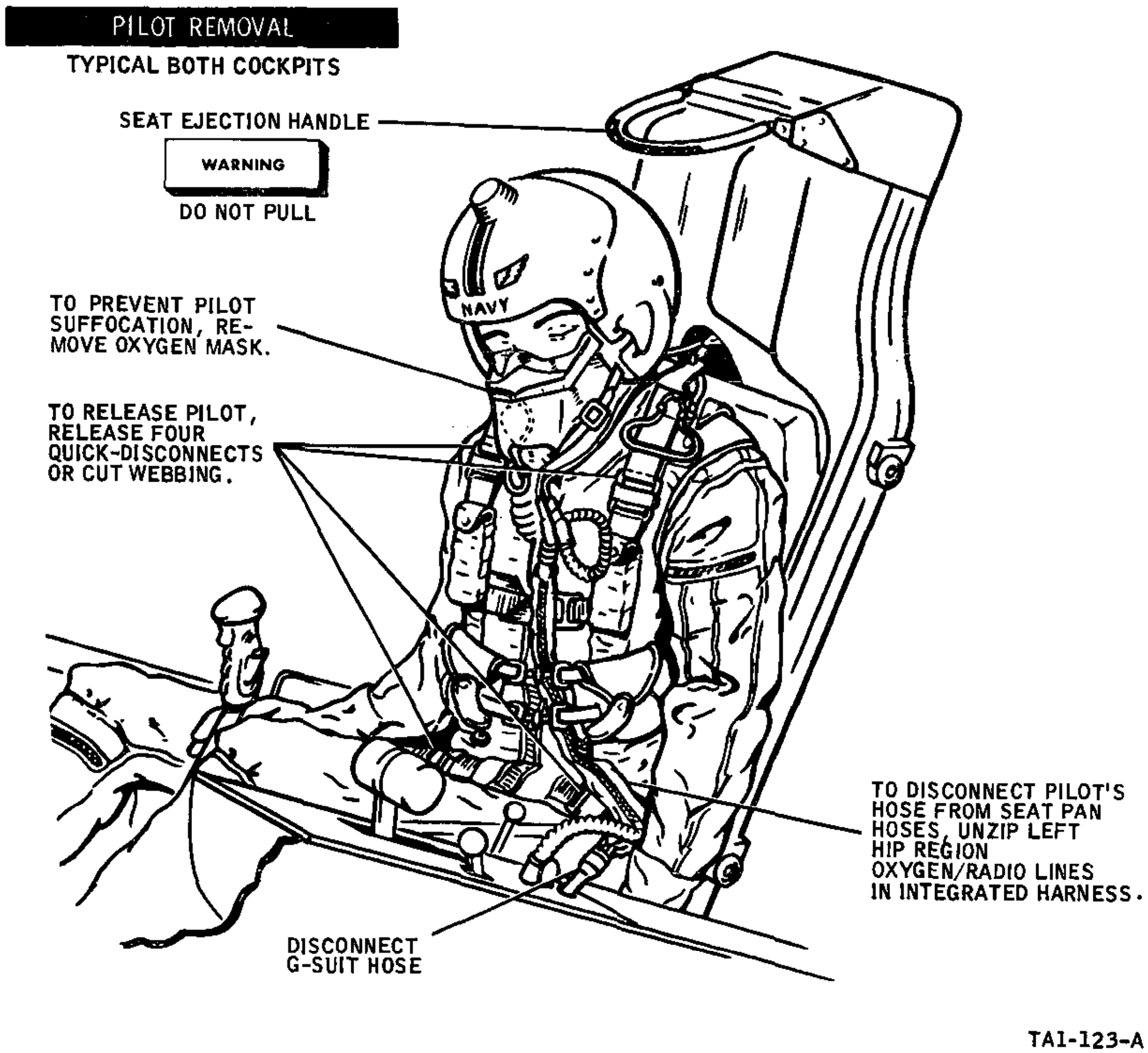
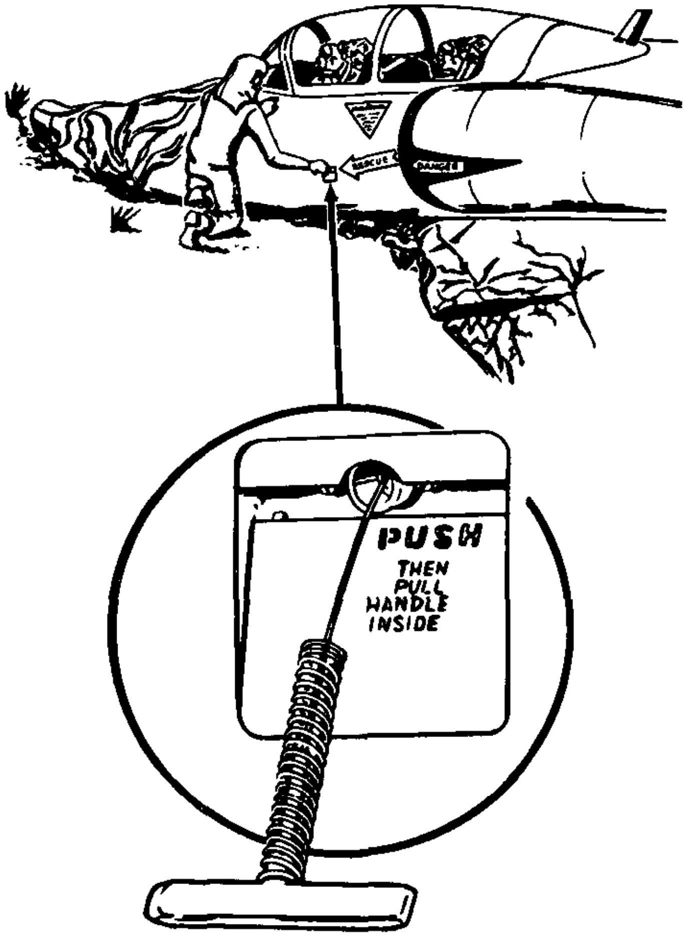


Figure 14-15. Emergency Entrance (Sheet 1 of 2)

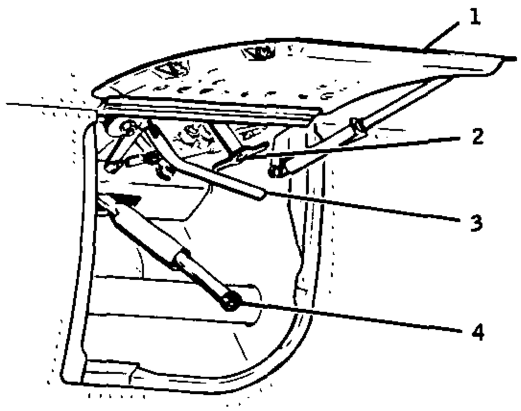
RESCUE - AIRCRAFT UPRIGHT



CANOPY JETTISON HANDLE
(TYPICAL BOTH SIDES FOR
EMERGENCY JETTISONING)

CANOPY JETTISON PROCEDURE

IF UNABLE TO JETTISON CANOPY, SPRAY CANOPY WITH CO_2 WHICH CAUSES CANOPY TO BECOME EXTREMELY BRITTLE AND EASY TO BREAK. AFTER BREAKING CANOPY, REACH INSIDE AND OPERATE CANOPY RELEASE LEVER LOCATED ON LEFT SIDE OF EITHER COCKPIT. IF CANOPY FAILS TO RELEASE, ENLARGE BREAK IN CANOPY TO REMOVE PILOTS.



1. CANOPY CONTROLS EXTERNAL ACCESS DOOR (LH ONLY).
2. CANOPY OVERRIDE (RIFLE BOLT) EXTERNAL LATCH HANDLE (A-4 AFC 419-II).
3. EXTERNAL CANOPY CONTROL HANDLE.
4. EXTERNAL HANDPUMP ACTUATING HANDLE.

CANOPY RELEASE PROCEDURE

A. (AIRCRAFT REWORKED PER A-4 AFC 419-II, ONLY).
PULL CANOPY OVERRIDE EXTERNAL LATCH HANDLE DOWN APPROXIMATELY 3/4-INCH. HOLD WHILE PERFORMING STEP B.

B. PULL EXTERNAL CANOPY CONTROL HANDLE DOWN AND OUTBOARD.

C. PULL EXTERNAL HANDPUMP ACTUATING HANDLE TO EXTENDED POSITION AND PUMP MANUALLY.

TA1-290-A

Figure 14-15. Emergency Entrance (Sheet 2 of 2)

14.19 EMERGENCY EXIT

Three methods for emergency exit are given, the choice of which depends on the emergency condition. Method 1 is recommended only under extreme emergency conditions where circumstances clearly indicate immediate exit. Methods 2 and 3 are recommended only when time permits.

14.19.1 Method 1. Eject. (Refer to Ejection.)

14.19.2 Method 2. This method may be used when the pilot elects to exit without his parachute and survival gear.

1. Jettison canopy by pulling the CANOPY JETTISON handle.

Note

The canopy can be jettisoned with the cockpit canopy control handle in any position.

2. Unfasten the four parachute harness fittings.

3. Disconnect oxygen hose.

4. If time permits, safety the ejection controls by pulling the safety handle on the pilot headrest to the DOWN and LOCKED position. This will preclude inadvertent ejection of the seat.

5. Exit from aircraft.

14.19.3 Method 3. This method may be used when the pilot elects to exit with his parachute and survival gear attached. However, it is not recommended when the height of the jump to the ground may result in injury which would prevent the pilot from moving a safe distance from the aircraft. Also, retaining the parachute and survival kit unduly restricts body movement, consequently compromising quick exit from the cockpit.

1. Jettison canopy by pulling the CANOPY JETTISON handle.

2. Pull the emergency restraint release handle. This releases the pilot from the seat with the parachute and survival gear attached.

3. If time permits, safety the ejection controls by pulling the safety handle on the pilot headrest to the DOWN and LOCKED position. This will preclude inadvertent ejection of the seat.

4. Exit from aircraft.

14.20 EMERGENCY ENTRANCE

When it is necessary to gain entrance to the cockpit in an emergency, it may also be necessary to effect the quick and safe removal of the pilot from his seat and parachute. This entry-and-rescue operation requires that certain procedures be followed and that certain precautions be taken. (See Figure 14-15.)

An external control for jettisoning the canopy is provided on each side of the fuselage. Push in on the rescue-access door and PULL the canopy-jettison handle that extends; this will jettison the canopy regardless of the position of the canopy or canopy handle.

WARNING

When the canopy is jettisoned, the seat-catapult interlock is extracted, and be careful to avoid firing the seat-catapult charge. Pull the ejection control safety-handle down prior to removal of the pilot from the seat.

To release the pilot from the seat without the parachute and survival equipment attached, unfasten the harness fasteners (four places) and disconnect the pilot oxygen hose from the seat-pan oxygen hose.

Pulling the emergency restraint release handle releases the pilot from the seat with the parachute and survival equipment attached.

14.21 DITCHING

14.21.1 Ditching at Sea. A forced landing at sea should be made only as a last resort. Ejection is recommended whenever possible. Whenever possible, ditch while power is still available.

If power is not available, the pilot must necessarily choose between either a high sink-rate or increased speed, both extremely dangerous approaches to the water. Moreover, the pilot has the difficult problem of determining exactly how high to flare above the water without stalling, often without any visual references to assist in height determination.

As many as possible of the following should be accomplished if water ditching is imminent:

1. Shoulder harness lock lever – LOCKED.
2. Landing gear – UP.
3. Jettison all external stores.
4. Seat – MIDPOSITION.
5. Wing flaps – DOWN.
6. IFF – EMERGENCY.
7. Transmit MAYDAY position report.
8. Helmet visor – DOWN.
9. Emergency oxygen – PULL.
10. All armament switches – SAFE.
11. Cockpit pressurization – RAM.
12. Canopy – JETTISON.
13. Arresting hook DOWN to feel for the water.
14. If engine is running, shut down just prior to impact.

Land into the wind, if there are no swells, and in light seas. Land along the top of and parallel to the swells if they are large roller swells and if the wind is less than 25 knots. Land into the wind in higher force winds to take advantage of the lowered forward speed, but recognize the possibility of ramming a wave or of striking the tail on a wave crest and nosing in. Maintain sufficient airspeed to flare the aircraft just before touchdown. *DO NOT STALL*. Remain braced until all shocks stop. If not previously accomplished, jettison canopy. Pull emergency restraint release handle to separate from seat with survival gear, and abandon the aircraft as soon as possible.

14.21.2 Underwater Escape. In the event of submersion from porpoising, remain braced until all shocks stop. Keep the oxygen mask on. Jettison the canopy. In the event of malfunctioning of the canopy jettison system, the pilot in the forward cockpit can open the canopy by holding the manual canopy control handle in the OPEN position and actuating the handpump handle located on the inboard side of the right console. Use the emergency restraint release handle to disconnect from the seat and to retain the survival gear. Lean forward to clear the parachute past the headrest and to ensure separation of the shoulder harness fittings. To escape, the pilot in the forward cockpit should grasp the upper edge of the windshield bow and pull and at the same time push with his feet. The pilot in the aft cockpit should push on the sides of the cockpit and at the same time push with his feet.

In extreme circumstances where impact results in damage that prevents the canopy from being jettisoned or opened by the manual method, escape will necessitate braking through the canopy. The canopy may be cracked open with the pilot's service revolver or survival knife. If the revolver is used, the helmet and oxygen mask should be worn with the helmet visor down over the eyes, and as much of the body as possible should be covered for protection from flying plexiglass. The revolver must not be fired if immerser in water. It has been found possible to crack the plexr glass with the survival knife by holding the knife with both hands, the blade pointing up, and striking the canopy above the head with the point of the knife.

During an underwater escape, the survival gear should be retained. Releasing the lower left fitting prior to surfacing should prevent head-down flotation.

The UNDERWATER CANOPY-JETTISON RELIEF-VALVE is designed to facilitate removal of the canopy under water. It is recommended, however, that the canopy be jettisoned by pulling the CANOPY-JETTISON handle prior to submersion.

14.21.2.1 Underwater Escape Procedure

1. Remain braced until all shocks stop.
2. Emergency oxygen – PULL.
3. Disconnect oxygen hose from left console.
4. CANOPY-JETTISON handle – PULL.
5. Emergency restraint release handle – PULL.
6. Lean forward to clear the parachute past the headrest and to ensure separation of the shoulder-harness fittings.
7. To escape, the pilot in the forward cockpit should grasp the upper edge of the windshield bow and pull, and at the same time push with his feet. The pilot in the aft cockpit should push on the sides of the cockpit and at the same time push with his feet.
8. When clear of the cockpit, inflate flotation gear.

WARNING

Do not inflate flotation gear until clear of cockpit, as inflated gear may trap the pilot in the cockpit.

It is recommended that pilots periodically practice exiting from the cockpit with the parachute and pararaft to ensure separation from the seat and clearing the headrest. The canopy should not actually be jettisoned in practice. Proper oxygen-mask fit will prevent water from seeping in during the critical underwater escape.

14.22 TOW SYSTEM MALFUNCTIONS

14.22.1 A/A47U-3/4 Tow System Malfunctions

WARNING

If it becomes necessary to eject from the aircraft during towing operations and time allows, select TOW CUT prior to ejection.

14.22.1.1 Jettison Target On Ground

1. Launcher – DOWN.
2. Shielded Switch – TOW CUT.
3. Taxi clear of target.
4. After 2 seconds, LAUNCHER – UP.

14.22.2 Loss of Electrical Power to RMK-19/31 Reel-Launcher

14.22.2.1 Indications. Indications are loss of indicators and lights on control panel, and loss of response to control switches. RAM air turbine has stopped as the result of automatic brake application.

Note

Loss of primary 28-vdc bus power to the RMK-19/31 will automatically apply the RAM air turbine brake. Application of the brake at towline speeds in excess of 100 FPM may result in the loss of the target or RMK-19/31 damage. Following automatic brake application at towline speeds in excess of 100 FPM, further operation of the RMK-19/31 is not recommended. TOW CUT is available from the essential 28-vdc bus.

14.22.2.2 Procedures. If the brake was off when power was lost:

1. Brake – ON.

CAUTION

Reapplication of primary 28-vdc bus power with the brake off may damage the RMK-19/31.

2. Shielded switch – TOW CUT.

CAUTION

Illumination of the TOW CUT light only indicates that electrical power has been applied to the cable cutting circuitry. It does not ensure that the cartridge has fired or that the towline has separated from the aircraft.

3. Do not attempt to operate the RMK-19/31.

If the brake was on when power was lost:

1. Ensure BRAKE – ON.

14.22.3 Low Air Pressure (TDU-22/34/37 Targets)

14.22.3.1 Indications. The LOW AIR light is seen.

Note

One complete operational cycle of the reel can be completed after low air light comes on if condition is caused by use.

14.22.3.2 Procedures

1. Do not launch target or operate launcher when LOW AIR light is on.

If launcher is up:

2. Reel in target to within 200 feet towline length.
3. Feather blades; that is, beep IN/OUT ANGLE switch until IN ANGLE and OUT ANGLE lights are both out.
4. Brake – ON.
5. Shielded switch – TOW CUT.

If launcher is down:

1. Attempt to recover target. If launcher fails to retract, refer to Launcher Fails to Retract procedure.

14.22.4 Low Air Pressure (TDU-32 Targets)

14.22.4.1 Indications. The LOW AIR light is seen.

14.22.4.2 Procedures

1. Jettison target in drop area.

CAUTION

If landing is to be attempted with target attached, tow reel RAM air turbine will not prevent reel out with landing gear down because of airflow disturbance from nose gear.

14.22.5 Towline Recovery With Target Shot Off Towline

14.22.5.1 Indications. Towline tension is relieved or is erratic.

14.22.5.2 Procedures

1. Confirm by all available means that the target was shot off.
2. Launcher – DOWN.
3. Recover towline at reduced reeling rate consistent with time available.

4. Perform a countercheck for each 10,000 feet of towline recovered. Refer to towline length/speed check procedure.

CAUTION

Do not recover the last remaining 1,000 feet of towline.

5. Feather blades to STOP when within 1,000 feet of indicated towline remaining.

6. Brake – ON.

7. Shielded switch – TOW CUT.

8. Launcher – UP.

14.22.6 Towline Failure/Loss of Target/Towline Length/Speed Indicator Fails, Stops, or Is Erratic

14.22.6.1 Indications. Towline tension is relieved or is erratic.

Note

- If towline fails at or inside reel, towline length will stop counting.
- Use chase plane, if available, for recovery if counter fails.

14.22.6.2 Procedures. With launcher up:

1. Feather blades.

2. Shielded switch – TOW CUT.

3. Brake – ON.

With launcher down:

1. Feather blades.

2. Brake – ON.

3. Launcher – UP .

4. Shielded switch – TOW CUT, if towline can be seen.

CAUTION

Recovery of failed towline may result in the further fracture of the very hard towline strand wires and the distribution of wire fragments within the spool compartment, including the levelwind screw threads. Extensive damage and/or difficult maintenance actions may result; and unless fragments are removed, future flight failures may occur as a consequence.

14.22.7 Launcher Fails to Extend

14.22.7.1 Indications. LCHR DOWN light is not on or launcher is seen to be retracted following extension attempt.

CAUTION

Launcher may not extend until OUT ANGLE light is on.

14.22.7.2 Procedures

1. Confirm Launcher – DOWN.

2. Confirm Brake – OFF.

If LCHR DOWN light is seen:

3. Feather blades

If launcher fails to extend or LCHR DOWN light is not on:

4. IN/OUT ANGLE switch – Beep IN ANGLE until IN ANGLE light illuminates and tension indicates approximately 400 pounds.

5. Brake – ON.

6. Feather blades.

CAUTION

Do not attempt further launcher operation if the launcher will not extend.

During recovery of target:

1. Reel in target to 200 feet of towline length.
2. Feather blades.

Note

Launcher may not extend until target is within 200 feet of the RMK-19/31.

3. Brake – ON.
4. Shielded switch – TOW CUT.

14.22.8 Launcher Fails to Retract

14.22.8.1 Indications. LCHR DOWN light is on with LAUNCHER UP selected. Launcher is seen in the down position following retraction attempt.

14.22.8.2 Procedures. With target in the launcher:

1. Confirm Launcher – UP.
2. IN/OUT ANGLE switch – Beep IN ANGLE to increase tension to 1,200 pounds maximum.

Note

Launcher should retract with 600 pounds tension even if LOW AIR is on.

3. Brake – ON.
4. Feather blades.

CAUTION

Do not attempt further launcher operation.

Without target:

1. Confirm Launcher – UP.
2. Confirm Brake – ON.
3. Confirm feathered blades.
4. Shielded switch – TOW CUT, if towline is exposed.

Note

Field landings are permitted with the launcher down. Minor damage to the launcher may occur.

14.22.9 Tow Cut Does Not Activate Cable Cutter

14.22.9.1 Indications. Towline tension is not relieved.

14.22.9.2 Procedures. Activate alternate cutter using the weapons release circuit.

1. Armament switch – BOMB and GM ARM.
2. Station Select – Centerline.
3. Master Arm – ON.
4. Depress bomb release button "pickle" switch.

14.22.10 Alternate Cutter Procedure Does Not Activate Cable Cutter

14.22.10.1 Indication. Towline tension is not relieved.

14.22.10.2 Procedures If TOW CUT light is exhaust all air in order to release brakes. Beep O ANGLE until OUT ANGLE light comes ON. Cycle LAUNCHER DOWN/UP until launcher will not go down or up. Reel all towline off of spool; or reel-out at least 20,000 feet of towline and fail towline by increasing airspeed or drag in water. If some towline remains, reel in. Feather blades for zero speed.

CAUTION

Blade angle must be used to stop/hold reel when the air supply is depleted.

14.22.11 Loss of Turbine Control (IN/OUT Angle)

1. Reduce airspeed.
2. Shielded switch – TOW CUT.

14.22.12 Towline Speed Exceeds 5,500 FPM

14.22.12.1 Indications. Stop and cut function did not operate.

14.22.12.2 Procedures

1. Reduce airspeed.
2. Feather blades.
3. Brake – ON.
4. Shielded switch – TOW CUT.

PART VI

All-Weather Operation

CHAPTER 15

All-Weather Operation

15.1 INTRODUCTION

Discussion of special techniques and procedures for operation in adverse weather necessarily includes some instructions found in other sections of this handbook. Operating instructions covered in this section will be repeated only to establish the correct sequence of operations or to emphasize the importance of certain procedures. Any discussion concerning systems operation will be found in Part I.

15.2 INSTRUMENT FLIGHT PROCEDURES

This section presents certain characteristics and limitations of the aircraft during instrument flight conditions as a supplement to previous training and experience. Successful fulfillment of a mission under instrument flight conditions requires careful preflight planning, current instrument proficiency on the part of the pilot, and adequate instrumentation for climbout, cruise, and approach. The UHF receiver-transmitter (ARC-51A/ARC-159(V)) provides static free communication, and works in conjunction with the UHF homing adapter (ARC-50) receiver (automatic direction finding equipment). The ARR-69 is an auxiliary receiver providing the capability of full communications UHF-ADF approaches. The tacan operates in conjunction with surface navigation beacons to provide continuous directional and distance information to the pilot. The automatic flight control system (autopilot) facilitates instrument flying.

15.2.1 Instrument Takeoff

15.2.1.1 Prior to Takeoff. To reduce fuel consumption, complete as much as possible of the pretakeoff check in both cockpits before starting the engine.

1. Connect external source of electrical power.

2. Check all communications and navigation equipment for correct operation.

3. Set navigation equipment on local channel so that an immediate heading indication is available if an emergency develops after takeoff.

4. Check cockpit lighting and set as low as possible in order to retain night vision. Adjust the forward floodlights for use in reading instrument flight guides, maps, etc.

5. Check oxygen supply and oxygen mask fit.

6. Set the altimeter and note the altimeter error.

7. Adjust the all-attitude indicator.

8. Set clock.

9. Make mandatory autopilot preflight checks.

10. Check for proper operation of all directional instruments while taxiing.

11. Check canopy closed.

12. Complete normal checklist.

13. Review the procedure used to jettison stores during takeoff emergency.

15.2.1.2 Takeoff. When in takeoff position and lined up with the runway:

1. Check compass SLAVED and in synchronization.

2. Check all-attitude indicator for correct operation.

3. Switch IFF to NORMAL.

4. Turn on engine anti-icing/pitot heat switch as required. Do not prolong pitot heat use on the ground.

5. Advance throttle, maintaining directional control with brakes until rudder control is effective (approximately 70 knots).

6. When takeoff speed is reached, lift nose gently from the ground to prevent an excessively high angle of attack.

7. When aircraft is well clear of the ground, raise the gear.

8. Raise flaps 170 KIAS minimum wings level.

15.2.2 Basic Instruments. The procedures to be used in performing basic instrument maneuvers in the TA-4F/J are discussed in the following paragraphs:

15.2.3 Climb Schedule. Climb schedule for basic instrument flights will be 310 KIAS to 0.72 IMN to 240 KIAS minimum at higher altitudes.

Note

Although 310 KIAS is the preferred climb speed, when feasible climb speed will conform to local procedures.

15.2.4 Speed Changes

1. To reduce airspeed, reduce power to approximate power setting necessary for airspeed desired and extend speedbrakes. Retract speedbrakes 5 knots above desired airspeed. During transition, retrim aircraft as necessary.

2. When increasing airspeed, advance power to MILITARY. When desired airspeed is attained, reduce power to approximate power setting necessary to maintain desired airspeed and altitude.

15.2.5 Turns and Reversals

1. Turns and reversals will be performed at 300 knots. At bank angles steeper than 30°, it will be necessary to advance throttle to maintain airspeed.

2. Banks used will be 30°, 45°, and 60°.

3. Turns will be made in both directions with each of the above angles of bank. Turns will be maintained for twice the number of degrees as the angle of bank. For a 30° bank, turn right or left for 60° of turn; for 45° bank, turn right or left for 90° of turn; etc.

15.2.6 Vertical S-1 Pattern

1. The pattern describes a "W" in that it is a series of descents and climbs of 1,000 feet of altitude, while maintaining constant airspeed and heading.

2. The pattern will be performed at 250 knots in a clean configuration with speedbrakes IN.

3. Rate of descent will be 1,000 FPM and should be timed with the clock. It will be necessary to lead all transitions by 5 seconds.

15.2.6.1 Vertical S-2 Pattern

1. A vertical S-2 pattern is similar to the vertical S-1 pattern, except that a constant one-half standard-rate turn is maintained throughout the pattern.

2. After 1 minute, the pilot should have lost 1,000 feet and turned 90°. At the end of the second minute, he should have climbed 1,000 feet and turned 180°. After 3 minutes, he should have descended 1,000 feet and turned through 270°. After 4 minutes, he should have climbed 1,000 feet, bringing him back to the original heading and altitude.

15.2.6.2 Vertical S-3 Pattern. The vertical S-3 pattern is similar to the S-2 pattern, except that the turn is reversed after 180° of turn.

15.2.6.3 Yankee Pattern. Figure 15-1 is a diagram of the Yankee pattern.

15.2.7 Hooded Instrument Flight. Hooded instrument flight will not be undertaken unless positive ICS is available to both cockpits. If ICS is lost in flight, the aft cockpit shall go contact immediately.

15.2.8 Jet Penetrations. A penetration is a maneuver that combines a high rate of descent with a constant airspeed and maintains the aircraft within a specified airspace. It is designed to minimize fuel consumption and the effects of turbulence, icing, and wind; and serves to place the aircraft in position for a low approach. Prior to commencing a penetration, the following checklist should be completed.

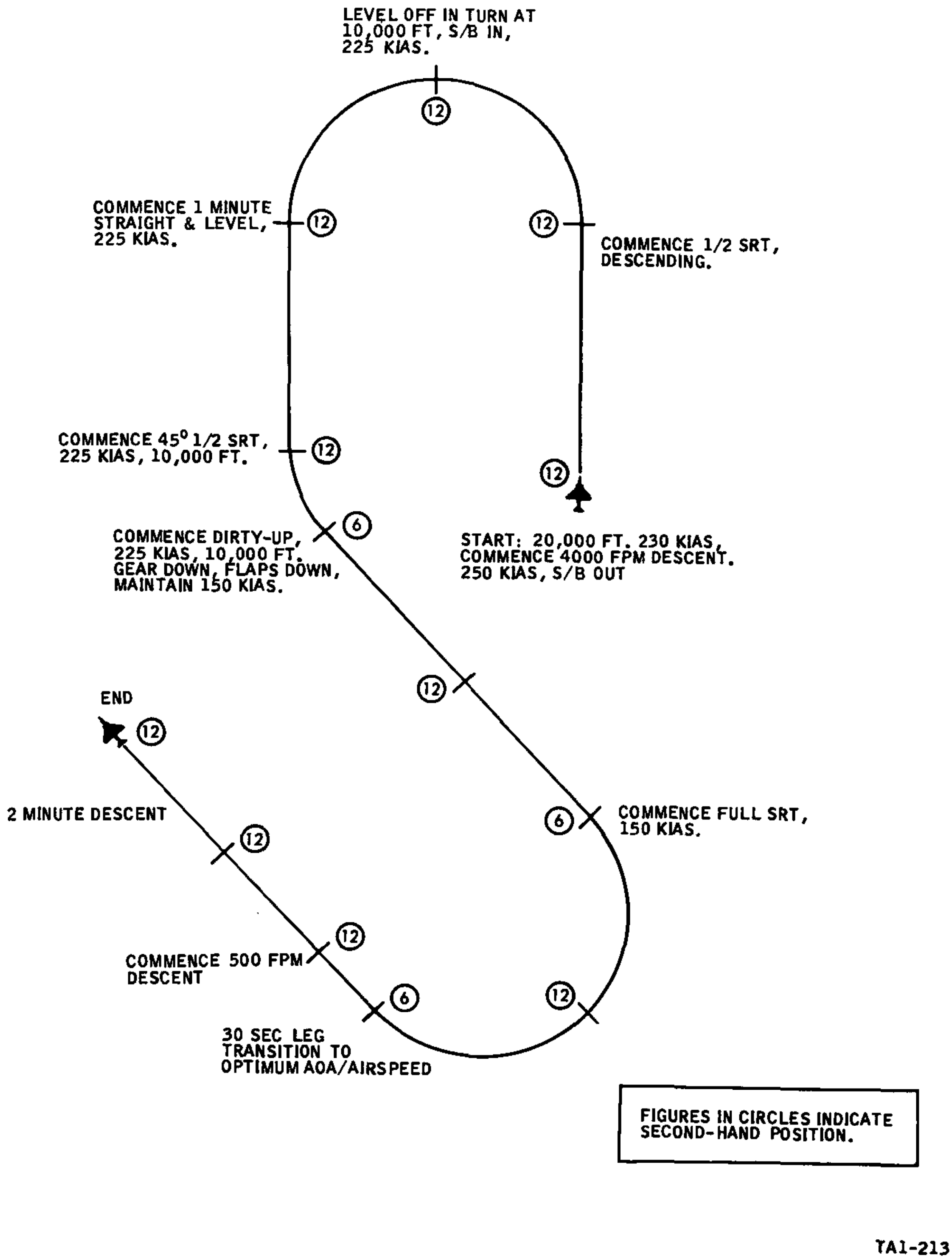


Figure 15-1. Yankee Pattern

1. Navaids — TUNED/IDENTIFIED.
2. Compass — ALIGNED.
3. Weather/field conditions — CHECKED.
4. Fuel — CHECKED.
5. Air conditioning — HOT.
6. Anti-ice — AS REQUIRED.
7. Pressure altimeter — CHECKED AND SET.
8. Radar altimeter — SET.

15.2.8.1 Clean Penetration. The clean penetration is conducted at 250 KIAS, speedbrakes OUT, and a rate of descent of 4,000 to 6,000 FPM. This will require an initial power setting of about 80 percent. At penetration fix and 230 KIAS, the nose is lowered to about 7° nosedown to start penetration. As airspeed reaches 245 knots, speedbrakes are extended. Maintain 250 knots and adjust power as necessary to maintain 4,000 to 6,000 FPM rate of descent. It is vital that the pilot be conscious of the aircraft's approach to each even 10,000-foot level to preclude misreading of the altimeter by 10,000 feet.

In the event of low-fuel state, a penetration can be accomplished, utilizing IDLE rpm and speedbrakes IN. Maintain 250 KIAS and adjust power as necessary to provide 4,000 to 6,000 FPM rate of descent. Windshield may frost up during this type of descent because of reduced defrost air circulation.

Start transition to level flight about 1,500 feet above the desired altitude. There is a tendency to lose altitude after bottoming out of the penetration and dirty-up which can be avoided by leading with adequate power. At leveloff during single aircraft approaches, retract speedbrakes and slow to and maintain gear-down speed. Gear and flaps shall be lowered in order to reach the final approach fix in a landing configuration at desired approach speed.

15.2.8.2 Dirty Penetration. The dirty penetration is recommended when one member of the flight has radio and/or NAVAIDS failure and it is necessary to penetrate in section to a minimum ceiling. Dirty-up is accomplished "VFR on top." When performed at night, the lead aircraft will keep his lights on BRT/STDY and his fuselage/anticollision light OUT. The controlling agency must be advised of the airspeed deviation prior to initiating this type of penetration.

The dirty penetration is performed at 170 knots, wheels and flaps DOWN, speedbrakes OUT, and a rate of descent of 3,000 to 5,000 FPM. Just prior to reaching initial penetration fix, slow to 225 knots, drop wheels and flaps. Upon reaching the fix, reduce throttle to 80 percent, drop the nose about 7° below the horizon, and extend the speedbrakes. Maintain 170 knots. Start transition to level flight about 1,500 feet above the desired altitude.

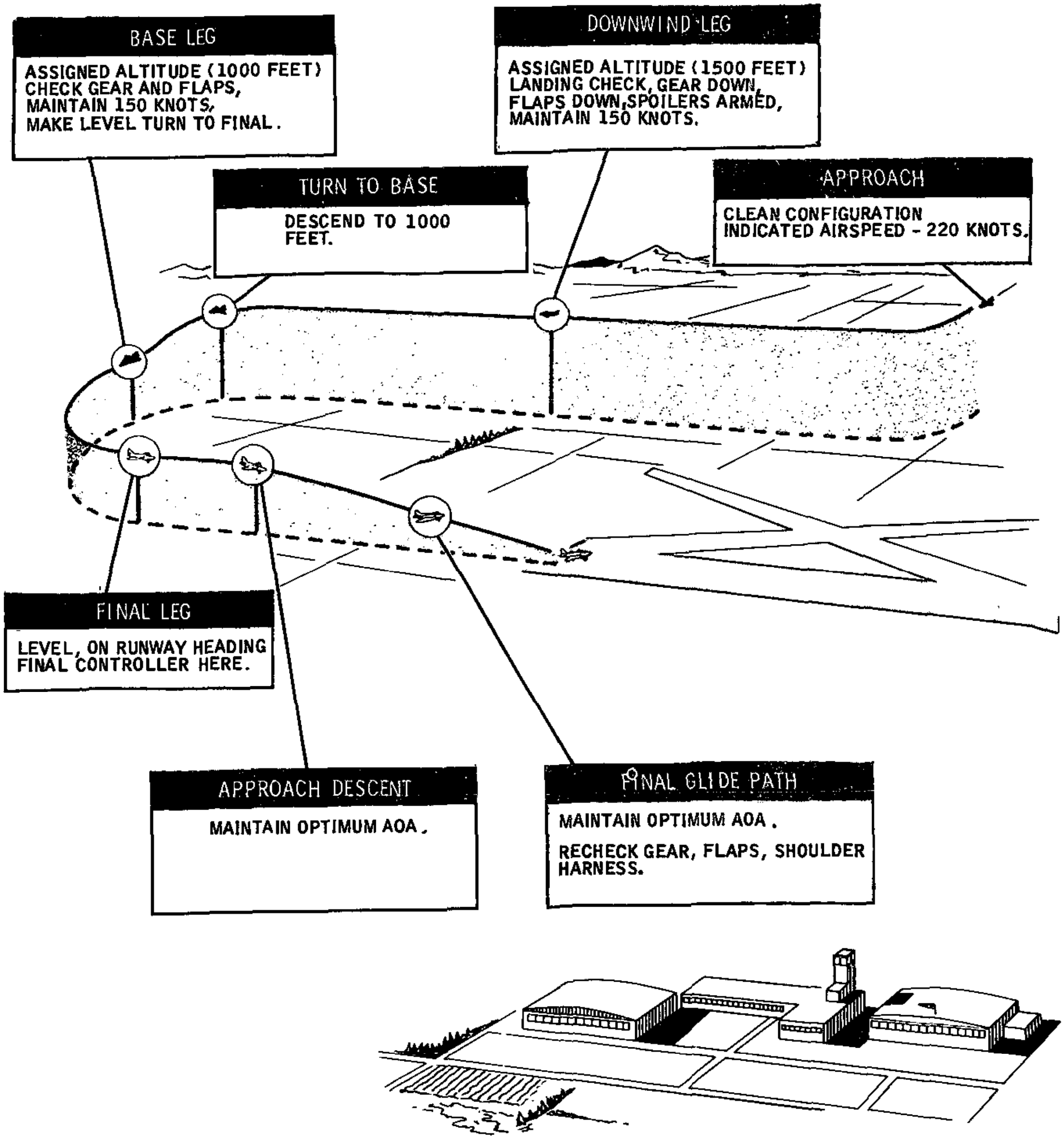
15.2.9 Ground-Controlled Approach. Achieving the precision necessary to make successful GCAs to minimums will require practice, alert flying, and smooth, coordinated control of power, attitude, and altitude. Turns in the pattern will be standard rate, with the following exceptions:

1. Do not exceed 30° bank.
2. Do not exceed 15° bank on final approach. Use positive rudder control in all turns.

The relatively small reflecting surfaces of the A-4 design may make it difficult, when precipitation is heavy, for the GCA controller to pick up the aircraft with radar for an initial entry. The pilot can assist the pickup by extending speedbrakes and landing gear higher in the pattern, until identified. Then he should go back to the normal GCA procedure. A typical GCA approach for the aircraft is shown on Figure 15-2.

15.2.9.1 Glidepath. Prior to descent down the glidepath, complete Landing Checklist. Assuming that the airspeed has been properly adjusted to final approach speed prior to reaching the glidepath, the following entry procedure will be used: When the controller says "You are approaching glidepath, commence standard rate of descent," *DO NOT* commence descent. When the controller says "You are up and on the glidepath," reduce throttle, drop nose slightly, and establish an initial rate of descent in accordance with the following table.

Groundspeed (knots)	Rate of Descent (FPM)
150	795
140	745
130	690
120	635
110	585



NOTES:

ALL TURNS STANDARD RATE.

ALL ALTITUDES ARE TERRAIN CLEARANCE.

VARY POWER SETTINGS WITH EXTERNAL STORES CARRIED.

AVERAGE FUEL CONSUMPTION: 400 POUNDS (INCLUDING PENETRATION).

AVERAGE TIME: 8 MINUTES (INCLUDING PENETRATION).

TA1-215-A

Figure 15-2. Typical Ground-Controlled Approach

In general, a 700 FPM rate of descent is most common, with a 100 FPM change per 20 knots change in groundspeed. Change rate of descent by 100 FPM for each 1/2° variation from a 3° glide slope.

15.2.9.2 Waveoff. When instructed, or when at GCA minimums and the field is not in sight, waveoff by adding full throttle, retracting speedbrakes (if applicable) when rotating the nose to a climbing attitude. When a positive climb is indicated by the vertical velocity indicator and altimeter, raise the gear, and commence a turn, if required. Do not raise the flaps until the wings are level and airspeed is 170 knots minimum. When the controller advises "Waveoff, tower instruction," this is a mandatory waveoff.

15.3 INSTRUMENTS

15.3.1 Section Penetrations/GCA. Section penetrations and/or GCAs will be necessary when certain conditions occur which preclude making an individual instrument approach (loss of Navaids, radio failure, flight-instruments failure, etc.). In section penetrations/GCAs, the wingman flies a comfortable parade formation, close enough to ensure visual contact on the side opposite the missed-approach turn, unless a significant crosswind component exists. In this case, the wingman should be positioned on the upwind side. It will be necessary for the leader to monitor the surface wind and position the wingman accordingly.

The wingman will follow the configuration changes of the leader. Appropriate signals for use in the penetration or GCA pattern are contained in Figure 16-10. After turning onto final, the leader should reduce speed to 140 knots for aircraft gross weight of 14,000 pounds or less with an increase of 5 knots for every additional 1,000 pounds in gross weight. The wingman should not descend below the leader once the descent on final is started until the leader signals the runway is visible and the wingman has the runway in sight. The leader will execute a low-visibility approach, another GCA, or a section landing as conditions (fuel, weather, etc.) require.

15.3.2 Section Landings. If a section landing is to be made, the leader will not pass the lead and each aircraft will land and roll out in the middle of his half of the runway.

WARNING

To preclude danger of decelerating approach or flying into leader's jet wash, NO ATTEMPT WILL BE MADE TO ESTABLISH LANDING INTERVAL ON FINAL.

CAUTION

If section landings must be made on slick runways or where significant crosswinds exist, be very careful during lineup, touchdown, and rollout.

Note

Prior to landing, coordinate the use of spoilers between aircraft.

Section penetrations/GCAs may be practiced to a landing; however, precedence dictates that individual landings will normally be made.

15.3.3 Section Loss of Visual Contact

1. When visual contact with the flight is lost during VFR conditions, proceed to a predetermined point for rendezvous.

2. When visual contact is lost during instrument conditions, the following procedures shall be followed:

a. Notify flight leader by radio.

b. Go on instruments, take 30° heading change away from leader, hold for 1 minute, and then resume original heading. If flying in division "fingertip" formation, dash 4 man take 60° heading change from base course away from section leader, hold for 1 minute, then resume original heading.

c. If flight conditions permit, wingman should reduce power slightly (1 to 2 percent) to permit additional separation.

d. The flight leader will have to determine whether the flight should attempt to rendezvous in VFR conditions, or if separation is to be established and maintained through normal ARTC procedures.

15.3.4 Low-Visibility Approaches. A low-visibility approach is used in conditions of low ceiling and/or visibility, when:

1. The approach heading of the aircraft varies from the runway heading to such a degree that it precludes an immediate landing from that direction.

2. The runway is crossed at an airspeed and/or altitude that precludes an immediate landing.

This approach should be made only when unable to maintain visual contact with the ground.

15.3.4.1 Procedure

1. When approaching a runway with a landing direction that is approximately 180° from the heading of the aircraft, fly two-thirds of the runway length, then execute a 90° SRT turn to the right, followed by a 270° SRT reversal to the left to the runway heading. Maintain an airspeed about 10 knots above optimum approach speed/AOA and at or above minimum circling altitude until the runway is again in sight.

2. When approaching the runway in the proper direction, but too high and fast for a landing, maintain an airspeed about 10 knots above optimum AOA/approach speed and execute a 360° left or right SRT. Adjust position by adding a straightaway downwind if necessary. Remain at or above circling minimums until the runway is again in sight.

3. When the aircraft is approximately 90° from the landing runway, cross at not more than one-third of the runway length from the approach end, at 90° from the runway heading. Hold this heading for 20 seconds and then execute a right or left SRT, as appropriate, for the runway heading.

15.4 WEATHER CONSIDERATIONS

In order to conduct flights in accordance with the latest weather information available, pilots on IFR flight plans in the continental United States should make maximum use of pilot-to-forecaster services. In addition, radar following can be requested of ARTCC on assigned frequency to assist in circumnavigation of storm centers.

Flights which are conducted at high altitudes following climbout through rain or aircraft cold-soaked during a previous flight, will occasionally experience control system icing (aileron or elevator). This is seldom of a serious nature and the controls may be kept free by frequent movement of the control stick fore and aft, or right and left, through neutral. If this is not effective, use trim as necessary and descend below freezing level, if possible.

15.4.1 Ice, Snow, and Rain. Precipitation can create flight hazards when the temperature borders on freezing. A thorough preflight inspection just prior to takeoff is essential. Frost can form on the wing surface in a very short time, making takeoff hazardous. Wet snow, if allowed to accumulate while the aircraft is on the ground, may freeze while the aircraft is gaining altitude and seriously reduce airspeed and range for an indefinite period. Takeoffs should never be attempted when frost, ice, or patches of wet snow adhere to the surfaces.

Note

The white and grey color of the aircraft surface may make it difficult to detect glaze ice formation on the wings. Because of the rapidity with which icing conditions may occur, the importance of making last minute checks of the exterior of the aircraft cannot be overstressed.

Taxiing on ice may present problems, particularly in a wind. Icing occurs in flight when freezing conditions exist and one or more of the following weather types are encountered: rain, fog, sleet, wet snow, supersaturated vapor, and high humidity.

WARNING

The aircraft is not equipped to prevent ice formation on the wings or fuselage and should not be flown in areas where heavy icing is likely to be encountered.

Two kinds of icing may be encountered in flight: aircraft icing or engine icing. A loss of airspeed is an indication of both types of icing. Engine icing is recognized by a decrease of engine rpm and an increase in tailpipe temperature. Icing may form in the air intake ducts forward of the engine, and is indicated by an increase in tailpipe temperature and a loss of airspeed, with rpm remaining constant. If engine chugs and stalls occur and icing of the inlet probe of the fuel control is the suspected cause, turn on engine anti-icing system, remain in PRIMARY and change altitude.

Snow or fog may occur in the cockpit on certain days when humid air reaches a low (air conditioning) temperature. This usually occurs during takeoffs and landings; within a few seconds visible moisture in front of the pilot may be so thick as to obscure the entire instrument panel. In the event of this phenomenon, the air conditioning control knob should be adjusted to full hot (to be readjusted later to a more comfortable temperature) by moving the air distribution lever to the FOOT position. Should this fail to correct the situation, the cockpit pressure switch should be moved to RAM. If high humidity exists on takeoff so that cockpit fogging or snow is anticipated, it is recommended that takeoffs be accomplished with the cockpit pressure switch at RAM, moving it to NORMAL after comfortably airborne.

In extremely cold weather, some moving parts may freeze. The two most likely to freeze are the slats and the landing gear microswitches. Because of the great force used to actuate the landing gear and gear doors, the gear doors themselves are not likely to freeze open or closed. Prior to takeoff, the pilot should check both slats for freedom of movement. In flight, there is the possibility that one or both slats may freeze closed in freezing rain. After flying in freezing rain, the pilot should check both slats during the approach and, if the slats are frozen in, should approach at an airspeed higher than the recommended approach speed. In order to get the proper rate of descent and flareout, the pilot must consider buffet onset as a minimum speed factor if the condition of wing slats is not known. Should a landing gear microswitch become frozen, an incorrect gear position indication would result.

Should canopy frosting occur from ice crystals on the inside, some side vision may be temporarily obtained by scraping off the ice.

On fields which have arresting gear, the arresting hook may be used for landing on wet or icy runways.

There is no water separator in the air conditioning system.

15.4.1.1 Rain Removal. The aircraft is equipped with a rain removal system to permit improved visibility upon encountering rain. (Refer to Rain Removal System, Part I, for additional information.)

15.4.1.2 Antifogging Compound. An antifogging compound, FSN RD 6850-200-2397-G500, for coating the interior surface of the windshield and canopy, prevents fogging of these transparent surfaces.

The antifogging compound is applied as follows:

1. Wash interior surface if it is excessively soiled.

2. Apply the antifogging compound, using the application unit.

3. Wipe the surface with a clean lintless cloth until it is clear.

CAUTION

- The antifogging compound has a detrimental softening effect on cellulose nitrate instrument lacquer when in contact over 1 hour. Care should be taken to prevent contact of the compound with the instrument panel finish.

- The antifogging compound has a severe swelling effect on rubber. Care should be taken to minimize contact of the compound with the rubber and sealant surrounding the windshield and canopy.

One application of the antifogging compound is effective for a minimum of 10 fogging and drying cycles. When there is doubt as to the condition of the film, a new film should be applied.

15.4.2 Flight In Turbulence and Thunderstorms. Flights through known areas of clear icing or severe turbulence should not be conducted.

15.4.2.1 Turbulence. The key to flying in turbulent air is to "fly attitude." Reduce airspeed to approximately 250 knots, fly the all-attitude indicator and pay less attention to altitude changes.

15.4.2.2 Thunderstorms. Whenever possible, thunderstorms should be bypassed. In the event a thunderstorm penetration is unavoidable, the following procedures have been thoroughly tested and proven to be effective.

If a storm area covers a wide front, it is usually advisable to fly above the weather to avoid heavy icing and hail-damage to the plastic nose. However, never attempt to top a storm by sacrificing optimum penetration airspeed. Should operations require some thunderstorm flying, an airspeed of about 250 KIAS will aid in reducing excessive gust loads in the structure. Vertical air currents in well developed thunderstorms will sometimes alter the aircraft altitude several thousand feet, and airspeed will fluctuate considerably. Rather than attempt to fly at a constant altitude, the pilot should maintain the initial flight attitude commensurate with a safe airspeed, keep a constant throttle setting, and use light stick forces to fly the attitude indicator. Abrupt pitch corrections should be avoided. Chasing the airspeed indicator should be avoided because the readings are unreliable during pressure changes within the storm cell and have been known to go to zero during thunderstorm penetration. Flying by pitch attitude reference should keep the airspeed and altitude relatively constant regardless of instrument indications.

15.4.2.2.1 Before Takeoff. A flight plan avoiding known thunderstorms must be made. A check should be made of all flight instruments, navigation equipment, interior lighting, and the anti-icing system. Pitot heat should not be left ON, as prolonged ground operation without cooling airflow can damage the heating element.

15.4.2.2.2 Approaching the Storm. Preparation before entering the storm may be generalized into four basic steps. The first letter of each step spells HALT: Heat, airspeed/attitude, light, and tight.

1. Heat – Anti-icing switch to ALL.

2. Airspeed/Attitude

   a. Reduce airspeed to about 250 KIAS and set throttle friction.

   b. Go on instruments and stabilize airspeed and attitude prior to penetrating the storm.

   c. Adjust all-attitude reference.

   d. Fly on a heading calculated to provide the quickest passage through the storm at an altitude affording the least turbulence and icing while clearing all ground obstacles by a wide margin. Use autopilot, if desired, but do not engage ALT hold.

3. Light – Turn all cockpit lights on BRIGHT including white floodlights. (Annunciator panel caution lights will be dimmed.)

4. Tight

   a. Lower the seat to prevent striking the head against the canopy and to reduce the blinding effect of lighting.

   b. Tighten torso harness straps.

   c. Lock shoulder harness.

15.4.2.2.3 In the Storm. Once inside the storm, the problem becomes one of holding attitude and heading. Don't chase the altimeter or the airspeed. The primary instrument is the attitude indicator. All control movements should be small and the tendency to fight every motion of the aircraft should be avoided. Maintain wings level and use as little horizontal stabilizer control as possible to minimize the possibility of overstressing the aircraft. The pilot should remember at all times that the aircraft is capable of safely penetrating the storm, however, some damage can be expected from the hail usually encountered. Maintain the initial heading through the storm, correcting any deviation from flight plan after emerging from the weather. Devote all attention to flying the aircraft. Expect turbulence, precipitation, and lightning. Do not allow these conditions to cause undue concern.

15.5 OPERATING CONDITIONS

15.5.1 Cold Weather Operations. Low temperatures will be encountered in all regions at high flight altitudes. However, most cold weather difficulties exist on the deck or airfield. Safety of flight depends on thorough preparation and careful observation of weather by the pilot. Equally important are preflight inspections which lessen the hazards of cold weather when the aircraft is exposed to ice, snow, and frost while on the ground.

WARNING

The collection of ice, snow, and frost on the aircraft surfaces constitutes one of the major flight hazards in low temperature operation and can result in loss of lift and treacherous stalling characteristics.

15.5.1.1 Before Entering the Aircraft. A thorough check of the following items should be made by the pilot before entering the cockpit:

1. Visually check engine intakes for evidence of ice.

2. Check fuel drains (defueling valves), fuel lines, and shutoff valves for frozen condensation.

3. Remove all ice from fuel tank vents, static air sources, and pitot tube.

4. Remove dirt and ice from shock struts. Inspect limit switches, door hinges, actuating cylinders, and wheels.

5. Check control surfaces and hinges.

6. Check wing slats for smooth roller and track movement and that they can be closed manually.

7. Check the entire aircraft for freedom from ice, snow, and frost. Remove ice carefully by approved methods and remove snow or frost by light brushing.

CAUTION

- Do not permit ground crew to scrape or chip ice from aircraft surfaces, as damage to skin will result.
- Check that water from ice removal does not refreeze, particularly on the control hinges.

8. Make sure that wheels are chocked securely to prevent slippage.

15.5.1.2 On Entering the Aircraft. The canopy seal must be inspected to ensure that no ice has accumulated to prevent proper seating.

15.5.1.3 Before Starting the Engine

1. Check that compressor rotates freely by momentary starter application. Engine heat on shutdown melts ice accumulated during previous flight, and the moisture may refreeze on the lower sections of the low pressure compressor blades. Heat may be applied to melt ice, and engine should be started as quickly as possible after the compressor is free.

2. Before starting, and with external power engaged, the pitot heater should be checked, but should not be left ON, as prolonged ground operation without cooling airflow can damage the heating element.

3. Connect antiexposure suit and check blower operation.

15.5.1.4 Starting and Warmup Ground Check

1. Use normal procedure for starting engine. If temperature is less than -35 °C, run at IDLE for 2 minutes before takeoff.

2. Make sure all instruments have been sufficiently warmed up to ensure normal operation.

Check for sluggish instrument indicator movement during taxiing.

3. Check all flight controls, both visually and by feel, for unrestricted movement.

4. Run through a complete cycle with rudder trim, stabilizer trim, aileron trim (observing the tab), stick, speedbrakes, and flaps, several times, to ensure correct operation.

5. Cabin temperature knob as desired.

6. Use caution while running engine up on a slippery surface, as the chocks may slide. A normal full power check can be made during the initial part of the takeoff roll.

15.5.1.5 Taxiing

1. If it is necessary to taxi on ice or snow, allow greater distance for braking action. Skidding may occur with temporary loss of control when sharp turns are made or when a crosswind exists. Taxiing in deep snow is difficult and may also cause freezing of brakes and gear after takeoff.

2. Avoid taxiing through melted snow or slush caused by the jet blast of the other aircraft, to prevent accumulation of ice on the aircraft surfaces.

3. Use caution when taxiing in the vicinity of other aircraft. Increase the space between aircraft to ensure safe stopping distance. Jet blast can impair visibility by blowing clouds of dry snow over a large area.

4. Minimize taxi time to conserve fuel and reduce amount of ice-fog generated by jet engines.

15.5.1.6 Before Takeoff

1. Turn air conditioning temperature to hot temporarily, to ensure minimum fogging and frosting.

WARNING

Do not take off with frosted windshield, or with frost, snow, or ice on wings or control surfaces.

2. Pitot heat ON just prior to takeoff.

3. If surface of runway is too slippery for engine runup, the power check must be made during early part of takeoff.

15.5.1.7 Takeoff

1. When starting the takeoff run, advance the throttle rapidly and check engine instruments.

2. After takeoff from snow or slush covered runways, operate the landing gear and wing flaps through several cycles to prevent possible freezing in the up position. (Expect considerably slower operation of the landing gear in cold weather.)

CAUTION

- Do not exceed the wheels and flaps down airspeed limits during the cycling operation.
- Do not apply brakes to stop rotation of retracted wheels.

3. Check instruments – At extremely low outside air temperatures, instruments should be sufficiently warmed up to ensure reliable operation.

15.5.1.8 During Flight

1. The flight characteristics of the aircraft are not affected by cold weather, although colder than normal temperature increases air density and produces greater RAM pressure. Engine rpm, therefore, may be reduced to establish the desired airspeed-altitude combination for maximum range.

2. Use cockpit air conditioning system as desired.

15.5.1.9 Descent

1. Should canopy frosting or fog or snow in the cockpit occur, increase the temperature. The heated windshield (nesa glass) should give forward vision and, in an emergency, some side vision can be obtained by scraping off the ice with a glove. (Use a kneeboard or sharp object only in an extreme emergency.)

2. If flight has been through freezing rain, check that slats open in the landing approach. (Refer to Ice, Snow, and Rain.)

3. A carrier-type approach is recommended for landing on wet and icy runways to lessen the possibility of skidding. This gives the maximum runway available, requires a minimum of braking, and allows landing at the lowest airspeed.

WARNING

Ice present on wing surface may significantly increase stalling speed even if slats operate normally. Approach speed should be held above optimum if ice is detected. Consider arrested landing if higher than normal approach speed is utilized.

15.5.1.10 Landing. When landing on snow, wet, or ice-covered runways, be careful to avoid drift which will cause skidding and consequent loss of control. Maintain a straight course down the runway, applying brakes evenly and lightly. The best approach to a landing on wet and icy runways is a carrier type approach, with touchdown as close to the end of the runway as possible. After touchdown, if crosswinds are not a factor, leave flaps down for increased drag and shortened rollout. The proper braking technique is light, even application of the pedals. If the aircraft starts to skid, the brakes should be released and light, even braking resumed after the aircraft again tracks normally.

Note

Hard braking on icy or wet runways may result in dangerous skidding or fishtailing.

Be certain to turn the pitot heater and engine antiicing switch OFF after landing.

15.5.1.11 Shutdown and Postflight

1. Use normal shutdown procedures.

2. See that wheels are chocked securely.

3. Have aircraft serviced, and fuel lines (defueling valves) drained. Every effort should be made during servicing to prevent moisture from entering fuel system.

4. Have covers and plugs installed in mooring outside. Make certain aircraft is tied down securely.

5. If it is not snowing or raining, leave canopy open to allow circulation until cockpit has cooled off, to prevent canopy cracking from differential contraction.

15.5.2 Hot Weather and Desert Operation. When wearing tight clothing, take as little time as possible in getting the engine started if ground connected air conditioning is not provided for the cockpits. Metal exposed to the sun can inflict severe burns.

15.5.2.1 Before Starting Engine

1. Make visual inspection of aircraft exterior, checking for system leakages, sand or dust accumulation, tire overinflation or blistering, corrosion, and loose inspection plates.

2. See that all lockpins, protective covers, and plugs (including pitot head cover) are removed.

3. Make any other necessary ground checks prior to starting engine, such as oxygen and fuel servicing.

4. Make sure air-conditioning system is turned on.

15.5.2.2 After Starting Engine

1. Make engine ground runup as short as possible.

2. Acceleration to IDLE rpm will take longer than on normal or cold day.

15.5.2.3 Taxiing and Takeoff

1. Use nosewheel steering for directional control during taxi.

2. Avoid excessive use of brakes.

CAUTION

When aggravated by hot weather, excessive use of brakes is likely to increase tire pressure and decrease both tire and wheel strength sufficiently to cause explosive failure. Such a failure, if it occurs after a wheel is retracted, can rupture a door fairing or integral fuel tank.

3. Watch exhaust temperatures closely.

4. Because of the lower density of air in hot weather, be prepared for slower acceleration, longer takeoff distance, and reduced thrust at all throttle settings. The increased requirements for takeoff distances commonly associated with hot weather operation of any aircraft is even greater for jets. An increase in temperature of 1 °C will result in a 1-percent increase in takeoff distance. TAS will be greater for the normal IAS and strict adherence to recommended IAS is essential to safe flight.

CAUTION

Do not attempt to take off in a sandstorm or dust storm. Park the aircraft crosswind and shut down the engine to prevent sand or dirt from damaging the engine.

Note

When operational conditions require takeoffs where computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on chart, lift-off speed should be increased approximately 5 to 10 knots; not to exceed tire limiting speed. This will result in increased rates of climb. Runway length and location of abort gear must be considered in planning this type of takeoff.

15.5.2.4 Before Leaving Aircraft

1. If sand or dust is not blowing, leave canopy open to permit air circulation within the cockpit.

2. Check that protective covers are installed on pitot tube, canopy, and intake and exhaust ducts.

PART VII

Communication Procedures

CHAPTER 16

Communication Procedures

16.1 COMMUNICATIONS

16.1.1 General. Because of the nature of jet operations, voice radio is normally used for communications between aircraft. Occasionally, however, conditions of radio silence are prescribed for certain operations. Proficiency in the use of visual signals must therefore be maintained by all pilots.

Information and additional references concerning the following categories of radio/electronic communications are contained in NWP 4:

1. Communications procedures and terminology
2. Operational use of voice radio
3. Standard fleet weather reporting procedures
4. Contact reports
5. Aircraft identification procedures
6. IFF/SIF procedures.

16.1.2 Radio Communications

16.1.2.1 Radio Discipline. Good operating procedures must be practiced by each pilot if radio communication is to be effective. Compliance with the basic, common-sense guidelines of correct radio operation which follow, will eleminate the most frequent breaches of good radio discipline:

1. Use proper R/T voice procedure and terminology.
2. Do not cut in on other transmissions.
3. Make only necessary transmissions and then be as brief as possible.
4. Use complete call signs to avoid confusion.
5. Mentally phrase a message prior to keying the mike.
6. Delay the transmission about 1 second after keying the mike to avoid loss of the first syllable.
7. Transmit on the guard channel only in an emergency.
8. Leave the UHF selector switch on T/R & G position.
9. Take pride in a "silent" flight, if it can be accomplished safely and effectively.
10. Do not switch the radio of IFF/SIF frequency codes below 2,500 feet under night or instrument conditions except for urgent military necessity. If this necessity arises, the aircraft should be in stabilized, level flight before changing frequencies or codes. Preferably, changes in frequencies or codes should be made by the pilot not actively flying the aircraft.

16.1.3 Visual Communications. Aircraft visual communications include those made with the hands or other parts of the body, aircraft maneuver, code transmission, or lights. Ground-to-air signals also include panel signals or other displays.

Information and additional references concerning the following categories of visual communications are contained in NWP 4.

1. Air station control-tower light signals.
2. Signals between ground and aircraft for use by downed pilots. These include: body signals, international ground-air emergency codes and aircraft replies, paulin signals, pyrotechnics, miscellaneous, ground search-party signals, and RESCAP rescue signals.

Visual signals should be used between aircraft whenever practicable, provided no loss in operational efficiency results. Those signals with which the pilot is primarily concerned are contained in this manual, as follows:

1. Starting and poststart signals (Figure 16-2).

2. No-radio-penetration/instrument-approach signals (Figure 16-2).

3. Flight signals between aircraft:

   a. General signals – Figure 16-1

   b. Takeoff, changing lead, leaving formation, breakup, and landing – Figure 16-3

   c. Formation – Figure 16-4

   d. Electronic communications and navigation – Figure 16-5

   e. Armament – Figure 16-6

   f. Aircraft and engine operation – Figure 16-7

   g. Air refueling – Figure 16-8

   h. Emergency signals between aircraft – Figure 16-9.

4. Arming and dearming signals – Figure 16-11.

5. Postflight ground crew to pilot signals – Figure 16-12.

6. Signals between aircraft and surface ships – Part VII.

7. Surface ship one letter code – Part VII.

16.1.4 Night Tactical Signals. Night tactical signals are usually given on voice radio, but they may be transmitted by the use of external lights or by a maneuver using the appropriate signal as shown. Maneuvers at night should be kept to a minimum consistent with the effective performance of the assigned task.

16.1.5 Signals Between Aircraft and Surface Ships. If an aircraft which is not in radio communication with a ship wishes to attract attention to survivors or to an aircraft in distress, a standard procedure is used. The aircraft first circles the ship closely at low altitude. This circle is made at least once. The pilot then flies across the bow of the ship at low altitude with the hook up, changing power setting and rocking the wings. After this, he heads in the direction of the distress incident. Flight across the bow and in the direction of the incident is repeated until the ship acknowledges by following the aircraft.

The ship should either follow the aircraft or indicate by visual signal NOVEMBER that this is impossible. The action taken must be reported to the OTC. Surface ships may use signals from the one-letter code given below when assisting a distressed aircraft.

16.1.6 Surface Ship One-Letter Code. A one-letter aircraft code is available to surface ships for the controlling of aircraft. The code is peculiar to aircraft operations and is limited to that use. The signals are made only by flashing-light or deck panels. Letters and their meanings are as follows:

Code	Meaning	Code	Meaning
B	Make passes.	M	Proceed to base or carrier in accordance with doctrine or orders. (Unless otherwise briefed, this signal will mean to proceed to the designated bingo field, or, if not designated, to the nearest suitable field.)
C	Land aboard.	Q	Jettison bombs.
D	Delay; re-form; remain within signal distance until further notice. (When the delay in recovery will be for more than 5 minutes, the number of minutes, in tens, may be flashed after the letter D. Example: A 20-minute delay would be indicated by flashing the signal D2.	R	Radio failure. (By aircraft, utilizing the external lights or white fuselage lights.)
F	Flaps are not down.	S	Flight commander fly alongside and read signals.
G	Jettison droppable fuel tank(s).	U	Turn off (on) running lights.
H	Hook is not down.	W	Lower landing gear.
K	Your (my) plane is damaged (unless otherwise directed, plane should land aboard carrier last).	X	Previous landing order canceled.
		Z	Do not land aboard; land plane in water or eject.

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
1. Thumbs up, or nod of head.	Flashlight moved vertically up-and-down repeatedly.	Affirmative. ("Yes," or, "I understand.")	
2. Thumbs down, or turn of head from side to side.	Flashlight moved horizontally back-and-forth repeatedly.	Negative. ("No," or, "I do not understand.")	
3. Hand cupped behind ear as if listening.		Question. Used in conjunction with another signal, this gesture indicates that the signal is interrogatory.	As appropriate.
4. Hand held up, with palm outward.		Wait.	
5. Hand waved back and forth in an erasing motion in front of face, with palm turned forward.	Letter N in code, given with external lights.	Ignore my last signal.	
6. Hand held up, with thumb and forefinger forming an O and remaining fingers extended.		Perfect, well done.	
7. Employ fingers held vertically to indicate desired numerals 1 through 5. With fingers horizontal, indicate number which added to 5 gives desired number from 6 to 9. A clenched fist indicates 0. (Hold hand near canopy when signaling.)		Numerals as indicated.	A nod of the head ("I understand"). To verify numerals, addressee repeats. If originator nods, interpretation is correct. If originator repeats numerals, addressee should continue to verify them until they are understood.
8. Make hand into cup-shape, then make repeated pouring motions.		I am going to dump fuel.	
9. Slashing motion of index finger across throat.		I have stopped dumping fuel.	
10. Shaking stick sharply by pilot not in control of aircraft.	Same	I am assuming control of the aircraft.	Pilot in control shakes stick sharply signaling relinquishment of aircraft control. If hooded, go visual immediately.
11. Striking left side of canopy twice with clenched fist followed by pointing motion upward with index finger.	Striking left side of canopy with lighted flashlight followed by continued rotation of flashlight beam between opposite cockpit and vertically upward.	Assume ejection position and eject.	Execute.
12. Horizontal ∞ sign	Same with wands.	You are on fire.	As required.

Figure 16-1. General Signals

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
1. Pilot holds one finger vertically.	Same	Start GTC and apply electrical power.	P/C execute.	Same. NOTE 1
2. Plane captain holds two fingers vertically, then points to: Pilot (for pilot-controlled start) or Self (for ground-controlled start). NOTE 2	Same	GTC is up to speed and READY light is lit. GTC hose connected. Electrical power for ignition available. 1. This will be a pilot-controlled start. 2. This will be a ground-controlled start.	None	Same
3. Pilot holds two fingers vertically.	Same	1. If pilot-controlled start, START-ABORT switch is depressed. 2. If ground-controlled start, P/C open GTC air valve.	P/C returns rotating two-finger signal when GTC hose inflates.	P/C rotates flashlight vertically when GTC hose inflates.
4. Pilot holds three fingers vertically.	Same	1. Pilot-controlled start: START-ABORT switch has popped up. P/C remove starting air hose. 2. Ground-controlled start: Engine RPM is at 45 percent P/C close GTC air valve and remove starting air hose.	1. P/C checks for GTC hose collapse, removes starting air hose. 2.. P/C closes GTC air valve, checks for hose collapse, removes starting air hose.	Same
4A. Pilot holds four fingers vertically.	Same	Remove electrical cable.	P/C selects internal electrical power, secures power unit, removes electrical cable, secures access panels.	Same
5. If necessary, P/C attract pilot's attention by waving arms over head. Give "cut" signal by slashing motion of index finger across throat.	If necessary, P/C attract pilot's attention with flashlight. Give "cut" signal by repeated slashing of flashlight across throat.	Secure start/cut engine.	Pilot move throttle to OFF.	Same

Figure 16-2. Starting and Poststart Signals (Sheet 1 of 5)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
6. P/C gives "OK" signal by forming circle with thumb and forefinger, with remaining fingers extended.	Same	Hydraulic pressure is 3000 psi on wheelwell gages.	Pilot acknowledges with "thumbs-up."	Pilot moves horizontally-held flashlight up and down several times.
7. P/C holds vertical fist in front, makes large horizontal circle with fist. NOTE 2	Same, except with vertically held flashlight pointed upward. NOTE 2	Pilot move all controls through full travel, checking for proper throw and feel, no hydraulic ladder lights ON when flight controls are moved rapidly. Then position flight controls as follows: full left rudder, stick full aft and port.	Pilot execute. P/C check control surface for correct deflection.	Same
8. P/C holds hands in front of body with palms together horizontally and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2, 3, & 7	Same NOTES 2, 3 & 7	1. Lower flaps. 2. Raise flaps.	Pilot execute. P/C check both flaps for: 1. Full deflection and security. (Certain ordnance configurations may restrict flaps to less than full deflection.) 2. Full retraction and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
9. P/C gives previous signal, followed immediately by "plus" sign formed by index fingers. NOTES 2 & 3	Same NOTES 2 & 3	Pilot raise or lower flaps to 1/2 deflection as signaled.	Pilot execute. P/C check both flaps for 1/2 deflection and security. If satisfactory, give pilot "thumbs-up" after check is complete.	Same
10. P/C holds hand in front, palm vertical, and makes: Open, or Closing motion with palms in alligator-mouth fashion. NOTES 2 & 3	Same NOTES 2 & 3	1. Extend speedbrakes. 2. Retract speedbrakes.	Pilot execute. P/C check both speedbrakes for: 1. Full extension, leaks, security. 2. Full retraction. If satisfactory, give pilot "thumbs-up" after check is completed.	Same

Figure 16-2. Starting and Poststart Signals (Sheet 2 of 5)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
11. P/C holds hand in front and Suddenly lowers other fist, with thumb extended downward to meet horizontal palm of extended hand. Suddenly raises other fist, with thumb extended upward to meet horizontal palm of extended hand. NOTES 2 & 3	Same, except points flashlight vice thumb toward extended palm of hand in direction desired. NOTES 2 & 3	 1. Lower arresting hook. 2. Raise arresting hook.	Pilot execute. P/C check: 1. Hook down and for effective snubber action. 2. Hook retracted and centered. If satisfactory, give pilot "thumbs-up" after check is completed.	Same
12. P/C extends arms directly in front of himself placing *right palm on top of* left palm, and with positive movement, raises right hand directly overhead.	Same, except make signal with wands.	Activate spoilers open.	Turn spoiler switch to ARM. Advance and quickly retard throttle. Spoilers should close and reopen.	Same
P/C lowers arm to original extended position.	Same, except make signal with wands.	Activate spoilers closed.	Pilot turns spoiler switch OFF. When spoilers close, P/C gives "thumbs-up" to pilot.	Same
12A. P/C alternately extends his arms in a pushing motion with palms facing forward.	Same, except make signal with wands.	Momentarily deflect rudder pedals.	Pilot execute.	Pilot execute.
13. P/C holds one finger aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle and set rudder trim to 0 degrees, using trim indicator.	Pilot execute. P/C points index finger toward vertical palm of other hand in direction rudder must be moved if not faired by pilot. When faired, P/C give next sequential signal. Pilot check indicator for possible error and note.	Pilot: same. P/C: same, except use flashlight vice finger to indicate direction rudder must be moved.
14. P/C holds two fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTE 4	Cycle, override in both directions, and set the elevator trim to 8 degrees noseup, using trim indicator. (If a setting other than 8 degrees noseup trim is desired, the pilot shall inform P/C of desired setting prior to start.)	Pilot execute. P/C indicate trim setting by numerical hand signal. Pilot check indicator for possible error, note same and correct trim setting if error exists.	Pilot: same. P/C: same, except use flashlight vice finger to indicate direction elevator must be moved.

Figure 16-2. Starting and Poststart Signals (Sheet 3 of 5)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
15. P/C holds three fingers aloft. NOTE 4	Same. Illuminated by flashlight. NOTES 4 & 5	Cycle aileron trim and follow P/C signals. Check stick centered and aileron followup tab ±11/32 inch from aileron.	Pilot execute. P/C signal cycling of aileron trim and set ailerons to symmetrical (both equally up, down, or even) and tab at ±11/32 inch.	Same
16. P/C holds four fingers aloft.	Same. Illuminated by flashlight.	Pressurize external drop tanks and/or buddy store. P/C check pressurization.	Pilot execute.	Same
P/C holds five fingers aloft.	Same. Illuminated by flashlight.	Depressurize external drop tanks and/or buddy store. P/C check depressurization.	Pilot execute.	Same
16A. P/C gives two finger turnup then holds thumb and forefinger together, palm down, and moves hand in fore and aft motion. P/C gives "thumbs-up" or "thumbs-down."	Same. Illuminated by flashlight.	Select emergency transfer, throttle to 70-percent rpm, 10 to 15 seconds after fuel transfer caution light OUT, select emergency fuel transfer OFF. P/C places palm under vent mask, checks venting and pressure release.	Pilot execute.	Same
16B. P/C gives horizontal finger "SIX."	Same	Activate emergency transfer.	Pilot execute.	Same
P/C gives horizontal finger "SEVEN."	Same	Deactivate emergency transfer.	Pilot execute.	Same
17. Pilot points one finger at eye.	Same NOTE 6	P/C check all exterior lights BRIGHT, then DIM. (Modify locally, as necessary, according to situation.)	P/C execute. Give pilot "thumbs-up" after checking lights BRT, then check on DIM.	Same
18. P/C holds nose, then gives "thumbs-up or down."	Same	Aircraft has no visible fuel, oil, or hydraulic leaks. Fuel has ceased draining from gang drain. (During start, indicates wet start.)	Pilot acknowledge with "thumbs-up."	Same
19. Pilot holds closed fist with thumb extended horizontal.	Same except flashlight vice thumb held horizontal.	P/C cycle approach light hook bypass switch in nose wheelwell.	P/C execute.	Same
20. P/C's right hand unclasps/clasps left forearm with left fist clenched. P/C forms circle with thumb and forefinger, then extracts forefinger of opposite hand from circle.	Same	May I remove downlock/undercarriage pins and may arming crew remove external store/rack safety pins.	Pilot give "thumbs-up" (YES) or "thumbs-down" (NO). If yes, P/C removes pins and holds for pilot to count before stowing in pin bag in left-hand wheelwell or aft hell-hole.	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.

Figure 16-2. Starting and Poststart Signals (Sheet 4 of 5)

SIGNAL		MEANING	RESPONSE	
DAY	NIGHT	DAY AND NIGHT	DAY	NIGHT
21. P/C pats back of neck with hand.	Same. Use flashlight vice hand.	Check ejection control safety handle in desired position.	Pilot check handle.	Same
22. P/C gives one-finger turnup when cleared by flight deck director.	Same, illuminated by wand.	You are cleared for turnup for fuel control check.	Pilot executes fuel control check.	Same
23. P/C extends arm bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	Pilot gives "thumb-up" (YES) or "thumbs-down" (NO).	Same, except pilot moves horizontally-held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.
24. Plane director puts forefinger on end of nose then gives a "thumbs-up."	Same. Use wands vice fingers.	Tillerbar connected. Director will assume directional control.	Head nod. Pilot contronls only speed of aircraft with brakes.	Same
Plane director puts forefinger on end of nose then makes a downward sweeping motion with forearm toward direction of aircraft movement.	Same. Use wands vice fingers.	Tillerbar disconnected. Pilot will assume directional control.	Head nod. Pilot assumes directional control.	Same

NOTES:

1. Where night signal is listed as "Same," unless otherwise indicated, signal is identical to day signal, except red flashlight is used to illuminate hand (if appropriate).
2. Prior to giving this signal, the affected area must be checked visually by the P/C to ensure that there exists no hazard to personnel.
3. Normally, these hand signals will be given in close sequence without hesitation, i.e., flaps, speedbrakes, etc,. The pilot(s) shall hold up both hands to prevent actuation of any hydraulically operated system while the Plane Captain checks speedbrakes, flaps, spoilers, and hook.
4. P/C shall be stationed at port wing tip, within sight of pilot, for the trim signals.
5. After giving three-finger signal, P/C illuminates followup tab from inboard end.
6. For use prior to night flight or at pilot's discretion.
7. During extended periods of operation where ordnance configurations which limit flaps to less than full extension will be among those used, this check may be conducted using half flaps versus full flaps extension.

Figure 16-2. Starting and Poststart Signals (Sheet 5 of 5)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
1. Section takeoff-leader raises either forearm to vertical position. 2. Wingman raises forearm. 3. Leader lowers arm.	Refer to Night Flying, Section III, for night section takeoff light signals.	1. I have completed my takeoff checklist and am ready for takeoff. 2. I have completed my takeoff checklist and am ready for takeoff. 3. Takeoff path is clear, I am commencing takeoff.	1. Stands by for reply from wingman, holding arm up until answered. 2. Wingman lowers arm and stands by for immediate takeoff. 3. Execute section takeoff.
Leader pats self on the head, points to wingman.	1. Lead aircraft switches lights to BRT/STDY. 2. If external lights are inoperative, leader shines flashlight on hard hat then shines light on wingman.	Leader shifting lead to wingman.	1. Wingman pats head and assumes lead. 2. Wingman places lights on DIM/STDY and assumes lead. 3. Wingman shines flashlight at leader, then on his hard hat and assumes lead.
Wingman pats self on head, then points to self.	1. Wingman turns lights DIM/STEADY, ANTI-COLLISION LIGHT OFF. 2. If lights INOP, Wingman points flashlight at lead, then at his own helmet.	I desire to take the lead.	NIGHT: Lead aircraft turns lights on BRT/STEADY, ANTI-COLLISION lights on, assumes wingman position. DAY: Lead pats self on head, points to wingman, assumes wingman position.
Leader pats self on head and holds up two or more fingers.		Leader shifting lead to division designated by numerals.	Wingman relay signal; division leader designated assumes lead.
Pilot blows kiss to leader.		I am leaving formation.	Leader nods ("I understand") or waves goodby.
Leader blows kiss and points to aircraft.		Aircraft pointed out leave formation.	Wingman indicated blows kiss and executes.
Leader points to wingman then points to eye, then to vessel or object.		Directs plane to investigate object or vessel.	Wingman indicated blows kiss and executes.
Division leader holds up and rotates two fingers in horizontal circle, preparatory to breaking off.		Section break off.	Wingman relays signal to section leader. Section leader nods ("I understand") or waves goodby and executes.
Leader holds hand over head and makes a circular motion with forefinger extended.	Series of "I's" in code, given by external lights.	Breakup (and rendezvous).	Wingman take lead, pass signal after leader breaks, and follow.
Landing motion with open hand:		Refers to landing of aircraft, generally used in conjunction with another signal.	
1. Followed by patting head.		1. I am landing.	1. Nods. ("I understand") or waves goodby.
2. Followed by pointing to another aircraft.		2. Directs indicated aircraft to land.	2. Aircraft indicated repeats signal, blows a kiss and executes.

Figure 16-3. Takeoff, Changing Lead, Leaving Formation, Breakup, Landing

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Open hand held vertically and moved forward or backward, palm in direction of movement.		Adjust wing-position forward or aft.	Wingman moves in direction indicated.
Open hand held horizontally and moved slowly up or down, palm in direction of movement.		Adjust wing-position up or down.	Wingman moves up or down as indicated.
Open hand used as if beckoning inboard or pushing outboard.		Adjust wing-position laterally toward or away from leader.	Wingman moves in direction indicated.
Hand opened flat and palm down, simulating dive or climb.		I am going to dive or climb.	Prepare to execute.
Hand moved horizontally above glareshield, palm down.		Leveling off.	Prepare to execute.
Head moved backward.		Slow down.	Execute.
Head moved forward.		Speed up.	Execute.
Head nodded right or left.		I am turning right or left.	Prepare to execute.
Thumb waved backward over shoulder.	Series of 00's in code, given by external lights.	Take cruising formation or open up.	Execute.
1. Holds up right (or left) forearm vertically, with clenched fist or single wing-dip. 2. Same as above, except with pumping motion or double wing-dip.	1. Single letter R (or K) in code, given by lights. 2. Series of RR's (or KK's) in code, given by external lights.	1. Wingman cross under to right (or left) echelon or in direction of wing-dips. 2. Section cross under to right (or left) echelon or in direction of wing-dips.	1. Execute. 2. Execute.
Triple wing-dip.		Division cross under.	Execute.
	Series of VV's in code, given by external lights.	Form a Vee or balanced formation.	Execute.
Series of zooms.	Series of XX's in code, given by external lights.	Close up or join up; join up on me.	Execute.
Rocking of wings by leader.		Prepare to attack.	Execute preparation to attack.
Rocking of wings by any other member of flight.		We are being, or are about to be, attacked.	Standby for and execute defensive maneuvers.

Figure 16-4. Formation Signals (Sheet 1 of 2)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Lead plane swishes tail.		All aircraft in this formation form stepdown column in tactical order behind *column leader*.	Execute. Leader speeds up slightly to facilitate formation of column.
Shaking of ailerons.	Long dash, given with external lights.	Execute signal; used as required in conjunction with another signal.	Execute last signal given.

Figure 16-4. Formation Signals (Sheet 2 of 2)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Tap earphones, followed by patting of head, and point to another plane.		Take over communications.	Repeat signals, pointing to self, and assume communications lead.
Tap earphones, followed by patting of head.		I have taken over communications.	Nod ("I understand").
Tap earphones and indicate by finger-numerals, number of channel to which shifting.		Shift to radio frequency indicated by numerals.	Repeat signal and execute.
Tap earphones, extend forearm vertically, and rotate fingers, formed as if holding a grapefruit, followed by 4 numbers.		Manually set up ARC-51A on frequency indicated.	Repeat signal and execute.
Tap earphones, followed by question signal.		What channel (or frequency) are you on?	Indicate channel (or frequency) by finger-numerals.
Tap earphones and point to plane being called, followed by finger-numbers indicating frequency.		You are being called by radio on channel indicated by finger numbers.	Repeat numbers. Check receiving frequency and switch to channel indicated by originator. Dial in manually, if necessary.
Vertical hand, with fingers pointed ahead and moved in a horizontal sweeping motion, with four fingers extended and separated.		What is bearing and distance to TACAN station?	Wait signal, or give magnetic bearing and distance with finger numerals. The first three numerals indicate magnetic bearing and the last two or three, distance.

Figure 16-5. Electronic Communications and Navigation (Sheet 1 of 2)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Vertical hand, with four fingers extended and separated, pointed ahead in a fore-and-aft chopping motion, followed by a question signal.		What is bearing to TACAN station?	Repeat signal and give bearing in three digits.
Arm and vertical hand, with 4 fingers extended and separated, moved ahead in a fore-and-aft circular motion, followed by question signal.		What is distance to TACAN station?	Repeat signal and give distance in two or three digits.
TACAN bearing or distance signal, followed by thumbs up or down.		TACAN bearing or distance, up or down.	Thumbs up or nod ("I understand").
TACAN bearing signal, followed by finger-numerals.		Switch to TACAN station indicated.	Repeat and execute.
Hand held up. First and fourth fingers extended, moved in fore-and-aft chopping motion, followed by: 1. 4 numbers. 2. Question signal. 3. *Up or down signal.*		 1. Set up UHF/ADF on frequency indicated. 2. What is UHF/ADF bearing? 3. My UHF/ADF is up or down.	 1. Repeat signal and execute. 2. Repeat chopping motion, followed by wait, or three numerals indicating magnetic bearing. 3. Thumbs up or nod ("I understand").
Two fingers pointed toward eyes (meaning IFF/SIF signals), followed by: 1. "CUT." 2. 3-digit numerals.		 1. Turn IFF/SIF to "STANDBY." 2. Set mode and code indicated: first numeral-mode, second and third numerals-code.	Repeat, then execute.
1. Open hand held up, fingers together, moved in fore-and-aft chopping motion (by leader). 2. Followed by question signal. 3. Followed by three-finger numerals.		1. Course to be steered is present compass heading. 2. What is your compass heading? 3. My compass heading is as indicated by finger numerals.	1. Nod of head ("I understand"). 2. Repeat signal and give compass heading in finger-numerals. 3. Nod or clarify, as appropriate.
Tap oxygen mask (or earphones) and give thumbs-down.	Turn WING and TAIL lights BRT/FLASH.	I have UHF transmitter (or receiver) failure.	Execute no-radio procedure as briefed. Attempt contact on GRD if necessary.

Figure 16-5. Electronic Communications and Navigation (Sheet 2 of 2)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
1. Pistol-cocking motion with either hand. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Ready or safety guns, as applicable. 2. How much ammo do you have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Thumbs up – "over half"; thumbs down – "less than half." 3. Nod head ("I understand").
1. Shaking fist. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety bombs, as applicable. 2. How many bombs do I have? 3. I am unable to drop.	1. Repeat signal and execute. 2. Indicate with appropriate finger numerals. 3. Nod head ("I understand").
1. Shaking hand, with fingers extended downward. 2. Followed by question-signal. 3. Followed by thumbs-down signal.		1. Arm or safety rockets, as applicable. 2. How many rockets do I have? 3. I am unable to fire.	1. Repeat signal and execute. 2. Indicate with appropriate finger numerals. 3. Nod head ("I understand").
Pistol cocking motion with either hand, followed by fore-and-aft pulling motion with clenched fist.	1. Rotating beacon on and off by lead aircraft. 2. Rotating beacon turned on for second time (allow time for setting up switches).	Jettison external stores. 1. Set up your switches for jettison. 2. You are cleared to drop.	Repeat signal and execute. 1. Set up jettison/ordnance switches. 2. Execute.
Fingers to be extended horizontally: 1. One finger 2. Two fingers 3. Three fingers 4. Four fingers 5. Five fingers	Same signals with fingers held in front of flashlight.	1. JATO arming switch ARMED. 2. Depress JATO firing button. 3. Release JATO firing button. 4. JATO arming switch off. 5. JATO connected and ready.	1. Repeat signal and execute. 2. Repeat signal and execute. 3. Repeat signal and execute. 4. Repeat signal and execute. 5. JATO arming switch ARMED. Check JATO armed indicator light on. If no light, give four finger signal to ordnance crew to recheck. If no light after recheck, return to line.

Figure 16-6. Armament

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Raise fist with thumb extended in drinking position.		How much fuel have you?	Repeat signal, then indicate fuel in hundreds of pounds by finger numbers.
Rotary movement of clenched fist in cockpit as if cranking wheels, followed by head nod.	Letter W in code, given by external lights, or rotary motion of flashlight.	Lower or raise landing gear and flaps, as appropriate.	Repeat signal. Execute when leader changes configuration.
Leader lowers hook.	Letter H in code, given by external lights.	Lower arresting hook.	Wingman lower arresting hook. Leader indicate wingman's hook is down with thumbs-up signal.
Open and close four fingers and thumb.		Extend or retract speedbrakes, as appropriate.	Repeat signal. Execute upon head nod from leader or when leader's speedbrakes extend/retract.

Figure 16-7. Aircraft and Engine Operation

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
One finger turnup signal.		By receiver: start turbine.	Tanker execute. Receiver gives thumbs-up when turbine starts.
Form cone shape with hand, all fingers extended aft (make signal close to canopy).			Tanker execute. Receiver gives thumbs-up if:
1. Cone moved aft.		1. By receiver: extend drogue.	1. Drogue extends properly.
2. Cone moved forward.		2. By receiver: retract drogue.	2. Drogue retracts fully and air turbine feathers.
Make hand into cup shape; then make repeated pouring motions.		By tanker: I am going to dump fuel.	By receiver: Nod. Give thumbs-up when fuel dumping commences.
Slashing motion of index finger across throat.		By tanker: I have stopped dumping fuel.	By receiver: Give thumbs-up if fuel dumping has ceased.

Figure 16-8. Air Refueling

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Arm bent across forehead as if weeping: 1. Followed by HEFOE signal and code. 2. Followed by landing signal.	Series of dots with external lights followed by: 1. HEFOE signal and code. 2. HEFOE signal and code, followed by wheels signal.	I am in trouble. 1. I am having trouble with indicated system. 2. I must land immediately.	Escort disabled plane, assuming lead, if indicated, and return to base or nearest suitable field.
Closed fist, palm inward, moved in a vertical plane between chin and top of helmet.	None.	Recommend immediate ejection.	Thumbs up or head nod ("I understand").
MALFUNCTIONING OF EQUIPMENT (HEFOE CODE)			
Arm bent across forehead as if weeping and then indicating by finger numbers 1 to 5 the affected system.	Flashlight held close to top of canopy, pointed toward wingman, followed by 1 to 5 dashes to indicate system affected.	Number of fingers or dashes means: 1. Hydraulic system. 2. Electric system (including TACAN and flight instruments). 3. Fuel system. 4. Oxygen system. 5. Engine.	Day: nod, or thumbs-up ("I understand"). Night: Vertical movement of flashlight. Pass lead to disabled plane or assume lead, if indicated.

Figure 16-9. Emergency Signals Between Aircraft

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
Open and close 4 fingers and thumb in pinching motion.	3 dashes w/external lights.	Extend speedbrakes, commencing approach.	Execute when leader extends speedbrakes.
Rotary movement of clenched fist in cockpit as if cranking wheels.	2 dashes w/external lights.	Extend wheels and full flaps.	Execute when leader extends wheels, flaps.
Pointing index finger toward runway/ship in stabbing motion, repeatedly, followed by lead change signal.	Series of dashes w/external lights.	Landing runway/meatball and ship in sight.	Ashore: Take position for landing. Carrier: Break off and land.

Note: Configuration change should be executed promptly after completion of the signal.

Figure 16-10. Flight Signals Between Aircraft Penetration/Instrument Approach (No Radio)

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
ARMING			
1. Arming supervisor: Hands over the head with fingers touching.	Red wands over the head with tips touching.	Pilot, copilot/NFO: Check all armament switches OFF or SAFE.	Pilot, copilot/NFO: Raise both hands into view of arming supervisor after checking switch positions. (Hands remain in view during check and hook-up.)
2. Arming supervisor: Points at crewmember (used if applicable).	Same as day only with red wand.	Crew: Perform stray voltage checks.	Arming crew: Execute. Give arming supervisor thumbs up if no stray voltage exists. Thumbs down if exists. Night: Vertical sweep with flashlight indicates no stray voltage. Horizontal sweep indicates stray voltage.
3. Arming supervisor: Raise fist, thumb extended upward to meet horizontal palm of other hand.	Form a Tee with red wands.	Arming crew: Arm weapons (as applicable).	Arming crew: Execute. Give arming supervisor thumbs up when arming completed and clear immediate area. Thumbs down if a malfunction exists. Night: same as step 2 above.
4. Arming supervisor gives pilot:			Pilot:
a. Thumbs up.	a. Vertical sweep with red wand.	a. Aircraft is armed and all personnel and equipment clear of area.	a. Acknowledge with similar signal.
b. Thumbs down.	b. Horizontal sweep with red wand.	b. Aircraft is down for weapons.	b. Acknowledge with similar signal.
SAFING			
1. Safing supervisor: Hands over the head with fingers touching.	Red wands over the head with tips touching.	Pilot, copilot/NFO: Check all armament switches OFF or SAFE.	Pilot, copilot/NFO: Execute. Raise both hands into view of safing supervisor after checking switch positions. (Hands remain in view during safing.)
2. Safing supervisor: Points at crew member.	Same as day only with red wand.	Crew: Safe weapons (as applicable).	Crew: Execute.
3. Safing supervisor gives pilot: Thumbs-up.	Red vertical wand.	Pilot: Aircraft is safed and crew and equipment are clear.	Pilot: Acknowledge with similar signal.

Figure 16-11. Arming and Safing Signals

SIGNAL		MEANING	RESPONSE
DAY	NIGHT		
P/C rapidly fans hand in front of face and points to wheel with other hand.	Same, except with wand.	Your aircraft has hot brakes.	Comply with local hot brakes procedures.
P/C extends arms bent 90 degrees so hands are level in front of chest. Place right palm on top of left hand and with positive movement raise right hand and lower left hand.	Same, except make signal with wands.	Can I move EXT/INT switch to EXT position?	DAY: pilot give "thumbs-up" (YES) or "thumbs-down" (NO). NIGHT: same, except pilot moves horizontally held flashlight up and down several times (YES) vice "thumbs-up" signal, or left and right several times (NO) vice "thumbs-down" signal.

Figure 16-12. Postflight Groundcrew to Pilot Signals

PART VIII

Armament Systems

CHAPTER 17

Armament Systems

17.1 ARMAMENT EQUIPMENT

17.1.1 General. This section describes only the minimum armament equipment required to release external stores carried in a tactical environment and a basic description of the gunsight. A complete description of the aircraft weapons system is contained in NAVAIR 01-40AV-1T, A-4/TA-4 Tactical Manual. This flight manual is incomplete without the tactical manual.

The aircraft is capable of carrying a wide variety of ordnance. All stores are carried externally on five racks. A four-hook ejector bomb rack is installed on the centerline (fuselage) station, and a two-hook bomb ejector rack is installed on each of the four wing stations. The centerline rack (AERO-7A) can be used to carry stores requiring either 30-inch or 14-inch suspension. Wing racks (AERO 20A) are provided with 14-inch suspension only.

17.1.2 Armament Controls. All controls affecting release of armament are located in the forward cockpit except for aft cockpit controls used for emergency release of external stores. The forward cockpit includes an armament panel, control stick armament switches, emergency stores release handle, gunsight, and a gunsight reticle light control panel. Aft cockpit controls affecting the emergency release of external stores are the emergency select switch and the emergency stores release handle. Controls used with specific weapon systems–SHRIKE, SHRIKE Improved Display System (SIDS, A-4 AFC 386), WALLEYE (A-4 AFC 318), WALLEYE Video Monitor (A-4 AFC 395), GCBS (A-4 AFC 186), etc., are shown in Figure 17-1. Weapon system hardware, systems control operations, and weapons delivery techniques are covered in NAVAIR 01-40AV-1T, A-4/TA-4 Tactical Manual.

17.1.2.1 Armament Panel. The armament panel (Figure 17-1) is located below the instrument panel in the forward cockpit. Armament panel controls consist of the MASTER armament switch, STATIONS select switches, function selector switch, bomb ARM switch, GUNS switch, and EMER SELECT switch.

17.1.2.1.2 Master Armament Switch. All armament circuits are controlled by the MASTER armament switch (Figure 17-1) with exception of gun charging and emergency jettisoning of external stores. The MASTER armament switch must be in the ON position to energize armament circuits.

Note

- When the landing gear handle is in the DOWN position, an armament safety switch interrupts the power supply circuit to the MASTER armament switch and the gun charging circuit.
- When the aircraft is on the ground, an armament safety circuit disabling switch may be used to energize an alternate circuit for checking the armament system. This circuit is energized by momentarily closing the disabling switch located in the righthand wheelwell. Raising the landing gear or moving the MASTER armament switch to OFF will restore the armament safety circuit to normal operation.

When the MASTER armament switch is placed in the ON position, an armament advisory light (Figure 17-1) in the aft cockpit will come on displaying the ARMAMENT ON.

17.1.2.1.3 Stations Select Switches. Five STATIONS select switches (Figure 17-1) provides selection of any station or combination of stations for firing or release (except for emergency release) of external stores. The switches are lever-lock toggle switches and are identified by a number above each switch that corresponds to the external station the

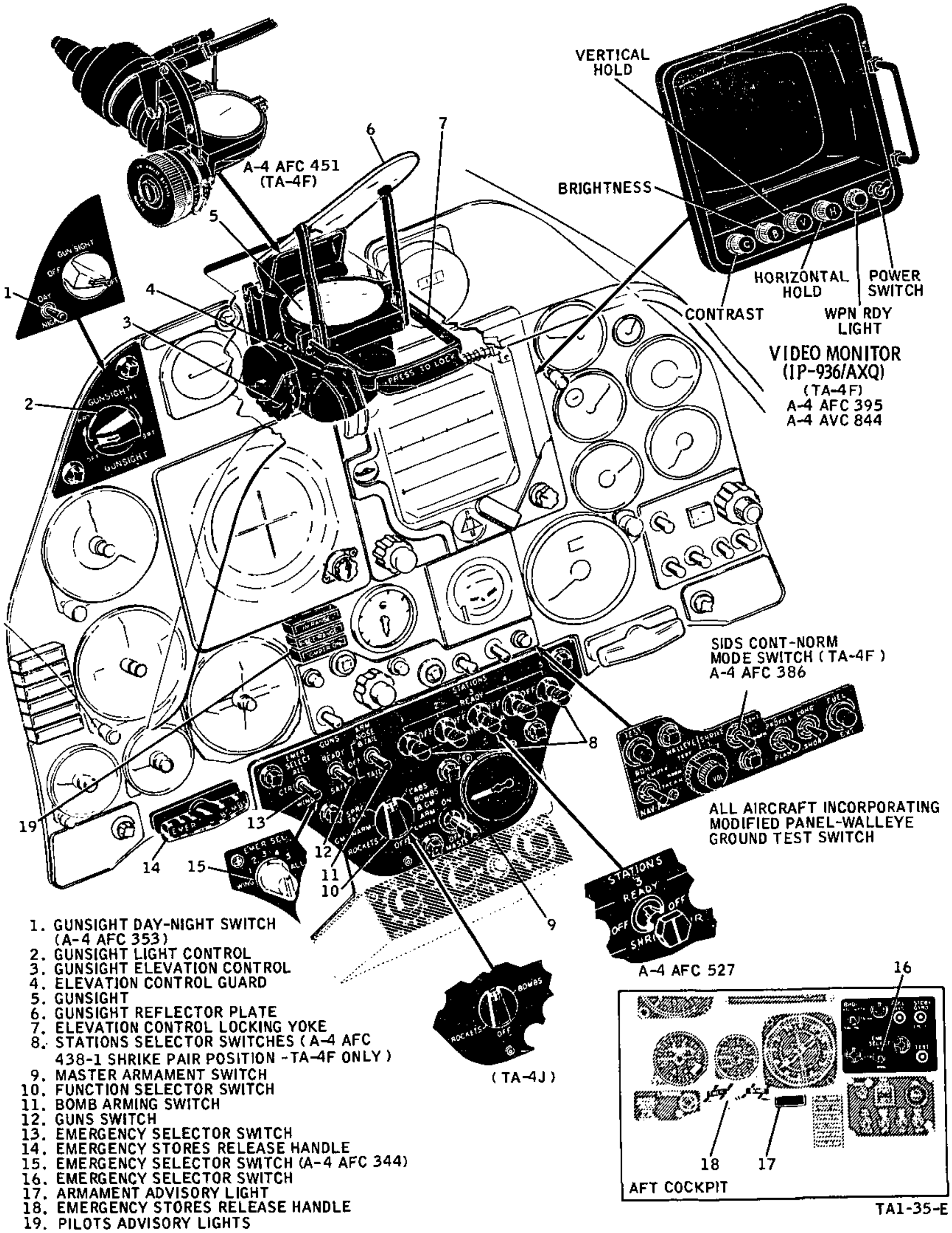


Figure 17-1. Typical Gunsight and Armament Panel

switch controls. TA-4F aircraft STATIONS select switches have three positions marked READY, OFF, and SHRIKE PAIR.

