EO 05-25E-1

ROYAL CANADIAN AIR FORCE

AIRCRAFT OPERATING INSTRUCTIONS

CF100 MK 4

REVISION NOTICE

LATEST REVISED PAGES SUPERSEDE
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Insert revised pages into basic publication.
Destroy superseded pages.

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15 FEB 60

Revised 21 Jun 63

LIST OF RCAF REVISIONS

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NOTES TO USERS

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

2 Part 1 - DESCRIPTION gives details of the controls and equipment with which the crew should be acquainted.

3 Part 2 - HANDLING describes the normal handling of the aircraft by the crew.

4 Part 3 - EMERGENCY HANDLING describes the emergency handling of the aircraft by the crew.

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 The captain must ensure that all applicable procedures, controls and instruments are fully understood by other crew members before commencement of a flight.

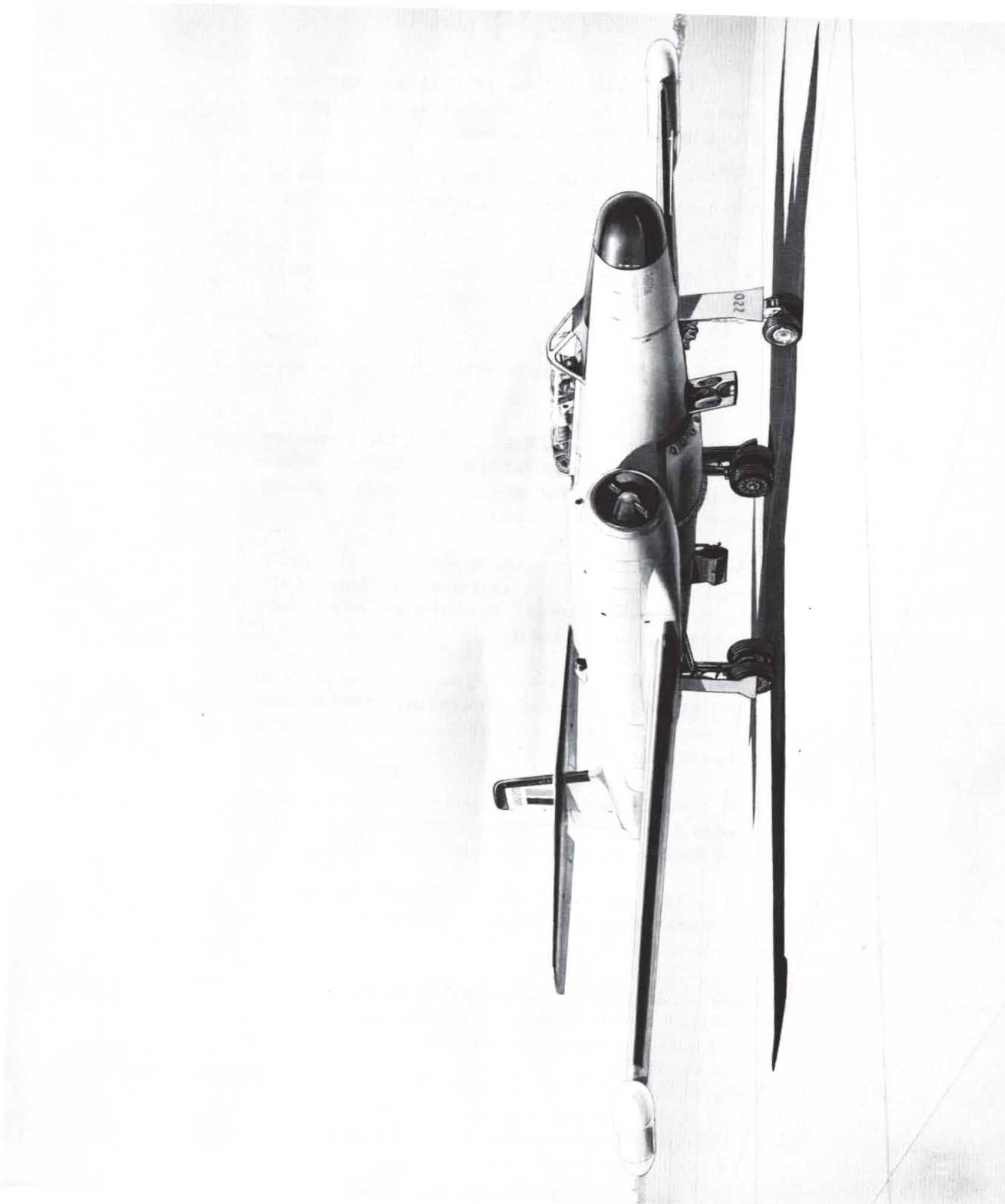
7 These notes are complementary to EO 05-1-1, Aircraft Operating Instructions General, and assume a thorough knowledge of its contents.

8 This publication relates to aircraft fitted with autopilot and does not consider those Canuck 4 aircraft without autopilot.

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

10 A record of Revisions is on Page A. The holder of this book is to ensure that revisions which have been promulgated are incorporated in the book.

11 Comments and suggestions should be forwarded through the usual channels to Air Force Headquarters.



1718-4M-1

Frontispiece - Canuck 4 Aircraft

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PART 1

DESCRIPTION

INTRODUCTION

GENERAL

1 The Canuck 4 is a twin engine jet propelled fighter powered by Orenda 9, 11 or 17 gas turbine engines and designed for all weather high altitude operations.

AIRFRAME

2 The fuselage, wing, empennage and control surfaces are of all metal construction. The inwardly retracting main wheels are attached to the centre section and the rearward retracting nosewheel is located beneath the pressurized cockpits. The flying controls are assisted by hydraulic boosters. Serrated edge speed brakes are fitted on the upper and lower surfaces of each wing. An E11B Autopilot is fitted and elevator trim is actuated electrically.

ENGINES

3 The Orenda 9 has a ten stage axial flow compressor, six combustion chambers and a single stage turbine. It develops approximately 6300 pounds static thrust at 7800 rpm at sea level. The **Orenda 11 and 17** are similar to the Orenda 9 but have a two stage turbine and develop approximately **7275 pounds static thrust** at 7800 rpm at sea level. The engines are equipped with automatic fuel systems compensated for airspeed and altitude variations. Acceleration controls limit engine acceleration during rapid opening of the throttle to prevent compressor stall and excessive exhaust temperatures. A self contained lubrication system is fitted. An electric starter is fitted within the nose bullet and is energized by a 28 volt DC ground supply. Both engines are equipped with an alcohol de-icing system.

NOTE

The Orenda 17 engine consists basically performance of the Series 11 and Series 17 engines is the same.

DIMENSIONS

4 The overall dimensions of the aircraft are as follows:

(a) Wing span with rocket pods - 53 ft. 6 in.

Wing span without rocket pods - 49 ft. 11 in.

Wing span with tip tanks - 57 ft. 6 in.

(b) Wing loading 60 lbs./sq. ft. at 34,000 lbs. weight.

(c) Length - 54 ft. 2 in.

(d) Height (to top of canopy) - 10 ft. 4 in.

(e) Height (to top of fin) - 14 ft. 4 in.

(f) Maximum gross landing weight - 31,000 lbs.

FUEL REMAINING FOR LANDING AT MAXIMUM LANDING WEIGHT

4(A) The maximum weight of fuel (JP-4) remaining, for various aircraft configuration on landing, are as follows:

(a) Clean - 5,000 lbs.

