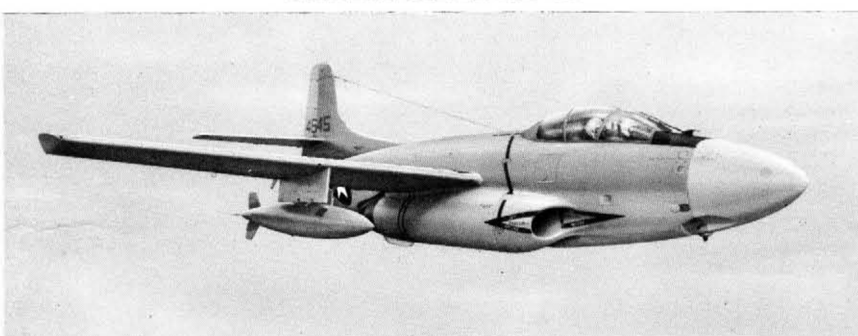
NATOPS FLIGHT MANUAL

NAVY MODEL EF-10B AIRCRAFT



THIS PUBLICATION IS INCOMPLETE WITHOUT SUPPLEMENTAL FLIGHT MANUAL NAVAIR 01-40FAB-1A

THIS PUBLICATION SUPERSEDES AN 01-40FAB-1 DATED 1 DECEMBER 1954 AND NAVWEPS 00-80Y-25 DATED 4 MAY 1961

ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND UNDER THE DIRECTION OF THE COMMANDER, NAVAL AIR SYSTEMS COMMAND

1 April 1969

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the current change is indicated by a vertical line in the outer margins of the page.

* The asterisk indicates pages changed, added or deleted by the current change.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS: **NASC**

USAF ACTIVITIES.—In accordance with Technical Order No. 00-5-2.

NAVY ACTIVITIES.—Use DD FORM 1348 and submit in accordance with the instructions contained in NAVSUP PUBLICATION 437—Navy Standard Requisitioning and Issue Procedure.

For information on other available material and details of distribution refer to NAVSUP PUBLICATION 2002, SECTION VIII and NAVAIR 00-500A.

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

LETTER OF PROMULGATION

1. The Naval Air Training and Operating Procedures Standardization Program (NATOPS) is a positive approach towards 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 his unit's combat potential without reducing his 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 Type/Fleet/Air Group/Air Wing/Squadron Commanders and subordinates are obligated and authorized to modify procedures contained herein, in accordance with the waiver provisions established by OPNAVINST 3510.9 series, 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.

Thomas F. Connolly

THOMAS F. CONNOLLY
Vice Admiral, USN
Deputy Chief of Naval Operations (Air)

NATOPS CHANGE RECOMMENDATION
OPNAV FORM 3500/22 (8-65) 0107-722-2001

TO BE FILLED IN BY ORIGINATOR

ORIGINATORS CHANGE RECOMMENDATION IDENT. NO. ______	DATE	☐ NATOPS MANUAL ☐ NATOPS FLIGHT MANUAL ☐ FLIGHT MANUAL	
MODEL AIRCRAFT	SECTION/CHAPTER	PAGE NUMBER	PARAGRAPH NUMBER

RECOMMENDATION *(be specific)*

☐ CHECK IF CONTINUED ON BACK

JUSTIFICATION

NAME	UNIT

ADDRESS

TO BE FILLED IN BY MODEL MANAGER *(Return to Originator)*

FROM	DATE

TO

REFERENCE
(a) Your Change Recommendation Number ______

☐ Your change recommendation number ______ 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/ ______ FOR MODEL MANAGER. ______

INTERIM CHANGE SUMMARY

THE FOLLOWING CHANGES HAVE BEEN CANCELED OR PREVIOUSLY INCORPORATED IN THIS MANUAL

CHANGE NUMBER(S)	REMARKS

THE FOLLOWING CHANGES HAVE BEEN INCORPORATED IN THIS CHANGE/REVISION

CHANGE NUMBER	CHANGE DATE	PURPOSE

INTERIM CHANGES OUTSTANDING – TO BE MAINTAINED BY CUSTODIAN OF THIS MANUAL

CHANGE NUMBER AND DATE	DATE CHANGE MADE	PAGES AFFECTED	PURPOSE

Table of Contents

* See Supplemental NATOPS Flight Manual NAVAIR 01-40FAB-1A

T113A-1-0-2

SCOPE

The NATOPS Flight Manual is issued by the authority of the Chief of Naval Operations and under the direction of the Commander, Naval Air Systems Command in conjunction with the Naval Air Training and Operating Procedures Standardization (NATOPS) Program. It provides the best available operating instructions for most circumstances, but no manual is a substitute for sound judgement. Emergencies, adverse weather, or terrain 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.

ARRANGEMENT

This manual is divided into eleven sections.

SECTION I - AIRCRAFT
- Part 1 - GENERAL DESCRIPTION
  Dimensions, cockpit layout, instrument panels.
- Part 2 - SYSTEMS
  Descriptive breakdown of system and system controls.
- Part 3 - SERVICING AND HANDLING
  Aircraft service and drain points, fluid capacities, parking and mooring.
- Part 4 - OPERATING LIMITATIONS
  Aircraft, engine, airspeed, acceleration limitations, maneuvers, and gross weight limitations.

SECTION II - INDOCTRINATION
Ground training, flight training, flight crew requirements, operating criteria, personnel flying equipment, and flight personnel categories.

SECTION III - NORMAL PROCEDURES
Briefing/debriefing, procedures from scheduling to postflight, to include system operation.

SECTION IV - FLIGHT PROCEDURES
Familiarization and transition, flight characteristics, stall speeds, stalls, spins, formation, and test flight procedures.

SECTION V - EMERGENCY PROCEDURES

SECTION VI - ALL WEATHER OPERATION
Simulated and actual instruments, turbulence and thunderstorms, cold weather, tropic operations, and desert operations.

SECTION VII - COMMUNICATIONS/NAVIGATION EQUIPMENT AND PROCEDURES
Radio communications, radar navigation, visual, and ground procedures.

SECTION VIII - COUNTERMEASURES EQUIPMENT AND PROCEDURES (NAVAIR 01-40FAB-1A).

SECTION IX - FLIGHT CREW COORDINATION
Includes a general comment on the duties of the individual crewmembers.

SECTION X - NATOPS EVALUATION

SECTION XI - PERFORMANCE DATA

HOW TO GET COPIES

Automatic Distribution

To receive future changes and revisions to this manual automatically, a unit must be established on the automatic distribution list maintained by the Naval Air Technical Services Facility (NATSF). To become established on the list or change distribution requirements, a unit must submit NAVWEPS Form 5605/2 to NATSF, 700 Robbins Ave., Philadelphia, Pa. 19111, listing this manual and all other NAVAIR publications required. For additional instructions refer to BUWEPSINST 5605.4 series and NAVSUP Publication 2002.

Additional Copies

Additional copies of this manual and changes thereto may be procured by submitting a NAVSTRIP Form DD1348 to NSD, Philadelphia in accordance with NAVSUP Publication 2002.

NATOPS POCKET CHECK LIST

The NATOPS Pocket Check List (NAVAIR 01-40FAB-1B) provides, in abbreviated form, essential information for operation of the EF-10B. This Check List may be obtained in the same manner as the NATOPS Flight Manual. Changes to it are concurrent with the NATOPS Flight Manual as required.

YOUR RESPONSIBILITY

NATOPS Flight Manuals are kept current through an active manual change program. If you find anything you don't like about this manual, if you have information you would like to pass along to others, or if you find an error in this manual, submit a change recommendation to the Model Manager at once.

CHANGE RECOMMENDATIONS

Recommended changes to this manual or other NATOPS publications may be submitted by anyone in accordance with OPNAVINST 3510.9 series. Change recommendations of the URGENT nature (safety of flight, etc) should be submitted directly to the NATOPS Advisory Group Member in the Chain of Command by priority message. Submit routine change recommendations to the Model Manager on OPNAV Form 3500-22. Address routine changes to:

Commanding General
3rd Marine Aircraft Wing
Marine Corps Air Station, El Toro
Santa Ana, California 92709

Attn: VMCJ-3

NATOPS FLIGHT MANUAL INTERIM CHANGES (FMIC's)

FMIC's are changes or corrections to the NATOPS Flight Manual promulgated by CNO or NAVAIRSYSCOM. FMIC's may be received by the individual custodian as a printed page or pages, or by the commands as a naval message. After the completion of the action directed by an interim change, it shall be retained in front of the Interim Change Summary Page of the manual unless it contains authorization to discard.

INTERIM CHANGE SUMMARY

The interim change summary in each manual is provided for the purpose of maintaining a complete record of all interim changes issued to the manual. Each time the manual is changed or revised, the interim change summary will be updated to indicate disposition and/or incorporation of previously issued interim changes. When a regular change is received, the interim change summary should be checked to ascertain that all outstanding interim changes have been either incorporated or cancelled; those not incorporated should be reentered and noted as applicable.

CHANGE SYMBOLS

Revised text is indicated by a black vertical line in either margin of the page, like the one printed next to this paragraph. This change might be material added or information restated.

WARNINGS, CAUTIONS, AND NOTES.

The following definitions apply to "WARNINGS," "CAUTIONS," and "NOTES" found throughout the manual.

WARNING

Operating procedures, practices, etc, which may result in injury or death, if not carefully followed.

CAUTION

Operating procedures, practices, etc, which, if not strictly observed, may damage equipment.

NOTE

An operating procedure, condition, etc, which is essential to emphasize.

WORDING

The concept of the 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 optional.

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

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

SECTION I

AIRCRAFT

PART 1

GENERAL DESCRIPTION

Table of Contents

AIRCRAFT

The EF-10B (figure 1-1) is a two place, twin turbojet reconnaissance aircraft. The aircraft is designed for all-weather, day-night electronic reconnaissance operations. Two J34-WE-36 (24C42) Westinghouse turbojet engines, thrust rated at 3400 pounds per engine, are installed in the aircraft. The enclosed cockpit accommodates a pilot and an electronic countermeasures (ECM) officer seated side-by-side. Entrance to the cockpit is through a sliding panel entrance door (ditching hatch) located in the upper section of the cockpit enclosure. The aircraft appearance is characterized by a straight mid-wing that has a 3-degree dihedral, and may be folded. There are 20-mm cannons mounted in the lower fuselage nose section on each side of the aircraft centerline.

Two configurations of the aircraft are covered in this manual; one version incorporates AFC No. 173 only, the other incorporates AFC No. 173 and AFC No. 199.

GENERAL ARRANGEMENT

The general arrangement of the aircraft is shown in figure 1-2. Dimensions and weight for the aircraft are as follows:

Length (ground line level) . . . . 45 ft, 6-1/4 in.

Span (wings spread) . . . . 50 ft, 0 in.

Span (wings folded) . . . . 26 ft, 10 in.

Height (over tail, measured from ground line) . . . . 16 ft, 1 in.

Height (over wings, wings folded) . . . . . . 16 ft, 6 in.

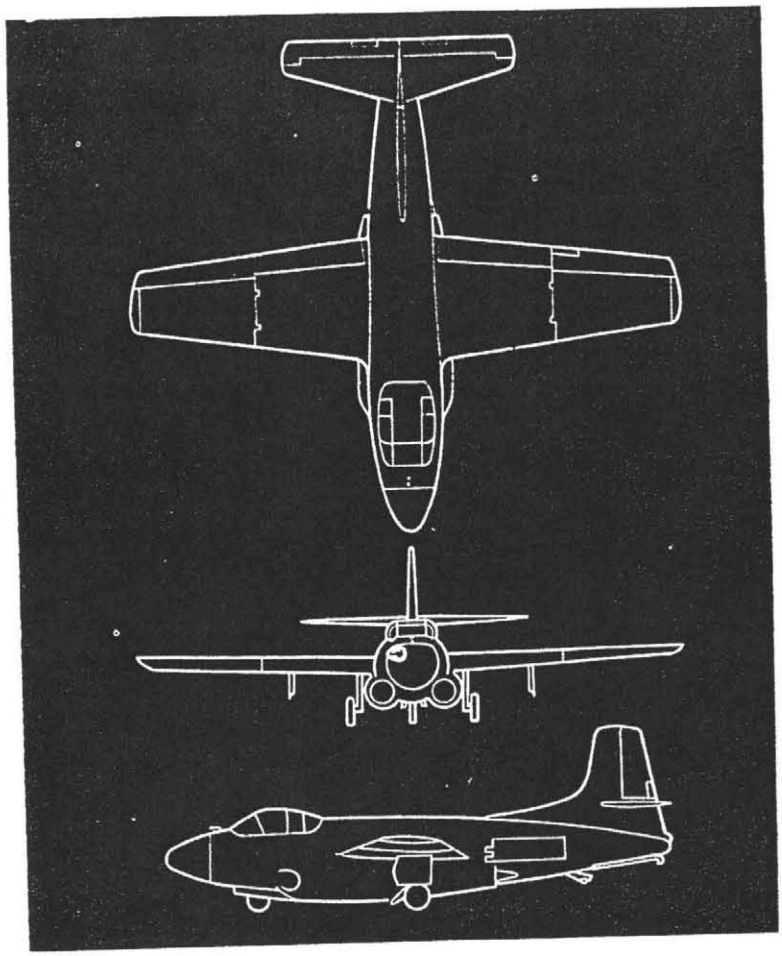
Weight (basic) . . . . 15,600 lb

Weight (normal gross) . . . .

- 1350 gal fuel (internal) . . . . 23,700 lb
- 1650 gal fuel (two 150 gal external tanks) . . . . 25,700 lb
- 1950 gal fuel (two 300 gal external tanks). . . . . 27,700 lb

COCKPIT LAYOUT

Typical cockpit layouts for aircraft incorporating AFC No. 173 and for aircraft incorporating AFC No. 199 are provided in figures 1-3 through 1-7.



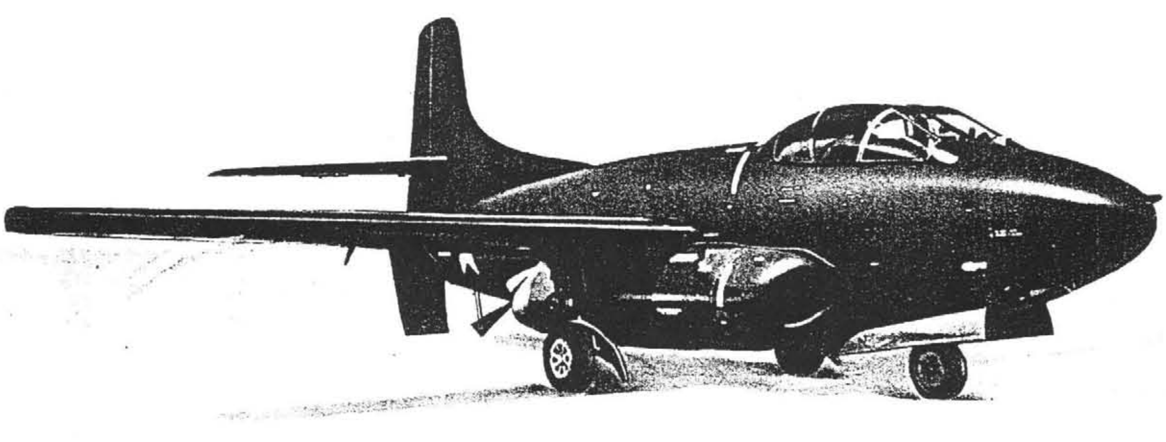
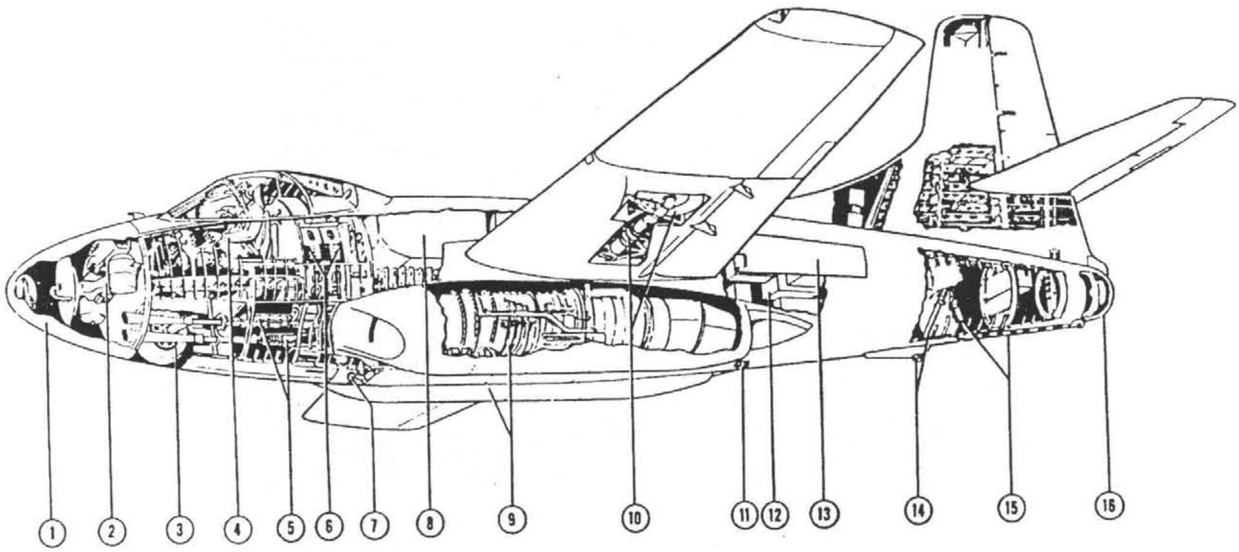
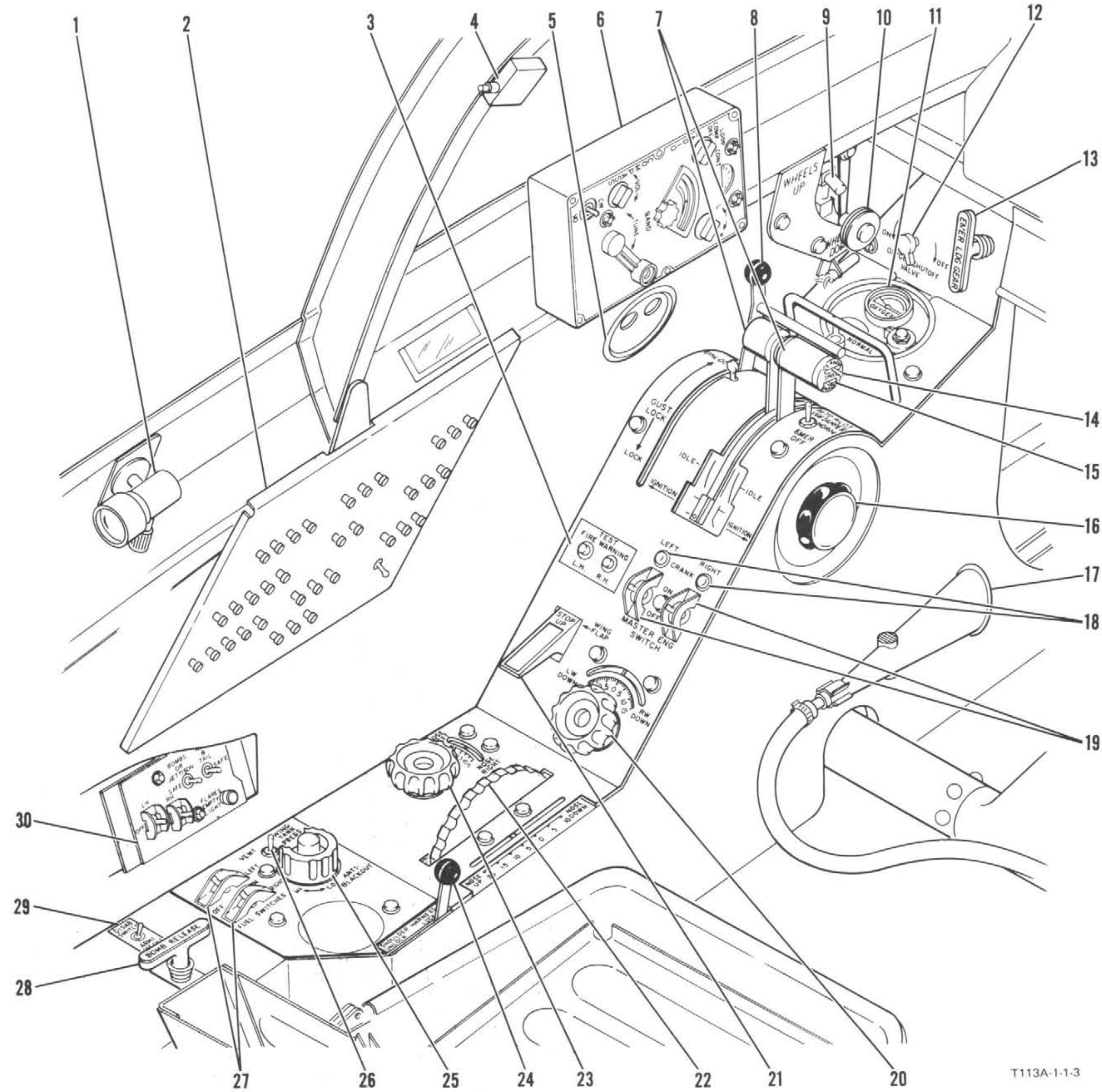


Figure 1-1. EF-10B reconnaissance aircraft



1. Nose radome
2. Radar equipment compartment
3. Nose landing gear
4. Pilot's and radar operator's compartment
5. 20-mm guns
6. Ammunition stowage
7. Catapult hook (both sides)
8. Fuel tank section
9. Jet engine installations
10. Main landing gear
11. Catapult hold back
12. Radio equipment compartment
13. Speed retarder brake
14. Tail bumper gear
15. Arresting hook
16. Tail radome

Figure 1-2. General Arrangement Diagram



1. Emergency Floodlight
2. Circuit Breaker Panel
3. Fire Warning Test Switches
4. Exterior Lights Keying Switch
5. Ash Tray Holder
6. Radio Compass Control (ARN-6)
7. Throttle Controls
8. Gust Lock Control
9. Landing Gear Control Safety Lock
10. Landing Gear Control Lever
11. Oxygen Regulator
12. Oxygen Shutoff Valve
13. Landing Gear Emergency Release Handle
14. Throttle Transmit Switch
15. Speed Brake Actuator Switch
16. Throttle Friction Control
17. Relief Tube
18. Engine Crank Switches
19. Master Engine Switches
20. Aileron Trim Tab Control
21. Wing Flaps Control
22. Elevator Trim Tab Control
23. Rudder Trim Tab Control
24. Pilot's Shoulder Harness Lock Control
25. Anti-g Control
26. Wing Tank Fuel Pressure Switch
27. Fuel Switches
28. External Stores Emergency Release Handle
29. Armament Disable Switch
30. External Stores Control

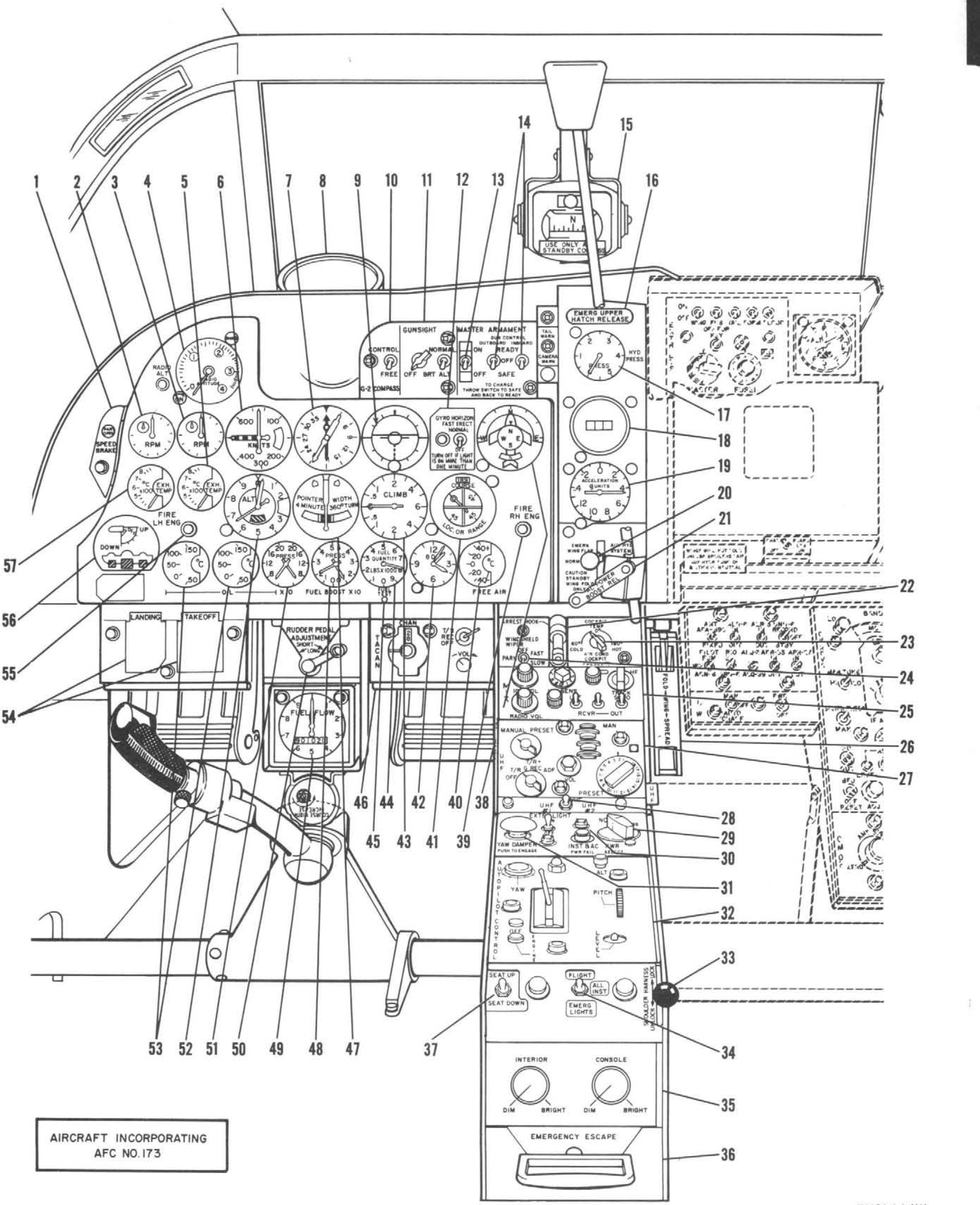
Figure 1-3. Cockpit – Left Side

KEY TO FIGURE 1-4 ➧

1. Speed Brake Position Indicator
2. LH Engine Tachometer
3. RH Engine Tachometer
4. Radio Altimeter Indicator
5. RH Turbine Outlet Temperature Indicator
6. Air Speed Indicator
7. Radio Magnetic Indicator
8. Gun Sight
9. Gyro Horizon Attitude Indicator
10. G-2 Compass Control
11. Gun Sight Control
12. Gyro Horizon Fast Erect Warning Light and Switch
13. Master Armament Switch
14. Gun Control Switches
15. Standby Compass
16. Upper Hatch Emergency Release Handle
17. Hydraulic Pressure Gage
18. Distance Measuring Equipment
19. Accelerometer
20. Emergency Wing Flap Control
21. Aileron Power Boost Release Handle
22. Arresting Hook Control Handle
23. Air Conditioning and Pressurization Control Switch
24. Windshield Wiper Switch
25. Radio/ICS Control (AIC-4)
26. Wing Fold Control Handle
27. UHF Radio Control (ARC-27)
28. UHF Selector Switch
29. Inverter Selector Switch
30. Power Failure Light
31. Yaw Damper Relay Control
32. Autopilot
33. ECMO's Shoulder Harness Control Lever
34. Pilot's Emergency Lights Switch
35. Interior Lights Control
36. Lower Escape Chute Door Emergency Release Handle
37. Pilot's Seat Adjustment Switch
38. Master Direction Indicator (G-2 Compass)
39. RH Engine Fire Warning Light
40. Free Air Temperature Indicator
41. Course Indicator
42. Clock
43. Vertical Speed Indicator
44. Fuel Quantity Gage
45. Fuel Quantity Gage Test Button
46. TACAN Radio Control (ARN-21)
47. Turn and Slip Indicator
48. Dual Fuel Boost Pressure Indicator
49. Fuel Flow Indicator
50. Rudder Pedal Adjustment Crank
51. Dual Oil Pressure Gage
52. Altimeter
53. Oil Temperature Indicators
54. Checkoff Lists
55. LH Engine Fire Warning Light
56. Wheels and Flaps Position Indicator
57. LH Turbine Outlet Temperature Indicator

AIRCRAFT INCORPORATING
AFC NO 173

Figure 1-4. Cockpit – Instrument Panel and Center Console (Sheet 1)



T113A-1-1-4(1)

Figure 1-4. Cockpit – Instrument Panel and Center Console (Sheet 2)

KEY TO FIGURE 1-4 ➧

1. Speed Brake Position Indicator
2. LH Engine Tachometer
3. RH Engine Tachometer
4. Radio Altimeter Indicator
5. RH Turbine Outlet Temperature Indicator
6. Air Speed Indicator
7. Bearing Distance Heading Indicator
8. Gun Sight
9. Gyro Horizon Attitude Indicator
10. G-2 Compass Control
11. Gun Sight Control
12. Gyro Horizon Fast Erect Warning Light and Switch
13. Cabin Altimeter
14. Standby Compass
15. Upper Hatch Emergency Release Handle
16. Hydraulic Pressure Gage
17. Accelerometer
18. Gun Control Switch
19. Master Armament Switch
20. Emergency Wing Flap Control
21. Aileron Power Boost Release Handle
22. Arresting Hook Control Handle
23. Air Conditioning and Pressurization Control Switch
24. Windshield Wiper Switch
25. Radar Receiver Control (APR-27)
26. Wing Fold Control Handle
27. UHF Radio Control (ARC-52)
28. Radio/ICS Control (AIC-4A)
29. HF Radio Control (ARC-94)
30. Pilot's Interior Lights Control
31. KY-28 Security Equipment
32. ECMO's Shoulder Harness Control Lever
33. Emergency Lights Switch
34. Inverter Selector Switch
35. Lower Escape Chute Door Emergency Release Handle
36. Standby Compass Light Switch
37. Extension Light Switch
38. Pilot's Seat Adjustment Switch
39. Master Direction Indicator (G-2 Compass)
40. RH Engine Fire Warning Light
41. Free Air Temperature Indicator
42. Course Indicator
43. Clock
44. Vertical Speed Indicator
45. Fuel Quantity Gage
46. Fuel Quantity Gage Test Button
47. TACAN Radio Control (ARN-21)
48. Turn and Slip Indicator
49. Dual Fuel Boost Pressure Indicator
50. Fuel Flow Indicator
51. Rudder Pedal Adjustment Crank
52. Dual Oil Pressure Gage
53. Altimeter
54. Oil Temperature Indicators
55. Checkoff Lists
56. LH Engine Fire Warning Light
57. Wheels and Flaps Position Indicator
58. LH Turbine Outlet Temperature Indicator

AIRCRAFT INCORPORATING
AFC NO. 199

Figure 1-4. Cockpit – Instrument Panel and Center Console (Sheet 3)

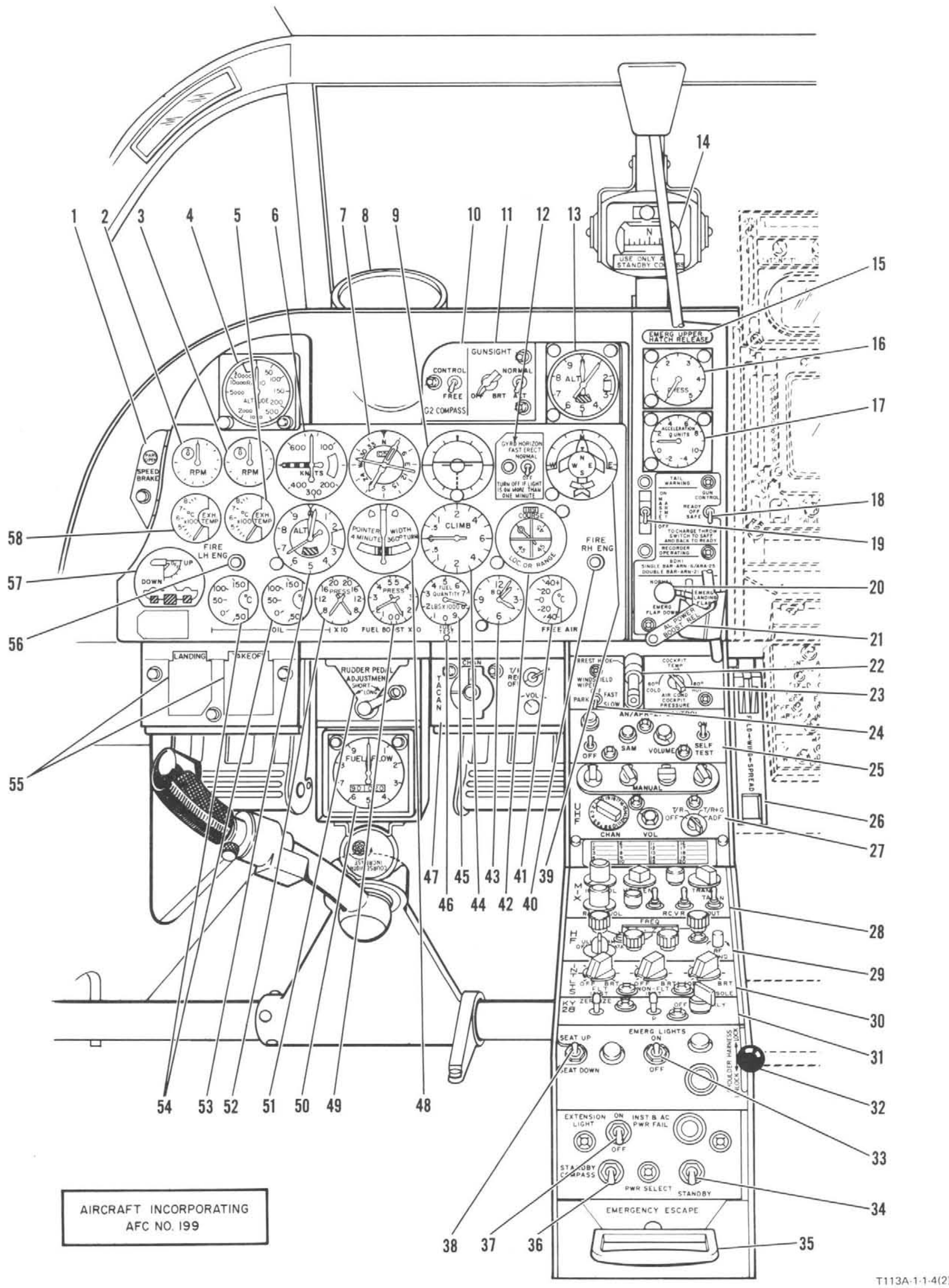
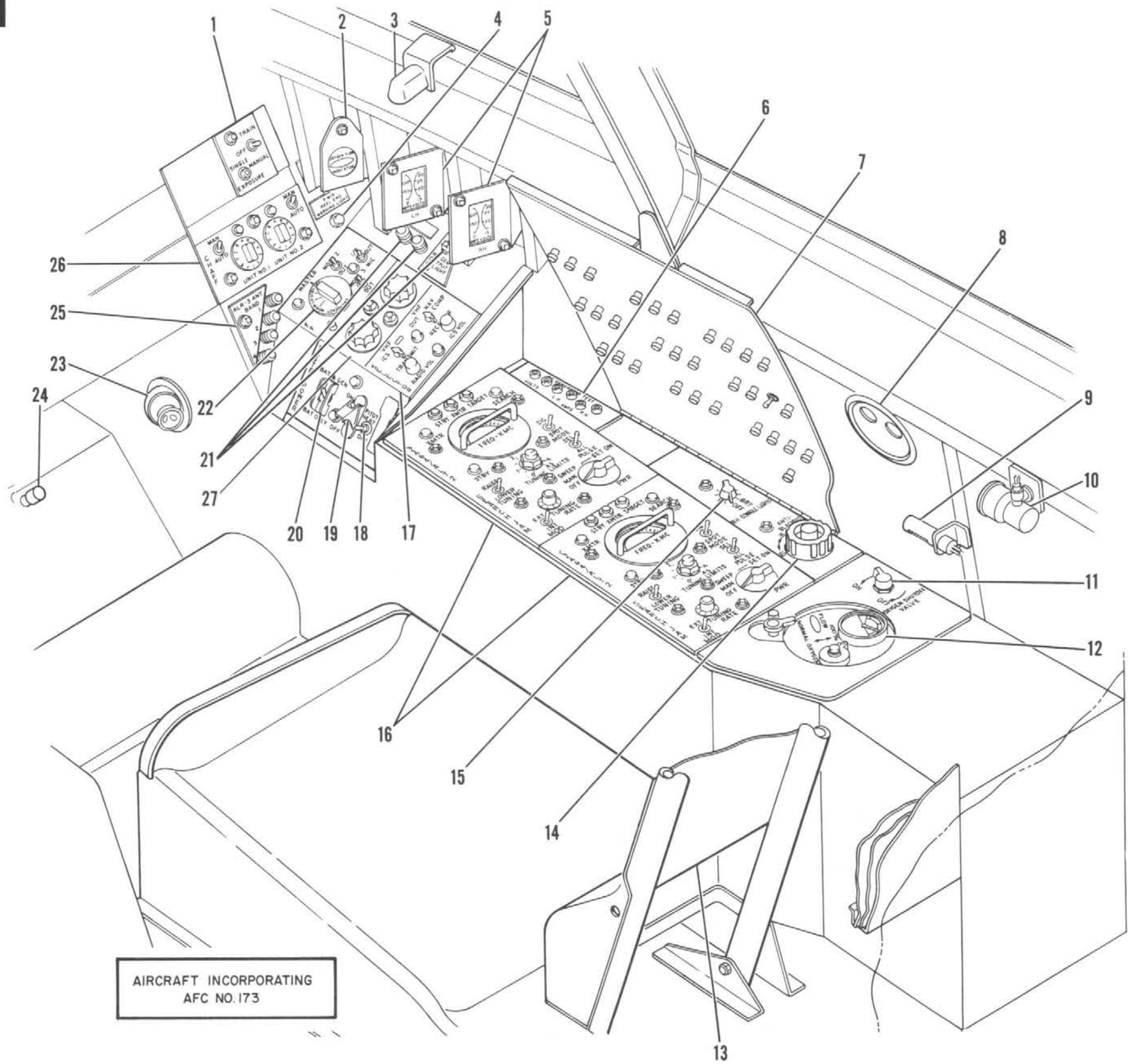


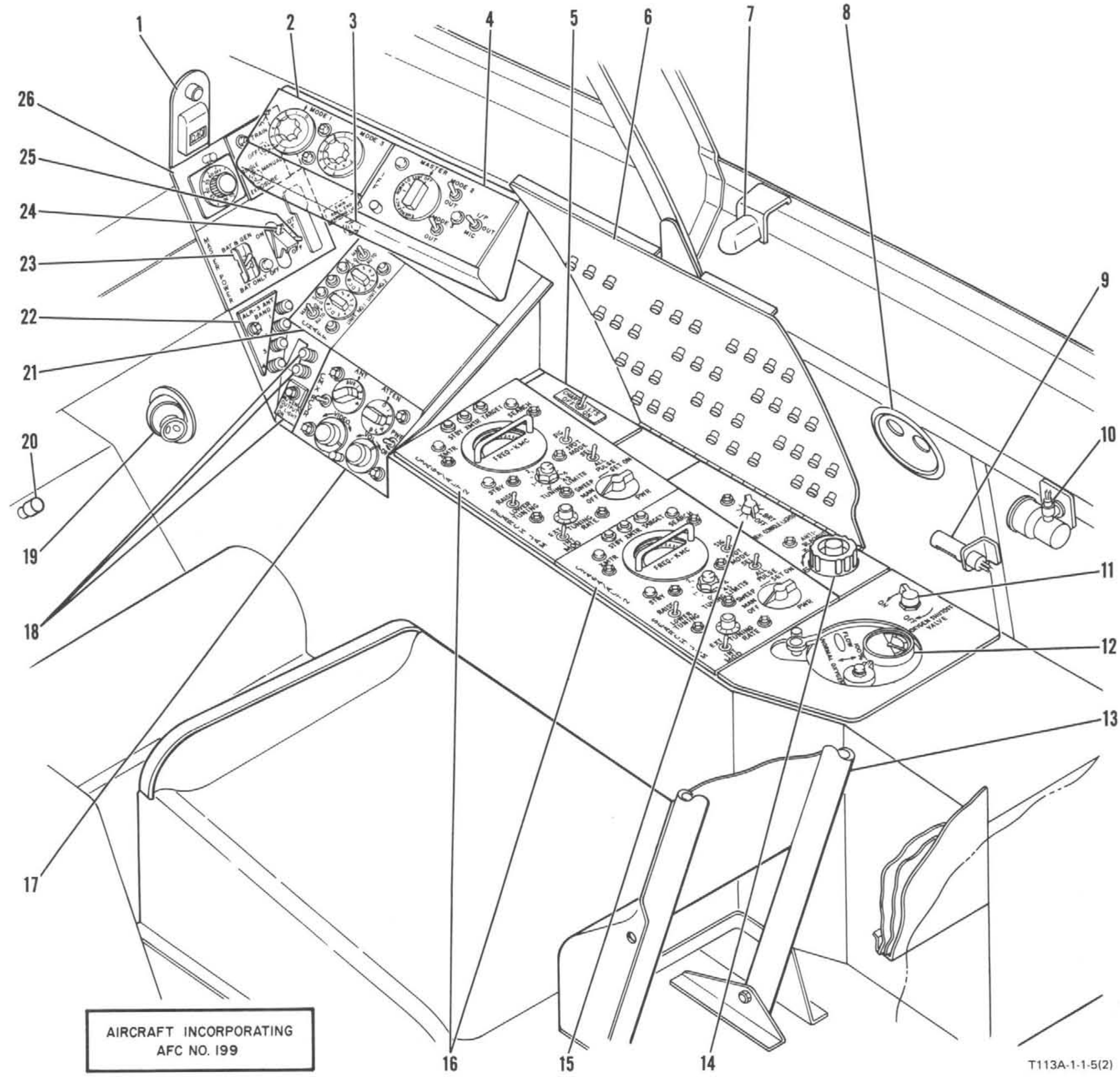
Figure 1-4. Cockpit – Instrument Panel and Center Console (Sheet 4)



1. K-17 Camera Control
2. Oxygen Flow Indicator
3. Chartboard Light
4. Reel-End Warning Light
5. Generator Volt-Ammeter
6. Generator Test Jacks
7. Circuit Breaker Panel
8. Ash Tray Holder
9. Oxygen Regulator Light
10. Emergency Floodlight
11. Oxygen Shutoff Valve
12. Oxygen Regulator
13. Seat
14. Anti-g Control
15. RH Console Lights Switch
16. ECM Transmitter Control (ALT-2)
17. Radio/ICS Control (AIC-4)
18. Pitot Heat Switch
19. Master Radio Switch
20. Battery/Generator Switch
21. Generator Warning Lights
22. IFF Control (APX-6)
23. Adjustable Air Inlet
24. Foot Transmit Switch
25. Antenna Band Indicator (ALR-3)
26. Chaff Dispenser Control (ALE-2)
27. SIF Control (APA-89)

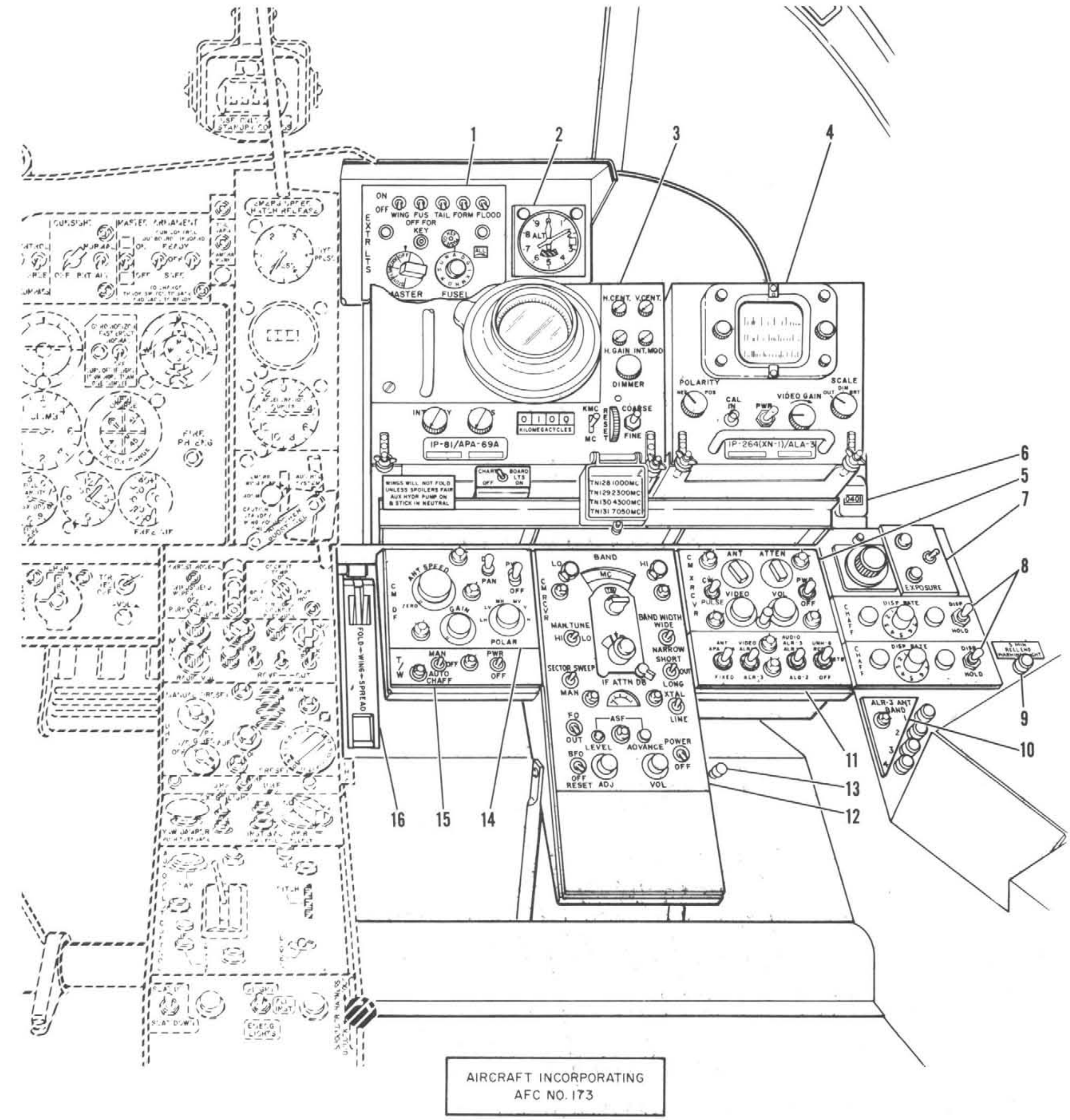
T113A-1-1-5(1)

Figure 1-5. Cockpit-Right Side (Sheet 1)



1. K-17 Camera Counter
2. SIF Control (APA-89)
3. Reel End Warning Light
4. IFF Control (APX-6B)
5. Chartboard Light Switch
6. Circuit Breaker Panel
7. Chartboard Light
8. Ash Tray Holder
9. Oxygen Regulator Light
10. Emergency Floodlight
11. Oxygen Shutoff Valve
12. Oxygen Regulator
13. Seat
14. Anti-g Control
15. RH Console Lights Switch
16. ECM Transmitter Control (ALT-2)
17. ECM Receiver Control (ALR-3)
18. Generator Warning Lights
19. Adjustable Air Inlet
20. Foot Transmit Switch
21. Chaff Dispenser Control (ALE-2)
22. Antenna Band Indicator (ALR-3)
23. Battery/Generator Switch
24. Master Radio Switch
25. Pitot Heat Switch
26. K-17 Camera Control

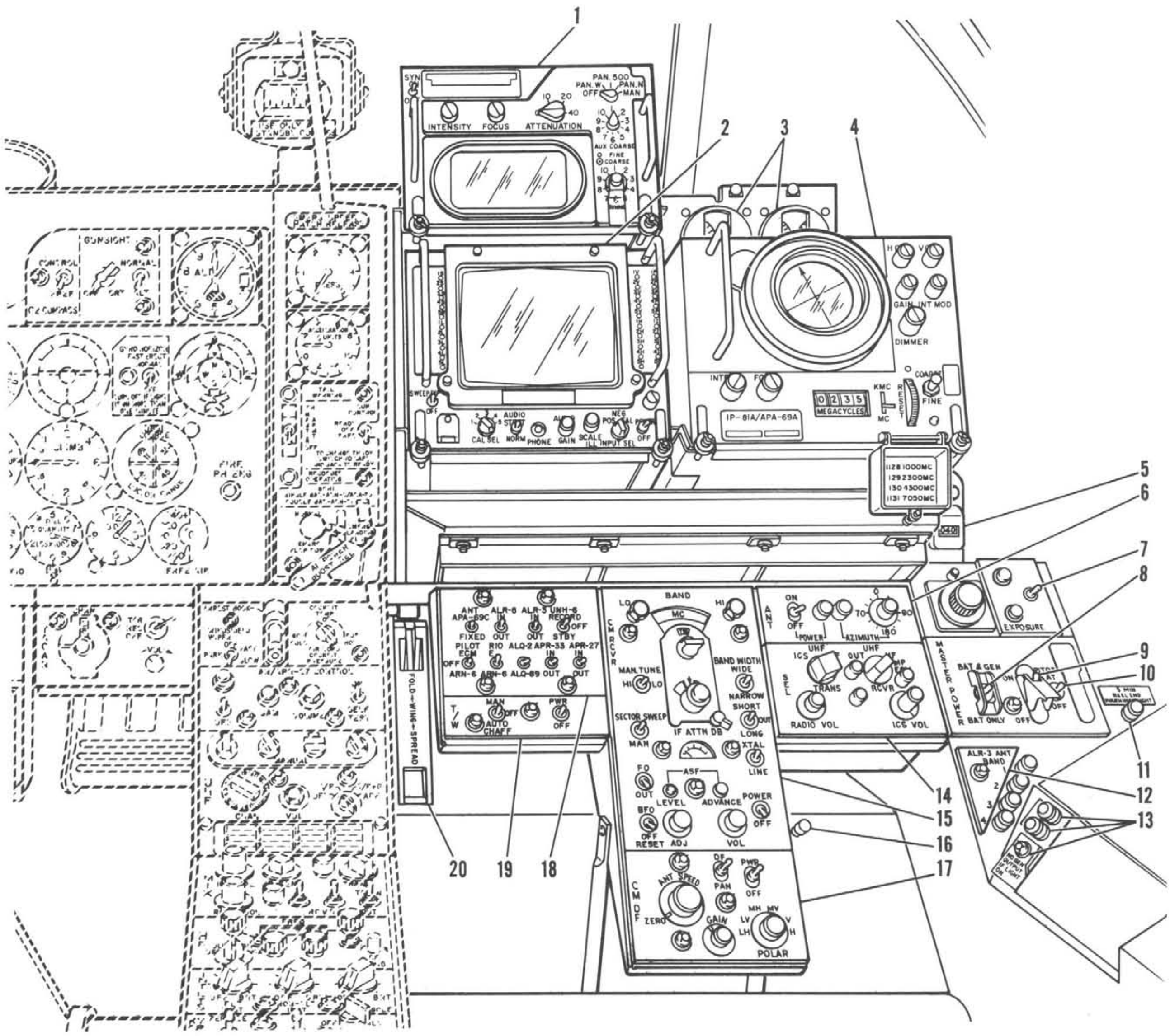
Figure 1-5. Cockpit-Right Side (Sheet 2)



1. Exterior Lights Control
2. Cabin Altimeter
3. Azimuth-Panoramic Indicator (APA-69)
4. Pulse Analyzer Indicator (ALA-3)
5. ECM Receiver Control (ALR-3)
6. K-17 Camera Counter
7. K-17 Camera Control
8. Chaff Dispenser Controls (ALE-2)
9. Reel-End Warning Light (UNH-6)
10. Antenna Band Indicator (ALR-3)
11. ECM Mixer Box
12. ECM Receiver Control (APR-9)
13. Foot Transmit Switch (AIC-4)
14. Direction Finder Control (APA-69)
15. Automatic Chaff Dispenser Control (ALQ-2)
16. Wing Fold Control Handle

T113A-1-1-6(1)

Figure 1-6. Cockpit-ECM Equipment (Sheet 1)

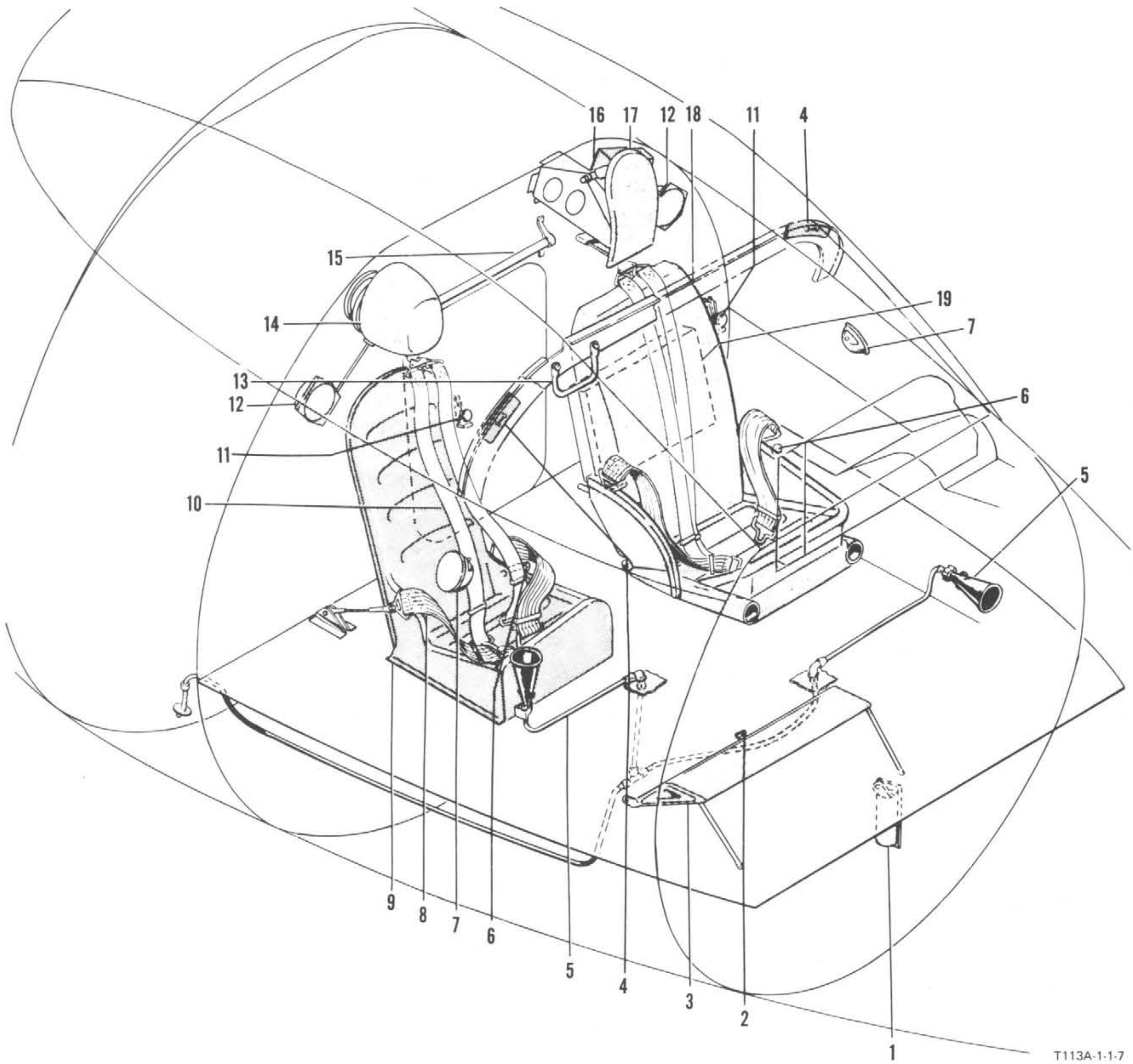


AIRCRAFT INCORPORATING
AFC NO. 199

1. Fire Control Monitor Receiver (APR-33)
2. Indicator Group (ULA-2)
3. Generator Volt-Ammeter
4. Azimuth-Panoramic Indicator (APA-69)
5. K-17 Camera Counter
6. Antenna Control (AN/ALA-32)
7. K-17 Camera Control
8. Battery/Generator Switch
9. Master Radio Switch
10. Pitot Heat Switch
11. Reel-End Warning Light (UNH-6)
12. Antenna Band Indicator (ALR-3)
13. Generator Warning Lights
14. Radio/ICS Control (AIC-4A)
15. ECM Receiver Control (APR-9)
16. Foot Transmit Switch (AIC-4A)
17. Direction Finder Control (APA-69)
18. ECM Mixer Box
19. Automatic Chaff Dispenser Control (ALQ-2)
20. Wing Fold Control Handle

T113A-1-1-6(2)

Figure 1-6. Cockpit-ECM Equipment (Sheet 2)



1. Aircraft Jack Pad Stowage
2. ECM Officer's Foot Transmit Switch
3. ECM Officer's Foot Rest
4. Rear-vision Mirror
5. Relief Tube
6. Anti-g Connection
7. Ash Tray
8. Lap Harness
9. ECM Officer's Seat
10. Shoulder Harness
11. Oxygen/Radio Connection
12. Shoulder Harness Inertia Reel
13. ECM Officer's Assist Handle
14. ECM Officer's Head Rest
15. Cockpit Aft Escape Hand Rail
16. First Aid Kit
17. Pilot's Head Rest
18. Pilot's Seat
19. Map and Oxygen Mask Stowage

Figure 1-7. Cockpit-Miscellaneous Equipment

PART 2

SYSTEMS

Table of Contents

FLIGHT CONTROL SYSTEM

Flight instrumentation, control stick and rudder pedals are provided for the pilot only. The rudder pedals may be adjusted by means of a crank (figure 1-4) located below the instrument panel. Figures 1-3 through 1-7 show the cockpit instruments and controls.

GUST LOCK

The gust lock control (figure 1-3) is located on the left console outboard of the throttle quadrant. The forward position of the control is UNLOCK. Moving the lever aft to LOCK secures all of the control surfaces in their neutral positions. This prevents ground check operation of the control surfaces until the gust lock system is unlocked. A takeoff with the control surfaces locked is prevented by means of a rod attached to the control lever. This rod engages the forward edges of the throttle levers and prevents their movement from the aft detent positions (engines off) until the gust lock is released. To move the gust lock control from one position to the other, a locking pin lever, located at the center of the gust lock control quadrant slot, must first be pressed inboard.

Note

All control surfaces should be in their neutral position before applying the gust lock.

TRIM TABS

Controllable trim tabs are located in the rudder, the left-hand aileron, and the elevator. The trim tab controls (figure 1-3) are located in the left console.

AILERON SPOILERS

A spoiler is installed on the upper surface of each wing forward of the wing flap and inboard of the wing fold joint. The spoilers are hydraulically actuated by pressure from the aileron power boost system. Both spoilers remain closed until the control stick is moved past approximately 10 degrees left or right of neutral. Beyond this position, the left-hand spoiler opens with left wing down and the right-hand spoiler opens with right wing down. The spoiler is closed as the control stick passes the same 10-degree position on its return toward neutral. Sequence valves are installed in the spoiler system and in the wing fold system to prevent damage from interference between open spoiler and folded wing. The valve system operates to prevent folding of a wing until the respective spoiler is faired, and prevents the spoiler from being opened after the respective wing has been folded.

AILERON POWER BOOST SYSTEM

An aileron 20:1 ratio power boost system operates from pressure supplied by the auxiliary hydraulic system. The boost system can be mechanically disconnected from the aileron control system by means of the AIL POWER BOOST REL control (figure 1-4), which is located adjacent to the center console. Once disconnected, the boost system cannot be reconnected during flight.

POWER PLANT CONTROLS

MASTER ENGINE SWITCHES

The master engine switches (figure 1-3), one for each engine, are located on the left console. Placing the switches in the ON position energizes the starter circuit up to the momentary contact crank switches.

ENGINE CRANK SWITCHES

Two pushbutton momentary crank switches (figure 1-3) that energize the starters are mounted on the left console aft of the throttle levers.

THROTTLES

Throttle controls (figure 1-3) are located on the left console. The throttle levers are moved outward at the aft position to IGNITION to energize the ignition coil and start the 30-second ignition timer, and are then advanced toward the IDLE position. The throttles must be advanced with care to prevent overtemping or rumbling the engine. After a start is made, the throttles operate in a normal manner from the idle stops to full power. A microphone switch and a speed brake switch are provided on the right-hand engine throttle grip.

TURBINE OUTLET TEMPERATURE INDICATORS

These gages (figure 1-4) on the instrument panel, receive impulses from thermocouples connected in parallel having matched leadwire resistances. This method provides an indication of turbine outlet temperature from 0 to 1000 degrees centigrade.

TACHOMETERS

Two tachometers (figure 1-4) on the instrument panel, read in percent rpm and indicate the percentage of 12,500 rpm, which is the maximum allowable. Important settings are as follows:

Takeoff and Military 100%

Maximum Continuous (normal rated) 95.5%

FUEL SYSTEM

AIRCRAFT FUEL SYSTEM

The fuel system (figure 1-8) is so designed that the transfer of internal fuel is performed automatically. The aircraft center of gravity is automatically held within allowable limits as fuel is consumed. Three self-sealing fuel cells are located in the fuselage aft of the cockpit. The forward fuselage cell has a capacity of 650 U.S. gallons; the center fuselage cell, 290 U.S. gallons; and the aft fuselage cell, 410 U.S. gallons of fuel. Provisions are made for suspending external fuel tanks from the external stores rack on each wing.

Transfer of fuel to the fuselage center fuel cell is accomplished through pressurization of the external fuel tanks. A WING TANK PRESS switch (figure 1-3) gives the pilot manual control over the transfer of fuel from the external tanks. Fuel from the forward and center fuselage cells feed into the aft fuselage cell through a common manifold. The forward lower section of the aft cell is baffled off to form a compartment for housing the booster pumps. A flapper valve at the aft end of the booster pump compartment prevents fuel from emptying into the aft cell during a climb. Flapper valves in the forward and center fuselage cells supply lines prevent return of fuel from the compartment during descents. By this means, fuel is supplied to the pumps from the forward and center fuselage cells during climbs and from the rear cell during dives. A flapper valve is installed at the top of the compartment to prevent fuel from returning to the center cell through the vent line during negative g operations. Sufficient fuel is contained in the compartment for approximately 30 seconds of negative g operation. The booster pumps supply fuel at a pressure of approximately 10 to 30 psi to the engine fuel system. The manually operated switch is incorporated for pressurizing or venting the external fuel tanks. This two-position switch (figure 1-3) is outboard of the anti-g control. This switch should be in the VENT position for takeoff and landing and whenever the throttle is being retarded to IDLE. Otherwise, it is left in the WING TANK PRESS position.

CAUTION

> If boost pump pressure falls below the minimum allowable of 10 psi while on the ground, shut down the engine and investigate. If this occurs during flight, power loss will be experienced and engine performance may be restricted with increase in altitude. Furthermore, above 18,000 feet flameout is highly probable.

Fuel Quantity Indicator

A fuel indicator (figure 1-4) on the instrument panel, indicates in pounds the total fuel quantity of all three fuselage cells. A test button (figure 1-4) is installed on the instrument panel below the fuel quantity indicator for use in testing the operation of the fuel quantity indicator. When the test button is pushed in with an external power source connected or with the generators operating, a fuel-cells-empty impulse is fed to the fuel quantity indicator circuit. If the fuel quantity indicating system is operating properly, the indicator needle deflects toward a zero reading, and then returns to an actual fuel quantity indication when the button is released. If the system is not functioning, the indicator will not deflect when the test button is pushed. The calibration on the fuel indicator is based on zero degree pitch of the aircraft.

Defueling Valve

An access door, located at the bottom of the fuselage between the two engines, permits access to the defueling valve. Defueling is at a continuous rate of 50 gallons per minute.

ENGINE FUEL SYSTEM

Fuel from the cells is supplied to the engine fuel system by the booster pumps. This fuel is metered by the regulator on the primary pump to obtain a constant engine rpm for a given throttle position regardless of ambient conditions. Flow from the regulator enters the fuel manifold section via the dump valve.