WARNING

The SHRIKE PAIR position is a hot position equivalent to the READY position for ordnance other than Shrike, and could be inadvertently selected when OFF position is intended.

On TA-4F/J aircraft reworked per A-4 AFC 438-1, each select switch incorporates a locking cap on the switch lever (Figure 17-1) to enable locking the select switches in OFF position thereby preventing inadvertent switch actuation. When the switch is in the OFF position and the locking cap is turned one-quarter turn clockwise (cap stripe horizontal), the lever-lock switch lever cannot be actuated. A one-quarter turn counterclockwise (cap stripe vertical unlocks the lever-lock switch lever allowing it to be pulled and the switch placed in the desired position.

On TA-4F/J aircraft reworked per A-4 AFC 527, STATIONS 3 (centerline) switch incorporates a hexagon shaped locking knob (Figure 17-1) to make the switch more easily identifiable from adjacent switches. This modification does not change the manner in which the select switch locking/unlocking feature operates.

17.1.2.1.4 Function Selector Switch. The TA-4F aircraft function selector switch (Figure 17-1) is an eight-position rotary-type switch. Seven of the eight detented positions are identified, and one (at the 12 o'clock position) is unidentified and unused. Starting clockwise from the bottom, positions are identified OFF, ROCKETS, GM UNARM, SPRAY TANK, LABS, BOMBS & GM ARM, and CMPTR.

In TA-4F aircraft reworked per A-4 AFC 319A, the eighth detent is used and identified CMPTR. The CMPTR position was added to preclude energizing the CP-741/A computer when either LABS or BOMBS & GM ARM mode is selected. In aircraft reworked per A-4 AFC 465, a computer on (CMPTR ON) light is provided in the pilot advisory light display.

The TA-4J aircraft function selector switch (Figure 17-1) is a rotary switch with three operational positions; OFF, ROCKETS, and BOMBS.

17.1.2.1.5 Bomb Arming Switch. The bomb arming switch (Figure 17-1) is a three-position toggle switch with positions labeled NOSE & TAIL, OFF, and TAIL. Placing the switch in the NOSE & TAIL position (with MASTER armament switch ON) energizes the nose and tail mechanical bomb arming units on each ejector rack. When in the TAIL position, only the tail arming unit on the ejector rack is energized. A mechanical bomb arming unit, when energized, locks onto the upper end of the arming wire, causing the arming wire to be withdrawn from the bomb fuze as the bomb falls from the aircraft . When the arming switch is in the OFF position, the mechanical arming units are not energized permitting the arming wires to fall with the bomb, and the bomb falls unarmed.

17.1.2.1.6 Guns Switch. The GUNS switch (Figure 17-1) is a two-position toggle switch with positions identified SAFE and READY. When the switch is in the SAFE position, the breechblock of each gun is in an out-of-battery position and the guns are inoperative. When in the READY position (with MASTER armament switch ON), the gun charging and firing circuits are completed, making the guns ready for firing.

Aircraft reworked per A-4 AFC 363 have gun firing interrupter switches installed on the emergency generator door and canopy hand pump access door. In the event of inadvertent opening of either door, the switch is automatically activated to halt gun firing.

17.1.2.1.7 Emergency Selector Switch. The emergency selector switch, identified EMER SELECT (Figure 17-1), is a three-position toggle switch with positions labeled ALL, CTR, and WING. The switch provides selection of the external stores to be jettisoned when the emergency stores release handle is pulled. The emergency selector switch functions with the main or emergency generator in operation.

Note

An emergency selector switch, the same as that described above, is located on the center console in the aft cockpit. The switch is used in conjunction with the emergency stores release handle located in the aft cockpit.

In aircraft reworked per A-4 AFC 344, the emergency selector switch in the forward cockpit is a rotary-type switch providing selection of WING, 1, 2, 3, 4, 5, or ALL stations when the emergency stores release handle is pulled.

17.1.2.2 Bomb Release Button. The bomb release button, often referred to as the pickle switch, is located on the left side of the control stick grip and is identified with the letter B. The bomb release button functions only when operating on the main generator.

Note

> The control stick grip in the aft cockpit includes a bomb release button; however, the button is not connected to armament release circuits and is unused.

17.1.2.3 Gun-Rocket Trigger. The gun-rocket trigger is located on the front of the control stick grip and is the initiator of gun and/or rocket firing when the proper conditions are established. When pressed, the gun-rocket trigger fires guns and/or rockets in any one of three arrangements: (1) with the function selector switch placed in OFF and the GUNS switch to READY, the guns are fired; (2) with the function selector switch placed in ROCKETS and the GUNS switch to SAFE, the rockets will be fired from all stations which have the STATIONS select switches placed in READY; (3) with the function selector switch placed in ROCKETS and the GUNS switch to READY, the guns will fire and all rockets will fire from stations which have the STATIONS select switches placed in READY. The gun-rocket trigger functions only when operating on the main generator.

Note

> The control stick grip in the aft cockpit includes a gun-rocket trigger; however, the trigger is not connected to gun-rocket firing circuits and is unused.

17.1.2.4 Emergency Stores Release Handle. An emergency stores release handle, identified EMER BOMB (Figure 17-1), is located on the lower left side of the instrument panel in each cockpit. Pulling the handle closes a switch in the emergency release circuit, bypassing the normal release controls. Power to the emergency circuit is supplied by the primary bus which is energized by either the main or emergency generator. Stores selected by the EMER SELECT switch may be released irrespective of the position of the landing gear control or MASTER armament switch.

17.1.2.5 External Stores Release. Release of external stores from the ejector-type racks is accomplished by electrical detonation of cartridges. When cartridges are fired by pressing the bomb release button, the initial force is an upward thrust which opens the hooks, followed by a downward ejector thrust of several inches which forces the store clear of the aircraft. An ejector foot is located aft of center on the bomb rack to counteract the twisting moment of the bomb caused by drag forces in high speed flight. Each ejector rack contains two cartridges, both of which are fired by either the normal or emergency release circuit.

Note

> Normal release of external stores is possible only while operating on main generator. Emergency release may be accomplished while operating on the main or emergency generator.

17.1.2.6 Normal Dive Bomb Release

1. Function selector switch – BOMBS & GM ARM.

2. STATIONS select switches (as desired) – READY.

3. MASTER armament switch – ON.

4. Bomb release button – DEPRESS.

Note

> For releasing live ordnance in an unarmed condition, the bomb ARM switch (controlling mechanical arming circuits) must be in the OFF position, and/or, the function selector switch on the AN/AWW-1 fuze function control panel (controlling electrical arming circuits) must be in the SAFE position.

17.1.2.7 Emergency Release

1. EMER SELECT switch – AS REQUIRED.

2. Emergency stores release (EMER BOMB) handle – PULL.

WARNING

When the emergency stores release handle is used to jettison bombs while operating on the main generator, bombs hung directly on parent racks will be dropped in an armed condition if the MASTER armament switch is ON and the related fuzing circuits are energized.

CAUTION

When the emergency stores release handle is used to jettison wing stores only (EMER SELECT switch set to WING), ensure that the STATIONS select switch for the centerline station (Number 3) is in the OFF position, to prevent electrical feedback through the normal bomb release circuit and inadvertent release of the center store.

17.1.3 Gunsight. A lighted gunsight (Figure 17-1) is located directly above the instrument panel in the forward cockpit. Gunsight controls include an elevation control knob, an elevation control locking yoke, and a gunsight reticle light control.

Light is beamed through a condenser lens and a ladder-type (fixed) reticle upward through a collimating lens and is superimposed on a transparent reflector plate. The proper ballistic drop of the projectile is set into the gunsight as MIL lead. The center of the reticle image (pipper) is kept on the center of the target, provided it is a fixed target. If the target is moving or wind is present, pipper offset must be established by using the graduations on the reticle.

The gunsight elevation control knob is located on the left side of the gunsight and is used to adjust the angle of the glass reflector for increasing or decreasing MIL lead angle. Prior to changing lead angle with the elevation control, the locking yoke must be lifted completely to an unlocked position.

TA-4 aircraft reworked per AFC 451 have improved braking action on the sight elevation adjustment mechanism to prevent loss of boresight from flight vibration and landing shock.

CAUTION

Failure to completely unlock the yoke prior to rotating the elevation control knob may damage the mechanism and result in sight elevation errors.

After the elevation control knob is set to the desired MIL lead, the locking yoke must be presented firmly against the sight body in the locked position.

CAUTION

When moving the yoke into the locked position, do not press on the elevation control guard attached to the locking yoke.

17.1.3.1 Gunsight Reticle Light Control

Note

In aircraft with AFC 638, the control of the reticle is accomplished with an ON, OFF switch.

The gunsight reticle light control (Figure 17-1) is located on the upper left corner of the instrument panel in the forward cockpit. By rotating the control knob, either of two filaments may be selected for lighting. Light intensity can be adjusted between the OFF and BRIGHT positions for either filament.

On aircraft reworked per A-4 AFC 353, a two-position toggle switch labeled DAY-NIGHT is located adjacent to the gunsight reticle light control. When the switch is in the DAY position, a gunsight light resistor circuit (also added by A-4 AFC 353) is bypassed, allowing maximum power to the gunsight reticle light control rheostat. With the switch in the NIGHT position, power is directed through the gunsight light resistor circuit, resulting in lower light intensity variance controlled by the reticle light control rheostat.

Aircraft reworked per A-4 AFC 388 have concentric light intensity control knobs on the gunsight control panel. The inner knurled knob, within the gunsight reticle light control knob, is labeled CMPTR LT and controls the intensity of the CP-741/A computer LOCK ON and IN RANGE display lights. The computer display lights are mounted on the upper gunsight assembly for pilot convenience. Although the CMPTR LT control knob does not have a direct function in gunsight light control, it enables the pilot to adjust the intensity of the display lights at the most comfortable level for gunsight vision.

Paragraph 17.2 and Figures 17-2 to 17-6 deleted by Change 1.

PART IX

Flight Crew Coordination

CHAPTER 18

Flight Crew Coordination

18.1 INTRODUCTION

The many and varied missions of the TA-4F/J dictate consideration be given to the subject of aircrew coordination. Missions of the TA-4 include, but are not limited to, the CNATRA advanced strike syllabus, fleet aggressor/tactics training, and airborne tactical control aircraft. While frequent reference is made to checklists, and certain important procedures are highlighted, the contents of this section are designed to be utilized as a basis for squadron and unit ground training syllabuses. So utilized this section will enhance the successful and safe completion of each unit's mission through intelligent and proper compliance with all NATOPS procedures and other applicable aviation directives. In each syllabus, flight safety and mission success rely on aircrew coordination, whether they are designated a naval aviator, naval flight officer, student naval aviator, or other crewmember.

18.2 SPECIFIC RESPONSIBILITIES

18.2.1 Description of Aircrew Position

1. Mission commander – Senior member in a multiplane flight qualified in stage. The mission commander bears responsibility for mission success and safety of flight items related to the mission in a multiplane environment.

2. Formation leader – Responsible for the safe and orderly conduct of the formation.

Note

Mission commander and formation leader positions may routinely be held by the same person.

3. Pilot in command – Position varies with syllabus requirements. Pilot in command is responsible for the safe control of the aircraft throughout the entire flight.

a. Instructor – Will be pilot in command on all dual flights. He must be NATOPS qualified and instructor qualified by parent commander. The instructor, although the pilot in command, will assume the duties as copilot in the majority of the CNATRA Intermediate Strike Syllabus Flights. The instructor may assume the duties as the pilot, as he deems appropriate.

b. Student – Will be pilot in command on solo flights. He is not required to be NATOPS qualified, but must have completed syllabus requirements designating him safe f[illegible] The student will be expected to perform [illegible]s as the pilot or the copilot, as directed by the instructor.

4. Copilot – When mission requirements dictate that the TA-4 is being flown by two NATOPS qualified pilots, one will be designated the pilot in command and the other will be designated the copilot. The copilot assists the pilot, as directed, in accomplishing the mission. He assists in performing the exterior and interior inspections or he performs the inspections upon instructions from the pilot. He assists the pilot in operating controls and equipment on the ground and in flight, and assumes the duties of the pilot when the pilot is incapable of performing them himself. He also assists the pilot in navigating the aircraft.

5. Other crewmember – NFO, SNFO, flight surgeon, or any other non-NATOPS qualified aircrew. Expected to perform appropriate duties as defined by the pilot in command.

18.2.1.1 Flight Planning

18.2.1.1.1 Mission Commander

1. Responsible for planning all phases of assigned mission.

18.2.1.1.2 Formation Leader

1. Assist the mission commander as directed.

18.2.1.1.3 Other Flight Members

1. Assist the mission commander of formation as directed.

18.2.1.2 Brief

18.2.1.2.1 Mission Commander

1. Responsible for ensuring all crewmembers are briefed on all aspects of the mission and conduct of the flight.

18.2.1.2.2 Formation Leader

1. Assist mission commander as directed; ensure that all flight crewmembers are briefed on all aspects of the mission and conduct of flight, to include:

   a. Crew coordination in each flight evolution

   b. Command/control of aircraft.

   c. Ejection command selector handle position.

   d. Related safety of flight items.

18.2.1.2.3 Other Pilots in Command

1. Have a thorough understanding of the conduct of the flight and be prepared to assume formation lead.

18.2.1.3 Preflight

18.2.1.3.1 Pilot in Command

1. Review aircraft discrepancies from the previous 10 flights (minimum requirement).

2. Ensure daily and preflight maintenance inspections are completed.

3. Responsible for accepting the aircraft assigned.

4. Ensure a complete preflight of aircraft is conducted in accordance with TA-4 NATOPS and OPNAVINST 3710.7.

18.2.1.3.2 Copilot/Other Crewmember

1. Assist the pilot in command as directed during preflight.

18.2.1.4 Prestart

18.2.1.4.1 Pilot

1. Execute Prestart Checklist in accordance with NATOPS.

2. Receive a clear-to-start signal from the plane captain ensuring security of the aircraft and adjacent area.

18.2.1.4.2 Copilot

1. Execute prestart checks in accordance with NATOPS.

2. Acknowledge pilot's intent to start.

18.2.1.4.3 Other Crewmember

1. Acknowledge pilot's intent to start.

18.2.1.5 Start

18.2.1.5.1 Pilot

1. Start engines in accordance with NATOPS.

2. Remain alert for any emergency signals from ground crew or copilot.

18.2.1.5.2 Copilot/Other Crewmember

1. Notify the pilot of any emergency signals noted from the ground crew or any unusual occurrences observed.

18.2.1.6 Poststart

18.2.1.6.1 Pilot

1. Complete all pretaxi checks in accordance with NATOPS.

2. Prior to moving the canopy, ensure canopy rail is clear by questioning "All clear of canopy?"

Receive "All clear" from copilot, and then close the canopy.

3. Inform the copilot when "Ready to taxi."

18.2.1.6.2 Copilot

1. Complete all pretaxi checks in accordance with NATOPS.

2. Answer "All clear" to pilot prior to canopy movements.

18.2.1.6.3 Other Crewmember

1. Answer "All clear" to pilot prior to canopy movement.

18.2.1.7 Taxi

18.2.1.7.1 Pilot

1. After aircraft has stated rolling, check brakes.

2. Exercise control of aircraft while taxiing; remain attentive for obstructions, taxi directions, and foreign object damage (FOD).

18.2.1.7.2 Copilot/Other Crewmember

1. Be prepared to assist in braking if pilot brake system fails.

2. Remain watchful for obstructions and taxi signals, and inform pilot.

18.2.1.8 Pretakeoff

18.2.1.8.1 Pilot

1. Complete pretakeoff checks in accordance with NATOPS prior to crossing the runway; hold short of jet blast deflector at the ship.

2. ICS – AS REQUIRED.

3. Inform copilot when ready for takeoff.

18.2.1.8.2 Copilot

1. Complete pretakeoff checks in accordance with NATOPS prior to crossing the runway; hold short of jet blast deflector at the ship.

2. ICS – AS REQUIRED.

3. Report "Ready for takeoff."

18.2.1.8.3 Other Crewmember

1. ICS – AS REQUIRED.

2. Report "Ready for takeoff."

18.2.1.9 Takeoff/Departure/Mission

18.2.1.9.1 Pilot

1. Verify minimum acceptable engine performance.

2. Report rolling or saluting as appropriate to copilot.

3. Execute takeoff.

4. Report GEAR UP and FLAPS UP to the copilot.

5. Comply with departure routing.

6. Communicate as required with controlling agencies.

7. Monitor and manage fuel as required.

18.2.1.9.2 Copilot/Other Crewmember (As Appropriate)

1. Verify engine performance with pilot.

2. Monitor engine and performance instruments and aircraft configuration.

3. Maintain a diligent lookout doctrine.

4. Monitor the published or clearance departure procedures and challenge the pilot on any deviations from prescribed heading or altitude.

5. Monitor and manage fuel as required.

18.2.1.10 Approach/Landing

18.2.1.10.1 Pilot

1. Determine weather at destination.

2. Determine bingo-fuel for divert as required.

3. Complete Penetration Checklist.

4. Execute approach in accordance with published directives.

5. Complete Landing Checklist and execute landing.

18.2.1.10.2 Copilot/Other Crewmember (As Appropriate)

1. Determine bingo-fuel for divert and compare with pilot computation.

2. Maintain a diligent lookout doctrine.

3. Monitor altitude, airspeed, and adherence to clearances during holding and approach.

4. Challenge pilot on any deviation from published or assigned procedures.

5. Confirm completion of Landing Checklist.

18.2.1.11 Postlanding

18.2.1.11.1 Pilot

1. Exercise control of aircraft while taxiing; remain attentive for obstructions, taxi directions, and FOD.

2. Complete appropriate checklists before securing engines.

3. Shutdown the aircraft when parked; chocked and chained if appropriate.

18.2.1.11.2 Copilot

1. Backup pilot in lookout for obstructions and taxi signals.

2. Monitor instruments on shutdown.

18.2.1.12 Postflight

18.2.1.12.1 Pilot

1. Conduct thorough postflight.

2. Ensure completion of yellow sheet.

3. Debrief maintenance personnel on status of aircraft.

4. Assist mission commander in debriefing.

18.2.1.12.2 Copilot/Other Crewmember

1. Assist pilot in command as directed.

PART X

NATOPS Evaluation

CHAPTER 19

NATOPS Evaluation

19.1 NATOPS EVALUATION

19.1.1 Concept. The standard operating procedures prescribed in this manual represent the optimum method of operating A-4/TA-4 aircraft. The NATOPS evaluation program is intended to evaluate compliance with NATOPS procedures by observing and grading individuals and units. This evaluation is tailored for compatibility with various operational commitments and missions of both Navy and Marine Corps units. The prime objective of the NATOPS evaluation program is to assist the unit commanding officer in improving unit readiness and safety through constructive comment. Maximum benefit from the NATOPS program is achieved only through vigorous support of the program by commanding officers as well as flight crewmembers.

19.1.2 Implementation. The NATOPS evaluation program shall be carried out in every unit operating naval aircraft. The various categories of flight crewmembers desiring to attain/retain qualification in A-4/TA-4 aircraft shall be evaluated in accordance with OPNAVINST 3710.7. Individual and unit NATOPS evaluations will be conducted periodically. Instruction in and observation of adherence to NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. NATOPS coordinators, evaluators, and instructors shall administer the program as outlined in OPNAVINST 3710.7. Evaluees who receive a grade of Unqualified on a ground or flight evaluation shall be allowed 30 days in which to complete a reevaluation. A maximum of 60 days may elapse between the date the initial ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

Note

- Pilots possessing a current A-4/TA-4 NATOPS report form (OPNAV Form 3610.8) are considered qualified in all A-4/TA-4 models, provided the applicable Ground Training Requirements outlined in Part II are met.
- Pilots attending a formal course of RCVW training shall be considered, as a minimum, conditionally NATOPS qualified for a period of 1 year, provided all required phases of instruction are completed. If practicable, RCVW graduates will be fully NATOPS qualified, ground and flight evaluations, upon completion of the required instruction. An appropriate entry of NATOPS qualifications shall be made in the pilot's logbook.

19.1.3 Definitions. The following terms, used throughout this section, are defined as to their specific meaning within the NATOPS program.

19.1.3.1 NATOPS Evaluation – A periodic evaluation of individual flight crewmember standardization consisting of an open-book examination, a closed-book examination, an oral examination, and a flight evaluation.

19.1.3.2 NATOPS Reevaluation – A partial NATOPS evaluation administered to a flight crewmember who has been placed in an Unqualified status by receiving an unqualified grade for any of his ground examinations or the flight evaluation. Only those areas in which an unsatisfactory grade was given need be observed during a reevaluation.

19.1.3.3 Qualified – Well standardized; evaluee demonstrated highly professional knowledge of and compliance with NATOPS standards and procedures; momentary deviations from or minor omissions in noncritical areas are permitted if prompt and timely remedial action is initiated by the evaluee.

19.1.3.4 Conditionally Qualified – Satisfactorily standardized; one or more significant deviations from

NATOPS standards and procedures, but no errors in critical areas and no errors jeopardizing mission accomplishment or flight safety.

19.1.3.5 Unqualified – Not acceptably standardized; evaluee failed to meet minimum standards regarding knowledge of and/or ability to apply NATOPS procedures; one or more significant deviations from NATOPS standards and procedures which could jeopardize mission accomplishment or flight safety.

19.1.3.6 Area – A routine of preflight, flight, or postflight.

19.1.3.7 Subarea – A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

19.1.3.8 Critical Area/Subarea – Any area or subarea which covers items of significant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

19.1.3.9 Emergency – An aircraft component, system failure, or condition which requires instantaneous recognition, analysis, and proper action.

19.1.3.10 Malfunction – An aircraft component or system failure or condition which requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

19.1.4 Ground Evaluation. Prior to commencing the flight evaluation, an evaluee must achieve a minimum grade of Qualified on the open book and closed book examinations. The oral examination is also part of the ground evaluation, but may be conducted as part of the flight evaluation. To assure a degree of standardization between units, the NATOPS instructors shall use the bank of questions contained in this section in preparing portions of the written examinations.

19.1.4.1 Open Book Examination. The open book examination shall be composed of not less than 50 questions and not more than 100 questions. This examination should require extensive use of Part XI Performance Data and provide a comprehensive review of the flight manual in general. No time limit.

19.1.4.2 Closed Book Examination. The closed book examination shall consist of not less than 50 questions and not more than 100 questions selected from the question bank. No time limit.

19.1.4.3 Oral Examination. The questions may be taken from this manual and drawn from the experience of the instructor/evaluator. Such questions should be direct and positive and should in no way be opinionated.

19.1.4.4 OFT/WST Procedures Evaluation. The OFT/WST (if available) will be utilized to evaluate the pilot's knowledge and performance of normal procedures and his reaction to simulated emergencies and malfunctions. In areas not served by OFT/WST facilities, the procedures check should be conducted in a Cockpit Orientation Trainer. If neither of these devices is available, the procedures check should be conducted by oral examination and discussion with the examinee in the cockpit of the applicable A-4 model. The following list of procedures and conditions are those which will be simulated during the OFT/WST procedures evaluation whenever possible. Critical emergency procedures which require an immediate response are designated by an asterisk (*).

1. Interior Inspection (Pocket Checklist)

2. Engine Starting Procedures

   *a. Wet start

   *b. Fire during start

   c. Normal start

   d. Oil pressure failure.

3. Ground Tests (Pocket Checklist)

4. Before Takeoff (Pocket Checklist)

5. Takeoff

   *a. Aborting takeoff (fire, thrust loss, runaway trim).

6. After Takeoff

   a. Retraction release solenoid inoperative

b. Unsafe nose gear indication after gear retraction

*c. Flameout below 250 KIAS after gear retraction.

7. During Flight

a. Fuel transfer pump failure

b. Fuel tank float valve sticks closed

c. Fuel boost pump failure

d. Oil pressure failure low, fluctuation, out

*e. Runaway aileron trim

f. Main generator failure

g. Flight control hydraulic failure only

h. Complete loss of both hydraulic systems

i. Speedbrake failure

j. Loss of oxygen supply

k. Engine failure above 20,000 feet

l. Fire warning light ON and remains ON (other indications of fire)

m. Maximum glide

*n. Ejection

o. Bailout

p. Transformer rectifier failure (primary)

*q. Electrical fire in flight

*r. Wing fire in flight

s. EGT and/or rpm failure

t. Gyro horizon failure

*u. Runaway elevator trim

v. Fuel quantity gauge failure (rotates)

w. Engine icing

x. 300-gallon drop tank on wing station will not transfer

y. Loss of airspeed indicator

z. Surging engine (rpm and EGT) or loss of thrust

aa. Fuel flow fluctuation/failure

*bb. Fire warning light ON (no other indications)

cc. Throttle linkage failure

dd. Smoke/fumes in cockpit

ee. Air conditioning goes full-hot

*ff. Smoke/fumes in cockpit in RAM position

*gg. Runaway rudder trim

hh. Ditching (land/sea)

*ii. Spoilers deployed in flight.

8. Pretraffic Pattern Checklist

a. Utility hydraulic system failure.

9. Traffic Pattern Checklist

a. Loss of wheel brake(s)

b. Unsafe main or nose gear indication

c. One main gear up.

10. Landing and Rollout

a. No airspeed indicator

b. Runaway nosedown trim.

11. Stopping the Engine

12. Before Leaving the Aircraft.

19.1.4.5 Grading Instructions. Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of Qualified or Unqualified. For the open book examination, the evaluee must obtain a minimum score of 3.5 to obtain a grade of Qualified.

For the closed book examination, the evaluee must obtain a minimum score of 3.3 to obtain a grade of Qualified.

For the oral examination and OFT/WST procedure check (if conducted), a grade of Qualified or Unqualified shall be assigned by the instructor/evaluator.

19.1.5 Flight Evaluation. The number of flights required to complete the flight evaluation should be kept to a minimum; normally one flight. The areas and subareas to be observed and graded on a flight evaluation are outlined in the grading criteria with critical areas designated. Subarea grades will be assigned in accordance with the grading criteria. These subareas shall be combined to arrive at the overall grade for the flight. Area grades, if desired, shall also be determined in this manner.

Note

Critical areas or subareas are indicated by an asterisk (*), or outlined in mission evaluation.

The flight evaluation will be flown in daylight conditions to facilitate observations and grading by the evaluator/instructor; however, instrument conditions may be encountered if desired.

OFT/WST procedures evaluation may be substituted for the flight evaluation at the commanding officer's discretion.

The flight evaluation may be conducted in a two-seat A-4 model or as separate aircraft in a multiplane flight.

19.1.5.1 Safety Considerations During Evaluation Flights. Because of the broad significance of safety, it is impractical to list all contingencies without, at the same time, developing a lengthy and voluminous grading criteria. Generally, mission success is subject to compromises because of safety infractions, violations, omissions, or deviations, beginning with mission planning and ending with the postflight debriefing. The following paragraphs provide additional guidance in these areas.

1. Violations of pertinent directives or procedures which have a direct bearing on the safe completion of the mission or negligence in following any procedure or directive to the extent of jeopardizing the safety of the pilot or aircraft will constitute an overall grade of Unqualified. The degree of jeopardy involved, in the absence of specific criteria, must be an evaluator/instructor determination based on experience and good judgment.

2. The latitude given evaluator/instructors in grading safety items must be exercised with care. They should avoid assumptions in concluding that a safety discrepancy exists. To reason that a safety discrepancy could possibly occur as a result of a remote set of circumstances, is unfair to the pilot being evaluated.

3. When an in-flight safety discrepancy is evident or is dangerously imminent, and the pilot appears to be unaware of the condition or has not taken appropriate action, the evaluator/instructor will correct the situation by directing or taking the necessary corrective action immediately. Safety of flight will not be compromised because of any reluctance on the part of the evaluator/instructor to correct the discrepancy.

4. If a grade of Unqualified is given, a brief descriptive statement concerning the safety discrepancy will be entered on the Evaluation Report Form. The statement should be recorded Safety Discrepancy.

19.1.5.2 Use of Judgment of NATOPS Evaluation Flights. The grading criteria establish standards for grading pilot performance, but this does not relieve the evaluator/instructor from using good judgment based upon experience. In those items where a pilot fails to meet the minimums set forth in the grading criteria but the evaluator/instructor, through past experience and judgment, knows the error to be caused by contributing factors such as weather, turbulence, etc., he may then assign the pilot a grade of Qualified. However, the reason for such action must be recorded on the worksheet and report form. If the pilot being evaluated consistently made poor or wrong decisions, a statement to this effect will be reflected in the worksheet and the Remarks portion of the report form, regardless of whether or not the pilot successfully completed the evaluation. The only way the final grade and degree of performance of the pilot can be determined is by use of the grading criteria. Unless an obviously unsafe act has been observed (which would automatically and immediately terminate the flight), the evaluator/instructor should not attempt to determine during the flight if the evaluee passes or fails.

19.1.5.3 Minor Discrepancies and/or Omissions. Minor discrepancies and/or omissions are defined as those which will not adversely affect the successful completion of the mission or jeopardize the safety of the pilot and/or aircraft.

19.1.5.4 Momentary Deviations. Deviations from the tolerances set forth in the grading criteria which are momentary in nature will not be considered in grading, provided the evaluee is alert in applying corrective action, the deviation does not jeopardize the safety of the pilot or aircraft, and the deviation does not exceed the limitations prescribed for a Conditionally Qualified grade. Cumulative momentary deviations will result in downgrading.

19.1.5.5 Flight Evaluation Areas

Note

Critical area or subareas are indicated by an asterisk (*) or are outlined in mission evaluation.

1. Mission Planning
   a. Flight plan
   b. Weather.
2. Briefing
3. Preflight
   a. Records check
   b. Preflight check.*
4. Start/Poststart
   a. Start
   b. Poststart procedures.
5. Taxi/Runup
   a. Taxi
   b. Engine runup
   c. Clearances.
6. Takeoff*
   a. Procedures.
7. Climb/Cruise
   a. Climb schedule
   b. Transition
   c. En route procedures.
8. Approach and Landings*
   a. Pattern entry
   b. Approach.
9. Emergency Procedures
   a. Simulated emergencies may be given.
10. Shutdown/Postflight
    a. Shutdown *
    b. Postflight inspection
    c. Yellow sheet
    d. Debriefing.

19.1.5.6 Mission Evaluation Areas

1. Rendezvous
   a. Procedures.
2. Weapons
   a. Target procedures
   b. Rendezvous procedures.

3. Navigation

   a. Low level

   b. Medium level.

19.1.5.7 Flight Evaluation Grading Criteria. Only those subareas provided or required will be graded. The grades assigned for a subarea shall be determined by comparing the degree of adherence to standard operating procedures with adjectival rating listed below. Momentary deviations from standard operating procedures should not be considered as unqualifying, provided such deviations do not jeopardize flight safety and the evaluee applies prompt corrective action. The NATOPS evaluation flight is intended to evaluate unit/individual compliance with approved standardized operating procedures. The successful completion of all ground checks and examinations is required before commencement of the flight evaluation. Insofar as possible, checks will be scheduled so as not to interfere with squadron operations. The flight evaluation check should conform to any syllabus flight. Only those areas observed, or required by the mission assigned, will be evaluated. The flight evaluation grade will be attained by comparing the degree of pilot adherence to standard operating procedures with the adjective ratings as outlined for individual areas and subareas of this section. Determinations of the final flight evaluation grade will be made as outlined in Final Grade Determination.

19.1.5.8 Flight Evaluation Grade Determination. The following procedure shall be used in determining the flight evaluation grade.

A grade of Unqualified in any critical area/subarea will result in an overall grade of Unqualified for the flight. Otherwise, flight evaluation (or area) grades shall be determined by assigning the following numerical equivalents to the adjective grade for each subarea. Only numerals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

1. Unqualified – 0.0

2. Conditionally Qualified – 2.0

3. Qualified – 4.0

To determine the numerical grade for each area and the overall grade for the flight, add all the points assigned to the subareas and divide this sum by the number of subareas graded.

The adjective grade shall then be determined on the basis of the following scale.

1. 0.0 to 2.19 – Unqualified

2. 2.2 to 2.99 – Conditionally Qualified

3. 3.0 to 4.0 – Qualified

Example: $\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20$ or Qualified

19.1.5.9 Final Grade Determination. The final NATOPS evaluation grade shall be the same as the grade assigned to the flight evaluation. An evaluee who receives an Unqualified on any ground examination or the flight evaluation shall be placed in an Unqualified status until he achieves a grade of Conditionally Qualified or Qualified on a reevaluation.

19.2 RECORDS AND REPORTS

The NATOPS Evaluation Report, OPNAV Forms 3610.8, shall be completed for each evaluation conducted, and shall be forwarded to the evaluee's commanding officer only. This report shall be filed in the individual's flight training/qualification jacket in accordance with OPNAVINST 3710.7.

An entry shall be made in the Pilot/NFO Flight Logbook under Qualification and Achievements as follows:

NATOPS Eval.	(Aircraft Model)	(Crew Pos)	(Date)	(Authenticating Signature)	(Unit which Administered Eval.)

In the case of enlisted flight crewmembers, an entry shall be made in the administrative Remarks section of his personnel record upon satisfactory completion of the NATOPS evaluation as follows:

1. (Date) Completed a NATOPS Evaluation in (aircraft designation) as (flight crew position) with an overall grade of (Qualified or Conditionally Qualified).

19.3 TA-4F/J NATOPS QUESTION BANK

The following bank of questions is intended to assist the unit NATOPS instructor/evaluator in the preparation of ground examinations and to provide an abbreviated study guide. The questions from the bank may be combined with locally originated questions in the preparation of ground examinations.

Note

The NATOPS QUESTION BANK pertains to the TA-4F, and TA-4J aircraft. Questions to be used by the different commands will be determined by equipment installed.

1. How is the 80 percent sensing circuit of the oil quantity indicator/switch checked?
2. With a throttle linkage failure how can the engine be secured?
3. Describe the functioning of the fuel quantity indicator after a failure of the transformer rectifier.
4. When external electrical power is not available during pressure fueling, what precautions must be taken to prevent possible damage to the internal fuel tanks structure?
5. Can a short circuit in the fire-detection system be detected by the pilot? If so, how?
6. Where are the hydraulic system pressure gauges located?
7. List the components operated by the utility hydraulic system.
8. What is the purpose of the rotary viscous dampers on the ailerons and rudder?
9. What caution must be observed when operating the horizontal stabilizer manual override lever?
10. In the event of a utility hydraulic system failure, what prevents the landing gear from extending when hydraulic pressure is lost?
11. What is the purpose of the aileron followup trim tab?
12. What is the purpose of the retraction release safety-solenoid?
13. What prevents spoiler operation during flight?
14. What caution should be observed after emergency landing gear handle has been pulled?
15. What is the purpose of the vortex generators?
16. Can the arresting hook be lowered after a complete hydraulic failure?
17. What precautions must be taken prior to opening or closing the canopy?
18. Can the canopy be jettisoned in the open position by pulling the canopy jettison handle?
19. What is the purpose of the DART system?
20. If the pilot separates from the seat manually (by use of the emergency restraint release handle) will the parachute deploy automatically?
21. Where is the gyro ground test switch located?
22. What is the maximum length of time that the fast erect switch may be pressed without damaging the circuitry?
23. How is the angle-of-attack indexer lighting integrity checked?
24. What switch activates the angle-of-attack vane heater?
25. Where is the UHF communication antenna located?

26. How many reply codes is the APX-64/72 system capable of providing in Mode 3/A?

27. How many minutes warmup should be allowed before switching tacan from REC to T/R?

28. What navaids are available on emergency generator?

29. What prevents frosting of the bullet-resistant glass center panel of the windshield?

30. What precaution must be taken to prevent windshield center panel from fogging when the emergency generator is extended?

31. If oil pressure exceeds 50 psi in flight, what action should be taken?

32. With fuel in the 300 gallon external fuel tanks, what limitations must be observed when performing aileron rolls?

33. During taxi, what indication would the pilot have if nose strut were overinflated?

34. What signal should pilot use to cut off starting air to engine?

35. What effect will shutting down the engine at touchdown have on reducing landing roll? Why?

36. Describe gouge for proper parade formation bearing.

37. Describe gouge for proper freecruise formation bearing.

38. If a successful takeoff is made with a blown tire, what precautions should be taken?

39. In the event of a confirmed engine failure during catapult launch, what action should be taken?

40. After takeoff the nose gear indicates unsafe with the landing gear handle up and both main gear indicating UP. What should you do?

41. What action is recommended when a loss of thrust occurs and icing is suspected?

42. You're cruising at FL 310 and suddenly experience fluctuating EGT, fuel flow, and EPR. What should you do?

43. Off your third bombing run, the oil quantity light comes on steady. What action would you take?

44. What indication would you have of failure of the engine driven fuel pump?

45. During flight you get dense smoke in the cockpit. You select RAM air and find no evidence of fire but the smoke becomes so dense that you can't see. What would you do?

46. You are climbing through 1,200 feet off the catapult and accelerating through 230 KIAS when a flameout occurs. What action would you take?

19.3.1 Fill in the Blanks

1. The aircraft is powered by a __________ gas turbine engine producing a sea-level static thrust rating of __________ pounds.

2. Basic weight (to nearest 50 pounds) is __________ (total operating weight from Figure 20-1).

3. Wingspan is _________ feet.

4. The total temperature sensor is located _________.

5. The engine utilizes a split _________ stage axial compressor.

6. There are _________ combustion chambers. Numbers _________ and _________ have spark igniters.

7. For engine starting, the timer energizes the high-power ignition unit supplying _________ joules to both igniters for a _________ to _________ second firing cycle.

8. The manual fuel control system compensates only for ___________________________.

9. When shifting the engine fuel control from PRIMARY to MANUAL below 225 KIAS, select a minimum throttle setting of _________ percent rpm.

10. During a normal start the manual fuel control warning light will go out at about _________ to _________ percent rpm.

11. List the two conditions which will cause the low fuel state warning light to come on.
____

12. The tachometer indicates the speed of the _________-pressure compressor rotor (N_________) as a percentage of _________ rpm.

13. The pressure ratio indicator provides the ratio of _________ pressure to pressure at the ___________________.

14. The pressure ratio indicator should be read at _________ airspeed.

15. In the high thrust range an increase of only _________ °C may double the rate of turbine blade creep.

16. The oil cooler employs _________ as a coolant.

17. Maximum oil consumption is approximately _________ quarts per hour.

18. Absence of oil pressure is permissible for a maximum of _________ seconds.

19. The wing tank transfer pump utilizes ___________________ for power.

20. The fuel transfer caution light will be on when engine rpm is below _________ percent rpm.

21. Approximately fuel transfer rates from the drop tanks (90-percent power setting) are: _________ PPH from SL to 5,000 feet MSL and _________ PPH from 25,000 to 35,000 feet MSL.

22. The emergency transfer system allows _________ to pressurize the _________.

23. List the usable fuel in pounds for the following: (standard day, JP-5, pressure fueling)

    a. Fuselage _________

    b. Wing _________

c. Two 300 gallon droptanks ________

d. Total ________

24. Indicated airspeed for most accurate fuel reading is ________ KIAS.

25. When fuselage tank quantity drops to about ________ pounds, wing fuel cell quantity will not be indicated on the fuel quantity indicator.

26. Electrical power is normally supplied by a ________ kVA engine-driven generator which furnishes ________/________ volt ________ phase ________ cycle constant-frequency ac power.

27. The emergency generator is rated at ________ kVA.

28. The main generator is driven at a constant speed of ________ rpm.

29. The emergency generator is driven by a variable-pitch propeller at approximately ________ rpm and provides power to the ________ and ________ buses.

30. The emergency generator bypass switch should be in the ________ position for normal flight operations.

31. While operating on emergency generator, actuation of ________________ or ________________ will divert all power from the monitored primary bus.

32. Fuses are located on three panels. Two of them located ________________ and the other located ________________.

33. The hydraulic systems operate at a pressure of about ________ psi and relief valves open at ________ psi.

34. When the speedbrakes are opened, the control stick moves ________.

35. The rudder system operates at a reduced hydraulic pressure of ________ psi.

36. Total travel of the rudder trim position indicator represents ________ ° of travel left and right of center.

37. List all possible cockpit indications of an unsafe landing gear condition:

a. ________________________________

b. ________________________________

c. ________________________________

38. List the conditions necessary to activate the nosewheel steering system.

a. ________________________________

b. ________________________________

c. ________________________________

d. ______________________________

e. ______________________________

39. During ground operations with the nosewheel steering switch in NORMAL and the arresting hook handle DOWN, the nosewheel will be ______________.

40. With full right rudder trim, the nosewheel will steer ________ degrees right and ________ degrees left.

41. The wing flaps are ________ controlled, ________ actuated and extended ________ degrees when full DOWN.

42. The speedbrakes begin to blow back at ________ KIAS and will not open fully above ________ KIAS.

43. The wing slats begin to open at some airspeed below ________ KIAS and are fully opened at ________.

44. Normal arresting hook snubber pressure is ________ psi.

45. How may the canopy be opened from inside cockpit with no utility system pressure available?

46. The automatic barometric parachute openers are set to operate at ________ feet altitude.

47. When the emergency restraint release handle is pulled up, the ______________ lanyard and the ______________ and ______________ attachments are released from the seat allowing the pilot to leave the cockpit with the ________ and ________ still attached to his torso harness.

48. Sea level liquid oxygen duration is about doubled at ________ feet altitude, increased four times at ________ altitude and increased ________ times at 40,000 feet altitude.

49. The emergency oxygen cylinder pressure gauge should register ________ psi when full at 70 °F.

50. The emergency oxygen supply will last from ________ to ________ minutes depending on altitude.

51. Pitot-static system instruments are:

a. ______________________________

b. ______________________________

c. ______________________________

52. Electrically-operated flight instruments are:

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

53. A maximum of _________ seconds may be required for gyro erection and amplifier warmup.

54. On the BDHI, needle 1 will always indicate _________ bearing, however, if the compass card is out of SYNC needle 2 will indicate _________ bearing only.

55. Maximum endurance is obtained at _________ units angle-of-attack (with two 300 gallon tanks).

56. Optimum angle-of-attack setting should be _________ units.

57. The approach light arresting hook bypass switch is located _________________________________.

58. The squelch-disable switch should normally be placed in the _________ position.

59. If the ICS amplifier in one cockpit should fail what can be done to restore communications?

____

60. Can the AN/ARR-69 (UHF) auxiliary receiver system be controlled from the rear cockpit? _________

61. A compass card error of ± _________ degrees will peg the synchronization needle of the compass controller.

62. For A/A tacan operation, the cooperating aircraft must be separated by exactly _________ channels.

63. A/A tacan may be utilized by one lead aircraft and up to _________ others.

64. To check the ASN-41, rotate function selector switch to TEST and place BDHI switch in NAV CMPTR. Proper indications are: (TA-4F)

   a. WIND SPEED ______________________

   b. WIND DIRECTION ___________________

   c. LAT PRESENT POSIT _________integration

   d. BDHI number 2 pointer _____________

   e. BDHI number 1 pointer _____________.

65. To check APN-153, allow _________ minute(s) warmup in STBY, then switch to TEST. Proper indications are: (TA-4F)

   a. Memory light ________________

   b. Ground speed ________________

   c. Drift angle _________________.

66. The AFCS will maintain a bank angle of _________ in a preselect heading turn.

67. Warmup period of the AFCS is _________ seconds.

68. The AFCS altitude-hold switch cannot be engaged in climbs or descents in excess of _________ FPM.

69. The AFCS will disengage from control stick steering mode when the ailerons are deflected over ____________________.

70. If the ladder lights are not visible in daylight, check the ____________________ switch(es) full OFF.

71. Normal cockpit pressurization schedule holds __________ feet cockpit altitude to an aircraft altitude of __________ feet.

72. With normal cockpit pressurization, cockpit altitude will be about __________ feet at an aircraft altitude of 20,000 feet, and __________ feet at an aircraft altitude of 35,000 feet.

73. In order to prevent excessive pressure differential in the cockpit, a relief valve opens at a positive pressure differential of __________ psi and at a negative differential of __________ psi.

74. For maximum use of the engine anti-icing system, the engine should not be operated below __________ percent rpm.

75. Rain removal system operations at MILITARY power is limited to __________ minutes on the ground, and __________ minutes in flight.

76. The centerline refueling store contains a __________ gallon fuel cell. (TA-4F)

77. The operational envelope of the store with the drogue extended is limited to __________ KIAS or __________ Mach, whichever is lower, at altitudes up to 35,000 feet. (TA-4F)

78. The amber light on the aft end of the air refueling store comes on when ____________________, and the green light comes on when ____________________. (TA-4F)

79. Actuating the air refueling store HOSE JETTISON switch removes all electrical power from the store controls except the ____________________. (TA-4F)

80. Do not start ground fueling operations within __________ feet of aircraft with radar equipment operating.

81. When pressure fueling by the alternate method, __________ must be removed to prevent possible damage to wing integral fuel tank structure.

82. The fuel control fuel selector is accessible through the engine __________ access door.

83. Checking or filling the engine oil system should be accomplished within __________ minutes after engine shutdown. If not serviced within this period, the engine must be turned up at 75-percent rpm or more for __________ to establish actual oil tank level.

84. Engine oil spec is __________.

85. The CSD utilizes __________ fluid.

86. To start the aircraft, __________ electrical power is required for ignition.

87. If EGT exceeds __________ °C __________ times, or reaches __________ °C to __________ °C for one period of __________ seconds or more, engine must be subjected to an overtemperature inspection. An EGT exceeding __________ °C for any period of time will require a teardown inspection of all hot section parts.

Operating Condition	Max EGT °C	Max rpm Percent	Time Limit
Idle			
Acceleration			
Normal			
Military			

88. If oil pressure indication is less than _________ psi at _________ -percent rpm, shut down and investigate cause.

89. Maximum operating time with oil pressure less than 40 psi in flight is _________.

90. With 20-percent light on at start, if oil pressure is within limits, operate engine at _________ rpm for _________ minutes.

91. Normal oil pressure limits for flight are _________ psi to _________ psi.

92. The maximum permissible change in angle of bank during rolling pullouts or pushovers is _________________.

93. The minimum approach speed is _______ knots with up to __________ foot-pounds asymmetric moment, varying linearly to _______ knots at _______ foot-pounds.

94. Airspeed limitations with gear and flaps extended are _________ KIAS with zero yaw and _________ KIAS with unrestricted yaw.

95. The airspeed limitation on buddy store hose retraction is _________ KIAS.

96. Airspeed limitations with flight controls disconnected are:

 a. Asymmetrical Loading: _________ KIAS

 b. Symmetrical Loading: _________ KIAS or _________ IMN whichever is lower.

97. The airspeed limitation with the emergency generator extended is _________ KIAS or _________ IMN whichever is lower.

98. The maximum recommended gross weight for field takeoff is _________ pounds.

99. The maximum gross weight for field landing is _________ with minimum rate of descent or _________ pounds normally.

100. Maximum recommended catapult weight is _________ pounds.

101. Carrier arrestment weight limitation is _________ pounds.

102. The maximum recommended gross weight for barricade engagement is _________ pounds.

103. Maximum asymmetrical load limitations are _________ foot-pounds for field takeoffs and carrier landings and _________ foot-pounds for carrier catapult launches.

104. Operations of the AFCS is unrestricted above _________ feet altitude.

105. Minimum altitude for operation of the AFCS is _________ feet.

106. HANDS OFF operation of the AFCS will be permitted between 1,000 feet and 7,500 feet, if ____________________.

107. At 18,000 pounds gross weight in symmetrical flight, structural acceleration limits are + ___________ g and - ___________ g.

108. Minimum requirements for night flying are: 1. ____

2. ____.

109. Before actual instrument flight in the A-4/TA-4, a pilot must have at least _________ hours in the A-4 in the last _________ months, one flight within _________ days, a current instrument card, and demonstrated instrument proficiency in model.

110. On preflight, the arresting hook holddown cylinder pressure gauge should read _________ psi.

111. On a cart-controlled start, the pilot should signal to cut off the air supply at _________ to _________-percent rpm.

112. Engine should light off within _________ seconds after throttle is moved outboard to start ignition.

113. Warmup time for electronic equipment is as follows:

ITEM	WARMUP TIME
ARC-51A	________________
ARR-69	________________
ARA-50	________________
ARN-52	________________
APX-64	________________
ASN-41 (TA-4F)	________________
APN-141	________________
AJB-3A	________________
AFCS	________________
APN-153 (TA-4F)	________________

114. Tacan switch should be placed in REC position for _________ minutes before going to T/R position.

115. Minimum taxi interval is _________ feet, or taxi in close formation.

116. For aileron trim check, P/C should check followup tab ± _________ inch from faired with aileron trailing edge.

117. List indications of closed and locked canopy.

a. ____

b. ____

c. ____

118. After takeoff, raise the flaps at __________ KIAS or above.

119. Section takeoffs are not permitted with a crosswind component in excess of __________ knots.

120. Takeoffs are not recommended when the crosswind component exceeds __________ knots.

121. To accomplish a minimum run takeoff, __________ noseup trim and __________ flaps should be employed.

122. At a gross weight of 12,000 pounds recommended approach speed (optimum AOA) is __________ knots and increases __________ knots for each 1,000 pounds increase.

123. Maximum recommended crosswind components for landing are:

a. With spoilers __________ knots

b. Without spoilers __________ knots.

124. With a power boost disconnect, maximum crosswind component is __________ knots.

125. After touchdown on a crosswind landing the control stick should be placed ____________________________.

126. Desired distance abeam in the FMLP pattern is __________ nm.

127. After an FMLP touch and go landing, climb straight ahead until reaching at least __________ feet altitude and __________ KIAS.

128. During night VFR conditions the wingman should have ____________________ lights on __________/__________, and the anticollision light __________.

129. At the end of the catapult power stroke the aircraft should be rotated to approximately __________ degrees on the attitude gyro.

130. During hot refueling at night, the emergency fuel cutoff signal is ____________________.

131. Aboard ship, the plane captain must ____________________ upon completion of hot refueling. Drop tanks must be either ____________________ or ____________________.

132. A ____________________ is installed in the elevator control system to provide longitudinal load feel.

133. Above .9 IMN the elevator effectiveness __________.

134. During recoveries from dives at supersonic speeds, a marked pitchup will occur at approximately __________ IMN.

135. The aircraft is subject to strong __________ tendencies above .9 IMN with flight control boost disconnected.

136. With flight control boost disconnected and asymmetric store loadings, the minimum initial approach airspeed is __________ KIAS and minimum final approach and touchdown is __________ KIAS.

137. Compute stalling speeds with speedbrakes retracted, gear down, takeoff thrust, and half flaps for the following gross weights:

12,000 pounds: _________ KIAS, 16,000 pounds: ________ KIAS, 20,000 pounds: ________ KIAS.

138. Compute stalling speeds with speedbrakes open, gear and full flaps down, and approach thrust, for the following conditions:

GROSS WT.	BANK ANGLE		
	0	30	45
12,000			
14,000			
16,000			

139. During flight with aft C.G. locations (aft of 26-percent MAC), __________________ may be encountered when applying load factor.

140. Do not select power settings below _________-percent rpm at speeds below _________ KIAS.

141. Eject if an inadvertent confirmed spin occurs below _________ AGL.

142. Spin recovery techniques are as follows:

TYPE SPIN	RUDDER	AILERON	STICK
ERECT	------- IF NO RESPONSE -------		
INVERTED			

143. Recovery from a fully developed spin requires _________ to _________ feet altitude with proper application of controls.

144. In uncontrolled flight, immediately after a full stall, the best control technique to prevent a spin is __________________.

145. Unless otherwise briefed, rendezvous are made at _________ KIAS.

146. The lead aircraft in a turning rendezvous should maintain _________ degrees of bank.

147. After engaging drogue, receiver aircraft must move forward _________ to _________ feet and extinguish amber light on the refueling store before fuel transfer can commence.

148. Maximum speed for unfeathering the air refueling store turbine is _________ KIAS. (TA-4F)

149. Maximum speed for extension of the drogue and air refueling is _________ KIAS or _________ IMN. (TA-4F)

150. Closure rates above _________ knots may induce hose whip.

151. Optimum airspeed for air refueling is _________ KIAS.

152. If fuel leaks from the probe after disengagement, the pilot should ________________.

153. Aircraft should maintain at least ________ feet lateral separation from the tanker during unfeathering or feathering of the air turbine.

154. Druing night formation flight, channel changes shall be made by ________ whenever possible.

155. A false start occurs when the time from lightoff to IDLE exceeds ________ seconds.

156. On a wet start the throttle should be retarded to OFF, being careful ________________________.

157. List the initial procedures for an engine fire during start:

a. ____

b. ____

c. ____.

158. The signal for brake failure on the flight deck is:

a. Day ________________________

b. Night ________________________.

159. On a takeoff abort, the hook should be dropped ________ feet prior to abort gear, if required.

160. With a fuel-boost pump failure, full power is available to ________ feet and possibly as high as ________ feet. Observe the following restrictions: ________________________.

161. To shift fuel control from PRIMARY to MANUAL, throttle should be ________.

162. If engine oil pressure drops below 40 psi, gradually adjust engine speed to ________________________.

163. Describe the AIRSTART PROCEDURES:

____
____
____
____
____
____
____
____
____

164. List three indications which may confirm a fire warning light indication:

____
____
____

165. Describe proper procedures to be taken with a fire warning light and other indications of fire:

____
____
____
____

166. Ejection is mandatory if the aircraft is in uncontrolled flight at __________ -feet AGL or below.

167. While on the run-in line for an O/S loft delivery the engine flames out. What would you do?

____

168. Canopy can be unlatched manually and removed by the airstream if airspeed is above __________ KIAS.

169. Deploying the RSSK-8 seat pack is not recommended over ____________________.

170. During any low altitude ejection the pilot should ______________________________ immediately after ejection.

171. Determine terrain clearance for safe ejection for the following conditions:

a. Wings level, 90 to 200 knots, 800 FPM descent; __________ feet altitude.

b. Wings level, 90 to 200 knots, 4,000 FPM descent; __________ feet altitude.

c. 60° bank, 90 to 200 knots, 1,000 FPM climb; __________ feet altitude.

d. 30° bank, 90 to 200 knots, 1,500 FPM descent; __________ feet altitude.

e. 90° bank, 90 to 200 knots, level flight; __________ feet altitude.

172. The recommended speed for maximum glide range with engine windmilling is approximately __________ KIAS for gross weights up to 12,000 pounds in clean configuration. Increase airspeed __________ knots for each 1,000 pounds increase over 12,000 pounds.

173. On a round-robin day instrument flight you suffer a bird-strike on missed approach from a GCA at an AFB. Your wingman determines that the bird hit the port side of the radome and did no visible structural damage. All engine instruments are normal and you have been cleared on your route to your home field 200 nm away. What would you do? ____

174. If a hydraulic system is lost during flight, be alert for evidence of ____________________.

175. Describe the flight control disconnect procedure:

____
____
____
____
____
____

176. What may happen if you deploy the emergency generator above 25,000 feet and 96-percent power? Why?

______________________________________.

177. With a main generator failure and while operating on the emergency generator, which of the following systems will continue to operate?

ARC-51A	ASN-41 (TA-4F)
TACAN	APPROACH LIGHTS
FUEL QUANTITY	NORMAL WEAPONS RELEASE
FIRE WARNING	AILERON TRIM
SPEEDBRAKES	OIL PRESSURE DIRECT READING
NORMAL TRIM	ARA-50 UHF HOMER
AJB-3A	EMERGENCY BOMB RELEASE
WING LIGHTS	HORIZONTAL STABILIZER OVERRIDE
TRIM INDICATORS	WHEEL AND FLAP INDICATORS
IFF	ANGLE OF ATTACK INDICATOR

178. If the AFCS malfunctions and cannot be disengaged with the AP button on the control stick or by turning the AFCS switch off, you should: ______________________________.

179. If normal aileron trim is not restored upon disengagement of the AFCS, what can you do to restore normal operation? ______________________________.
____

180. In the event spoilers deploy in flight, proceed as follows: ______________________________
____
____

181. During flight, with 1,200 pounds external fuel remaining, drop tanks pressurized, and full internal fuel, the fuel transfer light, and low fuel state warning light come ON steady and stay ON.
What malfunction is indicated? ______________________________
At this point, how much fuel would you assume you have available? __________ pounds. Would you actuate the emergency transfer system at this time? __________ Explain your decision.
____

182. List the restrictions applicable to flight with the EMER TRANS system activated:

a. Airspeed ____________________

b. Bank angle ____________________

c. Load factor ____________________

d. Attitude ____________________

e. Landings ____________________

f. Air refueling ____________________

g. Other ____________________
____
____

183. If unable to obtain drop tank fuel by normal means, what action may be taken to obtain the fuel?
____

184. If you have a pitot-static system failure which is not rectified by selecting pitot heat, and you require pitot-static instruments to complete the flight, what can you do to restore operation? ____________________
____

185. If the air refueling store drogue and coupling are lost, what must be done to feather the RAM air turbine blades? (TA-4F) ______________________________

186. What are the night light approach signals to a no-radio wingman?______________________________
____

187. For a PA, set the gunsight at __________ mils, place pipper __________ feet from the approach end of the runway to establish desired glide slope at __________ KIAS. Rate of descent will be __________ to __________ FPM depending on wind.

188. PA checkpoints are established on the basis of __________ feet altitude for each __________ nm from touchdown.

189. Which type of field arresting gear has the lowest maximum engaging speed limit (for all types of arrestments)?______________________

190. Which type of field arresting gear has the lowest maximum off-center engagement limit?
____________________.

191. If you must land gear up on a foamed runway, what is the maximum desired fuel load? Why?
____

192. Describe the emergency landing gear extension procedure:
____
____
____
____

193. In the event the landing gear does not indicate down and locked with the gear doors extended, slowly increase airspeed up to a maximum of __________ KIAS to obtain a down and locked indication.

194. How is approach speed determined on a no-flap approach? ______________________________

195. Maximum recommended gross weight for a no-flap landing aboard ship is __________ pounds.

196. What angle of attack should be flown on landing approach with a stuck slat?
____

197. With no airspeed or angle of attack, what can be used to indicate a safe approach speed?
____

198. Describe procedure for landing with full NOSEDOWN trim: ____
____
____

199. If you know prior to landing that you have a blown main tire, what type of field landing would you plan to make? ____________________

200. Procedures for a clean penetration are as follows: At penetration fix with 230 KIAS, lower nose to about ________ degrees nosedown. As airspeed reaches ________ KIAS extend speedbrakes. Maintain ________ KIAS and adjust power as necessary to maintain ________ to ________ FPM rate of descent. Initial power setting should be about ________-percent rpm.

201. The dirty penetration is performed at ________ KIAS, wheels and flaps DOWN, speedbrakes ________ and a rate of descent of ________ to ________ FPM. Power setting should be about ________ percent.

202. What is the approximate rate of descent for a GCA on a 3° glide slope with 5 knots of headwind? ________ FPM

203. On a section landing approach, when does the wingman obtain landing interval? ____________________
____

204. A section of aircraft is flying in instrument conditions when the wingman loses sight of the leader. He should:

a. ____________________

b. Go on instruments, take ________ degree turn away from leader, hold for ________ minutes then resume original heading.

205. The four basic steps of preparation for thunderstorm penetration are:

H____________________

A____________________

L____________________

T____________________

206. When utilizing the UHF transceiver, delay the transmission about 1 second after keying the mike to avoid ____________________.

207. Minimum altitude for switching radio or IFF under night or IFR conditions is ________ feet.

208. Describe the visual hand signal used to indicate a question. ____________________

209. What is the day signal that you are going to dump fuel? ____________________

210. Describe the day signal to put your flight into cruising formation. ____________________
____

211. A series of zooms is a signal to: ____________________

212. Describe the signal used to ask bearing and distance to a tacan station.

____

213. Describe visual signal to wingman to have him turn his IFF to STANDBY.

____

214. Describe signal that your UHF transmitter has failed.

DAY ____

NIGHT ____

215. Describe signal to ready guns. ______________________________

216. The day HE FOE signal is a weeping signal followed by a numeral hand signal 1 to 5. What does each number stand for?

1. ____

2. ____

3. ____

4. ____

5. ____

217. As a no-radio wingman, you have been brought back to the field or ship and are configured for landing; your leader gives you a thumbs-up and points his finger toward the runway or ship with repeated stabbing motions. What does this signal mean? ______________________________

a. What action would you take? ______________________________

218. What is pilot's response to the pistol cocking signal from the arming supervisor?

____

219. What signal should the ground crew use to indicate hot brakes?

____

220. Minimum acceptable grades for the NATOPS written examinations are:

Open Book ______________ Closed Book ______________

19.3.2 Performance Data

1. Weight and Drag Computations

Given: Operating weight from Figure 20-1 as basic weight. In addition to items listed, the aircraft carries:

Full internal fuel JP-5 (pressure fueling).
200 rounds ammo.

Station 3: Full 300 gallons fuel tank.
Station 1 & 5: AGM-12B missiles on Aero 5A launchers.
Station 2 & 4: 2 MK 82 LDGP (conical tails) on TER-7.

Find: Gross weight _________.
Total drag index _________.

2. Takeoff Speed – Operational

Given: Runway temperature 90 °F.
Runway pressure altitude 500 feet.
Takeoff weight 22,000 pounds.

Find: Takeoff speed – Operational _________ KCAS.

3. Takeoff Distance – Operational, Line Speed Check, Takeoff Refusal Speed, and Stopping Distance

Given: Data from takeoff speed problem above.
Headwind 6 knots.
Runway gradient +1 percent.

Find: Takeoff distance – Operational _________ feet.
Total distance to clear a 50 foot obstacle _________ feet.
Line speed check at the 2,000 foot runway marker _________ KCAS.
Takeoff refusal speed for an 8,500 foot runway _________ KIAS.
Stopping distance at takeoff refusal speed _________ feet.

4. Climb, Combat Ceiling and Optimum Cruise Altitude

Given: Initial gross weight 21,000 pounds.
Cruise altitude 27,000 feet.
Drag Index 100.
Temperature deviation + 5 °C.

Find: Climb fuel _________ pounds
Climb distance _________ nm.
Climb time _________ minutes.

Given: Gross weight 20,000 pounds.
Drag Index 100.

Find: Combat ceiling _________ feet.
Optimum cruise altitude _________ feet.

5. Fouled Deck Range

Given: Fuel on board 1,900 pounds
Altitude 20,000 feet.

Find: Chart is based on __________ drag index.
Reserve fuel allowance for landing __________ pounds.
Range at 20,000 feet __________ nm.
Optimum altitude __________ feet.
Range at optimum altitude __________ nm.
KCAS at optimum altitude __________ KCAS.
Climb schedule speed ____________________.
Descent speed __________ KCAS.
Start letdown from altitude with __________ pounds fuel remaining.

6. Long Range Cruise

Given: Average gross weight 16,000 pounds.
Cruise altitude: optimum.
Drag index 75.

Find: Optimum cruise altitude __________ feet.
EPR __________.
Mach number __________.
Specific range __________ nautical miles/1,000 pounds fuel.

7. Maximum Range Cruise

Given: Average gross weight 16,000 pounds.
Pressure altitude 35,000 feet.
Drag index 75.
Outside air temperature -50 °C.
Wind 50 knot headwind.
Ground distance 400 nm.

Find: True Mach number __________.
Maximum Range TAS __________ KTAS.
Time __________ minutes.
Specific range __________ nautical miles/1,000 pounds fuel
Fuel Flow __________ pph
Fuel required __________ pounds.

8. Nautical Miles Per Pound of Fuel

Given: Average gross weight 18,000 pounds.
Cruise altitude 15,000 feet.
Drag index 150.
True Mach number 0.59.
Outside air temperature -20 °C.

Find: Clean aircraft thrust required/δ amb __________ pounds.
Total thrust required/δ amb __________ pounds.
Nautical miles per pound of fuel __________.
True airspeed __________ KTAS.
Fuel flow __________ pph.
EPR __________.

9. Bingo Endurance

Given: Fuel on board 1,700 pounds.
Altitude sea level.

Find: Chart is based on __________ drag index.
Reserve fuel allowance for landing __________ pounds.
Endurance at sea level __________ minutes.
Optimum altitude __________ feet.
Endurance at optimum altitude __________ minutes.
KCAS at optimum altitude __________ KCAS.
Climb schedule airspeeds ____

____
Descent speed __________ KCAS.
Start letdown from altitude with __________ pounds fuel remaining.

10. Maximum Endurance

Given: Average gross weight 13,000 pounds.
Bank angle 15°.
Loiter altitude: optimum.
Drag index 100.
Temperature deviation from standard day + 6 °C.
Loiter time 40 minutes.

Find: Optimum altitude __________ feet.
Optimum true Mach number __________.
Loiter airspeed __________ KCAS.
Fuel flow __________ pph.
Fuel required __________ pounds.

11. Tanker Fuel Available for Transfer (TA-4F)

Given: Fuel JP-5
Refueling radius: 200 nautical miles.

Find: Fuel available for transfer __________ pounds.

12. Tanker Fuel Transfer Time (TA-4F)

Given: Fuel JP-5
Fuel transferred to receiver: 5,500 pounds.

Find: Elapsed time __________ minutes.
Point where fueling temporarily discontinued __________ minutes.
Point where fueling resumed __________ minutes.

13. Fuel Consumption of Tanker During Air Refueling (TA-4F)

Given: Refueling speed: 230 KCAS.
Gross weight: 22,000 pounds.

Find: Fuel flow at 30,000 feet __________ pph.
Fuel flow at 20,000 feet __________ pph.

14. Descent

Given: Initial gross weight 13,000 pounds.
Cruise altitude 40,000 feet.
Drag index 100.

Find: Fuel required __________ pounds.
Distance __________ nm.
Descent speed __________ KCAS.
Time __________ minutes.

15. Approach Speed

Given: Gear down
Speedbrakes open.
Thrust required to maintain 4° glide slope.
Optimum approach AOA.

Find: Indicated airspeeds as follows:

SPEED	FLAPS	GROSS WEIGHT – POUNDS			
		12,000	13,000	14,000	16,000
Stall speed	Flaps up				
	Full flaps				
Approach speed	Flaps up				
	Full Flaps				

16. Landing Distance

Given: Air temperature 40 °F.
Pressure altitude 4,000 feet.
Gross weight 14,000 pounds.
Flap deflection: Full.
Headwind 10 knots.
Runway gradient 0.

Find: Ground roll distance - dry runway __________ feet.
Total distance to clear a 50 foot obstacle with 4° glide slope for dry runway __________ feet.
Ground roll distance - wet runway __________ feet.
Ground roll distance - snow and ice __________ feet.

17. Turning Radius

Given: True airspeed: 350 KTAS.
Bank angle: 45°.
Heading change: 90°.

Find: Turning radius __________ feet.
Distance traveled in turn __________ nautical miles.

18. Maneuverability

Given: Gross weight 20,000 pounds.
Mach number 0.65.
Altitude sea level.
Drag index 100.

Find: Normal load factor X gross weight __________ pounds.
Normal load factor __________ g.

19. Maximum Mach Number

Given: Drag index 72.
Gross weight: 18,000 pounds.

Find: Maximum true Mach number - sea level __________.
Maximum true Mach number - 10,000 feet __________.

20. Military Fuel Flow

Given: Pressure altitude: 16,000 feet.
Mach number 0.8.

Find: Fuel flow __________ pounds/minute.
Fuel flow __________ pounds/hour.

19.3.3 True or False

1. The manual fuel control light should never be on while the fuel control switch is in the PRIMARY position.

2. The engine can be shut down utilizing throttle in aft cockpit.

3. High rates of roll can cause momentary erroneous EGT indications.

4. Fuel flow rates less than 300 pound per hour may be interpolated on the indicator dial.

5. The IDLE EGT limit of 340 °C is not a firm operating limit.

6. Oil pressure indication are not available on emergency generator.

7. Oil quantity indicator/switch indications should be valid during taxi.

8. When utilizing emergency transfer, fuel is transferred to the fuselage tank through the pressure fueling line only.

9. The emergency wing tank fuel transfer system will not operate on emergency generator.

10. Transfer of external fuel may not be possible with the wing fuel switch in the EMER TRANS position.

11. Operating the wing fuel switch to the DUMP position while the drop tanks are pressurized may overpressurize the wing fuel cell.

12. Drop tank fuel transfer is not available on emergency generator.

13. The fuel boost warning light normally comes on when the wing fuel cell is depleted.

14. The armament safety disable switch is a momentary switch and enables power to energize the armament bus only while it is held closed.

15. Hydraulic systems will operate normally with engine windmilling.

16. With a flight control hydraulic system failure, dropping the landing gear will cause a temporary decrease in the effectiveness of the flight controls.

17. Ailerons may be trimmed with the followup tab when on emergency generator.

18. Loss of rudder hydraulic power results in loss of rudder trim.

19. Pulling the manual flight control T-handle disconnects the elevator, aileron and rudder power cylinders from the flight controls.

20. Normal trim is available after a hydraulic power disconnect.

21. Speedbrakes are not available on emergency generator.

22. Wheelbrakes utilize utility hydraulic system pressure.

23. It is possible to receive erroneous indications on the gyro indicator without OFF flag showing.

24. Turn needle on AJB-3A is still reliable when OFF flag appears on gyro indicator.

25. The turn needle will operate on emergency generator power.

26. A/A mode of the tacan provides range and bearing information on a cooperating aircraft.

27. Excessive UHF-ADF bearing errors may result when stores are carried on centerline station.

28. The AFCS will not operate on emergency generator.

29. With both hydraulic systems normal, the AFCS will operate after the manual flight control disconnect handle is pulled.

30. The AFCS will continue to operate if only the utility hydraulic system fails.

31. The AFCS can be utilized in all modes with the aileron trim switch in the EMERG position.

32. The AFCS should be placed in STBY for takeoff.

33. The control stick trim switch is inoperative whenever the AFCS is engaged.

34. Depressing the PUSH TO SYNC button on the compass controller will disengage the AFCS.

35. The rain removal system is available on emergency generator.

36. A utility hydraulic system failure has no effect on JATO system operation.

37. Drop tanks cannot be pressure fueled if electrical power is not available.

38. External electrical power should be connected to the aircraft for gravity fueling.

39. Failure of the J52-P-8A engine fuel control to maintain EGT within limits at all altitudes is a downing discrepancy.

40. If directional control difficulties are encountered during takeoff, nosewheel steering may be safely engaged at speeds up to 70 knots.

41. Spoilers should be used when taxiing in a crosswind on the flight deck aboard ship.

42. When a tillerbar is used, nosewheel steering should be used judiciously.

43. If the aircraft goes down on the catapult, give the catapult officer a thumbs-down signal.

44. EPR readings are not valid on catapult launches because of the wind-over-the-deck.

45. The aircraft may be hot refueled through the probe or the pressure fueling receptacle.

46. The pilot will close and lock the canopy and select RAM air during hot refueling.

47. Raising the wing flaps or landing gear causes a nosedown trim change.

48. The AFCS is equipped with automatic pitch trim.

49. Receiver aircraft must ensure that the EMERGENCY WING TANK TRANSFER switch is OFF before engaging in air refueling.

50. After the HOSE JETTISON switch is actuated, it should be returned to the OFF position. (TA-4F)

51. The air refueling store turbine should not be energized after fuel is dumped from the store. (TA-4F)

52. Placing the SHIP-TANK switch in the TO STORE position imposes the same restrictions on the aircraft as placing the EMERGENCY WING TANK TRANSFER switch to EMER TRANS. (TA-4F)

53. Restrictions listed with SHIP-TANK switch in the TO STORE position do not apply unless a refueling store is actually carried. (TA-4F)

54. Brakes should be pumped for maximum effectiveness on a minimum distance landing.

55. If the retraction safety-solenoid is inoperative after takeoff, actuate the retraction-release switch manually, raise the gear, and continue the mission.

56. With a throttle linkage failure the engine will stabilize at 85- to 87-percent rpm.

57. Negative-g flight is recommended prior to lightoff on an airstart, to clear the engine of residual fuel.

58. With a wing fire in flight, you should jettison your drop tanks even though transfer has been completed.

59. In the event of electrical fire on normal generator, placing the emergency generator bypass switch to BYPASS will eliminate normal generator electrical power to the aircraft.

60. When a water landing is imminent, disconnect the parachute-riser releases just prior to water contact.

61. After flight control disconnect on a test hop you can utilize the AFCS.

62. With a complete hydraulic failure and the flight control system disconnected, high rudder forces should be expected because the tandem rudder actuator does not disconnect.

63. If aileron trim fails, you should attempt to check the trim circuit by operating the trim switch in the opposite direction.

64. If aileron trim runs to maximum deflection before it can be stopped, disconnect the flight control system.

65. Air refueling store hose jettison is available on emergency generator. (TA-4F)

66. Fuel cannot be transferred from the air refueling store to the wing when on emergency generator. (TA-4F)

67. For a carrier barricade engagement with a landing gear malfunction the cross deck pendants should be left on deck.

68. In an underwater escape situation, if the canopy cannot be jettisoned, the service revolver should be used to shoot out the plexiglass.

69. In an underwater escape situation, inflating the Mk 3C while in the cockpit will aid in escape by floating the pilot out of the cockpit.

70. Use of the rain removal system is recommended to remove ice from the windshield.

71. The air conditioning system contains a water separator.

72. If gun charging switch is inadvertently switched to SAFE after your first practice live strafing run, you can switch back to READY and continue making firing runs if guns fired normally on the first pass.

73. External stores cannot be jettisoned by the emergency release system if the landing gear are down.

74. A pilot who achieves a grade of conditionally qualified on a NATOPS evaluation may not fly without a qualified chase pilot.

75. The NATOPS ground evaluation must be satisfactorily completed prior to the flight evaluation.

MULTIPLE CHOICE

1. Horizontal stabilizer trim limits are:

   a. 12° noseup, 1° nosedown.

   b. 11° noseup, 1-1/2° nosedown.

c. 12-1/4° noseup, 1-1/4° nosedown.

d. 12-1/4° noseup, 1° nosedown.

2. When the master light switch is ON, the approach lights will be:

a. Unaffected.

b. Dimmed.

c. Bright.

d. Flashing.

3. On emergency generator:

a. all exterior lights are available.

b. exterior and interior lights are available.

c. probe light is available.

d. approach lights are available.

4. With a full air refueling store and 2 fuel drop tanks, placing the air refueling store SHIP-TANK switch in the FROM STORE position and the drop tank transfer switch OFF, external fuel will: (TA-4F)

a. not transfer.

b. transfer from air refueling store only.

c. transfer from air refueling store and drop tanks.

d. transfer from drop tanks only.

5. The rpm at MILITARY thrust:

a. does not vary with changes in inlet temperature.

b. decreases as inlet temperature decreases.

c. increases as inlet temperature decreases.

d. none of the above.

6. When P/C holds his fist vertically in front of himself and makes a large horizontal circle with his fist, proper pilot response is:

a. move all controls through full travel checking for proper throw and feel.

b. ascertain no hydraulic ladder lights come on when flight controls are moved rapidly.

c. position flight controls to full left rudder, stick full aft and port.

d. all of the above.

7. If refueling master switch is placed in OFF position with a receiver aircraft plugged in and receiving fuel, the following will result: (TA-4F)

   a. fuel transfer will stop.

   b. fuel transfer will stop and hose will retract.

   c. air turbine will feather.

   d. none of the above.

8. Which of the following will stop fuel transfer to a receiver aircraft: (TA-4F)

   a. turning SHIP-TANK switch OFF.

   b. placing refueling master switch OFF.

   c. turning fuel transfer switch OFF.

   d. all of the above.

PART XI

Performance Data

CHAPTER 20

Performance Data

20.1 INTRODUCTION

The operating data charts contained in this part provide the pilot with information enabling him to realize the maximum performance capabilities of the aircraft. Use of the chart material for preflight planning and application of the prescribed operating procedures will result in optimum effectiveness of the aircraft.

Part XI is divided into several parts to present performance data in proper sequence for preflight planning. Chapters 20 and 29 contain data pertinent to the complete section. Chapters 21 through 28 contain performance data for TA-4F aircraft equipped with J52-P-8 engines. Chapters 30 through 37 contain performance data for TA-4F/J aircraft equipped with J52-P-6 engines. Some charts in Chapters 30 through 37 are labeled TA-4F only, but are applicable to both TA-4F and TA-4J aircraft. Sample problems and charts are provided (in Chapters 20 through 29 only) to present the sequence of steps required to find the proper values and solution of a given problem. Performance data is presented in graphical type charts for ICAO standard day conditions. In some instances, temperature corrections for nonstandard atmosphere have been included.

20.2 PERFORMANCE DATA BASIS

Performance data is based on aircraft characteristics obtained from Navy and contractor flight tests on models A-4F and TA-4F aircraft, calculations, and engine data from Pratt and Whitney specifications. All charts are presented for ICAO standard atmosphere conditions, although ambient temperature correction scales are provided in a number of charts where temperature effects are significant. All performance is based on a center of gravity position of 25-percent MAC. All charts are applicable to JP-4 or JP-5 fuel, having a nominal density of 6.5 and 6.8 pounds per gallon respectively.

20.3 DRAG COUNT INDEX SYSTEM

The large variety of possible external store loadings permitted on the TA-4F/J requires revised methods of performance data presentation. The new method, called the Drag Count Index System, permits the presentation of performance data for a number of external store loadings on one chart, greatly reducing the number of charts required.

In the Drag Count Index System, each item of the external store configuration, such as a bomb, tank, pylon or multiple bomb adapter, is assigned a drag number whose value depends on the size and shape of the item and its location on the aircraft. The summation of these individual drag numbers, for a particular loading, defines the drag index for that configuration. This index, when applied to the performance charts, defines the performance of that configuration.

The individual store drag numbers used for determining the drag indexes are shown in Figure 20-1. Note that the drag numbers for a given store, depend on the store station on which they are carried. An X in a drag index column of Figure 20-1 indicates that the noted store is carried on that particular station but the drag index number is not available at time of publication. The weights of the external stores, pylons, tanks, and adapters are also included in Figure 20-1. The drag of the clean aircraft (drag index = 0) includes the drag of the centerline pylon but no guns or wing pylons.

Note

Drag index as indicated in Figure 20-1 is for a particular system only (i.e., does not include suspension).

20.3.1 Sample Problem

20.3.1.1 Drag Indexes. (For Figure 20-1). Assume the external configuration consists of a 300-gallon Aero 1-D fuel tank on the centerline pylon, a 5 X 300 pound Mk 81 Snakeye bomb cluster on each inboard wing pylon, and a 500-pound Mk 82 bomb on each outboard wing pylon.

External Store Item	Drag Index	Weight-Pounds
2 - Mk 12 20mm and ammunition	7.0	457
1 - 300-gallon Aero 1-D fuel tank on centerline	15.0	2,223
2 - inboard wing pylons	12.0	140
2 - outboard wing pylons	14.0	128
2 - MER-7 multiple bomb adapters	46.0	446
2 - 5 X 300 pound Mk 81 Snakeye bombs	70.0	3,000
2 - 500-pound Mk 82 bombs	6.0	1,060
Totals	170.0	7,454

As the mission is flown, tanks may be dropped and stores will be expended changing the external store configuration and thus the drag index.

1. After the centerline fuel tank is dropped:

External Store Item	Drag Index
2 - Mk 12 20mm guns	7.0
2 - inboard wing pylons	12.0
2 - outboard wing pylons	14.0
2 - MER-7 multiple bomb adapters	46.0
2 - 5 X 300 pound Mk 81 Snakeye bombs	70.0
2 - 500-pound Mk 82 bombs	6.0
Total Drag Index	155.0

2. After the centerline fuel tank is dropped and the bombs are expended:

External Store Item	Drag Index
2 - Mk 12 20mm guns	7.0
2 - inboard wing pylons	12.0
2 - outboard wing pylons	14.0
2 - MER-7 multiple bomb adapters	46.0
Total Drag Index	79.0

20.4 AIRSPEED CORRECTIONS

Several corrections to the airspeed indicator reading must be added to arrive at the true airspeed of the aircraft. Two corrections, peculiar to the indicator, are instrument error and lag. These errors, which are usually insignificant, are added algebraically to the indicator reading to obtain the indicated airspeed.

Calibrated airspeed is equal to the airspeed indicator reading corrected for position and instrument error. Position error, shown in Figure 20-6, is an error introduced because of the location of the static source at a point of nonambient static pressure.

Equivalent airspeed is equal to the airspeed indicator reading corrected for position error, instrument error, and for adiabatic compressible flow, compressibility correction, for the particular altitude.

True airspeed is related to equivalent airspeed by *the following:* $KTAS = KEAS \times 1/\sqrt{\sigma}$.

To convert calibrated airspeed to true airspeed and true Mach number, Figure 20-2 is provided. Figure 20-2 has compressibility effects reflected in the graph, permitting a direct step from calibrated to true airspeed.

A position error is associated with the Mach number indicated values and the true Mach number values. This relationship is shown in Figure 20-6.

20.4.1 Sample Problem

20.4.1.1 Airspeed Correction for Position Error. For Figure 20-6.

A. Indicated airspeed – 400 knots

B. True pressure altitude – 20,000 feet

C. ΔV – Correction to be added – 1 knot

(1) Calibrated airspeed – 401 knots.

20.4.1.2 Mach Number Correction for Position Error. For Figure 20-6.

D. Indicated Mach number – 0.854 M

E. ΔM – Correction to be added – 0.002 M

(1) True Mach number – 0.856 M.

20.1.4.3 Airspeed Conversion. For Figure 20-2.

A. Calibrated airspeed – 360 knots

B. True pressure altitude – 25,000 feet

C. True Mach number – 0.849 M

D. OAT – 20 °C

E. True airspeed – 565 knots.

20.5 ALTIMETER CORRECTIONS

The altimeter is connected to the static source. Position error corrections, similar to those for airspeed indications, must be applied to the altimeter indications to obtain true pressure altitude. The corrections are given in Figure 20-6. Instrument error and altimeter lag are also prevalent in the altimeter system. The lag error (approximately 100 feet) could be significant in a low-altitude dive pullout.

20.5.1 Sample Problem

20.5.1.1 Altitude Correction for Position Error. For Figure 20-6.

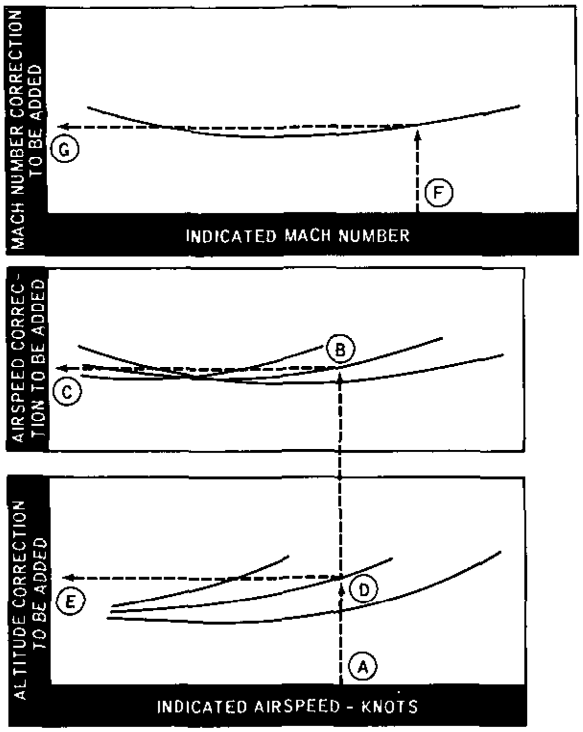
A. Indicated airspeed – 400 knots

B. Pressure altitude – 20,000 feet

C. Δh - Correction to be added – 75 feet

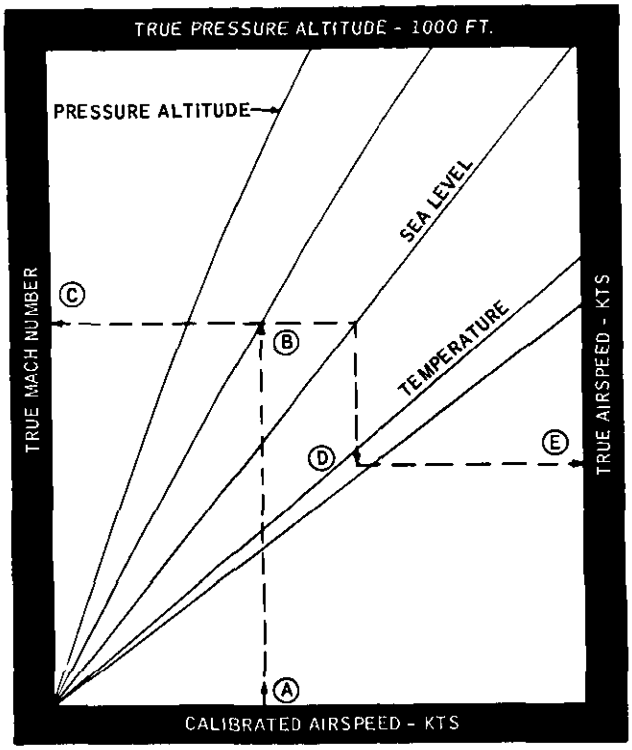
(1) True pressure altitude – 20,075 feet.

SAMPLE AIRSPEED - MACH NUMBER - ALTITUDE CORRECTION FOR POSITION ERROR



TA1-230-B

SAMPLE AIRSPEED CONVERSION



TA1-47-A

STORE DRAG INDEXES AND GROSS WEIGHTS

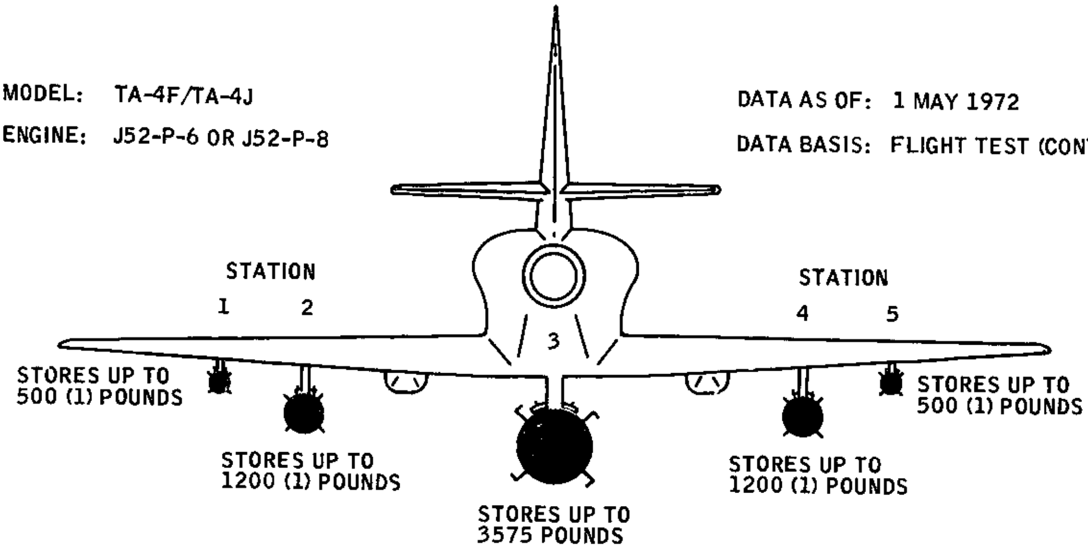
CLEAN AIRCRAFT CONFIGURATION (LESS GUNS AND WING PYLONS) DRAG INDEX = 0

MODEL: TA-4F/TA-4J

ENGINE: J52-P-6 OR J52-P-8

DATA AS OF: 1 MAY 1972

DATA BASIS: FLIGHT TEST (CONTRACTOR)



TYPICAL AIRCRAFT WEIGHT (POUNDS)			
WEIGHT EMPTY	J52-P-6A/B ENGINE		J52-P-8A/B ENGINE
	TA-4F	TA-4J	TA-4F
OPERATING WEIGHT (2, 3)	11,221	11,163	11,500
TWO 20MM GUNS (NO AMMO)	315	313	314
TWO AERO 20A RACK-PYLONS ON STATIONS 75	140	120	140
TWO AERO 20A RACK-PYLONS ON STATIONS 113.75	128	116	128
TWO 300-GALLON AERO-1D EXTERNAL FUEL TANKS	398	398	398
ARMOR PLATE (4)	347	163	336
TOTAL OPERATING WEIGHT	12,549	12,273	12,816

NOTES:

1. REFER TO THE A-4/TA-4 TACTICAL MANUAL NAVAIR 01-40AV-1T FOR CARRIAGE AND RELEASE LIMITATIONS, AND EXCEPTIONS FOR CARRIAGE OF CERTAIN STORES WEIGHING MORE THAN STATION LIMITATIONS SHOWN.
2. OPERATING WEIGHT INCLUDES A CENTERLINE AERO 7A RACK (WITH FAIRING), CREW, ENGINE OIL, TRAPPED FUEL AND OIL, OXYGEN (10 LITER), AND MISCELLANEOUS EQUIPMENT (PARAKITS, ETC.).
3. OPERATING WEIGHT DOES NOT INCLUDE ECM EQUIPMENT.
4. WEIGHT SHOWN FOR ARMOR PLATE INCLUDES 165 POUNDS OF BALLAST FOR THE MODEL TA-4F AND 13 POUNDS OF BALLAST FOR THE MODEL TA-4J WITH J52-P-6A/B ENGINE, 186 POUNDS OF BALLAST FOR THE MODEL TA-4F WITH J52-P-8A/B ENGINE.

N9/92
TA1-49-E

Figure 20-1. Drag Indexes (Sheet 1 of 2)

GUNS AND SUSPENSION EQUIPMENT	APPROX WEIGHT LB/EA	DRAG INDEX AT STORE STATION:				
		1	2	3	4	5
TWO MK 12 GUNS AND 200 ROUNDS AMMO	457			7		
200 ROUNDS 20-MM AMMO	142					
ONE AERO 20A RACK-PYLON	68		6		6	
ONE AERO 20A RACK-PYLON	64	7				7
AERO 1A ADAPTER						
AERO 2A LAUNCHER						
*AERO 5A LAUNCHER ADAPTER	99	7	7	7	7	7
A/A 37B-3 PMBR	87					
*TER-7	105		12	12	12	
*MER-7	223		23	23	23	
LAU-24/A LAUNCHER						
MK 51 BOMB RACK						

TANKS AND PODS(1)	SUSPENSION	NO. OF STORES	APPROX WEIGHT LB/EA	DRAG INDEX AT STORES STATION:				
				1	2	3	4	5
*150 GAL FUEL TANK; FULL/EMPTY(2)	AERO-20A, -7A	1	1156/136 (1111)		10	10	10	
*300 GAL FUEL TANK (BOBTAIL); FULL/EMPTY(2)	AERO-7A	1	2223/183 (2133)			15		
300 GAL FUEL TANK (FINNED) FULL/EMPTY(2)	AERO-20A	1	2239/199 (2149)		14		14	
400 GAL FUEL TANK; FULL/EMPTY(2)	AERO-7A	1	2960/240 (2840)			20		
*300 GAL REFUELING STORE; FULL/EMPTY(2)	AERO-7A	1	2765/725 (2675)			30/119(3)		
GTC-85 POD-MOUNTED; FULL/EMPTY	AERO-20A, -7A	1	700/650		19	21	19	

NOTES:

1. Refer to the A-4/TA-4 Tactical Manual, NAVAIR 01-40AV-1T, for all other applicable external store drag index and weight data, carriage and release limitations, and exceptions for carriage of the stores weighing more than station limitations noted on sheet 1.
2. Full tank weight for JP-5 fuel, JP-4 in parentheses.
3. Hose and drogue: retracted/extended.
4. Drag index does not include drag index of suspension equipment for above items.

*Changed by NAVAIRSYSCOM HQ letter, 10 Apr 69.