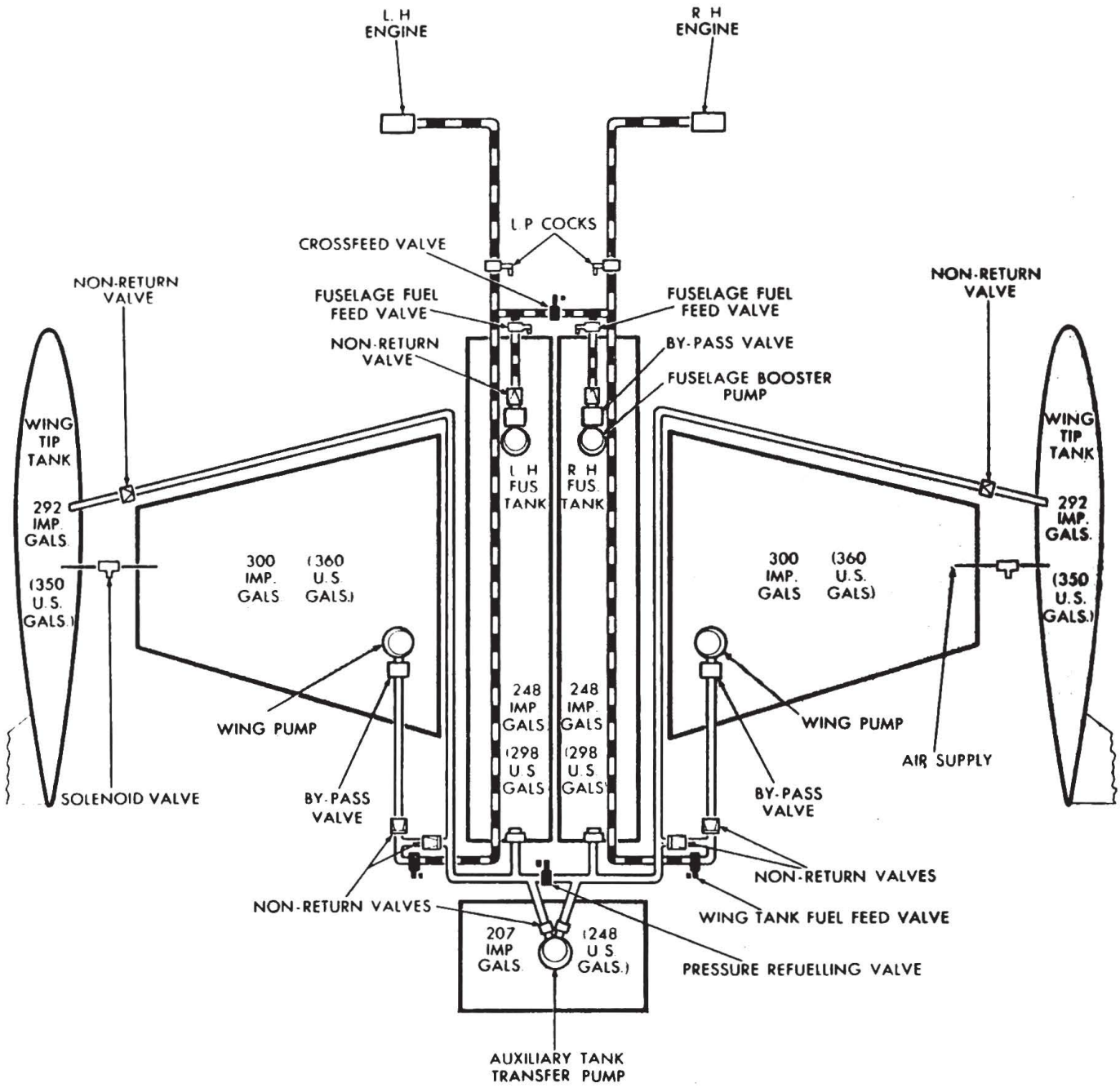
(b) Tip tanks - 4,500 lbs.

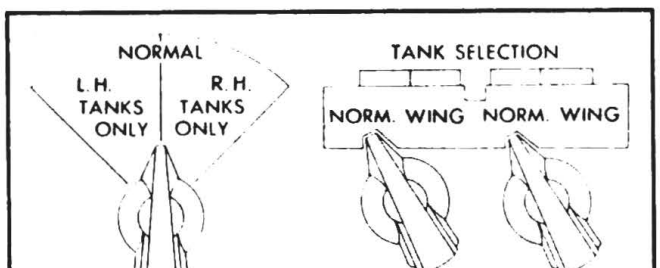
(c) Combat rocket pods (filled) - 3,550 lbs.

(d) 7 tube rocket pods (filled) - 4,350 lbs.

(e) 7 tube rocket pods (empty) - 4,600 lbs.

(f) 3 tube rocket launcher (filled) - 4,725 lbs.





FEED VALVES CLOSED

FEED VALVES OPEN

(h) Chaff dispenser - 4,750 lbs.

NOTE

These figures are based on an aircraft basic weight including crew of 26,000 lbs. Where this figure differs in the individual aircraft L14-8 the above figures must be altered accordingly.

FUEL SYSTEM

GENERAL

5 Fuel is carried in flexible fuel cells fitted in the fuselage and wings. Eight cells in the fuselage are connected in two groups of four to form two fuselage tanks. The tank on the LH side of the fuselage feeds the LH engine, and the tank on the RH side feeds the RH engine. An auxiliary tank in the fuselage feeds fuel into both the LH and RH tanks.

6 Twelve interconnected fuel cells in each wing form the two wing tanks, the LH wing tank feeding fuel into the LH fuselage tank, and the RH wing tank into the RH fuselage tank.

7 Wing tip tanks may be fitted for long range ferrying, in place of rocket pods.

FUEL TANK CAPACITIES

8 The fuel quantities given are for usable fuel. Weights are for JP 4 fuel, specific gravity .78.

Each set of wing cells	300 Imp gal 360 (US gal) 2340 lbs
Each set of fuselage cells	248 Imp gal 298 (US gal) 1934 lbs
Fuselage auxiliary tank	207 Imp gal 248 (US gal) 1615 lbs
Each tip tank	292 Imp gal 350 (US gal) 2278 lbs
Total without tip tanks	**1303 Imp gal** 1564 (US gal) **10163 lbs**

NORMAL FUEL SEQUENCE

9 Fuel is fed to each engine from its respective fuselage tank. The auxiliary tank fuel is transferred into both fuselage tanks to maintain them full.

10 After the auxiliary tank has emptied, fuel from the fuselage tanks is used until each tank contains only 140 gallons of usable fuel.

11 When the fuselage tanks reach the 140 gallon level, fuel from the wing tanks transfers into the fuselage tanks to maintain this level.

12 The final 140 gallons of fuel in each fuselage tank is used only when the wing tanks are empty.

13 If wing tip tanks are used, the contents of these must be transferred before the contents of the wing tanks. Compressed air from the

FUEL TANK PUMPS

14 The AUXILIARY TANK PUMP switch has two positions; ON and OFF, and is not connected to the landing gear.

15 The switch is normally OFF for take-off and is selected ON after the flaps have been retracted when airborne. Fuel is transferred to the fuselage tanks to maintain them full until the auxiliary tank is empty, when the pump is automatically switched OFF.

16 The wing tank switches are selected ON when the engines are started but are not energized until the auxiliary tank switch is automatically or manually switched OFF. When this occurs the pumps are started but do not transfer fuel until the fuselage tanks are down to the 140 gallon level.

