EO 05-5E-1A

## ROYAL CANADIAN AIR FORCE

# AIRCRAFT OPERATING INSTRUCTIONS
# SABRE 6

(This EO replaces EO 05-5E-1A dated 21 Feb 58 and all Revisions issued thereto)

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

20 JUL 62

# LIST OF RCAF REVISIONS

| DATE | PAGE NO | DATE | PAGE NO |
|---|---|---|---|

## NOTES TO USERS

1 This publication is divided into four parts: Description, Handling, Emergency Handling and Operating Data.

2 PART 1 - DESCRIPTION of the controls and equipment with which the pilot should be acquainted.

3 PART 2 - HANDLING describes the normal handling of the aircraft by the pilot.

4 PART 3 - EMERGENCY HANDLING describes the emergency handling of the aircraft by the pilot.

5 PART 4 - OPERATING DATA gives the flying and engine limitations and includes information on fuel consumption, range and endurance under various conditions of flight.

6 These notes are complementary to EO 05-1-1 Aircraft Operating Instructions General and assume a thorough knowledge of its contents.

7 In the text, words written in capital letters indicate actual markings on the controls concerned

8 Comments and suggestions should be forwarded by UCR through the usual channels to Air Force Headquarters.

Sabre Aircraft

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# PART 1
# DESCRIPTION

## INTRODUCTION

GENERAL

1 The Sabre 6 aircraft is a single-seat, jet-propelled monoplane, characterized by a slatted, swept-back wing and empennage. Designed primarily as a high-speed, high-altitude fighter, the aircraft may also be used to attack ground or naval objectives with gunfire, bombs, chemicals or rockets. The pilot is protected fore and aft by armour-plate bulkheads. For the general arrangement of the aircraft, see Figure 1-1. For interior cockpit arrangements, see Figures 1-2, 1-3 and 1-4.

2 The power plant is an Orenda 14 axial-flow, turbo-jet engine, providing approximately 7275 pounds static thrust at sea level. An electric starter-generator unit is provided for starting on an external source of power.

## LEADING PARTICULARS

DIMENSIONS

3 The overall dimensions of the aircraft are as follows:

| | | |
|---|---|---|
| (a) | Wing Span | 37.1 feet |
| (b) | Length | 37.5 feet |
| (c) | Height | 14.7 feet |

WEIGHT

4 Approximate weights are as follows: (Refer to EO 05-5E-8 for actual weights).

(a) Basic weight, (no fuel, oil, ammunition or pilot): 10,850 pounds.

(b) Clean aircraft loaded, (including internal fuel, oil, ammunition and pilot): 14,370 pounds.

(c) With two 100 Imperial gallon drop tanks, (including full fuel, oil, ammunition and pilot): 16,135 pounds.

NOTE

1 Imperial gal. = 1.2 US gal.

(d) With two 167 Imperial gallon drop tanks, (including full fuel, oil, ammunition and pilot): 17,315 pounds.

GROSS LANDING WEIGHT

5 The maximum gross landing weight for the Sabre 6 is 13,280 pounds. The approximate amount of fuel remaining at maximum gross landing weight with full weight of ammunition and oil is as follows:

(a) Clean aircraft - 1700 pounds of fuel.

(b) 100 gallon drop tanks installed - 1500 pounds of fuel.

(c) 167 gallon drop tanks installed - 1350 pounds of fuel.

FUEL CELL AND OIL TANK CAPACITIES

6 Capacities are as follows:

(a) Total available internal fuel is 357 Imperial gallons.

(b) Total fuel with 100 Imperial gallon drop tanks installed is 557 Imperial gallons.

(c) Total fuel with 167 Imperial gallon drop tanks installed is 691 Imperial gallons.

(d) The maximum oil tank capacity is approximately 2.9 Imperial gallons with an expansion space of approximately 0.8 Imperial gallon.

## FUEL SYSTEM

GENERAL

7 Five self-sealing fuel cells are installed in the aircraft; two in the fuselage, one in the centre wing section and one in each outer wing panel, see Figure 1-18. Fuel is supplied to the engine from the centre wing cell which is gravity fed from all other internal cells except the aft

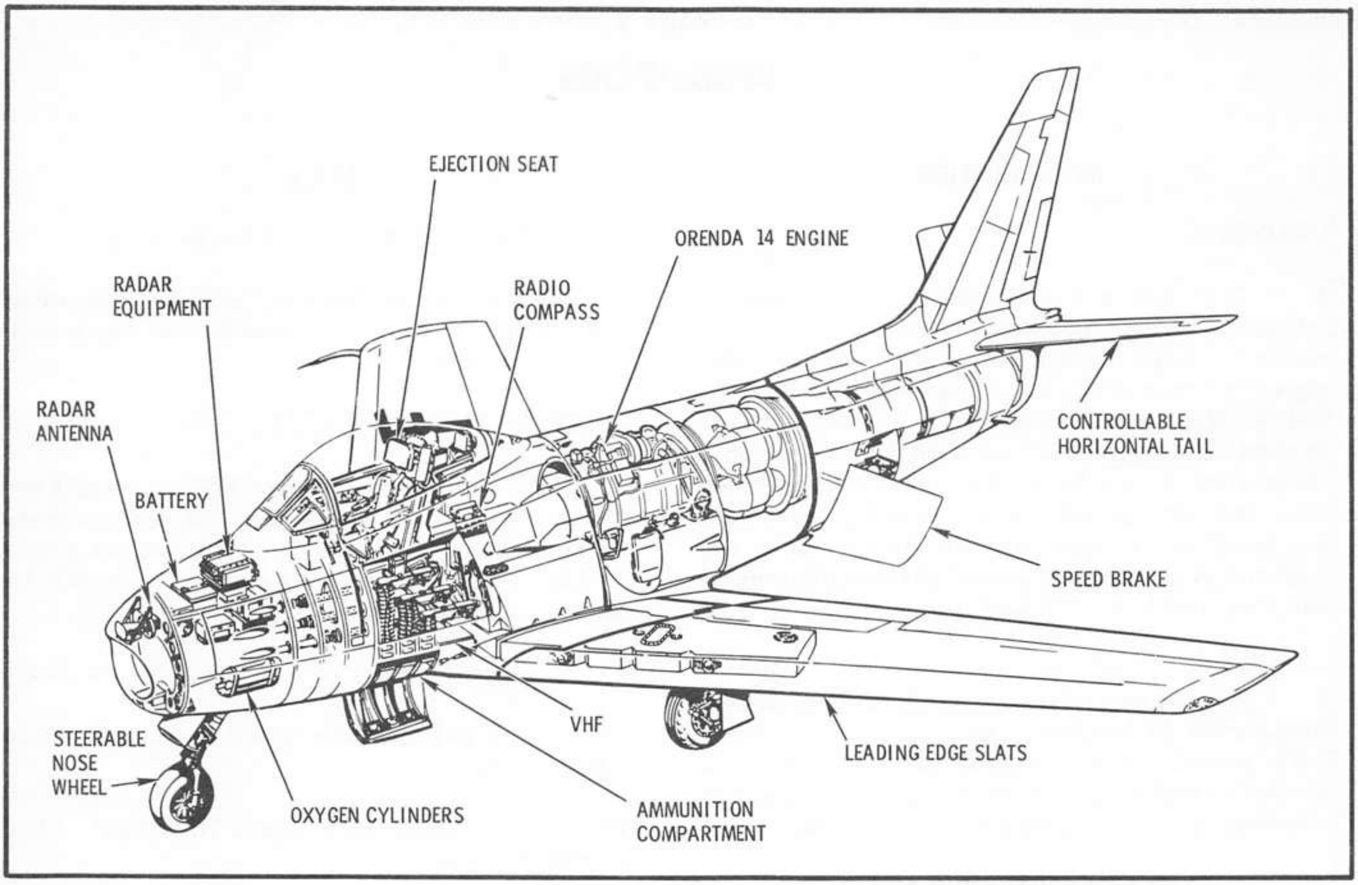


Figure 1-1 General Arrangement

fuselage cell. When 22 to 26 Imperial gallons of fuel have been used from the forward fuselage cell, the transmitter switch in the forward fuselage cell operates to start the transfer pump, transferring fuel from the aft fuselage cell via the centre wing cell. When 15 to 19 Imperial gallons have been transferred from the aft fuselage cell, the transmitter switch stops the transfer pump. When the forward fuselage cell has been emptied and 45 to 49 Imperial gallons remain in the centre wing cell, the transfer pump is switched off by the transmitter switch in the centre wing cell. The main fuel supply can be augmented by installing a 100 or 167 Imperial gallon drop tank under each outer wing panel. When necessary, the drop tanks may be jettisoned, Fuel from the drop tanks is forced, by compressed air from the engine compressor section, to the forward cell through a fuel level control valve, when the fuel level in the fuselage cell has fallen by 4 Imperial gallons. For a schematic diagram of the engine fuel system, see Figure 1-19.

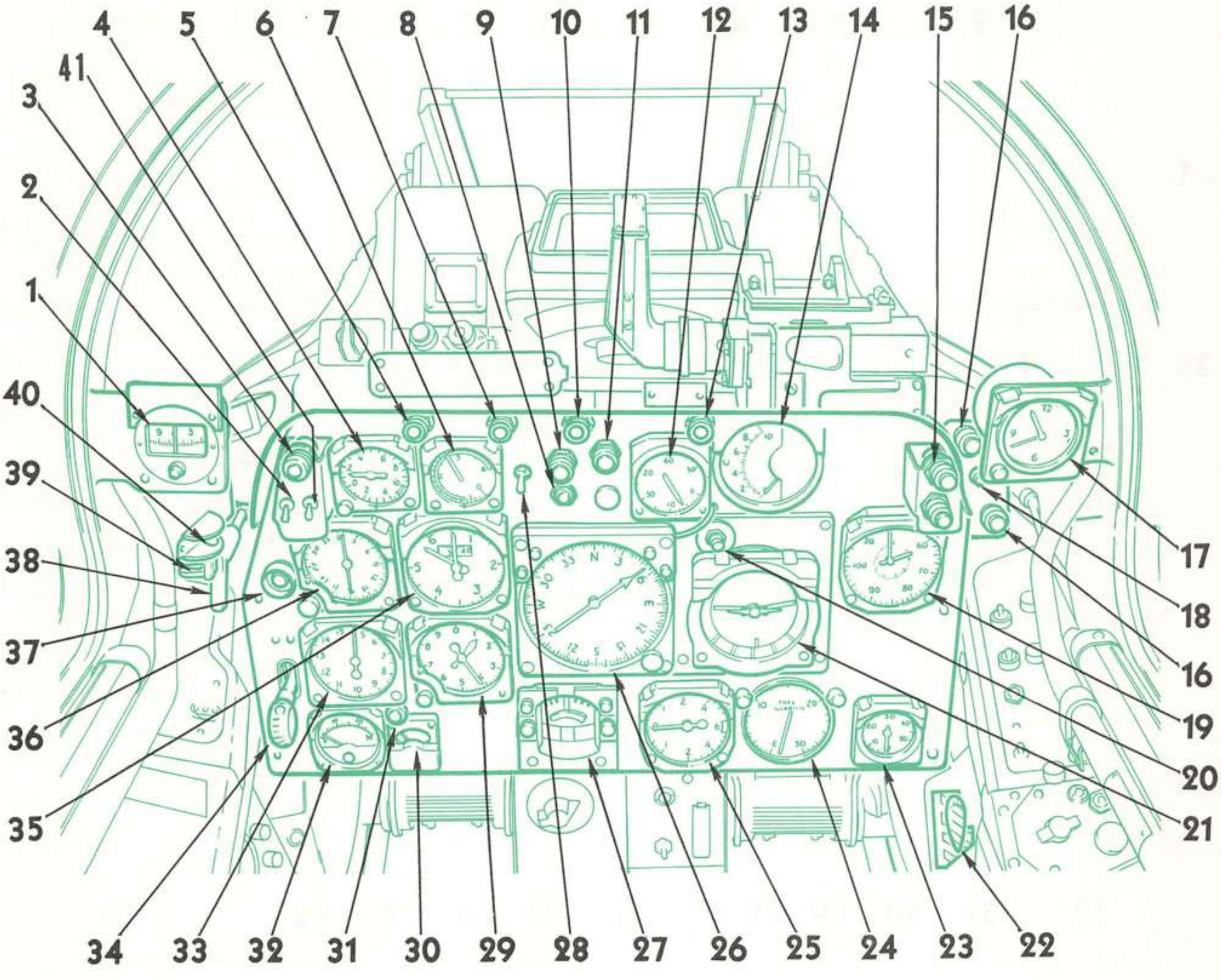
8 There are individual filler points for each tank except the centre wing tank which is filled through the forward fuselage tank. The fuel filler access doors cannot be closed unless the fuel tank filler caps are in the locked position. When refuelling the aircraft, the forward fuselage cell must be filled first in order to utilize the full capacity of the fuel system. If the wing tanks or the aft fuselage tank are filled first, fuel from these tanks will drain into the centre wing tank while the forward fuselage tank is being serviced. For servicing diagram, see Figure 1-5.

FUEL SPECIFICATIONS

9 For fuel specifications see Figure 1-6.

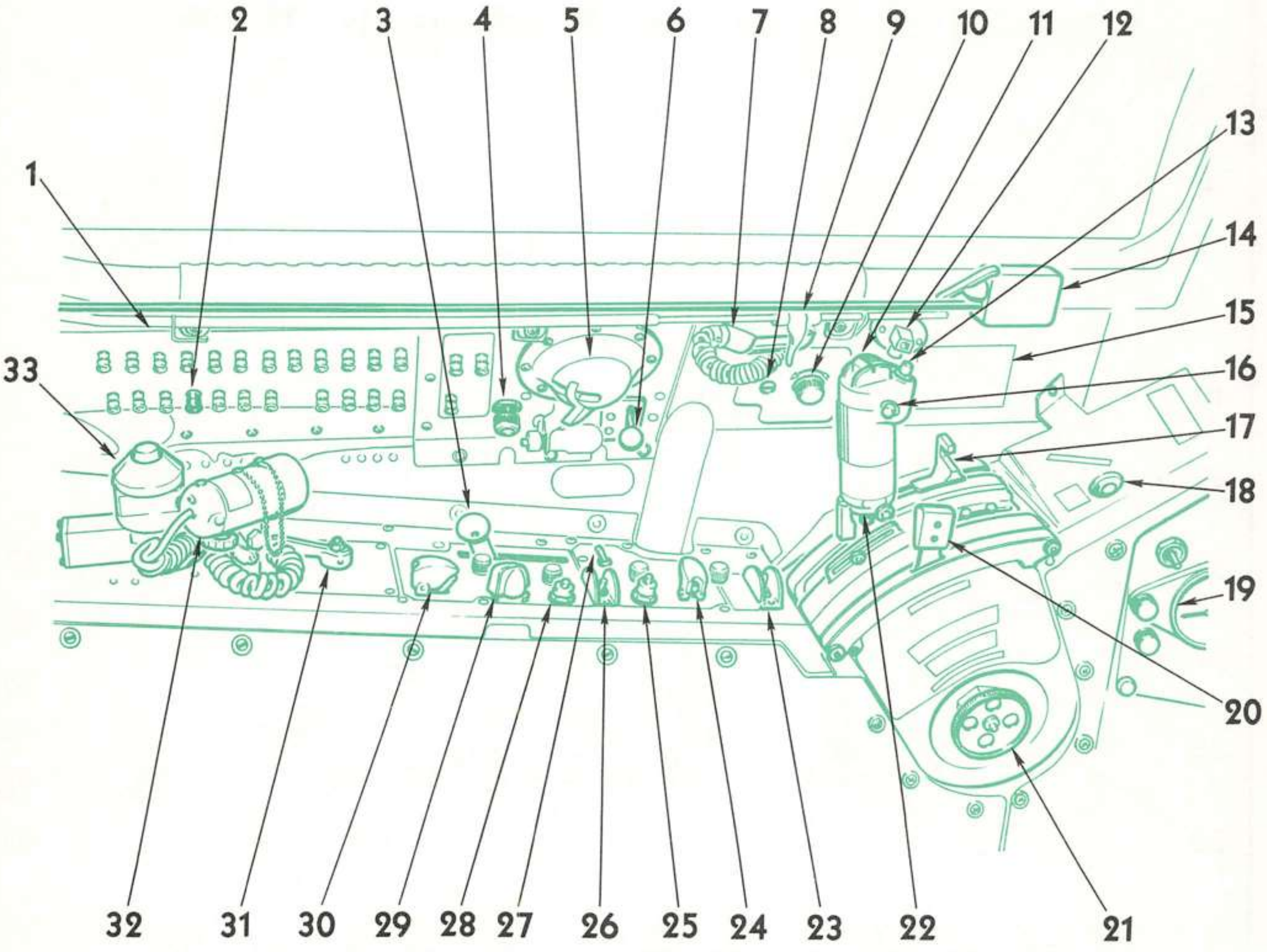
FUEL QUANTITY GAUGE

10 A fuel quantity gauge, located on the instrument panel, indicates total internal fuel in pounds. No gauge is provided for the drop tanks, but two lights on the instrument panel show when the drop tanks are empty. During take-off, with drop tanks full, the fuel quantity gauge will normally indicate a decrease until fuel begins to transfer from the drop tanks. At full power, fuel may be used at a greater rate than it is being transferred from the drop tanks.



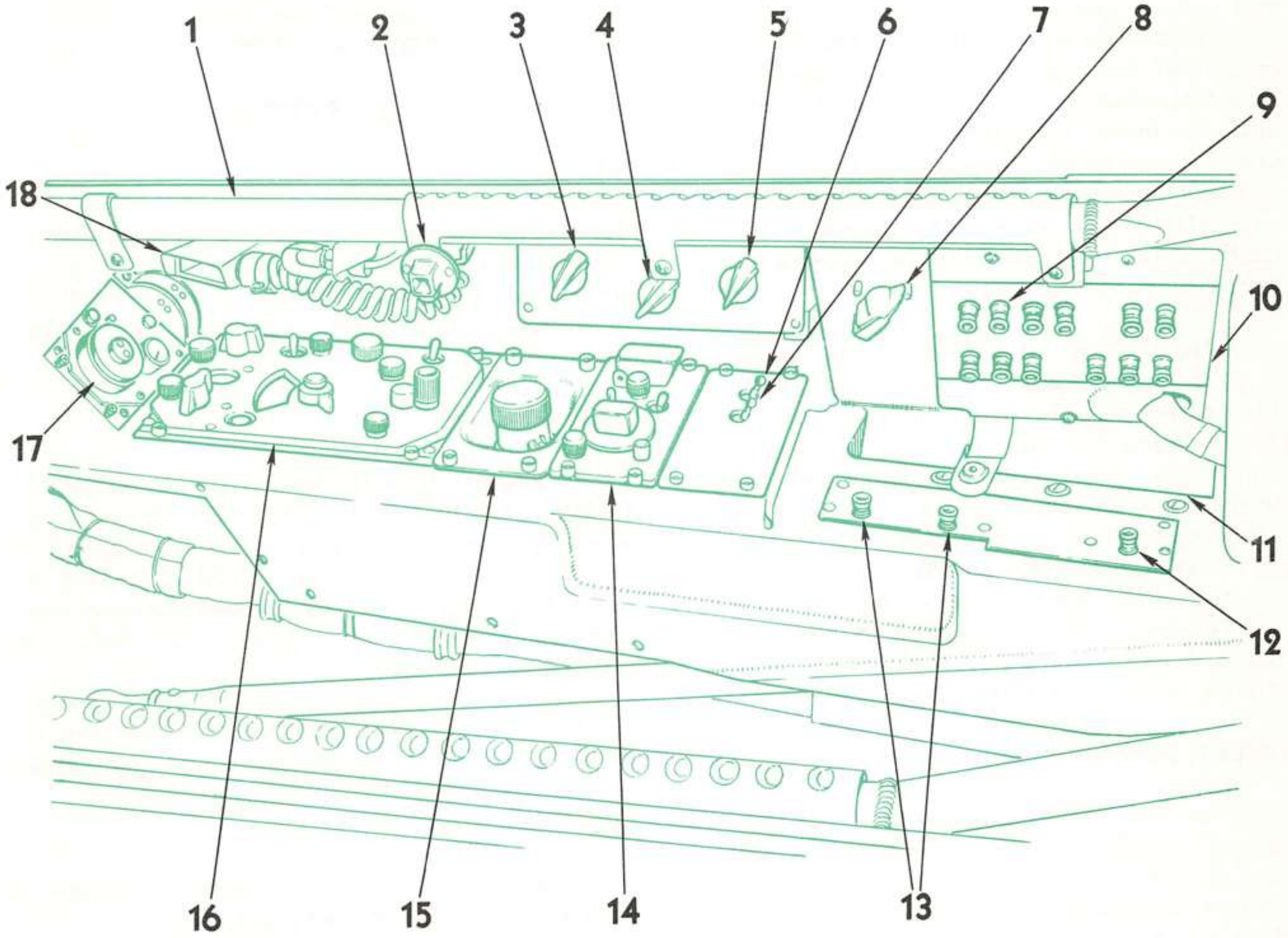
1 STANDBY MAGNETIC COMPASS
2 EMERGENCY FUEL CONTROL SWITCH
3 EMERGENCY FUEL CONTROL WARNING LIGHT
4 ACCELEROMETER
5 MAIN INSTRUMENT INVERTER WARNING LIGHT
6 HYDRAULIC PRESSURE GAUGE
7 BOTH INSTRUMENT INVERTERS WARNING LIGHT
8 GYRO COMPASS FAST SLAVING BUTTON
9 FLIGHT CONTROL ALTERNATE-ON LIGHT
10 MAIN RADAR INVERTER WARNING LIGHT
11 LOW FUEL PRESSURE WARNING LIGHT
12 OIL PRESSURE GAUGE
13 TAKE-OFF TRIM POSITION INDICATOR LIGHT
14 JET PIPE TEMPERATURE INDICATOR
15 DROP TANKS EMPTY WARNING LIGHTS
16 FIRE WARNING LIGHTS
17 CLOCK
18 FIRE WARNING LIGHT TEST BUTTON
19 TACHOMETER
20 ARTIFICIAL HORIZON FAST ERECTION BUTTON
21 ARTIFICIAL HORIZON
22 ALTERNATE CANOPY JETTISON RELEASE
23 CABIN ALTIMETER
24 FUEL QUANTITY GAUGE
25 VERTICAL SPEED INDICATOR
26 GYRO COMPASS
27 TURN AND BANK INDICATOR
28 HYDRAULIC PRESSURE GAUGE SELECTOR SWITCH
29 ALTIMETER
30 LOADMETER
31 GENERATOR WARNING LIGHT
32 VOLTMETER
33 MACHMETER
34 LANDING GEAR SELECTOR HANDLE
35 AIRSPEED INDICATOR
36 RADIO COMPASS
37 LANDING GEAR EMERGENCY UP BUTTON
38 PARKING BRAKE HANDLE
39 TOW TARGET JETTISON SWITCH (On aircraft so equipped.)
40 CANOPY ACTUATING SWITCH
41 EMERGENCY AIR START SWITCH

Figure 1-2 Cockpit - Forward View



| | |
|---|---|
| **1** | LEFT CIRCUIT-BREAKER PANEL |
| **2** | LANDING GEAR CONTROL CIRCUIT-BREAKER |
| **3** | COCKPIT AIR OUTLET SELECTOR LEVER |
| **4** | WINDSHIELD ANTI-ICING OVERHEAT WARNING LIGHT |
| **5** | COCKPIT AIR OUTLET |
| **6** | WINDSHIELD ANTI-ICING CONTROL LEVER |
| **7** | INSTRUMENT FLOODLIGHT (IN STOWED POSITION) |
| **8** | ROCKET RELEASE INDICATOR DIAL |
| **9** | CANOPY AND WINDSHIELD DEFROST CONTROL |
| **10** | ROCKET RELEASE CONTROL |
| **11** | SPEED BRAKE SWITCH |
| **12** | INSTRUMENT FLOODLIGHT MOUNT |
| **13** | GUNSIGHT GYRO CAGING BUTTON |
| **14** | TOW TARGET EMERGENCY RELEASE (On aircraft so equipped.) |
| **15** | FUEL SPECIFICATION PLACARD |
| **16** | MICROPHONE BUTTON |
| **17** | JET PIPE TEMPERATURE LIMITER OVERRIDE TELL-TALE |
| **18** | BOMB-ROCKET-TANK JETTISON BUTTON |
| **19** | OXYGEN REGULATOR |
| **20** | WING FLAP CONTROL |
| **21** | THROTTLE FRICTION WHEEL |
| **22** | THROTTLE CONTROL LEVER |
| **23** | FLIGHT CONTROL SWITCH |
| **24** | LONGITUDINAL ALTERNATE TRIM SWITCH |
| **25** | RUDDER TRIM SWITCH |
| **26** | COCKPIT PRESSURE CONTROL SWITCH |
| **27** | LATERAL ALTERNATE TRIM SWITCH |
| **28** | COCKPIT PRESSURE SCHEDULE SELECTOR SWITCH |
| **29** | COCKPIT TEMPERATURE CONTROL RHEOSTAT |
| **30** | COCKPIT TEMPERATURE CONTROL SWITCH |
| **31** | DROP TANK PRESSURE SHUT-OFF VALVE |
| **32** | CONSOLE EXTENSION LIGHT |
| **33** | ANTI-G SUIT PRESSURE REGULATING VALVE |

Figure 1-3 Cockpit - Left Side



**1** COCKPIT AIR OUTLET CONTROL
(Behind instrument light.)

**2** INSTRUMENT FLOODLIGHT MOUNT

**3** INSTRUMENT PANEL PRIMARY LIGHT RHEOSTAT

**4** INSTRUMENT PANEL AUXILIARY LIGHT RHEOSTAT

**5** CONSOLE AND PANEL LIGHT CONTROL RHEOSTAT

**6** AIR INTAKE DUCT PITOT HEATER SWITCH

**7** DROP TANKS EMPTY LIGHTS SWITCH

**8** CAMERA LENS APERTURE SELECTOR

**9** ENGINE IGNITION CIRCUIT-BREAKER

**10** RIGHT CIRCUIT-BREAKER PANEL

**11** MAP CASE

**12** FIRE WARNING CIRCUIT-BREAKER

**13** INSTRUMENT INVERTER CIRCUIT-BREAKERS

**14** IFF CONTROL PANEL

**15** GUNSIGHT TEST PLUG

**16** RADIO COMPASS CONTROL PANEL

**17** VHF CONTROL PANEL

**18** INSTRUMENT FLOODLIGHT
(In stowed position.)

Figure 1-4 Cockpit - Right Side

NOTE

Because of the characteristics of the fuel system, the low pressure warning light may illuminate even though the aircraft has a full fuel load. However when the fuel remaining is 500 lbs. or less, illumination of this light may be accompanied by a flameout. Flameouts are most likely to occur under conditions of full throttle and high speed while manoeuvring at low altitude. However, flameouts could conceivably occur under any condition of flight if the fuel quantity is allowed to drop below 400 lbs.

11 A liquidensitometer system is installed. This system incorporates a guarded selector switch on the right forward console. When the guard is down, the switch is at the IN or normal position and the fuel quantity gauge will show the total fuel supply in pounds, corrected for any variation in fuel density. When the guard is raised and the switch moved to OUT, the system is adjusted to permit uncompensated gauge readings. This condition is used when a standard indication of quantity, such as a full condition after refuelling, is desired.

BOOSTER PUMPS

12 Two fuel booster pumps in the centre wing cell supply fuel, under pressure, to the engine fuel system. The pumps are actuated by initial outboard movement of the throttle control lever.

13 The booster pumps and the transfer pump in the aft fuselage cell may be tested on the ground by means of three switches, two in the left wheel well and one in the right wheel well. In order to test the forward booster pump, power must be supplied to the secondary bus.

SHUT-OFF VALVE

14 The fuel shut-off valve, located upstream of the filter, is controlled through the engine master switch.

DROP TANK PRESSURE SHUT-OFF VALVE

15 A drop tank pressure shut-off valve is located on the left aft console. When the valve is turned ON, both tanks are pressured by air from the engine compressor section. The pressure shut-off valve should be ON at all times when drop tanks are carried to ensure that all fuel in the tanks is used to prevent collapse of the tanks during rapid descent. Two amber lights, one for each tank, indicate when the tanks are empty. The lights are controlled by a switch on the right aft console and should not be switched OFF until both tanks are empty.

## OIL SYSTEM

GENERAL

16 Lubrication is provided by a pressure-type oil system with a scavenge pump return to the oil tank located at the forward right side of the engine. No manual control of the system is provided.

OIL SPECIFICATION

17 The oil specification is 3-GP-901 (MIL-O-6081, Grade 1010) and 3-GP-900 (MIL-O-6081, Grade 1005, winter) (latest issues). In an emergency, OM71 3-GP-54 J D Eng RD 2479/1 may be used, or provided temperatures are not below -12. 2°C (10°F), 3-GP-38 (Utility Oil 44D) - classed as hydraulic fluid. If an emergency oil is used, an entry should be made in the L14T, and the system flushed and refilled with the approved oil as soon as possible.

OIL PRESSURE GAUGE

18 An electrical oil pressure gauge is located on the instrument panel.

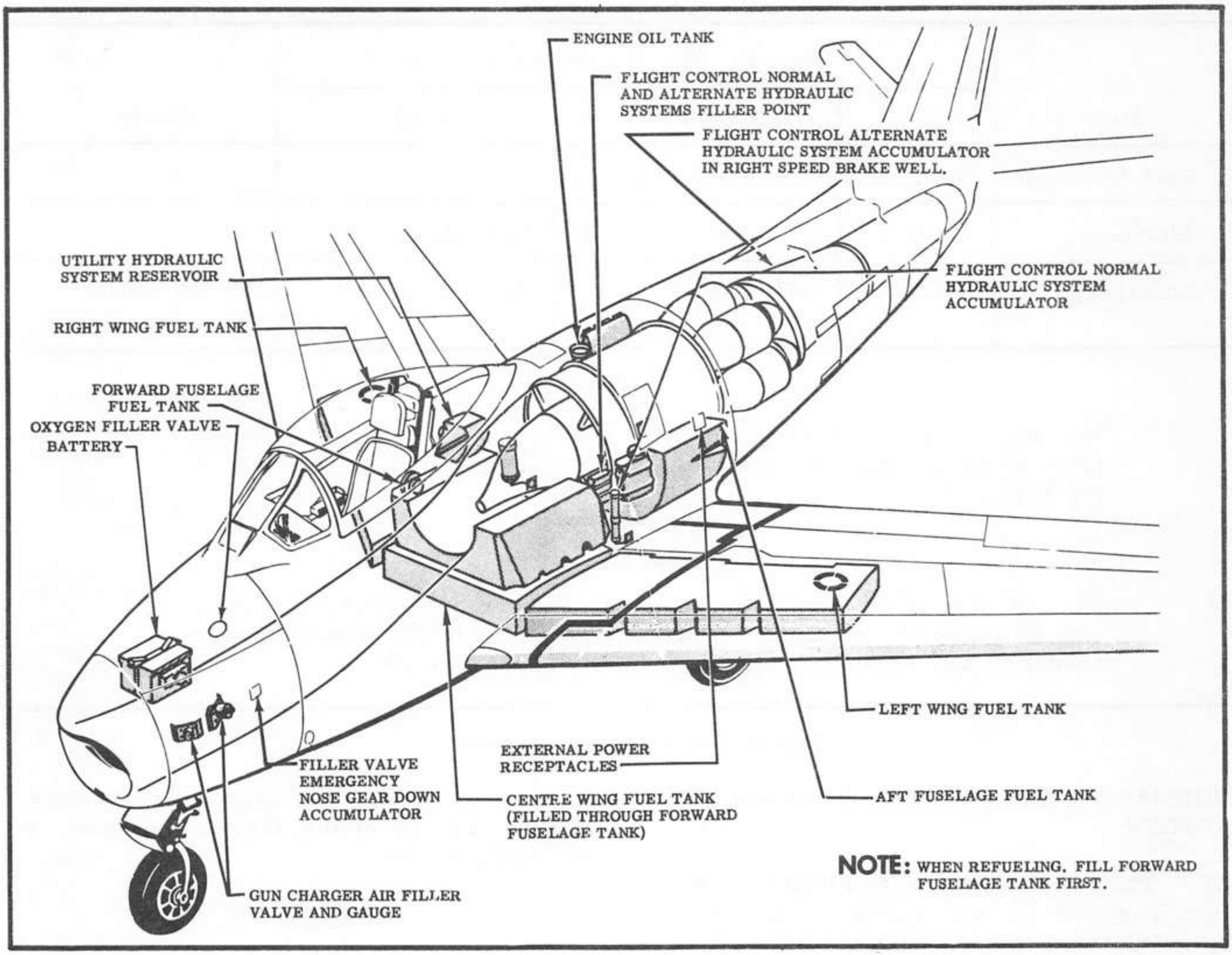
## HYDRAULIC SYSTEMS

GENERAL

19 The aircraft is equipped with three separate hydraulic systems; a utility system, a normal flight control system, and an alternate flight control system, see Figures 1-20 and 1-21. The systems are of the closed-centre constant-pressure type. The normal and alternate flight control hydraulic systems supply hydraulic power for operation of the ailerons and the horizontal tail.

UTILITY HYDRAULIC SYSTEM

20 The utility hydraulic system is a constant-pressure type system powered by an engine-driven pump. The system supplies power for the operation of landing gear, speed



**NOTE:** WHEN REFUELING, FILL FORWARD FUSELAGE TANK FIRST.

Figure 1-5 Servicing Diagram

brakes, nose wheel steering and the wheel brake boost. While the operation of speed brakes on a constant-pressure type system makes it unnecessary to return the control to neutral after each operation, the neutral position should be used. This will isolate the individual systems from the pressure supply and prevent loss of fluid in case of a damaged line.

## SYSTEM COMPENSATORS

21 Two spring-loaded compensators reduce pressure surges, pressurize the return lines of the systems and maintain head pressure on the reservoirs. Compensator pins, which should be visible to indicate correct system setting, may be checked through access doors just aft of each speed brake.

## EMERGENCY NOSE WHEEL LOWERING SYSTEM

22 The system consists of a hydraulic accumulator only. This provides sufficient pressure to lower the nose gear if the utility hydraulic system fails. The accumulator is automatically charged by utility system pressure.

## HYDRAULIC PRESSURE GAUGE AND PRESSURE GAUGE SELECTOR SWITCH

23 A three-position toggle switch, marked UTILITY, NORMAL (flight control) and ALTERNATE (flight control), selects pressure gauge readings for the corresponding systems. For ordinary flight conditions the switch should be kept at NORMAL. Both switch and gauge are located on the instrument panel.

| Fuel | Specification (latest issue) | | | Grade |
|---|---|---|---|---|
| | RCAF | U.S. | NATO | |
| Recommended | 3-GP-22 | MIL-F-5624 (JP-4) | F-40 | |
| Alternate | 3-GP-23 | MIL-F-5616 (JP-1) | F-30/32/33/34 | |
| Emergency | 3-GP-25 | MIL-F-5572 | F-12/15/18/22 | 80/87, 91/96<br>100/130, 115/45 |

NOTE

Not more than 25 hours per 150 or 225 hour overhaul period may be flown using gasoline. All such flying time must be entered in the engine log-book.

CAUTION

The use of gasoline in an engine having speed governors set for kerosene will increase the maximum rpm by approximately 1%. Maximum rpm should be kept within normal limits by use of the throttle.

Figure 1-6 Fuel Specifications

## NORMAL FLIGHT CONTROL HYDRAULIC SYSTEM

24 The normal flight control hydraulic system, powered by an engine-driven pump, operates the ailerons and the horizontal tail surfaces.

## FLIGHT CONTROL ALTERNATE HYDRAULIC SYSTEM

25 The flight control alternate hydraulic system is powered by an electrically-driven pump connected to the aircraft battery bus and operates automatically and independently when external power is connected or when the weight of the aircraft is off the nose gear and the generator is not charging. To operate the system when the aircraft is on the ground with only the battery connected, place the battery switch ON. The alternate hydraulic system is incorporated in the aileron and controllable horizontal tail control system so that, in the event of a loss of pressure in the normal system, the independent alternate system, operating from a separate reservoir, will be automatically engaged. Since the normal and alternate systems are independent, no single hydraulic failure can cause failure of both systems. The alternate system may be manually selected by placing the flight control switch, located just aft of the throttle quadrant, at ALTERNATE ON.

NOTE

Because of the lower output of the alternate pump, control movements should be held to a minimum to avoid the possibility of exhausting the hydraulic accumulator pressure supply while operating on the alternate system.

## FLIGHT CONTROL SWITCH

26 A three-position flight control switch on the left console, marked FLIGHT CONT, provides a means for manually changing from the normal to the alternate flight control hydraulic system. With the switch in the NORMAL position and with the engine running, the normal system supplies pressure to the flight controls. The alternate system will cut in automatically should the normal system fail. With the switch in the ALTERNATE ON position, the normal system pressure is by-passed through the hydraulic transfer valve and the alternate system supplies pressure to the flight controls. The RESET position will de-energize the normal and alternate system

transfer valves, allowing them to return to the normal position (normal system operating). This position of the flight control switch must be used whenever a switchover from alternate to normal system is desired. When the engine is not operating, the alternate system can be checked with an external source of power or with internal power by switching the battery to ON. To check the transfer to the normal system and the operation of the transfer valve, the engine must be running.

### ALTERNATE-ON WARNING LIGHT

27 The amber alternate-on warning light on the instrument panel is illuminated whenever the flight control alternate hydraulic system is operating.

## ELECTRICAL SYSTEM

### DC ELECTRICAL POWER SYSTEM

28 The dc power system, see Figure 1-7 is supplied by a 28-volt, 400-ampere engine-driven generator. A 36 ampere-hour 24-volt storage battery serves as a standby. Power is distributed from three electrical buses; battery, primary and secondary. The battery bus is energized at all times so that the essential equipment powered by the battery is operable regardless of the position of the battery-starter switch. The primary bus is energized by the battery bus when the battery switch is at BATTERY position or is energized directly when the generator is functioning or an external power supply is used. The secondary bus, which receives power through the primary bus, is energized, in addition to the primary and battery buses, only when the generator is operating or when an external power source is connected to the #1 receptacle.

### AC ELECTRICAL POWER SYSTEM

29 A main three-phase instrument inverter is powered from the primary bus. Should failure occur, an alternate three-phase inverter is engaged by moving the instrument power switch, located on the centre console, from NORM to ALTERNATE. For equipment operated by the three-phase inverter, see Figure 1-7.

30 A single-phase inverter, powered from the primary bus but operating only when the generator is operating, supplies power to the sight, radar and air conditioning control system. No transfer system is provided for the single-phase inverter. Lights indicate when the generator or individual inverters fail.

### BATTERY-STARTER SWITCH

31 The battery-starter switch is located on the right forward console. This three-position switch may be selected to maintained positions of BATTERY and OFF and may be selected against spring-loading to STARTER position.

### ELECTRICAL SYSTEM INDICATORS

32 A loadmeter and voltmeter are installed on the instrument panel. The loadmeter indicates the load on the generator as a percentage of the maximum generator output. The voltmeter indicates the generator voltage output. The voltmeter also indicates battery voltage when the battery-starter switch is at BATTERY and the generator is inoperative.

### INVERTER WARNING LIGHTS

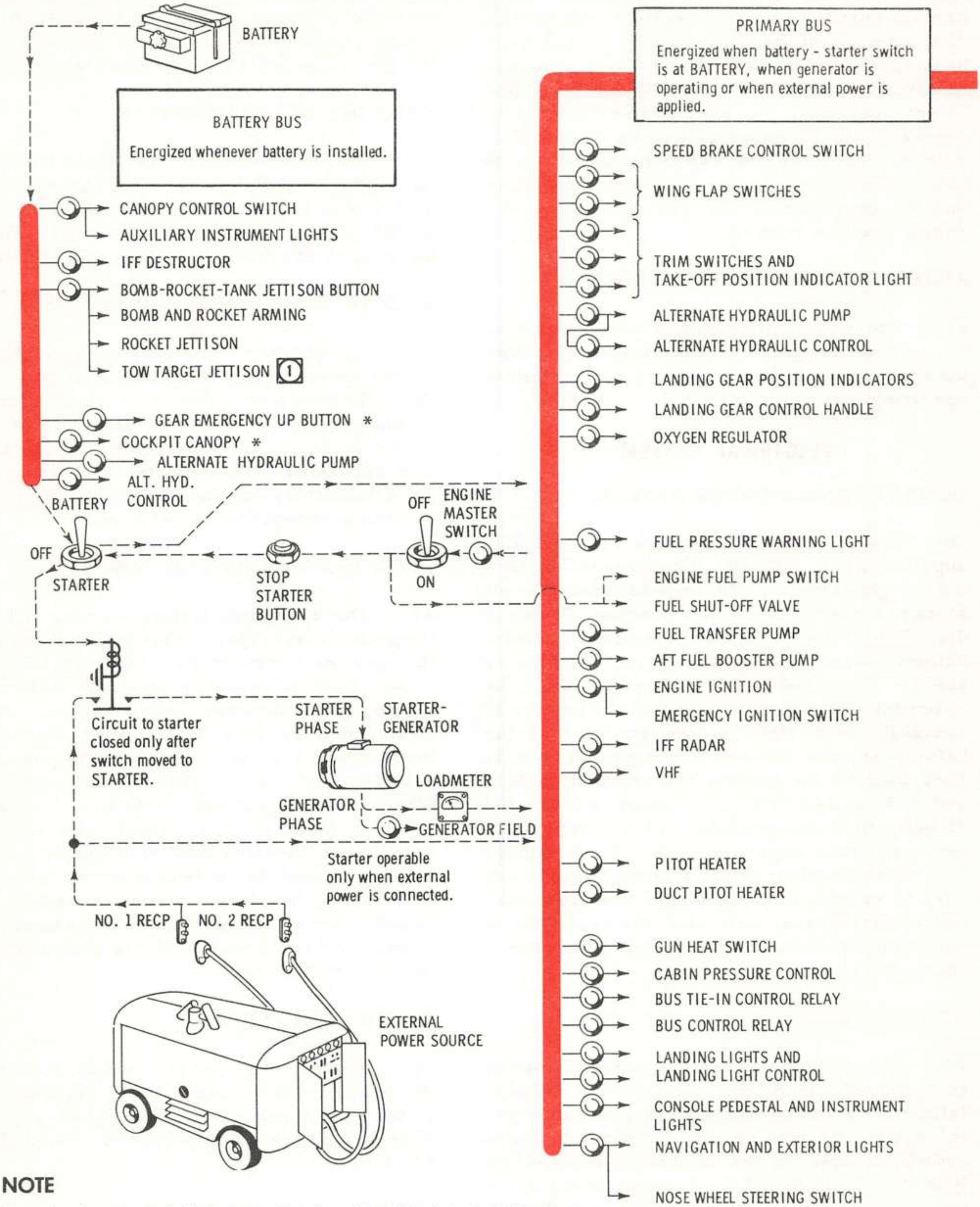
33 Three inverter failure warning lights, of the push-to-test type, are set horizontally along the upper left edge of the instrument panel. An amber light illuminates when the main radar single-phase inverter fails. Another amber light indicates loss of the main instrument three-phase inverter, at which time the alternate three-phase inverter should be selected. When both instrument inverters fail, a red warning light is illuminated. The alternate instrument inverter and gun heater circuit-breakers must be in before the warning light will show. If these circuit-breakers are tripped due to an overload in the system, the warning light will not illuminate if a subsequent inverter failure occurs.

### GENERATOR SWITCH

34 A generator control switch, located on the engine control panel on the right console, is held by a guard in its normal ON position, This switch has three positions; ON, OFF and RESET.

### GENERATOR WARNING LIGHT

35 In case of generator failure or when generator output falls below that required to close the reverse-current relay, a generator warning light located on the instrument panel



**NOTE**

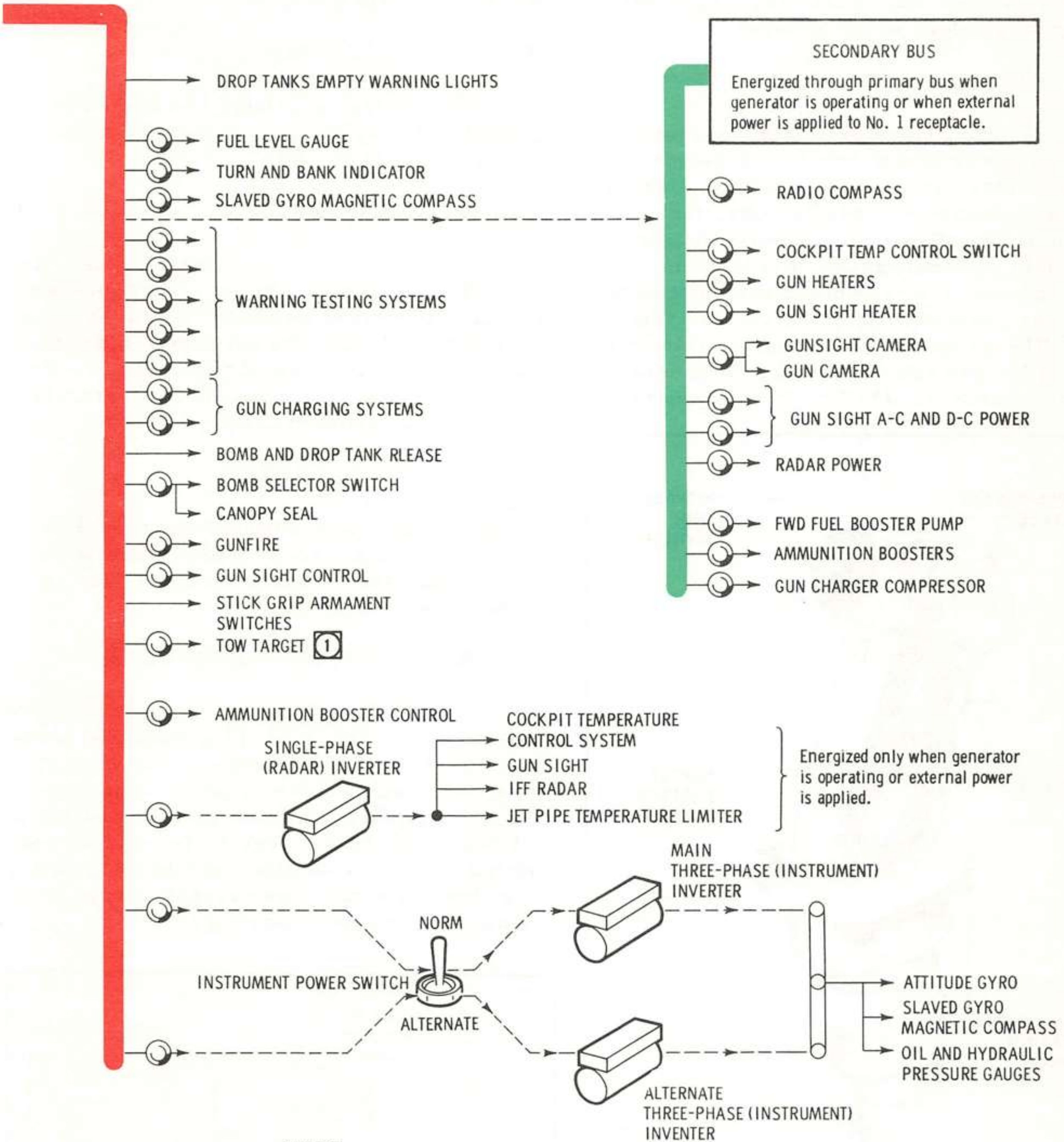
* These circuits are connected to secondary bus when secondary bus is energized.

All equipment operable when external power source is connected to No. 1 receptacle and battery-starter switch is at BATTERY.

→ ARROWS INDICATE DIRECTION OF CURRENT FLOW

○ CIRCUIT-BREAKERS

Figure 1-7 (Sheet 1 of 2) Electrical Power Distribution



**NOTE**

In case main three-phase (instrument) inverter fails, units normally powered by the main three-phase (instrument) inverter are transferred to the alternate three-phase (instrument) inverter by turning instrument power switch to ALTERNATE.

① On aircraft so equipped.

Figure 1-7 (Sheet 2 of 2) Electrical Power Distribution illuminates. This indicates that all equipment powered by the secondary bus is inoperative and that all non-essential electrical equipment should be turned off, as the electrical system is operating solely on the battery.

## OVERVOLTAGE PROTECTION

36 The overvoltage protection system consists of an overvoltage relay, a generator field control relay and a red warning light. If generator voltage exceeds 31 volts, the overvoltage relay will electrically trip the generator field control relay, disconnecting the generator from the system and illuminating the generator warning light on the instrument panel. The generator field control relay may be reset by momentarily holding the generator control switch at RESET. If the generator warning light goes out, a temporary overvoltage existed and is now rectified or is back to normal. The generator switch may then be placed in the ON position.