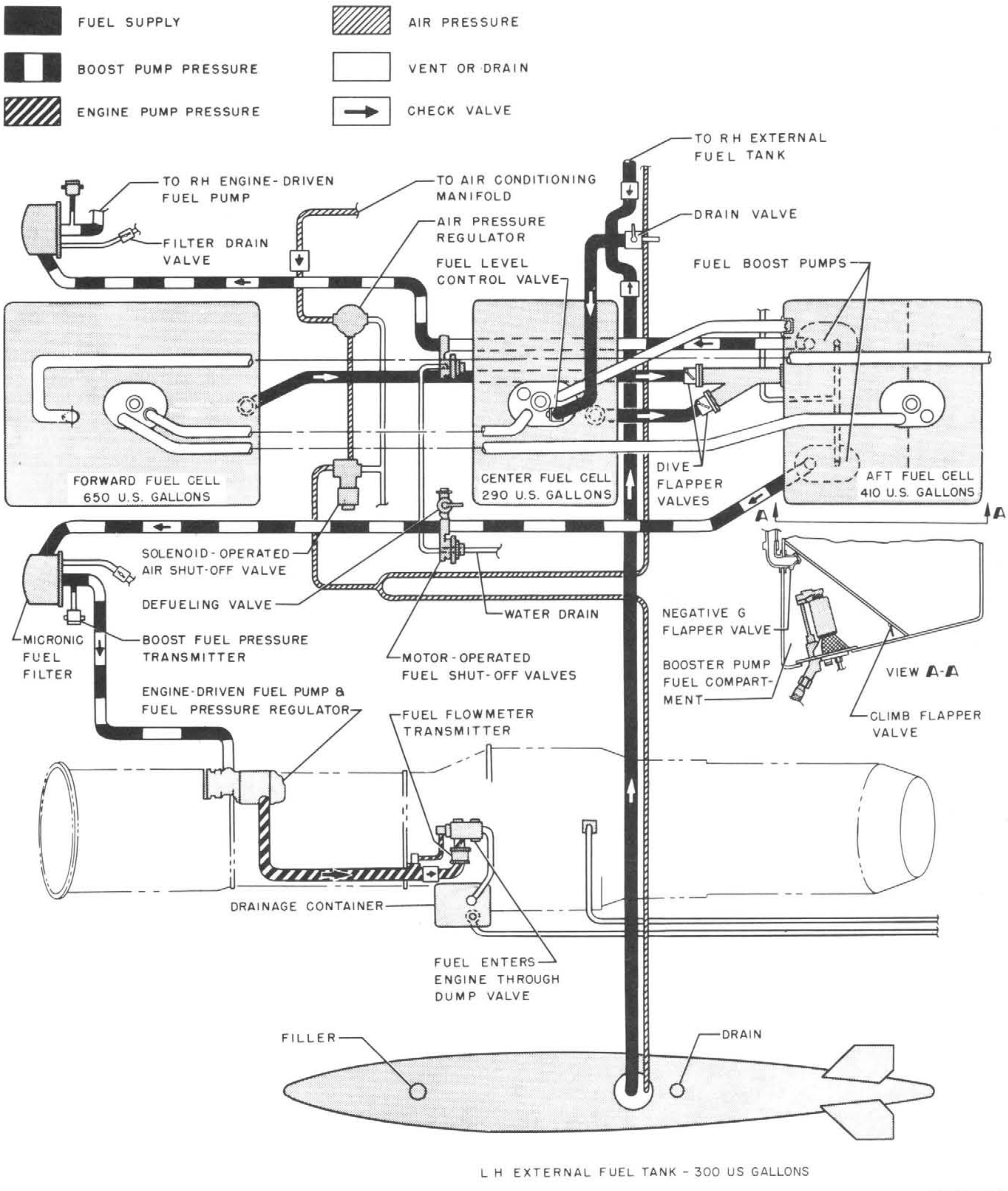


Figure 1-8. Fuel System

Dump Valve

The dump valve is attached to the fuel manifold section of the engine and is normally in the open (shutdown) position. In the open position, fuel from the fuel manifold is directed to a fuel drainage container. Such flow occurs automatically at shutdown when the throttle is retarded to the cutoff position. Upon starting the engine, the dump valve automatically goes to the closed (operating) position, which closes the overboard drain opening and permits fuel to flow directly from the governor into the engine.

Fuel Drainage Container

The fuel drainage container is provided to catch residual fuel dumped by the dump valve during false starts and upon shutting down the engine. The containers are drained before flight. A maximum of two shutdowns are allowed before the containers must be drained.

Fuel Switches

Two fuel switches (figure 1-3) are located on the left console. These switches control the booster pumps and open the fuel shutoff valves for each engine.

Fuel Boost Pressure Indicator

A dual fuel boost pressure indicator (figure 1-4) on the instrument panel, shows the pressure of the fuel being supplied to the engine fuel system.

Note

> Normal fuel boost pressure is 10 to 30 psi. Any variation of fuel boost pressure within these limits with changes in engine rpm is normal. Minor fluctuations of fuel boost pressure during steady engine operation may be expected and should be considered negligible.

Fuel Flow Indicator

The fuel flow indicator (figure 1-4) provides an indication of the amount of fuel flow in pounds per hour and an indication of the amount, in pounds, of fuel remaining in the aircraft. The outer dial and the indicating needle register the current rate of flow, while the smaller four-digit indicator at the lower center of the instrument indicates the amount of fuel remaining in the aircraft. An adjustment knob provides for manual setting of the known amount of fuel in the aircraft before flight.

OIL SYSTEM

An oil tank with a usable capacity of 3.45 U.S. gallons is located outboard of each engine. A dual oil pressure indicator (figure 1-4) and two oil temperature indicators (figure 1-4) are located on the instrument panel.

HYDRAULIC SYSTEM

MAIN HYDRAULIC SYSTEM

The main hydraulic system is a 3000 psi, pressure demand, variable displacement system and is powered by two engine-driven pumps, one located on each engine. The main hydraulic system operates the landing gear, flaps, wing fold, speed brakes, wheel brakes, gun charging, and arresting hook retractment (figure 1-9). Whenever all control handles are in the retract position, the main hydraulic system is depressurized to approximately 400-500 psi. With the control handles in this position, a solenoid shutoff valve is energized and hydraulic pressure is bypassed back to the main system. System pressure is immediately regained when any of the hydraulic controls are actuated. The system will be depressurized 30 seconds after the hydraulic controls are moved to the retract position. In the event of an electrical system failure, the solenoid bypass valve is deenergized and, therefore, provides for continuous system pressure for the operation of all hydraulically controlled units with the exception of the speed brakes. The speed brake system is electrically actuated through a switch on the throttle grip and is inoperative when an electrical system failure is encountered.

AUXILIARY HYDRAULIC SYSTEM

In aircraft BuNo. 125783 and subsequent, and aircraft with AFC No. 199 incorporated, an auxiliary hydraulic system is provided for aileron power boost and spoiler operation. Power is supplied by two engine driven pumps that operate at pressures between 400 and 2500 psi. If one of the two auxiliary hydraulic pumps should fail, the resultant reduction of aileron boost would reduce the roll rate of the airplane to approximately 80 percent of normal. In the event of failure of both auxiliary hydraulic pumps, a mechanical advantage shifter is automatically actuated. The complete loss of auxiliary hydraulic pressure would cause the spoilers to be inoperative.

In aircraft prior to BuNo. 125783 and without AFC No. 199 incorporated, an electrically driven auxiliary hydraulic pump is provided for aileron power boost, spoilers, and emergency flap extension. The system operates at pressures between 400 and 2500 psi for aileron boost and spoiler operation and is regulated at 2700 to 3000 psi for emergency flap extension. The auxiliary hydraulic system selector valve control handle is located to the right of the instrument panel.

LANDING GEAR SYSTEM

The landing gear control lever (figure 1-3) is located on the left-hand side of the cockpit. With the hydraulic system operating, the main landing gear and the nose gear may be raised or lowered by moving the control to WHEELS UP or WHEELS DOWN. A solenoid safety lock is provided to prevent inadvertent retraction of the gear when the airplane is on the ground. If the control lever cannot be moved to

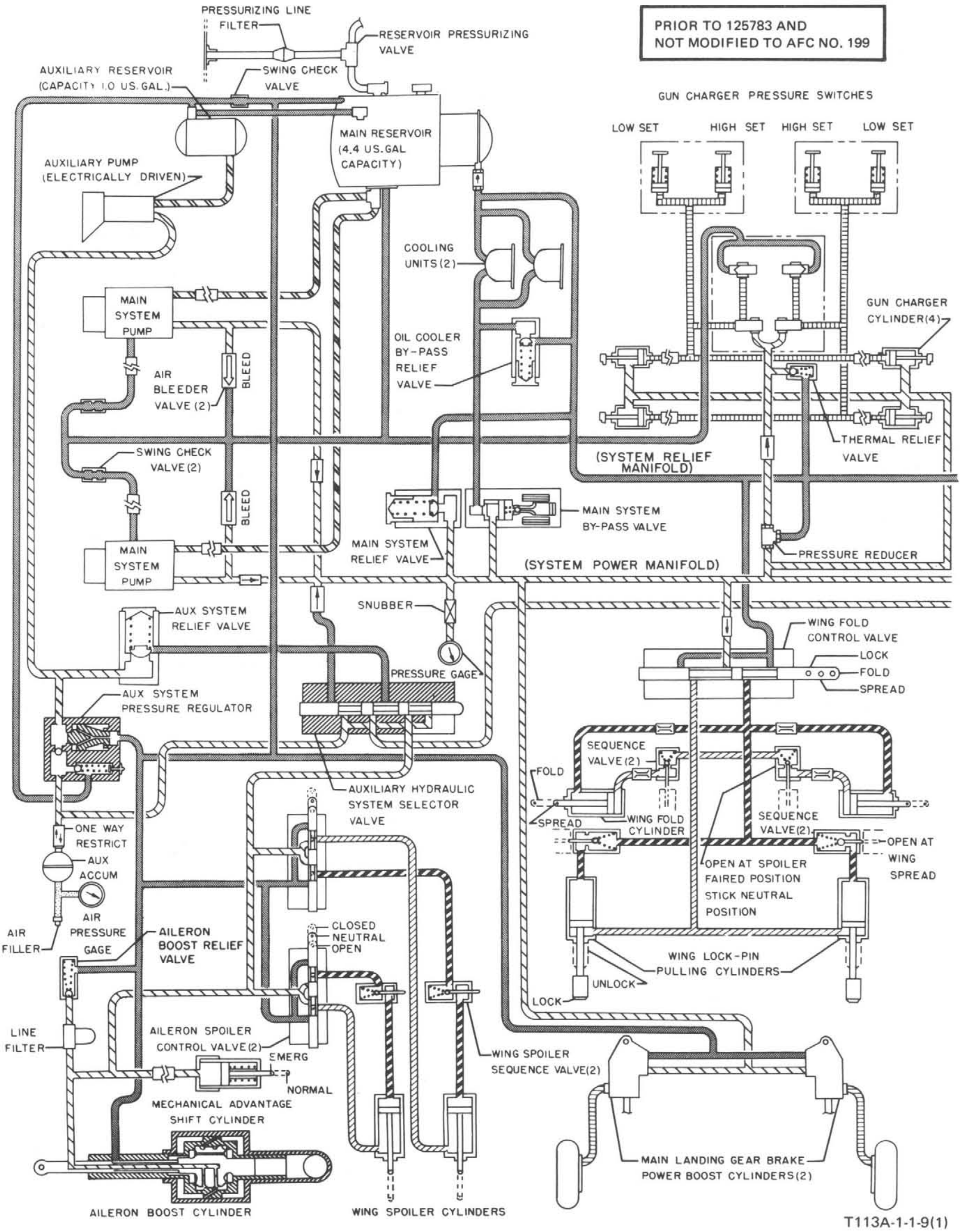


Figure 1-9. Hydraulic System (Sheet 1)

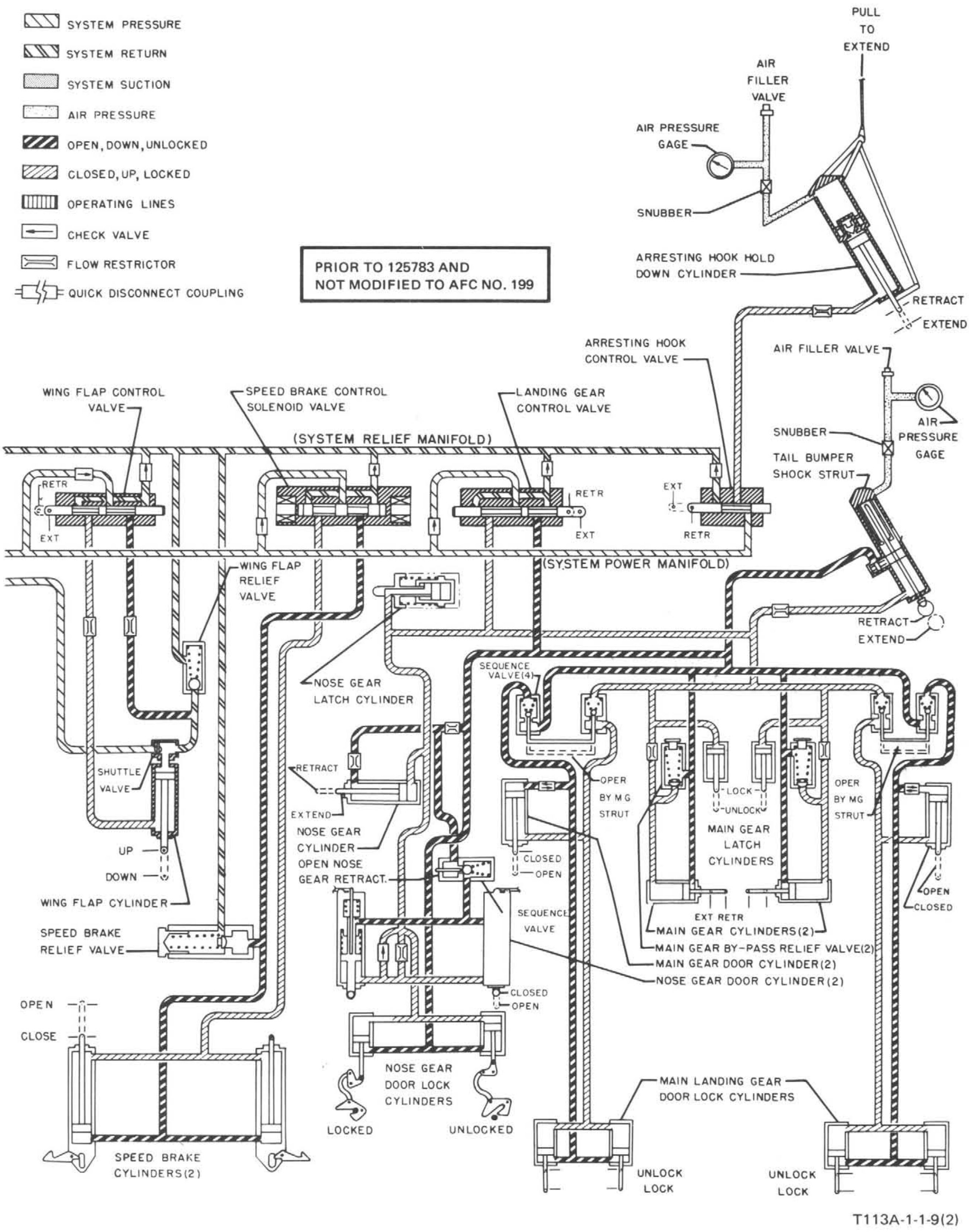


Figure 1-9. Hydraulic System (Sheet 2)

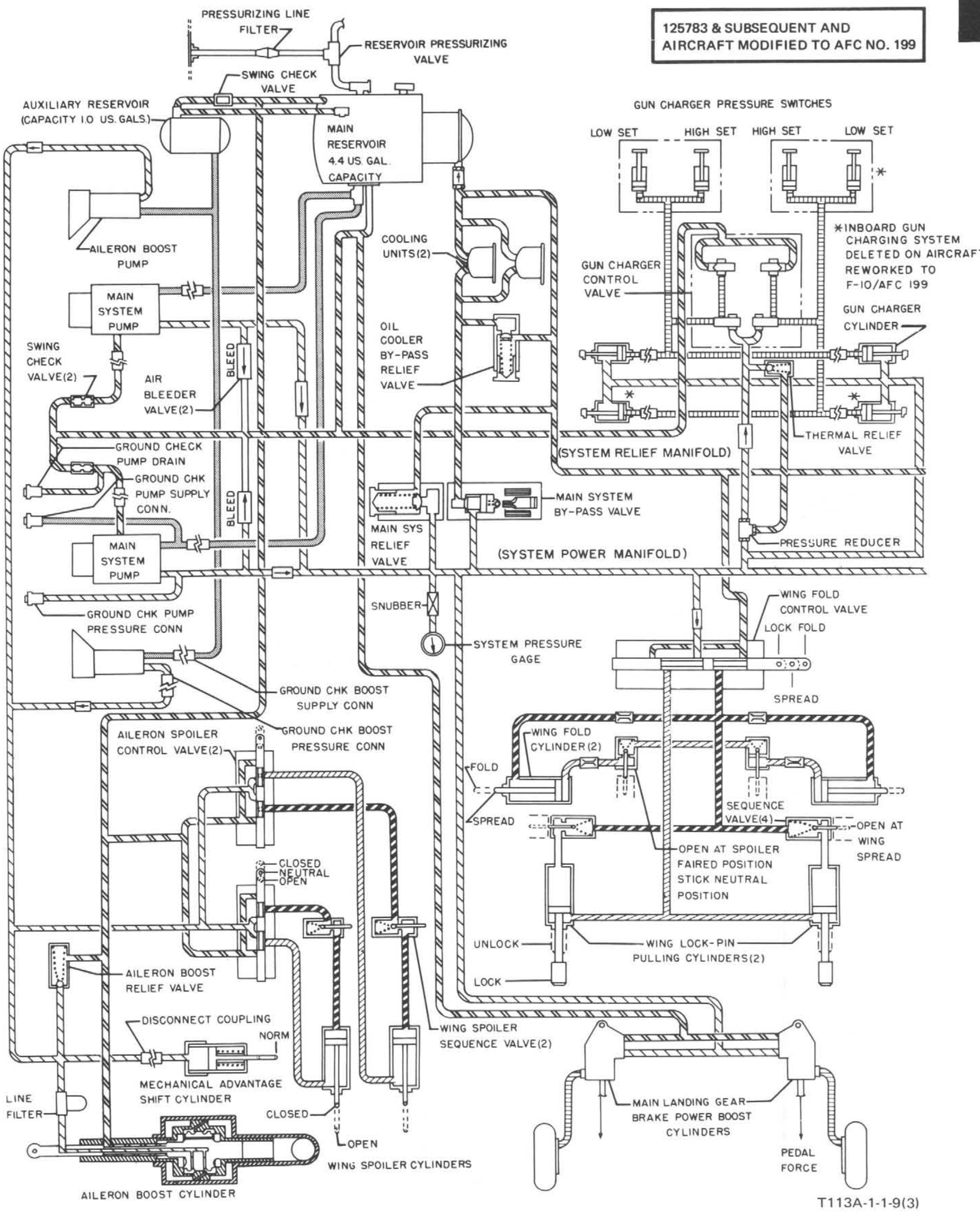


Figure 1-9. Hydraulic System (Sheet 3)

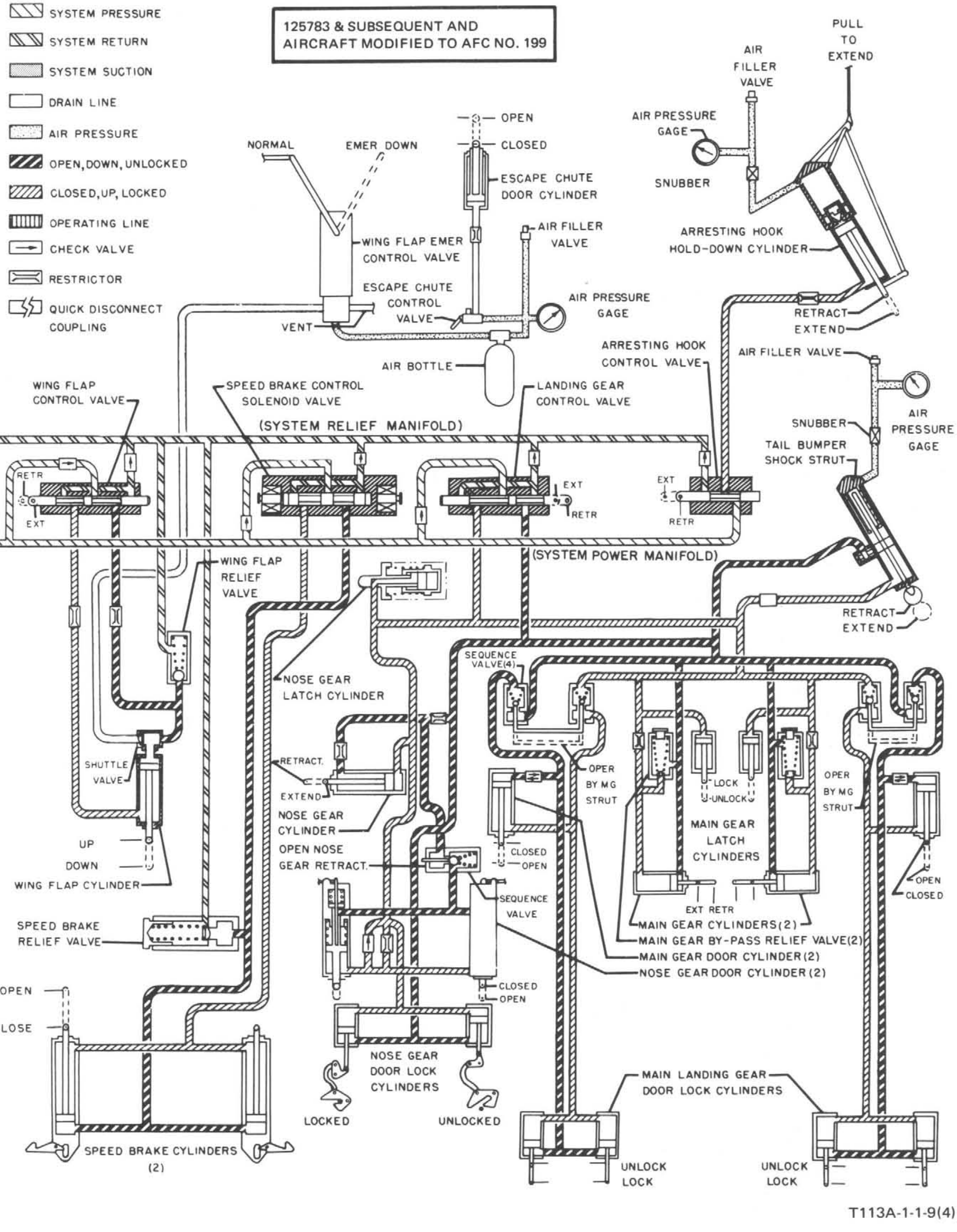


Figure 1-9. Hydraulic System (Sheet 4)

WHEELS UP in flight, the safety lock may be released by pushing in on the lock button (figure 1-3), which is adjacent to the landing gear control lever. Hydraulically actuated doors controlled by sequence valves operate automatically in conjunction with the landing gear. In normal control, the landing gear is locked in the extended position by overcenter mechanical locks. The tail bumper gear retracts and extends with the main gear.

EMERGENCY MAIN GEAR EXTENSION

The landing gear is held in the retracted position by the landing gear door and door latch mechanism. The manual landing gear emergency release handle (figure 1-3), located on the left console, releases the gear door mechanical latches and permits gravity extension of the gear in emergency.

POSITION INDICATOR

A combination landing gear and wing flap position indicator (figure 1-4) is located on the instrument panel.

WING FLAPS SYSTEM

The wing flaps are hydraulically operated and are controlled by a lever (figure 1-3) located on the left console. The lever has three marked positions, DOWN, STOP, and UP. During actuation, the flaps can be held at any intermediate position by placing the lever to STOP. A combination wing flap and landing gear position indicator (figure 1-4) is installed on the instrument panel. If the flaps are down and the speed of the aircraft is increased beyond the point where the hydraulic pressure counterbalances the air load on the flaps, the flaps will begin to blow back. In the full-down position (40 degrees) blowback begins at an indicated airspeed of approximately 110 knots. If the main hydraulic system fails, the flaps may be lowered by an emergency system.

SPEED BRAKES

Hydraulically operated fuselage speed brakes are controlled by a momentary contact switch on the inboard side of the right throttle control. Approximately 3 seconds are required to actuate the speed brakes to the full-open (45 degrees) position and approximately 1 to 1-1/2 seconds are required for closing. Any intermediate position can be obtained by releasing the switch when the speed brakes have reached the desired position.

BRAKE SYSTEM

A power boost brake system operating from the main hydraulic system is provided. The brakes are operated by toe pressure on the rudder pedals. In case of hydraulic system failure, sufficient hydraulic fluid will remain trapped in the brake system to permit braking action. Approximately twice the normal force will be required for braking with system failure.

ARRESTING GEAR SYSTEM

The arresting hook handle (figure 1-4) is located on the center console. The hook is lowered by air pressure independent of the hydraulic system. Retraction of the hook is a hydraulic system operation and consequently the hook cannot be raised in flight if hydraulic pressure fails. The hook may be raised manually from the ground with a required force of approximately 125 pounds. A fail-safe feature of the arresting hook provides for automatic extension of the arresting hook if the control cable is severed. The approach light operates automatically in conjunction with the hook. A warning light is installed in the arresting hook control handle. When the arresting hook handle is placed in the HOOK DOWN position, the warning light goes on and remains on until the arresting hook is completely extended.

WING FOLD SYSTEM

The wing fold handle (figure 1-4) is located adjacent to the center console. A positive detent on the end of the control handle must be depressed in order to move the handle. The wings are folded by moving the handle directly from SPREAD to FOLD. To spread the wings, the handle is moved from FOLD to as far as it will go toward SPREAD (approximately halfway). At this position, the wings are hydraulically spread and the locking pins positioned. When this operation is completed (approximately 5 to 7 seconds), the handle may be moved to SPREAD, which locks the locking pins and retracts the warning flags.

CAUTION

> To prevent damage to the wing, spoilers must be faired before wing folding. Fair spoilers by placing stick in neutral position if auxiliary hydraulic boost pumps are operating. The spoilers are spring-loaded, however, and close automatically whenever the pumps are inoperative.

Note

> The wing pins are not locked unless the red warning flags on the leading edges of the wings are faired.

ELECTRICAL SYSTEMS

Direct and alternating current power supply systems are provided for the operation of the aircraft electrical systems and components. There are two power supply systems, designated instrument and countermeasures, comprising the ac electrical system. Electrical power for the lighting equipment is furnished by the dc electrical system.

DC ELECTRICAL SYSTEM

Direct current is supplied by either a 24-volt, 34-ampere/hour battery or by two 28-volt, 400-ampere

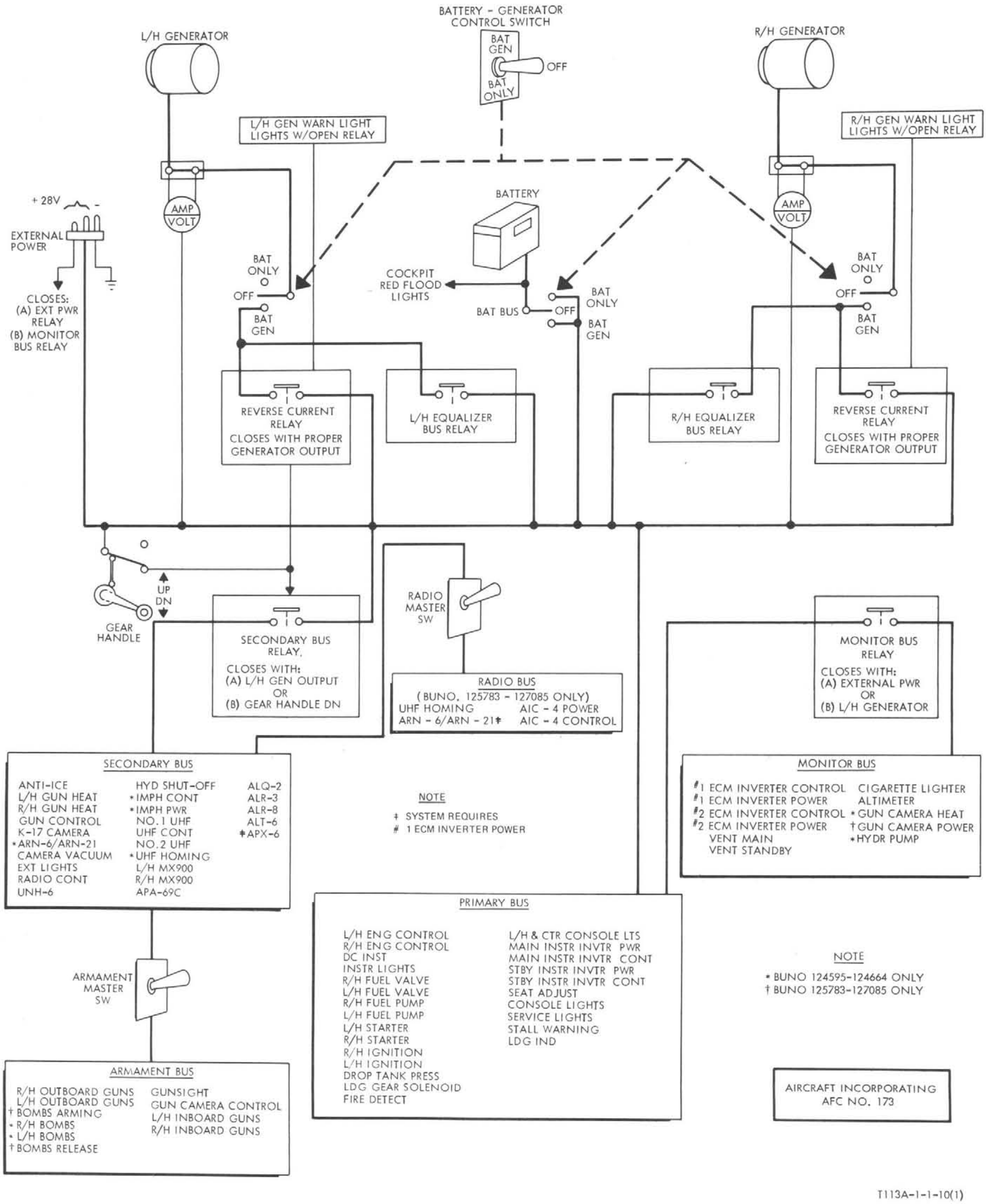


Figure 1-10. DC Electrical System (Sheet 1)

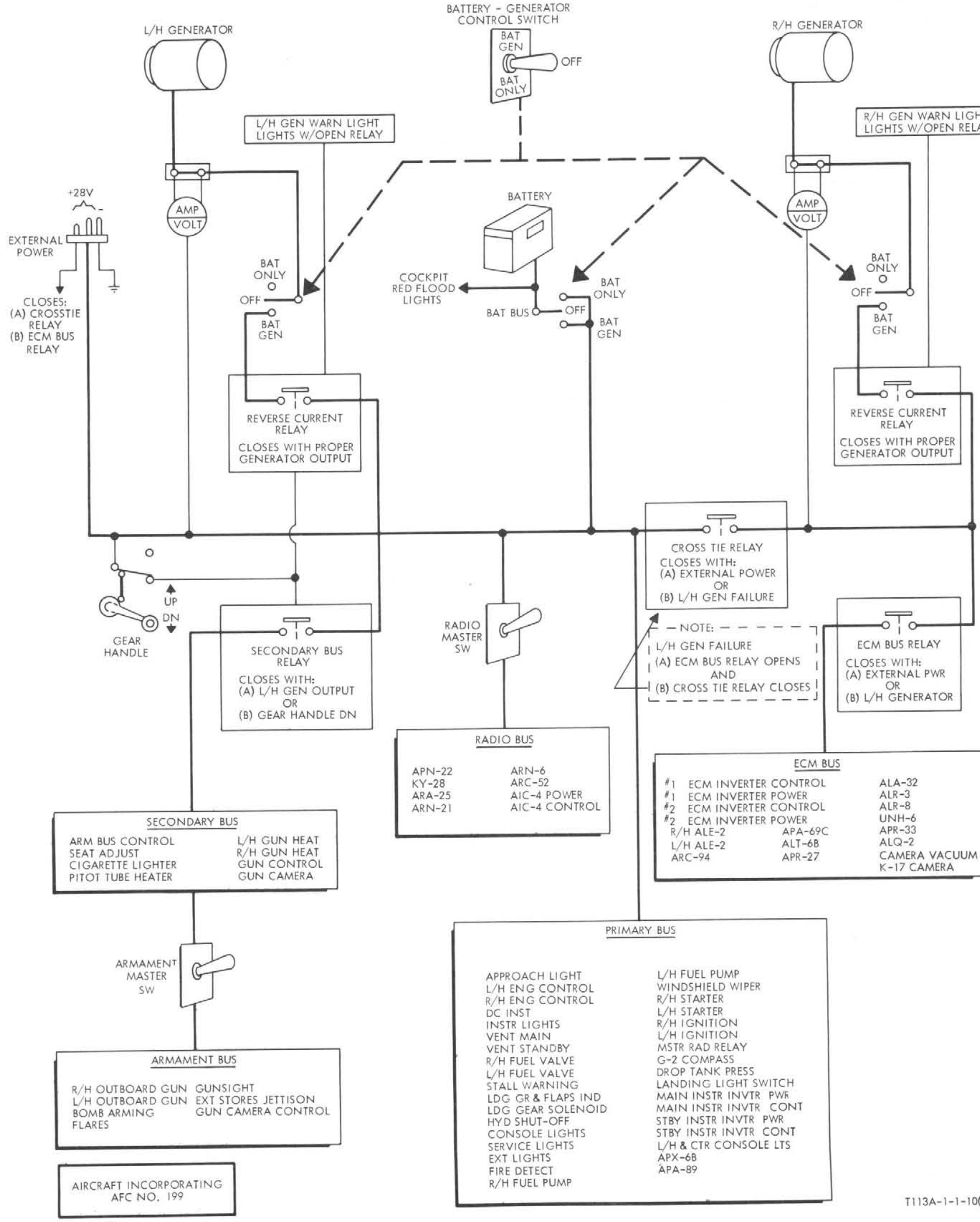


Figure 1-10. DC Electrical System (Sheet 2)

generators. An external source of dc power can also be connected to the aircraft for use during ground operations. Power distribution is accomplished through dc electrical buses as shown in figure 1-10.

Battery

The 24-volt, 34-ampere/hour battery is mounted on the centerline of the aircraft just aft of the escape chute and is accessible through the lower escape chute door. The battery-generator switch is located at the top of the right console (figure 1-5). The switch should be moved to the BAT & GEN position for normal operations and to OFF when leaving the aircraft. If both generators fail, the switch should be moved to the BAT ONLY position after first turning off all nonessential loads.

Generators

A 28-volt, 400-ampere generator is attached to the lower side of each engine. Each generator is capable of delivering full voltage at an engine speed of approximately 48 percent. Generator voltage output is regulated to 27.5 ± 0.5 volts by carbon-pile voltage regulators that vary the generator field voltage. The generators are connected to the distribution system through generator control (reverse-current) relays. Both generators are controlled by the battery-generator switch. Generator warning lights, located on the right console (figure 1-5), indicate low generator output.

External Power Receptacles

Three external power receptacles are provided; two for engine starting and one for aircraft dc power supply. The engine starting receptacles are located adjacent to the wheel wells on the rear spar. Both engines can be started from either receptacle using 28-volt, 1000-ampere dc power. The aircraft dc power supply receptacle is located adjacent to the right wheel well inboard of the engine starting receptacle. All three receptacles are accessible through covers in the lower wing.

DC POWER DISTRIBUTION

Power is distributed to the various dc circuits through electrical buses. The actual point of connection between a circuit and a bus is at one or more of the circuit breakers on the panels in the cockpit. The buses are energized as shown in figure 1-10.

DC Circuit Breaker Panels

Circuit breakers for all dc electrical circuits are provided on two vertical panels installed above the left and right consoles (figures 1-3 and 1-5) in the cockpit. If a circuit becomes overloaded, the circuit breaker will automatically spring out. Operation of the circuit may be restored by pushing the breaker in, but it will not remain in until the cause of the overload condition is remedied.

AC ELECTRICAL SYSTEM

Alternating current is supplied by the instrument and countermeasures ac power supply systems. Each system includes two dc inverters. The two instrument inverters receive dc operating power from the primary bus and convert it to ac power to operate the various instrument, communications, and navigation systems; countermeasures inverters receive operating power from the monitor (or ECM) bus for the countermeasures equipment. The equipment is controlled and operated by the ac electrical system as shown in figure 1-11.

Instrument AC Power Supply

The instrument ac power supply system is a manual system with a warning light to indicate that the operating inverter has failed. Switching to the remaining inverter is accomplished manually through the inverter control circuits.

Inverter Control

The inverter control circuits provide a means of manually selecting either the main or standby inverter to supply the ac instrument loads. The circuit detects the operating inverter output and a warning light (figure 1-4) comes on when the output drops to a value of approximately 70 volts or less. When the remaining inverter is manually selected by the inverter switch (figure 1-4), the warning light goes off. The control circuits include the main and standby inverters, inverter warning light, inverter selector switch in addition to the relays, transformers, and protective devices necessary to provide the control and voltages required for operation of the instrument, communications, and navigation equipment installed in the aircraft.

Countermeasures AC Power Supply

The countermeasures ac power supply system furnishes the ac power required to operate most of the ECM systems. The two ECM inverters receive operating control through the monitor or ECM bus and are controlled by closing or opening the inverter control circuit breakers on the right-hand circuit breaker panel in the cockpit.

AC POWER DISTRIBUTION

The prime source of power required to energize the instrument and countermeasures ac power supply systems for aircraft incorporating AFC No. 173 is derived from the 28-volt dc primary and monitor buses. For aircraft incorporating AFC No. 199, power is derived from the primary and ECM buses. When these buses are energized, dc power necessary to operate the inverters (instrument and countermeasures) is applied to each inverter through a protective current limiter. Inverter control is maintained by dc circuit breakers located on the circuit breaker panels in the cockpit.

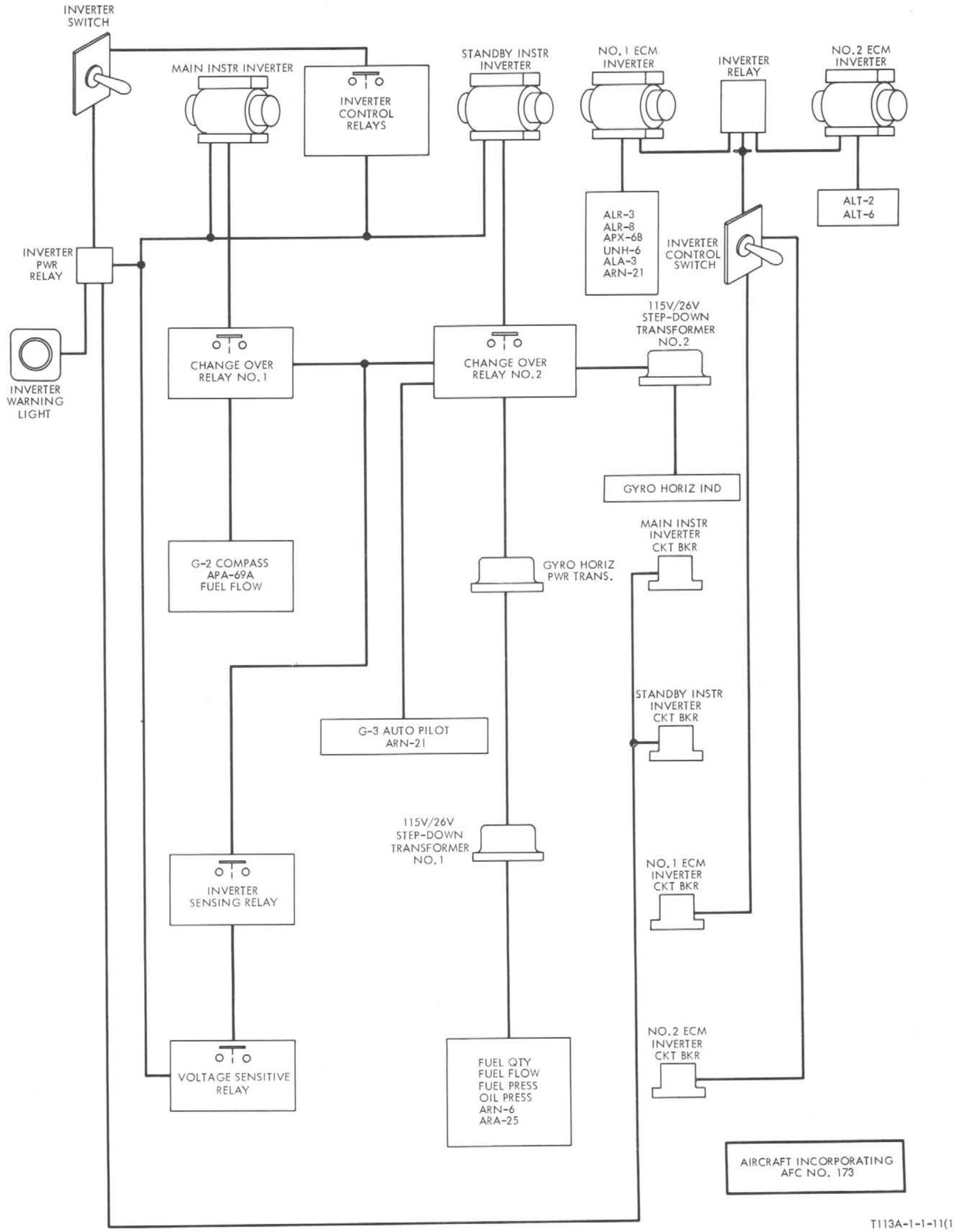


Figure 1-11. AC Electrical System (Sheet 1)

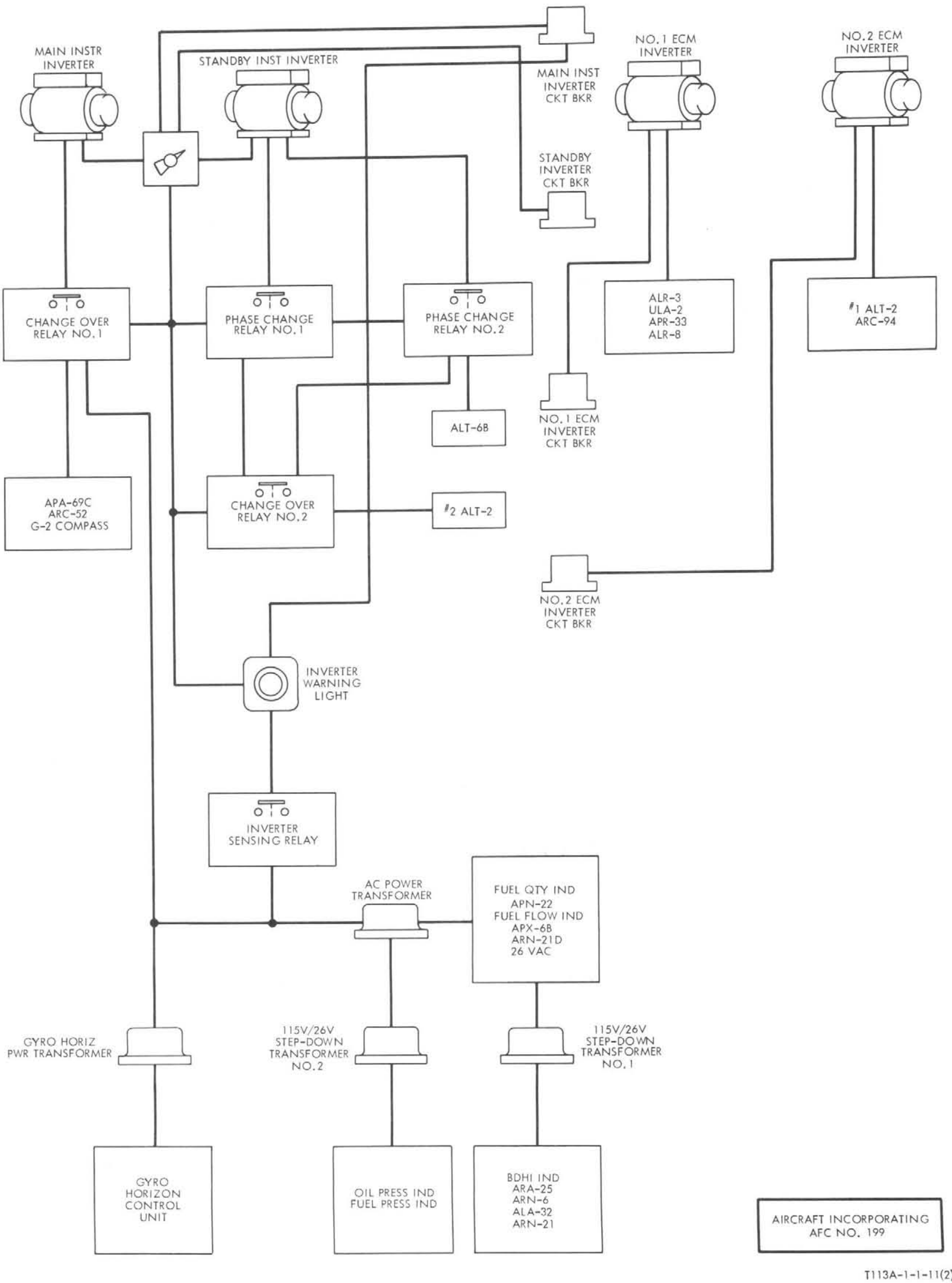


Figure 1-11. AC Electrical System (Sheet 2)

AC Fuse and Circuit Breaker Panels

An instrument fuse panel, located in the cockpit area, is provided for the protection of the various instrument circuits. On aircraft incorporating AFC No. 173, an ac circuit breaker panel is located in the same area for the ALA-3, ALR-3, ALR-8, APA-69, APX-6, ARN-21 and the gun camera test circuits. Two circuit breaker panels are provided for aircraft incorporating AFC No. 199. One panel, in the cockpit, protects the following: ARC-94 (3Ø), ALR-3, ALR-8, ALT-2 (3Ø), APA-69, APR-33, ULA-2, and gun camera circuits. A second panel, in the radio compartment protects the following: ARA-25, ARC-52 (3Ø), ALT-2 (3Ø), ALT-6, APN-22, APX-6B, ARN-21, fuel flow, and 26-volt ac circuits.

LIGHTING EQUIPMENT

Lighting equipment includes an exterior lighting system, interior lighting system, and a service lighting system for use by ground maintenance. All lights operate on direct current and are protected by trip-free circuit breakers located on the circuit breaker panels in the cockpit.

EXTERIOR LIGHTING SYSTEM

The exterior lighting system includes, in addition to the exterior position lights, a control console and a coder-flasher unit both located in the cockpit. The coder-flasher unit is interconnected with the control console to provide automatic code signaling with the exterior lights. The keying switch, on the left-hand windshield frame, provides a manual means of code signaling with the exterior lights. An approach light and, on some configurations a landing light, is included in the exterior lights.

Position Lights

Two white light assemblies are centrally located on the top and bottom of the fuselage, one in each location. Spare red, green, and yellow covers are stowed in the radio equipment compartment. One white and one yellow light are located on the trailing edge of the vertical stabilizer. Both lights can burn continuously or flash alternately, depending on the setting of the MASTER switch on the control console. Red and green lights are located on the left and right wing tips, respectively. These lights can also burn continuously or flash. A white, flush-mounted formation light is located forward of the rear spar on the lower surface of each outboard wing. These lights are not connected to the flasher circuit.

Approach Light

The approach light is installed in the leading edge of the left wing and indicates to the tower operator the condition of the landing gear and arresting gear during a night landing approach. When the landing gear is not down and locked the light is off. When the landing gear is down and locked, but the arresting hook is not down, the light flashes. When the landing gear is down and locked and the arresting gear is down, the light burns steadily.

Landing Light

The removable bracket-mounted landing light is normally located on the interior of the nose wheel landing gear door. This sealed-beam light is used to assist the pilot in night landings on short runways or in poorly lighted landing areas. The landing light switch is installed on the left-hand circuit breaker panel.

INTERIOR LIGHTING SYSTEM

The interior lighting system includes three separate circuits: flight instrument lights, nonflight instrument lights, and console lights. The interior light console controls these circuits. Included in the interior lighting system and separately controlled are the cockpit floodlights and the chartboard lights.

Cockpit Floodlights

Three cockpit floodlights are included in the interior light system. The primary purpose of the floodlights is to provide emergency lighting of the cockpit should the other circuits of the system fail. One light is located on each side of the cockpit, the third on a bracket on the aircraft centerline. The side lights can be swiveled to any desired position, but the center light is fixed. The center light has a red, light-diffusing lens. The lights are energized through the emergency circuits.

Chartboard Lights

Two chartboard lights, one located on the right-hand rail, the other on the center console, are installed in aircraft incorporating AFC No. 173. The switch for these lights is under the APA-69 scope. On aircraft incorporating AFC No. 199, a single chartboard light is located above the right-hand circuit breaker panel with the switch installed on the right console (figure 1-5) below and adjacent to the circuit breaker panel.

COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

An interconnected air conditioning and pressurization system (figure 1-12) using the eleventh stage engine compressor bleed air, ventilates and pressurizes the cockpit as required to maintain an efficient environment for the crew members. The hot, compressed air, which is bled from the compressor, can be passed through or directed around the refrigeration unit. Air passing through the refrigeration unit operates that unit and is passed through the mixing chamber as cooled air. The cool air, and the heated air that bypassed the refrigeration unit, is mixed in the mixing chamber and is delivered to the cockpit for heating or cooling as required by the position of the cockpit temperature control.

AIR CONDITIONING AND PRESSURIZATION CONTROLS

The cockpit air conditioning control (figure 1-4) on the center console, makes possible manual or

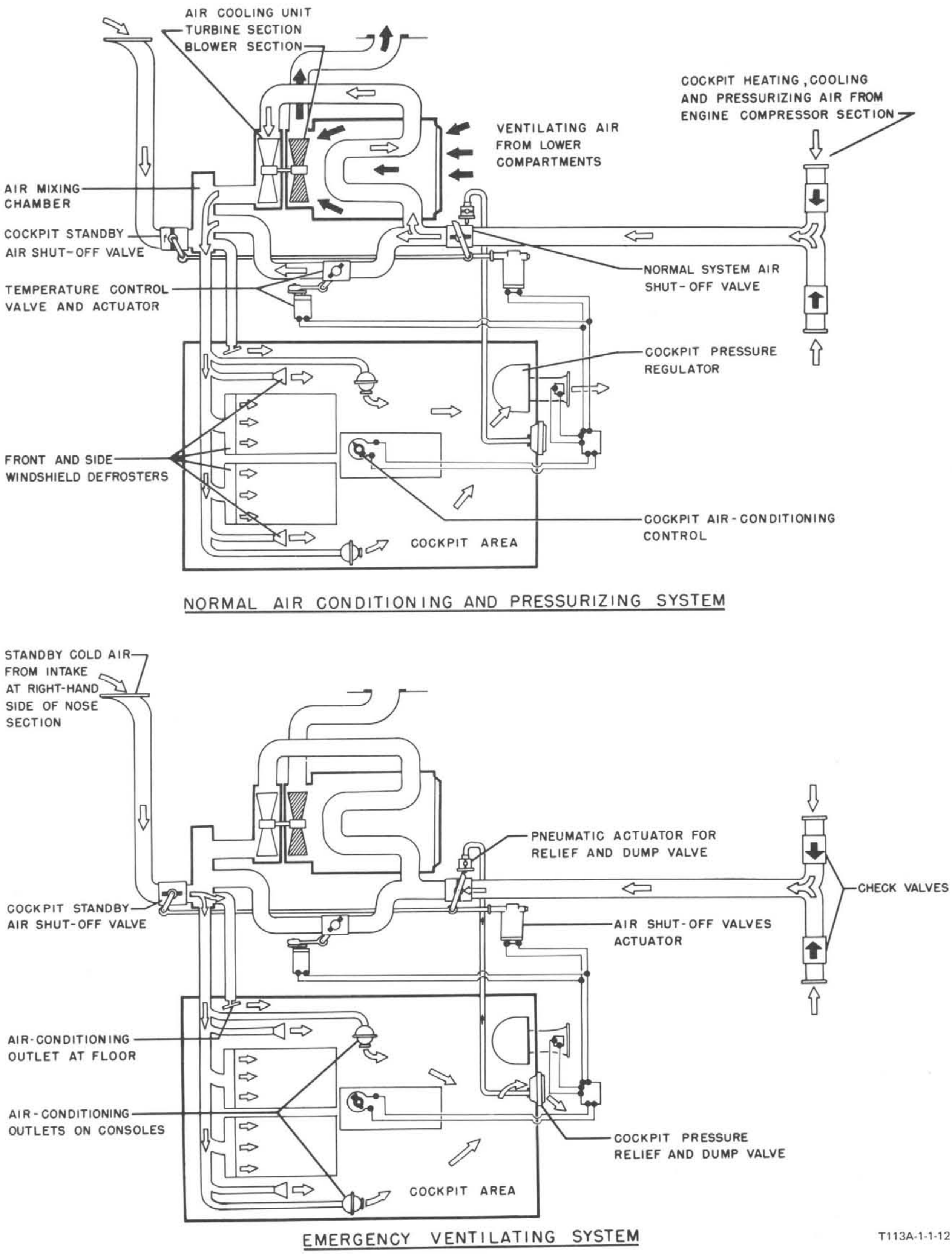


Figure 1-12. Air Conditioning and Pressurization System

automatic selection of cockpit temperature, or manual selection of the emergency ventilating system. The rheostat portion of the control is in the temperature control bridge circuit and provides for selection of cockpit temperatures from 60° to 80°F. The other positions of the control are **OFF**, **MANUAL HOT**, and **MANUAL COLD**. The **OFF** position also turns on emergency ventilation air and depressurizes the cockpit. Since cabin pressurization and windshield defogging are completely automatic, no controls are required.

COCKPIT AIR CONDITIONING

Provision is made to supply full hot or full cold air to the cockpit by manually holding the cockpit air conditioning control to MANUAL HOT or MANUAL COLD. When the control is placed in either of these positions, the hot-air bypass valve actuator moves the valve in the corresponding direction as long as the control position is held. When the control is released, it returns to a neutral position and the bypass valve setting remains at the position in which the actuator stopped. In MANUAL HOT, a temperature high limit control is provided in the circuit to prevent overheating of the windshield. In addition, a high limit safety element overrides all other circuits to operate on emergency ventilation if the defogging air becomes hot enough to threaten safety of the windshield. If this occurs, cockpit pressure is lost and cannot be regained until the fusible element is replaced after landing.

Under some conditions of flight in humid climates, the temperature in the cockpit may be below the dew point. In such cases, condensed water droplets (fog) may form in the cockpit. The fog will have the appearance of grey smoke and will appear to be issuing from the air conditioning outlets. This fog condition may be alleviated by operating the cockpit air conditioning control to increase the temperature of the air in the cockpit. In some cases ducting may have become sufficiently cooled so that fog may persist after the temperature control is moved to the highest setting in the automatic range (80°F).

EMERGENCY VENTILATION

When the cockpit air conditioning control is moved (counterclockwise) to **OFF**, the normal air conditioning system shutoff valve is closed, and the emergency ventilating and cockpit pressure relief valves are opened, thus permitting free circulation of outside air throughout the cockpit without cockpit pressurization.

COCKPIT PRESSURIZATION

When the normal air conditioning system is in operation, the air provided for heating, cooling, and ventilating also pressurizes the cockpit. The pressure in the cabin is automatically maintained on a predetermined schedule with regard to altitude by the pressure-regulating valve located just behind the ECMO's head. This pressure schedule is as follows: from sea level to 5000 feet altitude the cockpit pressure remains equal to atmospheric pressure. Above 5000 feet, the cockpit gradually pressurizes until at 13,200 feet, a maximum pressure differential of 3.3 psi is reached. Above 13,200 feet a constant pressure differential of 3.3 psi above atmospheric pressure is maintained. This information is shown graphically in figure 1-13. In the event of failure of the cockpit pressure regulating valve, the cockpit pressure relief valve prevents excessive positive pressure differentials. In the event of rapid descents or other such maneuvers, it prevents an excessive negative differential that might eventually damage the cockpit. This valve opens at pressure differentials of plus 3.0 psi and minus 0.1 psi. As previously mentioned, it also opens when the cockpit air conditioning control is moved to the **OFF** position.

ENGINE FIRE DETECTION SYSTEM

The engine fire detection system has detector units installed in each accessory, compressor, burner, and tail section.

ENGINE FIRE WARNING LIGHTS

Fire warning lights (figure 1-4), one for each engine, are located on the instrument panel. These lights are the push-to-test type for checking bulb failure. When the temperature in the accessory or compressor sections exceeds approximately 232°C or the temperature in the burner and tail sections exceeds 385°C, the fire detector shorts out, closes the electrical circuit, and illuminates the respective warning light.

ENGINE FIRE DETECTION TEST SWITCHES

Fire warning test switches (figure 1-3), one for each engine, are located on the left console. When in the depressed position, an indication is given through the warning light that the respective fire detection circuit is operative.

OXYGEN SYSTEM

An automatic, positive-pressure, diluter-demand oxygen system (figure 1-14) is provided from three 514-cubic-inch capacity cylinders. Emergency oxygen is available from an oxygen bailout bottle located in each seat. The bailout bottles are serviced to 1800 psi, which can be checked by means of a sight gage located on each bottle. Two oxygen cylinders, located in the radio compartment and one aft of the cockpit, are serviced with high pressure oxygen by means of a filler valve located below the cylinders. The pilot's regulator (figure 1-3) is on the left console. The ECMO's regulator (figure 1-5) is on the right console. The amount of air admitted through the air admission valve on the regulator is dependent upon the altitude up to approximately 30,000 feet, beyond which 100 percent oxygen is automatically delivered. Above 30,000 feet, an automatic pressure breathing mechanism operates, allowing internally regulated pressure to rise progressively to 10 inches of water or 0.36 psi at 43,000 feet altitude. A blinker flow indicator and oxygen system pressure gage is provided on each regulator console panel. An

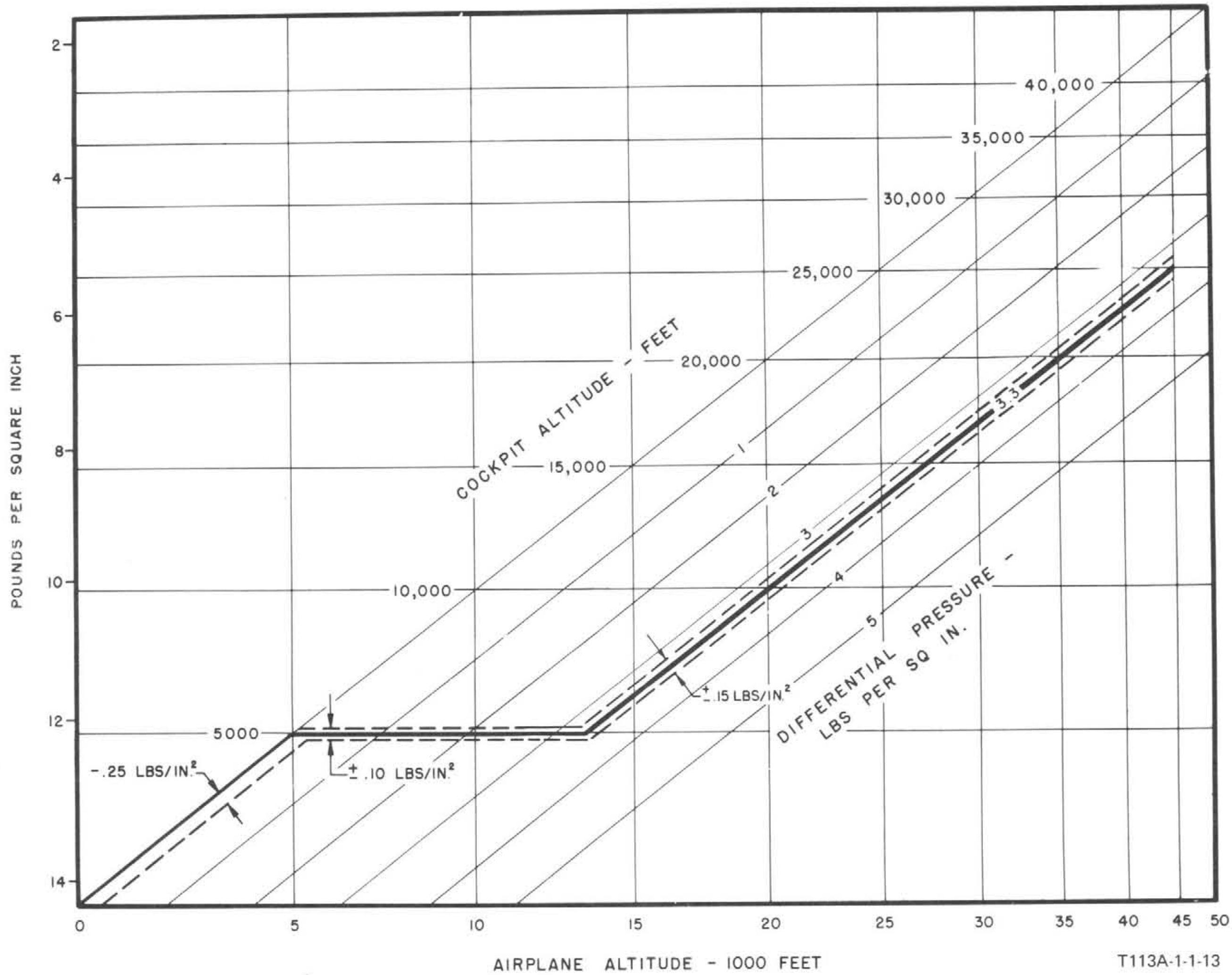


Figure 1-13. Cockpit and Aircraft Altitude Comparison Chart

additional oxygen flow indicator is installed in the cabin altimeter. This indicator (figure 1-4) provides the ECMO with a more readily visible oxygen flow indication.

OXYGEN REGULATOR CONTROLS

Shutoff Valve

The shutoff valve is a two-position selector (green) that activates the pressure gage, air valve knob, and safety pressure switch.

Air Valve Knob

In the NORMAL OXYGEN position of the air valve knob, diluted oxygen is supplied upon demand. The amount of dilution depends upon cabin altitude up to 30,000 feet, above which pure oxygen is supplied. Turning the control to 100% OXYGEN supplies undiluted oxygen upon demand, regardless of altitude.

Safety Pressure Switch

The safety pressure switch (red) is a manual control for oxygen delivered under pressure. With the switch in the ON position, positive pressure automatically supplies 100 percent oxygen, regardless of the position of the air valve knob. Routine use of safety pressure reduces the effectiveness of the air diluter and causes oxygen consumption.

Anti-G System

The anti-g system configuration is illustrated in figure 1-14.

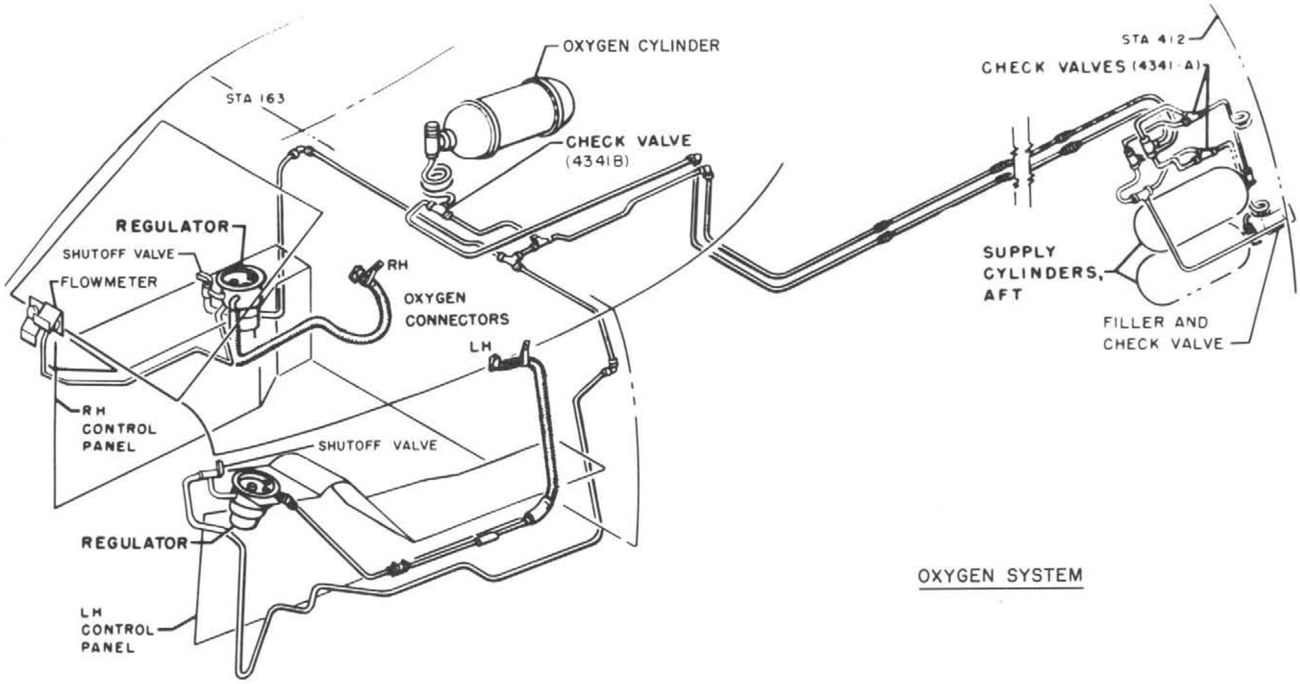
SYSTEMS OPERATION

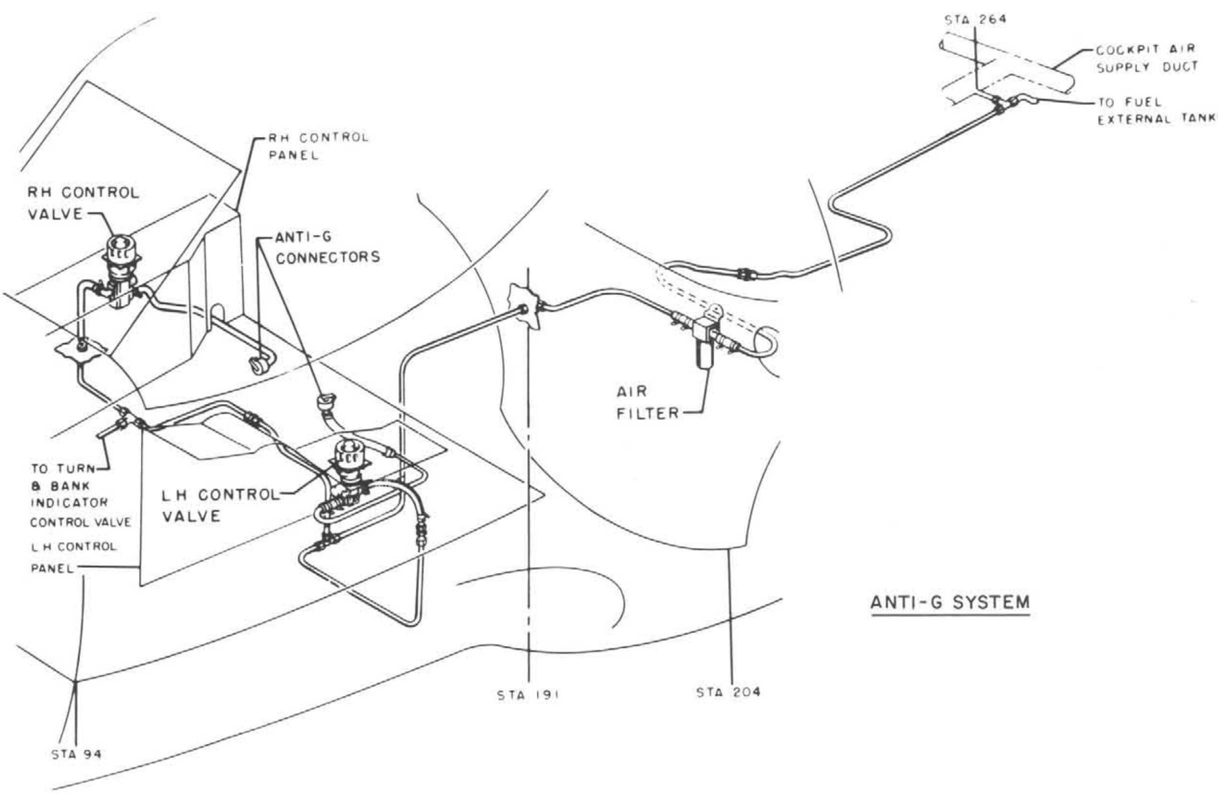
Oxygen shall be used during all flights. The following procedures should be used.