Figure 20-1. Drag Indexes (Sheet 2 of 2)

AIRSPEED CONVERSION

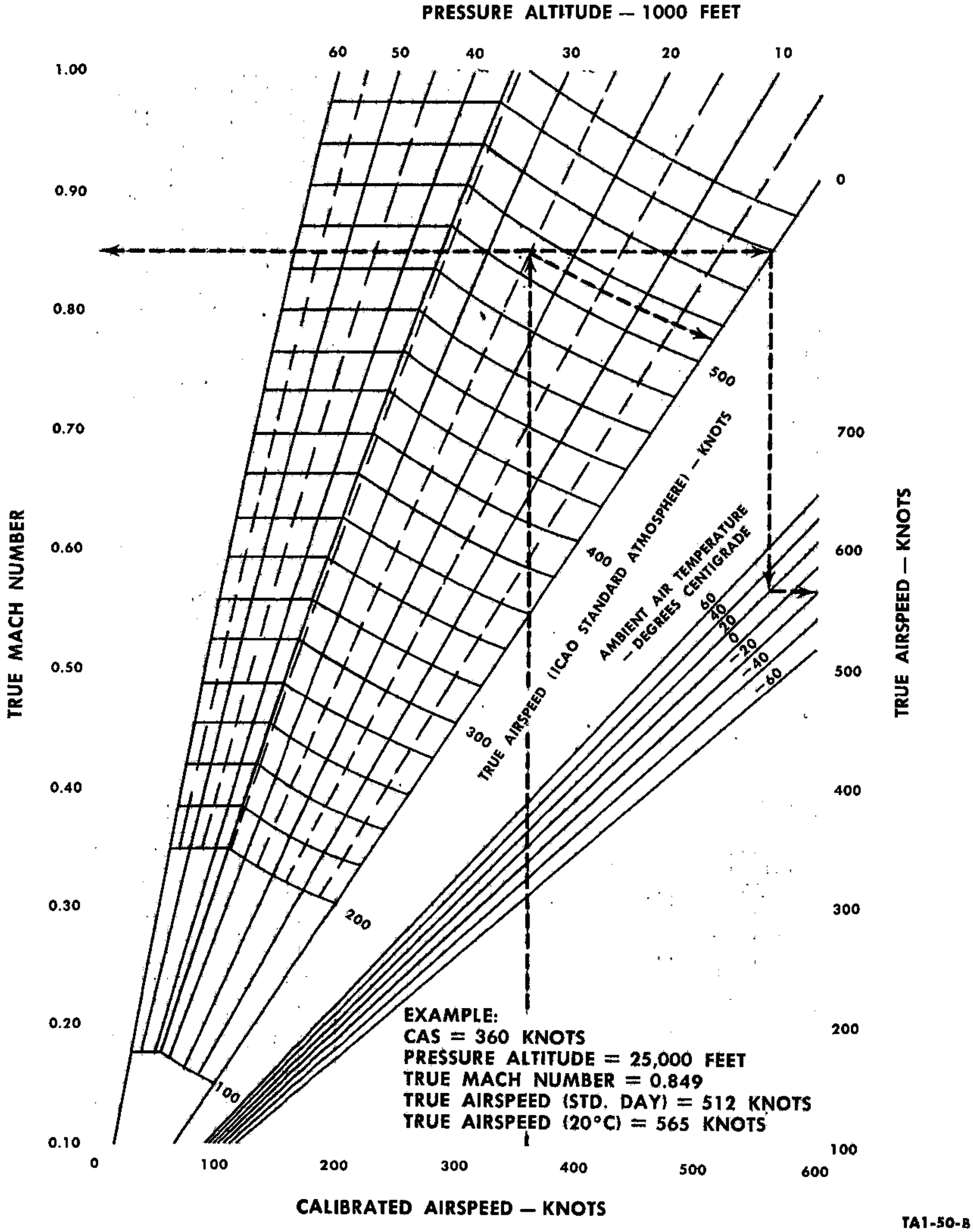


Figure 20-2. Airspeed Conversion

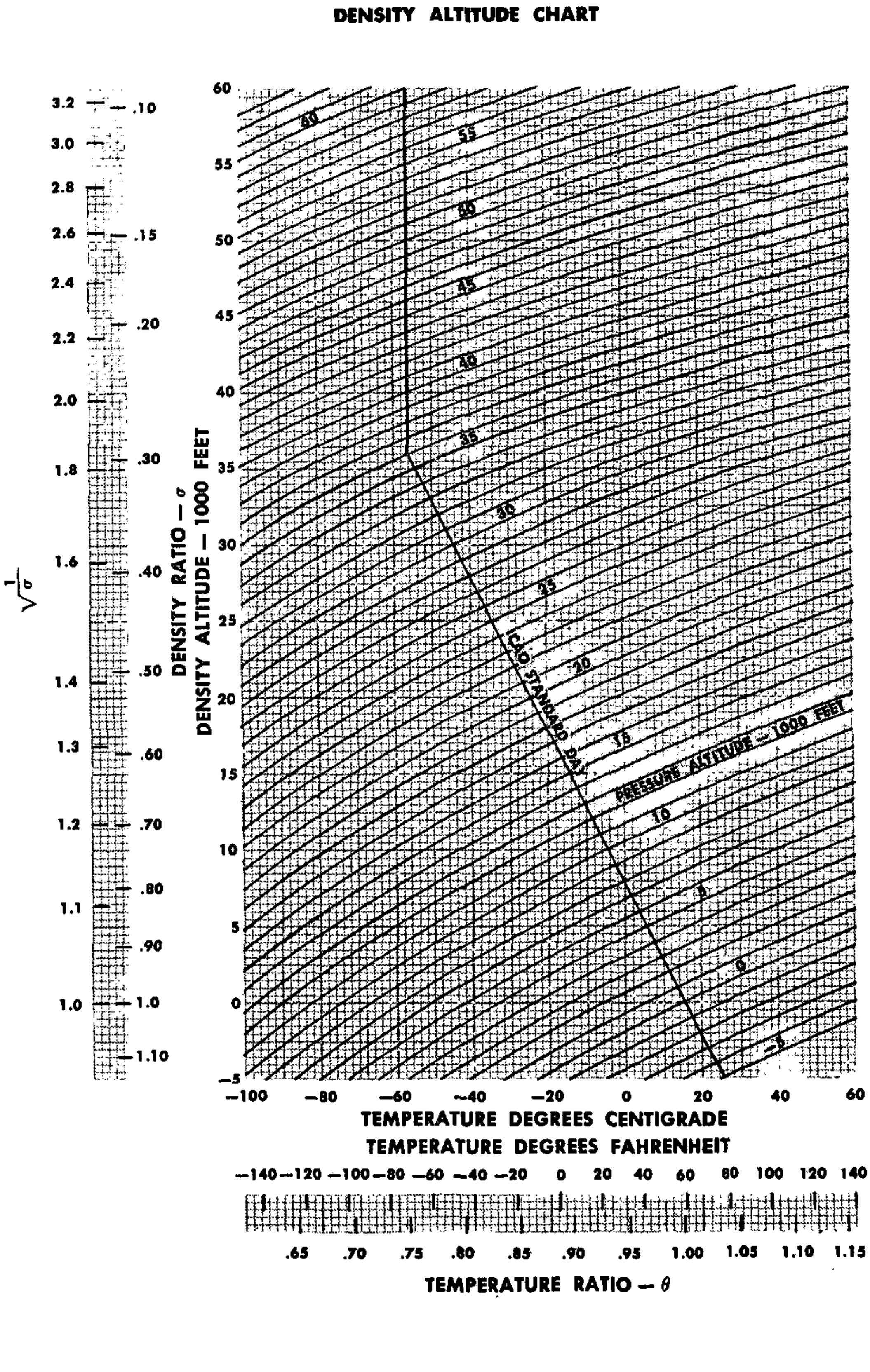


Figure 20-3. Density Altitude Chart

DEGREES CENTIGRADE	DEGREES FAHRENHEIT	DEGREES CENTIGRADE	DEGREES FAHRENHEIT	DEGREES CENTIGRADE	DEGREES FAHRENHEIT
-75	-103.0	-33	-27.4	9	48.2
-74	-101.2	-32	-25.6	10	50.0
-73	- 99.4	-31	-23.8	11	51.8
-72	- 97.6	-30	-22.0	12	53.6
-71	- 95.8	-29	-20.2	13	55.4
-70	- 94.0	-28	-18.4	14	57.2
-69	- 92.2	-27	-16.6	15	59.0
-68	- 90.4	-26	-14.8	16	60.8
-67	- 88.6	-25	-13.0	17	62.6
-66	- 86.8	-24	-11.2	18	64.4
-65	- 85.0	-23	- 9.4	19	66.2
-64	- 83.2	-22	- 7.6	20	68.0
-63	- 81.4	-21	- 5.8	21	69.8
-62	- 79.6	-20	- 4.0	22	71.6
-61	- 77.8	-19	- 2.2	23	73.4
-60	- 76.0	-18	0.4	24	75.2
-59	- 74.2	-17	1.4	25	77.0
-58	- 72.4	-16	3.2	26	78.8
-57	- 70.6	-15	5.0	27	80.6
-56	- 68.8	-14	6.8	28	82.4
-55	- 67.0	-13	8.6	29	84.2
-54	- 65.2	-12	10.4	30	86.0
-53	- 63.4	-11	12.2	31	87.8
-52	- 61.6	-10	14.0	32	89.6
-51	- 59.8	- 9	15.8	33	91.4
-50	- 58.0	- 8	17.6	34	93.2
-49	- 56.2	- 7	19.4	35	95.0
-48	- 54.4	- 6	21.2	36	96.8
-47	- 52.6	- 5	23.0	37	98.6
-46	- 50.8	- 4	24.8	38	100.4
-45	- 49.0	- 3	26.6	39	102.2
-44	- 47.2	- 2	28.4	40	104.0
-43	- 45.4	- 1	30.2	41	105.8
-42	- 43.6	0	32.0	42	107.6
-41	- 41.8	1	33.8	43	109.4
-40	- 40.0	2	35.6	44	111.2
-39	- 38.2	3	37.4	45	113.0
-38	- 36.4	4	39.2	46	114.8
-37	- 34.6	5	41.0	47	116.6
-36	- 32.8	6	42.8	48	118.4
-35	- 31.0	7	44.6	49	120.2
-34	- 29.2	8	46.4	50	122.0

Figure 20-4. Centigrade/Fahrenheit Conversion

Altitude Feet	Density Ratio $\sigma = \rho/\rho o$	$\frac{1}{\sqrt{\sigma}}$	Temperature ^oC	Temperature ^oF	Temperature Ratio $\theta = T/T_o$	Speed of Sound Ratio a/ao	Pressure In. of Hg	Pressure Ratio $\delta = P/P_o$
Sea Level	1.0000	1.0000	15.000	59.000	1.0000	1.000	29.921	1.0000
1000	0.9711	1.0148	13.019	55.434	0.9931	0.997	28.856	0.9644
2000	0.9428	1.0299	11.038	51.868	0.9862	0.993	27.821	0.9298
3000	0.9151	1.0454	9.056	48.302	0.9794	0.990	26.817	0.8962
4000	0.8881	1.0611	7.075	44.735	0.9725	0.966	25.842	0.8637
5000	0.8617	1.0773	5.094	41.169	0.9656	0.983	24.896	0.8320
6000	0.8359	1.0938	3.113	37.603	0.9587	0.979	23.978	0.8014
7000	0.8106	1.1107	1.132	34.037	0.9519	0.976	23.088	0.7716
8000	0.7860	1.1279	-0.850	30.471	0.9450	0.972	22.225	0.7428
9000	0.7620	1.1456	-2.831	26.905	0.9381	0.969	21.388	0.7148
10,000	0.7385	1.1637	-4.812	23.338	0.9312	0.965	20.577	0.6877
11,000	0.7156	1.1822	-6.793	19.772	0.9244	0.961	19.791	0.6614
12,000	0.6932	1.2011	-8.774	16.206	0.9175	0.958	19.029	0.6360
13,000	0.6713	1.2205	-10.756	12.640	0.9106	0.954	18.292	0.6113
14,000	0.6500	1.2403	-12.737	9.074	0.9037	0.951	17.577	0.5875
15,000	0.6292	1.2606	-14.718	5.508	0.8969	0.947	16.886	0.5643
16,000	0.6090	1.2815	-16.699	1.941	0.8900	0.943	16.216	0.5420
17,000	0.5892	1.3028	-18.680	-1.625	0.8831	0.940	15.569	0.5203
18,000	0.5699	1.3246	-20.662	-5.191	0.8762	0.936	14.942	0.4994
19,000	0.5511	1.3470	-22.643	-8.757	0.8694	0.932	14.336	0.4791
20,000	0.5328	1.3700	-24.624	-12.323	0.8625	0.929	13.750	0.4595
21,000	0.5150	1.3935	-26.605	-15.889	0.8556	0.925	13.184	0.4406
22,000	0.4976	1.4176	-28.586	-19.456	0.8487	0.921	12.636	0.4223
23,000	0.4807	1.4424	-30.586	-23.022	0.8419	0.918	12.107	0.4046
24,000	0.4642	1.4678	-32.549	-26.588	0.8350	0.914	11.597	0.3876
25,000	0.4481	1.4938	-34.530	-30.154	0.8281	0.910	11.104	0.3711
26,000	0.4325	1.5206	-36.511	-33.720	0.8212	0.906	10.627	0.3552
27,000	0.4173	1.5480	-38.493	-37.286	0.8144	0.902	10.168	0.3398
28,000	0.4025	1.5762	-40.474	-40.852	0.8075	0.899	9.725	0.3250
29,000	0.3881	1.6052	-42.455	-44.419	0.8006	0.895	9.297	0.3107
30,000	0.3741	1.6349	-44.436	-47.985	0.7937	0.891	8.885	0.2970
31,000	0.3605	1.6654	-46.417	-51.551	0.7869	0.887	8.488	0.2837
32,000	0.3473	1.6968	-48.399	-55.117	0.7800	0.883	8.106	0.2709
33,000	0.3345	1.7291	-50.379	-58.683	0.7731	0.879	7.737	0.2586
34,000	0.3220	1.7623	-52.361	-62.249	0.7662	0.875	7.382	0.2467

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft
0.4912 lb per sq in.

(2) ICAO Standard Sea Level Air
$t_o = 15^oC$
P_o = 29.921 in. of Hg
ao = 661.8 knots
ρ_o = 0.0023769 slug per cu ft

DATA BASIS: NACA Technical Note No. 3182

Figure 20-5. ICAO Standard Altitude Chart (Sheet 1 of 2)

Altitude Feet	Density Ratio $\sigma = \rho/\rho_o$	$\frac{1}{\sqrt{\sigma}}$	Temperature °C	Temperature °F	Temperature Ratio $\theta = T/T_o$	Speed of Sound Ratio a/ao	Pressure In. of Hg	Pressure Ratio $\delta = P/P_o$
35,000	0.3099	1.7964	-54.342	-65.816	0.7594	0.871	7.041	0.2353
36,000	0.2981	1.8315	-56.323	-69.382	0.7525	0.867	6.712	0.2243
36,089	0.2971	1.8347	-56.500	-69.700	0.7519	0.867	6.683	0.2234
37,000	0.2844	1.8753	↑	↑	↑	↑	6.397	0.2138
38,000	0.2710	1.9209					6.097	0.2038
39,000	0.2585	1.9677					5.811	0.1942
40,000	0.2462	2.0155					5.538	0.1851
41,000	0.2346	2.0645					5.278	0.1764
42,000	0.2236	2.1148					5.030	0.1681
43,000	0.2131	2.1662					4.794	0.1602
44,000	0.2031	2.2189					4.569	0.1527
45,000	0.1936	2.2728					4.355	0.1455
46,000	0.1845	2.3281					4.151	0.1387
47,000	0.1758	2.3848					3.956	0.1322
48,000	0.1676	2.4428					3.770	0.1260
49,000	0.1597	2.5022					3.593	0.1201
50,000	0.1522	2.5630					3.425	0.1145
51,000	0.1451	2.6254					3.264	0.1091
52,000	0.1383	2.6892					3.111	0.1040
53,000	0.1318	2.7546					2.965	0.0991
54,000	0.1256	2.8216					2.826	0.0944
55,000	0.1197	2.8903					2.693	0.0900
56,000	0.1141	2.9606					2.567	0.0858
57,000	0.1087	3.0326					2.446	0.0818
58,000	0.1036	3.1063					2.331	0.0779
59,000	0.09877	3.1819					2.222	0.0743
60,000	0.09414	3.2593					2.118	0.0709
61,000	0.08972	3.3386					2.018	0.0675
62,000	0.08551	3.4198					1.924	0.0643
63,000	0.08150	3.5029					1.833	0.0613
64,000	0.07767	3.5881	↓	↓	↓	↓	1.747	0.0584
65,000	0.07403	3.6754	-56.500	-69.700	0.7519	0.867	1.665	0.0557

REMARKS:

(1) One in. of Hg = 70.732 lb per sq ft = 0.4912 lb per sq in.

(2) ICAO Standard Sea Level Air
t_o = 15°C
P_o = 29.921 in. of Hg
ao = 661.8 knots
ρ_o = 0.0023769 slug per cu ft

DATA BASIS: NACA Technical Note No. 3182

Figure 20-5. ICAO Standard Altitude Chart (Sheet 2 of 2)

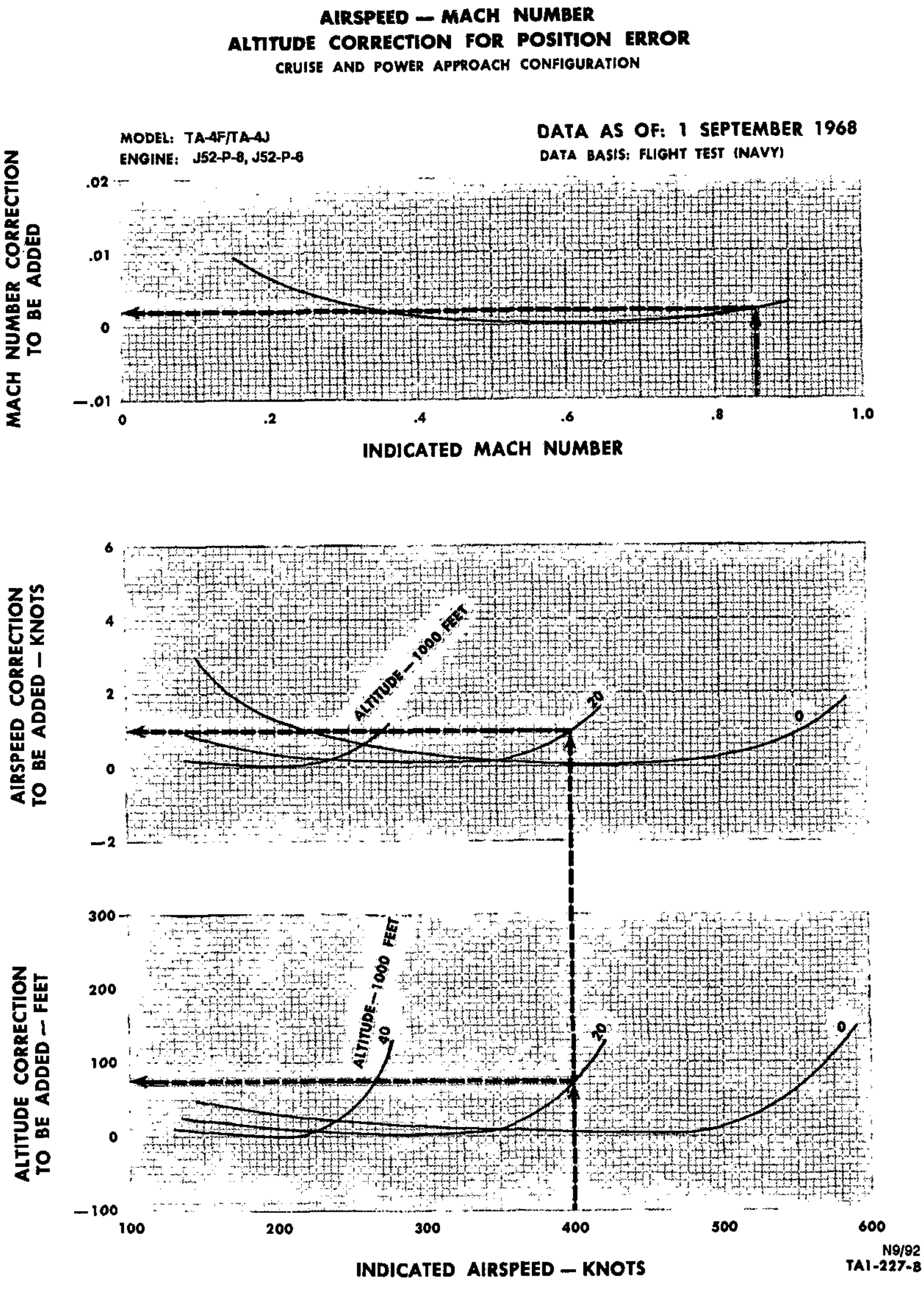


Figure 20-6. Airspeed – Mach Number – Altitude Correction for Position Error

CHAPTER 21

Takeoff

21.1 TAKEOFF CHARTS

The takeoff charts present takeoff distance, maximum takeoff weight, JATO firing delay, and JATO takeoff distance. The charts encompass such variables as takeoff weight, equivalent airspeed, ambient runway temperature, runway pressure altitude, wind, and runway gradient. Half flaps and MILITARY thrust are recommended for all takeoffs.

Variables, which are not considered in the charts, that will influence the acceleration of the aircraft during ground run are pilot braking to maintain directional control; runway surface conditions which constitute a lower or higher value for the rolling coefficient of friction (μ); external store loadings on the wing stations which protrude forward or near the leading edge of the wing and influence the flow field of air over the wing, reducing lift and increasing required takeoff speeds; and rough or bumpy runways which influence the taxi attitude of the aircraft, introducing aerodynamic braking during the ground run. Of these variables, pilot braking, which is a function of pilot technique, probably has the greatest influence on acceleration-retardation and will increase the ground run significantly.

21.2 OPERATIONAL TAKEOFF DISTANCE

Operational takeoff distance, total distance to clear a 50-foot obstacle, without JATO assist, and recommended takeoff speeds are shown in Figures 21-1 and 30-1. Takeoff distances are based on half flaps, MILITARY thrust, and 8° aircraft noseup trim.

Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limit speed of 175 knots groundspeed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under maximum takeoff weight.

The method of obtaining the ground run distance, total distance to clear a 50-foot obstacle, and the line speed check is described in the following example.

Note

When operational conditions require takeoffs where computed takeoff distance places the aircraft in the region labeled TAKEOFF IS MARGINAL on chart, lift-off speed should be increased approximately 5 to 10 knots; not to exceed tire limiting speed. This will result in increased rates of climb. Runway length and location of abort gear must be considered in planning this type of takeoff.

21.2.1 Sample Problem

21.2.1.1 Takeoff Distance – Operational. For Figure 21-1.

A. Takeoff weight – 20,000 pounds

B. Takeoff airspeed – 152.5 KEAS

C. Ambient runway air temperature – 30 °C

D. Runway pressure altitude – 2,000 feet

E. Headwind – 10 knots

F. Runway gradient – -2 percent

G. Ground run distance – 3,460 feet

H. Total distance to clear a 50-foot obstacle – 4,900 feet.

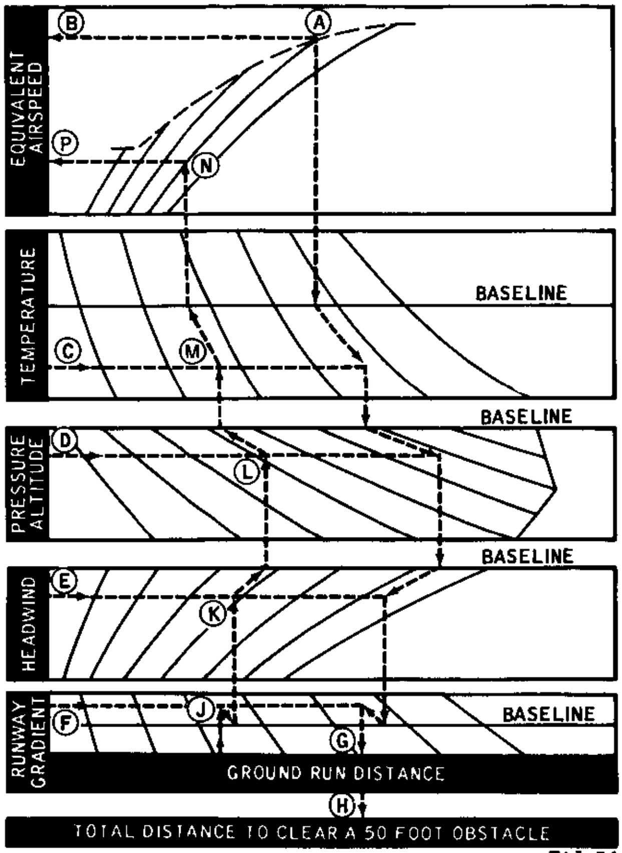
Observe that step D fell within the area labeled MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. To determine if this takeoff weight does exceed the maximum takeoff weight refer to 21-2 at the given temperature, pressure altitude, and wind conditions. For this problem the maximum takeoff weight is 24,000 pounds. Since the actual weight, 20,000 pounds is less than maximum this takeoff may be safely completed.

21.2.1.2 Line Speed Check

Note

> A line speed check is a simple device for ascertaining that aircraft acceleration during takeoff is normal, sufficiently early in the takeoff run to allow normal braking to stop the aircraft on the runway. The pilot selects a suitable and recognizable known distance down the runway from the point that takeoff run commences (such as runway distance marker, runway intersection, etc.). The operational takeoff distance charts are used by entering the charts at the selected distance and working in reverse through the chart, applying the corrections for variation from standard conditions.

SAMPLE TAKEOFF DISTANCE



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J. Runway gradient – -2 percent

K. Headwind – 10 knots

L. Runway pressure altitude – 2,000 feet

M. Ambient runway air temperature – 30 °C

N. Takeoff weight – 20,000 pounds

P. Equivalent airspeed – 120 knots.

21.3 MAXIMUM TAKEOFF WEIGHT - WITH AND WITHOUT JATO

The maximum takeoff weight (Figures 21-2 and 30-2) is given as a function of ambient air temperature, pressure altitude, and wind condition. The data basis for these charts assumes that the landing gear is fully extended, takeoff is at airspeeds shown in Figures 21-1 and 30-1, the aircraft is climbing out with MILITARY thrust, and wing flaps are set at the half-flaps position.

The maximum takeoff weight criteria is based on the most critical of the following:

1. Excess thrust shall not be less than minimum established by NATC flight test.

2. The safe tire speed limit of 175 knots groundspeed shall not be exceeded.

The preceding criteria, when met, will provide acceptable climbout characteristics. Since JATO burnout occurs at liftoff, this chart is valid for both with and without JATO assist.

To use the charts, it is required that a maximum takeoff weight be determined for each of the preceding criteria. The limiting weight will be the lightest of the two.

21.3.1 Sample Problem

21.3.1.1 Maximum Takeoff Weight. For Figure 21-2.

A. Ambient runway air temperature – 40 °C

B. Runway pressure altitude – 6,000 feet

C. Minimum headwind or maximum tailwind for takeoff at weights equal to or less than 17,250 pounds – 6 knots (tailwind)

D. Wind – 10 knots (headwind)

E. Maximum takeoff weight (limited by safe tire speed) – 22,500 pounds

F. Ambient runway air temperature – 40 °C

G. Runway pressure altitude – 6,000 feet

H. Maximum takeoff weight (limited by minimum excess thrust) – 23,050 pounds.

Since the maximum takeoff weight is determined by the most critical of the preceding criteria, the maximum takeoff weight for this sample is 22,500 pounds (limited by safe tire speed).

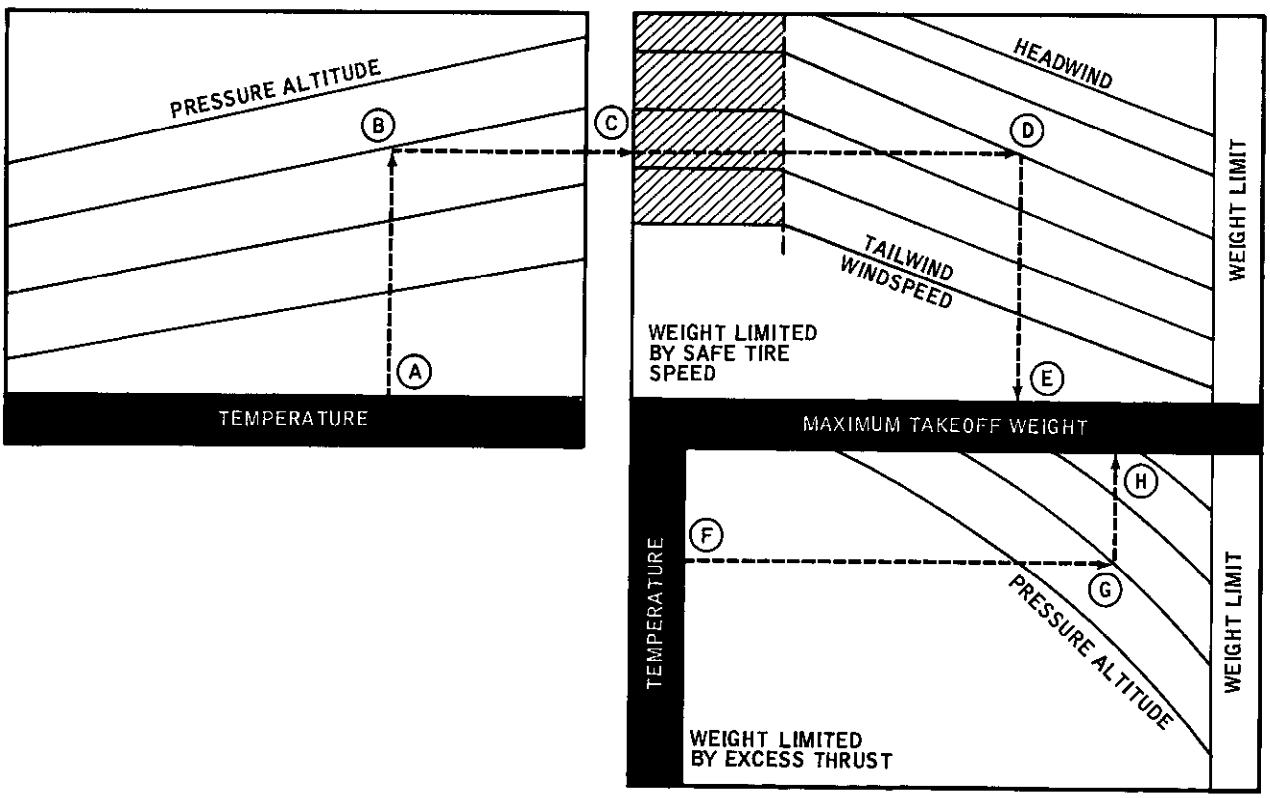
Observe that if the headwind had been approximately 15 knots or greater, the maximum takeoff weight (limited by safe tire speed) would have been 24,500 pounds. In this case, the maximum takeoff weight would have been 23,050 pounds (limited by minimum excess thrust).

21.4 JATO FIRING DELAY, MINIMUM TAKEOFF DISTANCE – TWO MK 7 MOD 2, 5KS-4500 JATO BOTTLES

The minimum ground run distance and the total distance to clear a 50-foot obstacle may be realized by firing the JATO bottles so that burnout occurs just prior to liftoff. This method is recommended for the following reasons:

1. Burnout at liftoff produces the shortest takeoff distance.

SAMPLE MAXIMUM TAKEOFF WEIGHT



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2. A misfire can be detected early and the takeoff can be aborted well before the refusal point.

The following trim settings are required for JATO operation to avoid excessive nose-high attitudes at low gross weights because of noseup pitching moments generated by possible JATO burning after liftoff.

Gross Weight (Pounds)	Recommended Trim (Degrees Noseup)
13,500	2
17,500	5
22,500	7
24,500	8

With the preceding recommended trim settings, the flight trim stick force without JATO burning varies linearly with gross weight from approximately 12 pounds pull at 16,000 pounds gross weight to 3 pounds pull at 24,500 pounds gross weight. This stick force is not objectionable since a reduction in angle of attack is required to maintain airspeed or acceleration.

It is recommended that the firing point be established by distance markers alongside the runway. This recommendation is made for the following reasons:

1. Using a time interval from brake release is considered to be too inaccurate.

2. Using airspeed as a reference for JATO firing would not be possible since, generally, JATO firing occurs at a speed below the speed at which the airspeed indicator begins to register.

Figures 21-3 and 30-3 show the ground run distance from brake release to ignition of JATO. Takeoff speed, ground run distance, and total horizontal distance to clear a 50-foot obstacle are presented in Figures 21-4 and 30-4. Takeoff distances are based on half-flaps, military thrust, and trim settings as recommended above.

Note the region in the altitude correction box where MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. This region represents an area in which the minimum acceptable thrust-to-weight ratio may be encountered, resulting in marginal climbout capability, or the safe tire limiting speed at 175 knots groundspeed may be exceeded. Since temperature and altitude are not independent, the boundary lines in this box are shown for extreme altitude-temperature combinations. A more detailed explanation of the marginal region is given under Maximum Takeoff Weight. The method of obtaining the JATO firing distance, JATO takeoff airspeed, JATO ground run distance, and total distance to clear a 50-foot obstacle is described in the following examples.

21.4.1 Sample Problem

21.4.1.1 JATO Firing Delay. For Figure 21-3.

A. Takeoff weight – 20,000 pounds

B. Takeoff airspeed – 152.5 KEAS

C. Ambient runway air temperature – 30 °C

D. Runway pressure altitude – 2,000 feet

E. Headwind – 10 knots

F. Runway gradient – -2 percent

G. JATO firing distance – 940 feet.

Observe that step D fell within the area labeled MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. To determine if this takeoff does exceed the maximum takeoff weight refer to Figure 21-2 at the given temperature, pressure altitude, and wind conditions. For this problem the maximum takeoff weight is 24,500 pounds. Since the actual weight, 20,000 pounds, is less than maximum this takeoff may be safely completed.

21.4.1.2 JATO Takeoff Distance. For Figure 21-4.

H. Takeoff weight – 20,000 pounds

J. Takeoff airspeed – 152.5 KEAS

K. Ambient runway air temperature – 30 °C

L. Runway pressure altitude – 2,000 feet

M. Headwind – 10 knots

N. Runway gradient – -2 percent

P. Ground run distance – 1,900 feet

Q. Total distance to clear a 50-foot obstacle – 3,260 feet

Observe that step L fell within the area labeled MAXIMUM TAKEOFF WEIGHT MAY BE EXCEEDED. To determine if this takeoff does not exceed the maximum takeoff weight refer to Figure 21-2 at the given temperature, pressure altitude, and wind conditions. For this problem the maximum takeoff weight is 24,500 pounds. Since the actual weight, 20,000 pounds, is less than maximum this takeoff may be safely completed.

Note

> Jettisoning of JATO bottles should be performed in 1.0g level flight, in cruise configuration, at or below 400 KIAS (maximum).

21.5 REFUSAL SPEED

The maximum refusal speed is that speed at which engine failure permits stopping the aircraft on a runway of specified length. Figures 21-5 and 30-5 present *this data for engine failure during a military thrust* takeoff without JATO burning. Data includes distance covered during a pilot reaction time of 2 seconds and for an 8-second engine deceleration time from military to idle rpm. Data are provided for operation with spoilers, and without spoilers.

Note

> The transfer scales on the refusal speed charts correct for variation in density altitude.

21.5.1 Sample Problem

21.5.1.1 Takeoff Refusal Speeds. For Figure 21-5. Configuration – All configurations.

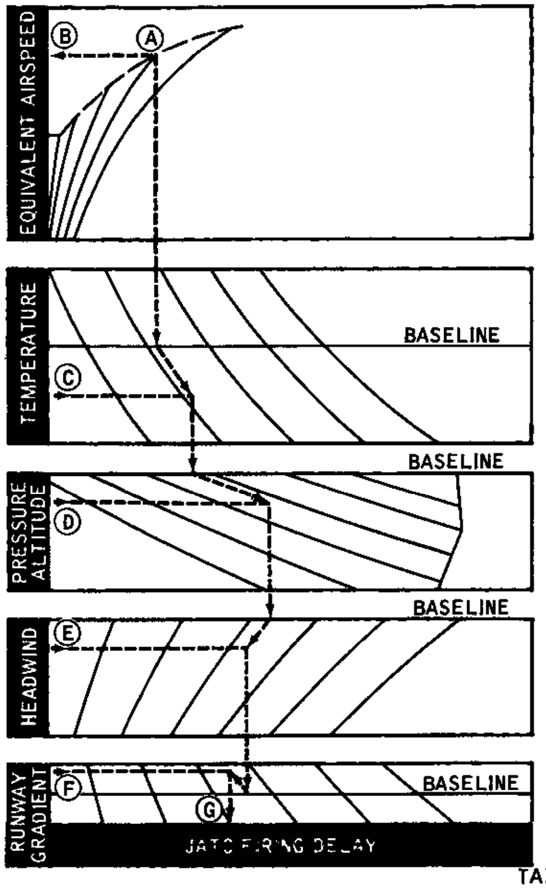
A. Runway temperature – 20 °C.

B. Runway pressure altitude – 2,000 feet.

C. Transfer scale – 0.95

D. Field length – 8,000 feet

SAMPLE JATO FIRING DELAY



TA1-56-B

E. Takeoff weight – 18,000 pounds

F. Headwind – 10 knots

G. Runway gradient – -1 percent

H. Takeoff refusal speed:

(1) Spoilers open – 99 KIAS

(2) Spoilers closed – 90 KIAS.

21.6 STOPPING DISTANCE

The stopping distance charts (Figures 21-6 and 30-6) are included for use if the takeoff should be aborted. It is not intended for use in determining landing distance. The data does not include pilot reaction and engine deceleration time. Distances are based on the application of maximum braking effort without skidding the tires, below brake energy limit speed, and throttle positioned at idle thrust. In order to minimize diversion of pilot's attention during this critical stage of the takeoff abort, it is recommended that flaps be left in the position selected for takeoff. Data are provided for operation with spoilers, and without spoilers.

Note

> Shutting down the engine at 80 KIAS will shorten the rollout considerably.

21.6.1 Sample Problem

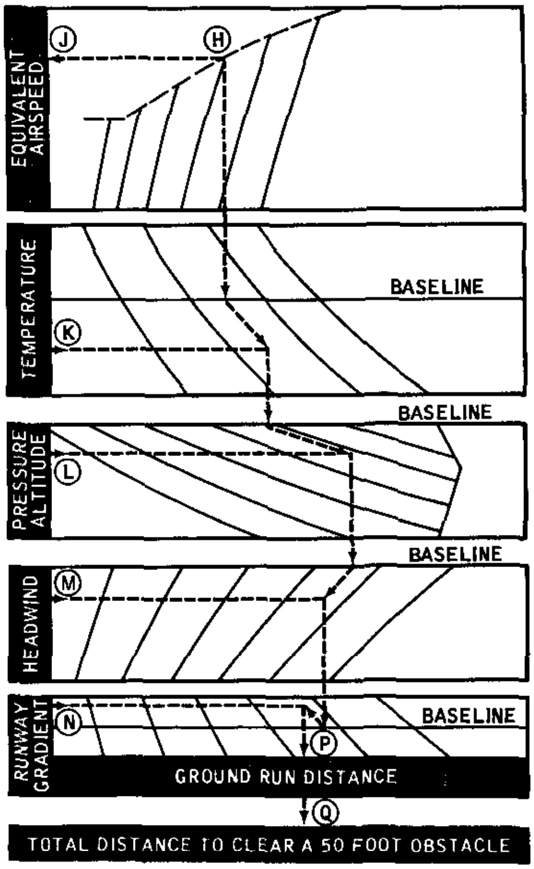
21.6.1.1 Stopping Distance For Figure 21-6.

Configuration: All configurations.

A. Runway temperature – 20 °C

B. Runway pressure altitude – 2,000 feet

SAMPLE JATO TAKEOFF DISTANCE



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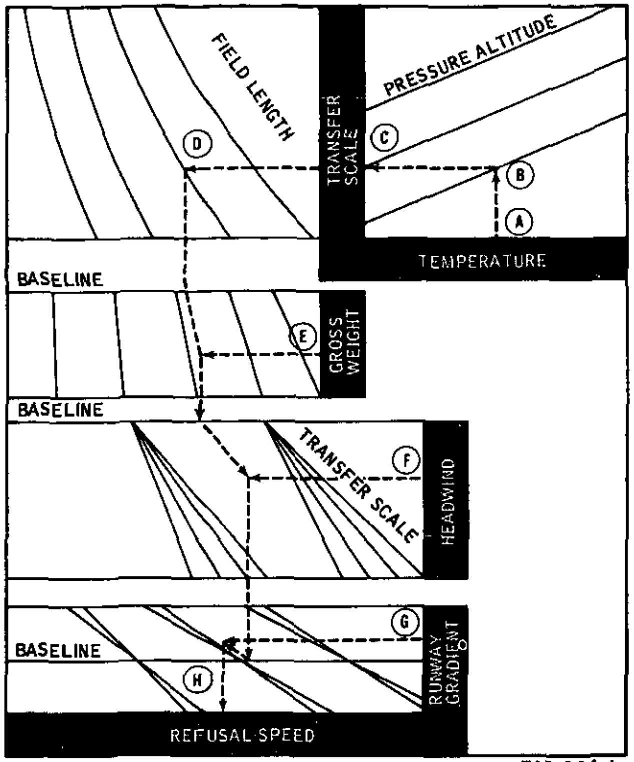
SAMPLE TAKEOFF REFUSAL SPEED



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C. Indicated airspeed at abort

(1) Spoilers open – 99 KIAS

(2) Spoilers closed – 90 KIAS

D. Aircraft gross weight – 18,000 pounds

E. Headwind – 10 knots

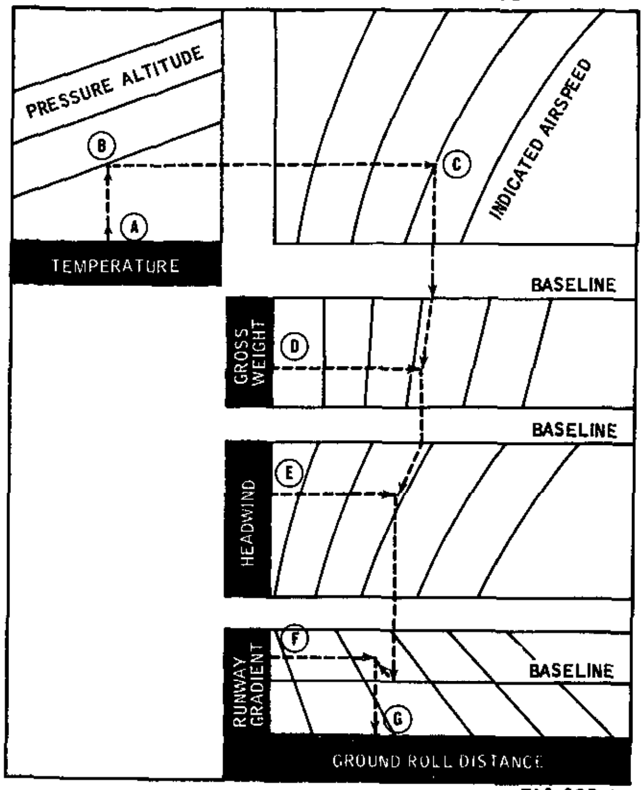
F. Runway gradient – -1 percent

G. Stopping distance

(1) Spoilers open – 4,350 feet

(2) Spoilers closed – 4,500 feet.

SAMPLE STOPPING DISTANCE



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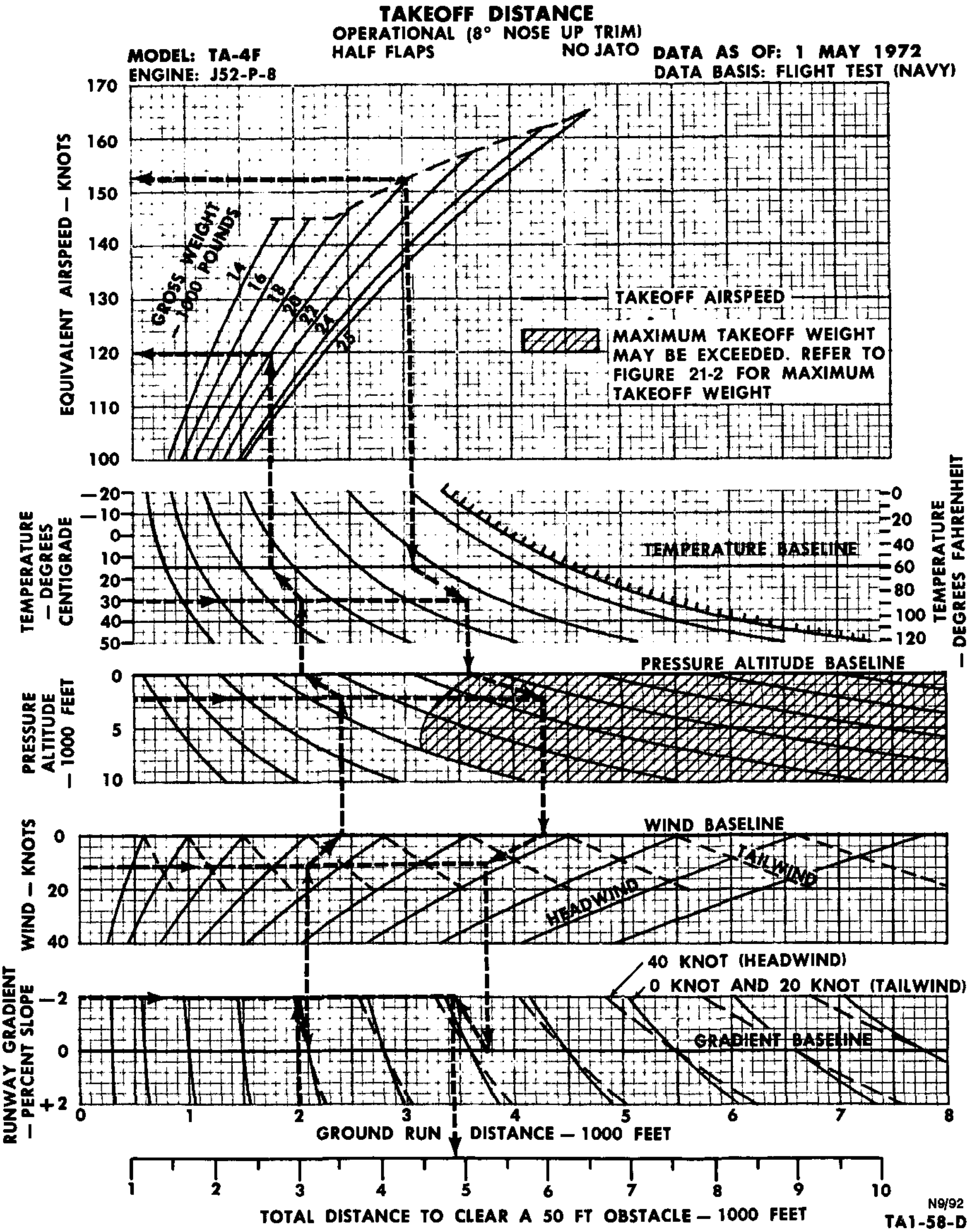
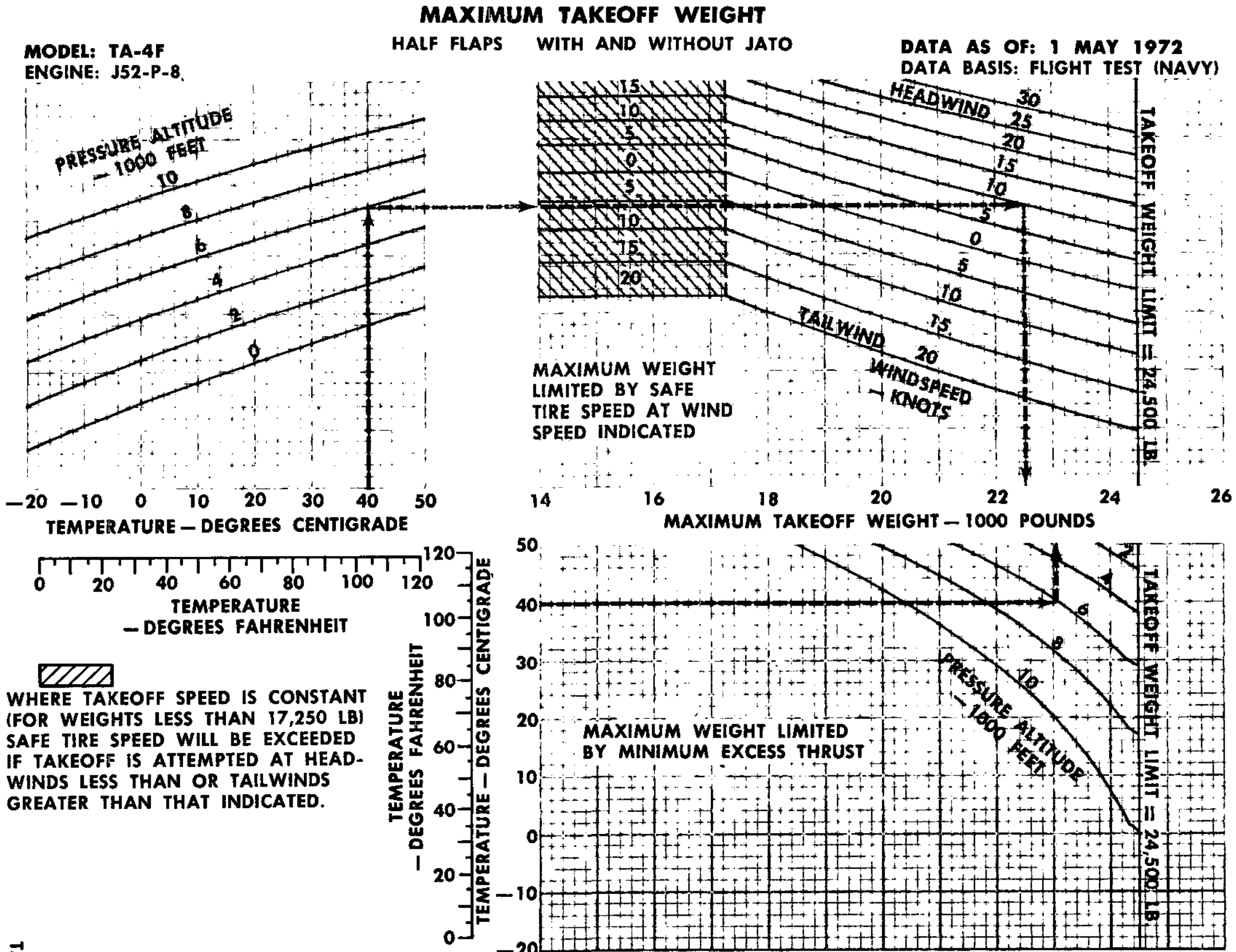


Figure 21-1. Takeoff Distance



TA1-59-C N9/82

Figure 21-2. Maximum Takeoff Weight

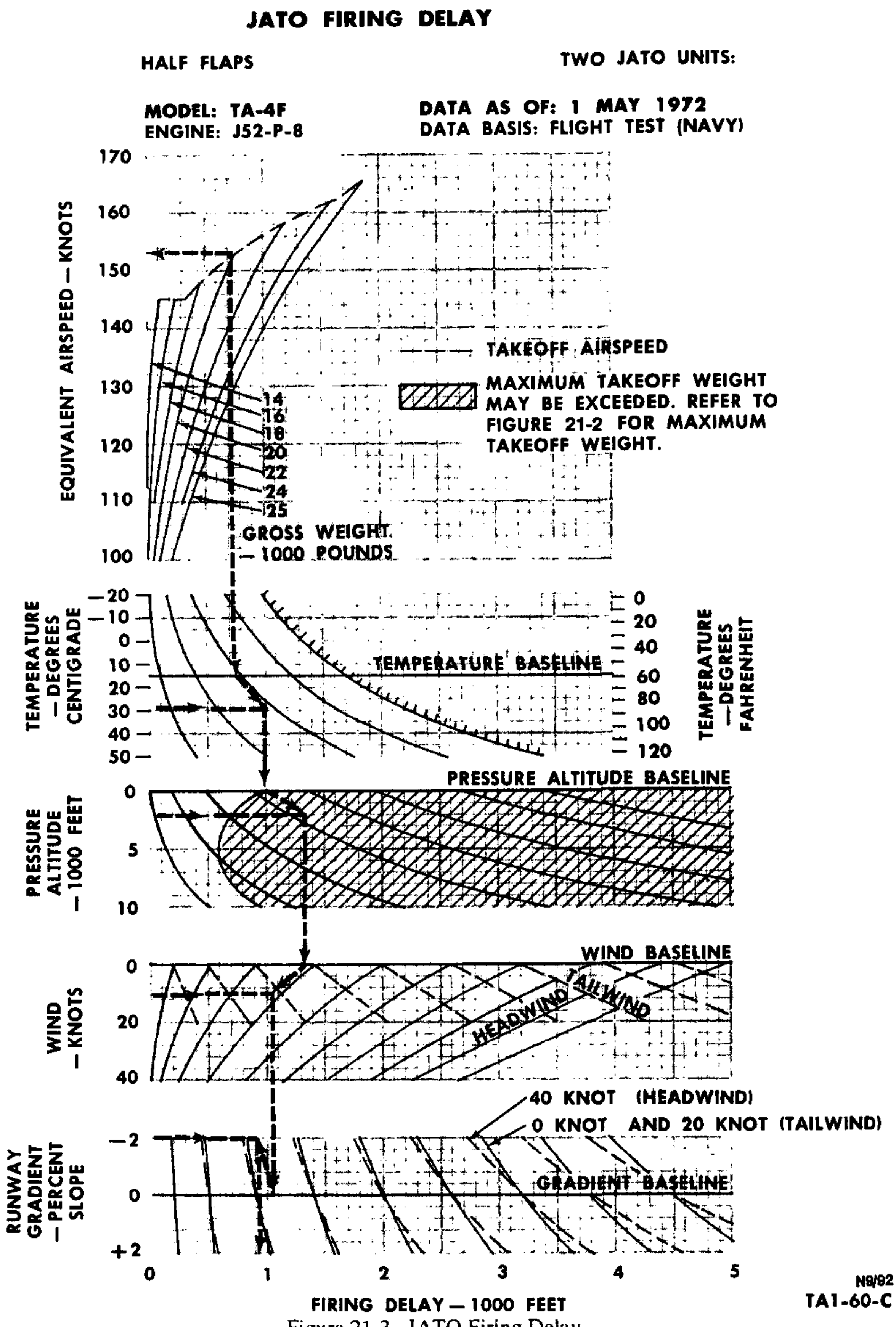


Figure 21-3. JATO Firing Delay

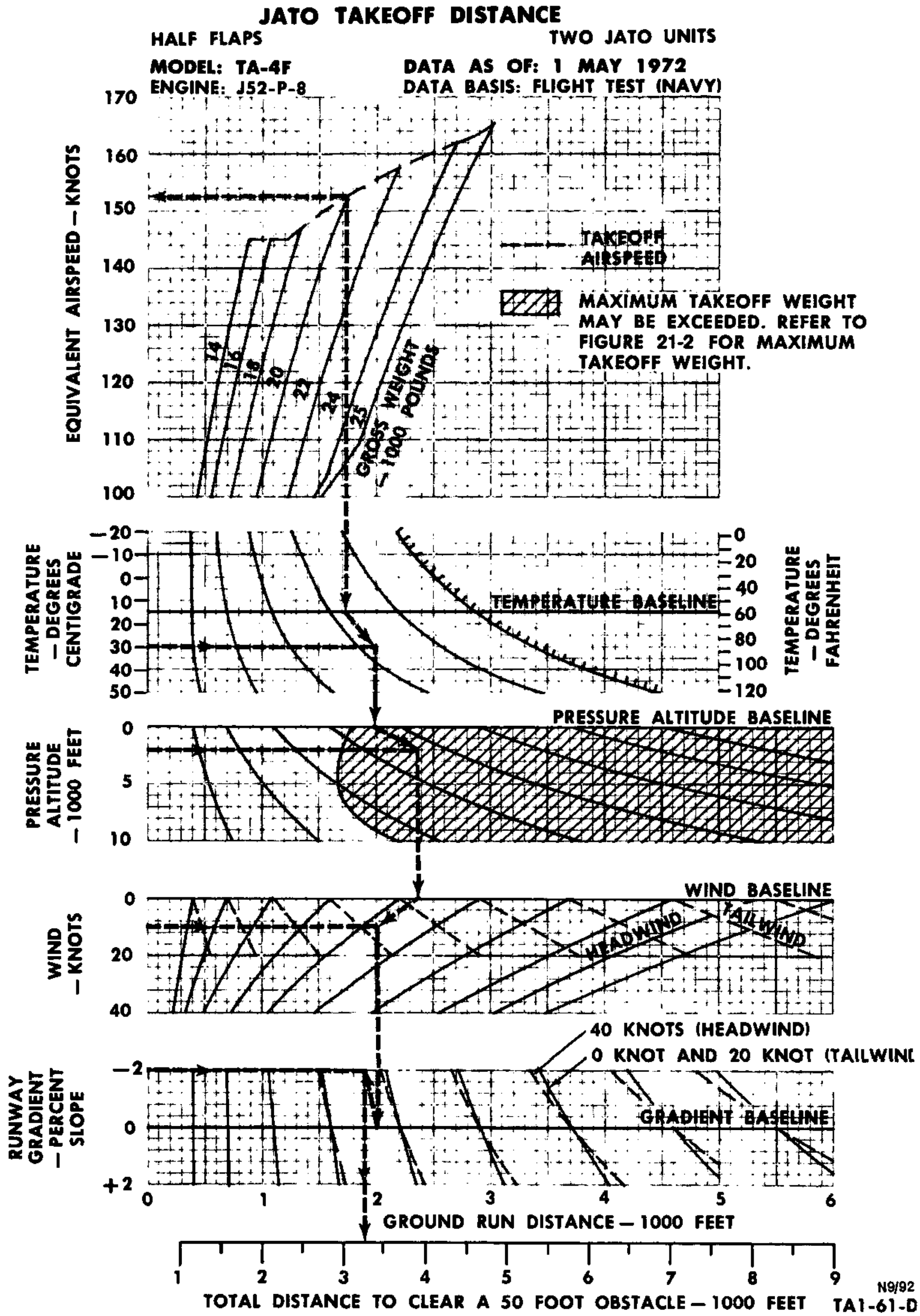


Figure 21-4. JATO Takeoff Distance

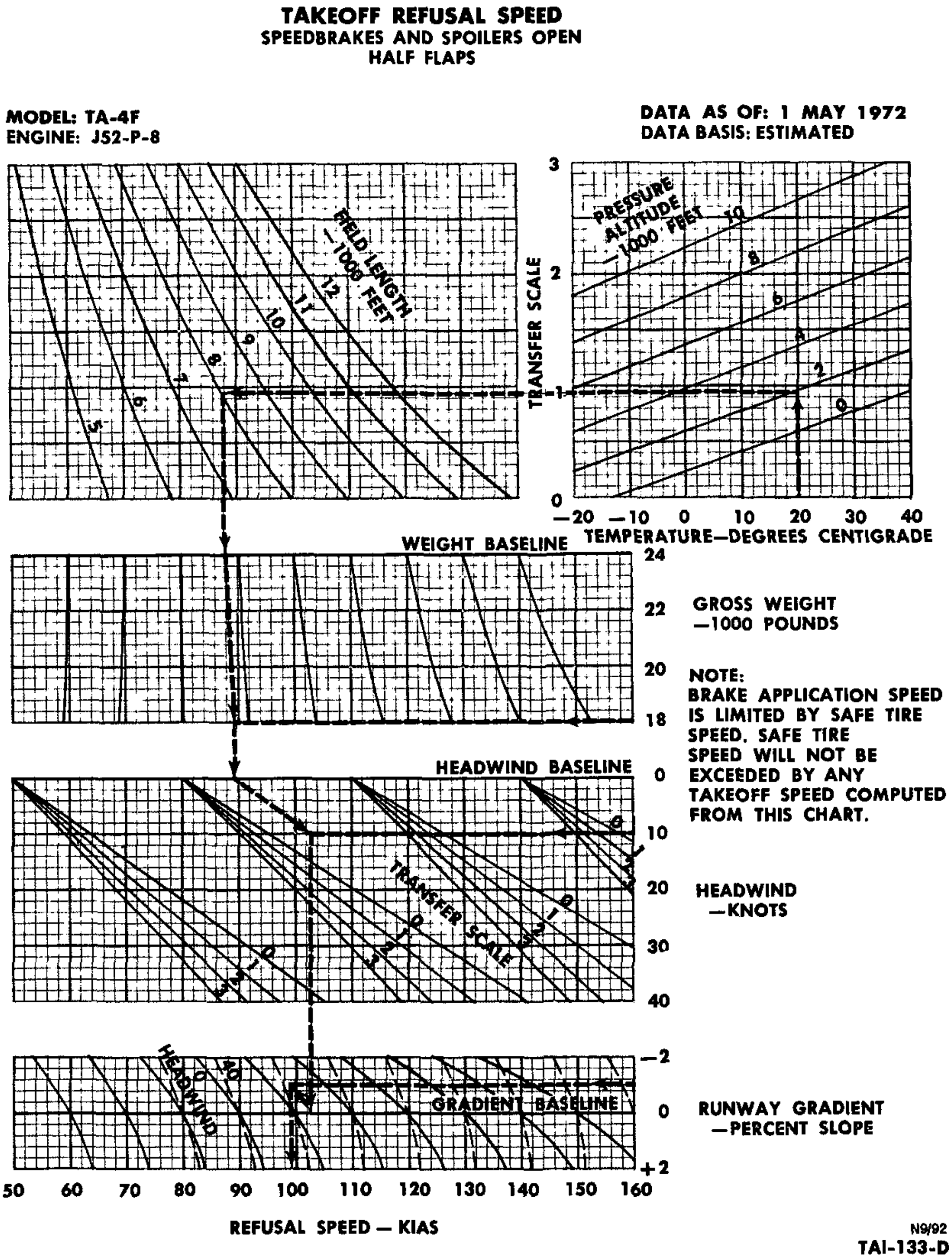


Figure 21-5. Takeoff Refusal Speeds (Sheet 1 of 2)

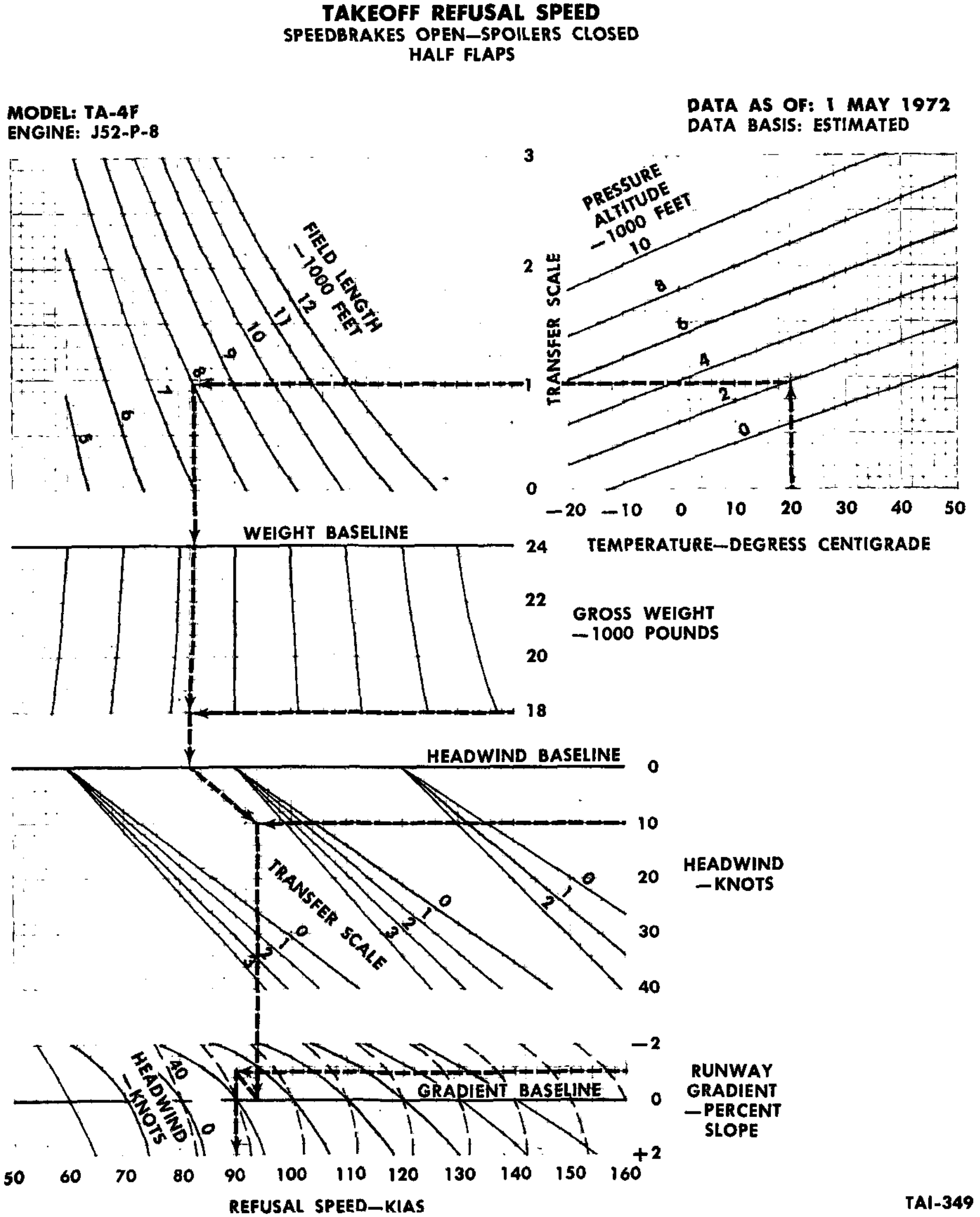


Figure 21-5. Takeoff Refusal Speeds (Sheet 2 of 2)

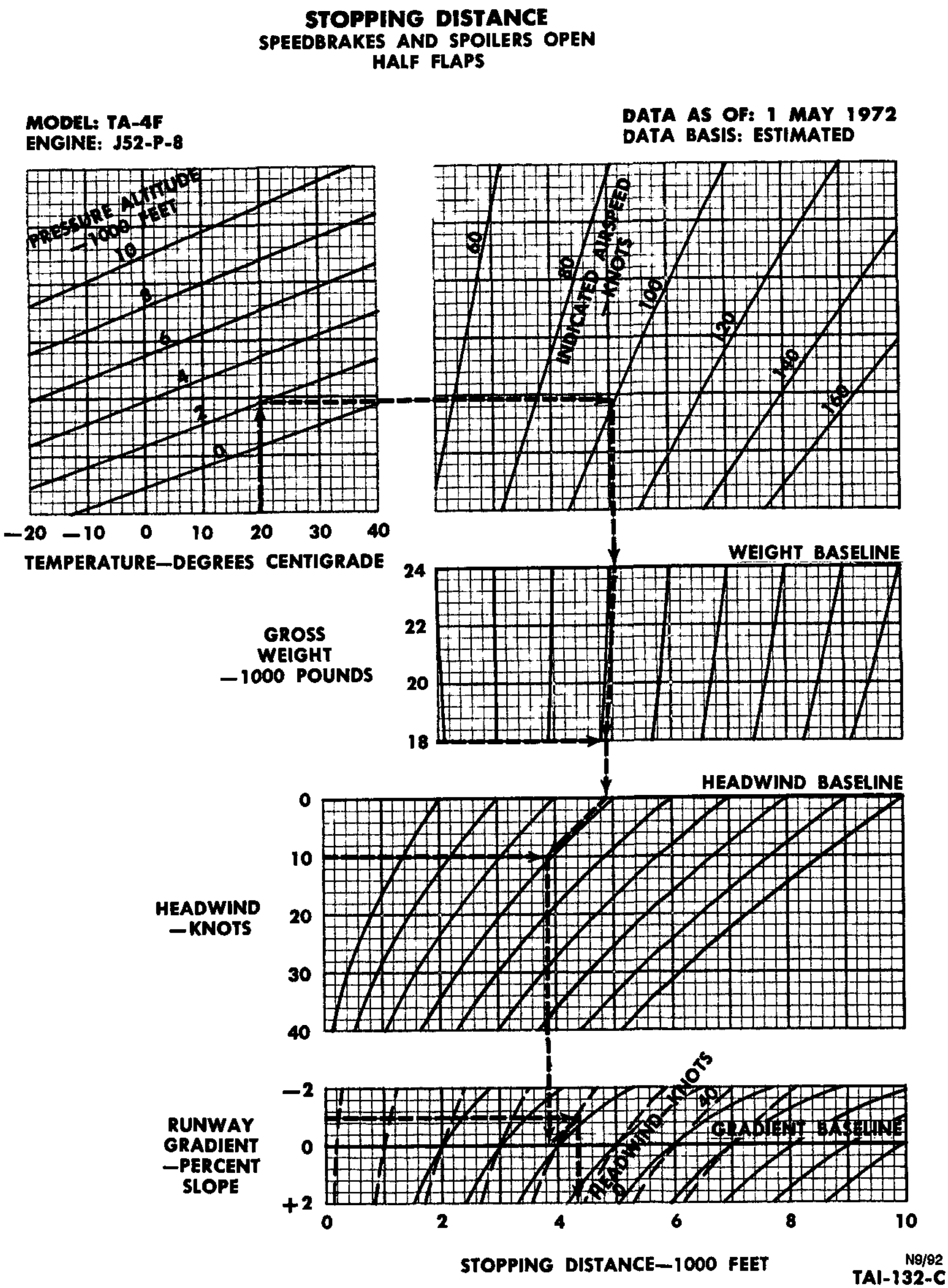


Figure 21-6. Stopping Distance (Sheet 1 of 2)

STOPPING DISTANCE
SPEEDBRAKES OPEN—SPOILERS CLOSED
HALF FLAPS

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

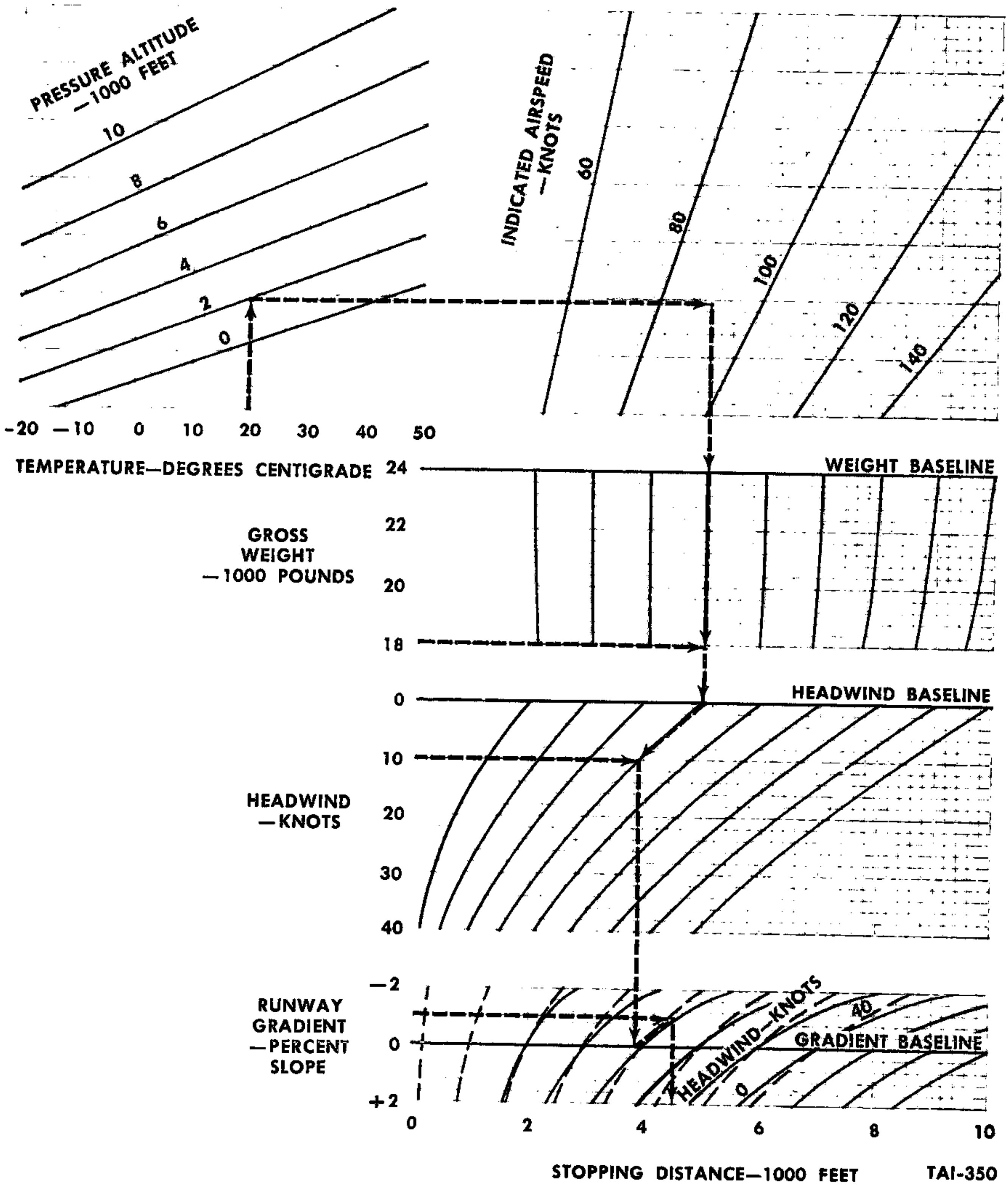


Figure 21-6. Stopping Distance (Sheet 2 of 2)

CHAPTER 22

Climb

22.1 CLIMB

Climb charts (Figures 22-1 through 22-4) present the climb performance for all drag index configurations with the engine operating at military thrust. Climb speeds are presented in figure 22-1 as a function of drag index but independent of gross weight. The climb speed schedule is based on a minimum time to climb and does not represent a maximum range climb.

Fuel, distance, and time to climb are presented in Figures 22-1 through 22-4 as a function of gross weight, pressure altitude, drag index, and temperature deviation from ICAO standard day. The data are based on the climb speed schedule shown in Figure 22-1.

22.1.1 Sample Problem

22.1.1.1 Climb Speed Schedule. For Figure 22-1.

A. Cruise altitude – 30,000 feet

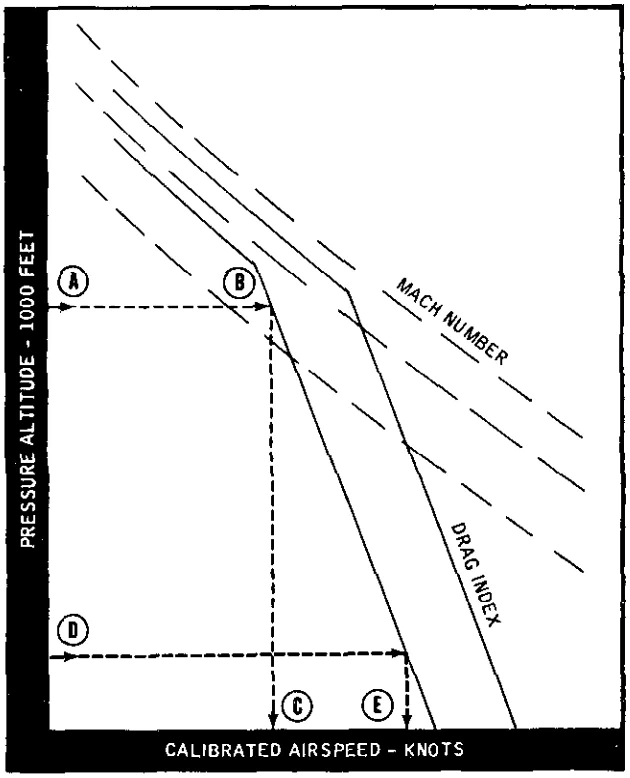
B. Drag index – 50

C. Climb speed at cruise altitude – 272 KCAS

D. Initial climb altitude – 5,000 feet

E. Climb speed at initial altitude – 319 KCAS.

SAMPLE CLIMB SPEED SCHEDULE



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22.1.2 Sample Problem

22.1.2.1 Climb Fuel. The method of presenting data for fuel, distance, and time is identical; therefore, only one sample is shown.

For Figure 22-2:

A. Initial gross weight – 18,000 pounds

B. Cruise altitude – 30,000 feet

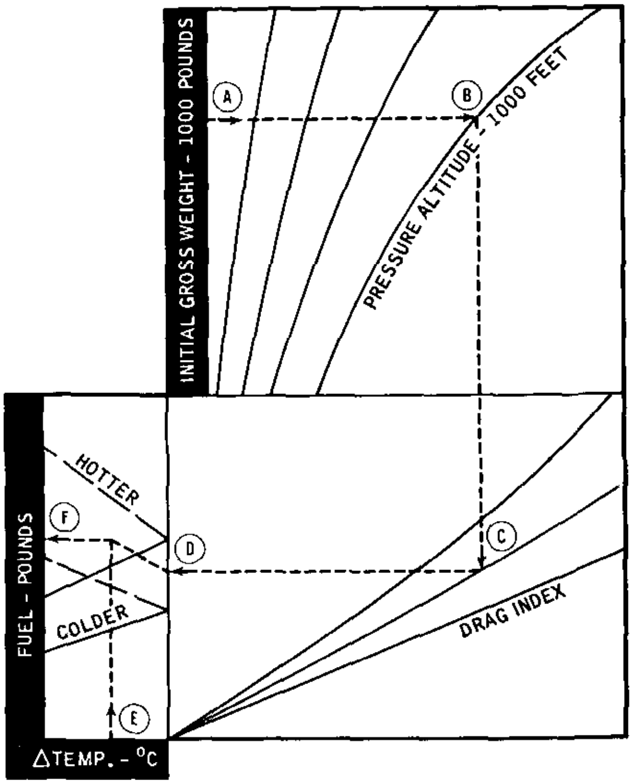
C. Drag index – 50

D. Temperature baseline

E. Temperature deviation from ICAO standard day – +10 °C

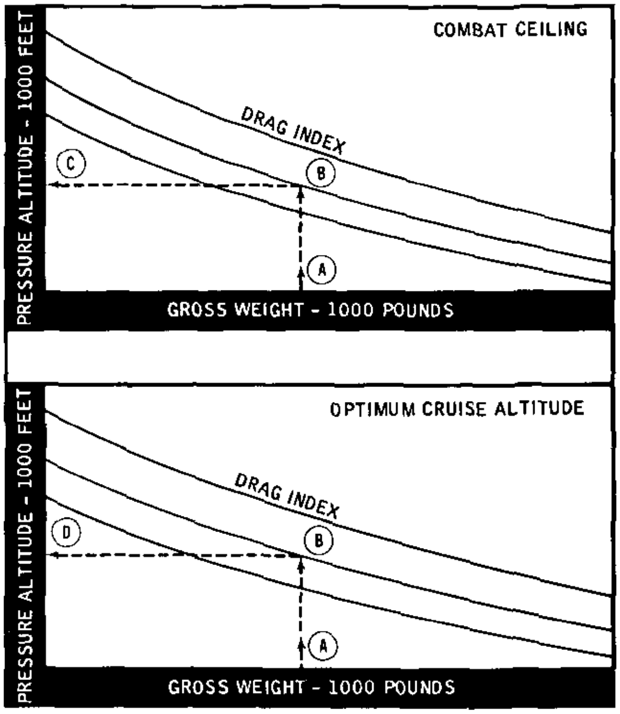
F. Fuel to climb from sea level – 590 pounds.

SAMPLE CLIMB FUEL



TA1-63-B

SAMPLE COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE



TA1-64-B

22.2 COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE

Combat ceiling, the altitude for 500 FPM rate of climb with military thrust, and optimum cruise altitude, the altitude that will produce the maximum cruise distance per pound of fuel, are presented in Figure 22-5. The data are presented as a function of gross weight and drag index.

22.2.1 Sample Problem

22.2.1.1 Combat Ceiling and Optimum Cruise Altitude. For Figure 22-5.

A. Aircraft gross weight – 18,000 pounds

B. Drag index – 50

C. Combat ceiling – 37,400 feet

D. Optimum cruise altitude – 30,900 feet.

CLIMB SPEED SCHEDULE
MILITARY THRUST

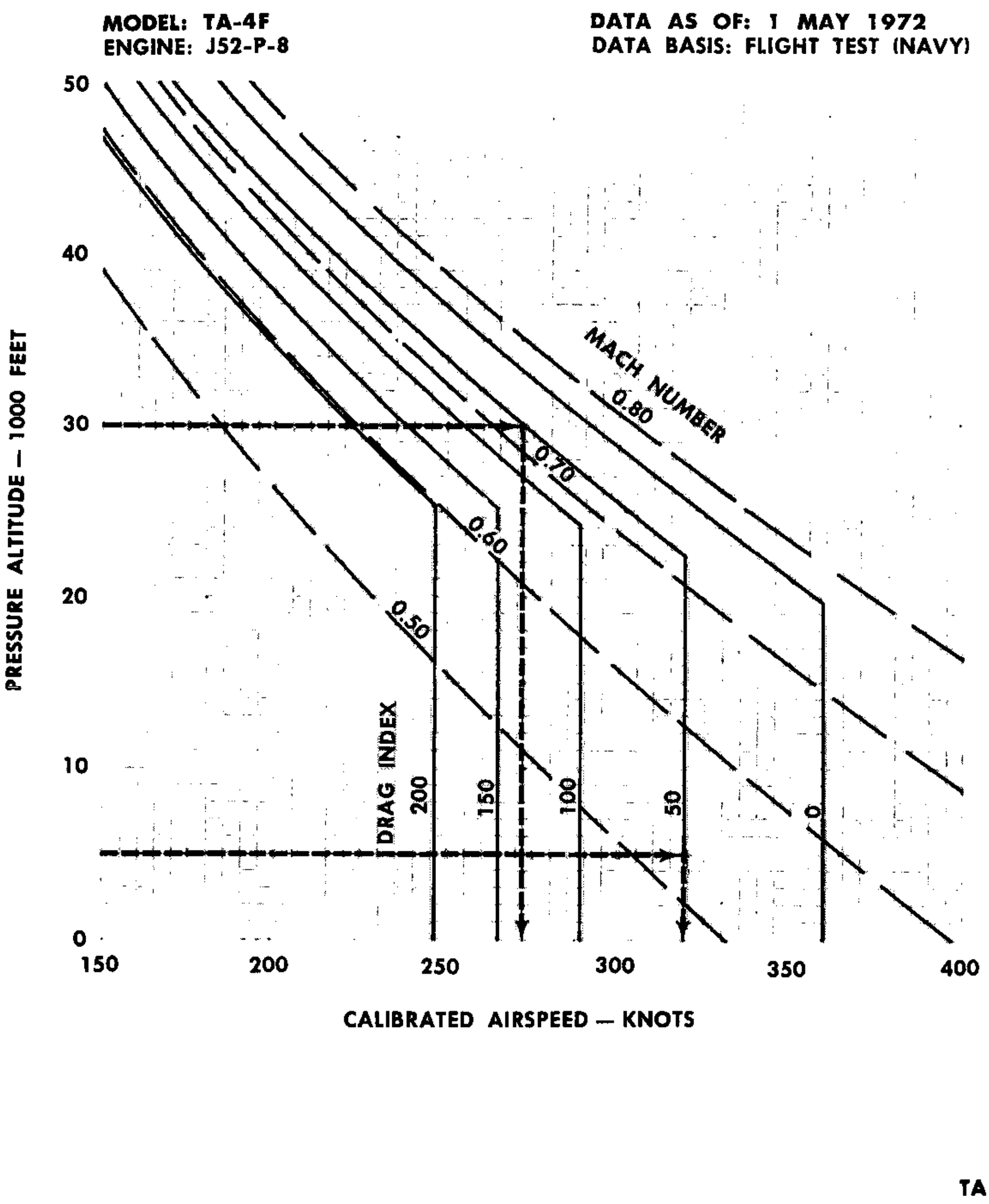
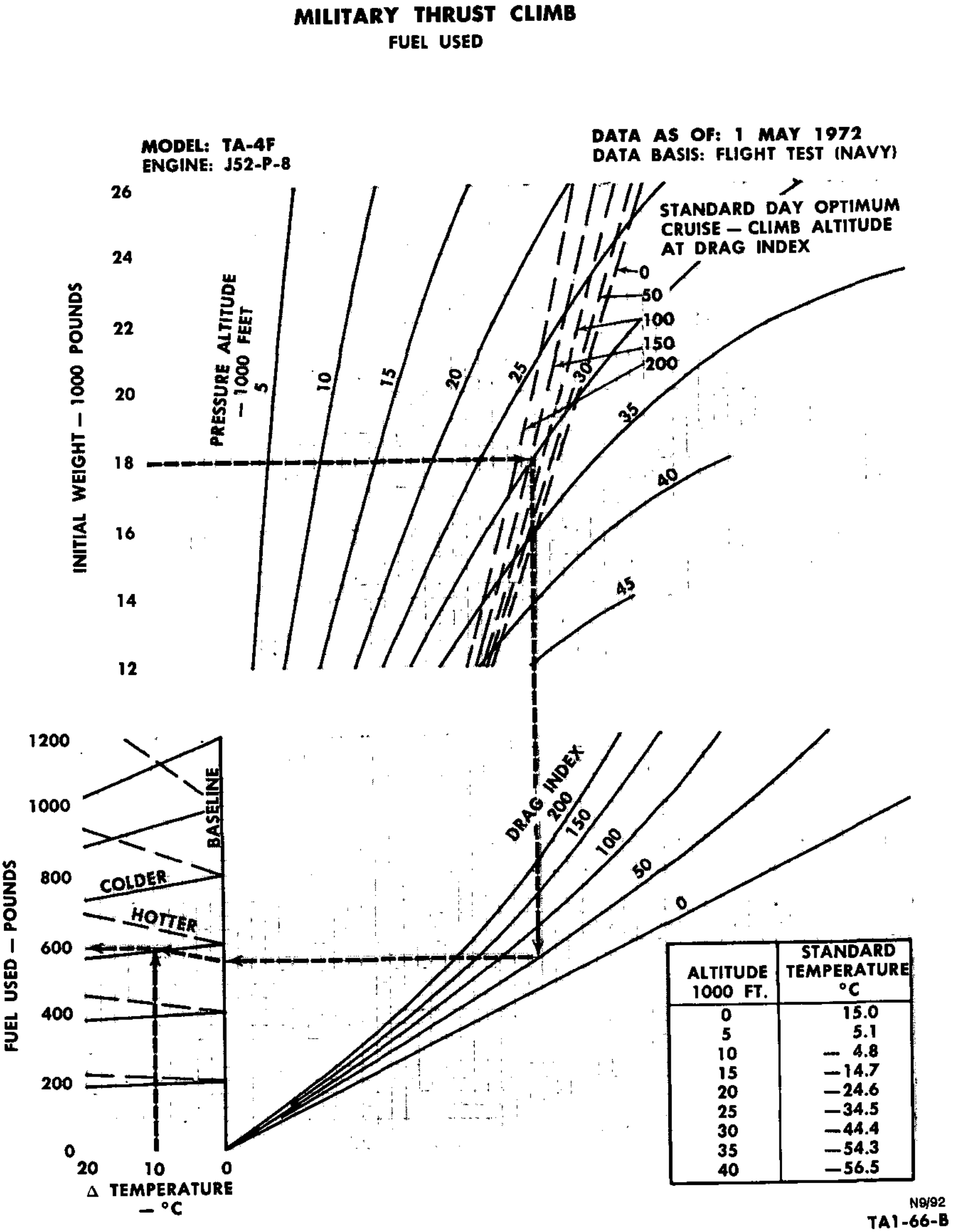


Figure 22-1. Climb Speed Schedule



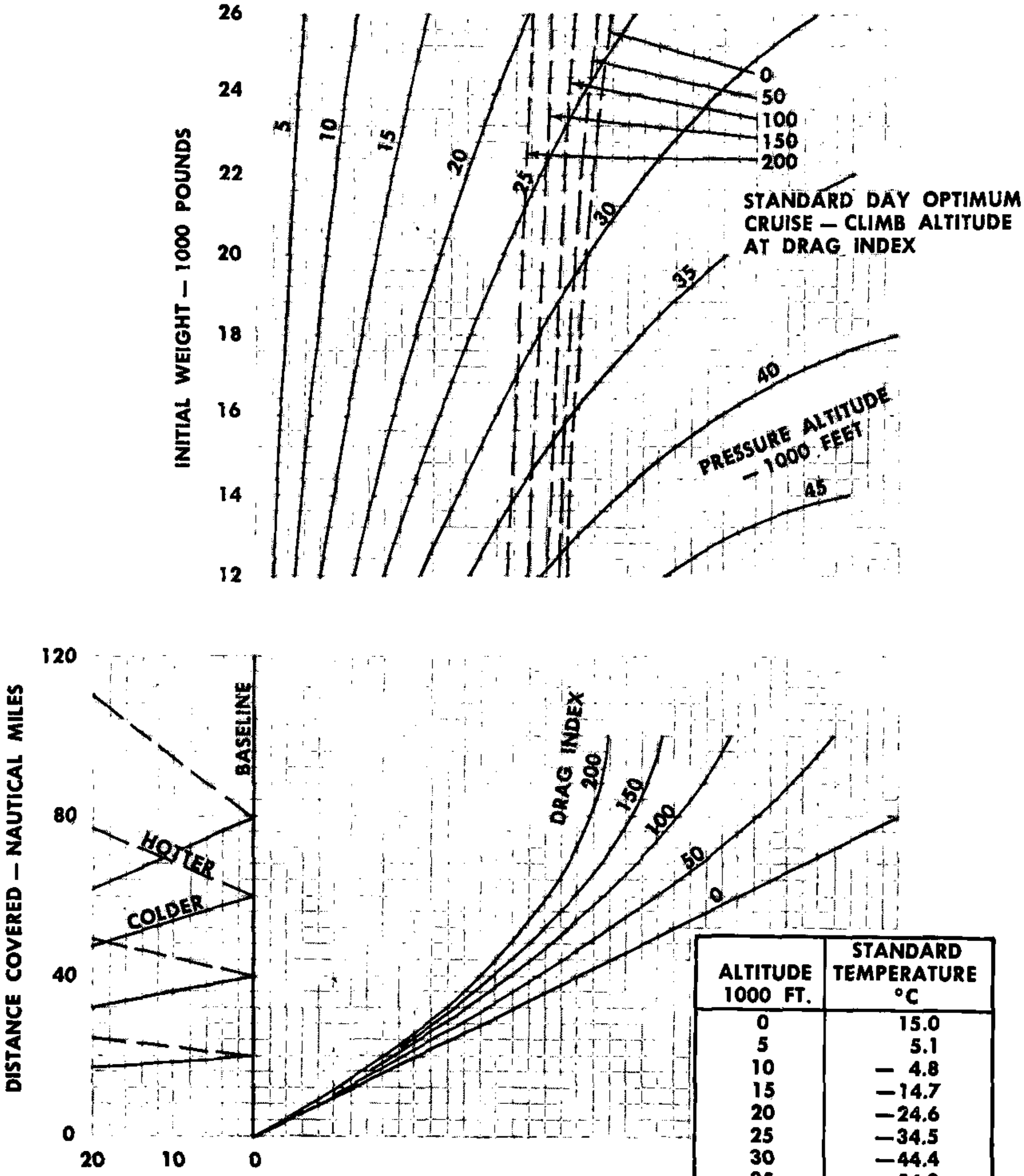
ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	— 4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5

Figure 22-2. Climb Fuel

MILITARY THRUST CLIMB
DISTANCE COVERED

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)



ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

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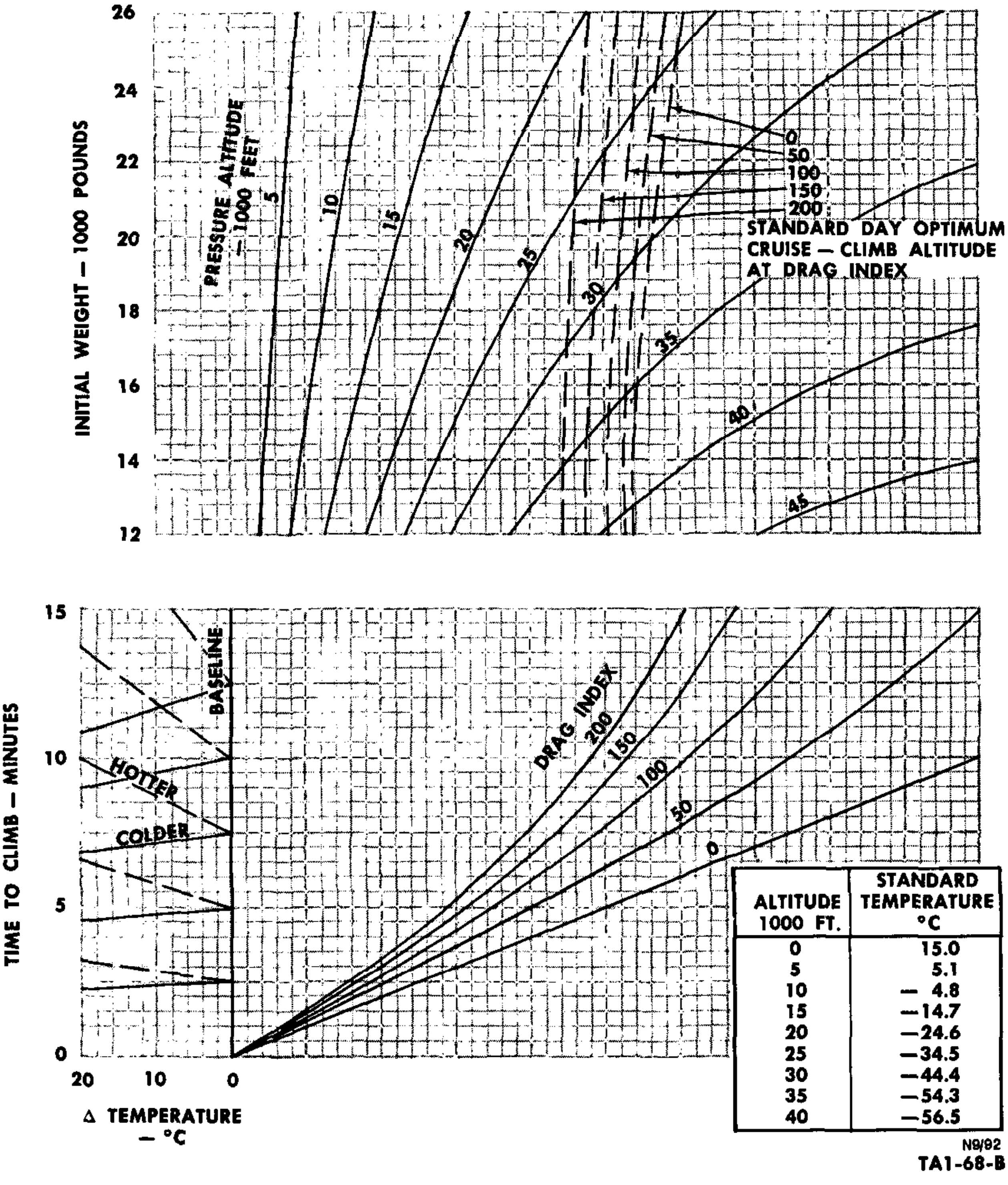
Figure 22-3. Climb Distance

MILITARY THRUST CLIMB

TIME TO CLIMB

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: MAY 1 1972
DATA BASIS: FLIGHT TEST (NAVY)



ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	— 4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5

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Figure 22-4. Climb Time

COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE

ICAO STANDARD ATMOSPHERE

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)

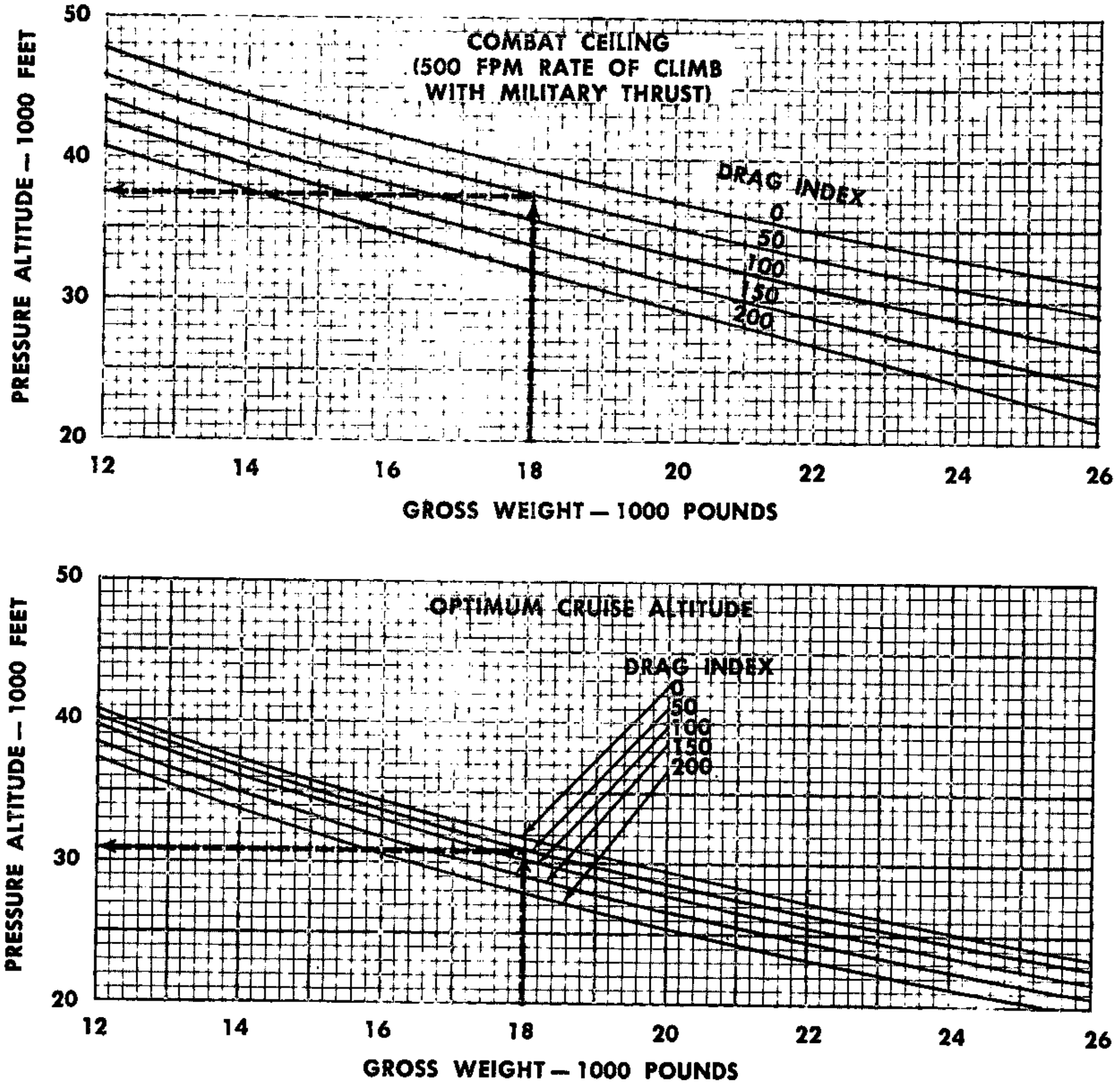

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Figure 22-5. Combat Ceiling and Optimum Cruise Altitude

CHAPTER 23

Range

23.1 RANGE FACTOR CHART

The Range Factor chart (Figure 23-1) provides a means of correcting specific (or total) range for existing wind effects. The presented range factors consider wind speeds up to 120 knots from any relative wind direction for aircraft speeds of 350 to 500 KTAS.

23.2 USE

Determine the relative wind direction by measuring the angular difference between the aircraft heading and the true wind direction. At a given wind direction, wind speed, and aircraft true airspeed, read the range factor. Multiply the specific range by this range factor to obtain specific range as affected by wind.

23.3 FOULED DECK RANGE

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desirable for the pilots and the air officer to be aware of the range capabilities of the unrecovered aircraft in order that an immediate decision can be made concerning the proper course of action. Should the estimated "clear deck" time be beyond the endurance time of the aircraft, then the aircraft must either depart immediately for the beach or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. The Fouled Deck Endurance chart is shown in Figure 24-1.

The Fouled Deck Range chart (Figure 23-2) tabulates the range distances obtainable for various quantities of fuel on board at both the initial altitude and the optimum, best range altitude. The aircraft configuration consists of four empty wing pylons plus guns, with a total drag index of 33. Climb speeds and airspeeds for maximum range are included in the chart as well as letdown instructions.

The time at which letdown should be initiated is given in terms of fuel on board, and represents the fuel required to conduct a maximum range descent from altitude to sea level. A 250-pound fuel allowance is included for approach and landing.

Bingo Range and Bingo Range - Gear Down charts are presented in Figures 23-3 and 23-4 respectively. These charts are provided for an aircraft configuration consisting of four wing pylons, guns, and two 300-gallon external fuel tanks, with a total drag index of 61 with gear up and 391 with gear down. The procedures for the use of these charts are identical to those for the Fouled Deck Range chart; however, an 800-pound fuel allowance is included in Bingo Range and Bingo Range - Gear Down charts for approach and landing.

In addition, Figure 23-5 is included for Bingo Range in graphic form. The Bingo Range Plots presented in Figure 23-5 allow quick interpolation of the bingo problem. To use the Bingo Range Plots, pressure altitude and distance, or fuel on board must be known. With these known conditions, the fuel required on board or bingo distance (climb, cruise, and descent) or bingo distance (constant altitude cruise) can be determined.

23.3.1 Sample Problem

23.3.1.1 Bingo Range – Fuel On Board Required or Bingo Constant Cruise. For Figure 23-5.

Climb to Altitude:

A. Pressure altitude – 15,000 feet

B. Bingo range – 96 nm

C. Fuel on board required – 1,215 pounds

D. Climb to 36,200 feet using 310 KCAS to Mach 0.71 as climb speed. Start descent at 62 nm.

Maintain Altitude:

E. Constant cruise at 15,000 feet

F. Bingo range – 82 nm

G. *Descent starts at – 24 nm.*

23.4 LONG RANGE CRUISE

The Long Range Cruise charts are shown in Figures 23-6 and 23-7. Long range cruise is defined as the highest Mach number which will result in 99 percent of the maximum miles per pound of fuel. Essentially, long range cruise permits an increase of 20 to 35 knots in airspeed for an increase of 1 percent in fuel consumption. To use the long range cruise charts, average gross weight, drag index, ambient temperature, and desired cruise altitude must be known for a given cruise leg. With these known conditions, long range cruise Mach number, engine power setting in terms of EPR, and specific range (nautical miles per pound of fuel) can be determined. The optimum long range cruise altitudes are also shown on Figures 23-6 and 23-7 and are the altitudes that will produce the maximum miles per pound of fuel at the long range cruise condition.