WARNING

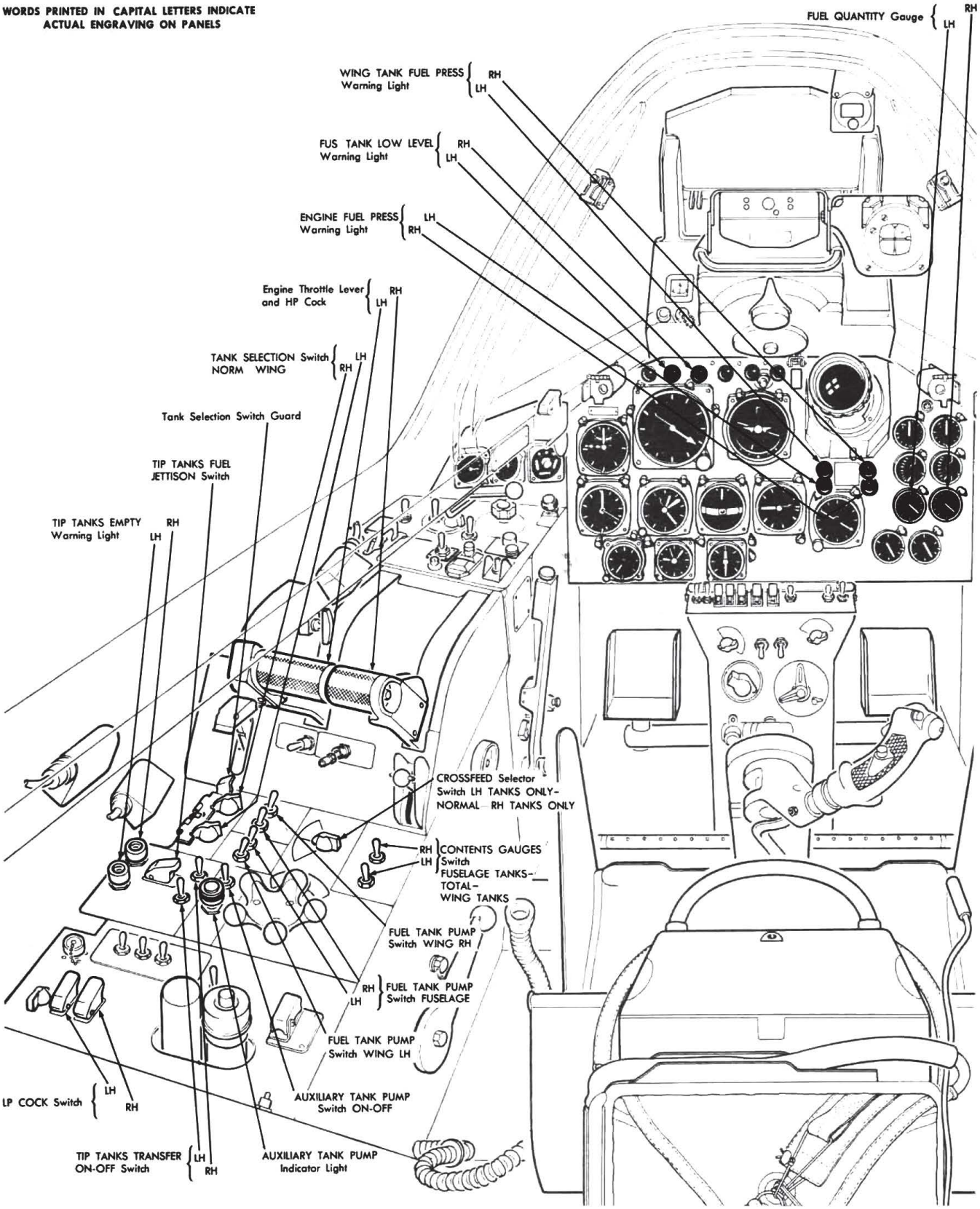
Unless the auxiliary pump switch is turned OFF either automatically or manually, the wing transfer pumps will not be energized and hence no wing fuel transfer will take place. (See also Part 3 para 30).

NOTE

When the wing tanks are empty the wing pumps must be selected OFF as they are fuel lubricated and will seize if allowed to run dry.

17 If wing tip tanks are used the fuel selections on starting the engines are: fuselage tanks ON, wing tanks OFF, auxiliary tank OFF until airborne and flaps retracted. When the auxiliary tank green transfer light goes out, the wing tip transfer switches should be selected ON. When the wing tip tanks are empty, two warning lights illuminate. The tip tank transfer switches should then be selected OFF, and the wing transfer pumps switched ON.

NOTE


WORDS PRINTED IN CAPITAL LETTERS INDICATE ACTUAL ENGRAVING ON PANELS
FUEL QUANTITY Gauge RH LH
WING TANK FUEL PRESS Warning Light RH LH
FUS TANK LOW LEVEL Warning Light RH LH
ENGINE FUEL PRESS Warning Light LH RH
Engine Throttle Lever and HP Cock RH LH
TANK SELECTION Switch NORM WING RH LH
Tank Selection Switch Guard
TIP TANKS FUEL JETTISON Switch
TIP TANKS EMPTY Warning Light RH LH
CROSSFEED Selector Switch LH TANKS ONLY- NORMAL RH TANKS ONLY
RH LH CONTENTS GAUGES Switch FUSELAGE TANKS- TOTAL- WING TANKS
FUEL TANK PUMP Switch WING RH
RH LH FUEL TANK PUMP Switch FUSELAGE
FUEL TANK PUMP Switch WING LH
LP COCK Switch LH RH
AUXILIARY TANK PUMP Switch ON-OFF
TIP TANKS TRANSFER ON-OFF Switch LH RH
AUXILIARY TANK PUMP Indicator Light

FUEL SYSTEM CONTROLS

18 A high pressure and a low pressure cock are fitted for each engine. The HP cocks are operated during the aft portion of travel of the throttle levers and the LP cocks are operated by two switches fitted on the rear of the LH console. A CROSSFEED switch, with an identification pin, is fitted on the LH console immediately aft of the throttle box and has three positions, LH TANKS ONLY, NORMAL, and RH TANKS ONLY. On each crossfeed position the crossfeed valve is open, permitting the tanks selected to supply both engines. Two rotary switches on the LH console marked TANK SELECTION, have two positions, NORM and WING. On NORM the position of the various shut-off valves is controlled to allow the fuel supply to be fed from the fuselage tanks, and on WING the fuel supply is from the wing tanks only. The tank selection switches are fitted with a guard which locks the switches at NORM.

CAUTION

The selections defined in Part 3 Emergency Handling must not be used except where a genuine emergency exists.

TIP TANK SWITCHES

19 Two switches marked TIP TANK TRANSFER are located on the LH console aft of the throttle box, and control the supply of air from the engine compressors to the tip tanks.

FUEL TANK WARNING LIGHTS

20 A green indicating light fitted on the LH console and marked AUXILIARY TANK PUMP is illuminated when the auxiliary tank transfer pump is switched on, and goes out when the transfer pump is switched off, either automatically or manually.

NOTE

operating. During transfer of fuel from the auxiliary tank a check should be kept on the fuselage tank contents. Any decrease in contents before the green indicating light goes out will signify malfunction of the auxiliary tank transfer pump. (See Part 3 para 30).

21 Two warning lights marked WING TANK FUEL PRESS on the main panel, illuminate when the wing tank fuel transfer is complete, and go out when the transfer pumps are switched off.

NOTE

The lights may also illuminate when the tanks are low and the aircraft is diving or rapidly decelerating.

22 Two warning lights marked TIP TANKS EMPTY, fitted on the left-hand console, indicate when the wing tip tanks are empty, and go out when the tip tank transfer switches are switched off.

23 Two warning lights identified FUS TANK LOW LEVEL are fitted on the main panel to indicate when the respective fuselage tank contents is below 100 usable gallons (120 US gal).

NOTE

The low level warning lights are float operated and illuminate at the 100 gallon level irrespective of the weight of the fuel.

FUEL PRESSURE INDICATORS

24 Two warning lights on the main panel marked ENGINE FUEL PRESS, will illuminate if the fuel pressure from the fuselage tank booster pumps falls below 3 psi.

FUEL TANK CONTENTS INDICATORS

Each switch has a FUSELAGE TANKS, WING TANKS and TOTAL positions. When the switches are held in the FUSELAGE position the gauges read the contents of the fuselage tanks; when held in the WING position the gauges read the contents of the wing tanks; in the central position the gauges read the TOTAL content of the wing and fuselage tanks. The aircraft must be flying level and the switches held in the required position for up to 15 seconds to ensure an accurate reading.

NOTE

The wing tip tanks or auxiliary tank contents are not indicated by either gauge.