1. The pressure gage should read 1800 ± 50 psi if the cylinder is fully charged.

2. Set the air valve to NORMAL OXYGEN for all normal flight conditions.

3. Put the mask on. Fully engage the mating portions of the disconnect couplings to connect the mask to the oxygen system. Attach clip of breathing tube





T113A-1-1-14

Figure 1-14. Oxygen System

to proximate strap of shoulder harness sufficiently high on the chest to permit free movement of the head without stretching of the mask tube.

4. Check mask fit by putting on the oxygen mask and attaching to the helmet as in flight. Connect the oxygen mask to regulator couplings and turn the manual safety pressure switch to ON. At pressure breathing altitudes the safety pressure need not be depressed. Take a deep breath and hold breath. Note the position of the oxygen flow indicator. If flow indicator opens (all black) a leak is indicated. Tighten mask straps until flow indicator closes (white face) indicating a leak tight mask seal has been obtained. Resume breathing and release manual safety pressure.

5. The oxygen flow indicator blinks upon the intermittent application of from 5 to 7 inches of water pressure created by the flow of oxygen. The automatic pressure breathing oxygen regulator delivers a pressure of 5 to 7 inches of water to the mask at approximately 41,000 feet, and this pressure is likewise transmitted to the oxygen flow indicator, which will remain open as long as this pressure is applied. Accordingly, the flow indicator will not blink above this altitude; however, the positive pressure in the mask is an unmistakable indication that oxygen is being delivered to the mask and no apprehension should be felt as long as the flow indicator remains open.

The following should be checked frequently while on oxygen:

1. Cylinder pressure gage for oxygen supply (do not exhaust supply below 300 pounds except in emergency).

2. Oxygen flow indicator for flow of oxygen through regulator.

3. Mask fit for leak tightness.

EMERGENCY OPERATION

1. Whenever excessive carbon monoxide or other noxious or irritating gas is present or suspected, regardless of altitude, the air valve should be turned to 100% OXYGEN, and undiluted oxygen used until the danger is past or the flight is completed.

2. Should symptoms occur suggestive of the onset of anoxia or should the regulator become inoperative, turn the safety pressure switch on the regulator to ON and descend below 10,000 feet cockpit altitude. If for any reason the regulator should become inoperative and a constant flow of oxygen is not obtained by use of safety pressure, activate the emergency oxygen bailout bottle and descend below 10,000 feet cockpit altitude.

Note

Do not exhaust supply cylinder below 300 psi except in an emergency.

G-2 COMPASS SYSTEM

G-2 COMPASS

This compass consists of a master direction indicator (figure 1-4), an adapter, a transmitter, and a control switch (figure 1-4). The compass gyro should be caged and set to correspond with the indication of the miniature dial in the center of the indicator face before takeoff. To correctly operate the reset adjustment, depress the knob firmly and rotate the main dial to the desired heading. Keep the knob fully depressed at the new heading for at least 2 seconds and then release the knob, avoiding any twisting motion. The switch that controls the compass system is located on the instrument panel. When the switch is in the FREE position, the gyro will have to be caged and reset periodically to maintain heading. In this position, the gyro is not subject to compass control. When the switch is in the CONTROL position, the adapter controls the gyro so that periodic resetting of the gyro is not necessary. Approximately 3 minutes are required for the gyro to reach operating speed after the battery switch has been turned on. The gyro will be automatically precessed to correspond with the indication on the miniature compass dial at a rate of approximately 3 degrees per minute when the switch is in the CONTROL position. The compass is nontumbling and does not require caging before or after maneuvers. The miniature dial on the center of the instrument face gives a remote indication of the heading of the compass transmitter. This dial is unstabilized and will be subject to swinging as a result of turns and maneuvers of the aircraft. When on CONTROL, the gyro will be stabilized by the compass transmitter and amplifier and provide a continuous indication of the magnetic heading of the aircraft.

GYRO HORIZON INDICATOR

This instrument (figure 1-4) is gyro stabilized and indicates the attitude of the aircraft in pitch and bank. The gyro horizon indicator does not require caging during maneuvers, since the gyro is universal and will not tumble. A fast erection switch and warning light (figure 1-4) are located adjacent to the indicator. With the switch in the NORMAL position, the fast erection electromagnet is energized when the battery-generator switch is placed in the BAT-GEN or BAT ONLY position. The warning light burns whenever the electromagnet is operating. After approximately 20 seconds, a thermal relay opens, disconnecting the dc power from the erecting magnet. If the warning light remains lit over 1 minute, power to the magnet has not been automatically disconnected, and the fast erect switch must be moved to OFF to prevent failure of the gyro horizon indicator.

CONTROL SWITCH

The G-2 compass control switch (figure 1-4) is located on the instrument panel. Normally, the switch is in the CONTROL position. Moving the switch to the FREE position disconnects the gyro torque motor from the compass circuit, permitting the compass to operate as a free directional gyro.

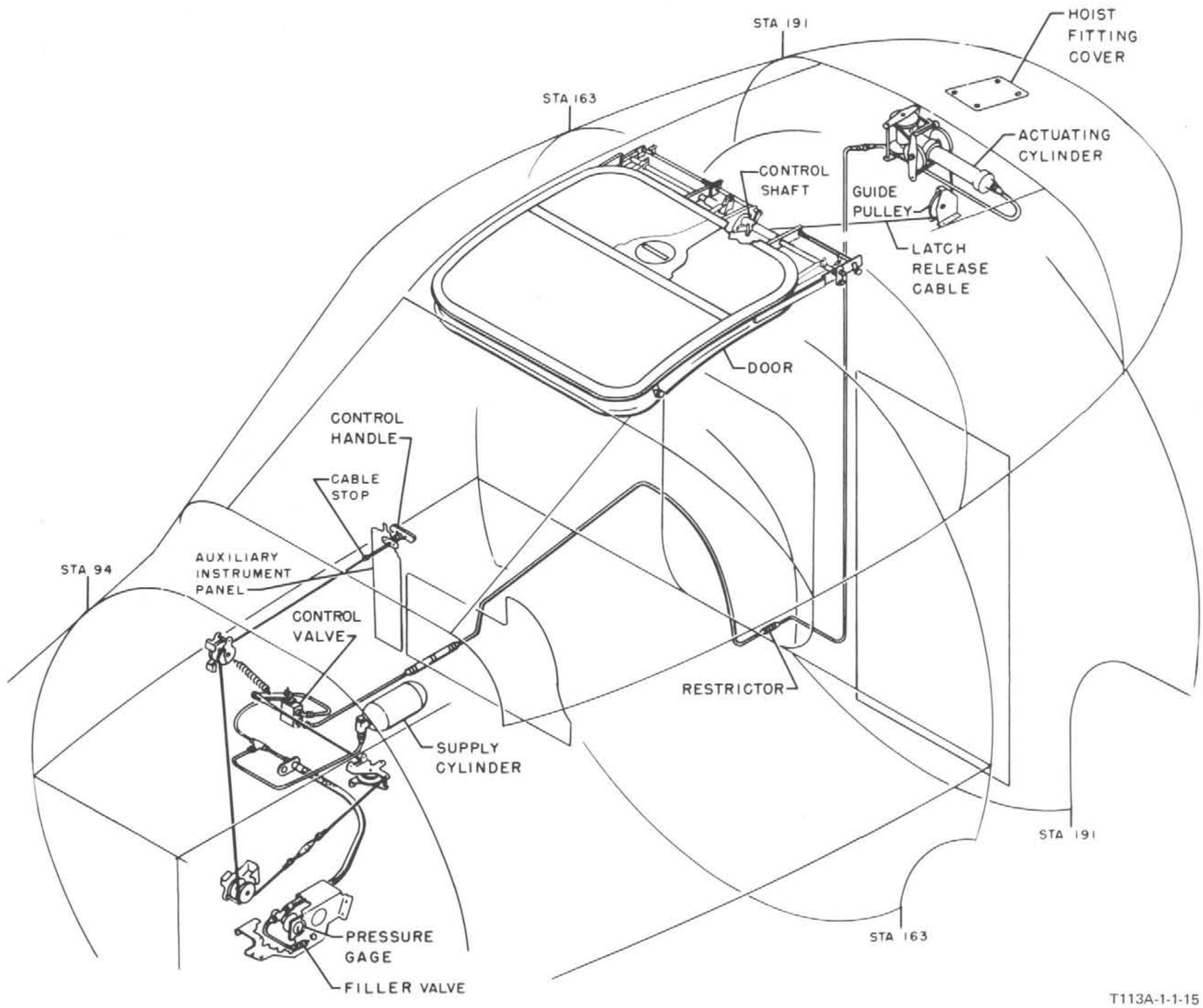


Figure 1-15. Cockpit Door Emergency Air Control System

The **FREE** position is used to prevent the system from becoming erratic due to excessive dip of the earth's magnetic field in the polar regions.

MISCELLANEOUS EQUIPMENT

COCKPIT ENTRANCE HATCH

The cockpit entrance hatch is manually operated and is controlled from within the cockpit by a lever arm that moves from a fore and aft lock position to a 45-degree angle to port for unlocking. This permits movement of the hatch to an intermediate position. To move the hatch from the intermediate position, it is necessary to depress the ring-type handle on the hatch forward frame.

To close the hatch, a spring-loaded lever in the forward recess of the hatch must first be depressed. After the hatch has been moved forward, the handle may be used to close the hatch and, when pushed to its extreme forward position, the hatch will be secured and locked. Entrance may be gained from the outside of the aircraft by means of spring-loaded handles located in the center of the cockpit entrance hatch. Turning the handles will release the locking mechanism and pulling aft will open the hatch.

COCKPIT ESCAPE SYSTEMS

Separate one-shot compressed air systems (figure 1-15) are provided for the upper escape hatch (ditching hatch) and for the lower escape chute door systems. Air bottles charged to 1980 ± 50 psi supply the power. Filler valves and gages for the two systems are installed on the right-hand side of the nose gear wheel well. The upper escape hatch release handle (figure 1-4) is located on the instrument panel, and the lower escape chute door system emergency release handle (figure 1-4) is located above the floor on the center console. The latter handle is cable-connected to a mechanism that jettisons the aft chute door on the bottom of the fuselage, actuates the one-shot air pressure system that opens the lower windscreen door, and opens the chute entrance door in the aft wall of the cockpit, between the pilot's and ECMO's seats. The back and inboard side of the pilot's seat unlatches and swings out of the way when the handle is pulled. A vaulting bar on the rear cabin bulkhead above the chute door is provided to expedite escape.

SEAT ADJUSTMENT

The pilot's seat is vertically adjustable and partly supported by an actuator that is electrically controlled and actuated. Power is furnished by the dc electrical system through the primary bus and a pilot seat control switch. The switch is located on the center control console. It has two momentary positions, SEAT UP and SEAT DOWN which controls the seat through a height of 5 inches.

SHOULDER HARNESS ADJUSTMENT

The pilot and the ECMO are both provided with shoulder harnesses. The lower two free ends of the shoulder harness fit into the safety belt catch and are held securely as long as the catch is closed. The harness and safety belt are released by opening the safety belt catch. Buckles on the front of the harness permit it to be adjusted. An inertia reel shoulder harness takeup mechanism is provided with each harness. Each harness may be locked in position by pushing the pilot's handle (figure 1-3) on the left console, or the ECMO's handle (figure 1-4) on the center console, forward. In the unlocked position, the reels are automatically locked when subjected to a deceleration along the thrust line of the aircraft (as in a head-on crash) in excess of 2.5g.

Note

If tension is being held against the shoulder harness, the inertia reel will not release even though the locking lever is moved to the UNLOCK position. Under this condition it is not enough to release tension on the shoulder harness, as the Stalock feature of the inertia reel will keep it locked. Tension on the shoulder straps must be released first, and then the locking lever must be moved to the UNLOCK position.

PART 3

SERVICING AND HANDLING

Table of Contents

AIRCRAFT SERVICING

The servicing data presented here (figure 1-16) provides assistance to the crew members if the aircraft lands at a strange field and the maintenance crews are unfamiliar with the aircraft.

AUTHORIZED AGE

The following is a list of authorized AGE peculiar to servicing and ground handling.

Navy/Marine NC-5
USAF A-1, A-3, C-22, C-26, MD-3, MD-3A

The starting requirement for the aircraft on the ground is 28 vdc at 1000 amperes.

CONSUMABLE MATERIAL

The following is a list of the materials that are consumed during normal operation of the aircraft.

MIL-G-5572, AvGas, 115/145

MIL-T-5624, JP-4 (emergency fuel)

MIL-H-5606, Hydraulic Fluid

MIL-L-6081, Grade 1010, Engine Lubricating Oil

High Pressure Oxygen
(1800 ± 50 psig, 514 in.^{3}/cylinder)

CAPACITIES

The following is a list of the tank/reservoir capacities.

FUEL SYSTEM

Internal	1350 gallons	8100 pounds
Maximum	1950 gallons	11,700 pounds

The filler ports are located topside of the fuselage. By gravity filling the forward cell first, working aft, then topping each forward, prevents the aircraft CG from shifting too far astern, and causing the aircraft to rotate on its tail.

HYDRAULIC SYSTEM

Main	4.4 gallons
Auxiliary	10 gallons

The filler valve is located beside the sight gage on the upper left side of the escape chute.

ENGINE LUBRICATION SYSTEM

Each engine 3.45 gallons (usable)

Filler ports are located on the outboard side of each engine.

OXYGEN SUPPLY SYSTEM

Capacity 1800 ± 50 psig at 21°C (70°F)

The filler valve is located in the radio compartment.

AIR CONDITIONING SYSTEM

Capacity 4 ounces (MIL-L-6085)

The filler valve is located in the nose wheel well near the sight gage.

PRESSURES

The following is a list of pressures peculiar to servicing the aircraft.

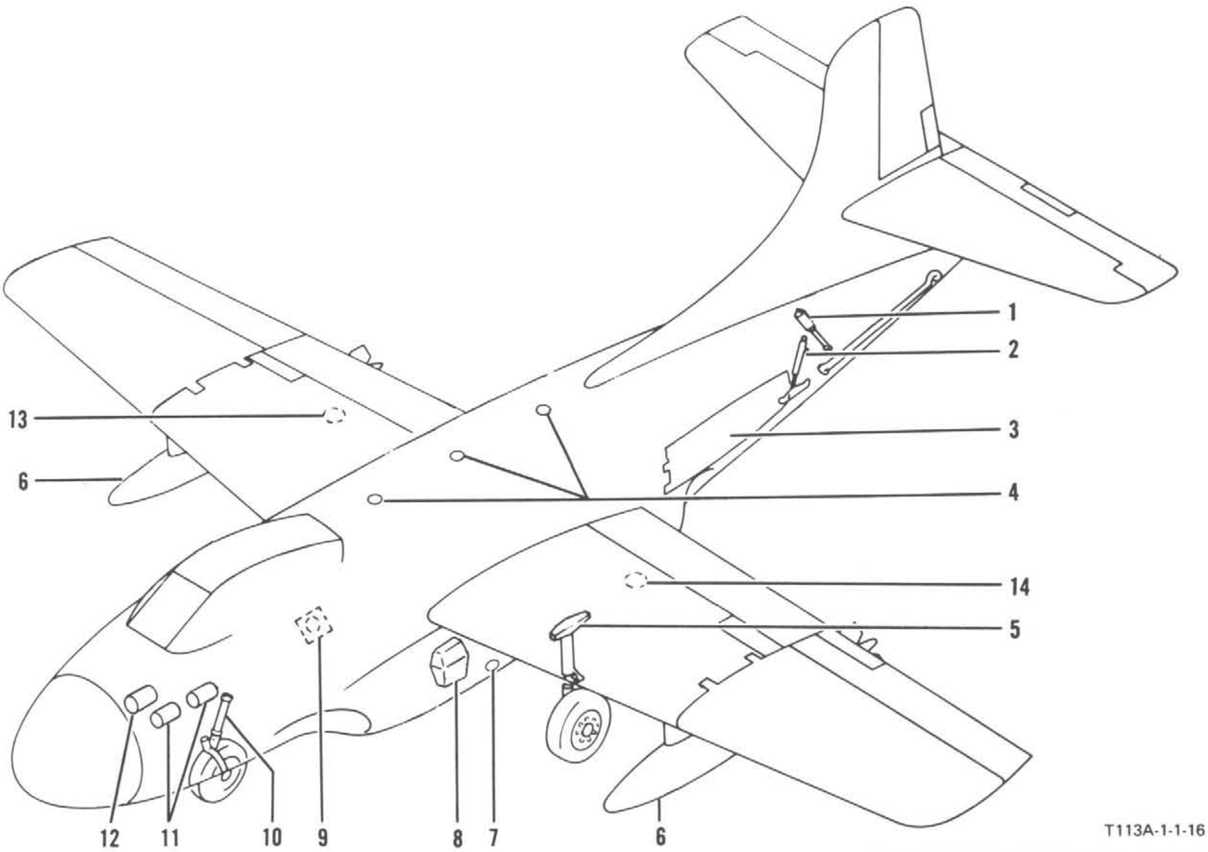
TIRES

Nose	165 pounds
Mains	145 pounds each

PNEUMATIC BOTTLES

Capacity 1980 ± 50 psig

The filler valves are located below the gages in the nose wheel well.



Index	Unit	Contents	Specification	Capacity			Remarks
				U.S.	Imperial	Metric	
1	Arresting hook hold-down cylinder	Hydraulic fluid Compressed air	MIL-H-5606	0.75 at 400-435 psig	0.62 qt	0.71 l	Inflate with cylinder compressed
2	Tail bumper shock strut	Hydraulic fluid Compressed air	MIL-H-5606	1.7 qt 40 psig	1.41 qt	1.5 l	Inflate with strut extended
3	Oxygen system	Oxygen	......	514 cu in per cyl	......	......	Charge to 1800 psig at 21°C(70°F)
4	Fuselage fuel tanks: Forward Center Rear	Fuel	MIL-G-5572, Grade 115/145 or JP4	650 gal 290 gal 410 gal	541 gal 241 gal 341 gal	2460.25 l 1096.65 l 1541.85 l	Fill front tank first; rear tank last
5	Main landing gear shock struts	Hydraulic fluid Compressed air	MIL-H-5606	....	....	....	Inflate to dimension shown on instruction plate
6	External auxiliary fuel tanks Aero 1A Aero 1D	Fuel	MIL-G-5572, Grade 115/145 or JP4	150 gal 300 gal	125 gal 250 gal	567.75 l 1135.512	....
7	Fuel drainage container	......	......	......	......	......	One container on each engine
8	Engine oil tanks	Engine oil	MIL-L-6081, Grade 1010	3.45 gal	2.87 gal	13.06 l	Access door in engine cowling
9	Hydraulic system filler	Hydraulic fluid	MIL-H-5606	4.4 gal	3.67 gal	16.65 l	Access from LH side of escape chute
10	Nose gear shock strut	Hydraulic fluid Compressed air	MIL-H-5606	......	......	......	Fill to dimensions shown on instruction plate
11	Pneumatic bottles	Compressed air	1980 ± 50 psig	......	......	......	Do not exhaust below 300 lbs
12	Air conditioning system oil filler	......	MIL-L-6085	4 oz.	......	......	Nose gear well, RH
13	External power receptacle	......	......	......	......	......	......
14	External emergency power receptacle	......	......	......	......	......	......

Figure 1-16. Service and Drain Points

TAIL BUMPER ACCUMULATOR

Capacity	1.7 quart (MIL-H-5606) 35 to 45 psig compressed air

Filler valve is located below the gage on the left side of the aft fuselage.

TAIL HOOK ACCUMULATOR

Capacity	0.75 quart (MIL-H-5606) 400 to 435 psig compressed air

Filler valve is located below the gage on the left side of the aft fuselage.

MAIN LANDING GEAR SHOCK STRUT

Capacity	Deflate shock strut slowly and fill to filler port with MIL-H-5606. Inflate with compressed air at 35 to 45 psig to length indicated on instruction plate.

NOSE STRUT EXTENSION

Capacity	Deflate shock strut slowly and fill to filler port with MIL-H-5606. Inflate with compressed air at 330 psig for 5 ± 1 inches on smooth terrain.

AIRCRAFT HANDLING

Ground crew handling instructions are provided in Section I, Handbook of Maintenance Instructions, NAVAIR 01-40FAB-2. Instructions include hoisting, jacking, leveling, mooring, parking, towing, special handling equipment and tools, servicing, cleaning, and weather protection. Flight personnel should assure that the aircraft is handled, serviced, parked, and moored as well as the local facilities permit. If outside mooring and weather protection facilities are inadequate, attempt to provide for protected hangar parking facilities.

PART 4

OPERATING LIMITATIONS

Table of Contents

AIRCRAFT OPERATING LIMITATIONS

The aircraft, engine, and system operating limitations that must be observed during normal operations are covered or referenced here. Some limitations that are characteristic only of a specialized phase of operation, such as emergency procedures, flight through turbulent air, starting procedures and so forth, are outlined in the discussion covering that specific operation or procedure.

AIRCRAFT LIMITATIONS

AIRSPEED LIMITS

The maximum permissible airspeed in smooth or moderately turbulent air with arresting hook, landing gear, wing flaps and speed brakes retracted is 480 knots IAS. In severe turbulence, speeds in the range from 218 to 350 knots IAS are recommended.

Note

Maximum airspeed is restricted to 300 KIAS in other than combat areas. This restriction is not authorized by Naval Air Systems Command at this time.

ACCELERATION LIMITS

The aircraft is limited to 3 positive g, and 0 negative g. Abrupt control movements and turbulence beyond moderate intensity are to be avoided.

PROHIBITED MANEUVERS

All acrobatic maneuvers and spins are prohibited.

GROSS WEIGHT LIMITS

The maximum allowable gross weights are as follows:

Field Takeoff 28,800 pounds
Field Landing 24,500 pounds

LANDING GEAR

The aircraft is limited to two touch-and-goes and one final landing per flight.

STORES

External stores may be carried singly or in combination under the same flight restrictions that apply without such stores except as noted below.

1. Takeoff or landing shall not be attempted with asymmetric external loads in excess of 1000 pounds. Although lateral control with such loading is in general adequate with aileron power boost on, if the power boost should fail, lateral control may become instantly inadequate.

2. Minimum airspeed with the ALQ-31 external store is 210 knots IAS; this is to prevent the ram air turbine from dropping below its airspeed requirement.

3. Speeds at which buffeting or lateral instability are encountered shall not be exceeded. The approximate speeds at which these phenomena occur are given in figure 1-18.

4. External store speed limitations are indicated in figure 1-17.

STORES	AERO 1A 150-GAL. TANK ALQ-31 POD DISPENSER	AERO 1D 300-GAL. TANK
Altitude (feet)	Knots IAS	Knots IAS
Sea Level	480	300
2,500	480	300
5,000	480	300
10,000	445	300
20,000	375	300
30,000	300	275
40,000	245	220

Figure 1-17. Speed Limitations with External Stores

ENGINE LIMITATIONS

RPM LIMITS

Engine RPM limitations are as follows:

30-minute operation 100%
Continuous operation (max) 95.5%

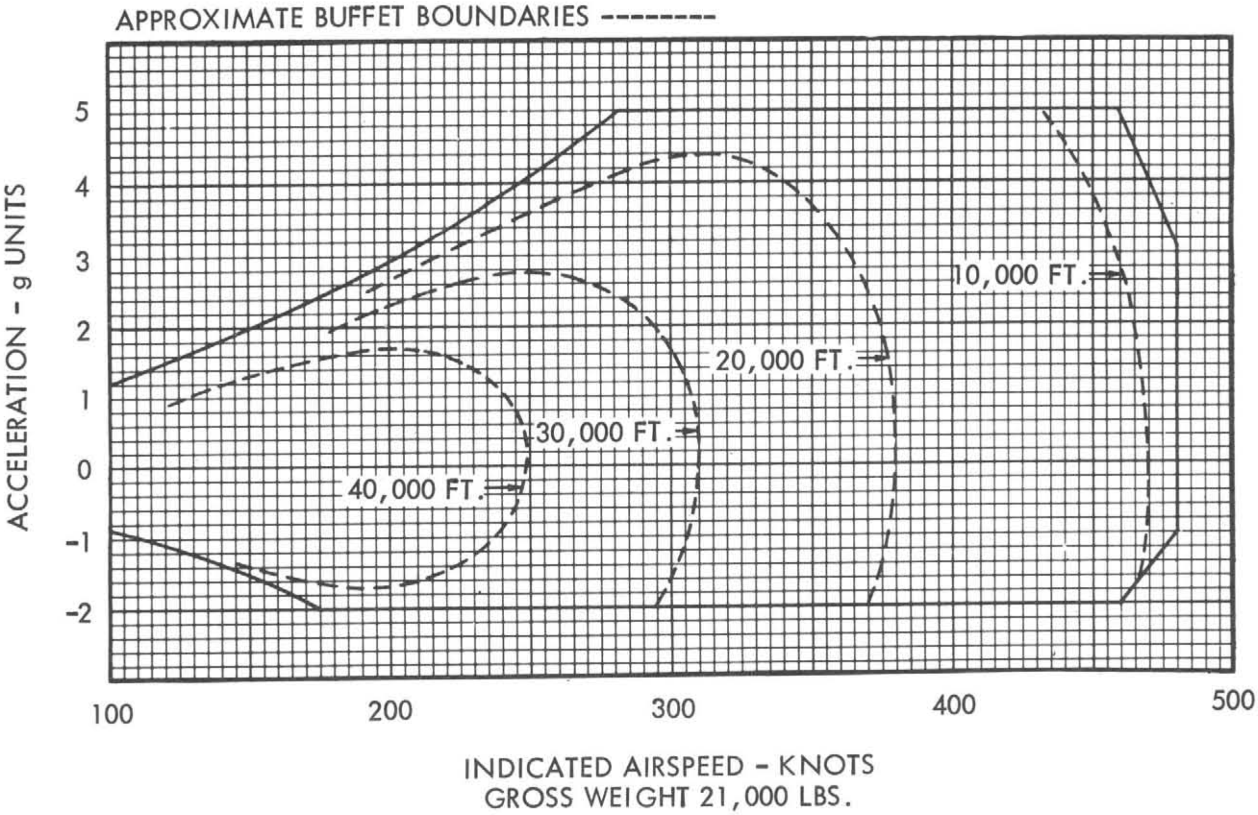


Figure 1-18. Operating Flight Strength Diagram

TOT LIMITS

Turbine outlet temperature limitations are as follows:

Maximum continuous	Indicator red line
Start	960°C
Maximum for 5 seconds	850°C
Maximum acceleration	905°C

STARTER LIMITS

The starter is restricted to two consecutive 30-second cycles followed by a 30-minute cooling period.

SYSTEM LIMITATIONS

Systems operating limitations are as follows:

CONDITION	AIRSPEED (KNOTS)
Landing gear extension	150
Emergency landing gear extension	120
Speed brakes	345
Flaps	170
Upper hatch open	310
Upper hatch open (escape chute closed)	175
Windshield wiper	200

INSTRUMENT MARKINGS

The limitation (red line) markings appearing on the instrument faces (figure 1-4) are as follows:

INSTRUMENT RANGE MARKINGS

	OIL PRESS.	OIL TEMP	FUEL BOOST PRESS.
Maximum	175 ± 5 psi	99°C	30 psi
Normal	75-155 psi	30-90°C	10-30 psi
Minimum	75 psi	30°C	10 psi

Tachometer	100 ± 1
Turbine Outlet Temperature	Individual engine red line

SECTION II

INDOCTRINATION

Table of Contents

GROUND TRAINING REQUIREMENTS

The overall ground training syllabus for each activity varies according to local conditions, field facilities, requirements from higher authority, and the immediate Unit Commander's estimation of squadron readiness. However, in order to ensure that all pilots are properly indoctrinated, thoroughly briefed, and adequately prepared to fly in the aircraft, certain specific courses must be standarized. The number of hours devoted to each course depends upon the progress and circumstances pertaining to each command. An outline of those courses and subjects that are required for all pilots is presented below. Also listed are the subjects upon which continued ground training is based.

GENERAL REQUIREMENTS

Before receiving familiarization flights in the EF-10B, the FAM pilot must:

1. Possess a current medical clearance.

2. Meet physiological requirements of the current edition of OPNAVINST 3710.7 series.

3. Complete the EF-10B Ground Support Lecture covering the following subjects.

   Power plants
   Electrical systems
   Fuel system
   Hydraulic and pneumatic systems
   Pressurization
   Flight controls
   Trim and stabilization
   Emergency procedures
   Escape system
   Flight characteristics and operating limitations
   Stalls and spins
   Preflight and hand signals
   Local area and facilities

4. Complete an emergency bailout drill.

5. Satisfactorily complete a blindfold cockpit check.

6. Complete a supervised engine start and taxi checkout.

7. Satisfactorily complete NATOPS open and closed book examinations on EF-10B operating limitations, normal and emergency procedures, and aircraft systems.

8. Complete appropriate course rules examination.

RECONNAISSANCE REQUIREMENTS

The aerial reconnaissance ground training syllabus will include:

1. ECM systems and operation

2. Flight procedures

3. Basic aerial photography

SUPPLEMENTAL REQUIREMENTS

The following subjects as guidelines should be included in the normal ground school syllabus that is supplemental and complementary to the flight training.

1. Technical subjects
   NATOPS Flight Manual
   Aircraft Maintenance Manuals
   Ordnance

2. Tactical subjects
   Rules of engagement

3. Instrument flight planning and cross-country navigation
   General flight planning
   Instrument flight, OPNAVINST 3710.7 series
   Navigation equipment

4. Flight safety
   AAR reviews
   Emergency procedures
   Flight safety equipment
   Use of emergency arresting gear

5. Intelligence
   Military situation
   Functions and organization of Air Intelligence
   Security of information
   Aircraft recognition

Maps, charts, and aerial photographs
EOB
Enemy aircraft aerial tactics
Anti-SAM tactics
Amphibious operations
Intelligence reports
EF-10B fighter support briefs

6. Communications
Types of communications
Brevity code
Authenticator tables

7. Survival
Physiological and medical aspects
Physical fitness and first aid
Survival on land and sea
Pilot rescue techniques

FLIGHT TRAINING REQUIREMENTS

The geographic location, specific flight training concept, local command restrictions, and other factors influence the actual flight syllabus and the sequence in which it is completed. This training is accomplished in the squadron.

FAMILIARIZATION PHASE QUALIFICATION REQUIREMENTS

The following criteria will be met before specific flight phases.

1. Before the familiarization phase, all pilots will have

Completed the ground training syllabus covered under General Requirements.

Satisfactorily completed three COT procedures familiarization periods, at least two of which must have been within two weeks of the first familiarization flight.

2. A qualified pilot will be assigned for a minimum of the first two familiarization flights and a FAM V check.

CEILING/VISIBILITY REQUIREMENTS

In general, the following ceiling/visibility minimums for time-in model apply.

Time-in-Model (hr)	Ceiling/Visibility (ft) (mi)
0 to 10	3000/5/no ceiling penetration
10 to 20	800/2; 900/1-1/2; 1,000/1
20 to 45	700/1; 600/2; 500/3
45 and above	OPNAV minimums

Where adherence to these minimums unduly hampers pilot training, Commanding Officers may waive time-in-type requirements for actual instrument flight, provided pilots meet the following criteria.

1. Have a minimum of 10 hours in model.

2. Completed two simulated instrument sorties.

3. Completed two actual or simulated TACAN penetrations to field minimums.

ADDITIONAL PHASE REQUIREMENTS

Additional phase requirements include

1. Instruments (actual).

Be basic instrument qualified in series.

Satisfactorily complete an instrument progress check on the instrument training portion of the aircraft series training syllabus and an in-type instrument check.

2. Night

Be instrument qualified in series.

3. Cross-country

Have 25 hours in series.

Be instrument qualified in series.

Satisfactorily complete a servicing checkout.

Have at least one night familiarization flight.

CURRENCY, AIRCRAFT FERRY, AND REQUALIFICATION REQUIREMENTS

To be considered currently qualified in the EF-10B, the pilot must meet the following requirements:

Total Time in EF-10B Series	Pilot must have flown . . .	Within last . . .
10 to 100 hours	5 hours	3 months
100 to 300 hours	10 hours	6 months

If these requirements are not met, familiarization phase requirements must be completed unless waived by the Commanding Officer.

Training requirements, checkout procedures, evaluation procedures, and weather minima for ferry squadrons are governed by the provisions contained in OPNAVINST 3710.6 series.

GENERAL REQUIREMENTS

Any pilot not flying for a two-week period after commencing a training syllabus will complete at least one COT procedures flight before his next EF-10B flight.

SAFETY AND SURVIVAL EQUIPMENT

Flight safety survival requirements and equipment shall be in accordance with OPNAVINST 3710.7 series.

OXYGEN REQUIREMENTS

Oxygen will be used during all flights. For takeoffs, landings, and all night flights above 5000 feet, 100 percent oxygen is recommended.

SECTION III

NORMAL PROCEDURES

Table of Contents

BRIEFING/DEBRIEFING

The Commanding Officer shall ensure that every flight crew is properly briefed on all facets of the assigned mission.

PREFLIGHT BRIEFING

These briefs are presented immediately before the launching of scheduled flights and, therefore, must be carried out in the most expeditious manner. Each brief shall include, but not be limited to the following.

1. General
   - Call signs – A/C assignments – A/C configuration
   - Times: engine start – taxi – takeoff – chock
   - Mission: primary – secondary
   - Operating area
   - Time on station
2. Weather
   - Present weather: local area
   - Forecast weather: local area – destination-alternate
   - High altitude weather: winds – jet stream – temperature
   - Contrail band width
3. Communications/Navigation
   - Frequencies
   - Radio procedure and discipline – visual signals
   - Identification (IFF/SIF) – ADIZ procedures
   - Mission route – control agencies
   - Navigation aids
   - Fuel/oxygen management
4. Conduct of Flight
   - Taxi
   - Takeoff – rendezvous
   - Climbout – formation
   - Enroute procedures
   - Conduct of mission
   - Recovery: holding – penetration – GCA
5. Emergency procedures
   - Aborts
   - Divert fields
   - Bingo and low fuel state
   - Radio failure – ICS failure
   - Aircraft systems failures
   - Loss of visual contact with flight
   - Downed plane – SAR procedures
   - Weapons systems failure

FLIGHT PREPARATION

When both crew members are present, it is recommended that a thorough briefing be conducted concerning normal and emergency procedures, crew coordination, and cooperation through the planned mission.

CHECK LISTS

The takeoff and landing check lists (figure 1-4), located on the pilot's instrument panel, list takeoff and landing procedures in general terms, and are used only as a reminder. The pilot must be thoroughly familiar with the complete procedures outlined in this manual in order to understand how these items should be checked. Each step within the check list must be performed or carried out in sequence as outlined in the appropriate check list and NATOPS Pocket Check List NAVAIR 01-40FAB-1B.

PREFLIGHT PROCEDURES

EXTERIOR PREFLIGHT

Before signing the yellow sheet make certain that a preflight inspection form has been filled out, properly dated, and attached to the yellow sheet. Check at least ten of the preceding yellow sheets noting discrepancies, and check to see if corrective action was taken. Perform exterior inspection as follows.

1. Starboard engine intakes: check for foreign matter, damaged guide vanes or compressor blades, security of starter motor cover, and visible oil leaks.

2. Starboard center fuselage area: check hydraulic sight gage, security of ammunition cans, and starboard engine oil.

3. Starboard wing area: check for hydraulic leaks, condition of tires (a tire with a cut through more than two cords is unsatisfactory), downlocks removed and stowed, struts extended 2-3/4 inches minimum and clean, brake pucks extended to minimum of 1/16 inch puck. Check gear telescoping rod jam nut secure and paint stripe on rod and nut lineup. Check hinges on main gear doors for cracks. Check security of wing pylon and security and fuel level of external tanks. Check wing fold for loose gear and frayed cable, and check spoiler for hydraulic leaks.

4. Starboard aft fuselage: check tailpipe for cracks, and check turbine blades for cracks or erosion. Check speed brakes hinge and fuselage skin for cracks. Check radio compartment for security and for freedom from fuel leaks and control cables free.

Note

The use of 115/145 AvGas results in varying shades of white or amber discoloration in the tailpipe and on exhaust turbine blades.

5. Center aft fuselage: visual inspection for security and cleanliness.

6. Port aft fuselage: tail bumper pressure gage 35 to 45 psi. Tail hook pressure gage 400 to 435 psi. Tail bumper extended, and tail hook retracted. Check turbine blades, fuselage skin, speed brake hinge, and tailpipe for cracks.

7. Port wing area: check spoiler for hydraulic leaks. Check wing fold for loose gear and frayed cables. Check security and fuel level of external tank. Check security of wing pylon. Check main gear door hinges for cracks. Gear telescoping rod jam nut secure, brake pucks extended to minimum of 1/16 inch, struts extended to 2-3/4 inches and clean, downlocks removed and stowed, condition of tires. Check for hydraulic leaks.

8. Port center fuselage: ensure that starboard engine oil is visible in screen. Check for security of ammunition cans.

9. Port engine intake: check for oil leaks. Ensure that starter motor cover is secure. Check guide vane and compressor blade for damage. Check for foreign matter.

10. Radome area: ensure that radome is secure.

11. Nose wheel well: check air conditioning sight gage for reading. 1980 ± 50 psi on air pressure bottles, downlock removed, nose radome crank secure, condition of tire, strut extended 5 to 7 inches, shimmy damper indicator extended 1/8 inch, security of landing gear free-fall cables, security of emergency escape chute door, and emergency escape chute valve – OFF.

Note

Due to the altitude restrictions of the aircraft and the maximum cockpit pressure differential, there is little danger of explosive decompression.

12. A general visual inspection shall be made of tail surfaces, wing butts, speed brakes, tail bumper, tail hook, fuselage, and engines for oil, fuel, or hydraulic leaks. Inspect the fuselage skin for cracks. All skin cracks must be stop-drilled.

13. Upper fuselage: check security of caps, and fuel level of forward, center, and aft fuel cells. Check upper surfaces for security. Surfaces should be clean.

PRESTART PROCEDURES

On Entering Aircraft

Check of the cockpit should follow a routine similar to that listed below.

Escape chute – cockpit exit doors open, gun bay doors and lower escape chute door latched; secure cockpit exit door.

Parachutes – checked

Bailout bottles – checked

Oxygen equipment – checked

Circuit breaker panel – IN, except auxiliary hydraulic pump

AN/ARN-6 – OFF

External stores relief handle – safety-wired

External stores panel – OFF

Fuel boost – OFF

Wing tank press switch – VENT

Trim tabs – ZERO

Flap handle – UP

Master engine switch – OFF

Throttles – OFF

Gust lock – OFF

Throttle friction – as desired

Oxygen – 100 percent check pressure

Gear handle – DOWN

Landing gear emergency release handle – safety-wired

Altimeter – SET

Compass switch – CONTROL

Gun sight – OFF

Gyro-horizon – FAST-ERECT

TACAN – OFF

Rudder pedal adjust – as desired

Emergency upper hatch release – safety-wired OFF

Master armament switch – OFF

Gun control switch – OFF

Emergency flap handle/auxiliary hydraulic system control – safety-wired OFF

Aileron power boost release – safety-wired OFF

Windshield wiper – OFF

Arresting gear hook – UP

Air conditioning cockpit pressurization switch – OFF

*APR-27 – OFF

Wing fold control handle – Correspond with relative position of wing

AN/ARC-52 or AN/ARC-27 – OFF

*AN/ARC-94 – OFF

Interior lights control panel – as desired

*KY-28 – OFF

Emergency light switch – OFF

Inverter selector switch – EMER/STBY

Lower escape hatch release handle – Stowed

AN/APX-6 – OFF

Master radio switch – ON

Battery – momentary ON/OFF (22V minimum)

ECM power switches – OFF

ECM inverter circuit breakers – OUT

*Aircraft with AFC No. 199 incorporated

ENGINE STARTING

1. Check fire warning system on each engine.
2. For night flights check operation of all interior and exterior lights.
3. Normally start left engine first. Hold one finger up to the Plane Captain. When he answers your signal, turn boost pump ON, check fuel pressure 10 to 30 psi, master engine switch ON; depress starter button until an indication of an rpm rise is noted.
4. At rpm indication of 10 percent move the throttle outboard striking the igniters; immediately advance throttle to a point midway between idle and cutoff detent.
5. Continue to make contact with the igniters while maintaining a hand on the throttle in order to control the TOT closely after lightoff.
6. Observe TOT; a delay can be expected before lightoff indications. If no lightoff occurs within the 30-second start cycle, follow False Start procedures described in Section 5.
7. The starter normally disengages at 25 to 30 percent; if the engine does not accelerate beyond 30 percent, throttle off, pull starter circuit breaker, master engine switch OFF, and follow False Start procedures.
8. Check for 10 psi oil pressure; check hydraulic system for 3000 psi.
9. After Plane Captain has signalled thumbs up, indicating post engine operation, hold two fingers up. When he answers your signal, repeat starting procedures on the right engine.

WARNING

So that crewmen who might be on the other side of the aircraft will not be injured, do not start second engine until the signal to do so is given.

10. When both engines are started, give signal to disconnect starting unit and immediately place battery switch to BATT-GEN.
11. Aux Hyd pump circuit breaker – IN.
12. ECM No. 1 inverter circuit breaker – IN.
13. Radio and navigation equipment – ON.
14. Check fuel gage.
15. Instrument power inverter switch – NORMAL.
16. Check all instruments for normal indications.

17. Give Plane Captain thumbs up when internal checks are completed.

18. On signal from the Plane Captain conduct external checks (flaps, speed brakes, arresting hook, spoilers, wing fold).

19. Pretaxi checklist completed.

PREFLIGHT CHECK

The following items should be checked at regular intervals when the aircraft is on the ground and whenever possible before flights to ensure proper functioning of the system.

OXYGEN SYSTEMS CHECK

1. Turn oxygen shutoff valve to ON.
2. Pressure gage should read 1800 ± 50 psi if the cylinder is fully charged.
3. Test the breathing tube couplings; blow into the open end of the disconnect until the flow indicator face opens. Seal the end of the disconnect with the tongue. If the flow indicator does not close within five seconds, the leakage is within acceptable limits. If leakage exists, check the coupling, outlet elbow, and breathing tube clamps for tightness.
4. Attach the mask to the regulator couplings and hold the mask away from the face while turning the manual SAFETY PRESSURE switch to ON for 1 to 2 seconds to ensure that the mask is free of debris and clean of oil or grease. Return the manual SAFETY PRESSURE switch to OFF.
5. Check mask fit by attaching to the helmet as in flight. Turn the manual SAFETY PRESSURE switch to ON. Take a deep breath and hold. Note the position of the oxygen flow indicator. If the flow indicator opens (all black) a leak is indicated. Tighten the mask straps until the flow indicator closes (white face) indicating a leaktight mask seal has been obtained. Resume breathing and turn SAFETY PRESSURE switch to OFF.
6. Breathe several times with the regulator air valve in both NORMAL OXYGEN and 100% OXYGEN positions and with the SAFETY PRESSURE switch ON, to check regulator operation and observe the flow indicator for a blink, verifying the positive flow of oxygen.

FUEL BOOST CHECK

When starting engines, turn fuel boost pumps on one at a time to prevent the possibility of unobserved fuel leakage on the engine yet to be started. Check to see that the proper fuel boost pressure gage is indicating from 10 to 30 psi. This check will also reveal a possible reverse in the electrical or fuel connections.

HYDRAULIC SYSTEM CHECK

Check operation of the left-hand engine-driven hydraulic pump when starting the left-hand engine. The hydraulic pressure gage should read 3000 psi since the hydraulic system remains pressurized as long as the landing gear is extended and the engine is running.

ELECTRICAL SYSTEM CHECK

1. Increase the engine speed gradually until the voltmeter reads approximately 27 volts. If the generator warning light goes out, it is an indication that the reverse-current relay is functioning properly.
2. Increase the engine speed and check the voltmeter. The voltmeter reading should not increase beyond 28 volts and should remain at that reading regardless of any further increase in engine speed.
3. A takeoff should not be made if the generator warning lights are on or if the voltmeter reading is too high (above 28.5 volts).

TAXIING

1. Exercise extreme caution while taxiing in confined areas. The responsibility for safety of the aircraft rests solely with the pilot.
2. Pump brakes to ensure positive braking action and signal for removal of chocks. Make sure the area to the rear of your aircraft is clear before adding throttle for initial taxi. Advance the throttle and roll straight ahead, keeping in mind the aircraft and ground-handling equipment on either side of your aircraft. Wheel brakes should be used to steer the aircraft. Idle or slightly higher rpm will be sufficient for normal taxi speeds.
3. Follow other aircraft at sufficient distance to avoid induction of foreign objects into the aircraft engine intake ducts.
4. Bring the aircraft to a stop before taking the duty for takeoff and complete the cockpit mounted takeoff checklist (figure 3-1). The takeoff checklist should not be completed while taxiing.
5. Damage to asphalt can be caused by the blast and heat from the tail pipes. Keep the aircraft moving if possible and use reduced power settings when taxiing on asphalt.

TAKEOFF

NORMAL TAKEOFF

1. With the aircraft lined up on the runway, apply brakes and increase engine rpm to 100 percent.

LANDING

- SHOULDER HARNESS
- AUTO PILOT
- ARMAMENT SWITCH
- SPEED BRAKES
- TRIM TABS
- UPPER HATCH
- ARRESTING HOOK
- LANDING GEAR
- FLAPS

TAKE OFF

- ESCAPE CHUTE
- WING LOCK
- UPPER HATCH
- SPEED BRAKES
- AUTO PILOT
- TRIM TABS
- FLAPS
- SHOULDER HARNESS

T113A-1-3-1

Figure 3-1. Takeoff and Landing Check Lists

2. If all instruments indicate proper readings, release the brakes and commence takeoff run. When starting takeoff roll, use the brakes to maintain directional control until the rudder becomes effective (approximately 50 knots).

3. At 80 to 90 knots, use slight back pressure, but not enough to lift the nose wheel off the runway. At 120 knots, increase back pressure to assume takeoff attitude, and the aircraft will fly off smoothly.

Note

If extreme nose wheel shimmy is encountered on takeoff roll, apply back pressure on the control stick to reduce the weight on the nose wheel.

4. When safely airborne, apply brakes to stop the wheels from spinning and retract the landing gear before reaching 150 knots.

Note

The landing gear will retract in approximately six seconds.

5. At 150 knots and at least 200 feet AGL retract the flaps.

6. Turn air conditioning and pressurization switch on.

7. Accelerate to climb schedule.

TAKEOFF ABORTS

Aborts during takeoff will be immediately announced over the radio by the pilot. If possible, continue straight ahead to allow the next aircraft to clear the abort, and thereafter clear the runway as expeditiously as possible. Raising the flaps, speed brakes out, maximum braking, and securing of engines, will materially reduce the distance of rollout. If an engagement of emergency arresting gear cable is anticipated, engage it on the runway heading and in the center of the runway.

MINIMUM RUN TAKEOFF

For a minimum run takeoff, the controls should be set in the same position as for a normal takeoff, except that the flaps should be full down.

CLIMB

Refer to Section XI.

CRUISE

Refer to Section XI.

DESCENT

Before descent, after prolonged cold-soaking at high altitudes, the cockpit temperatures should be increased. Set the power at approximately 80 percent, extend speed brakes, and descend at a speed of 250 knots. For maximum range glide, refer to Emergency Procedures (Section V). The descent speed is maintained without the use of speed brakes.

APPROACH

1. The visual entry for break will be made in the cruise configuration at an airspeed between 250 knots and 300 knots. Altitude and airspeed for entry will be in accordance with local instructions.

2. The desired particulars and configuration for the 180-degree position are as follows:

Distance abeam	6000 to 7000 feet
Altitude	1000 feet AGL or as specified in local operations instructions
Airspeed	140 knots
Landing gear	DOWN
Flaps	Full DOWN

3. The turn at the 180-degree position will be commenced 3 to 5 seconds beyond the exact abeam position.

4. Complete and report the cockpit mounted landing checklist.

5. The approach is planned and made to arrive at the 90-degree position at approximately 500 feet AGL and an airspeed of 125 to 130 knots.

6. The final approach should use the mirror landing system as an aid for determining rate of descent and touchdown point. Before touchdown the pilot will be flying at a speed of 110 knots with up to 3000 pounds of fuel remaining. For each additional 1000 pounds of fuel, add 5 knots to the approach speed.

LANDING

NORMAL LANDINGS

Under normal runway and landing conditions, landing rollout can be reduced by using aerodynamic braking until the nose falls through, at which time wheel brakes will be applied until stopped.

MINIMUM ROLLOUT LANDINGS

A minimum rollout landing is accomplished by opening the speed brakes on touchdown, raising the flaps when the aircraft is solidly on the runway, and using maximum wheel braking.

WET RUNWAY LANDINGS

Wet runway landings are made in the same manner as normal landings, except that care should be taken to avoid skidding. Whenever possible, plan for a field arrestment.

CROSSWIND LANDINGS

In a crosswind, use a combination of crab and wing down. Just before touchdown, correct the aircraft's heading parallel to the runway heading.

TAKEOFF IF LANDING IS NOT COMPLETED

1. Advance the throttle smoothly.

2. Close the speed brakes.

3. Raise the landing gear when safely airborne.

4. Raise the flaps at 150 knots, 200 feet AGL.

FIELD ARRESTMENTS

There are several types of field arrestment equipment. The types of arresting gear include the anchored chain cable type, MOREST-type, tape, and water-squeeze equipment. At most USAF bases and many USN/USMC fields there is some form of jet barrier, usually a Davis type. It is imperative that all pilots be aware of the type, location, and load limitations of the gear in use. Normally, the abort or short field, and overrun or normal arresting gear, are rigged at all times. In general, the arresting gear is engaged on the centerline at as slow a speed as possible.

SHORT FIELD ARRESTMENT

At any time before landing, when you know that a directional problem exists or a minimum rollout is desired, the short field equipment is used. In addition, an LSO, equipped with a radio, should be stationed near the touchdown point to aid the pilot in landing. The hook should be lowered while airborne and a positive hook check made. The pilot lands just short of the arresting gear with his shoulder harness locked and his feet off the brakes. Be prepared for a waveoff if the gear is missed.

NORMAL OR LONG FIELD ARRESTMENT

This situation occurs when a stopping problem exists with insufficient runway remaining. Lower the hook in sufficient time for it to effectively extend (normally at 1000 to 2000 feet in front of arresting gear). Do not lower the hook too early and scrape off the hook point. If the arrestment is to be made at night, the pilot should request to have the position of the arresting gear illuminated.

FIELD BARRIER

If the field barrier is to be engaged, the aircraft should be in a three-point attitude and the engines secured.

POST-LANDING PROCEDURES

1. After clearing the runway, the following is to be accomplished.
    - Air conditioning and cockpit pressurization – OFF
    - IFF – OFF
    - Speed brakes – IN
    - Flaps – UP
    - Navigation equipment – OFF
    - Inverter – STBY or EMERGENCY
    - Inverter No. 1 circuit breaker – OUT
    - Oxygen – OFF

2. Wing folding procedures:
    - Bring the aircraft to a complete stop.
    - Check spoilers faired with the wing.
    - Wing fold handle to full UP position.

ENGINE SHUTDOWN

1. Left engine
    - Set 60 percent and allow TOT to stabilize.
    - Close throttles rapidly avoiding contact with the ignition system.
    - Engine rpm below 10 percent – boost pump OFF, master engine switch OFF.

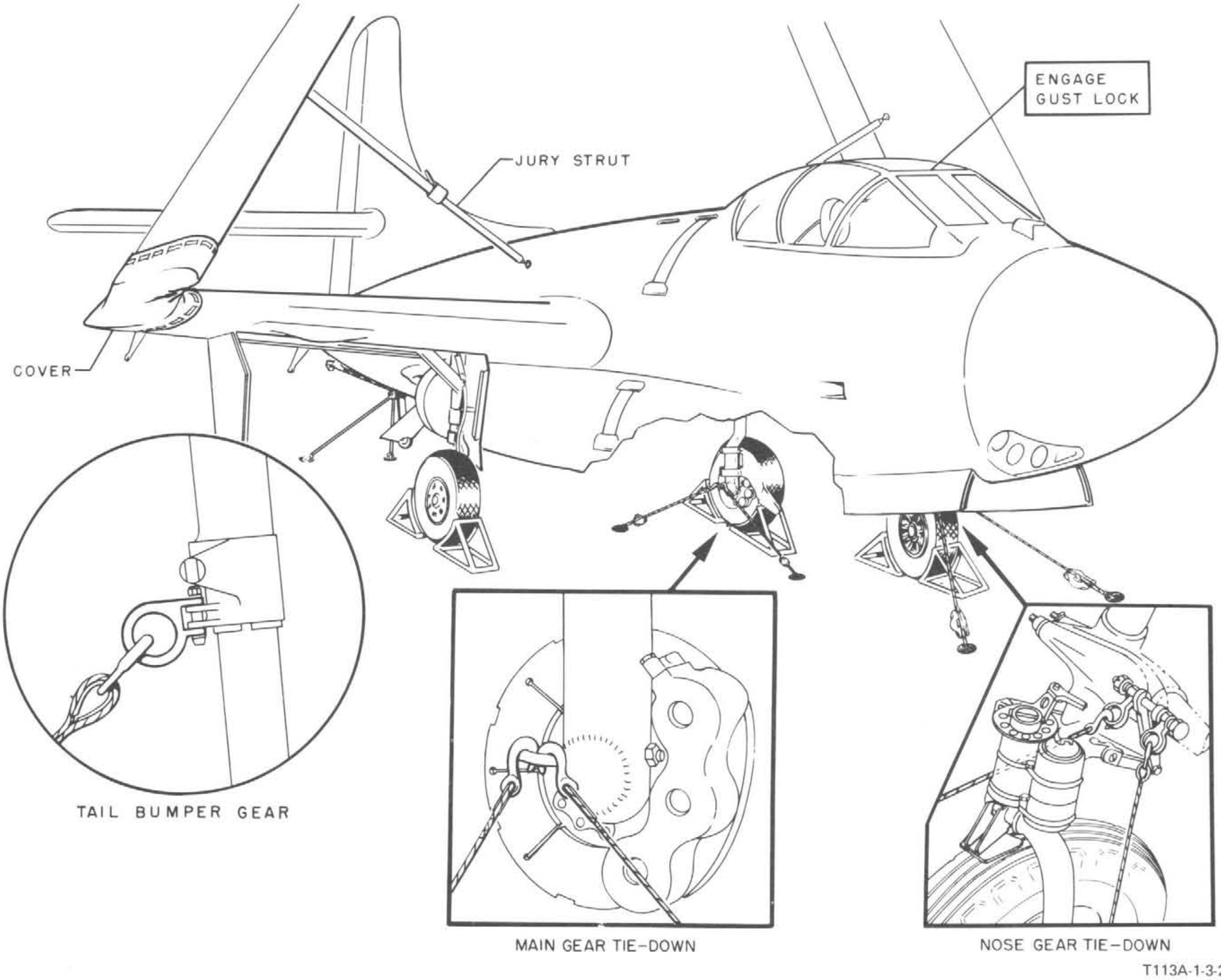


Figure 3-2. Mooring

2. Right engine
   Shut down the right engine in the same manner as the left engine.
   Master radio switch – OFF.
   Bat-Gen switch – OFF (engine rpm below 10 percent).

HYDRAULIC PUMP CHECK

1. Hydraulic pumps are individually checked in the following manner:

   The left engine-driven hydraulic pump is checked by starting the left engine first and noting 3000 psi on the hydraulic gage.

   The right engine-driven hydraulic pump is checked by shutting down the left engine first and noting 3000 psi on the hydraulic gage.

BEFORE LEAVING THE AIRCRAFT

1. All electrical switches – OFF.
2. Trim tabs – 0, 0, 0.
3. Gust lock – LOCK position.

NIGHT FLIGHT CHECK

Check the operation of all interior and exterior lights. Spare light bulbs are carried in a container at the forward end of the right-hand side of the center console.

Note

If the exterior lights master switch is placed in either the CODE, FLASH, or STEADY position, the approach light may be checked by lowering the arresting hook.

MOORING

1. Surface controls – locked.

2. Wheels – chock.

3. If gusty wind conditions prevail, tie the aircraft down (figure 3-2).

SECTION IV

FLIGHT PROCEDURES

Table of Contents

FLIGHT PROCEDURES

The following general flight and operating procedures are provided to minimize confusion, maintain air discipline, and achieve maximum effectiveness in the air. The general briefing guide (Section III) will be used to brief each flight. Any mission not covered by the briefing guide must be briefed by a qualified individual who has thorough knowledge of all aspects of the mission.

FLIGHT CHARACTERISTICS

STABILITY

The EF-10B aircraft possess positive longitudinal stability in all configurations except in dives to high mach number.

TRIM CHANGES

Longitudinal trim changes are small. Asymmetric power trim change is small except at low speeds and large asymmetric power.

SPEED BRAKE USE

The speed brakes are operated by the switch on the inboard throttle control grip. Extension of speed brakes causes a slight nose up pitch.

AILERON SPOILER EFFECTIVENESS

The spoilers are provided to improve the lateral control characteristics of the aircraft. The rate of roll is increased by diminishing the lift of the down wing in the turn maneuver. The effectiveness is greatest in the higher speed ranges. However, at approach speeds the lateral control is moderately improved.

STALLS

The stalling characteristics are normal and the aircraft has very little tendency to roll at the stall. The ailerons remain effective and will provide lateral control through the stall. Although a mild stall warning in the form of general aircraft and tail buffeting is present, the warning occurs too close to the stall (from one to four knots above stall) to be considered a reliable warning. This is especially true in the power approach configuration, where the very low control force stability tends to aggravate the possibility of inadvertent stalling. During flap-up stalls, some warning is present in the form of general buffeting. However, only a minor amount of warning exists in the landing condition.

STALL WARNING DEVICE

The aircraft is equipped with a warning device to warn the pilot of impending stalls. A sensing unit mounted in the leading edge of the right wing actuates a small electrical motor on the pilot's control stick, causing it to shake the stick. Warnings are given at percentages of stalling speed above stalling speed. Therefore, a slight shaking of the stick will be experienced at 15 percent above stalling speed, and a more severe shaking at 5 percent above stalling speed.

POWER-OFF STALLING SPEEDS

APPROXIMATE INDICATED STALLING SPEEDS (KNOTS)

Gross Weight (lb)	Flaps Up Gear Up	Flaps Down 25° Gear Down	Flaps Down 40° Gear Down
15,000	88	78	74
18,000	96	86	82
21,000	103	92	88
24,000	111	99	94
27,000	118	105	100

POWER-ON STALLING SPEEDS

TAKEOFF POWER, FLAPS DOWN 40 DEGREES, GEAR DOWN

Gross Weight (lb)	Approximate Indicated Airspeed (knots)
18,000	78
21,000	85
24,000	91
27,000	97

STALLING SPEEDS

GEAR DOWN, FLAPS FULL DOWN

Percent RPM	GROSS WEIGHT (LB) 18,000	21,000	24,000	27,000
	STALLING SPEED (KNOTS)			
POWER-OFF or IDLE	82	88	94	100
IDLE – 85%	80	87	93	99
85% – 95%	79	86	92	98
95% – 100%	78	85	91	97

STALL RECOVERY ENGINE OPERATION

In stall recovery the turbine outlet temperature is of utmost importance. During and before stall recovery the use of power may cause an increase in turbine outlet temperature beyond maximum limits and may lead to possible engine failure.

CAUTION

During stall recovery, power should not be applied until recovery is well under way or completed.

SPINS

Spin tests show that the aircraft is markedly resistant to entering a spin, particularly with any power above idle. The spin itself is very steep with the aircraft axis 60 degrees to 80 degrees nose down. Recovery is easily accomplished by application of opposite rudder followed by use of down elevator. If flaps or speed brakes are in use, they should be retracted before spin recovery is attempted. If a normal erect spin is entered inadvertently with external stores aboard, use recovery procedure as outlined above. If the aircraft does not respond satisfactorily, jettison the external stores and repeat recovery procedure. Intentional inverted spins are not permitted; however, if an inverted spin is entered inadvertently, immediate recovery should be attempted by neutralizing rudder and ailerons and placing the stick aft.

ACROBATICS

Acrobatics, steep dives, or spins are not authorized in the EF-10B aircraft. Do not use snap pullouts in recovering from dives. Do not move the controls abruptly in any maneuvers at high speeds.

CLIMB SCHEDULE

The normal climb schedule starts at 280 knots indicated airspeed at sea level, reducing 10 knots for every 5000 feet of altitude.

The airspeed for best rate of climb varies with weight, external load, altitude, and power setting.

1. Normal power (95.5 percent rpm). The best climbing airspeed at gross weights between 20,000 and 22,000 pounds is approximately 240 knots IAS from sea level to 20,000 feet. From 20,000 feet to service ceiling the best climbing airspeed is approximately 200 knots IAS.

2. Military power (100 percent rpm). The best climbing airspeed at gross weights between 20,000 and 22,000 pounds is approximately 270 knots IAS from sea level to 20,000 feet. From 20,000 feet to service ceiling the best climbing airspeed is approximately 220 knots IAS.

Note

If time in climb is anticipated to be more than 30 minutes using 100 percent rpm, best climb performance will be gained by using 95.5 percent during the initial phase of the climb.

FORMATION

1. Formation flight in the EF-10B is enjoyable and easy. One hazard is the lack of visibility aft and out of the right side from the pilot's seat, but this can be overcome by keeping heavy-right whenever possible.

2. Normal parade formation in the aircraft will use 5 feet of stepdown, 5 feet wingtip clearance, and with the flight on a 30° angle off leader's cockpit (well forward). When in echelon the leader's wingman will set the example; the second section will line up canopies.

3. For normal cruise to and from target, the angle off is increased to 40 to 50 degrees with 200 to 300 feet of lateral separation to provide adequate lookout doctrine.

4. Section takeoffs will be from right echelons only.

RENDEZVOUS

1. Keep the aircraft ahead constantly in view. Keep the nose of the aircraft slightly ahead of the leader's, with your speed equal to or slightly in excess of the leader's. As the wingman approaches the leader he should assure that he is

aft the leader's beam. To avoid overshooting, excess speed must be reduced before reaching the wing position. As necessary, the wingman should abort rendezvous by leveling his wings, sighting all aircraft ahead, and moving to the outside of the formation. During rendezvous only enough stepdown should be used to insure separation of the aircraft ahead. If one plane is "sucked" during rendezvous, the pilot shall move to the outside of the leader. All relative motion should be stopped before joining up to the inside wing position; a cross-under to the outside can then be made.

2. During a running rendezvous, caution must be observed in the final steps of joining up since relative motion is difficult to discern when approaching from the rear.

3. When possible, rendezvous should be conducted in a right turn due to limited visibility of the pilot.

NIGHT FLYING

Lights should be used as required. The proper use of oxygen during night flights is of particular importance. Oxygen should be used on all flights with cockpit altitude above 5000 feet.

POWER PLANT OPERATION

MAXIMUM ENGINE SPEED

The engines should never be operated above 95.5 percent rpm for more than 30 minutes in any one run. After 30 minutes of continuous operation above 95.5 percent power, a cooling period of at least 10 minutes at less than 95.5 percent rpm must be allowed before higher power is again used. 95.5 percent rpm is the maximum allowable for continuous operation.

COMPRESSOR STALL

At altitudes above 30,000 feet, abrupt increases in engine speed or decreases in airspeed can result in compressor stall. This is a condition of compressor pulsation accompanied by fluctuations of engine rpm and turbine outlet temperatures. It can be eliminated, if recognized immediately, either by increasing airspeed, decreasing engine rpm, or both. If allowed to continue, this condition of compressor instability can result in deadband operation, whereby turbine outlet temperatures increase beyond limits, with resultant loss of control of engine rpm and turbine outlet temperature. In extreme cases where turbine outlet temperature has exceeded the limits, it will be necessary to retard the throttle for the affected engine to cut off the fuel flow. When the turbine outlet temperature has reached a safe limit, the throttle may then be slowly advanced until the desired engine rpm has been reached. At high altitudes care must be taken to advance the throttle slowly to avoid compressor stalls.

SINGLE ENGINE OPERATION

During single engine operation, the throttle of the windmilling engine must be cracked for 30 seconds at 30-minute intervals, unless the engine has been shut down due to a failure and fire exists. This allows fuel to flow through the engine-driven fuel pump to maintain lubrication of the fuel pump and thus prevent it from overheating.

FUEL SYSTEM MANAGEMENT

FUEL FLOW

The fuel system (figure 1-8) is so arranged that the aircraft center of gravity is automatically held within allowable limits as fuel is consumed and no manual selection of internal fuel cells is required. The fuel switches must be on during all engine operations since the fuel switches control the fuel shutoff valves and the fuel boost pumps.