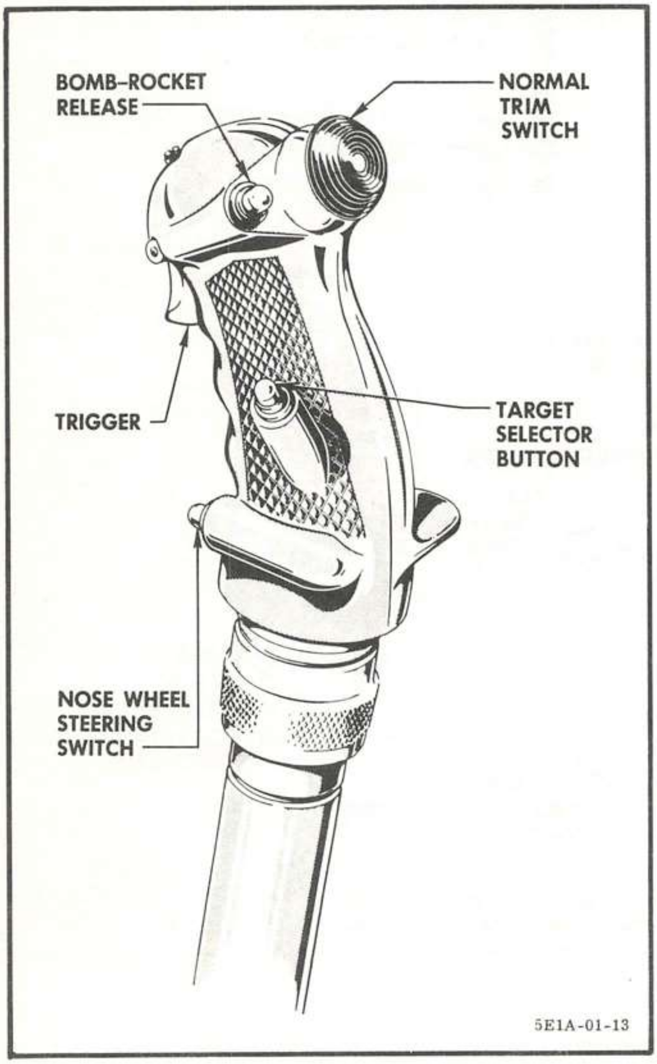


Figure 1-8 Stick Grip

## VOLTAGE REGULATOR

37 The voltage regulator is adjusted on the ground. With engine rpm above 45%, voltmeter readings should be 28 (±0.5) volts.

## CIRCUIT-BREAKERS

38 Most of the dc electrical circuits are protected by push-to-reset circuit-breakers or circuit-breaker switches. Circuit-breaker panels are located on each side of the cockpit and two panels are located on the nose section. All ac circuits are protected by fuses which are not replaceable in flight.

NOTE

On aircraft so modified, charts will be found on the canopy sill to assist in locating the circuit-breakers in an emergency.

## EXTERNAL POWER RECEPTACLES

39 Two external power receptacles are located on the left side of the fuselage, above and aft of the trailing edge of the wing. The external power source must be connected to the #1 receptacle to make power available to all buses. If the #2 receptacle only is connected, power is supplied only to the primary bus. Both external power receptacles must be connected for engine starting.

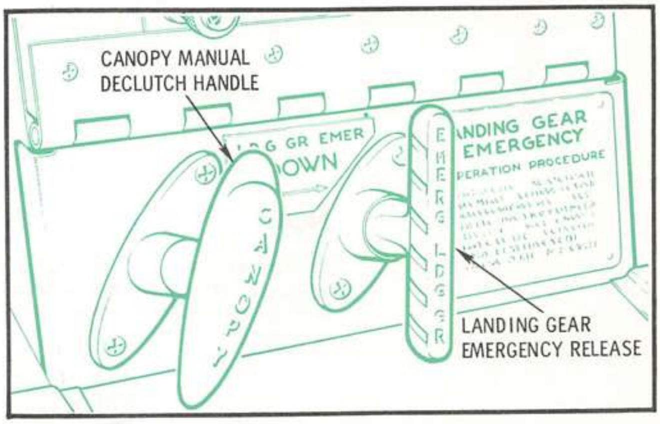


Figure 1-9 Lower Centre Pedestal

## SURFACE CONTROLS

### CONTROL COLUMN

40 The control column is of the normal stick type with a stick grip, see Figure 1-8 which mounts the following controls: radar target selector button, lateral and longitudinal normal trim switch, bomb-rocket release switch, nose wheel steering switch and the gun trigger.

41 To reduce stick forces in flight, the ailerons and horizontal tail-plane are operated by the surface control hydraulic power system. The control column actuates hydraulic valves through rod and cable linkage. The valves control the flow of fluid to hydraulic jacks which operate the ailerons and horizontal tail. Should the normal flight control hydraulic system fail, the alternate system will automatically engage. (Refer to paras. 23 through 27, preceding). Since the operating struts are irreversible, control surface attitude cannot change except in response to control column movement. In the event of a failure in the linkage between the control column and the artificial feel bungee, the horizontal stabilizer can be controlled through approximately half its maximum range by the use of trim. The rudder is cable operated and is provided with an electrically-actuated trim tab.

### ARTIFICIAL FEEL SYSTEM

42 Because no feel of air loads can be transmitted through the irreversible hydraulic control system, an artificial feel system is installed. Normal stick forces resulting from G loads are provided through a bob-weight. Control surface air loads are simulated by bungees connected into the control system. The bungees apply loads in proportion to degree of control column deflection from neutral position. To trim the aircraft, the neutral position is changed by means of the normal or alternate trim switch, and bungees are repositioned correspondingly to maintain proper feel.

NOTE

> In case of failure of the artificial feel system, while the stick forces are reduced to practically nil, the aircraft is still completely controllable. Care is required to avoid over-control.

### RUDDER PEDALS

43 Pedal adjustment is conventional and exact alignment is facilitated by a position indicating wheel on the outboard side of each pedal. When the visible dial numbers correspond, the pedals are adjusted evenly.

### CONTROLLABLE HORIZONTAL TAIL

44 The elevators and horizontal stabilizer are controlled and operated as one unit, known as the controllable horizontal tail. The horizontal stabilizer part of this unit is pivoted at the aft edge so that the leading edge can be moved up or down by control column action. The elevators are operated at the same time through mechanical linkage to the stabilizer section and move in proportion to movement of the stabilizer. Elevator travel is greater than that of the stabilizer. The controllable horizontal tail can be trimmed through use of either the normal or the alternate trim switch.

### NORMAL TRIM SWITCH

45 Normal trim of the horizontal tail or of the ailerons is provided through a five-position knurled switch on top of the stick grip. This switch is spring-loaded to centre OFF position. When the lateral alternate trim switch is at NORMAL and the longitudinal alternate trim switch is at NORMAL GRIP CONT, lateral movement of the normal trim switch produces corresponding aileron trim. When the longitudinal alternate trim switch is at NORMAL GRIP CONT, fore-and-aft movement of the normal trim switch produces corresponding elevator trim. When the switch is released, it automatically returns to off and trim action stops.

### LONGITUDINAL ALTERNATE TRIM SWITCH

46 A four-position switch on the left side of the cockpit provides an alternate trim circuit for the horizontal tail. Operation of this switch accomplishes longitudinal trim at the same speed obtained through use of the normal trim control. The switch is usually kept at NORMAL GRIP CONT, which allows the normal trim switch to be used. Holding the longitudinal alternate trim switch at NOSE UP or NOSE DOWN disconnects the normal trim circuit for the stabilizer, and trims the aircraft accordingly through the alternate trim system. The

switch is spring-loaded to OFF and is guarded in the NORMAL GRIP CONT position. When the switch is at OFF, both the normal longitudinal trim circuit and the alternate longitudinal trim are inoperative.

## LATERAL ALTERNATE TRIM SWITCH

47 A four-position switch on the left aft console provides an alternate means of lateral trim. This switch is usually kept at NORMAL. Holding the switch to either LEFT or RIGHT produces corresponding aileron trim and disconnects the normal aileron trim circuit. The switch is spring-loaded to OFF. Both the normal and alternate lateral trim circuits are inoperative when the alternate lateral trim switch is off.

## RUDDER TRIM SWITCH

48 An electrically-actuated rudder trim switch is located on the left aft console. The switch is held to LEFT or RIGHT for corresponding rudder trim.

## TAKE-OFF TRIM POSITION INDICATOR LIGHT

49 An amber light on the instrument panel indicates take-off trim position for ailerons, horizontal tail and rudder. The light will illuminate whenever any one of these controls is trimmed to the take-off position and will go out when the trim switch is released. It will illuminate again when the next control is trimmed for take-off.

NOTE

The take-off trim position indicator light does not operate when the longitudinal and lateral alternate trim switches are used.

50 The horizontal tail trim should be slightly forward of the fully aft position for take-off. Soon after becoming airborne, continuous forward trim will be desirable while accelerating to best climbing speed. Regardless of the trim position, a pilot of average strength will be able to overcome any stick forces encountered.

## WING SLATS

51 Wing slats extend along the leading edge of each wing. Aerodynamic forces cause the slats to open and close automatically under varying flight conditions. At low airspeeds, (below 185 knots IAS with a clean aircraft), the slats open to improve lateral stability and reduce the stalling speed. In accelerated flight the slats open at speeds up to Mach 0.9, the actual speed at opening depending on the altitude and amount of G loading.

## WING FLAPS

52 Slotted-type flaps extend from the aileron to the fuselage on each wing panel. Each flap is actuated through an individual electric motor and electric circuit. The flaps are mechanically interconnected to prevent either complete failure on one side or asymmetric operation. The flaps are loaded by the actuators in the up position to prevent airloads from moving them out of this position. No emergency system is provided, as there is sufficient protection present in the normal system.

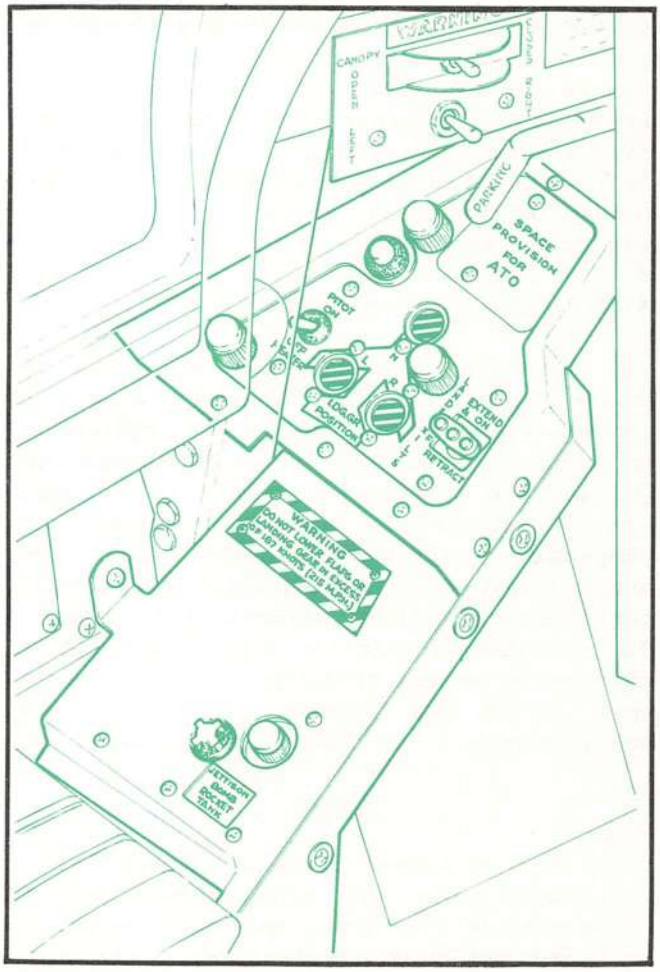


Figure 1-10 Left Forward Console

NOTE

If flaps are positioned only 1-1/2" down, they will not retract unless further down selection is made first.

WING FLAP CONTROL LEVER

53 The wing flap control lever, inboard of the throttle on the left console, moves in a quadrant marked UP, HOLD and DOWN. To move the flaps, the lever is placed at UP or DOWN and then returned to HOLD when the desired flap position has been obtained. There is no flap position indicator. A red line painted on the leading edge of the flap indicates flap take-off position when it becomes visible.

RUDDER CONTROL LOCK

54 A rudder control lock is permanently installed beneath the centre of the instrument panel. When the handle is pulled aft, a rudder cable lock is set to engage when the rudder is neutral. The nose wheel steering cable is locked at the same time. The other surfaces, being hydraulically operated, are irreversible and do not require a lock.

SPEED BRAKES

55 Hydraulically-operated speed brakes are located on each side of the rear fuselage.

SPEED BRAKE SWITCH

56 A switch on top of the throttle lever controls the speed brake hydraulic control valve. The switch has three fixed positions: IN, OUT and a neutral position which is indicated by a white mark on the switch guide. After the brakes have been opened or closed, the switch should be returned to neutral.

**WARNING**

Since the hydraulic lines to the speed brake actuating cylinders are routed near the engine, it is extremely important that the speed brake switch be kept in the neutral position tc minimize the fire hazard should a line be damaged.

## LANDING GEAR

GENERAL

57 The landing gear and wheel fairing doors are hydraulically actuated and electrically controlled and sequenced. A removable ground safety lock may be inserted in the nose gear assembly to prevent inadvertent nose gear retraction on the ground. No ground safety locks are provided for the main gear, as the weight of the aircraft on the main gear prevents accidental retraction while the aircraft is motionless.

NORMAL LANDING GEAR CONTROL

58 A landing gear control handle at the left side of the instrument panel electrically controls the landing gear and door hydraulic selector valves. The control handle has two positions: UP and DOWN. When the gear is down and locked and the weight of the aircraft is on the gear, a ground safety switch prevents retraction if the gear handle is inadvertently moved to UP. The fairing doors are not controlled by this switch and will follow their normal sequence, opening when the gear control is moved to UP, thereby providing warning to the ground crew that the gear control is in the wrong position for taxiing.

LANDING GEAR EMERGENCY UP CONTROL

59 If it is necessary to collapse the gear in an emergency, the landing gear ground safety switch can be overridden by use of a shielded EMERG UP push-button switch located above the gear control handle. When the gear control is at UP and the EMERG UP button is depressed, the ground safety switch and the landing gear door solenoid are by-passed and the gear is retracted hydraulically in the normal manner, except that the fairing doors will not open and will be damaged by retraction of the gear.

LANDING GEAR EMERGENCY RELEASE

60 When the landing gear emergency release at the bottom of the centre pedestal, see Figure 1-9, is pulled all the way out and held for at least 11 seconds, the main gear and all the fairing doors are mechanically unlocked and the gear and door hydraulic selector valves are positioned to lower the gear. If the electrical

control system has failed, the gear will lower under pressure from the main hydraulic system. If the hydraulic system has failed, the main gear will fall free when the emergency release is pulled.

**WARNING**

Whenever the landing gear emergency lowering system has been used, the nose gear cannot be retracted in flight. It will be necessary to manually reset the nose gear emergency lowering valve on the ground. This will automatically charge the accumulator by utility system pressure.

## LANDING GEAR POSITION INDICATORS

61 The position of the landing gear is shown by three indicators on the left forward console, see Figure 1-10. One indicator is provided for each gear and will display parallel red and yellow diagonal lines if its respective gear is in an unlocked condition. The diagonal lines will also appear when the battery-starter switch is OFF or when primary bus is not energized. The word UP appears if the gear is up and locked. A miniature wheel shows when the gear is down and locked.

## LANDING GEAR WARNING HORN

62 When the throttle is retarded below cruising power, a warning horn in the cockpit sounds if the landing gear is not down and locked. A horn cut-out button is located on the left forward console.

## LANDING GEAR CONTROL WARNING LIGHT

63 A red warning light is located within the landing gear control handle. The light may be tested by pressing the warning horn cut-out button with the throttle in the retarded position. The light illuminates under the following conditions.

(a) With the handle UP and any gear or door unlocked.

(b) With the handle DOWN and any gear unlocked.

(c) With the handle UP, the gear and doors locked up, and the throttle retarded below minimum cruising rpm.

## NOSE WHEEL STEERING SYSTEM

64 The nose wheel steering system is electrically engaged, hydraulically powered and controlled by the rudder pedals. Steering is accomplished by depressing a switch on the stick grip, synchronizing the rudder pedals with the nose wheel, and then operating the rudder pedals to control a hydraulically-operated nose wheel steering unit. This unit permits the wheel to be turned approximately 21° each side of centre. When not engaged for steering, the unit serves as a conventional hydraulic shimmy damper. A safety switch, mounted on the nose wheel strut torque link, prevents engagement of the steering unit whenever the weight of the aircraft is off the nose gear.

## NOSE WHEEL TOWING RELEASE PIN

65 The nose wheel towing release pin is located on the left side of the nose gear strut just above the wheel fork. For towing the aircraft, the pin is disengaged, disconnecting the steering damper unit and allowing the wheel to swivel. Before flight, make sure the safety cap is on. This will ensure that the release pin is engaged.

## NOSE WHEEL STEERING SWITCH

66 The push-button type nose wheel steering switch on the stick grip actuates a shut-off valve to supply hydraulic pressure to the nose gear steering unit. To engage the steering unit the switch must be depressed and the rudder pedals synchronized with the nose wheel. When the nose wheel and rudder pedals are coordinated in this manner, the nose wheel steering unit is automatically engaged. The unit will not engage if the nose wheel is more than 21° either side of centre. Should the nose wheel be turned more than this, it must be brought within the steering range by use of the wheel brakes.

## WHEEL BRAKES

### GENERAL

67 The wheel brakes are operated by toe action on the rudder pedals. Brake pressure is supplied from brake master cylinders supplemented by power boost from the utility hydraulic system. If no pressure is available from the utility hydraulic system, the brakes function through conventional action of the brake master cylinders when toe pressure is applied to the rudder pedals, but greater effort is required for a given effect.

### PARKING BRAKE CONTROL

68 The parking brake handle is located on the left side of the cockpit, above and outboard of the landing gear control. Parking brakes are set by pressing hard on the toe brakes, pulling the parking brake handle all the way out, releasing toe brake pressure and releasing the parking brake handle. Parking brakes are released by exerting pressure on the toe brakes. If brakes do not release easily, the toe brakes should be pressed hard and the parking brake handle pushed all the way in.

**CAUTION**

To avoid the possibility of brake malfunction, ensure that the parking brake handle is pushed fully in before taxiing. To prevent seizing, allow the wheel brakes to cool after taxiing, before setting the parking brake.

## POWER PLANT CONTROL SYSTEM

### MAIN FUEL CONTROL SYSTEM

69 The fuel system consists of two engine-driven, variable-delivery pumps, proportional flow control unit, acceleration control unit, jet pipe temperature (JPT) limiter, non-return valves, flow distributor, minimum pressure valve and dump valve. Engine requirements are sensed through a servo mechanism which controls the fuel pump delivery according to various throttle openings. Ram pressure and varying altitudes are also a controlling factor. Each pump is capable of delivering sufficient fuel to ensure rated thrust, depending on temperature and type of fuel.

### EMERGENCY FUEL SYSTEM

70 The emergency fuel system provides full manual control of the fuel flow in the event of failure of one of the fuel pumps or malfunction of the automatic flow control units. When the emergency fuel control switch on the main instrument panel is placed ON, the fuel flow is directed through a separate emergency flow control unit to the flow distributor, by-passing the proportional flow control unit, acceleration control unit and JPT limiter. The servo system is isolated and the fuel pumps deliver full output at all engine speeds up to governing rpm.

**CAUTION**

When operating on the emergency fuel system, all accelerations are manually controlled and it is essential that a slow, steady movement of the throttle be maintained.

### EMERGENCY FUEL CONTROL SWITCH

71 A two-position switch on the upper left side of the instrument panel, when placed ON, directs the flow from the engine fuel pumps through the emergency fuel system. A warning light indicates when the switch is ON.

### LOW FUEL PRESSURE WARNING LIGHT

72 A warning light on the instrument panel indicates when the fuel pressure drops to approximately 3 psi.

### JET PIPE TEMPERATURE VARIATION

73 The jet pipe temperature of engines with fixed area exhaust nozzles is affected by ambient air temperature, altitude, airspeed and rpm. Generally, with constant altitude and rpm, JPT will increase with ambient air temperature above 5°C (41°F) or with airspeed. It will increase with altitude up to approximately 20,000 feet. These factors can change singly or coincidentally, thus causing an inconsistent JPT for any given rpm. Ordinarily, an increase

in JPT can be expected during take-off, and on the climb to approximately 20, 000 feet, up to (715° ± 15°C), (1319° ± 59°F) when it will be controlled by the JPT limiter. Control by the JPT limiter with the throttle lever at the normal full throttle stop, will result in a drop in engine speed. The engine speed will continue to drop as altitude is increased.

74 No action can be taken by the pilot if jet pipe temperature is below the limit, although it should be remembered that thrust decreases with a decrease in JPT during operation at a constant engine rpm. Jet pipe temperatures are automatically controlled, when using normal engine fuel system, by the incorporation of a limiter system which does not allow the temperature to exceed approximately 715° (±15°C), (1319° ± 59°F). The limiter is inoperative when operating on the emergency fuel system.

## THROTTLE CONTROL LEVER

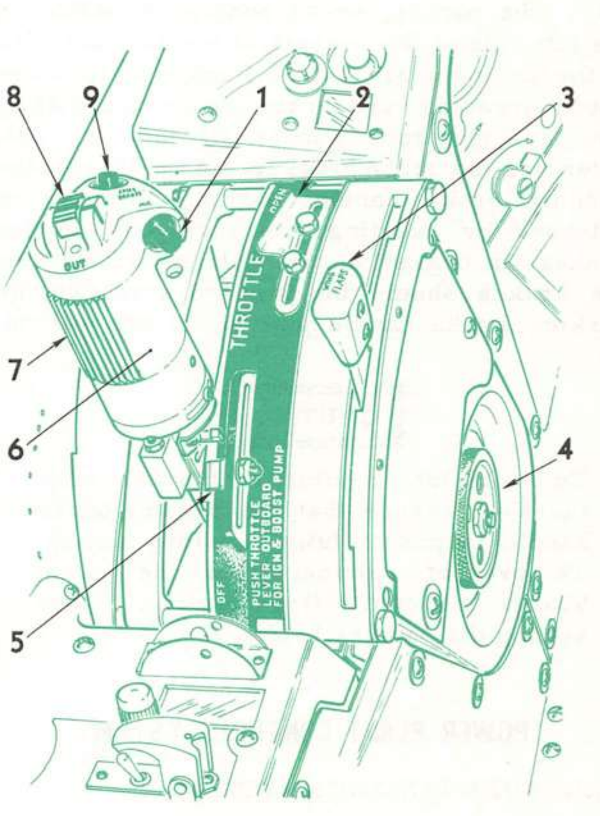
75 The throttle control lever, see Figure 1-11 is linked to the throttle valves on the proportional flow control and emergency flow control units. With the engine master switch ON, initial outboard movement of the throttle lever energizes the fuel booster pump and the ignition circuits. When the throttle lever is advanced from OFF to IDLE, fuel flow for idling is maintained by a by-pass from the throttle valve. Closing the throttle lever cuts off the idling flow, thus obviating the necessity for a separate high pressure shut-off cock. A stop is fitted to the quadrant at the IDLE position to prevent inadvertent shutting off of the fuel supply. This stop may be by-passed when starting or stopping the engine. The grip on the throttle lever contains the speed brake switch, the gunsight, gyro caging button and the microphone button. Rotation of the grip will manually range the radar gunsight. The normal full throttle stop may be overridden in an emergency by moving the throttle lever outboard and advancing it to the end of the quadrant. This action will override the JPT limiter and at the same time will break the wire tell-tale. (Refer to Part 3).

## ENGINE MASTER SWITCH

76 The shielded engine master switch on the right console, see Figure 1-12, controls the low pressure fuel shut-off valve and completes the electrical circuits to the fuel booster pumps and to the throttle lever actuated micro-switch controlling ignition during starting.

## IGNITION

77 Current for ignition is supplied to the spark plugs when the engine master and starter switches are ON and the throttle lever is moved from the OFF position. When the starter is subsequently disconnected from the circuit the ignition relay is de-energized. Ignition is required only during the starting procedure, since the mixture in the combustion chambers will burn continuously after being ignited.

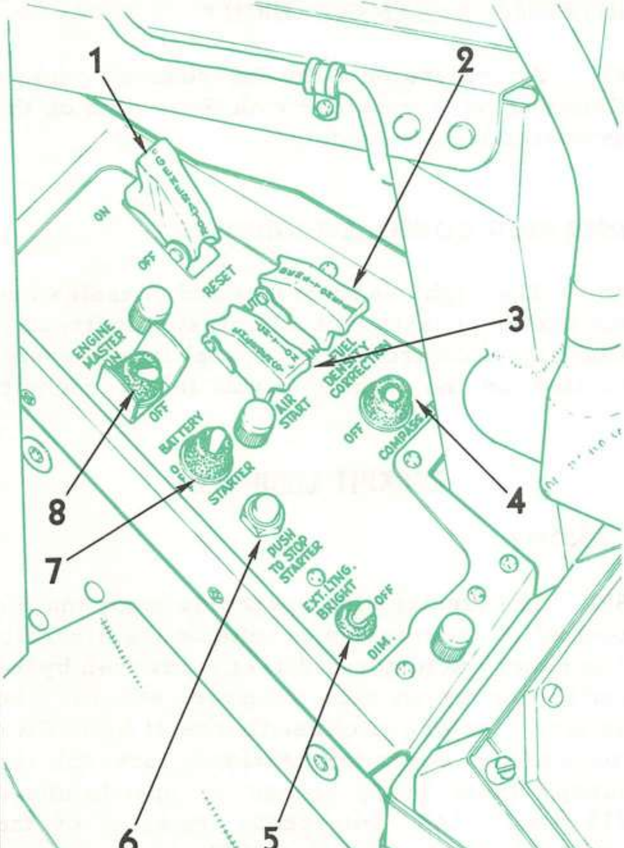


1 MICROPHONE BUTTON
2 JET PIPE TEMPERATURE LIMITER OVERRIDE STOP
3 WING FLAP LEVER
4 THROTTLE LEVER FRICTION WHEEL
5 IDLE STOP
6 THROTTLE CONTROL LEVER
7 RADAR GUNSIGHT MANUAL RANGE CONTROL
8 SPEED BRAKE SWITCH
9 GYRO GUNSIGHT CAGING BUTTON

Figure 1-11 Throttle Control Lever

### EMERGENCY IGNITION SWITCH

78 A duplicate air start ignition switch is installed on upper left hand corner of instrument panel to enable the pilot to operate the emergency ignition and emergency fuel switches simultaneously with his left hand. The switches are located, one on right forward console, see Figure 1-12, and the other one on a bracket at the upper left hand corner of the instrument panel, see Figure 1-2. These switches are used to supply ignition for restarting the engine in flight. With the emergency ignition switch on (forward), the battery is connected to the ignition system when the throttle lever is advanced from OFF and the battery switch is ON. The emergency ignition switch should be left on only until ignition occurs, as it causes an additional drain on the battery. If the switch is left on for longer than three minutes or is used too frequently, the ignition transformer will be damaged.



1 GENERATOR CONTROL SWITCH
2 FUEL DENSITY CORRECTION SWITCH
3 EMERGENCY IGNITION SWITCH
4 STANDBY COMPASS LIGHT SWITCH
5 EXTERIOR LIGHTS SWITCH
6 PUSH-TO-STOP-STARTER BUTTON
7 BATTERY-STARTER SWITCH
8 ENGINE MASTER SWITCH

5E1A-01-16C

Figure 1-12 Right Forward Console

### STARTER

79 A combination starter-generator unit is provided for cranking the engine. An external power source must be used for starting, as the starter cannot be powered by the aircraft battery. The battery-starter switch on the engine control panel operates the starter when held momentarily at the STARTER position. A starter relay continues to energize the starter until engine speed reaches the required rpm at which point the starter circuit is automatically disconnected.

### PUSH-TO-STOP-STARTER BUTTON

80 A button, marked PUSH TO STOP STARTER, is located below the battery starter switch on the right forward console. During the normal starting procedure, this button is used to de-energize the starter if the engine fails to start and also to prevent damage to the starter if the starter cut-out fails to operate.

## FLIGHT AND ENGINE INSTRUMENTS

### FLIGHT INSTRUMENTS

81 The following flight instruments are provided: altimeter, airspeed indicator, vertical speed indicator, turn and bank indicator artificial horizon, gyro compass, magnetic compass, radio compass, accelerometer, machmeter, clock and cabin altimeter.

### GYRO COMPASS FAST SLAVING BUTTON

82 The gyro compass fast slaving button located on the instrument panel de-energizes the slow slaving cycle to permit faster gyro recovery to the tube heading. When the primary bus is powered for starting purposes, the gyro compass is automatically on a fast slaving cycle for the first two or three minutes, making operation of the fast slaving button unnecessary.

NOTE

A period of ten minutes should elapse between successive operations of the fast slaving button.

CAUTION

The J-2 compass system uses a thermal time delay switch for fast slaving. A series of repeated operations of the fast slaving switch may cause the compass slaving cycle to finish before the compass is slaved to the correct magnetic heading. After sustained manoeuvres, where several fast slaving operations may be performed over a short period of time, the J-2 heading indicator should be cross-checked with the standby compass. The gyro of the J-2 compass system is limited to 80° freedom in both the roll and pitch axes and may topple in flight if these limits are exceeded. Erroneous heading indications will result in such instances. This condition can be aggravated if rolls are done on an East/West heading or loops performed on a North/South heading.

### ENGINE INSTRUMENTS

83 The following engine instruments are provided: oil pressure gauge, tachometer, fuel quantity indicator, jet pipe temperature indicator, ammeter (loadmeter), low fuel pressure warning light, voltmeter, hydraulic pressure gauge and an emergency fuel control warning light.

## LIGHTING EQUIPMENT

### NAVIGATION LIGHTS

84 The aircraft is equipped with navigation lights which are controlled by a three-position switch on the right forward console.

### LANDING LIGHTS

85 Two retractable lights are located in the fuselage nose just forward of the nose wheel door. Both lights are automatically turned off when retracted regardless of the position of the landing and taxi light switch. The landing and taxi lights are controlled by one switch, located on the left forward console. When the switch is at EXTEND, both lights illuminate and extend to landing position. When the aircraft touches the ground, the landing light goes out and the taxi light extends further to taxiing position.

### INTERIOR LIGHTS

86 The instrument panel is illuminated by two auxiliary lights. Two red console lights and ring-type instrument lights are controlled by rheostats on the right sidewall. The standby compass ring-light is controlled by a switch on the right console.

### INTERIOR EXTENSION LIGHT

87 An extension light for general cockpit illumination is provided with the switch on the extension light assembly.

### INTERIOR CONSOLE LIGHTING

88 The right and left forward consoles and the centre pedestal are illuminated indirectly. Lighting is controlled by a panel light rheostat located on the right sidewall in the cockpit.

## COCKPIT EQUIPMENT

### CANOPY

89 The electrically-operated canopy may be controlled from inside or outside the aircraft. The canopy actuator is directly powered by the battery or by an external power source. The battery-starter switch need not be at BATTERY for canopy operation. Airloads prevent the canopy from being opened at speeds above 215 knots IAS. Emergency release of the canopy in flight is accomplished by means of a remover which fires the canopy off the aircraft. The handgrip on either armrest will jettison the canopy when raised. Raising either handgrip also deflates the canopy seal, locks the shoulder harness and cocks its seat firing trigger. With the gas-actuated canopy and seat ejection system, the pilot can eject himself through the canopy should the canopy fail to jettison. Three ground safety pins must be installed, one in each of the gas initiators, to prevent accidental firing of the ejection system when the aircraft is on the ground. The safety pins must be removed before flight and replaced after flight. Safety pins are stowed in the map case during flight.

## ALTERNATE CANOPY JETTISON RELEASE

90 The canopy may also be jettisoned by pulling the release handle located below the right forward console. When this method is used, the shoulder harness remains unlocked and the seat triggers are not exposed.

## CANOPY SEAL

91 An inflatable canopy seal is provided which seals the canopy in the fully closed position. Pressure for inflation of the seal is automatically controlled by a pressure regulator. When the canopy switch is actuated, the seal is automatically deflated to allow the canopy to move. The seal is also automatically deflated before canopy ejection. Should the canopy switch be moved to CLOSED during flight, it will cause the seal to deflate and will result in loss of cockpit pressurization. When the switch is released, the canopy seal will be inflated and the cockpit will become pressurized again.

## EXTERNAL CANOPY CONTROLS

92 The canopy is operated externally by means of two push-buttons located on each side of the fuselage approximately two feet below and in line with the windshield. The buttons are marked OPEN and CLOSED. Operation of any external button overrides the selection of the cockpit switch, but if the cockpit switch is left at OPEN and an external button used for closing, the canopy will open again as soon as the external button is released.

## CANOPY SWITCH

93 From inside the cockpit, the canopy is controlled by a three-position toggle switch above the left forward console. To close the canopy, the switch should be moved to the spring loaded close position and held for 2 or 3 seconds after canopy closing to ensure tight sealing. To open the canopy, the switch is placed in the OPEN position. When the canopy has fully opened, power to the canopy actuator is automatically cut off. When the switch is at the centre position, the canopy is locked, whether partially open, fully open or closed.

## CANOPY DECLUTCH AND MANUAL CONTROL HANDLES

94 A canopy declutch handle at the bottom of the centre pedestal, when pulled, disengages the canopy from the canopy latches so that it can be moved manually by the manual control handle on the right side of the canopy bow. During flight, the canopy can be manually opened for approximately two inches after the internal canopy declutch handle is operated, when airloads will prevent further opening. The canopy can be electrically opened during flight at speeds below 215 knots IAS and can then be declutched. Airloads should remove it from the aircraft.

NOTE

Once the canopy declutch handle has been pulled, it will be impossible for the pilot to return it to the closed position.

## EXTERNAL CANOPY EMERGENCY RELEASE

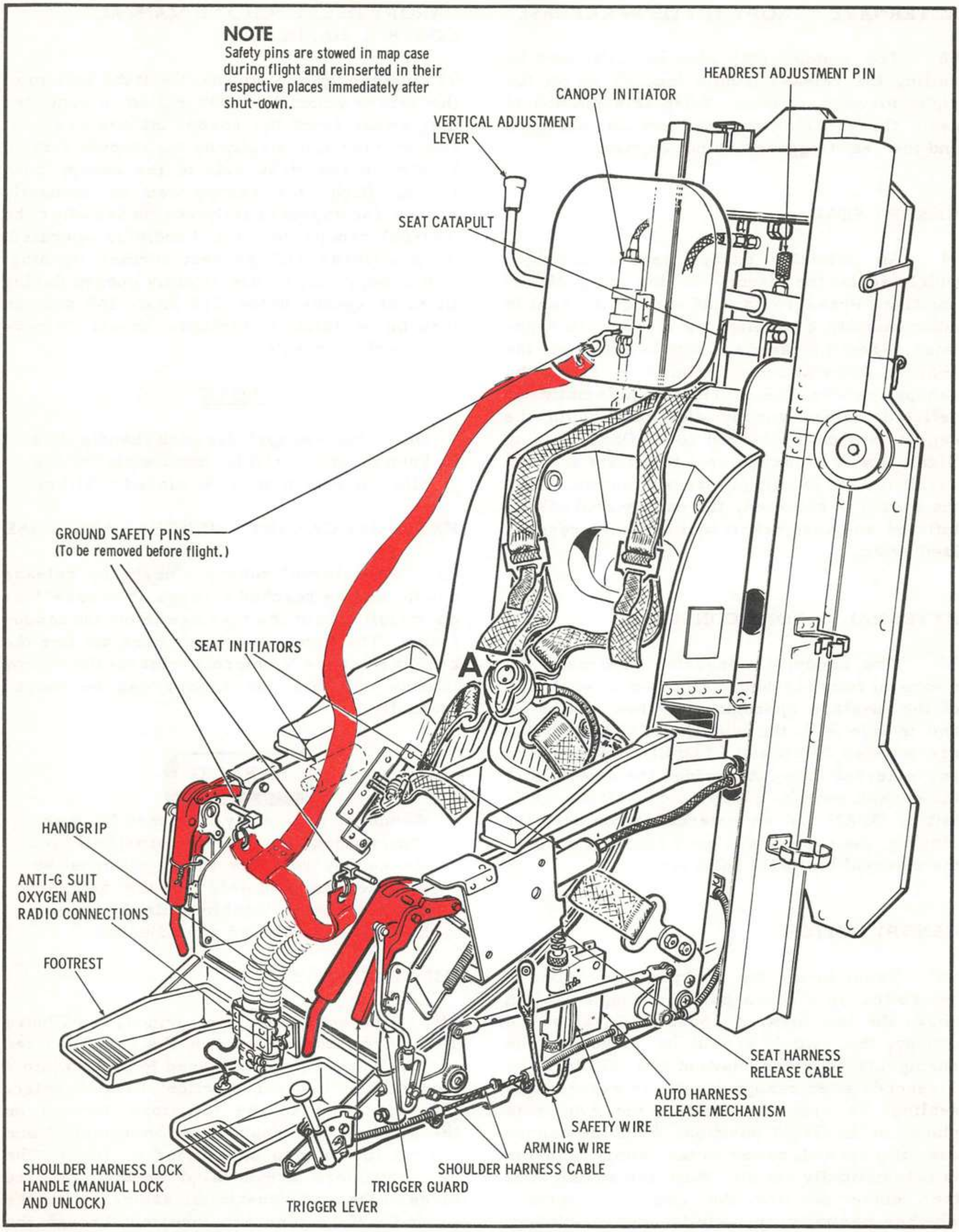
95 An external canopy emergency release handle can be reached through an access door on the left side of the fuselage below the canopy frame. The external release does not fire the canopy remover but merely releases the canopy latches so that the canopy can be moved manually.

**WARNING**

Whenever the canopy is opened by operating the declutch or the external release, the canopy remover safety pin must be installed immediately and the aircraft declared unserviceable while the canopy is being re-installed and adjusted.

## EJECTION SEAT

96 An ejection seat is provided, see Figure 1-13, Arm and footrests on the seat are fixed but the handgrips are hinged to pull up into a vertical position for ejection. Ground safety pins, installed in the initiators located on the sides of the seat, must be removed and stowed in the map case prior to flight. The seat initiators are located on the outboard sides of the seat beneath the armrests and the ground safety pins are inserted through the



**NOTE**
Safety pins are stowed in map case during flight and reinserted in their respective places immediately after shut-down.

Figure 1-13 Ejection Seat

ejection triggers. When the seat is ejected, anti-G suit, oxygen hose, microphone and headset connections automatically disconnect at a single fitting attached to the seat between the footrests, and the VHF and IFF equipment is automatically switched to the distress frequency.

### HANDGRIPS

97 The canopy is jettisoned and the shoulder harness is locked by raising either the right or the left handgrip. The seat may be fired by squeezing the trigger under either handgrip. A sequencing latch is provided on the trigger to stop its upward movement if the canopy firing handgrip and trigger are accidentally pulled up together. The trigger is released when the handgrip reaches the locked position.

NOTE

> After the harness has been locked up pulling the canopy jettison handgrip, it will be impossible for the pilot to unlock the harness.

### AUTOMATIC HARNESS RELEASE

98 Provision is made for the automatic release of the seat harness following ejection of the seat. As the seat leaves the aircraft, the harness release mechanism, located on the lower left side of the seat, is actuated by a release cable attached to the fuselage. After a brief delay, gas pressure, generated by the firing of two .22-calibre blank cartridges in the release mechanism, actuates a piston assembly and opens the harness lock through a flexible cable. The ability to unlock the harness manually is unaffected by the automatic features.

### AUTOMATIC OPENING OF PARACHUTE AND DELAYED DROP PROVISION

99 When the seat harness has been unlocked, and as the pilot separates himself from the seat, the parachute auto rip cord connection, which is attached to the left console, is pulled by the seat moving up the rails on ejection. This actuates the delay mechanism in the parachute pack and, at a preset time interval, unlocks the aneroid-type release, which opens the parachute at the preset altitude. If below altitude, the parachute will open at the preset time interval.

### HEADREST ADJUSTMENT PINS

100 The seat headrest can be adjusted fore-and-aft on the ground. Pulling up the spring-loaded pin in each of the two tubes aft of the headrest releases it for adjustment.

### SEAT VERTICAL ADJUSTMENT LEVER

101 A control for mechanical seat adjustment is provided by a handle to the right of the headrest. Pulling the handle down releases the seat for adjustment. The seat can be raised when the pilot lifts his weight.

**WARNING**

> Do not pull down the seat adjustment handle unless the seat is occupied or suitably loaded. The powerful balance springs might otherwise drive the seat abruptly against the upper stops, flinging up the triggers and firing the seat. For the same reason, seat adjustments should never be made in flight under conditions of negative G loading.

### SHOULDER HARNESS LOCK HANDLE

102 The shoulder harness inertia reel lock handle, located on the left side of the seat, is operated for manually locking and unlocking the shoulder harness. The shoulder harness inertia reel will automatically lock under a 2G to 3G deceleration, as in a crash landing. The automatic locking mechanism is a safety feature only. Reliance on its operation may result in the head contacting the instrument panel on impact and before locking occurs.

NOTE

> Before making a forced landing, battery, generator and engine master switches not readily accessible with the shoulder harness locked should be switched off before moving harness lock handle to the locked position.

103 If the harness is manually locked while the pilot is leaning forward, as he straightens up the harness will retract with him, moving into successive locked positions as he moves back against the seat. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. If the harness

is locked while the pilot is leaning back hard against the seat, he may not be able to unlock the harness without first releasing it momentarily at the safety belt or by releasing the harness buckles. After automatic locking of the harness, it will remain locked until the lock handle is moved to the locked position and then back to unlocked.

## PNEUMATIC SYSTEM

### GENERAL

104 An air pressure outlet connection on the front of the seat provides for attachment of the air pressure intake tube of the anti-G suit. Air pressure for inflation of the anti-G suit bladders is conducted from the engine compressor through a pressure regulating valve located on the left console. The valve starts functioning at a predetermined number of Gs, depending on the setting of the valve, which is marked HI and LO. Acceleration above approximately 1.75G causes the valve to open, inflating the anti-G suit. For each additional 1G acceleration force, a corresponding 1 psi (LO setting) or 1.5 psi (HI setting) air pressure is exerted in the anti-G suit. A button on top of the valve can be manually depressed to inflate the suit momentarily when desired.

## AIR CONDITIONING AND PRESSURIZING SYSTEMS

### GENERAL

105 Air is extracted from the eighth stage of the engine compressor and is delivered to the cockpit under pressure at a pre-selected temperature for either heating or ventilating. The cockpit is not pressurized from sea level to 12,500 feet. Above this altitude, either of two (2.75 psi or 5 psi) cockpit pressure schedules are available through a selectively controlled automatic pressure regulator. The hot air from the engine compressor is cooled by passage through two heat exchangers and an expansion turbine. Air outlets, located on both sides of the windshield and forward of the pilot's feet, are selectively controlled by a lever on the left aft console. The temperature of the air is controlled by regulating the flow of air in the heat exchanger and by by-passing one heat exchanger and the turbine.

### COCKPIT PRESSURE CONTROL SWITCH

106 A two-position cockpit pressure control switch is located on the left aft console. To provide controlled cockpit pressures the pressure control switch is set at PRESS. This opens

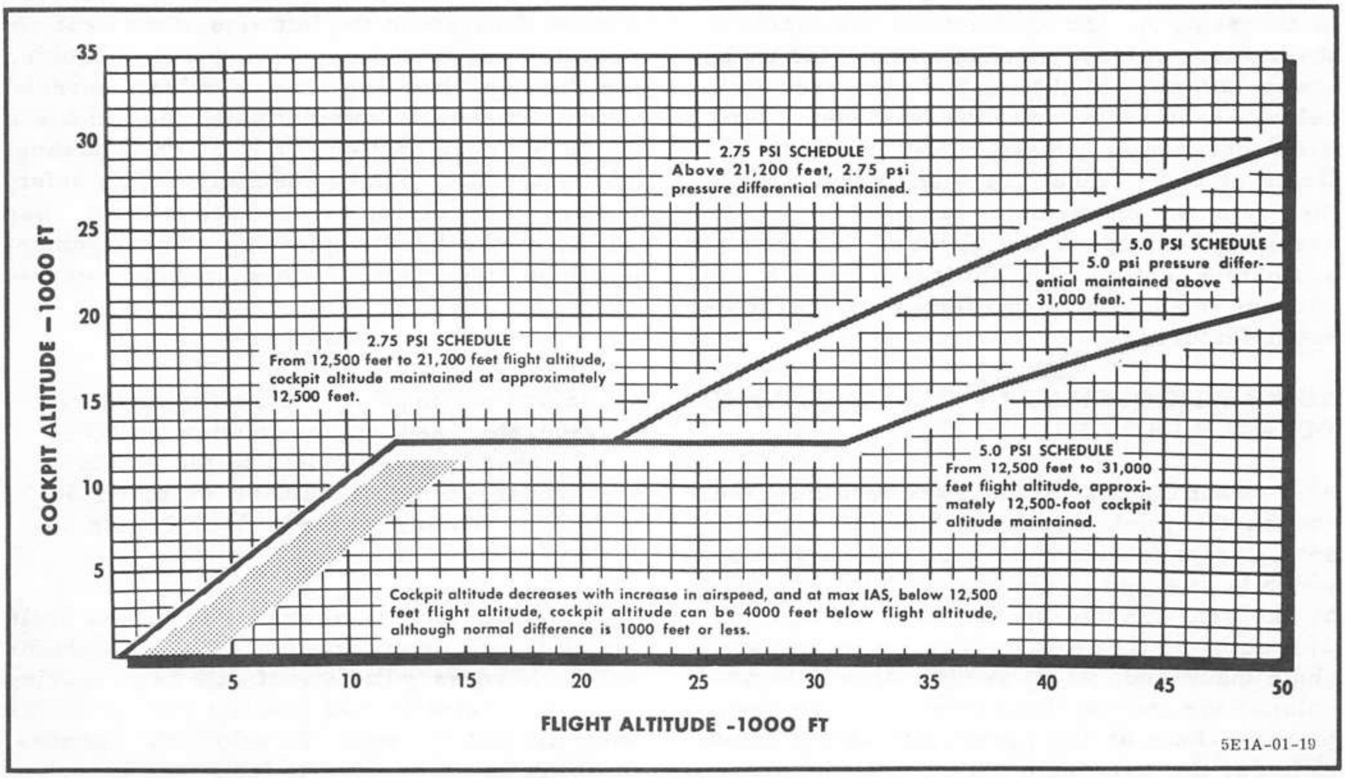


Figure 1-14 Cockpit Pressure Schedule

the system shut-off valve and closes the ram air shut-off valve so that air flows from the engine compressor into the cockpit to maintain the selected cockpit pressure schedule, as determined by a pressure selector switch. When the switch is placed at RAM, the system shut-off valve is closed and the cockpit dump valve and the ram air shut-off valve are opened. This shuts off all incoming pressurizing hot air from the engine compressor, releases the cockpit pressure and permits cold ram air to enter the cockpit. A dive rate control unit is installed on the pressure regulator to regulate the rate of pressure differential increase to one psi per minute.

### COCKPIT PRESSURE SCHEDULE SELECTOR SWITCH

107 A pressure selector switch, located on the left aft console, is positioned, at either 2.75 psi or 5 psi to select the desired cockpit pressure schedule. During operation on the lower pressure schedule, the regulator maintains a cockpit altitude of 12,500 feet until a flight altitude of 21,200 feet is reached. Above 21,200 feet, the regulator maintains a constant cockpit pressure 2.75 psi greater than the corresponding outside air pressure. The higher pressure schedule maintains a cockpit altitude of 12,500 feet up to a flight altitude of 31,000 feet, with a 5 psi pressure differential maintained above that altitude. At altitudes above either 21,200 or 31,000 feet, depending on the pressure schedule selected, the cabin altimeter will rise above 12,500 feet on a scale proportional to the flight altitude, see Figure 1-14 for comparison of flight altitudes with cockpit altitude and for cockpit altitude tolerances.

NOTE

Flight tests indicate that cockpit pressure cannot be maintained if engine speed is reduced below cruising rpm at heights above 40,000 feet.

### COCKPIT AIR OUTLETS

108 Airflow from the windshield defrost and floor outlets is controlled by the air outlet selector lever on the left console. The lever has three positions: FLOOR, DEFROST (windshield) and BOTH. Two other air outlets are located on the sides of the cockpit. Direction of airflow from the outlet on the left side of the cockpit is manually controlled by rotation of the outlet. Airflow from the outlet on the right side of the cockpit is manually controlled by a control valve under the right longeron.

### COCKPIT AIR TEMPERATURE CONTROL SWITCH

109 Temperature of the air admitted to the cockpit is controlled by a four-position temperature control switch on the left aft console, marked AUTO - OFF - HOT - COLD. The switch is guarded to the AUTO position, and works in conjunction with a rheostat control which is just forward of the switch.

### COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT

110 With the switch in the AUTO position, temperature may be maintained at any desired setting within the range of 4.4° to 26.7°C (40° to 80°F) by selecting the desired temperature on the rheostat control. In the event of failure of the automatic system, or if it is desired to increase the temperature range beyond that available under automatic control, the switch should be placed in the HOT or COLD position. In this way the temperature range limits are increased to -5.6° to 93.3°C (22° to 200°F) but there is no rheostat control. This increased range may be necessary under excessively high or low outside air temperatures, when the full capacity of the refrigeration or heating units under automatic control may not be sufficient to provide adequate cockpit temperature control.

## DEFROSTING AND ANTI-ICING SYSTEMS

### GENERAL

111 Windshield defrosting is accomplished by directing heated cockpit air through windshield defrost outlets. Perforated tubes along the windshield and canopy tracks direct engine compressor air for canopy defrosting. Windshield anti-icing is provided from an outlet that passes engine compressor air over the outside surface of the windshield.

### WINDSHIELD ANTI-ICING CONTROL LEVER

112 Windshield anti-icing is turned on or off by means of a windshield anti-icing control lever located forward of the air outlet above the left console.

NOTE

This system should be used during icing conditions only and the lever should be OFF at all other times.