TIP TANKS FUEL JETTISON

26 A guarded switch, marked TIP TANKS FUEL JETTISON, is located on the LH console outboard of the tip tank transfer switches.

27 When it is necessary to jettison the fuel in the tip tanks, switching the TIP TANKS FUEL JETTISON switch to ON releases the contents of a high pressure air bottle in the fin of each tip tank. The air pressure blows off the rear ends of the tip tanks and releases the fuel to atmosphere. A micro-switch on the landing gear makes jettisoning of the fuel impossible when the weight of the aircraft is on the wheels.

OIL SYSTEM

GENERAL

28 The oil system on each engine is entirely self contained and automatic, the pilot having no manual control. An oil tank with a capacity of 17.3 pints is fitted on each engine.

OIL PRESSURE INDICATORS

29 Two oil pressure gauges, one for each engine, are mounted on the RH side of the main panel.

HYDRAULIC SYSTEM

GENERAL

system. The following components are hydraulically operated:

Landing gear
Main landing gear up-locks
Landing flaps
Speed brakes
Flying control hydro-boosters
Brakes
Nose-wheel Steering

31 Normal system pressure is 1900-2300 psi and is shown on the hydraulic pressure gauge mounted on the bottom left-hand side of the pilot's main panel. A relief valve fitted in the power line relieves any pressure in excess of 2700-2950 psi.

POWER PACK

32 The power pack is normally used for operating the hydraulic services when the aircraft is on the ground and the engines are stopped. In an emergency the power pack may be used for a short period in the air as outlined in Part 3 para 15.

WARNING

Do not use the power pack for any other malfunction.

33 Control of the power pack is by means of a spring-loaded ON-OFF switch marked HYD TEST PUMP, located on the LH console, outboard of the emergency undercarriage control.

CAUTION

A maximum time limit of 10 seconds at full operating pressure is imposed and must then be followed by a cooling period of two minutes. Intermittent operation of the power pack may be carried

PNEUMATIC SYSTEMS

HIGH PRESSURE PNEUMATIC SYSTEMS

34 Two independent high pressure pneumatic systems are fitted, one for the landing gear, and the other for the flaps. One DOWN selection only is permitted with each system.

LOW PRESSURE PNEUMATIC SYSTEM

35 The low pressure pneumatic system supplies air bled from the engine compressors to the canopy seal, the hydraulic reservoir, the wing tip tanks, and the anti-g suits.

ANTI-G SUIT CONTROLS

36 A shut-off valve located at the aft end of the LH console in each cockpit controls the low pressure air supply to the anti-g suit. Selection for HI or LO can be made at the crew members discretion, but the suit will only be inflated when "g" is experienced. A hinged protection cover is fitted to the valve in the navigator's cockpit.

CANOPY SEAL

37 The canopy seal is automatically inflated when the canopy is in the closed position, and deflated when the canopy is selected open by either the internal or external switches, or when any of the canopy declutch handles are operated.

ELECTRICAL SYSTEM

GENERAL

38 The 28 volt DC power supply is provided by a 400 amp generator on each engine, and by a 24 volt battery fitted in the rear centre section.

GROUND/FLIGHT SWITCH

39 A FLIGHT-OFF-GROUND switch is mounted at the forward end of the pilots RH console. The switch is selected to FLIGHT for engine starting and when the engines are running. In the GROUND position external

GENERATORS

40 A control switch for each generator is mounted on the forward RH console in the rear cockpit. These switches have ON and OFF positions and are marked DC GENERATORS LEFT/RIGHT. They allow the generators to be switched off in the event of generator malfunction.

41 Two warning lights, marked GENERATORS, are mounted on the main instrument panel in the front cockpit. A light will illuminate if a generator circuit breaker opens, a generator fails, a short circuit occurs or an overvoltage condition exists.

NOTE

The GENERATOR fail warning lights illuminate when the Ground/Flight switch is selected on, and remain illuminated until the engines are started and the generators are switched on.

42 One GENERATOR FAIL RESET push button switch is located in the rear cockpit on the forward RH console and controls both generators.

ALTERNATORS

43 An alternator is fitted to the LH engine and its operation is automatic when the engine is running. Two ALTERNATOR OVER TEMP warning lights are fitted on the forward RH console in the rear cockpit, however only the LH light is operative.

44 The alternator supplies the following services:

Front cockpit console lights
Windshield de-icing heating elements
IFF (Emergency operation)

INVERTERS

45 The aircraft is equipped with the following inverters; a main and emergency for air-

46 The following units are supplied by the main aircraft inverter, the operation of which is automatic on selecting the Ground/Flight switch to GROUND or to FLIGHT:

IFF
Fuel quantity gauges
Attitude gyro indicator
R-Theta system
J2 compass
Oil pressure gauges
Flap position indicator
Windshield de-icing temp. control unit
Auto-pilot
Yaw damper

47 Changeover to the aircraft emergency inverter, and the UHF emergency inverter, is automatic should the respective main inverters fail. On the aircraft emergency inverter the following services will not function; auto pilot, yaw damper and R Theta computor. The IFF will automatically transfer to the alternator.

48 Failure of the main aircraft inverter is indicated by the illumination of a warning light, marked EMERGENCY INVERTER, fitted on the top RH corner of the main panel.

49 Failure of the main UHF inverter is indicated by the illumination of a warning light marked INVERTER UHF No 2 ON fitted on the forward LH console of the rear cockpit.

FUSE AND CIRCUIT BREAKER PANELS

50 The main fuse panel is located on the RH console in the rear cockpit. Spare fuses are carried in a container marked SPARE FUSE BOX on the RH side wall. The main circuit breaker panel is fitted on the RH side panel, with auxiliary circuit breakers for armament and radio respectively on the RH and LH side walls of the rear cockpit. A voltmeter and ammeter are located on the rear cockpit RH console, left or right generator selection being obtained through a BUS-LEFT-RIGHT selection switch aft of the indicators.

ENGINE STARTING SERVICES

taken from an external 28 volt ground energizer when ground starting, and from the aircraft battery when relighting an engine in the air.

52 The ground energizer also provides the power supply for the engine starters, through the external power supply socket.

53 The timer unit in the starter system is normally set to operate for 40-50 seconds. If faster engine starts are required, the timer may be reset to operate for 28-30 seconds. In either case the timer cuts out automatically after the preset period. The average time taken to reach self-sustaining rpm on a standard day is approximately 20-22 seconds, and to reach idle rpm approximately 30 seconds.

CAUTION

The timer should normally be permitted to complete a full cycle prior to selecting the second engine start. In the case of an operational scramble when a faster engine start is required, following the procedure given in Part 2 para 10, will ensure no damage occurs to the ignition relays.

WARNING AND INDICATING LIGHTS

54 All standard red and amber warning lights and green indicating lights may be rotated for day or night use and incorporate a "press to test" switch.

FLYING CONTROLS

GENERAL

55 The flying controls are of conventional design utilizing the divided type control column and parallel pedal rudder bar. Manual control is assisted by hydraulic boosters.

FLYING CONTROL BOOSTERS

56 A hand operated lever fitted to the side of the LH console and marked CONTROL

hydraulic failure. The lever is normally in the "up", on, position and is witness wired in this position.

57 A warning light fitted on the main panel and marked BOOST PRESS gives warning of decreasing hydraulic pressure, and if this light comes on, the control lever should immediately be pushed down to the OFF position. The boost pressure warning light will remain illuminated with the control booster OFF.

NOTE

The warning light is fitted with a spring-loaded cover which is normally wire-locked "up". The light may be covered to prevent glare when required by breaking the lock-wire and allowing the cover to spring closed.

58 A green indicating light is fitted on the main panel and is marked BOOSTER TEST. When the bulb is pressed it will illuminate if all hydro-booster units are properly engaged.

59 A hydraulic accumulator in the control booster circuit prevents a sudden drop of hydraulic pressure which would result in the controls locking.