FUEL TRANSFER

Under certain conditions, it is possible for the total engine fuel consumption to exceed the external tank fuel transfer rate. Therefore, a drop in fuel quantity in the main fuel cell system is not always a true indication that the external tanks are empty. After the landing gear is retracted, approximately 30 to 40 minutes will be required for completion of the transfer operation at high power operation. Such a time interval should be allowed to elapse before accepting a drop in fuel quantity as definite indication of empty external tanks.

POST-MAINTENANCE CHECK PROCEDURES

Only qualified pilots, designated in writing by the Squadron Commanding Officer, will conduct post-maintenance flight checks in squadron aircraft. Before being designated, each pilot will meet the following minimum requirements.

1. 100 flight hours in model.
2. Will be thoroughly familiar with the following publications.
   a. EF-10B NATOPS Flight Manual.
   b. NAVAIRINST 47.2 series.
3. Have received briefing by Squadron Operations Officer and Squadron Maintenance Officer concerning test procedures and use of flight test cards.

SAFETY

Safety of operations will be paramount and final decisions on questionable conditions, practices, or borderline situations shall be in favor of safety.

POST-MAINTENANCE CHECK FLIGHT PROCEDURES

1. Post-maintenance check flights will be flown only by designated pilots.

2. The flight duration shall be planned for the minimum time necessary to check all required systems for operations use. Squadron check flight cards will be used for all post-maintenance check flights.

3. Thorough preflight and ground checks will be completed before a post-maintenance check flight.

4. Post-maintenance check flights shall be conducted within the local area and away from populated areas when feasible.

5. Post-maintenance check flights should be conducted under VFR conditions during daylight hours. However, if the Squadron Commanding Officer determines that a requirement exists to conduct a post-maintenance check flight during night/IFR conditions, he may authorize it. The necessity for flight under other than VFR conditions should receive adequate consideration, and the Unit Commander shall not delegate this authority.

6. Post-maintenance check flights may be in combination with operational flights, provided the operational portion of the flight is not conducted until the check pilot is satisfied that the aircraft is safe for operational flights.

7. All post-maintenance check flights will be scheduled through the Squadron Operations Officer who will assign a designated pilot for the post-maintenance check flight. The Maintenance Officer will control and issue the check cards.

8. Pilots will receive any instructions peculiar to the aircraft being checked from the Squadron Maintenance Officer.

SECTION V

EMERGENCY PROCEDURES

Table of Contents

EMERGENCY PROCEDURES

Knowledge of the aircraft and emergency procedures must be reviewed on a regular basis to ensure that the crew will take the correct course of action when faced with difficulties. The initial training should be thorough in this respect. Above all, the crew must recognize and admit the emergency situation, then take positive steps in accordance with recommended procedures. Due to the many situations that can arise concerning emergencies, it is impossible to set an absolute policy. The crew must consider all factors of a given situation and then take appropriate action for the particular situation. The following are some likely courses of action and recommended ways of handling certain emergencies.

GROUND EMERGENCIES

FALSE START

If the engine fails to start within 30 seconds after crank, perform the following.

1. Throttle – OFF
2. Fuel boost – OFF
3. Engine master switch – OFF
4. Starter circuit breaker – OUT
5. Give THUMBS UP signal to Plane Captain. Two 30-second starting periods are allowed. After the first starting period, investigate the cause of the false start before attempting a second. After a second false start, let the starter cool for 30 minutes.

ENGINE FIRE ON START

If the Plane Captain gives a TURN UP signal, there is a fire; perform the following.

1. Throttle – OFF
2. Fuel boost – OFF
3. Starter circuit breaker – IN
4. Engine master switches – OFF
5. Crank button – DEPRESS (crank engine)

If fire persists, the ground crew introduces PPK into the air intake duct or between exhaust pipe and cowling.

CAUTION

PPK may be used in the cowl around the tail pipe, but not within the tail pipe itself as damage to the engine may result.

HOT START

If the turbine outlet temperature exceeds 960°C, momentarily, or 850°C for 5 seconds during start, shut down the engine immediately, and issue a report on yellow sheet.

HOT BRAKES

Hot brakes can be expected when the takeoff is aborted, excessive braking is used after landing, or from dragging brakes. Any of these conditions could raise temperatures to a point where normal takeoff would heat a wheel enough to produce explosive failure. Time temperature histories indicate that normal taxiing, takeoffs, and touch-and-go landings do not significantly increase wheel temperature.

Hot Brake Procedures

1. Taxi (or have aircraft towed) to nearest hot brakes area.

   If hot brakes are discovered on the line, promptly taxi or have aircraft towed to an isolated position, and warn personnel to stay clear.

2. Notify tower to alert crash crew.

3. Park aircraft with wheel axis pointed in safe direction.

   Tire/wheel failure usually occurs after returning to the line. This is because maximum transfer of heat from the brake discs to the wheel usually requires 15 to 20 minutes. Therefore, should it become necessary to approach the aircraft, personnel should move toward the aircraft from the front or rear, never from the sides.
   Where hot brakes result in fire, the use of dry chemicals in preference to CO_2 and foam (as fire extinguishing agents on tires and brakes) is recommended due to metal stresses caused by the cooling action of CO_2.

EMERGENCY EGRESS

1. Open cockpit entrance hatch

2. Unstrap

3. Depart

TAKEOFF EMERGENCIES

ABORT PROCEDURES

1. Throttles – OFF

2. Arresting hook – DOWN

3. Flaps – UP

4. Maximum wheel braking

5. Transmit abort

6. Engine master switches – OFF

7. Fuel boost – OFF

8. BATT/GEN switch – OFF

FIRE DURING TAKEOFF ROLL

1. Execute abort procedures if sufficient runway length is available.

2. If unable to abort.

   Continue takeoff
   External stores – JETTISON

3. When airborne,

   Gear – UP
   Flaps – takeoff setting
   Secure affected engine

Note

The prime consideration prior to securing the affected engine is to gain flying speed and altitude.

ENGINE FAILURE DURING TAKEOFF

1. Execute abort procedures if sufficient runway length is available.

2. If unable to abort (gear and flaps down).

   Continue takeoff
   External stores – JETTISON
   Flaps – FULL DOWN
   Seat – LOWER
   Throttles – OFF
   Engine master switches – OFF
   Fuel pump switches – OFF
   BAT/GEN switch – OFF
   Land straight ahead

INFLIGHT EMERGENCIES

ENGINE FIRE

If an engine fire occurs during flight, warning will be given by the fire detection warning lights. The following procedure should be employed.

1. Throttle – IDLE

2. If fire indications are positive, secure the engine

3. Fuel boost – OFF

4. Engine master switch – OFF

5. Cut off all electrical power to the engine by pulling the required circuit breakers

WARNING

The fire itself may destroy the fire warning circuits causing the warning light to go out. If the warning light goes out, check the circuit by using the fire detector test switch (figure 1-3).

ELECTRICAL FIRES

In the event of a fire in the electrical system, the following procedure should be applied.

1. Turn **OFF** the battery-generator switch.

2. Turn off all electrical equipment except fuel boost switches.

3. If the fire is extinguished and certain circuits are needed for the operation of the aircraft, turn the circuits on one at a time, starting with the battery-generator switch and watch for the one that caused the fire.

WING FIRE

If a wing fire occurs during night flight operation the following procedure should be applied.

1. Turn the switches which control all the lights within the wing **OFF**.

2. Attempt to extinguish the fire by sideslipping the aircraft away from the wing fire.

3. If fire persists, abandon aircraft.

FUSELAGE FIRE

If a fuselage fire develops it is not possible to cut off the fuel supply from any one tank as no fuel selection is incorporated in this aircraft due to the gravity feed system. With fuselage fires that are uncontrollable by means outlined in previous paragraphs, it is left to the pilot's discretion whether to land immediately or to abandon the aircraft.

SMOKE IN THE COCKPIT

If there is smoke in the cockpit proceed as follows.

1. Oxygen – 100%

2. Air conditioning and cockpit pressurization switch – **OFF**

SINGLE ENGINE FAILURE

If one engine fails during flight after flaps and gear are up, proceed as follows.

1. Operative engine – 100% rpm

2. Secure inoperative engine

3. Trim aircraft

4. Execute air start procedures on inoperative engine

5. If prolonged single-engine flight is to be maintained, readjust the operative engine for a single-engine flight in accordance with Section XI.

DOUBLE ENGINE FAILURE INFLIGHT/ PRECAUTIONARY APPROACH

Should both engines flame out, and air start procedures are unsuccessful, efforts should be concentrated on making a safe forced landing or bailout, depending upon the terrain or other factors. If a pilot commits himself to a dead stick landing when flying at high or medium altitudes, he should execute the following general procedures.

1. The recommended glide speed should be established. The best range glide speed varies from 175 knots IAS with full internal fuel tanks to about 145 knots IAS with no fuel. With external stores the glide ratio is 14:1 and in the clean configuration the glide ratio is 15:1. See figure 5-1 for a plot of gross weight versus airspeed for best range glide. The indicated airspeeds on this chart will give the theoretical maximum gliding range, but strict adherence to these speeds is not critical as a 10-knot deviation in recommended airspeed will cause only a 1 to 2 percent loss of gliding range. The gliding range in the clean and landing configuration is shown in figure 5-2.

2. The engine-off rate of descent at various altitudes is shown in figure 5-3.

3. During engine-off descents at normal glide speed, the engine windmill speed varies from approximately 31 percent rpm at 35,000 feet to 11 percent rpm at sea level. Engine windmill speed versus pressure altitude at an indicated airspeed of 160 knots is shown in figure 5-4.

4. The windmilling engines provide sufficient hydraulic pressure to actuate the landing gear, flaps, and speed brakes within an acceptable time. At 12 percent windmill rpm the landing gear will extend and lock in approximately 15 seconds and retract in 30 seconds; the flap will lower in about 7 seconds and retract in about 5 seconds; the speed brakes will open in about 11 seconds and close in approximately 7 seconds. At higher windmill speeds the hydraulic components will operate faster, but the times are representative of the average dead-stick approach. Hydraulic pressure remains at approximately 3000 psi when no hydraulic components are being operated. Aileron boost is retained throughout the dead-stick approach. Brakes are available, but require a higher pedal force than normal.

5. Generator power is lost when both engines are flamed out, which results in the loss of the secondary and monitor busses. Necessary components on the secondary bus such as radio and flight instruments may be regained by placing the battery-generator switch to BAT ONLY. Unnecessary electrical loads should be turned off before placing the battery-generator switch to BAT ONLY. When the landing gear handle is placed in the WHEELS DOWN position, the secondary bus is energized

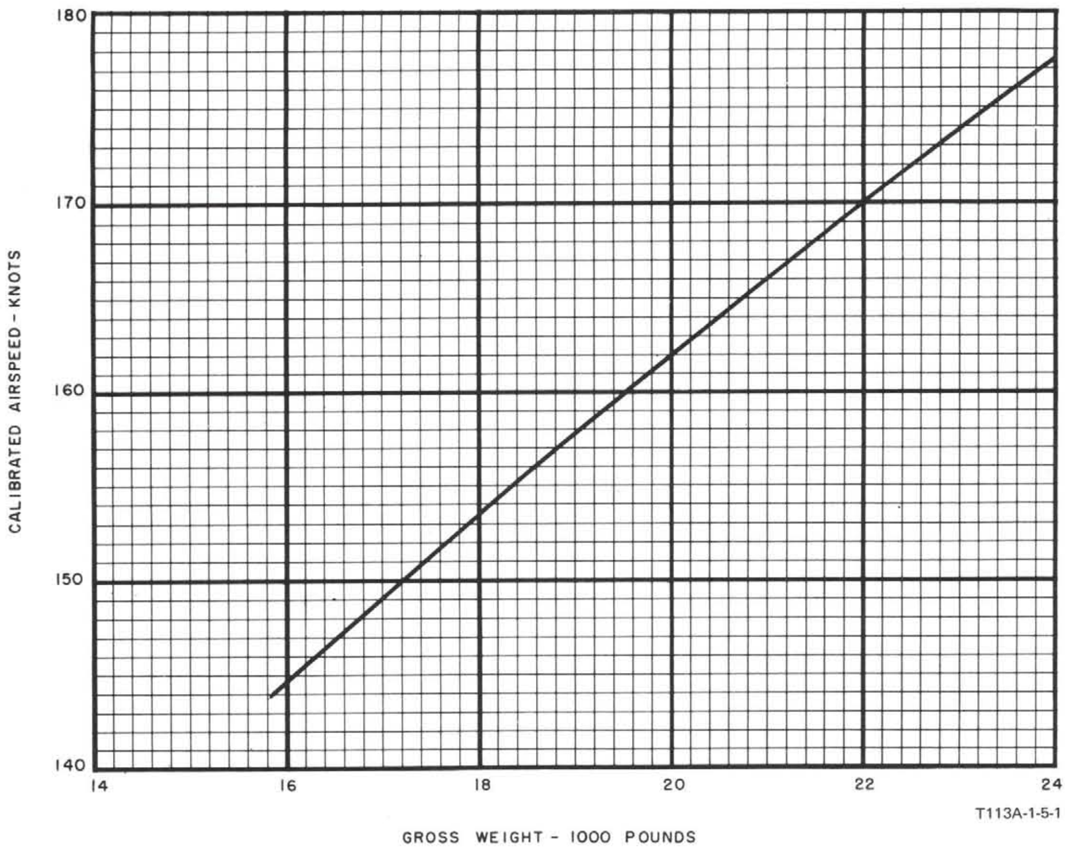


Figure 5-1. Airspeed for Best Range Glide

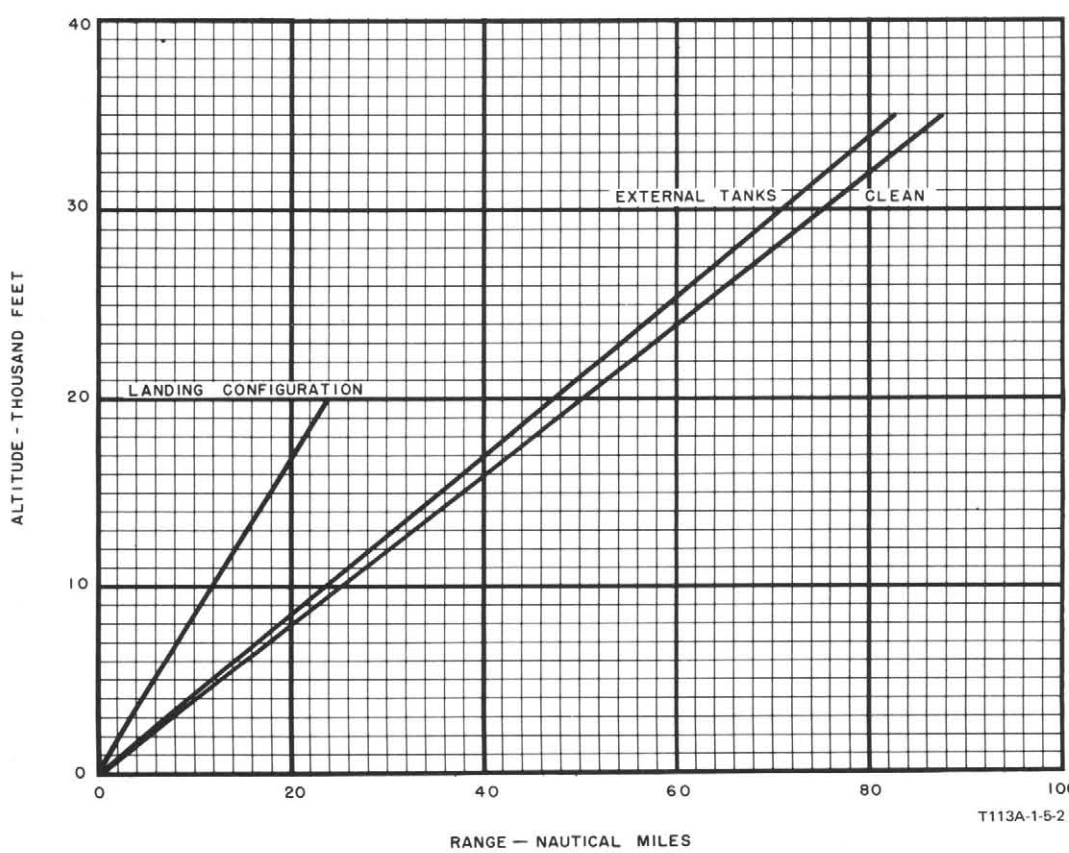


Figure 5-2. Engine – Off Glide Range

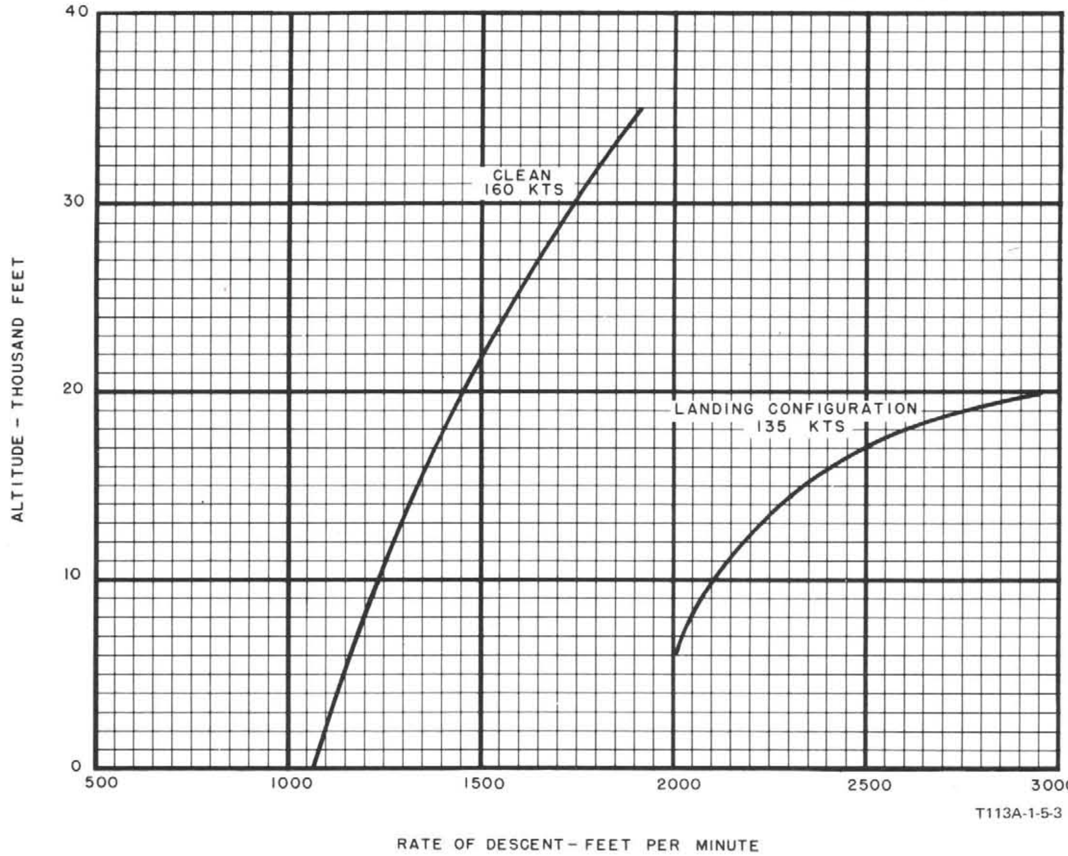


Figure 5-3. Engine – Off Rate of Descent

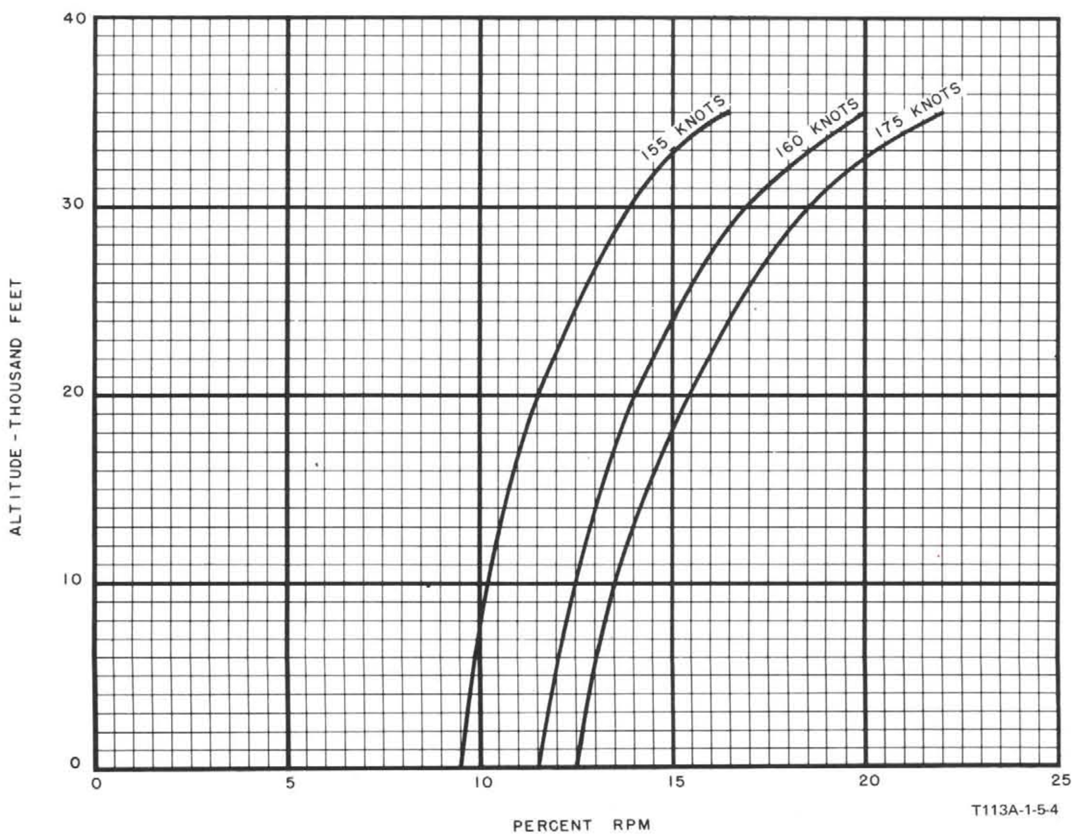


Figure 5-4. Engine Windmill Speed

automatically. If an air start is to be attempted, it is advisable to conserve the battery to insure sufficient power for the air start.

6. Moderate windshield frosting will probably occur during the engine-off descent due to the loss of the air conditioning system. When the relative humidity is low, the frosting will be very light.

PRECAUTIONARY APPROACH

The recommended pattern for a precautionary approach is shown in figure 5-5. The flaps should be lowered before reaching the initial point. If the approach is being made to a suitable airfield, the landing gear should also be lowered before reaching the initial point. The following breakdown shows recommended glide speeds and pattern altitudes for a precautionary approach.

1. Best glide speed for clean configuration with one-half internal fuel: 160 knots IAS.

2. Approach speed in landing configuration: 130 to 135 knots IAS.

3. Optimum altitude at initial point (gear and flaps down): 4000 feet.

4. Optimum altitude at 180-degree point (gear and flaps down): 2100 feet.

5. Optimum altitude at 90-degree point (gear and flaps down): 1200 feet.

6. Minimum altitude at initial point (gear and flaps up): 3000 feet.

7. Minimum altitude at 180-degree point (gear down): 1500 feet.

An error of 500 feet at the initial point and 300 feet at the 180-degree point will cause no difficulty. In an actual precautionary approach the speed brakes should not be used except on the final approach in conjunction with slipping and lowering the nose to correct for overshooting the intended landing point. If it appears that the initial point will be reached with less than 3200 feet, the flaps, gear, and speedbrakes should be extended early and a straight-in approach effected.

ENGINE SHUTDOWN DURING FLIGHT

Emergency stopping of engines is accomplished by normal shutdown procedure.

For shutdown procedure for engine fire in flight see the paragraph on Fire During Flight, page 5-2.

AIR START PROCEDURE

If an engine shuts down in flight and aircraft performance is adequate on the operative engine, or if sufficient altitude is available with both engines shut down, an attempt should be made to restart either or both engines. The technique of air starts at altitude requires close monitoring of the TOT in order to determine when lightoff takes place, and excessive engine temperature readings are not attained.

CAUTION

If the engine oil temperature falls below -40°C (-40°F) while the engine is stopped, do not attempt a restart as serious damage to the engine may result. If possible, descend to a lower altitude, allow oil temperature to rise, and restart.

Nose the aircraft down, or if one engine is inoperative, fly at an airspeed that will permit the dead engine to windmill at least 12 percent rpm (1500 rpm) at altitudes of 12,000 feet or below, and rpm equal to altitude above 12,000 feet. Above 30,000 feet engine windmilling rpm as much as 28 percent (3500 rpm) may be necessary for air starts. With the fuel and master engine switches turned ON, manipulate the throttle in the same manner as for a normal start.

CAUTION

Do not windmill engine without fuel supplied to the fuel pump inlet as fuel is needed to lubricate the pump. The fuel pump will recirculate the internal fuel, however, and thus provide its own lubrication during windmilling, up to 30 minutes. The pilot should then turn the fuel switch on momentarily to provide a fresh supply of fuel to the pump.

Note

Since the engine is windmilling above the maximum starter cranking speed, only the 30-second cycle of the ignition system is needed for an air start.

ENGINE FUEL SYSTEM FAILURE

No emergency provisions are made. If the engine fuel pump fails, procede with instructions given in Engine Failure paragraph. See figure 1-8 for schematic of fuel system.

AILERON POWER BOOST PRESSURE SYSTEM FAILURE

If the aileron power boost hydraulic pressure should fail, the mechanical advantage shifter will automatically shift to give a 2:1 aileron control advantage. Aileron travel will be reduced to half of normal, and because of the pressure loss, the spoilers will also be inoperative. The rate of roll, therefore, will be reduced and aileron control forces will increase. Decrease the airspeed to lower the control forces.

If failure occurs within some component of the aileron power boost system, resulting in forces that

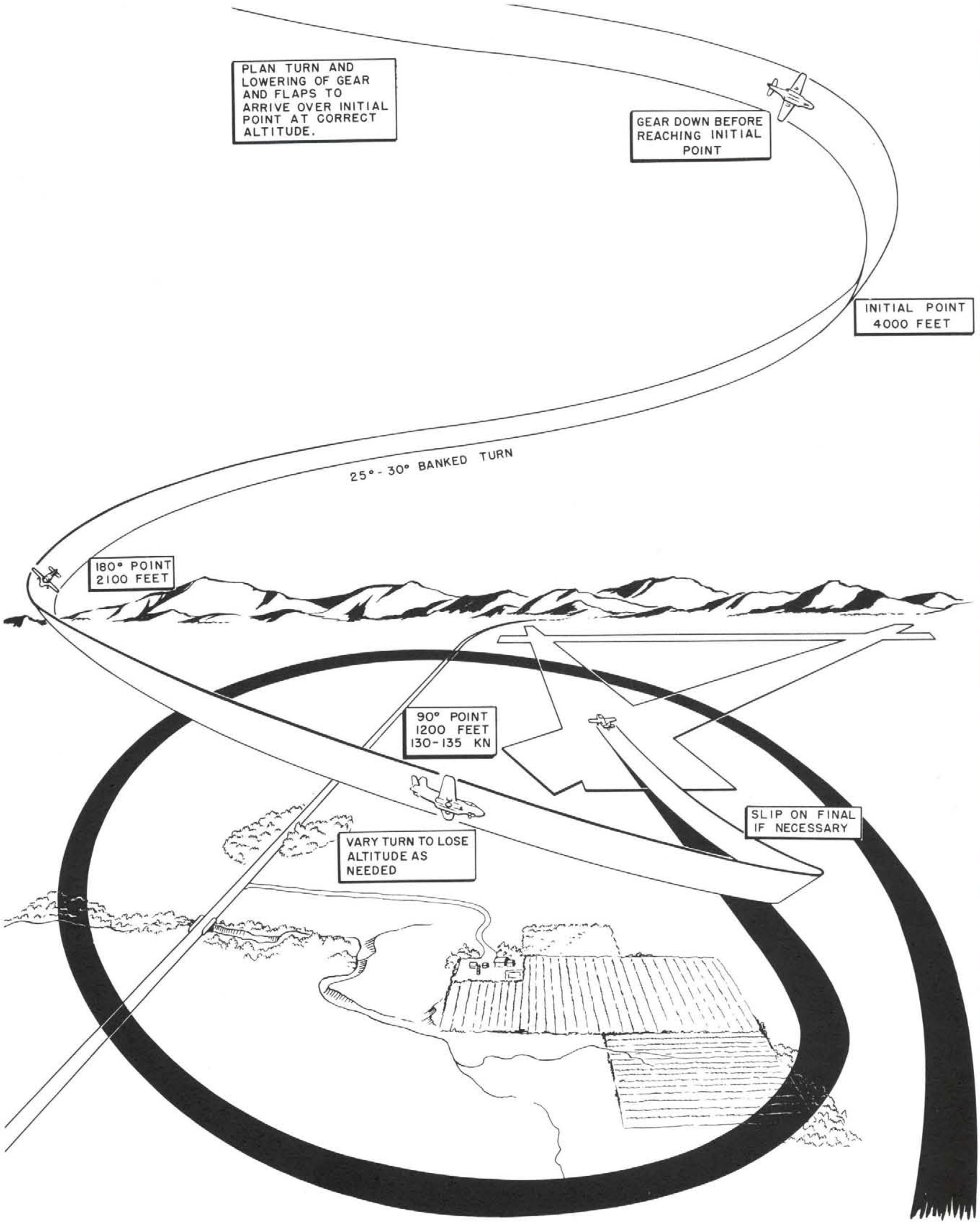


Figure 5-5. Precautionary Approach Landing Pattern

tend to drag upon or freeze the aileron control system, attempt to manually overpower the restricting force to alleviate this condition. Do not pull the AILERON POWER BOOST RELEASE handle, as the added advantage of power boost to assist in overcoming the malfunction would be lost immediately. However, if unable to free the control system manually, then pull the AILERON POWER BOOST RELEASE handle. Reduce airspeed to lower the air forces on the control surfaces.

EXTERNAL STORES JETTISON

To electrically jettison external stores.

1. Master armament switch – ON
2. Bomb selector – LH and RH
3. Bomb release trigger (on the stick) – DEPRESS

If electrical release of external stores fails, pull out on the emergency external stores release handle (figure 1-3).

Note

Armament bus is deenergized with the landing gear down.

ELECTRICAL SYSTEMS MALFUNCTIONS

If a generator warning light comes on, it is an indication that the reverse current relay for that generator is open, thereby leaving only one generator connected into the electrical system. In such a condition, the electrical load on the remaining generator should be maintained below 400 amperes. If both generator warning lights are ON, the electrical system becomes dependent upon the battery. The battery contains sufficient charge to operate the engine, instruments, radio equipment, and fuel boost pumps for approximately 10 minutes if both generators are inoperative, providing no other electrical equipment is in use. Furthermore, if all radio equipment and the fuel boost pumps are turned off, the battery contains sufficient charge to operate the engine and instruments for approximately 30 minutes. With fuel boost pumps turned off, however, a power loss, which is increasingly critical at higher altitudes, will be experienced. The battery-generator switch must be moved to BAT ONLY position after all nonessential equipment has been turned off.

Note

Turn off fuel boost pumps by pulling the circuit breakers only, as the fuel switch also controls the fuel shutoff valves. Fuel boost pumps should not be turned off at altitudes above 18,000 feet as engine shutdown is highly possible.

MANUAL CHANGEOVER TO EMERGENCY INVERTER

The INST & AC PWR FAIL warning light comes on to indicate failure of the normal inverter. The PWR SELECT switch must be turned to the EMERG position to effect changeover to emergency inverter power. The warning light will go out if the emergency inverter is functioning properly. If the warning light remains illuminated, no power is available for operation of the essential flight and engine instruments, and a landing should be made as soon as possible.

Note

Do not turn main battery switch OFF except as a last resort as no power will then be available for essential flight and engine instruments.

BAILOUT PROCEDURES

ESCAPE CHUTE USE

Pull the escape chute door emergency release handle, located on the center console and leave the aircraft as shown in figure 5-6.

Note

Use lower escape chute for emergency escapes in the air. At speeds above 175 knots, the upper escape hatch must be closed or the differential pressure will hold the lower escape chute doors closed. It is recommended that a feet-first, facing-aft escape be employed. Although it is possible to escape through the chute head first, it is much less desirable.

OPENING UPPER ESCAPE HATCH

Pull the upper escape hatch emergency release handle, located on the instrument panel and leave the aircraft as shown in figure 5-6.

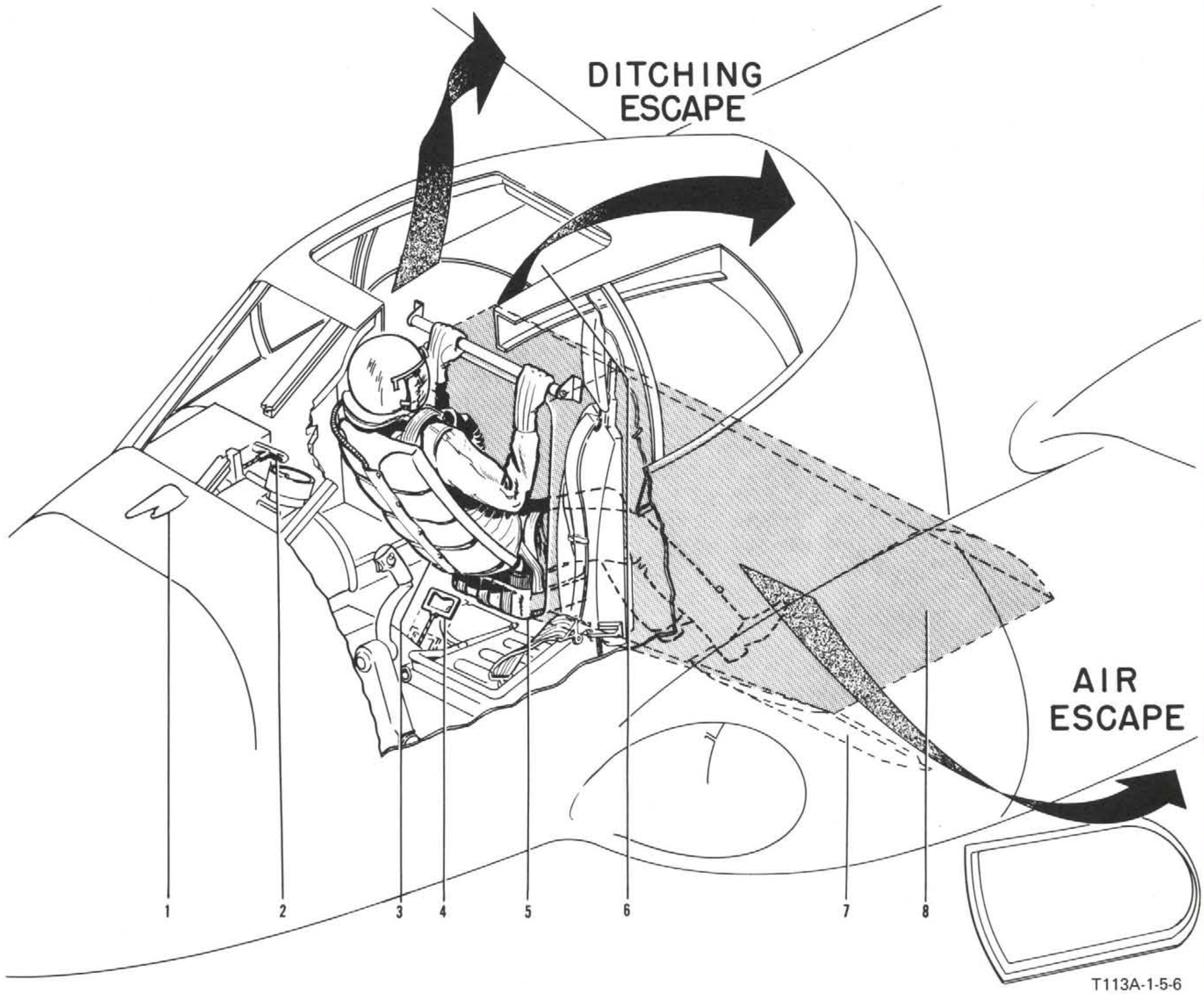
COCKPIT FLOODLIGHTS

The floodlights are turned on before an emergency escape at night to provide extensive lighting for the escape operation. Floodlights are installed at each side and on the aft bulkhead of the cockpit. The floodlights are turned on by the emergency lights selector switch (figure 1-4) on the center console.

OXYGEN SYSTEM EMERGENCY PROCEDURE

OXYGEN REGULATOR

Should symptoms occur that suggest the onset of anoxia, immediately turn the SAFETY PRESSURE switch located on the regulator to ON and descend below 10,000 feet cockpit altitude. If for any reason the regulator should become inoperative and a constant flow of oxygen is not obtained by use of safety pressure, activate the oxygen bailout equipment and descend below 10,000 feet cockpit altitude.



1. Pitot Tube -- Barrier Crash Hook
2. Upper Escape Hatch Emergency Release Handle
3. Back-Type Parachute
4. Lower Escape Chute Emergency Release Handle
5. Pararaft Kit
6. Upper Escape Hatch
7. Windshield
8. Lower Escape Chute

Figure 5-6. Emergency Equipment and Exits

LANDING EMERGENCIES

LANDING GEAR EMERGENCY EXTENSION

1. Slow to 120 knots
2. Gear handle – DOWN
3. Emergency release handle – PULL
4. Yaw aircraft
5. Check gear indicator – DOWN and LOCKED
6. Short field arrestment

BRAKE MALFUNCTION

If hydraulic system brake failure occurs, normal braking will be lost. Approximately twice the normal force on the rudder brake pedals will be required to stop the aircraft. Allowance for extra rollout should be made.

FLAP MALFUNCTIONS

Aircraft with Emergency Wing Flap Control

1. Conditions permitting, execute a no-flap landing.
2. If the main hydraulic system fails and it is desired to extend the wing flaps in an emergency,

move the wing flap control to the DOWN position. Move the auxiliary system control to the EMERGENCY WING FLAP position to provide hydraulic pressure.

Note

Aileron power boost is off when emergency wing flap hydraulic pressure is used. Reduce airspeed to lower the aileron control forces. After the wing flaps are down, aileron power boost cannot be regained without the loss of emergency flap extension.

Aircraft with Emergency Landing Flap Control

If the main hydraulic system fails, the wing flaps can be lowered in an emergency by moving the EMERG LANDING FLAP control handle from the upper detent position (NORMAL) down to the EMERG FLAP DOWN position. Move the wing flap control to DOWN. Returning the EMERG LANDING FLAP control handle to NORMAL allows the flaps to blow back to the up position.

Note

The emergency wing flap system is powered from the same compressed air bottle that is used to actuate the lower escape chute. Full flap extension at approach speed can be obtained with full escape chute air bottle charge of 1980 psi unless the escape chute has been actuated.

LANDING WITH ONE ENGINE INOPERATIVE

If a landing is to be made with one engine inoperative, it is desirable to maintain the normal approach speed for the applicable gross weight, but it is extremely important not to get low and slow. The minimum single approach speed is 125 knots IAS. This will require approximately normal rated power on the remaining engine when the gear is down and flaps are fully extended. If the pilot should take a waveoff, this speed will place him in an advantageous condition to immediately assume a maximum rate of climb with the addition of full military power. It is advisable to retract the gear as soon as power is applied. With an increase in ambient air temperature a corresponding increase in power settings will be necessary in order to maintain a constant altitude and the air speed for maximum rate of climb. On extremely hot days the rate of climb may be insignificant with gear and flaps extended, even with full military power.

FORCED LANDING PROCEDURES

Before effecting a forced landing, the following check should be performed.

1. Landing gear control – WHEELS DOWN
2. Wing flaps control – FULL DOWN
3. Shoulder harness and safety belt – LOCKED
4. Upper escape hatch – OPEN
5. Fuel switches – OFF
6. Engine master switches – OFF
7. External stores – JETTISON
8. All unnecessary electrical equipment – OFF
9. BATT/GEN switch – BATTERY ONLY (turn switch OFF before landing on unprepared surfaces)

If a forced landing appears imminent due to a very low fuel supply, it is possible to extend the range of the aircraft by shutting down both engines and making an engine-off descent to 5000 feet over the field, restarting the engines, and using the remaining fuel to effect a landing. This procedure will save an estimated 150 pounds of fuel over a normal letdown from 35,000 feet.

DITCHING PROCEDURES

PREPARATION FOR DITCHING

1. Open upper emergency escape hatch
2. Jettison loose equipment

CAUTION

Do not open lower escape chute door to jettison equipment.

3. Lock shoulder harness and safety belt

HANDLING THE AIRCRAFT

Experience gained in ditching similar aircraft has shown that best results are obtained by adhering to the following procedure.

1. If possible use up most of the fuel supply to lighten the aircraft and reduce stalling speed. Empty tanks are also a contribution to flotation.
2. Ditch while power is available. Power will allow the pilot to choose the spot for ditching to obtain best possible sea conditions and most favorable landing position and attitude.
3. Ditch at lowest possible forward speed. At time of contact, attempt to have the lowest possible forward speed consistent with safe control of the aircraft; this will reduce the landing impact. Under no circumstances should the aircraft be stalled in, as this will result in severe impact, and cause the aircraft to nose into the sea.
4. Ditch at the lowest possible rate of descent; 100 feet per minute is recommended.
5. Ditch the aircraft 5 degrees nose high. This attitude gives best distribution of landing shock over the fuselage.

6. Ditch with the landing gear up and use flap setting of 20 degrees. This flap setting should be used in most cases; however, it is left to the pilot's discretion for final judgment.

7. Avoid bouncing since bouncing will cause loss of control.

8. In daylight it is recommended that the airplane be ditched along the top of the swell, parallel to the row of swells if the wind does not exceed 35 knots. In higher winds, it is recommended that ditching be conducted upwind to take advantage of lowered forward speed. However, it must be remembered that the possibility of ramming nose-on into a wave is increased, as is the possibility of striking the tail on a wave crest and nosing in.

UP-WIND DITCHING

The basic rules for ditching previously listed will apply, in addition to the following.

1. Maintain nose-up condition, avoid nose striking wave face

2. Touch down immediately before the crest of a rising wave

3. Hold nose up after first impact

CROSSWIND DITCHING

The basic rules for ditching previously listed will still apply in addition to the following.

1. Crab the aircraft to kill drift

2. Land on downward side of the swell or wave

DITCHING WITH PARTIAL POWER FAILURE

On letdown with one engine inoperative, it is advisable to hold speed well above stalling speed until flare-out, at which time speed will be reduced to just above stalling and aircraft set up for 5 degrees nose high landing.

NIGHT DITCHING

Make an instrument letdown holding airspeed well above stalling speed, and at the lowest possible rate of descent. Landing attitude should be 5 degrees nose high, with 20 degrees flap.

FIRE ON SHUTDOWN

If fire persists in the burner on turbine section after closing the throttles, perform the following.

1. Fuel boost switch – OFF

2. External power – CONNECTED

3. Crank switch – DEPRESS

If fire still persists, introduce PPK into engine intake.

MISCELLANEOUS EMERGENCY EQUIPMENT

PARARAFT KIT

Each seat is designed to accommodate a seat-type pararaft kit and back-type parachute (figure 5-6). The parachute is operated in the usual manner by pulling the rip cord handle on the left retainer strap. After descending to land or into water, the pararaft kit should be separated from the harness by removing the release link on the container and pulling out the kit by the handle provided for that purpose.

CAUTION

The pararaft should be attached to the life vest or belt by means of the lanyard provided. The pararaft may be lost after the parachute harness is removed if this attachment is not correctly made.

SECTION VI

ALL WEATHER OPERATION

Table of Contents

INSTRUMENT FLYING

The following are procedures that differ from, or are in addition to, the normal operating procedures (Section III). In a few instances, repetition is necessary, either to establish the proper sequence of operation or to stress the importance of an operation. Use of instruments, instrumentation, and instrument procedures can be found in the NATOPS Instrument Flight Manual.

SIMULATED INSTRUMENT FLYING

Simulated instrument flights shall be scheduled for pilots preparing for their annual instrument flight check. A qualified crewmember shall be assigned to fly in the right seat as observer and lookout.

PILOT INSTRUMENT PROFICIENCY

Pilots must maintain instrument proficiency by requesting practice instrument departures, penetrations, and controlled approaches on all normal training flights. Flight crews must be aware of the importance of good lookout doctrine during climbouts and descents. During this portion of the flight, high-density traffic is normally encountered. The pilot must refer to his instruments frequently, even though flying contact and, therefore, must relay upon the ECM Officer for lookout.

INSTRUMENT FLIGHT PROCEDURES

Since standard jet instrument procedures must be used, only procedures that require special precautions or are peculiar to this aircraft will be described.

If any possibility of rain is anticipated during the time of takeoff or approach and landing, ensure that the aircraft has an operating windshield wiper before takeoff.

A 5-minute warmup period is required for all instruments before an instrument takeoff.

For instrument clearance purposes, the EF-10B is a multipiloted aircraft when the right seat is occupied by an instrument-qualified crewmember. Standard speeds and procedures are given in the following paragraphs.

Because the EF-10B is a single-control aircraft, hooded ITO's shall not be practiced. Practice non-hooded ITO's during normal takeoff. The takeoff speed and technique for ITO is the same as for VFR takeoff.

INSTRUMENT DEPARTURE

When safely airborne retract the landing gear. With a minimum of 150 knots and 200 feet, retract flaps and proceed in compliance with the departure clearance.

Pilots will not go hooded before 2000 feet AGL.

The normal climb schedule shall be adhered to during climb under instrument conditions. GCA or control-center radar monitor departure should be used where available.

CRUISING

Cruising procedures and techniques are the same under instrument conditions as under VFR. When on instruments in thunderstorm areas, flight-following service shall be used continuously to avoid flying through thunderstorms.

HOLDING

Use 220 knots IAS for standard jet holding patterns unless gross weight or altitude requires higher holding speed.

AIR CONDITIONING SYSTEM OPERATION

Actuate the pitot heat before entering clouds or other visible moisture. Icing conditions should be anticipated, as this system is primarily an anti-icing system rather than a deicing system. For climbs and descents in warm, humid climates and in other situations when necessary, place the air conditioning switch to HOT (not MAN HOT).

JET PENETRATIONS

ALTITUDE MONITORING

During a penetration or any letdown, the ECMO shall monitor the instruments to prevent any deviations from headings or mandatory altitudes. During IFR or simulated IFR conditions the ECMO shall call out passing each 5000 feet of altitude, and below 5000 feet MSL the ECMO shall call out passing each 1000 feet as the aircraft descends. Each altitude check must be confirmed by the pilot.

PENETRATION DESCENT

Complete the predescent checklist before commencing penetration. Penetrations are made at 250 knots IAS, speed brakes extended, and 80 percent throttle. This configuration produces a rate of descent of approximately 4500 feet per minute. Throttle adjustments must be made as altitude decreases. Idle descents are made when fuel conservation is the primary consideration. Refer to index charts for maximum range descents performance data.

DIRTY PENETRATION

Under certain emergency conditions it may be required to penetrate with the landing gear down (dirty configuration). The following procedure is recommended.

1. Before executing a dirty penetration the controlling agency must be advised of the nonstandard approach speed. The approach speed will be 150 knots IAS and rate of descent approximately 2500 feet per minute. The decreased indicated air speed and rate of descent gives virtually the same track as the standard approach although it lasts longer.

2. Approaching the initial penetration fix, lower the flaps, gear, and extend speed brakes.

3. Commencing the penetration.

   Retard throttle to 66 percent.

   Lower and adjust nose to maintain 150 knots IAS and 2500 feet-per-minute descent.

   Initiate roundout to reach GCA pickup or TACAN gate at proper altitude and 140 knots.

   Continue with a normal approach.

TRANSITION FROM PENETRATION

Proceed as follows when transitioning to level flight and desiring to maintain descent airspeed.

1. Retract speed brakes 1000 feet above leveloff altitude.

2. Leave throttles at 80 percent and maintain 250 knots IAS by smoothly raising the nose.

3. As aircraft reaches leveloff altitude, add power to maintain desired airspeed.

TRANSITION TO LANDING CONFIGURATION

Proceed as follows when transitioning to the landing configuration.

1. Commence raising nose smoothly 1000 feet above leveloff altitude with speed brakes out.

2. As indicated airspeed drops to 170 knots, lower flaps. Lower gear when indicated airspeed reaches 150 knots. Retract speed brakes.

3. Continue descent and add power as required to level off. Maintain at least 140 knots until turning final, slowing to 130 knots.

APPROACH

The final approach fix aircraft speed/configuration shall be determined as follows.

1. For TACAN approaches (figure 6-1), airspeed shall be 130 knots IAS crossing the gate in the landing configuration.

2. The ECM Officer will tap the pilot's right knee upon visual contact of the field on all approaches.

3. A typical ADF approach is shown in figure 6-2.

GCA APPROACHES

GCA approaches (figure 6-3) shall be used whenever possible, even in visual weather. Communications must be established before commencing penetration. The pilot may delegate communications to his crewmember with the exception of GCA approaches. Perform penetration as described in penetration descent. Fly the GCA pattern at 140 knots with landing gear and half flaps until approaching final, then slow to 130 knots, lowering full flaps.

Waveoffs shall be as directed by the GCA controller. The aircraft shall normally remain in the landing configuration while in the GCA pattern.

CHANGING RADIO CHANNELS

While on instruments or at night, the pilot must not change radio channels below 2500 feet unless required by the mission and then only in level flight. The ECMO may change radio channels at any altitude as directed by the pilot.

WEATHER CONSIDERATIONS

ICE

The EF-10B is not equipped to fly continuously in icing conditions. All flights must be planned to avoid areas of continuous icing. The rate-of-climb and descent are sufficient that icing should be encountered for only a short time. If considerable ice builds up on the wings and other areas, it is important to maintain airspeed. The standard climb schedule should be adequate for the climbout, and 250 knots should be

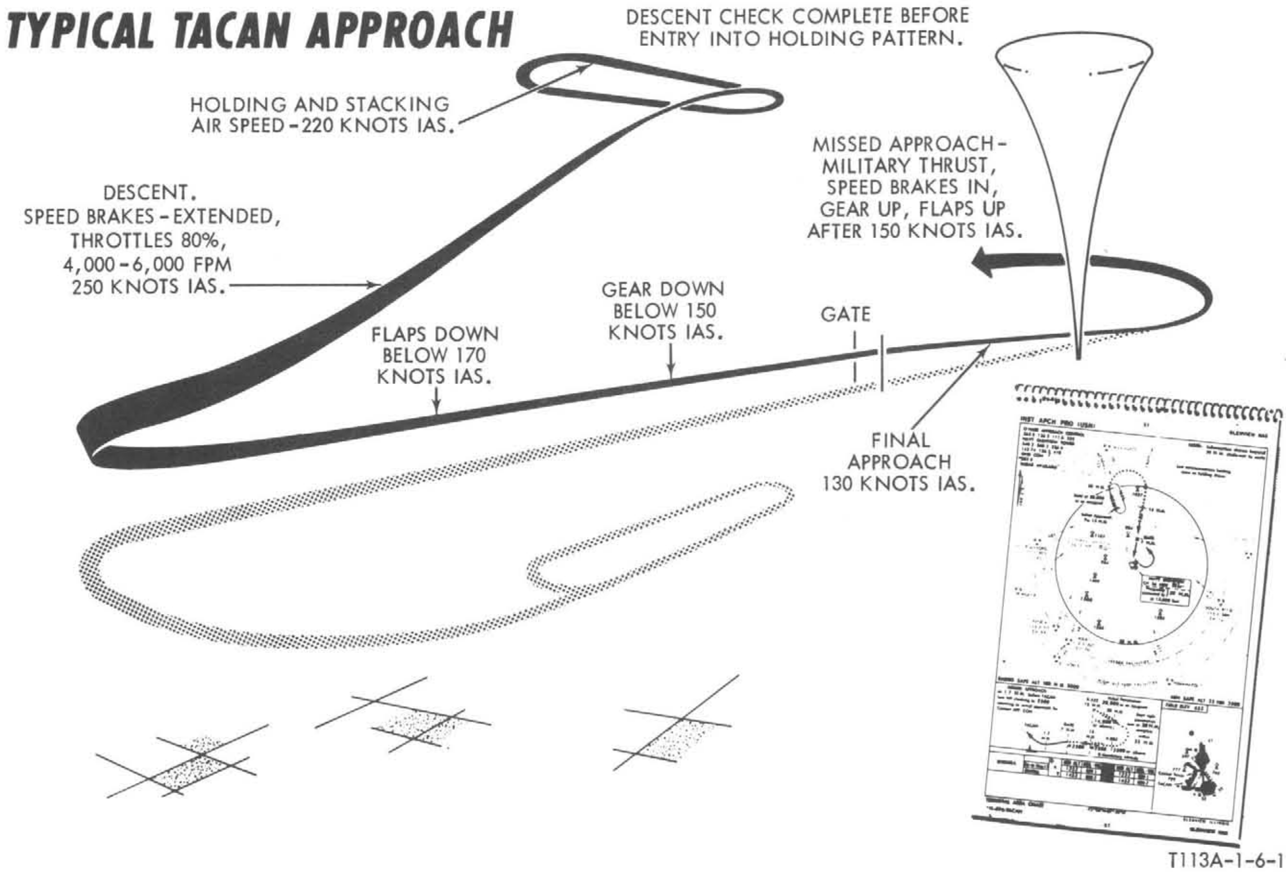


Figure 6-1. TACAN Approach Pattern

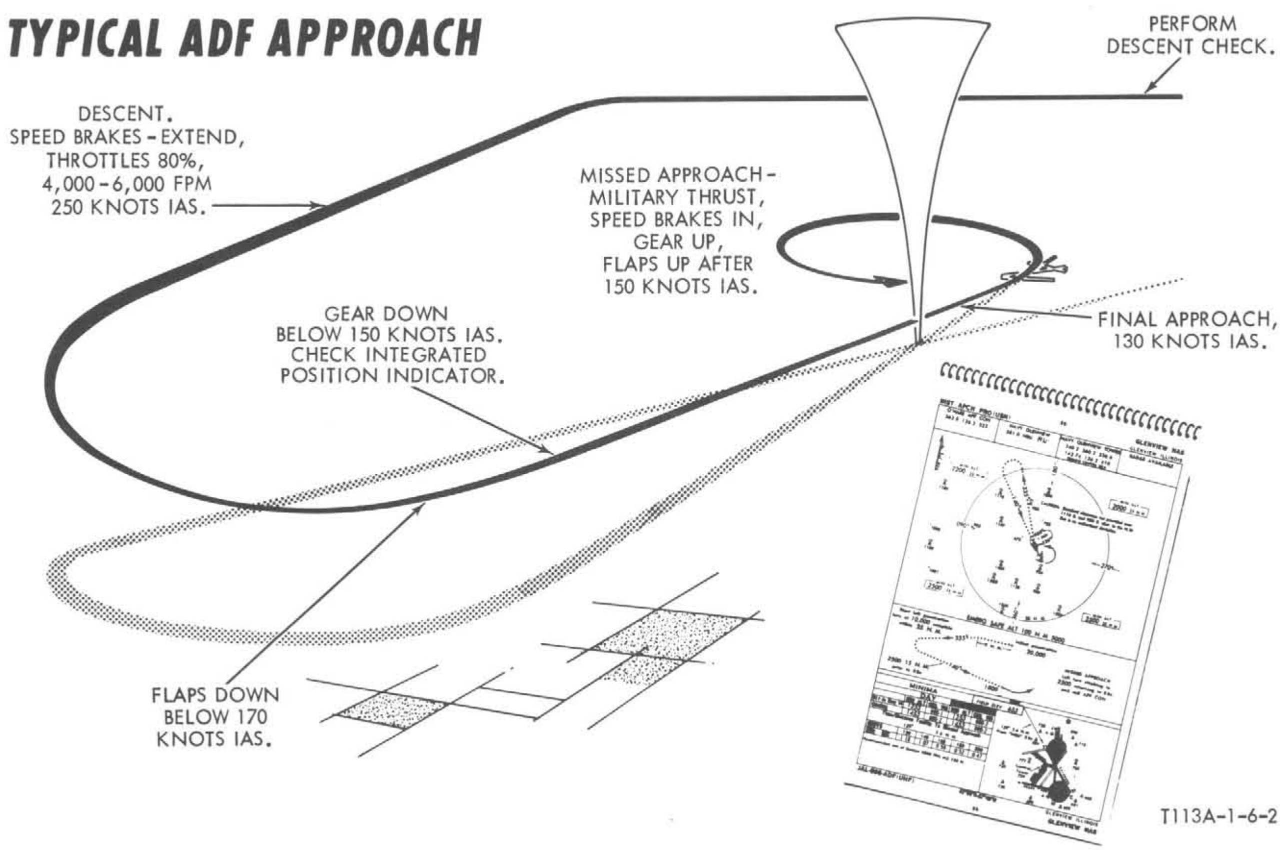


Figure 6-2. ADF Approach Pattern

TYPICAL GCA PATTERN

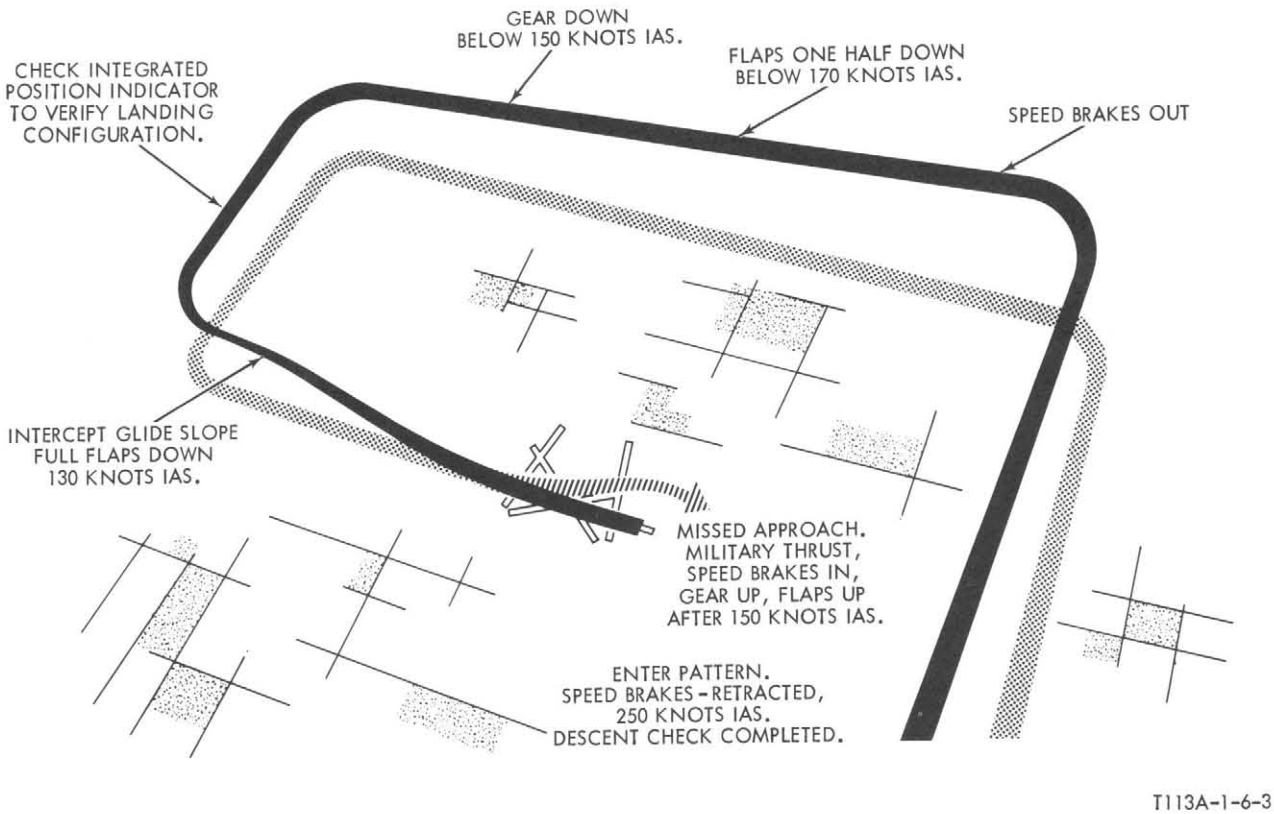


Figure 6-3. GCA Approach Pattern

adequate for penetration. If ice is encountered during the penetration, a higher approach speed and shallow turns must be used because of increased stalling speed.

THUNDERSTORM PENETRATION

Avoid thunderstorms, if possible. Power and attitude are keys to good thunderstorm flying. If necessary to penetrate a thunderstorm, the following procedures shall apply.

The storm should be penetrated at the recommended speeds (220 to 250 knots) and at an altitude where least turbulence is expected. If this is impossible, penetrate at as high an altitude as possible, where good control can be maintained. It is better to penetrate at 25,000 feet with good control and extra thrust available, than to penetrate at 35,000 feet, with aircraft just above the buffet. Use the attitude indicator and compass to maintain pitch attitude and heading. Whether at high or low altitude, the possibility of icing always exists in a thunderstorm, so the pitot heat switch must be turned on before penetration. Turn instrument lights on bright.

PITOT-STATIC INSTRUMENT ICING

The pitot heat is anti-icing equipment, not deicing equipment, and shall be turned on before entering area where icing is expected. Icing may sometimes result in loss of pitot static instruments. This may be recognized by simultaneous failure of airspeed, altimeter, and rate-of-climb. Fly the aircraft on power settings and the vertical gyro indicator.

COLD WEATHER OPERATION

The majority of cold weather operating difficulties are encountered on the ground. Extreme diligence must be exercised by both ground and flight personnel if operations are to be successful. The procedures presented here are intended to supplement those outlined for normal operations (Section III).

ICE, SNOW, AND RAIN

Ice, snow, and rain may be encountered both in flight and on the ground. Ground protection consists mainly of a thorough preflight inspection and the provision of adequate cover for the aircraft. 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. Rain and dry snow present no particular problem except that of restricted vision. The aircraft is equipped with pitot heat for the prevention of ice formation during normal operation; however, this equipment is not sufficient protection, should prolonged exposure to icing conditions become necessary.

Before Entering Aircraft

In addition to a thorough preflight inspection by the ground crew, the following checks should be made.

1. See that all protective covers and plugs are removed.

2. Check engine intakes for evidence of ice. Make sure the compressors are free to rotate; engine heat on shutdown melts ice accumulated during the previous flight, and the moisture may refreeze in the lower sections of the low-pressure compressor blades. Apply external heat if necessary, and start the engines as soon as possible after they are free.

3. Check fuel tank vents, pitot tube, temperature sensing element, fuselage, wing drainage and vent outlets, and remove all ice.

4. Make sure fuel sumps have been drained. Check lines and shutoffs.

5. Clean dirt and ice from struts and exposed actuating cylinder pistons.

6. Thoroughly check control surfaces and hinges.

7. Check the entire aircraft for freedom from frost, snow, and ice. Remove frost or snow by light brushing; remove ice by application of heat.

CAUTION

Ensure that ice melted by external heat does not reform. Recheck control hinges thoroughly. Do not scrape or chip ice from any surface.

8. Check landing gear and struts for freedom from ice, snow, or dirt. Inspect limit switches and fairing door hinges, actuating cylinder pistons, and wheels.

9. Check flaps, rollers, and limit switches.

10. Check battery for 22 v minimum.

11. Use external power for operating and ground checking all electrical and radio equipment.

On Entering Aircraft

1. Check operation of upper and lower escape hatches.

2. Make a thorough check of the controls, both by feel and visually.

Before Starting Engines

Make certain wheels are securely chocked to prevent slippage during the start.

STARTING AND WARMUP

1. Start the engines using normal starting procedure. Heating of jet engines is seldom required unless external power source is weak. If necessary, apply external heat to accessory section to reduce starter loads.

2. Check oil pressure for indication within 30 seconds. Pressure may exceed maximum limits temporarily during extreme cold-weather starts.

3. Turn on necessary electrical equipment only after positive indication of generator operation.

4. Check all instruments for normal operation and indications within allowable limits.

5. Recheck hydraulic system. Each control should be operated through its complete cycle several times for assurance of proper hydraulic pressure and operation.

TAXIING

1. Exercise extreme caution when passing other aircraft, buildings, and other obstructions when ice is present. Fast runs or heavy crosswinds can cause skidding. Brakes are ineffective on ice.

2. Be particularly careful in maneuvering near other aircraft, since exhaust heat and blast will blow melted snow and slush, which will refreeze on contact.

3. Avoid taxiing in deep snow or slush. Steering will be more difficult and brakes, gear, and flaps may freeze after takeoff.

Before Takeoff

Turn pitot heat on if required.

TAKEOFF

1. Apply brakes and advance throttles to MILITARY. If aircraft starts to skid, release brakes and begin takeoff run. Continue engine check during early part of takeoff run. If takeoff must be aborted, use brakes lightly.

2. After takeoff from a snow or slush-covered runway, operate landing gear and flaps through several cycles to prevent their freezing in the up position.

3. Watch closely for signs of icing. Engine icing will be indicated by excessive tail pipe temperatures and loss of thrust.

CAUTION

At low outside air temperatures, turbine outlet temperatures may exceed operating limits at a lower engine rpm than at normal OAT, and flight instruments may be inaccurate. Maintain a reasonable margin of safety on all indicators.

During Flight

Under certain atmospheric conditions it is possible for fog to accumulate in the cabin while pressurized, causing a serious restriction to visibility. Turn the cabin temperature rheostat to the full increase position or the momentary MAN HOT position. After the cabin has cleared, readjust the temperature control rheostat to a temperature higher than the original. If a comfortable temperature cannot be maintained without fogging, depressurize the cabin until more favorable atmospheric conditions exist.

DESCENT

Follow the normal procedure for letdown.

LANDING

Follow normal landing procedures, exercising extreme caution at touchdown. All drift must be eliminated before touchdown to prevent blowing the tires.