### CANOPY AND WINDSHIELD DEFROST CONTROL LEVER

113 Air to both sides of the canopy and the windshield is controlled by a defrost control lever on the left longeron in the cockpit. Pulling the lever aft turns the system off, pushing it forward turns the system on. Since there is no temperature protection in the system, do not operate the system on the ground if outside temperature is 32.2°C (90°F) or above.

NOTE

To prevent formation of frost on the canopy due to rapid changes in temperature and humidity during a descent from altitude, it is recommended that the canopy defrosting system be maintained on or partially on in flight at all times. For operation of the defrost systems, the canopy must be completely closed.

### WINDSHIELD ANTI-ICING OVERHEAT WARNING LIGHT

114 Indication of anti-icing air temperatures in excess of 135°C (275°F) is provided by an amber warning light on the left side of the cockpit aft of the side air outlet. The light is controlled by an overheat thermostat in the anti-icing air outlet. The windshield anti-icing lever should be moved to OFF when the light is illuminated.

### PITOT HEATER

115 The pitot tube on the right wing is heated by an electric element controlled by a circuit-breaker type toggle switch located on the left forward console. A switch on the right console controls the heating element of the pitot tube in the air intake duct. The heater elements should not be used on the ground, as serious overheating will occur due to the lack of cooling airflow.

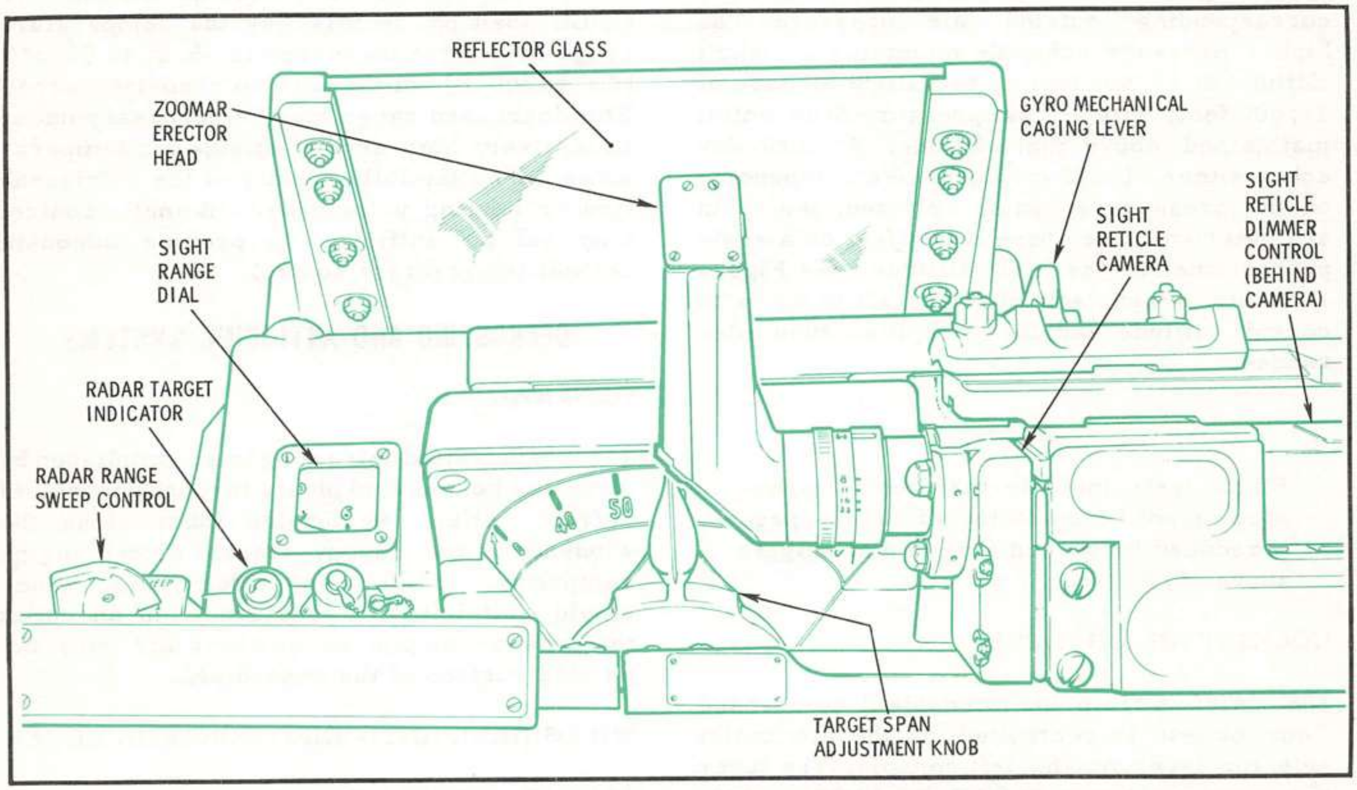


Figure 1-15 Gun-Bomb-Rocket Sight

## OXYGEN SYSTEM

### GENERAL

116 A low-pressure oxygen system is used, including an automatic pressure-demand regulator which incorporates a flow indicator and a pressure gauge. Normal minimum pressure for the system is 400 psi. A type D-1 or D-2 regulator is installed.

NOTE

> With the D-2 regulator, positive oxygen pressure will not be obtained automatically until a cockpit altitude of approximately 29,000 feet is reached.

### OXYGEN PRESSURE GAUGE AND FLOW INDICATOR

117 The combination oxygen pressure gauge and flow indicator is located on the face of the regulator. The switch marked WARNING LIGHT on the face of the D-1 regulator is inoperative. On the D-2 regulator, the switch is removed.

## ARMAMENT EQUIPMENT

### GENERAL

118 The aircraft is equipped with a sight for use with the machine guns, bombs, chemical tanks and rockets. Three 50-calibre machine guns are located on each side of the engine air intake. Bomb racks for bombs or chemical tanks and rocket launchers may be carried under each wing.

### GUN-BOMB-ROCKET SIGHT

119 A gun-bomb-rocket sight, see Figure 1-15 is located above and forward of the instrument panel shroud and automatically shows the computed lead on a target. It may also be used for rocket firing and for bomb release. The sight reticle image is a centre dot with an outer circle composed of diamond-shaped dots. The image is projected on the reflector glass aft of the windshield and indicates the required lead for gun and rocket firing. Range data for gunnery operation is supplied to the sight by AN/APG-30 radar ranging equipment or by pilot-operated manual range control. The radar system automatically locks onto and tracks a target in range and indicates when the equipment is tracking a target. Bombs can be released automatically at the proper release point by a mechanism within the sight. Electrical power is supplied to the sight through the single-phase inverter. Manual sight ranging by means of the throttle twist grip may be used if the ac power supply or radar fails. The sight can be operated as a fixed reticle as long as dc power is available and the sight is mechanically caged. On aircraft so modified, AN/APG-501 equipment, incorporating a higher powered transmitter giving increased radar range, replaces the AN/APG-30.

**WARNING**

> The APG-501 radar will remain locked on the target down to a range of 400 feet. If an attack is held until lock-on is broken, there is a danger of collision.

### GUN SAFETY SWITCH

120 Electric power for operating the sight, gun camera, radar and guns is controlled by the guarded gun safety switch on the centre pedestal, see Figure 1-16. Power is supplied to the sight, camera and radar when switch is in either GUNS or SIGHT CAMERA & RADAR position. The gun firing circuit receives power only when switch is at GUNS. When the guard is down, the switch is OFF.

### RETICLE DIMMER CONTROL

121 Brilliancy of the reticle may be adjusted by means of a reticle dimmer control to the sight. When the sight is not in use, the control should be turned to DIM.

### SIGHT FILAMENT SELECTOR SWITCH

122 A filament selector switch on the centre pedestal controls the primary or secondary filament within the lamp that illuminates the sight reticle image.

### SIGHT ELECTRICAL CAGING BUTTON

123 An electrical caging button is provided on the throttle grip to stabilize the reticle image while manoeuvring for an attack.

### SIGHT MECHANICAL CAGING LEVER

124 A mechanical caging lever on the right side of the sight is moved left to CAGE and

right to UNCAGE. For firing at ground targets or in the event of sight failure, the caging lever may be placed at CAGE and the reticle used as a fixed sight.

## WING SPAN ADJUSTMENT KNOB

125 Used in connection with the manual ranging system during gunnery operation, the wing span knob is set to correspond to the span of the target aircraft.

### NOTE

> It is not necessary to use the span adjustment when radar ranging is used.

## MANUAL RANGING CONTROL

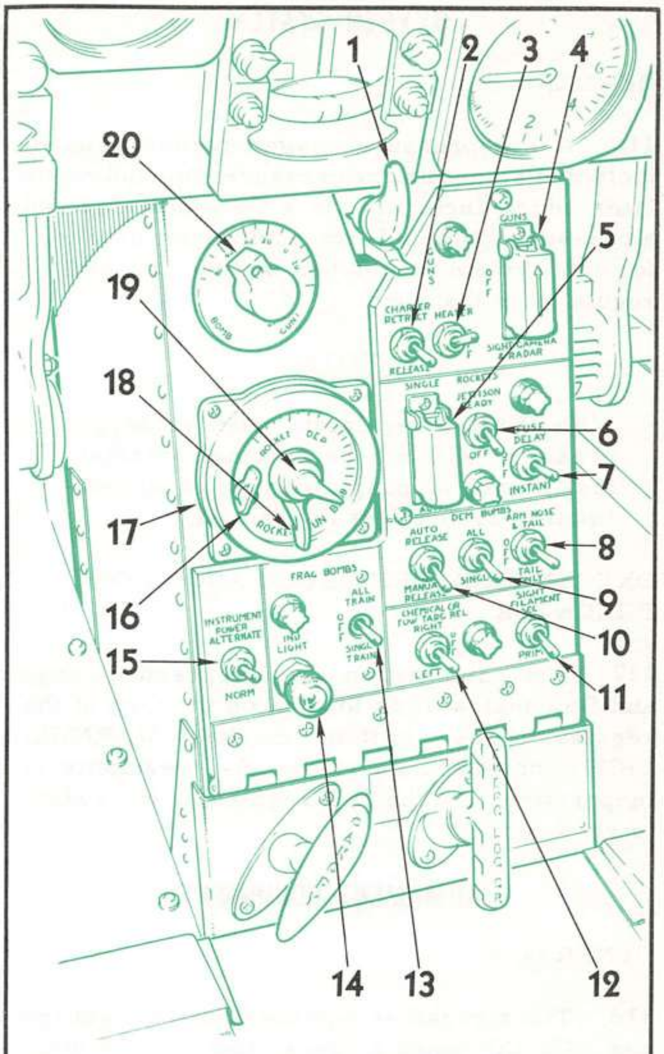
126 A twist grip incorporated in the throttle lever provides for manual ranging during gunnery operation when radar ranging is erratic (below 6000 feet). The range control covers a span of 1500 feet, from approximately 1200 to 2700 feet. Clockwise rotation of the twist grip reduces the range by increasing reticle size. The manual ranging control is spring-loaded to the full counterclockwise position for operation of the radar ranging system.

## RADAR TARGET SELECTOR

127 When the radar detects a target, it locks on it and measures its range. The radar may be shifted to another target by means of a target selector button on the stick grip. Holding the selector button depressed momentarily causes the radar to reject the target upon which it has locked. The radar can then lock on targets at ranges greater than the one rejected, until the maximum sweep range is reached, It then automatically re-cycles, commencing to sweep from minimum range. Depressing the radar target selector button automatically moves the sight function selector lever to GUN.

## RADAR RANGE SWEEP CONTROL

128 The range sweep control rheostat on the left side of the instrument panel shroud can be



1 RUDDER LOCK
2 GUN CHARGER SWITCH
3 GUN HEATER SWITCH
4 GUN SAFETY SWITCH
5 ROCKET RELEASE SELECTOR SWITCH
6 ROCKET JETTISON SWITCH
7 ROCKET FUSE ARMING SWITCH
8 DEMOLITION BOMB ARMING SWITCH
9 DEMOLITION BOMB SINGLE-ALL SELECTOR SWITCH
10 DEMOLITION BOMB RELEASE SELECTOR SWITCH
11 SIGHT FILAMENT SELECTOR SWITCH
12 CHEMICAL TANK OR TOW TARGET RELEASE SWITCH
13 FRAGMENTATION BOMB RELEASE SELECTOR SWITCH
14 FRAGMENTATION BOMB INDICATOR LIGHT
15 INSTRUMENT POWER SELECTOR SWITCH
16 TARGET SPEED SWITCH
17 SIGHT SELECTOR UNIT
18 SIGHT FUNCTION SELECTOR LEVER
19 ROCKET SETTING LEVER
20 BOMB-TARGET-WIND CONTROL

Figure 1-16 Centre Pedestal

used to lower radar ranging distance to prevent radar from locking on the earth when aircraft is at low altitude. Turning the rheostat toward MINIMUM decreases the range, but reducing the range with this control reduces sensitivity and may cause erratic lock-on. During normal operations, control should be at MAXIMUM.

### BOMB-TARGET-WIND CONTROL

129 The bomb-target-wind control on the centre pedestal is used for bombing operations only. Setting the control adjusts the sight to compensate for components of wind velocity and target motion parallel to the direction of the attacking aircraft. For stationary targets, corrections are made on the dial UPWIND for a bombing run into a head wind or DOWNWIND when a bombing run is made with a tail wind, according to the estimated wind velocity. If wind direction is not in line with the course of the aircraft during a bombing run, the amount of correction must be estimated. When the target is moving, additional correction must be made for velocity of target. For approaching targets, correction is DOWNWIND; for receding targets, correction is UPWIND. When the target is travelling at right angles to the line of attack, no correction is necessary. When the sight is used for firing either rockets or guns, the pointer should be positioned on ROCKET GUN.

### SIGHT SELECTOR UNIT

130 Three independent sight controls, the sight function selection lever, the rocket setting lever, and the target speed switch are incorporated in the sight selector unit. The sight function selector lever on the lower arc is set at the sight system for the desired operation. When it is moved to BOMB, the sight reticle image dot is depressed to approximate the bomb trajectory. Moving it to ROCKET permits subsequent operation of the rocket setting lever to adjust the sight reticle image for rocket firing. The selector lever will automatically return to GUN, position, if set at BOMB or ROCKET, when the radar target selector button on the stick grip is depressed. The rocket setting lever on the upper arc of the unit has four index tabs (1, 2, 3, and 4) to which it can be set for the type of rocket carried. This automatically adjusts the sight for the trajectory, or rocket depression angle, of the type of rocket for which it is set. The target speed switch, on the left side of the selector unit, is used during gunnery missions to control lead angle data in accordance with the speed ratio between the attacking aircraft and its target. When an attack is to be made on a slow target, the target speed switch is set at LO. The switch is moved to HI when the target speeds are high, (approximately the speed of the attacking aircraft). The TR position is used when firing on a drogue or other training target.

### RADAR TARGET INDICATOR

131 The radar target indicator light is on the sight head just below the range dial. The light is illuminated when the radar ranging equipment locks on a target.

### GUNNERY EQUIPMENT

132 The aircraft is equipped with six .50-calibre machine guns mounted three on each side of the engine air intake duct in the nose of the aircraft. Three hundred rounds of ammunition may be carried for each gun, although the normal load is 267 rounds. A pneumatically-operated gun charging system is installed. Simultaneous charging of all guns or retraction of the guns may be selectively controlled by means of the gun charger switch. The system includes an air storage tank and a pressure-controlled compressor to maintain an adequate continuous air pressure for charger operation.

### GUN CAMERA

133 A type N-6 or N-9 gun camera is mounted in the nose below the intake duct. The camera operates automatically when the trigger on the stick grip is depressed.

### SIGHT RETICLE CAMERA

134 A type N-6 or N-9 camera is mounted on the sight head to photograph the sight reticle and the target simultaneously, making it possible to analyse aiming technique and accuracy. The sight reticle camera is electrically connected in parallel with the gun camera and functions concurrently with it.

#### NOTE

The camera lens aperature selector switch located on the right sidewall of the cockpit, and marked DULL, HAZY and BRIGHT, selects the lens aperture on both gun and sight reticle cameras when type N-9 cameras are fitted.

### TRIGGER

135 The stick grip contains a trigger for firing the guns and for operating the gun camera and the sight reticle camera. The trigger has two positions when depressed, the first position operating the camera and the ammunition booster, the second position, fully depressed, firing the guns.

### GUN CHARGER SWITCH

136 Selective control of the gun charging system is provided by the charger switch on the centre pedestal. The three-position switch, which actuates all gun chargers simultaneously, is spring-loaded from the RETRACT and RELEASE positions to the centre OFF position. Momentarily holding the switch at RETRACT causes the gun bolts to be brought to the rear and held in this position. Release of the bolts and subsequent charging occurs when the charging switch is momentarily held at RELEASE or the trigger is depressed to fire the guns. The RETRACT position is utilized when it is necessary to have the bolts at the rear for safety (preventing cook-offs) or for gun cooling purposes. Release allows the bolts to go forward to aid gun heating. In the event of a stoppage, momentarily hold the gun-charger switch at RETRACT and then RELEASE to clear the stoppage.

### GUN HEATER SWITCH

137 Electric gun heaters, one mounted on each gun, are controlled by the gun heater switch on the centre pedestal.

### BOMBING EQUIPMENT

138 A removable bomb rack can be installed on the lower surface of each outer wing panel. Each rack will carry single bombs from 100 to 1000 pounds, bomb clusters up to 500-pound size, a chemical tank, or one fragmentation bomb rack assembly. The sight is used for bomb sighting and automatic bomb release. Controls are provided for normal and emergency release of either demolition or fragmentation bombs. Normal release may be accomplished automatically or manually with bombs released singly or simultaneously. The arming condition of bomb nose and tail fuses, upon release, is also selectively controlled.

**CAUTION**

To prevent damage to the aircraft, do not release bombs during negative-G load conditions.

### DEMOLITION BOMB SINGLE-ALL SELECTOR SWITCH

139 The demolition bomb single-all selector switch on the bomb section of the centre pedestal provides for releasing bombs, other than fragmentation type, or chemical tanks, singly or simultaneously when the bomb-rocket release button on the stick grip is depressed. With the selector switch set at SINGLE, the left bomb rack is tripped as the release button is actuated. The right rack releases when the release button is depressed again. Bomb racks release simultaneously when the demolition bomb selector switch is at ALL and the bomb-rocket release button is depressed.

### DEMOLITION BOMB ARMING SWITCH

140 All bombs except the fragmentation type are armed by means of an arming switch in the bomb section of the centre pedestal. With the switch at ARM NOSE & TAIL, bombs are armed to explode instantly on impact. When switch is at TAIL ONLY, bombs are armed for delayed detonation.

### DEMOLITION BOMB RELEASE SELECTOR SWITCH

141 A two-position bomb release selector switch on the centre pedestal provides for selecting either MANUAL RELEASE or AUTO RELEASE. With switch at MANUAL RELEASE, the bomb release occurs when the bomb-rocket release button is depressed. When the selector switch is in the AUTO RELEASE position and the release button is held closed, the bomb is released automatically by mechanism within the sight when the path of the aircraft on the bombing spiral is tangential to the bomb trajectory. During both release conditions, the correct bomb release point is indicated by automatic extinction of sight reticle image circle. If the bomb single-all selector switch is in the SINGLE position, only one bomb (left hand first) will be dropped during each bombing run.

## FRAGMENTATION BOMB RELEASE SELECTOR SWITCH

142 The fragmentation bomb release selector switch is located on the left side of the centre pedestal and should be used during release of fragmentation bombs only. Placing the switch at SINGLE TRAIN results in release of fragmentation bombs in a train, from the left rack and then from right, as long as bomb-rocket release button is depressed. When the fragmentation bomb selector switch is at ALL TRAIN, the bombs are released in train, from left and right rack simultaneously. Bombs are automatically armed upon release. Whenever fragmentation bombs are to be released, the demolition bomb release selector switch must be at MANUAL RELEASE position.

## FRAGMENTATION BOMB INDICATOR LIGHT

143 The fragmentation bomb indicator light, which is adjacent to the fragmentation bomb switch on the centre pedestal, is illuminated whenever bombs are installed on the bomb racks. The indicator light is automatically extinguished when the last fragmentation bomb is released.

## BOMB-ROCKET-TANK JETTISON BUTTON

144 All external loads (bombs, fragmentation bombs, rockets, droppable fuel tanks, and chemical tanks) may be jettisoned unarmed by depressing the bomb-rocket-tank jettison button recessed in the left forward console. Bombs and rockets are jettisoned unarmed regardless of the position of the arming switch. Rockets cannot be jettisoned from the cockpit while the aircraft is on the ground.

## ROCKET EQUIPMENT

145 Eight rockets may be carried under each wing on four removable rocket launchers, each holding two rockets one above the other. The sight is used for aiming. The rockets are fired by depressing the bomb-rocket release button on the control stick grip. The camera in the nose of the aircraft operates automatically when rockets are fired.

## ROCKET RELEASE SELECTOR SWITCH

146 A rocket release selector switch on the centre pedestal has OFF, SINGLE and AUTO positions. With the selector at SINGLE, one rocket is fired with each depression of the bomb-rocket release button. When the selector is at AUTO, all rockets are released in train by sustained pressure on the stick grip release button. Sequence of rocket firing is shown in Figure 1-17. Automatic firing will stop whenever the button is released. The release selector will not function unless the rocket jettison switch is at OFF.

## ROCKET FUSE ARMING SWITCH

147 Rocket arming is controlled by the rocket fuse arming switch on the centre pedestal. When switch is at INSTANT, the rocket nose fuse is armed to provide instantaneous detonation upon contact. The nose fuse is unarmed when switch is at DELAY or OFF. An internal fuse will cause delayed detonation after impact upon a normal release condition. During salvo release, the nose fuse is automatically unarmed. The internal fuse is inoperative during jettison and salvo release conditions.

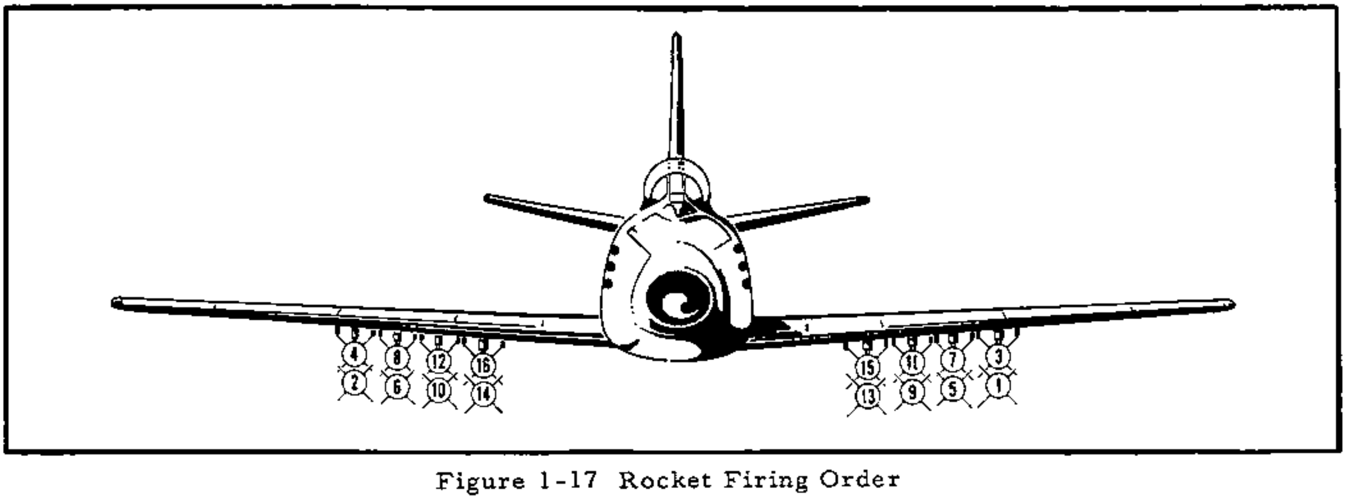


Figure 1-17 Rocket Firing Order

ROCKET RELEASE CONTROL AND INDICATOR

148 The rocket release control, mounted on the left side of the cockpit is an intervalometer for releasing rockets in sequence during automatic and manual release. When the rocket and the bomb-rocket selector switches are at AUTO and the bomb-rocket release button on the stick grip is depressed, the rocket release control will release rockets in sequence at approximately 1/10-second intervals as long as the button is held down. With the selector switch at SINGLE, one rocket is actuated and the rocket release control automatically maintains the correct firing sequence. An indicator, visible through the windows in the rocket release control housing, indicates the rocket to be fired. The reset knob is used to return the dial to position 1 when all rockets have been released, or is set for release of any one particular rocket in case of misfire or other malfunction. If the lower rocket fails to fire during a normal release, the upper rocket on the same mount cannot be fired. The unfired rockets should be jettisoned in a safe area. Jettisoning is not selective and all rocket stations jettison simultaneously.

ROCKET JETTISON SWITCH

149 The rocket jettison switch on the centre pedestal permits the rockets to be jettisoned unarmed only. Rockets are jettisoned by moving the jettison switch to READY and depressing the bomb-rocket release button. The jettison switch must be OFF for the rocket release selector to be operative.

CHEMICAL TANK EQUIPMENT

150 A type AN-M10 chemical tank may be carried on each bomb rack. Tank selection is provided by a switch on the centre pedestal, and, after discharge of chemicals by means of bomb-rocket release button, the tanks may be dropped by operation of the bomb-rocket-tank jettison button or the normal bomb release system.

TOW TARGET RELEASE

151 On aircraft so equipped, a tow target may be carried on each bomb rack. The target may be released from the canister by means of the switch on the centre pedestal. The canister may be dropped by operation of the bomb-rocket-tank jettison button or the normal bomb release system. The drogue may be jettisoned by means of a guarded switch or a handle on the left sidewall.

## COMMUNICATIONS EQUIPMENT

GENERAL

152 The following communications equipment is installed in the aircraft.

(a) AN/ARC552 - 1750 channel UHF installation.

(b) AN/ARN6 - Radio Compass installation.

(c) AN/APX25 - IFF/SIF installation.

UHF EQUIPMENT

153 The UHF installation (ARC552) consists of a transceiver unit, a UHF control unit, a preset channel control unit and an inverter.

(a) Transceiver - 1750 channels transmit and receive plus a guard (243.0 mcs) receive channel.

(b) Control Unit - The control unit is located directly above the ejection lever on the STBD console.

(1) Function Switch - The function switch is marked OFF-TR-TR+G-ADF. The UHF may be activated by selecting TR or TR+G on the function switch. When TR is selected the UHF will transmit or receive on any channel selected. When TR+G is selected the UHF will transmit on the selected channel and receive both the selected channel and guard (243.0 mcs). ADF position is inoperative.

(2) Preset-Manual - This control activates either the preset channel selector or the manual selector switches.

(3) Manual Selector Switches - Consists of 4 rotary switches, one for hundreds, one for tens, one for digits and one for tenths. As an example if 243.0 mcs was the desired frequency the switches would read from left to right 2-4-3-0.

(4) Volume Control - Is the only means of changing the volume of the UHF receiver to the pilot's headset.

(5) Lighting - Edge lighting is used and is controlled from the light rheostat above the right hand control.

(c) Preset Channel Selector - Is located on the sloped portion of the Port Console immediately forward of the throttle. 23 frequencies may be preset on the ground and selected in the air by rotating the switch to the desired channel (ensure that Preset - Manual switch is in the PRESET position). The NIXIE light unit located above the upper port side of the instrument panel will indicate the channel selected. Position 24 on the switch is always Guard (243.0 mcs) and cannot be changed.

(d) UHF Inverter - The UHF inverter provides the ac power necessary to operate the transceiver. Turning ON the UHF automatically activates the UHF inverter. The UHF circuit breakers are located on the vertical breaker panel outboard of the ARN6 control.

(e) UHF Press to Transmit - A UHF press to transmit button is mounted on the top of the throttle.

## RADIO COMPASS

154 An AN/ARN6 radio compass (ADF) is installed in the aircraft covering 100 kcs to 1750 kcs in 4 bands.

(a) Control Unit - The control unit is located on the STBD console aft of the UHF control.

(1) Function Switch - The function switch has 4 positions OFF-ANT-COMP-LOOP. When the function switch is on ANT only the sense antenna is connected and the receiver provides no directional information. When the switch is on COMP the loop and sense antennae are used and a bearing to the selected ground station relative to the nose of the aircraft is automatically presented on the compass indicator. When the function switch is on LOOP only the loop antenna is connected and the Aural Null method of orientation must be used.

(2) Volume Control - A volumn control on the control unit allows the occupant to vary ADF volume level.

(3) L-R Switch - The L-R switch controls a motor which turns the antenna left or right as desired for Aural Null orientation.

(4) Band Switch - A four position switch below the tuning dial switches to the desired frequency band.

(5) Tuning Crank - Rotation of the tuning crank tunes in the desired frequency on the selected band.

(6) Tuning Meter - A tuning meter provides a visual indication of maximum signal strength.

(b) Compass Indicator - Is located on the Port side of the instrument panel immediately above the machmeter.

(c) Circuit Breaker - The ARN6 circuit breaker is located on the vertical breaker panel outboard of the cockpit extension light bracket.

## IFF/SIF INSTALLATION

155 An IFF/SIF (APX25) installation is provided for tactical identification. The APX 25 enables the aircraft to identify itself when interrogated by a properly equipped radar set. The CODED interrogation can be transmitted in Modes 1, 2 or 3. Each Mode of interrogation initiates the transmission of a corresponding Mode of reply from the APX 25 transponder. The reply is presented on the interrogators radar display adjacent to the target blip. The IFF/SIF is controlled by two panels on the STBD console of the front cockpit.

(a) IFF Master Control - Is located at the forward end of the STBD console outboard of the Coder (SIF) control.

(1) Master Selector - Marked OFF - STANDBY - LOW-NORMAL-EMERGENCY. On STANDBY only low voltage power is "on" and equipment is ready for use. On LOW the transponder is operating at reduced sensitivity and only replies to strong interrogating signals. On NORMAL the transponder operates at maximum sensitivity. A release button adjacent to the switch must be pressed to select emergency. In emergency all other Mode settings are inoperative and the transponder transmits the

emergency reply to any Mode of interrogation in NORMAL IFF or to Mode 1 interrogation in SIF operation.

(2) Mode 2 And Out Switch - When selected to Mode 2 the transponder will reply to Mode 1 and 2 interrogations.

(3) Mode 3 And Out Switch - When selected to Mode 3 the transponder will reply to Mode 1 and 3 interrogations.

(4) IP-OUT-MIC-Switch - When the switch is held at the spring loaded IP (identification of position) selection, the system will respond to Mode 1 interrogation with two Mode 1 SI (Security Identification) replies while the switch is held and for 30 seconds afterwards. In the MIC position IP replies are transmitted when the UHF Press-To-Transmit button is pressed.

(b) SIF Control Panel - The SIF (Selective Identification Feature) or Coder Control panel is located at the forward end of the STBD console and inboard of the IFF control. This control comprises two dual concentric selector knobs for selecting Mode 1 and Mode 3 response coding.

(1) Mode 1 Control Knob - Consists of an 8 position outer and a 4 position inner dial giving 32 possible codes.

(2) Mode 3 Control Knob - Consists of an 8 position outer and an 8 position inner dial giving 64 possible codes.

(3) Mode 2 coding must be preset on the ground and is not accessible during flight.

(c) Circuit Breakers - The IFF/SIF circuit breakers are located on the vertical breaker panel outboard of the ARN6 control. AC power is not supplied to the IFF/SIF unless the generator is charging.

### UHF AND IFF EMERGENCY OPERATION AFTER EJECTION

156 If the UHF and IFF are selected ON and the pilot ejects the UHF will transmit a continuous DF tone on 243.0 mcs and the IFF will Squawk Emergency. If the IFF is not selected ON it will Squawk Emergency after 60 seconds. A transfer relay is incorporated to provide ac power to the IFF/SIF after ejection whether or not the generator is charging.

## ENGINE FIRE DETECTOR SYSTEM

### GENERAL

157 There is no fire extinguishing system on the aircraft. Indication of an overheat condition or engine fire in the fuselage is given by two cockpit warning lights mounted above the artifical horizon on the instrument panel. The lights, marked FWD (Red) and AFT (amber), indicate which section of the fuselage is affected. The forward and aft fuselage sections are divided by a stainless-steel firewall immediately aft of the compressor. The forward section includes the compressor and engine accessories, the aft section includes the combustion chambers and tailpipe. The AFT (amber) warning light does not necessarily signify the existence of fire since it may also indicate an overheat condition. It may be actuated by:

(a) Defective circuitry.

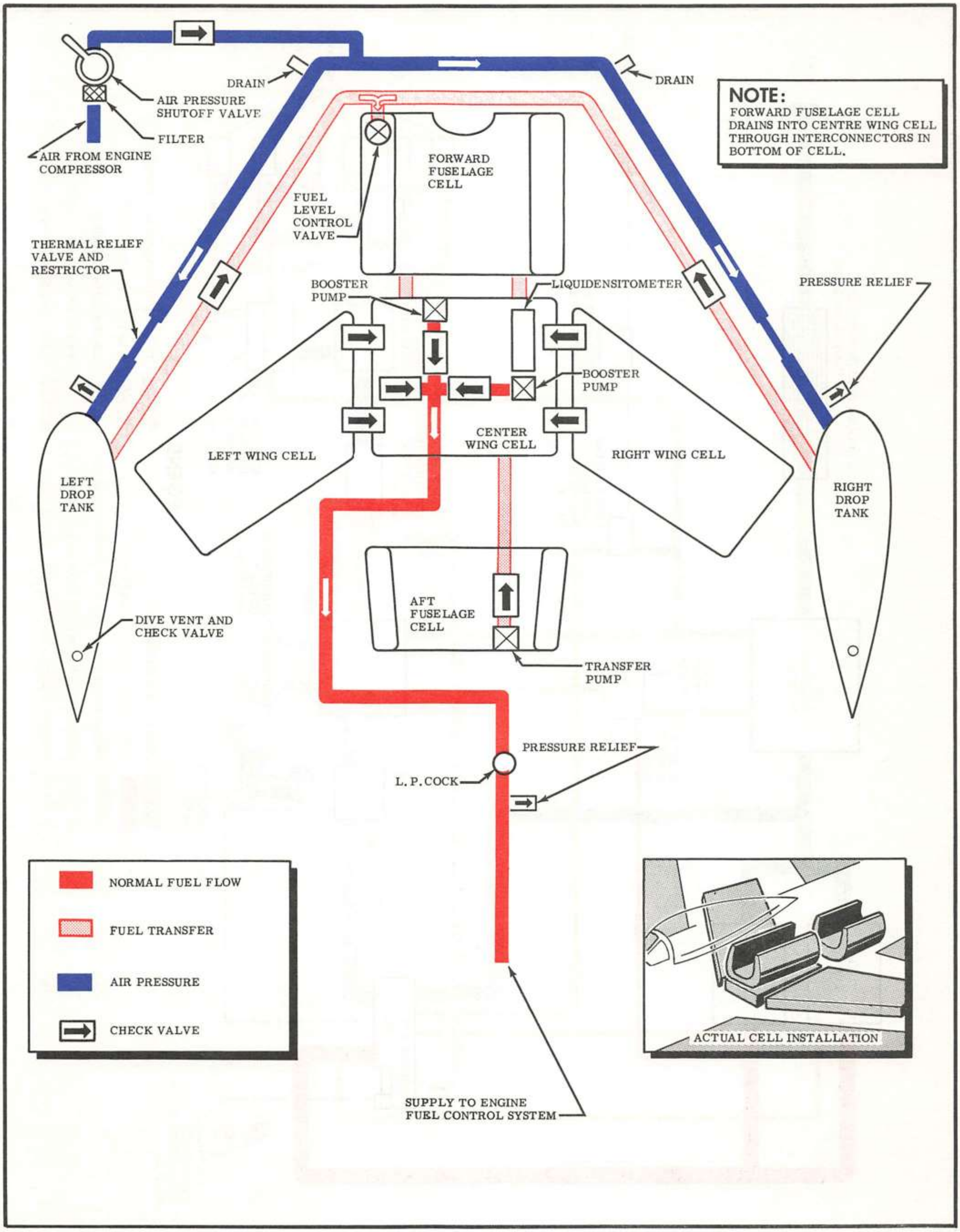
(b) Leaky tail-pipe, tail cone or connection.

(c) An overheat condition caused by rapid throttle advancement, malfunction of the fuel control, climbing at low airspeed and high rpm, or prolonged parking in a tail wind with the engine running.

(d) Fire.

158 Illumination of the FWD (red) warning light generally indicates a fire condition necessitating immediate emergency action. (Refer to Part 3, following).

159 Operation of the fire detector system and lights can be checked by means of the system test button, located between the lights. The lights are of the push-to-test type, permitting a check of the lamps independent of system operation.



**NOTE:**
FORWARD FUSELAGE CELL DRAINS INTO CENTRE WING CELL THROUGH INTERCONNECTORS IN BOTTOM OF CELL.

Figure 1-18 Aircraft Fuel System

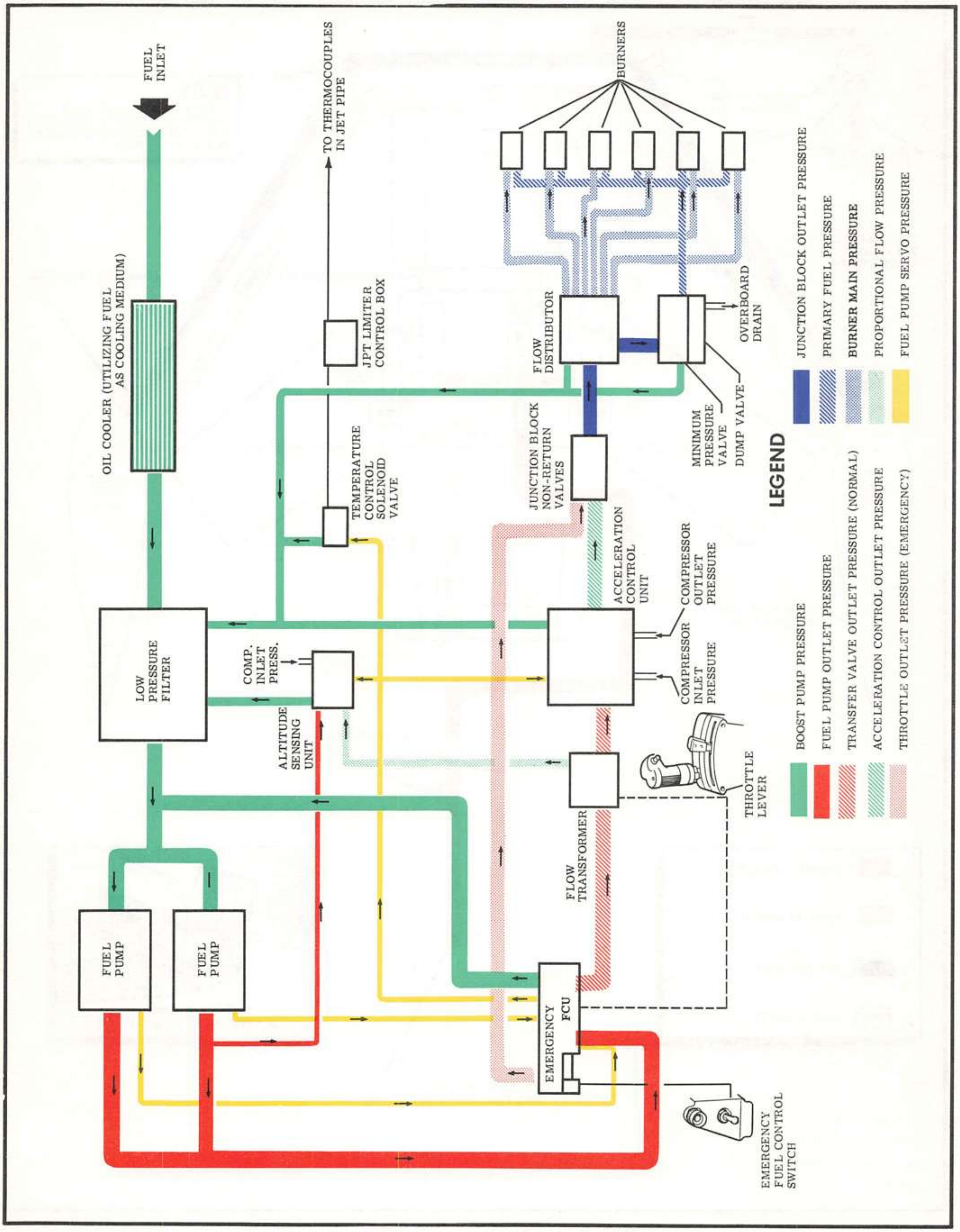
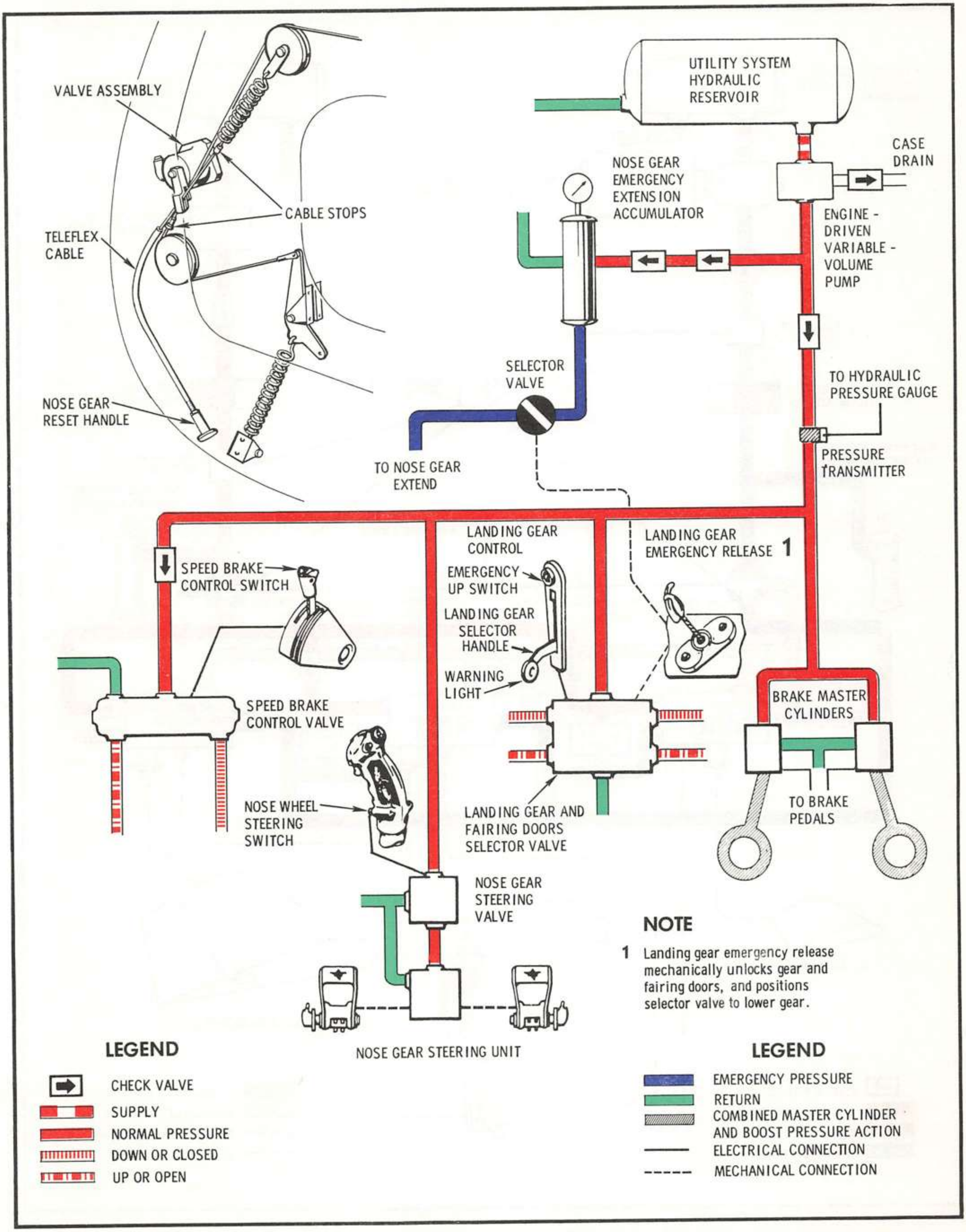


Figure 1-19 Engine Fuel System



**NOTE**

1 Landing gear emergency release mechanically unlocks gear and fairing doors, and positions selector valve to lower gear.

Figure 1-20 Utility Hydraulic System

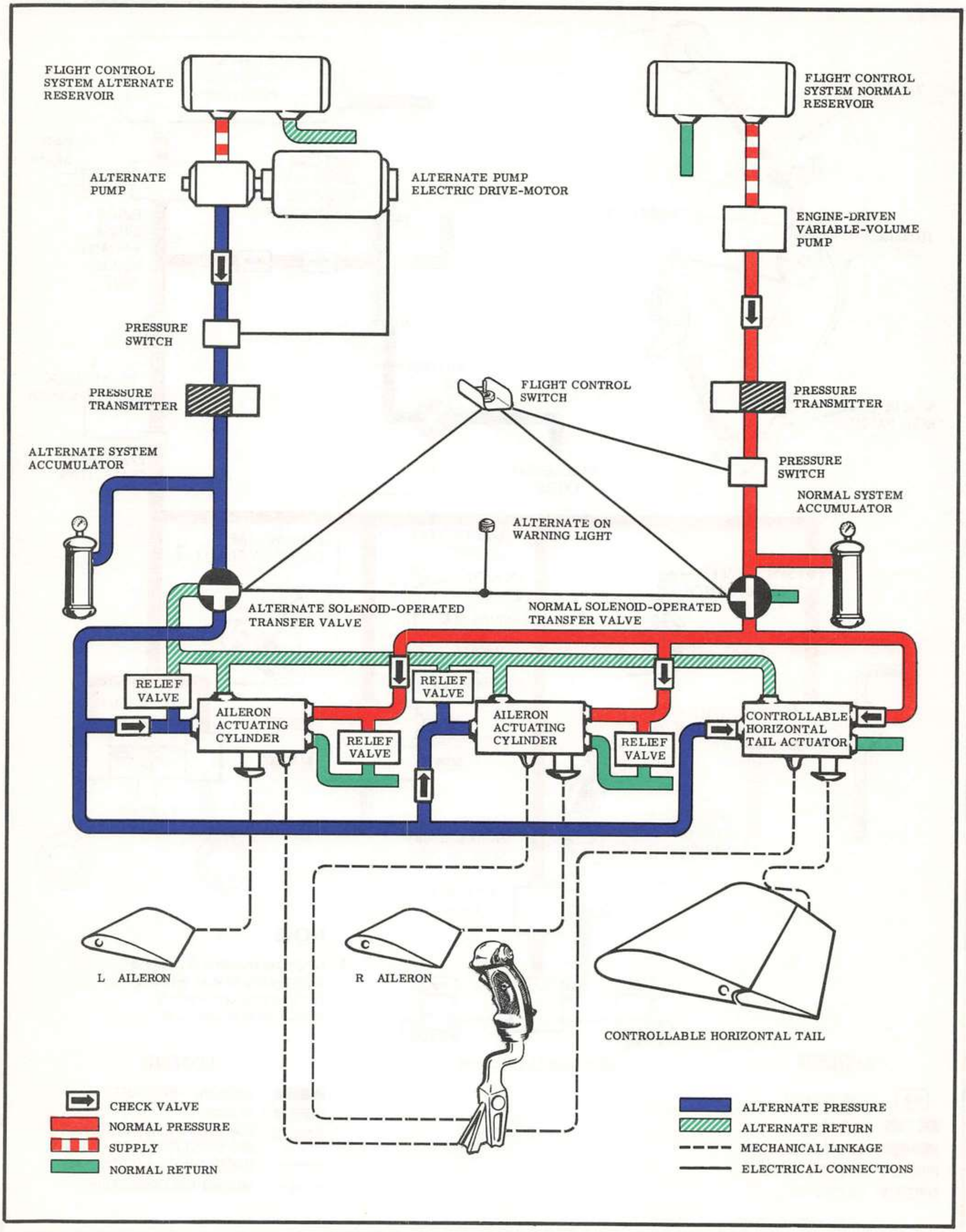


Figure 1-21 Flight Control Hydraulic System

# PART 2

# HANDLING

## PRELIMINARIES

### BEFORE ENTERING AIRCRAFT

1 Check Form L14A for engineering status and make sure that the aircraft has been serviced with required amounts of fuel, oil, hydraulic fluid and oxygen. Make pre-flight check as shown in Figure 2-1.

NOTE

The cockpit is accessible from either side of the aircraft. The lower ammunition access door on either side of the fuselage hinges down, serving as a step to the wing. The door must be closed by the ground crew. A kick-in step and handle are provided above the access door. The canopy is operated by means of two electrical push-buttons located on either side of the fuselage below the edge of the windshield.

CAUTION

Do not use handle on fuselage side for a step. Do not step on canopy seal, track or ejection seat bucket shelf.

2 Before entering the cockpit, check as follows:

(a) Check that both handgrips of seat are in the down position and that lockwire is not damaged.

(b) Remove ground safety pins from canopy remover and seat triggers.

(c) Adjust headrest, ensuring that it is securely locked in the desired position.

(d) Check that all cockpit circuit-breakers are in.

### AFTER ENTERING AIRCRAFT

3 Tighten safety belt and shoulder harness and attach parachute auto rip cord connection to the snap on the left console. Connect radio, oxygen and anti-G suit to their respective leads from between the footrests. Attach the alligator clip of the oxygen accordian tube to the seat harness and snap the oxygen wrap around cord to the harness.