CONTROL LOCKS

60 The control surfaces may be locked either by fitting external control locks, or hydraulically from the cockpit. With the engines stopped and the power pack or external ground rig switched off, continued movement of the control column will reduce the hydraulic system pressure to the point where a hydraulic lock is achieved in the flying control booster circuit, rendering the controls immovable. The control booster lever must be in the up position during this operation.

TRIM TAB CONTROLS

61 A handwheel and position indicator for the rudder trimmer is located at the aft end "forward" (nose down) and "back" (nose up) by the pilot's thumb. The elevator trimmer is driven by a DC reversible electric motor.

63 When the trim tab limit is reached, the trim servo clutches will slip and prevent further movement of the trim tabs. This applies to auto-trim function also. The clutches must not be slipped for more than 1-1/2 minutes at any one time.

NOTE

The elevator trim position indicator is marked from 24° NOSE UP to 6° NOSE DOWN. However, the available nose down trim is limited to 2-1/2°.

64 The elevator trim position indicator is located on the left-hand side panel and is marked ELEV TRIM.

65 An ELEVATOR TRIM switch with NORMAL and EMERGENCY OFF positions is located on the left console, immediately in front of the throttle levers. When selected to EMERGENCY OFF the elevator trim motor is shut off and the elevator trim button and the autopilot auto-trim are ineffective. The trim tabs will be left in the position they occupied at that time.

YAW DAMPER

66 The yaw damper can be considered as part of the autopilot. (See para 86). It may be used independently, if desired. (See Part 2 para 87).

NOTE

When the autopilot is engaged, the yaw damper is engaged regardless of the positionof the DAMPER-ON-OFF switch or the position of the landing gear.

YAW DAMPER ADJUSTMENT

67 A knurled knob located on the pilot's armament panel and marked YAW DAMPER ADJUSTMENT is used to trim the aircraft until

unless ground adjustments have been carried out on the yaw damper system. The arrow on the adjustment knob should be approximately in the 12 o'clock position for engagement and should agree with a reference mark on the armament panel.

YAW DAMPER LIMITATIONS

68 The yaw damper has the following limitations:

(a) It is only effective against transient yaw and will not give co-ordinated flight if the static stability of the aircraft changes (such as asymmetric power). The yaw damper adjustment can be used to trim for a different static stability configuration.

(b) Due to the positioning of the turn and bank indicator, slight skid indication may be shown even in a co-ordinated turn. This indication will increase with the rate of roll.

(c) It will only co-ordinate turns up to 60° of bank angle and to a maximum roll rate of 45° per second.

(d) It is not designed for unco-ordinated manoeuvres such as slow roll, etc.

RUDDER PEDAL ADJUSTMENT

69 A handle fitted on the LH side panel and marked RUDDER PEDALS PULL TO ADJUST, releases a locking pin which allows the pedals to spring towards the pilot's feet. When the desired adjustment is made the handle should be released and then pushed in. The pedals should be moved slightly to ensure positive re-engagement of the locking pin.

LANDING FLAPS

70 The landing flap selector lever is installed on the rear face of the throttle box. It is protected by guards and is marked FLAPS UP -25° -60°. The lever operates in a gate fitted with stops to ensure positive location of the lever for the various flap settings. An EMERG

71 The LANDING FLAP indicator is mounted on the LH side panel.

LANDING GEAR CONTROLS

72 The landing gear is operated by two buttons marked DOWN and UP respectively, located on the LH console forward of the throttle box and marked UNDERCARRIAGE. A force of approximately 40 pounds must be applied to the UP button when the aircraft is on the ground, should it be necessary for the landing gear to be retracted in an emergency.

LANDING GEAR POSITION INDICATOR

73 A landing gear position indicator on the LH side panel incorporates a dimming shade and an alternative filament switch. The indications are:

Landing gear locked UP - No lights

Landing gear between locks - Three red lights

Landing gear locked DOWN - Three green lights

NOTE

On selection of the speed brakes, a momentary fluctuation in the hydraulic return line may actuate the landing gear red position lights micro-switches. This indication is only momentary and in no way implies a landing gear malfunction.

74 A landing gear warning light marked U/C WARNING, located at the forward end of the LH console, will illuminate when the RH throttle lever is less than one third open if the landing gear is not locked down.

EMERGENCY LOWERING LANDING GEAR

75 A button identified U/C EMERGENCY DOWN is mounted on the RH side of the rear

76 Emergency lowering of the landing gear by air pressure is effected by means of the control lever marked EMER U/C DOWN mounted outboard of the control buttons, and protected by a spring-loaded guard. One down selection only is permitted.

BRAKES

77 The brakes are controlled by toe operated extensions fitted to the rudder pedals, and are operated by hydraulic pressure from the hydraulic pump. In the event of pump failure an emergency accumulator in the system provides fluid under pressure for brake operation.

78 The Maxaret brake system reduces the possibility of tire blow-out due to the locking of the aircraft wheels. It can also reduce the landing run considerably, if required.

79 Should the pilot's pressure on the brake pedals be sufficient to cause skidding of an individual wheel, the Maxaret unit senses the start of the skid and cuts off the pressure supply to the brakes. At the same time the brake pressure is reduced and consequently the brake torque. When the wheel has recovered speed the pilot's pressure is again introduced to the brake cylinder and full torque is applied. A rapid cycling of the Maxaret units will result from intentional over-braking.

80 The main and emergency brake accumulators are part of separate systems, although both are maintained at pressure by the main hydraulic supply. The main accumulator serves the brakes in the event of low pressure, or loss of pressure in the main supply, and is controlled by the operation of the foot-pedals.

81 If a failure occurs in the main supply, cycling of the Maxaret units due to heavy braking may cause the main accumulator to be exhausted. An emergency supply is available stored in the emergency accumulator and is controlled by the operation of the EMERGENCY and PARKING BRAKE. The hand brake applies the brakes evenly on both sets of wheels, therefore no differential control is possible. The hand brake is very effective and, as the

SPEED BRAKES

82 A speed brakes selector switch, identified DRAG FLAPS, is fitted on the forward face of the RH throttle lever and has two positions, OPEN and CLOSED.

NOSE-WHEEL STEERING

83 The aircraft is equipped with a nose wheel steering system which facilitates taxying.

84 Depressing the push button switch (see fig 1-5) on the control column handgrip completes the power supply for the system. The system is energized by the initial movement of a brake pedal, which causes fluid from the main hydraulic system to flow to one side of the shimmy damper and turn the nose wheel in the appropriate direction. The power supply is interrupted when the button is released and the system is de-energized when the pressure on the brake pedal is removed or when both brake pedals are depressed.

85 The following operating characteristics and limitations should be noted:

(a) The system is designed for use during low speed taxying and parking only, and minimum radius turns should only be carried out at very low speeds. Side loads on the nose wheel, caused by turning too fast, may be very high and may easily damage the leg mechanism.

(b) The steering angle of the nose wheel is limited by micro-switches to approximately 50° to the left or right, but the nose wheel can castor through a greater angle.

(c) Should the nose wheel skid during manoeuvres on ice, the selection should be released immediately to allow the nose wheel to castor and prevent the excessive side loads which occur when skidding from ice onto dry ground.

(d) When the steering is engaged, the flaps and dive brakes are inoperative.

CAUTION

Nose wheel steering must not be energized during take-off or landing. This is a precaution to prevent steering of the nose wheel while it is off the ground and the weight of the aircraft is still on the main wheels.

AUTOMATIC PILOT

GENERAL

86 The automatic pilot (E11B) consists of three control channels which are utilized to provide automatic control in the roll, pitch and yaw axes of the aircraft.

87 Direct control is afforded the pilot by means of a turn control knob and a pitch control wheel. They allow the aircraft to be adjusted to any attitude of flight within limits, by operation of the ailerons and elevators. Any yawing tendency is corrected by the turn co-ordinating yaw damper through rudder action.