SHUTDOWN AND POST FLIGHT

1. Follow normal procedure for shutdown.
2. See that wheels are securely chocked.
3. Have aircraft serviced and fuel sumps drained.
4. See that all covers and plugs are securely installed and that aircraft is tied down.
5. If aircraft is not to be flown for several days, remove battery.

HOT WEATHER AND DESERT OPERATION

Proper protection of the aircraft while on the ground is of primary importance during hot weather operation. The procedures presented here are intended to supplement those outlined for normal operations (Section III).

Before Entering Aircraft

1. Check tires and struts for proper inflation, as high temperatures may cause overinflation.
2. Check thoroughly for accumulation of sand or dust, especially in the engine intake ducts.
3. Check for fuel, oil, and hydraulic leaks that may have been caused by expansion of valves or packing.
4. In locations where high humidity is encountered, nonmetallic equipment is subject to corrosion, fungus, and moisture absorption. See that such equipment is completely dry and in operating condition.
5. Cool cabin with a portable cooler, if available.

On Entering Aircraft

If necessary, apply heat to dry instruments and controls that may be damp with condensed moisture.

STARTING ENGINES

Use normal starting procedures. Engines will accelerate to idle much more slowly than on a normal or cold day.

TAXI AND TAKEOFF

1. Use brakes as little as possible during taxi and takeoff.
2. Hold taxi time to a minimum and watch turbine outlet temperatures closely.
3. True stalling speeds are increased in extremely hot weather. Strict adherence to recommended takeoff and indicated climbing speeds is necessary, as takeoff distances are considerably increased in hot weather, due to decreased aircraft acceleration from the lower available thrust of the engine.

CLIMB

Extremely high OAT has a considerable effect on climb performance. On a very hot day, military thrust may be required to give nearly the same rate of climb as normal thrust on a standard day. Since fuel vaporization losses are high during rapid climbs to altitude, the rate of climb should be held as low as practicable.

DESCENT AND LANDING

Use normal letdown and landing procedure. True airspeed will be higher than normal for a given indicated airspeed, and touchdown speed will be higher than usual. Turbulence during the final approach and flareout may be expected, and the landing roll will be considerably longer.

POST FLIGHT

1. Have wheels securely chocked.
2. See that protective covers and plugs are installed.
3. Leave upper hatch and emergency escape chute doors open on calm days to provide ventilation. If sandstorms or other foul weather is anticipated, close hatches and doors, and tiedown aircraft (figure 3-2).
4. Have aircraft serviced. Fuel tanks must not be topped since excessive heat will cause the tanks to overflow creating a fire hazard.
5. In dusty or sandy areas, interior equipment should be covered.

NIGHT FLYING

All night flights should be treated as actual instrument flights with reference to planning, cockpit, and flight procedures.

SECTION VII

COMMUNICATIONS/NAVIGATION EQUIPMENT AND PROCEDURES

Table of Contents

COMMUNICATIONS AND NAVIGATION EQUIPMENT

There are three types of communications and navigational equipment installed in the aircraft. They are broadly classified as communications, navigation, and identification.

1. Communications Equipment
   *Interphone (AN/AIC-4 or AN/AIC-4A)
   **Interphone (AN/AIC-4 or AN/AIC-4A)
   *UHF Radio (AN/ARC-27) Range - horizon
   **UHF Radio (AN/ARC-52) Range - horizon
   **HF Radio (AN/ARC-94) Range - long range

2. Navigation Equipment
   Radio Compass (AN/ARN-6) Range - 200 nautical miles
   DF Radio (AN/ARA-25) Range - horizon
   TACAN Radio (AN/ARN-21) Range - 195 nautical miles
   *Radar Altimeter (AN/APN-1) Range - zero to 400 feet
   **Radar Altimeter (AN/APN-22) Range - zero to 2000 feet

3. Identification Equipment
   *Identification Radar (AN/APX-6 and APA-89) Range - horizon
   **Identification Radar (AN/APX-6B and APA-89) Range - horizon

Horizontal ranges are approximate and depend upon altitude, existing conditions and ground equipment.

*Installed on aircraft incorporating AFC No. 173 only.

**Installed on aircraft incorporating AFC No. 199 only.

MASTER RADIO SWITCH

The MASTER RADIO switch (figure 1-5) is located on the right console, and furnishes power to all communication and navigation equipment with the exception of the radar altimeter. Before leaving the aircraft, all radio equipment should be secured and the MASTER RADIO switch set to OFF.

UHF RADIO SELECTOR SWITCH

The two-position UHF radio selector switch (figure 1-4), located on the center console, allows selection of the No. 1 or No. 2 UHF radio. This switch is installed only in aircraft incorporating AFC No. 173.

ELECTRONIC EQUIPMENT CHECK

With the engines running at approximately 40 percent rpm (or above) and the generators charging, or with an external power source connected to the aircraft, set the MASTER RADIO switch to ON and allow 1 minute for the equipment to warm up. Adjust the volume control on the applicable interphone control panel for power output and perform a preflight equipment check as follows.

1. Turn on all radio equipment that operates in conjunction with the interphone (ICS) system.

2. The communications receivers may be checked by operating the UHF and HF switches (figure 1-4) to the desired channel settings.

3. The communications transmitters may be checked by setting the transmit and receiver

switches, on the Pilot and ECM Officer's Radio Interphone Control Panel, to UHF and HF.

4. The AN/ARN-6 Radio Compass is checked by the pilot.

5. The ICS should be checked for reception from one station to the other with transmit switch at a position other than ICS, to check that ICS signals will be heard at both stations regardless of transmit switch settings.

RADIO INTERPHONE EQUIPMENT (ICS)

The radio interphone equipment installed in the aircraft is either the AN/AIC-4 System or the transistorized version, AN/AIC-4A. Both systems function in a similar manner to control the selection and volume of the radio communications equipment and to provide voice communication between the pilot and the ECMO.

PILOT'S CONTROL PANEL

The pilot's control panel (figure 7-1), located on the center console (figure 1-4), provides operating controls for the system.

Control Panel (AN/AIC-4)

A modified C-242/AIC-4 (MIXER) control panel (figure 7-1, view A) contains the RADIO and ICS volume controls, UHF and ECM receiver selector switches and a NORMAL/ALTERNATE selector switch. The ICS/UHF transmission selector switch and the HF sensitivity control are not used in this system. Under normal conditions, the NORMAL position of the selector switch is used, amplifying all radio receiver outputs through the interphone amplifier. If the amplifier becomes inoperative, the switch is moved to ALTERNATE, in which position the amplifier circuit is bypassed. In this position, any radio receiver output selected by the pilot will also appear in the ECMO's headphones and, accordingly, may interfere with other radio reception.

Control Panel (AN/AIC-4A)

A modified C-737/AIC-4A (MIX) control panel (figure 7-1, view B) contains the RADIO VOL and ICS VOL volume controls, UHF, HF and TACAN receiver selector switches. The ICS/UHF/HF transmission switch and the HF sensitivity control are not used in this system.

ECM OFFICER'S CONTROL PANEL

The ECM Officer's control panel (figure 7-1), located on the right console (figures 1-5 and 1-6), provides operating controls for the system.

Control Panel (AN/AIC-4)

A modified C-387/AIC-4 (SELECTOR) control panel (figure 7-1, view C) contains the RADIO VOL and ICS VOL volume controls, ICS/UHF/RCD transmission selector switch and an OUT/UHF/ECM/COMP receiver selector switch. The RCD portion of the transmission selector switch is not used in this system.

Control Panel (AN/AIC-4A)

A modified C-736/AIC-4A (SEL) control panel (figure 7-1, view D) contains the RADIO VOL and ICS VOL volume controls, ICS/UHF/RCD transmission selector switch and an OUT/UHF/ECM/COMP receiver selector switch. The RCD portion of the transmission selector switch is not used in this system.

Note

For aircraft incorporating AFC No. 199, the AN/AIC-4 and AN/AIC-4A control panels have been further modified to meet the functional requirements of the change. Refer to NATOPS Supplemental Flight Manual NAVAIR 01-40FAB-1A for additional information.

THROTTLE TRANSMIT SWITCH

The throttle transmit switch (figure 1-3) is located on the inboard throttle control lever. The switch is a two-position type, forward for radio transmission and aft for interphone operation. When the switch is in the RADIO position, relays in the HF or UHF receiver-transmitters are energized enabling the pilot to transmit on either of these systems. The ICS position activates the interphone system.

FOOT TRANSMIT SWITCH

The foot transmit switch (figure 1-5) is located on the floor forward of the ECMO's seat. The switch is used by the ECMO for either radio transmission or interphone operation.

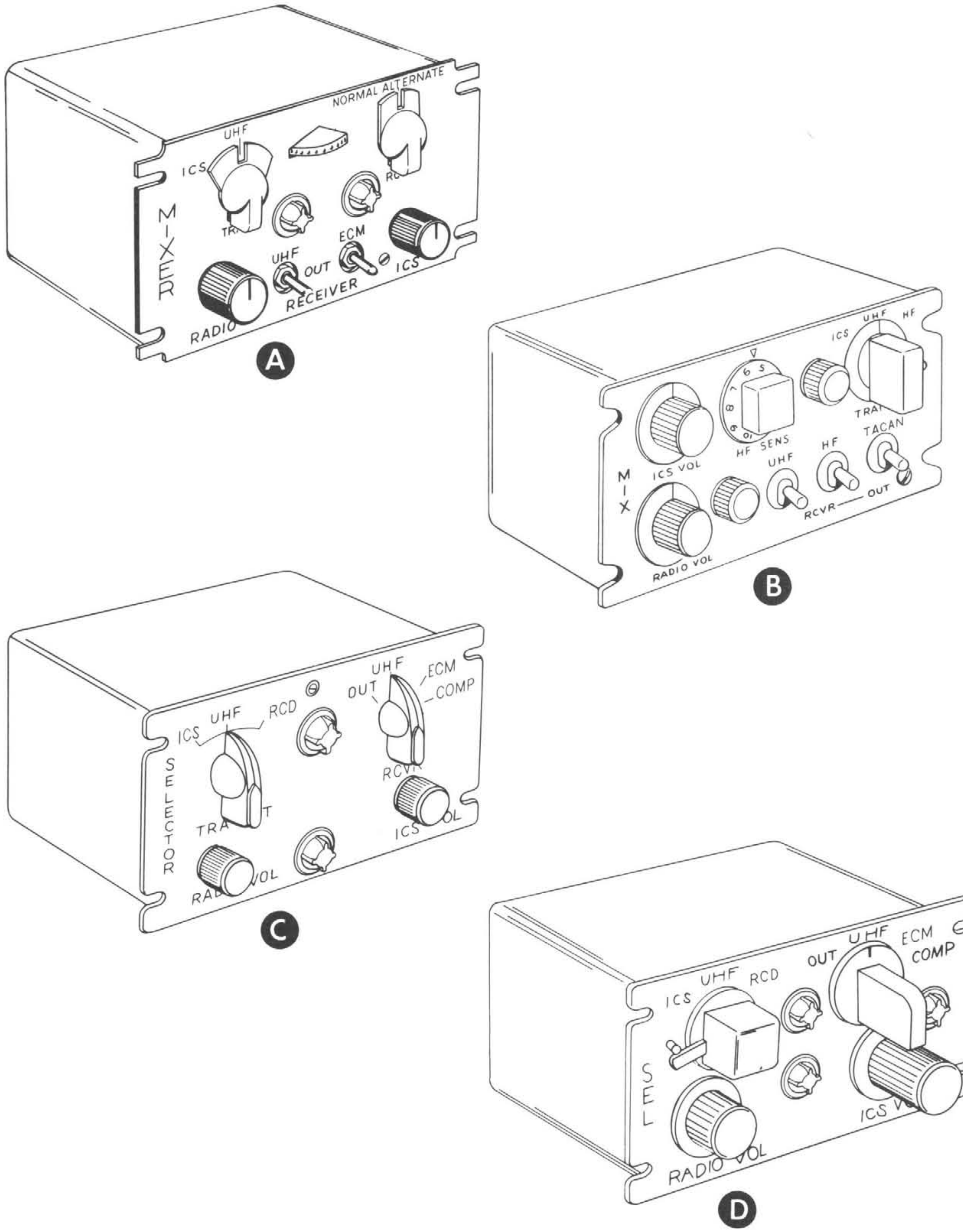
SYSTEM OPERATION

To Operate System

1. Set MASTER RADIO switch to ON.
2. Set ECMO's TRANSMIT switch to ICS.
3. Adjust pilot's ICS VOL control to desired audio level.
4. Adjust ECMO's ICS VOL control to desired audio level.
5. To transmit, the pilot moves the throttle transmit switch aft; ECMO presses foot transmit switch.

Note

Interphone reception is at either station regardless of position selected on the receiver selector switches.



T113A-1-7-1

Figure 7-1. Radio Interphone Controls (AIC-4)

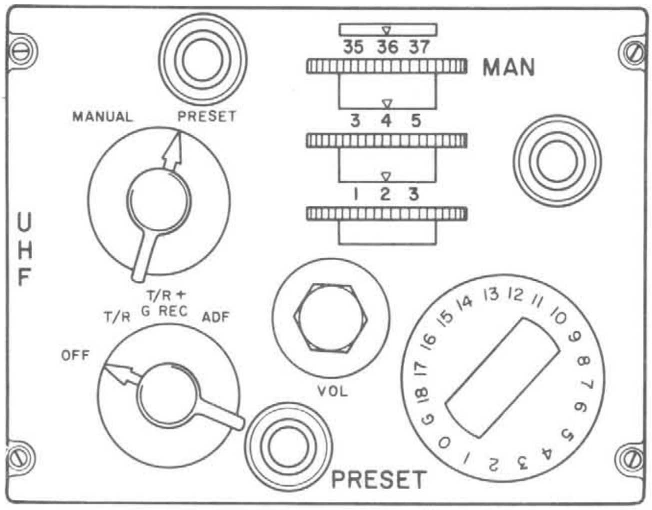


Figure 7-2. UHF Radio Controls (ARC-27)

UHF RADIO COMMUNICATION EQUIPMENT

Aircraft incorporating AFC No. 173 have two AN/ARC-27 radio sets installed. The AN/ARC-52 set is used in aircraft incorporating AFC No. 199. These systems provide UHF radio communication between aircraft or between aircraft and surface stations.

UHF RADIO COMMUNICATION SYSTEM (AN/ARC-27)

The AN/ARC-27 Radio Communication System includes an RT-178/ARC-27 Receiver-Transmitter, C-628/ARC-27 Radio Set Control, and an AN/ARC-27 Antenna.

RECEIVER-TRANSMITTER

The RT-178/ARC-27 Receiver-Transmitter provides voice transmission and reception in the frequency range of 225.0 to 399.9 mHz. There are 1750 channels available. Provisions are made for the remote selection of any one of 18 preset frequencies or for operation on a guard channel frequency. Constant monitoring of the guard channel may be selected. Transmission and reception are on the same frequency and by the same antenna.

RADIO SET CONTROL

The C-628/ARC-27 Radio Set Control (figure 7-2), located on the center console (figure 1-4), provides operating control for the system. The panel has a function switch, channel selector, volume control, manual/preset selector switch and three manual selector dials. The four position (OFF, T/R, T/R+G REC, ADF) function switch is used to turn the set on, control receiver-transmitter operation and turn the set off. When the switch is in the T/R position, normal transmission and reception are available. In the T/R+G REC position, normal transmission and reception and guard frequency reception are available. The ADF position is used in conjunction with the UHF direction finding equipment (AN/ARA-25). The channel selector is used to select any of the 18 preset frequencies or the guard frequency. The volume control is used to adjust the audio output of the receiver. The manual/preset selector switch works in conjunction with the three manually operated dials and the channel selector switch. When the switch is in the MANUAL position, the dials may be set for any frequency in the range of 225.0 to 399.9 mHz. The channel selector switch can be used when the switch is in the PRESET position.

SYSTEM OPERATION

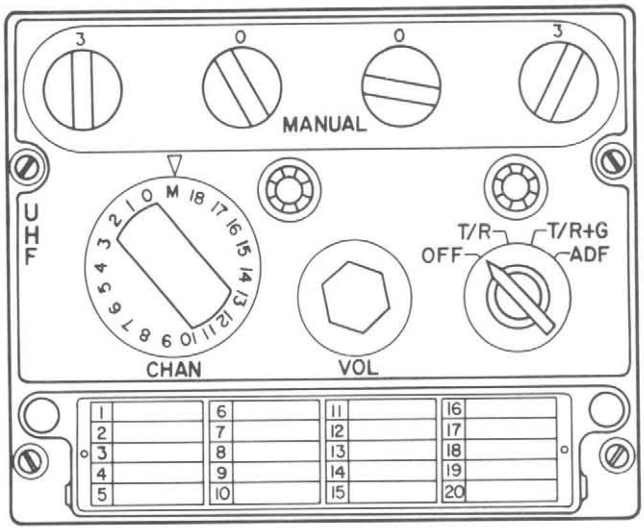
To Operate Set

1. Set function switch for desired operation (T/R-T/R+G REC-ADF).
2. Allow 1 minute for warmup.
3. For manual operation, set manual/preset switch to MANUAL and rotate manual selector dials to desired frequency. Preset channels are selected by placing the manual/preset switch in PRESET and rotating the channel selector to the desired number.

Note

To monitor guard channel, function switch must be on T/R+G REC. To transmit on guard channel, channel selector must be on G.

4. Adjust VOL to desired audio level.
5. To transmit, the pilot moves the throttle transmit switch forward; ECMO presses foot transmit switch.
6. Set function switch to OFF to turn off set.



T113A-1-7-3

Figure 7-3. UHF Radio Controls (ARC-52)

UHF RADIO COMMUNICATION SYSTEM (AN/ARC-52)

The AN/ARC-52 Radio Communication System includes an RT-332B/ARC-52 Receiver-Transmitter, C-1607/ARC-52 Radio Set Control, and an AN/ARC-52 Antenna.

RECEIVER-TRANSMITTER

The RT-332B/ARC-52 Receiver-Transmitter provides voice transmission and reception in the frequency range of 225.0 to 399.9 mHz. There are 1750 frequencies, in steps of 100 kHz, available. Two receivers are used, a main receiver and a guard receiver. The main receiver can be tuned to any selected frequency in the operating range; the guard receiver remains on the guard frequency. The receiver-transmitter has the capability of retaining 18 preset frequencies with controls for manually selecting any frequency in the operating range. Receiver and transmitter tuning are automatically completed after a channel change. Transmission and reception are on the same frequency and by the same antenna.

RADIO SET CONTROL

The C-1607/ARC-52 Radio Set Control (figure 7-3), located on the center console (figure 1-4), provides operating control for the system. The panel has a function switch, channel selector, volume control, and four manual selector knobs. The preset selector pins and preset tool are located behind the hinged door on the front of the control panel. The four position (OFF, T/R, T/R+G, ADF) function switch is used to turn the set on, control receiver-transmitter operation and turn the set off. When the switch is in the T/R position, normal transmission and reception are available. In the T/R+G position, normal transmission and reception are available and the guard receiver is energized. The ADF position is used in conjunction with the UHF direction finding equipment (AN/ARA-25) for bearing indications from the transmitter. The channel selector is used to select any of the 18 preset frequencies, the guard frequency, or for the manual frequency selecting function. The volume control is used to adjust the audio output of the receiver. The manual selector knobs are used to manually select any frequency in the range of 225.0 to 399.9 mHz, in increments of 100 kHz. The preset selector pins, behind the hinged door, are used to select and set the 18 preset frequencies.

SYSTEM OPERATION

To Preset Frequencies

1. Set function switch to OFF.

2. Rotate CHAN selector switch until the desired channel number appears in the preset channel window.

Note

The number appearing in the preset channel window will always be different from the number indicated on the channel selector dial.

3. Use the preset tool to adjust the preset pins to the desired frequency.

To Operate Set

1. Set function switch for desired operation (T/R-T/R+G-ADF).

2. Allow 1 minute for warmup.

3. For manual operation, set CHAN switch to M and rotate manual selector knobs to desired frequency. Preset channels are selected by rotating the CHAN switch.

4. Adjust VOL to desired audio level.

5. To transmit, the pilot moves the throttle transmit switch forward; ECMO presses foot transmit switch.

6. Set function switch to **OFF** to turn off set.

HF RADIO COMMUNICATION EQUIPMENT

Aircraft incorporating AFC No. 199 are equipped with an AN/ARC-94 Radio Set. This system provides long-range communication between aircraft or between aircraft and surface stations.

HF RADIO COMMUNICATION SYSTEM (AN/ARC-94)

The AN/ARC-94 Radio Communication System includes an RT-648/ARC-94 Receiver-Transmitter, C-3940/ARC-94 Radio Set Control, 490T-1 Antenna Tuning Unit, and AN/ARC-94 Antenna. The single sideband remote controlled receiver-transmitter is located in the nose section, the control unit in the center console, antenna tuning unit in the fuselage aft of the cockpit, and the wire antenna extends from the vertical stabilizer to the forward area of the fuselage.

RECEIVER-TRANSMITTER

The RT-648/ARC-94 Receiver-Transmitter provides long-range voice communication capabilities within the frequency range of 2.000 mHz to 29.999 mHz. The system's 28,000 channels, spaced 1 kHz apart, are combined with upper sideband, lower sideband and amplitude modulation equivalent modes of operation making it a highly effective and reliable communication system.

RADIO SET CONTROL

The C-3940/ARC-94 Radio Set Control (figure 7-4), located on the center console (figure 1-4), provides operating control for the system. The unit includes a function selector switch, four frequency selector knobs, operating frequency indicator, and radio frequency sensitivity control. The function selector switch, with positions of **OFF**, USB (upper sideband), LSB (lower sideband) and AM (amplitude modulation) is used to turn the set on and off and to select the three operating modes. The frequency selectors are used to set the desired frequency in the operating frequency indicator. There are four selectors; one controls the mHz digits and the other three control the 100, 10, and 1 kHz digits of the frequency selected. The operating frequency indicator furnishes digital readout of the frequency presently set in the radio set. The indicator is lighted internally and the light intensity may be controlled with the instrument panel lights control knob. The **RF SENS** control is used to achieve the best compromise between received signals and atmospheric noise.

SYSTEM OPERATION

To Operate Set

1. Set function switch for desired operation (USB-LSB-AM).

2. Allow 1 minute for warmup.

3. Select desired operating frequency using frequency selector knobs.

Note

After selecting the desired frequency, depress transmit switch for 10 seconds to allow the antenna coupler to tune to the proper electrical wavelength.

4. Adjust VOL (radio interphone control panel) to desired audio level.

5. To transmit, the pilot moves the throttle transmit switch forward; ECMO presses foot transmit switch.

WARNING

During ground checkout, do not operate transmitter when personnel are working near the aircraft. Transmissions could cause serious radio frequency burn injuries.

6. Set function switch to **OFF** to turn off set.

RADIO COMPASS SYSTEM (AN/ARN-6)

The AN/ARN-6 Radio Compass System includes a R-101/ARN-6 Receiver, C-149/ARN-6 Control Unit, ID-90/ARN-6 Indicator, AS-313/ARN-6 Loop Antenna, and an AN/ARN-6 Antenna. This equipment is used to guide the aircraft to a transmitting station or to take bearings on transmitting stations as an aid to navigation. The system has a frequency range of 100 to 1750 kHz and may also be used as a radio communication receiver.

CONTROLS

The C-149/ARN-6 Control Unit (figure 7-5) is located above the throttle quadrant (figure 1-3).

RADIO COMPASS OPERATION

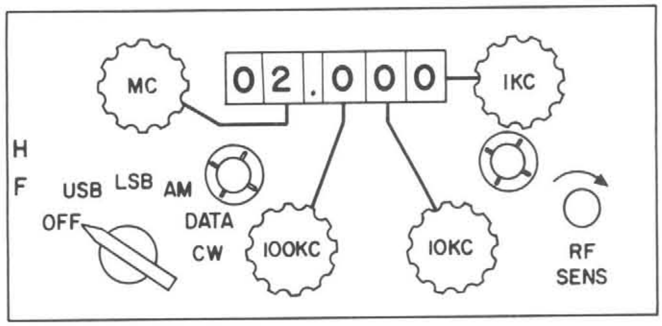
The radio compass equipment will perform three major functions: homing compass, position finding (automatic and aural-null), and receiver operation (antenna or loop). The equipment is started by turning the function switch on the control unit to **COMP**, **ANT**, or **LOOP**. To stop the equipment, turn the function switch to **OFF**.

Homing Compass Operation

1. Set function switch to COMP.

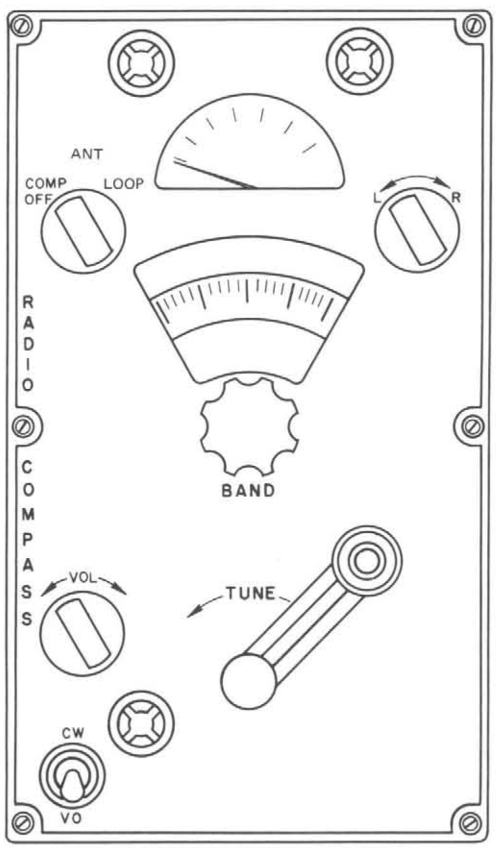
2. Rotate band switch to desired frequency band.

3. Turn the tuning crank to the desired station frequency and tune for maximum swing of the tuning meter. Greater accuracy in tuning may



T113A-1-7-4

Figure 7-4. HF Radio Controls (ARC-94)



T113A-1-7-5

Figure 7-5. Radio Compass Controls (ARN-6)

be obtained by placing the CW/VOICE switch in CW position. A 900 Hz tone will be heard along with the station modulation. This will aid in accurate tuning. After tuning, return the CW/VOICE switch to VOICE to eliminate the 900 Hz tone.

4. Adjust VOL control for desired headset level.

5. Listen for station identification to be sure that the correct station is being received.

6. The indicator pointer shows the relative bearing of the station. For example, if the pointer is to the left, the station is on your left. Turn your aircraft to the left until the pointer is at the lubberline. If the aircraft heading is held constant, you will ultimately fly over the radio station antenna. Crosswinds, however, will cause the flight path to be a curved line. Direction of wind drift may be determined by noting any change in magnetic bearing while homing with the radio compass. In the northern hemisphere, an increasing magnetic bearing indicates a wind from the right while a decreasing magnetic bearing indicates a wind from the left. Compensate for wind drift by offsetting the aircraft heading until there is a minimum rate of change of the magnetic compass reading. The radio compass indicator shows directly in degrees the relative aircraft to station heading necessary to correct for wind drift and coriolis effect.

Automatic Position Finding

1. Select three stations whose geographical locations are spaced at approximately equal intervals about the aircraft.

2. Tune in the stations, identify them, and log their dial readings.

3. Set function switch to COMP.

4. Tune in one of the selected stations, and record the bearing as indicated by the tail of the indicator pointer.

5. Repeat step 4 for the other stations, in rapid succession, while flying with a steady level heading.

Note

Because of the aircraft motion, the less time taken for observations, the more accurate the fix.

6. The recorded bearings will be the station to aircraft bearing. Project lines from the stations at the recorded bearings. The aircraft position will be within the vicinity of the small triangle made by the intersection of the projected lines.

Aural-Null Position Finding

1. Select three stations whose geographical locations are spaced at approximately equal intervals about the flight pattern of the aircraft.
2. Tune in the stations, identify them, and log their dial readings.
3. Set function switch to LOOP.
4. Tune in the desired station. To obtain good signal strength for station identification it may be necessary to rotate the loop by means of the LOOP L-R switch knob for maximum signal. Direction and speed of the loop's rotation are controlled by direction and amount of LOOP L-R switch rotation, respectively.
5. Use the LOOP L-R switch knob, as in step 4 and rotate loop for minimum headset volume. Record the bearings shown by the indicator pointer. Better definition of the null may be obtained by turning the VOL control fully clockwise and locating the null by either listening for minimum audio signal or noting a counterclockwise dip of the tuning meter pointer. The use of CW operation also improves the definition of the null. To obtain CW operation place the CW/VOICE switch to CW position.

Note

Position finding in LOOP operation is subject to a 180-degree error since there are two null points in a 360-degree rotation of the loop. This ambiguity is overcome by keeping aware of the general geographical location and selecting stations located well to the left and right of the course and alternately shifting the function switch between ANT and LOOP positions.

Antenna Receiver Operation

1. Set function switch to ANT.
2. Rotate band switch to the desired frequency band.
3. Set CW/VOICE switch to the CW position for aural reception of unmodulated signals.
4. Turn the tuning crank to tune in the desired station.

Note

For best definition of A-N loop radio range stations adjust the VOL control for the lowest usable headset volume and continue to reduce volume as the A-N signals increase in strength. Adjust until morse code letter A and morse code letter N overlap to produce the on-course heading.

5. Adjust VOL control for desired headset volume.

Note

If reception on the ANT position is noisy due to precipitation static (rain or snow static), better results may be obtained by operating in the LOOP position.

Loop Receiver Operation

1. Set function switch to LOOP.
2. Rotate band switch to the desired frequency band.
3. If station is unmodulated, place CW/VOICE switch in the CW position.
4. Turn the tuning crank to tune in the desired station.
5. Rotate loop with the LOOP L-R switch until maximum signal is obtained. If flight course is not straight, readjustments may be necessary
6. Adjust VOL control for desired headset volume.
7. For best definition of radio range A-N signals on LOOP, it is necessary to maintain the loop near the 90 to 270 degree position relative to the transmitting station and adjust the VOL control for lowest usable headset volume.

Note

Cone of silence indications are not always reliable while receiving on LOOP. In some cases, an increase instead of a decrease in signal may be noted.

RADIO COMPASS OPERATION PRECAUTIONS

1. Select radio stations that provide stable bearings. Do not use a station for bearing unless it can be identified by headset signal on COMP operation. High-powered, clear-channel stations should be used when possible. Any interference from other stations or thunderstorms will cause an error in bearing. Tune equipment accurately. Station identification must be checked, especially stations broadcasting network programs. Avoid taking bearings on synchronized stations except when close to desired station. If station stops transmitting or fades, bearings may change to other stations of the same frequency thus causing errors. This is especially true of code stations operating in a network. Check call signs and frequency.
2. Night effect or reflection of radio waves from the sky may be recognized by fluctuations in bearings. Night effect is worst at sunrise and sunset. The higher the frequency of operation the greater the night effect. It may be present at distances over 20 miles when receiving 850 to 1750 kHz stations; however, with 100 to 450 kHz stations, reliable bearings above 200 miles

can be taken even when night effect is present. The remedies for night effect are to increase altitude, thereby increasing signal strength of direct waves; to use stations operating on lower frequency; and to take an average of the fluctuations.

3. Mountain effect is considered to be the reflection of radio waves from mountain surfaces. It is known to exist around Salt Lake City and Pittsburgh. Do not rely fully on bearings taken in such areas.

4. For aural reception of A-N signals operate equipment on ANT or LOOP instead of COMP since the action of AVC in COMP position will cause broad course indications. Always operate the equipment with the VOL control set at lowest usable headset volume and reduce it as the A-N signal strength increases. Cone of silence indications are not always reliable when operating the equipment on LOOP. Use equipment on ANT for cone of silence indication.

5. This equipment should provide compass bearings during conditions of moderate precipitation static that interrupt normal reception. When static becomes too severe it will be necessary to operate on LOOP position. In this position, satisfactory aural reception and aural-null direction finding will be possible most of the time.

6. Do not depend on two stations for a fix of location; use at least three stations with bearings spaced at approximately equal intervals throughout 360 degrees for greatest accuracy.

7. While taking bearings always keep aircraft on a steady level heading.

8. When homing or direction finding on LOOP operation there is a 180-degree ambiguity and station bearings may be 180 degrees from the null obtained. Use stations with good signal strength for sharply defined nulls. Width of null may be controlled by position of the VOL control. The tuning meter may be used as a visual-null indicator.

AUTOMATIC DIRECTION FINDING EQUIPMENT

The automatic direction finding equipment installed in the aircraft includes the AN/ARA-25 Direction Finder Group which is used in conjunction with the AN/ARC-27 and AN/ARC-52 Communication Radio Sets. A visual indication of the output of these UHF receivers is reflected on a Radio Magnetic Indicator (RMI) or a Bearing, Distance, and Heading Indicator (BDHI).

RADIO MAGNETIC INDICATOR

The radio magnetic indicator (figure 7-6), located on the instrument panel (figure 1-4) is used on aircraft incorporating AFC No. 173. The instrument combines a magnetic direction compass card with two indicator needles. The number 1 indicator needle is connected to Direction Finder Group AN/ARA-25 and Radio Compass AN/ARN-6. This system combines the magnetic compass data with the radio compass data, indicating the magnetic direction of the aircraft and the relative bearing of the radio station. The direction finder group has priority selection of the number 1 needle. The number 2 needle operates in conjunction with the AN/ARN-21 TACAN Radio Set and indicates the bearing to the station selected by that receiver.

BEARING, DISTANCE, AND HEADING INDICATOR

The bearing, distance, and heading indicator (figure 7-6), located on the instrument panel (figure 1-4) is used on aircraft incorporating AFC No. 199. The instrument is a multipurpose indicator which provides a visual display of input signals supplied by the AN/ARA-25 Direction Finder Group, AN/ARN-6 Radio Compass, G-2 Compass and the AN/ARN-21 TACAN Radio Set. When the indicator is receiving all of the necessary input signals, it displays four different types of navigational information. The number 1 needle indicates the relative bearing of any selected radio transmitting station (AN/ARA-25 or AN/ARN-6). The number 2 needle indicates the bearing to the TACAN beacon; the three-digit numerical indicator, in the center of the dial, indicates the nautical miles to the beacon (AN/ARN-21). The aircraft heading is indicated by input signals from the G-2 Compass System.

DIRECTION FINDER OPERATION

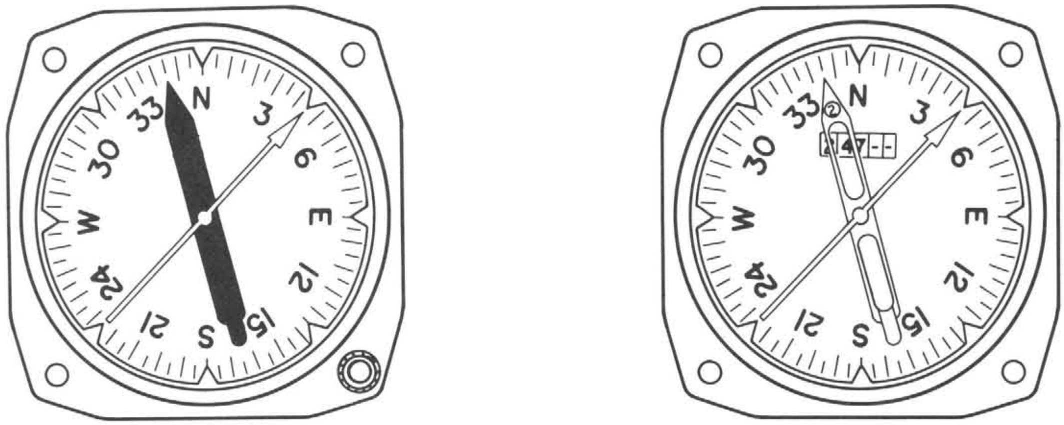
Note

Radio Set AN/ARC-27 is installed on aircraft incorporating AFC No. 173; aircraft incorporating AFC No. 199 uses Radio Set AN/ARC-52.

1. Set function switch on AN/ARC-27 or AN/ARC 52 to ADF.
2. Allow 1 minute for warmup or 3 minutes if function switch was in the OFF position.
3. On aircraft incorporating AFC No. 173, set manual/preset switch to MANUAL and rotate selector dials to desired frequency.
4. On aircraft incorporating AFC No. 199, set CHAN switch to M and rotate selector knobs to desired frequency.
5. On aircraft incorporating AFC No. 173, read relative bearing of received station on the Radio Magnetic Indicator (RMI).
6. On aircraft incorporating AFC No. 199, read relative bearing of received station on the Bearing, Distance, and Heading Indicator (BDHI).

TACTICAL AIR NAVIGATION (TACAN)

The TACAN equipment installed in the aircraft consists of an AN/ARN-21 System which includes an



RMI BDHI

T113A-1-7-6

Figure 7-6. ADF Indicators

RT-220/ARN-21 Receiver-Transmitter, C-866/ARN-21 or C-1763/ARN-21 Radio Set Control, ID-387/ARN or ID-351/ARN Course Indicator, ID-307/ARN Azimuth Indicator, ID-310/ARN Range Indicator, Bearing, Distance, and Heading Indicator, CV-279/ARN Phase Detecting Network and an AS-133/APX Antenna.

Note

The ID-307/ARN and ID-310/ARN indicators are installed on aircraft incorporating AFC No. 173; aircraft incorporating AFC No. 199 uses the Bearing, Distance, and Heading Indicator.

The navigation receiver-transmitter (transponder) converts radio signals into visual displays of azimuth and range. The azimuth and range signals are displayed on the RMI and DME (on aircraft incorporating AFC No. 173) or the BDHI (on aircraft incorporating AFC No. 199) that are located on the instrument panel (figure 1-4). The receiver-transponder is used in conjunction with a receiver-transmitter located at a ground site or aboard ship.

The signals used for azimuth measurement originate at the surface beacon, are radiated by a rotating antenna, and are displayed on the RMI or BDHI. A pulse signal from the TACAN transponder in the aircraft triggers a responding pulse from the ground station (delayed 50 microseconds). The time lapse between the initial pulse and response pulse is translated into distance and displayed in nautical miles on the DME or BDHI. The maximum range of TACAN is approximately 195 nautical miles; however, bearing information is accurate beyond this range under most conditions. All controls for the equipment are on the TACAN control panel. When the transponder in the aircraft triggers (queries) the ground beacon, the ground beacon transmits back to the aircraft a north-burst, which is converted, by a 40-degree gate circuit, to true-north azimuth. This burst is converted to magnetic heading or bearing at the indicator.

RADIO SET CONTROL

The C-866/ARN-21 (and C-1763/ARN-21) Radio Set Control (figure 7-7), located below the instrument panel (figure 1-4), provides operating control for the system. The unit includes a function selector knob, volume control and two channel selector knobs. The function selector knob has three positions: OFF, REC and T/R. In the OFF position, there is no power applied to the TACAN equipment. In the REC position, pulse signals are not transmitted and no range information is received. Only bearing (azimuth) data is received and displayed. Both range and bearing are received and displayed when the switch is set to T/R.

The volume control knob adjusts the volume of the station identification signal heard in the pilot's and ECMO's headsets. The signal is transmitted in international Morse code, with a three-letter designation representing the station's call letters. This identification is transmitted every 37 seconds. The desired operating TACAN channel is selected by two selector knobs. The outer knob selects the first two digits of the desired channel, and the inner knob selects the last digit. All digits are displayed through the channel digit display window. There are 126 TACAN channels available to determine the exact location of the aircraft. It is necessary to know the location and identity of the received TACAN station, which is identified by Morse code.

INDICATORS

The indicators required for the TACAN System installed on aircraft incorporating AFC No. 173 include, in addition to the ID-387/ARN or ID-351/ARN Course Indicator (also used on aircraft incorporating AFC No. 199), an ID-307/ARN Azimuth Indicator and an ID-310/ARN Range Indicator. The aircraft incorporating AFC No. 199 uses the Bearing, Distance, and Heading Indicator in place of these two indicators. The RMI and BDHI are shown in figure 7-6 and described under automatic direction finding equipment.

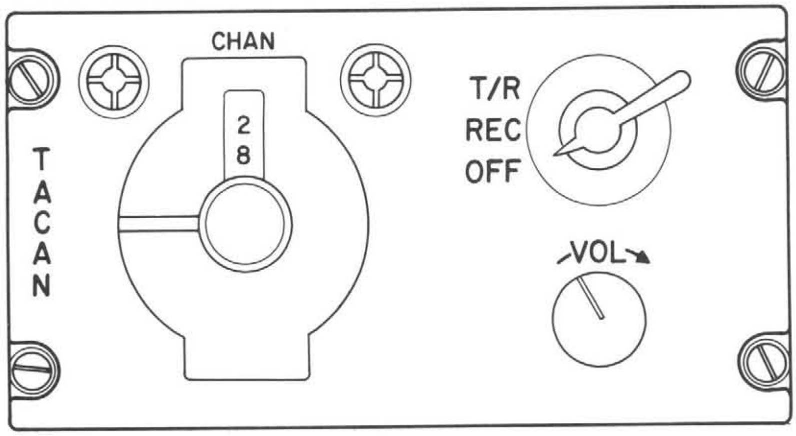


Figure 7-7. TACAN Controls (ARN-21)

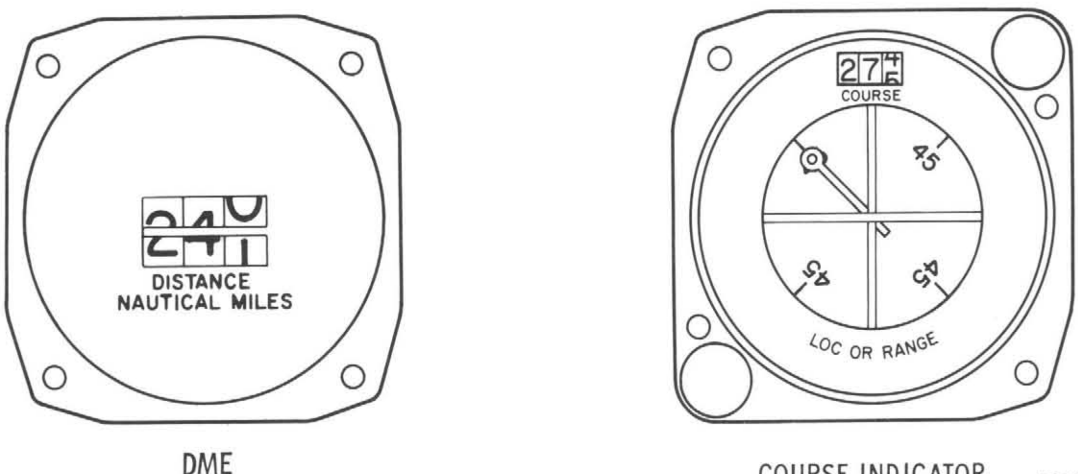


Figure 7-8. TACAN Indicators

Course Indicator

The ID-387/ARN or ID-351/ARN Course Indicator (figure 7-8), located on the instrument panel (figure 1-4), is a multipurpose indicator used to display four functions of the TACAN radio system. The heading of the aircraft is set to a desired course by turning a control knob located on the front of the indicator. A vertical bar extending from the top to the bottom of the dial face indicates the aircraft's deviation from the selected heading. This element operates in conjunction with the CV-279/ARN Phase Detecting Network. In addition to the course-deviation indicator, the unit contains an ambiguity indicator (flag), which informs the pilot that his course is TO (or FROM) the beacon, and a flag alarm that appears on the dial face if the electronic system malfunctions. The horizontal glide-slope indicator and associated flag alarm are not used in this system, nor is the lamp actuated by the ground 75-mHz Z marker.

Azimuth Indicator

The ID-250/ARN Azimuth Indicator (figure 7-6), located on the instrument panel (figure 1-4), indicates the heading the aircraft must follow to reach the beacon to which the TACAN System is tuned. The indicator has a dial face calibrated from zero to 360 degrees and a centrally pivoted pointer, electronically controlled by the RT-220/ARN-21 azimuth circuits. While the indicator is searching, for the correct bearing, the pointer rotates at a rate which prevents bearing readings.

RADAR ALTIMETER EQUIPMENT

The radar altimeter equipment installed in the aircraft includes either an AN/APN-1 Radar Set or an AN/APN-22 Radar Set. This equipment provides an indication of the altitude of the aircraft above the surface as an aid in takeoff, navigation, and landing.

RADAR ALTIMETER SYSTEM (AN/APN-1)

The AN/APN-1 Altimeter System is installed on aircraft incorporating AFC No. 173. The system includes an RT-7/APN-1 Receiver-Transmitter, ID-14/APN-1 Height Indicator, SA-1/APN-1 Limit Switch, AN/APN-1 Limit Indicating Light, and a pair of AN/APN-1 Antennas.

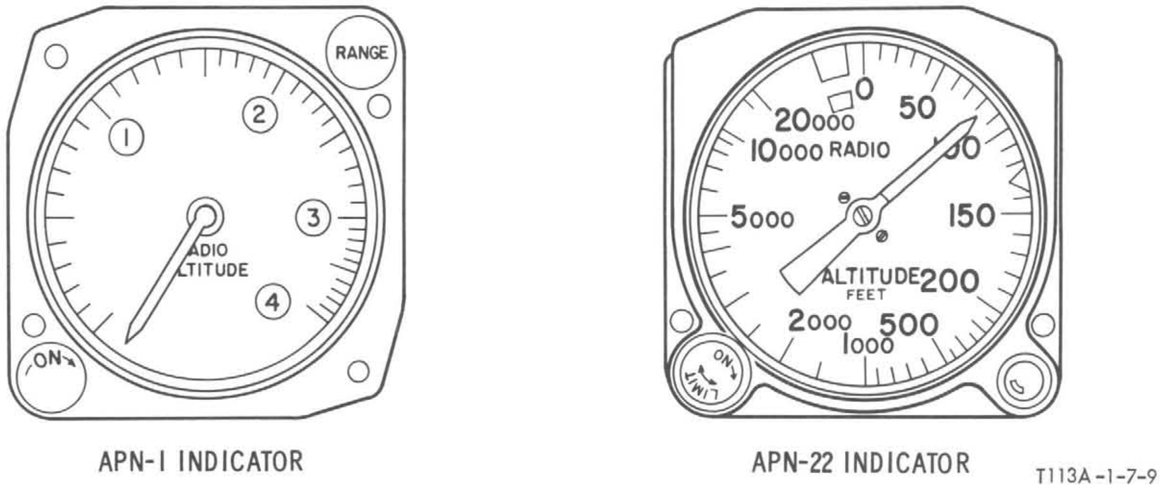


Figure 7-9. Height Indicators

HEIGHT INDICATOR

The height indicator (figure 7-9), located on the instrument panel (figure 1-4), incorporates a power switch and an altitude range limit switch. The power switch controls the input to the receiver-transmitter and the altitude range limit switch selects the desired altitude in either the low or high range. The numerals 1, 2, 3, and 4 indicating the altitude for the low range in hundreds of feet, and 10, 20, 30, and 40, also in hundreds of feet, for the high range are visible through four windows on the face of the instrument. The full scale reading for the low range is 400 feet; full scale reading for the high range is 4000 feet.

LIMIT SWITCH

The limit switch is located on the left console and operates in conjunction with the limit indicating light and the range switch on the indicator. The switch can be preset to any altitude in increments of 25 feet within the range of the indicator; the setting determines the altitudes at which the indicating light will function.

LIMIT INDICATING LIGHT

The limit indicating light is located on the right side of the instrument panel (figure 1-4) and comes on when the aircraft is at a lower altitude than that preset on the limit switch. The light can be dimmed by turning the cap clockwise.

RADAR ALTIMETER SYSTEM (AN/APN-22)

The AN/APN-22 Altimeter system is installed on aircraft incorporating AFC No. 199. The system includes an RT-160/APN-22 Receiver-Transmitter, ID-257/APN-22 Height Indicator, and an AM-291 Amplifier. The antennas are built into the receiver-transmitter.

HEIGHT INDICATOR

The height indicator (figure 7-9), located on the instrument panel (figure 1-4), incorporates a combination ON/LIMIT switch near the face of the instrument. The ON side of the switch supplies power to the system and the LIMIT side controls the limiting cursor pointer on the face of the instrument. The selection of this pointer indicates the desired minimum altitude for operation. A red warning light is incorporated on the face of the instrument, which comes on if the aircraft descends below this preset altitude.

RADAR ALTIMETER OPERATION

Note

Radar Set AN/APN-1 is installed on aircraft incorporating AFC No. 173; aircraft incorporating AFC No. 199 uses Radar Set AN/APN-22.

1. Turn power control switch clockwise.
2. Allow 1 minute for warmup and observe that the indicator has moved from its subzero stop position to some other position, indicating that the equipment is energized.

Note

When the aircraft is on the ground, the indicator pointer may not indicate zero altitude.

3. Set the range switch on the indicator to show the desired altitude range.
4. Set the limit switch for the altitude at which the limit indicator light will come on.

WARNING

The high range of the AN/APN-1 Altimeter cannot be relied upon below 500 feet over water and 600 feet over land. Below these altitudes, when on the high range, the indicator will usually read high and may fail to read below 400 feet, no matter how close to the terrain the aircraft may actually be. Therefore, when flying below 600 feet under conditions of poor visibility, the ID-14/APN-1 Height Indicator should always be on the low range.

5. To turn off the altimeter equipment, turn the power control switch on the height indicator fully counterclockwise.

IDENTIFICATION RADAR EQUIPMENT

The identification radar equipment installed in the aircraft includes either an AN/APX-6 Radar Set or an AN/APX-6B Radar Set. This equipment provides automatic radar identification of the aircraft in which it is installed, when challenged by proper signals from surface or airborne I-R (Interrogator-Responser) units using specific coded pulse transmissions.

IDENTIFICATION RADAR SYSTEM (AN/APX-6 AND AN/APA-89)

The AN/APX-6 (IFF) and AN/APA-89 (SIF) Identification Radar System is installed on all aircraft. The system includes an RT-82/APX-6 Receiver-Transmitter, C-1159/APX-6 and C-1272/APA-89 Control Panels, KY-81B/APA-89 Video Coder and a flush-mounted AN/APX-6 Antenna Assembly. This system includes, in addition to identification (IFF), a selective identification feature (SIF). The IFF and SIF work together to provide automatic selective identification of the aircraft when properly challenged by other radar sets. The system also provides momentary identification of position and transmits emergency upon Mode 1 interrogation. In operation, the radar identification system receives interrogation signals, and automatically transmits coded response signals to the source of the challenge, where this response is displayed together with associated radar information (such as aircraft) on ground or airborne radar scopes. The proper reply identifies the target as being friendly.

Note

Some aircraft have an APX-6B IFF system installed; operation is identical to the AN/APX-6.

CONTROL PANELS

The control panels (figure 7-10), marked IFF and SIF, are on the right console (figure 1-5). The IFF panel includes the master switch, two mode switches and an identification-of-position switch. The SIF panel contains two code selector switches.

IFF CONTROL PANEL

MASTER Switch

The MASTER switch has five positions; OFF, STBY, LO, NORM, and EMERGENCY. In the OFF position, the identification system is deenergized. In the STBY position, power is supplied to the set, but the receiver portion is not sensitized and no replies can be transmitted. Selecting the LO position causes the receiver to operate at reduced sensitivity (the transmitter is not affected), and replies will be transmitted upon receipt of strong interrogation signals. Positioning the switch to NORM selects maximum receiver sensitivity, and the transponder will operate at maximum performance. In the EMERGENCY position, the receiver has maximum sensitivity and a distinctive code train is transmitted on Mode 1. When the system MASTER switch is turned on, the equipment is automatically set for Mode 1 operation.

MODE 2/OUT Switch

The two-position MODE 2/OUT switch is used to select Mode 2 interrogation-response. The OUT position of the switch corresponds to the off position of Mode 2.

MODE 3/OUT Switch

The MODE 3/OUT switch selects Mode 3 interrogation-responses. The OUT position of the switch corresponds to the off position of Mode 3.

IP/OUT/MIC Switch

The IP/OUT/MIC switch is a three-position switch used to reply to interrogations. This switch is momentary in the I/P position and will respond to interrogations as long as the switch is held to the I/P position, plus an additional 30 seconds of transmission upon release of the switch. When this switch is positioned to MIC, interrogations are answered when the microphone button (UHF) is depressed, plus an additional 30 seconds upon release. Use of the I/P or MIC position essentially doubles whatever code train that has been selected, giving positive identification of position.

SIF CONTROL PANEL

MODE 1 and MODE 3 Switches

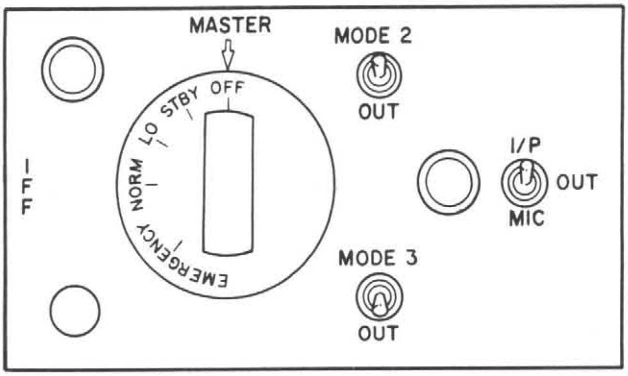
The coder group (SIF) control panel consists of two sets of coaxial switches placarded MODE 1 and MODE 3. Translucent numbers placed on the skirts of the rotary switches mark the setting of the selected coded pulse train. There are 32 codes available in Mode 1 and 64 codes available in Mode 3.

MODE 3 Emergency Code

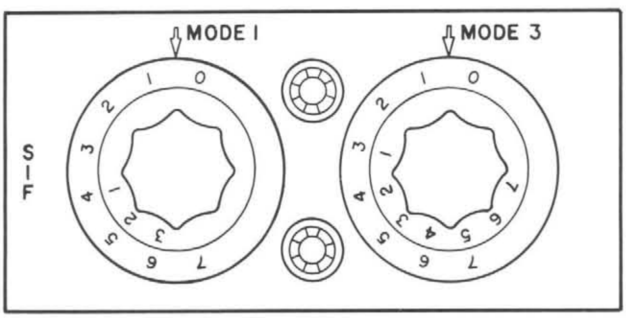
The most similar code in Mode 3 to the normal Mode 1 EMERGENCY code train is code 77. Whenever an emergency is declared, the pilot should select MODE 3, code 77 in addition to the normal EMERGENCY function to ensure the most widespread coverage, (including ATC, Approach Control, etc).

MODE 2 Switch

Code selections for Mode 2 are provided by rotary switches located in the radio equipment compartment. These codes must be preset on the ground and the pilot has no control over them from the cockpit.



IFF CONTROL PANEL



SIF CONTROL PANEL

T113A-1-7-10

Figure 7-10. Identification Radar Controls

IFF/SIF OPERATION

1. Rotate master switch to STBY to maintain equipment inoperative, but ready for instant use.

2. Rotate master switch to NORM to place equipment in operation.

Note

The LO position of the master switch should not be used unless by direction. Mode 1 is in operation when master switch is in NORM.

3. Set Mode 2 and Mode 3 switches OUT unless otherwise directed.

4. Set Mode 1 and Mode 3 code selector switches as directed.

5. For emergency operation, press dial stop and rotate master switch to EMERGENCY.

The system will then transmit a distinct coded distress signal upon any Mode 1 interrogation.

CAUTION

The emergency position will transmit on Mode 1 only. Therefore, when selecting EMERGENCY, also use MODE 3 code 77 to attract the most widespread attention (ATC and Approach Control).

SECTION VIII

COUNTERMEASURES EQUIPMENT AND PROCEDURES

See Supplemental NATOPS Flight Manual NAVAIR 01-40FAB-1A

SECTION IX

FLIGHT CREW COORDINATION

Table of Contents

FLIGHT CREW ASSIGNMENTS

Each flight crewmember shall be assigned by the Commanding Officer to his specific responsibility and authority within the air crew.

PILOT'S DUTIES

The pilot is assigned the responsibility for the safe and successful accomplishment of the designated mission. His authority and responsibility shall be in accordance with the current OPNAVINST 3710.7 series. He shall sign the yellow sheet for custody of the aircraft before flight, and shall report discrepancies in full upon termination of the flight. The pilot may delegate such duties to the ECMO as deemed necessary, insofar as functions within the cockpit, or preflight instructions. The pilot's specific duties shall include, but not be limited to:

1. Performing preflight inspection.
2. Completing the action required in the use of check lists, and giving the required replies to the ECMO.
3. Performing starting procedures, systems and control checks, taxiing, engine runup, launching, recovery, and ground secure.
4. Inflight procedures in accordance with OPNAVINST 3700.7 series.
5. Instructing the ECMO relative to the assistance he desires to maintain operational integrity of the aircraft.

ECM OFFICER'S DUTIES

The primary duty of the ECMO is to operate the electronic warfare systems, so that, together, the pilot and ECMO can conduct the assigned mission under all weather conditions. The ECMO's specific duties shall include, but not be limited to:

1. Flight Planning - Responsible for the preparation of charts and flight log computations. Sharing the responsibility with the pilot for fuel planning, checking NOTAMS, obtaining weather information and completing required flight plans. Ensuring that a navigation bag is provided which shall include current publications, a computer, a plotter, a flashlight, and all applicable charts and fuel packets.
2. Briefing - In lead aircraft, sharing responsibility with pilot for ensuring that the flight is adequately briefed.
3. Preflight - Assisting pilot in performing preflight inspection. Responsible for the preflight inspection of all ECM systems loaded on the aircraft and ensuring that safety and lock pins are in place before manning the aircraft.
4. Prestart - Executing all prestart checks for his aircraft equipment and assisting the pilot as necessary.
5. Starting - Remaining alert for any emergency signals from the ground crew.
6. Post Start - Executing all post-start checks for his aircraft equipment and reporting the status of equipment.
7. Pretakeoff - Calling for taxi clearance and takeoff instructions when directed by the pilot. Maintaining visual lookout while taxiing and assisting the pilot in accomplishing the pretakeoff checklist. Copying all clearances.
8. Takeoff/Departure - Monitoring engine and flight instruments and, when departures are made under actual instrument conditions, monitoring departure procedures and informing the pilot of any deviations. Providing any navigational assistance required. On VFR departures, maintaining a constant lookout until clear of airport traffic.
9. Inflight - Assisting in changing communication frequencies and requesting, copying, and acknowledging clearances, or making position reports in normal and emergency situations as directed by the pilot. Maintaining a visual lookout for other aircraft when not engaged in operation of equipment, and assisting the pilot in spotting hazards to flight. Being cognizant of the pilot's fuel management procedures and existing fuel status.

10. Emergencies - Assisting the pilot wherever possible in the resolution of inflight emergencies. Specific actions are dictated by emergency procedures NATOPS Pocket Check List. If navigational equipment is lost, using aircraft equipment to continue the flight or directing the pilot to an emergency landing field.

11. Descents - Monitoring all descents with particular attention devoted to intended assigned leveloff and pull-out altitudes.

12. Instrument Approaches - Monitoring aircraft instruments and appropriate approach plate during holding, penetration and approach, and providing pilot with required information. Advising the pilot of any deviations from the course or minimum altitudes prescribed on the approach plate. Informing pilot of every 5000-foot altitude change during descent until reaching 5000 feet, and every 1000 feet thereafter, tapping pilot's right knee upon visual sighting of the runway.

13. Landing - Ensuring that landing check list has been completed before landing.

14. Post Landing - Assisting the pilot in conducting a postflight inspection of the aircraft.

15. Debrief - Debriefing the weapons system and mission as applicable.

SECTION X

NATOPS EVALUATION

Table of Contents

CONCEPT

The standard operating procedures prescribed in this manual represent the optimum method of operating EF-10B 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 compatability 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 Evaluation Program is achieved only through vigorous support of the program by Commanding Officers as well as flight crewmembers.

IMPLEMENTATION

The NATOPS Evaluation Program shall be carried out in every unit operating Naval aircraft. The various categories of flight crewmembers desiring to attain or retain qualification in the EF-10B shall be evaluated in accordance with OPNAVINST 4510.9 series. Individual and unit NATOPS Evaluations will be conducted annually; however, instruction in, observation of, and adherence to, NATOPS procedures must be on a daily basis within each unit to obtain maximum benefits from the program. The NATOPS Coordinators, Evaluators, and Instructors shall administer the program as outlined in OPNAVINST 3510.9 series. 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 ground evaluation was commenced and the date the flight evaluation is satisfactorily completed.

DEFINITIONS

The following terms, used throughout this section, are defined as to their specific meaning within the NATOPS program.

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.

NATOPS RE-EVALUATION

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 level was noted need be observed during a reevaluation.

QUALIFIED

That degree of standardization demonstrated by a very reliable flight crewmember who has a good knowledge of standard operating procedures and a thorough understanding of aircraft capabilities and limitations.

CONDITIONALLY QUALIFIED

That degree of standardization demonstrated by a flight crewmember who meets the minimum acceptable standards. He is considered safe enough to fly as pilot-in-command or to perform normal duties without supervision, but more practice is needed to become qualified.

UNQUALIFIED

That degree of standardization demonstrated by a flight crewmember who fails to meet minimum acceptable criteria. He should receive supervised instruction until he has achieved a grade of Qualified or Conditionally Qualified.

AREA

A routine of preflight, flight, or postflight.

SUBAREA

A performance subdivision within an area, which is observed and evaluated during an evaluation flight.

CRITICAL AREA/SUBAREA

Any area or subarea that covers items of significant importance to the overall mission requirements, the marginal performance of which would jeopardize safe conduct of the flight.

EMERGENCY

An aircraft component, system failure, or condition that requires instantaneous recognition, analysis, and proper action.

MALFUNCTION

An aircraft component, system failure, or condition that requires recognition and analysis, but which permits more deliberate action than that required for an emergency.

GROUND EVALUATION

Before 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.

OPEN BOOK EXAMINATION

The open book examination shall consist of, but not be limited to, the questions from the question bank. The number of questions shall not exceed 50 or be less than 25. The maximum time allowed for the examination should not exceed 8 hours.

CLOSED BOOK EXAMINATION

Questions for the closed book examinations may include, but shall not be limited to, questions from the questions bank. The number of questions on this examination shall not exceed 100 or be less than 40. Questions designated critical will be so marked. An incorrect answer to any question in the critical category will result in a grade of Unqualified being assigned to the examination.

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.

COT PROCEDURES EVALUATION

The COT (if available) will be used to evaluate the pilot's knowledge and performance of normal procedures and his reaction to simulated emergencies and malfunctions. If one of these trainers is not available, an aircraft cockpit may be substituted.

GRADING INSTRUCTIONS

Examination grades shall be computed on a 4.0 scale and converted to an adjective grade of Qualified or Unqualified.

Open Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.5.

Closed Book Examination

To obtain a grade of Qualified, an evaluee must obtain a minimum score of 3.3.

Oral Examination and COT Procedure Check (if conducted)

A grade of Qualified or Unqualified shall be assigned by the Instructor/Evaluator.

FLIGHT EVALUATION

The NATOPS Flight Evaluation is intended to measure pilot and crewmembers performance with regard to knowledge of and adherence to prescribed procedures. The number of flights required to complete the flight evaluation should be kept to a minimum, normally one flight. It may be conducted on any operational or training flight and only those areas observed will be graded. The grade for the flight evaluation shall be determined as outlined in this section.

FLIGHT EVALUATION AREAS

Mission Planning

1. Flight plan.
2. Weather.

Briefing

Preflight

1. Records check.
2. Preflight check.

Start/Poststart

1. Start.
2. Poststart procedures.

Taxi/Runup

1. Taxi procedures.
2. Engine runup.
3. Clearances.

Takeoff

1. Procedures (VFR).
2. Type takeoff:
   a. Crosswind.
   b. Maximum gross.

Climb/Cruise

1. Climb schedule.
2. Transition.
3. Enroute procedures (VFR).

Approach and Landing

1. Pattern entry.
2. Approach.
3. Type of landing:
    a. Crosswind.
    b. Maximum gross.

Emergency Procedures

Procedures (evaluated only in case of actual emergency).

Shutdown/Postflight

1. Shutdown.
2. Postflight inspection.

Yellow Sheet

Debriefing

MISSION EVALUATION AREAS

Rendezvous

Weapons

1. Target procedures.
2. Rendezvous procedures.

Navigation

1. Low level.
2. Medium level.

Special

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 ratings 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.

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.

Conditionally Qualified

Satisfactorily standardized; one or more significant deviations from NATOPS standards and procedures, but no errors jeopardizing mission accomplishment or flight safety.

Unqualified

Not acceptably standardized; evaluee fails to meet minimum standards regarding knowledge of and/or ability to apply NATOPS procedures; one or more significant deviations from NATOPS standards and procedures that could jeopardize mission accomplishment or flight safety.

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 the numerals 0, 2, or 4 will be assigned in subareas. No interpolation is allowed.

Unqualified 0.0
Conditionally Qualified 2.0
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.

0.0 to 2.19 – Unqualified
2.2 to 2.99 – Conditionally Qualified
3.0 to 4.0 – Qualified

Example: (Add subarea numerical equivalents)

$$\frac{4+2+4+2+4}{5} = \frac{16}{5} = 3.20 \text{ Qualified}$$

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.

NATOPS EVALUATION REPORT
OPNAV FORM 3510-8 (8-65) 0107-723-0000

NAME (Last, first initial)	GRADE	SERVICE NUMBER
SQUADRON/UNIT	AIRCRAFT MODEL	CREW POSITION
TOTAL PILOT/FLIGHT HOURS	TOTAL HOURS IN MODEL	DATE OF LAST EVALUATION

NATOPS EVALUATION

REQUIREMENT	DATE COMPLETED	GRADE		
		Q	CQ	U
OPEN BOOK EXAMINATION				
CLOSED BOOK EXAMINATION				
ORAL EXAMINATION				
*EVALUATION FLIGHT				

FLIGHT DURATION	AIRCRAFT BUNO	OVERALL FINAL GRADE

REMARKS OR EVALUATOR/INSTRUCTOR

☐ CHECK IF CONTINUED ON REVERSE SIDE

GRADE, NAME OF EVALUATOR/INSTRUCTOR	SIGNATURE	DATE
GRADE, NAME OF EVALUEE	SIGNATURE	DATE

REMARKS OF UNIT COMMANDER

RANK, NAME OF UNIT COMMANDER	SIGNATURE	DATE

*WST, OFT, COT, or cockpit check in accordance with OPNAVINST 3510.9 (effective edition).