CAUTION

To prevent inadvertent opening of parachute, ensure by visual inspection prior to engaging the parachute arming wire loop on the snap hook of the lap belt, that the single strand of safety wire is in place through the arming wire flexible casing end-fitting.

NOTE

A Pilot's Check List is located under the right side of the instrument panel.

(a) Armament switches OFF.

CAUTION

To prevent jettisoning bombs or drop tanks if the bomb-rocket release button on the stick grip is accidentally depressed, the demolition bomb release selector switch must be at AUTO RELEASE and the demolition bomb single-all selector switch at OFF except during actual armament operation.

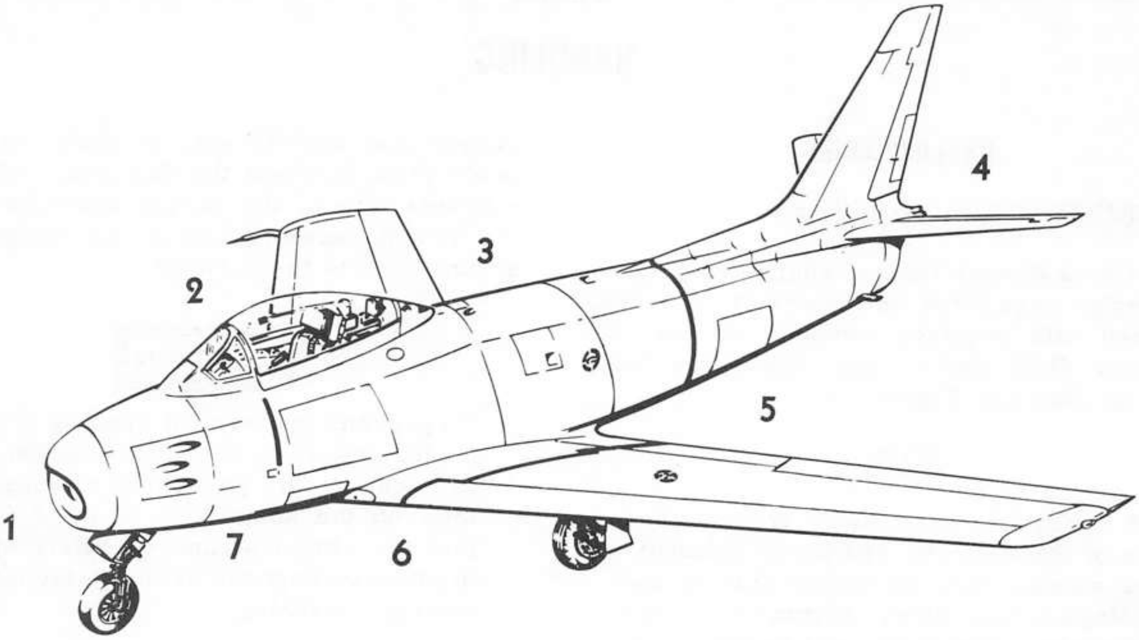
Armament switches must be in the OFF position before starting and during ground operation since low voltages will cause damage to the sight electronic inverter.

(b) Throttle control OFF and speed brake switch at neutral.

(c) Check engine master and emergency ignition switches off.

(d) Anti-G suit regulator valve HI or LO.

(e) Drop tank pressure shut-off ON if drop tanks installed. OFF if tanks not installed.



Starting at nose of aircraft, make following checks:

**1 NOSE**

Nose gear ground safety lock removed.
Tow pin safety cap tight.
Nose gear emergency extension accumulator air pressure 1200 psi. (Gauge in nose wheel well.)
Nose gear oleo strut extension.
Check tire for creep and proper inflation.
Check for hydraulic fluid leaks.
Intake duct pitot head uncovered.

**2 FORWARD FUSELAGE AND RIGHT WING LEADING EDGE**

Armament door secured.
Fuel caps, (wing and fuselage), secured.
Oil and hydraulic tank access doors secured.
Drop tank sway braces for looseness and alignment of retaining lugs.
Pitot head uncovered. Navigation light.
Check slat operation.

**3 RIGHT WING TRAILING EDGE AND AFT FUSELAGE**

Aileron and flap for loose rivets, etc.
Gear door position.
Gear strut extension.
Hydraulic leaks.
Check brakes and brake lines for leaks.
Check tire for creep and proper inflation.
Wheel chocked.
All access doors secured.
Compensator pin extension.
Flight control alternate hydraulic accumulator pressure 600 psi (in speed brake well).

**4 EMPENNAGE**

Tail surfaces for condition.
Navigation lights.
Tail-pipe cover removed.
Tail-pipe for cracks or excessive distortion.
Check tail-pipe for sufficient play and movement.

**5 AFT FUSELAGE AND LEFT WING TRAILING EDGE**

All applicable items in check on right wing trailing edge and aft fuselage.
Compensator pin extension.
Normal flight control system accumulator air pressure 600 psi (in wheel well).
Emergency flight control circuit-breaker in.
Check undercarriage door switches and microswitch in port wheel well.
Wheel chocked.

**6 LEFT WING LEADING EDGE AND FORWARD FUSELAGE**

Make same checks as on right wing on all applicable items.

**7 CANOPY** (From cockpit level.)

Cracks or crazing in canopy.
Canopy alignment pointers coincide. (2).

Figure 2-1 Exterior Inspection

(f) Cockpit temperature control switch AUTOMATIC. Desired temperature selected on rheostat.

(g) Cockpit pressure control at desired pressure schedule.

(h) Windshield anti-icing control lever OFF.

(j) Lateral alternate trimming switch at NORMAL.

(k) Longitudinal alternate trimming switch at NORMAL GRIP CONT.

(m) Emergency fuel control switch OFF.

(n) Oxygen regulator air valve at NORMAL OXYGEN. Check oxygen pressure and oxygen system for operation.

(p) Pitot heat and landing light switches OFF

(q) Landing gear handle DOWN.

(r) Parking brake off.

(s) Instrument power switch at NORM.

(t) Gunsight caging lever CAGED.

(u) Set clock and altimeter.

(v) Sight dimmer at DIM.

(w) Generator switch ON.

(x) Battery-starter switch OFF.

(y) External power source connected to both receptacles.

(z) Wing flap lever HOLD.

(aa) Check landing gear unsafe warning light by depressing horn cut-out button.

(ab) Check all warning lights and indicators for operation.

(ac) All light switches OFF.

(ad) Release rudder lock and check rudder, ailerons, trim and horizontal tail for the proper response to control action.

(ae) Flight control switch NORMAL.

NOTE

> Only the flight control alternate hydraulic system will operate until the engine is started. After the engine has been started, the alternate hydraulic system may be by-passed and the normal hydraulic system brought into action by moving the flight control switch to RESET and then back to NORMAL.

(af) Switch ON and check operation of the communication equipment, set the desired frequency and adjust volume control. Contact ground station for tuning and reception.

(ag) Check fuel quantity. Densitometer IN and OUT.

(ah) Prior to night or instrument take-off, check all lights and electrical flight instruments. Allow instruments to warm up.

## OPERATION OF FUEL SYSTEM

### GENERAL

4 Although operation of the fuel system is essentially automatic, requiring no tank selection, the drop tank pressure shut-off should be ON at all times during flight with drop tanks installed to make sure that all fuel is used. OFF if tanks are not installed.

**WARNING**

OPERATION WITH LOW FUEL STATE

> A possibility of fuel starvation and subsequent engine flameout will exist when failure of the aft fuselage transfer pump or fuel level transmitter occurs with the aircraft in a climbing attitude at low fuel state i.e. below 500 lbs.
>
> A considerable amount of fuel can be trapped in the aft fuselage cell under these conditions. Where flight is necessary with low fuel state pilot's should avoid nose high attitudes. At level or slightly nose down attitudes all the fuel from the cell will be available.

## STARTING PROCEDURE

### BEFORE STARTING

5 External power, supplied through both receptacles, must be used for starting, as the battery does not supply power to the starter. Ensure that the energizer is functioning correctly, is properly connected to the aircraft, is set at 28.5 volts and is selected to GROUND POWER.

**WARNING**

> Make sure danger areas fore and aft of aircraft are clear of personnel, aircraft and vehicles, see Figure 2-2. Suction at the intake duct is sufficient to kill or seriously injure personnel if they are drawn into or against the duct. Danger aft of the aircraft is created by the high jet pipe temperature and blast from the tail-pipe. Whenever practicable, start and run up engine on a concrete surface to minimize the possibility of dirt and foreign objects being drawn into the aircraft headed into or at right angles to the wind as jet pipe temperature may be increased or an engine fire aggravated by a tail wind.

### STARTING

6 To perform a normal start, proceed as follows:

(a) Check that ignition circuit-breaker is in.

(b) Place engine master switch ON.

(c) Place throttle lever outboard.

(d) Check that low fuel pressure warning light goes out.

NOTE

> Operation of the engine under conditions of low inlet fuel pressure to the engine-driven fuel pumps (causing the fuel pressure warning light to be on) must not exceed a total of 30 minutes between pump overhauls. The periods should be recorded on the L14A.

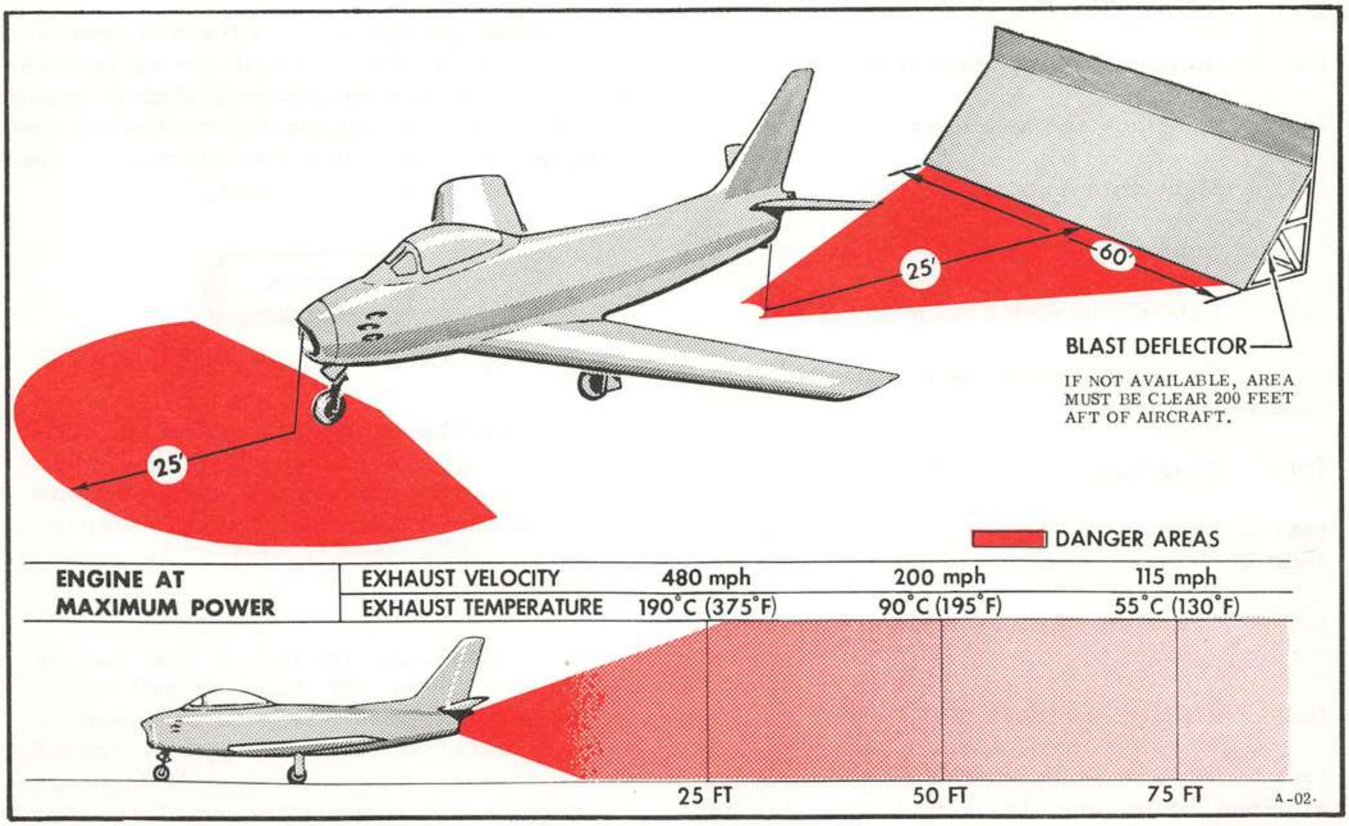


Figure 2-2 Danger Areas

(e) Hold the battery-starter switch in STARTER position for three seconds, then move to BATTERY.

**CAUTION**

The high starting current will quickly burn out the starter if the engine does not begin to turn as soon as the starter is engaged. If there is no audible indication of engine rotation or if the tachometer fails to register within three seconds, depress the push-to-stop-starter button immediately.

(f) At a minimum of 9% engine rpm, advance the throttle to IDLE.

**CAUTION**

Do not advance throttle past the IDLE stop. If a minimum of 9% rpm is not obtained within 45 seconds, abandon start by pressing push-to-stop-starter button and place aircraft unserviceable.

NOTE

An audible report in the combustion chambers and a large exhaust flame may be experienced when starting the engine. This is a normal occurrence.

(g) At approximately 30% rpm, depress the push-to-stop-starter button. Engine motoring period should not exceed 45 seconds.

(h) Check that the engine accelerates to idling speed and stays there (34% to 39%).

(j) Check that jet pipe temperature does not exceed 850°C (1562°F) at any time.

(k) Have external power disconnected after engine has reached idling rpm.

FALSE START

7 If, during the normal starting sequence, the throttle is advanced to idle and there is no noticeable rise in jet pipe temperature within ten seconds, proceed as follows:

(a) Retard throttle to the OFF position.

(b) Allow engine to complete 45-second motoring cycle to clear excess fuel.

(c) Press the push-to-stop-starter button.

(d) Allow engine to run down to a stand still.

(e) Place engine master switch OFF.

(f) Place battery switch OFF.

(g) Investigate cause of failure to light up.

(h) When cause has been ascertained and rectified, motor engine for 40 seconds to blow out excess fuel if evident.

(j) Allow at least 1-1/2 minutes after engine has stopped rotating before attempting to restart.

NOTE

A maximum of two repeated cycles of 45 seconds each is permissible. A cooling period of at least 90 minutes must then elapse before attempting further starts.

HOT START

8 If, during the normal starting sequence, the jet pipe temperature exceeds 850°C (1562°F) proceed as follows:

(a) Retard throttle to the OFF position immediately.

(b) Press the push-to-stop-starter button.

(c) Allow engine to run down to a standstill.

(d) Place engine master switch OFF.

(e) Place battery switch OFF.

(f) Investigate cause of hot start. Do not attempt a restart until cause has been ascertained.

NOTE

All hot starts, and the period of excessive temperature, must be recorded in the engine log book. When five starts of 850°C (1562°F) or above have been recorded, the engine must be removed for a hot-end inspection.

## GROUND TESTS

GENERAL

9 No engine warm-up is necessary. As soon as the engine stabilizes at idling speed with normal gauge readings, the throttle may be opened to full power. After engine is started, check the following:

**CAUTION**

If a full power engine run-up is made during ground tests, be sure wheels are chocked and brakes are held on.

(a) Check that engine idling rpm is between 34% and 39%.

(b) Check that jet pipe temperature does not exceed 540°C (1004°F).

(c) Check that oil pressure at idling rpm is at least 2 psi.

(d) Check engine instruments for desired readings.

(e) Check flight control hydraulic systems as follows:

(1) Hold flight control switch in RESET momentarily (one second) to engage normal flight control system. Check alternate light goes out.

(2) With flight control switch and the hydraulic pressure gauge selector switch in NORMAL, move control column and visually check control surfaces movement. Check pressure returns to normal range of 2550 to 3200 psi.

(3) Operate ailerons and elevators to reduce normal pressure and check that alternate light comes on when normal pressure is between 960 and 540 psi. Normal pressure should then build up to 3000 (+160-60) psi.

(4) Place hydraulic pressure gauge selector switch in ALTERNATE and check that pressure cycles between 2550 and 3200 psi. Pump the control column slightly to verify that alternate system is operating.

(5) Hold flight control switch in RESET momentarily (one second) and check that alternate light goes out and normal system is operating.

(f) Check the utility hydraulic system by running speed brakes through one complete cycle and, with the hydraulic pressure gauge selector switch at UTILITY, check pressure indicated on the gauge.

**CAUTION**

Before operating speed brakes, be sure area around speed brakes is clear, as brakes operate rapidly and forcefully, and can injure personnel.

(g) Gunsight on.

(h) At 45% engine rpm, check electrical loadmeter reading. Check voltmeter for approximately 28 (±0.5) volts. (Generator will not operate below approximately 23% rpm).

## TAXIING

GENERAL

10 Directional control of the aircraft is maintained through the steerable nose wheel by means of the rudder pedals. Nose wheel and rudder pedal position must be co-ordinated before steering mechanism will engage and the steering switch must be held depressed at all times while taxiing.

11 Before commencing to taxi, proceed as follows:

(a) Signal for removal of wheel chocks.

(b) Check parking brakes off. Depress toe pedals and check that parking brake handle is fully in.

12 Observe the following instructions for taxiing.

(a) Once the aircraft is moving, taxi at the lowest practical rpm.

(b) Avoid excessive or rapid jockeying of the throttle while taxiing.

(c) Minimize taxi time, as aircraft range is considerably reduced by high fuel consumption during taxiing.

CAUTION

Nose wheel steering becomes ineffective during speed brake cycling if speed brakes are operated whilst taxiing.

## TAKE-OFF PROCEDURES

### VITAL ACTIONS BEFORE TAKE-OFF

13 Just prior to take-off, complete the following checks:

H - Hydraulic - Pressure 3000(+160 - 60)psi.

Harness and safety belt - Tightened. Lockhandle unlocked.

T - Trim - Set for take-off.

F - Fuel - Sufficient for flight.

Flaps - One-half down, Speed brakes IN.

G - Gyros Erected.

S - Switches - Generator ON.

- Engine master ON.
- Battery-starter switch BATTERY.
- Instrument power NORM.
- Bomb release selector switch AUTO RELEASE.
- All other armament switches OFF.

NOTE

To jettison drop tanks or other external stores during take-off, use bomb-rocket-tank jettison button.

O - Oxygen - Checked and NORMAL.

C - Canopy - Closed.

P - Pitot heat (wing and duct) - As required.

14 Taxi to take-off position, heading aircraft straight down runway with nose wheel centered.

### TAKE-OFF

15 Use the following procedure for take-off.

(a) Move throttle fully forward. Check that rpm obtained is 100 (+0. 5 -1. 0)% and JPT is normally(715° ± 15°C)(1319° ± 59°F). Take-off may proceed, however, if JPT is not less than 660°C (1220°F).

(b) Release brakes and begin take-off run.

(c) Maintain directional control by using nose wheel steering until rudder control becomes effective.

(d) With a gross weight of 15, 000 pounds and a clean aircraft, the nose wheel lift-off speed is 100 knots and take-off speed 115 knots.

(e) With a gross weight of 18, 000 pounds and two 167 Imperial gallon drop tanks, nose wheel lift-off speed is 110 knots and take-off speed 125 knots.

(f) A nose-high attitude must be maintained for take-off. After take-off, the aircraft will assume a more normal attitude as airspeed increases and flaps are raised.

(g) Refer to Take-off Chart in Part 4, for required take-off distances.

16 Refer to Part 3, for procedure in case of engine failure during take-off.

17 When the aircraft is definitely airborne, proceed as follows:

(a) Landing gear handle UP. Approximately eight seconds required for gear retraction.

(b) Wing flaps UP immediately after landing gear handle UP. No sink will occur because of the rapid acceleration of the aircraft. When flaps are full up, the flap lever may be left in the UP position or returned to the HOLD position.

CAUTION

Aircraft speed must be kept below 185 knots IAS until the flaps are fully raised and the gear is locked up, otherwise excessive airloads may damage gear operating mechanism and prevent subsequent extension of gear. If flaps do not fully retract, avoid high speed and high G pull-ups. Failure of the flap actuating mechanism may occur if the flaps are not supported against the up-stop (fully retracted) during accelerated manoeuvres at high speed. If flaps are left down or accidentally lowered over 185 knots, leave them extended and avoid high speed. Land as soon as possible.

NOTE

To allow for the more rapid acceleration due to increased thrust during cold weather operation, the initial climb angle should be steepened, so that the placard limit speed for gear and flaps extended will not be exceeded before retraction is complete.

(c) Trim horizontal tail as required.

(d) Level off and accelerate immediately to best climbing speed. Refer to Part 4, for climb data.

## CLIMB

GENERAL

18 Climb at take-off rpm (time limit - 15 minutes at 720°C (1328°F) or limiter temperature, 30 minutes at 685°C (1265°F) JPT). Refer to Climb Charts in Part 4 for recommended indicated airspeed to be used during climb and for rates of climb and fuel consumption.

## DURING FLIGHT

GENERAL

19 The aircraft must be frequently and accurately trimmed to maintain maximum aerodynamic efficiency.

NOTE

The elevator and aileron trim switch installed on the type B-8 stick grip is designed to return to the neutral position automatically when thumb pressure is released after actuating the switch. Experience has shown that is is possible for this switch to remain in the actuated position, causing an overtrim condition. To prevent this, the switch should be manually returned to the neutral position.

ENGINE OPERATION

20 Observe the following engine operating instructions:

(a) To check for normally functioning JPT Limiter.

(1) In the full throttle climb, rpm will begin at 15-20,000 feet, with the JPT holding at the Limiter setting. If held at full throttle to 40,000 feet, rpm will have reduced 1 to 3%.

(2) To check at 40,000 feet, cruise 2 minutes at 95%. Open to full throttle and hold for 2 minutes. In a few seconds rpm will begin to reduce and in less than 2 minutes should be 1 to 3% below the normal ground level governor setting. The JPT should hold at the Limiter setting.

(3) If a check of the Limiter over-ride is made this should not be held for more than 10 to 15 seconds. The rpm may rise to 102% and JPT to as high as 760°C (1400°F).

(b) Retard throttle control to the desired setting (Refer to Flight Operation Instruction Charts in Part 4 for cruise data).

(c) Periodically check for desired instrument readings.

**WARNING**

If the oil pressure drops below 14 psi at engine speeds of 75% rpm and above, or if it fluctuates more than 4 psi continually, return to base immediately.

HYDRAULIC SYSTEM FLIGHT CHECK

21 Check hydraulic systems periodically as follows:

(a) Place pressure gauge selector at UTILITY and read gauge for proper utility system pressure.

(b) Fly straight and level for 30 seconds. With the gauge selector switch at NORMAL, read pressure gauge for flight control normal system pressure.

(c) Without moving control column and with gauge selector switch at ALTERNATE, read gauge for flight control alternate hydraulic system pressure.

(d) Check flight control alternate hydraulic system operation as follows: Place the flight control switch at ALTERNATE ON and check operation of the horizontal tail and the ailerons, Hold the switch at RESET momentarily (one second) and then release. System will then return to NORMAL.

## FLYING CHARACTERISTICS

### GENERAL

22 The hydraulic flight control system is considerably more sensitive than conventional control systems. Until experience is gained in handling the increased power of the system, large or abrupt control movements should be avoided. Two completely independent hydraulic flight control systems are provided as a safety feature in case one of the systems is damaged in combat.

23 Inverted flying or any manoeuvre which results in negative G must be limited to three seconds duration, as there is no means of ensuring a continuous flow of fuel due to starvation of the fuel booster pumps.

24 With the slatted wing leading edges, the resultant changes in flight characteristics are improved stability, improved low speed characteristics with better lateral stability, reduced stall speeds and improved manoeuvrability at high altitudes.

### LOW-SPEED STALL

25 The stall, with gear and flaps down, is preceded by a light, general aircraft buffet about 10 knots above the stall and a rudder buffet of medium intensity just before the stall. For normal stalling speeds, see Figure 2-3.

Gear and Flaps Down. Speed in knots IAS.

| | Fuel in pounds | Nose Gear lift-off | Take-off | Power-off stall | Final approach |
|---|---|---|---|---|---|
| Clean | Full fuel | 100 | 115 | 104 | 140 |
| | 1500 | | | 99 | 135 |
| | 500 | | | 95 | 130 |
| Two 100 Imperial Gallon Tanks | Full fuel | 105 | 120 | 110 | 150 |
| | 1500* | | | 99 | 135 |
| | 500* | | | 95 | 130 |
| Two 167 Imperial Gallon Tanks | Full fuel | 110 | 125 | 114 | 160 |
| | 1500* | | | 100 | 135 |
| | 500* | | | 96 | 130 |

*All external fuel used. Empty tanks retained. Ammunition or ballast aboard.

Figure 2-3 Stall Speeds

HIGH-SPEED ACCELERATED STALLS

26 An accelerated or high-speed stall below approximately 25,000 feet can damage the aircraft or cause pilot black-out and consequent loss of control. As the aircraft approaches a high-speed stall, there is considerable airframe buffeting, which may cause severe stress and possible structural damage. This buffet onset gives ample warning to permit relaxation of back pressure and thus avoid the stall, Abrupt use of elevators should be avoided, especially during speed brake opening, (refer to para. 37 following).

SPINS

27 The aircraft shows normal spin characteristics during spin entry, sustained spin and recovery. Spins are initiated in the normal manner. They may vary between spins to the left and spins to the right, and in some cases it may be impossible to properly spin the aircraft at all. In a fully developed spin, the nose rises and falls slowly during each turn, which takes about four seconds and about 2000 feet of height. Buffeting occurs and usually decreases as the spin progresses. A non-oscillatory type spin may be encountered. The nose of the aircraft will not rise and fall through each turn; instead, the aircraft will spin rapidly with a steady pitch angle. This type of spin usually requires more turns for recovery after corrective action is taken.

SPIN RECOVERY

28 To recover from a spin proceed as follows:

(a) Reduce throttle to IDLE rpm, retract flaps and landing gear, and close speed brakes.

(b) After determining the direction of rotation by reference to the turn indicator, apply full opposite rudder.

(c) Move the control column slowly forward until the spin stops. Do not push the control fully forward as this is not necessary and will only result in an excessively steep recovery attitude, possibly beyond the vertical.

(d) Keep ailerons neutral.

(e) Centralize rudder as soon as spin stops.

(f) Gently ease out of the resulting dive. Be sure to regain flying speed before opening speed brakes or pulling up, or the aircraft will stall and snap into another spin.

NOTE

If in a non-oscillatory type spin, maintain standard recovery control for a minimum of three turns, ensuring that ailerons are neutral and that the control column is neutral or slightly forward. If spin does not stop, hold recovery control and apply power.

29 Actual tests have shown that this procedure applies to the following configurations:

(a) Clean aircraft, speed brakes in or out, right or left hand spins.

(b) With 100 Imperial gallon drop tanks empty, speed brakes in or out, right or left hand spins.

NOTE

Although spins with external armament stores and 100 or 167 Imperial gallon tanks are prohibited, recovery from inadvertent spins can be made as outlined but may require up to three turns. If at this time recovery is not successful and altitude permits, jettison stores and repeat normal recovery action, which should be effective in 1/4 to 1 turn.

MINIMUM ALTITUDE FOR SPIN RECOVERY

30 Flight tests indicate that 7000 feet is required to complete recovery from a one-turn spin plus a one-turn recovery and a 4G pullout. The altitude loss during this manoeuvre will be about 6500 feet. In a spin below 10,000 feet bail out, since the margin of safety is too small to try a recovery.

INVERTED SPINS

31 Two types of inverted spins may be encountered in this aircraft. The first is characterized by a roll upright into a 45° dive

attitude approximately every three-fourths turn, followed by a roll again into the inverted spin position, repeating the initial spin. Each turn takes approximately six seconds. Recovery can be initiated at any time by neutralizing the controls and dropping the nose as the aircraft rolls upright.

32 The second type spin is entered from an extreme nose-up angle followed by the nose dropping through to some 80° below the horizon and the aircraft rolling to an inverted position with the wings approximately horizontal. Complete pilot disorientation results from this type of spin, causing the pilot to take incorrect recovery action. The direction of rotation in the spin can only be determined by reference to the turn indicator. Recovery action is to establish first the direction of rotation by reference to the turn indicator, then carry out the normal recovery action.

NOTE

Although inverted spin recovery is described, it is improbable that such a condition will be encountered.

## PILOT-INDUCED OSCILLATION (PORPOISING)

33 Occasionally an over-control manoeuvre may be induced, consisting of a rapid up-and-down pitching of porpoising motion. The tendency is to induce this manoeuvre at low altitudes. It is usually initiated by pushing over to zero or negative G too rapidly or by attempting to correct too rapidly for a trim change such as caused by a gust, speed brake operation or rapid throttle movement. The magnitude of the oscillation will depend upon how rapidly and how much corrective control is applied.

34 The oscillation is basically caused by a combination of applied stick forces, control column displacement and the inherent longitudinal response characteristics of the aircraft. Pilot-applied boosts sustain the oscillation and this is further aggravated by the effects of G upon the pilot, throwing his weight up and down as well as fore and aft, sustaining the oscillation through inadvertent control column movements. The quickest way to damp the oscillation is to release the control column. The oscillation will damp in approximately one cycle. It may also be stopped by making a slow, positive pull-up to approximately 3G while attempting to maintain a steady back pressure. The oscillation will not damp out quite as fast for the positive pull-up method as for the control release method.

NOTE

Do not try to stop the oscillation by attempting to push the control column fore and aft in opposition to the motion. This will only aggravate the condition, since the motion is too rapid to estimate and apply corrections.

## HIGH ALTITUDE PILOT OVERCONTROL

35 An overcontrol manoeuvre consisting of erratic up-and-down pitching can be induced at high altitudes. It may be found difficult to fly close formation at high altitudes due to unintentionally overcontrolling the aircraft. The resulting oscillation is not violent but is objectionable because of the constant necessity for corrective control. To minimize this overcontrol manoeuvre when flying formation, adhere to recommended climb and cruise schedules, since the oscillation becomes less pronounced as Mach is increased.

## AILERON CONTROL

36 Until familiar with aileron effectiveness at high speeds, care should be taken not to overcontrol in making abrupt or consecutive rolls. Refer to Part 4 for restrictions with external stores. Should failure of the normal flight control system occur, automatic changeover to the alternate system is provided instantaneously with no reduction in effect of aileron control or increase in pilot effort.

## USE OF SPEED BRAKES

37 To reduce speed, especially in aerobatics or formation flight, speed brakes may be used without objectionable buffeting or uncontrollable changes in trim. In a pull-out, recovery may be effected with minimum altitude loss by first opening the speed brakes and then pulling out a maximum permissible G. Opening the speed brakes without applying elevator control results in an automatic pitch-up of up to 3G, the actual amount of pitching depending on the airspeed.

**WARNING**

Except in extreme emergencies, do not pull the control column back during the time the speed brakes are opening. To do so may result in exceeding the load factor limit. The speed brakes open fully in approximately two seconds.

## CRUISE SPEED

38 In the medium-to-high speed range, level flight handling characteristics are considered good about all three axes. For those accustomed to conventional elevator control, the more effective stabilizer may appear considerably more sensitive because of the faster reaction to small control column movements. It is advisable not to attempt close flight in formation until accustomed to the control. Maximum available rate of roll is quite high at all altitudes. The aircraft is most sensitive to small fore-and-aft control movements between Mach 0.8 and Mach 0.9 at low altitudes.

## HIGH SPEED

39 Stability and control are unaffected by compressibility up to approximately Mach 0.95 with the exception of a slight flattening tendency in the stick force gradient for 1G flight between Mach 0.85 and Mach 0.90. The aircraft nose-up tendency which appears in this high-speed region requires steadily increasing forward control column movement to increase the speed of the aircraft, As in other speed ranges, use of the stabilizer results in quite positive and immediate reaction. The power of the controllable horizontal tail will become particularly noticeable above 500 knots, especially in turbulent air. Based on structural design limits, a limit airspeed of 600 knots, or the airspeed where wing roll becomes excessive, has been established. This limit has been imposed because wing heaviness, although easily controllable at high altitude, may become a limiting condition at lower altitudes.

## AILERON AERODYNAMIC LOCK

40 At altitudes below 40,000 feet, pull-out acceleration greater than 2G combined with

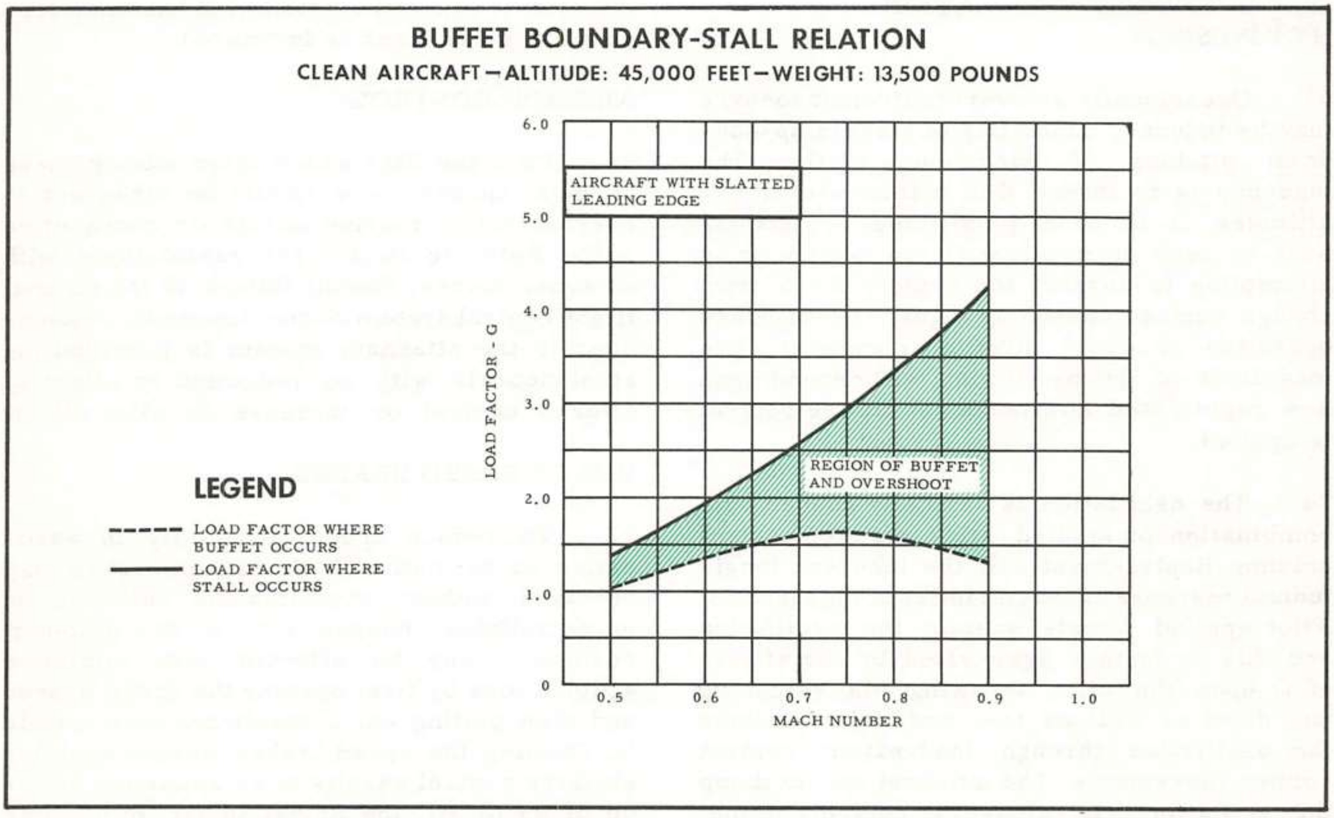


Figure 2-4 Buffet Boundary - Stall Relation

speeds higher than Mach 0.95 can produce aerodynamic loads in excess of power available in aileron jacks, resulting in aileron locking. Recovery from a dive at speeds in excess of Mach 0.95 should be initiated at a sufficiently high altitude to ensure that speed is reduced below Mach 0.95 before reaching 25,000 feet, unless speed is reduced by dive brakes or throttle adjustment.

**CAUTION**

Aileron trim should not be applied when ailerons are locked, as this may result in a severe rolling manoeuvre when aileron control is restored.

## TURNING RADIUS CONTROL

41 Turning radius varies directly with airspeed and altitude, an increase in either resulting in a wider turn. The most important factor in turning radius control is reduction in airspeed. This can be effected in two ways. One method is to exchange the excess speed for altitude by making a sharp climbing turn. The alternative is to open the speed brakes, remembering to reduce control column pressure simultaneously with speed brake opening in order to maintain the same G. If forward control is not applied with speed brake opening, the aircraft may stall at high altitudes or may exceed the limit G at low altitudes. Conversely, a backward control movement is necessary when closing the brakes to maintain the same G. When using either method of reducing speed, be careful not to let the airspeed fall below the best climb speed. Tighter turns may be made at high altitudes with the slat-equipped aircraft because more G may be applied before the stall. The onset of buffet may commence at a lower G loading, but, once the slats have opened, the magnitude of the buffet is reduced.

## LETDOWN

42 Normally, the most economical letdown with a clean aircraft is at Mach 0.8 with a throttle setting which allows minimum operating jet pipe temperature. Emergency letdown rates of descent as high as 27,000 feet per minute can be obtained by closing the throttle, opening the speed brakes and diving to maintain Mach 0.95.

## RECOMMENDED SPEED FOR MINIMUM RADIUS TURNS

43 Although minimum radius turns can be achieved at low Mach, it is better not to let the speed drop below that for best climb. This would place the aircraft in a speed range where acceleration to higher speeds is very difficult without loss of height. The same information applies to diving turns made at maximum G at constant Mach. Note also that the high-speed manoeuvring essential in combat will lead to larger turning radii.

## G-LIMIT OVERSHOOT

44 A basic characteristic towards longitudinal instability under conditions of high load factor, which is experienced during a turn or pull-up, results in a tendency to automatically increase the rate of turn or pull-up to a point where the limit load factor may be exceeded. This is termed over-shoot. The approach to this condition can usually be recognized by a distinct increase in aircraft buffeting, which should be treated as a warning that the manoeuvre is becoming critical. This applies under all conditions of altitude, Mach, gross weight or configuration, but the use of the stabilizer as a primary control surface makes immediate and effective recovery action possible before the aircraft exceeds its limit G load.

(a) When encountering the buffet boundary, check the rate of turn or pull-up, and be prepared to apply further preventative control against overshoot condition, and possible resultant damage to the aircraft, see Figure 2-4.

(b) The aircraft is limited to stated load factors, (refer to Load Factor Limit Tables, in Part 4). Never deliberately exceed these limits.

## DIVE RECOVERY

45 Because of aircraft trim changes which occur during pull-ups at high Mach, the following procedure is recommended for recovery from high Mach dives or manoeuvres.

(a) Open the speed brakes. Do not move the control column back until after speed brakes have opened and the nose up reaction to brake extension has developed.

(b) Apply backward pressure as necessary to effect the desired pull-out, see Figure 2-5.

## WING HEAVINESS

46 At a speed of approximately Mach 0.9 the aircraft becomes one-wing heavy. Either wing may tend to drop but aileron control is sufficient to counteract it.

## FLIGHT STRENGTH DIAGRAM

47 The Flight Strength Diagram, see Figure 2-6, describes the strength limitations of the clean aircraft for symmetrical manoeuvres. The left boundary lines, marked for various altitudes, show indicated stalling speeds under various load factor conditions from +7G to -3G. For other conditions, such as an asymmetrical or rolling pull-out and external load, refer to Load Factor Limits Table in Part 4, following.

NOTE

> If the accelerometer records Gs in excess of those specified for any particular flight condition in the Load Factor Limits Table, have the aircraft inspected after landing for signs of structural damage.

## FLIGHT WITH EXTERNAL LOADS

48 For flights with external loads, refer to the Load Factor Limits Table in Part 4, to obtain G and speed limits and special manoeuvre restrictions. The following comments refer to general aircraft handling with each specific external load. With all external loads, take-off distances will be greater and the rate-of-climb and acceleration reduced due to increased aircraft drag and weight. Refer to Part 4, to determine performance effects.

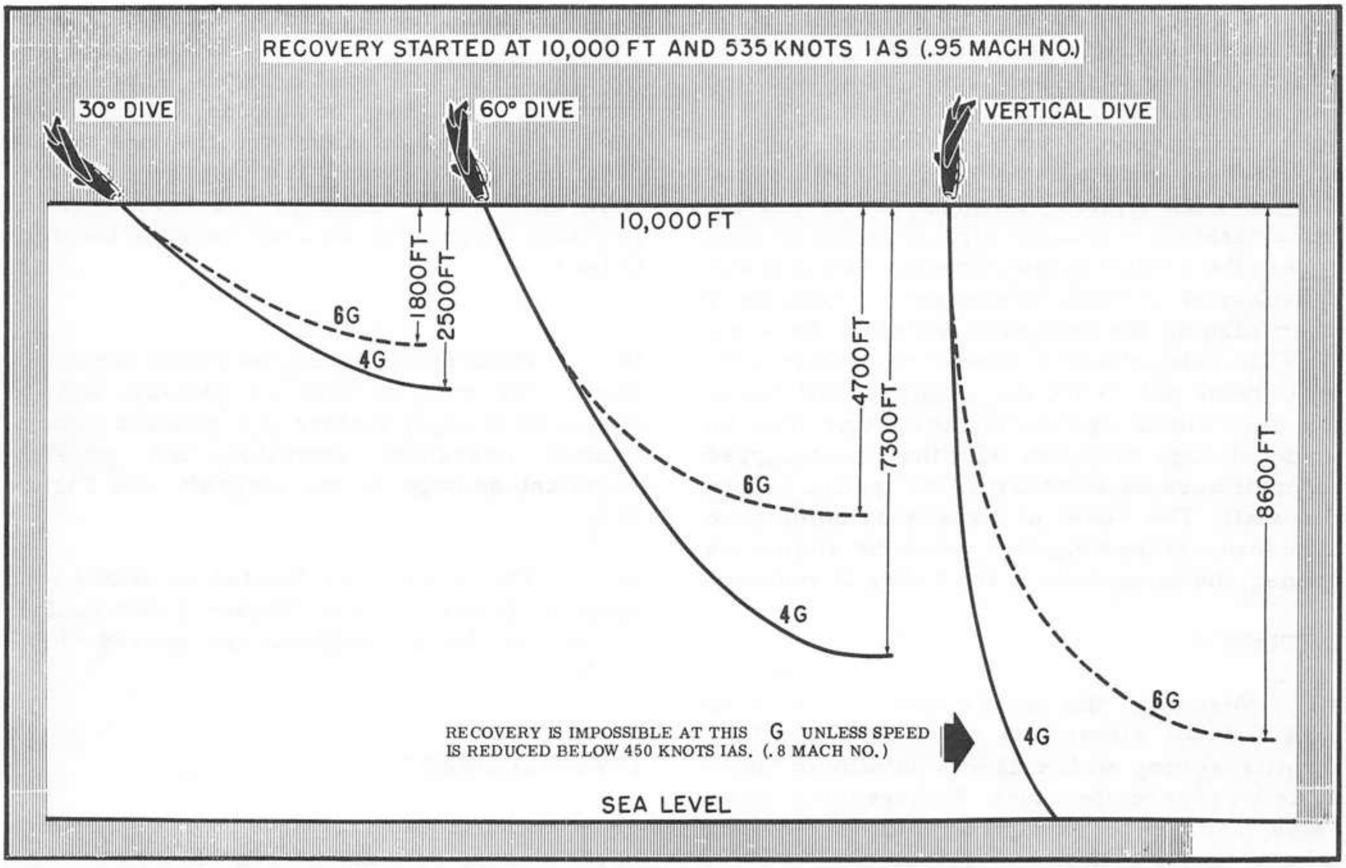


Figure 2-5 Typical Dive Recovery

DROP TANKS - 100 AND 167 IMPERIAL GALLONS

49 The tanks may be dropped full or empty up to allowable maximum level flight speeds for the particular flight altitude. To jettison the tanks, proceed as follows:

(a) Check rocket jettison switch OFF.

(b) Check fragmentation bomb selector switch OFF.

(c) Place demolition bomb release selector switch at MANUAL RELEASE.

(d) Place demolition bomb single-all selector switch at ALL.

(e) Press bomb-rocket release button on stick grip.

**CAUTION**

The 167 Imperial gallon drop tanks must not be jettisoned partially full, or at airspeeds below 220 knots IAS, except in extreme emergency. When jettisoning of partially full tanks is imperative, this should be carried out at 1G with the aircraft in a slightly nose up attitude.

NOTE

Jettison 167 Imperial gallon drop tanks when ammunition is to be expended, since, with the larger moment of the 167 gallon tanks, the C.G. moves aft of limits when ammunition is used.

ROCKETS

50 Carrying rockets does not affect the stability and control of the aircraft. Avoid buffet regions.

BOMBS - 100 AND 1000 POUND

51 Bombs may be released at all speeds up to the limit of Mach 0.85 or the airspeed at which buffet is encountered, whichever is lower. The bomb release will be evidenced by a longitudinal lurch of the aircraft. The lurch is not objectionable and the aircraft will immediately return to trim.

BOMBS - 500 POUND

52 The lower limit, (refer to Part 4), for this bomb without the T127 fins installed is due to the bomb itself, which, at high speeds, causes turbulence severe enough to damage the wing flaps.

## OPERATION OF AIR CONDITIONING AND PRESSURIZING SYSTEMS

GENERAL

53 Operate the air conditioning and pressurizing system as follows:

(a) Cockpit pressure control switch at PRESS. Pressure selector at either 2.75 or 5 psi.

(b) The cockpit air temperature control switch at AUTO.

(c) Air temperature control rheostat set at desired cockpit temperature.

(d) The air outlet selector at FLOOR, DEFROST or BOTH.

(e) Side outlets adjusted as desired.

(f) Turn on canopy defrost lever if necessary.

OPERATION OF ANTI-ICING AND DEFROSTING CONTROLS

54 Proceed as follows:

(a) If the outer surface of the windshield becomes iced, move windshield anti-icing control lever to ON.

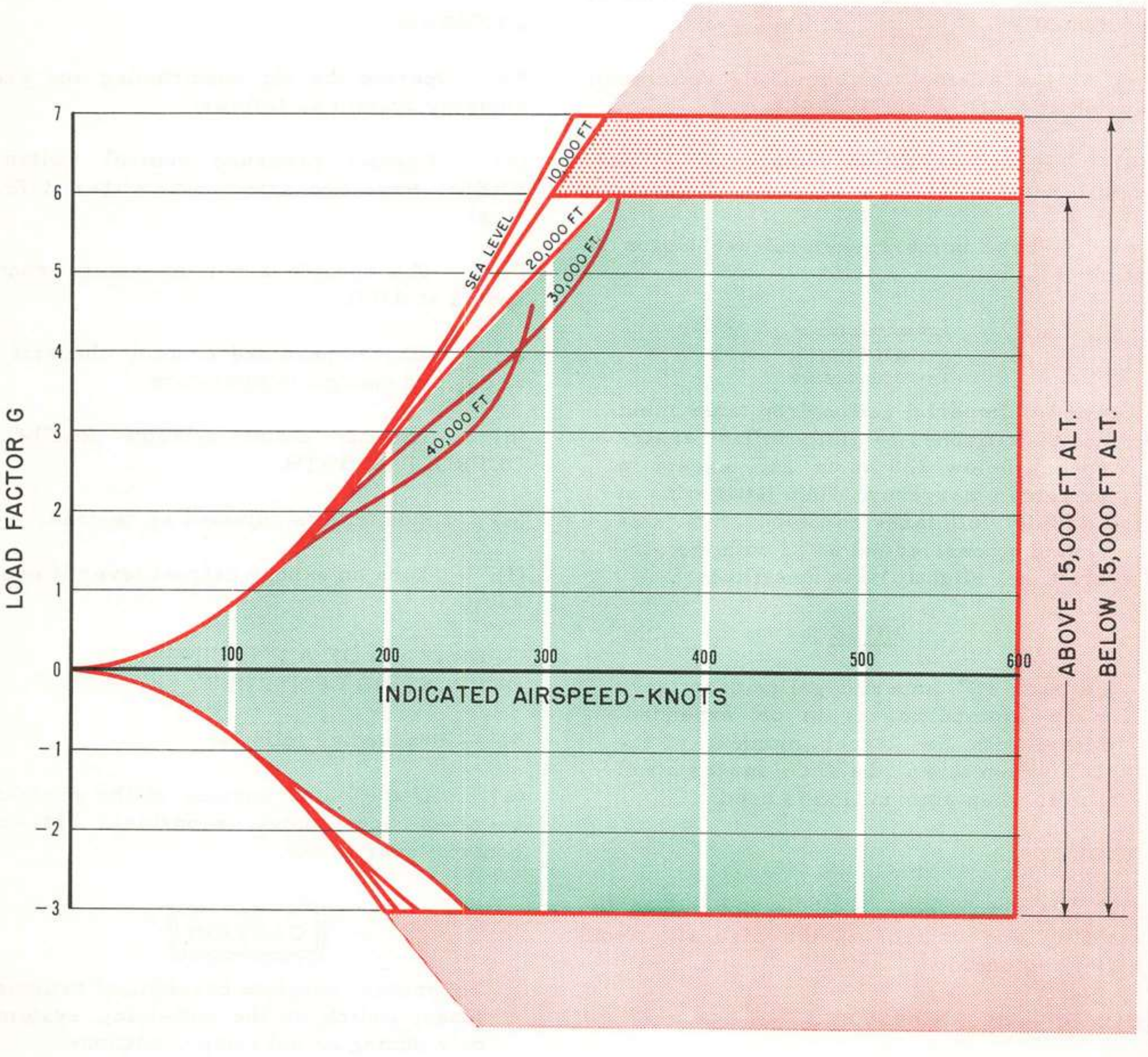
**CAUTION**

To prevent possible cracking of armour glass, switch on the anti-icing system only during actual icing conditions.