88 An automatic trim control is fitted, which, if selected on with the autopilot engaged, maintains correct elevator trim for varying conditions of flight.

89 The autopilot controls comprise the following:

(a) A Flight Controller panel and a Function Selector panel located on the pilot's RH console.

(b) A release button fitted at the base of the control column grip.

(c) A warning light marked AUTO TRIM located on the LH side of the main instrument panel.

FLIGHT CONTROLLER PANEL

(a) A spring-loaded switch fitted with guards and marked ENGAGE. It is spring-loaded to off and only remains in the on position when the gyros are at operating speed and the turn control is in detent.

(b) A TURN control knob with a centre detent position. It must be in detent before engaging the autopilot. When moved out of detent to either side, with the autopilot engaged, command signals are fed to the ailerons and allow turns to be made. These turns will be co-ordinated by the yaw damper automatically.

NOTE

A directional coupler amplifier serves as a link between the autopilot and the J2 compass. This maintains the aircraft on the course at which the autopilot was engaged and any movement of the turn control out of detent disconnects the J2 compass from the system. It is reconnected when the turn control is returned to detent.

CAUTION

The variation setting knob of the G.S.I. computer in the rear cockpit must not be moved by the navigator while the aircraft is being flown with the autopilot engaged. Any movement of the variation knob will effect the J2 compass, and with the turn control in detent the autopilot will turn the aircraft rapidly to the new heading.

(c) A PITCH control wheel which is positioned fore and aft. With the autopilot engaged this wheel is rotated forwards for the aircraft to descend or backwards to climb. The control wheel is continuously repositioned with movement of the elevators when the autopilot is disengaged, therefore no adjustment is required before engaging the autopilot.

FUNCTION SELECTOR PANEL

(a) A POWER ON/OFF switch which provides power to all three control channels. It must be ON for the autopilot to operate and for the yaw damper to be used independently.

(b) An AUTO TRIM ON/OFF switch which controls the power to the elevator trim sensor and with the autopilot engaged, automatically maintains elevator trim. Any "out-of-trim" condition which is beyond the correcting capacity of the auto trim circuit is indicated by a red warning light located on the pilot's instrument panel.

(c) A DAMPER ON-OFF switch which enables the yaw damper system to be used independently (i.e. without elevator and aileron channels) when the landing gear is raised. With the landing gear lowered this switch is rendered inoperative and the yaw damper is automatically disengaged.

(d) BREAKAWAY ON/OFF switch (fitted with guards). Not at present operative.

(e) ATTACK ON/OFF switch. Not at present operative.

(f) APPROACH ON/OFF switch. Not at present operative.

(g) LOCALIZER ON/OFF switch. Not at present operative.

(h) ALTITUDE ON/OFF switch. Provides input, through the altitude controller to the elevator channel and maintains the altitude at which the controller is engaged. See Part 2 para 84.

RELEASE BUTTON

92 The autopilot release button is fitted at the base of the control column grip. When this is pressed the autopilot is disengaged and the engage switch on the controller panel automatically returns to the disengage position.

AUTO TRIM OPERATION

93 Under normal flying conditions with the However, as soon as a predetermined out-of-trim load is applied to the elevator control system a micro-switch closes and causes actuation of the elevator trim tabs in the direction which will reduce the out-of-trim load. This will open the micro-switch, and further movement of the trim tabs will cease.

WARNING LIGHT

94 Any out-of-trim condition which is beyond the correcting capacity of the auto-trim circuit is indicated by the illumination of a red warning light marked AUTO TRIM, located on the pilot's instrument panel. (See Part 3, para 28).

NOTE

When the auto-trim switch is ON with the autopilot engaged, the manual trim switch on the control column is inoperative.

95 A momentary illumination of the light would indicate that maximum loading on the elevator controls had been reached but correcting action of the trim tabs had automatically taken place and the load reduced.

ELEVATOR TRIM NORMAL-EMERGENCY OFF SWITCH

96 This switch, located in front of the throttle levers, controls both manual trim and auto trim function. It is a safety feature for quick 'cut-out' of the trimmer in case of failure to stop in the desired position.

AUTOPILOT LIMITATIONS

97 The autopilot has the following limitations:

(a) It will not engage if the aircraft is banking at an angle in excess of 29^{o}.

(b) It may take up to ten seconds to achieve lateral level after engagement or coming out of turns.

(d) The maximum angle of climb or dive with the pitch control is 50°

(e) The altitude control should maintain the reference altitude to ± 60 feet or .2% of the reference altitude whichever is the greater.

(f) With the altitude control engaged in turns (of less than 180°), the reference altitude should be maintained to ± 70 feet, or .7% of the reference altitude, whichever is the greater.

(g) The maximum heading change obtainable is unlimited. However, if a continuous heading change is made of more than 180°, precession of the vertical gyro may take place. This will be indicated by an excessive loss or gain in altitude during turning, and upon returning the turn control to detent, lateral level may take some time to attain.

CAUTION

If the autopilot produces an "out of control" manoeuvre, it should not be re-engaged until it has been ground checked and found serviceable.

ENGINE CONTROLS

THROTTLE CONTROLS

98 Two conventionally operated throttle levers are installed on the LH console. Moving the levers aft of the idle position cuts off the HP fuel supply to the engines. The levers are moved to the cut-off position by lifting and pulling the levers back. A friction nut is fitted on the side of the throttle box.

NOTE

It is not necessary to depress the levers when moving them forward to the idle position.

ENGINE STARTING CONTROLS

99 The engine starting controls comprise:

(a) A GROUND/FLIGHT switch located on

(b) An ENGINE STARTING switch with LEFT-RIGHT positions which is spring-loaded to the centre "off" position, located on the LH console.

(c) A relight button on each throttle lever.

(d) A switch, marked C26 START/NORMAL, located under the external power supplies access panel. The switch must remain at NORMAL, except when starting with a C-26 energizer. See Part 2 para 11.

OTHER CONTROLS

SLIDING CANOPY

100 The canopy is opened or closed electrically. A switch, spring-loaded to the centre "off" position and marked CANOPY, OPEN and CLOSE, controls the operation. The switch is located on the forward LH console in the front cockpit and is protected by a guard. A similar switch is fitted on the forward LH console in the rear cockpit.

NOTE

To ensure, from inside the pilot's cockpit, that the canopy is fully closed, a white line is marked on the canopy and seal retainer on both sides of the cockpit. The thinner lines on the canopy must be within the limits of the thicker line on the seal retainer.

101 The canopy will lock in any intermediate position when the switch is released. In the air the canopy may be opened up to 10 inches at speeds not exceeding 250 knots IAS at altitudes not exceeding 10,000 feet. A placard attached to the LH canopy decking marks the 10 inch open position.

102 Two push button switches marked OPEN and CLOSED respectively, mounted on the left-hand side of the fuselage at eye level below the windshield, control the canopy from outside the cockpits.

and a handle with a hinged cover, secured by a fastener, mounted externally on the left side of the fuselage at the rear of the canopy. The cover is marked CANOPY EMERGENCY RELEASE - LIFT COVER, ROTATE HANDLE, PUSH BACK CANOPY, in red letters.

WARNING

The CANOPY DECLUTCH PULL lever must not be operated in flight (except under extreme emergency - see Part 3 para 55).

104 In an emergency the canopy can be jettisoned at any time by means of a lever, protected by a cover, located on the LH thigh guard of each ejection seat. The cover is witness wired, and is marked PUSH COVER FORWARD TO EXPOSE CANOPY JETTISON LEVER. The lever handle is fitted with a spring-loaded latch which must be raised to release the lever locking plunger from detent. The action of pulling the lever fully back withdraws the canopy sear and mechanically fires a primary cartridge. The primary cartridge fires the main cartridge which then fires a cartridge in each explosive link. The links separate and release the canopy rails. At the same time gas pressure from the main cartridge passes to two jacks which extend and force the canopy away from the aircraft. Two sprags are fitted to the rear seat guide rail to stop the rear end of the canopy in case it tends to pivot forward into the rear cockpit.