23.4.1 Sample Problem

23.4.1.1 Long Range Cruise – Mach Number and EPR. For Figure 23-6.

A. Average gross weight – 18,000 pounds

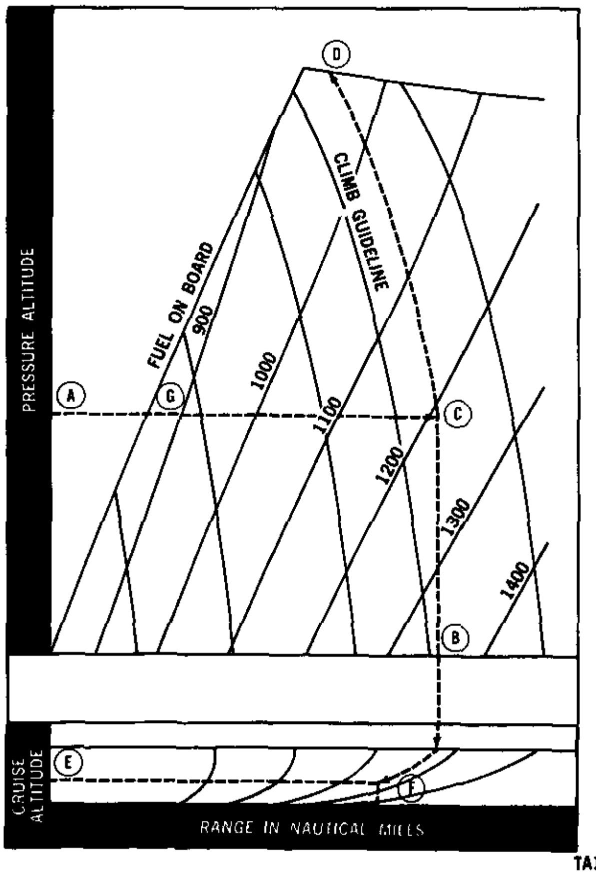
B. Cruise altitude – 25,000 feet

C. Drag Index – 100

D. Mach number – 0.647

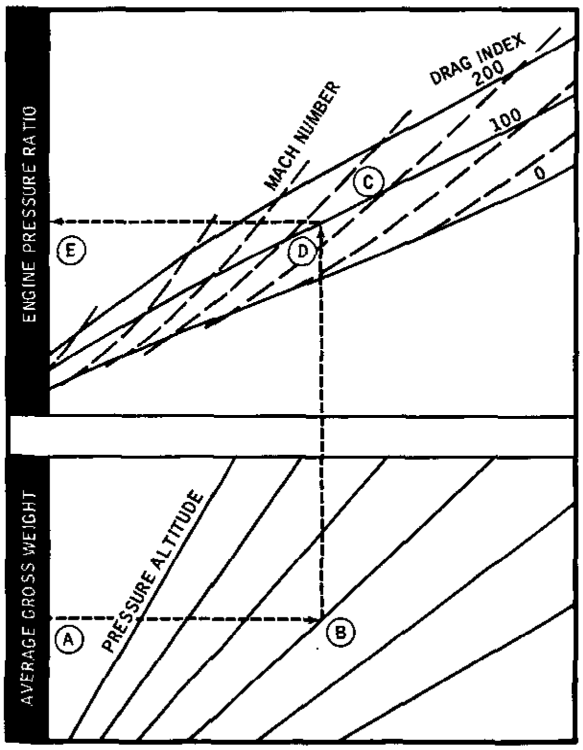
E. EPR – 2.23.

SAMPLE BINGO RANGE PLOT



TA1-370

SAMPLE LONG RANGE CRUISE–MACH NUMBER AND EPR



TA1-268-A

23.4.1.2 Long Range Cruise – Nautical Miles per Pound of Fuel. For Figure 23-7.

F. Average gross weight – 18,000 pounds

G. Pressure altitude – 25,000 feet

H. Temperature deviation from ICAO standard (Ambient temperature = -24.5 °C) – +10 °C

J. Drag index – 100

K. Pressure altitude – 25,000 feet

L. Ambient temperature – -24.5 °C

M. Nautical miles per pound of fuel – 0.161.

23.5 MAXIMUM RANGE CRUISE

Maximum range cruise charts, shown in Figures 23-8, 23-9, and 23-10, present the necessary mission planning data to set up maximum range cruise schedules for a constant cruise altitude. To use the maximum range charts, the average gross weight, cruise altitude, drag index, ambient air temperature, relative wind, and ground distance to be covered must be known. It is then possible to determine true Mach number, true airspeed, time en route, nautical miles per pound of fuel, fuel flow, and total fuel required. Optimum cruise altitude (altitude for best range) lines are superimposed on the pressure altitude plot.

23.5.1 Sample Problem

23.5.1.1 Maximum Range Cruise – Time and Speed. For Figure 23-8.

A. Average gross weight for cruise leg – 18,000 pounds

B. Cruise altitude – 25,000 feet

C. Drag index – 100

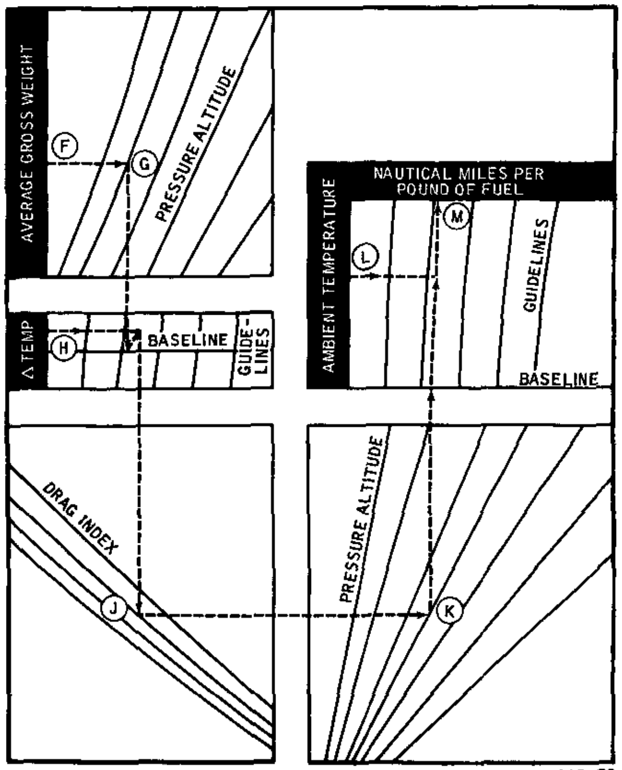
D. True Mach number – 0.610

E. Ambient air temperature at cruise altitude (ICAO standard temperature +10 °C) – -24.5 °C

F. True airspeed – 375 knots

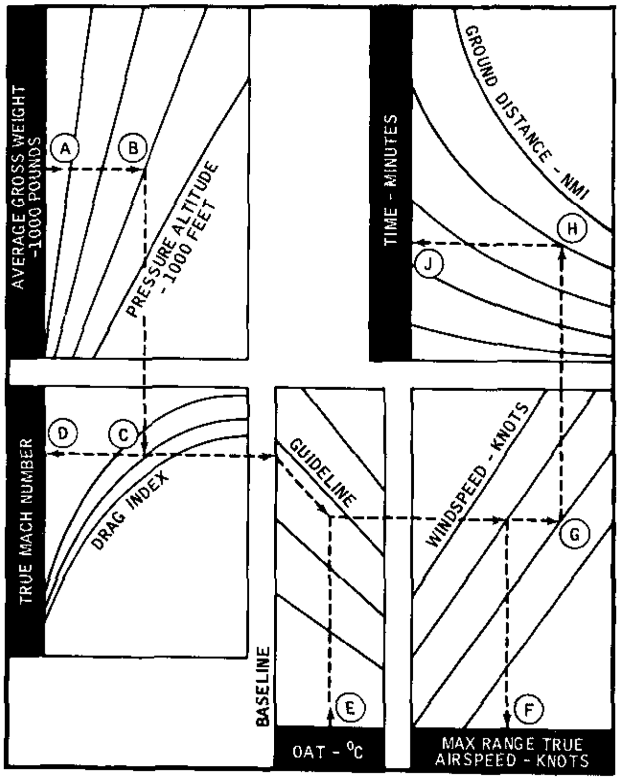
G. Tailwind – 50 knots

SAMPLE LONG RANGE CRUISE–
NAUTICAL MILES PER POUND OF FUEL



TA1-70-A

SAMPLE MAXIMUM RANGE CRUISE—TIME AND SPEED



TA1-71-A

H. Ground distance – 200 nm

J. Time – 28.5 min.

23.5.1.2 Maximum Range Cruise – Nautical Miles per Pound of Fuel. For Figure 23-9.

K. Average gross weight – 18,000 pounds

L. Cruise altitude – 25,000 feet

M. Temperature deviation from ICAO standard (Ambient temperature = -24.5 °C) – +10 °C

N. Drag index – 100

P. Cruise altitude – 25,000 feet

Q. Ambient temperature – -24.5 °C

R. Nautical miles per pound of fuel – 0.162 nm/pound.

23.5.1.3 Maximum Range Cruise – Fuel. For Figure 23-10.

S. Nautical miles per pound of fuel – 0.162 nm/pounds

T. Maximum range true airspeed – 375 KTAS

W. Fuel flow – 2,320 pounds/hour

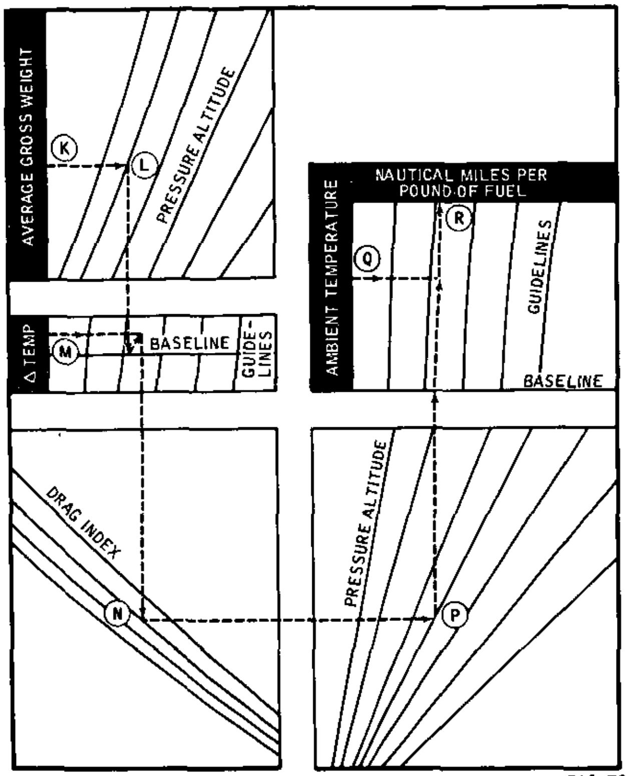
X. Time – 28.5 minutes

Y. Total fuel required – 1,100 pounds.

23.6 NAUTICAL MILES PER POUND OF FUEL

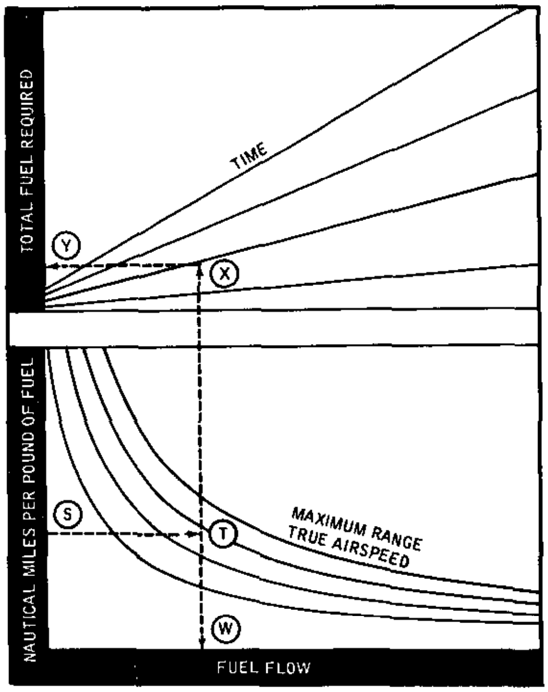
Nautical Miles per Pound of Fuel charts (Figure 23-11, sheets 1 through 6) present cruise data throughout the gross weight, airspeed, and drag index range of the aircraft. These data are presented for use when cruise data are required for speed conditions other than maximum range or long range cruise. To use the nautical miles per pound of fuel charts, the average gross weight, pressure altitude, cruise Mach number, drag index, and ambient air temperature must be known. It is then possible to determine true airspeed, nautical miles per pound of fuel, fuel flow, and engine pressure ratio.

SAMPLE MAXIMUM RANGE CRUISE– NAUTICAL MILES PER POUND OF FUEL



TA1-72-B

SAMPLE MAXIMUM RANGE CRUISE – FUEL



TA1-73-B

23.6.1 Sample Problem

23.6.1.1 Nautical Miles per Pound of Fuel. For Figure 23-11, sheet 1.

A. Average gross weight – 14,000 pounds

B. Cruise pressure altitude – 30,000 feet

C. Drag index – 0 (baseline)

D. Cruise Mach number – 0.75

E. Thrust required/δ amb – clean aircraft – 6,000.

23.6.1.2 Nautical Miles per Pound of Fuel. For Figure 23-11, sheet 2.

F. Thrust required/δ amb – clean aircraft – 6,000

G. Cruise Mach number – 0.75

H. Drag index – 100

J. Total thrust required/δ amb – 8,600 pounds.

23.6.1.3 Nautical Miles per Pound of Fuel. For Figure 23-11, sheet 3.

K. Ambient air temperature – -44.4 °C

L. Pressure altitude – 30,000 feet

M. Cruise Mach number – 0.75

N. Reynolds number index (RNI) – 0.503.

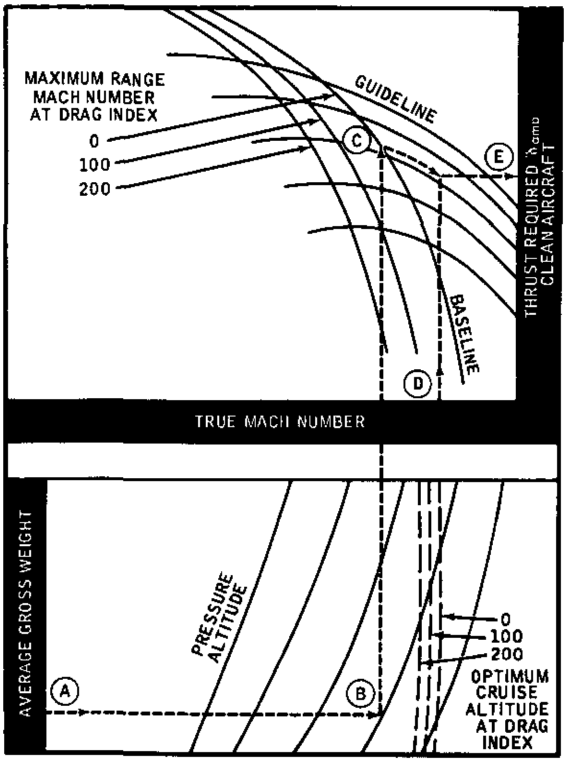
23.6.1.4 Nautical Miles per Pound of Fuel. For Figure 23-11, sheet 4.

P. Total thrust required/δ amb – 8,600 pounds

Q. Cruise Mach number – 0.75

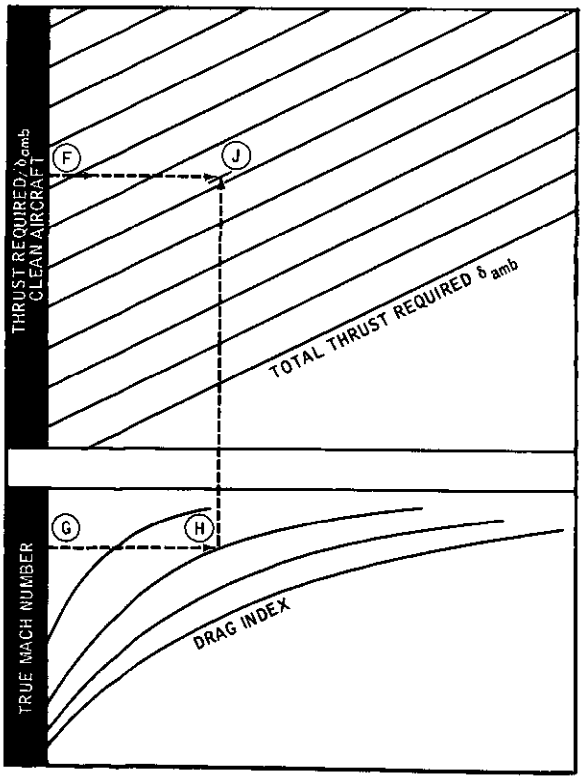
R. Generalized fuel flow parameter (uncorrected for Reynolds number effect) – 6.05

SAMPLE NAUTICAL MILES PER POUND OF FUEL



TA1-74-B

SAMPLE NAUTICAL MILES PER POUND OF FUEL



TA1-75-A

S. Reynolds number index (RNI) – 0.503

T. Generalized fuel flow parameter (corrected for Reynolds number effect) – 6.25.

23.6.1.5 Nautical Miles per Pound of Fuel For figure 23-11, sheet 5.

U. Generalized fuel flow parameter (corrected for Reynolds number effect) – 6.25

V. Cruise Mach number – 0.75

W. Pressure altitude – 30,000 feet

X. Ambient air temperature – -44.4 °C

Y. Nautical miles per pound of fuel – 0.180.

23.6.1.6 Nautical Miles per Pound of Fuel. For Figure 23-11, sheet 6.

A. True Mach number – 0.75

B. Ambient air temperature – -44.4 °C

C. True airspeed – 442 knots

D. Nautical miles per pound of fuel – 0.180

E. Fuel flow – 2,450 pounds/hour.

23.6.2 Sample Problem

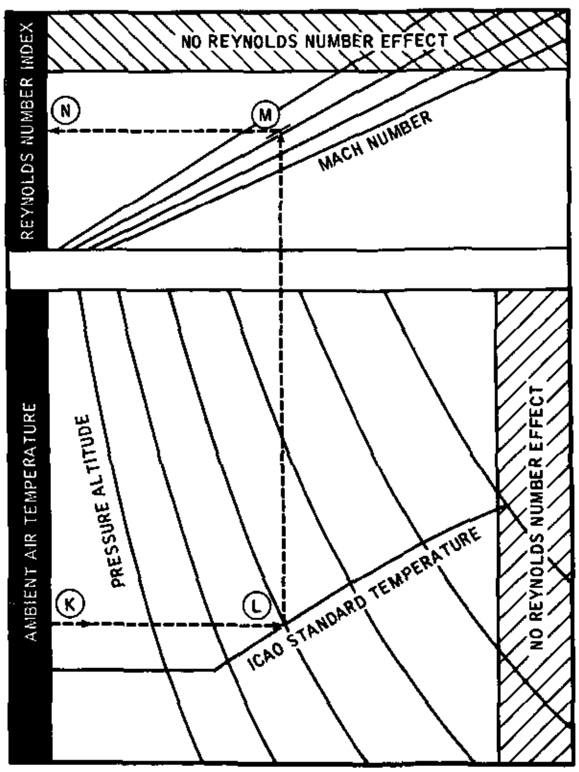
23.6.2.1 Engine Pressure Ratio for Cruise. For Figure 23-12.

F. Total thrust required/δ amb – 8,600 pounds

G. True Mach number – 0.75

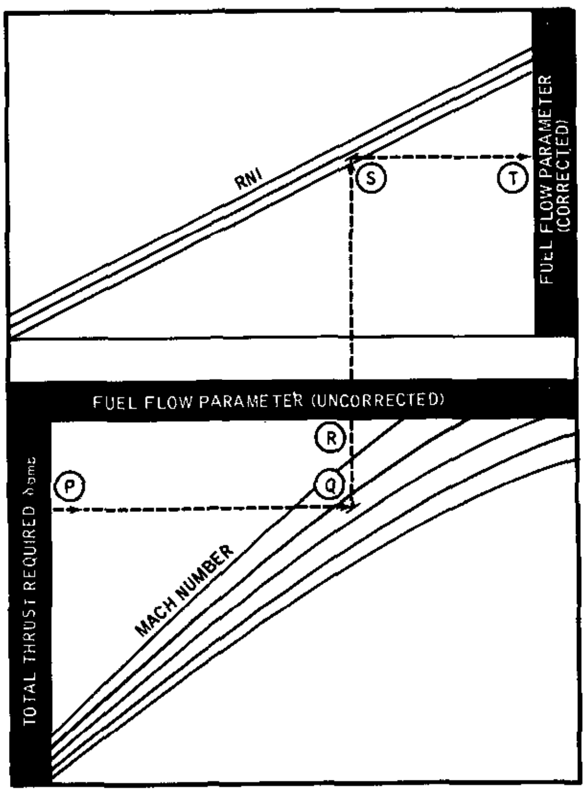
H. Engine pressure ratio – 2.43.

SAMPLE NAUTICAL MILES PER POUND OF FUEL



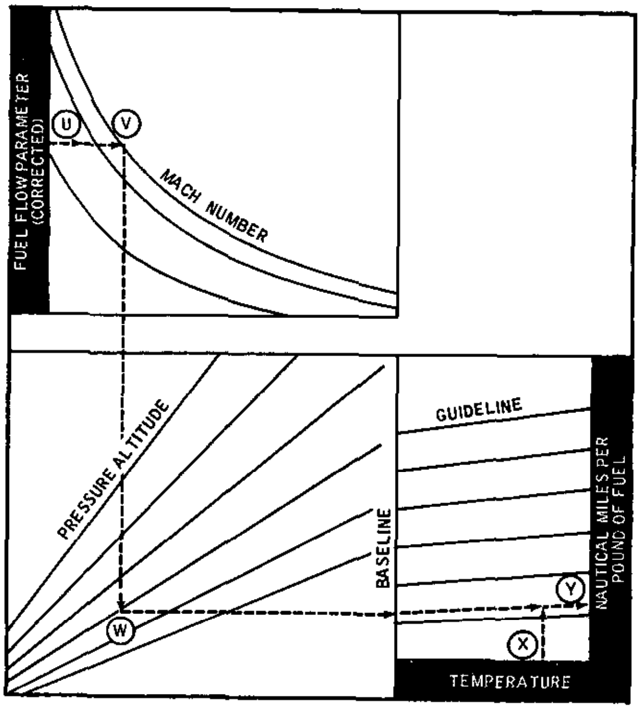
TA1-76-8

SAMPLE NAUTICAL MILES PER POUND OF FUEL



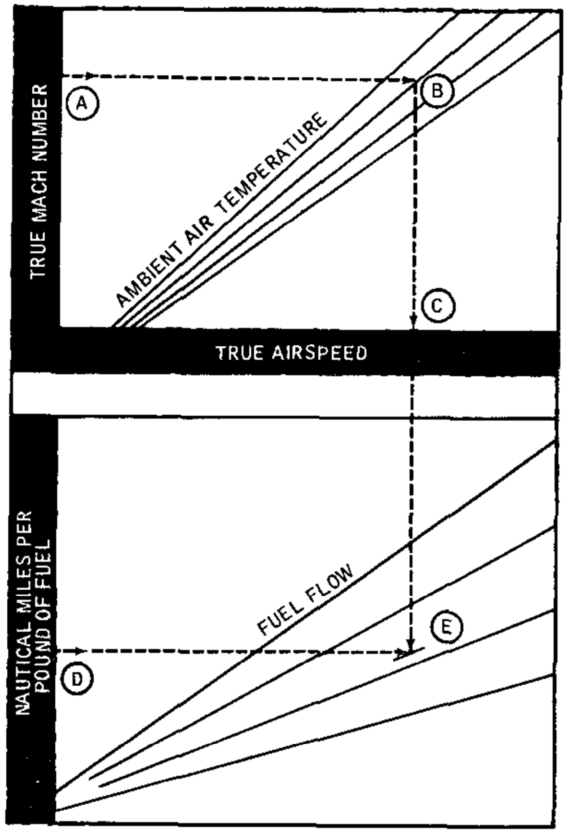
TA1-326

SAMPLE NAUTICAL MILES PER POUND OF FUEL



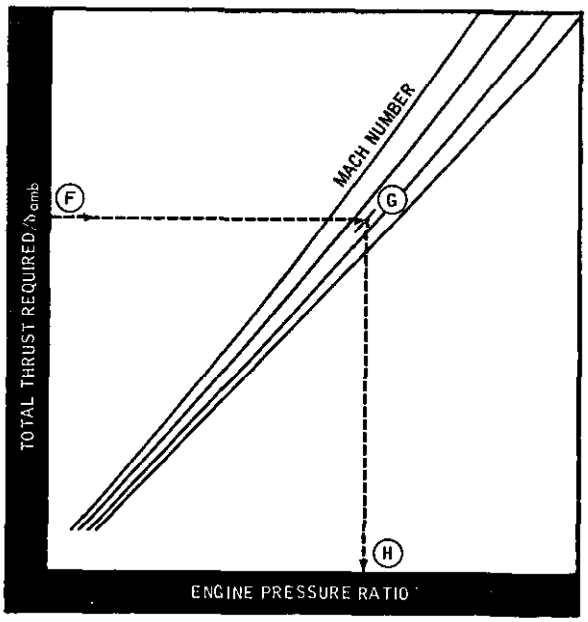
TA1-327

SAMPLE NAUTICAL MILES PER POUND OF FUEL



TA1-328

SAMPLE ENGINE PRESSURE RATIO FOR CRUISE



TA1-329

RANGE FACTOR CHART

RELATIVE WIND—DEGREES	TAS KNOTS	WIND SPEED—KNOTS				
		40	60	80	100	120
0° HEADWIND	350	0.886	0.829	0.772	0.714	0.657
	400	0.900	0.850	0.800	0.750	0.700
	450	0.911	0.867	0.822	0.778	0.733
	500	0.920	0.880	0.844	0.800	0.760
	550	0.927	0.891	0.855	0.818	0.782
30°	350	0.899	0.848	0.796	0.742	0.688
	400	0.912	0.867	0.822	0.776	0.729
	450	0.922	0.882	0.842	0.801	0.760
	500	0.930	0.894	0.858	0.822	0.785
	550	0.936	0.904	0.871	0.839	0.805
60°	350	0.938	0.903	0.866	0.824	0.784
	400	0.946	0.917	0.885	0.852	0.816
	450	0.953	0.927	0.889	0.870	0.840
	500	0.958	0.935	0.910	0.885	0.856
	550	0.962	0.941	0.919	0.897	0.873
90°	350	0.994	0.985	0.974	0.959	0.941
	400	0.995	0.989	0.980	0.969	0.955
	450	0.996	0.991	0.984	0.975	0.964
	500	0.997	0.992	0.987	0.980	0.971
	550	0.997	0.994	0.985	0.984	0.976
120°	350	1.062	1.097	1.134	1.176	1.216
	400	1.054	1.083	1.115	1.148	1.184
	450	1.047	1.073	1.101	1.130	1.160
	500	1.042	1.065	1.090	1.115	1.142
	550	1.038	1.059	1.081	1.103	1.127
150°	350	1.101	1.152	1.205	1.258	1.312
	400	1.088	1.133	1.178	1.224	1.271
	450	1.078	1.118	1.158	1.199	1.240
	500	1.070	1.106	1.142	1.176	1.215
	550	1.064	1.096	1.129	1.162	1.195
180° TAILWIND	350	1.114	1.172	1.228	1.286	[illegible]
	400	1.100	1.150	1.200	1.258	1.300
	450	1.089	1.133	1.178	1.222	1.267
	500	1.080	1.120	1.160	1.200	1.240
	550	1.073	1.109	1.146	1.182	[illegible]

Figure 23-1. Range Factor Chart

FOULED DECK RANGE

Drag Index = 33
Aircraft Weight (Less Fuel) = 12,418 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel for Landing = 250 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 MAY 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL			IF YOU ARE AT 10,000 FEET			IF YOU ARE AT 20,000 FEET		
	RANGE AT: SEA LEVEL	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 10,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 20,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE
	n mi	n mi	feet	n mi	n mi	feet	n mi	n mi	feet
2300	243	494	35,000	311	517	35,000	434	539	40,000
1900	196	395	40,000	250	419	40,000	355	442	40,000
1700	173	345	40,000	220	369	40,000	315	392	40,000
1500	149	294	40,000	189	318	40,000	275	341	40,000
1300	126	242	40,000	158	267	40,000	235	290	40,000
1100	102	190	40,000	127	214	40,000	194	237	40,000
900	78	136	35,000	96	161	40,000	154	184	40,000
700	54	84	30,000	64	107	35,000	113	130	40,000
500	30	39	15,000	33	56	25,000	71	76	30,000

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET			IF YOU ARE AT 35,000 FEET			IF YOU ARE AT 40,000 FEET		
	RANGE AT: 30,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 35,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 40,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE
	n mi	n mi	feet	n mi	n mi	feet	n mi	n mi	feet
2300	530	558	35,000	566	566	40,000	571	574	35,000
1900	435	459	40,000	467	467	40,000	475	475	40,000
1700	387	409	40,000	416	418	40,000	425	425	40,000
1500	339	359	40,000	365	367	40,000	375	375	40,000
1300	290	307	40,000	313	316	40,000	324	324	40,000
1100	241	255	40,000	261	264	40,000	273	272	40,000
900	191	202	40,000	208	211	40,000	219	219	40,000
700	142	148	40,000	155	157	40,000	165	165	40,000
500	91	94	35,000	101	102	40,000	110	110	40,000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST		CRUISE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ DISTANCE REMAINING
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds/n mi
Sea Level	330		270	190	250/0
5,000	330		265	190	274/8
10,000	330		260	190	292/17
15,000	330		255	190	307/25
20,000	330		255	190	321/34
25,000		0.735	255	190	335/43
30,000		0.735	240	190	349/53
35,000		0.735	230	190	362/63
40,000		0.735	215	190	375/74

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Figure 23-2. Fouled Deck Range

BINGO RANGE

Drag Index = 61
Aircraft Weight (Less Fuel) = 12,816 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 MAY 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL			IF YOU ARE AT 10,000 FEET			IF YOU ARE AT 20,000 FEET		
	RANGE AT: SEA LEVEL	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 10,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 20,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE
	n mi	n mi	feet	n mi	n mi	feet	n mi	n mi	feet
2700	[illegible]	402	35,000	281	425	35,000	372	448	35,000
2500	186	358	35,000	253	381	35,000	335	403	35,000
2300	165	313	35,000	225	337	35,000	299	359	35,000
2100	143	268	35,000	197	292	35,000	262	314	35,000
1900	121	223	35,000	168	246	35,000	226	269	35,000
1700	99	177	35,000	140	200	35,000	189	222	35,000
1500	77	130	35,000	111	153	35,000	151	176	35,000
1300	55	83	30,000	83	106	35,000	114	129	35,000
1100	33	44	15,000	54	61	25,000	76	81	35,000

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET			IF YOU ARE AT 35,000 FEET			IF YOU ARE AT 40,000 FEET		
	RANGE AT: 30,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 35,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE	RANGE AT: 40,000 FEET	RANGE AT: OPTIMUM ALTITUDE	OPTIMUM CRUISE ALTITUDE
	n mi	n mi	feet	n mi	n mi	feet	n mi	n mi	feet
2700	449	465	35,000	473	473	35,000	466	480	35,000
2500	407	421	35,000	429	429	35,000	424	437	35,000
2300	364	377	35,000	385	385	35,000	382	392	35,000
2100	320	332	35,000	340	340	35,000	339	347	35,000
1900	276	286	35,000	294	294	35,000	296	301	35,000
1700	232	240	35,000	248	248	35,000	251	255	35,000
1500	188	194	35,000	201	201	35,000	206	209	35,000
1300	143	147	35,000	154	154	35,000	160	162	35,000
1100	97	99	35,000	106	106	35,000	113	114	35,000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST		CRUISE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ DISTANCE REMAINING
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds/n mi
Sea Level	310		270	190	800/0
5,000	310		265	190	823/7
10,000	310		260	190	839/15
15,000	310		260	190	853/23
20,000	310		260	190	867/32
25,000		0.71	255	190	880/40
30,000		0.71	240	190	892/49
35,000		0.71	225	190	904/59
40,000		0.71	215	190	916/69

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Figure 23-3. Bingo Range

BINGO RANGE

Gear Down

Drag Index = 391
Aircraft Weight (Less Fuel) = 12,816 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 MAY 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD - POUNDS	IF YOU ARE AT SEA LEVEL			IF YOU ARE AT 10,000 FEET		
	RANGE AT:		OPTIMUM CRUISE ALTITUDE	RANGE AT:		OPTIMUM CRUISE ALTITUDE
	SEA LEVEL	OPTIMUM ALTITUDE		10,000 FEET	OPTIMUM ALTITUDE	
	n mi	n mi	feet	n mi	n mi	feet
2700	131	206	25,000	176	221	25,000
2500	117	184	25,000	158	199	25,000
2300	104	161	25,000	141	176	25,000
2100	90	139	25,000	123	153	25,000
1900	76	116	25,000	106	131	25,000
1700	63	92	25,000	88	107	25,000
1500	49	69	25,000	70	84	25,000
1300	35	46	20,000	52	60	25,000
1100	21	25	15,000	34	37	20,000
	IF YOU ARE AT 20,000 FEET			IF YOU ARE AT 30,000 FEET		
	RANGE AT:		OPTIMUM CRUISE ALTITUDE	RANGE AT:		OPTIMUM CRUISE ALTITUDE
	20,000 FEET	OPTIMUM ALTITUDE		30,000 FEET	OPTIMUM ALTITUDE	
	n mi	n mi	feet	n mi	n mi	feet
2700	225	234	25,000	246	246	30,000
2500	204	212	25,000	223	223	30,000
2300	182	190	25,000	201	201	30,000
2100	160	167	25,000	178	178	30,000
1900	138	144	25,000	155	155	30,000
1700	116	120	25,000	132	132	30,000
1500	94	97	25,000	108	108	30,000
1300	71	73	25,000	84	84	30,000
1100	49	49	25,000	60	60	30,000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST	CRUISE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ DISTANCE REMAINING
Feet	KCAS	KCAS	KCAS	Pounds/n mi
Sea Level	190	215	165	800/0
5,000	190	210	165	817/5
10,000	190	210	165	830/10
15,000	190	205	165	840/15
20,000	190	200	165	850/20
25,000	190	195	165	860/25
30,000	190	185	165	869/31

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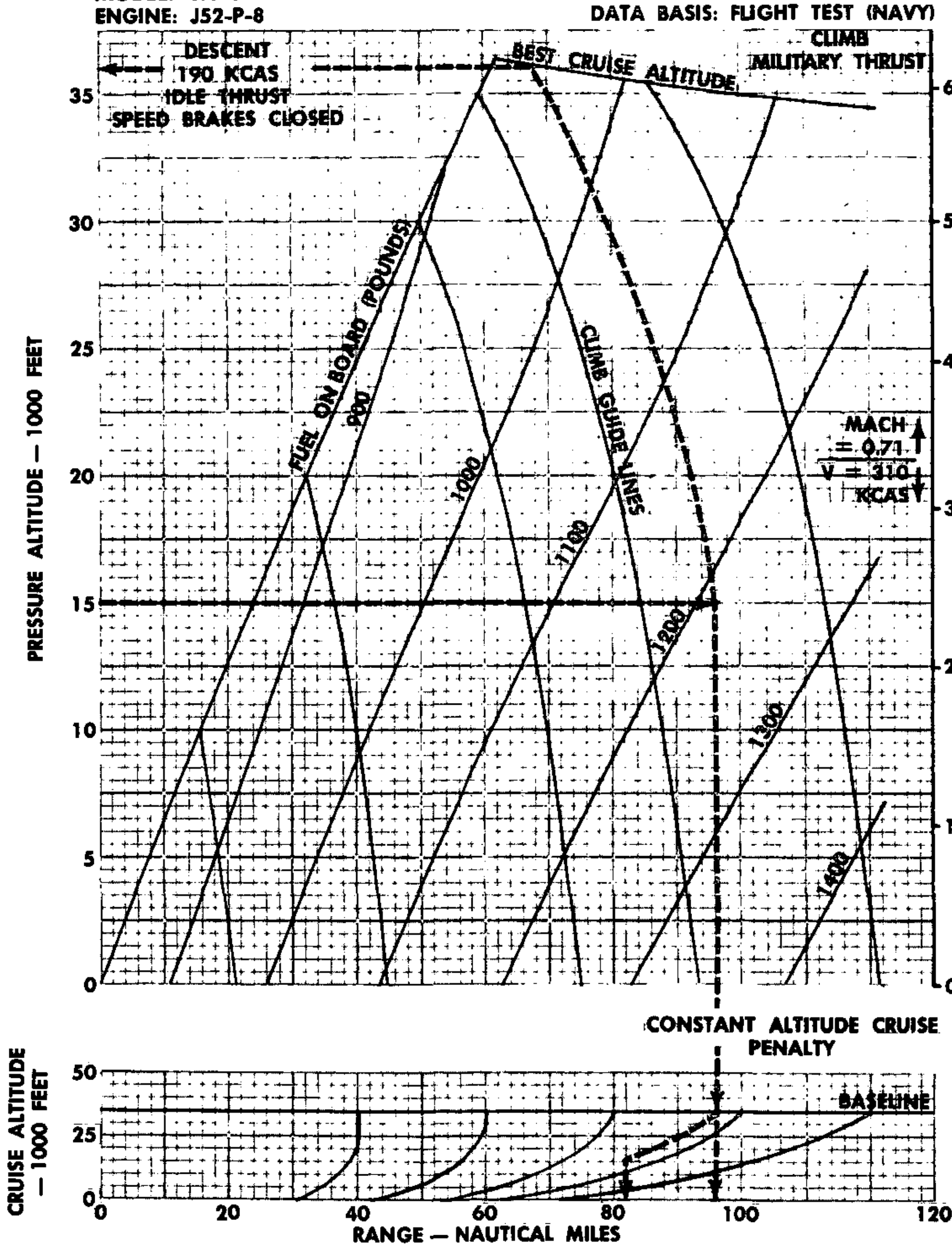
Figure 23-4. Bingo Range Chart – Gear Down

BINGO RANGE PLOT

DRAG INDEX — 61
AIRCRAFT WEIGHT (LESS FUEL) = 12,816 POUNDS
ALL PYLONS, GUNS (NO AMMO), AND TWO 300 GALLON EXTERNAL TANKS
RESERVE FUEL FOR LANDING = 800 POUNDS

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)



PRESSURE ALTITUDE (1000 FEET)	0	10	20	30	35
CRUISE SPEED (KCAS)	270	260	260	240	225

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Figure 23-5. Bingo Range Plot

LONG RANGE CRUISE

MACH NUMBER AND EPR

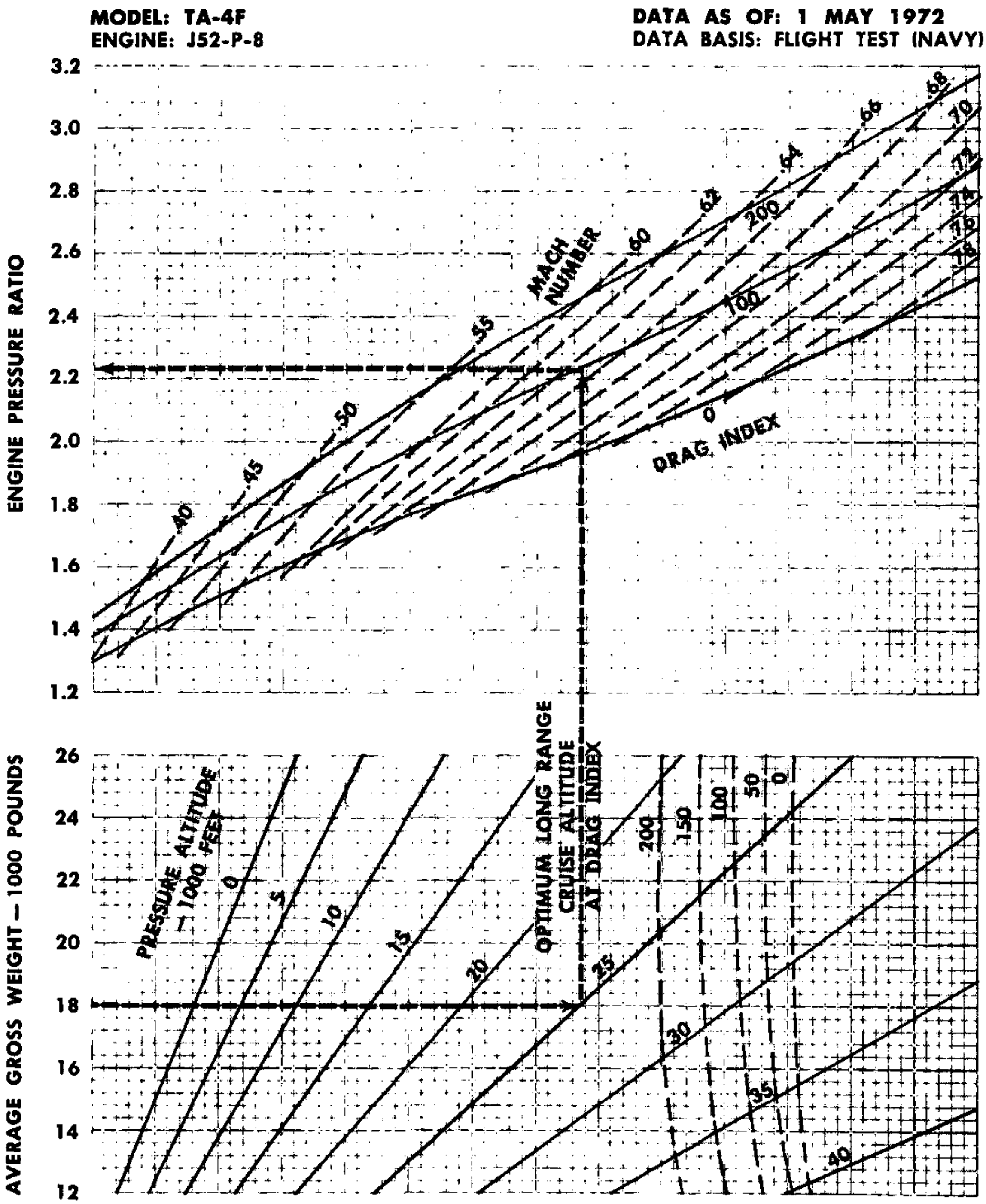

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Figure 23-6. Long Range Cruise – Mach Number and EPR

LONG RANGE CRUISE
NAUTICAL MILES PER POUND OF FUEL

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)

PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5
45	—56.5

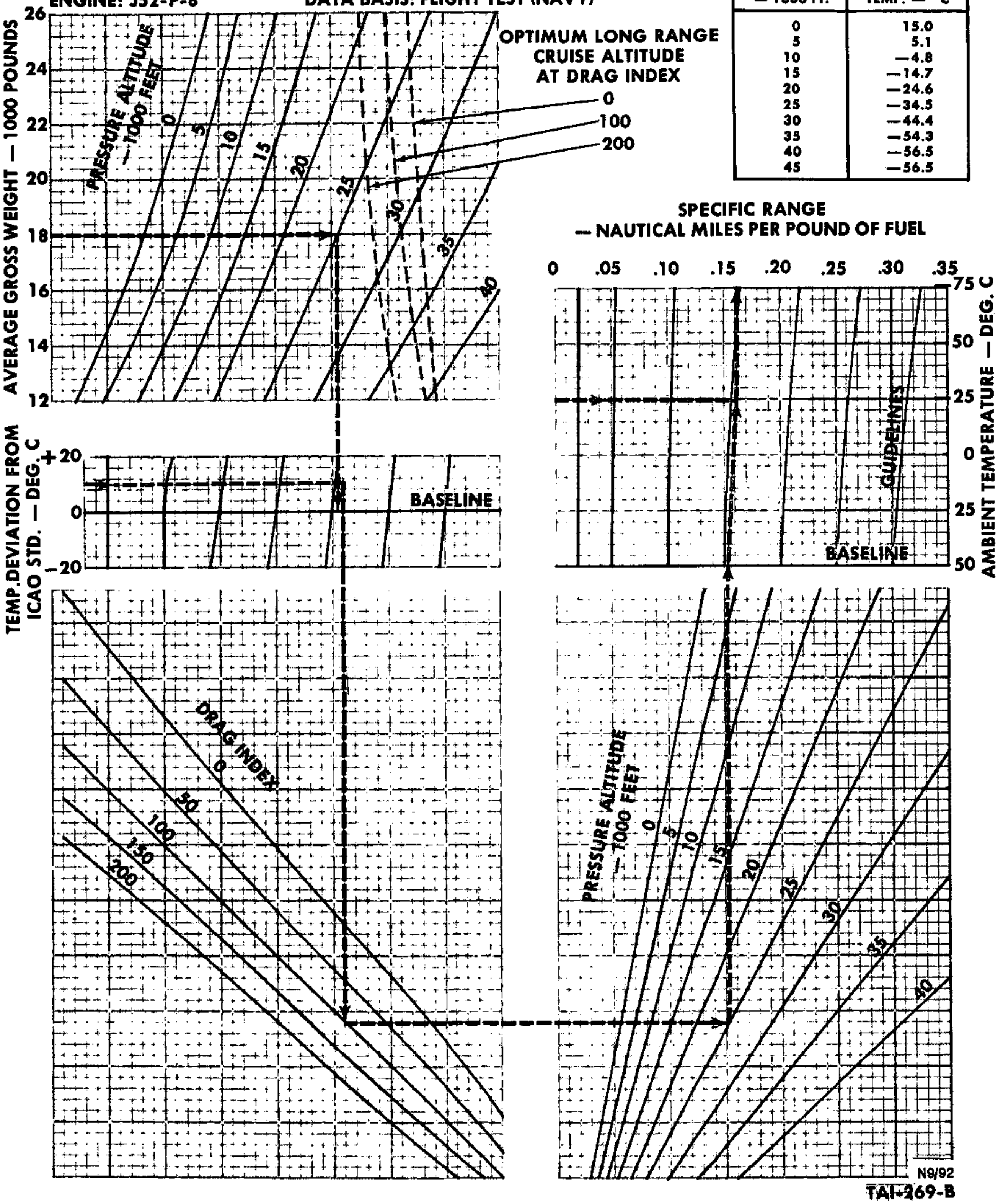


Figure 23-7. Long-Range Cruise – Nautical Miles per Pound of Fuel

MAXIMUM RANGE CRUISE
TIME AND SPEED

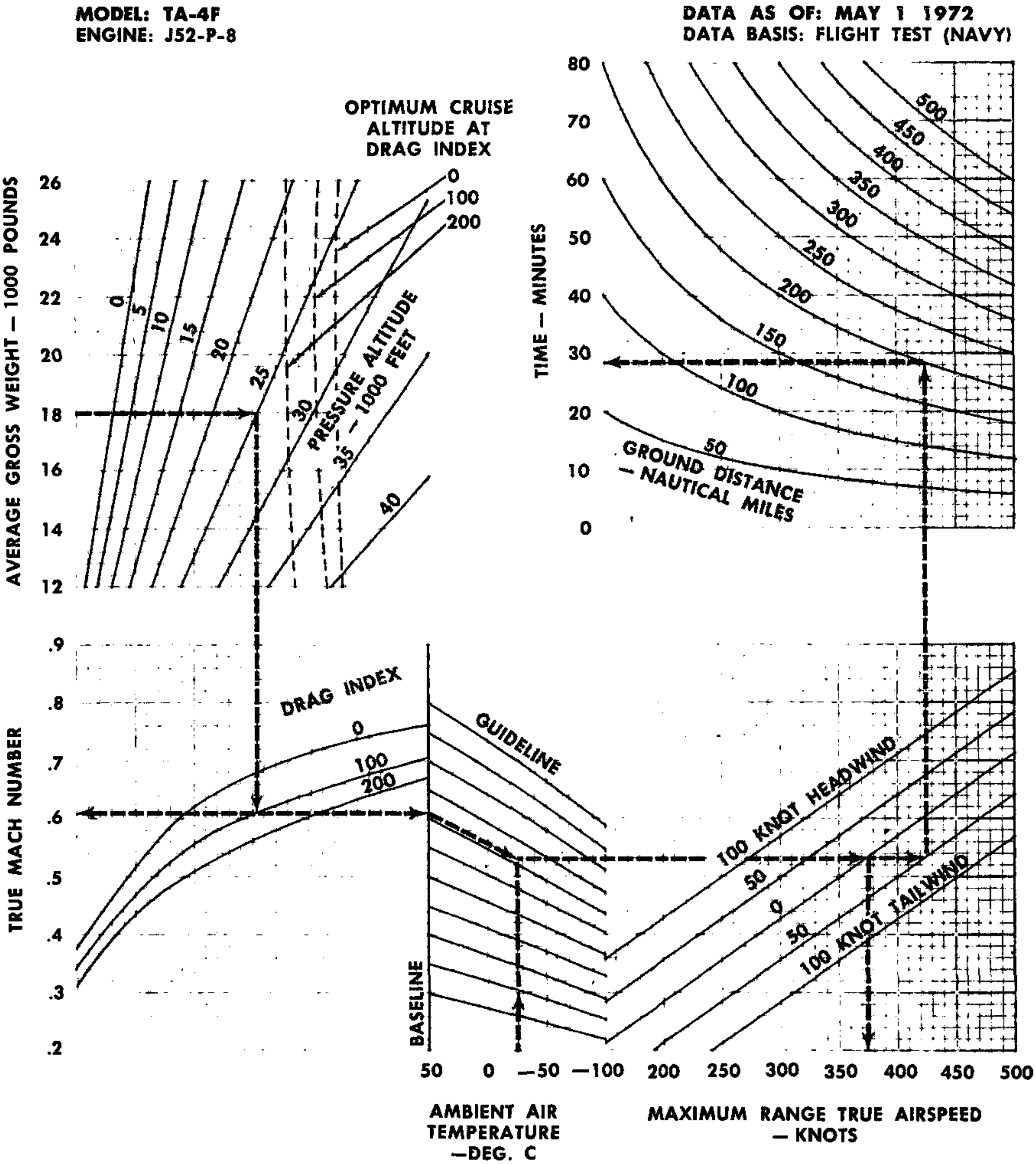


Figure 23-8. Maximum Range Cruise – Time and Speed

MAXIMUM RANGE CRUISE
NAUTICAL MILES PER POUND OF FUEL

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)

PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5
45	—56.5

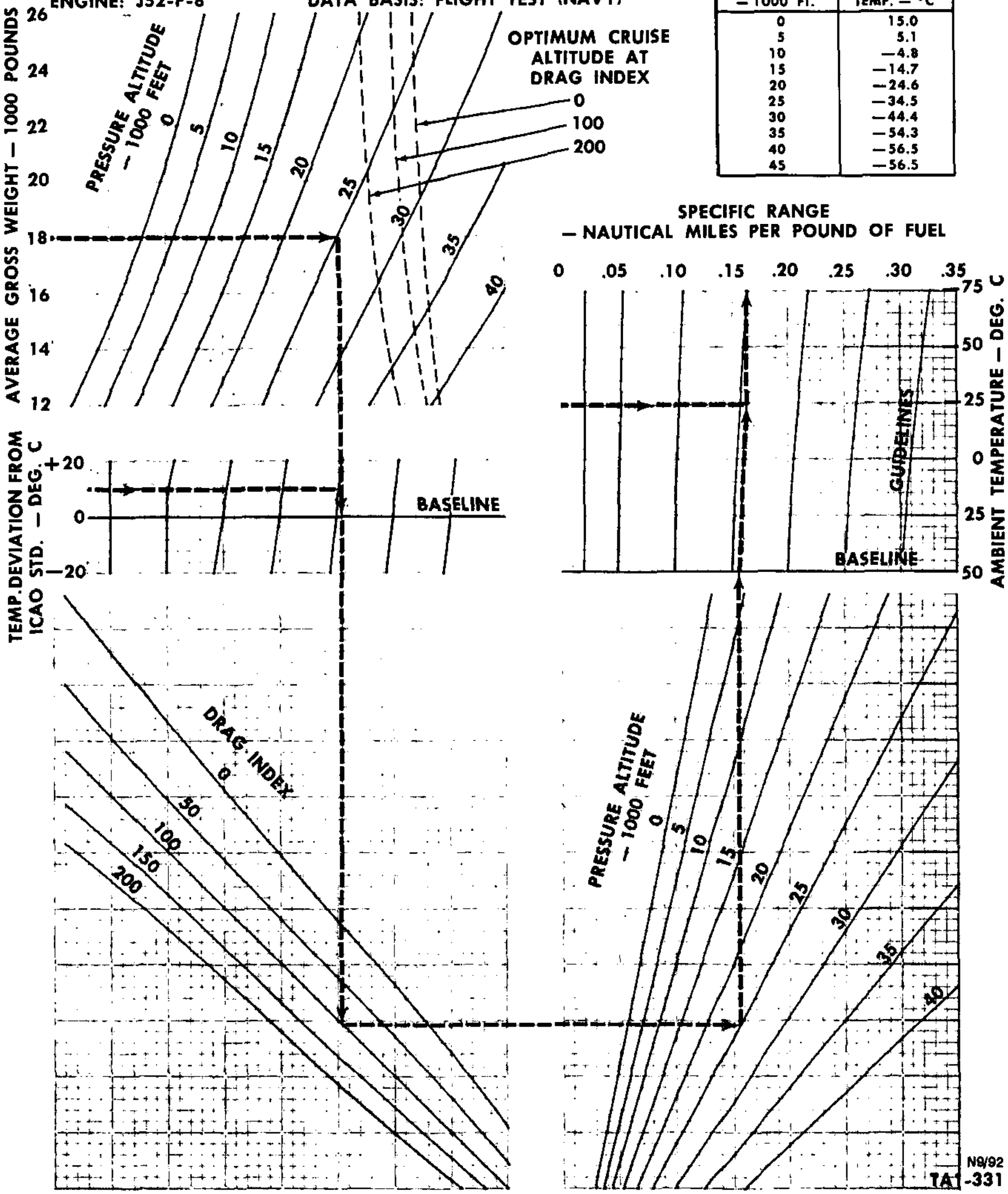


Figure 23-9. Maximum Range Cruise – Nautical Miles per Pound of Fuel

MAXIMUM RANGE CRUISE
FUEL

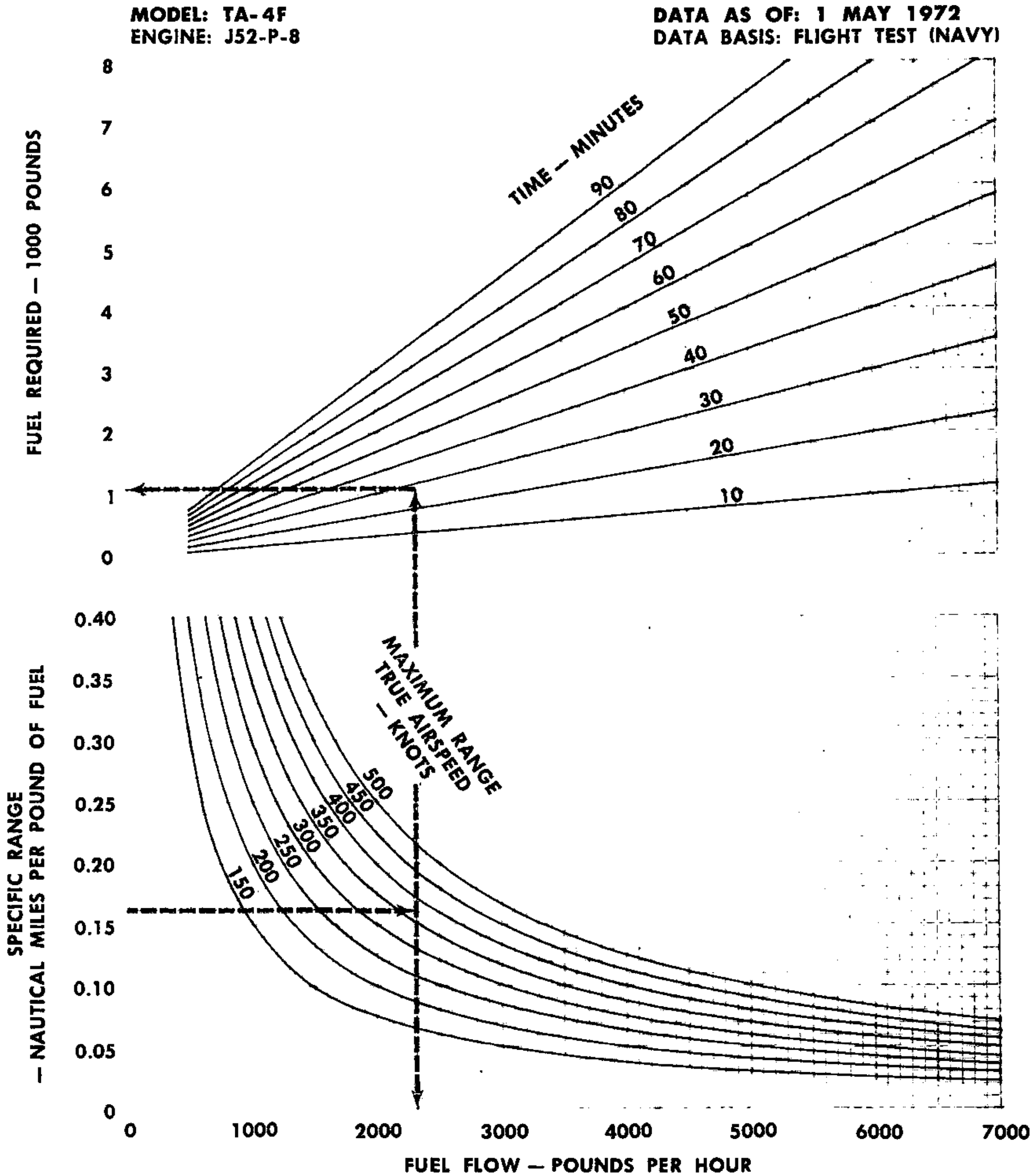


Figure 23-10. Maximum Range Cruise – Fuel

NAUTICAL MILES PER POUND OF FUEL
CLEAN AIRCRAFT THRUST REQUIRED

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)

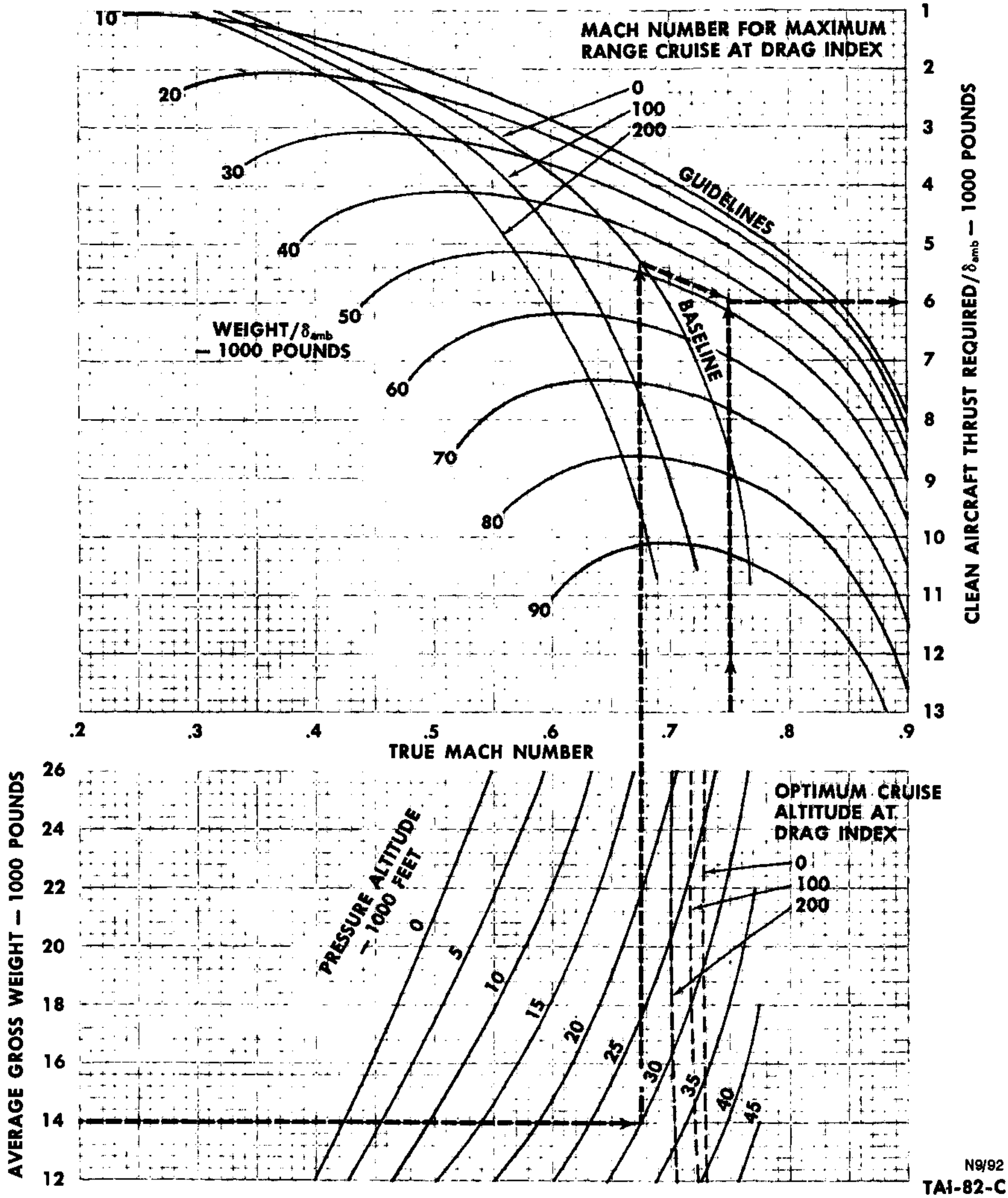


Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 1 of 6)

NAUTICAL MILES PER POUND OF FUEL
TOTAL THRUST REQUIRED

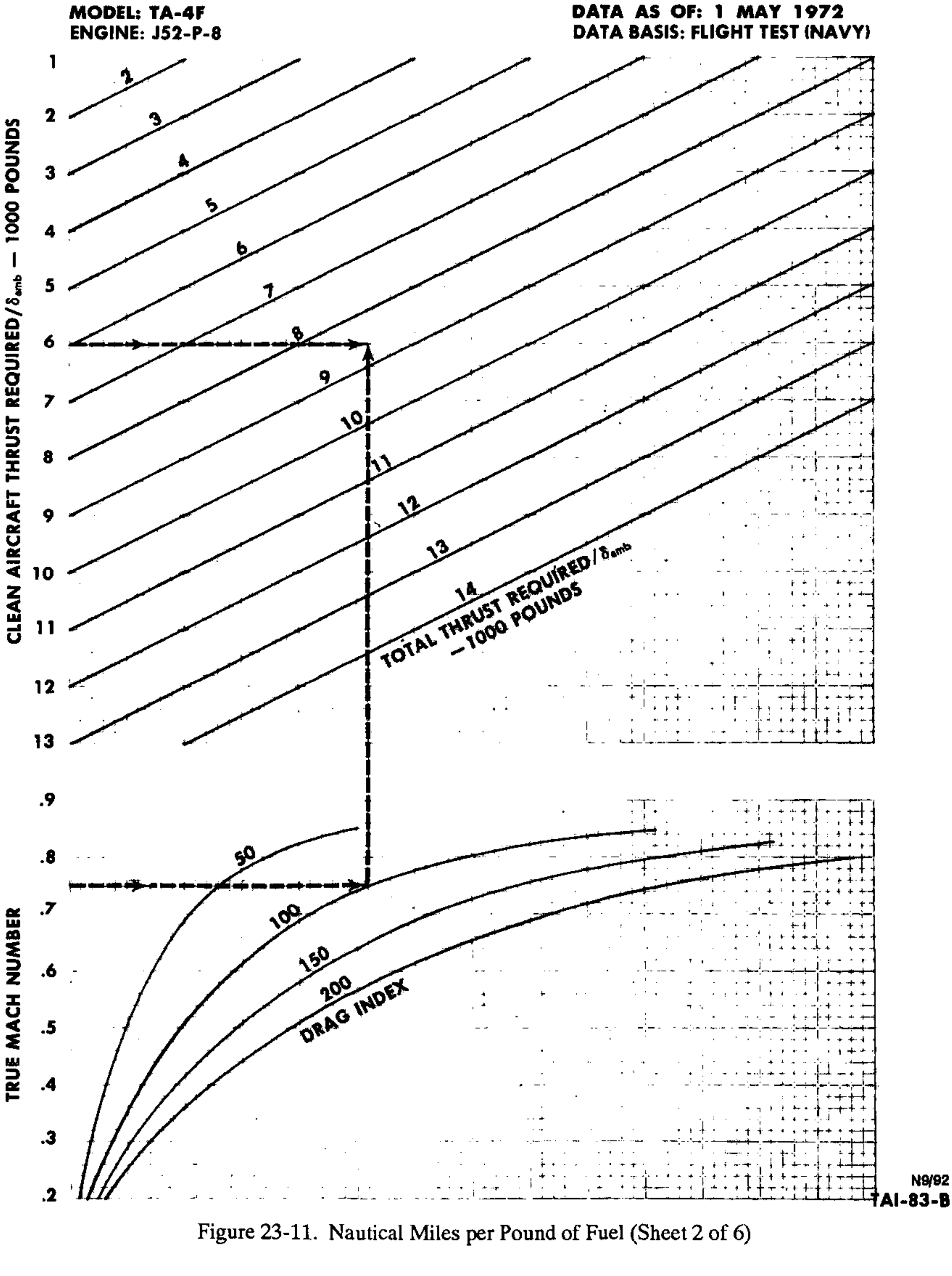


Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 2 of 6)

NAUTICAL MILES PER POUND OF FUEL
REYNOLDS NUMBER INDEX

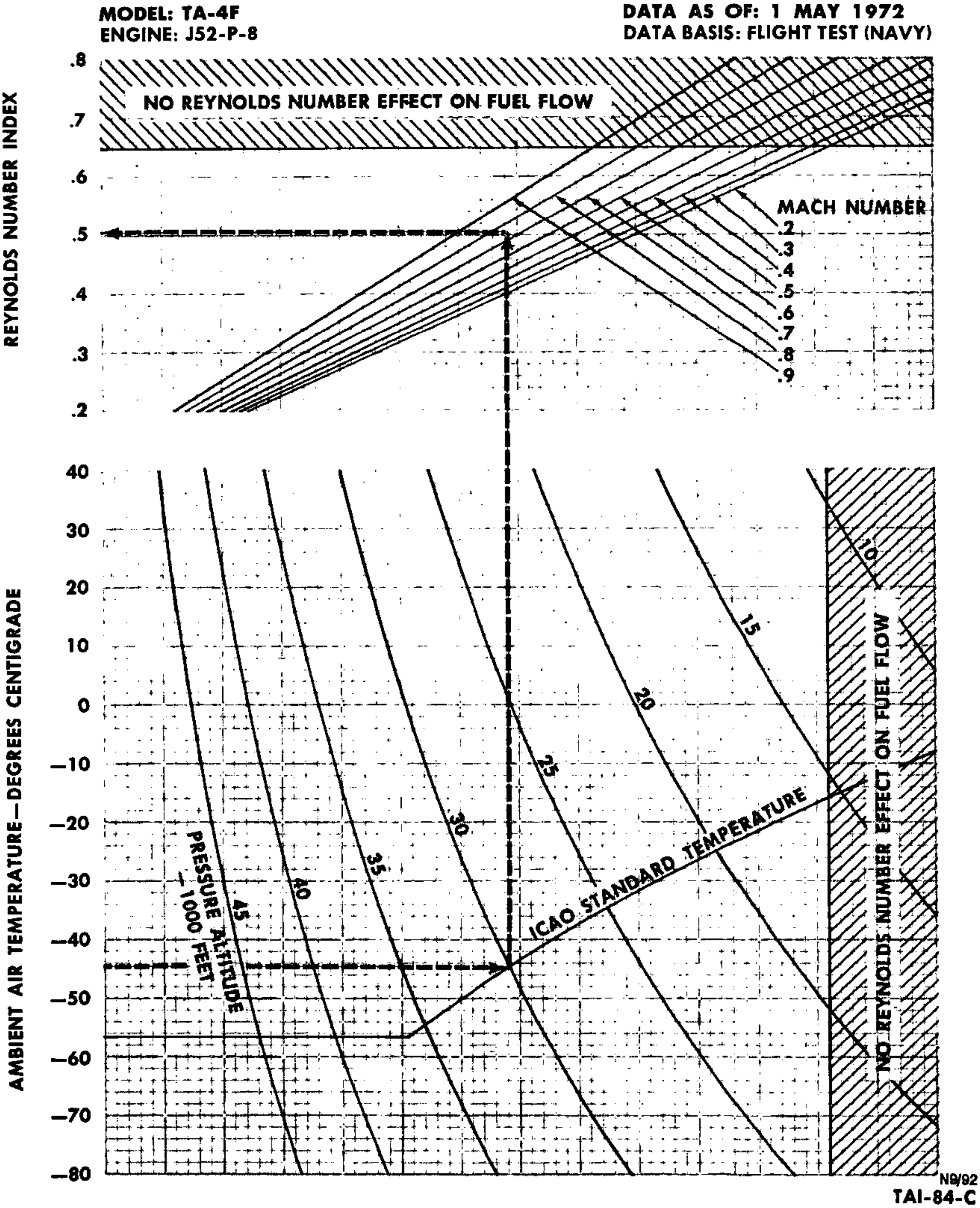


Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 3 of 6)

NAUTICAL MILES PER POUND OF FUEL
GENERALIZED FUEL FLOW PARAMETER

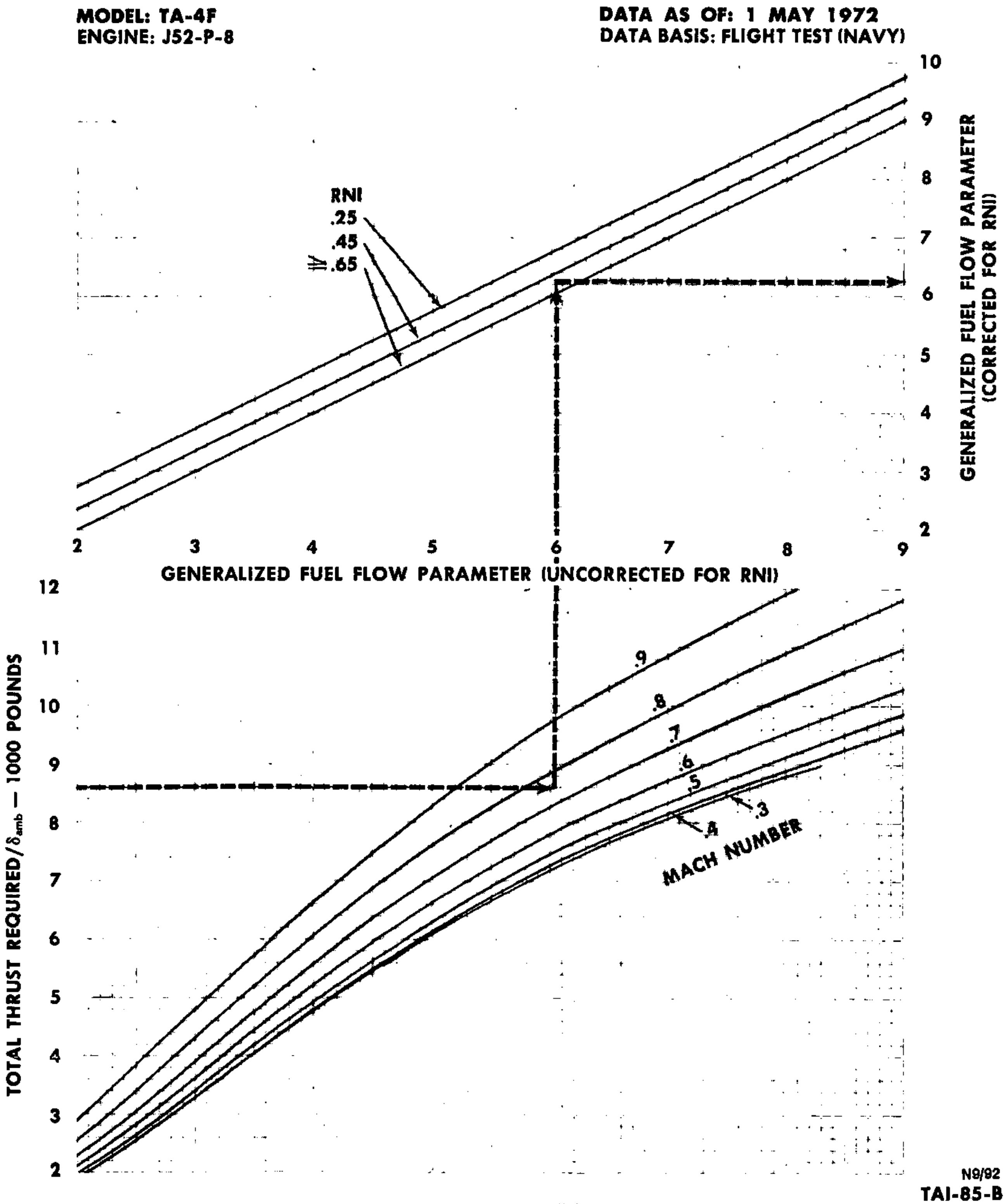
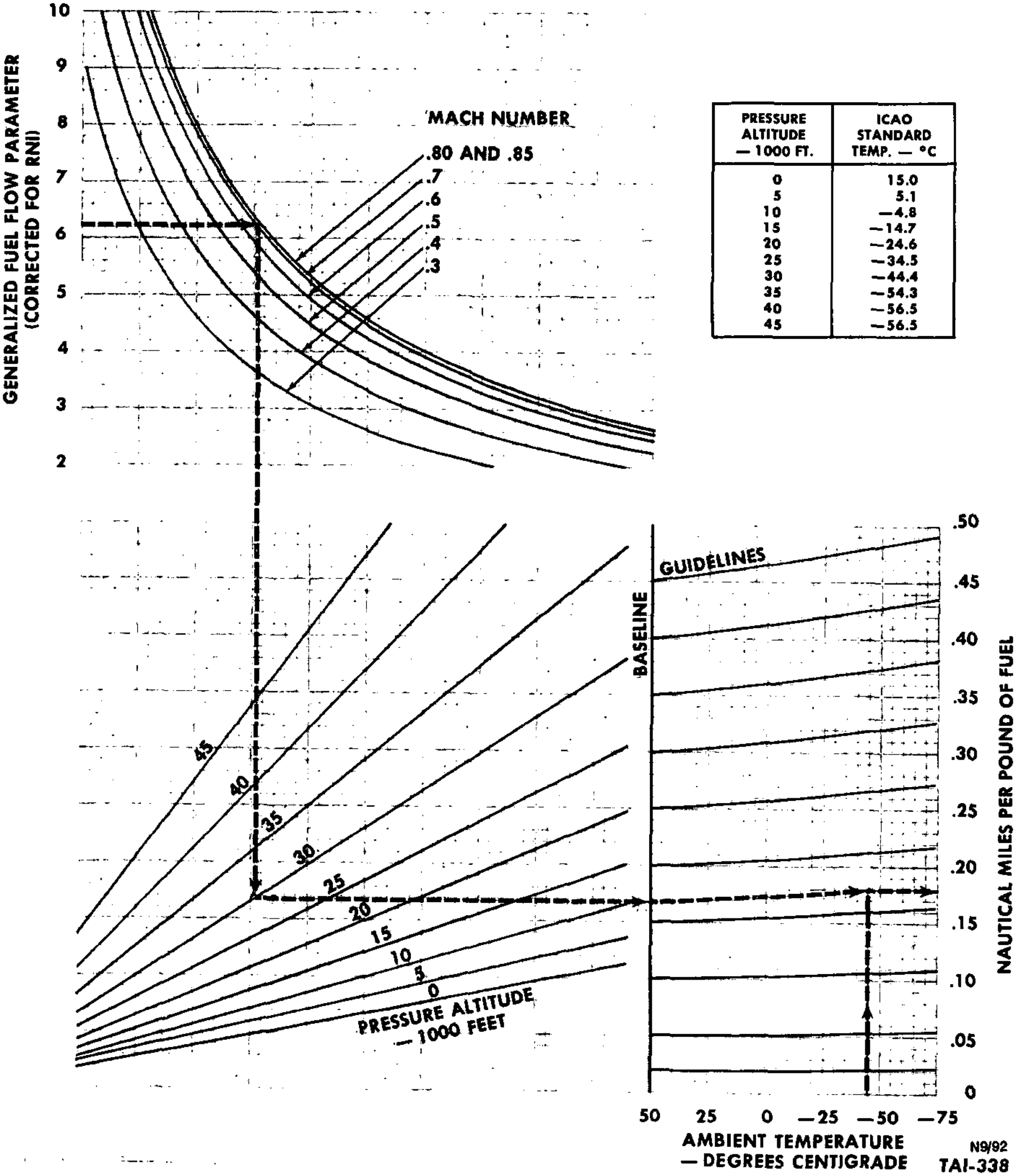


Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 4 of 6)

NAUTICAL MILES PER POUND OF FUEL

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)



PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	−4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5
45	−56.5

Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 5 of 6)

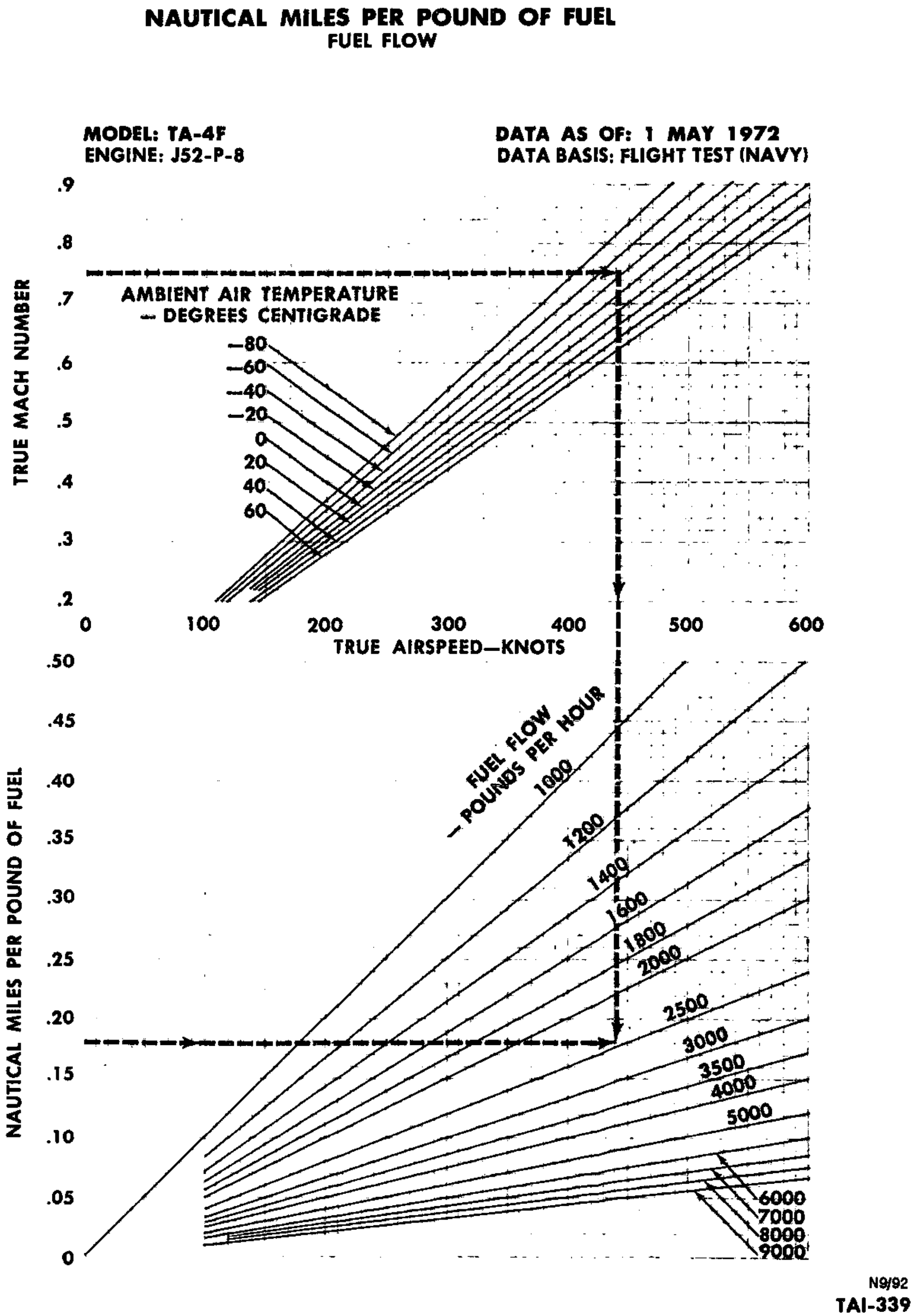


Figure 23-11. Nautical Miles per Pound of Fuel (Sheet 6 of 6)

ENGINE PRESSURE RATIO FOR CRUISE

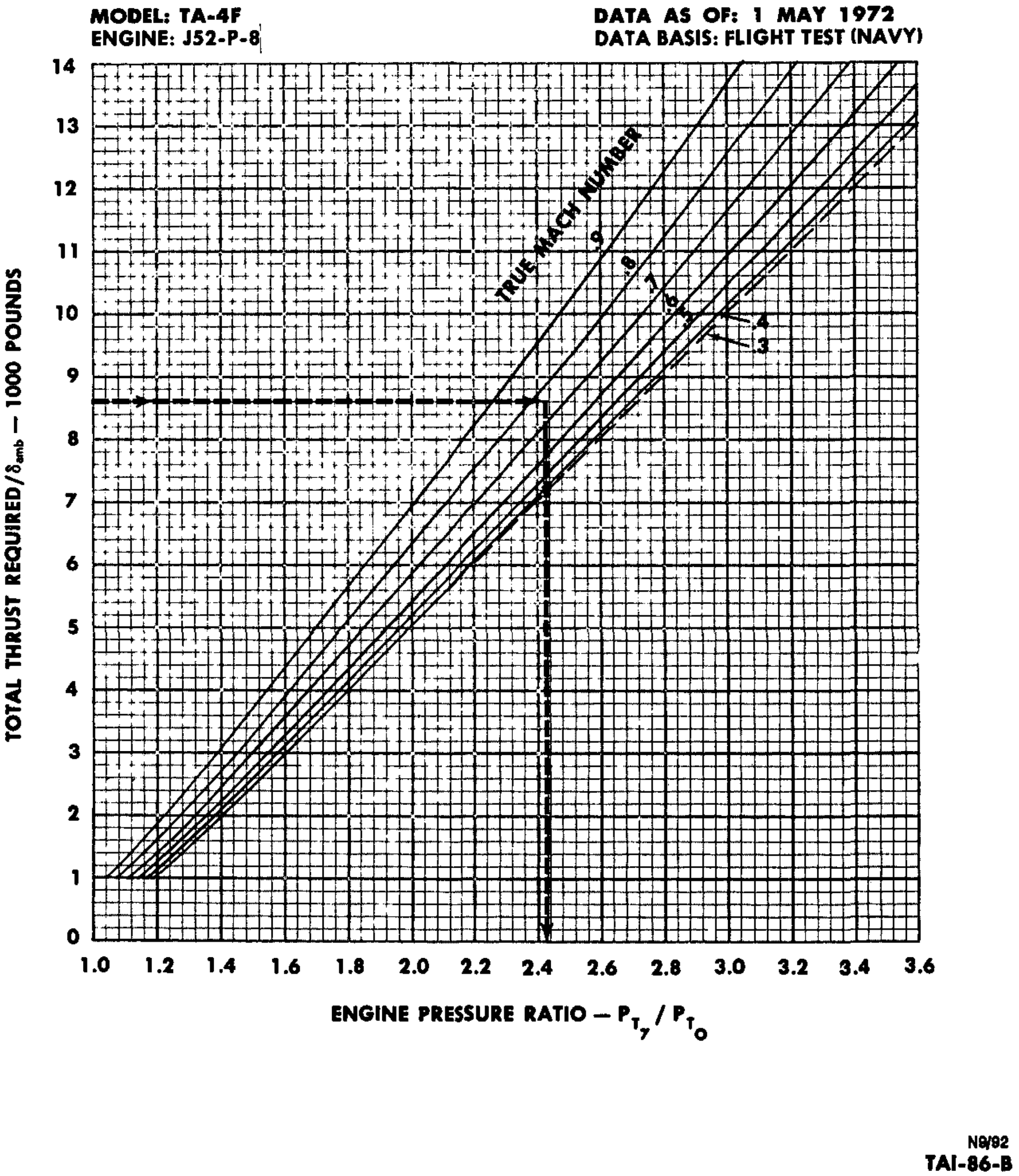


Figure 23-12. Engine Pressure Ratio for Cruise

CHAPTER 24

Endurance

24.1 FOULED DECK ENDURANCE

Occasions arise during carrier operations when the deck becomes fouled and aircraft cannot be taken aboard until the deck is cleared. In these instances, it is desireable for the pilots and the air officer to be aware of the endurance capabilities of the unrecovered aircraft so that an immediate decision can be made concerning the proper course of action. Should the estimated clear deck time be beyond the endurance time of the aircraft, then it must either depart immediately for the beach, or land aboard the ready deck of another carrier, if available. However, if it is either desirable or mandatory that the aircraft orbit until the deck is clear, it is necessary that the pilot fully understand the proper procedure to obtain the maximum endurance with the available fuel. The Fouled Deck Endurance chart (Figure 24-1) tabulates the endurance times for various quantities of fuel on board at both the initial altitude and the optimum, best endurance altitude. The aircraft configuration consists of four empty wing pylons plus guns with a total drag index of 33. The endurance values are given in minutes; for the optimum altitudes include the time required for a military thrust climb to that altitude and a maximum range descent to sea level with 250 pounds of fuel remaining for approach and landing. The endurance times for the initial altitude include only the descent time since no climb is required. Climb speeds and airspeeds for maximum endurance are included in the chart together with letdown instructions.

The time at which letdown should be initiated is given in terms of fuel on board and represents the fuel required to conduct a maximum range descent from altitude to sea level. A 250-pound fuel allowance is included for approach and landing.

Bingo Endurance and Bingo Endurance - Gear Down charts are presented in Figures 24-2 and 24-3 respectively. These charts are provided for an aircraft configuration consisting of four wing pylons, guns, and two 300-gallon external fuel tanks with a total drag index of 61 with gear up and 391 with gear down. The procedures for the use of the charts are identical to those for the fouled deck endurance chart; however, an 800-pound fuel allowance is included for approach and landing.

24.2 MAXIMUM ENDURANCE

The maximum endurance charts provide a means of determining the Mach number and calibrated airspeed for maximum endurance with the associated fuel flow and fuel required for a specified loiter time. These data are provided for a constant altitude loiter condition. Optimum loiter altitude lines, altitude for best endurance, are superimposed on the pressure altitude plots. To use these charts, the average gross weight, bank angle, pressure altitude, drag index, ambient air temperature, and loiter time must be known. The charts then provide Mach number, calibrated airspeed, fuel flow, and fuel required for maximum endurance.

24.2.1 Sample Problem

24.2.1.1 Maximum Endurance Speed. For Figure 24-4.

A. Average gross weight – 15,000 pounds

B. Bank angle – 15°

C. Loiter pressure altitude – 25,000 feet

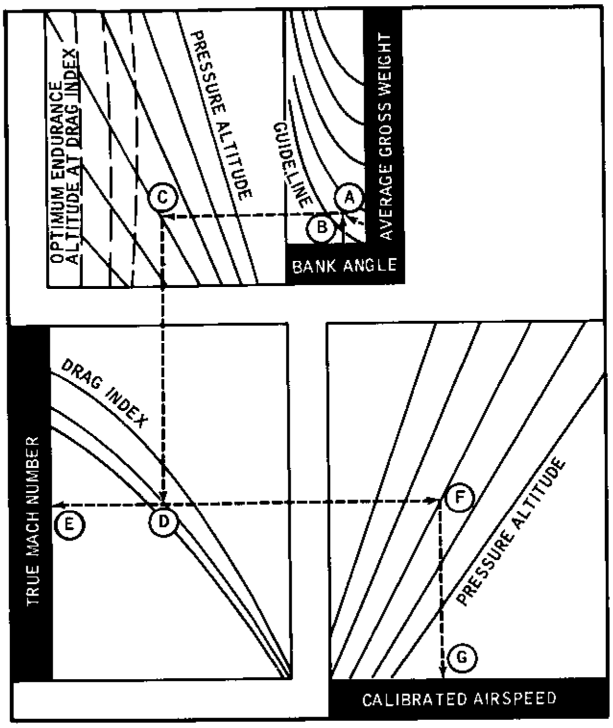
D. Drag index – 100

E. Mach number for maximum endurance – 0.475

F. Loiter pressure altitude – 25,000 feet

G. Loiter airspeed – 195 KCAS.

SAMPLE MAXIMUM ENDURANCE SPEED



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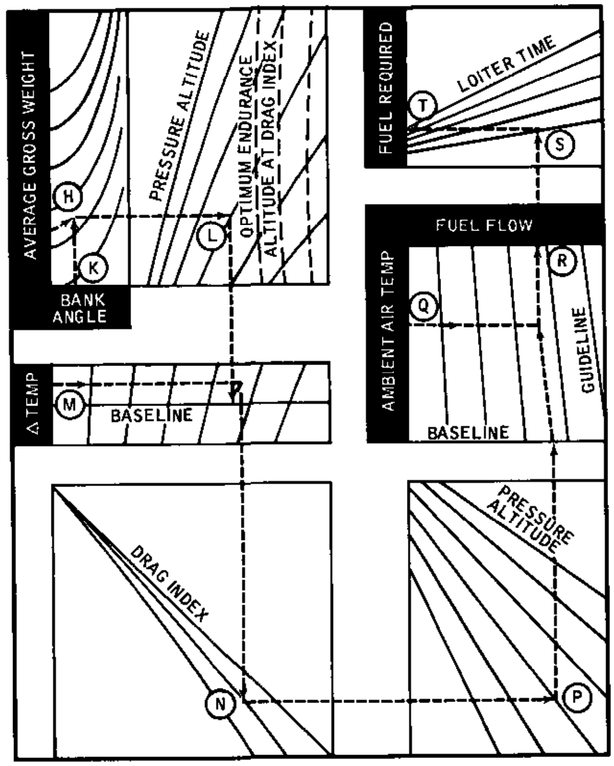
SAMPLE MAXIMUM ENDURANCE FUEL



TA1-88-A

24.2.2 Sample Problem

24.2.2.1 Maximum Endurance Fuel. For Figure 24-5.

H. Average gross weight – 15,000 pounds

K. Bank angle – 15°

L. Loiter pressure altitude – 25,000 feet

M. Temperature deviation from ICAO standard (Ambient temperature = -24.5 °C) – +10 °C

N. Drag index – 100

P. Loiter pressure altitude – 25,000 feet

Q. Ambient air temperature – -24.5 °C

R. Fuel flow – 1,800 pounds/hour

S. Loiter time – 30 minutes

T. Fuel required – 900 pounds.

FOULED DECK ENDURANCE

Drag Index = 33
Aircraft Weight (Less Fuel) = 12,418 Pounds
All Pylons and Guns (No Ammo)
Reserve Fuel for Landing = 250 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 MAY 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL			IF YOU ARE AT 10,000 FEET			IF YOU ARE AT 20,000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	SEA LEVEL	OPTIMUM ALTITUDE		10,000 FEET	OPTIMUM ALTITUDE		20,000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet	minutes	minutes	feet
2300	66	87	35,000	79	91	35,000	91	94	35,000
1900	53	70	35,000	65	74	35,000	75	78	35,000
1700	47	62	35,000	58	66	35,000	67	70	35,000
1500	41	53	35,000	50	57	35,000	59	61	35,000
1300	35	45	35,000	43	49	35,000	51	53	35,000
1100	28	36	35,000	36	40	35,000	43	44	35,000
900	22	27	35,000	28	31	35,000	34	35	35,000
700	15	18	30,000	21	22	35,000	26	26	35,000
500	8	10	15,000	13	14	15,000	17	17	30,000

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30,000 FEET			IF YOU ARE AT 35,000 FEET			IF YOU ARE AT 40,000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	30,000 FEET	OPTIMUM ALTITUDE		35,000 FEET	OPTIMUM ALTITUDE		40,000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet	minutes	minutes	feet
2300	97	98	35,000	99	99	35,000	94	100	35,000
1900	80	81	35,000	83	83	35,000	80	84	35,000
1700	72	73	35,000	74	74	35,000	72	76	35,000
1500	64	65	35,000	66	66	35,000	64	67	35,000
1300	55	56	35,000	57	57	35,000	56	59	35,000
1100	47	47	35,000	49	49	35,000	48	50	35,000
900	38	38	35,000	40	40	35,000	40	41	35,000
700	29	29	35,000	31	31	35,000	32	32	35,000
500	20	20	35,000	22	22	35,000	23	23	35,000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST		ENDURANCE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ TIME REMAINING
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds/Minutes
Sea Level	330		195	190	250/0
5,000	330		195	190	274/2
10,000	330		195	190	292/5
15,000	330		195	190	307/7
20,000	330		195	190	321/9
25,000		0.735	195	190	335/11
30,000		0.735	195	190	349/13
35,000		0.735	195	190	362/15
40,000		0.735	195	190	375/17

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Figure 24-1. Fouled Deck Endurance

BINGO ENDURANCE

Drag Index = 61
Aircraft Weight (Less Fuel) = 12, 816 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 MAY 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD – POUNDS	IF YOU ARE AT SEA LEVEL			IF YOU ARE AT 10, 000 FEET			IF YOU ARE AT 20, 000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	SEA LEVEL	OPTIMUM ALTITUDE		10, 000 FEET	OPTIMUM ALTITUDE		20, 000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet	minutes	minutes	feet
2700	56	72	30, 000	68	75	30, 000	78	79	30, 000
2500	50	64	30, 000	61	68	30, 000	71	72	30, 000
2300	45	57	30, 000	55	61	30, 000	64	65	30, 000
2100	39	49	30, 000	48	53	30, 000	56	57	30, 000
1900	33	42	30, 000	41	45	30, 000	49	49	30, 000
1700	27	34	30, 000	35	38	30, 000	41	42	30, 000
1500	21	26	30, 000	28	30	30, 000	34	34	30, 000
1300	15	18	20, 000	21	22	20, 000	26	26	20, 000
1100	9	11	15, 000	14	14	15, 000	18	18	20, 000

FUEL ON BOARD – POUNDS	IF YOU ARE AT 30, 000 FEET			IF YOU ARE AT 35, 000 FEET			IF YOU ARE AT 40, 000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	30, 000 FEET	OPTIMUM ALTITUDE		35, 000 FEET	OPTIMUM ALTITUDE		40, 000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet	minutes	minutes	feet
2700	83	83	30, 000	83	84	30, 000	77	85	30, 000
2500	75	75	30, 000	76	77	30, 000	71	78	30, 000
2300	68	68	30, 000	69	69	30, 000	65	70	30, 000
2100	60	60	30, 000	61	62	30, 000	58	63	30, 000
1900	53	53	30, 000	54	54	30, 000	51	55	30, 000
1700	45	45	30, 000	46	46	35, 000	45	47	35, 000
1500	37	37	30, 000	38	38	35, 000	38	40	35, 000
1300	29	29	30, 000	30	30	35, 000	30	32	35, 000
1100	21	21	30, 000	22	22	35, 000	23	24	35, 000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST		ENDURANCE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ TIME REMAINING
Feet	KCAS	Mach No.	KCAS	KCAS	Pounds/Minutes
Sea Level	310		195	190	800/0
5, 000	310		195	190	823/2
10, 000	310		195	190	839/4
15, 000	310		195	190	853/6
20, 000	310		195	190	867/8
25, 000		0. 71	195	190	880/10
30, 000		0. 71	195	190	892/12
35, 000		0. 71	195	190	904/14
40, 000		0. 71	195	190	916/16

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Figure 24-2. Bingo Endurance Chart

BINGO ENDURANCE

Gear Down

Drag Index = 391
Aircraft Weight (Less Fuel) = 12,816 Pounds
All Pylons, Guns (No Ammo), and Two 300 Gallon External Tanks
Reserve Fuel for Landing = 800 Pounds

Model: TA-4F
Engine: J52-P-8

Data as of: 1 May 1972
Data Basis: FLIGHT TEST (NAVY)

FUEL ON BOARD - POUNDS	If You Are At SEA LEVEL			If You Are At 10,000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	SEA LEVEL	OPTIMUM ALTITUDE		10,000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet
2700	43	51	20,000	51	54	20,000
2500	39	46	20,000	47	49	20,000
2300	35	41	20,000	42	44	20,000
2100	30	35	20,000	37	39	20,000
1900	26	30	20,000	32	33	20,000
1700	21	24	20,000	26	28	20,000
1500	16	19	20,000	21	22	20,000
1300	12	13	15,000	16	16	15,000
1100	7	8	10,000	11	11	15,000

FUEL ON BOARD - POUNDS	If You Are At 20,000 FEET			If You Are At 30,000 FEET		
	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE	ENDURANCE AT:		OPTIMUM ENDURANCE ALTITUDE
	20,000 FEET	OPTIMUM ALTITUDE		30,000 FEET	OPTIMUM ALTITUDE	
	minutes	minutes	feet	minutes	minutes	feet
2700	58	58	20,000	55	60	20,000
2500	52	52	20,000	51	55	20,000
2300	47	47	20,000	46	49	20,000
2100	42	42	20,000	41	44	20,000
1900	36	36	20,000	36	39	20,000
1700	31	31	20,000	31	33	20,000
1500	25	25	20,000	26	27	20,000
1300	20	20	20,000	21	22	20,000
1100	14	14	20,000	16	16	20,000

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST	ENDURANCE SPEED	DESCENT SPEED ENGINE IDLE SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL/ TIME REMAINING
feet	KCAS	KCAS	KCAS	Pounds/Minutes
Sea Level	190	170	165	800/0
5,000	190	170	165	817/1
10,000	190	170	165	830/3
15,000	190	170	165	840/4
20,000	190	170	165	850/6
25,000	190	170	165	860/7
30,000	190	170	165	869/9

N9/92

Figure 24-3. Bingo Endurance – Gear Down

MAXIMUM ENDURANCE SPEED

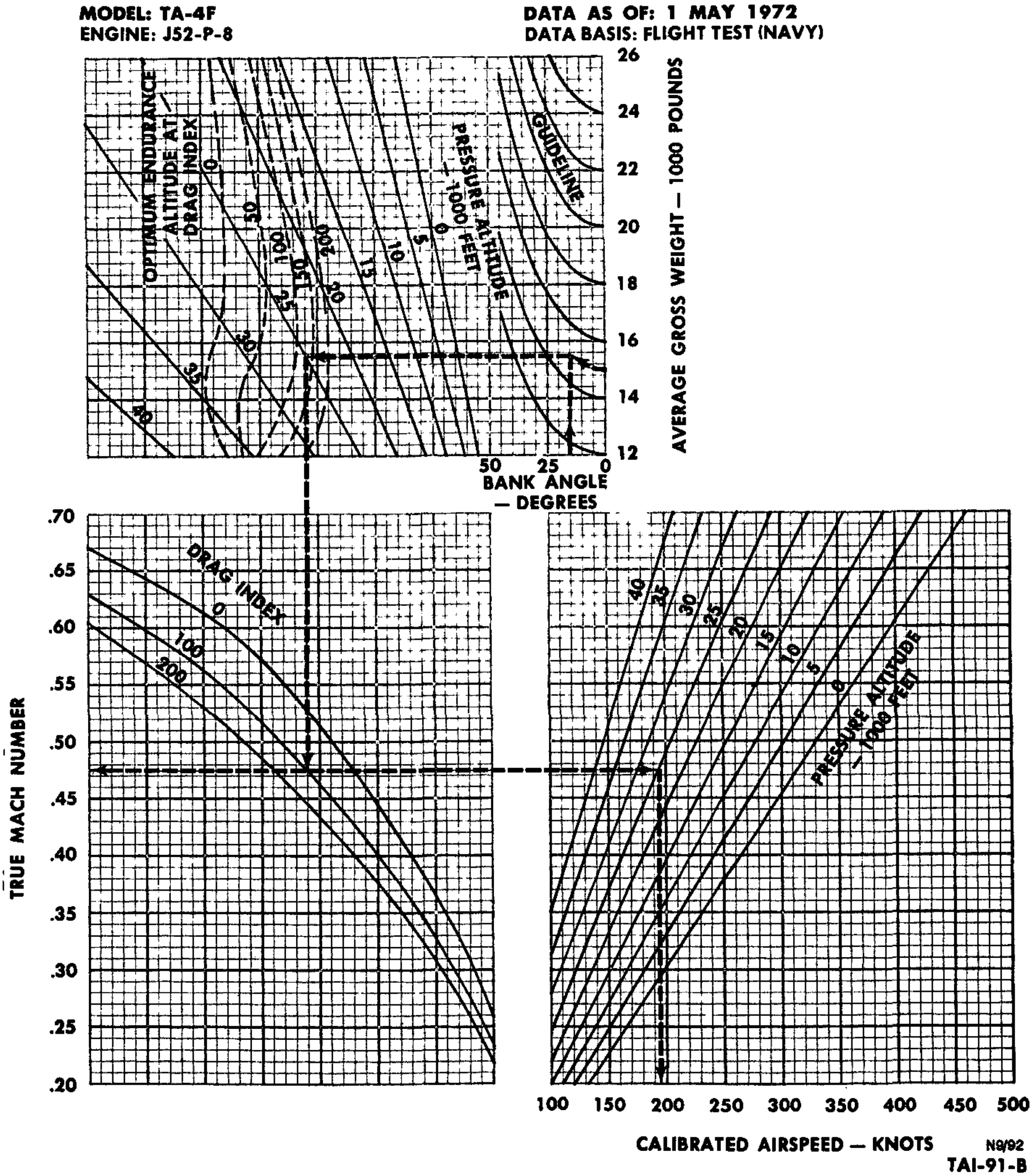
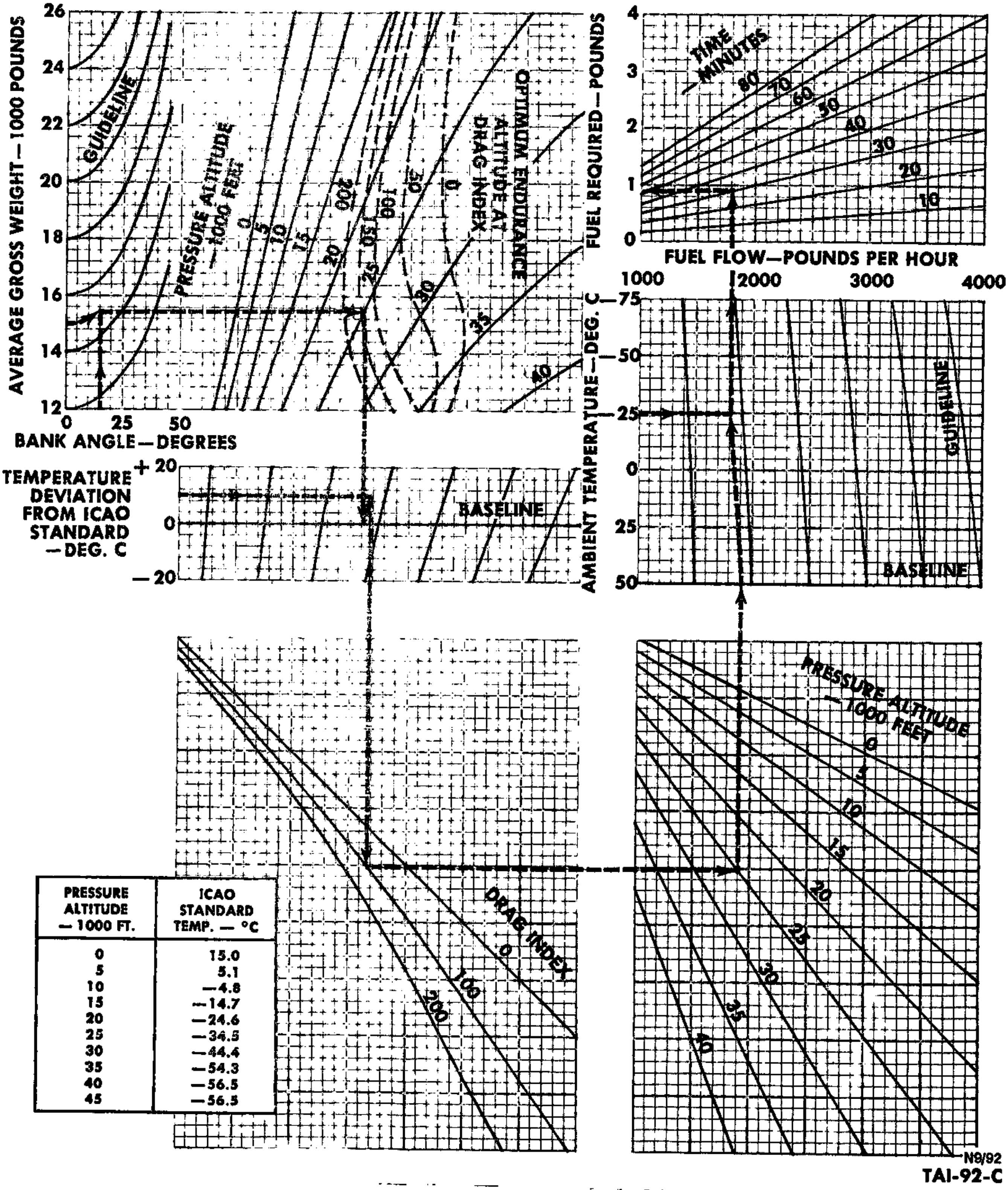


Figure 24-4. Maximum Endurance Speed

MAXIMUM ENDURANCE FUEL

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)



PRESSURE ALTITUDE — 1000 FT.	ICAO STANDARD TEMP. — °C
0	15.0
5	5.1
10	—4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5
45	—56.5

Figure 24-5. Maximum Endurance Fuel

CHAPTER 25

Air Refueling

25.1 AIR REFUELING CHARTS

The air refueling charts present the performance of a tanker configured with an air-refueling buddy store on the centerline pylon, four wing pylons, two 300-gallon external fuel tanks, and two 20mm guns. All performance data shown are based on an ICAO standard atmosphere.