(b) If the inner surface of the canopy or windshield becomes frosted, move air outlet selector lever on the left console to DEFROST. Operate the canopy and windshield defrost control on the left longeron and close both side outlets until frost is removed.

**OPERATING FLIGHT LIMITATIONS**

**CLEAN AIRCRAFT AT 15,000 POUNDS ALL-UP WEIGHT**



**NOTE**

When 100 imperial gallon drop tanks or rockets are carried, the limit load factors are +6G or -2G at all altitudes.

Figure 2-6 Flight Strength Diagram

(c) If atmospheric or flight conditions cause fog to be emitted from windshield and side outlets, turn cockpit air temperature control rheostat to the HOT position. If fogging continues, move cockpit air temperature control switch to HOT.

**CAUTION**

Care should be taken to avoid application of excessive heat when the aircraft is on the ground.

## ARMAMENT OPERATION

FIRING GUNS

55 Operate as follows, see Figure 2-7.

(a) Gun safety switch at GUNS. Before attempting gunnery, the sight and radar should be in operation 10 to 15 minutes to allow for warm-up.

(b) Gun heater switch to HEATER if outside air temperature is 1.7°C (35°F) or below.

(c) Gun charger switch at RETRACT for approximately two seconds, then move switch to RELEASE.

(d) Set sight function selector lever at GUN. Target speed switch at TR, HI or LO, depending upon rate of closure.

(e) Instrument power selector switch at NORM. Check inverter warning light off.

(f) Reticle dimmer control adjusted to desired brilliancy.

(g) Set wing span adjustment dial on sight head to wing span of aircraft expected to be encountered in combat, so that in case of radar failure manual ranging can be used.

(h) If more than one target is within range along the aircraft flight path, make sure radar is tracking the desired target. As range is decreased, the reticle should grow larger to span the target continually. Check range dial against estimated range of target.

(j) Depress caging button momentarily to stabilize reticle image and begin tracking by placing reticle on target and holding in that position.

(k) After releasing caging button, continue to track the target smoothly without slipping or skidding for about one second, then fire.

(m) Should the radar fail, indicated by the on-target light going out or by improper range indication, use manual range control incorporated in the throttle control lever. Keep target closely encompassed by reticle image circle.

(n) In the event of sight failure or for firing at ground targets, move mechanical caging lever on the sight to CAGE and use as a fixed reticle sight.

(p) Hold the gun charger switch momentarily in RETRACT after firing is completed,

NOTE

If, at an altitude of 10,000 feet or less, the sight appears to lock-on without any target in sight, it may be due to side lobe reflections from the earth. Rotate range sweep control counterclockwise. Radar should unlock.

RELEASING DEMOLITION BOMBS

56 Operate as follows, see Figure 2-7.

(a) Gun safety switch at SIGHT CAMERA and RADAR to supply power to the sight.

(b) Instrument power selector switch at NORM. Check inverter warning light off.

(c) Sight reticle dimmer control adjusted for desired brilliancy.

(d) Bomb release selector at AUTO RELEASE for automatic release through the sight or at MANUAL RELEASE for selective manual release.

(e) Demolition bomb single-all selector switch at ALL or SINGLE. Check fragmentation bomb selector is OFF. If this switch is not OFF, the demolition bomb switch is inoperative.

## GUN-BOMB-ROCKET SIGHT CHART OF SWITCHING AND OPERATION

| | B.T.W. CONTROL | SIGHT FUNCTION SELECTOR LEVER | ROCKET SETTING LEVER | TARGET SPEED SWITCH | ELECTRICAL CAGING BUTTON | MECHANICAL CAGING LEVER | MANUAL RANGE | BOMB RELEASE SELECTOR | MANUAL BOMB RELEASE | SIGHTHEAD ELEVATION MIRROR | SIGHTHEAD DEFLECTION MIRROR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GUNFIRE (ON APPROACH) | ROCKET-GUN | GUN | GUN | TR. HI OR LO | CLOSED | UNCAGED | MANUAL OR NORMAL | MANUAL RELEASE OR AUTO RELEASE | OPEN | FOLLOWS COMPUTER | FOLLOWS COMPUTER |
| GUNFIRE (TRACKING) | ROCKET-GUN | GUN | GUN | TR. HI OR LO | OPEN | UNCAGED | MANUAL OR NORMAL | MANUAL RELEASE OR AUTO RELEASE | OPEN | FOLLOWS COMPUTER | FOLLOWS COMPUTER |
| BOMBING (ON APPROACH) | BOMB | BOMB | BOMB | HI | CLOSED | UNCAGED | NORMAL | AUTO RELEASE | OPEN | PULLED DOWN AGAINST 10° STOP | FOLLOWS COMPUTER |
| BOMBING (TRACKING) | BOMB | BOMB | BOMB | HI | OPEN | UNCAGED | NORMAL | AUTO RELEASE | CLOSED | PULLED DOWN AGAINST 10° STOP | FOLLOWS COMPUTER |
| ROCKET FIRE (ON APPROACH) | ROCKET-GUN | ROCKET | TYPE AND DIVE ANGLE SELECTED | HI | CLOSED | UNCAGED | MANUAL OR NORMAL | MANUAL RELEASE OR AUTO RELEASE | OPEN | FOLLOWS COMPUTER PLUS FIXED ROCKET SETTING | FOLLOWS COMPUTER |
| ROCKET FIRE (TRACKING) | ROCKET-GUN | ROCKET | TYPE AND DIVE ANGLE SELECTED | HI | OPEN | UNCAGED | MANUAL OR NORMAL | MANUAL RELEASE OR AUTO RELEASE | OPEN | FOLLOWS COMPUTER PLUS FIXED ROCKET SETTING | FOLLOWS COMPUTER |
| FIXED SIGHT | ROCKET-GUN | GUN | GUN | TR. HI OR LO | OPEN | CAGED (wing span at 60 for 100 mil) | NORMAL | MANUAL RELEASE OR AUTO RELEASE | OPEN | CAGED AT ZERO | CAGED AT ZERO |

**NOTES**

1 Pressing the radar out button (on stick grip) returns the sight function selector lever to GUN.

2 In mechanical cage condition, sight goes back to 600 feet.

Figure 2-7 Gun-Bomb-Rocket Sight Chart of Switching and Operation

(f) After sighting target and before starting approach, position bomb arming switch at NOSE and TAIL or TAIL ONLY.

(g) Set bomb-target-wind control for proper target and wind conditions. Set sight function selector lever at BOMB.

(h) Depress electrical caging button during the push-over into the dive.

(j) Begin tracking run and release caging button. For automatic release, depress bomb-rocket release button on stick grip at this point.

(k) Track smoothly and keep centre dot on the target.

(m) On AUTO RELEASE, the bombs will automatically drop as the reticle circle image disappears. For MANUAL RELEASE, depress bomb-rocket release button as the circle image disappears.

## RELEASING FRAGMENTATION BOMBS

57 Operate as follows: see Figure 2-7.

NOTE

> Fragmentation bombs should not be released automatically through operation of the sight, as the sight is used for dive bombing only.

(a) Check demolition bomb release selector at MANUAL RELEASE.

(b) Fragmentation bomb selector switch at ALL TRAIN or SINGLE TRAIN. Check indicator light on.

(c) To release bombs, depress bomb-rocket release button on control stick grip.

(d) Check that indicator light goes out when the last bomb is released.

## FIRING ROCKETS

58 Operate as follows, see Figure 2-7.

CAUTION

> Before initial firing of rockets, make sure rocket release control is on position 1, as rockets must be fired in proper sequence to ensure that upper rocket will not be fired while rocket below it is still in place.

(a) Gun safety switch at SIGHT CAMERA and RADAR to supply power to the sight.

(b) Instrument power selector switch at NORM. Check inverter warning light off.

(c) Sight reticle dimmer control adjusted to desired brilliancy.

(d) Set sight function selector lever at ROCKET.

(e) Rocket release selector switch at SINGLE or AUTO.

(f) Rocket arming switch at DELAY or INSTANT.

(g) Rocket jettison switch OFF.

(h) During push-over into the dive, depress electrical caging button.

(j) Begin tracking run and release caging button.

(k) Track target smoothly for five seconds, Fire rockets by depressing bomb-rocket release button.

## CHEMICAL TANK EQUIPMENT

59 Tank selection is provided by a switch on the centre pedestal. After discharge of chemicals by means of bomb-rocket release button, the tanks may be dropped by operation of the bomb-rocket-tank jettison button or the normal bomb release system.

CAUTION

> When chemicals are released, the demolition bomb single-all selector switch must be OFF to prevent dropping the tanks.

## OXYGEN SYSTEM NORMAL OPERATION

GENERAL

60 The oxygen consumption table for both the D-1 and D-2 oxygen regulators is shown in Figure 2-8. The system is operated as follows:

(a) Check that oxygen pressure is between 400 and 500 psi. Check that oxygen supply knob, if fitted, is ON.

(b) Set diluter control lever (top forward face of regulator) at NORMAL OXYGEN for all normal flight conditions.

(c) Check that mask is correctly fitted.

(d) During flight, frequently check oxygen pressure, oxygen flow indicator and hose disconnect coupling.

(e) Do not exhaust oxygen supply below 50 psi except in an emergency.

## LANDING PROCEDURE

VITAL ACTIONS BEFORE LANDING

61 During approach to field make the following checks:

**CAUTION**

> Prior to rapid descent from altitude, turn on windshield and canopy defrosting. To prevent possible cracking of armour glass, turn off as soon as they are no longer required.

(a) Safety belt and shoulder harness tightened. Shoulder harness lock handle unlocked.

(b) Armament' switches OFF. Gunsight caging lever CAGE.

(c) Hold gun charger switch momentarily in RETRACT.

(d) Check hydraulic pressures normal.

62 For complete approach and landing procedures, see Figure 2-9. Observe the following precautions.

(a) Do not lower gear in turns, pull-ups, while side-slipping, or above 185 knots IAS.

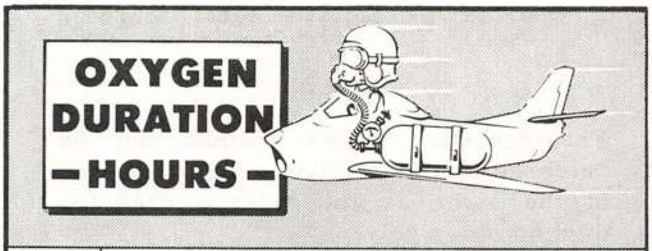
(b) During night landings, do not lower landing lights until final approach.

(c) Rapid increases in thrust are possible only above approximately 63% rpm. To ensure adequate acceleration in an emergency, it is best to use full flaps and speed brakes and to hold 60% to 70% rpm on final approach.

63 For landing patterns, see Figure 2-9. Refer to Part 4, for estimated landing distances. Observe the following precautions:

(a) Do not attempt a full-stall landing, because of the yaw condition preceding the stall and also because the angle of attack at the stall is so high that the tail will drag.

(b) Do not apply brakes before nose wheel is on runway.



| CABIN ALT - FEET - | GAUGE PRESSURE PSI | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 400 | 350 | 300 | 250 | 200 | 150 | 100 | BELOW 100 |
| 40,000 | 5.7<br>5.7 | 4.9<br>4.9 | 4.1<br>4.1 | 3.2<br>3.2 | 2.4<br>2.4 | 1.6<br>1.6 | 0.8<br>0.8 | EMERGENCY - DESCEND TO ALTITUDE NOT REQUIRING OXYGEN |
| 35,000 | 5.7<br>5.7 | 4.9<br>4.9 | 4.1<br>4.1 | 3.2<br>3.2 | 2.4<br>2.4 | 1.6<br>1.6 | 0.8<br>0.8 | |
| 30,000 | 4.2<br>4.2 | 3.6<br>3.6 | 3.0<br>3.0 | 2.4<br>2.4 | 1.8<br>1.8 | 1.2<br>1.2 | 0.6<br>0.6 | |
| 25,000 | 3.4<br>4.0 | 2.9<br>3.4 | 2.4<br>2.8 | 1.9<br>2.3 | 1.4<br>1.7 | 1.0<br>1.1 | 0.5<br>0.6 | |
| 20,000 | 2.7<br>4.5 | 2.3<br>3.9 | 1.9<br>3.2 | 1.5<br>2.6 | 1.2<br>1.9 | 0.8<br>1.3 | 0.4<br>0.6 | |
| 15,000 | 2.1<br>5.4 | 1.8<br>4.6 | 1.5<br>3.9 | 1.2<br>3.1 | 0.9<br>2.3 | 0.6<br>1.5 | 0.3<br>0.8 | |
| 10,000 | 1.8<br>7.2 | 1.5<br>6.2 | 1.3<br>5.2 | 1.0<br>4.1 | 0.7<br>3.1 | 0.5<br>2.1 | 0.3<br>1.0 | |

BLACK FIGURES INDICATE DILUTER LEVER **"NORMAL"**

RED FIGURES INDICATE DILUTER LEVER "100 %"

CYLINDERS: FOUR TYPE D-2

5E1A-02-8

Figure 2-8 Oxygen Consumption Table

(c) Do not use nose wheel steering during landing run except where necessary due to a main tire failure, brake failure, severe cross-wind conditions or poor braking conditions.

(d) Retract flaps as soon as possible.

CROSS-WIND LANDING

64 A cross-wind landing may be accomplished as follows:

(a) Maintain 160 knots IAS in turn into final approach.

**CAUTION**

Approach speed should be increased with an increase in cross-wind velocity.

(b) Slow to 110 knots IAS for touchdown.

(c) At touchdown get nose wheel down as soon as possible.

MINIMUM-RUN LANDING

65 Proceed as follows:

(a) Maintain a minimum of 160 knots IAS in turn into final approach.

(b) On final approach, maintain a minimum of 115 knots IAS using 70% to 80% rpm.

(c) Get nose wheel down quickly after touchdown to permit braking. Use brakes evenly and smoothly, as hard as runway conditions will permit without locking the wheels.

(d) Turn off wing and duct pitot heat as soon as possible after landing.

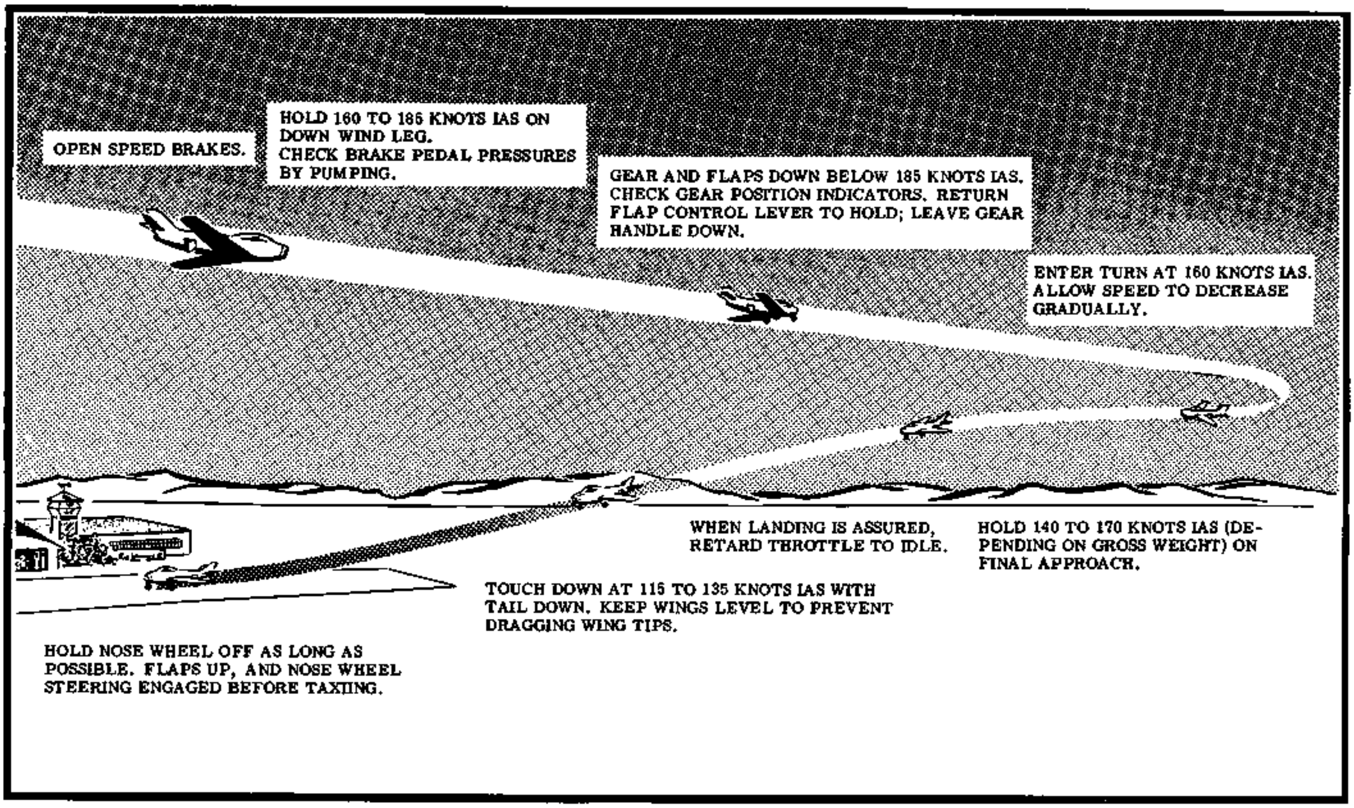
MISLANDING

66 For complete go-around procedure, see Figure 2-10.

## END OF FLIGHT PROCEDURE

STOPPING ENGINE

67 To stop engine proceed as follows:



OPEN SPEED BRAKES.

HOLD 160 TO 185 KNOTS IAS ON DOWN WIND LEG. CHECK BRAKE PEDAL PRESSURES BY PUMPING.

GEAR AND FLAPS DOWN BELOW 185 KNOTS IAS. CHECK GEAR POSITION INDICATORS. RETURN FLAP CONTROL LEVER TO HOLD; LEAVE GEAR HANDLE DOWN.

ENTER TURN AT 160 KNOTS IAS. ALLOW SPEED TO DECREASE GRADUALLY.

WHEN LANDING IS ASSURED, RETARD THROTTLE TO IDLE.

HOLD 140 TO 170 KNOTS IAS (DEPENDING ON GROSS WEIGHT) ON FINAL APPROACH.

TOUCH DOWN AT 115 TO 135 KNOTS IAS WITH TAIL DOWN. KEEP WINGS LEVEL TO PREVENT DRAGGING WING TIPS.

HOLD NOSE WHEEL OFF AS LONG AS POSSIBLE. FLAPS UP, AND NOSE WHEEL STEERING ENGAGED BEFORE TAXIING.

Figure 2-9 Normal Approach and Landing

**WARNING**

To minimize danger of explosion due to accumulation of fuel vapour, always park the aircraft headed into the wind, and wait at least 15 minutes after any engine operation (flight or ground) before moving aircraft into hangar.

(a) Set parking brakes.

**CAUTION**

To prevent seizing, allow wheel brakes to cool before setting the parking brakes.

(b) To ensure that the fuselage structure will not become overheated and to allow engine temperatures to stabilize, idle engine at approximately 65% rpm for at least two minutes.

NOTE

Whenever the engine has been ground run at 100% rpm, it should be idled at approximately 65% rpm for at least five minutes before closing down.

(c) Retard throttle to full aft.

(d) Allow engine to run down to standstill.

(e) Listen for any rubbing noises during run-down.

(f) Place engine master switch OFF.

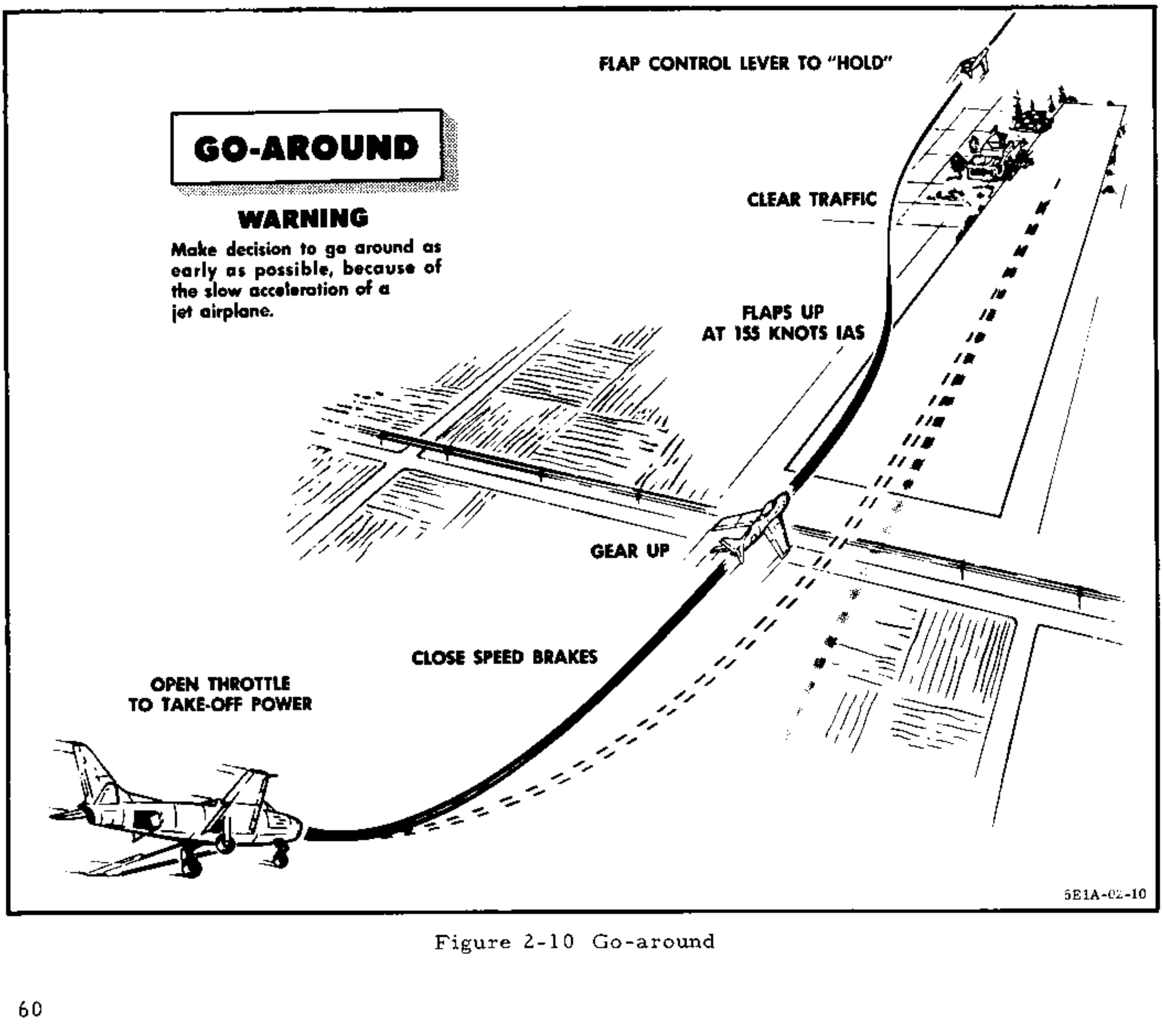


Figure 2-10 Go-around

**CAUTION**

To avoid possible damage to the pumps or fuel system components, the engine must be allowed to stop rotating before placing the master switch to OFF.

(g) Turn off all switches except generator switches.

BEFORE LEAVING AIRCRAFT

68 Before leaving cockpit proceed as follows:

(a) Check that all electrical controls are OFF except generator switch.

(b) Detach parachute auto rip cord connection from snap on left console.

(c) Ensure that all ejection equipment safety pins are installed (as required).

(d) Rudder lock engaged.

(e) Landing gear handle DOWN.

**WARNING**

Do not use the emergency landing gear selector to open the undercarriage doors on the ground except as part of a test procedure.

## HOT WEATHER OPERATION

NOTE

Do not attempt take-off in a sandstorm. Park aircraft cross-wind and shut down engine.

TAKE-OFF

69 The increase in required take-off distances, commonly associated with hot-weather operation of any aircraft, is even greater when the aircraft is powered by a jet engine.

AFTER TAKE-OFF

70 Follow normal flight procedures, being particularly careful to maintain a power setting that will keep the tail-pipe exhaust temperature within its prescribed limits.

BEFORE LEAVING AIRCRAFT

71 Make sure that protective covers are installed on pitot head, canopy and intake and exhaust ducts. Leave canopy slightly open to permit air circulation within the cockpit.

## COLD WEATHER OPERATION

GENERAL

72 The following recommendations relate to operation in temperatures below -17.8°C (0°F) when heated hangar space is not available.

BEFORE STARTING ENGINE

73 Ensure that the engine has been preheated for at least 1 hour when the aircraft has been standing out for long periods under sub-zero conditions, or if temperature and high humidity conditions indicate the possibility of icing in the compressor.

STARTING ENGINE

74 After pre-heat, a normal start can be attempted. Immediately investigate any unusual noises heard during starting or ground running which might indicate the possibility of ice entering the compressor.

PROCEDURE AFTER STARTING

75 Allow the engine to idle at least one minute before commencing to open the throttle very slowly until maximum rpm is obtained. This idling period should be increased to five minutes at temperatures below -30°C (-22°F). Oil pressure should not exceed 50 psi, nor should there be a drop below 2 psi at idling rpm.

**CAUTION**

If it is found that the engine cannot be rotated, an engine start should not be attempted until additional heat has been applied and the engine rotates freely. Otherwise damage to the starter motor and other engine components may result.

PROCEDURE AFTER FLIGHT

76 Covers should be fitted to the intake and jet pipe nozzle as soon as possible after shut-down.

## ARCTIC OPERATION

GENERAL

77 Normal cold weather operating procedures should be adhered to, with the following additions and exceptions.

BEFORE ENTERING COCKPIT

78 Proceed as follows:

(a) Remove all protective covers and dust plugs.

(b) At temperatures below -26.1°C (-15°F) use preheat in the cockpit and on the canopy seal.

(c) Check the entire aircraft for freedom from frost, snow and ice. Brush off all light snow or frost. Remove all ice by a direct flow of air from a portable ground heater. Do not chip or scrape ice, as this may damage the aircraft.

**WARNING**

The collection of snow, frost and ice on the aircraft surfaces constitutes a major flight hazard in low-temperature operation and will result in the loss of lift and treacherous stalling.

(d) Check bottom section of front stator blades for evidence of ice. Moisture collected on previous flights and condensation after landing can accumulate and freeze in this part of the engine. If ice is present or suspected, check freedom of engine by hand. If engine does not rotate freely, apply external heat to forward engine section and, after thawing, start engine before further freezing occurs.

(e) Ensure that shock struts and actuating cylinders are clear of ice and dirt and that shock struts are correctly inflated.

(f) Check oil cooler drain, fuel filter and fuel tank drain cocks for ice. Drain condensation.

(g) Inspect wing and duct pitot heads, fuel tank vent and oil tank vent. Remove any ice.

(h) Check oil system for proper lubricant.

(j) Check fuel system for proper fuel.

(k) Make sure that an external power source of 28.5 volts at 1500 amperes is available for starting. Use preheat on engine accessory section, if necessary, to reduce starter loads. Ground heating equipment can be connected to the air intake duct of the engine compartment if preheating is necessary.

ON ENTERING AIRCRAFT

79 Proceed as follows:

(a) External power source connected.

(b) Check flight controls for proper operation.

(c) Make sure that the canopy can be fully closed.

(d) Check electrical and radio equipment.

STARTING ENGINE

80 Carry out the normal starting procedure.

**CAUTION**

Engine must not be started if the oil and/or fuel temperature is less than -40°C (-40°F).

WARM-UP AND GROUND CHECK

81 Proceed as follows:

**WARNING**

Use firmly anchored wheel chocks for engine run-ups. The aircraft should be tied down securely before attempting a full power run-up. Because of low outside air temperatures, the thrust developed at all engine speeds is noticeably greater than normal.

(a) Avoid taxiing in deep snow, as taxiing and steering are extremely difficult and frozen brakes are likely to result.

(b) Increase taxi interval between aircraft during sub-freezing temperatures to ensure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice in the blast of a preceding aircraft.

(c) Minimize taxi time to conserve fuel and reduce amount of ice fog generated by jet engines.

(d) Make sure all instruments have warmed up sufficiently to ensure normal operation. Check flight instruments for sluggishness during taxiing.

## BEFORE TAKE-OFF

82 Proceed as follows:

(a) Check that the canopy is properly closed.

(b) Make normal full-power check. If field conditions make this impossible the final instrument check must be made during the first part of the take-off run.

(c) Turn wing and duct pitot heaters ON just before moving into take-off position.

## TAKE-OFF PROCEDURE

83 Follow normal take-off procedures. (Refer to para. 13 to 16 preceding).

## AFTER TAKE-OFF

84 After take-off, proceed as follows:

NOTE

> Extremely cold weather will cause considerably slower operation of the landing gear due to stiffening of the lubricants.

(a) Turn on gun heaters immediately after take-off.

(b) Check instruments.

## DURING FLIGHT

85 Use cockpit heat and defroster as required.

## ICING

86 Ice will normally adhere to the windshield, leading edge of the wings, empennage and nose of the external fuel tanks. It is recommended that the altitude be changed immediately so that reduction in airspeed due to ice accumulation will not reduce the range of the aircraft.

**WARNING**

> Ice accumulation can cause the stalling speed to be greatly increased and extreme caution must be exercised when landing under such conditions.

87 Icing of the engine air intake area may occur whenever the aircraft is operated in weather with temperatures near the freezing point. Engine icing does not necessarily occur with wing icing. Low airspeed and high engine rpm are conducive to engine icing. During take off into fog or low cloud in near freezing temperatures, climb at a higher indicated airspeed than usual. One of the normal indications of engine icing is a major rise in jet pipe temperature coupled with a reduction in engine speed and a loss of power. When engine icing is detected, reduce power to minimum cruising rpm and change altitude to leave the icing layer.

**CAUTION**

> If engine icing is allowed to accumulate, damage may be caused to the engine compressor by pieces of ice breaking away and entering the compressor. If the throttle is not retarded immediately engine icing is encountered, excessive jet pipe temperatures may result.

## DESCENT

88 During descent, operate the windshield defroster.

## APPROACH

89 Proceed as follows:

(a) Make normal pattern and landing but allow for flatter glide due to increase thrust caused by extremely low ambient temperatures.

(b) Pump brake pedals several times.

## AFTER LANDING

90 Proceed as follows:

(a) If snow and ice tires are installed on aircraft, apply brakes carefully to keep treads from filling and glazing over.

(b) Turn wing and duct pitot heaters OFF.

## STOPPING ENGINE

91 The engine is stopped in the normal manner.

## BEFORE LEAVING AIRCRAFT

92 Release brakes after the wheels are chocked.

# PART 3

# EMERGENCY HANDLING

## EMERGENCY TAKE-OFF

GENERAL

1 The aircraft is ready for take-off as soon as the engine is started. No warm-up period is necessary.

## EMERGENCY RELIGHTING IN FLIGHT

GENERAL

2 Relights may be attempted at altitudes up to 35, 000 feet. If malfunction of the normal fuel system is suspected as the cause of engine flameout, the relight should be made on the emergency system and the engine should be left on emergency system throughout the remainder of the flight.

NORMAL SYSTEM RELIGHT

3 For normal system relights, turn off all non-essential electrical equipment and proceed as follows:

(a) Below 35, 000 feet.

(1) If altitude permits, windmill engine for one minute to evaporate excess fuel.

(2) With throttle OFF, place emergency ignition switch ON.

(3) At 14% to 25% rpm, move and hold throttle outboard for 4 to 6 seconds.

(4) Check that the low fuel pressure warning light is out.

(5) Advance throttle slowly to idle stop.

(6) Allow rpm to stabilize before slowly advancing throttle, to avoid possibility of compressor stall.

(7) Place emergency ignition switch OFF.

EMERGENCY SYSTEM RELIGHT

4 For emergency system relights turn off all non-essential electrical equipment and proceed as follows:

(a) Move throttle to the OFF position.

(b) Place emergency ignition switch and emergency fuel control switch on. This can be done simultaneously. Low pressure fuel warning light should be out.

(c) At 14% to 25% rpm move and hold throttle outboard for 4 to 6 seconds.

(d) Advance throttle slowly around the horn to the idle stop if above 20, 000 feet taking 4 to 6 seconds to complete the movement. If below 20, 000 feet advance throttle slowly around the horn to approximately one half inch forward of the idle stop, taking four to six seconds to complete the movement.

(e) When relight has occurred as indicated by a rise in exhaust temperature, advance the throttle smoothly from the idle stop position.

NOTE

When operating with the emergency system all accelerations are manually controlled. Slow, steady movements of the throttle must be made to prevent over-temperature or possible compressor stall.

(f) Place emergency ignition switch OFF.

NOTE

Except at very low level where time is critical, allow the engine to windmill at 14% to 20% rpm to clear it of unburned fuel. A relight on emergency should not be attempted at altitudes above 30, 000 feet. At these altitudes it is preferable to adjust the gliding speed to keep the generator output, and depending on altitude 210 to 260 knots will be required to maintain this rpm. However, above 20% rpm a successful relight may not occur.

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a forced landing. If drop tanks are empty, retain them, otherwise jettison all external load.

(f) If no runway is available, bail out. If a forced landing is contemplated, maintaining the glide at 185 knots IAS (gear and flaps up, speed brakes in), will provide the maximum gliding distance. Unless the engine is damaged, it will windmill at sufficient speed to provide power for the hydraulic system, although landing gear operation is slower than usual. Therefore, if an emergency wheels-down landing is contemplated, use the landing gear emergency release, allowing sufficient time for the operation. The flight control hydraulic system will operate normally. Excessive use of the controls should be avoided in order to conserve accumulator pressure. At normal gliding speeds, engine windmilling does not provide adequate generator output and the battery is then the only source of electrical power. With engine master switch, IFF radar, radio, armament equipment, pitot heater and lights turned off, the battery can supply power for approximately 5 to 10 minutes, provided that the alternate flight controls are not used.

**WARNING**

If engine damage prevents windmilling, causing normal hydraulic system pressure failure, the automatic operation of the alternate flight control hydraulic pump imposes the maximum drain on battery power and results in minimum duration of battery output. Should engine seizure occur and sufficient altitude remain to permit successful ejection, abandon the aircraft.

## COMPRESSOR STALL AND RECOVERY

### COMPRESSOR STALL

9 When the airflow through the compressor becomes less than required for a given rpm, the resultant relative airflow to the compressor blades is then above the angle of attack for stall and the individual blades stall in the same manner as a wing does. This is a compressor stall. Compressor stall can be initiated by rapid throttle movements during unstabilized compressor inlet conditions such as can occur during slipping or skidding manoeuvres or low airspeed, high angle of attack conditions particularly at high altitudes. If throttle movement is required during these conditions, a steady progressive motion of 3 to 4 seconds will produce the same rate of acceleration with less danger of initiating a stall.

10 The most common stall characteristics are simply a decrease in rpm to around 64 - 68% without noise or vibration and a small temperature rise only.

(a) A change or surging in engine noise level, sometimes accompanied by loud reports like pistol shots.

(b) An increase in aircraft vibration.

(c) Extremely bad instances may cause vapour or smoke at the jet pipe and/or inlet. This may also be accompanied by a rapidly rising JPT.

### RECOVERY

11 The following procedure has been determined as both operationally affective and technically sound and shall be used by all pilot's in recovering from a recognized compressor stall.

(a) Correct any abnormal attitude or excess loading.

(b) Immediately reduce throttle to idle stop.

(c) Select AIR START switch ON.

(d) Move throttle gently onto the idle stop thus slowly reducing the fuel supply, until the stall clears. This will be evidenced by a cessation of rumble, slight increase in rpm and a drop in JPT.

(e) Open throttle smoothly to desired power setting.

(f) Select AIR START switch ON.

NOTE

If the engine flames out during this procedure or if recovery cannot be effected and pilot intentionally flames out the engine, relight is to be done on the normal fuel system.

NOTE

All compressor stalls are to be reported after landing. Record exhaust temperature and engine rpm at time of stall.

12 It is desirable, in view of the difficulty in distinguishing between true hang up and compressor stall, to treat both as compressor stall.

CAUTION

If possible try to reach a safe area, preferably a runway, before stop-cocking the engine in case a flame-out landing has to be made.

## EMERGENCY FUEL SYSTEM OPERATION

### GENERAL

13 The emergency fuel flow control system provides full manual control in case of failure of the normal fuel system. Its design is such that the fuel supply is constant at all altitudes for a fixed throttle setting. Thus, on a fixed throttle climb, the rpm will rise steadily with altitude, and throttle opening requirements for 100% rpm will decrease with altitude.

CAUTION

When the emergency fuel system is in operation, the engine fuel pumps are operating at maximum output and the Jet Pipe Temperature Limiter is inoperative therefore, indiscriminate use of the Emergency system must be avoided.

No changeover from the Emergency to Normal system shall be made other than in controlled test flights. When the changeover is required as in controlled test flights this shall be done at an altitude of 20,000 to 25,000 feet at an engine rpm of 85 to 95%.

(a) Retard throttle to IDLE.

(b) Place emergency fuel control switch ON.

(c) Advance throttle carefully.

(d) If a flameout results, attempt a restart if altitude permits.

WARNING

To prevent flameout with the emergency fuel system in operation, the throttle is to be manipulated carefully and in such a way that the engine speed is not allowed to drop below 40% until the engine is shut down.

### JET PIPE TEMPERATURE LIMITER OVER-RIDE

14 The normal full throttle stop may be over-ridden by moving the throttle lever outboard and advancing it to the end of the quadrant. This action over-rides the JPT Limiter, at the same time breaking the wire tell-tale.

WARNING

This is a combat emergency device, the use of which may be accompanied by excessive jet pipe temperature, and is not to be used during normal flight operations. When used, the fact must be recorded in Form L14A.

## TRIM FAILURE

### HORIZONTAL TAIL NORMAL TRIM FAILURE

15 If a failure of the normal trim control for the horizontal tail occurs, the tail can be trimmed through use of the alternate longitudinal trim switch.

### AILERON NORMAL TRIM FAILURE

16 If the normal aileron trim control fails, the aileron can be trimmed through use of the alternate lateral trim switch on the left console.

### WING FLAP FAILURE

17 No emergency flap control system is provided. If unequal retraction or extension of the flaps occurs during normal flap operation, hold aircraft level and return flap control to original position. Land as soon as possible

without attempting to operate the flaps. Aileron control is sufficient to overcome the rolling effect of unequal flap extension.

## LANDING GEAR EMERGENCY OPERATION

### LANDING GEAR FAILURE TO RETRACT

NOTE

If, when selecting landing gear UP the nose wheel fails to retract, or indicate UP, no reselection should be made until the position of the nose wheel can be ascertained. However, if the nose wheel retracts and the "D" door remains in the down position, reduce airspeed and re-cycle. If the nose wheel is down, or hanging in a partially retracted position, the landing gear should be selected DOWN, and a landing made when practicable. No further reselections should be made. If the nose wheel fails to indicate DOWN, do not reselect UP, but use emergency lowering procedure, and carry out procedure indicated in para.17.

18 If it is necessary to retract the gear while the aircraft is on the ground, move the normal gear control handle to UP and hold emergency up button depressed until gear retracts. On aircraft 23720 and subsequent, and on previous aircraft so modified, it is not necessary to hold the button depressed as a retract relay actuated by momentary depression of the up button holds the UP selection.

### LANDING GEAR EMERGENCY EXTENSION

19 When the landing gear indicators or the horn indicate one or more of the wheels are not locked down, see Figure 3-1, a visual check should be made by the control tower, if feasible. In the wheels down cycle, the downlock microswitches will not close the landing gear doors until all three wheels are down and locked. If the tower confirms that the wheels are down and the doors closed, the landing gear must be locked down, and continued evidence by the indicators or horn of an unsafe gear can be attributed to an electrical fault in the system.

CAUTION

If the utility system has failed and the emergency system has been used, the hydraulic nose wheel steering will be inoperative and much more than normal pressure will have to be applied to the brake pedals.

### MALFUNCTION OF LANDING GEAR SELECTOR CONTROLS

20 Upon release of the emergency handle following emergency extension of the landing gear, malfunction of the landing gear control

1 REDUCE AIRSPEED BELOW 175 KNOTS IAS (OTHERWISE, AIR LOADS MAY HOLD FAIRING DOORS CLOSED).

2 LANDING GEAR HANDLE "DOWN"

3 PULL GEAR EMERGENCY RELEASE; HOLD EXTENDED FOR MINIMUM OF 11 SECONDS TO LOWER GEAR.

CAUTION
PULL EMERGENCY RELEASE TO FULL EXTENSION (APPROXIMATELY 28 INCHES) TO ENSURE RELEASE OF ALL UP-LOCKS.

4 CHECK INDICATOR FOR SAFE GEAR INDICATION.
IF NECESSARY, YAW AIRPLANE TO LOCK MAIN GEAR.

Figure 3-1
Landing Gear Emergency Extension

handle or associated electrical components may result in the main gear retracting again. If this occurs, the landing gear control circuit-breaker (fourth from rear, bottom row, left panel) should be pulled out before further operation of the emergency release.

NOTE

In the event of the landing gear control handle becoming jammed in the UP position, the landing gear control circuit-breaker must be pulled out before operating the landing gear emergency extension.

### MAIN GEAR DOWN, NOSE GEAR UP OR UNLOCKED

21 If the nose gear will not extend or lock down and if time and conditions permit, fire all ammunition and expend any excess fuel to establish an aft centre of gravity and to minimize fire hazard. If drop tanks are empty and landing can be made on a hard, prepared surface, retain drop tanks. Otherwise jettison all external load. The landing should be made in the following manner:

(a) Jettisoning of the canopy is a decision which must be made by the pilot according to the dictates of the situation. It is recommended that the canopy be jettisoned by use of the alternate release handle.

(b) Plan approach to touchdown as near end of runway as possible.

(c) Make a normal approach with flaps and speed brakes open.

(d) Throttle control OFF.

(e) Just before touchdown, place engine master, generator and battery-starter switches OFF.

CAUTION

Leave the battery-starter switch until last so that power is still available to close the fuel shut-off valve when the engine master switch is turned off.

(f) Manually lock the shoulder harness.

(g) After touchdown, keep nose of aircraft off the ground as long as possible.

(h) Do not use brakes unless necessary.

NOTE

If nose gear is down but not locked, attempt to snap it into the locked position by making a touch-and-go landing. Make a power approach and touch the main gear to the runway with a slight bounce, then go around.

### ONE MAIN GEAR UP OR UNLOCKED

22 If one or both main gears will not extend or lock down, jettison all external load and, if conditions permit, fire all ammunition and expend any excess fuel to minimize fire hazard. Retract gear and make a belly landing. If gear cannot be retracted, land on the runway with as many wheels down as possible. Use the following procedure:

(a) Jettisoning of the canopy is a decision which must be made by the pilot according to the dictates of the situation. It is recommended that the canopy be jettisoned by use of the alternate release handle.

(b) Just before touchdown, place throttle control, engine master, generator and battery-starter switches OFF.

CAUTION

Leave the battery-starter switch until last so that power is still available to close the fuel shut-off valve when the engine master switch is turned off.

(c) Manually lock shoulder harness.

## COCKPIT PRESSURIZATION EMERGENCY OPERATION

### EMERGENCY DEPRESSURIZATION

23 Should sudden depressurization of the cockpit be necessary, proceed as follows:

**WARNING**

Always have oxygen available for immediate use when flying above 10,000 feet with cockpit pressurized.

(a) Move cockpit pressure switch to RAM. Select oxygen regulator to 100%.

(b) If at high altitude, immediately descend to below 25,000 feet.

COOLING UNIT FAILURE

24 Failure of the cooling unit of the cockpit air conditioning and pressurizing system will allow air at high temperatures to enter the cockpit. If very high temperature air enters the cockpit, proceed as follows:

(a) If at high altitude, immediately descend to 20,000 feet or less.

(b) Move cockpit pressure switch to RAM.

## OXYGEN SYSTEM EMERGENCY OPERATION

GENERAL

25 Should symptoms of anoxia occur or should the regulator become inoperative, immediately deflect the EMERGENCY toggle switch to the right or left and descend below 10,000 feet.

26 Whenever excessive carbon monoxide or noxious or irritating gases are present or suspected, the diluter lever should be set at 100% OXYGEN regardless of aircraft altitude until the danger is past.

## ARMAMENT EMERGENCY OPERATION

BOMB, ROCKET AND CHEMICAL TANK EMERGENCY RELEASE

27 To jettison demolition bombs unarmed, press the bomb-rocket-tank jettison button. The bombs can also be dropped safe by having the bomb arming switch OFF, the demolition bomb single-all selector switch at ALL, the release selector switch at MANUAL RELEASE and then depressing the bomb-rocket release button on the stick grip.

28 Fragmentation bombs are automatically armed as they are released from the rack, so that unarmed release of individual fragmentation bombs is impossible. However, if the complete fragmentation bomb rack is released with bombs installed, the bombs will be dropped safe. This unarmed release of fragmentation bombs is accomplished by depressing the bomb-rocket release button on the stick grip after positioning the fragmentation bomb selector switch at OFF, the demolition bomb single-all selector switch at ALL and the release selector switch at MANUAL RELEASE.

29 Rockets may be jettisoned by pressing the bomb-rocket-tank jettison button or by positioning the rocket fuse arming switch at DELAY or OFF and the rocket jettison switch at JETTISON READY, then depressing the bomb-rocket release button on the stick grip.

30 The chemical tanks or tow target canisters may be dropped by operation of the bomb-rocket-tank jettison button on the normal bomb release system.

## ACTION IN EVENT OF FIRE

GENERAL

31 There is no fire extinguishing system in the aircraft. The fire warning system consists of two detector circuits, the forward circuit controlling a red cockpit warning light, marked FWD, and the aft circuit controlling an amber light, marked AFT. The forward circuit senses fire in the forward engine compartment; the aft circuit senses overheat or fire in the engine compartment aft of the firewall, (refer to Part 1, preceding). Since the aft compartment is much more resistant to immediate fire damage than the forward compartment, less drastic action is called for if the aft compartment fire warning light goes on.

FIRE DURING STARTING

32 If either fire warning light comes on during starting, or there is other indication of fire, proceed as follows:

(a) Throttle control OFF.

(b) Turn engine master and battery-starter switches OFF.

(c) Leave aircraft as quickly as possible.

FIRE DURING FLIGHT

33 If a fire warning light comes on immediately after becoming airborne or during flight, proceed as follows:

(a) If the FWD (Red) Warning Light comes on in flight, immediate emergency action is mandatory. The illumination of this warning light may indicate an overheat condition but could also be caused by a defective circuit. Depending on the altitude, airspeed and flight conditions at the time, an attempt should be made to determine whether the fire warning is actual or false. The recommended procedure is as follows:

(1) Throttle control to IDLE.

(2) Take immediate action to determine if a fire exists by first ensuring that oxygen is on normal, next by either seeing or smelling smoke or if in formation by having another aircraft check for fire. Check for abnormal instrument indications, fuel, oil, hydraulic pressures. An overheat condition in the forward zone is not necessarily indicated on the JP gauge.

(3) If fire exists or smoke is detected eject immediately or force land if altitude does not permit ejection.

(4) If the warning light goes out when the throttle is retarded and no other indications of fire exist, return to base or land at the nearest suitable aerodrome at a reduced power setting.

(5) If the warning light remains on when the throttle is retarded stop cock the engine, engine master switch off. Regardless of whether the warning light remains on or goes out, eject or force land if altitude does not permit ejection, under no circumstances is the engine to be relit.

(6) If at any time during the above procedures the pressure of fire is observed, the aircraft should be abandoned immediately.

(b) If the AFT (amber) warning light comes on, adjust throttle to the minimum practical power to gain or maintain a safe ejection altitude. Check for abnormal jet pipe temperature or negative instrument readings due to burned electrical circuits, commence turn and check for trailing black smoke from the tail section. If no smoke is noted, maintain a safe ejection altitude at minimum practical power and return to the nearest base. Because of the possibility of fire reaching the aircraft controls, it is imperative to establish control effectiveness, before descending below safe ejection altitude, prior to landing, If at any time during flight the existence of fire becomes obvious abandon the aircraft.

SMOKE OR FUMES IN COCKPIT

34 If smoke or fumes should enter the cockpit, proceed as follows:

(a) Move cabin pressure control switch to RAM.

(b) Oxygen regulator diluter lever 100% OXYGEN.

(c) If not at too great a height, reduce airspeed to 215 knots IAS and open canopy.

ELECTRICAL FIRE

35 Circuit-breakers and fuses protect most of the electrical circuits and will tend to isolate an electrical fire. If an electrical fire occurs, turn battery and generator switches OFF and land as soon as possible, since the battery will last only from six to seven minutes if the flight control alternate hydraulic pump has to be used.

## EXTERNAL LOAD EMERGENCY RELEASE

GENERAL

36 To drop any external load during an emergency in flight, proceed as follows:

(a) Push bomb-rocket-tank jettison button.

(b) Check to make sure load is released.

(c) If a check reveals that load did not release and if time permits, check circuit-breakers in and demolition bomb release selector switch at MANUAL RELEASE. Place demolition bomb single-all selector switch at ALL and rocket jettison switch at READY. Press bomb-rocket release button on stick grip.