Figure 10-1. NATOPS Evaluation Report

RECORDS AND REPORTS

A NATOPS Evaluation Report, OPNAV Form 3510-8 (figure 10-1), shall be completed for each evaluation and forwarded to the evaluee's Commanding Officer. This report shall be filed in the individual flight training record and retained therein for 18 months. In addition, an entry shall be made in the pilot/NFO flight logbook under "Qualifications and Achievements" as follows:

QUALIFICATION			DATE	SIGNATURE	
NATOPS EVAL.	(Aircraft Model)	(Crew Position)	(DATE)	(Authenticating Signature)	(Unit which Administered Eval.)

NATOPS EVALUATION QUESTION BANK

The following bank of questions is intended to assist the NATOPS Instructor/Evaluator in the preparation of ground examinations and to provide an abbreviated study guide. The questions from the bank should be combined with locally originated questions as well as questions obtained from the Model Manager in the preparation of ground examinations.

1. Operating procedures, conditions, etc, which are essential to emphasize in the NATOPS manual are indicated by__________.

2. Operating procedures, practices, etc, which will result in personnel injury or loss of life if not carefully followed are indicated in the NATOPS manual by__________.

3. The cockpit will begin to pressurize at______ feet. At 30,000 feet, the cabin altitude should be approximately__________.

4. The windshield wiper is limited to______ KIAS.

5. The arresting hook is lowered by________ and raised by__________.

6. With a loss of electrical power the arresting hook may be lowered. T___, F___.

7. The maximum recommended airspeed for landing gear extension is______KIAS.

8. The maximum RPM on either engine is______ percent.

9. Airframe acceleration limitations are______ positive and ______ negative.

10. In a GCA transition to the landing configuration, full flaps are lowered. T___, F___.

11. Maximum airspeed for flap extension is______ KIAS.

12. Maximum allowable continuous RPM is______.

13. The normal fuel boost range is___to___PSI, with a maximum of____PSI.

14. The emergency landing gear extension speed is ______ KIAS.

15. The wing tank pressure systems switch should be in the vent position during takeoff and landing. T___, F___.

16. If the fuel quantity indicator is not functioning, the indicator will not deflect toward zero when the test button is depressed. T___, F___.

17. Total capacity of the internal fuel cells is______ pounds.

18. ______ is the minimum RPM required for an air start.

19. ______ is the minimum single engine landing speed.

20. The pilot may go hooded at______ feet on a simulated instrument departure.

21. The starter may be operated through______ consecutive 30-second cycles, after which______ minutes must be allowed for cooling.

22. The aileron spoilers must be flush in order to fold the wings. T___, F___.

23. In an IFR approach to landing the ECMO will signify field contact by a call on ICS. T___, F___.

24. If crosswind prevents a formation takeoff in right echelon, left echelon is permissible. T___, F___.

25. Stalls are permissible in the EF-10B. T___, F___.

26. ______ pounds is the maximum field landing weight.

27. The "dirty" penetration air speed and rate of descent is 150 KIAS/3500 FPM. T___, F___.

28. The proper oil level during preflight inspection is oil visible in the filler screen. T___, F___.

29. Endurance and range may be gained by securing one engine below______feet.

30. The fuel boost pump switch controls the______ valve.

31. Rendezvous should be conducted in a ______ turn due to limited visibility of the pilot.

32. The maximum airspeed with the upper hatch open is_______ KIAS.

33. The recommended climb schedule starts at _____ KIAS.

34. Designated EF-10B test pilots are required to have ________ hours in type.

35. If a main gear fails to extend a short field arrestment is recommended. T___, F___.

36. LSO assistance is recommended for all short field arrestments. T___, F___.

37. A fuel boost pump failure above_____feet will probably cause a flameout.

38. Military power may be maintained for _______ minutes.

39. List the steps for emergency gear extension.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________

40. List the items that should be checked prior to a forced landing.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________

41. Minimum bailout altitude for uncontrolled flight is_______ feet.

42. Under IFR conditions, departure should be made from the approach fix with a minimum of _________ pounds of fuel.

43. To indicate loss of radio receiver fly two triangles to the _______ using _____minute legs. Repeat this pattern every______ minutes.

44. Minimum safe bailout altitude during controlled flight is______feet.

45. The EF-10B utilizes ________aviation fuel.

46. The ECMO's No. 2 Inverter Circuit Breaker must be engaged to activate the ARN-21 TACAN in aircraft incorporating AFC 173. T___, F___.

47. The ARA-25 has priority selection over the number one needle of the RMI. T___, F___.

48. The high range of the APN-1 altimeter cannot be relied upon below______feet over water and _______feet over land.

49. The ARN-6 control unit is located on the left-hand side of the cockpit above the throttle quadrant. T___, F___.

50. There are________codes available in Mode 1 and______codes available in Mode 3 on the SIF Control Panel.

51. Code selection for Mode____are provided by switches in the electronics equipment compartment.

52. The "low" position of the IFF Master Switch should not be used unless directed. T___, F___.

53. When selecting IFF Emergency also use Mode ____Code_____to attract the most widespread attention.

54. A pilots authority and responsibilities shall be in accordance with the current OPNAV INST _______ SERIES.

55. The ECMO will inform the pilot of every_____ feet altitude change during descent until reaching ______feet, then each_____feet thereafter.

56. The ECMO will monitor all ______ and ______ changes during instrument departures and inform the pilot of any deviations.

57. ___________ is the maximum number of days that may elapse from date of testing to the NATOPS flight evaluation.

58. All control surfaces should be in their_______ position before applying the gust lock.

59. The gust lock restricts the landing gear handle from being raised with weight on the gear. T___, F___.

60. Upon immediate loss of aileron boost the Ail Power Boost release should be pulled. T___, F___.

61. Maximum endurance IAS at 25,000 feet is_____.

62. Maximum range IAS at 30,000 feet is________.

63. TAS is________when OAT is -35°C, IAS is 240 KTS and press altitude is 25,000 feet.

64. J-__WE-___engines are installed in the EF-10B.

65. EF-10B engines are thrust rated at__________ pounds per engine.

66. Describe the procedures for securing an engine in flight.

____

____

67. Describe the procedures for an inflight restart of a secured engine.

____

____

68. If no light off occurs within______ seconds after a start attempt, follow false start procedures.

69. Fuel is transferred by______________ from the forward and center tanks.

70. List the following TOT limitations:
Maximum Continuous__________________
Maximum Starting________Momentary_______
five seconds_________________________
Maximum acceleration__________________

71. Normal oil pressure is________. Maximum oil pressure is___________.

72. With the system pressurized, the hydraulic gage should read_______PSI.

73. The EF-10B has_____________ inverters.

74. The primary bus is energized by___________, _______________ and _______________.

75. Normal oil temperature is_________________.

76. The EF-10B uses__________ grade oil.

77. When encountering thrust instability climbing out, what action should be taken?

____

____

78. The usable capacity of the oil reservoir is _________ gallons.

79. The oxygen system utilizes___________oxygen cylinders with each having a capacity of______cubic inches.

80. Air conditioning and pressurization utilize _____ stage bleed air.

81. Cockpit air conditioning is controlled by a _________position switch.

82. The cockpit air conditioning control also controls cabin pressurization and windshield defogging. T___, F___.

83. When the cockpit air conditioning control is moved to OFF, the normal air conditioning system shutoff valve is________, and the emergency ventilating and cockpit pressure relief valves are _________ thus permitting free circulation of________ air throughout the cockpit.

84. Explosive decompression is not a major factor of the EF-10B pressurization. T___, F___.

85. Engine fire detection system detectors are located in each_______, ___________, __________, and ___________section.

86. Two attempts are provided for the pneumatic action of the lower escape chute door. T___, F___.

87. Mil- _________________hydraulic fluid is used in the EF-10B.

88. With the inertia reels of the shoulder harness in the unlocked position, a force of____________ g is required to automatically lock them.

89. To be cross-country qualified in the EF-10B, you must possess the following:

____

____

____

____

90. To be current in the EF-10B, a pilot who has less than 100 hours in model must have flown_______ hours within the past_______ months.

91. In the full down position (40°), flap blowback begins at approximately________KIAS.

92. Speedbrakes can be stopped at any intermediate position. T___, F___.

93. Aircraft power may be used to operate the engine starters. T___, F___.

94. Ignition has a________second time cycle.

95. If fuel boost pump pressure drops below______ PSI while on the ground, shut down the engine and investigate.

96. The maximum height of the EF-10B is_______ feet_______inches.

97. Basic weight of the EF-10B is________pounds.

98. Gross weight of the EF-10B with two 300 gallon external tanks is_______pounds.

99. The EF-10B utilizes an electric trim system. T___, F___.

100. The EF-10B (will – will not) fly, with a loss of either engine on lift off with external tanks and gear down. T___, F___.

PART 1

INTRODUCTION

Table of Contents

INTRODUCTION

The performance data charts contained in this section 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.

Section XI is divided into eight parts to present performance data in proper sequence for preflight planning. Performance data, based on Navy Flight tests, contractor flight tests, and calculations are presented in graphical type charts for ICAO Standard day conditions. In some instances, temperature corrections for nonstandard atmosphere have been included. Descriptive information and general instructions on the usage of the chart are given at the beginning of each part. Examples are included to indicate the steps required to find the proper values. This graphical data has been used to develop the tabulated cruise and Bingo data. Integrated use of this performance data in mission planning is in Part VIII.

PERFORMANCE DATA BASIS

Performance data are based on aircraft characteristics obtained from EF-10B Navy flight tests. These data are applicable to an EF-10B with properly trimmed engine, operating on 115/145 aviation gas with a nominal density of 6.0 pounds per gallon. 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.

ABBREVIATIONS, SYMBOLS, AND DEFINITIONS

Abbreviation	Definition
Alt	Altitude
°C	Degrees Centigrade
CAS or V_c	Calibrated airspeed (IAS corrected for position error)
CG	Center of gravity
Deg	Degrees
Amb	Free stream static condition
EAS or V_e	Equivalent airspeed (CAS corrected for compressibility effect)
EGT	Exhaust gas temperature
EPR	Engine pressure ratio
°F	Degrees Fahrenheit
Flt	Flight
FPM or fpm	Feet per minute
Ft or ft	Feet
g	Gravity Force
H or h	Altitude
Hg	Mercury
hr	Hour
IAS or V_i	Indicated airspeed (instrument reading corrected for instrument error)
ICAO	International Civil Aviation Organization
In.	Inches
KCAS	Knots calibrated airspeed
KEAS	Knots equivalent airspeed
KIAS	Knots indicated airspeed
KTAS	Knots true airspeed
Kts	Knots
lb	Pounds
M	Mach number
MAX	Maximum
min	Minutes
mm	Millimeters
n	Normal load factor
NM or N. Mi	Nautical miles
OAT	Outside air temperature
P	Static atmospheric pressure at any altitude
P_o	Static atmospheric pressure at sea level ICAO standard day = 29.92 inches of mercury
psi	Pounds per square inch
RPM	Revolutions per minute (engine speed)
SL	Sea level
Std	Standard
T	Static absolute temperature at any altitude
T_o	Static absolute temperature at sea level ICAO standard day = 288.2 degrees Kelvin
TAS	True airspeed
Vol	Volume
Wt	Weight
δ or P/P_o	Delta - ratio of static air pressure to ICAO standard sea level static air pressure
μ	Coefficient of rolling friction

ρ	Rho - density of atmosphere in slugs/foot at any altitude
σ	Sigma - ratio of density at any altitude to density at sea level, ICAO standard day
θ or T/T_0	Theta - ratio of absolute temperature of any altitude to absolute temperature at sea level. ICAO standard day.

AIRSPEED CORRECTIONS

Several corrections must be applied to the airspeed indicator reading to obtain true airspeed. The first correction is for instrument error. This error will vary for each airspeed indicator since it is the result of manufacturing the tolerances. The error is obtained by bench testing each individual airspeed indicator and is noted on the instrument correction card posted in the aircraft. The airspeed indicator reading corrected for this error is the indicated airspeed (IAS). Usually, this error is so small as to be negligible, and in general practice the airspeed indicator reading is read directly as indicated airspeed.

The second correction is for the error resulting from a particular airspeed system installation. This error, known as position error, is introduced by the location of the static source at a point of nonambient static pressure. The correction for this effect is obtained from figure 11-1, Airspeed Correction for Position Error. The addition of this error correction to the indicated airspeed (IAS) results in the calibrated airspeed (CAS).

The third correction is for the effect of compressibility. The correction of calibrated airspeed for compressibility results in the equivalent airspeed (EAS). The true airspeed is related to equivalent airspeed by the following relation: KTAS = KEAS x $1/\sigma$.

A direct conversion of calibrated airspeed to true airspeed can be obtained from figure 11-2. Figure 11-2 has compressibility effects built into the graph permitting a direct step from calibrated to true airspeed.

The true ambient temperature of the outside atmosphere is obtained by applying a temperature correction increment for installation and compressibility error, to cockpit temperature indicator reading which always reads high. This temperature correction increment may be obtained from figure 11-2, Temperature Correction for Compressibility.

The following example illustrates the use of the graphs discussed above.

Sample Problem. Assume the airplane is at a pressure altitude of 20,000 feet with gear and flaps up and power on. The airspeed indicator reading is 240 knots and the temperature indicator reading is -10°C. The true airspeed, assuming zero airspeed and temperature indicator instrument error, is calculated as follows:

Airspeed indicator reading	240 knots
Correction for instrument error	0 knots
Indicated airspeed	240 knots
Correction for position error (figure 11-1)	-2 knots
Calibrated airspeed	238 knots
Temperature indicator reading	-10°C
Indicated temperature correction for compressibility (figure 11-2)	-16°C
Ambient temperature	-26°C
True airspeed (figure 11-3)	306 knots

ALTIMETER CORRECTIONS

The altimeter is connected to the static source. Position error corrections, similar to those for airspeed indicators, must be applied to the altimeter to obtain true pressure altitude. These corrections are given in figure 11-4.

Sample Problem. Assume the airplane is at a pressure altitude of 20,000 feet with an airspeed indicator reading of 240 knots. The actual altitude is calculated as follows:

Indicated airspeed	240 knots
Pressure altitude	20,000 ft
Altimeter correction to be added	-100 ft
True pressure altitude	19,900 ft

DRAG COUNT SYSTEM

To simplify data presentation and application for various EF-10B configurations, a drag count system is used. In the drag count system, each external store or tank is assigned a drag count whose value depends on the size and shape of the item. The summation of these individual drag numbers, for a particular loading, defines the drag count for that configuration. This drag count, when applied to the performance charts, defines the performance characteristics of that configuration.

The individual drag count numbers used to determine a particular configuration are given in figure 11-5. The drag count of the aircraft with empty pylons and associated equipment is 0.

Sample Problem. Assume the external configuration consists of an ALE-2 chaff dispenser and one 300-gallon Aero 1A external tank. The following drag count can be obtained from figure 11-5:

EXTERNAL STORE ITEM	DRAG COUNT
ALE-2 Chaff Dispenser	8
Aero 1A External Tank	13
Total Drag Count	21

Thus the total drag count used in mission calculation would be 21.

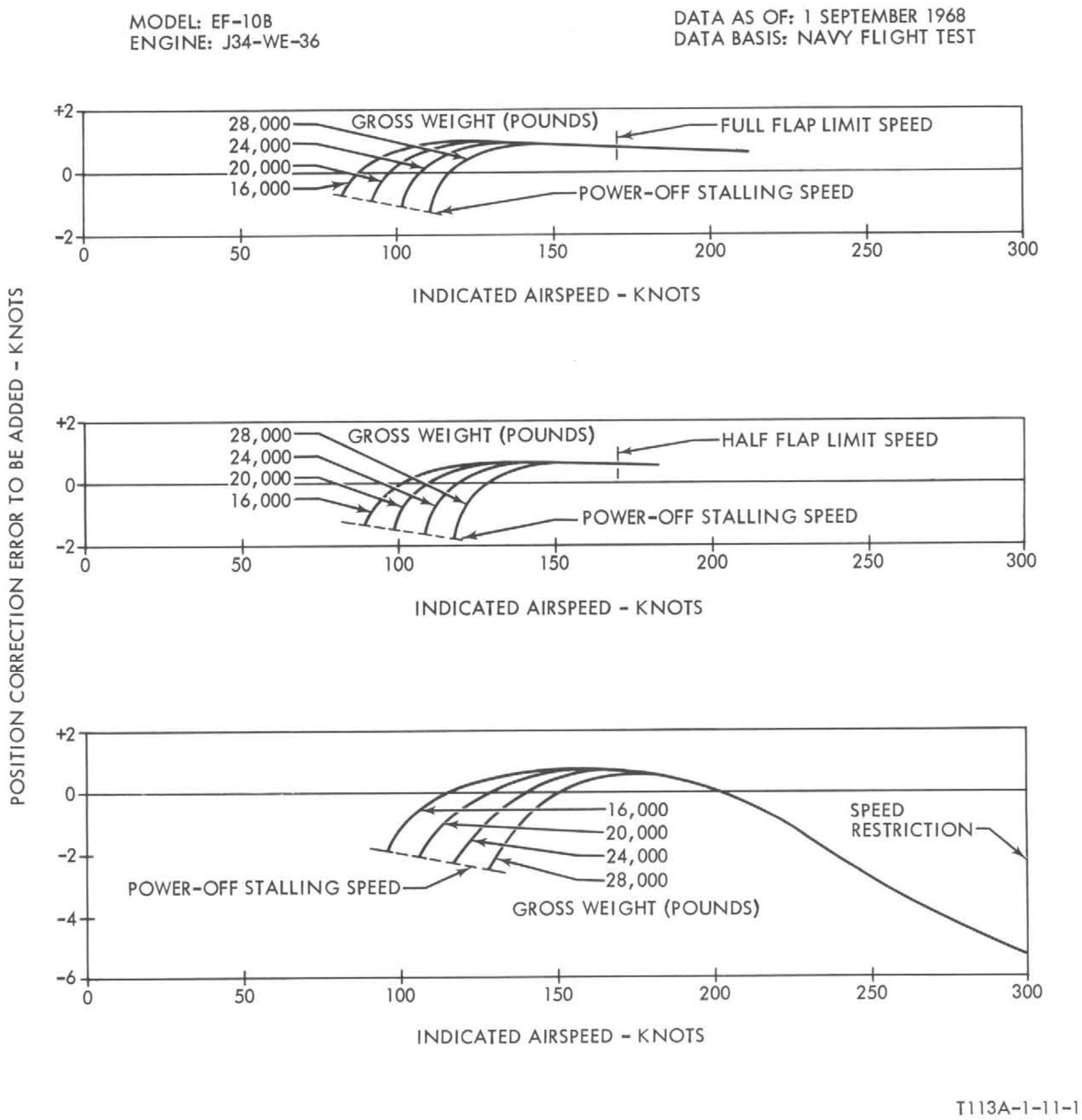
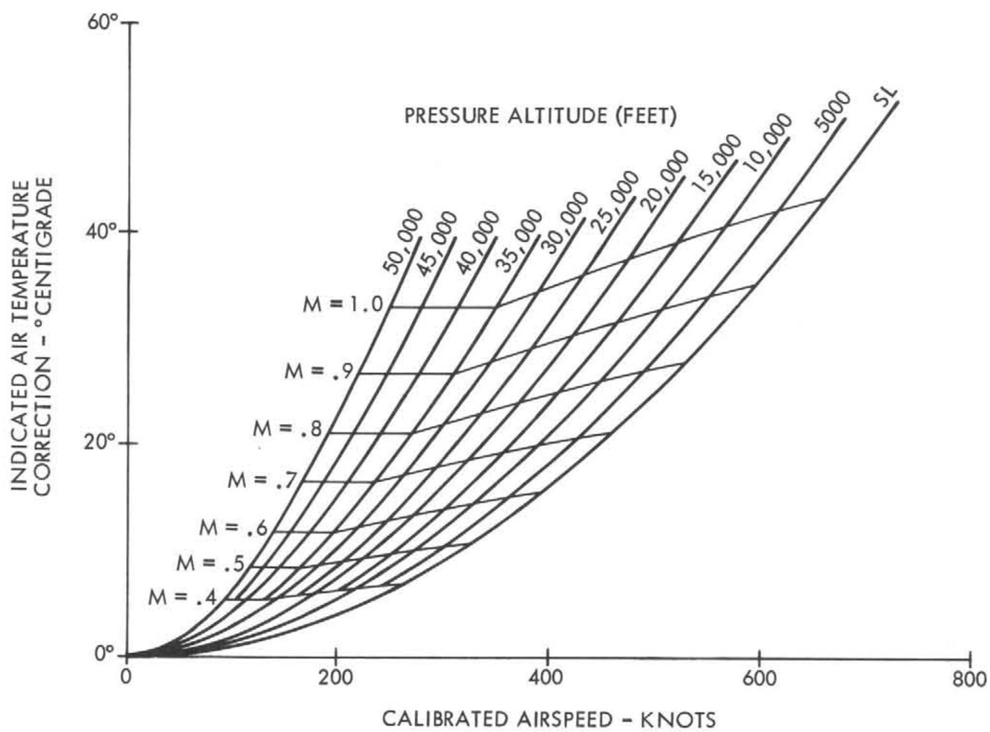


Figure 11-1. Airspeed Correction For Position Error

MODEL: EF-10B
ENGINE: J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: CONTRACTOR FLIGHT TESTS



T113A-1-11-3

Figure 11-2. Temperature Correction for Compressibility

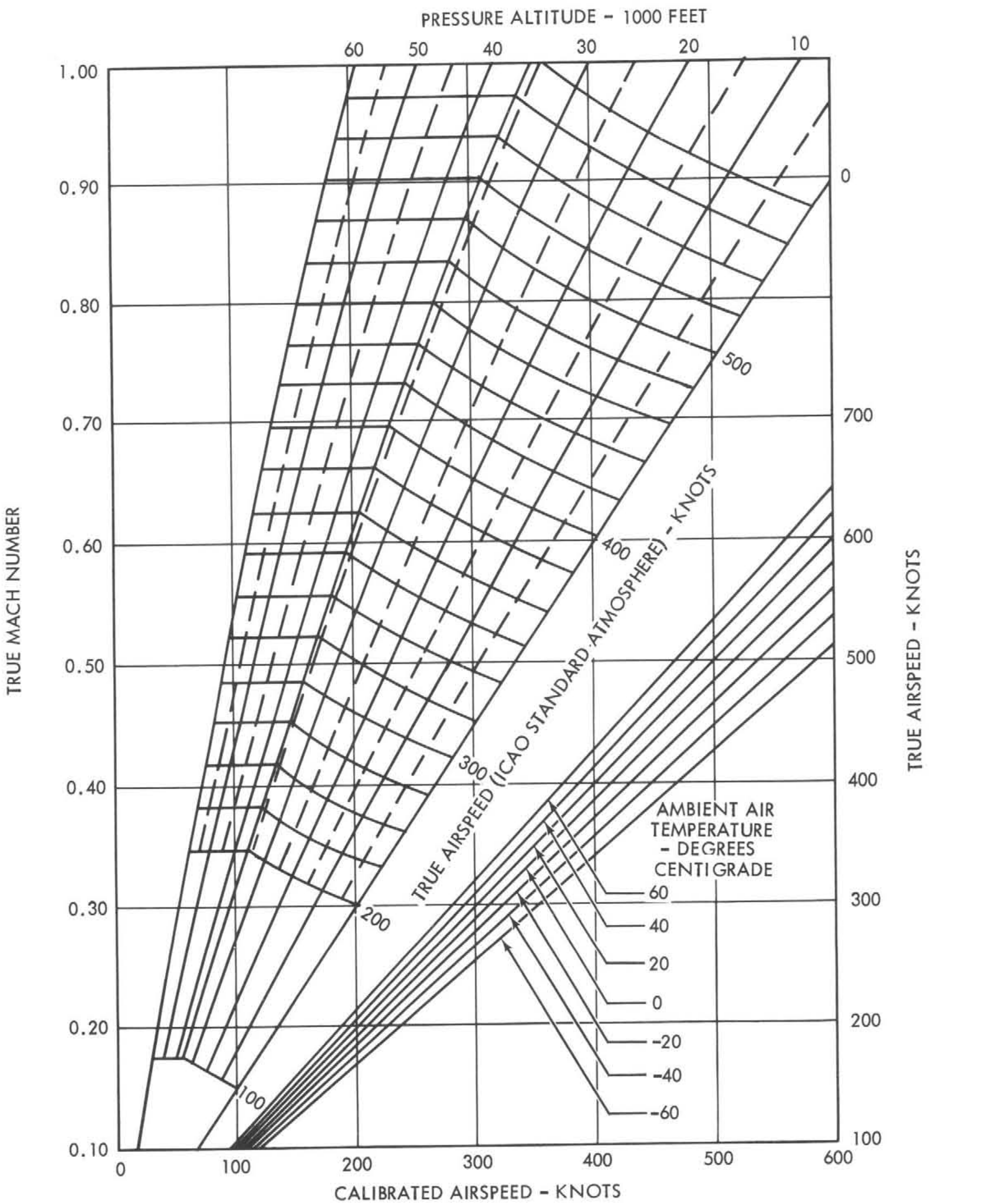
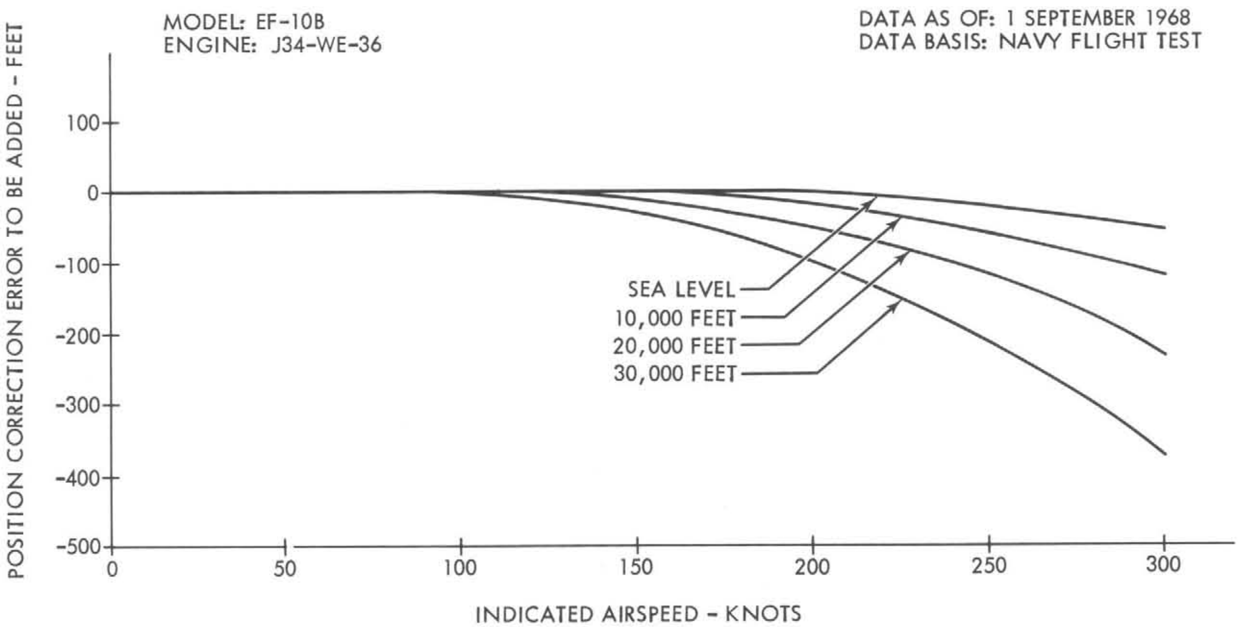


Figure 11-3. Airspeed Conversion



T113A-1-11-2

Figure 11-4. Altitude Correction For Position Error

STORE DRAG COUNTS AND GROSS WEIGHTS

Store	Approximate Weight Lb/Each	Drag Count
300 Gal. - Aero 1A External Fuel Tank Full/Empty	1983/183	13
150 Gal. - Aero 1A External Fuel Tank Full/Empty	1043/143	8
ALE - 2 Chaff Dispenser	350	8
ALQ - 31 ECM Pod	1000	12
ALQ - 76 ECM Pod	600	12
ALQ - 89 ECM Pod	800	15

Figure 11-5. Store Drag Count and Gross Weight Table

ALTITUDE FEET	DENSITY RATIO $\sigma = \rho/\rho_o$	$\sqrt{\frac{1}{\sigma}}$	TEMPERATURE DEG. C	DEG. F	RATIO $\theta = T/T_o$	SPEED OF SOUND RATIO a/ao	PRESSURE IN. OF Hg	RATIO $\delta = P/P_o$
Sea Level	1.0000	1.0000	15.000	59.000	1.0000	1.000	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	.9931	.997	28.856	.9644
2000	.9428	1.0299	11.038	51.868	.9862	.993	27.821	.9298
3000	.9151	1.0454	9.056	48.302	.9794	.990	26.817	.8962
4000	.8881	1.0611	7.075	44.735	.9725	.966	25.842	.8637
5000	.8617	1.0773	5.094	41.169	.9656	.983	24.896	.8320
6000	.8359	1.0938	3.113	37.603	.9587	.979	23.978	.8014
7000	.8106	1.1107	1.132	34.037	.9519	.976	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	.9450	.972	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	.9381	.969	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	.9312	.965	20.577	.6877
11,000	.7156	1.1822	-6.793	19.772	.9244	.961	19.791	.6814
12,000	.6932	1.2011	-8.774	16.206	.9175	.958	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	.9106	.954	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	.9037	.951	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	.8269	.947	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	.8900	.943	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	.8831	.940	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	.8762	.936	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	.8694	.932	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	.8625	.929	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	.8556	.925	13.184	.4406
22,000	.4976	1.4176	-28.586	-19.456	.8487	.921	12.636	.4223
23,000	.4807	1.4424	-30.586	-23.022	.8419	.918	12.107	.4046
24,000	.4642	1.4678	-32.549	-26.588	.8350	.914	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	.8281	.910	11.104	.3711
26,000	.4325	1.5206	-36.511	-33.720	.8212	.906	10.627	.3552
27,000	.4173	1.5480	-38.493	-37.286	.8144	.902	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	.8075	.899	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	.8006	.895	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	.7937	.891	8.885	.2970
31,000	.3605	1.6854	-46.417	-51.551	.7869	.887	8.488	.2837
32,000	.3473	1.6968	-48.399	-55.117	.7800	.883	8.106	.2709
33,000	.3345	1.7291	-50.379	-58.683	.7731	.879	7.737	.2586
34,000	.3220	1.7623	-52.361	-62.249	.7662	.875	7.382	.2467
35,000	.3099	1.7964	-54.342	-65.816	.7594	.871	7.041	.2353
36,000	.2981	1.8315	-56.323	-69.382	.7525	.867	6.712	.2243
36,089	.2971	1.8347	-56.500	-69.700	.7519	.867	6.683	.2234
37,000	.2844	1.8753					6.397	.2138
38,000	.2710	1.9209					6.097	.2038
39,000	.2585	1.9677					5.811	.1942
40,000	.2462	2.0155					5.538	.1851
41,000	.2346	2.0645					5.278	.1764
42,000	.2236	2,1148					5.030	.1681
43,000	.2131	2,1662					4.794	.1602
44,000	.2031	2.2189					4.569	.1527
45,000	.1936	2.2728					4.355	.1455
46,000	.1845	2.3281					4.151	.1387
47,000	.1758	2.3848					3.956	.1322
48,000	.1676	2.4428					3.770	.1260
49,000	.1597	2.5022					3.593	.1201
50,000	.1522	2.5630					3.425	.1145
51,000	.1451	2.6254					3.264	.1091
52,000	.1383	2.6892					3.111	.1040
53,000	.1318	2.7546					2.965	.0991
54,000	.1256	2.8216					2.826	.0944
55,000	.1197	2.8903					2.693	.0900
56,000	.1141	2.9606					2.567	.0858
57,000	.1087	3.0326					2.446	.0818
58,000	.1036	3.1063					2.331	.0779
59,000	.09877	3.1819					2.222	.0743
60,000	.09414	3.2593					2.118	.0709
61,000	.08972	3.3386					2.018	.0675
62,000	.08551	3.4198					1.924	.0643
63,000	.08150	3.5029					1.833	.0613
64,000	.07767	3.5881					1.747	.0584
65,000	.07403	3.6754	-56.500	-69.700	.7519	.867	1.665	.0557

REMARKS:

(1) ONE INCH OF Hg = 70.732 LB/SQ FT
= 0.4912 LB/SQ IN.

(2) ICAO STANDARD SEA LEVEL AIR
t_o = 15°C
P_o = 29.921 IN. OF Hg
a_o = 661.8 KNOTS
ρ_o = .0023769 SLUGS/CU FT

DATA BASIS: NACA Technical Note No. 3182

Figure 11-6. ICAO Standard Altitude Chart

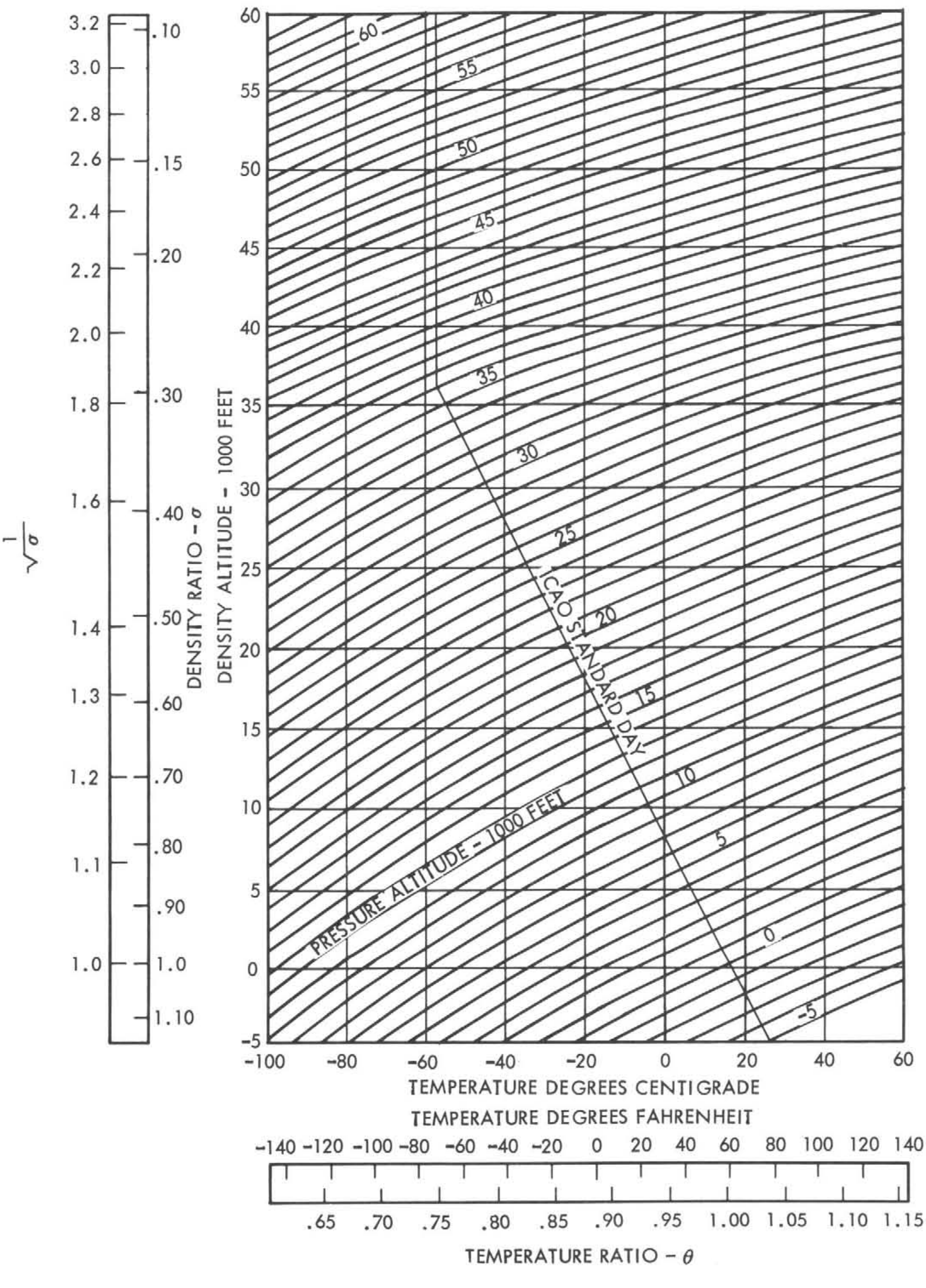


Figure 11-7. Density Altitude Chart

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 11-8. Centigrade/Fahrenheit Conversion

PART 2

TAKEOFF

Table of Contents

STALL SPEEDS

The stall speeds for gear and flaps up, gear down with half flaps, and gear down with full flaps are given in figure 11-9. These charts cover a range of power settings from 100% RPM to idle. Recommended approach and takeoff speeds are also given in these charts to show their relation to stall speeds.

TAKEOFF DISTANCE

Figures 11-10 and 11-11, Take-off Distance, present the takeoff performance of the airplane in respect to ground roll distance as a function of ambient air temperature, airfield pressure altitude, gross weight, and headwind. Data are presented in figure 11-10 for a normal takeoff with half flaps, and in figure 11-11 for a minimum run takeoff with full flaps. Note that the total distance required to clear a 50-foot obstacle is presented below the ground roll distance on figure 11-10, for half flaps. This distance can also be determined by multiplying the ground roll distance obtained in figure 11-10, by a factor of 1.3.

The takeoff speeds are shown with their corresponding weights in the takeoff distance charts. They may also be found in the stall speed chart, figure 11-9. The takeoff speed may be obtained by multiplying the takeoff stall speed by 1.05. The airspeed over a 50-foot obstacle is the stall speed multiplied by 1.2.

The takeoff charts give no specific indication of the external drag items loaded aboard the aircraft for a given gross weight, since takeoff distance is not significantly affected by this factor. At each gross weight, however, an increase in drag due to an external loading compatible with that weight has been incorporated into the takeoff data.

Takeoff consists of acceleration to 1.05 stall speed, followed by rotation to takeoff attitude. At lift-off, a constant attitude was maintained and the aircraft was allowed to accelerate to 1.2 stall speed. The remaining portion of the climb to clear the 50-foot obstacle was made at a constant airspeed of 1.2 stall speed.

Sample Problem. Assume that a half flaps field takeoff is to be made under the following conditions: a takeoff weight of 26,000 pounds, 20°C ambient air temperature, 1000 feet pressure altitude, and a 20-knot headwind. Refer to figure 11-10, Half Flaps Takeoff Distance, and perform the following:

a. Enter the altitude chart located in the upper left-hand corner of the page at 20°C air temperature and move vertically upward to the 1000 foot pressure altitude line.

b. Move horizontally to the right to the 26,000 pound gross weight line on the gross weight portion of the chart. Note that the recommended takeoff speed for 26,000 pounds is 113 knots.

c. Move vertically downward to the air temperature chart, and then follow the guide line to the intersection of the 20°C temperature line. At the intersection of the 20°C line, move vertically downward to the headwind chart.

d. Follow parallel to the guide lines on the headwind chart to the 20-knot headwind line. At the intersection of the 20-knot line, move vertically downward to read the ground roll distance. The ground roll distance in this example is 2700 feet.

e. The total distance to clear a 50-foot obstacle may be found by projecting a line vertically downward from the value obtained for ground roll distance. This figure may also be obtained by multiplying the ground roll distance by 1.3. The total distance to clear a 50-foot obstacle in this example is 3500 feet.

MODEL: EF-10B
ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: NAVY FLIGHT TESTS

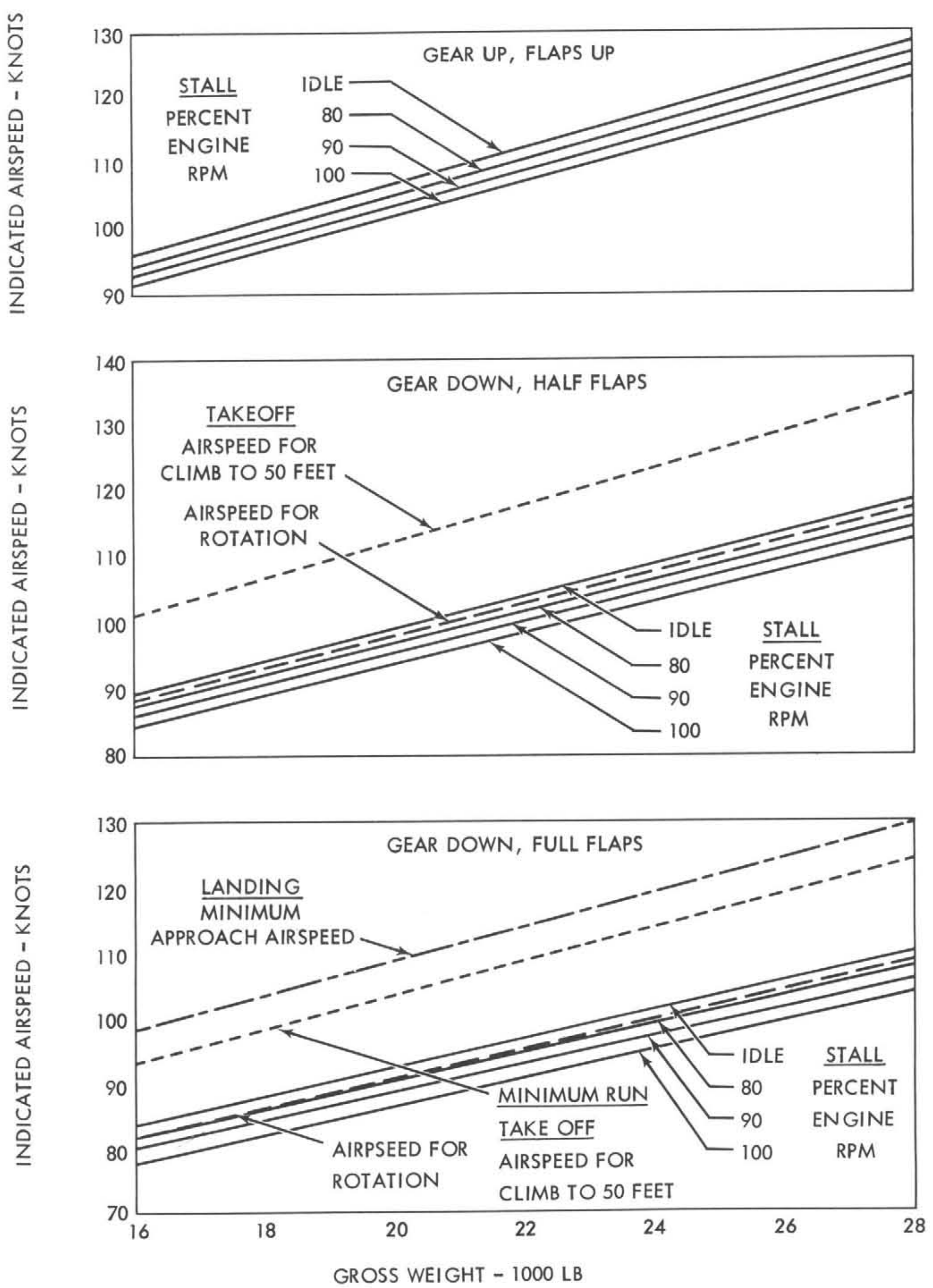


Figure 11-9. Stall Speeds

TAKEOFF DISTANCE
HALF FLAPS

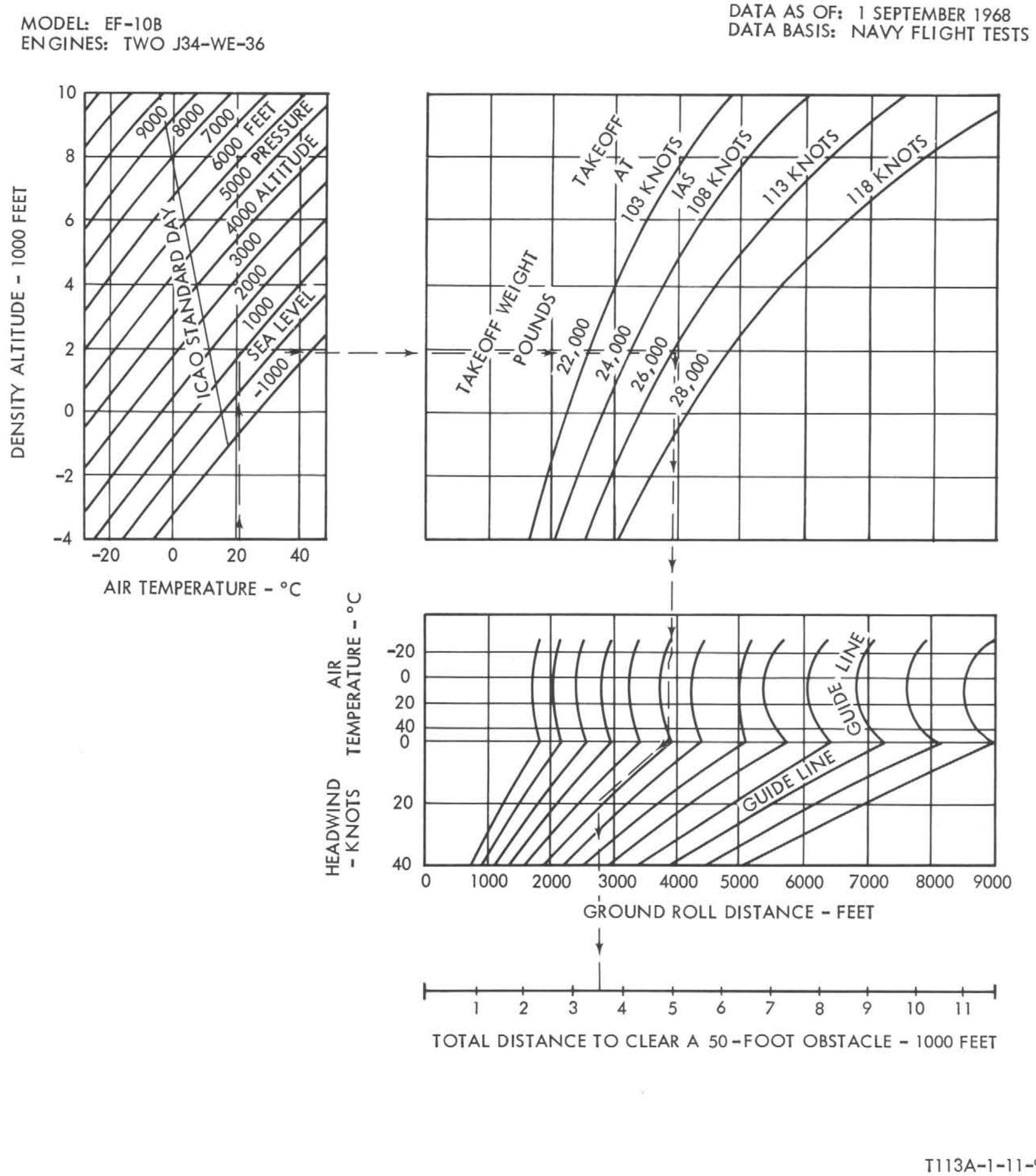


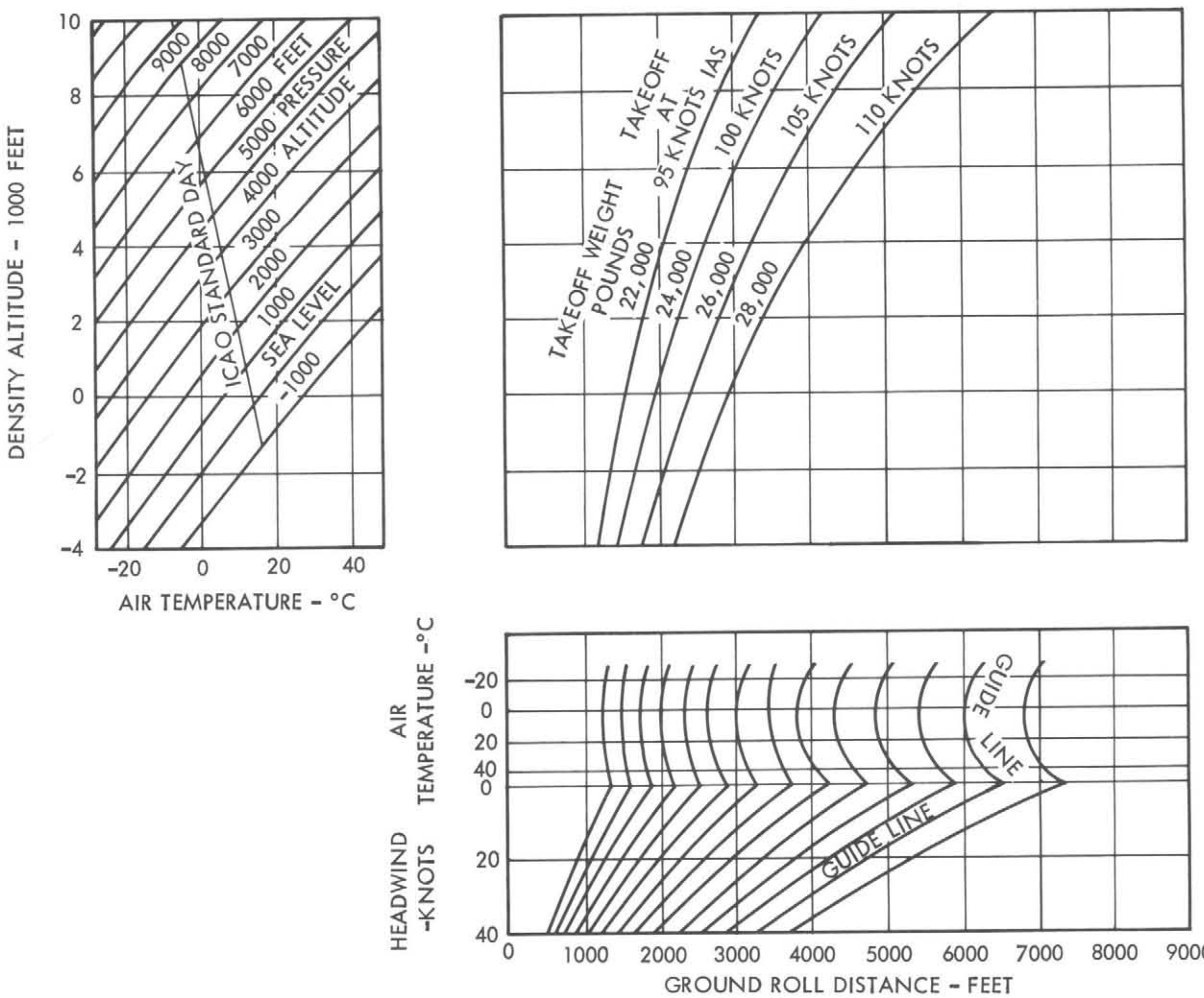
Figure 11-10. Takeoff Distance

TAKEOFF DISTANCE

FULL FLAPS

MODEL: EF-10B
ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: NAVY FLIGHT TESTS



T113A-1-11-10

Figure 11-11. Takeoff Distance

PART 3

CLIMB

Climb Performance for military power climbs are presented in figures 11-12, 11-13, 11-14, and 11-15. The fuel consumed during climb, the time required to climb, and recommended climb speed schedule may be obtained from these charts. In addition, these charts allow correction for temperature variations from standard day conditions (15°C at sea level). Also included in this section are data for two engine cruise ceiling and single engine service ceiling.

Each climb chart contains data for gross weights up to 28,000 pounds and an altitude of 35,000 feet. This weight - altitude range should cover the present operational environment of the aircraft. Although no drag effects are shown in these charts, the increased drag associated with higher climb weights has been accounted for by adjusting the climb data. The drag effects on climb are relatively small for the altitude given in the climb charts.

The climb charts are presented at military power, since a climb at military power to a given altitude requires less fuel than a climb at normal power to the same altitude. The time to climb is also substantially reduced by using military power. The climb schedule associated with the climb data contained in this section is given in figure 11-12. While it is desirable to climb at the recommended airspeeds given in this schedule, flight test data has shown a 20-knot variation either above or below the recommended airspeed will not significantly affect the climb performance.

Two engine cruise ceiling and single engine service ceiling are given in figure 11-16. Although the aircraft will not ordinarily operate at these altitudes, the chart is presented for information.

Sample Problem. Assume that a climb is to be made from sea level to 30, 000 feet. The aircraft weight (including external stores) is 26, 000 pounds and the outside air temperature is 30°C. The fuel, time, and distance to climb under these conditions are required.

a. Fuel to Climb - Enter the Fuel Used Chart, figure 11-13, at the initial climb weight of 26, 000 pounds and move horizontally to the left until the 30, 000 foot altitude line is intersected. At this intersection move vertically downward to the temperature baseline. (Since the outside temperature in this problem is 30°C, a 15° temperature correction is necessary.) At the baseline intersection, move downward, parallel to the guidelines until the °C = 15 line is reached. At this line, move vertically downward to read the fuel used. In this problem the fuel required will be 1620 pounds.

b. Distance to Climb - The procedure used to read the Distance to Climb Chart, figure 11-14, is the same as that outlined above. In this problem the distance will be 103 nautical miles.

c. Time to Climb - The procedure used to read the Time to Climb Chart, figure 11-15, is the same as that outlined above. In this problem the time will be 20. 0 minutes.

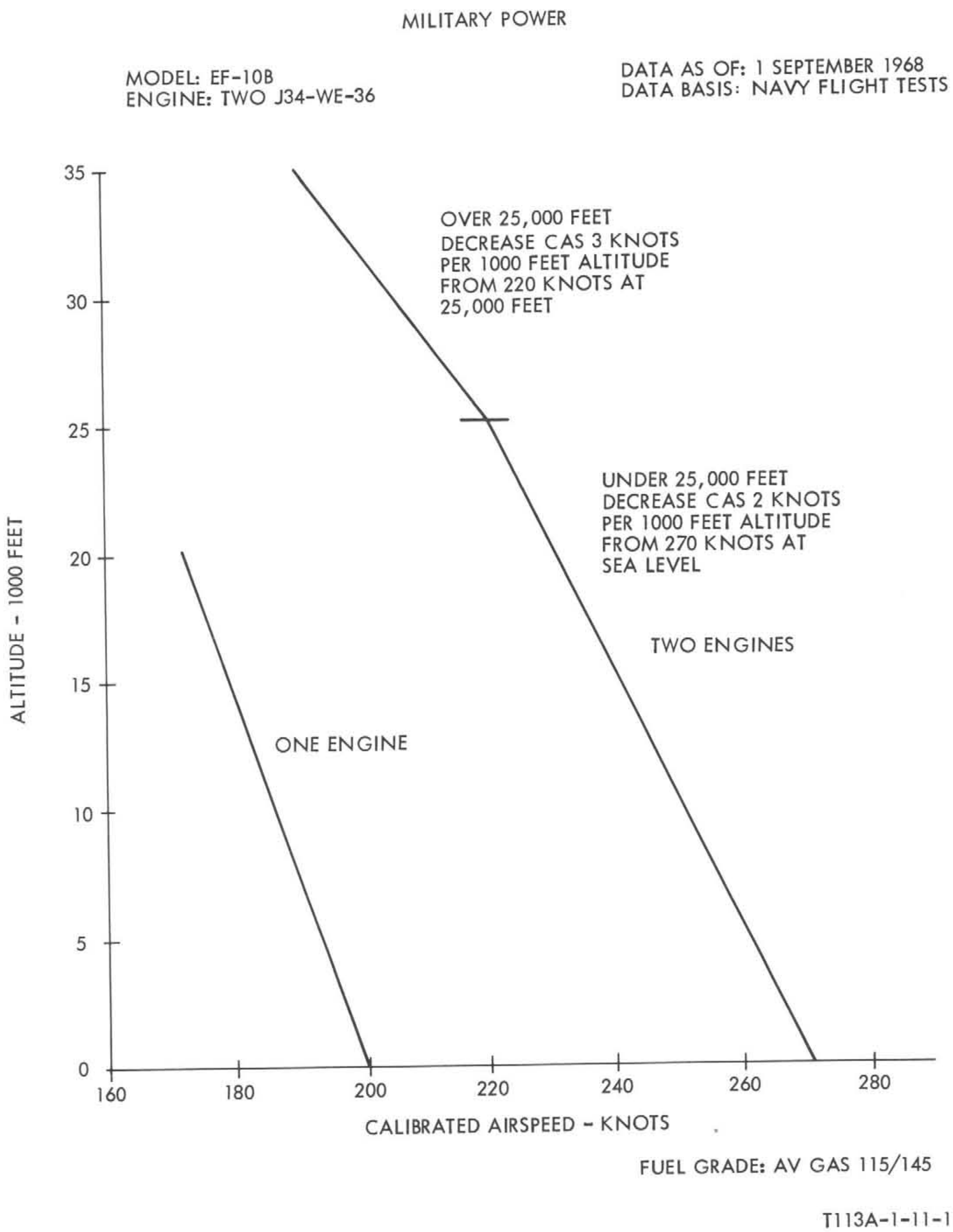


Figure 11-12. Climb Speed Schedule

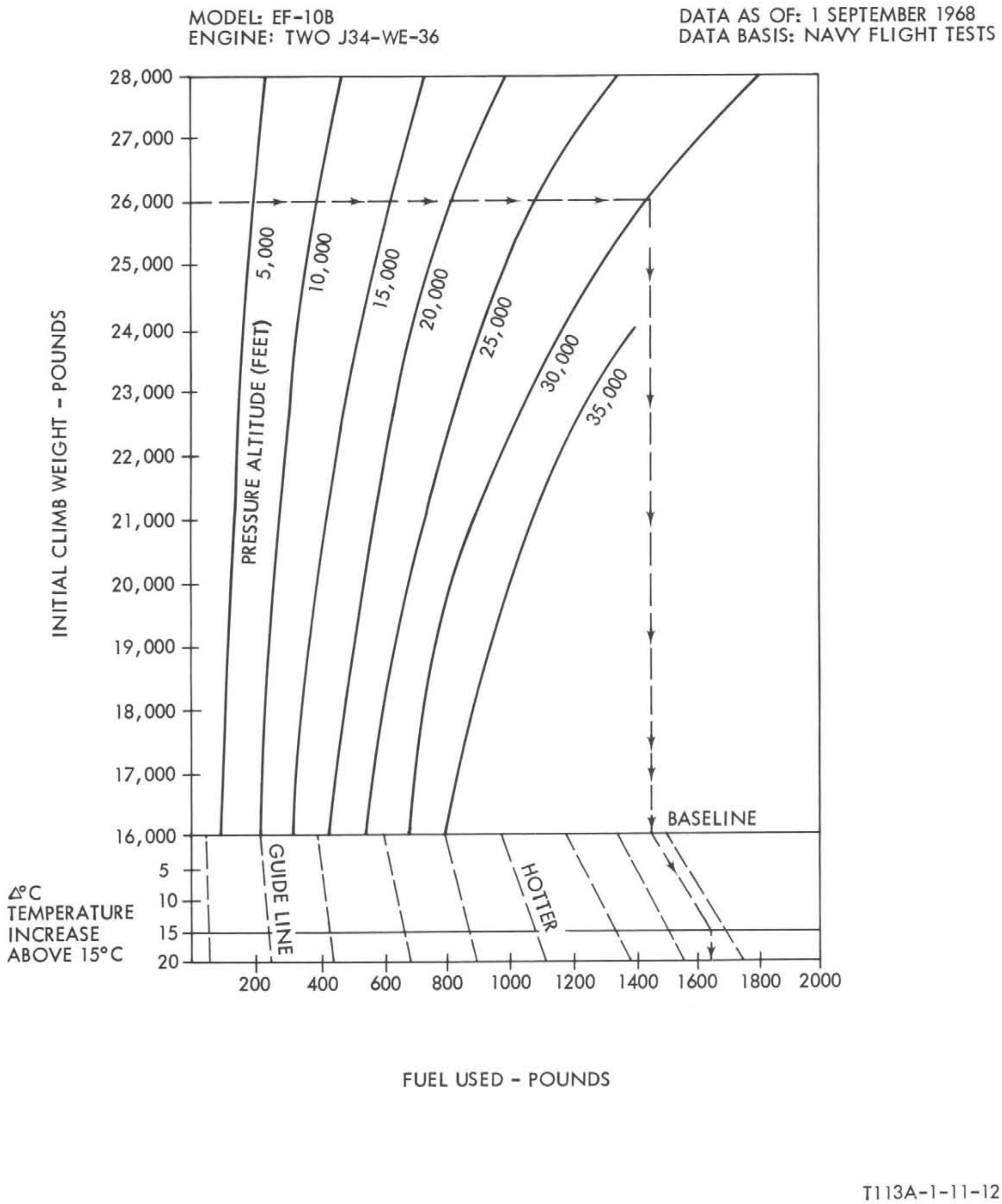
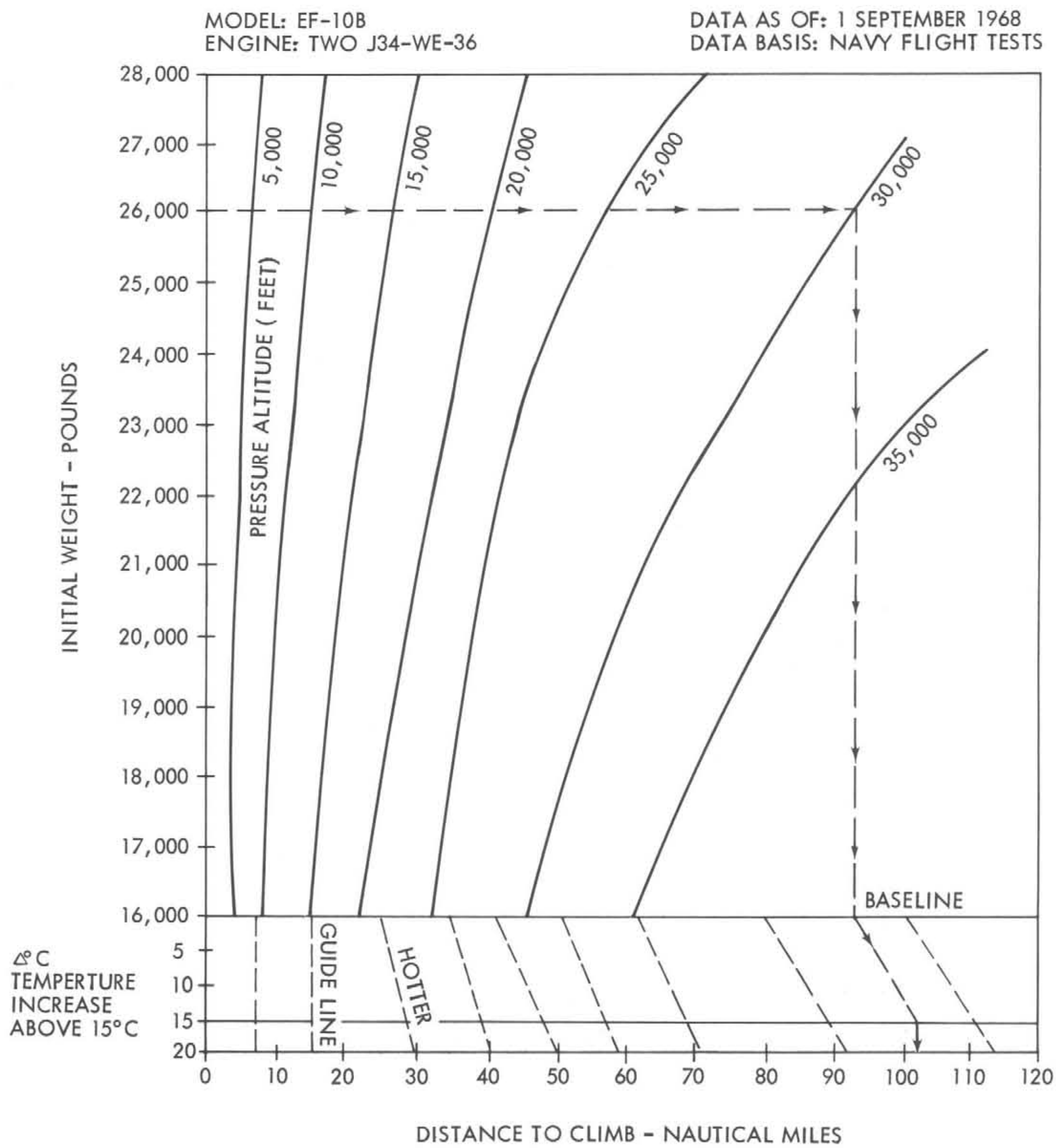


Figure 11-13. Military Thrust Climb - Fuel Used

MILITARY THRUST CLIMB



T113A-1-11-13

Figure 11-14. Distance to Climb

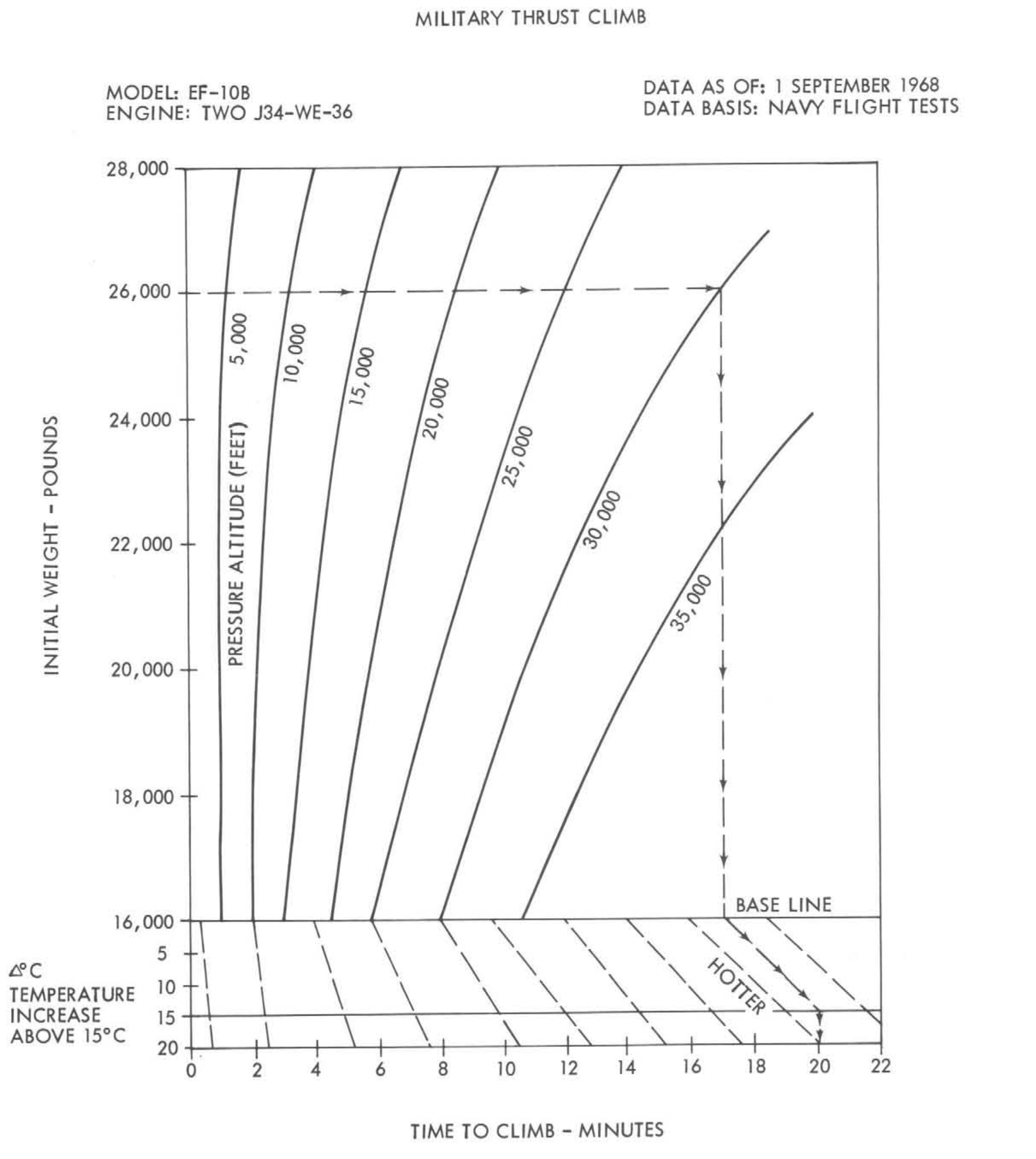
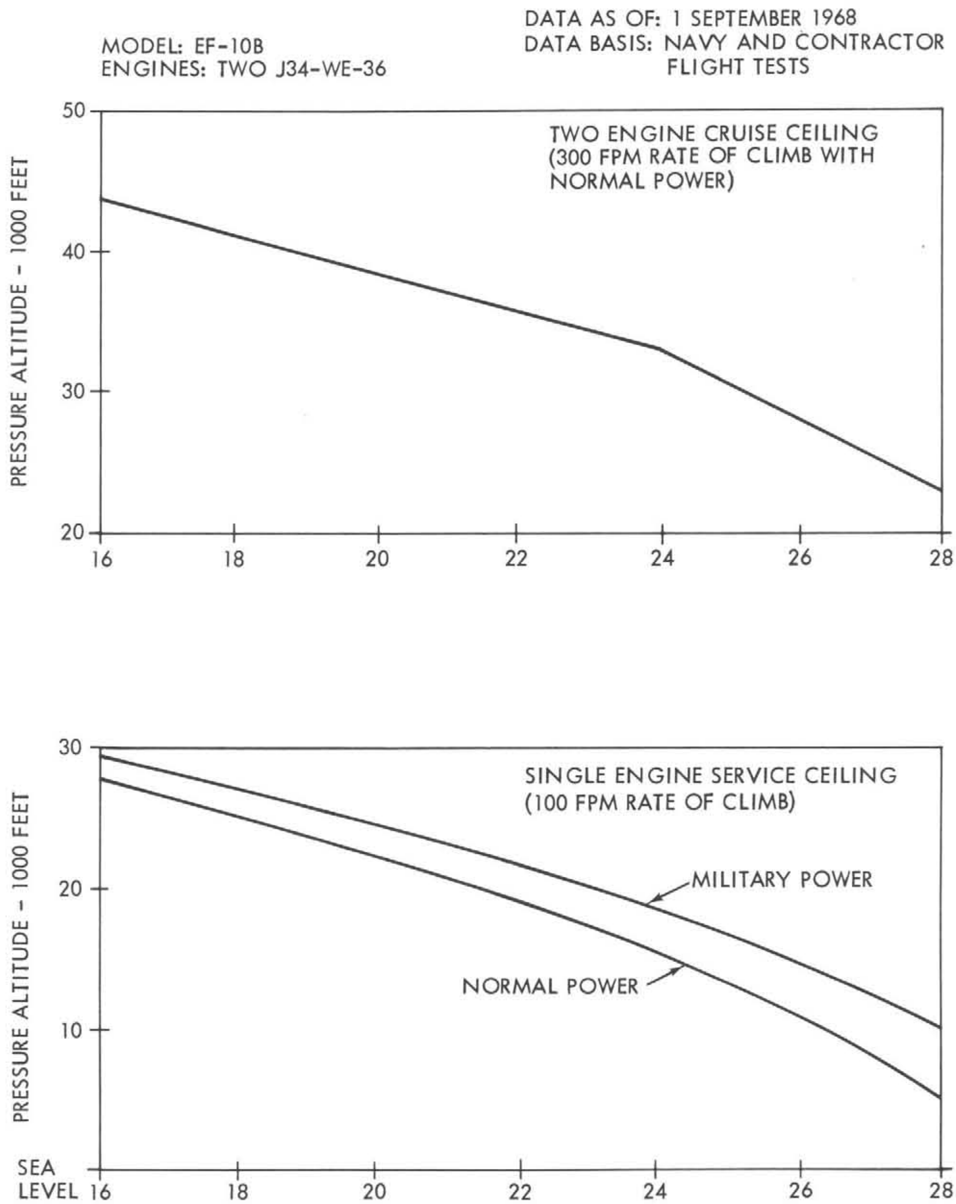


Figure 11-15. Time to Climb



T113A-1-11-15

Figure 11-16. Two Engine Cruise and Single Engine Service Altitudes

PART 4

RANGE

Table of Contents

GENERAL

This section contains charts to determine the specific range, airspeed, and fuel flow for all EF-10B flight conditions. Figure 11-17 is a generalized chart to determine the maximum range fuel flow at a constant altitude. Figures 11-18 through 11-39 present the specific range data, while figures 11-40 through 11-43 are the Bingo Charts for the aircraft.