NOTE

The canopy will jettison when the aircraft is stationary, and from any position between closed and 10 inches open.

105 The canopy seal deflates when the canopy is selected open by the internal or external switches or when any of the canopy declutch handles are operated.

SEAT HEIGHT ADJUSTMENT

lever, which can then be raised or lowered to obtain the desired seat adjustment. Ensure that the ratchet pawl is engaged on releasing the button, and then allow the lever to spring back to its original position.

NOTE

The seat height should be adjusted before flight to position the occupant's head in the correct position against the headrest in order to facilitate operation of the overhead blind for seat ejection, if required.

SEAT BACK ADJUSTMENT

107 The seat back angle is adjusted by pulling back the control lever which projects from the RH thigh guard. The seat will only lock in the fully back position when the lever is released.

AIR CONDITIONING SYSTEM

GENERAL

108 The cabin pressurization, ventilation and temperature control is automatic once initial selection is made. A three position CABIN AIR control switch marked NORMAL-OFF-EMERGENCY, and a temperature setting rheostat switch marked COOL-HEAT, and a manual override switch marked AUTO-HEAT-COOL, are mounted on the LH forward console. The manual override switch will remain in the AUTO or off positions but is spring-loaded to off from the HEAT or COOL positions. Cabin temperature may be controlled by this switch if the automatic operation fails. The cabin may also be heated or cooled quickly at any time by holding this switch to the appropriate position for 30 seconds. It should be returned to AUTO when the desired temperature is reached. A warning light fitted on the RH side panel, and marked CABIN PRESSURE WARNING, will illuminate if at any time the cockpit pressure is reduced to the equivalent of 31,000 feet (± 1800 feet) or higher.

NORMAL OPERATION

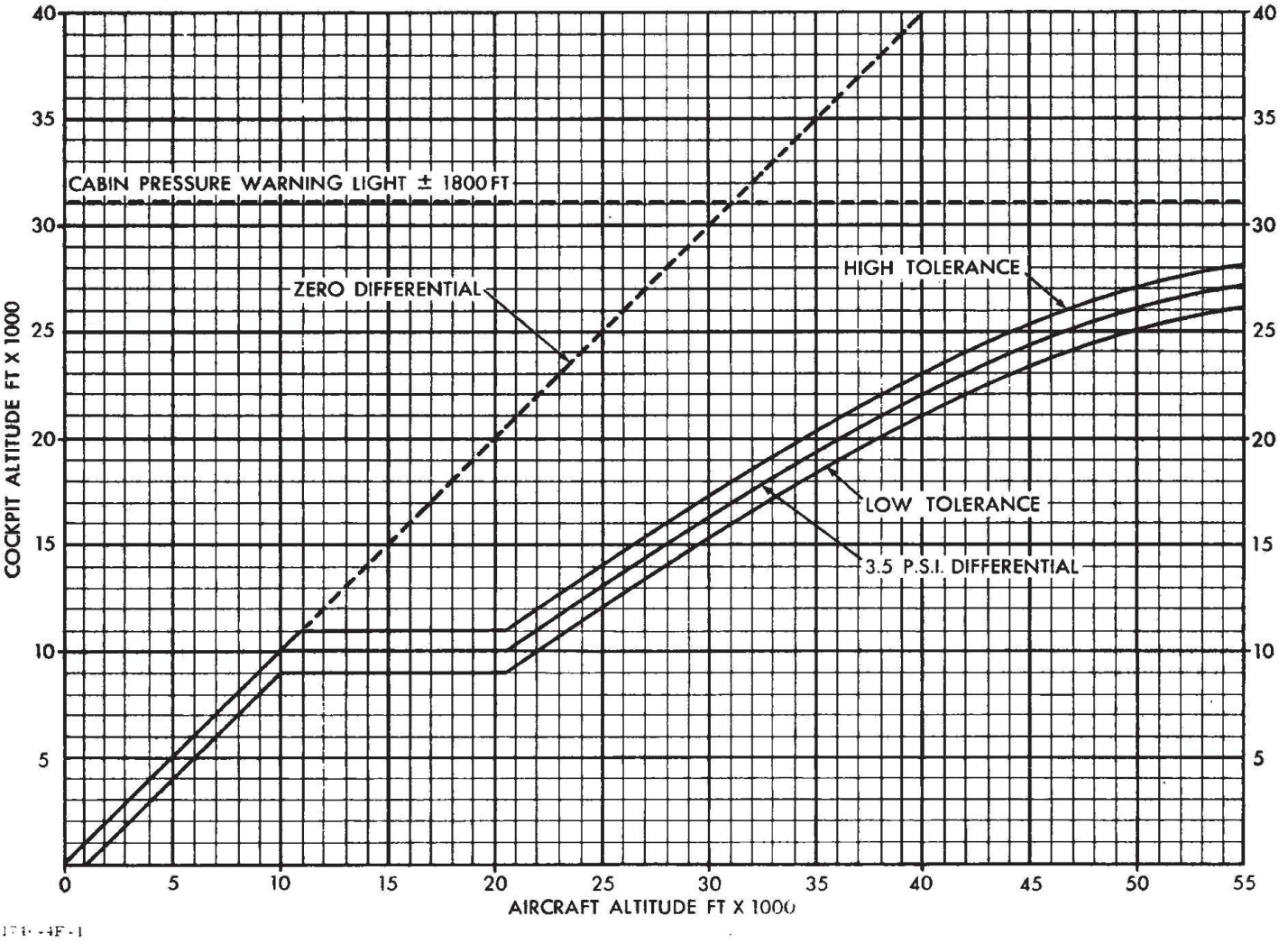


Fig. 1-3 Pressurization Curve

110 The position occupied by the CABIN AIR control switch when the pilot enters the aircraft does not necessarily show the degree of opening of the shut-off valve which controls pressurization. To ensure positive control of the valve, if the pilot wishes to complete the take-off without pressurization, the NORMAL position should be selected for a minimum of 30 seconds and the switch then returned to EMERGENCY and left in this position until the aircraft is in flight. If normal operation of pressurization is required, EMERGENCY should first be selected for three seconds and then the switch may be moved to NORMAL.

NOTE

close or alternatively it must be fully closed in order to open.

111 The cabin pressure altitude is shown on a gauge fitted to the main instrument panel in the pilot's cockpit and is marked CABIN PRESSURE. The cabin pressure remains the same as the outside air up to 10,000 feet. From 10,000 feet to 20,500 feet it is maintained at the 10,000 feet pressure. From 20,500 feet up to aircraft ceiling, it is maintained at a pressure differential of 3.5 psi to the outside air.

112 When the engine de-icing system is in operation, alcohol fumes may become very

will clear the fumes but will automatically depressurize the cabin.

CABIN VENTILATION

113 Cabin air EMERGENCY may be selected at any time in the air if the normal air conditioning fails, or when the aircraft is on the ground. With the selector in this position the dumping valve is open, the supply of air from the engine compressors is shut off, and the ventilation blower supplies outside air to the cabin. The ventilation blower does not pressurize the cabin.

LIGHTING EQUIPMENT

EXTERNAL LIGHTS

114 The retractable landing light in the left wing is operated by an ON-OFF switch, and an EXTEND-RETRACT position switch with a central STOP position. The landing light switches are mounted on the rear face of the throttle box. The navigation lights are controlled by a FLASH-OFF-STEADY switch marked NAV LIGHTS, on the RH console in the front cockpit.

COCKPIT LIGHTS

115 Individual lights for the instruments on the main panel and a red panel floodlight on the control column are controlled by a rheostat switch fitted at the end of the RH console, marked INSTRUMENT PANEL LIGHTS. Console red lights are controlled by an adjacent rheostat switch marked CONSOLE LIGHTS. On the same panel is a toggle switch marked STANDBY COMPASS LIGHT ON-OFF.