## ELECTRICAL SYSTEM EMERGENCY OPERATION

GENERAL

37 If a complete electrical failure should occur or if for any reason it becomes necessary to turn off both battery and generator, proceed as follows:

(a) If possible before turning off electrical power, reduce airspeed and adjust trim, as trim or flaps are not adjustable after switching off electrical power.

(b) The fuel booster pumps will be inoperative when electrical power is shut off. It may be necessary to reduce altitude and rpm in order to maintain satisfactory engine operation.

(c) Reduction of rpm for satisfactory engine operation without booster pumps may require that the aircraft be held in a slightly nose-high attitude to maintain altitude. If prolonged flight in this condition is necessary, approximately 21 Imperial gallons of fuel may be trapped in the aft fuselage tank since the transfer pump will also be inoperative. The actual quantity of fuel trapped will depend upon the total fuel in all tanks at the time of electrical failure. When sufficient altitude is available, some trapped fuel can be drained into the centre wing tank by levelling off or nosing down slightly for a short period.

(d) Land as soon as possible.

GENERATOR FAILURE

38 If the generator-off warning light illuminates, indicating generator failure or drop in generator output, all non-essential equipment should be turned off to reduce the load on the battery. If generator output falls off because of engine failure, the engine master switch should be moved to OFF to lessen battery loads. Battery output duration may be decreased by a number of variable factors including a low state of battery charge, excessive electrical loads and low battery temperature.

NOTE

If the generator fails, the IFF will be inoperative.

WARNING

In case the normal flight control hydraulic system fails while generator is out, battery power for alternate hydraulic pump operation will last only for a short and indeterminate time and the aircraft should be abandoned without delay.

GENERATOR OVERVOLTAGE

39 Generator overvoltage is indicated by the generator warning light illuminating. Attempt to bring the generator back into the circuit as follows:

(a) Momentarily hold generator switch at RESET, then turn switch ON. If the generator warning light goes out and the voltmeter reads normal system voltage, it indicates that the overvoltage was temporary.

(b) If the voltage cannot be brought within allowable limits, place generator switch OFF. Reduce the load on battery and land as soon as possible.

INVERTER FAILURE

40 Move instrument power switch to ALTERNATE when main instrument (three-phase) inverter off warning light is illuminated.

CAUTION

Loss of both three-phase inverters results in failure of the hydraulic and oil pressure gauges. These instruments, while operative, will provide erroneous indications as pointers may continue to register conditions which existed when the power failed.

## FLIGHT CONTROL HYDRAULIC SYSTEM FAILURE

GENERAL

41 In case of failure in the normal flight control hydraulic system, the alternate system will automatically take over, as indicated by the alternate-on warning light. If the alternate system fails to take over automatically, move the flight control switch to ALTERNATE ON.

STEPS

1 Ensure instrument floodlights in stowed position, and, if at high altitude, pull ball handle on bailout bottle.

**WARNING**

**LOWER HEAD AND BODY AS FAR AS POSSIBLE BEFORE JETTISONING CANOPY.**

2 Lower head, pull up both hand grips to lock shoulder harness and jettison canopy.

NOTE

Should the canopy fail to jettison, open electrically at speeds below 215 knots IAS. Once open, airloads should remove the canopy when it is declutched. In the event of the canopy failing to open electrically it is possible to eject the seat through the canopy by pulling either trigger. It is important to first lower the seat fully, to permit the top of the seat rails to strike the canopy first and thereby shatter the plexiglas.

3 Rock the body back into the seat bringing the legs into the foot rests with the same motion.

4 Sit erect, ensure head hard back against headrest, chin tucked in, arms braced on arm rests.

5 Squeeze either seat ejection trigger.

6 After ejection and release of safety harness, kick away from seat.

NOTE

The present automatic parachute may be used successfully as low as 150 feet, in straight and level flight.

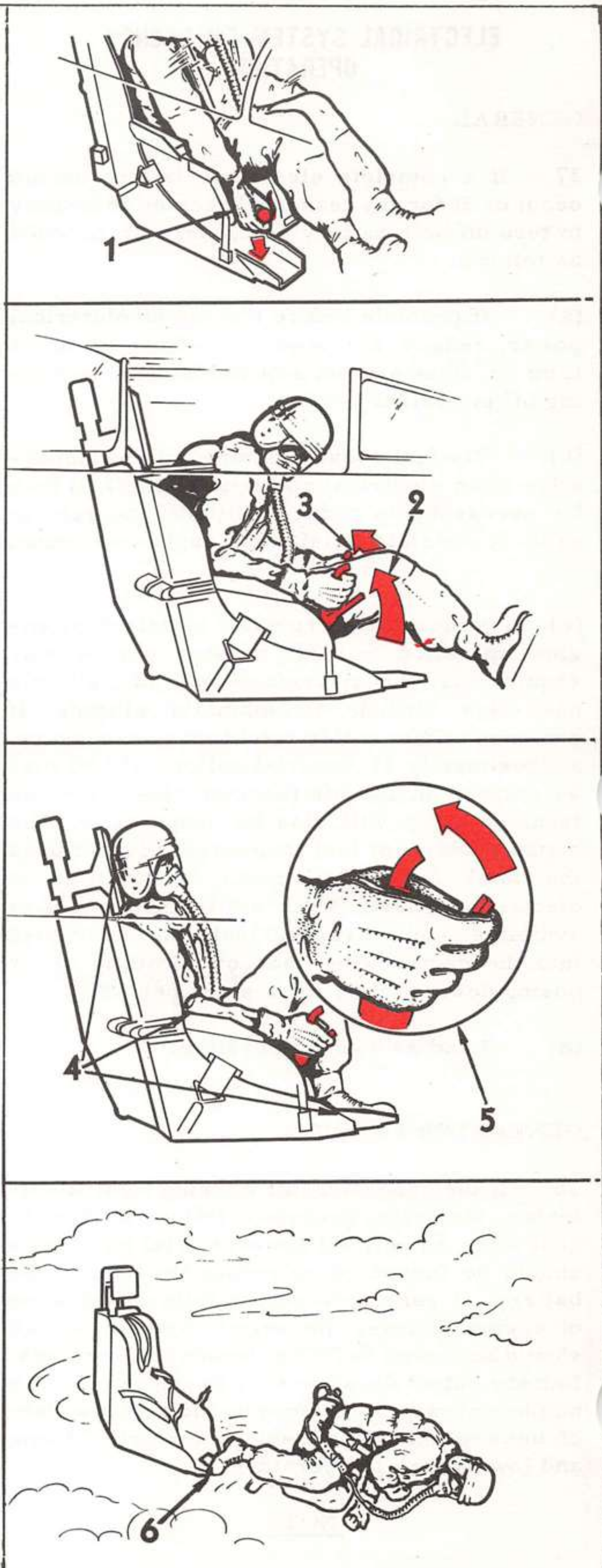


Figure 3-2 Ejection Seat Operation

**WARNING**

Because of the power output of the alternate pump, control movement should be held to a minimum to avoid the possibility of exhausting hydraulic accumulator pressure supply.

## ABANDONING IN FLIGHT

### GENERAL

42 All cases of emergency exit in flight should be made by means of the seat ejection. For seat ejection procedure, see Figure 3-2.

**NOTE**

The normal canopy jettison system is intended to be used only if followed by the emergency exit of the pilot. Once the canopy has been jettisoned by use of the right or left handgrips, the shoulder harness will be locked with no means for the pilot to release. Should it be necessary to jettison the canopy for any reason other than for emergency escape, the alternate canopy jettison release should be used.

## EMERGENCY ENTRANCE

### GENERAL

43 For emergency access to cockpit on the ground, if the canopy cannot be opened by the external electrical push-button, pull the emergency canopy release on left of fuselage just below the canopy frame and slide the canopy to the rear of the fuselage deck.

## CRASH LANDING

### GENERAL

44 See Figure 3-3 for maximum glide distance with a dead engine. See Figure 3-4 for procedure to follow in case of a forced landing.

**CAUTION**

If utility hydraulic system is inoperative, do not cycle the speed brakes at any time during the glide as remaining pressure will be exhausted and will not be available when needed for landing.

45 When practicing forced landings, it should be realised that a jet engine at idling rpm continues to give several hundred pounds of thrust, whereas a powerless, windmilling engine creates drag. If the speed brakes are opened and the throttle set at 72%, the gliding angle will approximate that given by a windmilling engine with the undercarriage raised. With the undercarriage lowered, set the throttle at 69% rpm.

### BELLY LANDING

46 If a belly landing is unavoidable, proceed as follows:

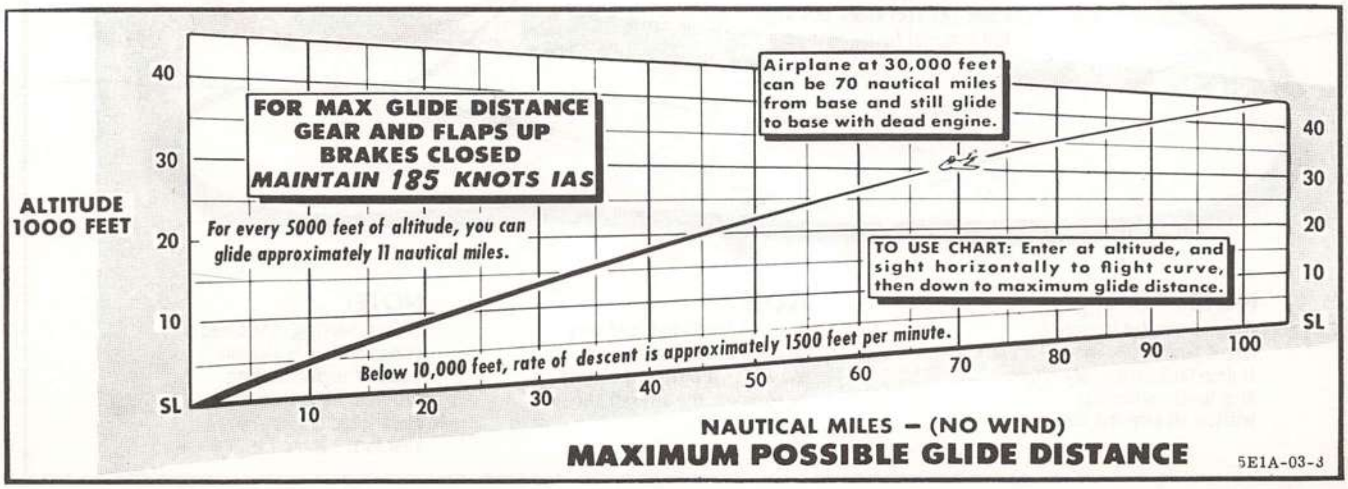
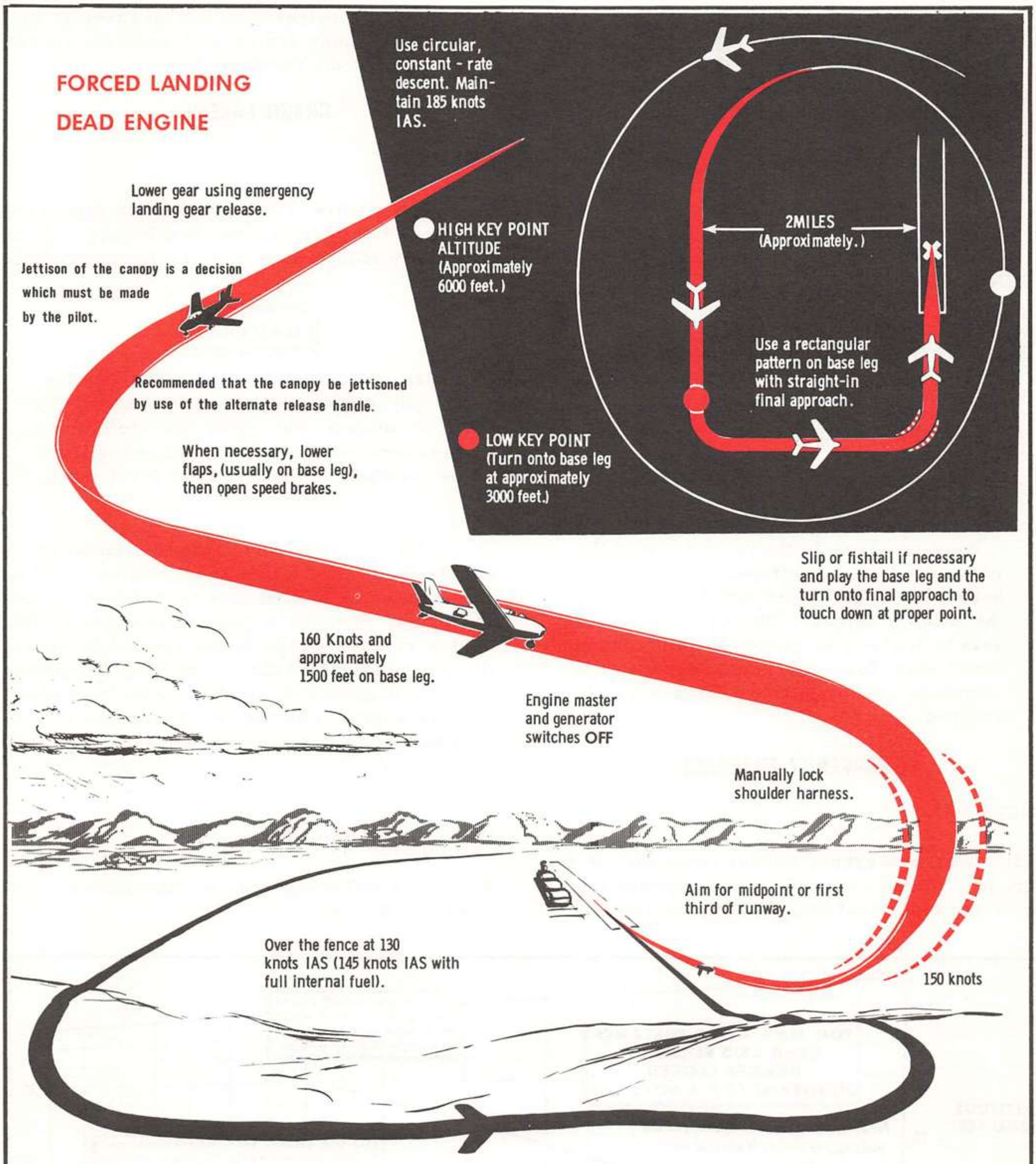


Figure 3-3 Glide Distance with Dead Engine



**FORCED LANDING**
**DEAD ENGINE**

Use circular, constant - rate descent. Maintain 185 knots IAS.

Lower gear using emergency landing gear release.

● HIGH KEY POINT ALTITUDE (Approximately 6000 feet.)

Jettison of the canopy is a decision which must be made by the pilot.

Recommended that the canopy be jettisoned by use of the alternate release handle.

When necessary, lower flaps, (usually on base leg), then open speed brakes.

● LOW KEY POINT (Turn onto base leg at approximately 3000 feet.)

Use a rectangular pattern on base leg with straight-in final approach.

Slip or fishtail if necessary and play the base leg and the turn onto final approach to touch down at proper point.

160 Knots and approximately 1500 feet on base leg.

Engine master and generator switches **OFF**

Manually lock shoulder harness.

Aim for midpoint or first third of runway.

Over the fence at 130 knots IAS (145 knots IAS with full internal fuel).

**NOTE:**
When compelled to make a forced landing:
If drop tanks are empty retain drop tanks, otherwise jettison all external load.

**NOTE:**
A forced landing should only be made when a runway is available. If a runway cannot be reached, the aircraft should be abandoned.

**NOTE:**
If overshooting, use speed brakes sooner to steepen glide. If undershooting with gears and flaps down, close speed brakes and slow to 120 knots IAS.

Figure 3-4 Forced Landing

(a) If drop tanks are empty and landing can be made on a hard, prepared surface, retain drop tanks, Otherwise, jettison all external stores.

(b) Jettisoning of the canopy is a decision which must be made by the pilot according to the dictates of the situation. It is recommended that the canopy be jettisoned by use of the alternate release handle.

(c) Establish glide at 185 knots.

(d) Make normal approach with flaps down, speed brakes open and undercarriage up.

(e) When sure of landing, throttle OFF.

(f) Just before touchdown, place engine master, generator and battery-starter switches OFF.

**CAUTION**

Leave the battery-starter switch until last so that power is still available to close the fuel shut-off valve when the engine master switch is turned off.

(g) Manually lock shoulder harness.

(h) Touchdown should be made in the normal landing attitude.

(j) Abandon the aircraft immediately forward motion stops.

## DITCHING

### GENERAL

47 Ditch only as a last resort. All emergency survival equipment is carried by the pilot and there is no advantage in riding the aircraft down. If altitude is not sufficient for emergency exit and ditching is unavoidable, proceed as follows:

NOTE

Inspect emergency equipment, parachute, life vest and raft pack before an over-water flight.

(a) Follow radio distress procedure.

(b) Jettison drop tanks, bombs, or rockets.

(c) See that no personal equipment will foul when leaving the cockpit. Disconnect anti-G suit and oxygen hose. Unlock parachute harness.

(d) Check gear up and speed brakes in.

(e) Throttle control OFF.

(f) Jettison canopy by means of alternate canopy release.

(g) Lower wing flaps. Flaps collapse on impact and do not tend to make aircraft dive.

(h) Place engine master, generator, and battery-starter switches OFF.

**CAUTION**

Leave the battery-starter switch until last so that power is still available to close the fuel shut-off valve when the engine master switch is turned off.

(j) Manually lock shoulder harness and tighten.

(k) Unless wind is high or sea is rough, plan approach parallel to any uniform swell pattern and try to touch down along wave crest just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

(m) Make normal approach and flare out to normal landing attitude, being careful to keep the nose high.

**WARNING**

Avoid ditching the aircraft in a near-level attitude, as a violent dive will result upon contact.

# PART 4

# OPERATING DATA

## FLIGHT RESTRICTIONS

GENERAL

1 The following tabulation summarizes the aircraft load factor limits and restrictions for various configurations and manoeuvres. The aircraft has been demonstrated within these boundaries but not beyond. If the accelerometer records Gs in excess of those specified for any particular flight condition, the aircraft shall be inspected after landing for signs of structural damage.

LOAD FACTOR LIMITS

| Configuration | Speed Limits | Symmetrical | | Rolling Pull Out | | Miscellaneous |
|---|---|---|---|---|---|---|
| | | Max | Min | Max | Min | |
| Clean (Below 13,395 pounds gross weight) | 600 knots IAS or airspeed where wing roll is excessive | 7.33G | -3.0G | 4.88G | -1.0G | |
| Clean (Above 13,395 pounds gross weight) | 600 knots IAS or airspeed where wing roll is excessive | 7.0G at 15,000 ft or below.<br>6.0G over 15,000 ft. | -3.0G | 4.5G at 15,000 ft or below.<br>4.0G over 15,000 ft | -1.0G | |
| Rockets | Max obtainable (avoid buffet regions) | 6.0G | -2.0G | 4.0G | -1.0G | No continuous rolls. (A continuous roll is defined as one exceeding 360°) |
| 100 Imperial gallon drop tanks | Above 15,000 ft; Max obtainable unless excessive wing heaviness is encountered<br>At 15,000 ft and below, Mach 0.90 or 555 knots, whichever is less. Do not exceed buffet initiation speed | 6.0G | -2.0G | 4.0G | -1.0G | |
| 167 Imperial gallon drop tanks | (R)550 knots IAS or airspeed where wing roll is excessive | 5.0G | -2.0G | 3.33G | -1.0G | No continuous rolls |

### ACCELEROMETER

🟥 + 5G MAXIMUM - 167 IMP. GAL. DROP TANKS
🟥 + 6G MAXIMUM - 100 IMP. GAL. DROP TANKS
🟥 + 7G MAXIMUM - CLEAN AIRCRAFT
- ABOVE 13,395 POUNDS GROSS WEIGHT
🟥 - 2G MAXIMUM - 167 IMP. GAL. DROP TANKS
🟥 - 2G MAXIMUM - 100 IMP. GAL. DROP TANKS
🟥 - 3G MAXIMUM - CLEAN AIRCRAFT

### EXHAUST TEMPERATURE

🟩 280 - 650° C NORMAL CONTINUOUS OPERATION
🟥 720° C MAXIMUM - MILITARY POWER
🟥 850° C MAXIMUM - START

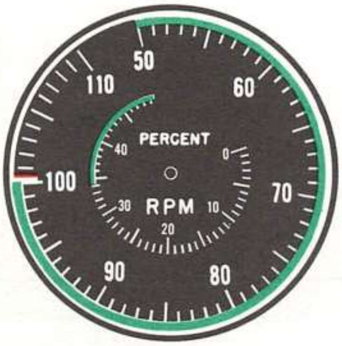
### OIL PRESSURE

🟥 IDLING MINIMUM 2 PSI
🟩 NORMAL 14-30 PSI
🟥 MAXIMUM 30 PSI

**NOTE**

**Based on fuel to specification 3-GP-22 (JP4) or 3-GP-23 (JP1).**

### TACHOMETER



🟩 34% - 100% NORMAL
🟥 101% OVERSPEED

### MAX ALLOWABLE AIRSPEED

🟨 MAXIMUM WITH GEAR AND FLAPS EXTENDED
🟥 MAXIMUM - CLEAN AIRCRAFT
△ MAXIMUM MACH SETTING KNOB. MACH .95
◁🟥 SPEED CORRESPONDING TO MAXIMUM MACH SETTING

### HYDRAULIC PRESSURE

| | UTILITY HYDRAULIC SYSTEM | FLIGHT CONTROL NORMAL HYDRAULIC SYSTEM | FLIGHT CONTROL ALTERNATE HYDRAULIC SYSTEM |
|---|---|---|---|
| 🟨 650 -2470 PSI | MALFUNCTION WITHIN SYSTEM - UNIT OPERATION SLUGGISH | | NORMAL ONLY IF SYSTEM IS ENGAGED AND CONTROLS ARE OPERATING |
| 🟩 2470 - 3250 PSI | NORMAL | | NORMAL WHEN CONTROLS ARE NOT IN USE |
| 🟥 3250 PSI | MAXIMUM | | |
| 🟨🟥 3250 - 4000 PSI | PRECAUTIONARY OPERATING RANGE | | |

Figure 4-1 Instrument Range Markings

LOAD FACTOR LIMITS (Cont'd)

| Configuration | Speed Limits | Symmetrical | | Rolling Pull Out | | Miscellaneous |
|---|---|---|---|---|---|---|
| | | Max | Min | Max | Min | |
| 100 or 1000-lb bomb | Any altitude;Mach 0.85. Do not exceed buffet initiation speed | 6.0G | -2.0G | 4.0G | -1.0G | No continuous rolls |
| 500-lb bomb | Any altitude;Mach 0.70. Do not exceed buffet initiation speed | 6.0G | -2.0G | 4.0G | -1.0G | No continuous rolls |
| 500-lb bomb with T-127 fins installed | Above 25,000 ft. Mach 0.90<br>Below 25,000 ft. Mach 0.85 or 500 knots IAS, whichever is less | 6.0G | -2.0G | 4.0G | -1.0G | No continuous rolls |
| 250-lb bomb CP | Above 15,000 ft; Max obtainable unless excessive wing heaviness is encountered<br>15,000 ft and below, Mach 0.90 or 555 knots, whichever is less. Do not exceed buffet initiation speed | 6.0G | -2.0G | 4.0G | -1.0G | |

CAUTION

Pilot's are to avoid flying for prolonged periods in the buffet or aileron buzz region where wing heaviness occurs.

In turbulent air, manoeuvres causing over 2G are not recommended.

ENGINE LIMITATIONS

2 The engine speed and jet pipe temperature limits under Standard Day conditions are as follows:

| Thrust Rating | Engine % | Speed (rpm) | Maximum Jet Pipe Temp | Maximum Time Limit |
|---|---|---|---|---|
| Maximum | 100.0 | 7800 | *720°C (1328°F) | 5 minutes (Static)<br>15 minutes (Flight) |
| Military (Climb) | 97.5 | 7600 | 685°C (1265°F) | 30 minutes |
| Normal (Cruise) | 93.0 | 7250 | 620°C (1148°F) | Unrestricted |
| Idle | 34.0 to 39.0 | 2650 to 3050 | 540°C (1004°F) | Unrestricted |

* Maximum jet pipe temperature with JPT limiter in operation is (715° ± 15°C) (1319° ± 59°F).

## INSTRUMENT RANGE MARKINGS

3 Instrument range markings are shown in Figure 4-1.

## PROHIBITED MANOEUVRES

4 The following manoeuvres are prohibited:

(a) Opening canopy above 215 knots.

(b) Lowering landing lights above final approach speed.

(c) Raising or lowering landing gear or flaps above 185 knots.

(d) Practice spinning in all configurations.

(e) All aerobatics are prohibited when bombs or rockets are installed.

(f) Inverted flying or any manoeuvre resulting in negative acceleration must be limited to 3 seconds duration.

(g) Continuous rolls when rockets, 500-pound or 1000-pound general purpose bombs, or 167 Imperial gallon drop tanks are carried.

(h) Refer to EO 05-1-1, Aircraft Operating Instructions - General, for standard prohibited manoeuvres.

# FLIGHT PLANNING

## GENERAL

5 To promote efficient operation of the aircraft and to facilitate flight planning, the charts on the following pages present performance data. All charts are based on operation in NACA standard atmosphere, except the Take-off Distance Charts, which have columns for various temperatures. The Flight Operation Instruction Charts are also applicable in non-standard atmosphere if the recommended CAS values are maintained. The charts provided for cruise control are easy to interpret and their use results in greater distances at better cruising speeds and arrival at destination with more reserve fuel. Fuel quantities are given in pounds so that the charts can be used with standard jet fuels.

## AIRSPEED INSTALLATION CORRECTION

6 Airspeed installation error at or near stall speeds causes the indicated airspeed (IAS) to be approximately 3 knots higher than the calibrated airspeed (CAS). At higher speeds, the error may be considered negligible with the aircraft in any configuration, except when speed exceeds approximately Mach 0.9.

## AIRSPEED COMPRESSIBILITY CORRECTION TABLE

7 A Compressibility Correction Table, see Figure 4-2, is provided for computing equivalent airspeed (EAS) from calibrated

## COMPRESSIBILITY CORRECTION TABLE

SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED
TO OBTAIN EQUIVALENT AIRSPEED

| PRESSURE ALTITUDE | CAS - KNOTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 |
| 5,000 | 0 | 0 | 1 | 2 | 2 | 3 | 5 | 6 | 8 | 10 |
| 10,000 | 0 | 1 | 2 | 3 | 5 | 7 | 10 | 13 | 17 | 21 |
| 15,000 | 1 | 2 | 3 | 5 | 8 | 12 | 16 | 21 | 27 | |
| 20,000 | 1 | 3 | 5 | 8 | 12 | 17 | 23 | 31 | | |
| 25,000 | 2 | 4 | 7 | 11 | 17 | 24 | 32 | | | |
| 30,000 | 2 | 5 | 9 | 15 | 23 | 32 | | | | |
| 35,000 | 3 | 7 | 12 | 20 | 29 | | | | | |
| 40,000 | 4 | 9 | 16 | 25 | | | | | | |

5E1A-04-2

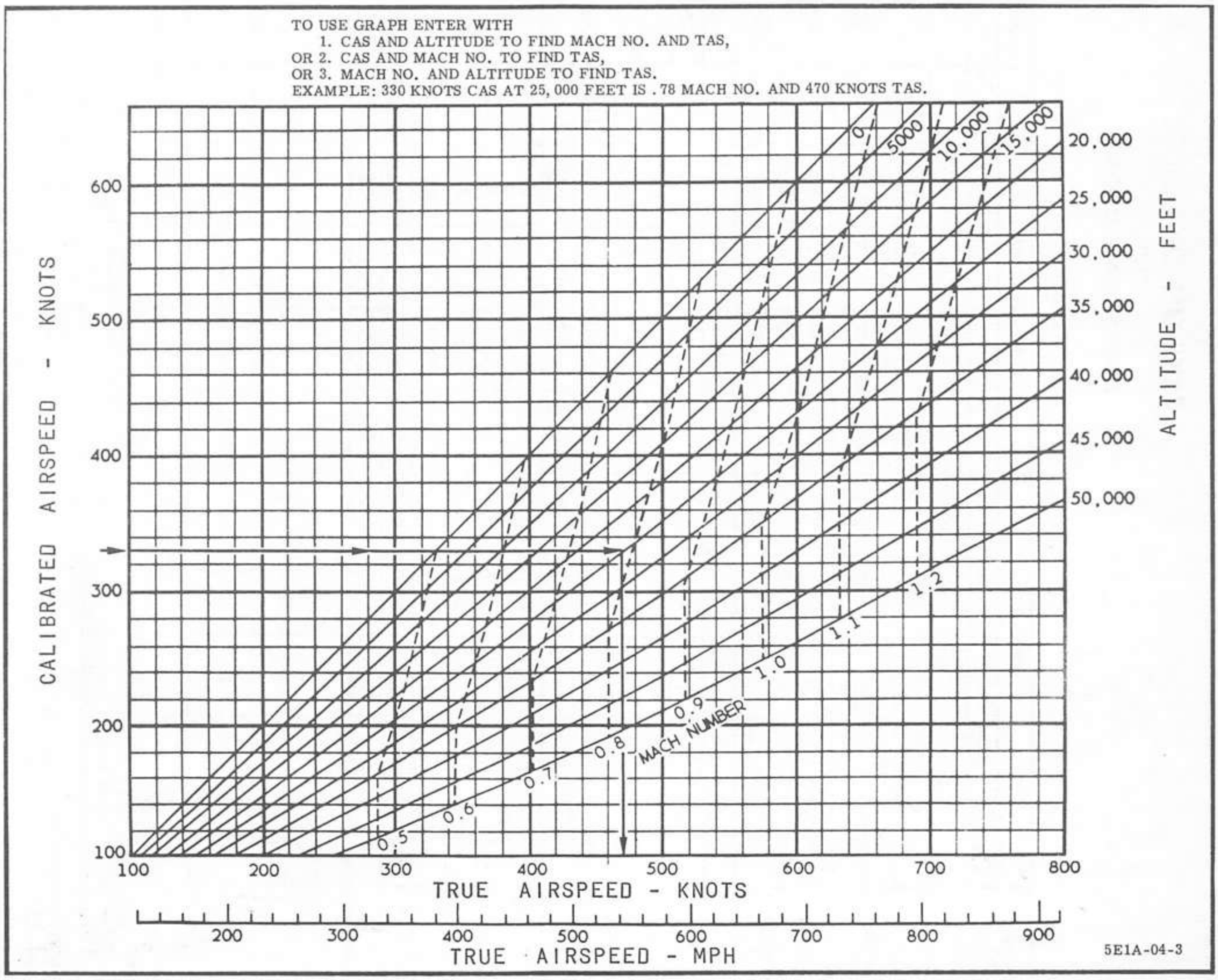
Figure 4-2 Compressibility Correction Table airspeed (CAS). For direct conversion of calibrated airspeed to true airspeed on an NACA standard day, an Airspeed Conversion Graph, see Figure 4-3, is provided.

## USE OF AIRSPEED COMPRESSIBILITY CORRECTION TABLE

8 An aircraft is flying at 20, 000 feet, with a true free air temperature of -29°C (-20.2°F) and an airspeed indicator reading of 393 knots. The value of 393 knots is also the calibrated airspeed (CAS), as installation error is negligible in any configuration, except as noted in para. 6, preceding. Use CAS and true air temperature with a Type D-4 or Type G-1 airspeed computer to determine true airspeed (TAS) of 512 knots. When the dead-reckoning computer (AN5835-1) is used, the CAS (393 knots) must be corrected for compressibility error. The Compressibility Correction Table, see Figure 4-2, shows that 17 knots must be subtracted from CAS (393 knots) to obtain equivalent airspeed (376 knots). Use the dead-reckoning computer and the values of 376 knots and -29°C (-20. 2°F) to determine the true airspeed of 512 knots.

NOTE

Indicated airspeed (IAS) is the airspeed indicator reading. Calibrated airspeed (CAS) is indicated airspeed corrected for installation error. Equivalent airspeed



TO USE GRAPH ENTER WITH
1. CAS AND ALTITUDE TO FIND MACH NO. AND TAS,
OR 2. CAS AND MACH NO. TO FIND TAS,
OR 3. MACH NO. AND ALTITUDE TO FIND TAS.
EXAMPLE: 330 KNOTS CAS AT 25, 000 FEET IS . 78 MACH NO. AND 470 KNOTS TAS.

Figure 4-3 Airspeed Conversion for NACA Day

# TAKE-OFF DISTANCES

(FEET)

## HARD SURFACE RUNWAY

**MODEL:** SABRE 6

(AIRCRAFT WITH SLATTED LEADING EDGE)

**ENGINE(S):** (1) ORENDA 14

| CONFIGURATION AND GROSS WEIGHT | PRESSURE ALTITUDE | - 25 DEGREES CENTIGRADE | | | | - 5 DEGREES CENTIGRADE | | | | + 15 DEGREES CENTIGRADE | | | | + 35 DEGREES CENTIGRADE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | |
| | | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. |
| TWO<br>167 IMPERIAL<br>(200 U.S.)<br>GALLON<br>DROP TANKS<br>17, 300 POUNDS | SL | 1200 | 2000 | 650 | 1300 | 1450 | 2400 | 800 | 1550 | 1800 | 2800 | 1000 | 1850 | 2200 | 3350 | 1250 | 2200 |
| | 1000 | 1300 | 2150 | 700 | 1400 | 1600 | 2550 | 900 | 1650 | 1950 | 3050 | 1100 | 1950 | 2400 | 3600 | 1400 | 2350 |
| | 2000 | 1400 | 2300 | 800 | 1500 | 1700 | 2750 | 1000 | 1800 | 2100 | 3250 | 1250 | 2150 | 2600 | 3850 | 1550 | 2550 |
| | 3000 | 1500 | 2450 | 850 | 1600 | 1850 | 2950 | 1050 | 1900 | 2300 | 3500 | 1350 | 2300 | 2800 | 4150 | 1700 | 2750 |
| | 4000 | 1650 | 2650 | 950 | 1700 | 2050 | 3150 | 1150 | 2050 | 2500 | 3750 | 1500 | 2500 | 3100 | 4500 | 1900 | 3000 |
| | 5000 | 1800 | 2850 | 1050 | 1850 | 2250 | 3400 | 1300 | 2250 | 2750 | 4050 | 1650 | 2700 | 3400 | 4900 | 2150 | 3300 |
| TWO<br>100 IMPERIAL<br>(120 U.S.)<br>GALLON<br>DROP TANKS<br>16,100 POUNDS | SL | 1000 | 1800 | 550 | 1150 | 1250 | 2100 | 700 | 1350 | 1500 | 2450 | 850 | 1600 | 1850 | 2900 | 1050 | 1900 |
| | 1000 | 1100 | 1900 | 600 | 1200 | 1350 | 2250 | 750 | 1450 | 1650 | 2650 | 950 | 1700 | 2000 | 3100 | 1150 | 2050 |
| | 2000 | 1200 | 2000 | 650 | 1300 | 1450 | 2400 | 800 | 1550 | 1800 | 2800 | 1000 | 1850 | 2200 | 3350 | 1250 | 2200 |
| | 3000 | 1300 | 2150 | 700 | 1400 | 1600 | 2550 | 900 | 1650 | 1950 | 3050 | 1100 | 2000 | 2400 | 3600 | 1400 | 2350 |
| | 4000 | 1400 | 2300 | 750 | 1500 | 1700 | 2750 | 950 | 1800 | 2100 | 3250 | 1250 | 2150 | 2600 | 3900 | 1550 | 2550 |
| | 5000 | 1500 | 2450 | 850 | 1600 | 1850 | 2950 | 1050 | 1950 | 2300 | 3500 | 1350 | 2300 | 2850 | 4150 | 1700 | 2800 |
| CLEAN AIRCRAFT<br>14,400 POUNDS | SL | 800 | 1500 | 400 | 900 | 950 | 1750 | 500 | 1100 | 1150 | 2000 | 650 | 1300 | 1450 | 2350 | 800 | 1500 |
| | 1000 | 850 | 1600 | 450 | 1000 | 1050 | 1850 | 550 | 1150 | 1250 | 2150 | 700 | 1400 | 1550 | 2500 | 900 | 1650 |
| | 2000 | 950 | 1700 | 500 | 1050 | 1150 | 1950 | 600 | 1250 | 1400 | 2300 | 800 | 1500 | 1700 | 2700 | 950 | 1750 |
| | 3000 | 1000 | 1800 | 550 | 1150 | 1250 | 2100 | 700 | 1350 | 1500 | 2450 | 850 | 1600 | 1850 | 2900 | 1050 | 1900 |
| | 4000 | 1100 | 1900 | 600 | 1200 | 1350 | 2200 | 750 | 1450 | 1650 | 2600 | 950 | 1700 | 2000 | 3100 | 1150 | 2050 |
| | 5000 | 1200 | 2000 | 650 | 1300 | 1450 | 2350 | 800 | 1550 | 1800 | 2800 | 1000 | 1850 | 2200 | 3350 | 1250 | 2200 |
| | SL | | | | | | | | | | | | | | | | |
| | 1000 | | | | | | | | | | | | | | | | |
| | 2000 | | | | | | | | | | | | | | | | |
| | 3000 | | | | | | | | | | | | | | | | |
| | 4000 | | | | | | | | | | | | | | | | |
| | 5000 | | | | | | | | | | | | | | | | |

**REMARKS:** Take-off distances are aircraft requirements under normal service conditions.
1. Take-off with full flaps and 100% rpm.
2. Chart values based on normal take-off technique.
3. Maximum power - 5 minute time limit.
4. Jet pipe temperature limit - 720°C.

**FUEL GRADE:** BASED ON ANY FUEL

**DATA AS OF:** SEPT 26TH 1955

**BASED ON:**

Figure 4-4 (Sheet 1 of 2) Take-off Distance

## TAKE-OFF DISTANCES

(FEET)

## HARD SURFACE RUNWAY

MODEL: SABRE 6

(AIRCRAFT WITH SLATTED LEADING EDGE)

ENGINE(S): (1) ORENDA 14

| CONFIGURATION AND GROSS WEIGHT | PRESSURE ALTITUDE | -65 DEGREES CENTIGRADE | | | | -45 DEGREES CENTIGRADE | | | | DEGREES CENTIGRADE | | | | DEGREES CENTIGRADE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | | ZERO WIND | | 30-KNOT WIND | |
| | | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. | GROUND RUN | TO CLEAR 50 FT. OBST. |
| TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS<br>17,300 POUNDS | SL | 800 | 1500 | 400 | 900 | 950 | 1750 | 500 | 1100 | | | | | | | | |
| | 1000 | 850 | 1550 | 450 | 950 | 1050 | 1850 | 550 | 1150 | | | | | | | | |
| | 2000 | 900 | 1650 | 500 | 1000 | 1150 | 1950 | 600 | 1250 | | | | | | | | |
| | 3000 | 950 | 1750 | 550 | 1100 | 1200 | 2100 | 650 | 1350 | | | | | | | | |
| | 4000 | 1050 | 1850 | 600 | 1200 | 1300 | 2200 | 750 | 1450 | | | | | | | | |
| | 5000 | 1150 | 1950 | 650 | 1250 | 1450 | 2350 | 800 | 1550 | | | | | | | | |
| TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS<br>16,100 POUNDS | SL | 700 | 1300 | 300 | 800 | 850 | 1550 | 400 | 950 | | | | | | | | |
| | 1000 | 750 | 1400 | 350 | 850 | 900 | 1650 | 450 | 1000 | | | | | | | | |
| | 2000 | 800 | 1500 | 400 | 900 | 950 | 1750 | 500 | 1050 | | | | | | | | |
| | 3000 | 850 | 1600 | 400 | 950 | 1050 | 1850 | 550 | 1150 | | | | | | | | |
| | 4000 | 900 | 1650 | 450 | 1000 | 1100 | 1950 | 600 | 1250 | | | | | | | | |
| | 5000 | 950 | 1750 | 550 | 1100 | 1200 | 2100 | 650 | 1350 | | | | | | | | |
| CLEAN AIRCRAFT<br>14,400 POUNDS | SL | 550 | 1100 | 200 | 650 | 650 | 1300 | 300 | 750 | | | | | | | | |
| | 1000 | 600 | 1150 | 200 | 700 | 700 | 1350 | 350 | 800 | | | | | | | | |
| | 2000 | 650 | 1250 | 250 | 700 | 750 | 1450 | 350 | 900 | | | | | | | | |
| | 3000 | 700 | 1350 | 300 | 750 | 850 | 1550 | 400 | 950 | | | | | | | | |
| | 4000 | 750 | 1400 | 350 | 850 | 900 | 1650 | 450 | 1000 | | | | | | | | |
| | 5000 | 800 | 1500 | 350 | 900 | 950 | 1750 | 500 | 1100 | | | | | | | | |
| | SL | | | | | | | | | | | | | | | | |
| | 1000 | | | | | | | | | | | | | | | | |
| | 2000 | | | | | | | | | | | | | | | | |
| | 3000 | | | | | | | | | | | | | | | | |
| | 4000 | | | | | | | | | | | | | | | | |
| | 5000 | | | | | | | | | | | | | | | | |

**REMARKS:** Take-off distances are aircraft requirements under normal service conditions.

1. Take-off with full flaps and 100% rpm.
2. Chart values based on normal take-off technique.
3. Maximum power - 5 minute time limit.
4. Jet pipe temperature limit - 720°C.

**FUEL GRADE:** BASED ON ANY FUEL

**DATA AS OF:** SEPT 26TH 1955

**BASED ON:** ESTIMATED DATA

Figure 4-4 (Sheet 2 of 2) Take-off Distance

# NORMAL POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 17300 POUNDS

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14700 POUNDS

| | APPROXIMATE | | | | | | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 4900 | 0 | 0 | 400 (3) | 315 | SEA LEVEL | 310 | 400 (3) | 0 | 0 | 5900 |
| 4400 | 5 | 1.0 | 500 | 305 | 5,000 | 300 | 480 | 1.0 | 5 | 5300 |
| 3900 | 15 | 2.5 | 590 | 295 | 10,000 | 285 | 550 | 2.0 | 10 | 4800 |
| 3300 | 20 | 3.5 | 680 | 280 | 15,000 | 275 | 630 | 3.0 | 15 | 4200 |
| 2800 | 30 | 5.0 | 770 | 270 | 20,000 | 265 | 700 | 4.0 | 20 | 3500 |
| 2300 | 40 | 7.0 | 880 | 255 | 25,000 | 250 | 780 | 5.5 | 30 | 2900 |
| 1800 | 55 | 9.5 | 990 | 240 | 30,000 | 235 | 860 | 7.5 | 40 | 2400 |
| 1200 | 75 | 12.5 | 1110 | 230 | 35,000 | 225 | 950 | 9.5 | 55 | 1800 |
| 400 | 110 | 17.5 | 1280 | 210 | 40,000 | 205 | 1050 | 13.0 | 80 | 1000 |
| | | | | | 45,000 | | | | | |

**CONFIGURATION:** TWO 100 IMPERIAL 120 (U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 16100 POUNDS

**CONFIGURATION:** TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14500 POUNDS

| | APPROXIMATE | | | | | | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 5600 | 0 | 0 | 400 (3) | 345 | SEA LEVEL | 340 | 400 (3) | 0 | 0 | 6400 |
| 5100 | 5 | 1.0 | 480 | 330 | 5,000 | 325 | 470 | 1.0 | 5 | 5800 |
| 4600 | 10 | 2.0 | 560 | 315 | 10,000 | 310 | 540 | 1.5 | 10 | 5200 |
| 4000 | 20 | 3.0 | 650 | 300 | 15,000 | 295 | 620 | 2.5 | 15 | 4600 |
| 3500 | 25 | 4.5 | 720 | 285 | 20,000 | 280 | 680 | 4.0 | 20 | 4000 |
| 2800 | 35 | 6.0 | 810 | 270 | 25,000 | 265 | 760 | 5.0 | 30 | 3300 |
| 2300 | 50 | 8.0 | 890 | 250 | 30,000 | 250 | 820 | 7.0 | 40 | 2700 |
| 1700 | 65 | 10.0 | 980 | 235 | 35,000 | 235 | 900 | 8.5 | 55 | 2100 |
| 900 | 85 | 13.5 | 1100 | 215 | 40,000 | 215 | 990 | 11.5 | 70 | 1300 |
| 100 | 140 | 21.0 | 1300 | 195 | 45,000 | 195 | 1120 | 16.5 | 105 | 400 |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23 a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Normal power - no time limit.
6. Jet pipe temperature limit - 620° C.

**LEGEND**

RATE OF CLIMB -FEET PER MINUTE
DISTANCE -NAUTICAL MILES
TIME -MINUTES
FUEL -POUNDS
CAS -CALIBRATED AIRSPEED IN KNOTS

**DATA AS OF:** March 1, 1955.
**BASED ON:** ESTIMATED DATA

5E1A-04-6

**FUEL GRADE:**
**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-5 (Sheet 1 of 2) Normal Power Climb Chart

# NORMAL POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** CLEAN AIRCRAFT

**GROSS WEIGHT:** 14400 POUNDS

**CONFIGURATION:**

**GROSS WEIGHT:**

| RATE OF CLIMB | APPROXIMATE FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE FROM SEA LEVEL | | | RATE OF CLIMB |
|---|---|---|---|---|---|---|---|---|---|---|
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 6900 | 0 | 0 | 400 (3) | 390 | SEA LEVEL | | | | | |
| 6300 | 5 | 1.0 | 470 | 370 | 5,000 | | | | | |
| 5700 | 10 | 1.5 | 540 | 350 | 10,000 | | | | | |
| 5100 | 15 | 2.5 | 600 | 335 | 15,000 | | | | | |
| 4400 | 25 | 3.5 | 670 | 320 | 20,000 | | | | | |
| 3800 | 30 | 4.5 | 730 | 300 | 25,000 | | | | | |
| 3200 | 40 | 6.0 | 800 | 280 | 30,000 | | | | | |
| 2600 | 55 | 7.5 | 870 | 265 | 35,000 | | | | | |
| 1700 | 70 | 10.0 | 940 | 240 | 40,000 | | | | | |
| 800 | 95 | 13.0 | 1040 | 220 | 45,000 | | | | | |

**CONFIGURATION:**

**GROSS WEIGHT:**

**CONFIGURATION:**

**GROSS WEIGHT:**

| RATE OF CLIMB | APPROXIMATE FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE FROM SEA LEVEL | | | RATE OF CLIMB |
|---|---|---|---|---|---|---|---|---|---|---|
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| | | | | | SEA LEVEL | | | | | |
| | | | | | 5,000 | | | | | |
| | | | | | 10,000 | | | | | |
| | | | | | 15,000 | | | | | |
| | | | | | 20,000 | | | | | |
| | | | | | 25,000 | | | | | |
| | | | | | 30,000 | | | | | |
| | | | | | 35,000 | | | | | |
| | | | | | 40,000 | | | | | |
| | | | | | 45,000 | | | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23 a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Normal power - no time limit.
6. Jet pipe temperature limit - 620°C.

**LEGEND**

| | |
|---|---|
| RATE OF CLIMB | -FEET PER MINUTE |
| DISTANCE | -NAUTICAL MILES |
| TIME | -MINUTES |
| FUEL | -POUNDS |
| CAS | -CALIBRATED AIRSPEED IN KNOTS |

**DATA AS OF:** March 1, 1955.

**BASED ON:** ESTIMATED DATA

5E1A-04-7

**FUEL GRADE:**

**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-5 (Sheet 2 of 2) Normal Power Climb Chart

# MILITARY POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 17300 POUNDS

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14700 POUNDS

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | | | | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 6900 | 0 | 0 | 400 (3) | 365 | SEA LEVEL | 360 | 400 (3) | 0 | 0 | 8200 |
| 6100 | 5 | 1.0 | 490 | 350 | 5,000 | 345 | 470 | .5 | 5 | 7300 |
| 5400 | 10 | 1.5 | 570 | 330 | 10,000 | 325 | 540 | 1.5 | 10 | 6500 |
| 4600 | 15 | 2.5 | 660 | 315 | 15,000 | 310 | 610 | 2.0 | 15 | 5700 |
| 4000 | 25 | 4.0 | 750 | 300 | 20,000 | 295 | 690 | 3.0 | 20 | 4900 |
| 3300 | 30 | 5.0 | 840 | 285 | 25,000 | 280 | 760 | 4.0 | 25 | 4100 |
| 2600 | 45 | 7.0 | 930 | 265 | 30,000 | 260 | 830 | 5.5 | 35 | 3300 |
| 1900 | 60 | 9.0 | 1030 | 245 | 35,000 | 245 | 910 | 7.0 | 45 | 2500 |
| 1000 | 80 | 12.0 | 1160 | 225 | 40,000 | 220 | 1000 | 9.5 | 60 | 1600 |
| | | | | | 45,000 | 200 | 1110 | 13.0 | 90 | 700 |

**CONFIGURATION:** TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 16100 POUNDS

**CONFIGURATION:** TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14500 POUNDS

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | | | | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 7900 | 0 | 0 | 400 (3) | 390 | SEA LEVEL | 390 | 400 (3) | 0 | 0 | 8900 |
| 7100 | 5 | .5 | 480 | 370 | 5,000 | 370 | 470 | .5 | 5 | 8000 |
| 6400 | 10 | 1.5 | 550 | 350 | 10,000 | 345 | 530 | 1.5 | 10 | 7200 |
| 5600 | 15 | 2.0 | 620 | 335 | 15,000 | 330 | 600 | 2.0 | 15 | 6300 |
| 4800 | 20 | 3.0 | 700 | 310 | 20,000 | 310 | 660 | 3.0 | 20 | 5500 |
| 4000 | 30 | 4.0 | 770 | 295 | 25,000 | 290 | 730 | 3.5 | 25 | 4700 |
| 3300 | 40 | 5.5 | 850 | 270 | 30,000 | 270 | 800 | 5.0 | 35 | 3800 |
| 2500 | 50 | 7.0 | 930 | 255 | 35,000 | 250 | 860 | 6.0 | 45 | 3000 |
| 1500 | 65 | 9.5 | 1020 | 230 | 40,000 | 225 | 940 | 8.0 | 55 | 1900 |
| 500 | 100 | 13.5 | 1160 | 205 | 45,000 | 205 | 1040 | 11.5 | 80 | 900 |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22a (MIL-F-5624A)fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Military power - 30 minute time limit.
6. Jet pipe temperature limit - 685°C.