25.2 TANKER SPEED ENVELOPE

The operating speed envelope of the tanker aircraft is shown in Figure 25-1. Data are presented for both drogue extended and drogue retracted configurations as a function of gross weight.

25.2.1 Sample Problem

25.2.1.1 Tanker Speed Envelope. For Figure 25-1.

A. Pressure Altitude – 20,000 feet

B. Gross weight hose and drogue extended – 24,000 pounds

C. Minimum refueling Mach number – 0.502

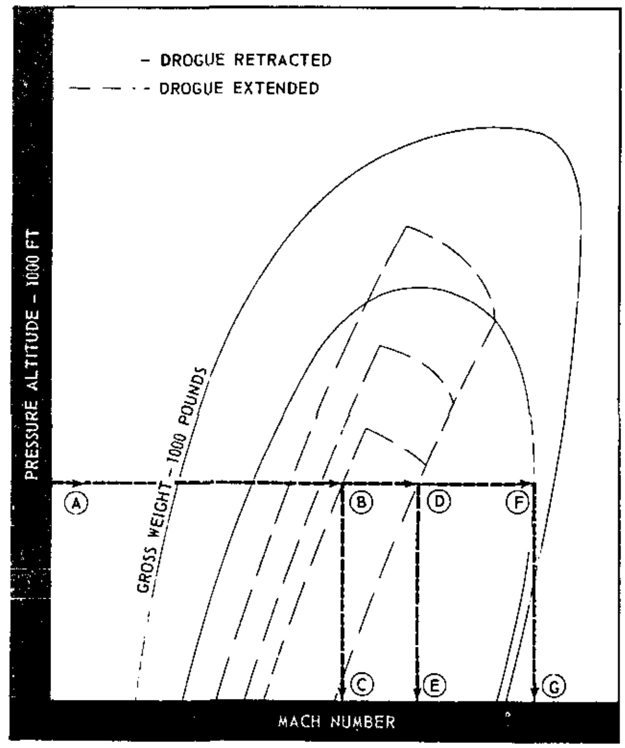
D. Maximum refueling calibrated airspeed – 300 knots

E. Maximum refueling Mach number – 0.65

F. Gross weight hose and drogue retracted – 24,000 pounds

G. Maximum Mach number – 0.83.

SAMPLE TANKER SPEED ENVELOPE



TA1-93-A

25.3 TANKER FUEL AVAILABLE FOR TRANSFER

The tanker fuel available for transfer is shown as a function of radius in Figure 25-2 for operation with JP-4 or JP-5 fuel. These data are presented, assuming standard buddy-tanker reserves consisting of fuel for 20 minutes of maximum endurance at sea level plus 5 percent of all fuel not transferred. In addition, a fuel allowance for rendezvous and hookup has been added. This allowance consists of fuel for 5 minutes at speed for maximum endurance, with hose and drogue extended, at 30,000 feet pressure altitude.

At refueling radii of less than 90 nautical miles with JP-5 fuel and less than 80 nautical miles with JP-4 fuel, the tanker is unable to consume all of the 180 gallons of nontransferable fuel. Therefore, if refueling is accomplished at radii less than those noted and all the available fuel is transferred, the tanker will return to base with an excess of reserve fuel.

25.3.1 Sample Problem

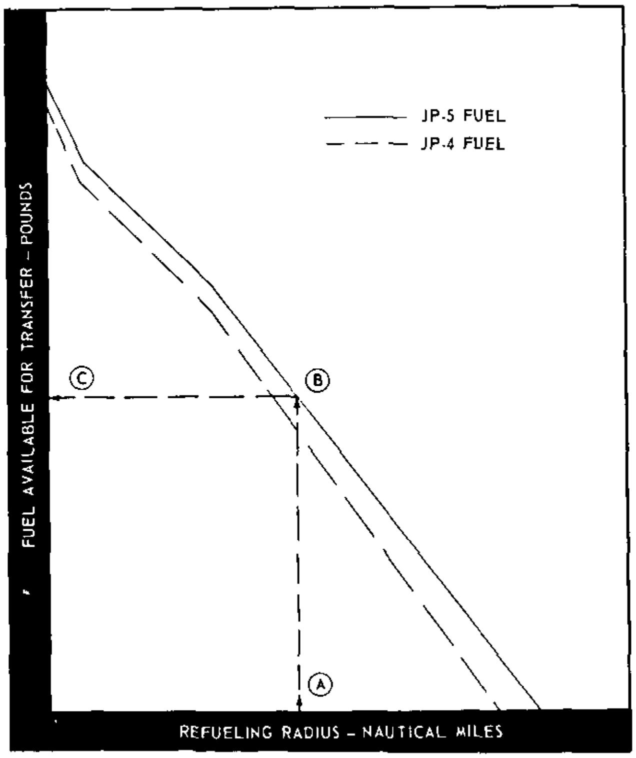
25.3.1.1 Tanker Fuel Available for Transfer. For Figure 25-2.

A. Refueling radius – 400 nm

B. JP-5 fuel line

C. Fuel available for transfer – 4,100 pounds.

SAMPLE TANKER FUEL AVAILABLE FOR TRANSFER



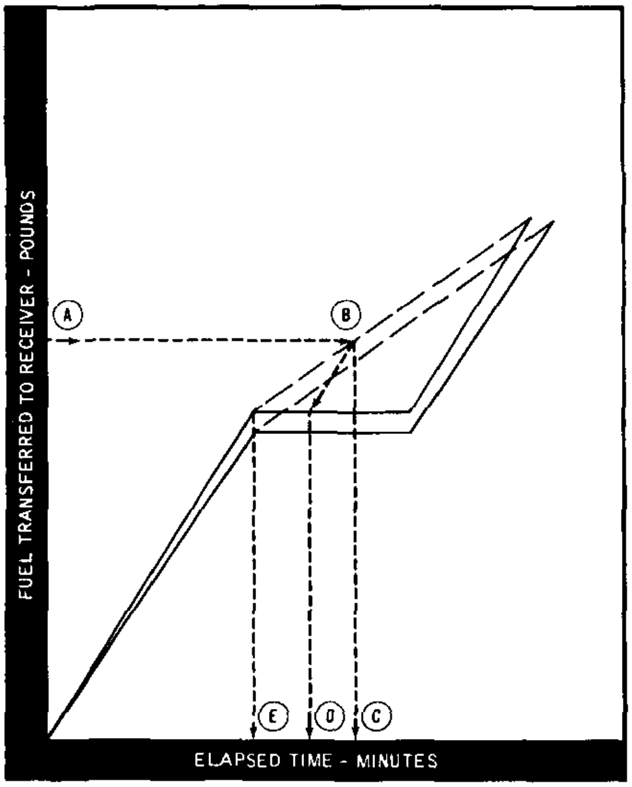
TA1-94-1

25.4 TANKER FUEL TRANSFER TIME

The relationship of fuel transferred to receiver versus elapsed time is presented in Figure 25-3. The flow rate to the receiver aircraft is 180 gallons per minute. After 2.85 minutes, refueling is temporarily discontinued to allow the refueling store to fill from the external fuel tanks.

The maximum amount of fuel that can be transferred to the receiver during a continuous refueling operation is limited to 513 gallons. The limiting factor is the external transfer rate of tanker fuel from the external fuel tanks and wing tanks to the refueling store. If more than 513 gallons is to be transferred to the receiver, refueling must be discontinued to allow the refueling store to be replenished from the tanker internal fuel. The time delay is dependent upon the amount of additional fuel to be transferred.

SAMPLE TANKER FUEL TRANSFER TIME



TA1-95-A

25.4.1 Sample Problem

25.4.1.1 Tanker Fuel Transfer Time. For Figure 25-3.

A. Fuel transferred to receiver (JP-5) – 4,500 pounds

B. JP-5 fuel flow line

C. Elapsed time – 4.87 minutes

D. Point where refueling is resumed – 4.04 minutes

E. Point where refueling is temporarily discontinued – 2.85 minutes.

25.5. FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

The tanker fuel consumption with the hose and drogue extended is presented in Figure 25-4 for two pressure altitudes for speeds throughout the flight envelope.

25.5.1 Sample Problem

25.5.1.1 Fuel Consumption of Tanker During Air Refueling. For Figure 25-4.

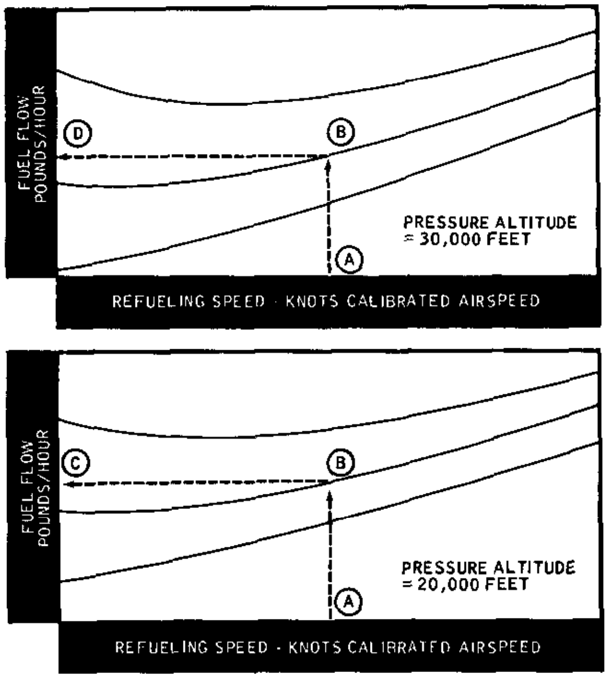
A. Refueling speed – 250 KCAS

B. Gross weight – 20,000 pounds

C. Fuel flow – 20,000 feet – 2,690 pounds/hour

D. Fuel flow – 30,000 feet – 3,090 pounds/hour

SAMPLE TANKER FUEL CONSUMPTION DURING AIR REFUELING

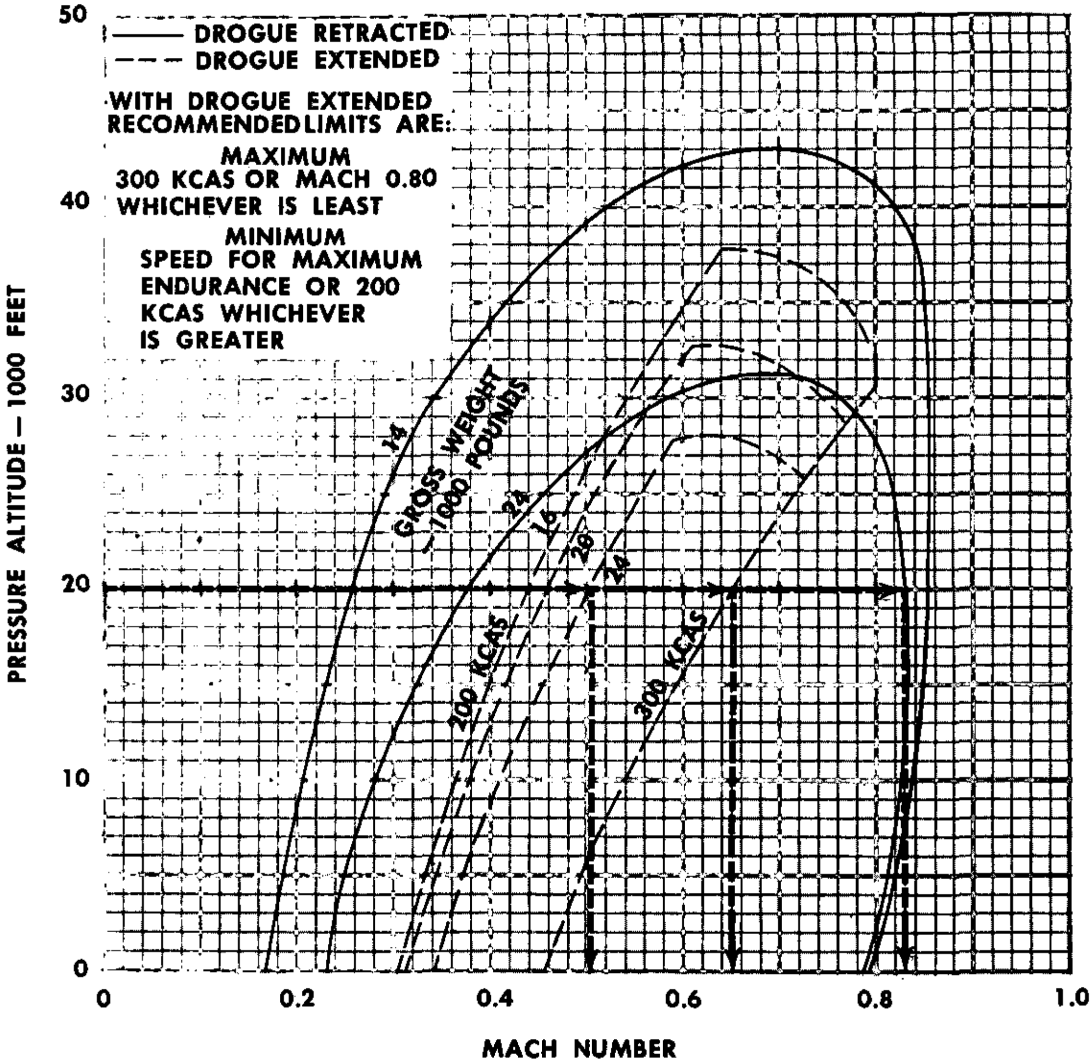


TA1-96-A

TANKER SPEED ENVELOPE
TANKER CONFIGURATION
1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
5-PYLONS AND GUNS

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)



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TA1-97-B

Figure 25-1. Tanker Speed Envelope

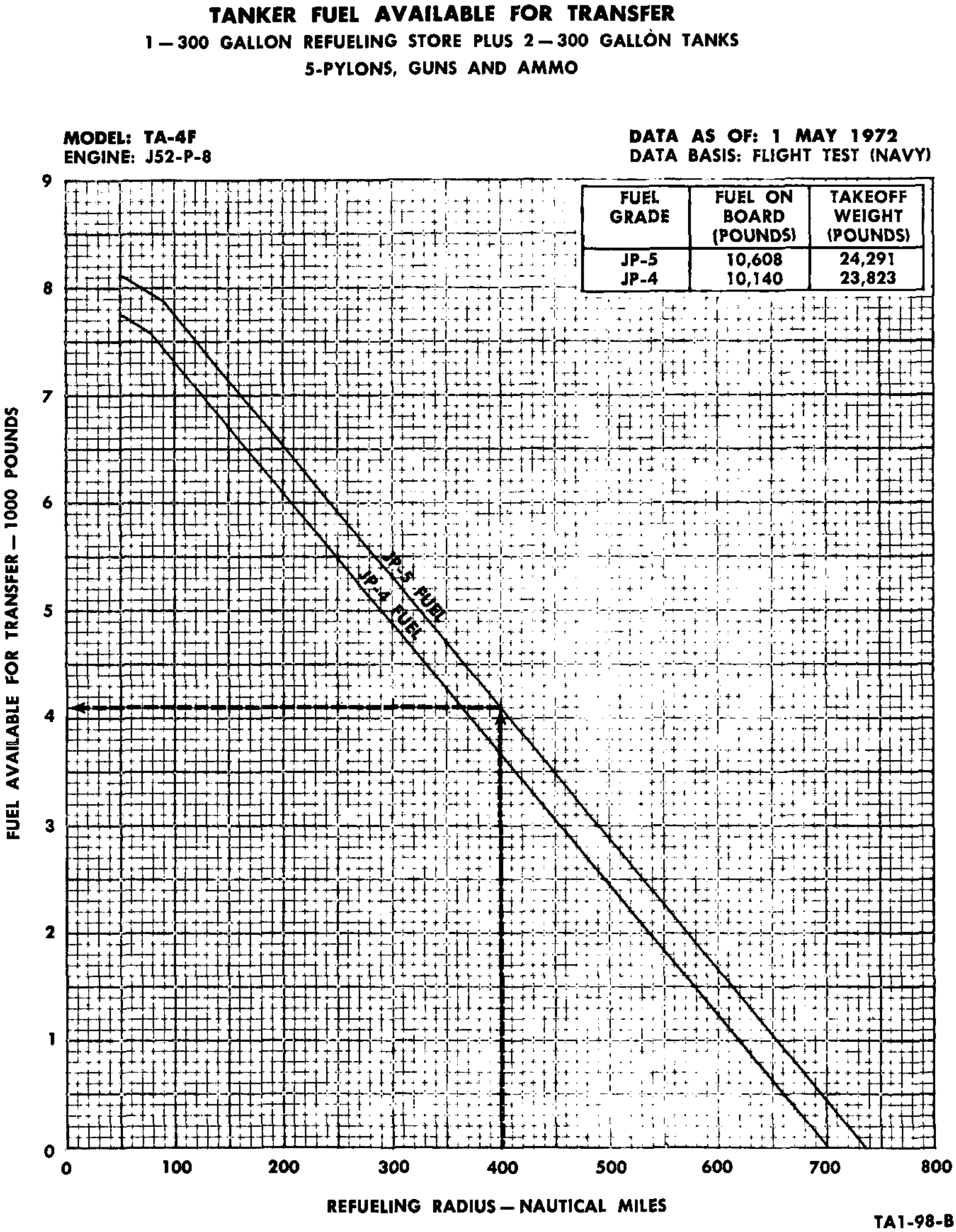


Figure 25-2. Tanker Fuel Available for Transfer

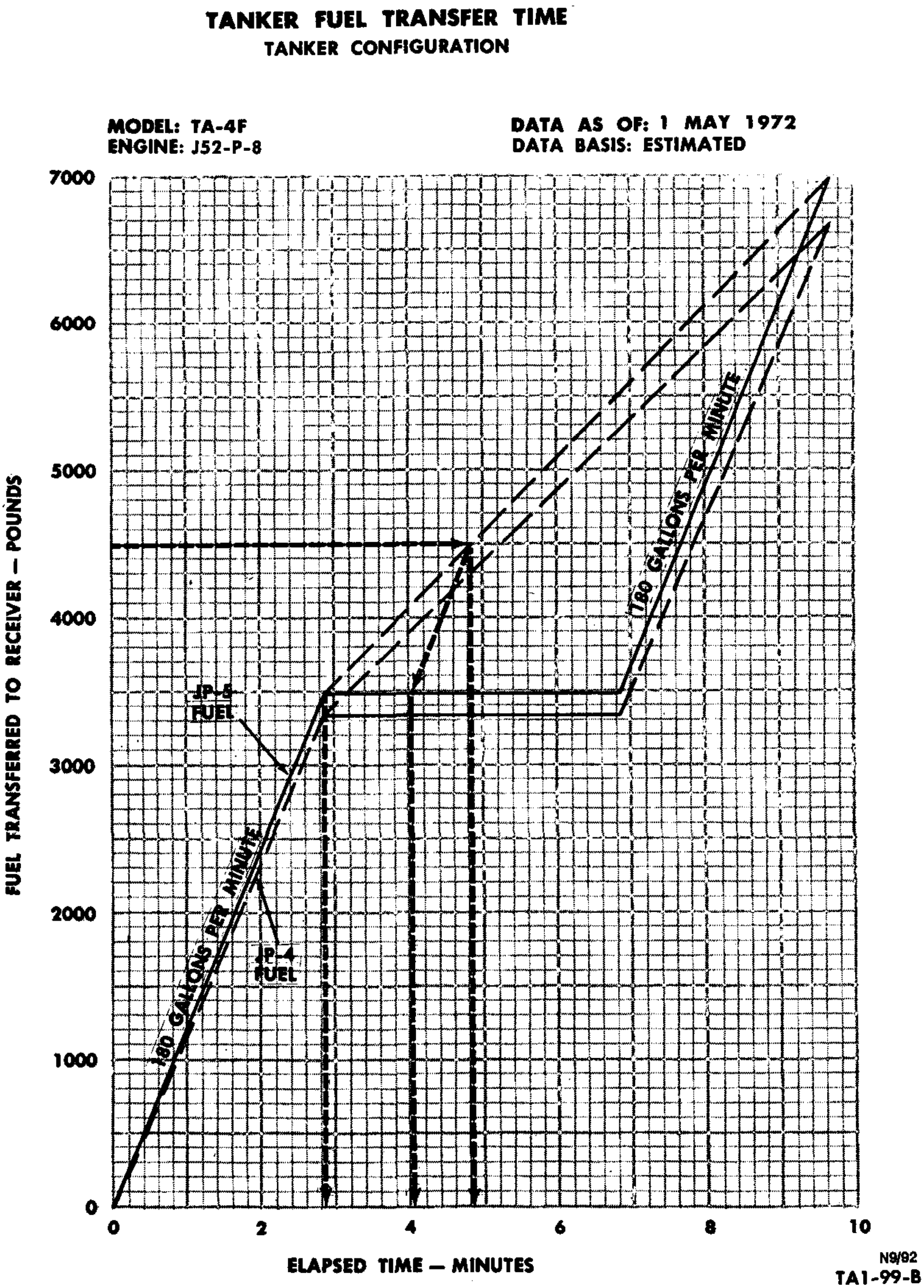
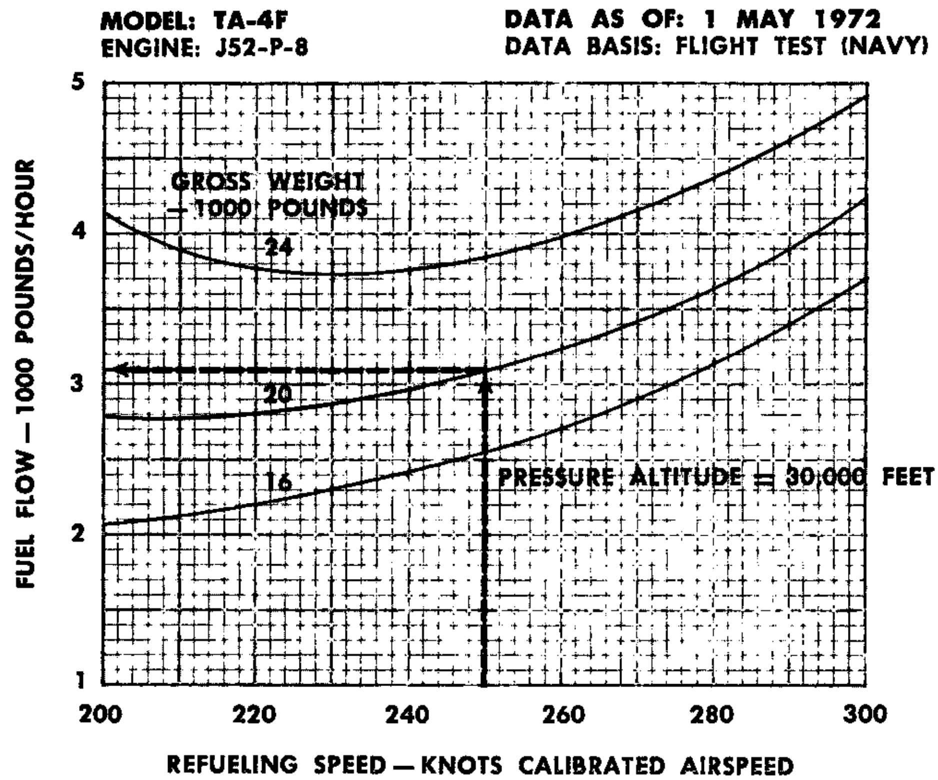
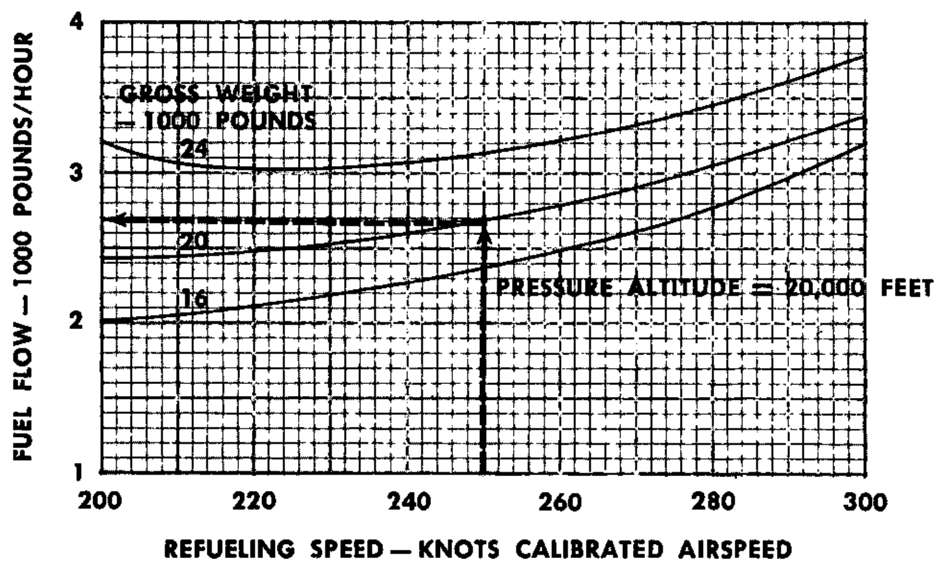


Figure 25-3. Tanker Fuel Transfer Time

FUEL CONSUMPTION OF TANKER DURING AIR REFUELING

1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
5-PYLONS, GUNS AND AMMO





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TA1-100-B

Figure 25-4. Fuel Consumption of Tanker During Air Refueling

CHAPTER 26

Descent

26.1 MAXIMUM RANGE DESCENT

Graphical data is presented on Figures 26-1 through 26-3 for a maximum range descent using idle thrust and speedbrakes closed. Recommended maximum range descent speed, fuel consumed, distance covered, and elapsed time from any desired altitude to sea level are presented as a function of gross weight and drag index. All data is based on an ICAO standard atmosphere.

The methods of presenting data for fuel, distance, and time are identical. Therefore, only one sample problem is shown.

26.1.1 Sample Problem

26.1.1.1 Descent Fuel. For Figure 26-1.

A. Initial gross weight – 14,000 pounds

B. Cruise altitude – 35,000 feet

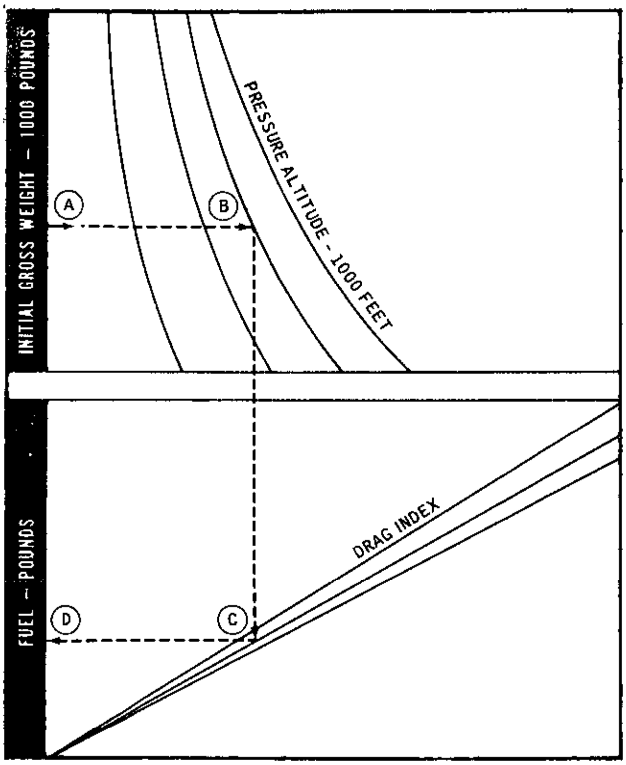
C. Drag index – 0.

D. Fuel required from cruise altitude to sea level – 110 pounds

Note

From Figure 26-2 descent speed is 205 KCAS.

SAMPLE DESCENT FUEL



TA1-101-A

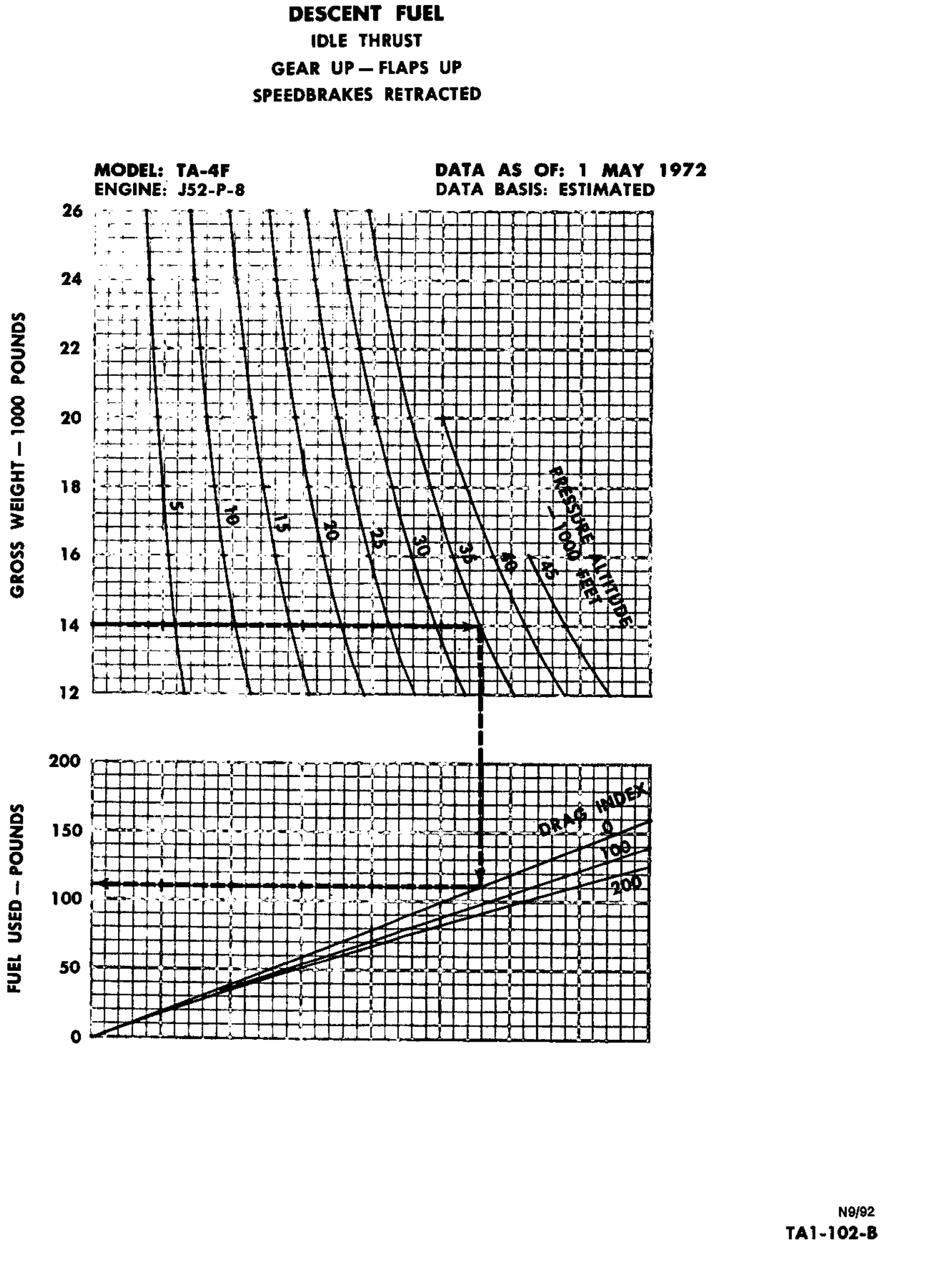
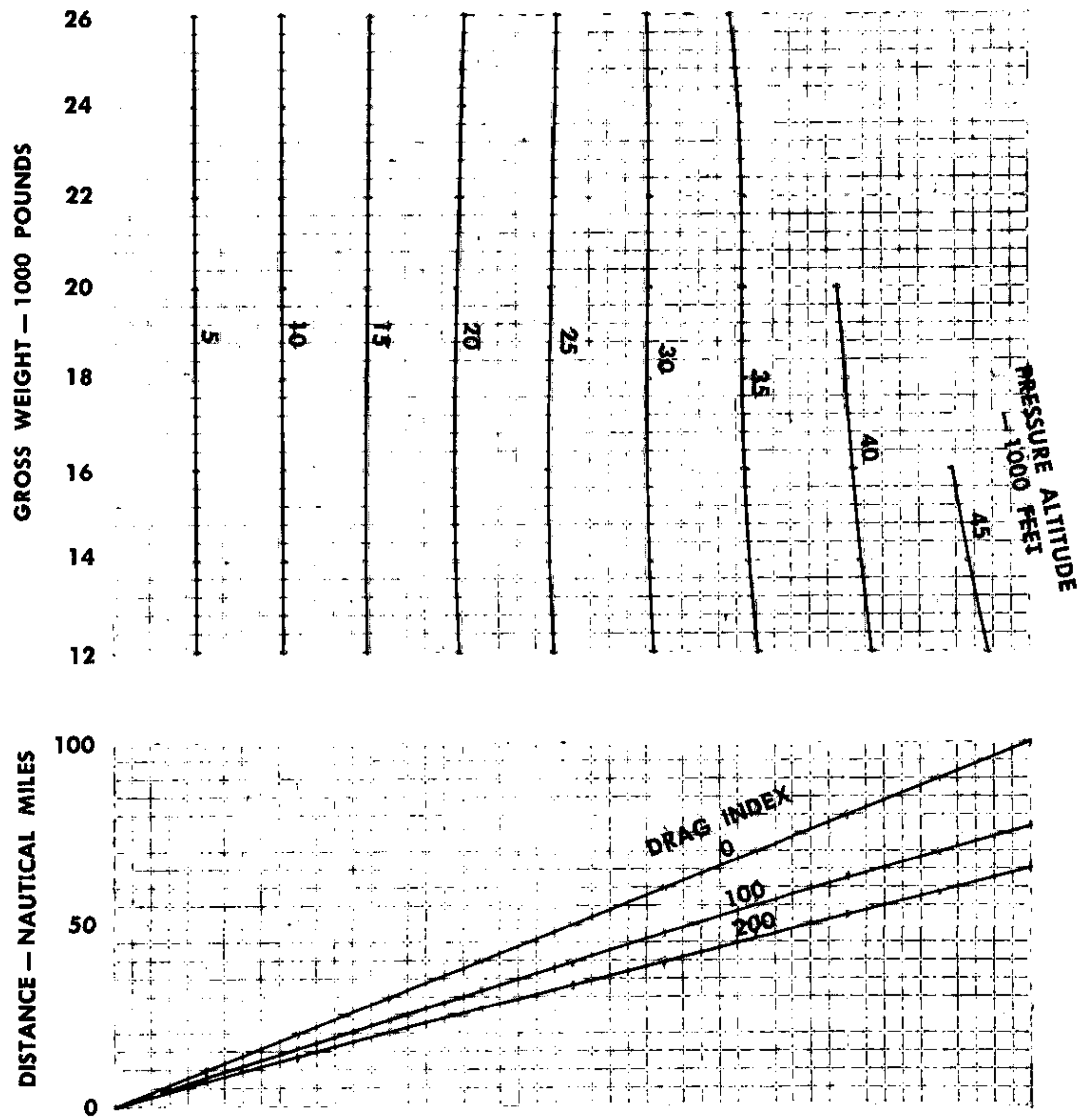


Figure 26-1. Descent Fuel

DESCENT DISTANCE
IDLE THRUST
GEAR UP — FLAPS UP
SPEEDBRAKES RETRACTED

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED



DESCENT SPEED SCHEDULE — KCAS

	GROSS WEIGHT — 1000 POUNDS							
DRAG INDEX	12	14	16	18	20	22	24	26
0	190	205	220	235	245	260	270	280
100	175	185	200	210	220	230	240	250
200	160	175	185	195	205	215	225	235

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TA1-103-B

Figure 26-2. Descent Distance

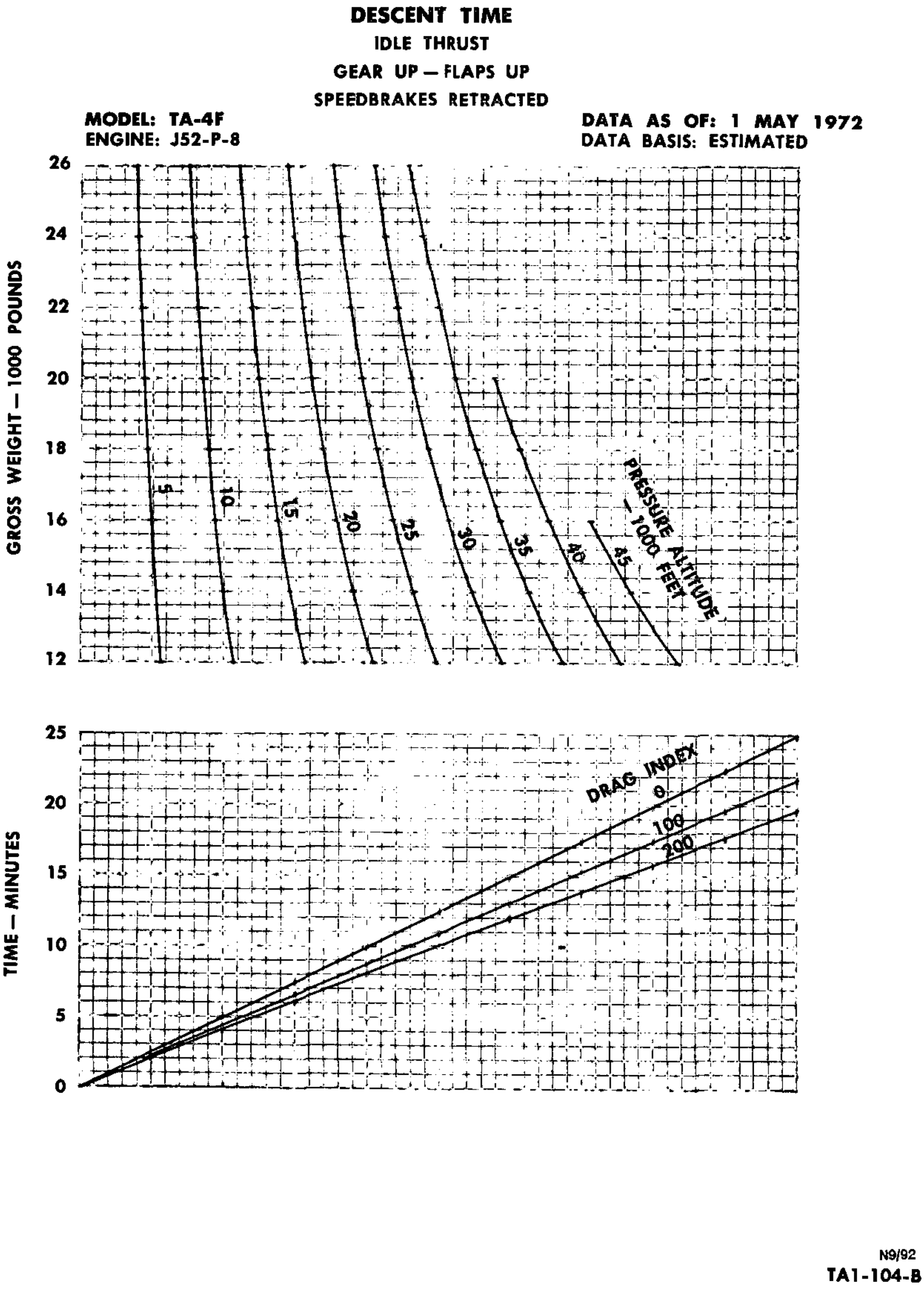


Figure 26-3. Descent Time

CHAPTER 27

Landing

27.1 LANDING

Approach speeds, stall speeds for the landing configurations, and corresponding angles-of-attack units are presented on Figure 27-1. The speeds are shown as calibrated airspeeds. To obtain indicated airspeed, the airspeed that the pilot reads on the airspeed indicator, subtract the position error corrections shown on Figure 20-6 as explained in Chapter 20 of this part. The position error correction is significant; for example, at 130 knots the correction is over 5.5 knots. If an angle-of-attack indication of 16.5 units with the flaps fully extended does not produce the indicated airspeed for the configuration computed from Figure 27-1, recheck the aircraft configuration. If the appropriate configuration is established, disregard the angle-of-attack indicator and make the approach at the computed indicated airspeed from Figure 27-1.

The landing ground roll of the aircraft is dependent upon the runway pressure altitude, outside air temperature, the force of the headwind, flap deflection, runway gradient, and braking action. The ground roll distance, as given on Figure 27-2, is calculated assuming maximum braking action without skidding the tires, aerodynamic braking produced with wing flaps at any setting, and that speedbrakes and spoilers are extended. A graph is provided for determining landing distance for various runway conditions including hard dry, wet, snow covered, and icy runways. The distance to clear a 50-foot obstacle is measured horizontally from the 50-foot obstacle to the end of rollout and is obtained by adding 715 feet to the ground roll distance, assuming a standard 4° glide slope. Obviously, if the obstacle is situated at a distance from the runway which is greater than the ground distance required (715 feet) to descend from 50 feet, it will have no effect on the usable runway length. If the obstacle is very near the runway, that portion of runway length consumed in the descent from 50 feet may not leave enough distance to brake to a stop.

27.1.1 Sample Problem

27.1.1.1 Approach Speed. For Figure 27-1.

A. Gross weight – 12,000 pounds

B. Stall speed (Full flaps) – 99.7 KCAS

(1) Angle of attack – 22.3 units

C. Approach speed (Full flaps) – 116.3 KCAS

(1) Angle of attack – 16.5 units.

27.1.2 Sample Problem

27.1.2.1 Landing Distance. For Figure 27-2.

Runway Condition – Wet

A. Outside air temperature – 30 °C

B. Runway pressure altitude – 2,000 feet

C. Aircraft landing weight – 12,000 pounds

D. Flap deflection – Half

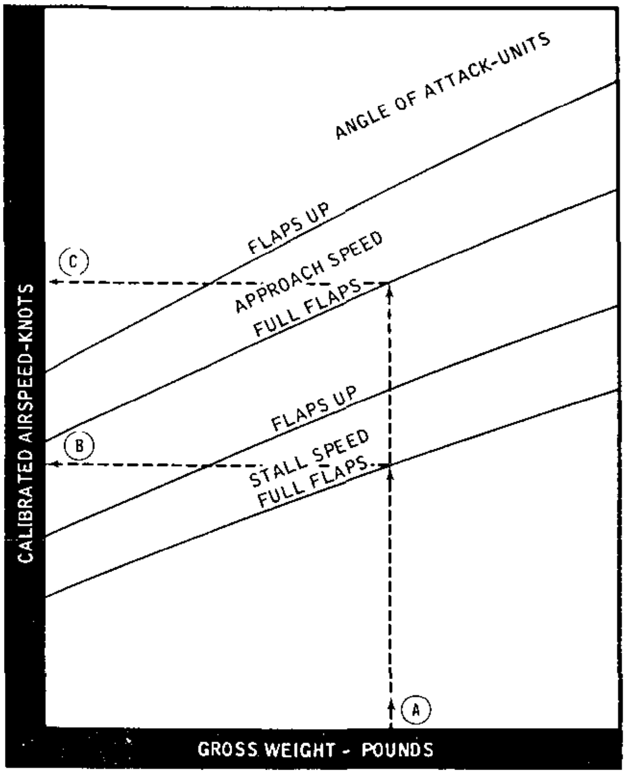
E. Headwind – 15 knots

F. Runway gradient – -1 percent

G. Ground roll distance – 4,400 feet

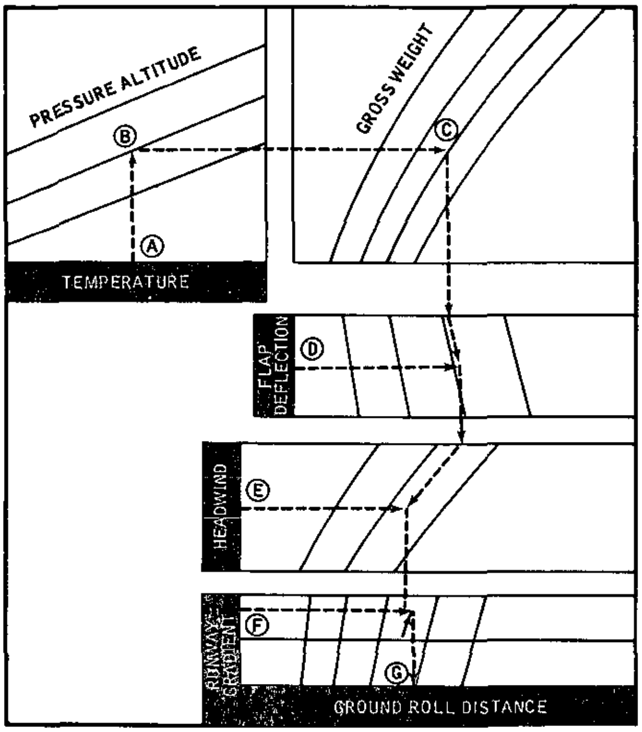
Total Distance to
Clear a 50-Foot
Obstacle with
4° glide slope – 5,115 feet.

SAMPLE APPROACH SPEED



TA1-105-A

SAMPLE LANDING DISTANCE



TA1-114-1

APPROACH SPEED

GEAR DOWN — SPEEDBRAKES OPEN

THRUST REQUIRED TO MAINTAIN 4° GLIDE SLOPE

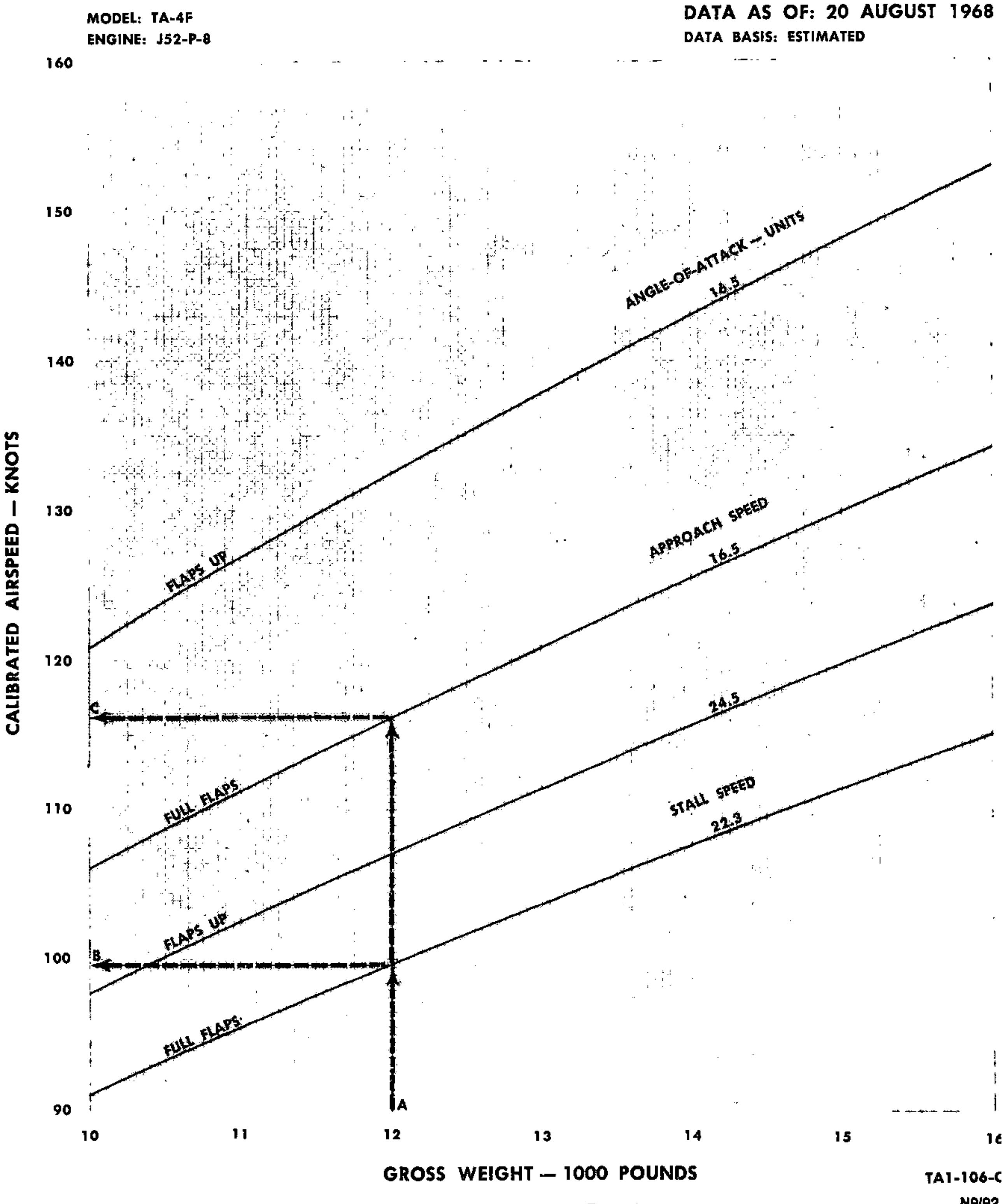


Figure 27-1. Approach Speed

LANDING DISTANCE
HARD SURFACE RUNWAY
DRY
SPEEDBRAKES AND SPOILERS OPEN
RCR = 23

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY AND CONTRACTOR)

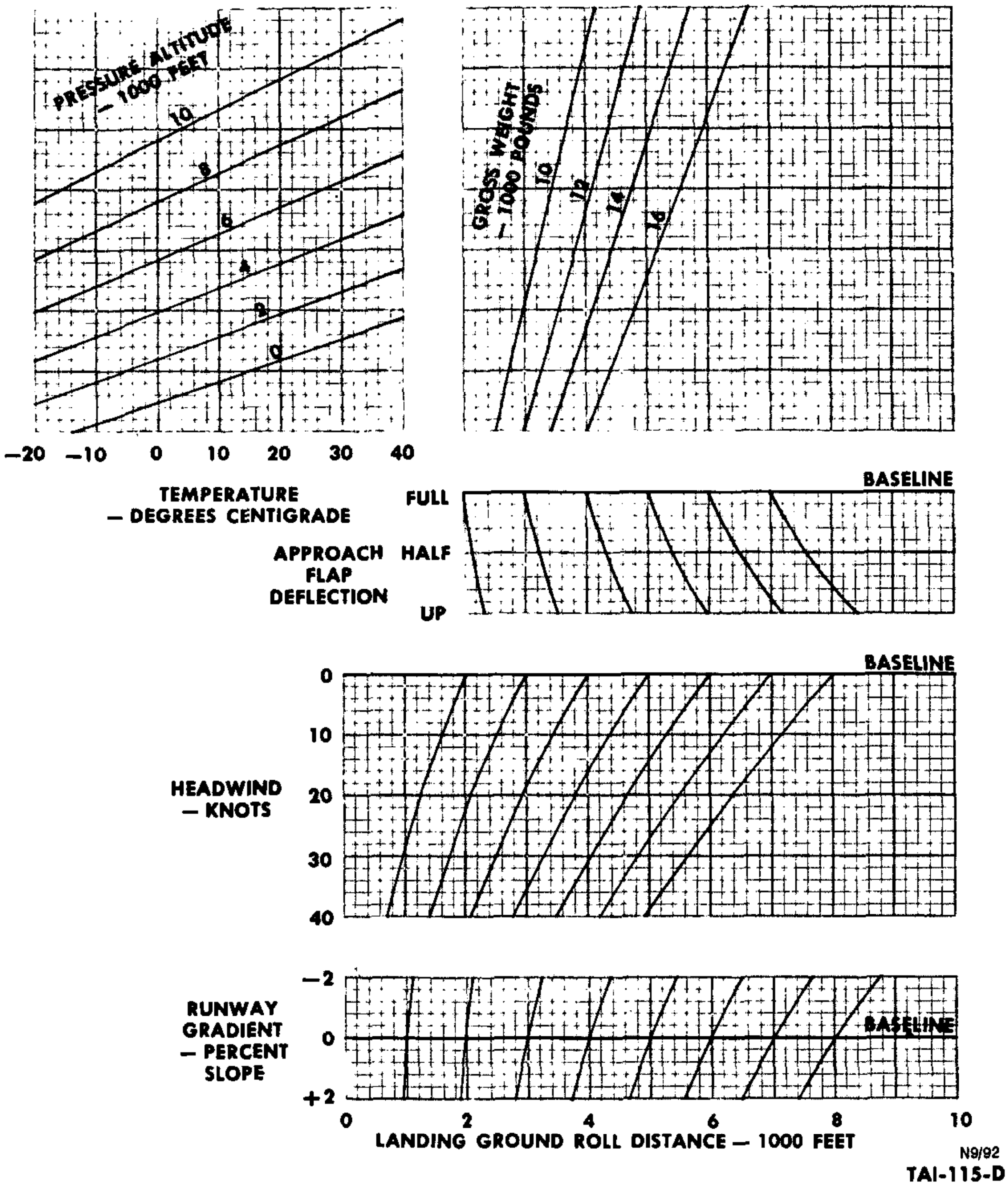


Figure 27-2. Landing Distance (Sheet 1 of 3)

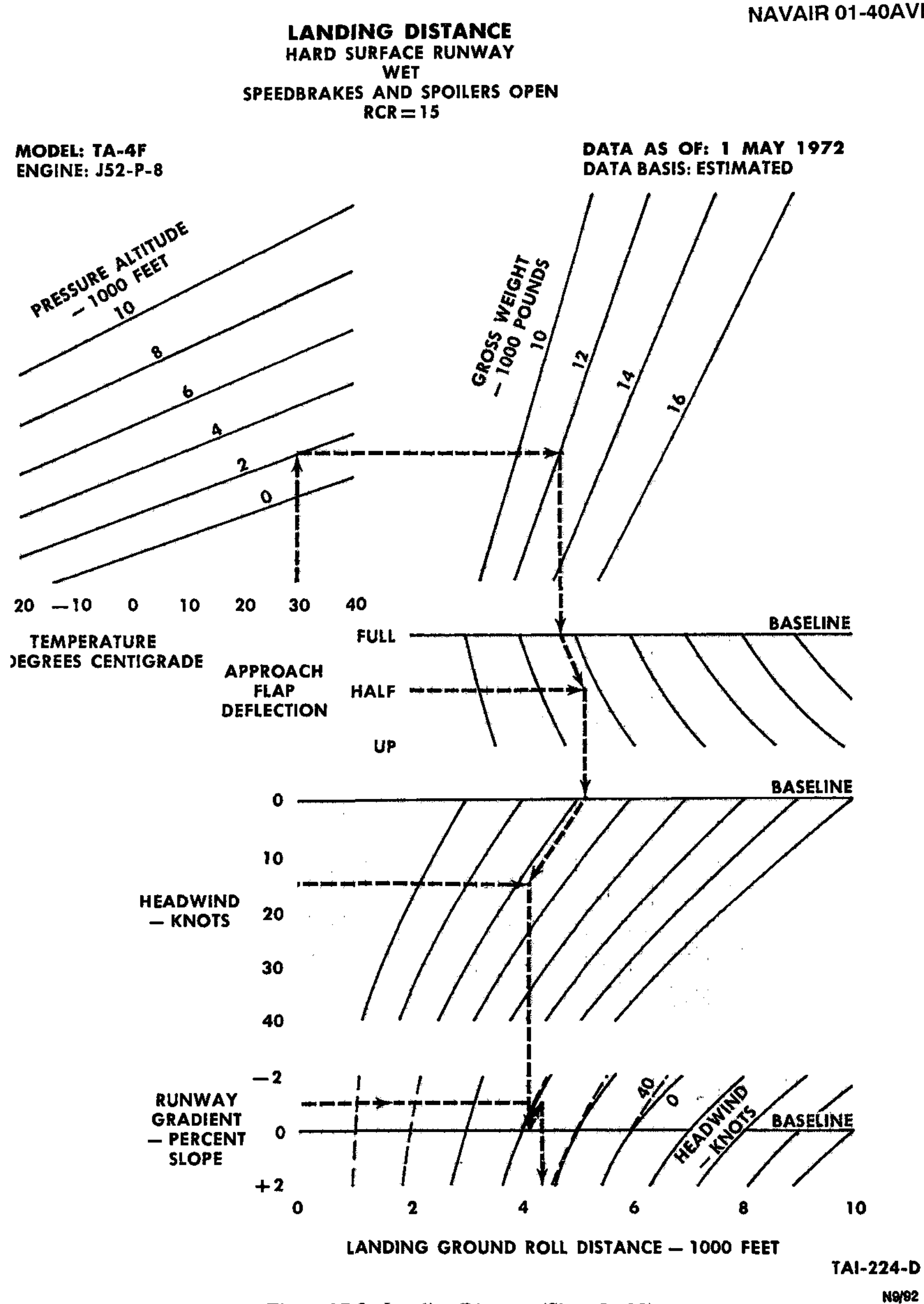


Figure 27-2. Landing Distance (Sheet 2 of 3)

LANDING DISTANCE
HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES AND SPOILERS OPEN
RCR=9

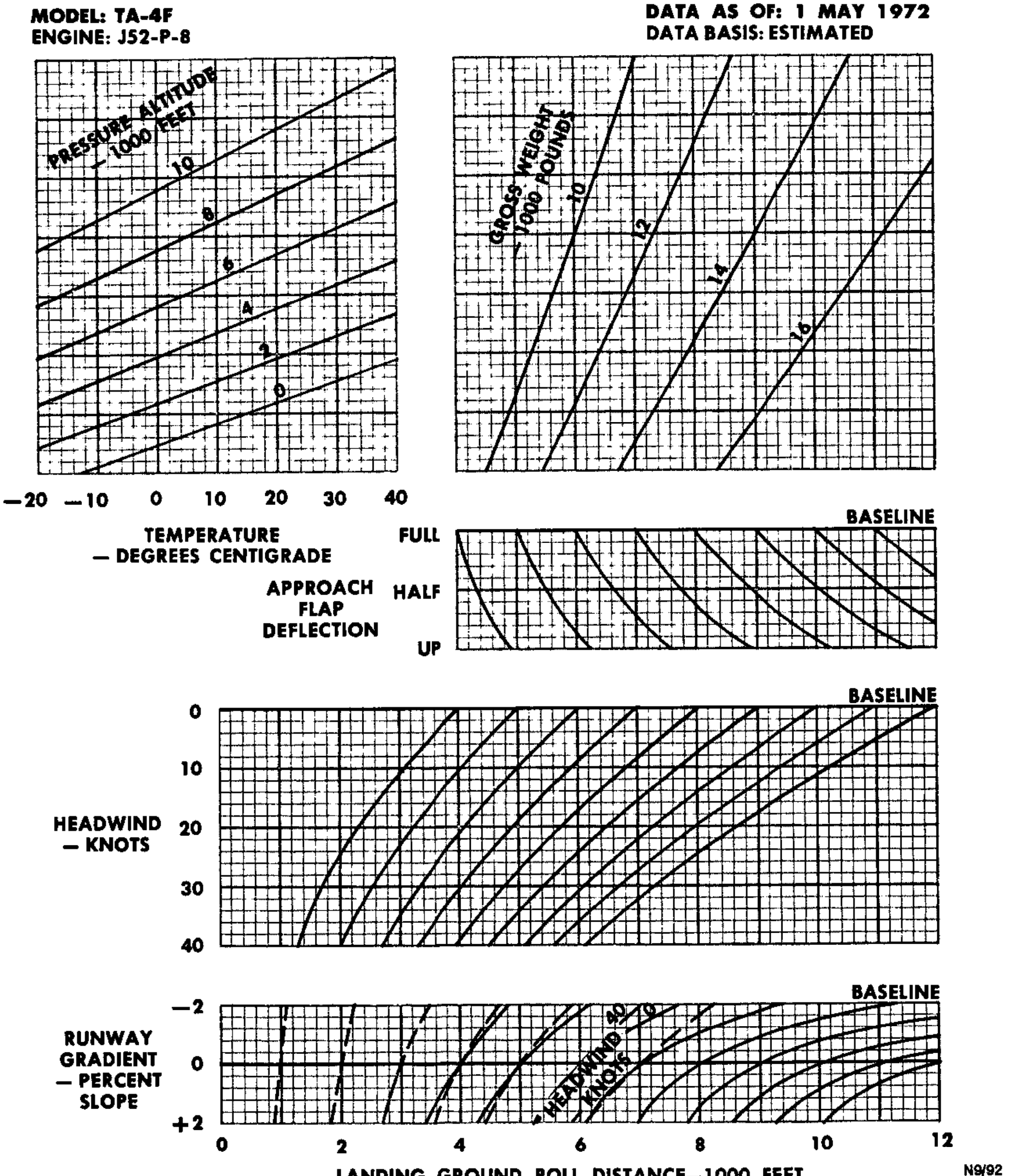


Figure 27-2. Landing Distance (Sheet 3 of 3)

CHAPTER 28

Combat Performance

28.1 COMBAT PERFORMANCE

This part contains the performance charts associated with the combat phase of the mission. Turning radius, maneuverability, maximum Mach number, and military fuel flow are included.

28.2 TURNING RADIUS

The turning radius nomograph, Figure 28-1, presents data for steady state level turns as a function of true airspeed, normal load factor, bank angle, distance traveled, and heading change. When used in conjunction with the load factor limitations of the maneuverability charts, Figure 28-2, the aerodynamic, engine, and structural characteristics of the aircraft are taken into account.

Note

At normal low level airspeeds a rough planning aid for turning radius is the use of a dime on an ONC (1:1,000,000) or a quarter on a PC (1:500,000).

28.2.1 Sample Problem

28.2.1.1 Turning Radius. For Figure 28-1.

From maneuverability sample problem 1 (Figure 28-2):

1. Mach Number – 0.75

2. Normal Load Factor – 3.11g

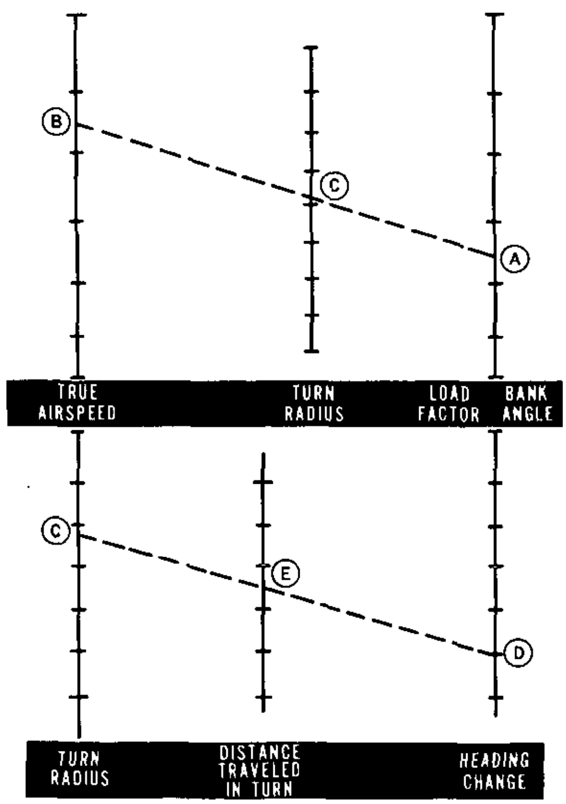
   A. Normal Load Factor – 3.11g

      (1) Bank Angle – 71.2°

   B. True Airspeed – 496 KTAS

      (1) From Figure 20-2 at M = 0.75

SAMPLE TURNING RADIUS



TA1-319

   C. Turning Radius – 7,400 feet

   D. Heading change – 90°

   E. Distance Traveled in Turn – 11,600 feet.

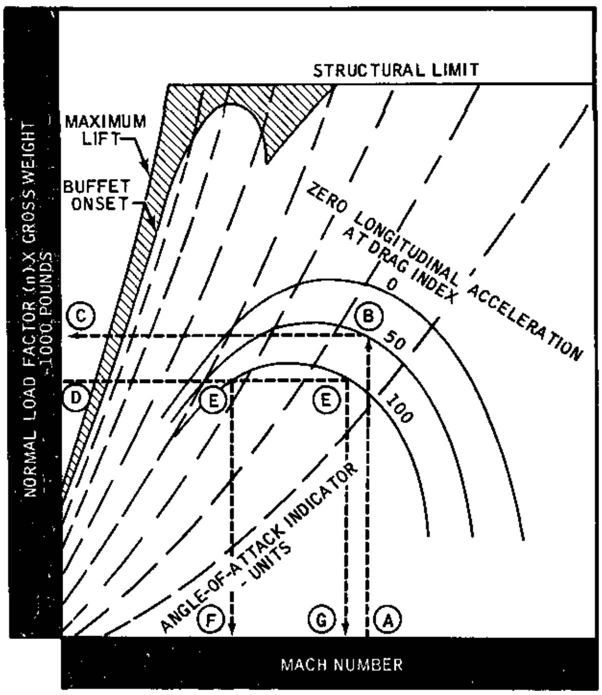
28.3 MANEUVERABILITY

Low-altitude maneuverability characteristics are shown in Figure 28-2. These data provide a means of determining either the maximum load factor attainable at a specified Mach number (sample problem 1) or the maximum (and minimum) Mach number for a predetermined load factor requirement (sample problem 2). These data are presented as a function of altitude, normal load factor times gross weight, Mach number, angle of attack, and drag index for zero longitudinal acceleration. Superimposed on the graphs are lines showing maximum lift, buffet onset, and structural limits. All data presented are based on the engine developing military thrust.

28.3.1 Sample Problem 1

28.3.1.1 Maneuverability. For Figure 28-2, sheet 1:

SAMPLE MANEUVERABILITY



TA1-277-A

1. Altitude – Sea level
2. Gross weight – 18,000 pounds

   A. Mach number – 0.75

   B. Drag index – 50

   C. Normal load factor X gross weight – 56,000 pounds

      (1) Gross weight – 18,000 pounds

      (2) Normal load factor at zero longitudinal acceleration – 3.11g.

28.3.2 Sample Problem 2

28.3.2.1 Maneuverability. For Figure 28-2, sheet 1:

1. Altitude – Sea level
2. Gross weight – 20,000 pounds
3. Normal load factor required – 2.5g

   D. Normal load factor X gross weight – 50,000 pounds

   E. Drag index – 100

   F. Minimum Mach number at 2.5g – 0.396

   G. Maximum Mach number at 2.5g – 0.710.

28.4 MAXIMUM MACH NUMBER

Level flight maximum Mach number, at military thrust, is shown in Figure 28-3 as a function of drag index and gross weight at altitudes of sea level, 10,000, 20,000, and 30,000 feet. Military thrust fuel flow is presented in Figure 28-4 as a function of pressure altitude and Mach number.

28.4.1 Sample Problem

28.4.1.1 Maximum Mach Number. For Figure 28-3.

A. Drag index – 60

B. Gross weight at sea level – 18,000 pounds

C. Maximum Mach number – 0.812.

28.4.2 Sample Problem

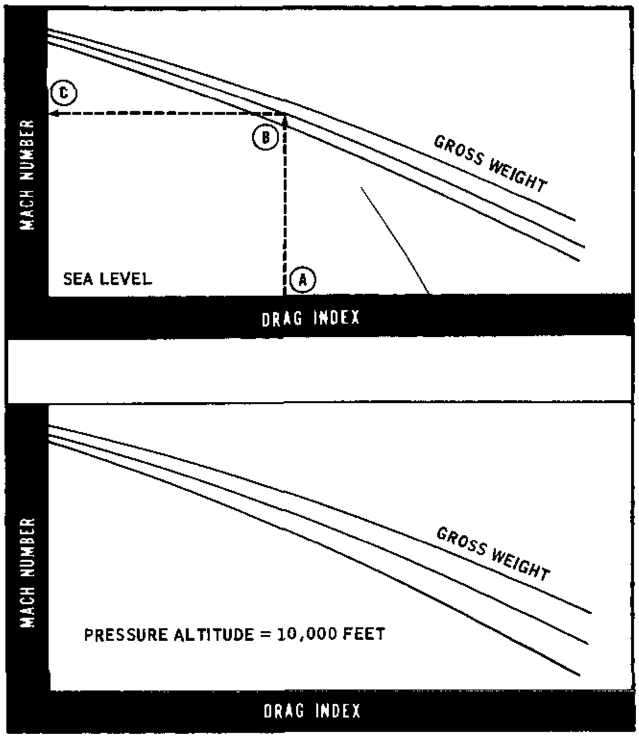
28.4.2.1 Military Fuel Flow. For Figure 28-4.

A. Pressure altitude – 10,000 feet

B. Mach number – 0.90

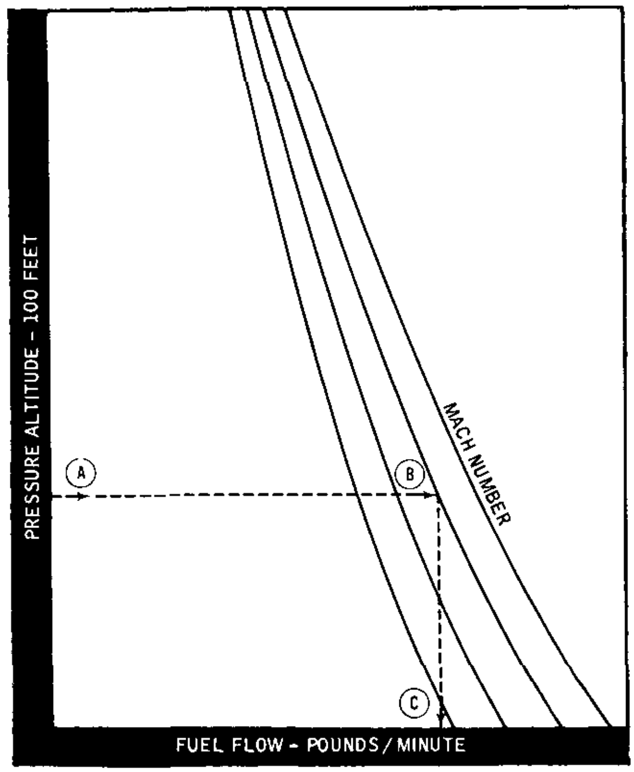
C. Fuel flow – 122 pounds/minute.

SAMPLE MAXIMUM MACH NUMBER



TA1-108-B

SAMPLE MILITARY FUEL FLOW



TA1-109-1

TURN RADIUS

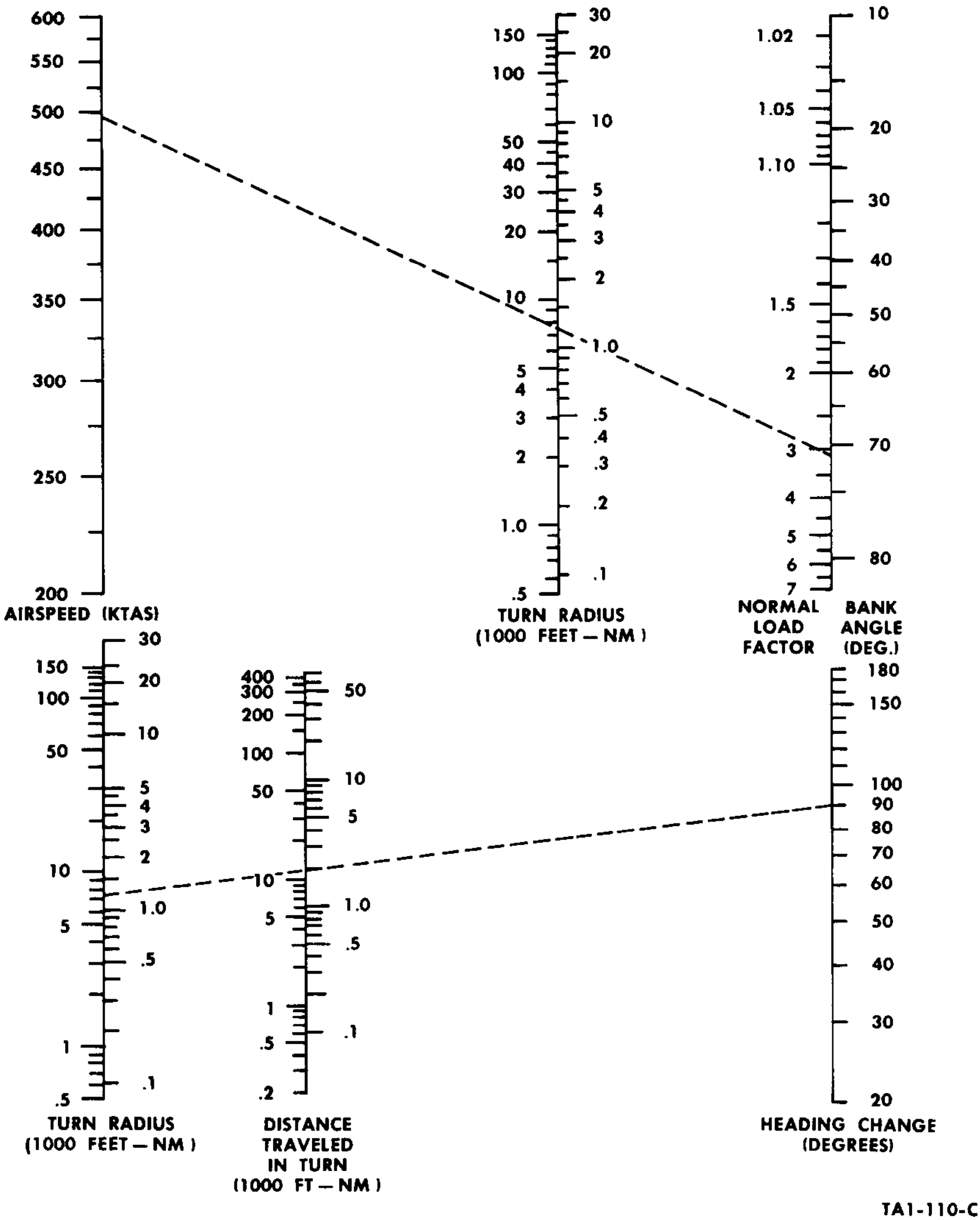


Figure 28-1. Turning Radius

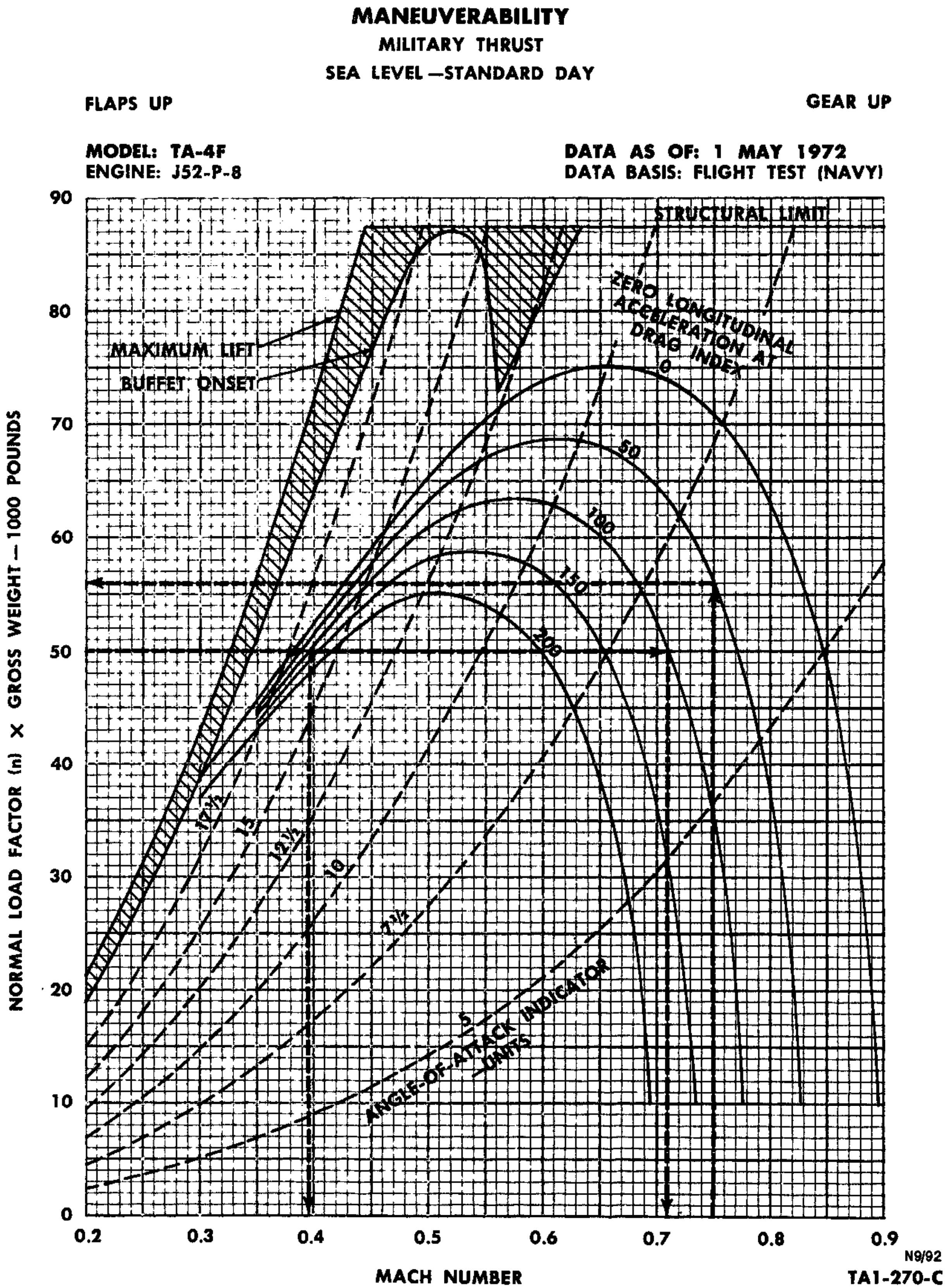


Figure 28-2. Maneuverability (Sheet 1 of 3)

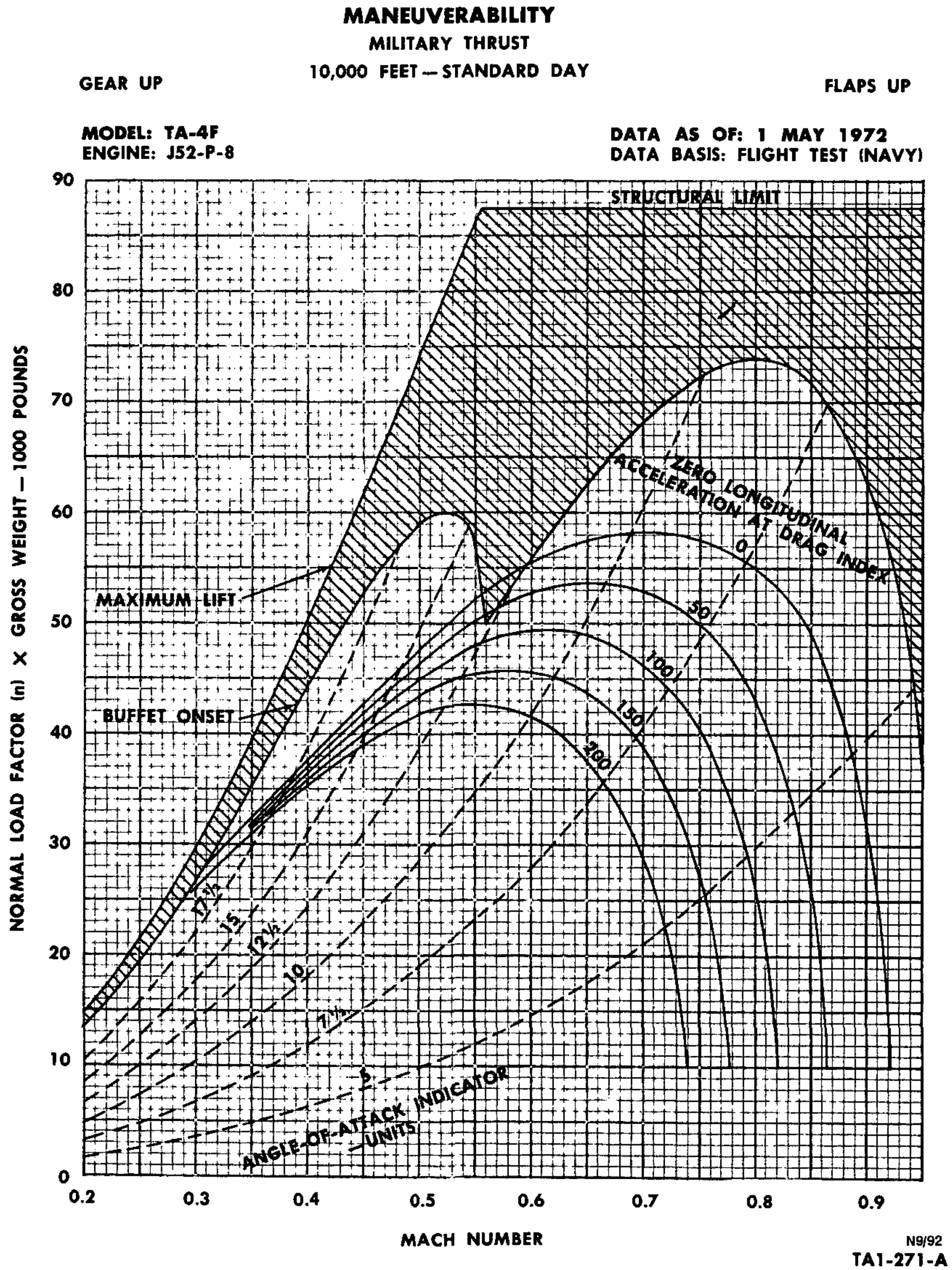


Figure 28-2. Maneuverability (Sheet 2 of 3)

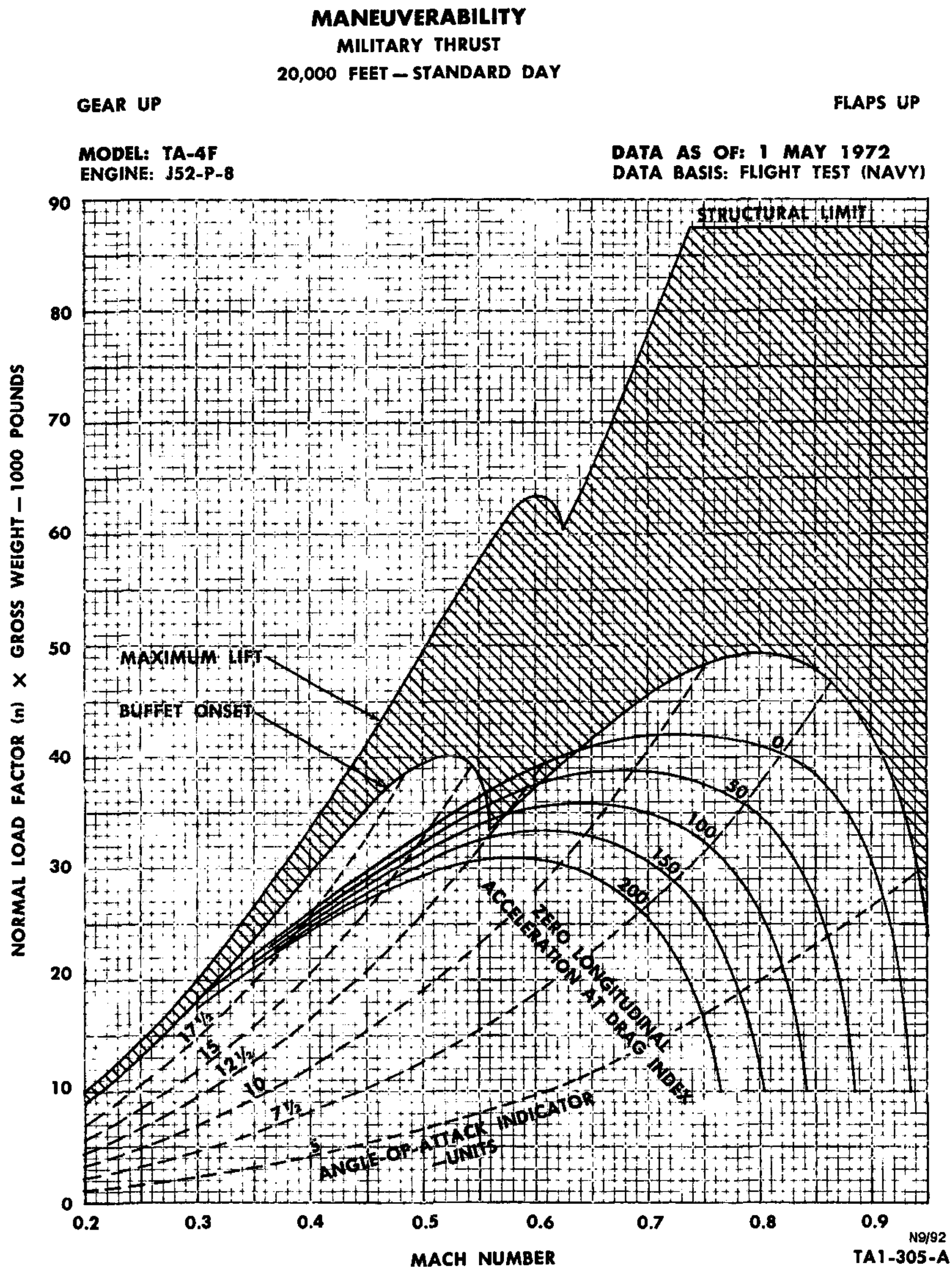
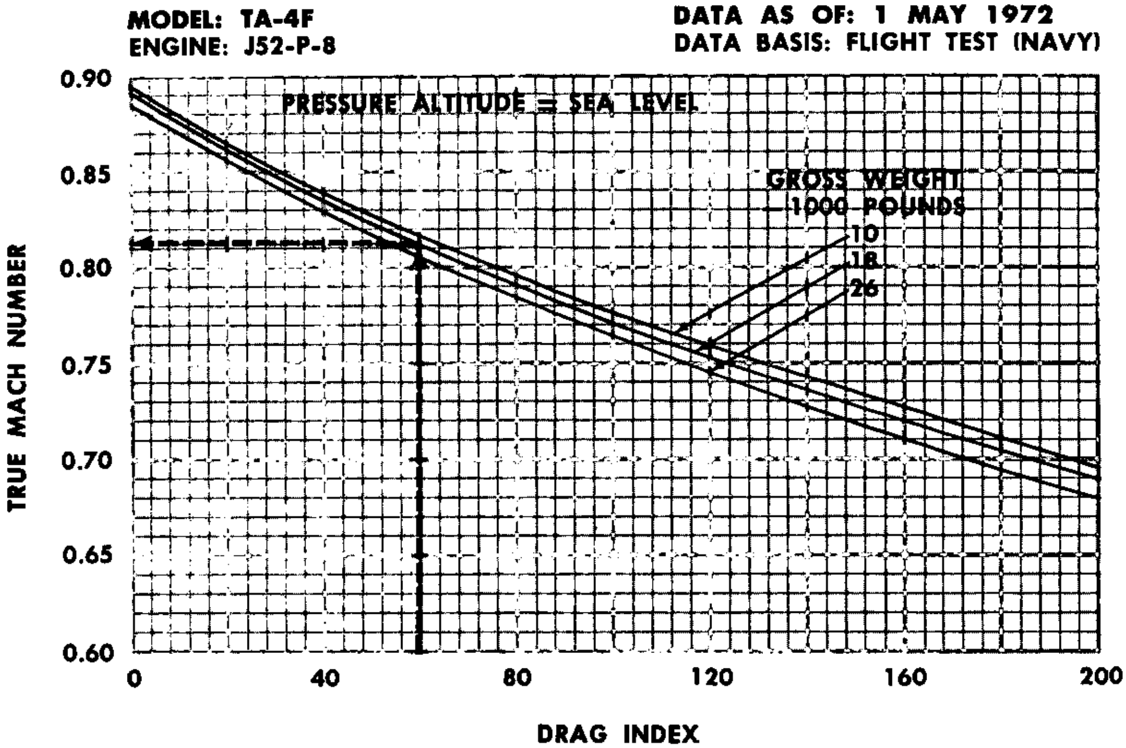


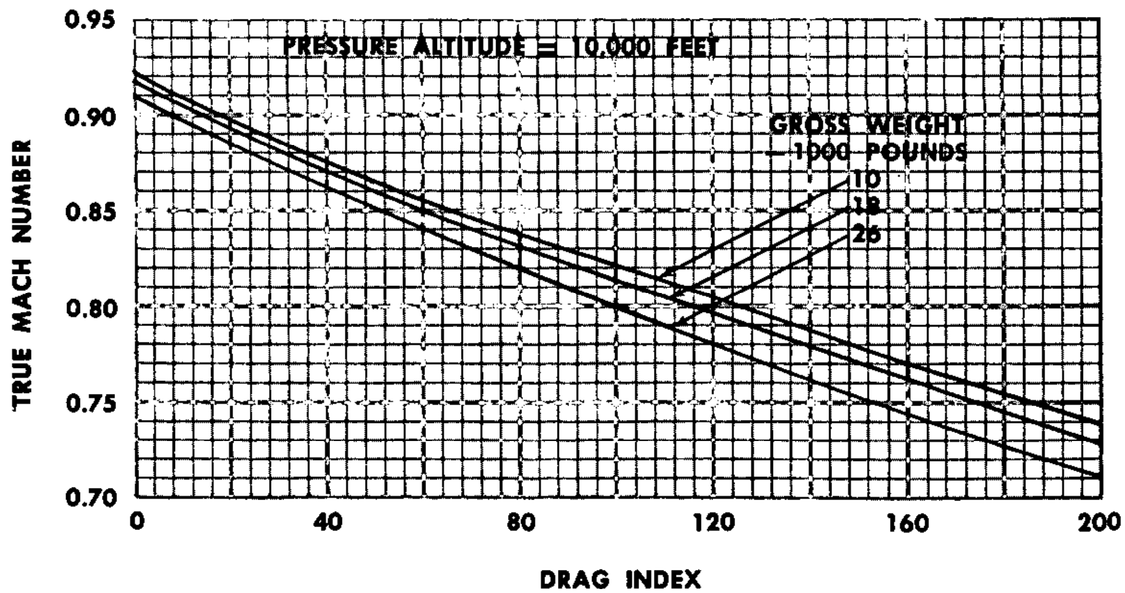
Figure 28-2. Maneuverability (Sheet 3 of 3)

MAXIMUM MACH NUMBER

MILITARY THRUST

ICAO STANDARD ATMOSPHERE





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TA1-306-A

Figure 28-3. Maximum Mach Number (Sheet 1 of 2)

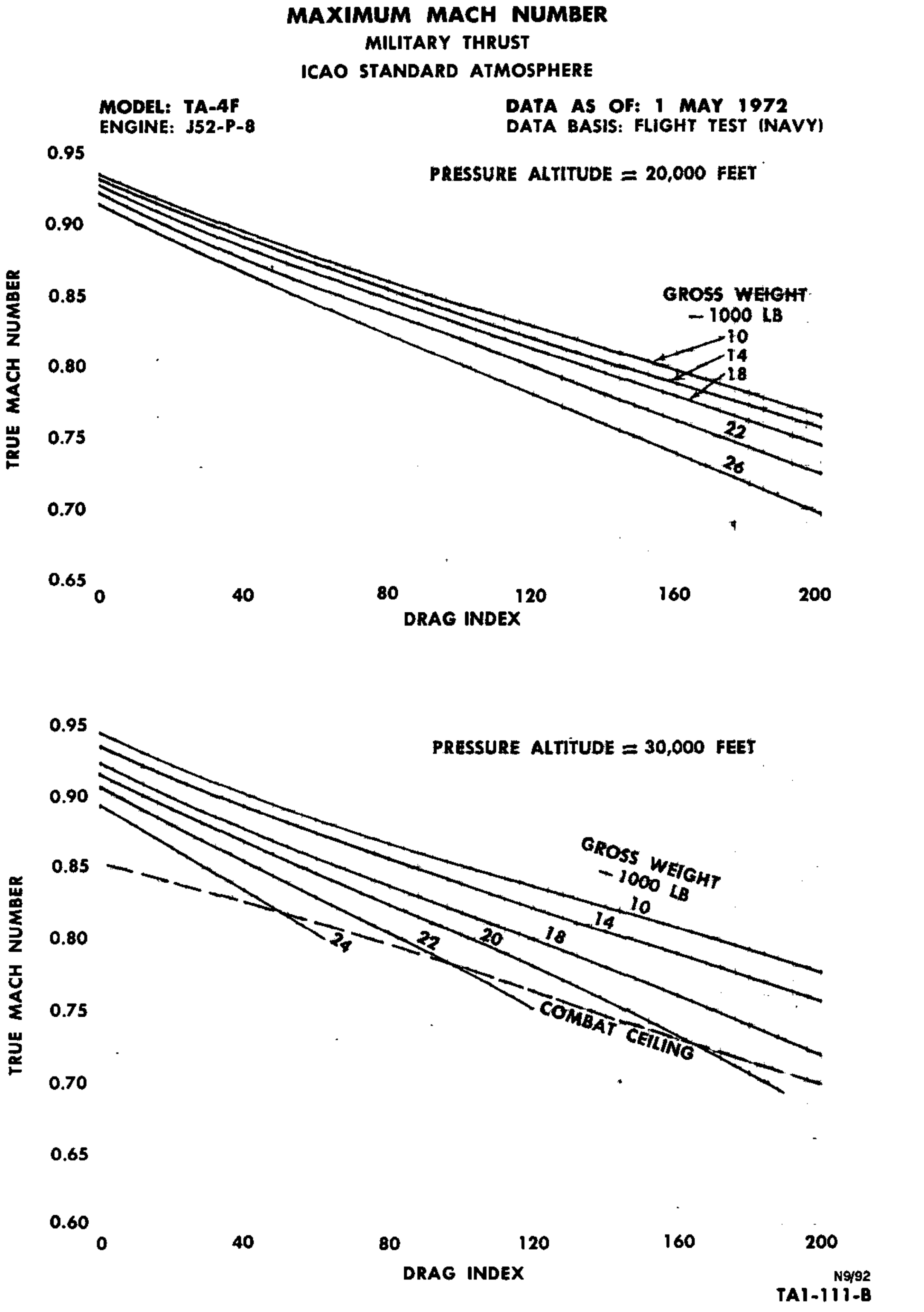


Figure 28-3. Maximum Mach Number (Sheet 2 of 2)

MILITARY FUEL FLOW

ICAO STANDARD ATMOSPHERE

MODEL: TA-4F
ENGINE: J52-P-8

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY)

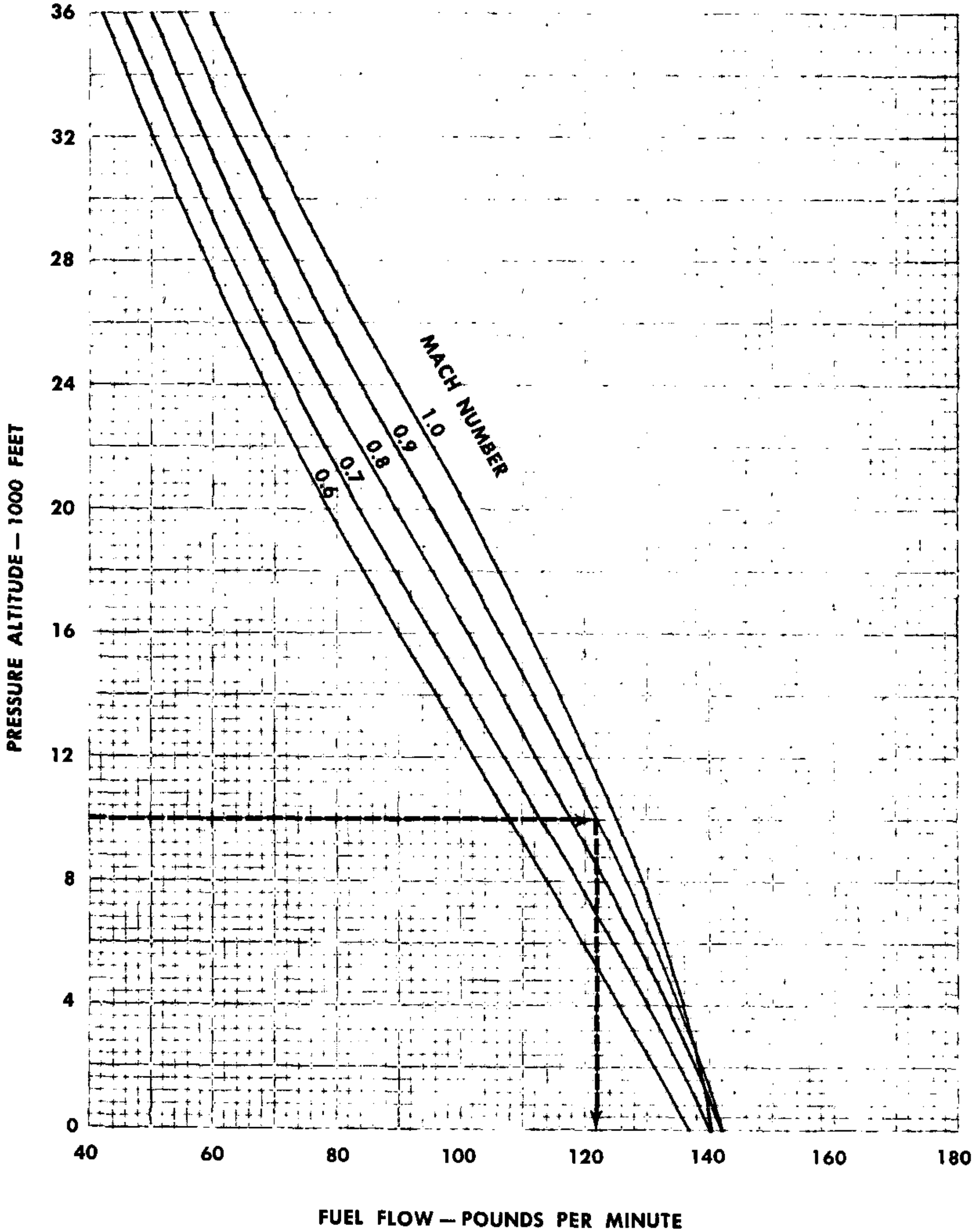


Figure 28-4. Military Fuel Flow

CHAPTER 29

Mission Planning

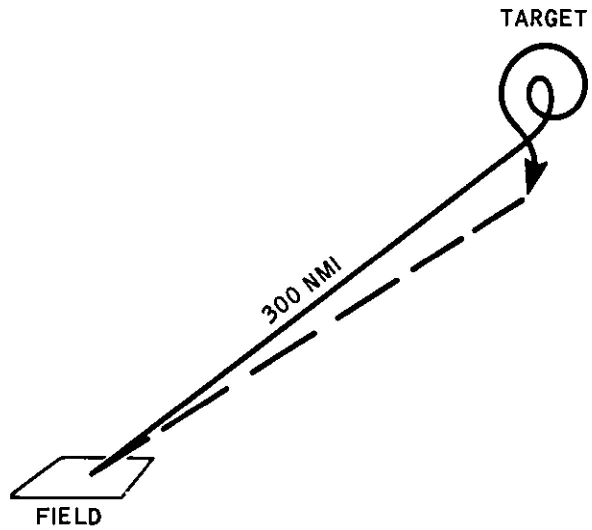
29.1 MISSION PLANNING

Optimum use of the aircraft to obtain maximum performance at a minimum rate of fuel consumption requires careful preflight planning for the mission. One of the most important phases of mission planning is the determination of the maximum radius of action from the field which will allow return with an adequate fuel reserve.