MAXIMUM RANGE AT CONSTANT ALTITUDE

Figure 11-17 presents the maximum range cruise data for constant altitude. Use of this chart enables determination of specific fuel consumption, fuel flow, and fuel required for a given cruise time interval. These data are presented in such a manner that any drag count can be used with the charts.

Sample Problem. Assume that an aircraft with a drag count of 25 and an average cruise weight of 24,500 pounds is to cruise at 18,000 feet. The maximum range true airspeed is determined by interpolating between the 15,000 foot and 20,000 foot charts of figures 11-28 and 11-29. Using both these figures, a true airspeed of 320 knots is determined. The data for the sample problem can be obtained from figure 11-17 in the following manner:

a. Enter the upper left-hand chart at a gross weight of 24,500 pounds and move horizontally right until the 18,000 foot altitude line is intersected.

b. At this intersection, move vertically downward to the 25 drag count line. At this intersection move horizontally to the right to read the specific fuel consumption. In this example, the value is read as 9.5 pounds of fuel per nautical mile.

c. Continue to the right until the maximum range true airspeed of 320 knots is intersected. Move vertically upward to read the fuel flow of 3150 pounds per hour.

d. If a desired cruise time of 40 minutes is required, move vertically to the intersection of the 40-minute line. At this intersection move horizontally to the left and read a fuel required of 2100 pounds.

SPECIFIC RANGE CHARTS

Figures 11-18 through 11-24 present the two engine specific range for a drag count of 0. Figures 11-25 to 11-31 present these data for a drag count of 25. Single engine cruise data are presented in figures 11-32 through 11-39.

The specific range charts present complete cruise performance for maximum range airspeeds and maximum endurance airspeeds. Specific range (nautical miles per pound of fuel), calibrated airspeeds, true airspeeds, Mach numbers, fuel flow, and engine RPM may be obtained from these charts. The use of these charts entails selecting the proper altitude and drag count, and entering the appropriate chart to determine the desired flight condition.

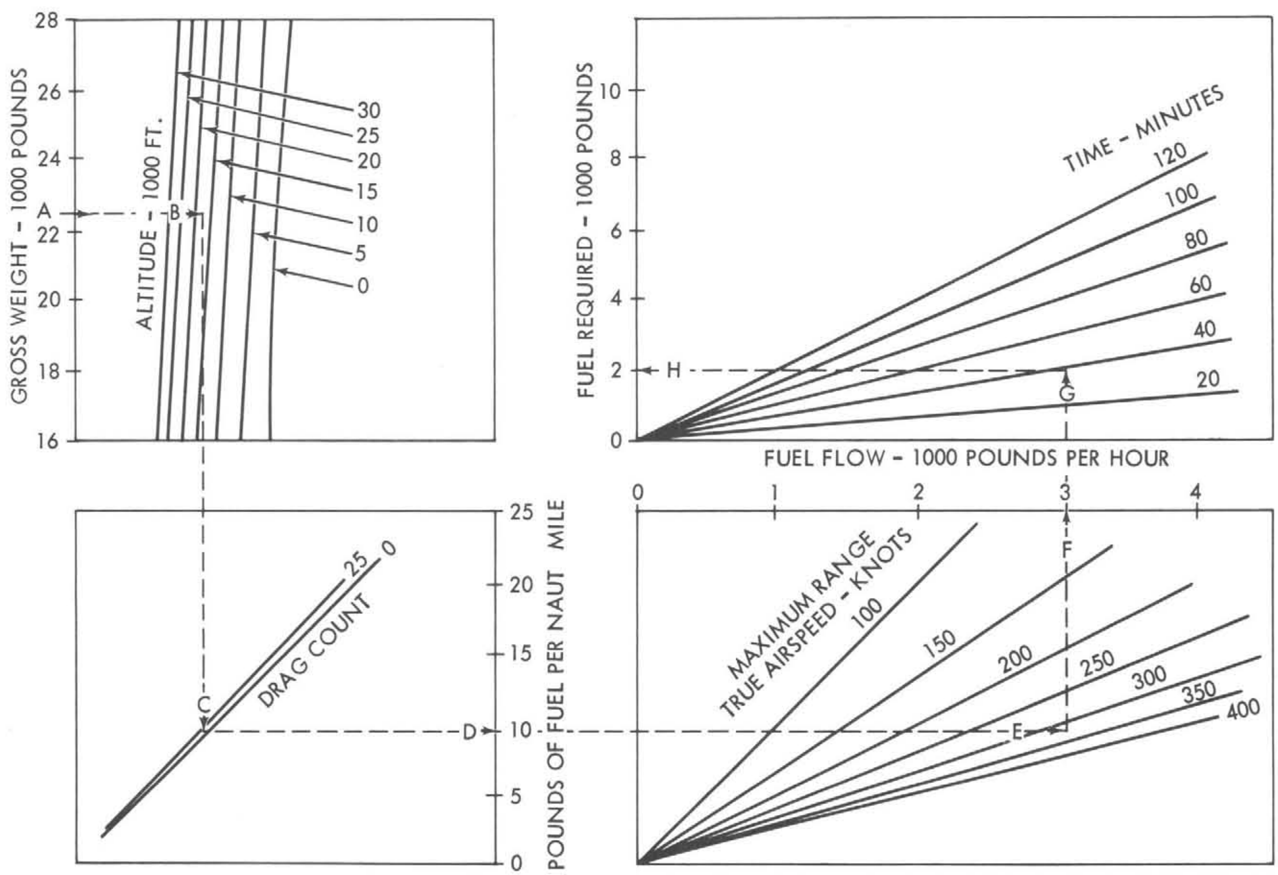
For values of altitude and drag count which lie between those given by the charts, a linear interpolation is necessary. Cruise performance at maximum endurance or maximum range airspeeds is dependent largely upon the cruise airspeed, and therefore it is recommended that the CAS shown be maintained. The fuel flows and power settings given in the charts correspond to a given airspeed. A line is shown on each chart for the recommended maximum range airspeed. Maximum endurance lines are also shown in these figures, but figure 11-44, Maximum Endurance Fuel, is more concise.

BINGO RANGE CHARTS

The two engine Bingo Range Charts are given in figure 11-40 for zero drag count and figure 11-41 for a drag count of 25. Single engine Bingo Range is given in figures 11-42 and 11-43. For drag counts between 0 and 25, interpolation is necessary.

MODEL: EF-10B
ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: NAVY FLIGHT TESTS



T113A-1-11-16

Figure 11-17. Maximum Range Cruise at Constant Altitude

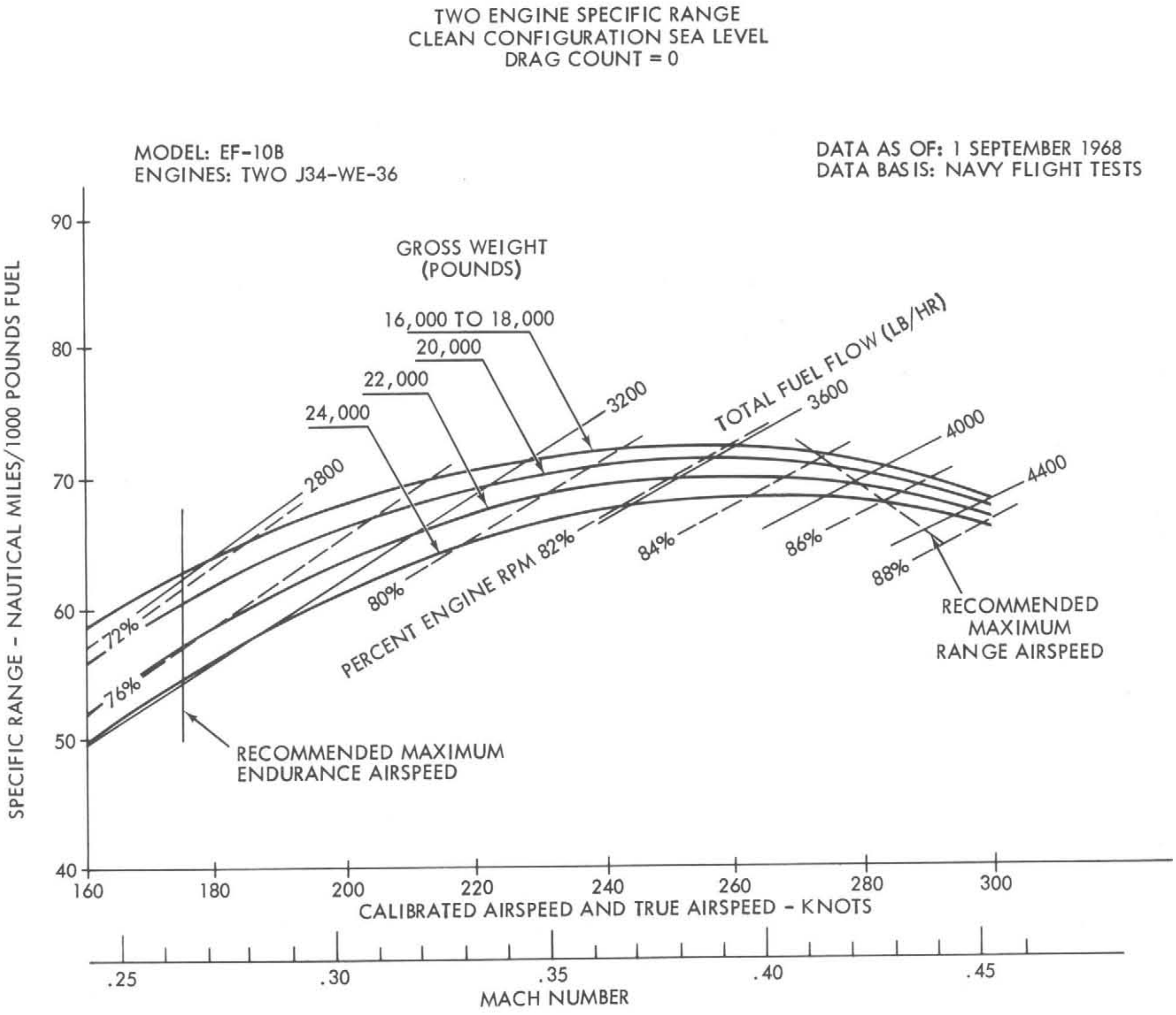
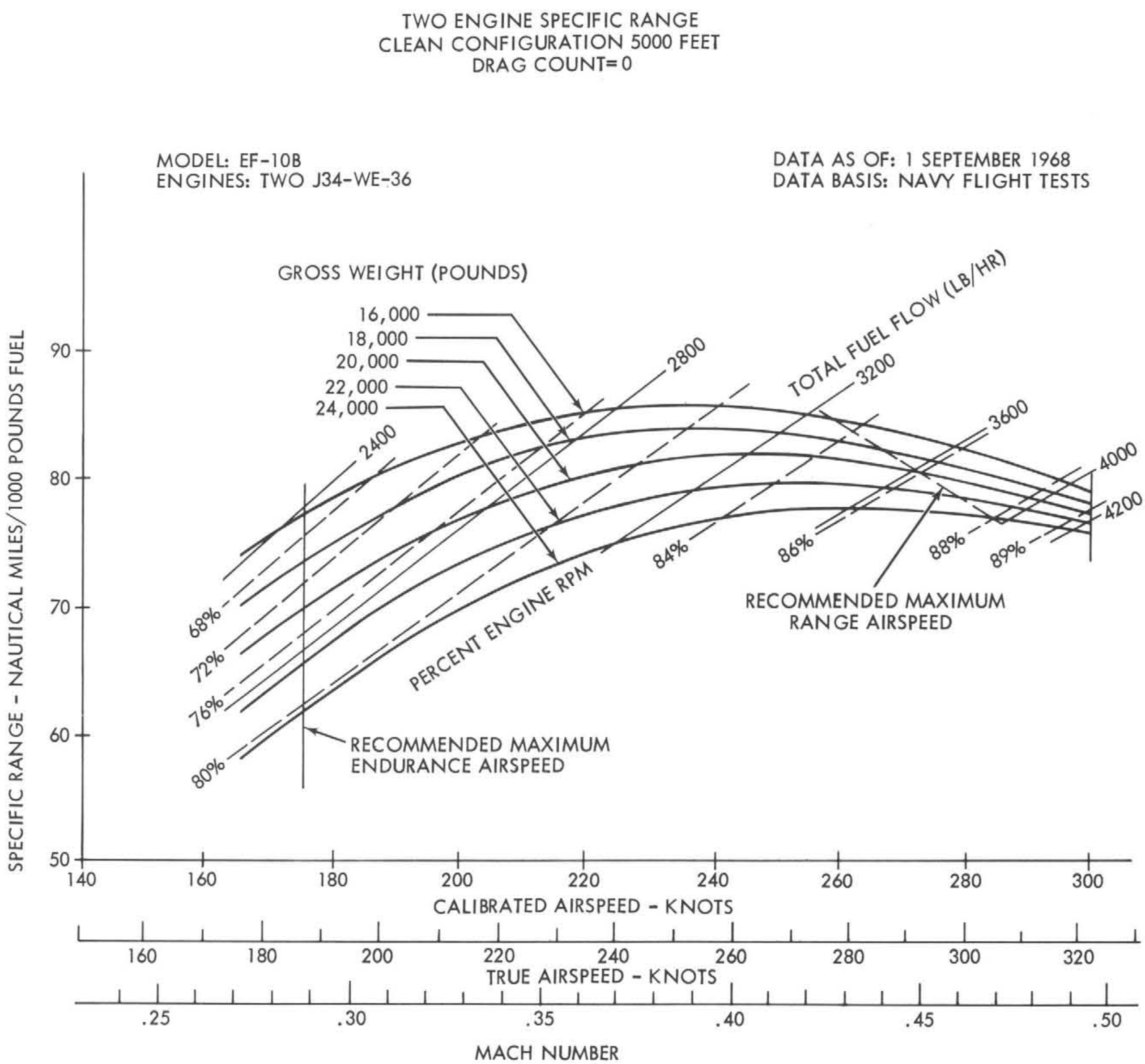


Figure 11-18. Two Engine Specific Range at Sea Level - Drag Count = 0



T113A-1-11-18

Figure 11-19. Two Engine Specific Range at 5000 Feet - Drag Count = 0

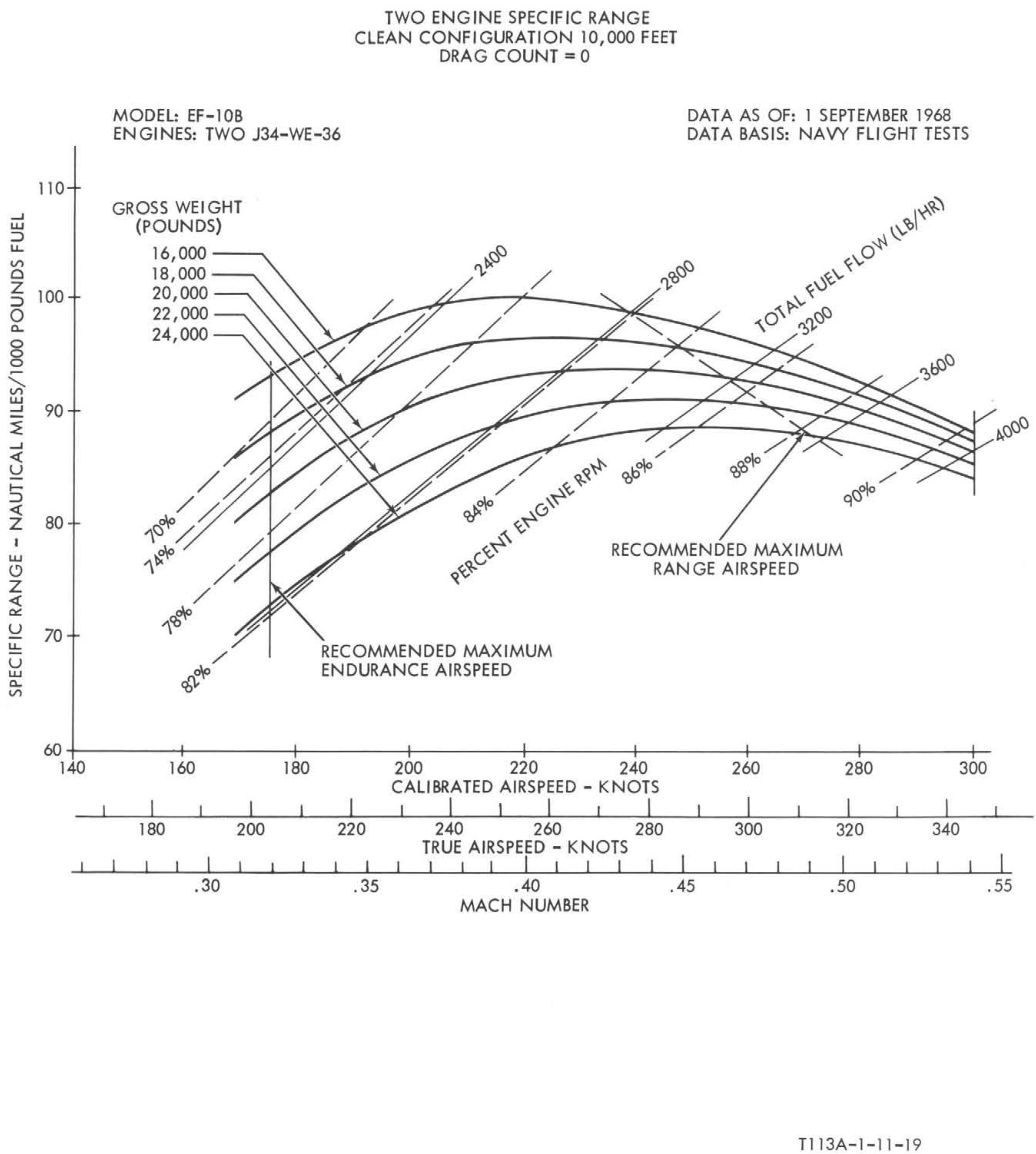
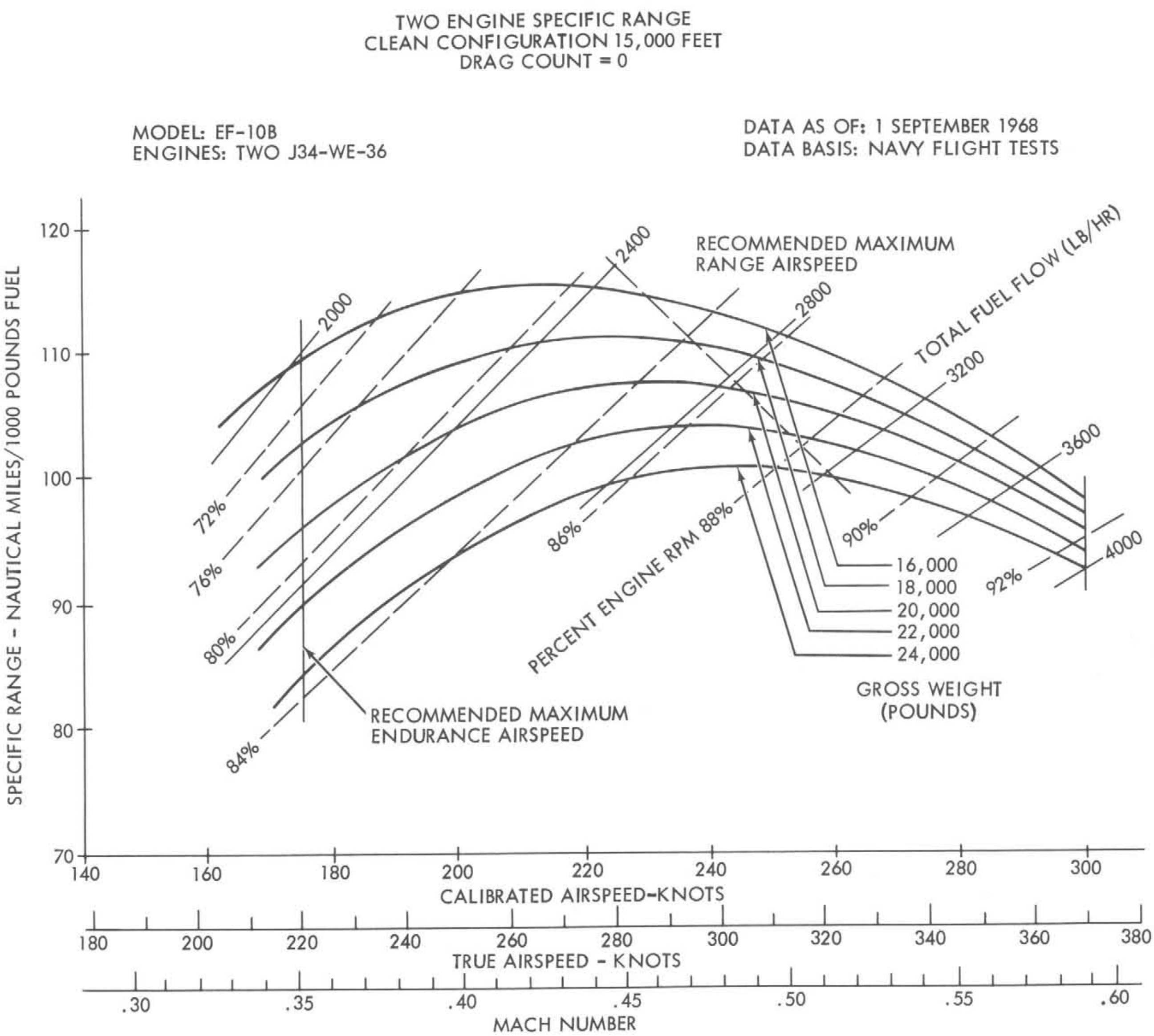
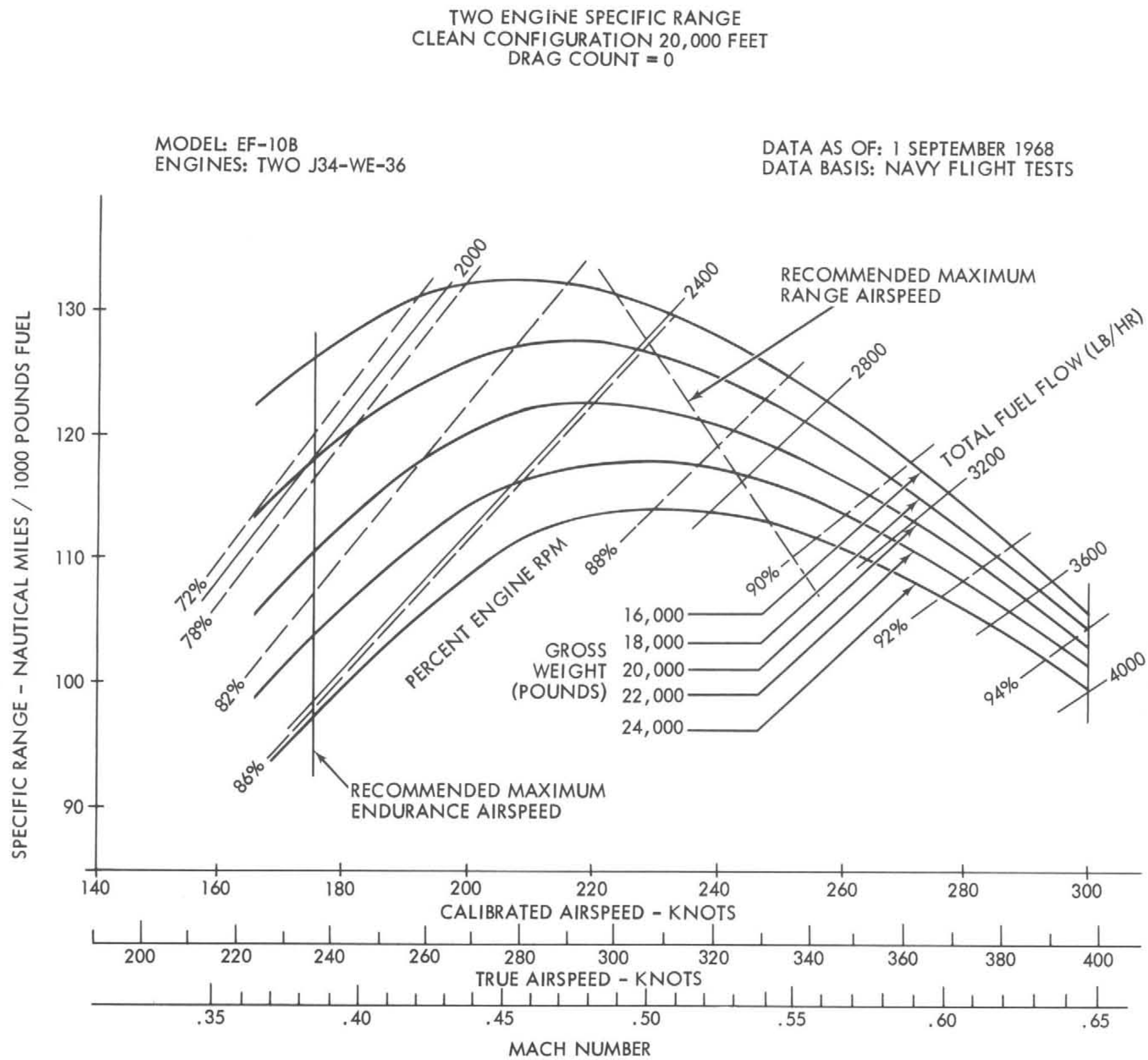


Figure 11-20. Two Engine Specific Range at 10,000 Feet - Drag Count = 0



T113A-1-11-20

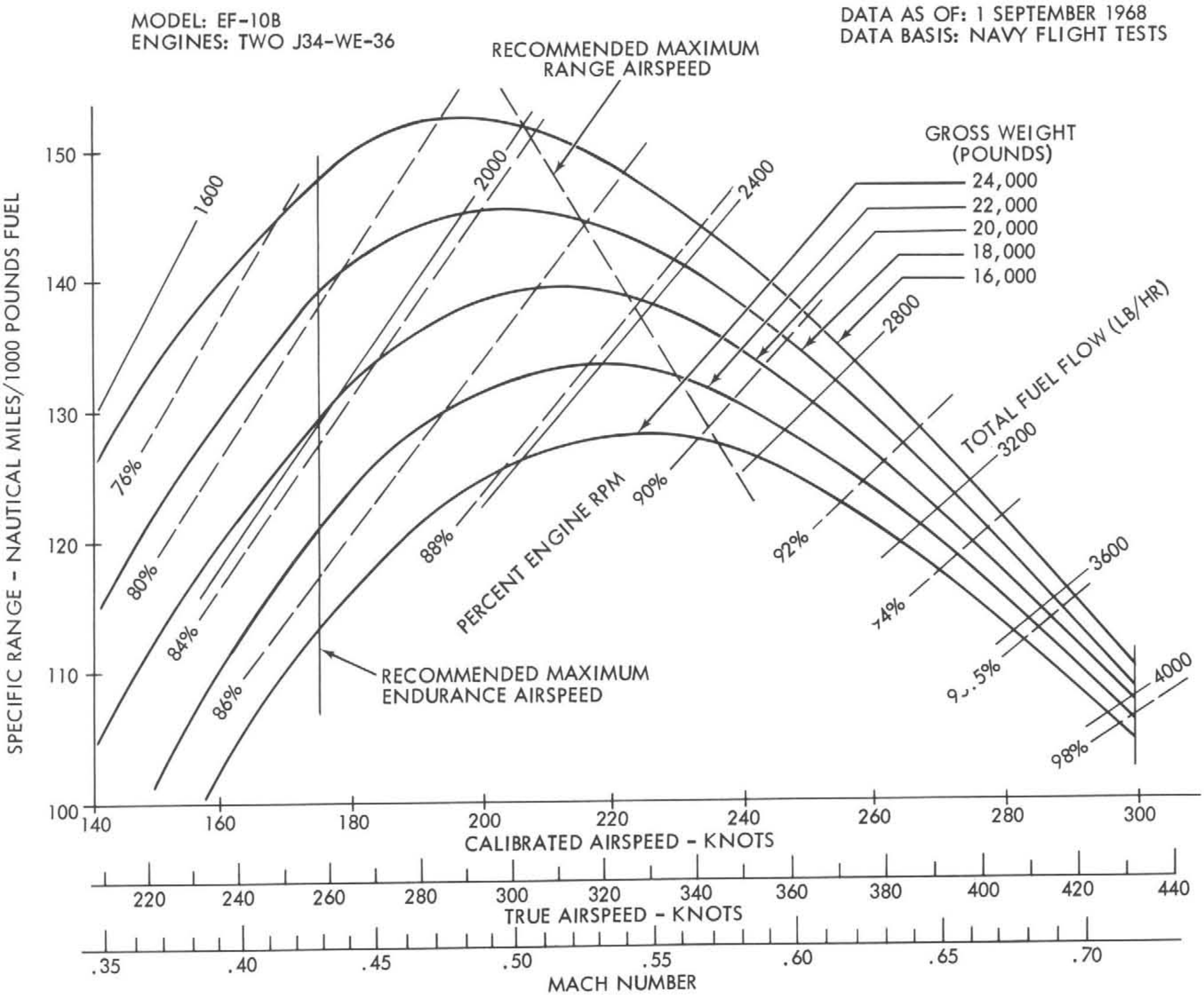
Figure 11-21. Two Engine Specific Range at 15,000 Feet - Drag Count = 0



T113A-1-11-21

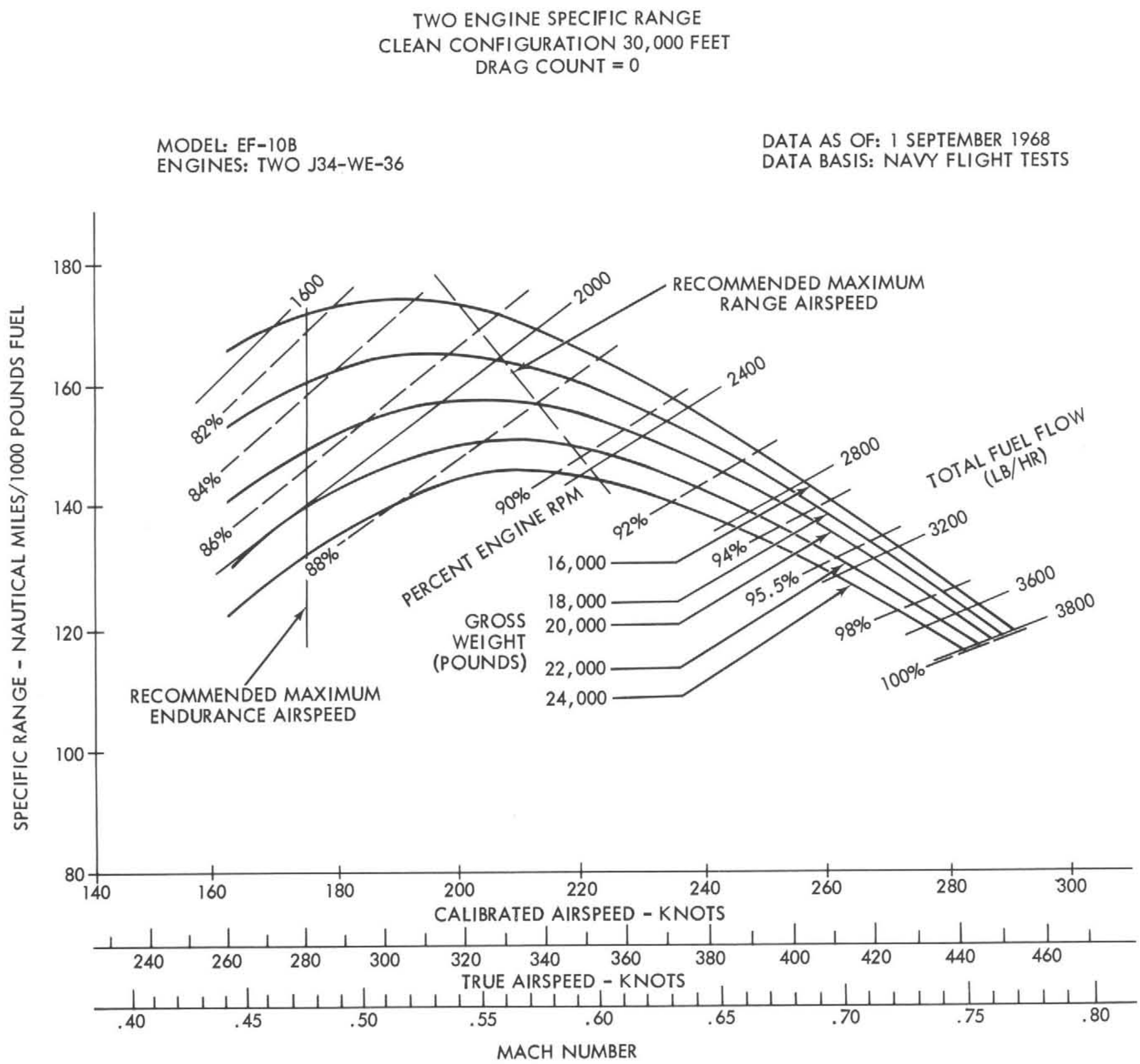
Figure 11-22. Two Engine Specific Range at 20,000 Feet - Drag Count = 0

TWO ENGINE SPECIFIC RANGE
CLEAN CONFIGURATION 25,000 FEET
DRAG COUNT = 0



T113A-1-11-22

Figure 11-23. Two Engine Specific Range at 25,000 Feet - Drag Count = 0



T113A-1-11-23

Figure 11-24. Two Engine Specific Range at 30,000 Feet - Drag Count = 0

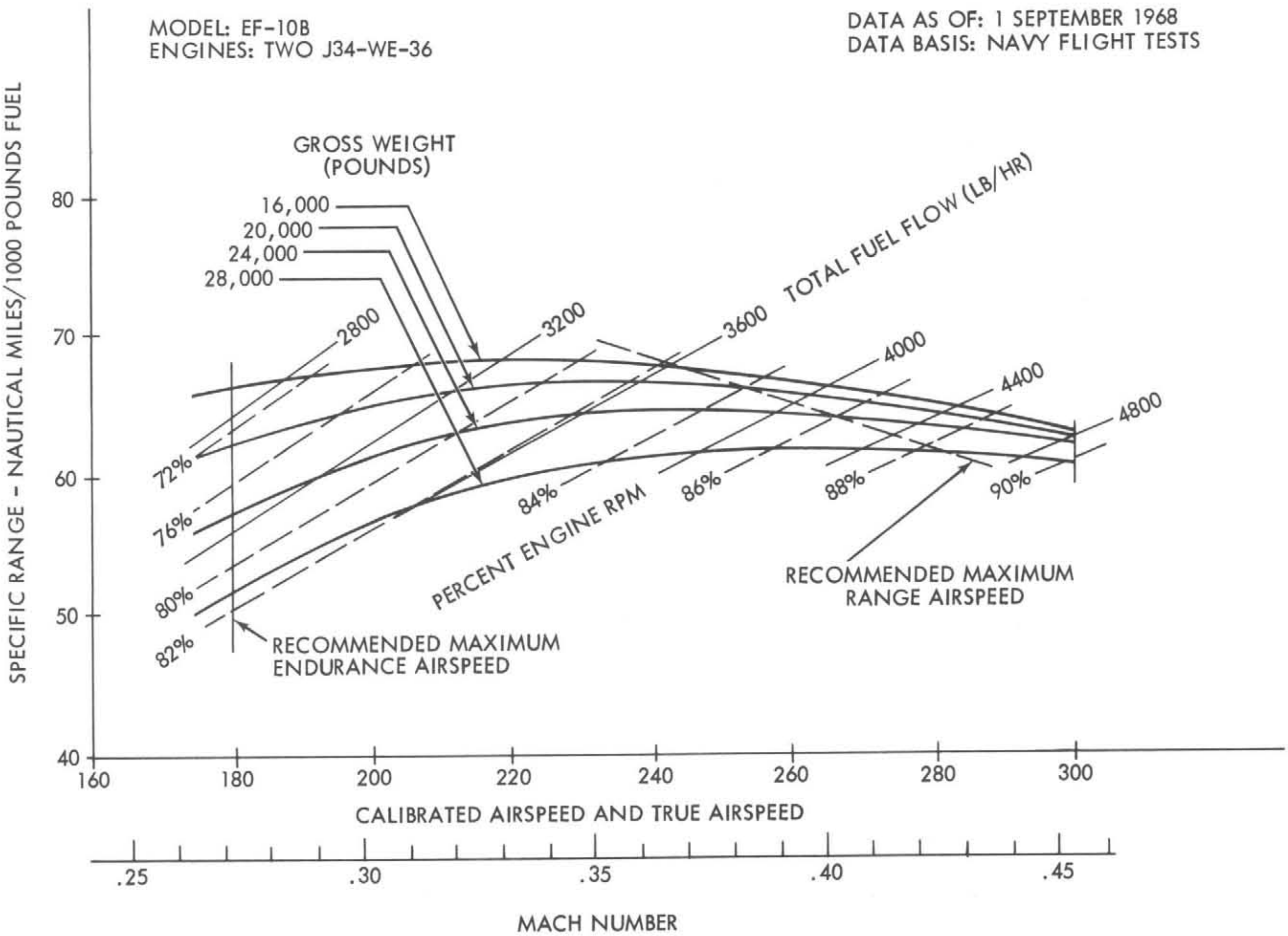
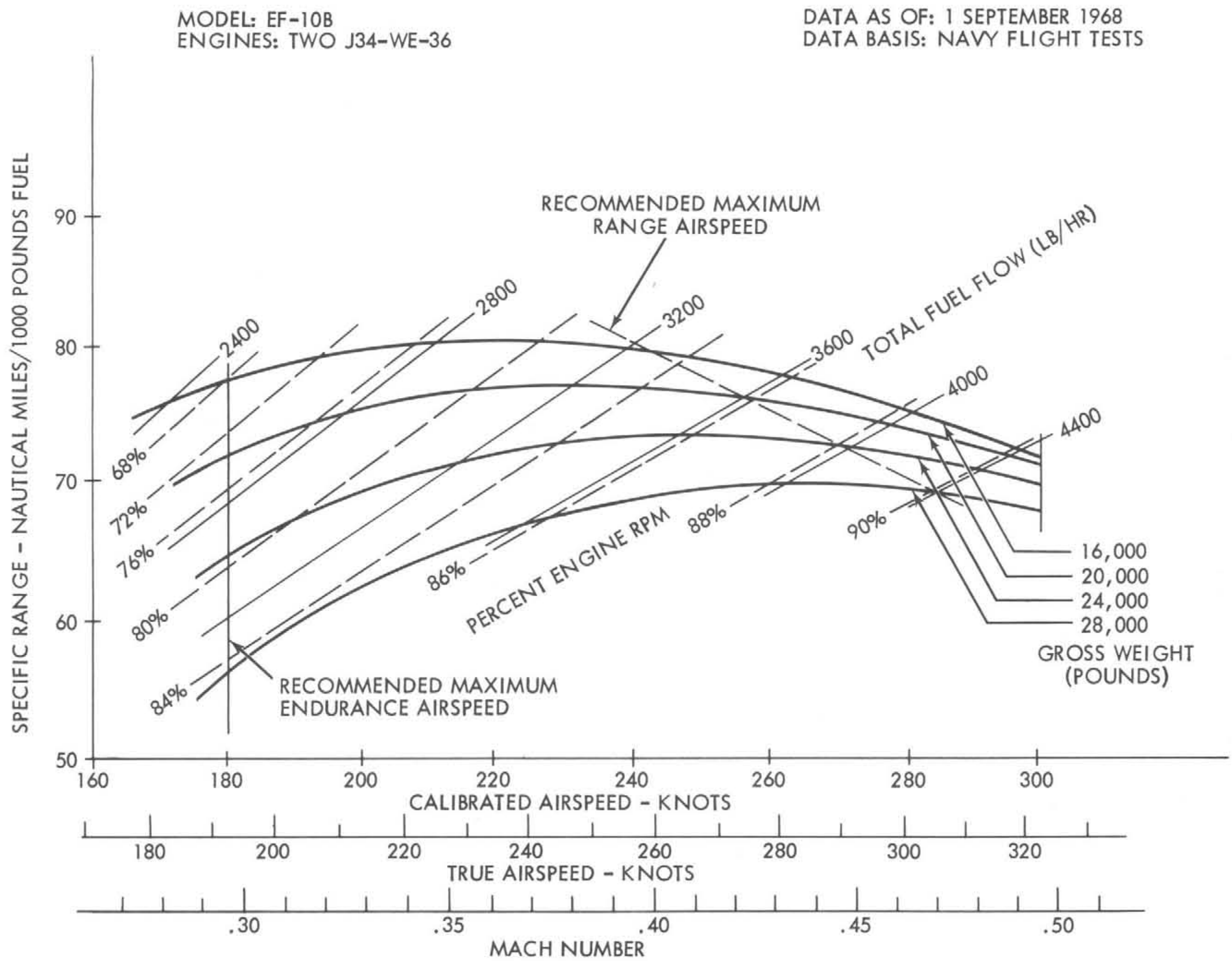


Figure 11-25. Two Engine Specific Range at Sea Level - Drag Count = 25



T113A-1-11-25

Figure 11-26. Two Engine Specific Range at 5000 Feet - Drag Count = 25

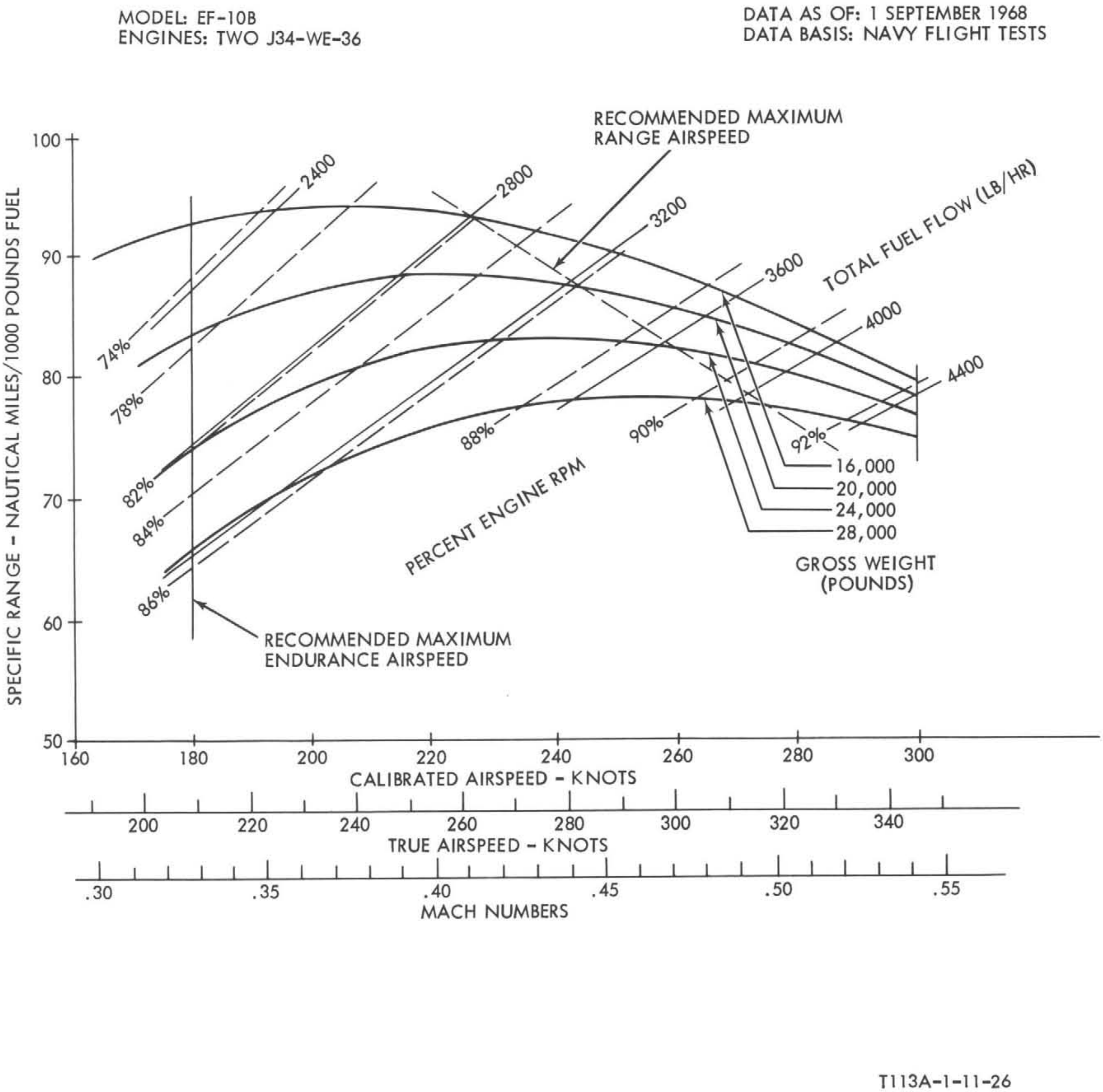


Figure 11-27. Two Engine Specific Range at 10,000 Feet - Drag Count = 25

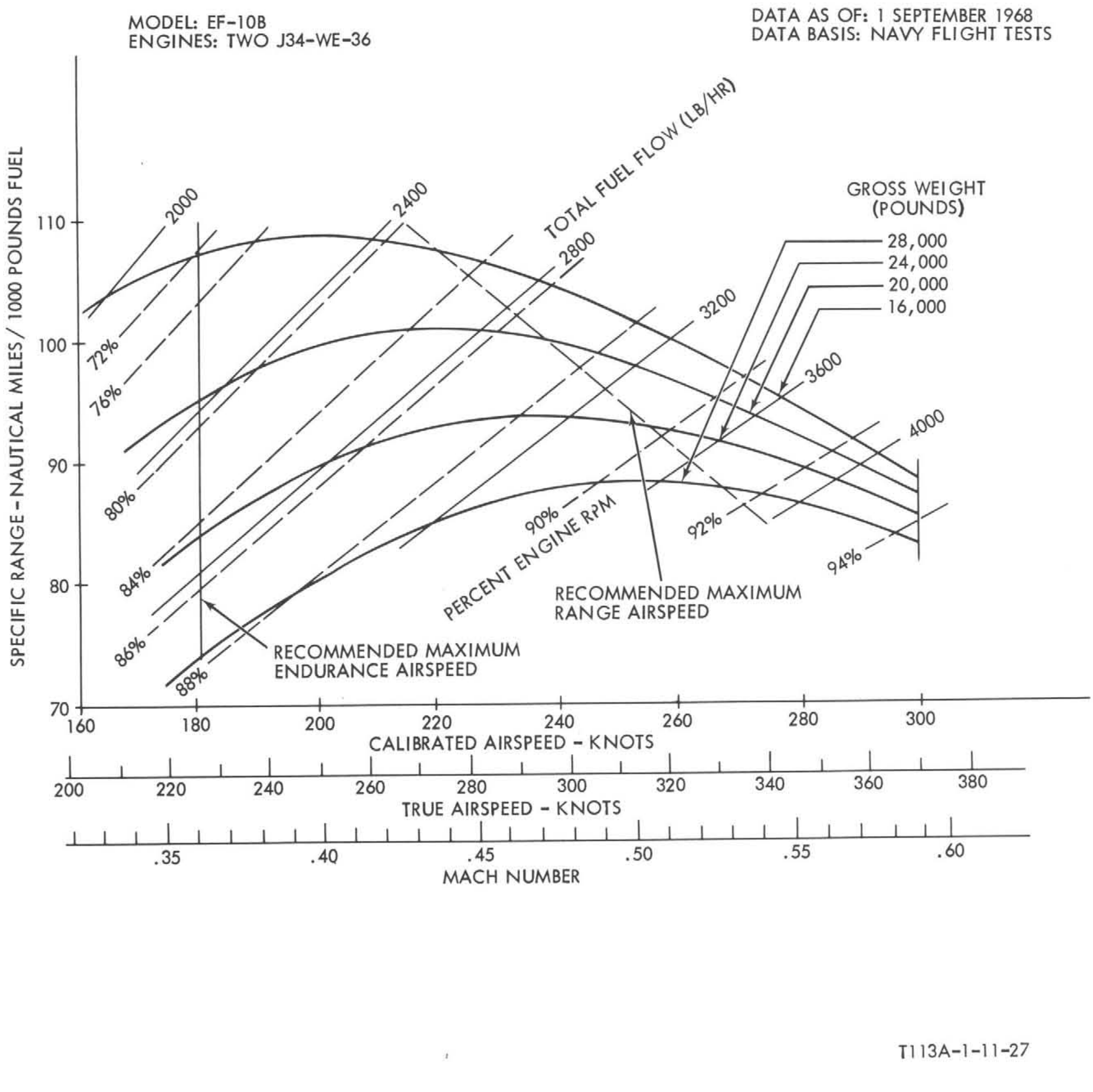
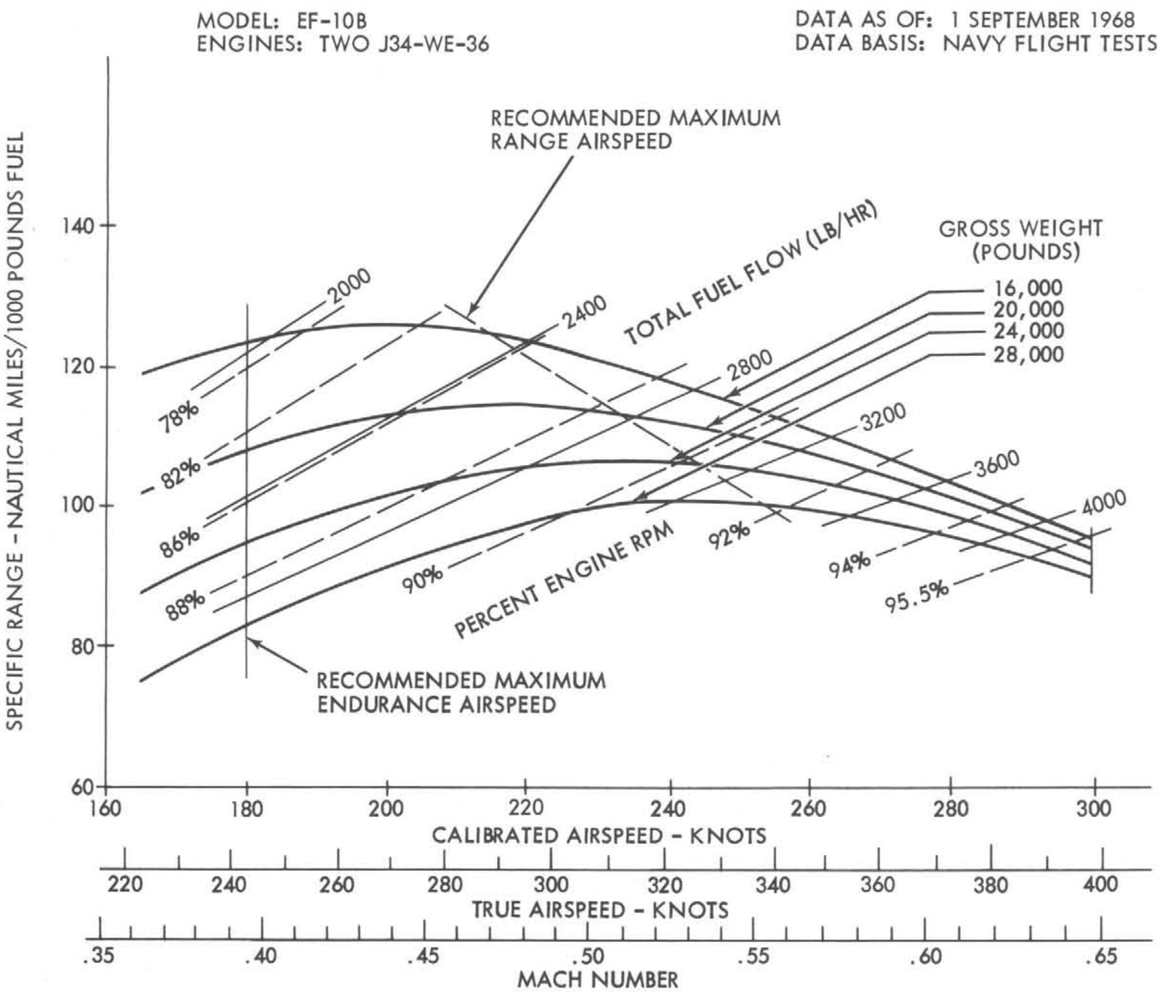


Figure 11-28. Two Engine Specific Range at 15,000 Feet - Drag Count = 25

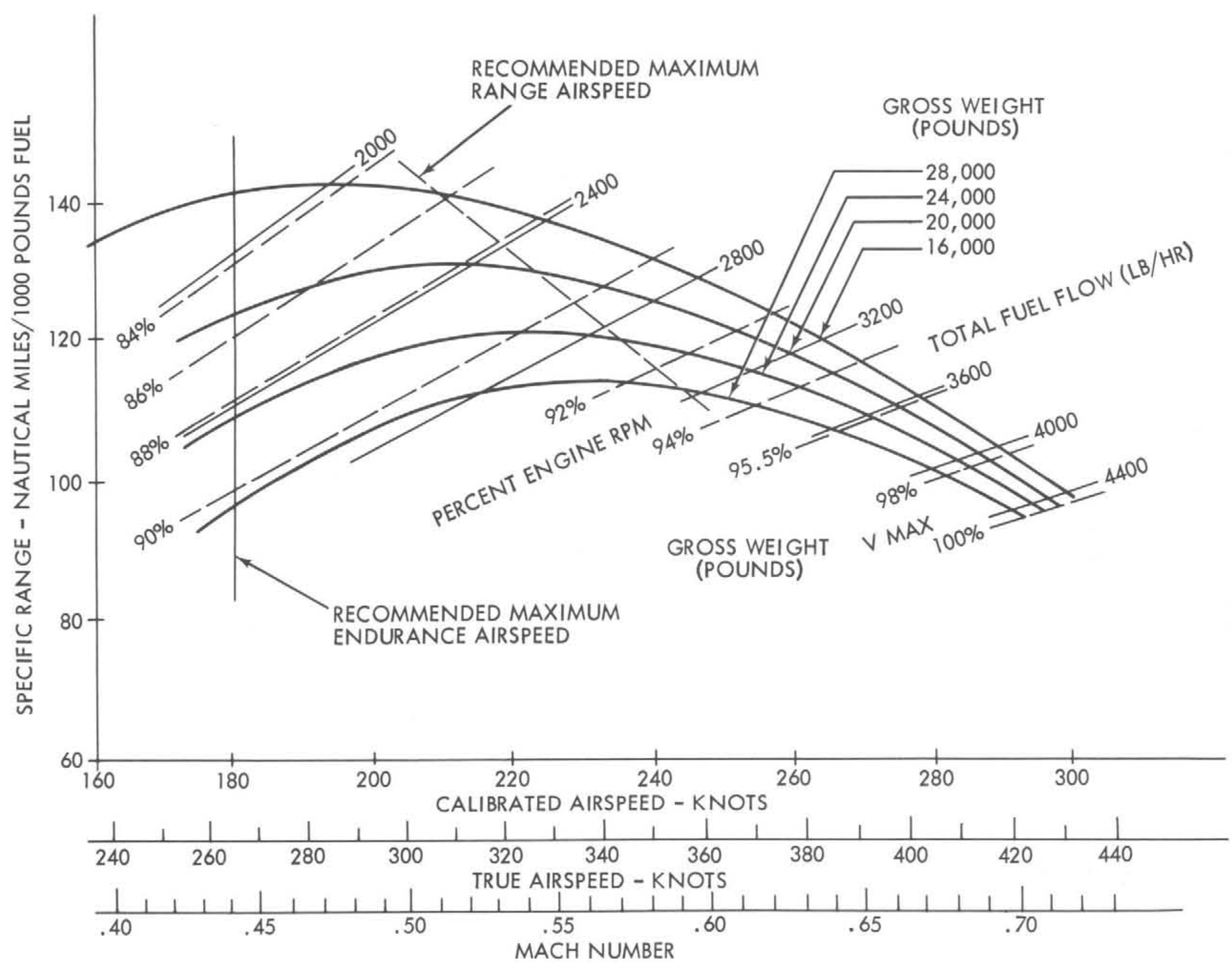


T113A-1-11-28

Figure 11-29. Two Engine Specific Range at 20,000 Feet - Drag Count = 25

MODEL: EF-10B
ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: NAVY FLIGHT TESTS