**LEGEND**

RATE OF CLIMB -FEET PER MINUTE
DISTANCE -NAUTICAL MILES
TIME -MINUTES
FUEL -POUNDS
CAS -CALIBRATED AIRSPEED IN KNOTS

**DATA AS OF:** MAR. 1, 1955
**BASED ON:** ESTIMATED DATA

**FUEL GRADE:**
**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-6 (Sheet 1 of 2) Military Power Climb Chart

# MILITARY POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** CLEAN AIRCRAFT

**GROSS WEIGHT:** 14400 POUNDS

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | | | | | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 9800 | 0 | 0 | 400 (3) | 435 | SEA LEVEL | | | | | |
| 8900 | 5 | .5 | 460 | 415 | 5,000 | | | | | |
| 8000 | 10 | 1.0 | 520 | 390 | 10,000 | | | | | |
| 7100 | 15 | 2.0 | 580 | 370 | 15,000 | | | | | |
| 6300 | 20 | 2.5 | 640 | 345 | 20,000 | | | | | |
| 5400 | 25 | 3.5 | 700 | 325 | 25,000 | | | | | |
| 4500 | 35 | 4.5 | 760 | 300 | 30,000 | | | | | |
| 3600 | 40 | 5.5 | 820 | 280 | 35,000 | | | | | |
| 2500 | 55 | 7.0 | 890 | 255 | 40,000 | | | | | |
| 1500 | 70 | 9.5 | 970 | 230 | 45,000 | | | | | |
| 600 | 102 | 14.0 | 1080 | 205 | 50,000 | | | | | |

**CONFIGURATION:**

**GROSS WEIGHT:**

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | | | | | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| | | | | | SEA LEVEL | | | | | |
| | | | | | 5,000 | | | | | |
| | | | | | 10,000 | | | | | |
| | | | | | 15,000 | | | | | |
| | | | | | 20,000 | | | | | |
| | | | | | 25,000 | | | | | |
| | | | | | 30,000 | | | | | |
| | | | | | 35,000 | | | | | |
| | | | | | 40,000 | | | | | |
| | | | | | 45,000 | | | | | |
| | | | | | 50,000 | | | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22a (MIL-F-5624A) fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Military power - 30 minute time limit.
6. Jet pipe temperature limit - 685°C.

**LEGEND**

| | |
|---|---|
| RATE OF CLIMB | -FEET PER MINUTE |
| DISTANCE | -NAUTICAL MILES |
| TIME | -MINUTES |
| FUEL | -POUNDS |
| CAS | -CALIBRATED AIRSPEED IN KNOTS |

**DATA AS OF:** MAR. 1, 1955

**BASED ON:** ESTIMATED DATA

**FUEL GRADE:**

**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

5E1A-04-9

Figure 4-6 (Sheet 2 of 2) Military Power Climb Chart

# MAXIMUM POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 17300 POUNDS

**CONFIGURATION:** TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14700 POUNDS

| RATE OF CLIMB | APPROXIMATE FROM SEA LEVEL |  |  | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE FROM SEA LEVEL |  |  | RATE OF CLIMB |
|---|---|---|---|---|---|---|---|---|---|---|
|  | DISTANCE | TIME | FUEL |  |  |  | FUEL | TIME | DISTANCE |  |
| 8000 | 0 | 0 | 400 (3) | 375 | SEA LEVEL | 370 | 400 (3) | 0 | 0 | 9600 |
| 7100 | 5 | .5 | 490 | 360 | 5,000 | 355 | 470 | .5 | 5 | 8500 |
| 6300 | 10 | 1.5 | 570 | 340 | 10,000 | 335 | 540 | 1.0 | 5 | 7500 |
| 5400 | 15 | 2.5 | 650 | 325 | 15,000 | 320 | 610 | 2.0 | 10 | 6500 |
| 4500 | 20 | 3.5 | 730 | 310 | 20,000 | 305 | 680 | 2.5 | 15 | 5500 |
| 3700 | 30 | 4.5 | 820 | 290 | 25,000 | 290 | 750 | 3.5 | 25 | 4600 |
| 2900 | 40 | 6.0 | 910 | 270 | 30,000 | 265 | 820 | 5.0 | 30 | 3700 |
| 2100 | 55 | 8.0 | 1010 | 255 | 35,000 | 250 | 900 | 6.5 | 40 | 2800 |
| 1200 | 70 | 10.5 | 1130 | 230 | 40,000 | 230 | 990 | 8.5 | 55 | 1800 |
| 300 | 115 | 16.0 | 1260 | 210 | 45,000 | 205 | 1090 | 12.0 | 80 | 900 |

**CONFIGURATION:** TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 16100 POUNDS

**CONFIGURATION:** TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

**GROSS WEIGHT:** 14500 POUNDS

| RATE OF CLIMB | APPROXIMATE FROM SEA LEVEL |  |  | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE FROM SEA LEVEL |  |  | RATE OF CLIMB |
|---|---|---|---|---|---|---|---|---|---|---|
|  | DISTANCE | TIME | FUEL |  |  |  | FUEL | TIME | DISTANCE |  |
| 9500 | 0 | 0 | 400 (3) | 400 | SEA LEVEL | 400 | 400 (3) | 0 | 0 | 10600 |
| 8500 | 5 | .5 | 470 | 380 | 5,000 | 380 | 460 | .5 | 5 | 9500 |
| 7500 | 10 | 1.0 | 540 | 360 | 10,000 | 355 | 530 | 1.0 | 5 | 8500 |
| 6500 | 15 | 2.0 | 610 | 340 | 15,000 | 335 | 590 | 1.5 | 10 | 7400 |
| 5500 | 20 | 2.5 | 680 | 320 | 20,000 | 315 | 650 | 2.5 | 15 | 6300 |
| 4600 | 25 | 3.5 | 750 | 300 | 25,000 | 295 | 710 | 3.0 | 20 | 5200 |
| 3700 | 35 | 5.0 | 830 | 275 | 30,000 | 275 | 780 | 4.0 | 30 | 4200 |
| 2700 | 45 | 6.5 | 910 | 255 | 35,000 | 255 | 850 | 5.5 | 40 | 3300 |
| 1700 | 60 | 8.5 | 1000 | 230 | 40,000 | 230 | 920 | 7.5 | 50 | 2200 |
| 700 | 85 | 12.0 | 1130 | 210 | 45,000 | 205 | 1020 | 10.0 | 70 | 1200 |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23 a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Maximum power - 15 minutes time limit per flight, including take-off.
6. Jet pipe temperature limit - 720° C.

**LEGEND**

| | |
|---|---|
| RATE OF CLIMB | -FEET PER MINUTE |
| DISTANCE | -NAUTICAL MILES |
| TIME | -MINUTES |
| FUEL | -POUNDS |
| CAS | -CALIBRATED AIRSPEED IN KNOTS |

**DATA AS OF:** MAR. 1ST, 1955

**BASED ON:** ESTIMATED DATA

5E1A-04-17

**FUEL GRADE:**

**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-7 (Sheet 1 of 2) Maximum Power Climb Chart

# MAXIMUM POWER CLIMB CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** CLEAN AIRCRAFT

**GROSS WEIGHT:** 14400 POUNDS

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | | | | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 11800 | 0 | 0 | 400 (3) | 445 | SEA LEVEL | | | | | |
| 10700 | 5 | .5 | 460 | 420 | 5,000 | | | | | |
| 9500 | 5 | 1.0 | 520 | 400 | 10,000 | | | | | |
| 8300 | 10 | 1.5 | 580 | 375 | 15,000 | | | | | |
| 7200 | 15 | 2.0 | 630 | 355 | 20,000 | | | | | |
| 6000 | 20 | 3.0 | 690 | 330 | 25,000 | | | | | |
| 5000 | 30 | 4.0 | 750 | 305 | 30,000 | | | | | |
| 4000 | 35 | 5.0 | 810 | 285 | 35,000 | | | | | |
| 2800 | 50 | 6.0 | 880 | 255 | 40,000 | | | | | |
| 1700 | 65 | 8.5 | 960 | 235 | 45,000 | | | | | |
| 700 | 100 | 12.0 | 1060 | 210 | 50,000 | | | | | |

**CONFIGURATION:**

**GROSS WEIGHT:**

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF CLIMB | FROM SEA LEVEL | | | | | | FROM SEA LEVEL | | | RATE OF CLIMB |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| | | | | | SEA LEVEL | | | | | |
| | | | | | 5,000 | | | | | |
| | | | | | 10,000 | | | | | |
| | | | | | 15,000 | | | | | |
| | | | | | 20,000 | | | | | |
| | | | | | 25,000 | | | | | |
| | | | | | 30,000 | | | | | |
| | | | | | 35,000 | | | | | |
| | | | | | 40,000 | | | | | |
| | | | | | 45,000 | | | | | |
| | | | | | 50,000 | | | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22a (MIL-F-5624A) fuel.
3. Warm up and take-off allowance.
4. Multiply nautical units by 1.15 to obtain statute units.
5. Maximum power - 15 minutes time limit per flight, including take-off.
6. Jet pipe temperature limit - 720°C.

**LEGEND**

| | |
|---|---|
| RATE OF CLIMB | -FEET PER MINUTE |
| DISTANCE | -NAUTICAL MILES |
| TIME | -MINUTES |
| FUEL | -POUNDS |
| CAS | -CALIBRATED AIRSPEED IN KNOTS |

**DATA AS OF:** MAR. 1ST, 1955

**BASED ON:** ESTIMATED DATA

5E1A-04-11

**FUEL GRADE:**

**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-7 (Sheet 2 of 2) Maximum Power Climb Chart

# DESCENT CHART

## STANDARD DAY

MODEL: SABRE 6

ENGINE(S): (1) ORENDA 14

CONFIGURATION: WITH OR WITHOUT DROP TANKS
SPEED BRAKES OPEN

GROSS WEIGHT: 12600 LB.

CONFIGURATION:

GROSS WEIGHT:

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF DESCENT | TO SEA LEVEL | | | | | | TO SEA LEVEL | | | RATE OF DESCENT |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| 5100 | 29 | 4.0 | 50 | 190 | 50, 000 | | | | | |
| 6500 | 23 | 3.0 | 40 | 215 | 45, 000 | | | | | |
| 8300 | 17 | 2.5 | 35 | 245 | 40, 000 | | | | | |
| 10600 | 14 | 2.0 | 30 | 270 | 35, 000 | | | | | |
| 12700 | 10 | 1.5 | 25 | 290 | 30, 000 | | | | | |
| 14900 | 8 | 1.0 | 20 | 310 | 25, 000 | | | | | |
| 17300 | 6 | 1.0 | 15 | 330 | 20, 000 | | | | | |
| 19600 | 4 | 0.5 | 15 | 350 | 15, 000 | | | | | |
| 21900 | 2 | 0.5 | 10 | 365 | 10, 000 | | | | | |
| 23900 | 1 | 0.5 | 5 | 380 | 5, 000 | | | | | |
| 25600 | 0 | 0 | 0 | 395 | SEA LEVEL | | | | | |

CONFIGURATION:

GROSS WEIGHT:

CONFIGURATION:

GROSS WEIGHT:

| APPROXIMATE | | | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RATE OF DESCENT | TO SEA LEVEL | | | | | | TO SEA LEVEL | | | RATE OF DESCENT |
| | DISTANCE | TIME | FUEL | | | | FUEL | TIME | DISTANCE | |
| | | | | | 50, 000 | | | | | |
| | | | | | 45, 000 | | | | | |
| | | | | | 40, 000 | | | | | |
| | | | | | 35, 000 | | | | | |
| | | | | | 30, 000 | | | | | |
| | | | | | 25, 000 | | | | | |
| | | | | | 20, 000 | | | | | |
| | | | | | 15, 000 | | | | | |
| | | | | | 10, 000 | | | | | |
| | | | | | 5, 000 | | | | | |
| | | | | | SEA LEVEL | | | | | |

REMARKS:

1. Speed brakes open - throttle at idle stop.
2. For maximum range without power, descend at 185 knots CAS with speed brakes closed.

LEGEND

RATE OF DESCENT - FEET PER MINUTE
DISTANCE - NAUTICAL MILES
TIME - MINUTES
FUEL - POUNDS
C A S - CALIBRATED AIRSPEED

DATA AS OF: MAR. 1ST, 1955

BASED ON: ESTIMATED DATA

5E -04-

Figure 4-8 Descent Chart

(EAS) is calibrated airspeed corrected for compressibility error. True airspeed (TAS) is equivalent airspeed corrected for atmospheric density.

## TAKE-OFF DISTANCES

9 Ground-run distances and total distance to clear a 50-foot obstacle are tabulated in Figure 4-4. A dry, hard-surfaced runway, zero wind, 30-knot wind and varying temperatures are considered. The charted distances are estimated, assuming the use of normal take-off technique.

## CLIMB

10 From the Normal Power Climb, Military Power Climb and Maximum Power Climb Charts, see Figures 4-5, 4-6 and 4-7, can be determined the best climb speed, fuel consumed, time to climb, distance covered and rate of climb for Normal Rated, Military and Maximum Power. A fuel allowance for warm-up and take-off is listed at sea level. Fuel requirements at other altitudes include this allowance plus the fuel needed to climb from sea level. Fuel required for an in-flight climb from one altitude to another is the difference of the tabulated fuel required to climb to each altitude from sea level. Time and distance covered during an in-flight climb may be obtained in the same manner.

## DESCENT

11 The Descent Chart, see Figure 4-8, is based on the use of speed brakes to provide

### LANDING DISTANCES

(FEET)

**STANDARD DAY**

MODEL: SABRE 6

ENGINE(S): (1) ORENDA 14

DATA AS OF SEPT 26TH 1955

| GROSS WEIGHT (LB) | | BEST CAS FOR APPROACH (3) | | HARD SURFACE—NO WIND | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | POWER ON | POWER OFF | AT SEA LEVEL | | AT 2000 FT | | AT 4000 FT | | AT 6000 FT | |
| | | (KNOTS) | (KNOTS) | GROUND ROLL | TO CLEAR 50 FT OBST | GROUND ROLL | TO CLEAR 50 FT OBST | GROUND ROLL | TO CLEAR 50 FT OBST | GROUND ROLL | TO CLEAR 50 FT OBST |
| WITH OR WITHOUT EXTERNAL STORES | 12000 | 130 | 130 | 1850 | 2850 | 1950 | 3050 | 2100 | 3200 | 2250 | 3400 |
| | 14000 | 140 | 140 | 2100 | 3200 | 2250 | 3400 | 2450 | 3650 | 2600 | 3850 |
| | 16000 | 150 | 150 | 2400 | 3600 | 2550 | 3800 | 2750 | 4050 | 2950 | 4300 |
| | 18000 | 160 | 160 | 2700 | 3950 | 2900 | 4200 | 3100 | 4450 | 3300 | 4750 |

BASED ON ESTIMATED DATA

**LEGEND**

CAS – CALIBRATED AIRSPEED

OBST – OBSTACLE

### NOTES

1 Landing distances are aircraft requirements under normal service conditions.

2 Distances are for full flaps and speed brakes open. If speed brakes are closed, increase distance 10 percent.

3 Decrease speeds 20 knots at 50 foot obstacle.

Figure 4-9 Landing Distance Chart

# MAXIMUM ENDURANCE CHART

## STANDARD DAY

MODEL: SABRE 6

ENGINE(S): (1) ORENDA 14

CONFIGURATION: TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS
GROSS WEIGHT: 17300 POUNDS

CONFIGURATION: TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS
GROSS WEIGHT: 14700 POUNDS

| APPROXIMATE | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | |
|---|---|---|---|---|---|---|
| LB/HR | %RPM | | | | %RPM | LB/HR |
| 2150 | 71 | 200 | SEA LEVEL | 185 | 68 | 2000 |
| 1950 | 73 | 200 | 5,000 | 185 | 70 | 1800 |
| 1800 | 75 | 200 | 10,000 | 185 | 72 | 1600 |
| 1650 | 77 | 200 | 15,000 | 185 | 74 | 1400 |
| 1500 | 78 | 200 | 20,000 | 185 | 76 | 1300 |
| 1450 | 79 | 200 | 25,000 | 185 | 77 | 1250 |
| 1400 | 81 | 200 | 30,000 | 185 | 79 | 1200 |
| 1400 | 84 | 205 | 35,000 | 190 | 81 | 1200 |
| 1450 | 88 | 205 | 40,000 | 190 | 85 | 1200 |
| | | | 45,000 | 195 | 90 | 1300 |
| | | | 50,000 | | | |

CONFIGURATION: TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS
GROSS WEIGHT: 16100 POUNDS

CONFIGURATION: TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS
GROSS WEIGHT: 14500 POUNDS

| APPROXIMATE | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | |
|---|---|---|---|---|---|---|
| LB/HR | %RPM | | | | %RPM | LB/HR |
| 2050 | 69 | 195 | SEA LEVEL | 185 | 67 | 2000 |
| 1850 | 71 | 195 | 5,000 | 185 | 69 | 1750 |
| 1650 | 73 | 195 | 10,000 | 185 | 71 | 1500 |
| 1450 | 75 | 200 | 15,000 | 190 | 73 | 1350 |
| 1400 | 77 | 200 | 20,000 | 190 | 75 | 1250 |
| 1300 | 78 | 200 | 25,000 | 190 | 77 | 1200 |
| 1250 | 79 | 200 | 30,000 | 190 | 78 | 1150 |
| 1250 | 82 | 200 | 35,000 | 190 | 80 | 1150 |
| 1300 | 86 | 205 | 40,000 | 190 | 84 | 1150 |
| 1350 | 91 | 210 | 45,000 | 195 | 89 | 1200 |
| | | | 50,000 | | | |

REMARKS:

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23 a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.

LEGEND

CAS - CALIBRATED AIRSPEED IN KNOTS
LB/HR - FUEL CONSUMPTION

DATA AS OF: MAR. 1st, 1955.
BASED ON: ESTIMATED DATA

FUEL GRADE:
FUEL DENSITY: ANY FUEL LISTED IN REMARKS

Figure 4-10 (Sheet 1 of 2) Maximum Endurance Chart

# MAXIMUM ENDURANCE CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14.

**CONFIGURATION:** CLEAN AIRCRAFT

**GROSS WEIGHT:** 14400 POUNDS

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | |
|---|---|---|---|---|---|---|
| LB/HR | %RPM | | | | %RPM | LB/HR |
| 1950 | 66 | 195 | SEA LEVEL | | | |
| 1700 | 68 | 190 | 5,000 | | | |
| 1450 | 70 | 190 | 10,000 | | | |
| 1300 | 72 | 190 | 15,000 | | | |
| 1150 | 74 | 195 | 20,000 | | | |
| 1100 | 75 | 195 | 25,000 | | | |
| 1050 | 76 | 195 | 30,000 | | | |
| 1050 | 78 | 200 | 35,000 | | | |
| 1050 | 82 | 200 | 40,000 | | | |
| 1100 | 86 | 205 | 45,000 | | | |
| 1200 | 92 | 210 | 50,000 | | | |

**CONFIGURATION:**

**GROSS WEIGHT:**

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | APPROXIMATE | |
|---|---|---|---|---|---|---|
| LB/HR | %RPM | | | | %RPM | LB/HR |
| | | | SEA LEVEL | | | |
| | | | 5,000 | | | |
| | | | 10,000 | | | |
| | | | 15,000 | | | |
| | | | 20,000 | | | |
| | | | 25,000 | | | |
| | | | 30,000 | | | |
| | | | 35,000 | | | |
| | | | 40,000 | | | |
| | | | 45,000 | | | |
| | | | 50,000 | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23 a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.

**LEGEND**

CAS - CALIBRATED AIRSPEED IN KNOTS

LB/HR - FUEL CONSUMPTION

**DATA AS OF:** MAR. 1st, 1955.

**BASED ON:** ESTIMATED DATA

**FUEL GRADE:**

**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS.

Figure 4-10 (Sheet 2 of 2) Maximum Endurance Chart

# MAXIMUM RANGE SUMMARY CHART

## STANDARD DAY

MODEL: SABRE 6

ENGINE(S): (1) ORENDA 14

CONFIGURATION: TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

GROSS WEIGHT: 17300 POUNDS

CONFIGURATION: TWO 167 IMPERIAL (200 U.S.) GALLON DROP TANKS

GROSS WEIGHT: 14700 POUNDS

| APPROXIMATE | | MACH No. | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | MACH No. | APPROXIMATE | |
|---|---|---|---|---|---|---|---|---|
| %RPM | MI/LB | | | | | | MI/LB | %RPM |
| 80 | .115 | .49 | 320 | SEA LEVEL | 310 | .47 | .119 | 79 |
| 80 | .130 | .50 | 305 | 5,000 | 290 | .48 | .142 | 79 |
| 80 | .148 | .53 | 290 | 10,000 | 275 | .50 | .163 | 79 |
| 81 | .170 | .56 | 280 | 15,000 | 265 | .53 | .184 | 79 |
| 81 | .194 | .60 | 280 | 20,000 | 265 | .58 | .206 | 80 |
| 82 | .215 | .66 | 275 | 25,000 | 260 | .63 | .232 | 81 |
| 84 | .236 | .70 | 270 | 30,000 | 250 | .67 | .260 | 82 |
| 86 | .253 | .74 | 250 | 35,000 | 240 | .71 | .286 | 83 |
| 91 | .262 | .78 | 235 | 40,000 | 225 | .75 | .304 | 87 |
| | | | | 45,000 | 215 | .79 | .305 | 92 |
| | | | | 50,000 | | | | |

CONFIGURATION: TWO 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

GROSS WEIGHT: 16100 POUNDS

CONFIGURATION: 100 IMPERIAL (120 U.S.) GALLON DROP TANKS

GROSS WEIGHT: 14500 POUNDS

| APPROXIMATE | | MACH No. | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | MACH No. | APPROXIMATE | |
|---|---|---|---|---|---|---|---|---|
| %RPM | MI/LB | | | | | | MI/LB | %RPM |
| 80 | .125 | .51 | 335 | SEA LEVEL | 330 | .50 | .127 | 78 |
| 79 | .151 | .52 | 315 | 5,000 | 310 | .52 | .150 | 79 |
| 79 | .172 | .54 | 300 | 10,000 | 300 | .54 | .174 | 79 |
| 79 | .193 | .57 | 290 | 15,000 | 285 | .56 | .199 | 79 |
| 80 | .217 | .61 | 280 | 20,000 | 275 | .59 | .225 | 79 |
| 80 | .241 | .65 | 270 | 25,000 | 265 | .63 | .253 | 79 |
| 82 | .268 | .69 | 260 | 30,000 | 250 | .67 | .286 | 80 |
| 83 | .290 | .72 | 240 | 35,000 | 235 | .70 | .314 | 81 |
| 87 | .302 | .76 | 230 | 40,000 | 225 | .75 | .332 | 85 |
| 93 | .296 | .80 | 220 | 45,000 | 210 | .79 | .334 | 90 |
| | | | | 50,000 | | | | |

REMARKS:

LEGEND

C A S - CALIBRATED AIRSPEED
MI/LB - MILES(NAUTICAL) PER POUND OF FUEL CONSUMED

DATA AS OF: MAR. 1ST, 1955
BASED ON: ESTIMATED DATA

Figure 4-11 (Sheet 1 of 2) Maximum Range Summary Chart

# MAXIMUM RANGE SUMMARY CHART

## STANDARD DAY

MODEL: SABRE 6

ENGINE(S): (1) ORENDA 14

CONFIGURATION: CLEAN AIRCRAFT

GROSS WEIGHT: 14400 POUNDS

CONFIGURATION:

GROSS WEIGHT:

| APPROXIMATE | | MACH No | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | MACH No | APPROXIMATE | |
|---|---|---|---|---|---|---|---|---|
| %RPM | MI/LB | | | | | | MI/LB | %RPM |
| 78 | .138 | .52 | 345 | SEA LEVEL | | | | |
| 78 | .162 | .53 | 325 | 5,000 | | | | |
| 78 | .188 | .55 | 305 | 10,000 | | | | |
| 78 | .214 | .57 | 285 | 15,000 | | | | |
| 78 | .244 | .59 | 275 | 20,000 | | | | |
| 78 | .276 | .64 | 265 | 25,000 | | | | |
| 79 | .310 | .70 | 260 | 30,000 | | | | |
| 80 | .348 | .75 | 250 | 35,000 | | | | |
| 83 | .384 | .79 | 240 | 40,000 | | | | |
| 88 | .393 | .85 | 230 | 45,000 | | | | |
| 93 | .387 | .87 | 210 | 50,000 | | | | |

CONFIGURATION:

GROSS WEIGHT:

CONFIGURATION:

GROSS WEIGHT:

| APPROXIMATE | | MACH No | CAS (KNOTS) | PRESSURE ALTITUDE (FEET) | CAS (KNOTS) | MACH No | APPROXIMATE | |
|---|---|---|---|---|---|---|---|---|
| %RPM | MI/LB | | | | | | MI/LB | %RPM |
| | | | | SEA LEVEL | | | | |
| | | | | 5,000 | | | | |
| | | | | 10,000 | | | | |
| | | | | 15,000 | | | | |
| | | | | 20,000 | | | | |
| | | | | 25,000 | | | | |
| | | | | 30,000 | | | | |
| | | | | 35,000 | | | | |
| | | | | 40,000 | | | | |
| | | | | 45,000 | | | | |
| | | | | 50,000 | | | | |

REMARKS:

LEGEND

CAS - CALIBRATED AIRSPEED

MI/LB - MILES (NAUTICAL) PER POUND OF FUEL CONSUMED.

DATA AS OF: MAR. 1ST, 1955

BASED ON: ESTIMATED DATA

5E'

Figure 4-11 (Sheet 2 of 2) Maximum Range Summary Chart high rates of descent. For descent (clean aircraft or any external load configuration), the airspeed selected corresponds to approximately Mach 0.8 at 35,000 feet or above, reducing proportionately to Mach 0.6 at sea level. To minimize fuel consumption, the engine is operated at flight idling conditions.

## LANDING DISTANCES

12 Figure 4-9 shows landing distances, both ground-run and total to clear a 50-foot obstacle, for landings with speed brakes open. A percentage increase noted on the chart may be applied to estimate the additional distance required for landing with speed brakes closed. A dry, hard-surfaced runway and no wind are the only landing conditions considered.

## MAXIMUM ENDURANCE

13 Airspeeds, power settings and fuel flow rates for maximum-endurance flight are shown in Figure 4-10 for different configurations and altitudes. The Maximum Endurance Charts should not be confused with the Maximum Range Summary Charts, see Figure 4-11. The Maximum Endurance Charts indicate time, while the Maximum Range Summary Charts list power settings for maximum distance under zero wind conditions.

## COMBAT ALLOWANCE

14 The Combat Allowance Chart, see Figure 4-12, presents fuel flow at maximum thrust and at military thrust.

## MAXIMUM CONTINUOUS POWER

15 Airspeeds and fuel flow rates in level flight at Maximum Continuous Power (Normal Rated Power) are shown in the Maximum Continuous Power Charts, see Figure 4-13, for different gross weights and altitudes.

## FLIGHT OPERATION INSTRUCTION CHARTS

16 The Flight Operation Instruction Charts, see Figures 4-14, 4-15, 4-16, 4-17 and 4-18, are provided to facilitate flight planning. They show the range of the aircraft at maximum-range airspeeds and the procedure required to obtain this range. The charts contain columns for each 5000 foot increase in altitude up to the maximum altitude at which 93% rpm operation is possible. On the line opposite available fuel in the upper half of the chart, ranges are shown for each initial altitude, In general two range values are quoted for each altitude and fuel quantity. One is for continued flight at the initial altitude, the other is for the maximum range obtainable by climbing to a higher altitude. The charted ranges do not include fuel consumed and distance covered during warm-up, take-off and initial climb at the start of a flight. Fuel used and distance covered during letdown or during in-flight climb to an optimum altitude are taken into account. No allowances are made for navigational errors, combat, formation flight, landing or other contingencies. Such allowances must be made as required.

17 The lower half of each chart presents operating procedure to obtain the ranges quoted in the upper half. When altitude is changed, operating instructions in the column according to the new altitude must be used if the ranges listed are to be obtained.

18 Under different wind conditions, ranges in ground miles are varied by the effect of wind

**COMBAT ALLOWANCE CHART**

**STANDARD DAY**

MODEL: SABRE 6 ENGINE(S): (1) ORENDA 14

| PRESSURE ALTITUDE (FEET) | FUEL REQUIRED (LB PER MINUTE) | |
|---|---|---|
| | MAXIMUM POWER 100 % RPM (15 MIN LIMIT) | MILITARY POWER 97.5 % RPM (30 MIN LIMIT) |
| SEA LEVEL | 165 | 145 |
| 5,000 | 145 | 130 |
| 10,000 | 125 | 110 |
| 15,000 | 110 | 95 |
| 20,000 | 95 | 85 |
| 25,000 | 80 | 70 |
| 30,000 | 70 | 60 |
| 35,000 | 55 | 50 |
| 40,000 | 45 | 40 |
| 45,000 | 35 | 30 |
| 50,000 | 25 | 25 |

REMARKS:

1. DIVIDE PM BY 8.15 TO OBTAIN GPM OF 3-GP-23A (JP-1) FUEL
2. DIVIDE PM BY 7.8 TO OBTAIN GPM OF 3-GP-22A (JP-4) FUEL
3. MAXIMUM POWER JET PIPE TEMPERATURE LIMIT 720°C.
4. MILITARY POWER JET PIPE TEMPERATURE LIMIT 685°C.
5. MAXIMUM POWER - 15 MINUTE TIME LIMIT PER FLIGHT, INCLUDING TAKE-OFF

DATA AS OF MAR 1ST 1955
BASED ON ESTIMATED DATA

Figure 4-12 Combat Allowance Chart

on the ground speed. Letdown distances are affected for the same reason. Recommended CAS also may change in order to maintain the most favourable ground miles per pound of fuel. To facilitate range computations under wind conditions, the operating procedure in the lower half of each chart contains instructions for various winds at each altitude listed. Ground miles in a wind are obtained by multiplying chart air miles by the range factor found opposite the effective wind at the cruising altitude. Thus range factors may be used to determine the best altitude for cruising when there is a known wind difference at different altitudes.

19 Although a wind may be from any direction with respect to the aircraft course, it may be expressed as an effective wind. An effective wind has the same effect on aircraft ground speed as does a straight head wind or tail wind. In other words, the wind component in the direction of the aircraft heading is the effective wind. For example, a 100-knot wind at 30 degrees to the course is an effective head wind of approximately 85 knots. If the true airspeed is 485 knots, the true ground speed is approximately 400 knots.

20 The approximate rpm values quoted on any one chart are based on the gross weight equal to the high limit of the chart weight band. If the recommended CAS values are maintained, the rpm values will decrease slightly as the gross weight decreases.

## PREFLIGHT RANGE PLANNING

21 Select the applicable Flight Operation Instruction Chart. Determine the amount of fuel available for flight planning. Available fuel is equal to the total amount in the aircraft before the engine is started, minus the amount needed for warm-up, taxi, take-off, initial climb and necessary reserves. Select a figure in the fuel column equal to, or less than, the amount available for flight planning. Interpolate if necessary.

22 To determine maximum range at a given altitude, move horizontally right or left to the desired altitude column. Multiply the range value thus obtained by the correct range factor and add the distance covered in initial climb to obtain total range with a given wind at altitude. Fly according to the instructions in the lower half of the chart.

23 To fly a given distance, determine range factors for the effective winds and altitudes considered. From the desired distance subtract the miles covered in climb. Divide the resultant figure by the range factor to obtain miles to be covered in cruise and descent. Enter the chart and move horizontally right or left to a range figure which exceeds the calculated air distance to be covered in cruise and descent. Fly according to the instructions for the altitude so obtained.

24 If altitude, wind or external load does not remain reasonably constant, break the flight up into several sections and plan each section separately.

## RANGE PLANNING IN FLIGHT

25 To use the charts in flight, determine altitude, available fuel and effective wind. Available fuel is equal to fuel on board minus necessary reserves. Enter the appropriate Flight Operation Instruction Chart at a fuel quantity equal to, or less than, the available fuel. Move horizontally right or left to the applicable column. From the ranges and wind factors listed, determine the altitude at which the flight will be continued. For continued cruising at the present altitude, refer to the instructions directly below in the lower half of the chart. When changing charts, refer to cruising instructions on the new chart at the altitude of flight.

26 To obtain the range shown at optimum altitude when flying at a given altitude, climb immediately according to the recommended climb procedure. For cruising instructions at the new altitude, refer to the lower half of the chart in the column under the new altitude. When changing charts, refer to cruising instructions on the new chart at the altitude of flight.

NOTE

For absolute maximum range, climb (using Military Power) until maximum rate of climb is 800 feet per minute. Level off and hold at Mach 0.83 for clean aircraft or Mach 0.76 for aircraft with external tanks and 90% rpm constant, allowing aircraft to seek own altitude.

# MAXIMUM CONTINUOUS POWER CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** TWO 167 IMPERIAL GALLON DROP TANKS
**GROSS WEIGHT:** 17300 POUNDS

**CONFIGURATION:** TWO 167 IMPERIAL GALLON DROP TANKS
**GROSS WEIGHT:** 14700 POUNDS

| APPROXIMATE | | | %RPM | PRESSURE ALTITUDE (FEET) | %RPM | APPROXIMATE | | |
|---|---|---|---|---|---|---|---|---|
| LB/HR | TAS (KNOTS) | CAS (KNOTS) | | | | CAS (KNOTS) | TAS (KNOTS) | LB/HR |
| 6450 | 505 | 505 | 93 | SEA LEVEL | 93 | 510 | 510 | 6450 |
| 5800 | 515 | 485 | 93 | 5,000 | 93 | 485 | 515 | 5800 |
| 5150 | 520 | 455 | 93 | 10,000 | 93 | 460 | 520 | 5150 |
| 4450 | 520 | 430 | 93 | 15,000 | 93 | 430 | 525 | 4450 |
| 3900 | 520 | 395 | 93 | 20,000 | 93 | 400 | 520 | 3900 |
| 3350 | 515 | 365 | 93 | 25,000 | 93 | 365 | 520 | 3350 |
| 2900 | 510 | 330 | 93 | 30,000 | 93 | 335 | 515 | 2900 |
| 2450 | 500 | 300 | 93 | 35,000 | 93 | 300 | 505 | 2450 |
| | | | | 40,000 | 93 | 265 | 495 | 1950 |
| | | | | 45,000 | | | | |
| | | | | 50,000 | | | | |

**CONFIGURATION:** TWO 100 IMPERIAL GALLON DROP TANKS
**GROSS WEIGHT:** 16100 POUNDS

**CONFIGURATION:** TWO 100 IMPERIAL GALLON DROP TANKS
**GROSS WEIGHT:** 14500 POUNDS

| APPROXIMATE | | | %RPM | PRESSURE ALTITUDE (FEET) | %RPM | APPROXIMATE | | |
|---|---|---|---|---|---|---|---|---|
| LB/HR | TAS (KNOTS) | CAS (KNOTS) | | | | CAS (KNOTS) | TAS (KNOTS) | LB/HR |
| 6500 | 525 | 520 | 93 | SEA LEVEL | 93 | 525 | 525 | 6550 |
| 5850 | 530 | 495 | 93 | 5,000 | 93 | 495 | 530 | 5850 |
| 5200 | 530 | 465 | 93 | 10,000 | 93 | 465 | 530 | 5200 |
| 4500 | 530 | 435 | 93 | 15,000 | 93 | 440 | 530 | 4500 |
| 3950 | 525 | 405 | 93 | 20,000 | 93 | 405 | 530 | 3950 |
| 3350 | 525 | 370 | 93 | 25,000 | 93 | 375 | 525 | 3350 |
| 2900 | 515 | 340 | 93 | 30,000 | 93 | 340 | 520 | 2900 |
| 2450 | 510 | 305 | 93 | 35,000 | 93 | 305 | 510 | 2450 |
| 1950 | 500 | 265 | 93 | 40,000 | 93 | 270 | 500 | 1950 |
| | | | | 45,000 | | | | |
| | | | | 50,000 | | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22 a (MIL-F-5624A) fuel.
3. Normal power (93% RPM) - no time limit.
4. Jet pipe temperature limit - 620° C.

**LEGEND**

**DATA AS OF:** MAR. 1ST, 1955
**BASED ON:** ESTIMATED DATA

**FUEL GRADE:**
**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-13 (Sheet 1 of 2) Maximum Continuous Power Chart

# MAXIMUM CONTINUOUS POWER CHART

## STANDARD DAY

**MODEL:** SABRE 6

**ENGINE(S):** (1) ORENDA 14

**CONFIGURATION:** CLEAN AIRCRAFT

**GROSS WEIGHT:** 14400 POUNDS

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | %RPM | PRESSURE ALTITUDE (FEET) | %RPM | APPROXIMATE | | |
|---|---|---|---|---|---|---|---|---|
| LB/HR | TAS (KNOTS) | CAS (KNOTS) | | | | CAS (KNOTS) | TAS (KNOTS) | LB/HR |
| 6800 | 575 | 575 | 93 | SEA LEVEL | | | | |
| 6050 | 575 | 540 | 93 | 5,000 | | | | |
| 5400 | 570 | 505 | 93 | 10,000 | | | | |
| 4650 | 565 | 470 | 93 | 15,000 | | | | |
| 4050 | 560 | 430 | 93 | 20,000 | | | | |
| 3450 | 550 | 395 | 93 | 25,000 | | | | |
| 3000 | 540 | 355 | 93 | 30,000 | | | | |
| 2500 | 530 | 320 | 93 | 35,000 | | | | |
| 2000 | 525 | 280 | 93 | 40,000 | | | | |
| 1550 | 520 | 250 | 93 | 45,000 | | | | |
| | | | | 50,000 | | | | |

**CONFIGURATION:**

**GROSS WEIGHT:**

**CONFIGURATION:**

**GROSS WEIGHT:**

| APPROXIMATE | | | %RPM | PRESSURE ALTITUDE (FEET) | %RPM | APPROXIMATE | | |
|---|---|---|---|---|---|---|---|---|
| LB/HR | TAS (KNOTS) | CAS (KNOTS) | | | | CAS (KNOTS) | TAS (KNOTS) | LB/HR |
| | | | | SEA LEVEL | | | | |
| | | | | 5,000 | | | | |
| | | | | 10,000 | | | | |
| | | | | 15,000 | | | | |
| | | | | 20,000 | | | | |
| | | | | 25,000 | | | | |
| | | | | 30,000 | | | | |
| | | | | 35,000 | | | | |
| | | | | 40,000 | | | | |
| | | | | 45,000 | | | | |
| | | | | 50,000 | | | | |

**REMARKS:**

1. Divide pounds by 8.15 to obtain gallons of 3-GP-23a (MIL-F-5616) fuel.
2. Divide pounds by 7.8 to obtain gallons of 3-GP-22a (MIL-F-5624A) fuel.
3. Normal power (93% RPM) - no time limit.
4. Jet pipe temperature limit 620°C.

**LEGEND**

LB/HR - FUEL CONSUMPTION
TAS - TRUE AIRSPEED IN KNOTS
CAS - CALIBRATED AIRSPEED IN KNOTS

**DATA AS OF:** MAR. 1ST, 1955
**BASED ON:** ESTIMATED DATA

**FUEL GRADE:**
**FUEL DENSITY:** ANY FUEL LISTED IN REMARKS

Figure 4-13 (Sheet 2 of 2) Maximum Continuous Power Chart

**MODEL** SABRE 6

**ENGINE(S):** ORENDA 14

# FLIGHT OPERATION INSTRUCTION CHART

**CHART WEIGHT LIMITS** 14,400 OR LESS **POUNDS**

**EXTERNAL LOAD ITEM**

CLEAN AIRCRAFT

| LIMITS | TIME LIMIT (MIN.) | % RPM | JET PIPE TEMP (C) | OIL PRESS. (PSI) |
|---|---|---|---|---|
| MAXIMUM | 15 | 100 | 720 | 15-25 |
| MILITARY | 30 | 97.5 | 685 | 15-25 |
| NORMAL | NONE | 93 | 620 | 15-25 |

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reverse, combat, navigational errors, formation flights, etc). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instruction in appropriate cruising altitude section.

(B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distance to range values. DATA BELOW CONTAINS NO FUEL RESERVE FOR LANDING.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (because of external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb-distance and fuel are included where climbs are indicated.

**DATA AS OF:** MARCH 1ST, 1955

**BASED ON:** ESTIMATED DATA

## LOW-ALTITUDE CHART

| IF YOU ARE AT SEA LEVEL | | | FUEL (POUNDS) | IF YOU ARE AT 5,000 FT | | | IF YOU ARE AT 10,000 FT | | | IF YOU ARE AT 15,000 FT | | | FUEL (POUNDS) | IF YOU ARE AT 20,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT SL | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 5000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 10,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 15,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 20,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | (RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL) | | | | | | | | | | | | |
| 410 | 45 | 1040 | 3000 | 490 | 45 | 1060 | 560 | 45 | 1080 | 640 | 45 | 1100 | 3000 | 730 | 45 | 1120 |
| 340 | 45 | 840 | 2500 | 400 | 45 | 860 | 470 | 45 | 880 | 530 | 45 | 900 | 2500 | 610 | 45 | 920 |
| 270 | 45 | 650 | 2000 | 320 | 45 | 660 | 380 | 45 | 690 | 430 | 45 | 700 | 2000 | 490 | 45 | 720 |
| 200 | 40 | 450 | 1500 | 240 | 45 | 470 | 290 | 40 | 490 | 330 | 40 | 500 | 1500 | 370 | 45 | 520 |
| 140 | 40 | 250 | 1000 | 160 | 40 | 270 | 190 | 40 | 290 | 220 | 40 | 310 | 1000 | 250 | 40 | 330 |
| 80 | 15 | 80 | 500 | 90 | 25 | 100 | 100 | 30 | 110 | 120 | 35 | 120 | 500 | 130 | 35 | 140 |

| CRUISING AT SEA LEVEL | | | | | | EFFECTIVE WIND | CRUISING AT 5,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120 HW | | | | | | |
| | | | | | | 80 HW | | | | | | |
| 355 | 79 | 2600 | 315 | .90 | 0 | 40 HW | 330 | 79 | 2150 | 315 | .90 | 1 |
| 345 | 78 | 2500 | 345 | 1.00 | 0 | 0 | 325 | 78 | 2100 | 345 | 1.00 | 1 |
| 335 | 77 | 2400 | 375 | 1.10 | 0 | 40 TW | 315 | 77 | 2000 | 375 | 1.10 | 1 |
| | | | | | | 80 TW | | | | | | |
| | | | | | | 120TW | | | | | | |

| EFFECTIVE WIND | CRUISING AT 10,000 FT | | | | | | CRUISING AT 15,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | APPROXIMATE | | | | | | APPROXIMATE | | | | |
| (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 120 HW | | | | | | | | | | | | |
| 80 HW | | | | | | | 305 | 79 | 1800 | 295 | .75 | 3 |
| 40 HW | 310 | 78 | 1900 | 320 | .90 | 2 | 295 | 78 | 1700 | 325 | .90 | 4 |
| 0 | 300 | 78 | 1850 | 350 | 1.00 | 2 | 285 | 78 | 1650 | 355 | 1.00 | 4 |
| 40 TW | 295 | 77 | 1800 | 380 | 1.10 | 2 | 280 | 77 | 1600 | 385 | 1.10 | 4 |
| 80 TW | | | | | | | 270 | 77 | 1550 | 415 | 1.25 | 5 |
| 120TW | | | | | | | | | | | | |

| EFFECTIVE WIND | CRUISING AT 20,000 FT | | | | | |
|---|---|---|---|---|---|---|
| | | APPROXIMATE | | | | |
| (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 120 HW | 310 | 80 | 1800 | 295 | .65 | 4 |
| 80 HW | 295 | 79 | 1650 | 310 | .80 | 5 |
| 40 HW | 285 | 78 | 1550 | 335 | .90 | 5 |
| 0 | 275 | 78 | 1500 | 365 | 1.00 | 6 |
| 40 TW | 265 | 77 | 1450 | 395 | 1.10 | 7 |
| 80 TW | 260 | 77 | 1400 | 425 | 1.25 | 8 |
| 120.TW | 250 | 77 | 1400 | 460 | 1.35 | 8 |

Figure 4-14 (Sheet 1 of 2) Flight Operation Instruction Chart - 14,000 Pounds or Less

## HIGH ALTITUDE CHART

MODEL: SABRE 6 ENGINE(S): ORENDA 14 CHART WEIGHT LIMITS 14,400 LBS. OR LESS EXT LOAD CLEAN AIRCRAFT

| IF YOU ARE AT 25,000 FT | | | FUEL | IF YOU ARE AT 30,000 FT | | | IF YOU ARE AT 35,000 FT | | | IF YOU ARE AT 40,000 FT | | | FUEL | IF YOU ARE AT 45,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | (POUNDS) | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | (POUNDS) | RANGE IN AIR MILES | | |
| BY CRUISING AT 25,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 30,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 35,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 40,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 45,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | ( RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL ) | | | | | | | | | | | | |
| 830 | 45 | 1130 | 3000 | 930 | 45 | 1150 | 1040 | 45 | 1160 | 1160 | 45 | 1180 | 3000 | 1190 | | |
| 690 | 45 | 930 | 2500 | 770 | 45 | 950 | 870 | 45 | 960 | 960 | 45 | 980 | 2500 | 990 | | |
| 550 | 45 | 730 | 2000 | 620 | 45 | 750 | 700 | 45 | 760 | 770 | 45 | 780 | 2000 | 790 | | |
| 410 | 45 | 540 | 1500 | 470 | 45 | 560 | 520 | 45 | 570 | 580 | 45 | 580 | 1500 | 600 | | |
| 280 | 40 | 350 | 1000 | 310 | 40 | 360 | 350 | 40 | 370 | 390 | 45 | 390 | 1000 | 400 | | |
| 140 | 40 | 150 | 500 | 160 | 40 | 170 | 180 | 40 | 180 | 200 | 45 | 200 | 500 | 200 | | |

| CRUISING AT 25,000 FT | | | | | | EFFEC-TIVE WIND | CRUISING AT 30,000 FT | | | | | | CRUISING AT 35,000 FT | | | | | | CRUISING AT 40,000 FT | | | | | | EFFEC-TIVE WIND | CRUISING AT 45,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 305 | 81 | 1700 | 320 | 70 | 6 | 120HW | 295 | 81 | 1500 | 330 | .70 | 8 | 270 | 81 | 1350 | 340 | .70 | 10 | 245 | 84 | 1250 | 345 | .75 | 14 | 120HW | 235 | 89 | 1300 | 380 | .75 | 17 |
| 290 | 80 | 1550 | 340 | .80 | 6 | 80 HW | 280 | 80 | 1450 | 355 | .80 | 9 | 265 | 81 | 1300 | 370 | .80 | 11 | 240 | 83 | 1200 | 380 | .80 | 14 | 80 HW | 235 | 88 | 1250 | 415 | .85 | 20 |
| 275 | 79 | 1450 | 360 | .90 | 7 | 40 HW | 270 | 80 | 1350 | 390 | .90 | 10 | 255 | 80 | 1250 | 400 | .90 | 13 | 240 | 83 | 1200 | 415 | .90 | 16 | 40 HW | 235 | 88 | 1250 | 450 | 90 | 21 |
| 265 | 78 | 1400 | 385 | 1.00 | 8 | 0 | 260 | 79 | 1300 | 410 | 1.00 | 11 | 250 | 80 | 1250 | 430 | 1.00 | 14 | 240 | 83 | 1200 | 450 | 1.00 | 18 | 0 | 230 | 88 | 1250 | 485 | 1.00 | 23 |
| 255 | 78 | 1350 | 415 | 1.10 | 9 | 40 TW | 255 | 79 | 1250 | 440 | 1.10 | 12 | 250 | 80 | 1200 | 465 | 1.10 | 15 | 235 | 83 | 1150 | 490 | 1.10 | 20 | 40 TW | 230 | 88 | 1250 | 525 | 1.10 | 25 |
| 250 | 77 | 1300 | 445 | 1.25 | 10 | 80 TW | 250 | 79 | 1250 | 470 | 1.20 | 13 | 245 | 80 | 1200 | 500 | 1.20 | 17 | 235 | 83 | 1150 | 525 | 1.20 | 22 | 80 TW | 230 | 88 | 1200 | 560 | 1.15 | 26 |
| 245 | 77 | 1300 | 480 | 1.35 | 11 | 120TW | 245 | 78 | 1250 | 510 | 1.35 | 15 | 245 | 79 | 1200 | 535 | 1.30 | 18 | 235 | 83 | 1150 | 565 | 1.30 | 23 | 120TW | 225 | 88 | 1200 | 600 | 1.25 | 29 |

**REMARKS:**

1. Climb at 97.5% r.p.m.
2. All distances and speeds are nautical units.
3. Multiply all nautical units by 1.15 to obtain statute units.
4. Divide lb./hr. by 8.15 to obtain gals./hr. of 3GP23a (JP-1) fuel. Divide lb./hr. by 7.8 to obtain gals./hr. of 3GP22a (JP-4) fuel.
5. Multiply gallons by factor in Note 4 to obtain pounds.
6. Maximum fuel available is: JP-1 = 2912 lb., JP-4 = 2787 lb.
7. Maximum Power - 15 minute time limit per flight including take-off.