To find the maximum radius, a combat plan must be formulated in advance, and a loiter altitude and distance must be established before the combat phase of the mission is begun. Fuel consumption is high during combat maneuvers and any delay in beginning the combat action will shorten the combat time, or seriously reduce the amount of planned fuel reserve.

The following sample problem is an exercise in the use of the performance charts contained in Chapter 20 through Chapter 28. The example is not intended to reflect an actual mission. The sample problem illustrates, through a graphical solution, how the performance charts can be integrated to form a complete mission flight plan. The steps used to develop such a plot are shown with the problem.

29.1.1 Sample Problem. Take off and proceed on course at 25,000 feet altitude at maximum range Mach number, descend to 5,000-feet altitude; hold on station awaiting instructions from ground observers, then attack the target with two clusters of 5 X Mk 81 LDGP bombs along with two single Mk 81 LDGP bombs. Return to the field at maximum range cruise altitude with 800 pounds of reserve fuel. Following is a plan view.



TA1-126-A

29.1.1.1 Assumptions and Comments

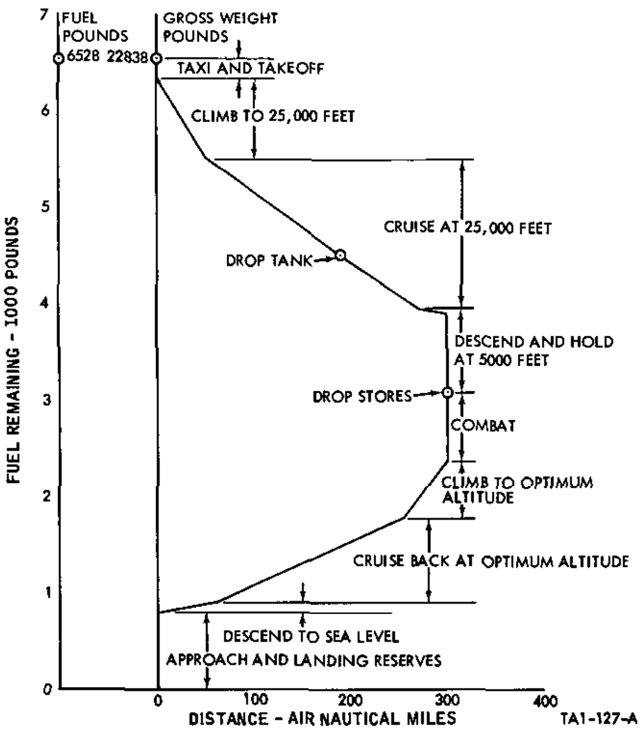
1. Assume zero wind and ICAO standard day conditions.

2. Assume the gun ammunition is not fired during the mission.

3. Assume a combat allowance of 5 minutes at military thrust to drop the bombs at the target.

The sample mission planning problem summary solution of the problem is introduced at this point so the pilot can see the complete graphic picture before the actual solution is broken into parts.

SAMPLE MISSION PLANNING PROBLEM SUMMARY



The problem is solved by plotting fuel remaining versus air distance. Gross weight is also superimposed on the vertical scale.

The first step is to derive gross weight and drag index values as shown. The mission problem is then solved in incremental steps, working from takeoff through descent and working backward from landing to combat.

Start solving the mission requirements by working backward from the landing reserves. The solution follows.

29.1.1.2 Gross Weight and Drag Index. From Figure 20-1 and NAVAIR 01-40AV-1T:

Items	Drag Index	Weight (pounds)
Zero fuel, zero payload	0	11,836
Two 20mm guns and ammo	7	457
Two station 75 wing pylons	12	140
Two station 113.75 wing pylons	14	128
Two MER-7 on station 75	46	446
One 300-gallon bobtail fuel tank on centerline station	15	183
Two 5 X Mk 81 LDGP bombs	28	2,600
Two 1 x Mk 81 LDGP bombs on station 113.75	4	520
Internal fuel (660 gallons JP-5)		4,488
External fuel (300 gallons JP-5)		2,040
Takeoff Totals	126	22,838
Drop 300-gallon tank	-15	-183
Total	111	
Drop bombs	-32	-3,120
Total	79	
Fuel used (internal)		-4,488
Fuel used (external)		-2,040
Total (Zero fuel weight)	79	13,007

29.1.1.4 Approach and Landing Reserve Allowances. The landing reserve is assumed to be 800 pounds which will permit sea level landing pattern operation for 20 to 25 minutes. This point is plotted as shown on the sample cruise back, descent, and landing reserve plot at 800 pounds of fuel remaining and zero nautical miles distance.

29.1.1.5 Descent from Optimum Cruise Altitude to Sea Level. Time, fuel, and distance for descent can be determined from the descent charts (Figures 26-1 through 26-3). The drag index for this configuration is 79. Assume that the weight at the beginning of the letdown is equal to the gross weight with the reserve fuel (13,007 pounds + 800 pounds = 13,807 pounds). The optimum cruise altitude for this weight and drag index is read from Figure 22-5.

Initial Weight (pounds)	Optimum Cruise Altitude (feet)	Time (minutes)	Distance (nautical miles)	Fuel (pounds)
13,807	36,400	14.5	60	105

These values are plotted as shown on the sample cruise back, descent, and landing reserve plot at fuel remaining of 905 pounds (800 pounds + 105 pounds = 905 pounds) and 60 nautical miles distance.

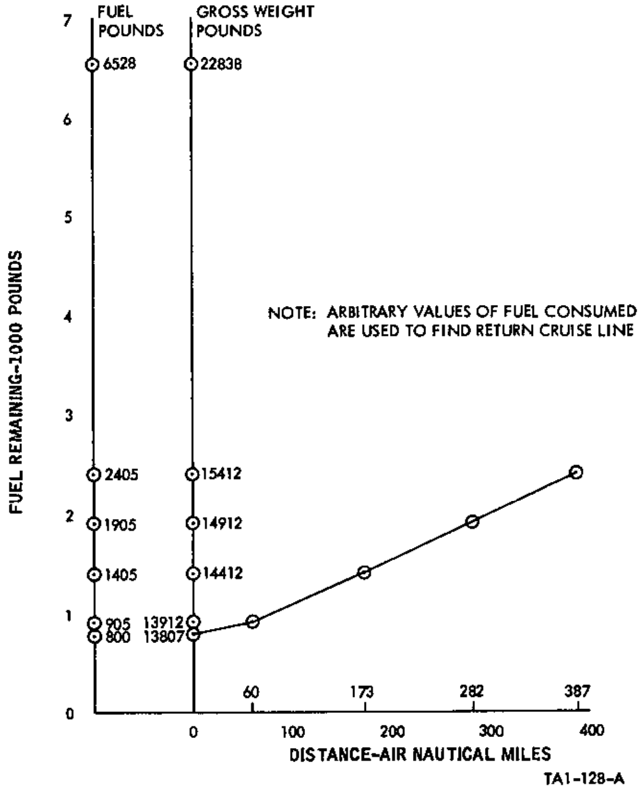
29.1.1.6 Return at Optimum Cruise Altitude. The optimum cruise altitude fuel requirements can be determined from Figures 23-8 and 23-9. The drag index is 79 and the weight at end of cruise is 13,912 pounds (13,007 pounds + 800 pounds + 105 pounds = 13,912 pounds). Assume arbitrary cruise fuel increments and construct the return fuel-distance line as shown on the sample cruise back, descent, and landing reserve plot.

Fuel Increment (pounds)	Average Weight (pounds)	Optimum Cruise Altitude (feet)	Optimum Cruise Mach Number
500	14,162	36,100	0.67
500	14,662	35,300	0.67
500	15,162	34,400	0.67

Nautical Miles per Pound of Fuel	Distance Increment (nautical miles)
0.226	113
0.218	109
0.210	105

These points are plotted as shown on the sample cruise back, descent, and landing reserve plot at fuel remaining of 1,405, 1,905, and 2,405 pounds respectively (fuel remaining = reserve fuel + descent fuel + cruise fuel increment). The corresponding distance points are 173, 282, and 387 air nautical miles (distance = descent distance + distance increment).

SAMPLE CRUISE BACK, DESCENT, AND LANDING RESERVE



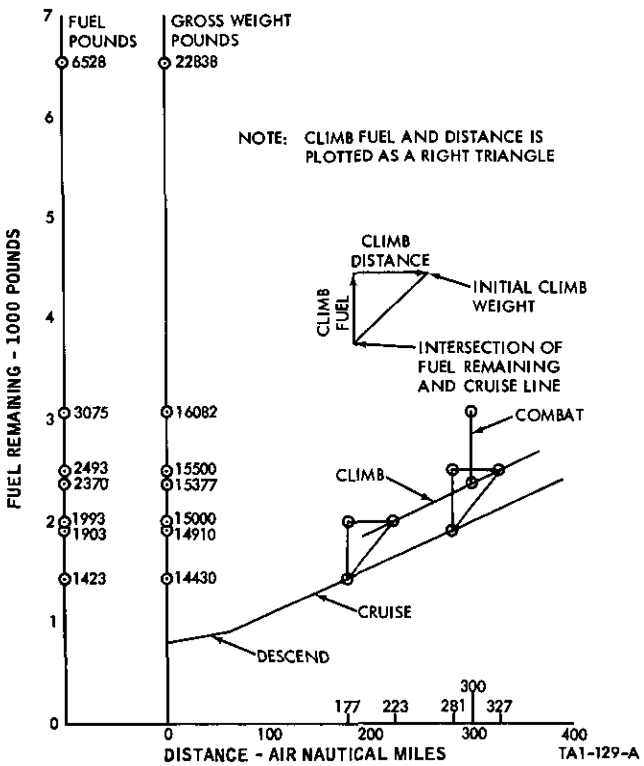
29.1.1.7 Climb to Optimum Cruise Altitude. The time, fuel, and distance to climb from sea level to optimum cruise altitude can be determined from Figures 22-1 through 22-5. Assume two arbitrary initial climb weights of 15,000 and 15,500 pounds and read the values at 79 drag index. Construct right triangle fuel-distance lines as shown on the sample combat and climb to optimum cruise altitude plot beginning at the appropriate fuel remaining values on the return at optimum cruise altitude line (fuel remaining = assumed initial climb weight - zero fuel weight - fuel to climb).

Initial Weight (pounds)	Fuel (pounds)	Distance (nautical miles)	Time (minutes)	Fuel Remaining (pounds)
15,000	570	46	7.3	1,423
15,500	590	46	7.4	1,903

29.1.1.8 Combat. A 5 minute sea level, maximum speed, combat allowance is assumed to expend the bombs over the target. To permit a conservative fuel allowance, it is assumed that the bombs have been dropped prior to combat and the drag index is 79.

Since the variation in maximum speed with gross weight at sea level is small, assume that the combat weight is that weight which is determined by the intersection of the climb line and the required mission radius (combat weight = zero fuel weight + fuel remaining at 300 nautical miles (15,377 pounds = 13,007 pounds + 2,370 pounds). From Figure 28-3 at a weight of 15,377 pounds and drag index of 79, maximum Mach number = 0.793. From Figure 28-4 at sea level and Mach number of 0.793, fuel flow = 141 pounds per minute. Therefore fuel for 5 minutes is 705 pounds. The combat allowance of 705 pounds is added to the fuel remaining at 300 nautical miles. Assume that no distance is covered during combat.

SAMPLE COMBAT AND CLIMB TO OPTIMUM CRUISE ALTITUDE



29.1.1.9 Taxi, Takeoff, and Acceleration. The first portion of the plot is constructed by working backwards from the landing reserve. The remainder of the plot can be developed by starting at the taxi-takeoff condition. Takeoff weight is 22,838 pounds with a drag index of 126. Assume a 5 minute taxi fuel flow at 12 pounds per minute, takeoff acceleration allowances of 150 pounds of fuel used, and no distance covered. Plot this point as shown on the sample takeoff, climb, cruise, descent, and hold on station plot at 6,318 pounds of fuel remaining (6,528 pounds - 60 pounds - 150 pounds = 6,318 pounds) and zero distance covered.

29.1.1.10 Climb to 25,000 Feet Cruise Altitude. The time, fuel, and distance to climb values are read from Figures 22-1 through 22-5 at a drag index of 126 and an initial weight of 22,628 pounds (22,838 pounds - 60 pounds - 150 pounds = 22,628 pounds).

Initial Weight (pounds)	Fuel (pounds)	Distance (nm)	Time (minutes)
22,628	830	51	8.7

These values are plotted, as shown on the sample plot, at a fuel remaining of 5,488 pounds (6,528 pounds - 830 pounds - 60 pounds - 150 pounds = 5,488 pounds) and a distance of 51 nautical miles.

29.1.1.11 Cruise Out at 25,000 Feet Altitude. The initial cruise-out weight is 21,798 pounds (22,628 pounds - 830 pounds = 21,798 pounds), and the drag index is 126. The fuel remaining in the 300-gallon drop tank is 1,000 pounds (2,040 pounds - 60 pounds - 150 pounds - 830 pounds = 1,000 pounds) and will be used during the initial portion of the cruise-out leg. Read nautical miles per pound of fuel from Figures 23-8 and 23-9.

Fuel Increment (pounds)	Average Weight (pounds)	Maximum Range Mach Number	NM/ Pound of Fuel	Distance Increment (nm)
1,000	21,298	0.630	0.138	138

Plot these values as shown on the sample plot at a fuel remaining of 4,488 pounds (6,528 pounds - 2,040 pounds = 4,488 pounds) and a distance of 189 nautical miles (51 nm + 138 nm = 189 nm).

At this point the external fuel tank is dropped and the aircraft weight is 20,615 pounds (21,798 pounds - 1,000 pounds - 183 pounds = 20,615 pounds) with a drag index of 111 (126 - 15 = 111). Assume arbitrary fuel increments and continue to construct the cruise out line.

Fuel Increment (pounds)	Average Weight (pounds)	Maximum Range Mach Number	NM/ Pound of Fuel	Distance Increment (nm)
500	20,365	0.625	0.147	74
500	19,865	0.620	0.150	75

These values are plotted as shown on the sample plot at fuel remaining values of 3,988 pounds (4,488 pounds - 500 pounds = 3,988 pounds) and 3,488 pounds (3,988 pounds - 500 pounds = 3,488 pounds) with corresponding distances of 263 nautical miles (189 nm + 74 nm = 263 nm) and 338 nautical miles (263 nm + 75 nm = 338 nm).

29.1.1.12 Descent to 5,000 Feet Altitude from 25,000 Feet Altitude Over Target. Assume the initial descent weight is that weight which is determined by the intersection of the cruise-out line and the required mission radius (300 nm). From the graph fuel remaining at 300 nautical miles is 3,750 pounds; therefore the assumed initial descent weight is 19,877 pounds (22,838 pounds - 6,528 pounds - 183 pounds + 3,750 pounds = 19,877 pounds). Read time, fuel, and distance to descent from Figures 26-1 and 26-2.

Initial Weight (pounds)	Time (minutes)	Distance (nm)	Fuel (pounds)
19,877	6.5	30	41

These values are plotted as shown on the sample plot in the following manner. The distance of 30 nautical miles is covered in the descent. To arrive at the required mission radius at 5,000 feet, a point is plotted on the cruise-out line at 270 nautical miles (300 nm - 30 nm = 270 nm). At this point read fuel remaining of 3,950 pounds; therefore fuel remaining at 300 nautical miles is 3,909 pounds (3,950 pounds - 41 pounds = 3,909 pounds). The aircraft has arrived at the required mission radius (300 nm) with a fuel remaining of 3,909 pounds.

29.1.1.13 Hold on Station at 5,000 Feet Altitude Over Target. The final step in planning the mission is to determine the loiter time available over the target with the remaining fuel. At this point it is advised that all the various parts of the problem be integrated into a single summary plot as shown at the beginning of the problem. Fuel available for loiter is then found to be fuel remaining at the end of descent to 5,000 feet, less the fuel remaining at start of combat. Fuel available is 834 pounds (3,909 pounds - 3,075 pounds = 834 pounds).

It is assumed that the holding condition is flown in a race track pattern and the average bank angle is 15°. It is also assumed that the stores are retained throughout the loiter.

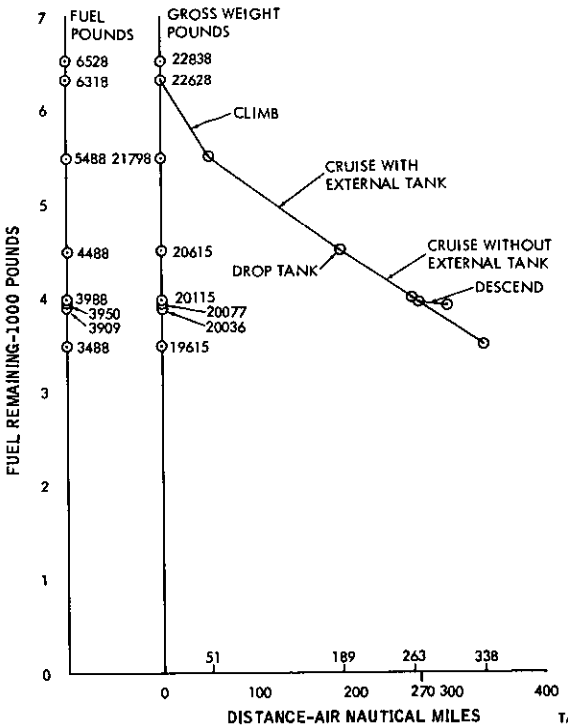
Average gross weight is 19,619 pounds (22,838 pounds - 183 pounds - 6,528 pounds + 3,075 pounds + 834/2 pounds = 19,619 pounds) with a drag index of 111. From Figures 24-4 and 24-5 read loiter conditions.

Average Weight (pounds)	Maximum Endurance Mach Number	Fuel Flow (pounds/ hour)	Hold Time at 5,000 Feet Altitude (minutes)
19,619	0.356	2,570	19.5

The mission requirements can be met, providing that the hold time over the target is restricted to approximately 20 minutes.

29.1.2 Takeoff and Landing Data Card. Certain items of takeoff performance can be entered on the takeoff and landing data card for convenient reference. Entries illustrated on Figure 29-2 are from the sample mission problem and may be read from Part XI, Chapter 21. Normal landing performance data are available in Chapter 27.

SAMPLE TAKEOFF, CLIMB, CRUISE, DESCENT, AND HOLD ON STATION



TA1-131-A

SEGMENT	INITIAL WEIGHT ~ LB	FUEL ~ LB	TIME *~MIN	DISTANCE ~ NMI	
TAKEOFF	22,838	210	5.0	0	
CLIMB TO 25,000 FT	22,628	830	8.7	51	CLIMB SPEED (ALT - 1000 FT / KCAS): 0 / 278; 10 / 278; 20 / 278; 25 / 278
CRUISE AT 25,000 FT (WITH TANK)	21,798	1000	21.8	138	CRUISE SPEED - KCAS: 260; FUEL FLOW LB/HR: 2750
CRUISE AT 25,000 FT (TANK DROPPED)	20,615	538	13.0	81	CRUISE SPEED - KCAS: 260; FUEL FLOW LB/HR: 2480
DESCENT TO 5000 FT	20,077	41	6.5	30	DESCENT SPEED - KCAS: 218
HOLD AT 5000 FT	20,036	834	19.5	0	LOITER SPEED - KCAS: 215; FUEL FLOW LB/HR: 2570
COMBAT	16,916	705	5.0	0	MACH NUMBER: 0.793; FUEL FLOW LB/HR: 8460
CLIMB TO OPTIMUM ALTITUDE (OPTIMUM ALTITUDE = 35,000 FT)	15,377	580	7.3	46	CLIMB SPEED (ALT - 1000 FT / KCAS OR MACH): 0 / 302; 10 / 302; 20 / 302; 30 / 0.70; 40 / 0.70
CRUISE BACK AT OPTIMUM ALTITUDE (FINAL ALTITUDE = 36,400 FT)	14,797	885	30.2	194	CRUISE SPEED (MACH / KCAS): 0.67 / 220; FUEL FLOW LB/HR: 1760
DESCENT TO SEA LEVEL	13.912	105	14.5	60	DESCENT SPEED - KCAS: 190
APPROACH AND LANDING RESERVE	13,807	800	0	0	
TOTAL		6528	131.5	600	

*MINUTES

Figure 29-1. Summary of Sample Mission

TAKEOFF AND LANDING DATA CARD

CONDITIONS

Gross Weight	22, 838 LB.
Runway Length	11, 000 FT.
Runway Temperature	+15°C
Pressure Altitude	SEA LEVEL
Runway Wind Component	0 KTS
Runway Gradient	0 PERCENT

TAKEOFF

Acceleration Check	119. 0 KEAS AT 2000 FT.
Takeoff Speed	159. 5 KEAS
Ground Run	3, 950 FT.
Total Distance to Clear 50-Foot Obstacle	5, 530 FT.
Refusal Speed (With Spoilers)	121 KIAS
Stopping Distance (With Spoilers)	6100 FEET

CONDITIONS

Gross Weight	13, 807 LB.
Runway Temperature	+15°C
Pressure Altitude	SEA LEVEL
Flap Deflection	FULL
Runway Wind Component	0 KTS
Runway Gradient	0 PERCENT
RCR	23

LANDING

Approach Angle-of-Attack	16 1/2 UNITS
Final Approach Speed	124. 7 KCAS
Landing Ground Roll	3, 700 FT.

Figure 29-2. Takeoff and Landing Data Card

PART XII

Performance Data — J52-P-6

CHAPTER 30

Takeoff

See Figures 30-1 through 30-6.

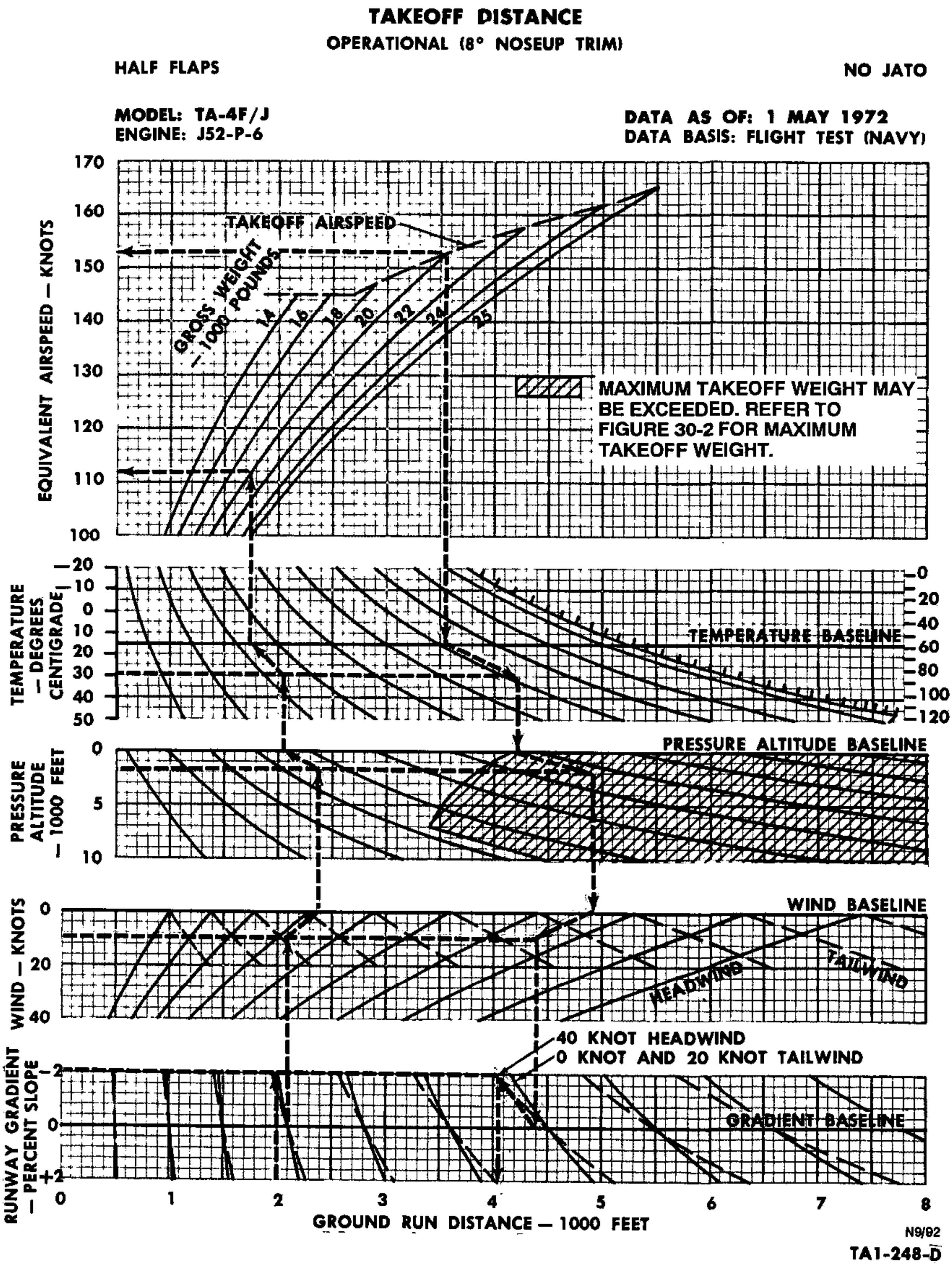


Figure 30-1. Takeoff Distance

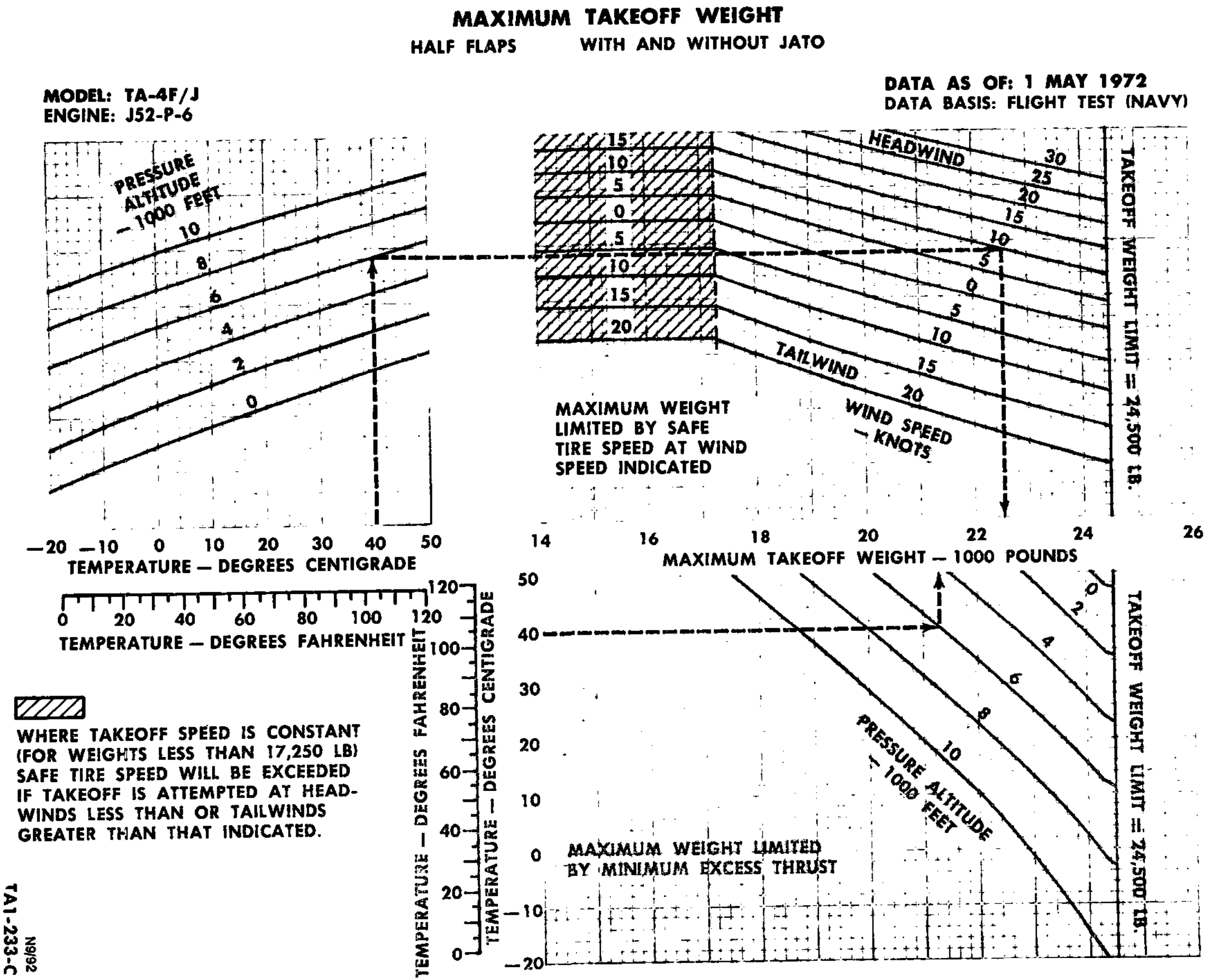


Figure 30-2. Maximum Takeoff Weight

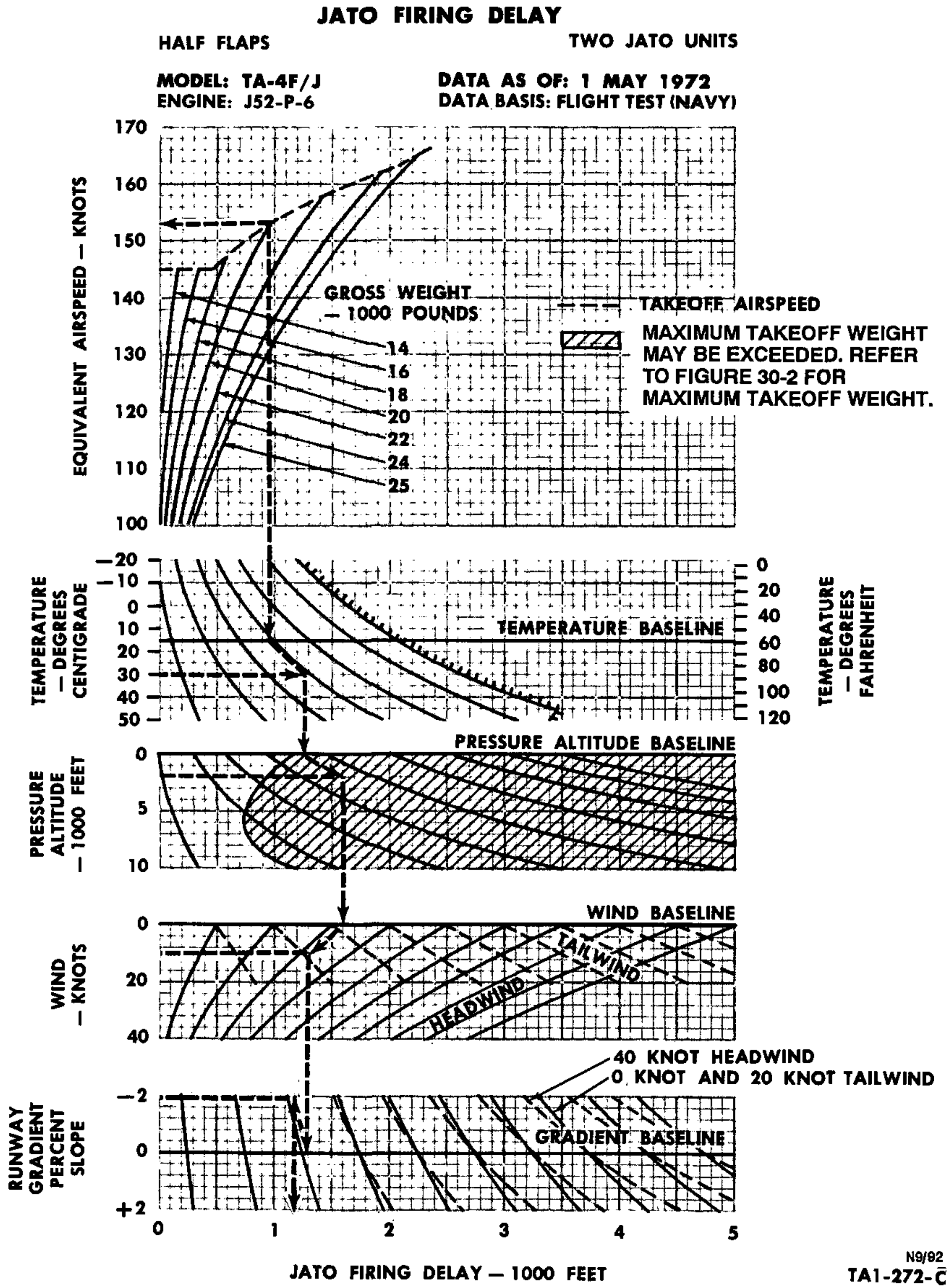


Figure 30-3. JATO Firing Delay

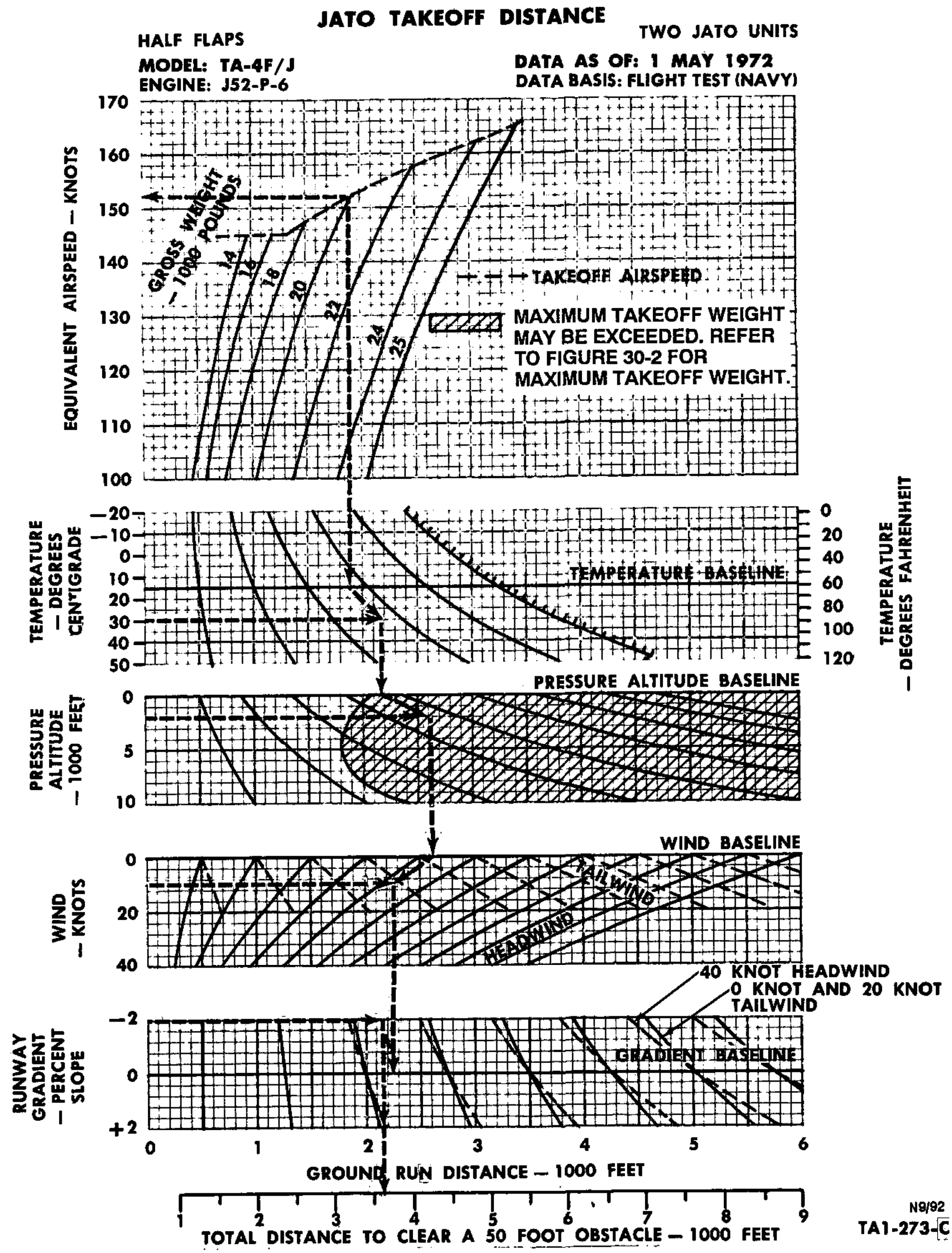


Figure 30-4. JATO Takeoff Distance

TAKEOFF REFUSAL SPEED
SPEEDBRAKES AND SPOILERS OPEN
HALF FLAPS

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

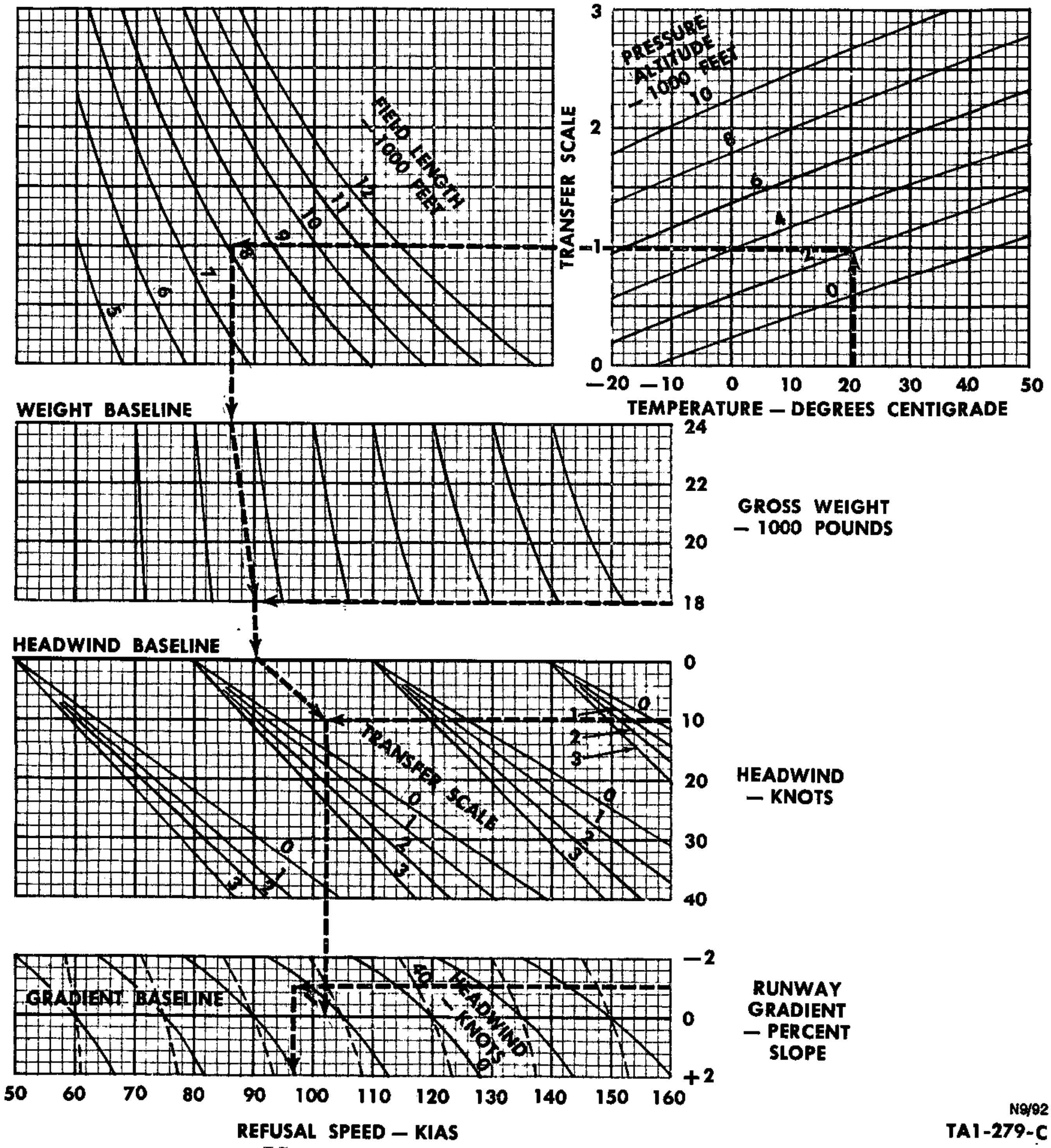


Figure 30-5. Takeoff Refusal Speeds (Sheet 1 of 2)

TAKEOFF REFUSAL SPEED

SPEEDBRAKES OPEN — SPOILERS CLOSED

HALF FLAPS

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

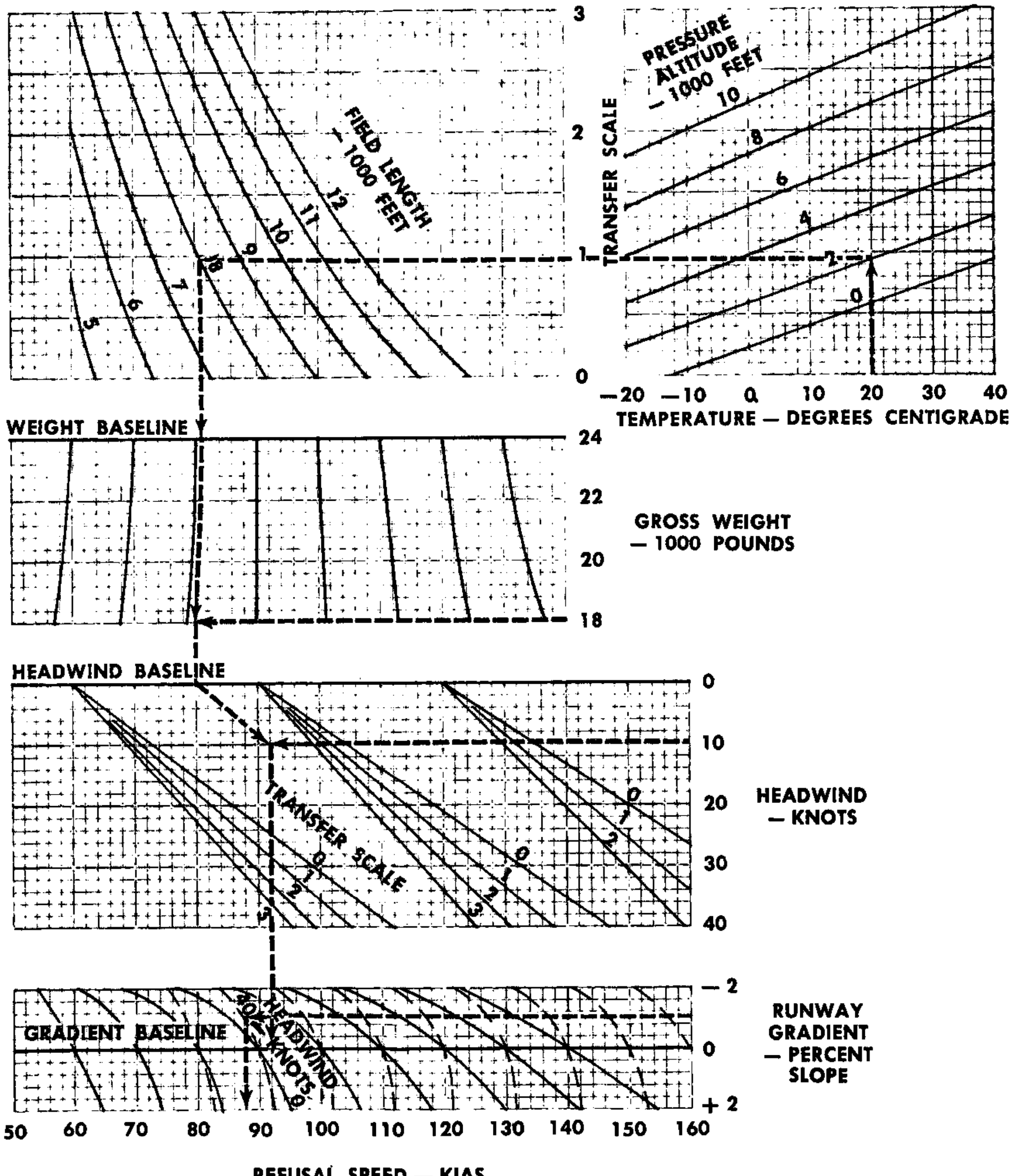


Figure 30-5. Takeoff Refusal Speeds (Sheet 2 of 2)

STOPPING DISTANCE

SPEEDBRAKES AND SPOILERS OPEN

HALF FLAPS

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

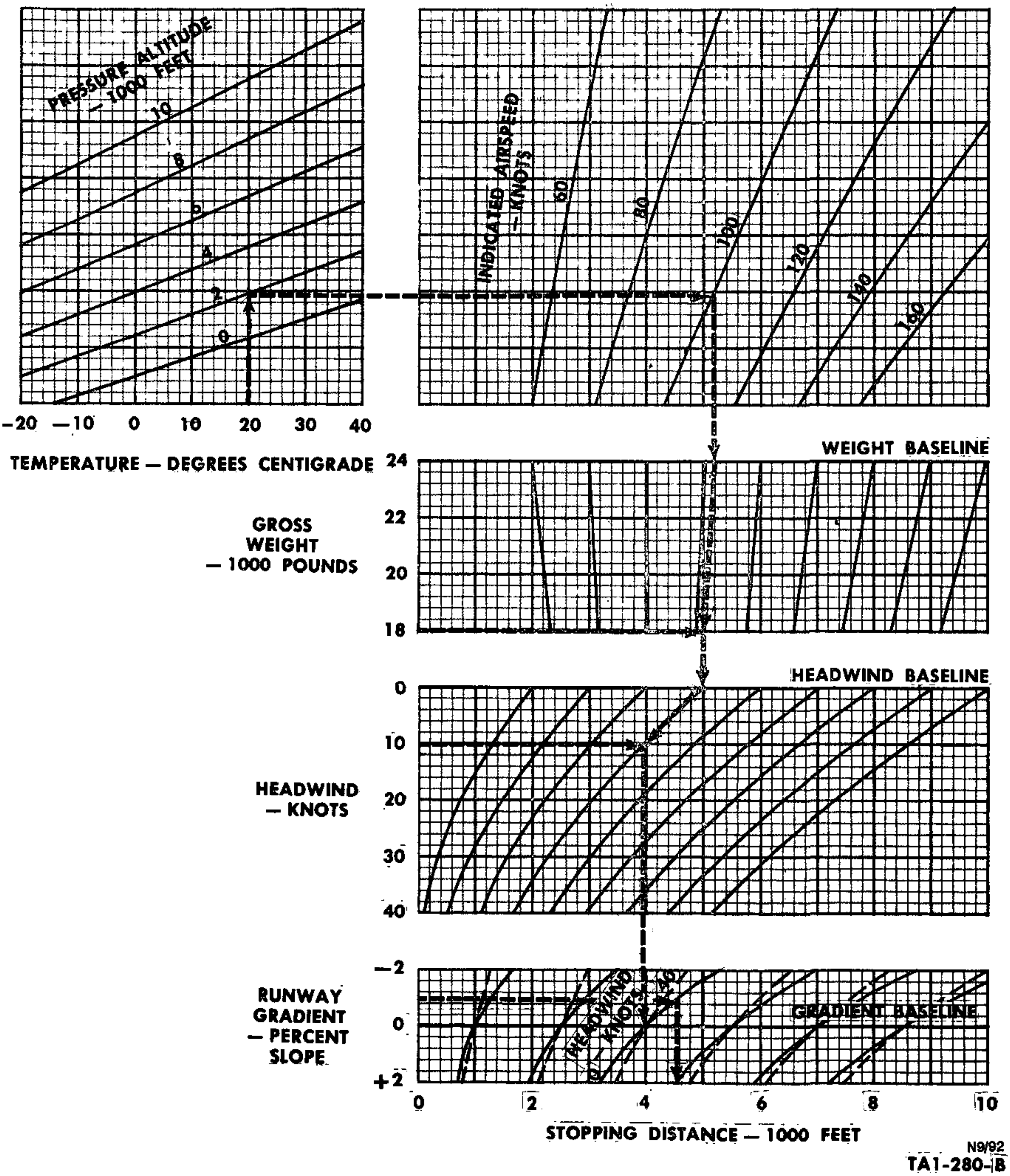
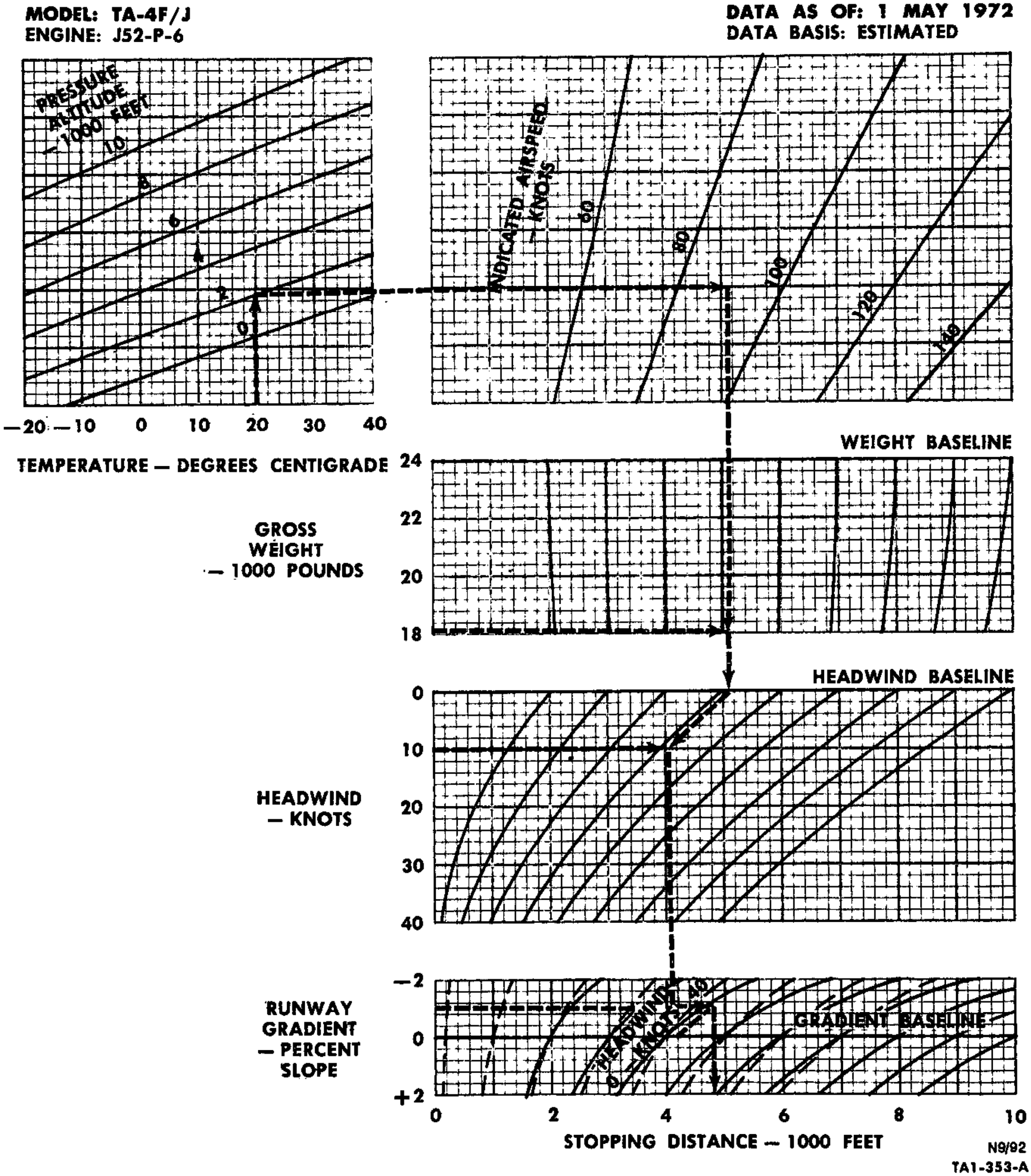


Figure 30-6. Stopping Distance (Sheet 1 of 2)

STOPPING DISTANCE

SPEEDBRAKES OPEN — SPOILERS CLOSED

HALF FLAPS



CHAPTER 31

Climb

See Figures 31-1 through 31-5.

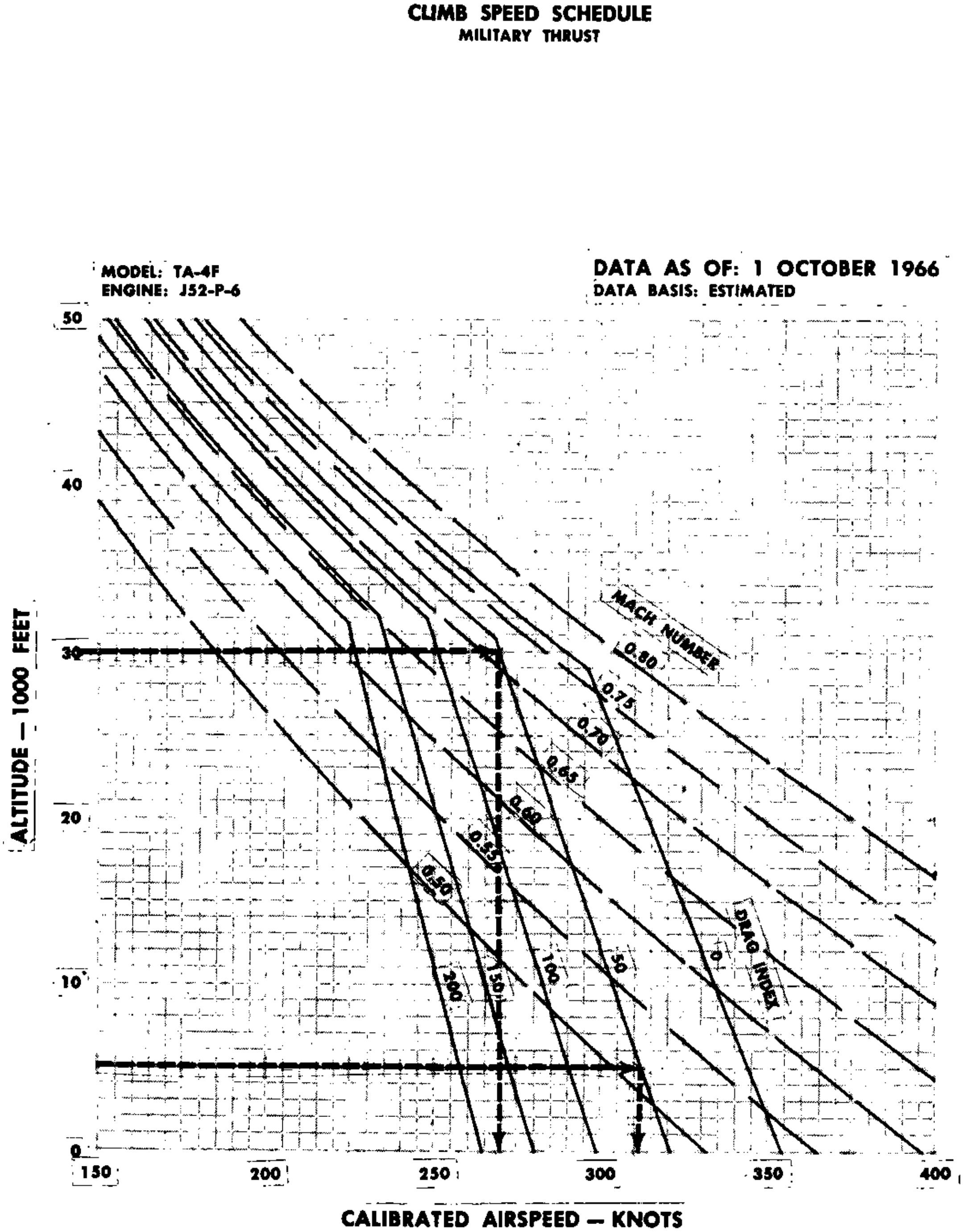
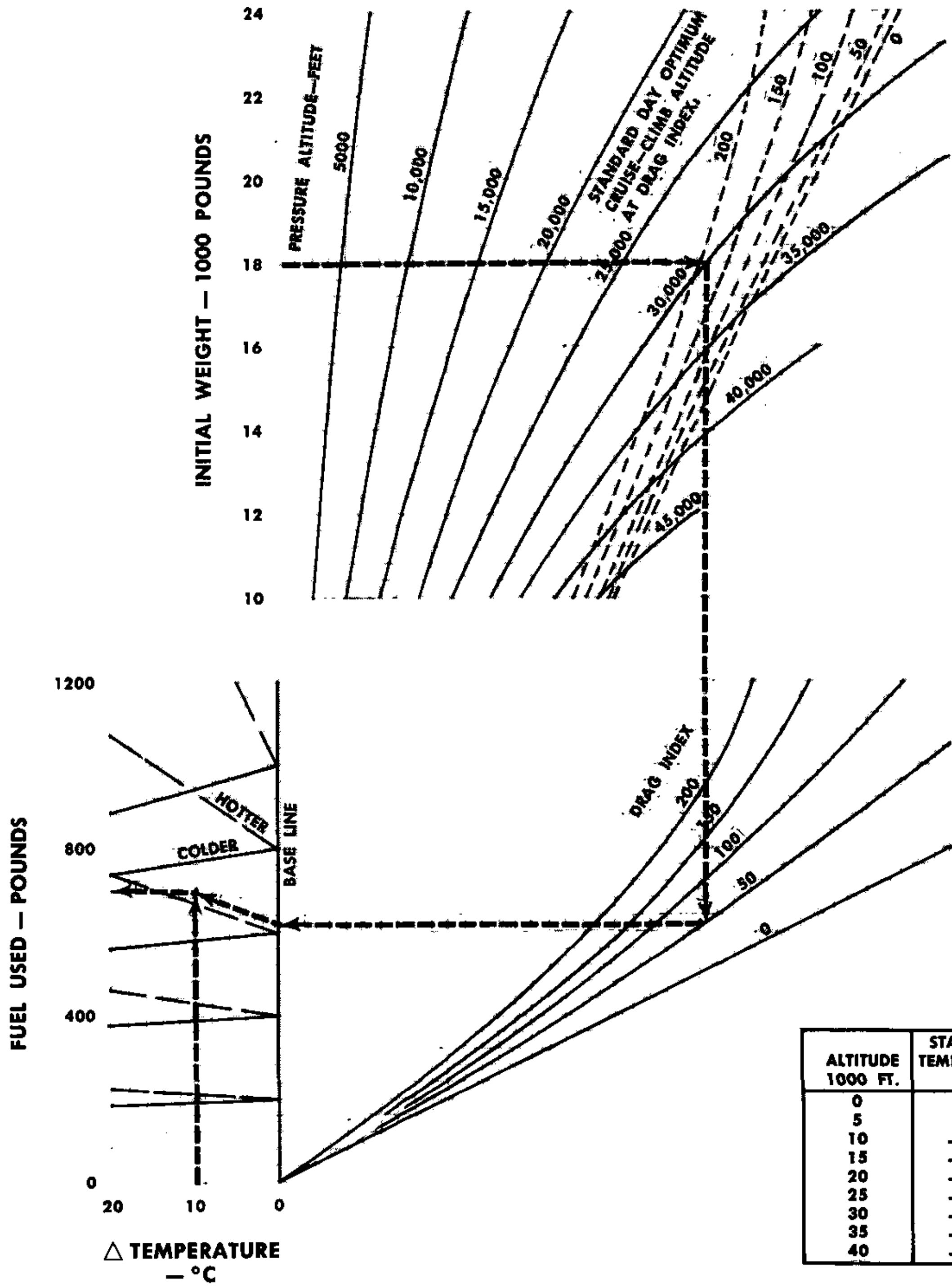


Figure 31-1. Climb Speed Schedule

MILITARY THRUST CLIMB
FUEL USED

MODEL: TA-4F
ENGINE: J52-P-6

DATA AS OF: 1 OCTOBER 1966
DATA BASIS: ESTIMATED



ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	− 4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3
40	−56.5

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Figure 31-2. Climb Fuel

MILITARY THRUST CLIMB
DISTANCE COVERED

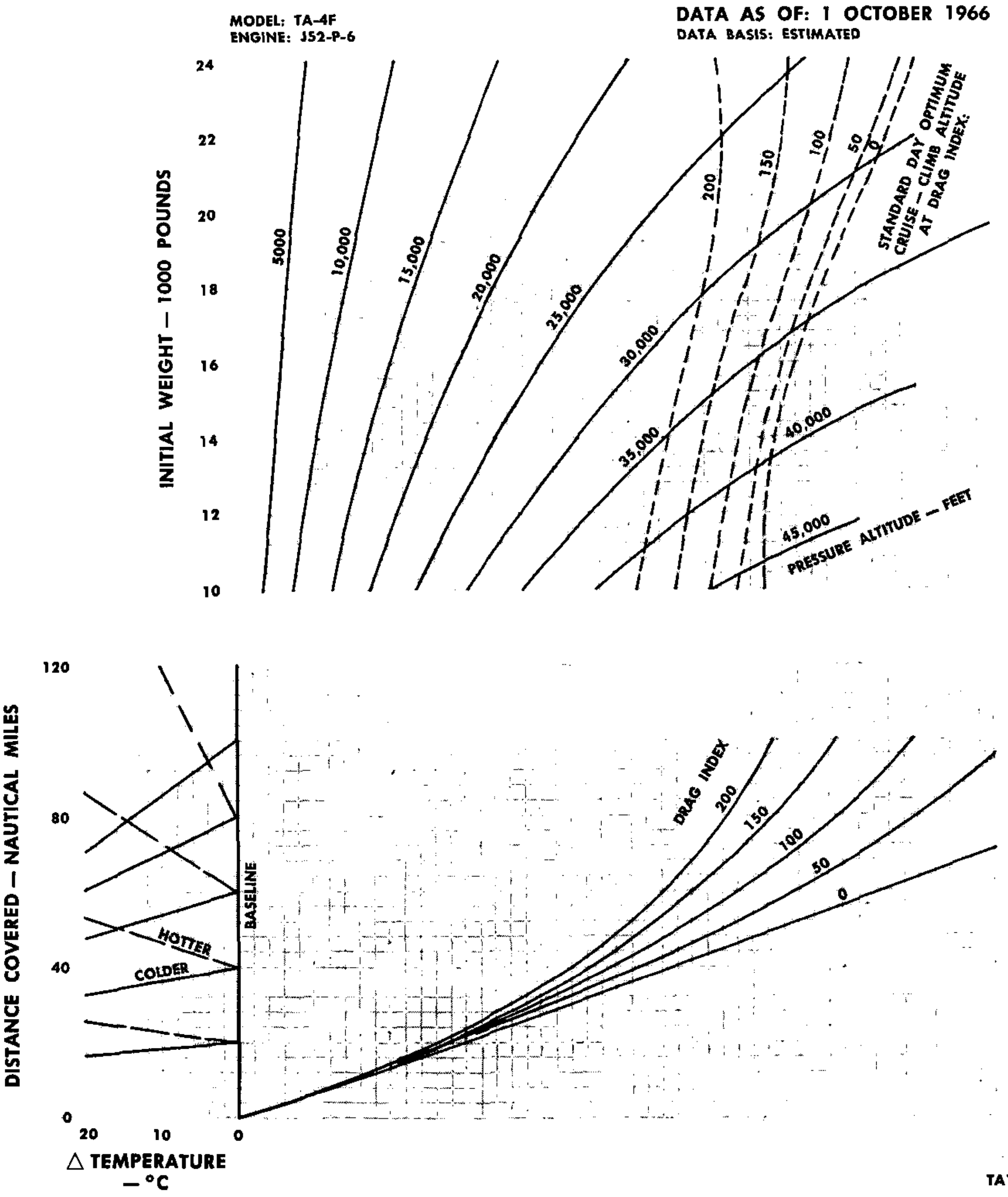
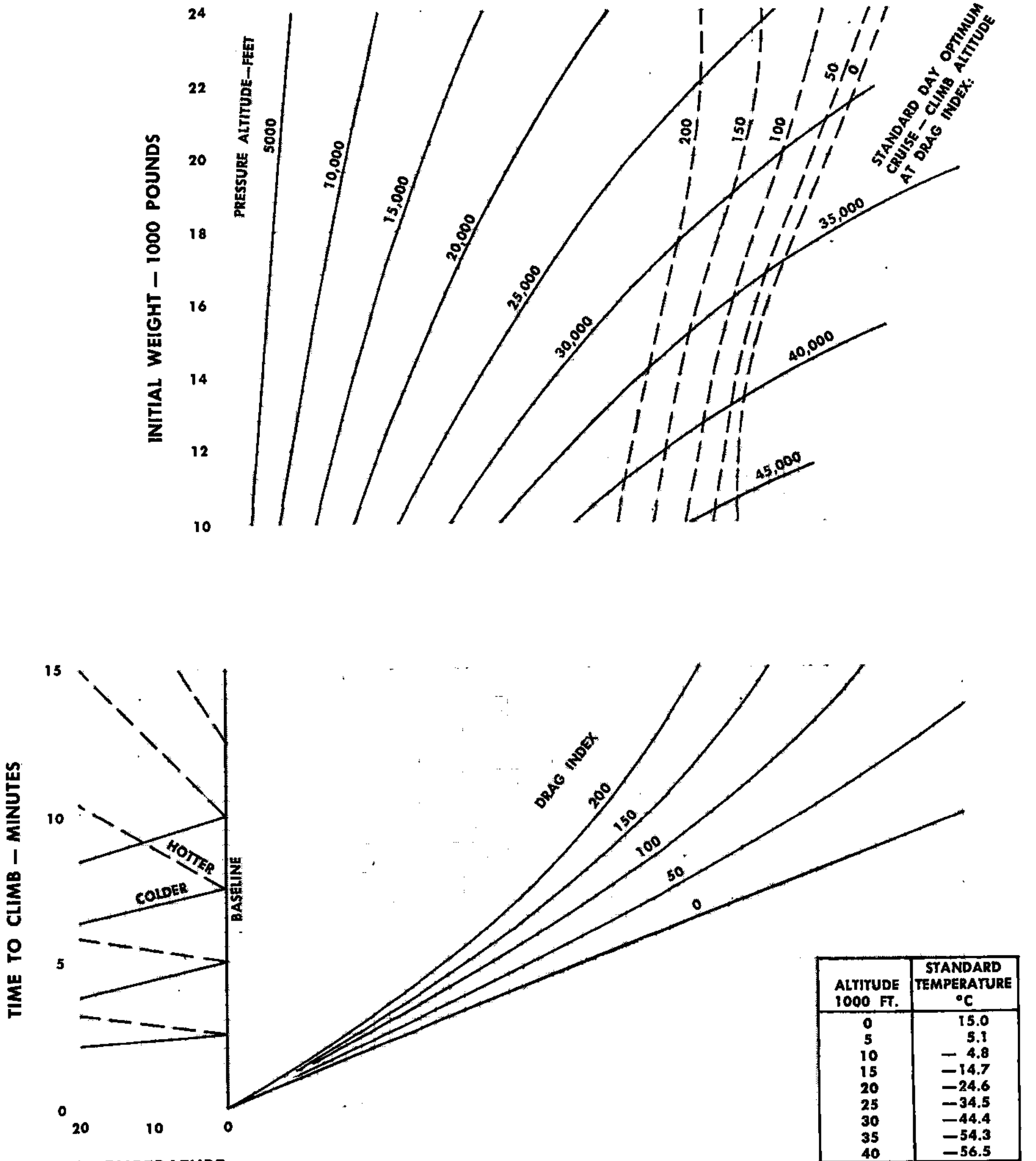


Figure 31-3. Climb Distance

MILITARY THRUST CLIMB
TIME TO CLIMB

MODEL: TA-4F
ENGINE: J52-P-6

DATA AS OF: 1 OCTOBER 1966
DATA BASIS: ESTIMATED



ALTITUDE 1000 FT.	STANDARD TEMPERATURE °C
0	15.0
5	5.1
10	— 4.8
15	—14.7
20	—24.6
25	—34.5
30	—44.4
35	—54.3
40	—56.5

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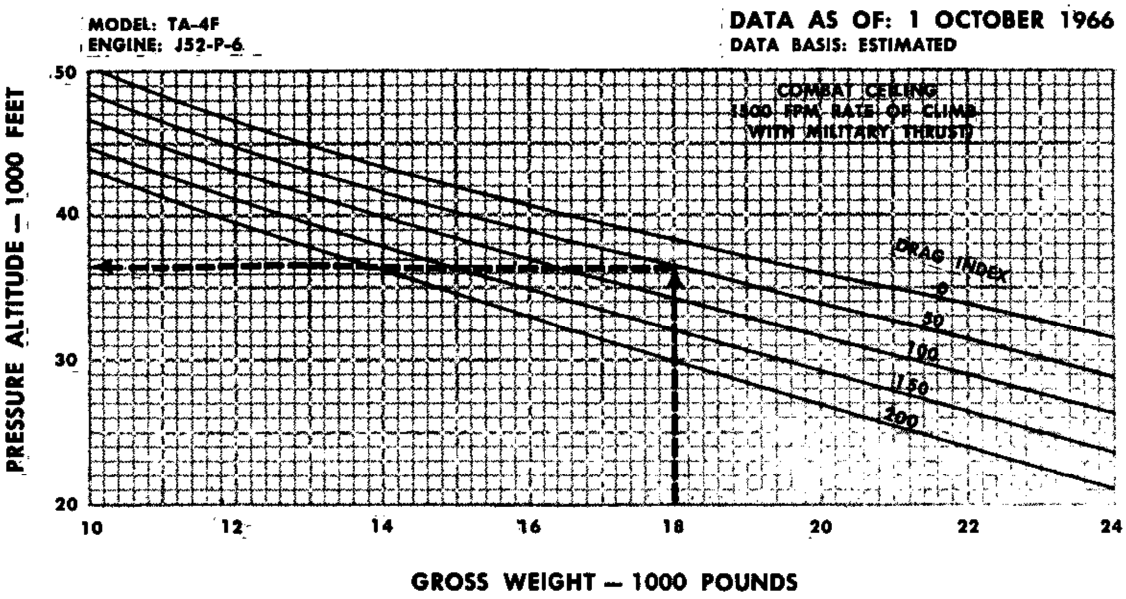
TA1-237

Figure 31-4. Climb Time

COMBAT CEILING AND OPTIMUM CRUISE ALTITUDE
ICAO STANDARD ATMOSPHERE



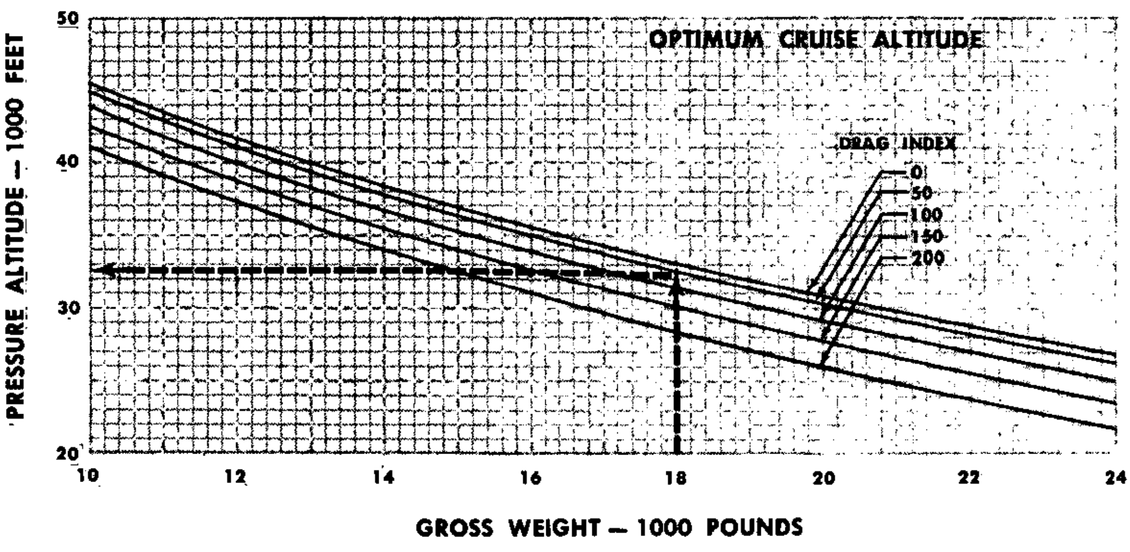


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Figure 31-5. Combat Ceiling and Optimum Cruise Altitude

CHAPTER 32

Range

See Figures 32-1 through 32-10.

RANGE FACTOR CHART

RELATIVE WIND-DEGREES	TAS KNOTS	WIND SPEED-KNOTS				
		40	60	80	100	120
0° HEADWIND	350	0.886	0.829	0.772	0.714	0.657
	400	0.900	0.850	0.800	0.750	0.700
	450	0.911	0.867	0.822	0.778	0.733
	500	0.920	0.880	0.844	0.800	0.760
	550	0.927	0.891	0.855	0.818	0.782
30°	350	0.899	0.848	0.796	0.742	0.688
	400	0.912	0.867	0.822	0.776	0.729
	450	0.922	0.882	0.842	0.801	0.760
	500	0.930	0.894	0.858	0.822	0.785
	550	0.936	0.904	0.871	0.839	0.805
60°	350	0.938	0.903	0.866	0.824	0.784
	400	0.946	0.917	0.885	0.852	0.816
	450	0.953	0.927	0.889	0.870	0.840
	500	0.958	0.935	0.910	0.885	0.858
	550	0.962	0.941	0.919	0.897	0.873
90°	350	0.994	0.985	0.974	0.959	0.941
	400	0.995	0.989	0.980	0.969	0.955
	450	0.996	0.991	0.984	0.975	0.964
	500	0.997	0.992	0 987	0.980	0.971
	550	0.997	0.994	0.989	0.984	0.976
120°	350	1.062	1.097	1.134	1.176	1.216
	400	1.054	1.083	1.115	1.148	1.184
	450	1.047	1.073	1.101	1.130	1.160
	500	1.042	1.065	1.090	1.115	1.142
	550	1.038	1.059	1.081	1.103	1.127
150°	350	1.101	1.152	1.205	1.258	1.312
	400	1.088	1.133	1.178	1.224	1.271
	450	1.078	1.118	1.158	1.199	1.240
	500	1.070	1.106	1.142	1.178	1.215
	550	1.064	1.096	1.129	1.162	1.195
180° TRAILWIND	350	1.114	1.172	1.228	1.286	1.343
	400	1.100	1.150	1.200	1.250	1.300
	450	1.089	1.133	1.178	1.222	1.267
	500	1.080	1.120	1.160	1.200	1.240
	550	1.073	1.109	1.146	1.182	1.218

Figure 32-1. Range Factor Chart

FOULED DECK RANGE

Drag Index - 33
Aircraft Weight (Less Fuel) - 11,948 lb.
Five Pylons and Guns
Includes 250 Pounds Reserve Fuel for Landing

Model: TA-4F
Engine: J52-P-6

Fuel On Board—Pounds	If You Are at Sea Level				If You Are at 10,000 Feet				If You Are at 20,000 Feet			
	Range at Sea Level	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 10,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 20,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots
2300	236	40,000	519	220	320	40,000	540	220	428	40,000	569	220
1900	190	40,000	412	220	261	40,000	435	220	349	40,000	463	220
1700	167	40,000	356	220	232	40,000	382	220	312	40,000	408	220
1500	144	40,000	302	220	201	40,000	327	220	271	40,000	354	220
1300	121	40,000	247	220	171	40,000	272	220	232	40,000	299	220
1100	98	40,000	190	220	141	40,000	215	220	192	40,000	241	220
900	75	35,000	135	230	110	40,000	159	220	152	40,000	186	220
700	52	25,000	83	235	80	35,000	103	230	111	40,000	129	220
500	29	15,000	41	245	49	20,000	55	240	71	25,000	75	235

Fuel On Board—Pounds	If You Are at 30,000 Feet				If You Are at 35,000 Feet				If You Are at 40,000 Feet			
	Range at 30,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 35,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 40,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots
2300	541	40,000	592	225	584	40,000	599	220	607	40,000	607	225
1900	444	40,000	487	220	483	40,000	496	220	504	40,000	504	225
1700	395	40,000	432	220	430	40,000	441	220	452	40,000	452	225
1500	346	40,000	379	220	378	40,000	386	220	398	40,000	398	225
1300	297	40,000	323	220	324	40,000	331	220	343	40,000	343	220
1100	246	40,000	266	220	270	40,000	276	220	287	40,000	287	220
900	196	40,000	210	220	215	40,000	219	220	230	40,000	230	220
700	144	40,000	153	220	160	40,000	163	220	173	40,000	173	220
500	93	35,000	95	230	104	35,000	104	230	114	40,000	114	220

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle—Speedbrakes Closed	Start Letdown From Altitude With Fuel/Distance Remaining
Feet	KCAS	Mach No.	KCAS	Pounds/NMI
Sea Level	330		185	250/0
10,000	315		185	290/17
20,000	295		185	325/34
30,000		0.74	185	355/53
35,000		0.74	185	370/63
40,000		0.74	185	385/74

Figure 32-2. Fouled Deck Range

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BINGO RANGE

Drag Index - 60
Aircraft Weight (Less Fuel) - 12,345 lb.
Five Pylons, Guns, and 2-300 Gallon External Tanks
Includes 800 Pounds Reserve Fuel for Landing

Model: TA-4F
Engine: J52-P-6

Fuel On Board—Pounds	If You Are at Sea Level				If You Are at 10,000 Feet				If You Are at 20,000 Feet			
	Range at Sea Level	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 10,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 20,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots
2700	201	40,000	402	220	278	40,000	428	220	360	40,000	453	220
2500	180	40,000	357	220	250	40,000	383	220	326	40,000	409	220
2300	159	40,000	312	220	222	40,000	338	220	290	40,000	363	220
2100	138	40,000	265	220	195	40,000	291	220	255	40,000	316	220
1900	117	40,000	218	220	167	40,000	244	220	219	40,000	270	220
1700	96	40,000	171	220	139	40,000	196	220	184	40,000	222	220
1500	75	35,000	122	230	111	40,000	147	220	147	40,000	173	220
1300	54	25,000	79	235	83	35,000	99	230	111	40,000	124	220
1100	32	15,000	45	240	55	20,000	60	235	75	25,000	77	230

Fuel On Board—Pounds	If You Are at 30,000 Feet				If You Are at 35,000 Feet				If You Are at 40,000 Feet			
	Range at 30,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 35,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude	Range at 40,000 ft.	Optimum Altitude	Range at Optimum Altitude	KCAS at Optimum Altitude
	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots	NMI	Feet	NMI	Knots
2700	444	40,000	478	220	480	40,000	484	220	486	35,000	488	235
2500	404	40,000	433	220	435	40,000	438	220	442	35,000	443	235
2300	361	40,000	387	220	389	40,000	394	220	398	40,000	398	220
2100	318	40,000	341	220	344	40,000	348	220	354	40,000	354	220
1900	274	40,000	294	220	298	40,000	302	220	308	40,000	308	220
1700	231	40,000	247	220	251	40,000	254	220	261	40,000	261	220
1500	187	40,000	199	220	204	40,000	206	220	214	40,000	214	220
1300	142	40,000	150	220	156	40,000	158	220	165	40,000	165	220
1100	97	35,000	98	230	107	40,000	108	220	116	40,000	116	220

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle—Speedbrakes Closed	Start Letdown From Altitude With Fuel/Distance Remaining
Feet	KCAS	Mach No.	KCAS	Pounds/NMI
Sea Level	315		185	800/0
10,000	300		185	835/15
20,000	285		185	865/32
30,000	265		185	895/49
35,000		0.72	185	910/59
40,000		0.72	185	925/69

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Figure 32-3. Bingo Range Chart

BINGO RANGE — GEAR DOWN
AIRCRAFT DRAG INDEX – 390 (GEAR DOWN)
WEIGHT (LESS FUEL) – 12,561 POUNDS
FIVE PYLONS, GUNS, AND TWO 300-GALLON EXTERNAL TANKS
INCLUDES 800 POUNDS RESERVE FUEL FOR LANDING

MODEL: TA-4F/TA-4J
ENGINE: J52-P-6

DATA AS OF: 1 SEPT 1968
DATA BASIS: ESTIMATED

FUEL ON BOARD — POUNDS	IF YOU ARE AT SEA LEVEL				IF YOU ARE AT 10,000 FEET			
	RANGE AT SEA LEVEL	OPTIMUM ALTITUDE	RANGE AT OPTIMUM ALTITUDE	KCAS AT OPTIMUM ALTITUDE	RANGE AT 10,000 FEET	OPTIMUM ALTITUDE	RANGE AT OPTIMUM ALTITUDE	KCAS AT OPTIMUM ALTITUDE
	NMI	FEET	NMI	KNOTS	NMI	FEET	NMI	KNOTS
2700	130	25,000	189	195	168	25,000	204	195
2500	116	25,000	168	195	152	25,000	183	195
2300	103	25,000	146	190	135	25,000	162	195
2100	89	25,000	125	190	118	25,000	140	190
1900	76	25,000	103	190	101	25,000	119	190
1700	62	25,000	81	190	84	25,000	96	190
1500	49	20,000	60	190	67	25,000	74	190
1300	35	15,000	40	195	50	20,000	53	190
1100	21	10,000	22	195	32	15,000	33	195

FUEL ON BOARD — POUNDS	IF YOU ARE AT 15,000 FEET				IF YOU ARE AT 20,000 FEET			
	RANGE AT 15,000 FEET	OPTIMUM ALTITUDE	RANGE AT OPTIMUM ALTITUDE	KCAS AT OPTIMUM ALTITUDE	RANGE AT 20,000 FEET	OPTIMUM ALTITUDE	RANGE AT OPTIMUM ALTITUDE	KCAS AT OPTIMUM ALTITUDE
	NMI	FEET	NMI	KNOTS	NMI	FEET	NMI	KNOTS
2700	189	25,000	212	195	208	25,000	219	195
2500	170	25,000	191	195	188	25,000	198	195
2300	151	25,000	169	195	168	25,000	176	195
2100	133	25,000	147	190	148	25,000	155	195
1900	114	25,000	126	190	127	25,000	133	190
1700	96	25,000	104	190	107	25,000	111	190
1500	77	25,000	81	190	86	25,000	88	190
1300	57	20,000	59	190	65	25,000	68	190
1100	38	20,000	39	190	44	20,000	44	190

PRESSURE ALTITUDE	CLIMB SPEED MILITARY THRUST		DESCENT SPEED ENGINE IDLE – SPEEDBRAKES CLOSED	START LETDOWN FROM ALTITUDE WITH FUEL REMAINING
FEET	KCAS	MACH NO.	KCAS	POUNDS
SEA LEVEL	205	0.310	156	800/0
10,000	205	0.371	156	850/10
15,000	205	0.409	156	866/15
20,000	205	0.451	156	878/20
25,000	205	0.588	156	888/25

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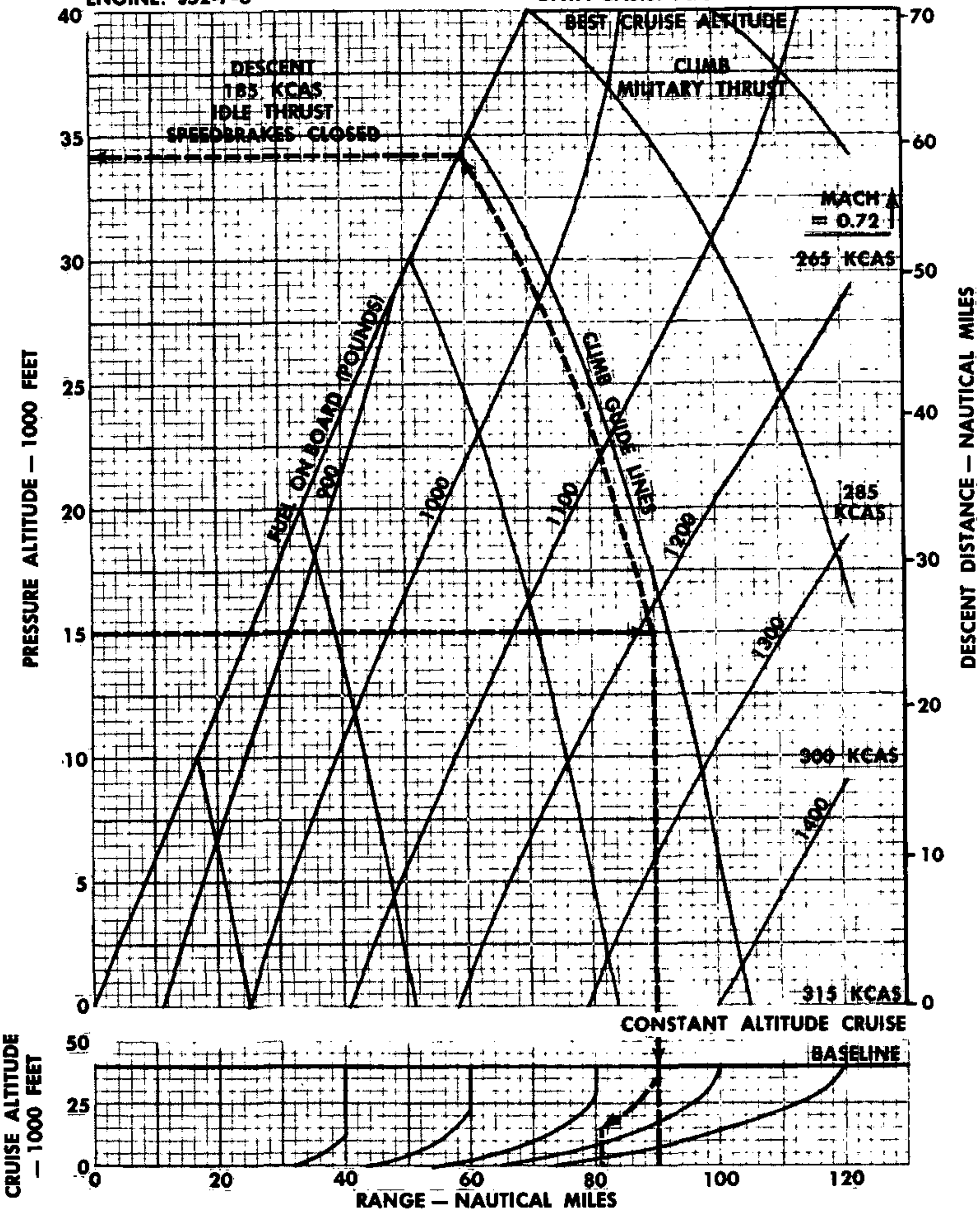
Figure 32-4. Bingo Range – Gear Down

BINGO RANGE PLOT

DRAG INDEX — 60
AIRCRAFT WEIGHT (LESS FUEL) = 12,345 POUNDS
FIVE PYLONS, GUNS AND TWO 300 GALLON EXTERNAL TANKS
RESERVE FUEL FOR LANDING = 800 POUNDS

MODEL: TA-4F
ENGINE: J52-P-6

DATA AS OF: 1 JANUARY 1967
DATA BASIS: FLIGHT TEST (NAVY)



PRESSURE ALTITUDE (1000 FEET)	0	10	20	30	35	40
CRUISE SPEED (KCAS)	255	245	235	230	230	220

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Figure 32-5. Bingo Range Plot