T113A-1-11-29

Figure 11-30. Two Engine Specific Range at 25,000 Feet - Drag Count = 25

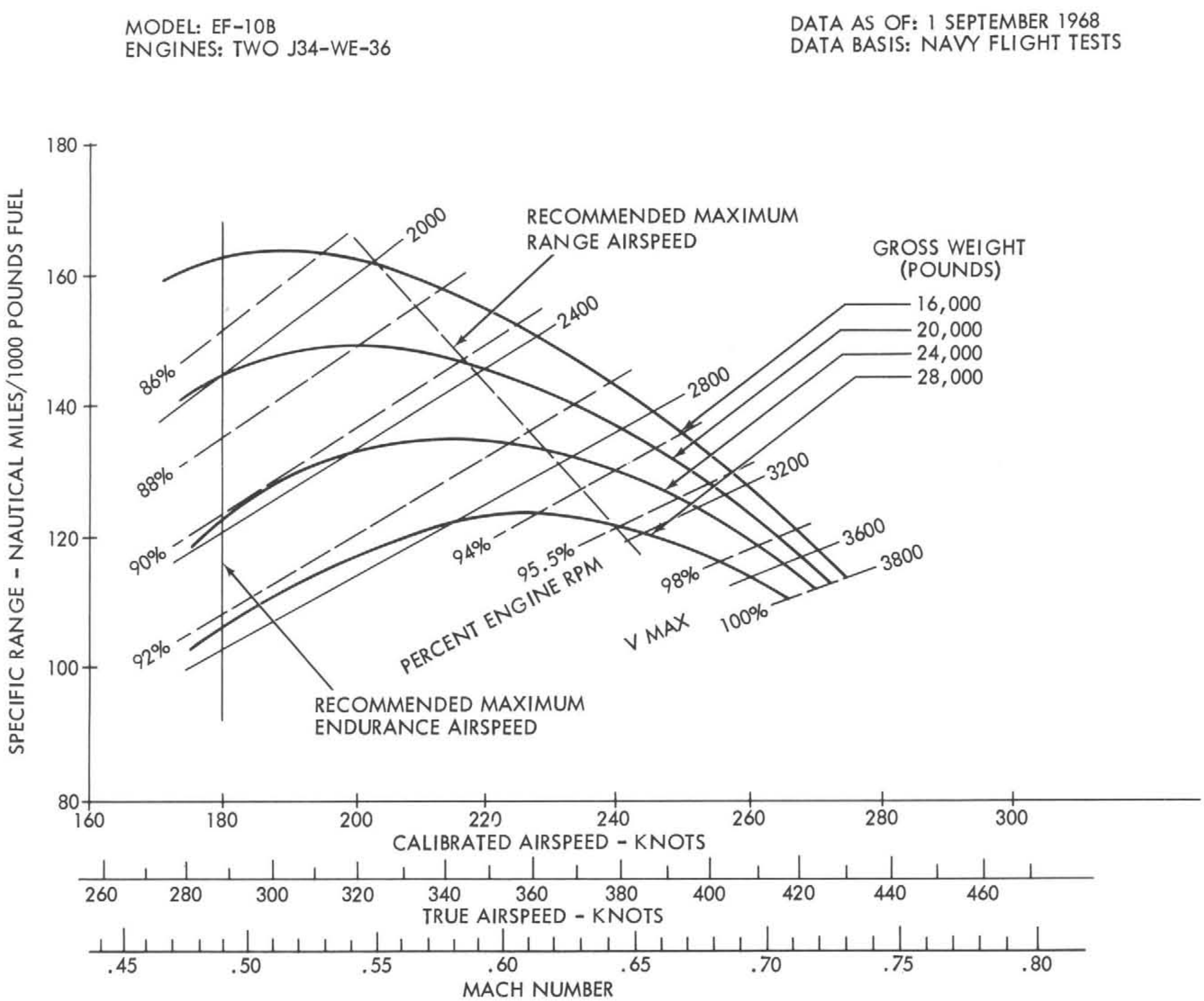


Figure 11-31. Two Engine Specific Range at 30,000 Feet - Drag Count = 25

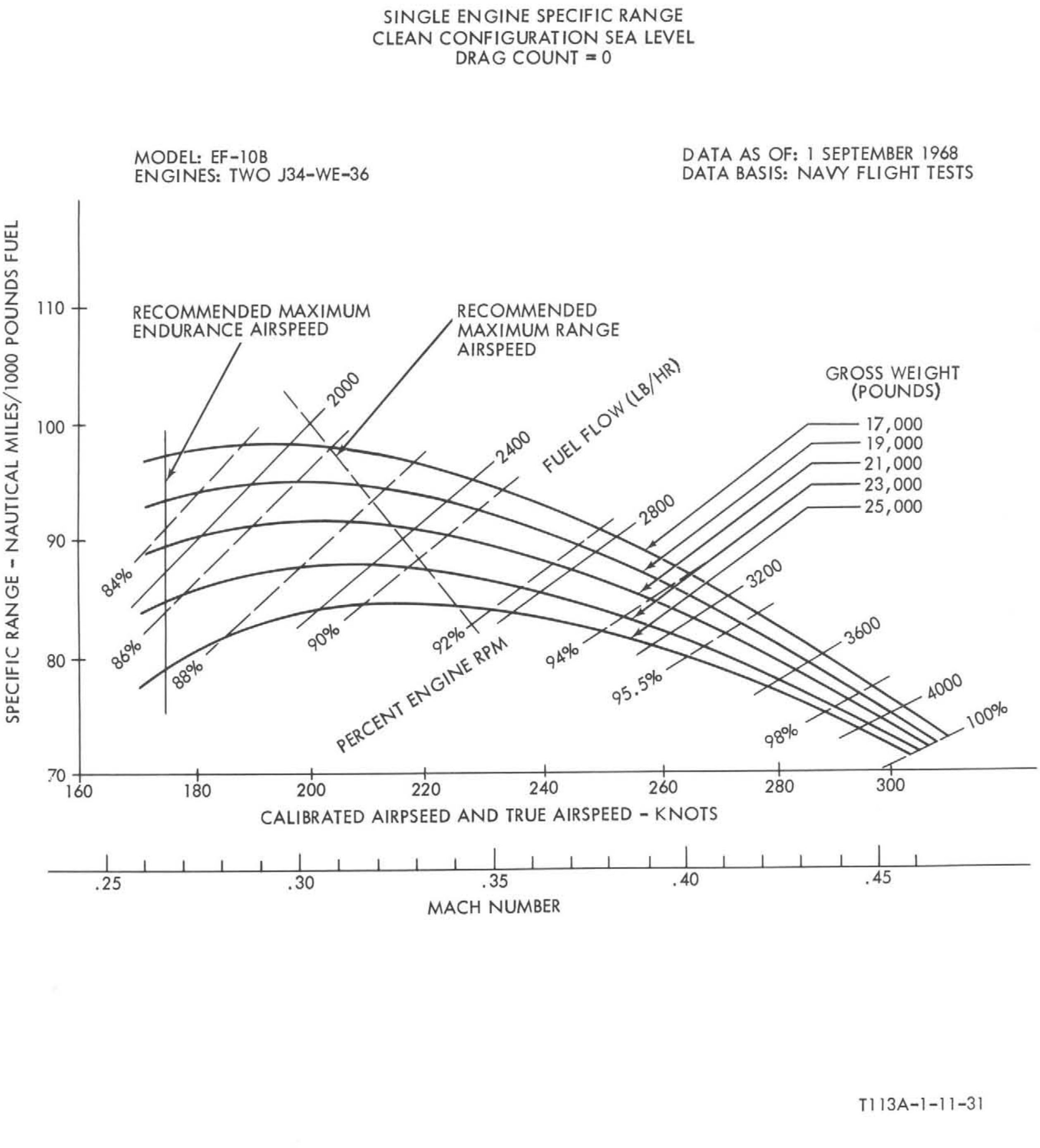


Figure 11-32. Single Engine Specific Range at Sea Level - Drag Count = 0

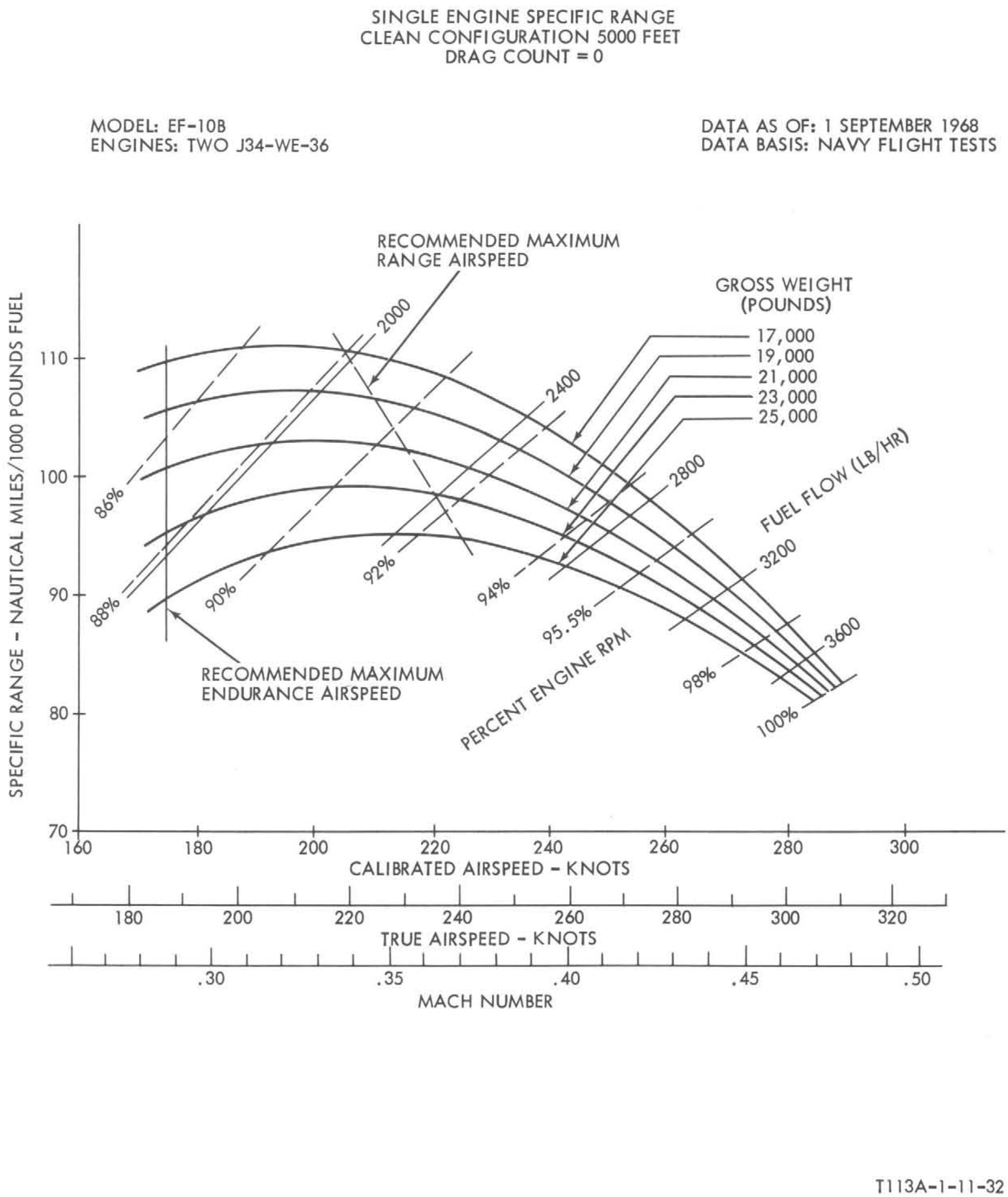


Figure 11-33. Single Engine Specific Range at 5000 Feet - Drag Count = 0

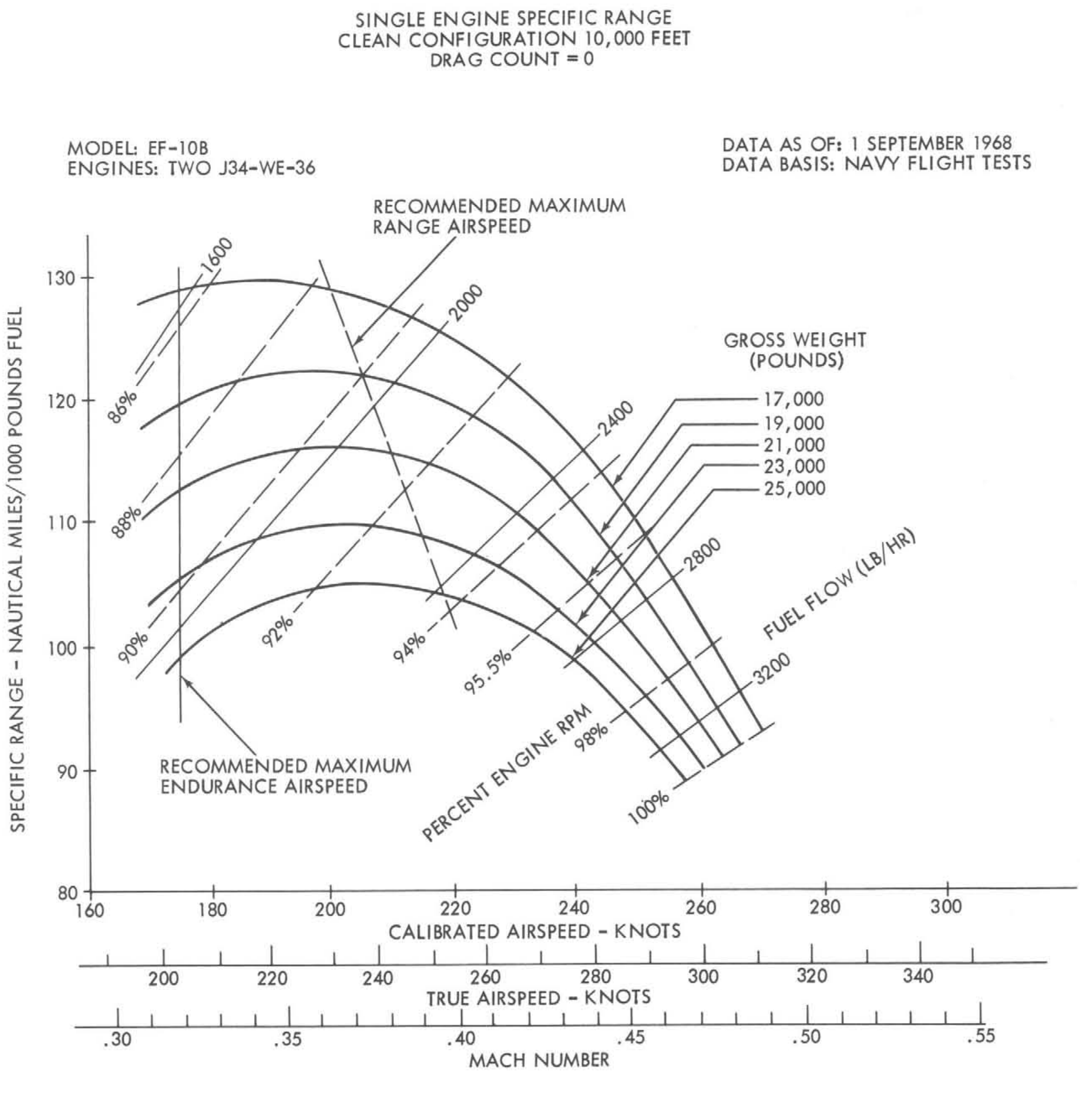


Figure 11-34. Single Engine Specific Range at 10,000 Feet - Drag Count = 0

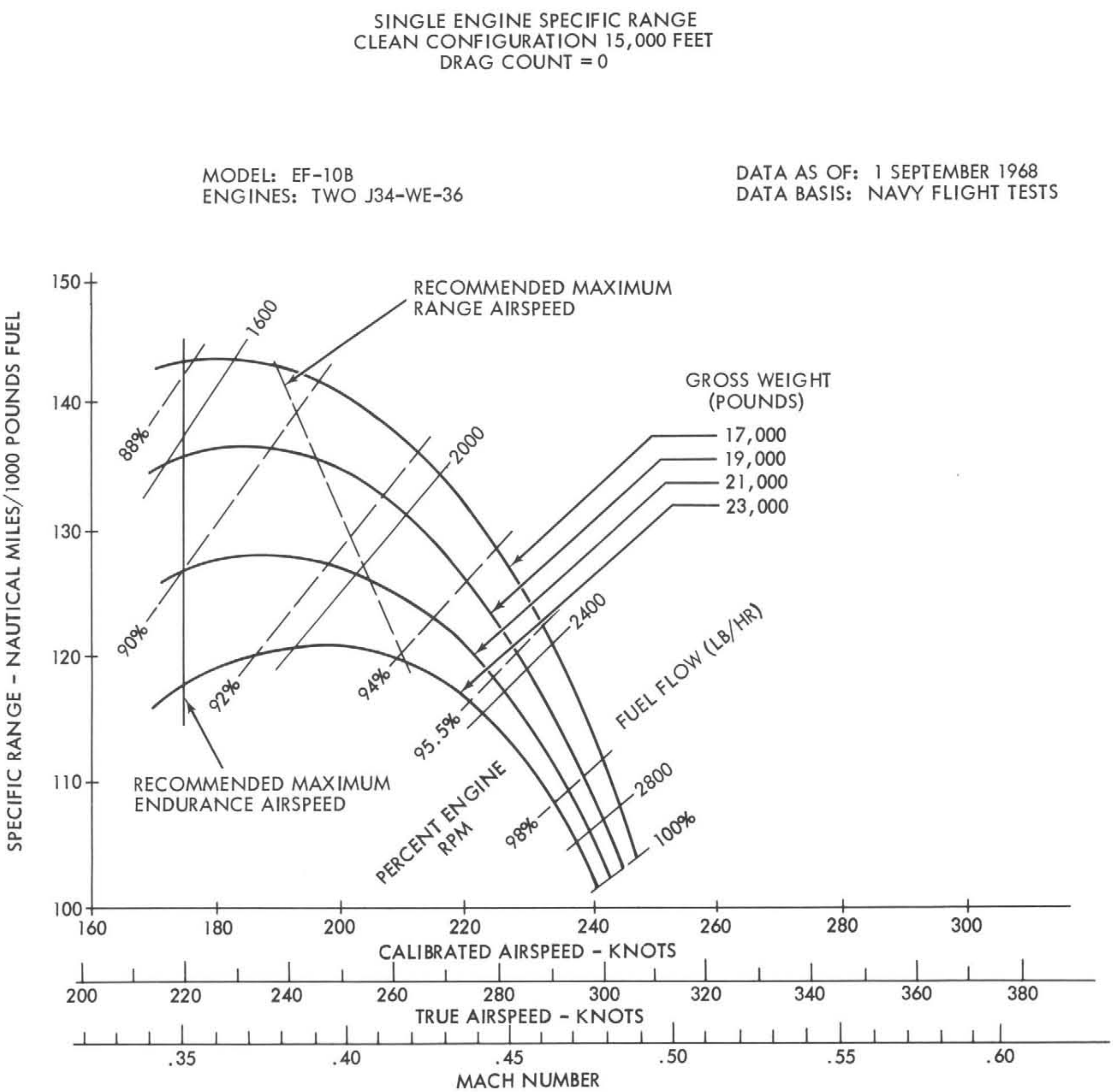
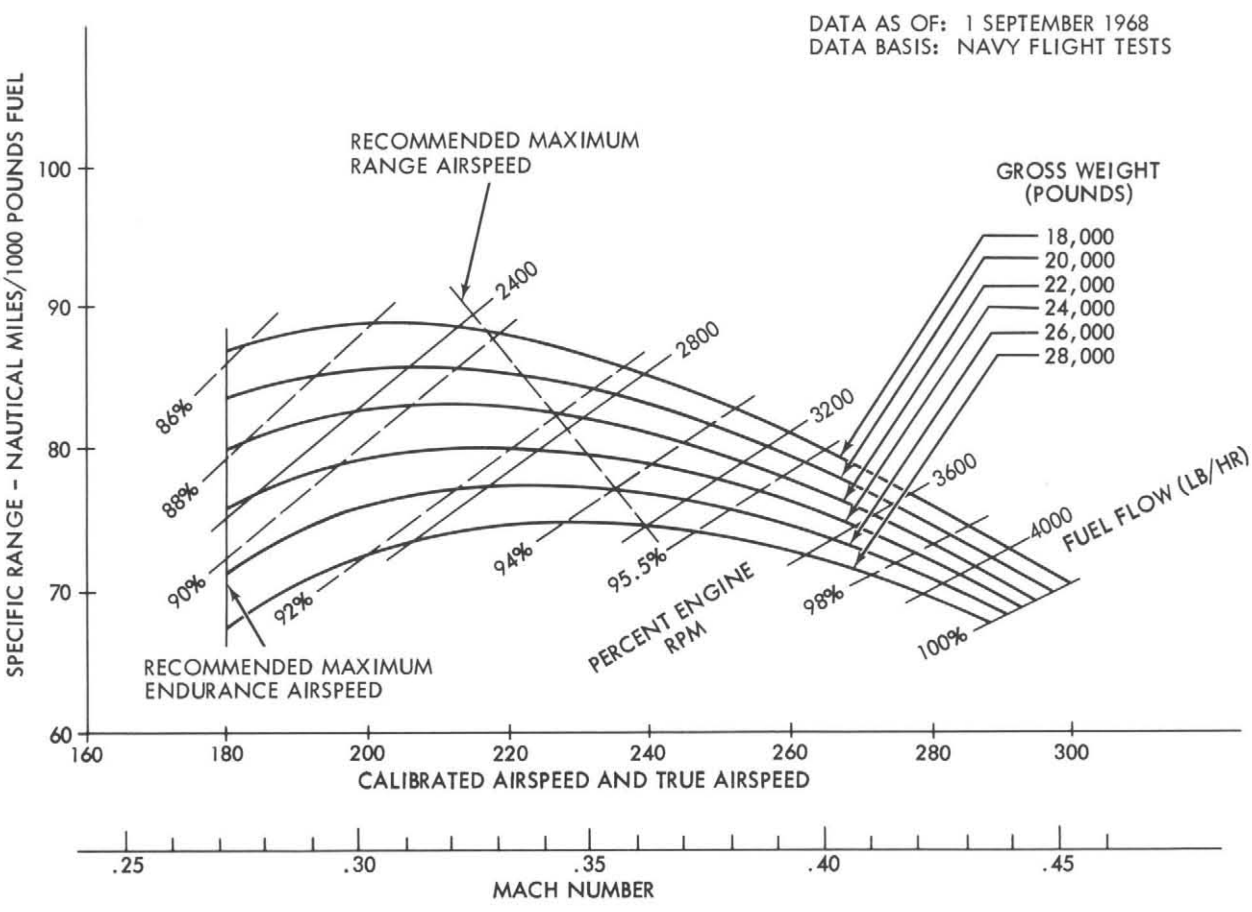


Figure 11-35. Single Engine Specific Range at 15,000 Feet - Drag Count = 0

MODEL: EF-10B
ENGINES: TWO J34-WE-36



T113A-1-11-35

Figure 11-36. Single Engine Specific Range at Sea Level - Drag Count = 25

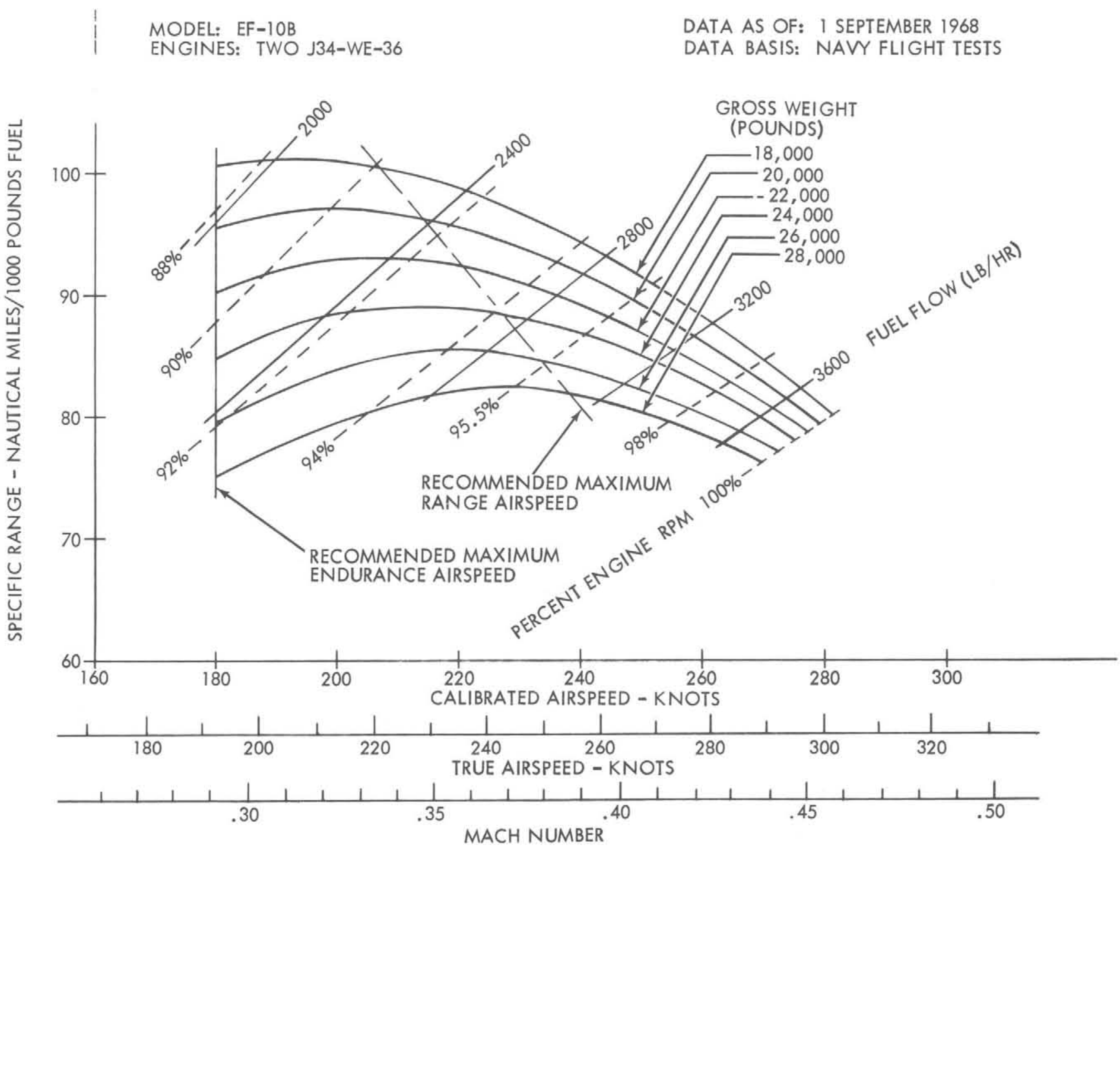
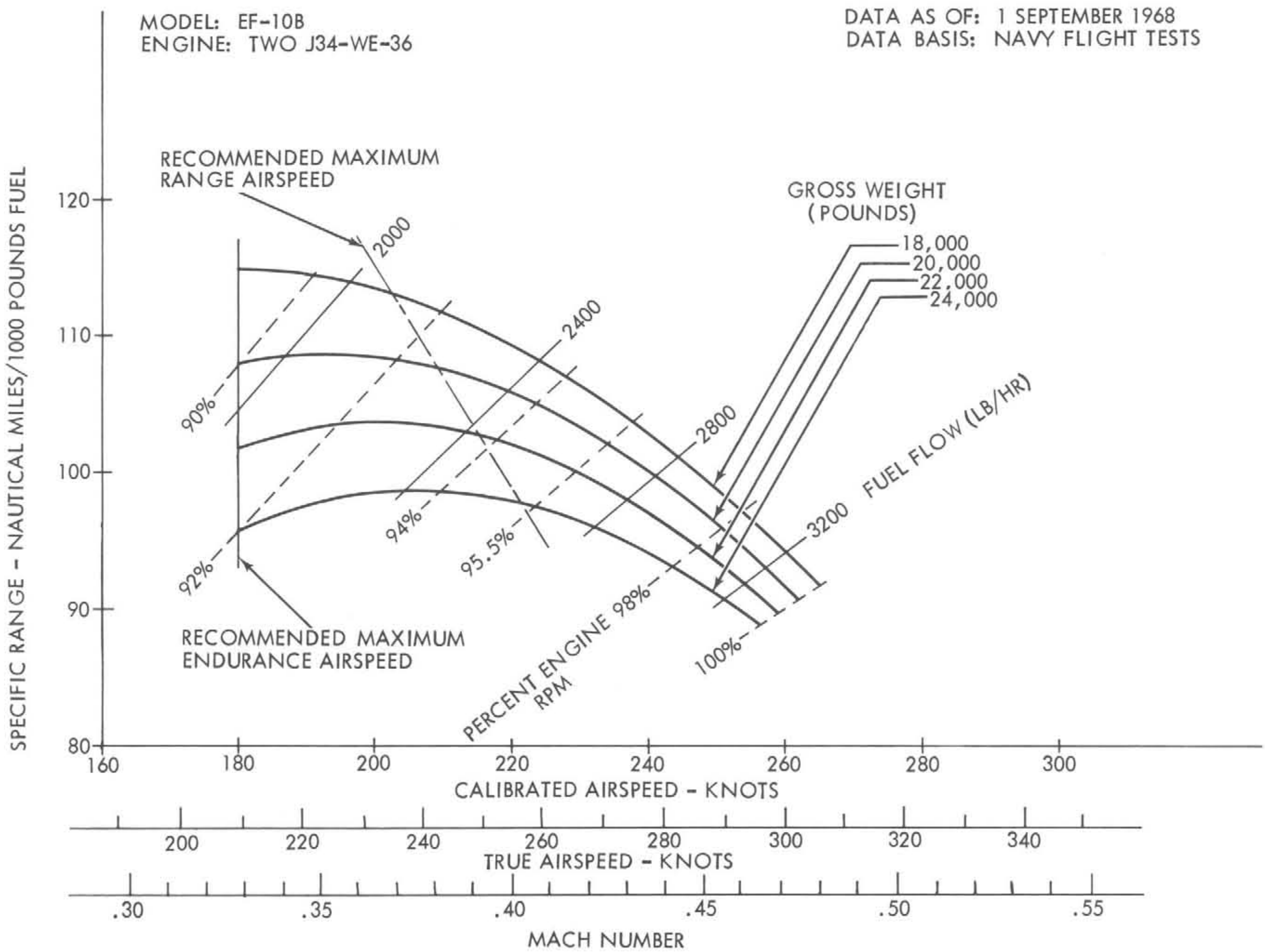


Figure 11-37. Single Engine Specific Range at 5000 Feet - Drag Count = 25



T113A-1-11-37

Figure 11-38. Single Engine Specific Range at 10,000 Feet - Drag Count = 25

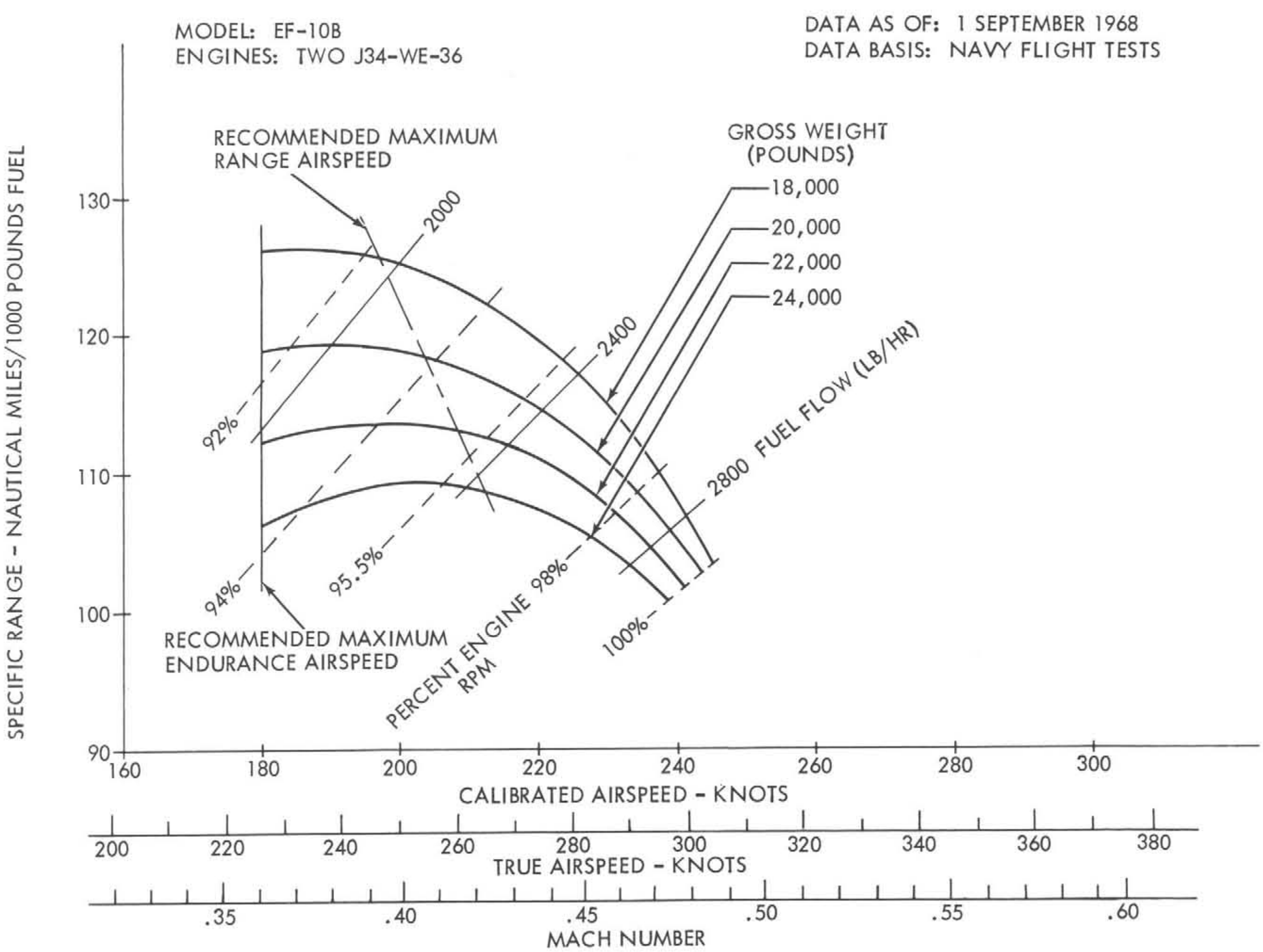


Figure 11-39. Single Engine Specific Range at 15,000 Feet - Drag Count = 25

MODEL: EF-10B

DATA AS OF: 1 SEPTEMBER 1968

ENGINES: TWO J34-WE-36

DATA BASIS: NAVY FLIGHT TESTS

BINGO RANGE CHART
TWO ENGINE OPERATION
CLEAN CONFIGURATION
DRAG COUNT = 0
NO RESERVE FUEL INCLUDED

If You Are At:	Usable Fuel On Board	At Altitude		At Best Altitude		
		Range	Airspeed	Altitude	Range	Airspeed
	Pounds		KIAS	Feet	N. Mi	KIAS
Sea Level	250	18	273	SL	18	273
	550	39	273	5,000	42	260
	850	61	273	15,000	74	240
	1150	82	273	25,000	120	208
	1450	104	273	30,000	170	200
	1750	125	273	30,000	226	200
	2150	154	273	30,000	298	200
5000 Feet	250	21	259	5,000	21	259
	550	47	259	10,000	48	239
	850	72	259	20,000	80	224
	1150	98	259	30,000	135	200
	1450	123	259	30,000	188	200
	1750	149	259	30,000	237	201
	2150	183	259	30,000	305	202
10,000	250	24	240	10,000	24	240
	550	54	240	15,000	58	231
	850	83	240	25,000	98	208
	1150	113	240	30,000	153	200
	1450	142	240	30,000	205	200
	1750	172	240	30,000	255	200
	2150	211	240	30,000	303	200
15,000 Feet	250	28	232	15,000	28	232
	550	62	232	15,000	62	232
	850	96	232	25,000	110	708
	1150	130	232	30,000	161	201
	1450	164	232	30,000	216	202
	1750	198	232	30,000	266	202
	2150	244	232	30,000	334	202

Figure 11-40. Two Engine Bingo Chart - Drag Count = 0 (Sheet 1)

If You Are At:	Usable Fuel On Board	At Altitude		At Best Altitude		
		Range	Airspeed	Altitude	Range	Airspeed
	Pounds	N. Mi	KIAS	Feet	N. Mi	KIAS
20, 000 Feet	250	33	224	20, 000	33	224
	550	72	224	25, 000	74	208
	850	111	224	30, 000	126	202
	1150	150	224	30, 000	177	202
	1450	189	224	30, 000	228	202
	1750	228	224	30, 000	279	202
	2150	280	224	30, 000	347	202
25, 000 Feet	250	37	208	25, 000	37	208
	550	83	208	30, 000	84	201
	850	128	208	30, 000	133	201
	1150	173	208	30, 000	185	201
	1450	218	208	30, 000	235	201
	1750	263	208	30, 000	286	201
	2150	324	208	30, 000	355	201
30, 000 Feet	250	43	202	30, 000	43	202
	550	94	202	30, 000	94	202
	850	146	202	30, 000	146	202
	1150	197	202	30, 000	197	202
	1450	249	202	30, 000	249	202
	1750	300	202	30, 000	300	202
	2150	370	202	30, 000	370	202

Figure 11-40. Two Engine Bingo Chart - Drag Count = 0 (Sheet 2)

MODEL: EF-10B

ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968

DATA BASIS: NAVY FLIGHT TESTS

BINGO RANGE CHART
TWO ENGINE OPERATION
EXTERNAL STORES
DRAG COUNT = 25
NO RESERVE FUEL INCLUDED

If You Are At:	Usable Fuel On Board	At Altitude		At Best Altitude		
		Range	Airspeed	Altitude	Range	Airspeed
	Pounds	N. Mi	KIAS	Feet	N. Mi	KIAS
Sea Level	250	17	247	SL	17	247
	550	37	247	5,000	39	248
	850	57	247	15,000	69	226
	1150	77	248	30,000	114	208
	1450	97	248	30,000	160	210
	1750	117	249	30,000	205	210
	2150	144	249	30,000	264	211
5000 Feet	250	19	247	5,000	19	247
	550	43	247	10,000	44	234
	850	66	248	20,000	78	222
	1150	89	248	20,000	123	209
	1450	136	249	30,000	173	209
	1750	167	250	30,000	217	210
	2150	167	250	30,000	277	211
10,000 Feet	250	22	233	10,000	22	233
	550	50	233	15,000	53	227
	850	76	234	25,000	92	214
	1150	104	234	30,000	143	209
	1450	131	235	30,000	187	209
	1750	151	235	30,000	234	210
	2150	194	236	30,000	294	211
15,000 Feet	250	26	225	15,000	26	225
	550	58	225	15,000	58	225
	850	89	226	25,000	100	215
	1150	120	227	30,000	152	209
	1450	158	228	30,000	198	209
	1750	182	229	30,000	242	210
	2150	222	230	30,000	302	211

Figure 11-41. Two Engine Bingo Chart - Drag Count = 25 (Sheet 1)

If You Are At:	Usable Fuel On Board	At Altitude		At Best Altitude		
		Range	Airspeed	Altitude	Range	Airspeed
	Pounds	N. Mi	KIAS	Feet	N. Mi	KIAS
20, 000 Feet	250	30	221	20, 000	30	221
	550	66	221	25, 000	69	215
	850	101	222	30, 000	115	208
	1150	136	222	30, 000	163	209
	1450	172	223	30, 000	309	209
	1750	206	224	30, 000	253	210
	2150	254	225	30, 000	315	211
25, 000 Feet	250	34	214	25, 000	34	214
	550	75	214	30, 000	85	208
	850	115	215	30, 000	126	208
	1150	156	215	30, 000	174	209
	1450	197	215	30, 000	219	209
	1750	233	216	30, 000	264	210
	2150	292	216	30, 000	326	211
30, 000 Feet	250	39	208	30, 000	39	208
	550	86	208	30, 000	86	208
	850	132	209	30, 000	132	209
	1150	178	209	30, 000	178	209
	1450	224	210	30, 000	224	210
	1750	270	210	30, 000	270	210
	2150	330	211	30, 000	330	211

Figure 11-41. Two Engine Bingo Chart - Drag Count = 25 (Sheet 2)

MODEL: EF-10B

Engines: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968

DATA BASIS: NAVY FLIGHT TESTS

BINGO RANGE CHART
SINGLE ENGINE OPERATION
CLEAN CONFIGURATION
DRAG COUNT = 0
NO RESERVE FUEL INCLUDED

If You Are At:	Usable Fuel On Board	At Altitude	
		Range	Airspeed
	Pounds	N. Mi	KIAS
Sea Level	250	24	205
	550	53	205
	850	83	205
	1150	112	205
	1450	142	205
	1750	171	205
	2150	210	205
5000 Feet	250	27	205
	550	60	205
	850	93	205
	1150	126	205
	1450	159	205
	1750	192	205
	2150	236	205
10,000 Feet	250	32	200
	550	70	200
	850	109	200
	1150	148	200
	1450	186	200
	1750	225	200
	2150	276	200
15,000 Feet	250	36	190
	550	79	190
	850	123	190
	1150	167	190
	1450	211	190
	1750	255	190
	2150	313	190

Figure 11-42. Single Engine Bingo Chart - Drag Count = 0

MODEL: EF-10B

ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968

DATA BASIS: NAVY FLIGHT TESTS

BINGO RANGE CHART
SINGLE ENGINE OPERATION
EXTERNAL STORES
DRAG COUNT = 25
NO RESERVE FUEL INCLUDED

If You Are At:	Usable Fuel On Board	At Altitude	
		Range	Airspeed
	Pounds	N. Mi	KIAS
Sea Level	250	22	217
	550	48	217
	850	75	217
	1150	101	217
	1450	128	217
	1750	255	217
	2150	190	217
5000 Feet	250	25	206
	550	55	206
	850	85	206
	1150	115	206
	1450	145	206
	1750	175	206
	2150	215	206
10,000 Feet	250	28	203
	550	62	203
	850	96	203
	1150	130	203
	1450	163	203
	1750	197	203
	2150	243	203
15,000 Feet	250	31	198
	550	68	198
	850	106	198
	1150	143	198
	1450	181	198
	1750	218	198
	2150	268	198

Figure 11-43. Single Engine Bingo Chart - Drag Count = 25

PART 5

ENDURANCE

Table of Contents

MAXIMUM ENDURANCE

The maximum endurance fuel chart, figure 11-44, presents the fuel consumption for the recommended endurance airspeed. At any given gross weight and altitude, the fuel flow and fuel required for a given time interval can be determined. Note that there is no difference in the fuel flow for the drag count range given in this chart. The recommended endurance speeds associated with the endurance fuel are also given in figure 11-44.

Sample Problem. Assume an aircraft is at a gross weight of 21,000 pounds and an altitude of 10,000 feet. The fuel flow and fuel required for 2 hours loiter are to be determined. Refer to figure 11-44, and perform the following operation:

a. Enter the upper left-hand chart at a gross weight of 21,000 pounds and move horizontally right until the 10,000 foot altitude line is intersected.

b. At this intersection, move vertically downward to the drag count line. At this intersection move horizontally to the right to read the fuel flow. The fuel flow for the conditions specified above is 2550 pounds per hour.

c. Continue beyond the fuel flow chart to the intersection of the 120-minute (2-hour) loiter time line. At this intersection move vertically upward to determine the total fuel required for 2-hour loiter at 10,000 feet. The fuel required in this problem would be 5100 pounds.

TWO ENGINE OPERATION

MODEL: EF-10B
ENGINE: J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: NAVY FLIGHT TESTS

RECOMMENDED ENDURANCE SPEED
ALL WEIGHTS

DRAG COUNT	ENDURANCE AIRSPEED
0	175 KCAS
25	180 KCAS

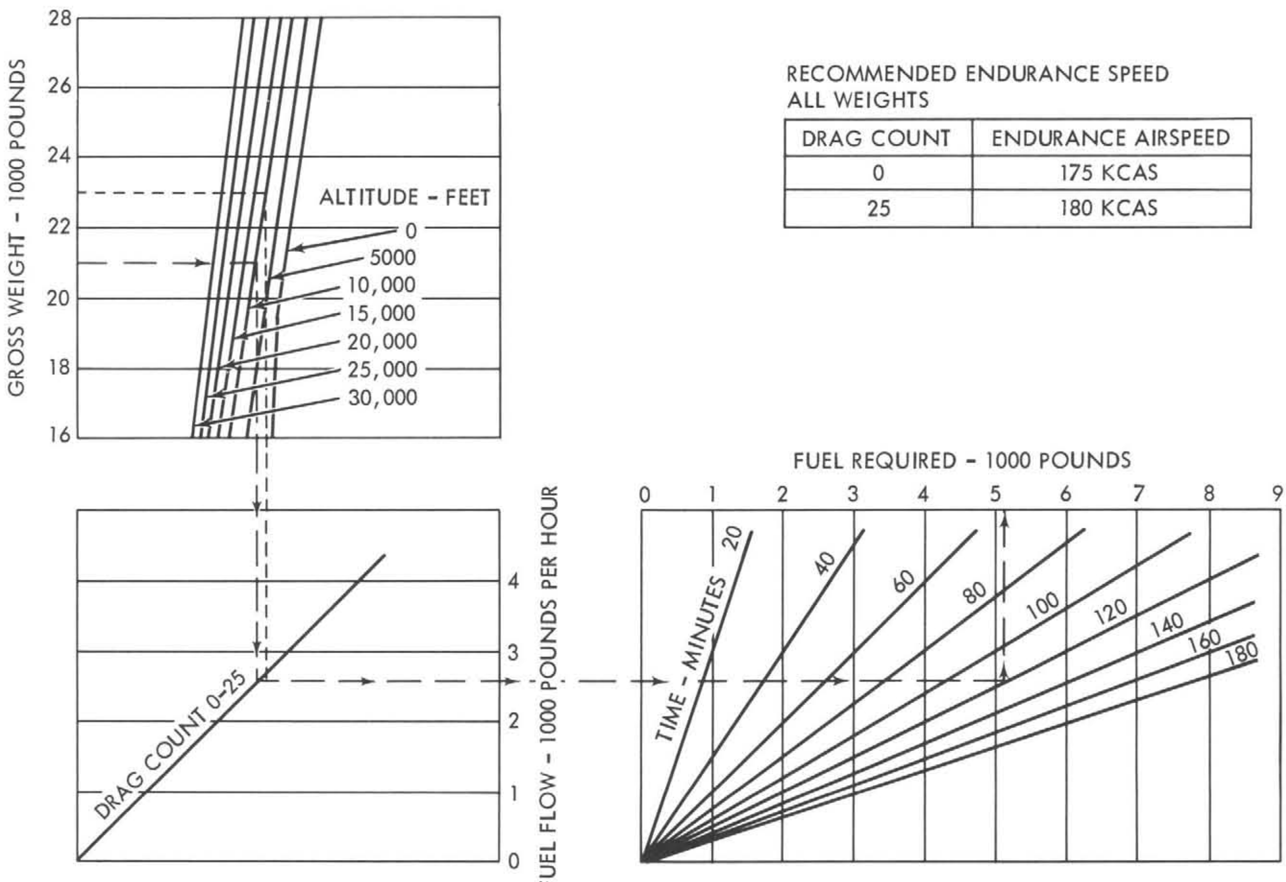


Figure 11-44. Maximum Endurance Fuel Chart

T113A-1-11-43

PART 6

DESCENT

Figure 11-45 presents the two engine descent data and figure 11-46 presents the single engine (one engine idle/one engine 80% RPM) for use on the EF-10B. These data are tabulated from Navy Flight Tests and are presented to give an indication of descent conditions. Two engine descent data is most economical in terms of fuel and time.

MODEL: EF-10B

DATA AS OF: 1 SEPTEMBER 1968

ENGINES: TWO J34-WE-36

DATA BASIS: NAVY FLIGHT TESTS

FUEL, DISTANCE, AND TIME FOR DESCENT
BOTH ENGINES 80% RPM
SPEED BRAKES EXTENDED
AIRSPEED = 250 KCAS

CLEAN AIRCRAFT - DRAG COUNT = 0
INITIAL WEIGHT AT 30,000 FEET = 17,000 POUNDS

ALTITUDE	DESCENT TO SEA LEVEL			
	FUEL	DISTANCE	TIME	RATE OF DESCENT
FEET	POUNDS	NAUTICAL MILES	MINUTES	FEET PER MINUTE
30,000	150	21	4.1	6650
25,000	130	17	3.5	6650
20,000	115	13	3.0	6650
15,000	90	10	2.3	6650
10,000	65	6	1.6	6600
5,000	30	3	0.7	6650

LOADED AIRCRAFT - DRAG COUNT = 25
INITIAL WEIGHT AT 30,000 FEET = 18,000 POUNDS

ALTITUDE	DESCENT TO SEA LEVEL			
	FUEL	DISTANCE	TIME	RATE OF DESCENT
FEET	POUNDS	NAUTICAL MILES	MINUTES	FEET PER MINUTE
30,000	170	23	4.7	6600
25,000	150	19	4.0	6600
20,000	130	15	3.2	6600
15,000	105	11	2.5	6600
10,000	80	8	1.8	6600
5,000	45	4	1.0	6450

Figure 11-45. Two Engine - Descent Data

MODEL: EF-10B

DATA AS OF: 1 SEPTEMBER 1968

ENGINES: TWO J34-WE-36

DATA BASIS: NAVY FLIGHT TESTS

FUEL, DISTANCE, AND TIME FOR DESCENT
ONE ENGINE IDLE/ONE ENGINE 80% RPM
SPEED BRAKES RETRACTED
AIRSPEED = 200 KCAS

CLEAN AIRCRAFT - DRAG COUNT = 0
INITIAL WEIGHT AT 30,000 FEET = 19,000 POUNDS

ALTITUDE	DESCENT TO SEA LEVEL			
	FUEL	DISTANCE	TIME	RATE OF DESCENT
FEET	POUNDS	NAUTICAL MILES	MINUTES	FEET PER MINUTE
30,000	1000	130	31.0	1450
25,000	900	112	27.16	1350
20,000	800	95	23.8	1200
15,000	730	73	19.2	1050
10,000	510	51	14.0	850
5,000	300	38	8.0	400

LOADED AIRCRAFT - DRAG COUNT = 25
INITIAL WEIGHT AT 30,000 FEET = 18,000 POUNDS

ALTITUDE	DESCENT TO SEA LEVEL			
	FUEL	DISTANCE	TIME	RATE OF DESCENT
FEET	POUNDS	NAUTICAL MILES	MINUTES	FEET PER MINUTE
30,000	690	116	25.6	1200
25,000	580	95	21.4	1200
20,000	460	74	17.0	1200
15,000	350	54	12.8	1200
10,000	230	35	8.7	1200
5,000	120	17	4.5	1200

Figure 11-46. Single Engine - Descent Data

PART 7

LANDING

Table of Contents

LANDING DISTANCE

The approach speeds and stall speeds for the landing configuration are given in figure 11-47. These data contain stall speeds for various flap and power settings, in order to show their relation to the approach speed.

Figure 11-47, Landing Distance, presents the landing performance of the airplane in respect to ground roll distance as a function of ambient air temperature, airfield pressure altitude, gross weight, and headwind. Data are presented for a full flap landing on a dry, hard runway surface. This requires full flaps (40°) during the ground roll, retarding the throttles to IDLE, and applying maximum braking action during the ground roll. The chart also presents the total distance to land over a 50-foot height as a ratio of total distance to clear a 50-foot height to the ground roll distance.

Sample Problem. Assume that a full flap field landing is to be made under the following conditions: ambient air temperature 20°C, 1000 feet pressure altitude, 21,000 pounds gross weight, and 20 knots headwind. To obtain the ground roll distance and 50-foot height distance for the above conditions, refer to figure 11-47, and perform the following:

a. Enter the temperature - altitude chart in the upper left-hand corner of figure 11-47, at 25°C air temperature and move vertically upward to the 1000-foot pressure altitude line.

b. Move horizontally to the right to the 21,000 pound gross weight portion of the chart.

c. Descend vertically from the 21,000 pound line to the top of the headwind correction chart. Follow the guide lines to the intersection of the 20-knot headwind line, and then descend vertically to the bottom of the chart to read ground roll distance. The ground roll distance for this sample problem is 1750 feet.

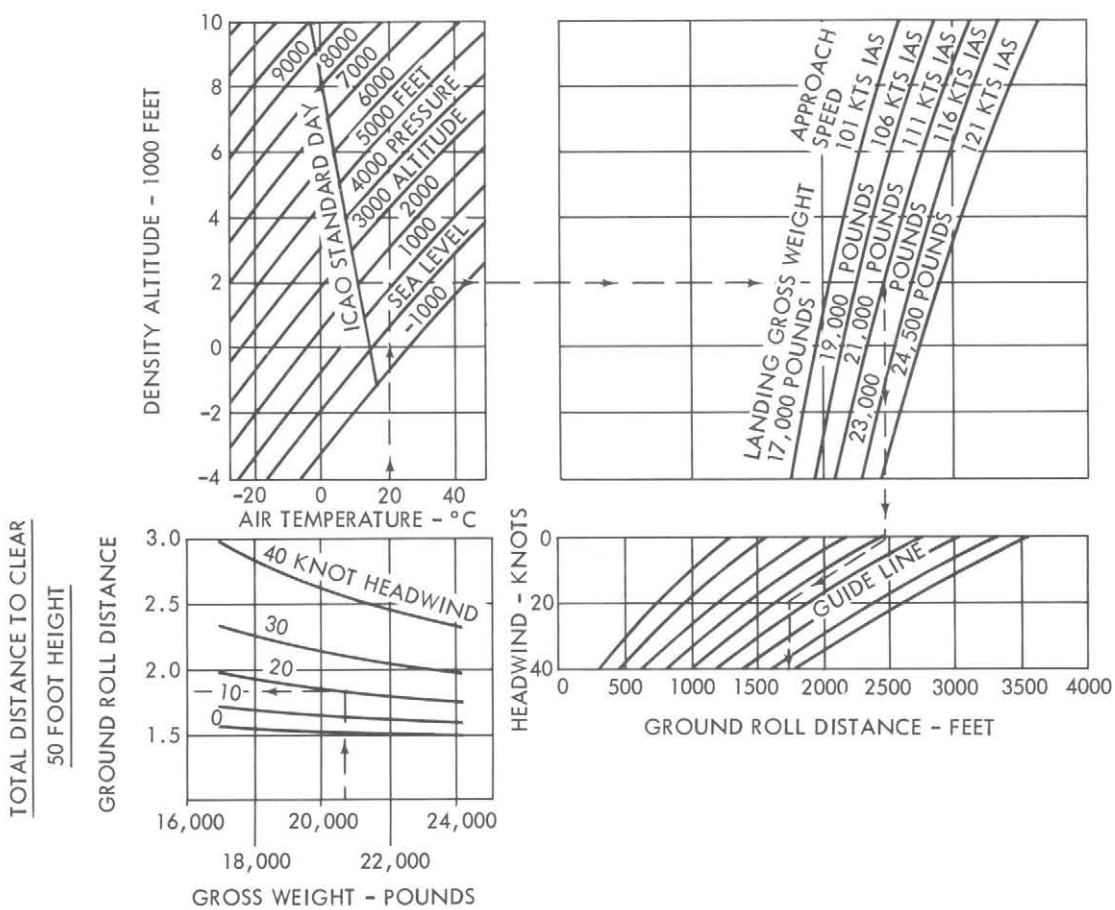
d. To find the total distance required to land after clearing a 50-foot height, enter the chart in the lower left-hand corner of the chart for the landing weight and move vertically upward to the 20-knot headwind line. At this point move horizontally to the left and read the ratio of "total distance to clear 50-foot height to ground roll distance."

The total landing distance over a 50-foot height for the sample problem is 1750 x 1.83 = 3200 feet.

HARD SURFACE RUNWAY
FULL FLAPS

MODEL: EF-10B
ENGINES: TWO J34-WE-36

DATA AS OF: 1 SEPTEMBER 1968
DATA BASIS: ESTIMATED



T113A-1-11-46

Figure 11-47. Landing Distance

PART 8

MISSION PLANNING

Table of Contents

GENERAL

This section contains a sample mission problem to illustrate the combined use of the performance charts contained in the previous sections of this manual. This 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.

Sample Problem. Takeoff with one ALQ-31 pod and one 300-gallon external tank. Proceed on course at 30,000 feet altitude at maximum range Mach number, descend to 10,000 feet altitude, 250 nautical miles from base. Loiter on station as long as possible, climb back to 30,000 feet and return to base.

The problem will be to determine the airspeeds, fuel flows, and distances for each leg of the mission.

GROSS WEIGHTS AND DRAG COUNTS

From figure 11-5 the drag counts of the ALQ-31 and 300-gallon tank are 12 and 13, respectively. The total drag count of 25 will be used for mission calculations.

The takeoff weight consists of the following items:

Basic weight	15,600 pounds
Internal fuel (1350 gallons)	8,100 pounds
One ALQ-31 Pod	1,000 pounds
One 300-gallon tank with fuel	2,000 pounds
Takeoff gross weight	26,700 pounds

Total fuel available for the mission would be:

Internal fuel (1350 gallons)	8,100 pounds
External fuel (300 gallons)	1,800 pounds
Total fuel	9,900 pounds

BASIC METHOD

The basic method used for mission planning is to graphically plot the mission segments, with aircraft weights as a function of mission radius. The cruise-out and return portions are calculated first, and the difference between these segments at a given radius is allocated to time on station. The basic plot is shown in figure 11-48, and should be referred to when following the various steps outlined below.

TAXI, TAKEOFF, AND ACCELERATION FUEL

The fuel required to taxi, takeoff, and accelerate to climb speed is assumed to be that amount of fuel consumed in 5 minutes of military thrust at sea level (100% engine RPM). In this case it is 708 pounds. This value is then subtracted from the initial gross weight, and the final value is placed on figure 11-48 with no distance gained. It should be noted this fuel allowance can be any value which a squadron feels is suitable for operations, and not necessarily that allowance given above.

Initial gross weight	26,700 pounds
Takeoff allowance	708 pounds
Initial climb weight	25,992 pounds

FUEL AND DISTANCE TO CLIMB

The mission requires a cruise altitude of 30,000 feet. Using the initial climb weight previously calculated (25,992 pounds), enter figures 11-13 and 11-14 to determine the fuel and distance required to climb to 30,000 feet altitude.

Climb fuel (figure 11-13)	1460 pounds
Climb distance (figure 11-14)	93 nautical miles

Once the fuel has been determined, it must be subtracted from the initial climb weight to find the final climb weight. This weight is also the weight at which the cruise-out begins.

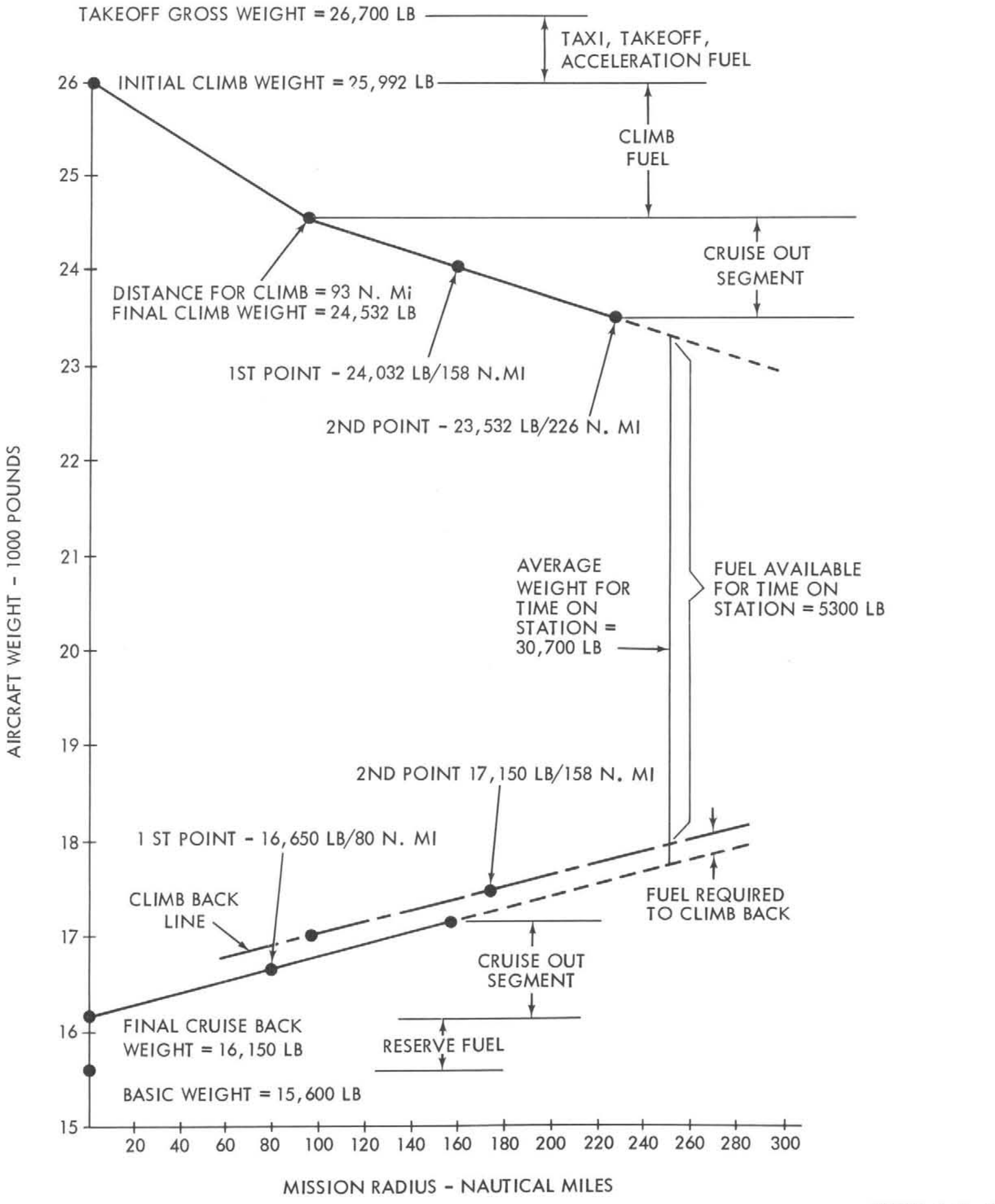


Figure 11-48. Graphical Solution For Mission Planning

Initial climb weight	25, 992 pounds
Fuel required for climb	1, 460 pounds
Final climb weight	24, 532 pounds

The final climb weight (24, 532 pounds), and the distance associated with the climb (93 nautical miles) are then placed on figure 11-48.

CRUISE-OUT AT 30, 000 FEET ALTITUDE

The initial cruise-out weight is 24, 532 pounds and the drag index is 25. Therefore figure 11-31, Two Engine Specific Range at 30, 000 feet - Drag Count = 25, should be used. The method used will be to take arbitrary incremental portions of fuel and determine the cruise distances associated with them. The weight distances will then be placed on figure 11-48 to establish a line for the cruise-out segment.

First Point

24, 532 lb initial weight

500 lb fuel increment

24, 032 lb final segment weight

Average cruise weight = 24, 282 lb

Maximum specific range (24, 782 lb) = 0. 131 N. Mi/lb (fig. 11-31)

Cruise distance = 500 lb fuel x 0. 132 N. Mi/lb = 66 N. Mi

Total distance = 93 N. Mi (climb) + 66 N. Mi (cruise) = 159 N. Mi

Point for figure 11-48 - 24, 032 lb/159 N. Mi

Second Point

24, 032 lb final weight of first point

500 lb fuel increment

23, 532 lb final segment weight

Average cruise weight = 23, 782 lb

Maximum specific range (23, 782 lb) = 0. 134 N. Mi/lb (fig. 11-31)

Cruise distance = 500 lb fuel x 0. 134 N. Mi/lb = 67 N. Mi

Total distance = 159 (from first point) + 67 N. Mi = 226 N. Mi

Point for figure 11-48 - 23, 532 lb/226 N. Mi

This procedure can be continued until enough points are obtained. After the cruise points have been placed on figure 11-48, a straight line is drawn between these and the final climb weight to obtain the cruise-out line. There should be a straight line and it can be extended to any distance.

RESERVE LANDING FUEL

The landing reserve fuel should be any operational value determined adequate by the squadron. For illustrative purposes, a value for 20 minutes maximum endurance at sea level will be assumed. The value for 20 minutes can be obtained from figure 11-44, Maximum Endurance Fuel. An initial gross weight approximating the basic weight (15, 600 pounds) can be used to determine the loiter fuel.

20 minute fuel flow (figure 11-44) = 550 pounds.

This fuel is then added to the basic weight to determine the weight the aircraft will be at after it has finished the cruise-back segment.

Basic Weight	15, 600 lb
20-minute Reserve Fuel	500 lb
Final Cruise-Back Weight	16, 150 lb

This value is then placed on figure 11-48 at zero mission radius.

CRUISE BACK at 30, 000 FEET ALTITUDE

The cruise-back segment is calculated using the same procedure as for the cruise-out segment, except fuel is added to final cruise-back weight. Here again figure 11-31, Two Engine Specific Range at 30, 000 feet - Drag Count = 25, is used.

First Point

16, 150 lb final cruise-back weight

500 lb fuel increment

16, 650 lb final segment weight

Average cruise weight = 16, 400 lb

Maximum specific range (16, 400 lb) = 0. 160 N. Mi/lb (fig. 11-31)

Cruise distance = 500 lb fuel x 0. 160 N. Mi/lb = 80 N. Mi

Total distance = 0 N. Mi (at mission finish) + 80 N. Mi (cruise) = 80 N. Mi

Point for figure 11-48 - 16, 650 lb/80 N. Mi

Second Point

16, 650 lb final weight of first point

550 lb fuel increment

17, 150 lb final segment weight

Average cruise weight = 16, 900 lb

Maximum specific range (17, 150 lb) = 0. 157 N. Mi/lb (fig. 11-31)

Cruise distance = 500 lb fuel x 0. 157 N. Mi/lb = 78 N. Mi

Point for figure 11-48 - 17, 150 lb/158 N. Mi

CLIMB BACK TO 30,000 FEET ALTITUDE

The fuel and distance to climb from 10,000 feet to 30,000 feet after time on station can be determined by the following procedure. Assume two arbitrary initial climb back weights on the cruise-back segment. For each weight assumed, perform the following operations.

Determine the fuel and distance to climb from 10,000 feet to 30,000 feet at the initial assumed weight. Subtract the climb fuel from the initial assumed weight, and read the radius on the cruise-back segment of figure 11-48 corresponding to this weight. Add this value to the climb distance previously obtained to get the total distance. This total distance along with the initial assumed climb weight becomes a point for the climb back line.

17,000 lb	Assumed arbitrary weight
490 lb	Fuel to climb at 17,000 lb from 10,000 ft to 30,000 ft (fig. 11-13)
16,510 lb	

Distance on cruise back was at 16,510 lb = 57 N. Mi

Distance to climb from 10,000 ft to 30,000 ft at initial assumed weight of 17,000 lb = 40 N. Mi

Total distance = 57 N. Mi + 40 N. Mi = 97 N. Mi

Point for climb back curve = 17,000 lb/97 N. Mi

Repeat this procedure for an assumed initial weight of 17,500 lb. This produces a point of 17,500 lb/175 N. Mi. A straight line is drawn between the two points to complete the climb back line. It should be noted this line should be approximately parallel to the cruise-back line.

TIME ON STATION

The final step in this procedure is to determine the loiter time on station. This can be done by drawing a vertical line from the points where the cruise-out line and cruise-back line intersect the mission radius (250 N. Mi for this example). The distance between the cruise-back line and the climb-back line is the fuel required to climb from 10,000 feet to 30,000 feet. The remaining segment, the distance from the climb-back line to the cruise-back line is the fuel available for use on station at 250 N. Mi radius. The distance halfway between these points is the average mission weight for the aircraft on station.

To find the loiter time on station, refer to figure 11-27, Two Engine Specific Range at 10,000 feet, Drag Count = 25. Use of this chart allows the pilot to determine the fuel flow for any airspeed he desires to use on station. For this mission, it is desired to remain on station as long as possible, therefore the recommended maximum endurance airspeed will be used.

Fuel available for time on station at 250 N. Mi (fig. 11-48) = 5300 lb

Average weight on station (fig. 11-48) = 20,700 lb

Recommended maximum endurance true airspeed (fig. 11-27) = 209 KTS

Specific range at 209 KTS and 20,700 lb (fig. 11-27) = 0.084 N. Mi/lb

Fuel flow = 209 N. Mi/hr x $\frac{1}{0.084}$ N. Mi/lb = 2490 lb/hr

Time on station = $\frac{5300 \text{ lb fuel}}{2490 \text{ lb/hr}} = 2.13$ hr

Therefore the total time the aircraft can remain at 250 N. Mi radius is 2.13 hours. The total mission time can be obtained by adding each segment time to determine the whole.

ALPHABETICAL INDEX

*Indicates Illustration

*Indicates Illustration

*Indicates Illustration

* Indicates Illustration

*Indicates Illustration