**EXAMPLE:**

If you are flying at 10,000 feet with 2500 pounds of available fuel, you can fly 470 nautical air miles by holding 300 knots CAS. However, you can fly 880 nautical air miles by immediately climbing to 45,000 feet using 97.5% r.p.m. At 45,000 feet, cruise at 230 knots CAS and start letdown 23 nautical miles from home. With an 80 knot head wind, the range at 45,000 feet would be.85 x 880, or 750 nautical miles. Cruise at 235 knots CAS with this wind and start letdown 20 nautical miles from destination.

**LEGEND**

EFFECTIVE WIND - HW HEAD WIND TW TAIL WIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIR MILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED IN KNOTS
CAS - CALIBRATED AIRSPEED IN KNOTS
LB/HR - FUEL CONSUMPTION - POUNDS PER HOUR
RANGE - NAUTICAL MILES
KN - KNOTS
OPT. ALT. - OPTIMUM ALTITUDE
DISTANCE - NAUTICAL MILES

DATA AS OF: MAR. 1ST, 1955.

BASED ON: ESTIMATED DATA

Figure 4-14 (Sheet 2 of 2) Flight Operation Instruction Chart - 14,000 Pounds or Less

**MODEL** SABRE 6

**ENGINE(S):** ORENDA 14

# FLIGHT OPERATION INSTRUCTION CHART

**CHART WEIGHT LIMITS** 16, 100 TO 14, 500 **POUNDS**

**EXTERNAL LOAD ITEM**

TWO 100 IMPERIAL
GALLON DROP TANKS

| LIMITS | TIME LIMIT (MIN.) | % RPM | JET PIPE TEMP (C) | OIL PRESS. (PSI) |
|---|---|---|---|---|
| MAXIMUM | 15 | 100 | 720 | 15-25 |
| MILITARY | 30 | 97.5 | 685 | 15-25 |
| NORMAL | NONE | 93 | 620 | 15-25 |

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reverse, combat, navigational errors, formation flights, etc). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instruction in appropriate cruising altitude section.

(B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distance to range values. DATA BELOW CONTAINS NO FUEL RESERVE FOR LANDING.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (because of external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

**DATA AS OF:** MARCH 1ST, 1955
**BASED ON:** ESTIMATED DATA

## LOW-ALTITUDE CHART

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

| IF YOU ARE AT SEA LEVEL | | | FUEL (POUNDS) | IF YOU ARE AT 5,000 FT | | | IF YOU ARE AT 10,000 FT | | | IF YOU ARE AT 15,000 FT | | | FUEL (POUNDS) | IF YOU ARE AT 20,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT SL | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 5000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 10, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 15, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 20, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| 560 | 40 | 1320 | 4500 | 680 | 40 | 1340 | 780 | 40 | 1360 | 890 | 40 | 1370 | 4500 | 1000 | 40 | 1390 |
| 500 | 40 | 1170 | 4000 | 610 | 40 | 1190 | 700 | 40 | 1200 | 790 | 40 | 1220 | 4000 | 890 | 40 | 1240 |
| 440 | 40 | 1020 | 3500 | 530 | 40 | 1040 | 610 | 40 | 1050 | 690 | 40 | 1070 | 3500 | 780 | 40 | 1090 |
| 380 | 40 | 860 | 3000 | 450 | 40 | 880 | 520 | 40 | 900 | 600 | 40 | 920 | 3000 | 680 | 40 | 940 |
| 320 | 40 | 710 | 2500 | 380 | 40 | 730 | 440 | 40 | 750 | 500 | 40 | 770 | 2500 | 560 | 40 | 780 |

| CRUISING AT SEA LEVEL | | | | | | EFFECTIVE WIND | CRUISING AT 5,000 FT | | | | | | CRUISING AT 10,000 FT | | | | | | CRUISING AT 15,000 FT | | | | | | EFFECTIVE WIND | CRUISING AT 20,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120 HW | | | | | | | | | | | | | 310 | 80 | 2050 | 260 | .65 | 3 | 120 HW | 300 | 81 | 1900 | 280 | .70 | 4 |
| | | | | | | 80 HW | | | | | | | | | | | | | 300 | 80 | 1950 | 295 | .75 | 3 | 80 HW | 295 | 80 | 1800 | 310 | .80 | 5 |
| 350 | 80 | 2850 | 310 | .90 | 0 | 40 HW | 325 | 80 | 2400 | 310 | .90 | 1 | 305 | 80 | 2100 | 315 | .90 | 2 | 295 | 80 | 1900 | 325 | .90 | 4 | 40 HW | 285 | 80 | 1750 | 340 | .90 | 5 |
| 335 | 80 | 2700 | 335 | 1.00 | 0 | 0 | 315 | 79 | 2300 | 340 | 1.00 | 1 | 300 | 79 | 2050 | 345 | 1.00 | 2 | 290 | 79 | 1850 | 355 | 1.00 | 4 | 0 | 280 | 80 | 1700 | 370 | 1.00 | 6 |
| 320 | 78 | 2600 | 360 | 1.15 | 0 | 40 TW | 305 | 79 | 2250 | 370 | 1.15 | 1 | 295 | 79 | 2000 | 380 | 1.15 | 2 | 285 | 79 | 1800 | 390 | 1.10 | 4 | 40 TW | 275 | 79 | 1700 | 405 | 1.10 | 7 |
| | | | | | | 80 TW | | | | | | | | | | | | | 280 | 79 | 1750 | 425 | 1.25 | 5 | 80 TW | 270 | 79 | 1650 | 440 | 1.25 | 8 |
| | | | | | | 120 TW | | | | | | | | | | | | | 275 | 79 | 1750 | 460 | 1.35 | 5 | 120 TW | 270 | 79 | 1650 | 480 | 1.35 | 8 |

Figure 4-15 (Sheet 1 of 2) Flight Operation Instruction Chart - Two 100 Imperial Gallon Tanks - 16,100 Pounds to 14,500 Pounds

# HIGH ALTITUDE CHART

**MODEL:** SABRE 6 **ENGINE(S):** ORENDA 14 **CHART WEIGHT LIMITS** 16,100 TO 14,500 LBS. **EXT LOAD** TWO 100 IMPERIAL GALLON DROP TANKS

| IF YOU ARE AT 25,000FT | | | FUEL (POUNDS) | IF YOU ARE AT 30,000FT | | | IF YOU ARE AT 35,000FT | | | IF YOU ARE AT 40,000FT | | | FUEL (POUNDS) | IF YOU ARE AT 45,000FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT 25,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 30,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 35,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 40,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 45,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | (RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL) | | | | | | | | | | | | |
| 1120 | 40 | 1400 | 4500 | 1250 | 40 | 1420 | 1370 | 40 | 1430 | 1440 | | | 4500 | | | |
| 990 | 40 | 1250 | 4000 | 1120 | 40 | 1270 | 1220 | 40 | 1280 | 1290 | | | 4000 | | | |
| 870 | 40 | 1100 | 3500 | 990 | 40 | 1120 | 1080 | 40 | 1130 | 1140 | | | 3500 | | | |
| 750 | 40 | 950 | 3000 | 860 | 40 | 960 | 930 | 40 | 980 | 990 | | | 3000 | | | |
| 630 | 40 | 800 | 2500 | 730 | 40 | 810 | 790 | 40 | 820 | 840 | | | 2500 | | | |

| CRUISING AT 25,000FT | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 30,000FT | | | | | | CRUISING AT 35,000FT | | | | | | CRUISING AT 40,000FT | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 45,000FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 290 | 82 | 1800 | **295** | .70 | 6 | 120 HW | 275 | 83 | 1650 | **310** | .70 | 7 | 255 | 84 | 1550 | **315** | .70 | 10 | 235 | 88 | 1500 | **330** | .70 | 13 | 120 HW | | | | | | |
| 285 | 81 | 1700 | **325** | .80 | 6 | 80 HW | 270 | 82 | 1600 | **340** | .80 | 8 | 250 | 84 | 1500 | **350** | .80 | 11 | 235 | 88 | 1500 | **365** | .80 | 14 | 80 HW | | | | | | |
| 275 | 81 | 1650 | **355** | .90 | 7 | 40 HW | 265 | 82 | 1550 | **370** | .90 | 9 | 245 | 83 | 1450 | **380** | .90 | 13 | 230 | 87 | 1450 | **405** | .90 | 16 | 40 HW | | | | | | |
| 270 | 80 | 1600 | **390** | 1.00 | 8 | 0 | 260 | 82 | 1500 | **405** | 1.00 | 10 | 240 | 83 | 1450 | **415** | 1.00 | 14 | 230 | 87 | 1450 | **440** | 1.00 | 18 | 0 | | | | | | |
| 265 | 80 | 1600 | **425** | 1.10 | 9 | 40 TW | 255 | 81 | 1500 | **440** | 1.10 | 11 | 240 | 83 | 1400 | **450** | 1.10 | 15 | 230 | 87 | 1450 | **475** | 1.10 | 20 | 40 TW | | | | | | |
| 265 | 80 | 1550 | **460** | 1.20 | 10 | 80 TW | 250 | 81 | 1450 | **475** | 1.20 | 12 | 235 | 82 | 1400 | **485** | 1.20 | 17 | 225 | 87 | 1400 | **515** | 1.20 | 22 | 80 TW | | | | | | |
| 260 | 80 | 1550 | **495** | 1.35 | 11 | 120 TW | 250 | 81 | 1450 | **510** | 1.30 | 13 | 235 | 82 | 1400 | **525** | 1.30 | 18 | 225 | 87 | 1400 | **550** | 1.30 | 23 | 120 TW | | | | | | |

**REMARKS:**

1. Climb at 97.5% rpm.
2. All distances and speeds are nautical units.
3. Multiply all nautical units by 1.15 to obtain statute units.
4. Divide lb /hr by 8.15 to obtain gals /hr of 3GP23a (JP-1) fuel.
   Divide lb /hr by 7.8 to obtain gals /hr of 3GP22a (JP-4) fuel.
5. Multiply gallons by factor in Note 4 to obtain pounds.
6. Maximum fuel available is: JP-1= 4542 lb.; JP-4 = 4347 lb.
7. Drop tanks carried all the way.
8. Maximum power - 15 minutes time limit per flight, including take-off.

**EXAMPLE:**

If you are flying at 10,000 feet with 4000 pounds of available fuel, you can fly 700 nautical air miles by holding 300 knots CAS. However, you can fly 1200 nautical air miles by immediately climbing to 40,000 feet using 97.5% rpm. At 40,000 feet, cruise at 230 knots CAS until the drop tanks are emptied; the weight will then have been decreased to about 14,500 pounds. Continue to cruise at 40,000 feet at 225 knots CAS and start letdown 17 nautical miles from home. With an 80-knot headwind, the range at 40,000 feet would be .8 x 1200, or 960 nautical miles. Cruise 5 knots CAS faster with this wind and start letdown 14 nautical miles from destination.

**LEGEND**

EFFECTIVE WIND - HW HEAD WIND TW TAIL WIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIR MILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED IN KNOTS
CAS - CALIBRATED AIRSPEED IN KNOTS
LB/HR - FUEL CONSUMPTION-POUNDS PER HOUR
RANGE - NAUTICAL MILES
KN - KNOTS
OPT. ALT - OPTIMUM ALTITUDE
DISTANCE - NAUTICAL MILES

**DATA AS OF:** MARCH 1ST, 1955. **BASED ON:** ESTIMATED DATA

Figure 4-15 (Sheet 2 of 2) Flight Operation Instruction Chart - Two 100 Imperial Gallon Tanks - 16,100 Pounds to 14,500 Pounds

**MODEL**

SABRE 6

**ENGINE(S):** ORENDA 14

# FLIGHT OPERATION INSTRUCTION CHART

**CHART WEIGHT LIMITS** 14,500 OR LESS **POUNDS**

**EXTERNAL LOAD ITEM**

TWO 100 IMPERIAL
GALLON DROP TANKS

| LIMITS | TIME LIMIT (MIN.) | % RPM | JET PIPE TEMP (C) | OIL PRESS. (PSI) | | |
|---|---|---|---|---|---|---|
| MAXIMUM | 15 | 100 | 720 | 15–25 | | |
| MILITARY | 30 | 97.5 | 685 | 15–25 | | |
| NORMAL | NONE | 93 | 620 | 15–25 | | |

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reverse, combat, navigational errors, formation flights, etc). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instruction in appropriate cruising altitude section.

(B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distance to range values. DATA BELOW CONTAINS NO FUEL RESERVE FOR LANDING.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (because of external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

**DATA AS OF:** MARCH 1ST, 1955.
**BASED ON:** ESTIMATED DATA

## LOW- ALTITUDE CHART

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

| IF YOU ARE AT SEA LEVEL | | | FUEL (POUNDS) | IF YOU ARE AT 5,000FT | | | IF YOU ARE AT 10,000FT | | | IF YOU ARE AT 15,000FT | | | FUEL (POUNDS) | IF YOU ARE AT 20,000FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT SL | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 5000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 10,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 15,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 20,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| 380 | 40 | 870 | 3000 | 450 | 40 | 890 | 520 | 40 | 910 | 600 | 40 | 930 | 3000 | 680 | 40 | 950 |
| 320 | 40 | 710 | 2500 | 380 | 40 | 730 | 440 | 40 | 750 | 500 | 40 | 770 | 2500 | 560 | 40 | 780 |
| 250 | 40 | 550 | 2000 | 300 | 40 | 560 | 350 | 40 | 580 | 400 | 40 | 600 | 2000 | 450 | 40 | 620 |
| 190 | 40 | 380 | 1500 | 230 | 40 | 400 | 260 | 40 | 420 | 300 | 40 | 440 | 1500 | 340 | 40 | 450 |
| 130 | 35 | 220 | 1000 | 150 | 40 | 240 | 170 | 40 | 250 | 200 | 40 | 270 | 1000 | 230 | 40 | 290 |
| 70 | 15 | 70 | 500 | 80 | 20 | 90 | 90 | 25 | 100 | 100 | 30 | 110 | 500 | 120 | 35 | 120 |

| CRUISING AT SEA LEVEL | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 5,000FT | | | | | | CRUISING AT 10,000FT | | | | | | CRUISING AT 15,000FT | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 20,000FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120 HW | | | | | | | | | | | | | | | | | | | 120 HW | 295 | 80 | 1800 | 270 | .70 | 4 |
| | | | | | | 80 HW | | | | | | | | | | | | | 300 | 80 | 1900 | 290 | .75 | 3 | 80 HW | 290 | 80 | 1700 | 300 | .80 | 5 |
| 345 | 80 | 2750 | 305 | .85 | 0 | 40 HW | 325 | 80 | 2350 | 310 | .85 | 1 | 305 | 79 | 2050 | 315 | .90 | 2 | 290 | 79 | 1850 | 320 | .90 | 4 | 40 HW | 280 | 79 | 1650 | 330 | .90 | 5 |
| 325 | 79 | 2550 | 325 | 1.00 | 0 | 0 | 310 | 79 | 2250 | 335 | 1.00 | 1 | 295 | 79 | 2000 | 345 | 1.00 | 2 | 285 | 79 | 1750 | 350 | 1.00 | 4 | 0 | 275 | 79 | 1600 | 365 | 1.00 | 6 |
| 315 | 78 | 2500 | 355 | 1.15 | 0 | 40 TW | 300 | 78 | 2150 | 385 | 1.15 | 1 | 290 | 78 | 1900 | 375 | 1.15 | 2 | 280 | 78 | 1700 | 385 | 1.10 | 4 | 40 TW | 270 | 79 | 1600 | 400 | 1.10 | 7 |
| | | | | | | 80 TW | | | | | | | | | | | | | 270 | 78 | 1650 | 415 | 1.25 | 5 | 80 TW | 265 | 78 | 1550 | 430 | 1.25 | 8 |
| | | | | | | 120 TW | | | | | | | | | | | | | | | | | | | 120 TW | 260 | 78 | 1550 | 470 | 1.35 | 8 |

Figure 4-16 (Sheet 1 of 2) Flight Operation Instruction Chart - Two 100 Imperial Gallon Tanks - 14,500 Pounds or Less

# HIGH-ALTITUDE CHART

MODEL: SABRE 6 ENGINE(S): ORENDA 14 CHART WEIGHT LIMITS 14, 500 LB OR LESS EXT LOAD TWO 100 IMPERIAL GALLON DROP TANKS

| IF YOU ARE AT 25,000 FT | | | FUEL (POUNDS) | IF YOU ARE AT 30,000 FT | | | IF YOU ARE AT 35,000 FT | | | IF YOU ARE AT 40,000 FT | | | FUEL (POUNDS) | IF YOU ARE AT 45,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT 25, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 30, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 35, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 40, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 45, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | ( RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL ) | | | | | | | | | | | | |
| 760 | 40 | 960 | 3000 | 860 | 40 | 970 | 950 | 40 | 980 | 1000 | | | | | | |
| 630 | 40 | 800 | 2500 | 720 | 40 | 810 | 790 | 40 | 820 | 840 | | | | | | |
| 510 | 40 | 640 | 2000 | 580 | 40 | 650 | 630 | 40 | 660 | 670 | | | | | | |
| 380 | 40 | 470 | 1500 | 430 | 40 | 480 | 480 | 40 | 490 | 500 | | | | | | |
| 250 | 40 | 300 | 1000 | 290 | 40 | 320 | 320 | 40 | 330 | 340 | | | | | | |
| 130 | 35 | 140 | 500 | 150 | 35 | 150 | 170 | 40 | 170 | 180 | | | | | | |

| CRUISING AT 25,000 FT | | | | | | EFFEC-TIVE WIND (KNOTS) | CRUISING AT 30,000 FT | | | | | | CRUISING AT 35,000 FT | | | | | | CRUISING AT 40,000 FT | | | | | | EFFEC-TIVE WIND (KNOTS) | CRUISING AT 45,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 285 | 81 | 1700 | **290** | .70 | 6 | 120 HW | 270 | 81 | 1550 | **300** | .70 | 7 | 250 | 82 | 1400 | **305** | .70 | 9 | 230 | 86 | 1350 | **325** | .70 | 12 | 120 HW | | | | | | |
| 275 | 80 | 1600 | **315** | .80 | 6 | 80 HW | 260 | 81 | 1500 | **330** | .80 | 8 | 245 | 82 | 1350 | **340** | .80 | 10 | 230 | 86 | 1350 | **360** | .80 | 14 | 80 HW | | | | | | |
| 270 | 80 | 1550 | **350** | .90 | 7 | 40 HW | 255 | 80 | 1450 | **365** | .90 | 9 | 240 | 82 | 1350 | **370** | .90 | 12 | 225 | 85 | 1300 | **395** | .90 | 15 | 40 HW | | | | | | |
| 265 | 79 | 1500 | **380** | 1.00 | 8 | 0 | 250 | 80 | 1400 | **395** | 1.00 | 10 | 235 | 81 | 1300 | **405** | 1.00 | 13 | 225 | 85 | 1300 | **420** | 1.00 | 17 | 0 | | | | | | |
| 260 | 79 | 1500 | **415** | 1.10 | 9 | 40 TW | 250 | 80 | 1400 | **430** | 1.10 | 11 | 235 | 81 | 1250 | **440** | 1.10 | 14 | 225 | 85 | 1300 | **465** | 1.10 | 19 | 40 TW | | | | | | |
| 255 | 79 | 1450 | **450** | 1.20 | 10 | 80 TW | 245 | 80 | 1350 | **465** | 1.20 | 12 | 230 | 81 | 1250 | **475** | 1.20 | 16 | 220 | 85 | 1250 | **505** | 1.20 | 20 | 80 TW | | | | | | |
| 255 | 79 | 1450 | **490** | 1.35 | 11 | 120 TW | 245 | 80 | 1350 | **505** | 1.35 | 13 | 225 | 81 | 1250 | **510** | 1.30 | 17 | 220 | 85 | 1250 | **545** | 1.30 | 22 | 120 TW | | | | | | |

**REMARKS:**

1. Climb at 97.5% rpm.
2. All distances and speeds are nautical units.
3. Multiply all nautical units by 1.15 to obtain statute units.
4. Divide lb /hr by 8.15 to obtain gals /hr of 3-GP-23a (JP-1) fuel.
   Divide lb /hr by 7.8 to obtain gals /hr of 3-GP-22a (JP-4) fuel.
5. Multiply gallons by factor in Note 4 to obtain pounds.
6. Drop tanks carried all the way.
7. Maximum Power - 15 minutes time limit per flight, including take-off.

**EXAMPLE:**

If you are flying at 10, 000 feet with 2500 pounds of available fuel, you can fly 440 nautical air miles by holding 295 knots CAS. However, you can fly 750 nautical air miles by immediately climbing to 40, 000 feet using 97.5% rpm. At 40, 000 feet cruise at 225 knots CAS and start letdown 17 nautical miles from home. With an 80 knot head wind, the range at 40, 000 feet would be .8 x 750, or 600 nautical miles. Cruise at 230 knots CAS with this wind and start letdown 14 nautical miles from destination.

**LEGEND**

EFFECTIVE WIND - HW HEAD WIND TW TAIL WIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIR MILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED IN KNOTS
CAS - CALIBRATED AIRSPEED IN KNOTS
LB/HR - FUEL CONSUMPTION - POUNDS PER HOUR
RANGE - NAUTICAL MILES
KN - KNOTS
OPT. ALT. - OPTIMUM ALTITUDE
DISTANCE - NAUTICAL MILES

DATA AS OF: MAR. 1ST, 1955

BASED ON: ESTIMATED DATA

6B

Figure 4-16 (Sheet 2 of 2) Flight Operation Instruction Chart - Two 100 Imperial Gallon Tanks - 14,500 Pounds or Less

**MODEL**

SABRE 6

**ENGINE(S):** ORENDA 14

# FLIGHT OPERATION INSTRUCTION CHART

**CHART WEIGHT LIMITS** 17300 TO 14700 **POUNDS**

**EXTERNAL LOAD ITEM**

TWO 167 IMPERIAL
GALLON DROP TANKS

| LIMITS | TIME LIMIT (MIN.) | % RPM | JET PIPE TEMP (C) | OIL PRESS. (PSI) |
|---|---|---|---|---|
| MAXIMUM | 15 | 100 | 720 | 15-25 |
| MILITARY | 30 | 97.5 | 685 | 15-25 |
| NORMAL | NONE | 93 | 620 | 15-25 |

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reverse, combat, navigational errors, formation flights, etc). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instruction in appropriate cruising altitude section.

(B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distance to range values. DATA BELOW CONTAINS NO FUEL RESERVE FOR LANDING.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (because of external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

**DATA AS OF:** MARCH 1ST, 1955
**BASED ON:** ESTIMATED DATA

## LOW- ALTITUDE CHART

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

| IF YOU ARE AT SEA LEVEL | | | FUEL (POUNDS) | IF YOU ARE AT 5,000 FT | | | IF YOU ARE AT 10,000 FT | | | IF YOU ARE AT 15,000 FT | | | FUEL (POUNDS) | IF YOU ARE AT 20,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT SL | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 5000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 10,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 15,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 20,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| 640 | 40 | 1420 | 5500 | 740 | 40 | 1450 | 850 | 40 | 1470 | 970 | 40 | 1480 | 5500 | 1100 | 40 | 1500 |
| 580 | 40 | 1300 | 5000 | 670 | 40 | 1320 | 780 | 40 | 1340 | 880 | 40 | 1350 | 5000 | 1000 | 40 | 1370 |
| 530 | 40 | 1170 | 4500 | 610 | 40 | 1190 | 700 | 40 | 1210 | 800 | 40 | 1220 | 4500 | 900 | 40 | 1240 |
| 470 | 40 | 1040 | 4000 | 550 | 40 | 1060 | 630 | 40 | 1080 | 710 | 40 | 1090 | 4000 | 800 | 40 | 1110 |
| 410 | 40 | 910 | 3500 | 480 | 40 | 930 | 560 | 40 | 950 | 630 | 40 | 960 | 3500 | 710 | 40 | 980 |
| 360 | 40 | 780 | 3000 | 420 | 40 | 790 | 480 | 40 | 810 | 540 | 40 | 830 | 3000 | 610 | 40 | 850 |
| 300 | 40 | 650 | 2500 | 360 | 40 | 660 | 410 | 40 | 680 | 460 | 40 | 700 | 2500 | 520 | 40 | 710 |

| CRUISING AT SEA LEVEL | | | | | | EFFEC-TIVE WIND (KNOTS) | CRUISING AT 5,000 FT | | | | | | CRUISING AT 10,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120HW | | | | | | | | | | | | |
| | | | | | | 80 HW | | | | | | | | | | | | |
| 340 | 81 | 3000 | 295 | .85 | 0 | 40 HW | 315 | 81 | 2550 | 300 | .85 | 1 | 300 | 81 | 2300 | 310 | .85 | 2 |
| 320 | 80 | 2800 | 320 | 1.00 | 0 | 0 | 305 | 80 | 2400 | 325 | 1.00 | 1 | 290 | 80 | 2200 | 335 | 1.00 | 2 |
| 300 | 79 | 2650 | 345 | 1.15 | 0 | 40 TW | 290 | 79 | 2350 | 350 | 1.15 | 1 | 280 | 80 | 2150 | 365 | 1.15 | 2 |
| | | | | | | 80 TW | | | | | | | | | | | | |
| | | | | | | 120TW | | | | | | | | | | | | |

| CRUISING AT 15,000 FT | | | | | | EFFEC-TIVE WIND (KNOTS) | CRUISING AT 20,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120HW | 300 | 83 | 2150 | 280 | .70 | 4 |
| 300 | 82 | 2200 | 290 | .75 | 3 | 80 HW | 290 | 82 | 2050 | 310 | .80 | 5 |
| 290 | 81 | 2150 | 320 | .90 | 4 | 40 HW | 285 | 82 | 2000 | 340 | .90 | 5 |
| 280 | 81 | 2050 | 350 | 1.00 | 4 | 0 | 280 | 81 | 1950 | 370 | 1.00 | 6 |
| 275 | 80 | 2000 | 380 | 1.15 | 5 | 40 TW | 270 | 81 | 1900 | 405 | 1.10 | 7 |
| 265 | 80 | 1950 | 410 | 1.25 | 5 | 80 TW | 270 | 81 | 1850 | 440 | 1.25 | 8 |
| | | | | | | 120TW | 265 | 80 | 1800 | 475 | 1.35 | 8 |

Figure 4-17 (Sheet 1 of 2) Flight Operation Instruction Chart - Two 167 Imperial Gallon Tanks - 17,300 Pounds to 14,700 Pounds

# HIGH ALTITUDE CHART

MODEL: SABRE 6 ENGINE(S): ORENDA 14 CHART WEIGHT LIMITS 17,300 TO 14,700 LBS EXT LOAD TWO 167 IMPERIAL GALLON DROP TANKS

| IF YOU ARE AT 25,000 FT | | | FUEL | IF YOU ARE AT 30,000 FT | | | IF YOU ARE AT 35,000 FT | | | IF YOU ARE AT 40,000 FT | | | FUEL | IF YOU ARE AT 45,000 FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | | RANGE IN AIR MILES | | |
| BY CRUISING AT 25,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | (POUNDS) | BY CRUISING AT 30,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 35,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 40,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | (POUNDS) | BY CRUISING AT 45,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | ( RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL ) | | | | | | | | | | | | |
| 1230 | | 1520 | 5500 | 1360 | 40 | 1530 | 1480 | 40 | 1540 | 1550 | | | 5500 | | | |
| 1120 | 40 | 1390 | 5000 | 1240 | 40 | 1400 | 1350 | 40 | 1410 | 1420 | | | 5000 | | | |
| 1010 | 40 | 1260 | 4500 | 1120 | 40 | 1270 | 1220 | 40 | 1280 | 1290 | | | 4500 | | | |
| 900 | 40 | 1120 | 4000 | 1010 | 40 | 1140 | 1100 | 40 | 1150 | 1160 | | | 4000 | | | |
| 800 | 40 | 990 | 3500 | 890 | 40 | 1000 | 970 | 40 | 1020 | 1030 | | | 3500 | | | |
| 690 | 40 | 860 | 3000 | 770 | 40 | 870 | 850 | 40 | 890 | 900 | | | 3000 | | | |
| 580 | 40 | 730 | 2500 | 650 | 40 | 740 | 720 | 40 | 750 | 770 | | | 2500 | | | |

| CRUISING AT 25,000 FT | | | | | | EFFECTIVE WIND | CRUISING AT 30,000 FT | | | | | | CRUISING AT 35,000 FT | | | | | | CRUISING AT 40,000 FT | | | | | | EFFECTIVE WIND | CRUISING AT 45,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | (KNOTS) | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| 290 | 84 | 2000 | 295 | .70 | 6 | 120HW | 280 | 85 | 1900 | 310 | .70 | 7 | 260 | 87 | 1800 | 320 | .70 | 9 | 245 | 91 | 1800 | 340 | .75 | 13 | 120HW | | | | | | |
| 285 | 83 | 1950 | 330 | .80 | 6 | 80 HW | 275 | 85 | 1850 | 345 | .80 | 8 | 255 | 86 | 1750 | 355 | .80 | 10 | 240 | 91 | 1750 | 375 | .80 | 14 | 80 HW | | | | | | |
| 280 | 83 | 1900 | 365 | .90 | 7 | 40 HW | 270 | 84 | 1800 | 380 | .90 | 9 | 255 | 86 | 1700 | 390 | .90 | 12 | 235 | 91 | 1750 | 415 | .90 | 15 | 40 HW | | | | | | |
| 275 | 82 | 1850 | 395 | 1.00 | 8 | 0 | 270 | 84 | 1750 | 415 | 1.00 | 10 | 250 | 86 | 1700 | 425 | 1.00 | 13 | 235 | 91 | 1700 | 450 | 1.00 | 17 | 0 | | | | | | |
| 270 | 82 | 1800 | 430 | 1.10 | 9 | 40 TW | 265 | 84 | 1750 | 450 | 1.10 | 11 | 245 | 86 | 1650 | 465 | 1.10 | 14 | 235 | 90 | 1700 | 480 | 1.10 | 19 | 40 TW | | | | | | |
| 265 | 82 | 1800 | 465 | 1.20 | 10 | 80 TW | 260 | 84 | 1700 | 485 | 1.20 | 12 | 245 | 86 | 1650 | 500 | 1.20 | 16 | 235 | 90 | 1700 | 525 | 1.20 | 20 | 80 TW | | | | | | |
| 265 | 82 | 1750 | 500 | 1.35 | 11 | 120TW | 260 | 83 | 1700 | 520 | 1.30 | 14 | 240 | 85 | 1600 | 535 | 1.30 | 17 | 230 | 90 | 1700 | 565 | 1.30 | 22 | 120TW | | | | | | |

REMARKS:

1. Climb at 97.5% rpm.
2. All distances and speeds are nautical units.
3. Multiply all nautical units by 1.15 to obtain statute units.
4. Divide lb /hr by 8.15 to obtain gals/hr of 3GP23a (JP-1) fuel.
   Divide lb /hr by 7.8 to obtain gals /hr of 3GP22a (JP-4) fuel.
5. Multiply gallons by factor in Note 4 to obtain pounds.
6. Maximum fuel available is: JP-1 = 5626 lb. JP-4 = 5384 lb.
7. Drop tanks carried all the way.
8. Maximum Power - 15 minute time limit per flight, including take-off.

EXAMPLE:

If you are flying at 10,000 feet with 5000 pounds of available fuel, you can fly 780 nautical air miles by holding 290 knots CAS. However, you can fly 1340 nautical air miles by immediately climbing to 40,000 feet using 97.5% rpm. At 40,000 feet, cruise at 235 knots CAS until the drop tanks are emptied; the weight will then have been decreased to about 14,700 pounds. Continue to cruise at 40,000 feet at 225 knots CAS and start letdown 17 nautical miles from home. With an 80 knot headwind, the range at 40,000 feet would be .8 x 1340, or 1070 nautical miles. Cruise 5 knots CAS faster with this wind and start letdown 14 nautical miles from destination.

LEGEND

| | |
|---|---|
| EFFECTIVE WIND | - HW HEAD WIND TW TAIL WIND |
| RANGE FACTOR | - RATIO OF GROUND DISTANCE TO AIR MILES FOR CORRESPONDING WINDS |
| G.S. | - GROUND SPEED IN KNOTS |
| CAS | - CALIBRATED AIRSPEED IN KNOTS |
| LB/HR | - FUEL CONSUMPTION - POUNDS PER HOUR |
| RANGE | - NAUTICAL MILES |
| KN | - KNOTS |
| OPT. ALT. | - OPTIMUM ALTITUDE |
| DISTANCE | - NAUTICAL MILES |

DATA AS OF: MARCH 1st, 1955

BASED ON: ESTIMATED DATA

Figure 4-17 (Sheet 2 of 2) Flight Operation Instruction Chart - Two 167 Imperial Gallon Tanks - 17,300 Pounds to 14,700 Pounds

| MODEL<br>SABRE 6 | FLIGHT OPERATION INSTRUCTION CHART | EXTERNAL LOAD ITEM<br>2 x 167 IMPERIAL<br>GALLON DROP TANKS |
|---|---|---|
| ENGINE(S): (1) ORENDA 14 | CHART WEIGHT LIMITS 14, 700 OR LESS POUNDS | |

| LIMITS | TIME LIMIT (MIN.) | % RPM | JET PIPE TEMP (C) | OIL PRESS. (PSI) |
|---|---|---|---|---|
| MAXIMUM | 15 | 100 | 720 | 15-25 |
| MILITARY | 30 | 97.5 | 685 | 15-25 |
| NORMAL | NONE | 93 | 620 | 15-25 |

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT - Select figure in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reverse, combat, navigational errors, formation flights, etc). Move horizontally right or left to section according to present altitude and read total range available (no wind) by cruising at that altitude or by climbing to another altitude of maximum range. For a flight at initial altitude, operating instructions are given directly below. For a flight at higher altitude, climb immediately to desired altitude and read cruising instruction in appropriate cruising altitude section.

(B) FLIGHT PLANNING - From initial fuel on board subtract fuel required for take-off and climb to desired cruising altitude and all other necessary allowances. Then use chart as for IN FLIGHT above, adding initial climb distance to range values. DATA BELOW CONTAINS NO FUEL RESERVE FOR LANDING.

NOTES: Ranges shown at optimum altitudes are maximum. In order to obtain maximum range on flights requiring more than one chart (because of external configuration or gross weight changes), it is necessary to observe the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA AS OF: MAR. 1, 1955.
BASED ON: ESTIMATED DATA

## LOW- ALTITUDE CHART

(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL)

| IF YOU ARE AT SEA LEVEL RANGE IN AIR MILES | | | FUEL (POUNDS) | IF YOU ARE AT 5,000 FT RANGE IN AIR MILES | | | IF YOU ARE AT 10,000 FT RANGE IN AIR MILES | | | IF YOU ARE AT 15,000 FT RANGE IN AIR MILES | | | FUEL (POUNDS) | IF YOU ARE AT 20,000 FT RANGE IN AIR MILES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BY CRUISING AT SL | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 5000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 10, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 15, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 20, 000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| 360 | 40 | 800 | 3000 | 430 | 40 | 820 | 490 | 40 | 830 | 550 | 40 | 850 | 3000 | 620 | 40 | 860 |
| 300 | 40 | 650 | 2500 | 360 | 40 | 660 | 410 | 40 | 680 | 460 | 40 | 700 | 2500 | 520 | 40 | 710 |
| 240 | 40 | 490 | 2000 | 280 | 40 | 510 | 330 | 40 | 530 | 370 | 40 | 540 | 2000 | 410 | 40 | 560 |
| 180 | 40 | 340 | 1500 | 210 | 40 | 360 | 250 | 40 | 380 | 280 | 40 | 390 | 1500 | 310 | 40 | 410 |
| 120 | 35 | 190 | 1000 | 140 | 35 | 210 | 160 | 40 | 230 | 190 | 40 | 240 | 1000 | 210 | 40 | 260 |
| 60 | 15 | 70 | 500 | 70 | 15 | 80 | 80 | 25 | 90 | 100 | 30 | 100 | 500 | 110 | 30 | 110 |

| CRUISING AT SEA LEVEL | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 5,000 FT | | | | | | CRUISING AT 10,000 FT | | | | | | CRUISING AT 15,000 FT | | | | | | EFFECTIVE WIND (KNOTS) | CRUISING AT 20,000 FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | | APPROXIMATE | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. |
| | | | | | | 120HW | | | | | | | | | | | | | 300 | 81 | 2200 | 250 | .65 | 3 | 120HW | 290 | 82 | 2000 | 270 | .65 | 4 |
| | | | | | | 80 HW | | | | | | | | | | | | | 290 | 80 | 2000 | 275 | .75 | 3 | 80 HW | 280 | 81 | 1900 | 300 | .75 | 5 |
| 325 | 80 | 2800 | 285 | .85 | 0 | 40 HW | 305 | 80 | 2350 | 290 | .85 | 1 | 290 | 79 | 2050 | 295 | .85 | 2 | 280 | 80 | 1900 | 305 | .85 | 3 | 40 HW | 270 | 80 | 1800 | 325 | .90 | 5 |
| 310 | 79 | 2650 | 310 | 1.00 | 0 | 0 | 290 | 79 | 2200 | 315 | 1.00 | 1 | 275 | 79 | 1950 | 320 | 1.00 | 2 | 265 | 79 | 1800 | 330 | 1.00 | 4 | 0 | 265 | 80 | 1700 | 355 | 1.00 | 6 |
| 305 | 78 | 2550 | 345 | 1.15 | 0 | 40 TW | 280 | 78 | 2050 | 350 | 1.15 | 1 | 265 | 78 | 1850 | 350 | 1.15 | 2 | 255 | 78 | 1700 | 360 | 1.15 | 5 | 40 TW | 255 | 79 | 1650 | 380 | 1.15 | 7 |
| | | | | | | 80 TW | | | | | | | | | | | | | 245 | 77 | 1650 | 390 | 1.30 | 5 | 80 TW | 250 | 79 | 1600 | 415 | 1.25 | 8 |
| | | | | | | 120TW | | | | | | | | | | | | | 240 | 77 | 1600 | 420 | 1.40 | 6 | 120TW | 245 | 78 | 1600 | 445 | 1.35 | 8 |

Figure 4-18 (Sheet 1 of 2) Flight Operation Instruction Chart - Two 167 Imperial Gallon Tanks - 14,700 Pounds or Less

# HIGH-ALTITUDE CHART

MODEL: SABRE 6 ENGINE(S): (1) ORENDA 14 CHART WEIGHT LIMITS 14,700 OR LESS EXT LOAD TWO 167 IMPERIAL GALLON DROP TANKS

| IF YOU ARE AT 25,000FT | | | FUEL | IF YOU ARE AT 30,000FT | | | IF YOU ARE AT 35,000FT | | | IF YOU ARE AT 40,000FT | | | FUEL | IF YOU ARE AT 45,000FT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGE IN AIR MILES | | | (POUNDS) | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | RANGE IN AIR MILES | | | (POUNDS) | RANGE IN AIR MILES | | |
| BY CRUISING AT 25,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 30,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 35,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | BY CRUISING AT 40,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT | | BY CRUISING AT 45,000 FT | OPT. ALT (1000 FT) | BY CRUISING AT OPT. ALT |
| | | | | ( RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB AND DESCENT TO SEA LEVEL ) | | | | | | | | | | | | |
| 700 | 40 | 880 | 3000 | 780 | 40 | 890 | 860 | 40 | 900 | 920 | | | 3000 | | | |
| 580 | 40 | 730 | 2500 | 650 | 40 | 740 | 720 | 40 | 750 | 770 | | | 2500 | | | |
| 470 | 40 | 580 | 2000 | 520 | 40 | 590 | 580 | 40 | 600 | 610 | | | 2000 | | | |
| 350 | 40 | 430 | 1500 | 390 | 40 | 440 | 430 | 40 | 450 | 460 | | | 1500 | | | |
| 240 | 40 | 270 | 1000 | 260 | 40 | 290 | 290 | 40 | 300 | 310 | | | 1000 | | | |
| 130 | 35 | 130 | 500 | 140 | 35 | 140 | 150 | 40 | 150 | 160 | | | 500 | | | |

| CRUISING AT 25,000FT | | | | | | EFFECTIVE WIND | CRUISING AT 30,000FT | | | | | | CRUISING AT 35,000FT | | | | | | CRUISING AT 40,000FT | | | | | | EFFECTIVE WIND | CRUISING AT 45,000FT | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | APPROXIMATE | | | | | (KNOTS) | | APPROXIMATE | | | | | | APPROXIMATE | | | | | | APPROXIMATE | | | | | (KNOTS) | | | | | | |
| CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | CAS | % RPM | LB/HR | G.S. (KN) | RANGE FACTOR | LET-DN DIST. | | CAS | % RPM | LB/HR | G.S. | RANGE FACTOR | LET-DN DIST. |
| 285 | 82 | 1850 | 290 | .70 | 6 | 120 HW | 270 | 83 | 1700 | 300 | .70 | 7 | 255 | 84 | 1550 | 310 | .70 | 9 | 235 | 88 | 1500 | 325 | .70 | 12 | 120 HW | | | | | | |
| 275 | 82 | 1750 | 330 | .80 | 6 | 80 HW | 265 | 83 | 1600 | 330 | .80 | 8 | 245 | 84 | 1500 | 340 | .80 | 10 | 230 | 87 | 1450 | 360 | .80 | 14 | 80 HW | | | | | | |
| 270 | 81 | 1700 | 350 | .90 | 7 | 40 HW | 260 | 82 | 1600 | 365 | .90 | 9 | 240 | 83 | 1450 | 375 | .90 | 12 | 230 | 87 | 1450 | 395 | .90 | 15 | 40 HW | | | | | | |
| 260 | 81 | 1650 | 380 | 1 00 | 8 | 0 | 255 | 82 | 1550 | 395 | 1.00 | 10 | 240 | 83 | 1450 | 410 | 1.00 | 13 | 225 | 87 | 1400 | 430 | 1.00 | 17 | 0 | | | | | | |
| 255 | 80 | 1600 | 410 | 1.10 | 9 | 40 TW | 250 | 81 | 1500 | 430 | 1.10 | 11 | 235 | 83 | 1400 | 440 | 1.10 | 14 | 225 | 87 | 1400 | 470 | 1.10 | 19 | 40 TW | | | | | | |
| 250 | 80 | 1550 | 445 | 1.25 | 10 | 80 TW | 245 | 81 | 1450 | 465 | 1.20 | 12 | 230 | 82 | 1350 | 475 | 1.20 | 16 | 220 | 87 | 1400 | 505 | 1.20 | 20 | 80 TW | | | | | | |
| 245 | 80 | 1500 | 480 | 1.35 | 11 | 120 TW | 240 | 81 | 1450 | 500 | 1.35 | 14 | 225 | 82 | 1350 | 510 | 1.30 | 17 | 220 | 87 | 1400 | 545 | 1.30 | 22 | 120TW | | | | | | |

REMARKS:

1. Climb at 97.5% rpm.
2. All distances and speeds are nautical units.
3. Multiply all nautical units by 1.15 to obtain statute units.
4. Divide lb /hr by 8.15 to obtain gals /hr of 3GP23a (JP-1) fuel.
   Divide lb /hr by 7.8 to obtain gals /hr of 3GP22a (JP-4) fuel.
5. Multiply gallons by factor in Note 4 to obtain pounds.
6. Drop tanks carried all the way.
7. Maximum Power - 15 minute time limit per flight, including take-off.

EXAMPLE:

If you are flying at 10,000 feet with 2500 pounds of available fuel, you can fly 410 nautical air miles by holding 275 knots CAS. However, you can fly 680 nautical air miles by immediately climbing to 40,000 feet using 97.5% rpm. At 40,000 feet, cruise at 225 knots CAS and start letdown 17 nautical miles from home. With an 80-knot head wind, the range at 40,000 feet would be .8 x 680. or 545 nautical miles. Cruise at 230 knots CAS with this wind and start letdown 14 nautical miles from destination.

LEGEND

EFFECTIVE WIND - HW HEAD WIND TW TAIL WIND
RANGE FACTOR - RATIO OF GROUND DISTANCE TO AIR MILES FOR CORRESPONDING WINDS
G.S. - GROUND SPEED IN KNOTS
CAS - CALIBRATED AIRSPEED IN KNOTS
LB/HR - FUEL CONSUMPTION - POUNDS PER HOUR
RANGE - NAUTICAL MILES
KN - KNOTS
OPT. ALT - OPTIMUM ALTITUDE
DISTANCE - NAUTICAL MILES

DATA AS OF: MAR. 1, 1955.

BASED ON: ESTIMATED DATA

Figure 4-18 (Sheet 2 of 2) Flight Operation Instruction Chart - Two 167 Imperial Gallon Tanks - 14,700 Pounds or less

## PROBLEMS ILLUSTRATING USE OF THE CHARTS

EXAMPLE 1 (Based on 3-GP-22 Fuel)

27 An aircraft must be ferried 700 nautical miles. For unexpected difficulties, a reserve of 900 pounds is considered necessary.

28 The aircraft configuration is with two 167 Imperial gallon drop tanks. As this is to be a ferry mission, it is not desired to drop the tanks. Maximum fuel capacity is 690 gallons with the tanks installed, which gives a total fuel load of 5380 pounds (fuel at 7.8 pounds per gallon).

29 List the conditions:

| | |
|---|---|
| Required range | 700 nautical miles. |

Effective winds

40-knot headwind at 20,000 ft and below.
80-knot headwind at 25,000 ft and above.

30 The data shown in Figure 4-19 is obtained from the Military Power Climb Chart, see Figure 4-6, and Flight Operation Instruction Chart for two 167 Imperial gallon drop tanks, see Figure 4-17. As an added safety feature, several altitudes are given in Figure 4-19 to show the minimum flyable altitude for the mission and to illustrate the increase in range with a corresponding increase in altitude.

31 From Figure 4-19 it can be seen that it is possible to fly the mission at 20,000 feet or above. Determination of cruise airspeeds is made from the bottom of the Flight Operation Instruction Chart for the altitude and corresponding weight being flown. For 30,000 feet with an 80-knot headwind and a weight above 14,700 pounds, the cruising airspeed is 275 knots CAS. When the weight has decreased to 14,700 pounds or less, the cruise airspeed becomes 265 knots CAS for the same altitude and wind conditions, with the descent beginning eight miles from the destination. The cruise speeds for 35,000 feet and an 80-knot headwind are 255 knots CAS for weights above 14,700 pounds and 245 knots CAS for weights below 14,700 pounds, with 10 nautical miles used to descend.

EXAMPLE 2

32 In conjunction with Example 1, suppose the pilot reaches 5000 feet during his descent to the destination when he is informed that the field is closed. He must fly to an alternate airport 160 nautical miles further on, using the

| Cruising altitude, feet | 20,000 | 30,000 | 35,000 | 40,000 |
|---|---|---|---|---|
| Fuel capacity, pounds | 5380 | 5380 | 5380 | 5380 |
| Reserve fuel, pounds | 900 | 900 | 900 | 900 |
| Fuel used to altitude, pounds (climb at 97.5% rpm) | 750 | 930 | 1030 | 1160 |
| Available cruise fuel, pounds (b-c-d) | 3730 | 3550 | 3450 | 3320 |
| Cruise and descent air distance (interpolate as necessary) | 750 | 900 | 960 | 985 |
| Range factor | 0.9 | 0.8 | 0.8 | 0.8 |
| Cruise and descent ground distance (f x g) | 675 | 720 | 770 | 790 |
| Nautical miles covered in initial climb | 25 | 45 | 60 | 80 |
| Total range in nautical ground miles (h + j) | 700 | 765 | 830 | 870 |

Figure 4-19

900 pounds of fuel originally planned for general reserve. Reference to the Flight Operation Instruction Chart for two 167 Imperial gallon drop tanks, see Figure 4-18, shows that with the existing headwind (40 knots at 5000 feet) and the empty tanks retained on the aircraft, available range would be 110 nautical miles at 5000 feet, (130 miles x 0.85 range factor - 110 nautical miles). An increase in range can be realized by climbing to an optimum altitude of 35,000 feet. This range is 145 nautical miles (180 x 0.80 range factor = 145 nautical miles). which is insufficient, It is evident, therefore, that the empty drop tank should be jettisoned immediately.

33 Reference to Flight Operation Instruction Chart for no external load, see Figure 4-14 shows that even without drop tanks only 130 (145 x 0.90) nautical miles can be covered at 5000 feet with 900 pounds of fuel against a 40-knot headwind. However, by climbing immediately to an optimum altitude (40,000 feet) at 97.5% rpm, a range of 190 nautical miles is possible (235 x 0.80), using 240 knots CAS to cruise against the 80-knot headwind and starting letdown 14 nautical miles from the airport.

34 Since the required range is only 160 nautical miles, the difference between 190 and 160 is the reserve which, expressed in time, is 4.7 minutes at 40,000 feet, (30 nautical miles 380 knots ground speed = 0.079 hour or 4.7 minutes). The corresponding fuel reserve is 95 pounds. (0.079 x 1200 pounds per hour = 95 pounds).