LONG RANGE CRUISE

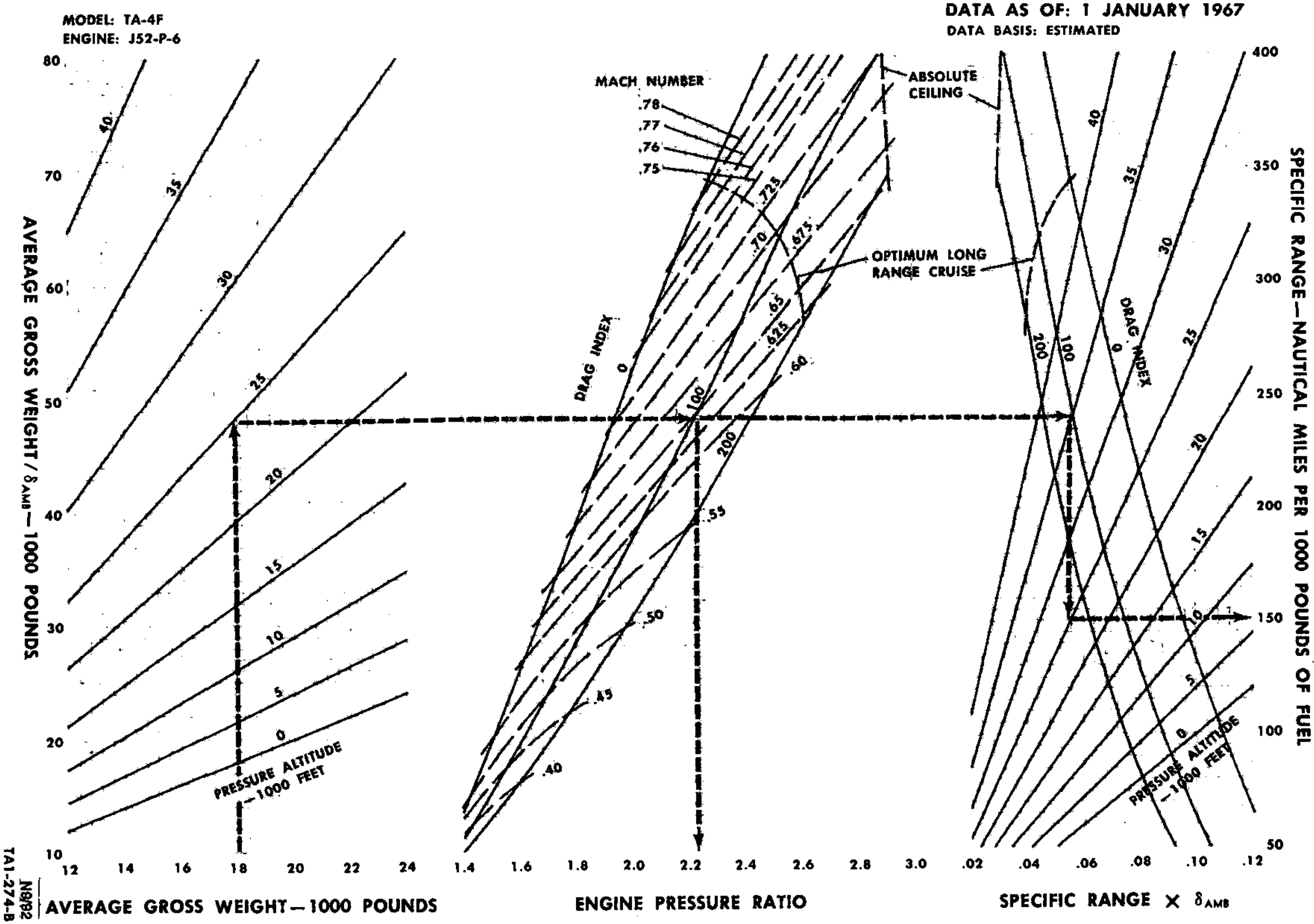

Figure 32-6. Long-Range Cruise

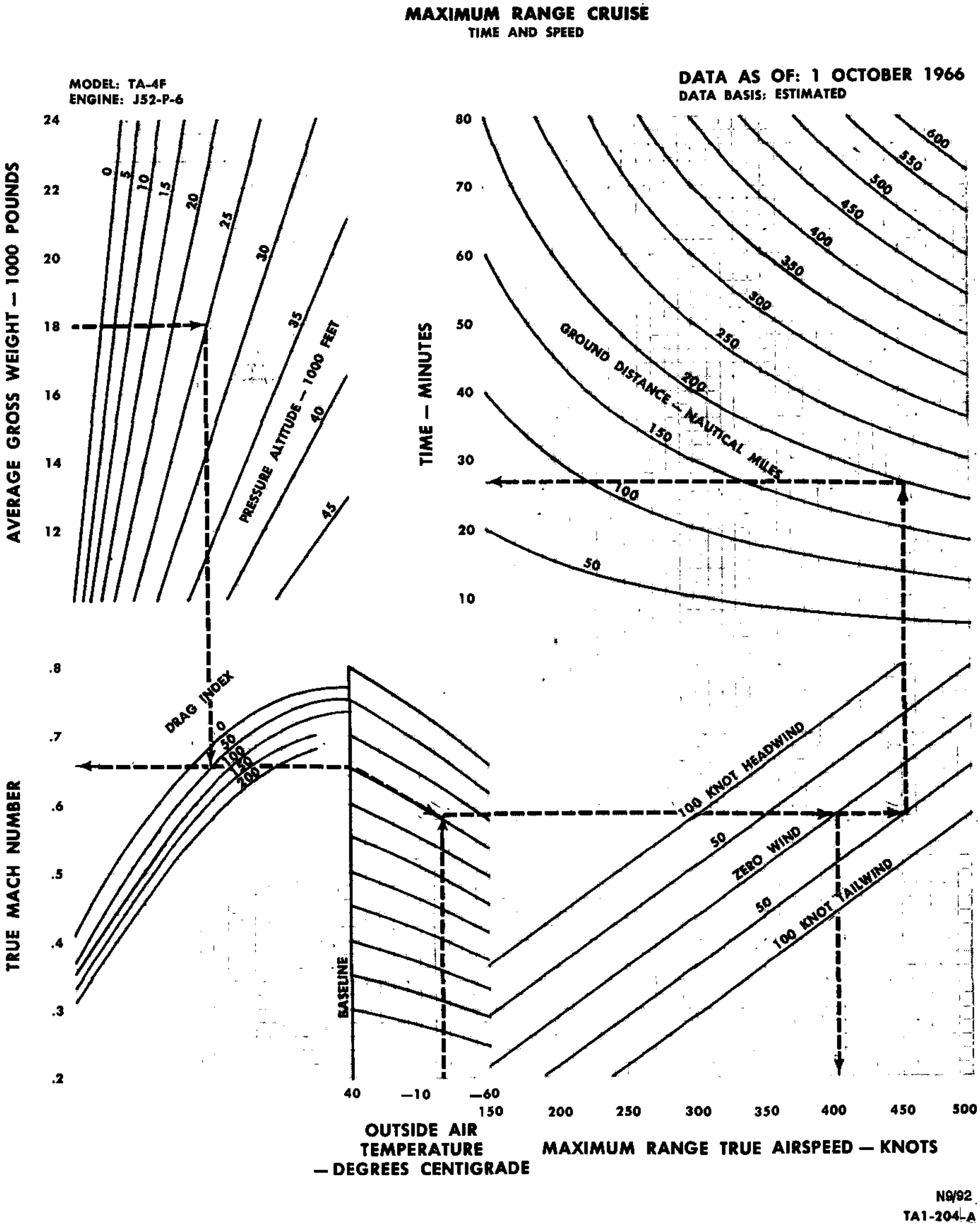

Figure 32-7. Maximum Range Cruise – Time and Speed

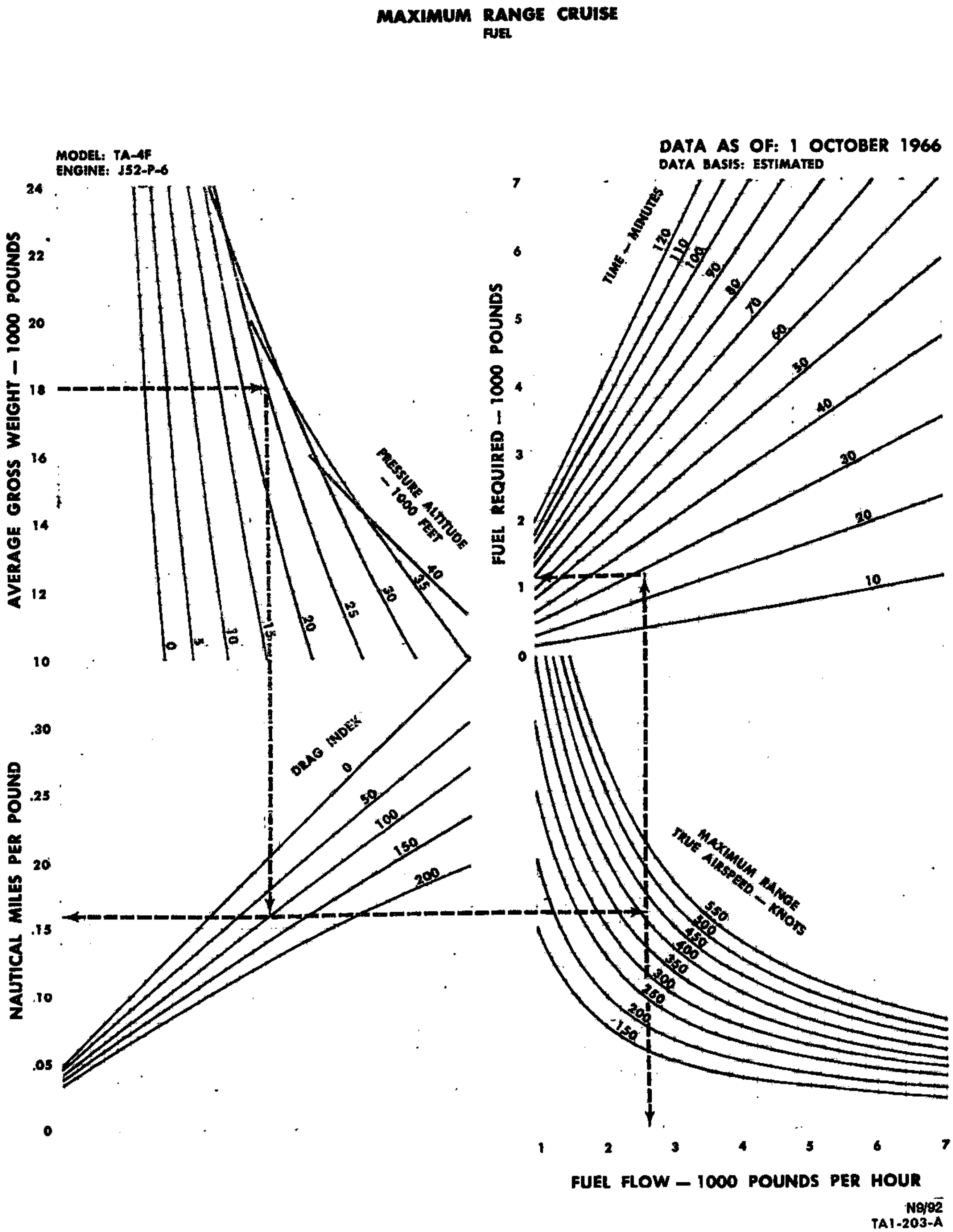

Figure 32-8. Maximum Range Cruise – Fuel

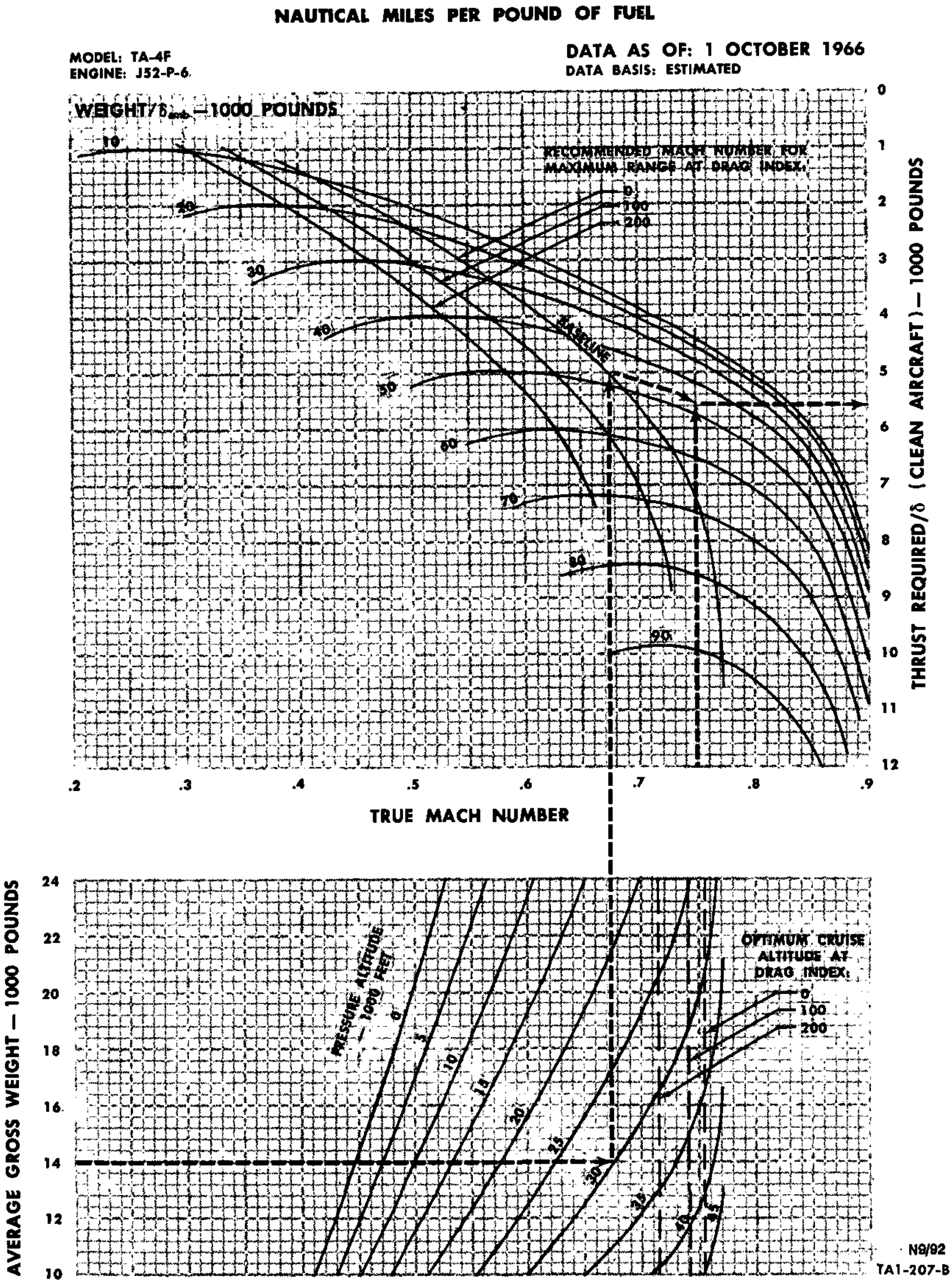

Figure 32-9. Nautical Miles Per Pound of Fuel (Sheet 1 of 4)

NAUTICAL MILES PER POUND OF FUEL

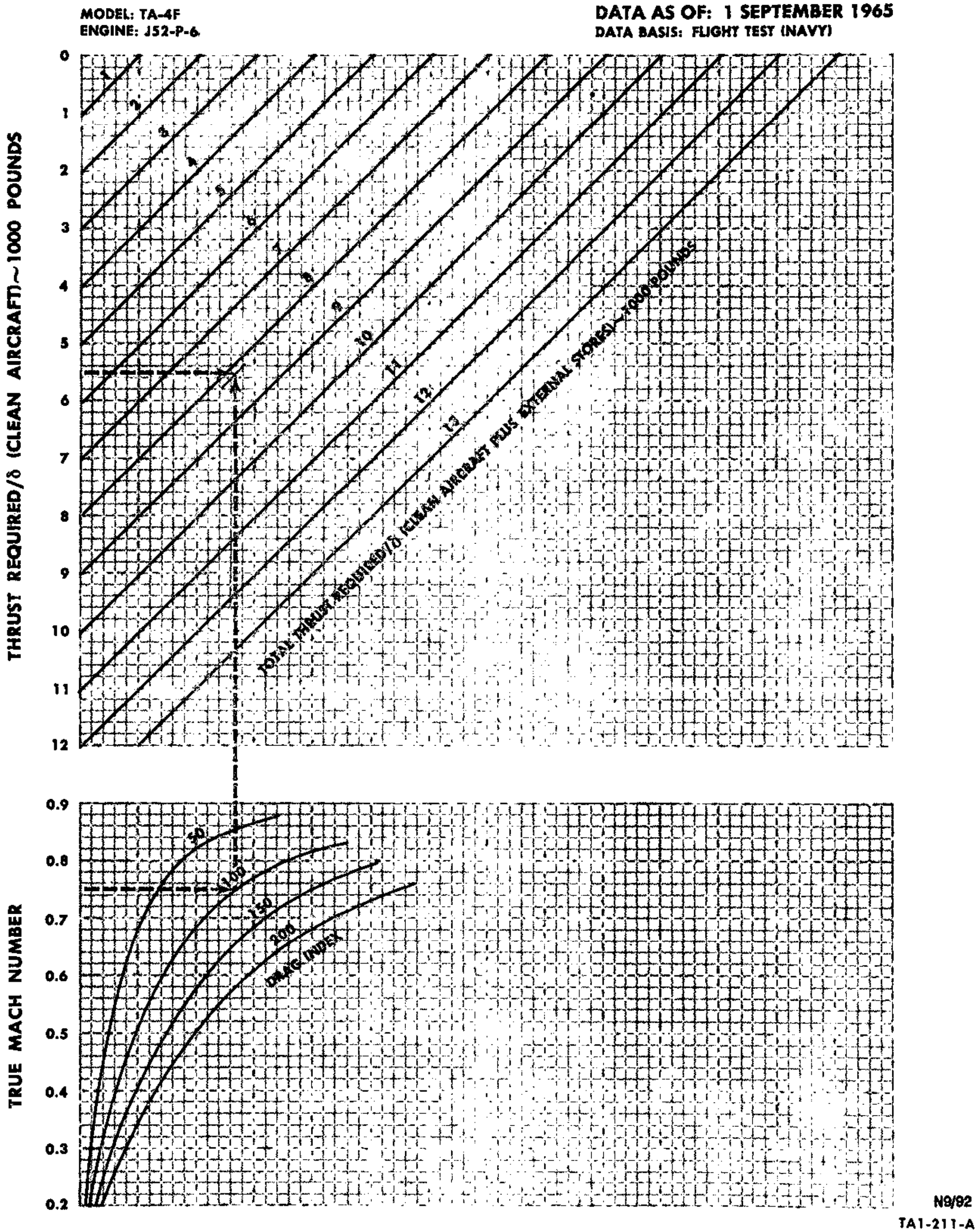

Figure 32-9. Nautical Miles Per Pound of Fuel (Sheet 2 of 4)

NAUTICAL MILES PER POUND OF FUEL

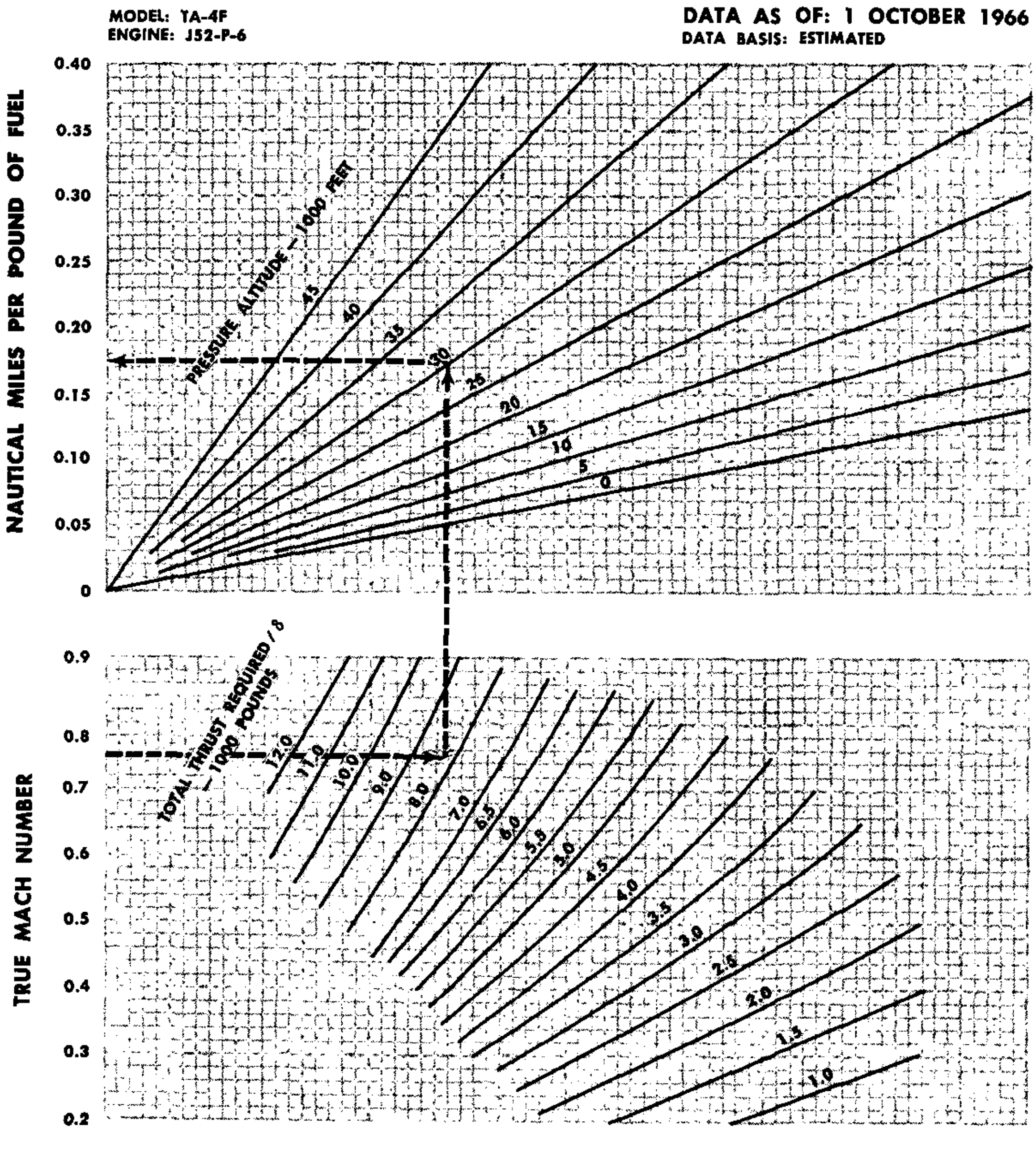

Figure 32-9. Nautical Miles Per Pound of Fuel (Sheet 3 of 4)

NAUTICAL MILES PER POUND OF FUEL

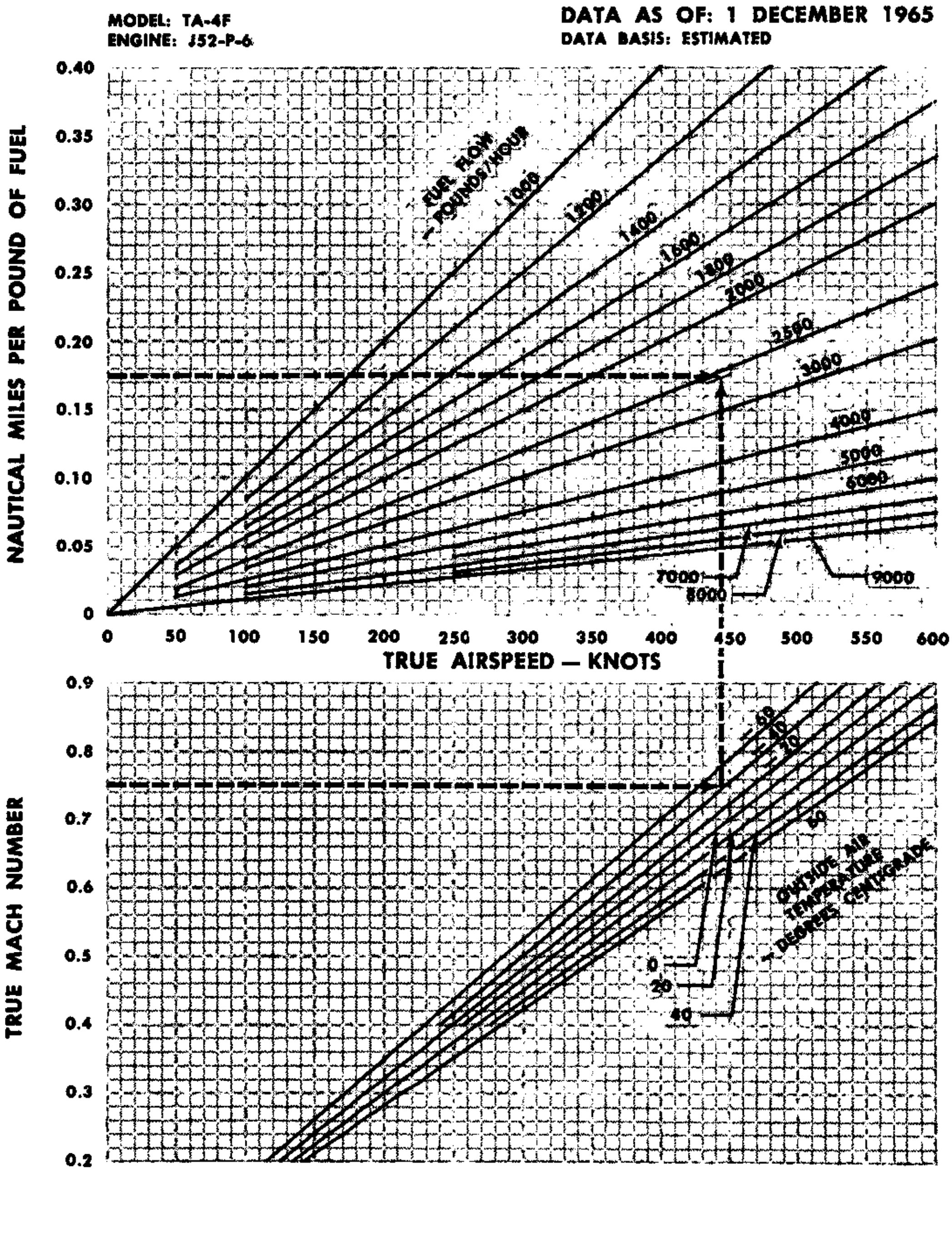

Figure 32-9. Nautical Miles Per Pound of Fuel (Sheet 4 of 4)

ENGINE PRESSURE RATIO FOR CRUISE

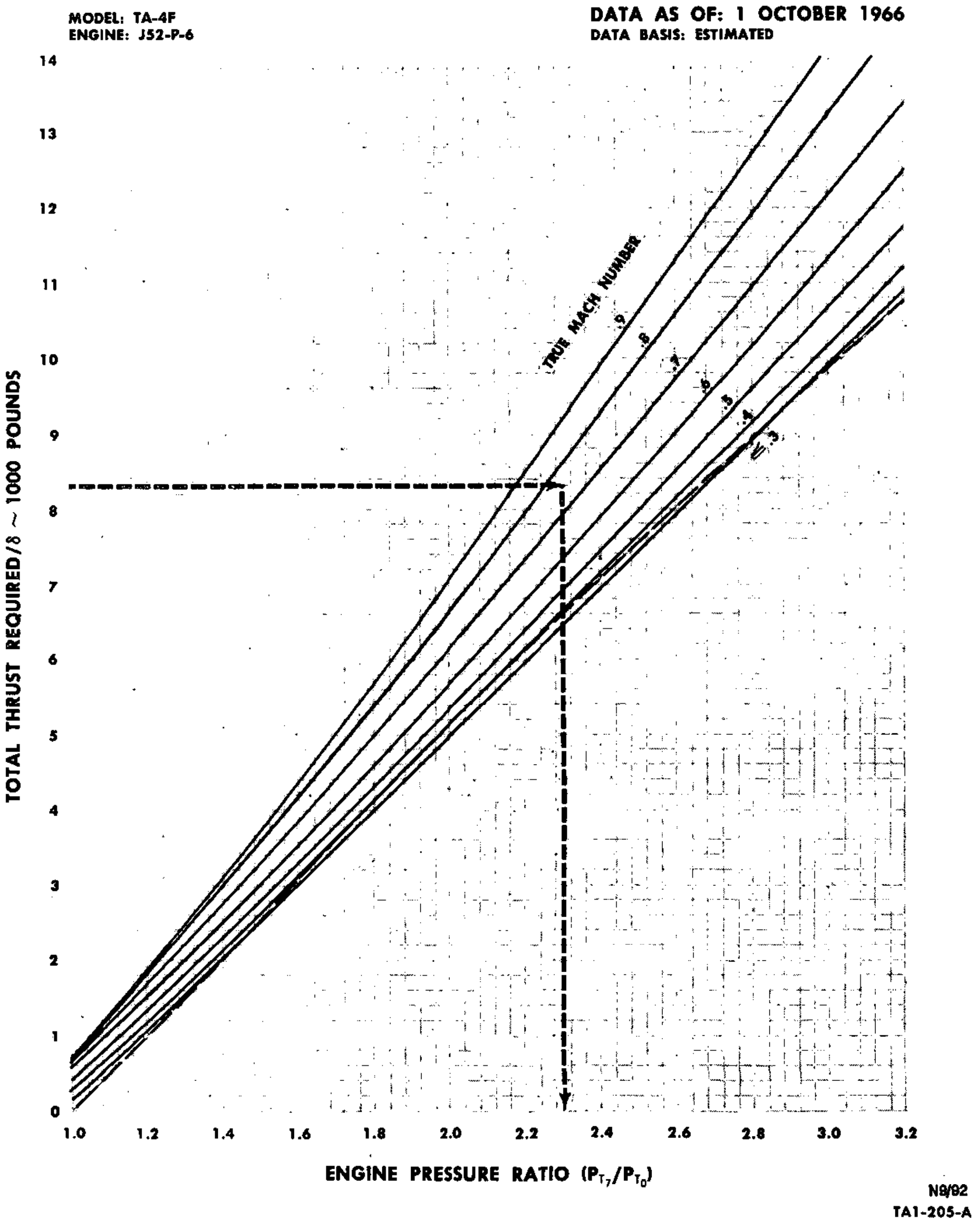

Figure 32-10. Engine Pressure Ratio for Cruise

CHAPTER 33

Endurance

See Figures 33-1 through 33-4.

FOULED DECK ENDURANCE CHART

Drag Index = 33
Aircraft Weight (Less Fuel) = 11, 948 lb.
Five Pylons and Guns
Includes 250 Pounds Reserve Fuel for Landing

Model: TA-4F
Engine: J52-P-6

Data as of: 1 January 1967
Data Basis: Estimated

Fuel On Board—Pounds	If You Are at Sea Level				If You Are at 10, 000 Feet				If You Are at 20, 000 Feet			
	Endur-ance at Sea Level	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude	Endur-ance at 10, 000 ft.	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude	Endur-ance at 20, 000 ft.	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude
	Min	Feet	Min	Knots	Min	Feet	Min	Knots	Min	Feet	Min	Knots
2300	64	35,000	88	190	79	35,000	92	190	90	35,000	96	190
1900	52	35,000	71	190	65	35,000	76	190	75	35,000	79	190
1700	45	35,000	63	190	58	35,000	67	190	67	35,000	71	190
1500	40	35,000	54	190	51	35,000	58	190	59	35,000	62	190
1300	34	30,000	46	190	44	35,000	50	190	51	35,000	54	190
1100	27	30,000	37	190	36	35,000	41	190	43	35,000	45	190
900	21	25,000	28	190	29	35,000	32	190	35	35,000	36	190
700	15	25,000	19	190	21	25,000	23	190	26	25,000	26	190
500	8	15,000	10	185	13	20,000	14	185	18	20,000	18	185

Fuel On Board—Pounds	If You Are at 30,000 Feet				If You Are at 35,000 Feet				If You Are at 40,000 Feet			
	Endur-ance at 30,000 ft.	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude	Endur-ance at 35,000 ft.	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude	Endur-ance at 40,000 ft.	Optimum Altitude	Endur-ance at Opti-mum Altitude	KCAS at Optimum Altitude
	Min	Feet	Min	Knots	Min	Feet	Min	Knots	Min	Feet	Min	Knots
2300	99	35,000	100	195	101	35,000	101	195	99	30,000	103	195
1900	83	35,000	83	190	85	35,000	85	190	83	35,000	86	190
1700	75	35,000	75	190	76	35,000	76	190	75	35,000	78	190
1500	66	35,000	66	190	68	35,000	68	190	67	35,000	70	190
1300	57	35,000	58	190	59	35,000	59	190	59	35,000	61	190
1100	48	35,000	49	190	50	35,000	50	190	51	35,000	52	190
900	39	35,000	40	190	41	35,000	41	190	42	35,000	43	190
700	30	35,000	31	190	32	35,000	32	190	33	35,000	33	190
500	21	35,000	21	190	23	35,000	23	190	24	35,000	24	190

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle — Speedbrakes Closed	Start Letdown From Altitude With Fuel/Time Remaining
Feet	KCAS	Mach No.	KCAS	Pounds/Minutes
Sea Level	330		185	250/0
10,000	315		185	290/5
20,000	295		185	323/10
30,000		0.74	185	355/14
35,000		0.74	185	370/16
40,000		0.74	185	385/18

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Figure 33-1. Fouled Deck Endurance

BINGO ENDURANCE CHART

Drag Index = 60
Aircraft Weight (Less Fuel) = 12,345 lb.
Five Pylons and Guns
Includes 800 Pounds Reserve Fuel for Landing
Two 300-Gallon External Tanks

Model: TA-4F
Engine: J52-P-6

Data as of: 1 January 1967
Data Basis: Estimated

Fuel On Board—Pounds	If You Are at Sea Level				If You Are at 10,000 Feet				If You Are at 20,000 Feet			
	Endurance at Sea Level	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude	Endurance at 10,000 ft	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude	Endurance at 20,000 ft	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude
	Min	Feet	Min	Knots	Min	Feet	Min	Knots	Min	Feet	Min	Knots
2700	56	30,000	72	195	68	30,000	76	195	77	30,000	80	195
2500	51	30,000	65	195	61	30,000	68	195	70	30,000	73	195
2300	45	30,000	57	190	55	30,000	61	195	63	30,000	65	195
2100	39	30,000	49	190	48	30,000	53	195	56	30,000	58	195
1900	33	30,000	42	190	42	30,000	45	190	48	30,000	50	195
1700	27	25,000	34	190	35	30,000	38	190	41	30,000	42	190
1500	21	20,000	26	190	28	25,000	30	190	34	25,000	34	190
1300	15	20,000	18	190	21	20,000	22	190	26	25,000	26	190
1100	9	15,000	11	190	14	20,000	14	190	18	20,000	18	190

Fuel On Board—Pounds	If You Are at 30,000 Feet				If You Are at 35,000 Feet				If You Are at 40,000 Feet			
	Endurance at 30,000 ft.	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude	Endurance at 35,000 ft	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude	Endurance at 40,000 ft	Optimum Altitude	Endurance at Optimum Altitude	KCAS at Optimum Altitude
	Min	Feet	Min	Knots	Min	Feet	Min	Knots	Min	Feet	Min	Knots
2700	84	30,000	84	195	84	30,000	85	195	79	30,000	86	195
2500	77	30,000	77	195	77	30,000	78	195	72	30,000	79	195
2300	69	30,000	69	195	69	30,000	70	195	66	30,000	71	195
2100	62	30,000	62	195	62	30,000	63	195	59	30,000	64	195
1900	54	30,000	54	195	54	30,000	55	195	53	30,000	56	195
1700	46	30,000	46	195	46	30,000	47	195	46	30,000	49	190
1500	38	30,000	38	190	39	30,000	39	190	39	30,000	41	190
1300	30	30,000	30	190	31	30,000	31	190	32	30,000	33	190
1100	22	30,000	22	190	23	30,000	23	190	24	30,000	25	190

Pressure Altitude	Climb Speed Military Thrust		Descent Speed Engine Idle — Speedbrakes Closed	Start Letdown From Altitude With Fuel/Time Remaining
Feet	KCAS	Mach No.	KCAS	Pounds/Minutes
Sea Level	315		185	800/0
10,000	300		185	835/4
20,000	285		185	867/9
30,000	265		185	896/13
35,000		0.72	185	910/15
40,000		0.72	185	923/17

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Figure 33-2. Bingo Endurance Chart

MAXIMUM ENDURANCE SPEED

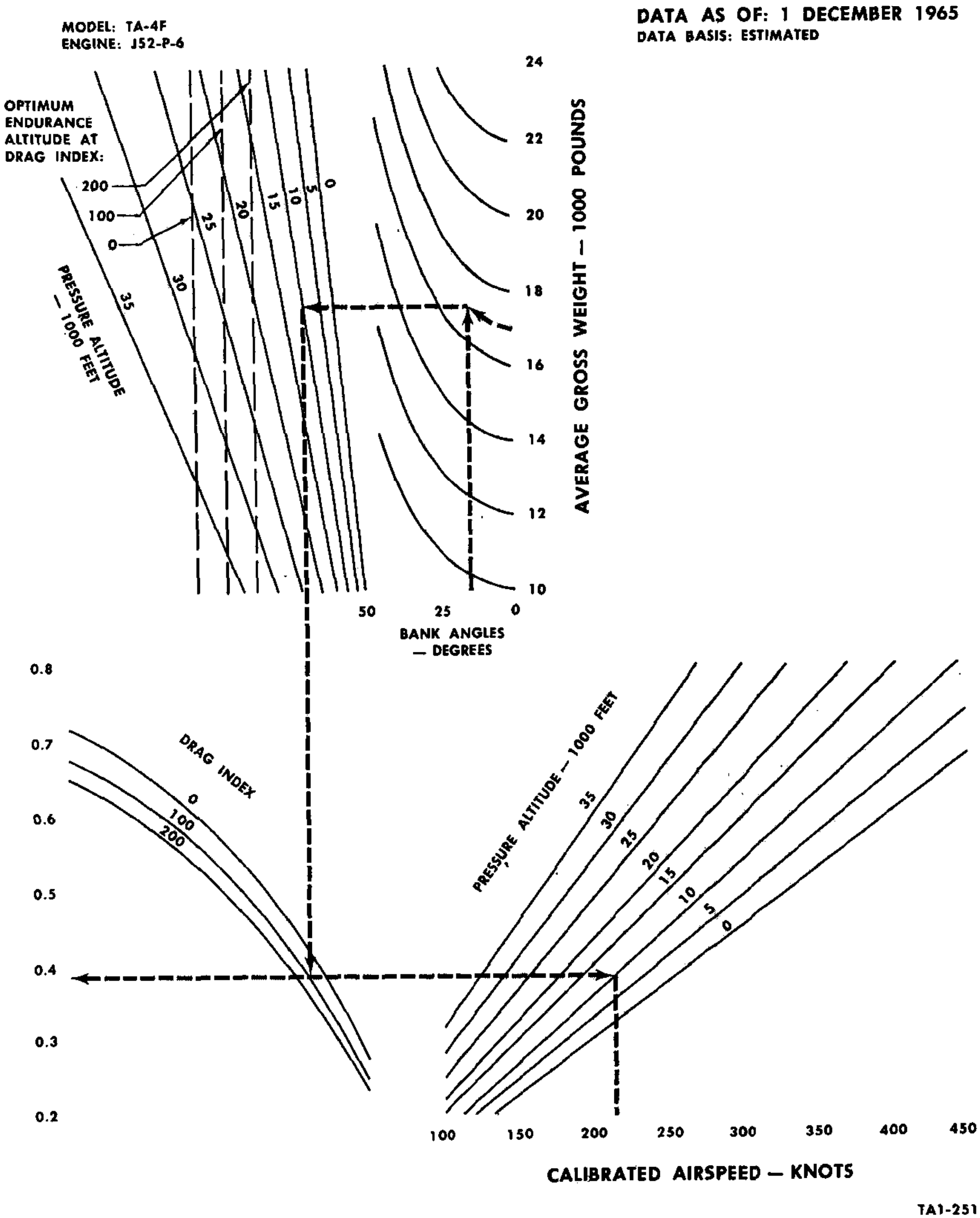
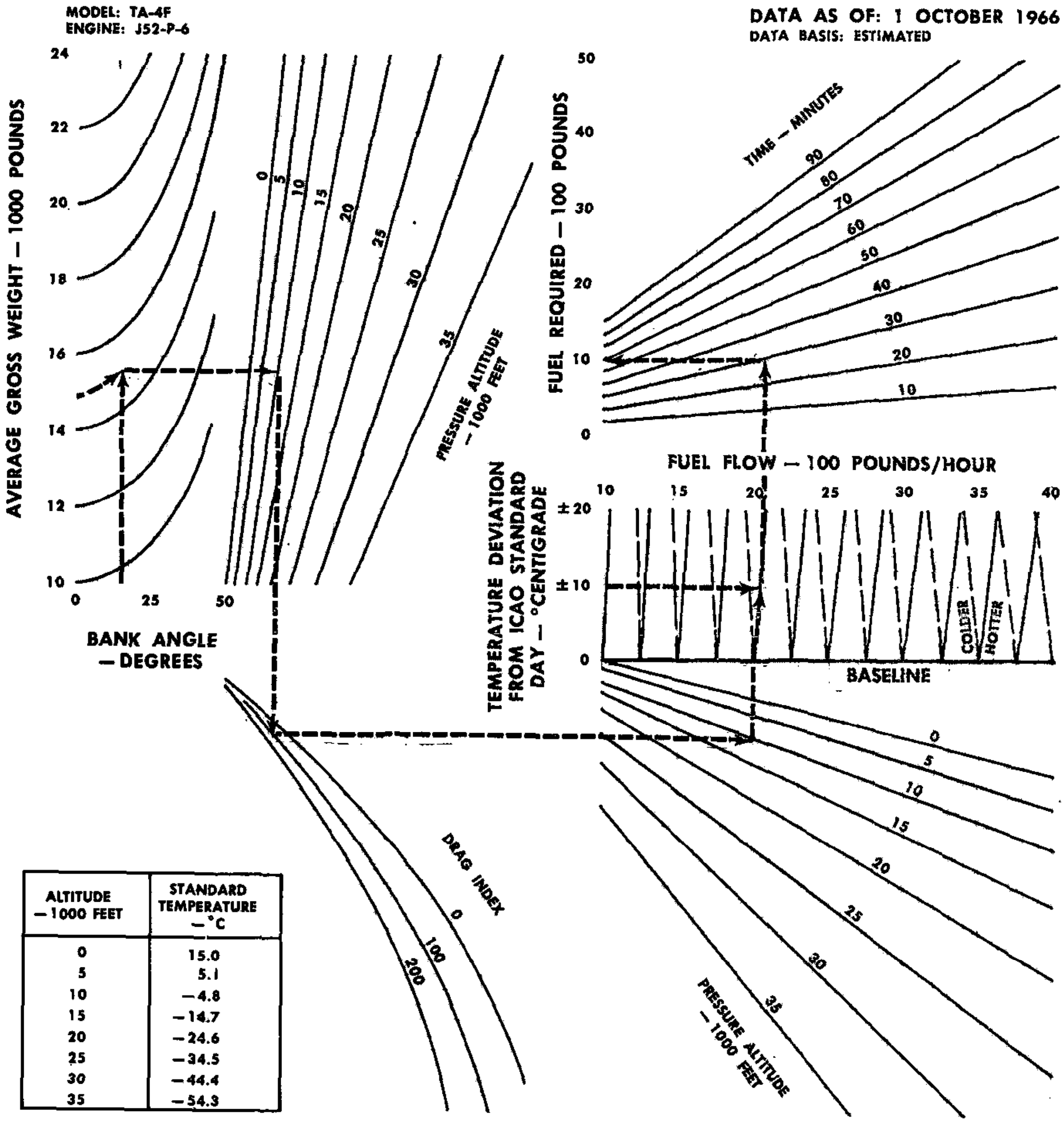


Figure 33-3. Maximum Endurance Speed

MAXIMUM ENDURANCE FUEL



ALTITUDE — 1000 FEET	STANDARD TEMPERATURE — °C
0	15.0
5	5.1
10	−4.8
15	−14.7
20	−24.6
25	−34.5
30	−44.4
35	−54.3

Figure 33-4. Maximum Endurance Fuel

CHAPTER 34

Air Refueling TA-4F

See Figures 34-1 through 34-4.

TANKER SPEED ENVELOPE
TANKER CONFIGURATION
ONE 300 GALLON REFUELING STORE
PLUS TWO 300 GALLON TANKS, THREE
PYLONS, NO GUNS OR AMMUNITION

MODEL: TA-4F
ENGINE: J52-P-6

DATA AS OF: 1 OCTOBER 1966
DATA BASIS: ESTIMATED

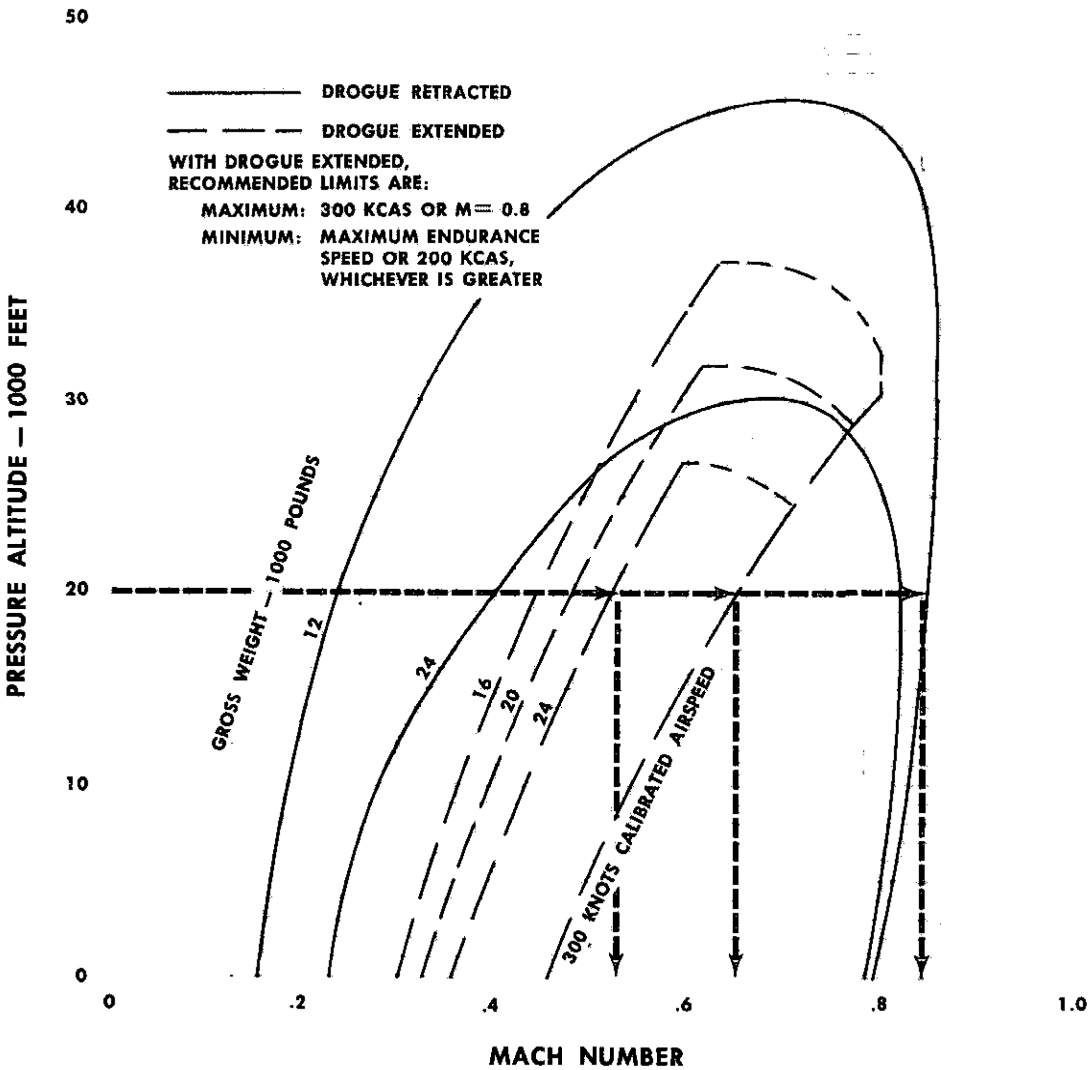


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Figure 34-1. Tanker Speed Envelope

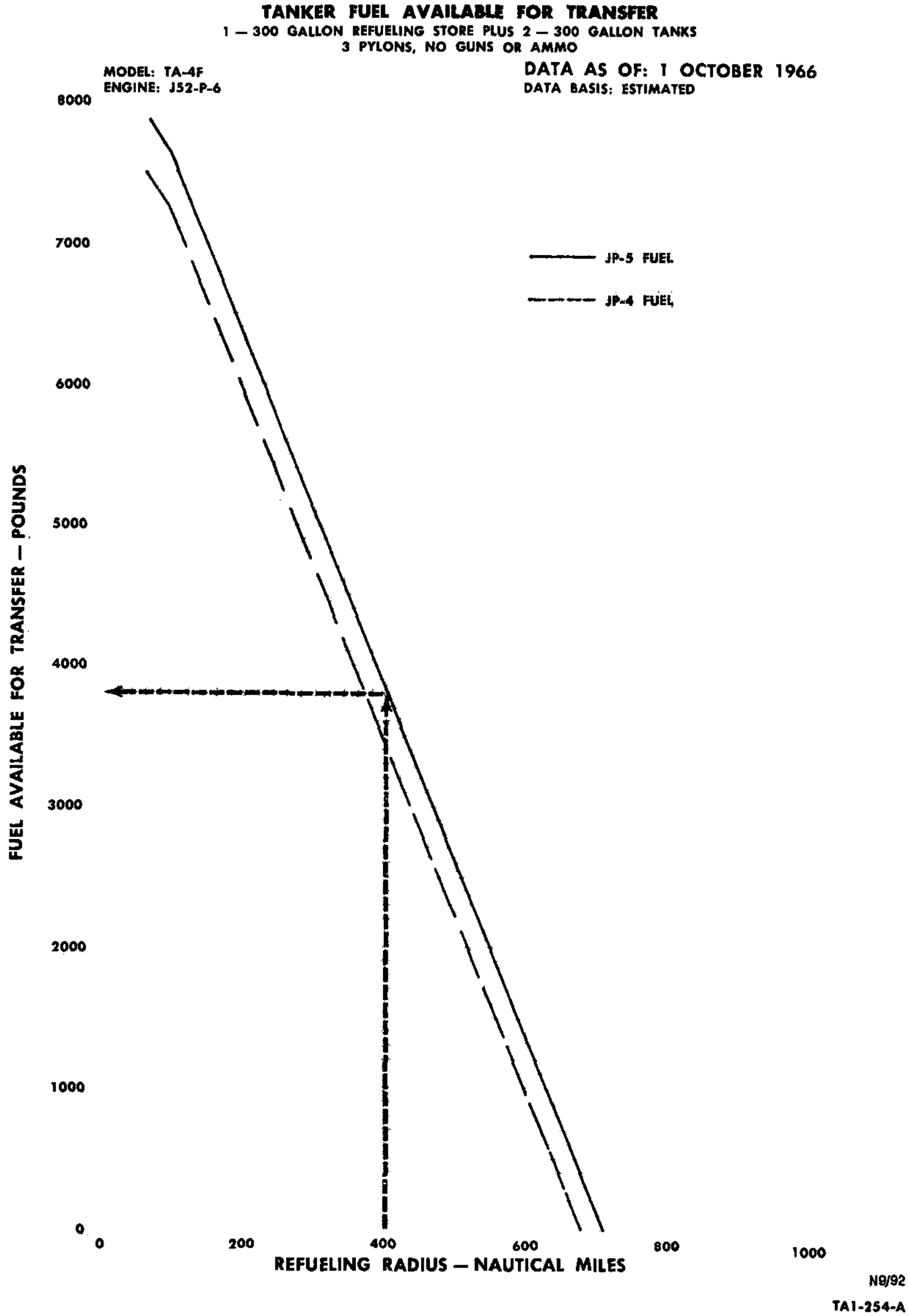


Figure 34-2. Tanker Fuel Available for Transfer

TANKER FUEL TRANSFER TIME
1 — 300 GALLON REFUELING STORE PLUS 2 — 300 GALLON TANKS
3 PYLONS, NO GUNS OR AMMO

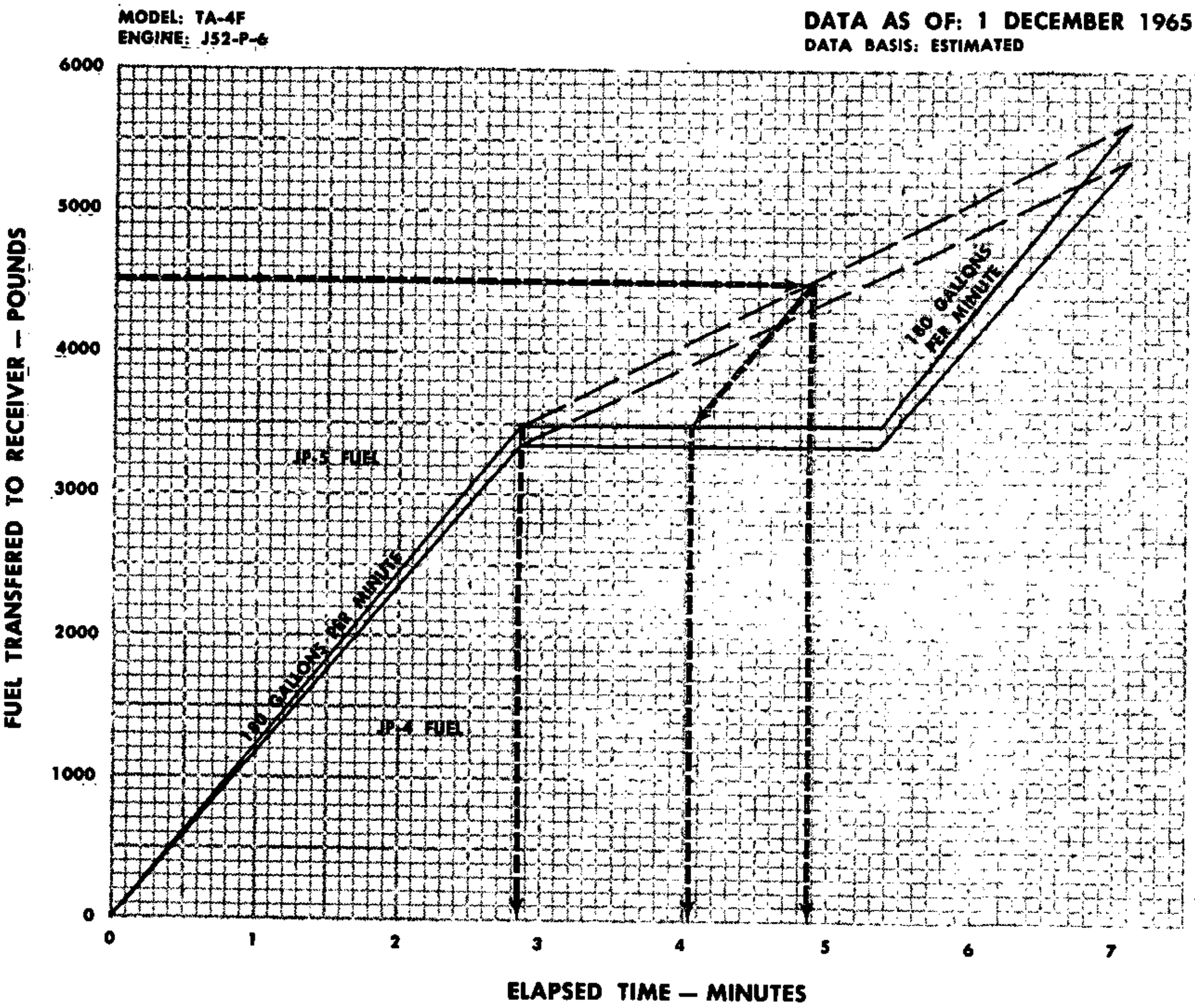


Figure 34-3. Tanker Fuel Transfer Time

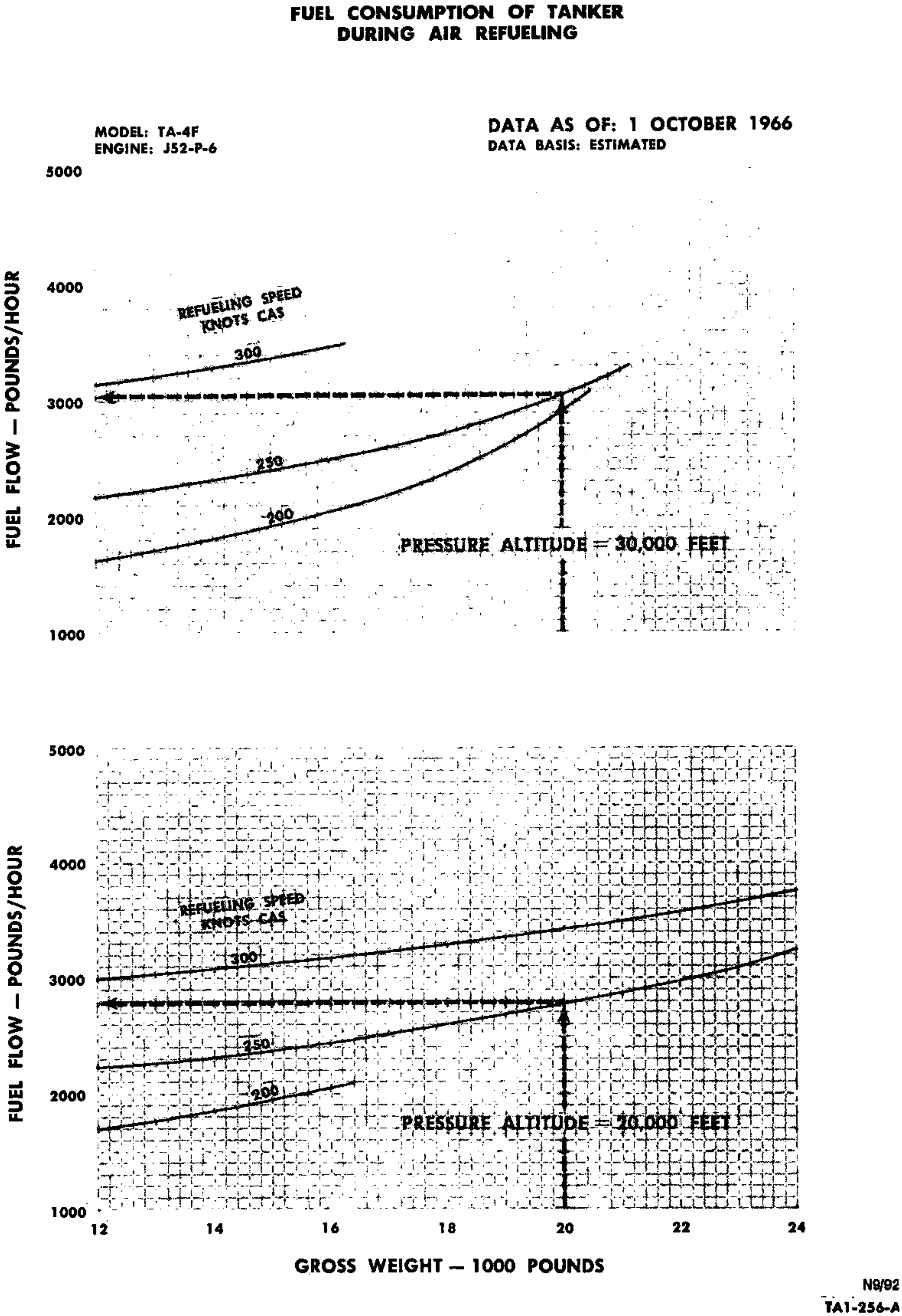


Figure 34-4. Fuel Consumption of Tanker During Air Refueling

CHAPTER 35

Descent

See Figures 35-1 through 35-3.

DESCENT FUEL

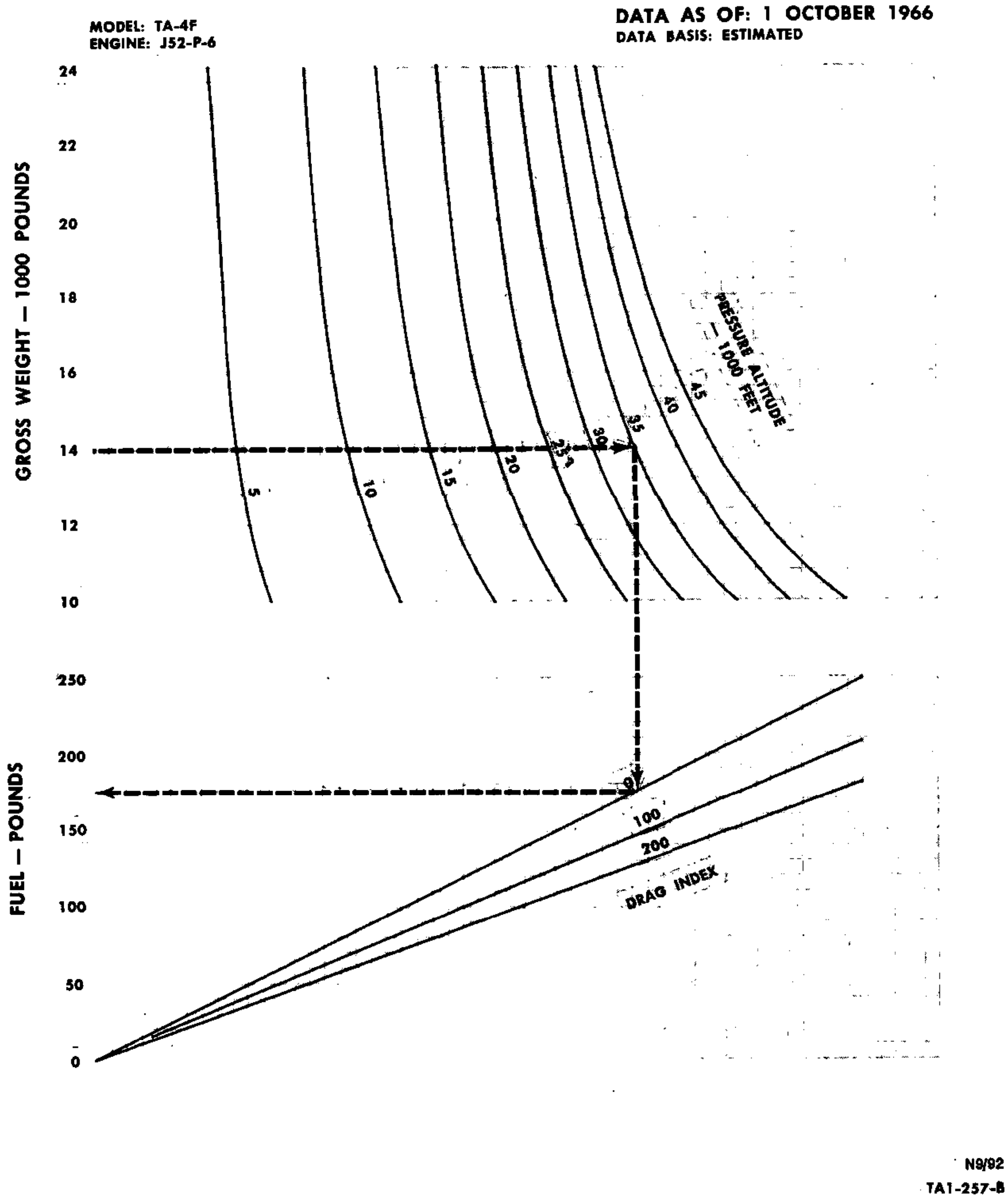
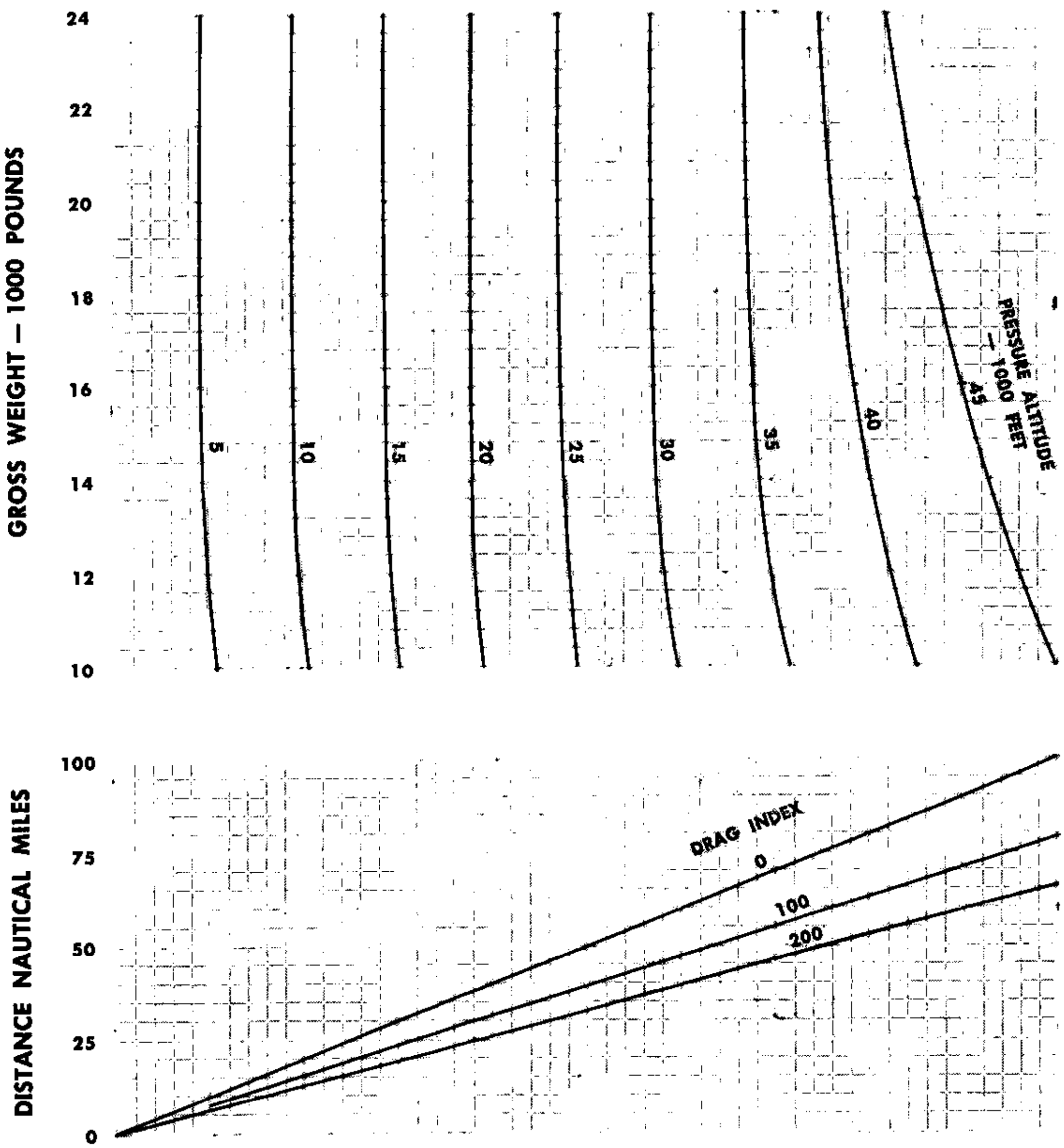


Figure 35-1. Descent Fuel

DESCENT DISTANCE
IDLE THRUST

MODEL: TA-4F
ENGINE: J52-P-6

DATA AS OF: 1 OCTOBER 1966
DATA BASIS: ESTIMATED



DESCENT SPEED SCHEDULE—KCAS

	GROSS WEIGHT — 1000 POUNDS							
DRAG INDEX	10	12	14	16	18	20	22	24
0	170	185	200	215	230	240	255	265
100	155	170	185	200	210	220	235	250
200	150	165	175	190	200	210	220	235

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Figure 35-2. Descent Distance

DESCENT TIME
IDLE THRUST

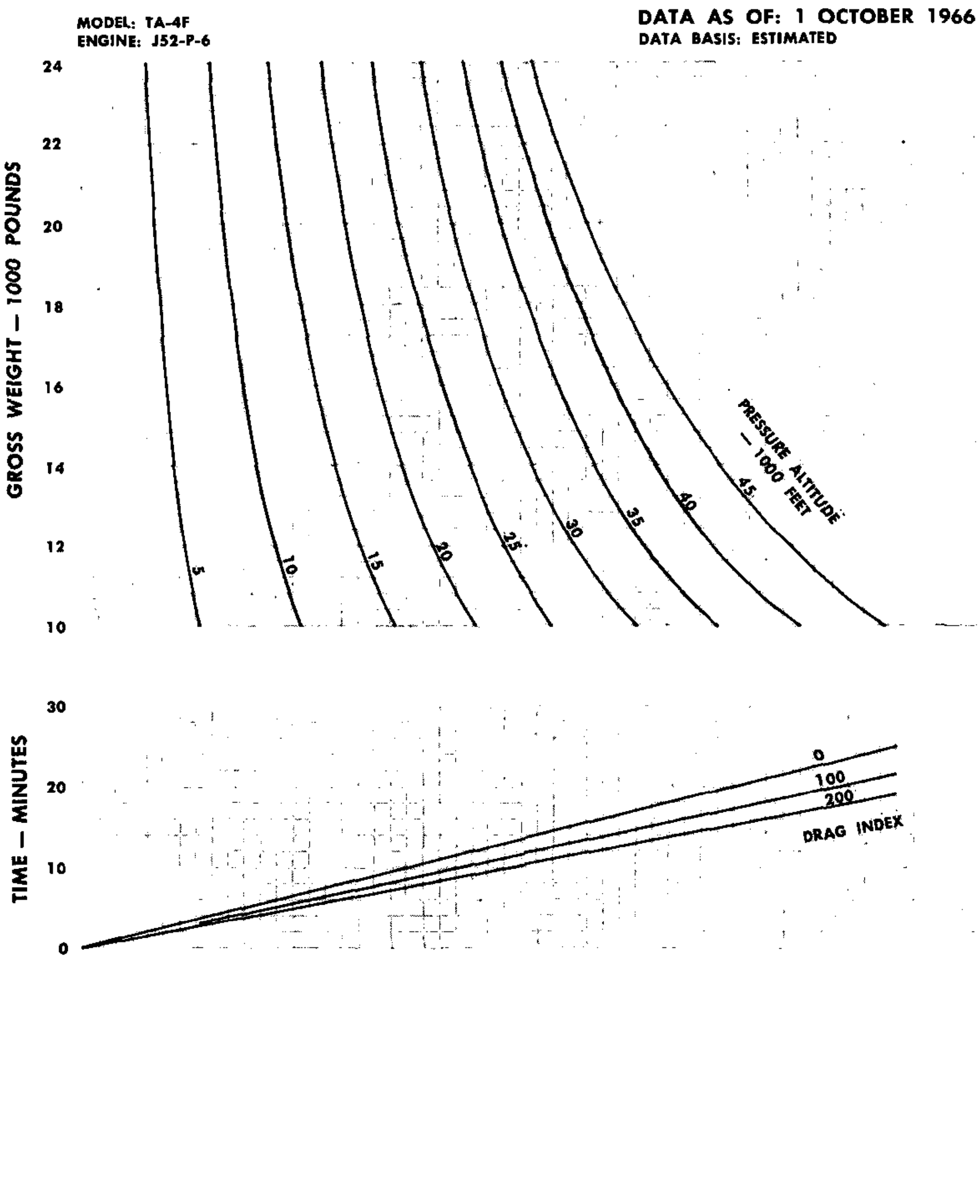


Figure 35-3. Descent Time

CHAPTER 36

Landing

See Figures 36-1 and 36-2.

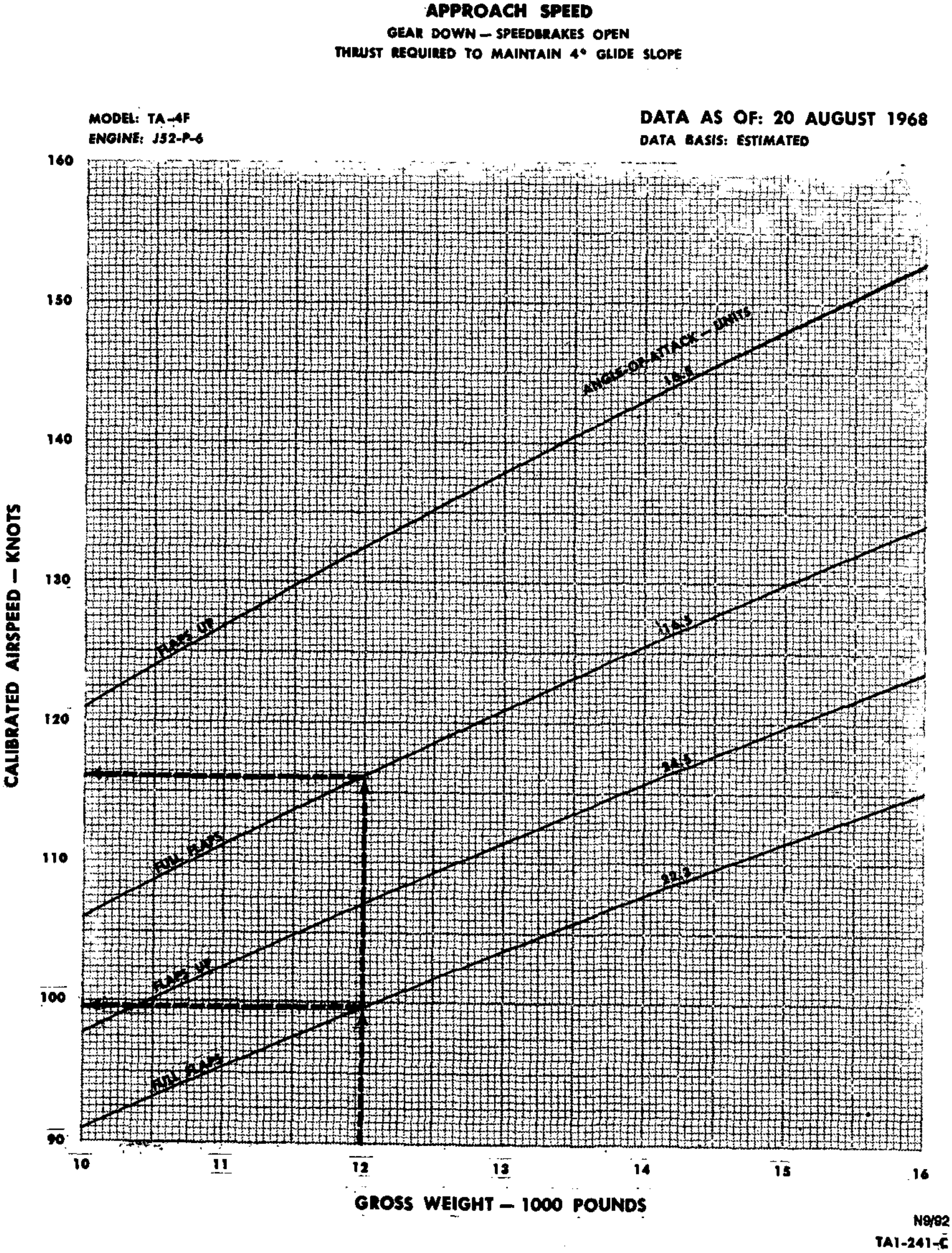


Figure 36-1. Approach Speed

LANDING DISTANCE

HARD SURFACE RUNWAY
DRY
SPEEDBRAKES AND SPOILERS OPEN
RCR = 23

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: FLIGHT TEST (NAVY AND CONTRACTOR)

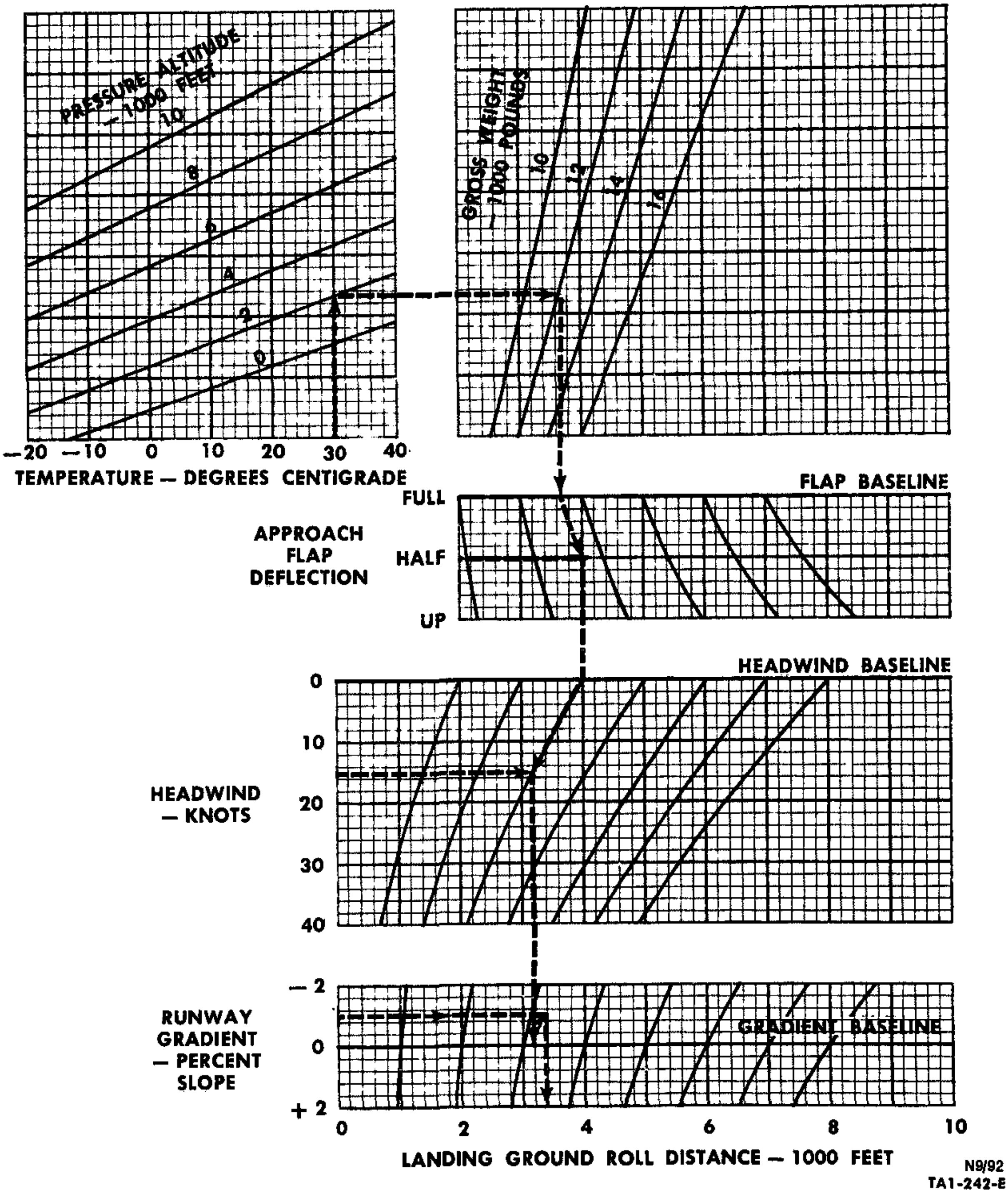


Figure 36-2. Landing Distance (Sheet 1 of 3)

LANDING DISTANCE

HARD SURFACE RUNWAY
WET
SPEEDBRAKES AND SPOILERS OPEN
RCR = 15

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

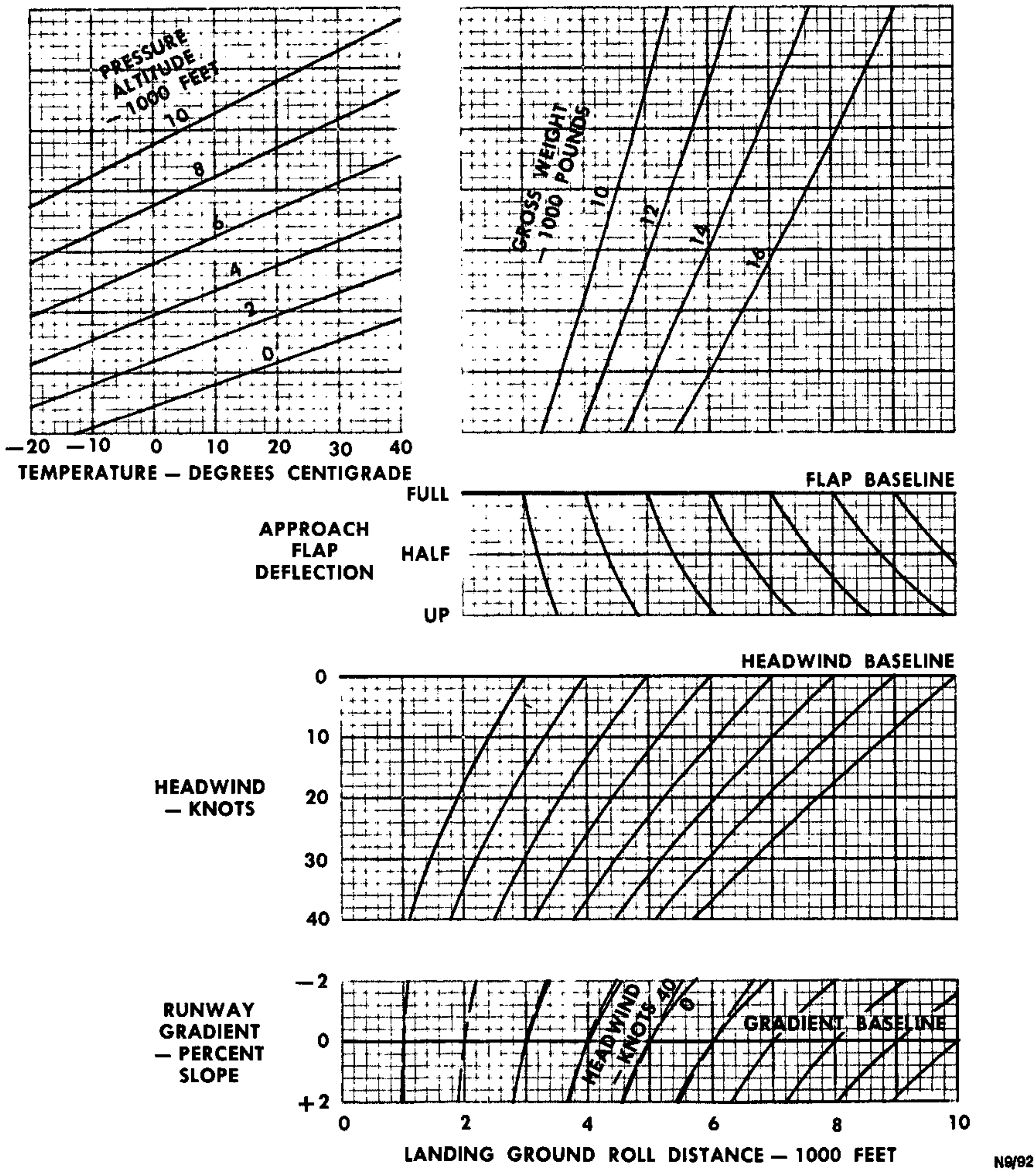


Figure 36-2. Landing Distance (Sheet 2 of 3)

LANDING DISTANCE

HARD SURFACE RUNWAY
SNOW AND ICE
SPEEDBRAKES AND SPOILERS OPEN
RCR = 9

MODEL: TA-4F/J
ENGINE: J52-P-6

DATA AS OF: 1 MAY 1972
DATA BASIS: ESTIMATED

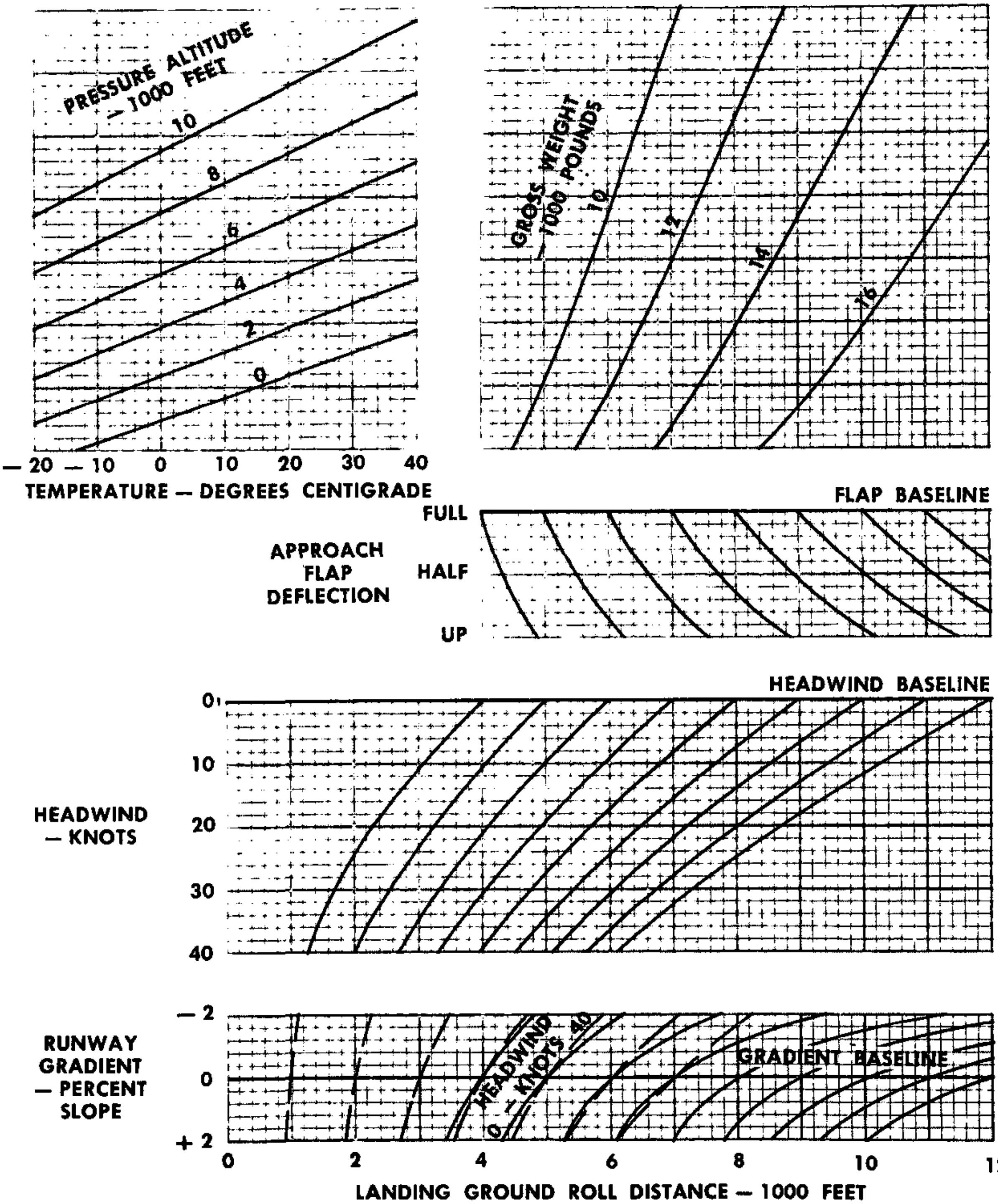


Figure 36-2. Landing Distance (Sheet 3 of 3)

CHAPTER 37

Combat Performance

See Figures 37-1 through 37-4.

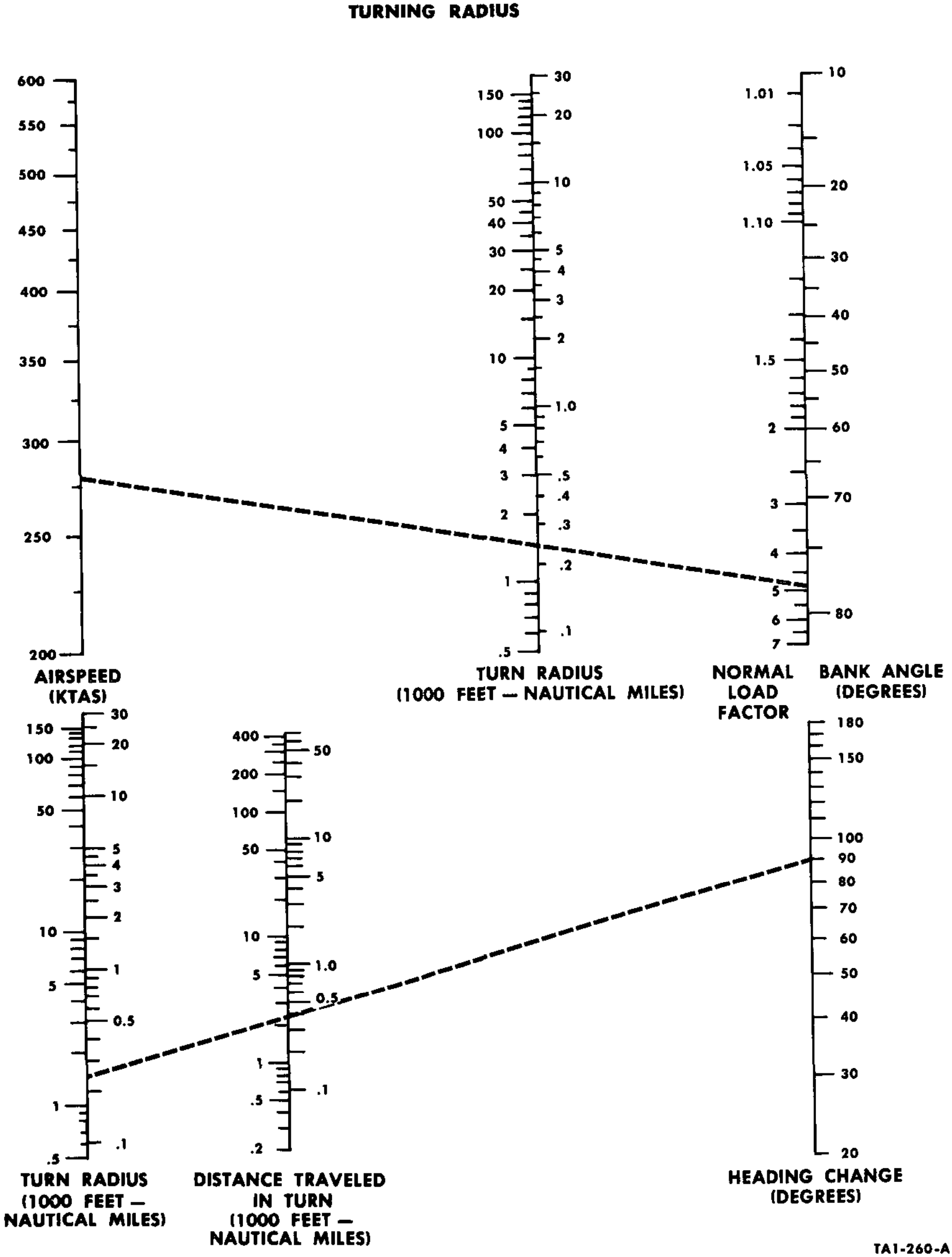


Figure 37-1. Turning Radius

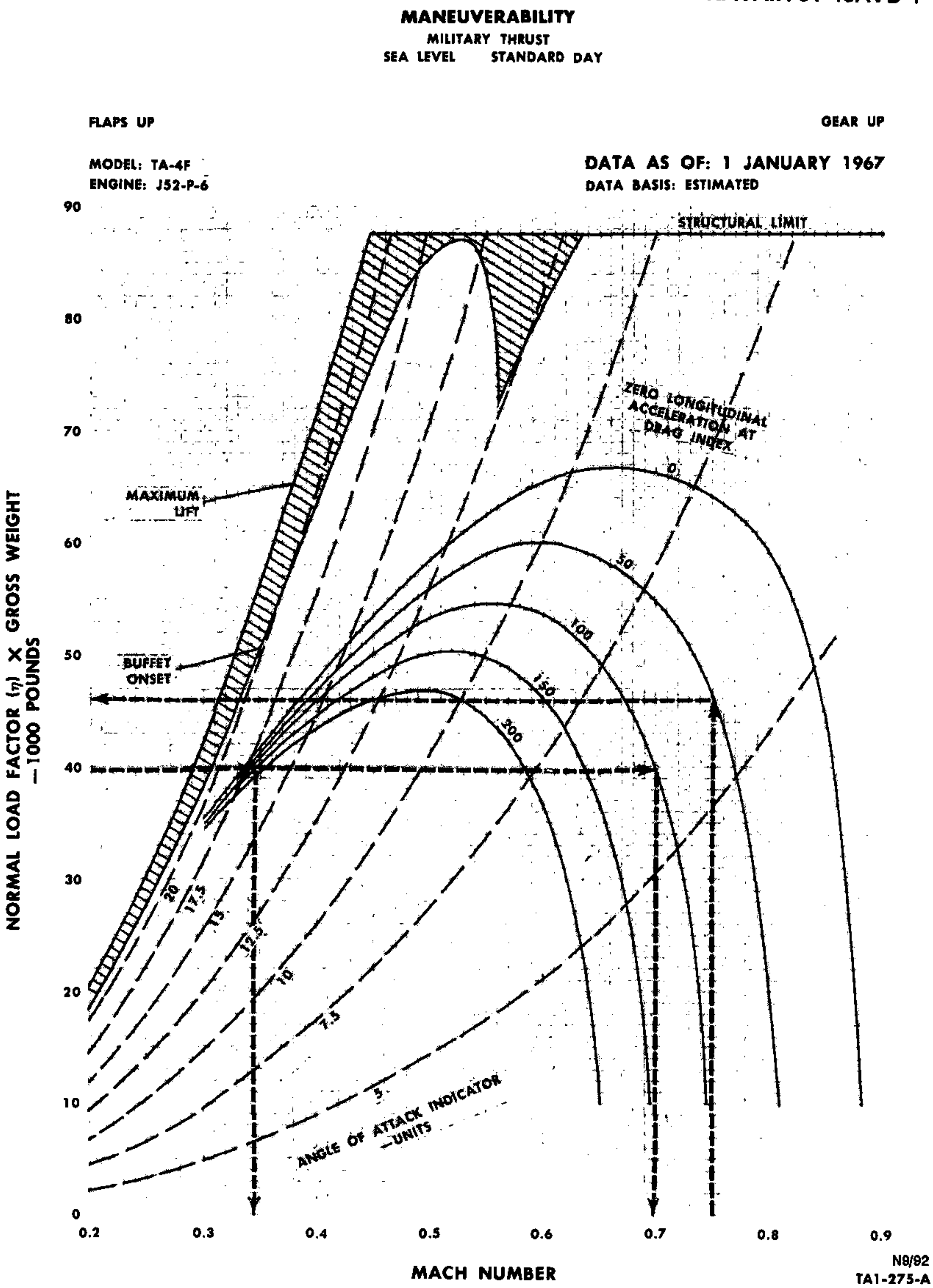


Figure 37-2. Maneuverability (Sheet 1 of 3)

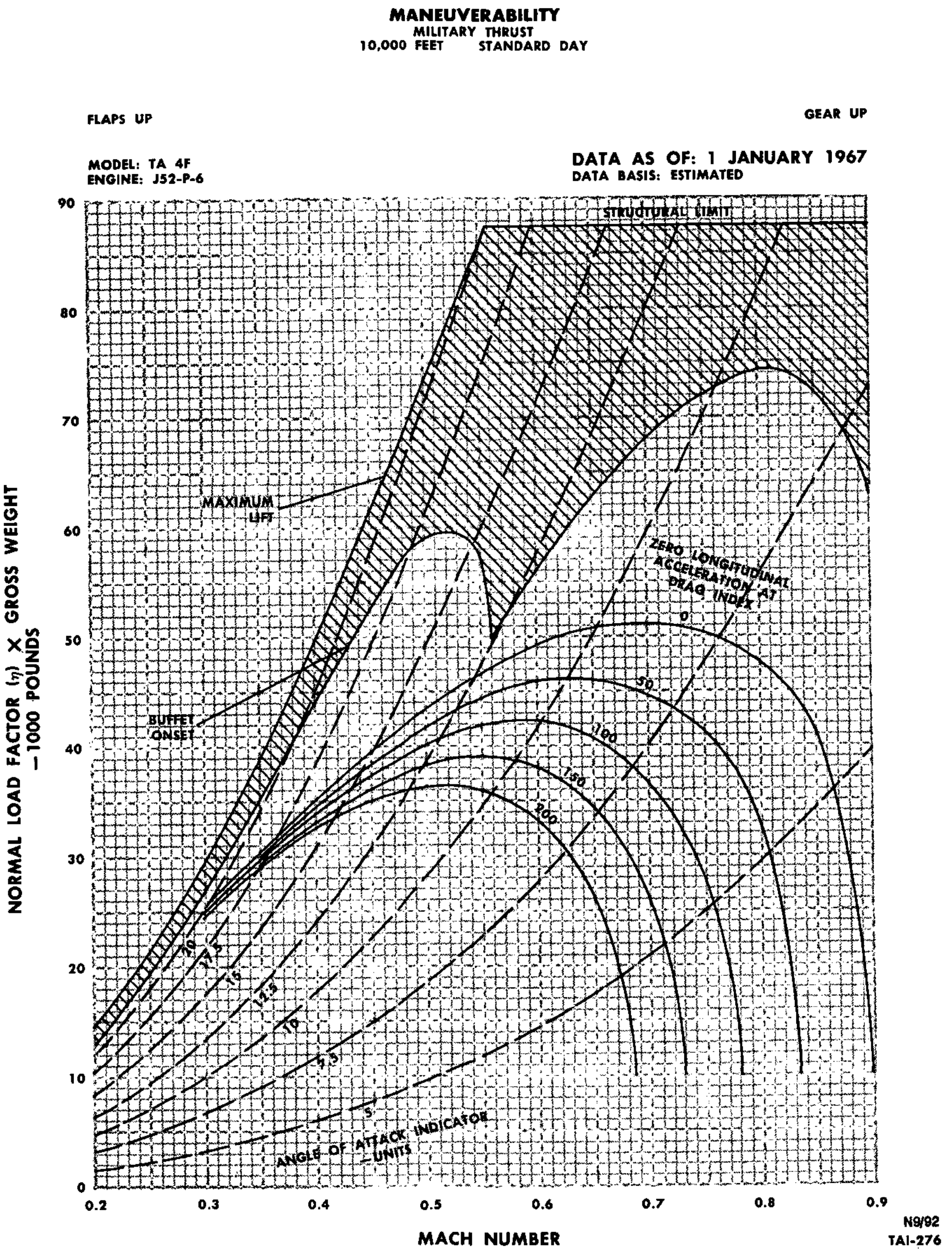


Figure 37-2. Maneuverability (Sheet 2 of 3)

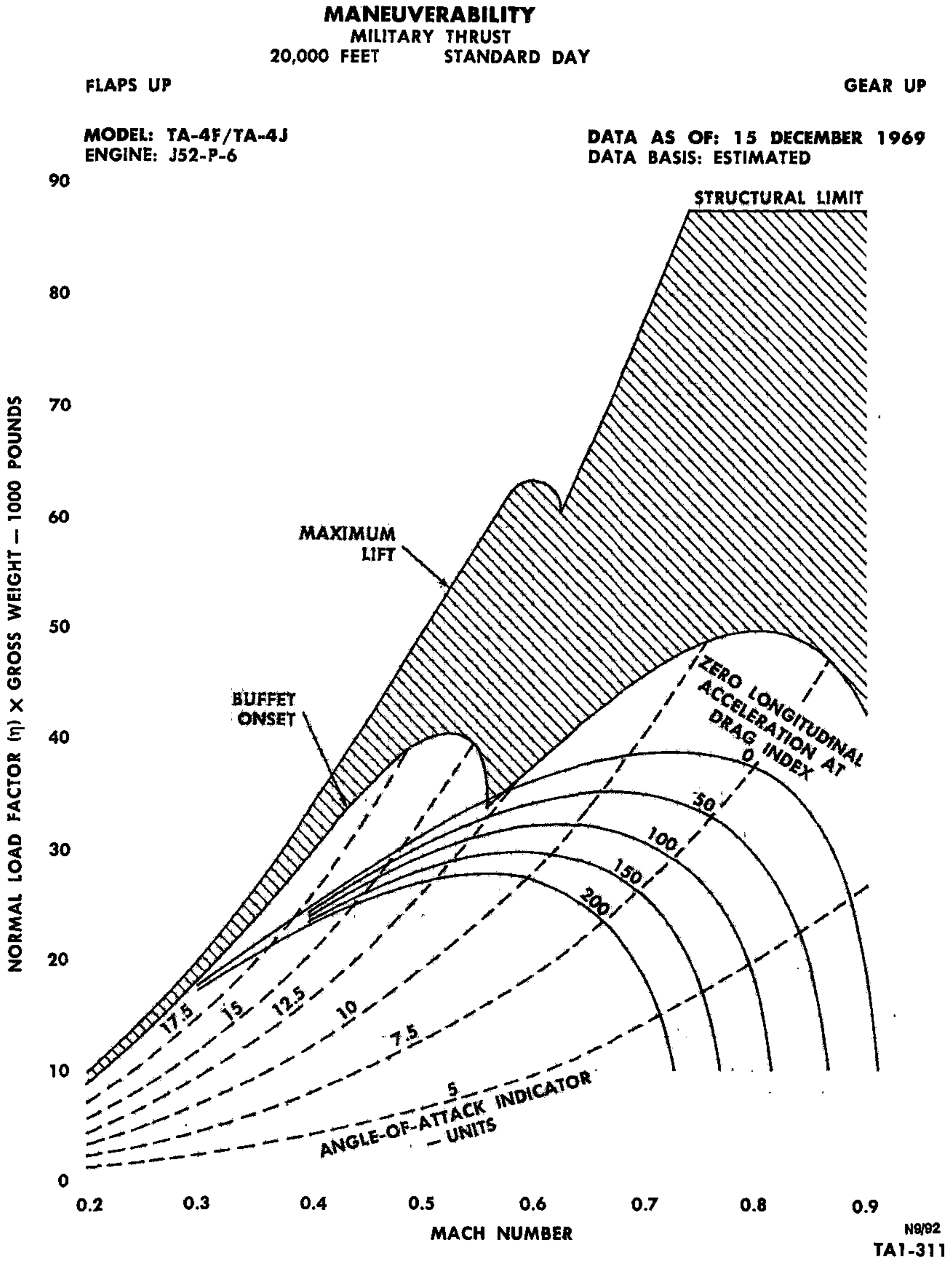
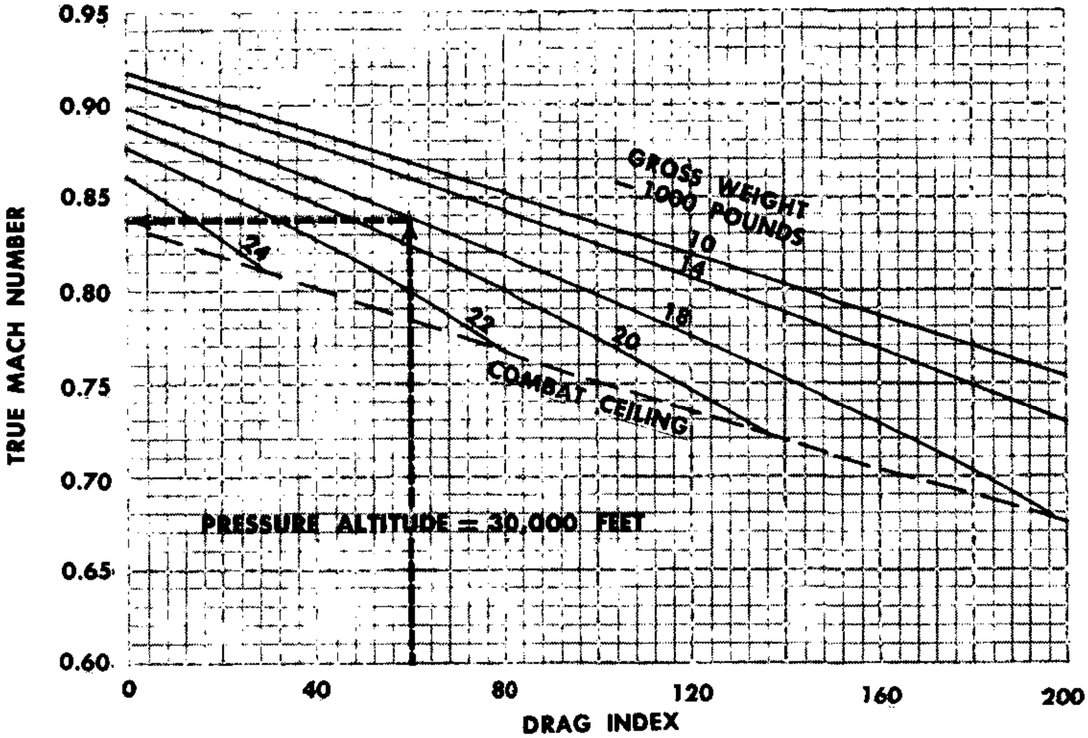


Figure 37-2. Maneuverability (Sheet 3 of 3)

MAXIMUM MACH NUMBER
MILITARY THRUST
ICAO STANDARD ATMOSPHERE

MODEL: TA-4F/TA-4J
ENGINE: J52-P-6

DATA AS OF: 15 DECEMBER 1969
DATA BASIS: ESTIMATED



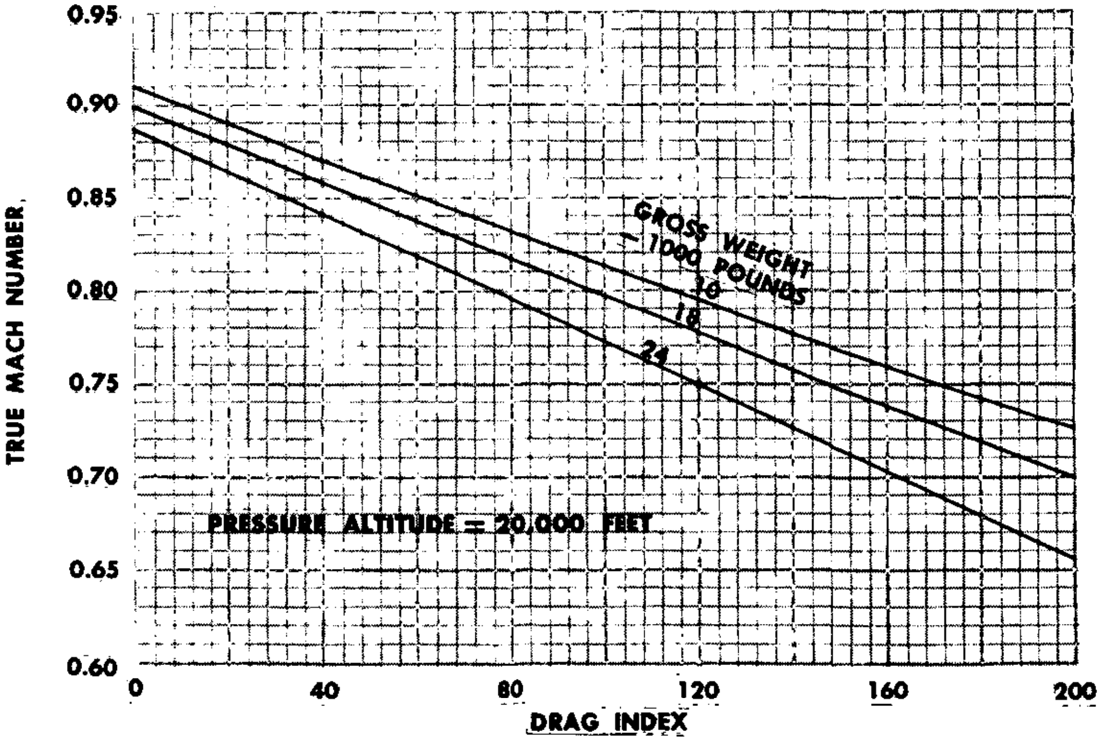


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Figure 37-3. Maximum Mach Number (Sheet 1 of 2)

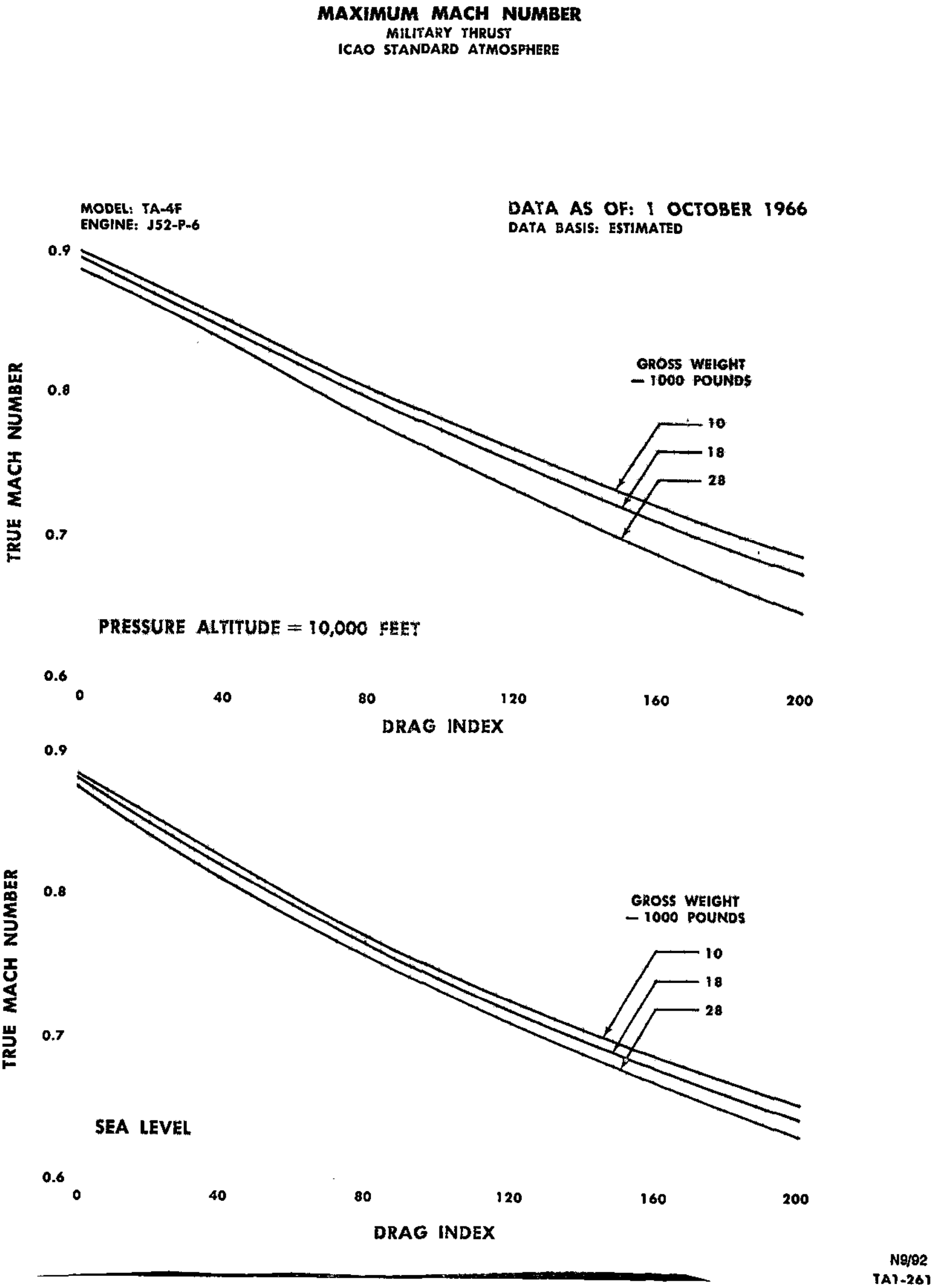

Figure 37-3. Maximum Mach Number (Sheet 2 of 2)

MILITARY FUEL FLOW
ICAO STANDARD ATMOSPHERE

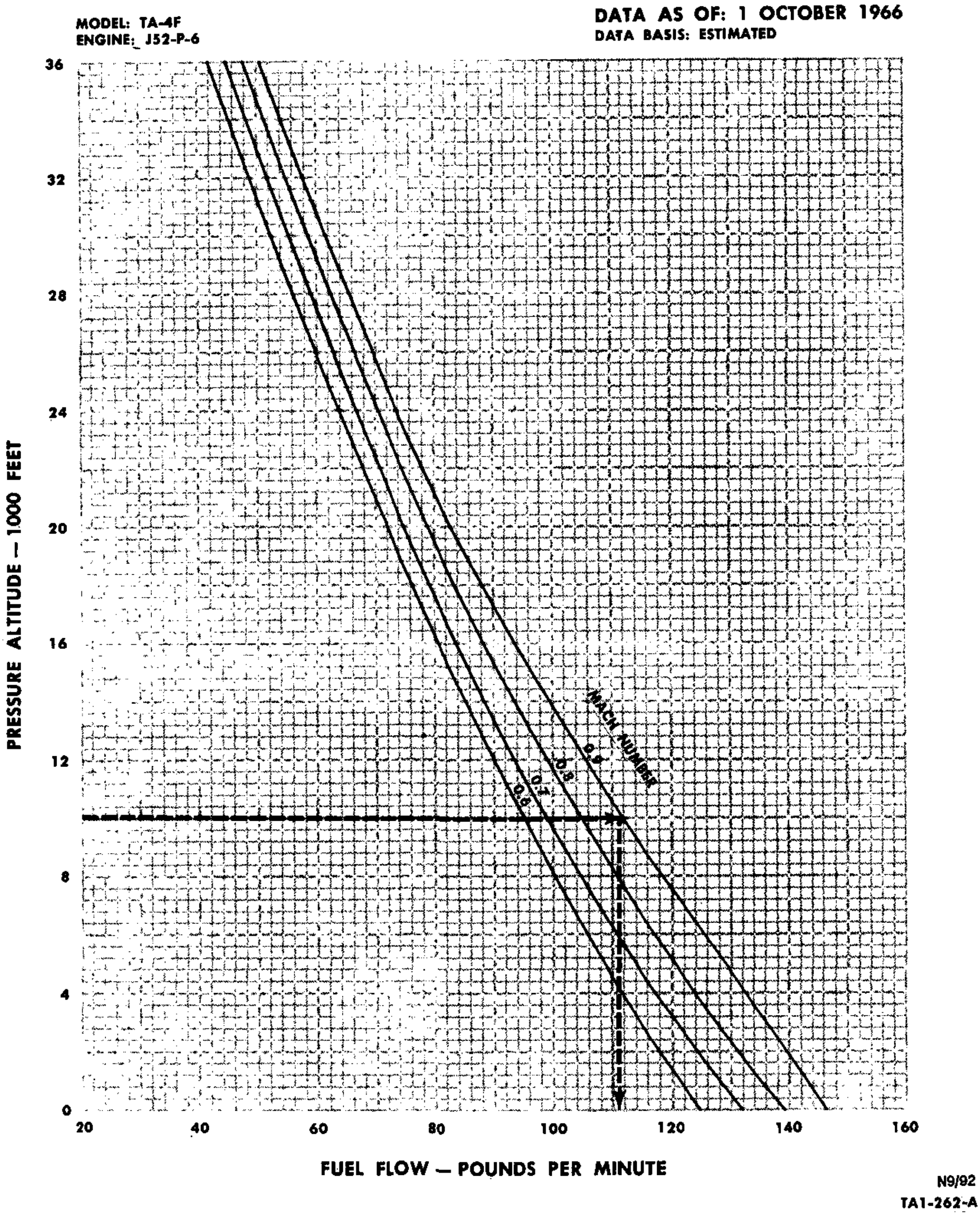

Figure 37-4. Military Fuel Flow

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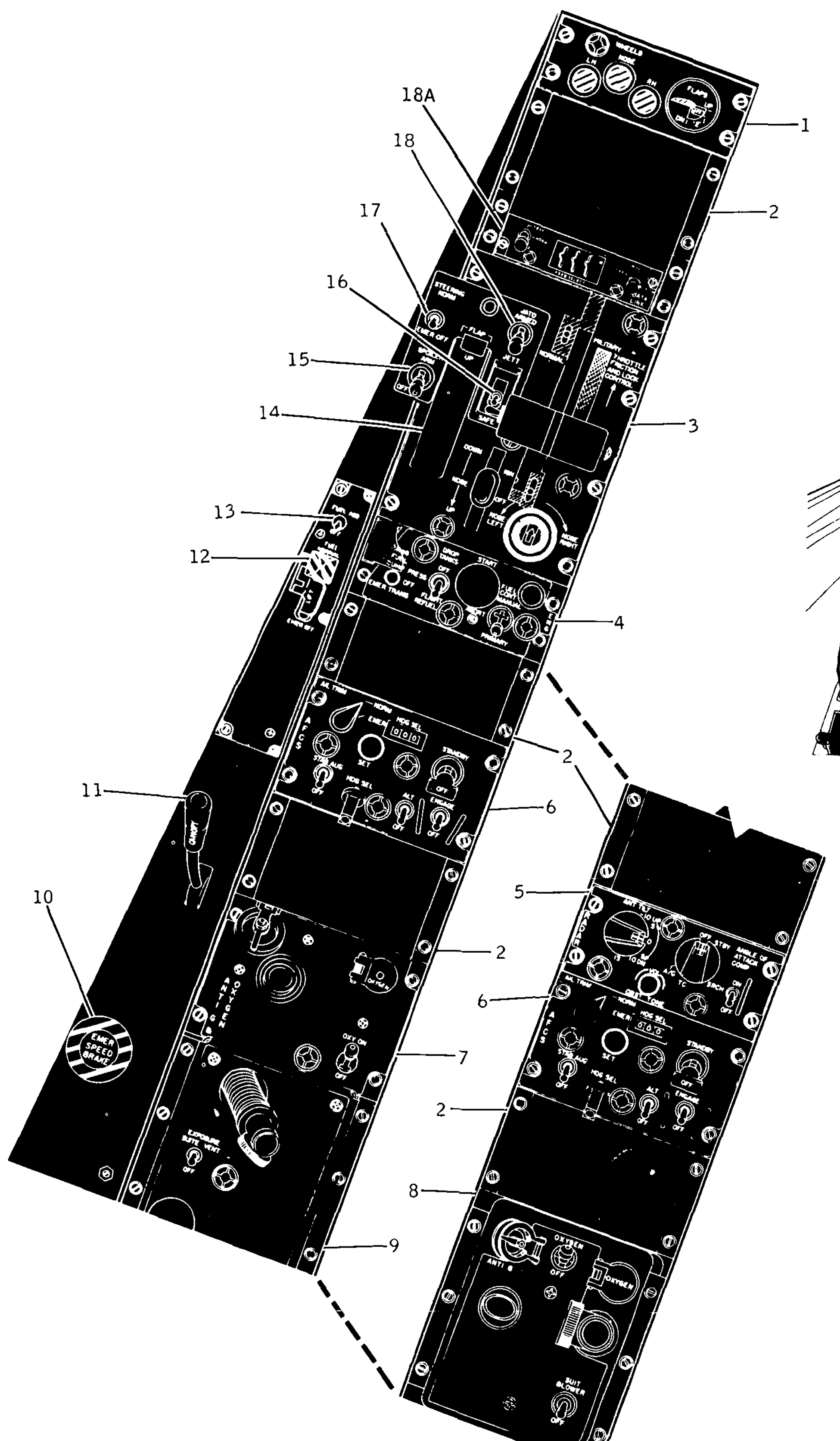

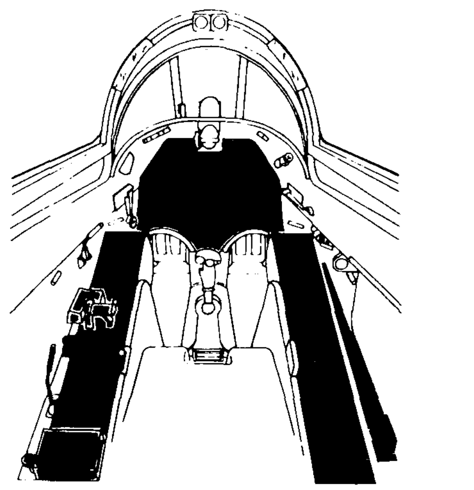

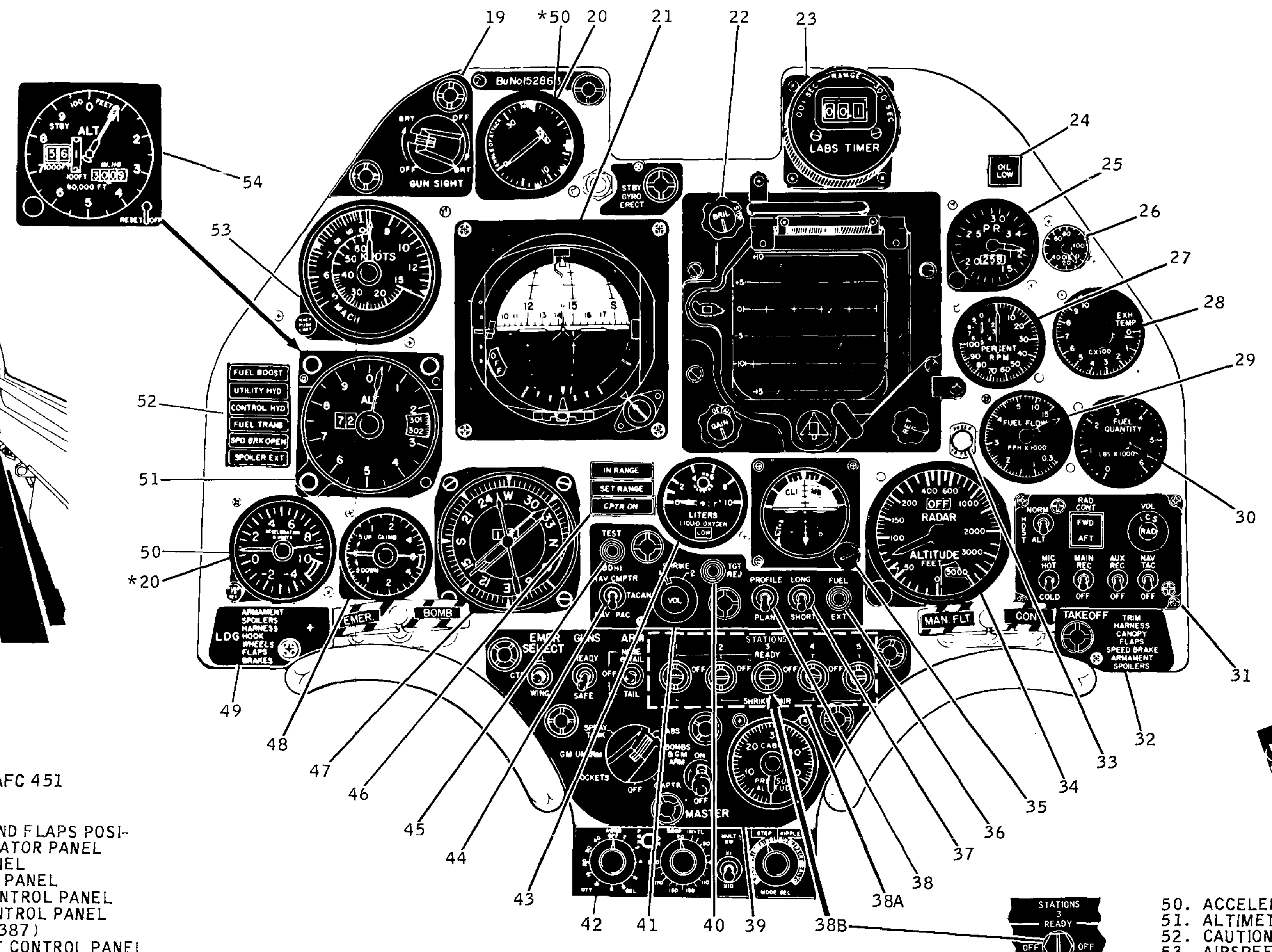

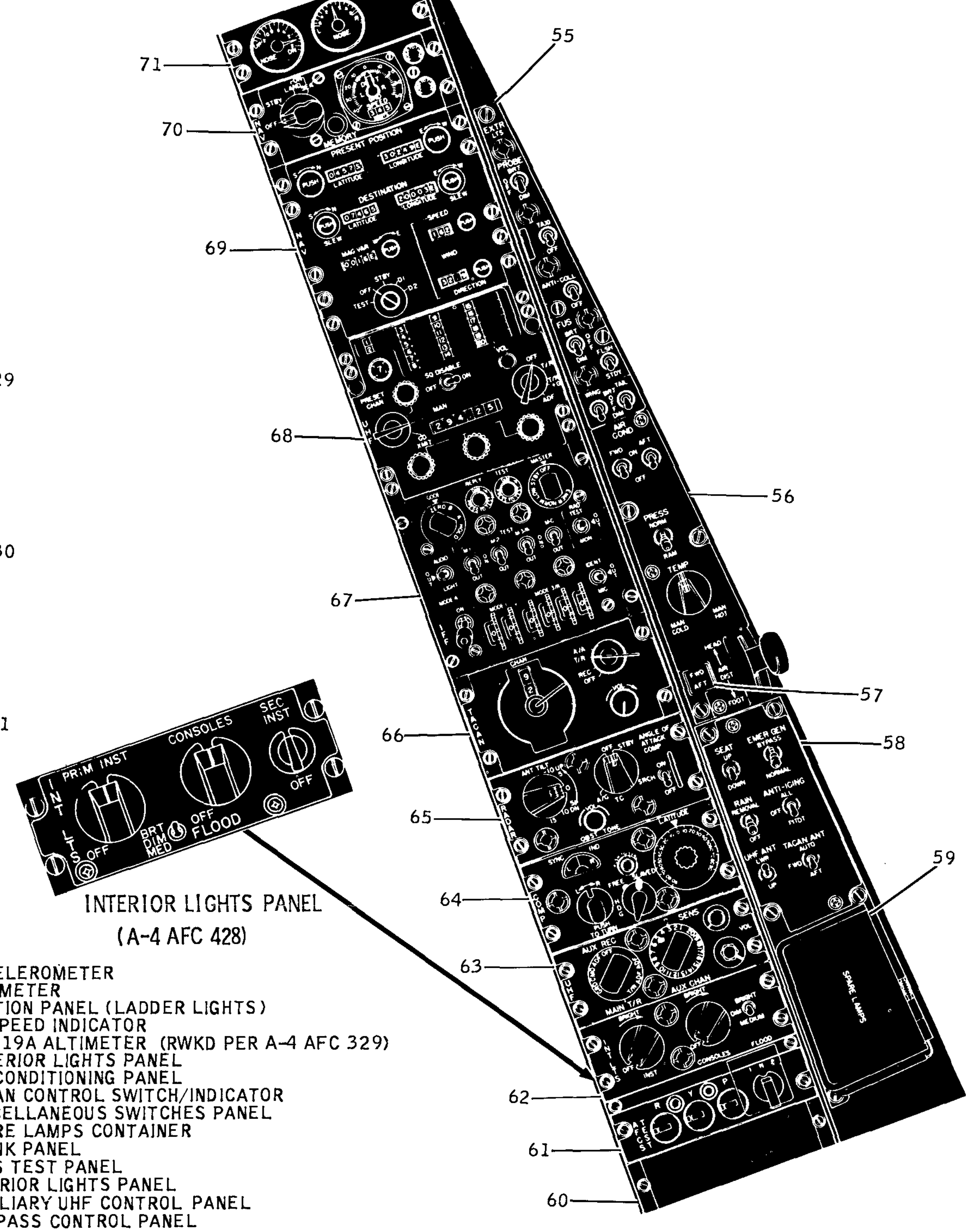

*A-4 AFC 451

1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. BLANK PANEL
3. THROTTLE PANEL
4. ENGINE CONTROL PANEL
5. RADAR CONTROL PANEL (A-4 AFC 387)
6. AUTOPILOT CONTROL PANEL
7. OXYGEN AND ANTI-G PANEL
8. OXYGEN, ANTI-G AND ANTI-EXPOSURE SUIT CONTROL PANEL (A-4 AFC 387)
9. ANTIEXPOSURE SUIT CONTROL PANEL
10. EMERGENCY SPEEDBRAKE CONTROL
11. CANOPY CONTROL PANEL
12. MANUAL FUEL SHUTOFF CONTROL LEVER
13. SMOKE ABATEMENT SWITCH
14. FLAP HANDLE
15. SPOILER ARM SWITCH
16. JATO JETTISON SWITCH
17. NOSEWHEEL STEERING SWITCH
18. JATO ARM SWITCH
18A. ASW-25A - CONTROL PANEL (RWKD PER A-4 AFC 455)
19. GUNSIGHT PANEL
20. ANGLE-OF-ATTACK INDICATOR
21. ALL-ATTITUDE INDICATOR
22. RADAR SCOPE
23. LABS TIMER
24. OIL QUANTITY INDICATOR/SWITCH
25. PRESSURE RATIO INDICATOR
26. OIL PRESSURE INDICATOR
27. TACHOMETER
28. EXHAUST TEMPERATURE INDICATOR
29. FUEL FLOW INDICATOR
30. FUEL QUANTITY INDICATOR
31. ICS AND RADIO CONTROL PANEL
32. TAKEOFF CHECKLIST
33. RADAR ALTIMETER LOW ALTITUDE WARNING LIGHT
34. RADAR ALTIMETER
35. STANDBY ATTITUDE INDICATOR
36. FUEL INT-EXT SWITCH
37. RADAR LONG-SHORT SWITCH
38. RADAR PROFILE-PLAN SWITCH
38A. STA SELECT SWITCHES (RWKD PER A-4 AFC 438-1)
38B. STA 3 (CENTERLINE) SWITCH (RWKD PER A-4 AFC 527)
39. ARMAMENT PANEL
40. TARGET REJECT SWITCH
41. SHRIKE VOLUME SWITCH
42. AIRCRAFT WEAPONS RELEASE SYSTEM PANEL
43. LIQUID OXYGEN QUANTITY INDICATOR
44. BHDI, NAV COMPUTER TACAN-NAVPAC SWITCH
45. TEST SWITCH
46. PILOT'S ADVISORY LIGHTS (RWKD PER A-4 AFC 465)
47. BEARING-DISTANCE-HEADING INDICATOR
48. VERTICAL VELOCITY INDICATOR
49. LANDING CHECKLIST (RWKD PER A-4 AFC 430)
50. ACCELEROMETER
51. ALTIMETER
52. CAUTION PANEL (LADDER LIGHTS)
53. AIRSPEED INDICATOR
54. AAU-19A ALTIMETER (RWKD PER A-4 AFC 329)
55. EXTERIOR LIGHTS PANEL
56. AIR CONDITIONING PANEL
57. TACAN CONTROL SWITCH/INDICATOR
58. MISCELLANEOUS SWITCHES PANEL
59. SPARE LAMPS CONTAINER
60. BLANK PANEL
61. AFCS TEST PANEL
62. INTERIOR LIGHTS PANEL
63. AUXILIARY UHF CONTROL PANEL
64. COMPASS CONTROL PANEL
65. RADAR CONTROL PANEL
66. TACAN CONTROL PANEL
67. IFF CONTROL PANEL
68. UHF CONTROL PANEL
69. NAVIGATION COMPUTER CONTROL PANEL
70. DOPPLER RADAR CONTROL PANEL
71. TRIM POSITION INDICATOR PANEL

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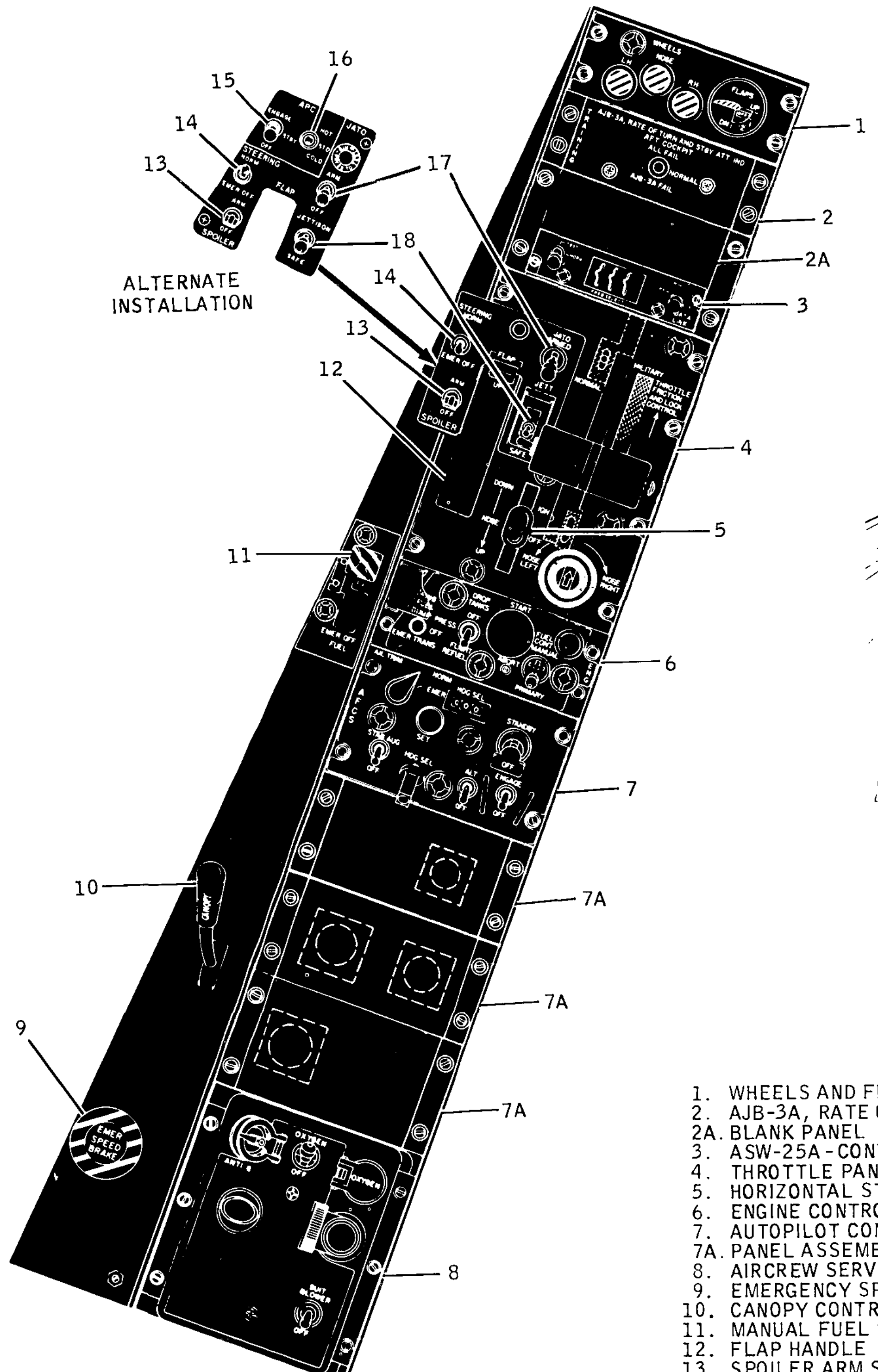
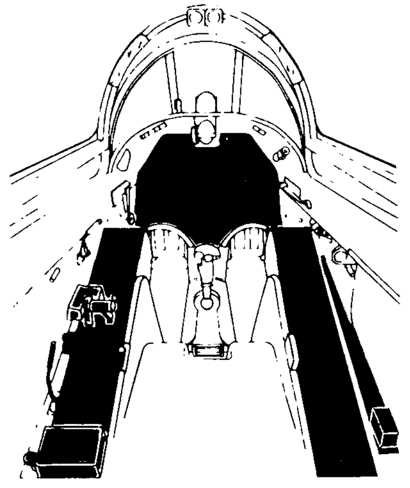
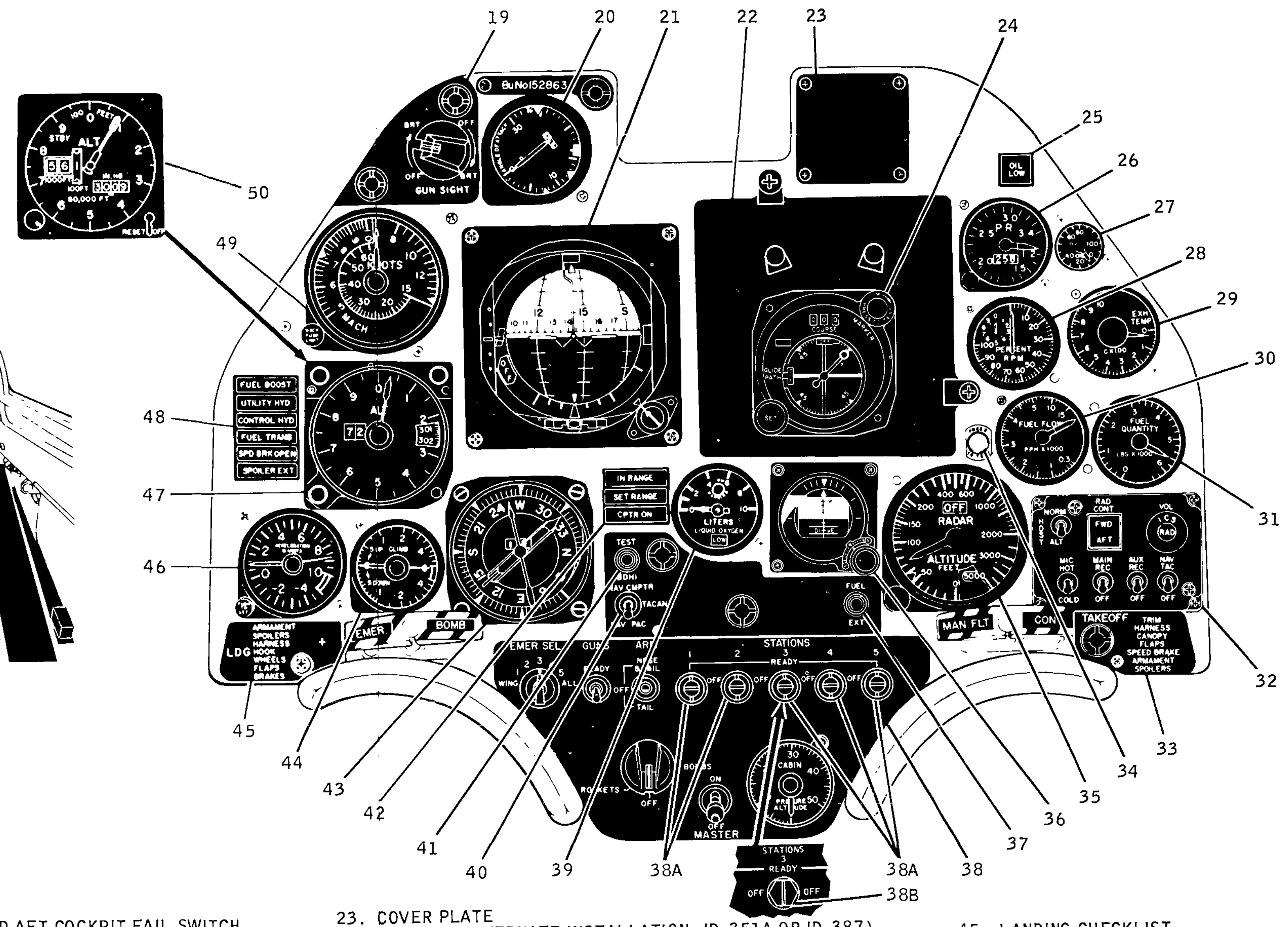
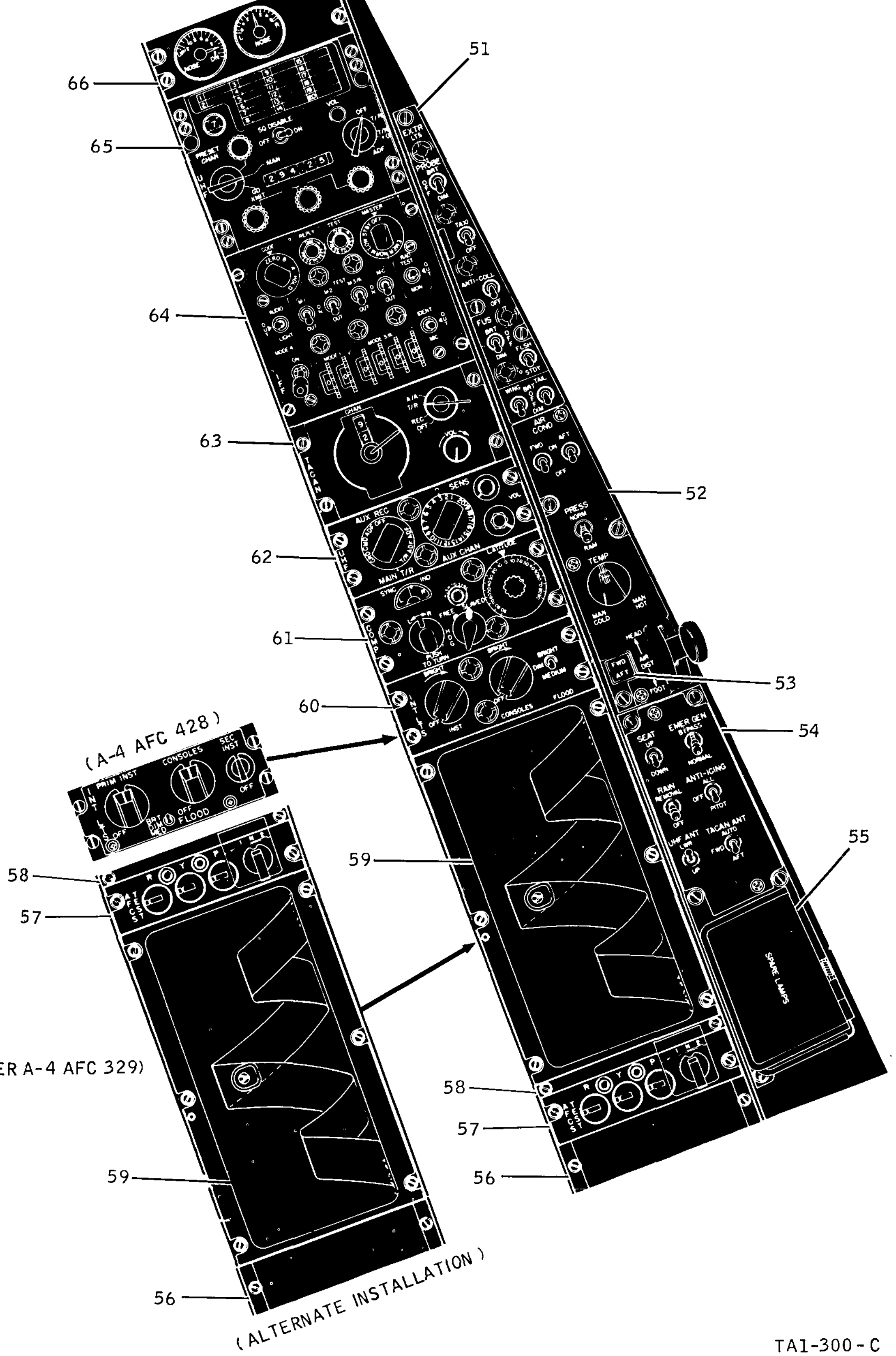
Figure FO-1. Forward Cockpit Consoles and Instrument Panel — TA-4F (Sheet 1 of 2)





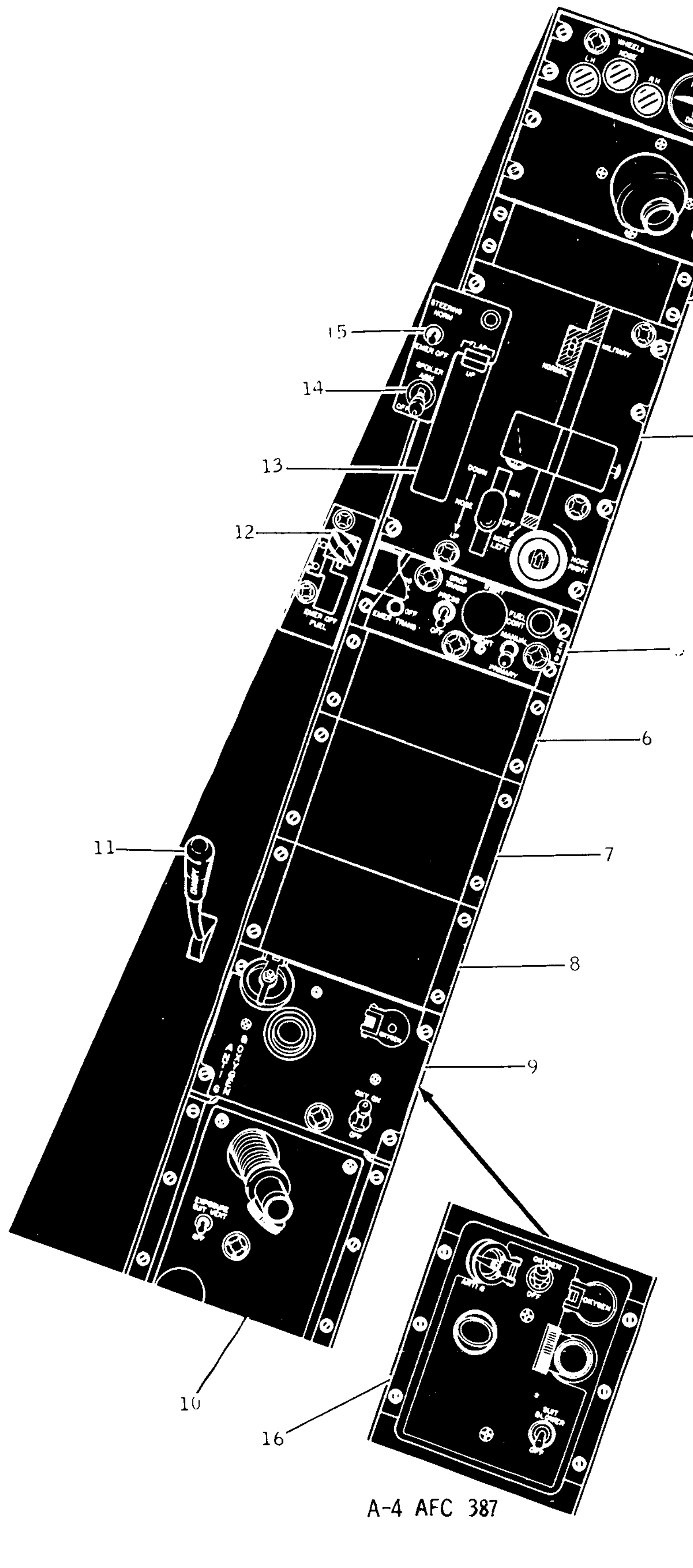


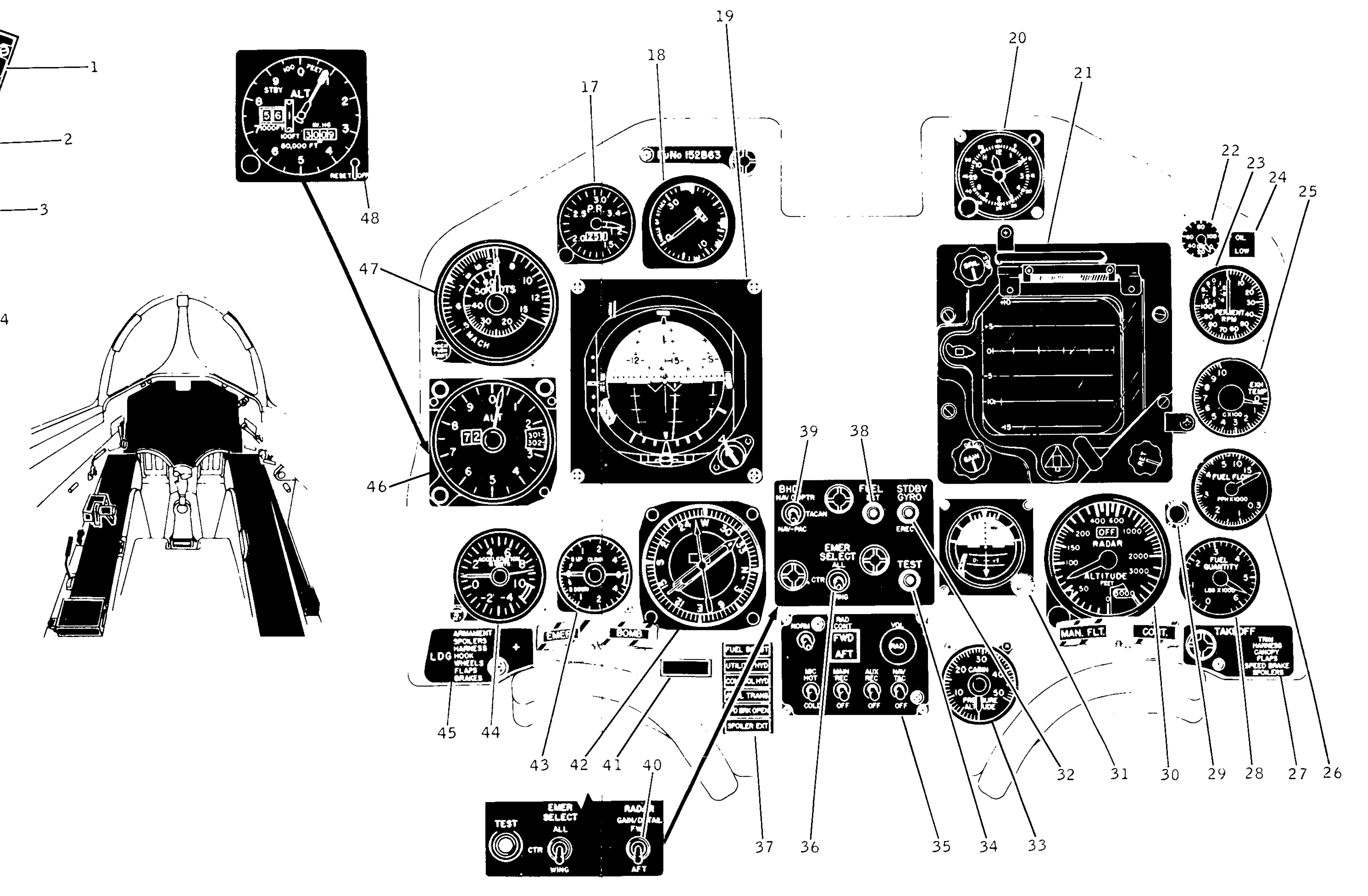


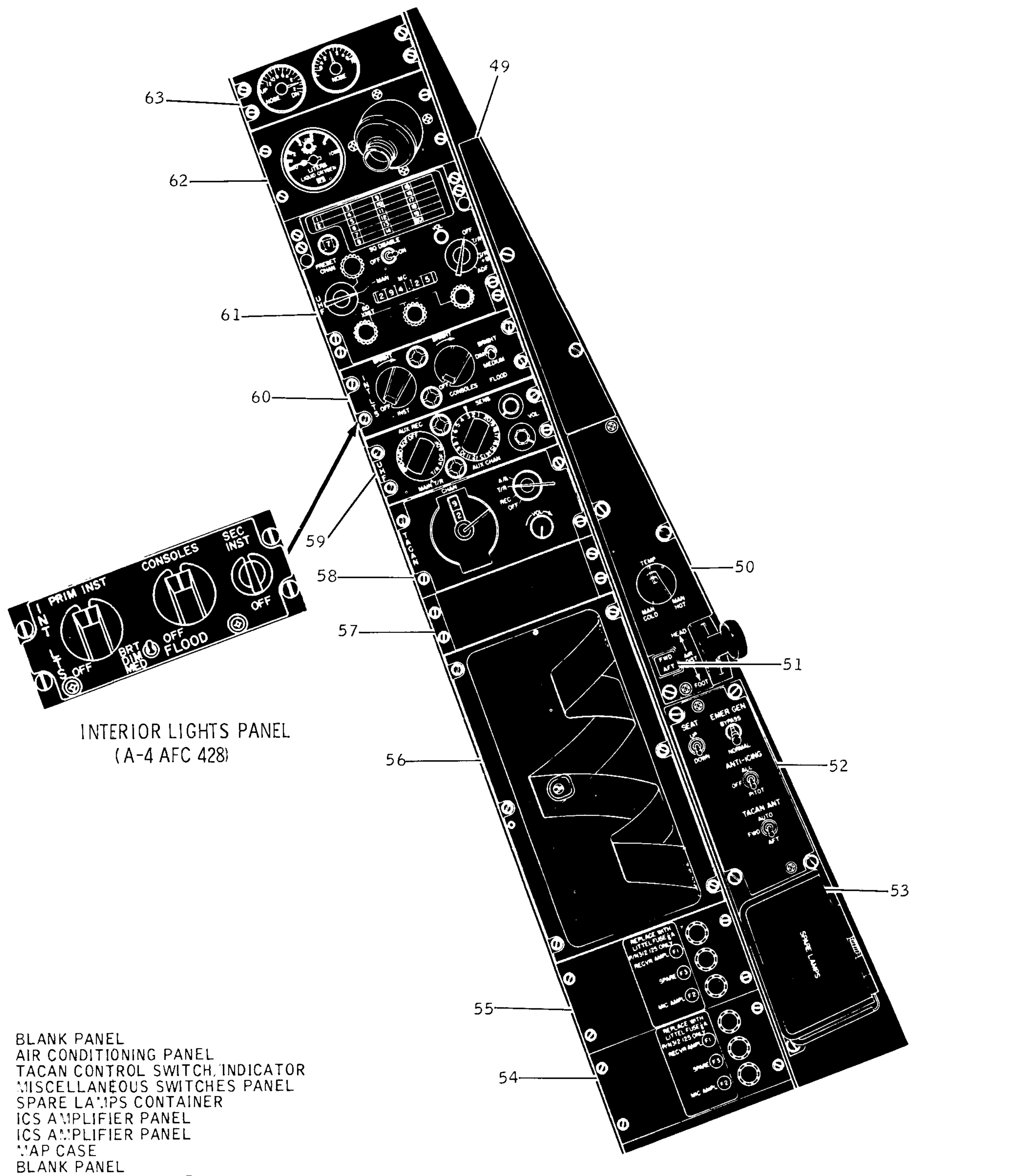
1. WHEELS AND FLAPS
2. AJB-3A, RATE OF TURN AND STBY ATT IND AFT COCKPIT FAIL SWITCH
2A. BLANK PANEL
3. ASW-25A-CONTROL PANEL (REWORKED PER A-4 AFC 455)
4. THROTTLE PANEL
5. HORIZONTAL STABILIZER MANUAL OVERRIDE TRIM SWITCH
6. ENGINE CONTROL
7. AUTOPILOT CONTROL PANEL
7A. PANEL ASSEMBLY ELECTRICAL CONNECTION STOWAGE
8. AIRCREW SERVICES PANEL
9. EMERGENCY SPEEDBRAKE CONTROL
10. CANOPY CONTROL PANEL
11. MANUAL FUEL SHUTOFF CONTROL LEVER
12. FLAP HANDLE
13. SPOILER ARM SWITCH
14. NOSEWHEEL STEERING SWITCH
15. APC-OFF STBY ENGAGE SWITCH
16. APC-HOT STD COLD SWITCH
17. JATO ARM SWITCH
18. JATO JETTISON SWITCH
19. GUNSIGHT PANEL
20. ANGLE-OF-ATTACK INDICATOR
21. ALL-ATTITUDE INDICATOR
22. COVER PLATE
23. COVER PLATE
24. ID-249A (ALTERNATE INSTALLATION, ID-351A OR ID-387)
25. OIL QUANTITY INDICATOR/SWITCH
26. PRESSURE RATIO INDICATOR
27. OIL PRESSURE INDICATOR
28. TACHOMETER
29. EXHAUST TEMPERATURE INDICATOR
30. FUEL FLOW INDICATOR
31. FUEL QUANTITY INDICATOR
32. ICS AND RADIO CONTROL PANEL
33. TAKEOFF CHECKLIST
34. RADAR ALTIMETER LOW ALTITUDE WARNING LIGHT
35. RADAR ALTIMETER
36. STANDBY ATTITUDE INDICATOR
37. FUEL INT-EXT SWITCH
38. ARMAMENT PANEL
38A. STA SELECT SWITCHES (REWORKED PER A-4 AFC 438-1)
38B. STA 3 (CENTERLINE) SWITCH (REWORKED PER A-4 AFC 527)
39. LIQUID OXYGEN QUANTITY INDICATOR
40. BDHI-NAV COMPUTER TACAN-NAVPAC SWITCH
41. TEST SWITCH
42. PILOT ADVISORY LIGHTS
43. BEARING-DISTANCE-HEADING INDICATOR
44. VERTICAL VELOCITY INDICATOR
45. LANDING CHECKLIST
46. ACCELEROMETER
47. ALTIMETER (MC-3)
48. CAUTION PANEL (LADDER LIGHTS)
49. AIRSPEED INDICATOR
50. ALTIMETER (AAU-19A) (REWORKED PER A-4 AFC 329)
51. EXTERIOR LIGHTS PANEL
52. AIR CONDITIONING PANEL
53. TACAN CONTROL SWITCH/INDICATOR
54. MISCELLANEOUS SWITCHES PANEL
55. SPARE LAMPS CONTAINER
56. BLANK PANEL
57. AFCS TEST PANEL
58. SWITCH GUARD
59. DATA BOX
60. INTERIOR LIGHTS PANEL
61. COMPASS CONTROL PANEL
62. AUXILIARY UHF CONTROL PANEL
63. TACAN CONTROL PANEL
64. IFF CONTROL PANEL
65. UHF CONTROL PANEL
66. TRIM POSITION INDICATOR PANEL

TA1-300-C

Figure FO-1. Forward Cockpit Consoles and Instrument Panel — TA-4J (Sheet 2 of 2)







1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. AIR CONDITIONING PANEL
3. BLANK PANEL
4. THROTTLE PANEL
5. ENGINE CONTROL PANEL
6. BLANK PANEL
7. BLANK PANEL
8. BLANK PANEL
9. OXYGEN AND ANTI-G PANEL
10. ANTIEXPOSURE SUIT CONTROL PANEL
11. CANOPY CONTROL HANDLE
12. MANUAL FUEL SHUTOFF CONTROL LEVER
13. FLAP HANDLE
14. SPOILER ARM SWITCH
15. NOSEWHEEL STEERING SWITCH
16. OXYGEN, ANTI-G, AND ANTIEXPOSURE SUIT CONTROL PANEL (A-4 AFC 387)
17. PRESSURE RATIO INDICATOR
18. ANGLE-OF-ATTACK INDICATOR
19. ALL-ATTITUDE INDICATOR
20. ELAPSED TIME CLOCK
21. RADAR SCOPE (AFC 355)
22. OIL PRESSURE INDICATOR
23. TACHOMETER
24. OIL QUANTITY INDICATOR SWITCH
25. EXHAUST TEMPERATURE INDICATOR
26. FUEL FLOW INDICATOR
27. TAKEOFF CHECKLIST
28. FUEL QUANTITY INDICATOR
29. RADAR ALTIMETER LOW ALTITUDE LIGHT
30. RADAR ALTIMETER
31. STANDBY ATTITUDE INDICATOR
32. STANDBY GYRO ERECT SWITCH
33. CABIN ALTIMETER
34. TEST SWITCH
35. ICS RADIO CONTROL PANEL
36. EMERGENCY SELECT SWITCH-ALL-CTR-WING
37. CAUTION PANEL (LADDER LIGHTS)
38. FUEL SWITCH EXT-INT
39. BHDI, NAV COMPUTER TACAN-NAVPAC SWITCH
40. RADAR GAIN DETAIL FWD-AFT SWITCH (AFC 355)
41. ARMAMENT ADVISORY LIGHT
42. BEARING-DISTANCE-HEADING INDICATOR
43. VERTICAL SPEED INDICATOR
44. ACCELEROMETER
45. LANDING CHECKLIST (REWORKED PER A-4 AFC 430)
46. ALTIMETER
47. AIRSPEED INDICATOR
48. AAU-19A ALTIMETER (REWORKED PER A-4 AFC 329)
49. BLANK PANEL
50. AIR CONDITIONING PANEL
51. TACAN CONTROL SWITCH INDICATOR
52. MISCELLANEOUS SWITCHES PANEL
53. SPARE LAMPS CONTAINER
54. ICS AMPLIFIER PANEL
55. ICS AMPLIFIER PANEL
56. MAP CASE
57. BLANK PANEL
58. TACAN CONTROL PANEL
59. AUXILIARY UHF CONTROL PANEL
60. INTERIOR LIGHTS PANEL
61. UHF CONTROL PANEL
62. OXYGEN INDICATOR AND AIR CONDITIONING PANEL
63. TRIM POSITION INDICATOR PANEL

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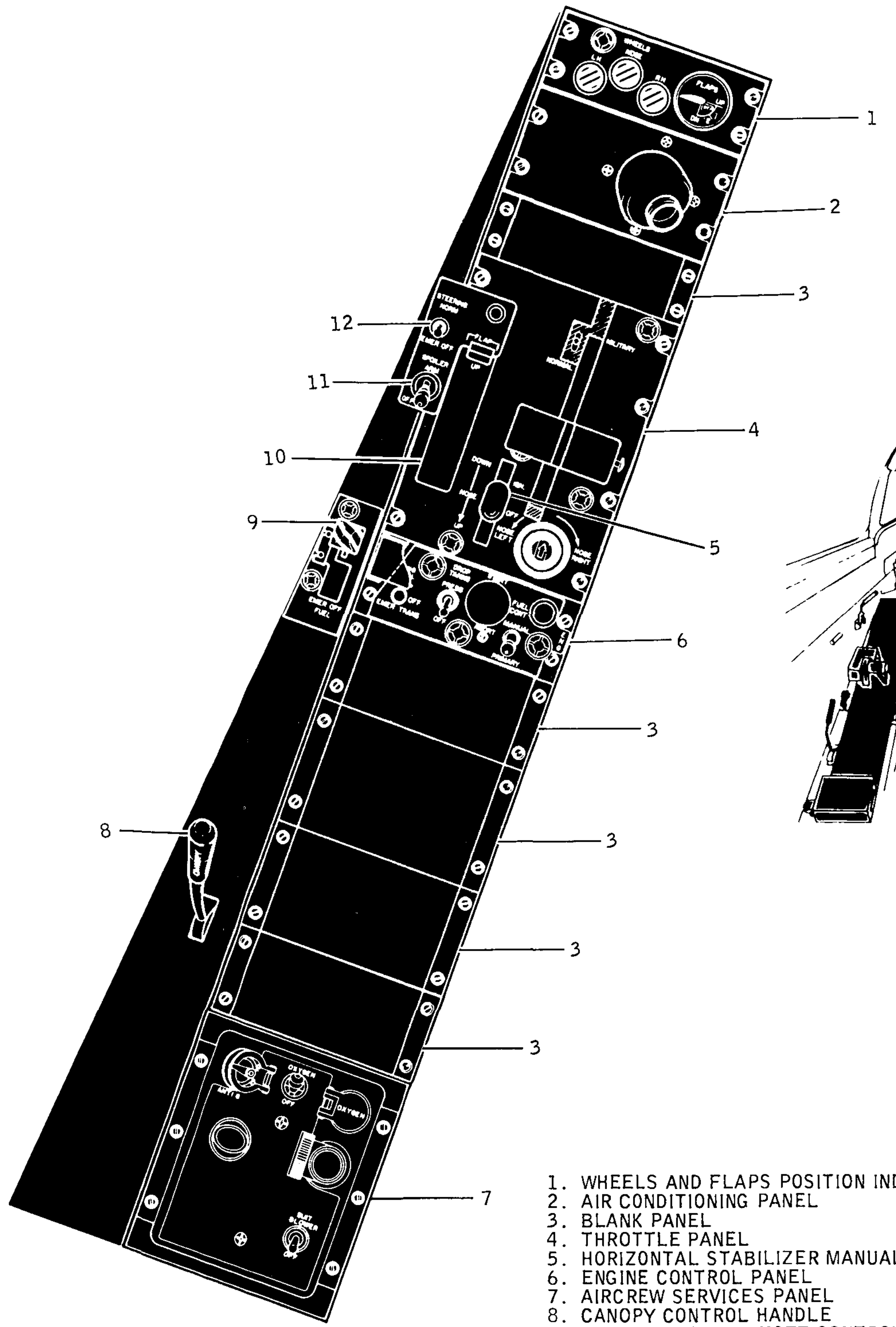
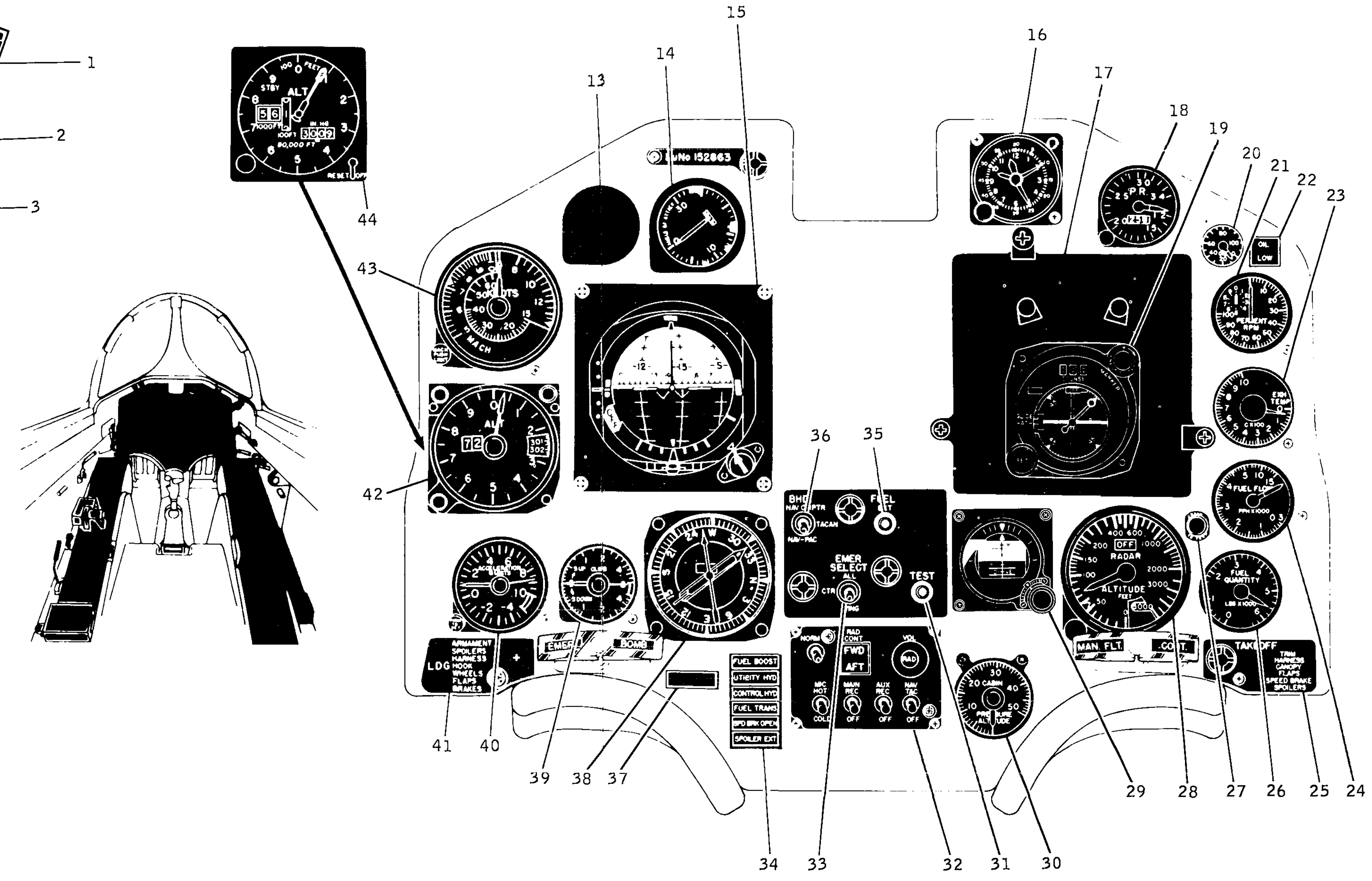
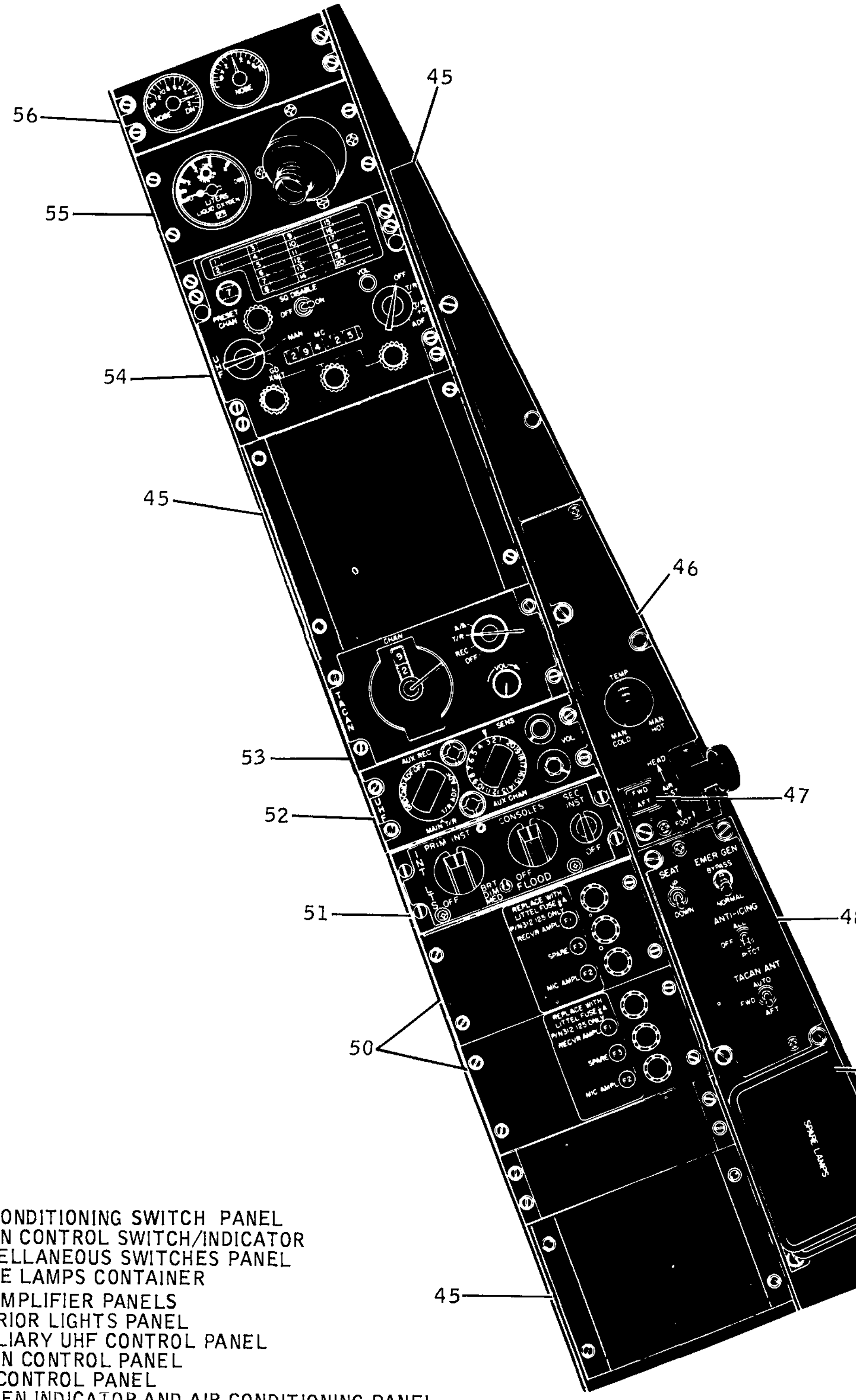
Figure FO-2. Aft Cockpit Consoles and Instrument Panel — TA-4F (Sheet 1 of 2)







1. WHEELS AND FLAPS POSITION INDICATOR PANEL
2. AIR CONDITIONING PANEL
3. BLANK PANEL
4. THROTTLE PANEL
5. HORIZONTAL STABILIZER MANUAL OVERRIDE TRIM SWITCH
6. ENGINE CONTROL PANEL
7. AIRCREW SERVICES PANEL
8. CANOPY CONTROL HANDLE
9. MANUAL FUEL SHUTOFF CONTROL LEVER
10. FLAP HANDLE
11. SPOILER ARM SWITCH
12. NOSEWHEEL STEERING SWITCH
13. COVER PLATE
14. ANGLE-OF-ATTACK INDICATOR
15. ALL-ATTITUDE INDICATOR
16. ELAPSED TIME CLOCK
17. COVER PLATE
18. PRESSURE RATIO INDICATOR
19. ID-249A (ALTERNATE INSTALLATION ID-351A OR ID-387)
20. OIL PRESSURE INDICATOR
21. TACHOMETER
22. OIL QUANTITY INDICATOR/SWITCH
23. EXHAUST TEMPERATURE INDICATOR
24. FUEL FLOW INDICATOR
25. TAKEOFF CHECKLIST
26. FUEL QUANTITY INDICATOR
27. RADAR ALTIMETER LOW ALTITUDE WARNING LIGHT
28. RADAR ALTIMETER
29. STANDBY ATTITUDE INDICATOR
30. CABIN ALTIMETER
31. TEST SWITCH
32. ICS RADIO CONTROL PANEL
33. EMERGENCY SELECT SWITCH-ALL-CTR-WING
34. CAUTION PANEL (LADDER LIGHTS)
35. FUEL SWITCH EXT-INT
36. BDHI-NAV COMPUTER TACAN-NAVPAC SWITCH
37. ARMAMENT ADVISORY LIGHT
38. BEARING-DISTANCE-HEADING INDICATOR
39. VERTICAL VELOCITY INDICATOR
40. ACCELEROMETER
41. LANDING CHECKLIST
42. ALTIMETER (MC-3)
43. AIRSPEED INDICATOR
44. ALTIMETER (AAU-19A) (REWORKED PER A-4 AFC 329)
45. BLANK PANEL
46. AIR CONDITIONING SWITCH PANEL
47. TACAN CONTROL SWITCH/INDICATOR
48. MISCELLANEOUS SWITCHES PANEL
49. SPARE LAMPS CONTAINER
50. ICS AMPLIFIER PANELS
51. INTERIOR LIGHTS PANEL
52. AUXILIARY UHF CONTROL PANEL
53. TACAN CONTROL PANEL
54. UHF CONTROL PANEL
55. OXYGEN INDICATOR AND AIR CONDITIONING PANEL
56. TRIM POSITION INDICATOR PANEL

TA1-301-A

Figure FO-2. Aft Cockpit Consoles and Instrument Panel — TA-4J (Sheet 2 of 2)

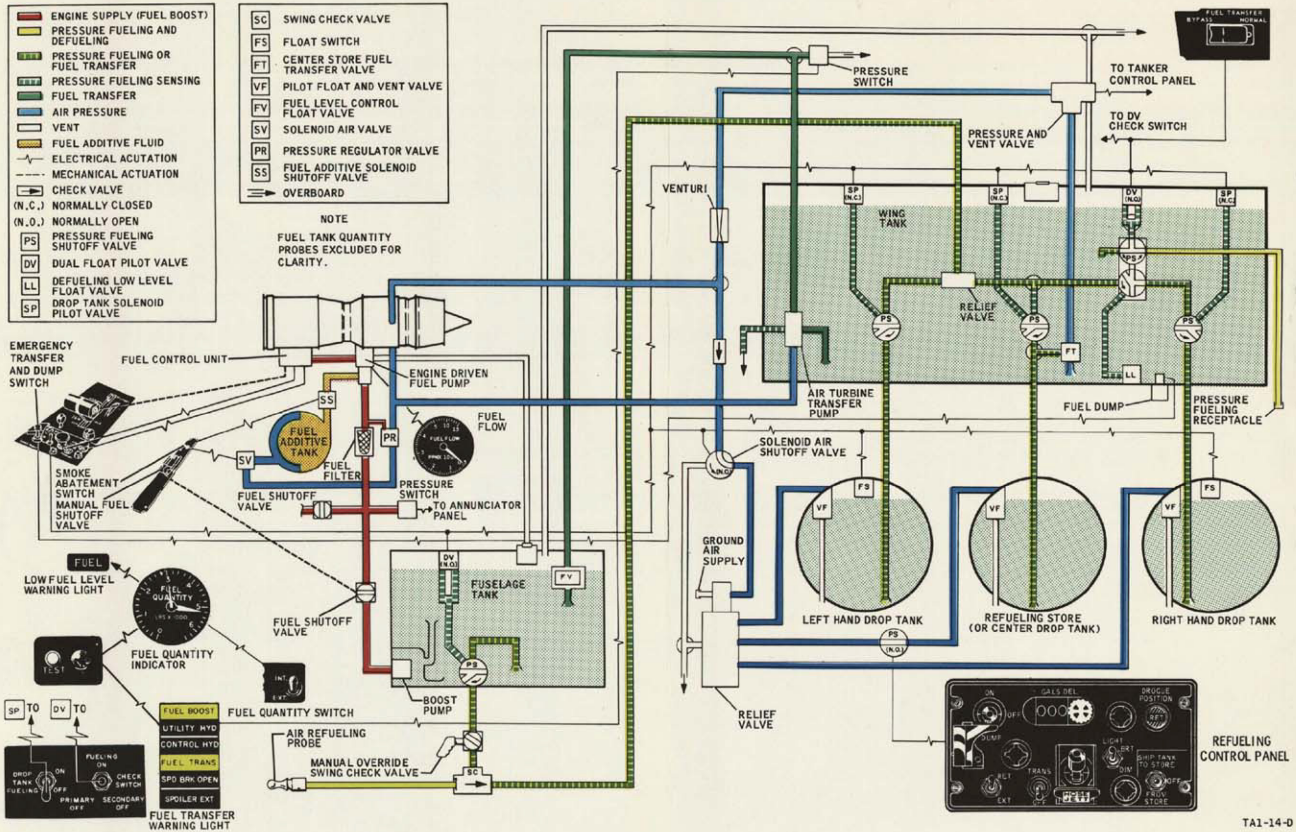


Figure FO-3. TA-4F Fuel System

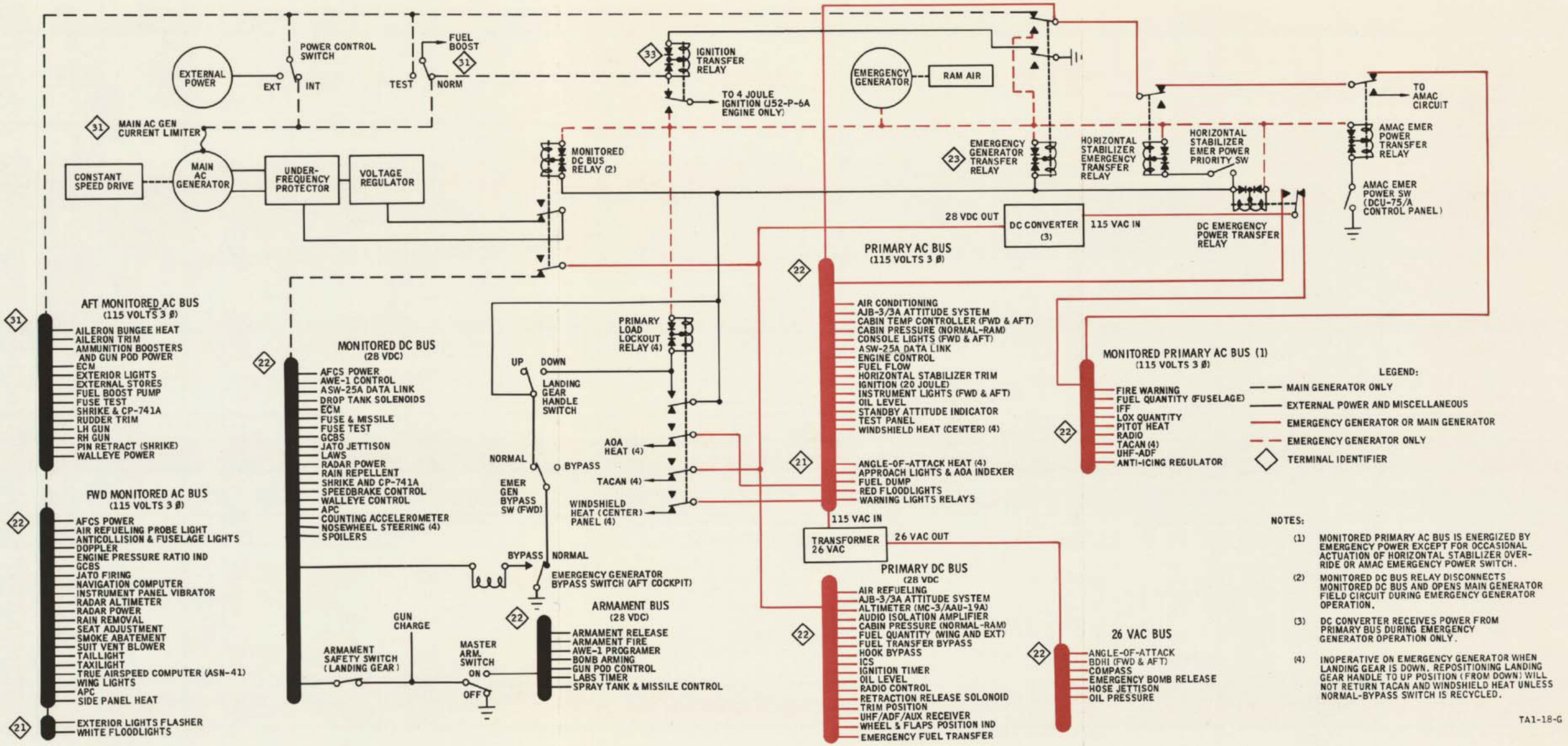


Figure FO-4. Electrical System — TA-4F (Sheet 1 of 2)

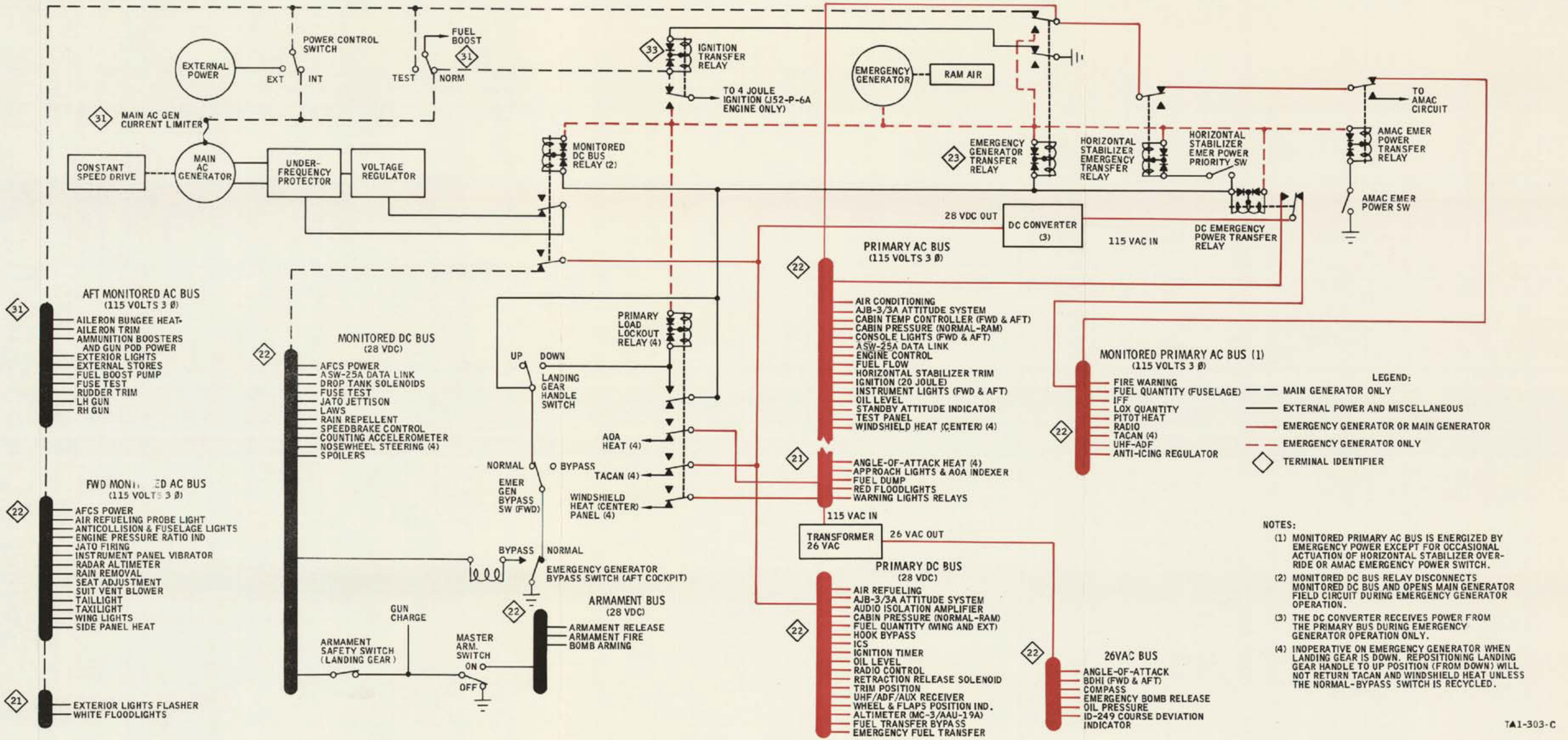


Figure FO-4. Electrical System — TA-4J (Sheet 2 of 2)

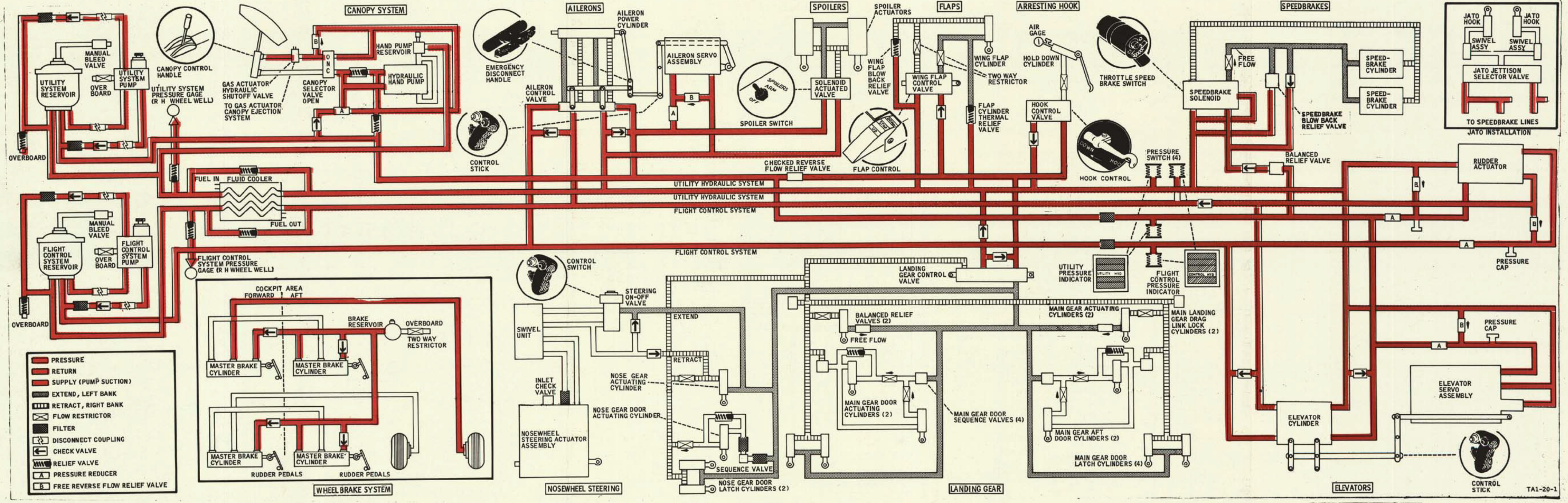


Figure FO-5. Hydraulic System

LIST OF EFFECTIVE PAGES

Effective Pages	Page Numbers
Change 1	1 (Reverse Blank)
Original	3 (Reverse Blank)
Original	5 thru 16
Change 1	17, 18
Original	19, 20
Change 1	21 thru 23
Original	24, 25
Change 1	26, 27
Original	28 thru 32
Change 1	33 thru 35
Original	36
Change 1	37 (Reverse Blank)
Original	39 (Reverse Blank)
Change 1	41 (Reverse Blank)
Original	43 (Reverse Blank)
Original	45 thru 50
Change 1	51 thru 53
Original	54, 55 (Reverse Blank)
Change 1	I-1-1
Original	I-1-2 thru I-1-9
Change 1	I-1-10
Change 1	I-2-1, I-2-2
Original	I-2-3, I-2-4
Change 1	I-2-5 thru I-2-8
Original	I-2-9 thru I-2-13
Change 1	I-2-14, I-2-14a
	(Reverse Blank)
Original	I-2-15 thru I-2-34
Change 1	I-2-35
Original	I-2-36 thru I-2-49
Change 1	I-2-50
Original	I-2-51 thru I-2-96
Original	I-3-1 thru I-3-35
	(Reverse Blank)
Change 1	I-4-1 thru I-4-5
Original	I-4-6 thru I-4-9
Change 1	I-4-10
Original	I-4-11, I-4-12
Original	57 (Reverse Blank)
Original	II-5-1 thru II-5-5
	(Reverse Blank)

Effective Pages	Page Numbers
Original	59 (Reverse Blank)
Change 1	III-6-1
Original	III-6-2
Original	III-7-1 (Reverse Blank)
Change 1	III-8-1 thru III-8-7
Original	III-8-8 thru III-8-10
Change 1	III-8-11 thru III-8-13
Original	III-8-14
Change 1	III-8-15
Original	III-8-16
Change 1	III-8-17 thru III-8-20
Original	III-8-21
Change 1	III-8-22, III-8-23
Original	III-8-24
Change 1	III-8-24a (Reverse Blank)
Original	III-8-25
Change 1	III-8-26 thru III-8-28
Original	III-8-29 thru III-8-36
Original	III-9-1 thru III-9-6
Original	III-10-1, III-10-2
Original	III-11-1 thru III-11-10
Change 1	III-11-11 thru III-11-13
Original	III-11-14 thru III-11-22
Change 1	III-11-23
Original	III-11-24 thru III-11-28
Change 1	III-11-29, III-11-30
Original	61 (Reverse Blank)
Original	IV-12-1
Change 1	IV-12-2
Original	IV-12-3, IV-12-4
Change 1	IV-12-5
Original	IV-12-6
Change 1	IV-12-7
Original	IV-12-8 thru IV-12-11
Change 1	IV-12-12 thru IV-12-14
Original	IV-12-15, IV-12-16
Change 1	IV-12-17 thru IV-12-19
	(Reverse Blank)
Original	IV-13-1
Change 1	IV-13-2
Original	IV-13-3 thru IV-13-5
Change 1	IV-13-6

LIST OF EFFECTIVE PAGES (Cont.)

Effective Pages	Page Numbers
Original	IV-13-7 thru IV-13-10
Change 1	IV-13-11
Original	IV-13-12 thru IV-13-15
	(Reverse Blank)
Change 1	63 thru 64b
Original	V-14-1
Change 1	V-14-2
Original	V-14-3 thru V-14-6
Change 1	V-14-7, V-14-8
Original	V-14-9
Change 1	V-14-10 thru V-14-14b
Change 1	V-14-15
Original	V-14-16 thru V-14-20
Change 1	V-14-21 thru V-14-24a
	(Reverse Blank)
Original	V-14-25 thru V-14-29
Change 1	V-14-30
Original	V-14-31 thru V-14-85
	(Reverse Blank)
Original	65 (Reverse Blank)
Original	VI-15-1 thru VI-15-3
Change 1	VI-15-4
Original	VI-15-5 thru VI-15-9
Change 1	VI-15-10
Original	VI-15-11 thru VI-15-13
	(Reverse Blank)
Original	67 (Reverse Blank)
Original	VII-16-1 thru VII-16-20
Original	69 (Reverse Blank)
Original	VIII-17-1 thru VIII-17-5
Change 1	VIII-17-6
Original	71 (Reverse Blank)
Original	IX-18-1 thru IX-18-4
Original	73 (Reverse Blank)
Original	X-19-1 thru X-19-14
Change 1	X-19-15
Original	X-19-16 thru X-19-34
Original	75 (Reverse Blank)
Change 1	XI-20-1
Original	XI-20-2 thru XI-20-4
Change 1	XI-20-5
Original	XI-20-6 thru XI-20-11

Effective Pages	Page Numbers
Change 1	XI-20-12
Original	XI-21-1 thru XI-21-7
Change 1	XI-21-8 thru XI-21-15
	(Reverse Blank)
Original	XI-22-1, XI-22-2
Change 1	XI-22-3 thru XI-22-7
	(Reverse Blank)
Original	XI-23-1 thru XI-23-8
Change 1	XI-23-9 thru XI-23-24
Original	XI-24-1, XI-24-2
Change 1	XI-24-3 thru XI-24-7
	(Reverse Blank)
Original	XI-25-1 thru XI-25-3
Change 1	XI-25-4 thru XI-25-7
	(Reverse Blank)
Original	XI-26-1
Change 1	XI-26-2 thru XI-26-4
Original	XI-27-1, XI-27-2
Change 1	XI-27-3 thru XI-27-6
Original	XI-28-1 thru XI-28-4
Change 1	XI-28-5 thru XI-28-10
Original	XI-29-1 thru XI-29-8
Change 1	77 (Reverse Blank)
Original	XII-30-1
Change 1	XII-30-2 thru XII-30-9
	(Reverse Blank)
Original	XII-31-1
Change 1	XII-31-2 thru XII-31-6
Original	XII-32-1, XII-32-2
Change 1	XII-32-3 thru XII-32-14
Original	XII-33-1
Change 1	XII-33-2 thru XII-33-5
	(Reverse Blank)
Original	XII-34-1
Change 1	XII-34-2 thru XII-34-5
	(Reverse Blank)
Original	XII-35-1
Change 1	XII-35-2 thru XII-35-4
Original	XII-36-1
Change 1	XII-36-2 thru XII-36-5
	(Reverse Blank)

LIST OF EFFECTIVE PAGES (Cont.)

Effective Pages	Page Numbers
Original	XII-37-1, XII-37-2
Change 1	XII-37-3 thru XII-37-8
Change 1	Index-1 thru Index-11
	(Reverse Blank)
Original	FO-1 (Reverse Blank)
Original	FO-3 (Reverse Blank)
Original	FO-5 (Reverse Blank)
Original	FO-7 (Reverse Blank)
Original	FO-9 (Reverse Blank)
Original	FO-11 (Reverse Blank)
Original	FO-13 (Reverse Blank)
Original	FO-15 (Reverse Blank)
Change 1	LEP-1 (Reverse Blank)