116 A switch with ON-OFF positions is fitted adjacent to the standby compass light switch and marked AUX FLOOD LIGHTS. This switch controls two red flood lights for use when starting the engines at night.

117 A toggle switch marked GROUND TEST AC LIGHTS, with NORMAL and TEST posi- be checked by a supply from the main inverter, provided an external source of DC power is available. The switch is spring-loaded from TEST, and returns to the NORMAL position when released.

DE-ICING

WINDSHIELD AND PITOT HEAD

118 The centre panel of the windshield is de-iced and de-misted by the current passing through a coating applied to one of the laminations of glass near the outer lamination. Electrically de-misted side windshield panels are also fitted. Selection is by a switch fitted on the RH console and marked W/SCREEN DE-ICE/PITOT HEAT ON-OFF. When selected ON heat is supplied to the windshield and pitot heads. A sensing unit automatically controls the maximum temperature of the windshield centre and side panels. The temperature of the pitot heads varies according to the amount of heat dissipation, but sufficient heat to prevent icing is maintained.

AIRFRAME AND ENGINE

119 Except for windshield and pitot-head anti-icing described above, the aircraft normally has no airframe or engine de-icing or ice detection systems connected. Two warning lights marked AIRFRAME and ENGINE ICING, and two push buttons marked MANUAL DE-ICING A/F and ENG, are fitted on the forward RH console in the front cockpit. The lights and push buttons are inoperative.

INSTRUMENTS

FLIGHT INSTRUMENTS

120 The standard blind flying instrument panel comprises:

Airspeed indicator
Machmeter
Rate of climb indicator
Altimeter

121 A press button switch marked GYRO ERECTION mounted above the attitude gyro indicator provides for faster recovery of the gyro after violent manoeuvres. This button should not be pressed during the first ten seconds of operation.

NOTE

Fast erection of the attitude gyro indicator should only be carried out when the aircraft is straight and level, on the ground or in flight. The press button must not be operated for a period longer than 60 seconds.

122 A cabin pressure altitude indicator and a clock are fitted on the main instrument panel. An accelerometer is fitted on the RH side instrument panel. A vertical reading type magnetic compass is attached to the upper edge of the windscreen and the deviation card holder marked STANDBY COMPASS is fitted on the side of the RH canopy decking. The gyro-magnetic compass has two deviation card holders, marked GYROSYN COMPASS and GYROSYN COMPASS (WITH TIP PODS), mounted on the side of the RH canopy decking.

WARNING

The accelerometer may under-read as much as .8 "g" at higher accelerations. Care should be taken when the needle approaches the "g" limitations.

123 A J2 COMPASS SLAVING switch is fitted on the RH side panel and has two positions, GYRO COMPASS and GYRO ONLY. On GYRO ONLY, the magnetic sensing of the flux valve is discontinued and the instrument functions as a gyro indicator, requiring resetting to compensate for the effects of precession. Immediately outboard of this switch is a J2 RECYCLE push button switch which enables resetting of the J2 compass when toppling has occurred.

absolutely necessary. Allow at least five minutes recovery time before recycling a second time, and at least ten minutes for any subsequent recycling operation.

NOTE

Do not recycle (fast slave) the gyrosyn compass while the autopilot is engaged, or engage the autopilot while the fast slave cycle is in operation, i.e. for three minutes after pressing the recycle switch.

CAUTION

Cross check the J2 compass heading with the standby compass heading after each recycling operation.

ENGINE INSTRUMENTS

125 The following engine instruments are mounted on the right-hand side of the main panel:

PERCENT RPM - LH and RH indicators
EXH TEMP - LH and RH gauges
OIL PRESS PSI - LH and RH gauges

OXYGEN

126 A high pressure automatic demand oxygen system is fitted, the supply being from four cylinders located in the rear fuselage. When fully charged the cylinders contain oxygen at a pressure of 1800 psi. A flexible tube with a quick release connection is attached to each seat. An oxygen hose plug is fitted in the rear cockpit on the underside of the RH canopy deck. The navigator's oxygen hose must be connected to this plug to prevent oxygen leakage at high altitudes when the aircraft is flown solo.

127 An oxygen regulator (Type A-20) marked AUTOMATIC PRESSURE DEMAND OXYGEN REGULATOR is mounted on the RH side wall of each cockpit. A manual diluter lever is located

allows cabin air to mix with the oxygen and automatically compensates for altitude. On 100% OXYGEN the luminous bars are no longer visible and only pure oxygen is fed to the mask. A press button marked TEST MASK is also provided. This controls a safety pressure valve. An oxygen cylinder pressure gauge is mounted immediately below the regulator and a 'blinker' indicator is mounted at the forward end of this console in the front cockpit. These instruments are duplicated at the forward end of the RH console in the rear cockpit.

128 The 'blinker' is in two halves and is yellow with a black background. On inhaling, the 'blinker' closes and then opens, and remains open until the next inhaling cycle.

129 The type A20 regulator provides automatic pressure breathing in case of cabin pressure failure at high altitudes. Pressure breathing commences at a cabin altitude of approximately 32,000 feet and the delivered pressure increases progressively with an increase in cabin altitude.

OPERATIONAL EQUIPMENT AND CONTROLS

IFF AN/APX-25

130 The AN/APX-25 radar equipment enables the aircraft in which it is installed to identify itself when interrogated by coded transmissions from ground or airborne radar sets. The coded interrogation can be transmitted in any of three modes, classified modes, 1, 2 and 3. Each mode of interrogation initiates the transmission of a corresponding mode of reply from the IFF transponder. The reply is presented on the interrogators radar display adjacent to the target blip. The installation incorporates two methods of reply, normal IFF and SIF (Security Identification Feature), only one of these facilities being available at a time as a pre-set adjustment is required.

131 Two control panels are provided in the rear cockpit on the RH console. The normal IFF panel, which is the operational control for either system, comprises the following:

(1) STDBY - All primary power is on and the set is in readiness for instant use.

(2) LOW - The receiver operates at low sensitivity and replies will be transmitted only on receipt of strong interrogation signals.

(3) NORM - The receiver operates at maximum sensitivity.

(4) EMERGENCY - The transponder operates at maximum sensitivity and transmits the emergency reply to any mode interrogation in normal IFF operation or in reply to Mode 1 interrogation in SIF operation. In both normal and SIF operation the settings of the mode switches do not affect emergency operation. A release button must be depressed to select EMERGENCY. Emergency operation is also initiated on ejection of the front or rear seats providing the MASTER selector is in one of the other three selections.

(b) Two toggle switches, marked MODE 2-OUT and MODE 3-OUT. When a switch is selected to a mode, the set will respond to interrogations in the mode selected, in addition to interrogations in Mode 1.

(c) A toggle switch marked I/P-OUT-MIC. When the switch is held at the spring-loaded I/P (Identification of Position) selection the system will respond to Mode 1 interrogations with two Mode 1/SI (Security Identification) replies while the switch is held and for 30 seconds afterwards. In the OUT position the system operates as controlled by the mode selection switches. In the MIC position, I/P replies are transmitted when the UHF transmitter is energized.

132 The coder control panel, marked SIF, comprises two dual concentric selector knobs for selecting Mode 1 and Mode 3 response coding. The Mode 1 control consists of an eight position outer, and a four position inner dial, giving 32 possible codes. The Mode 3 control consists of two eight position dials

NOTE

The source of AC power for normal IFF operation is the main aircraft inverter. Should the inverter fail the IFF supply is automatically taken from the alternator.

ARMAMENT

GENERAL

133 The armament equipment consists of eight calibre .50 M3 machine guns and two expendable rocket pods. Four 1000 pound bombs may be carried, two beneath each outer wing.

GUN PACKAGE

134 The eight machine guns are carried in a gun package in the underside of the fuselage. A compressed air supply for gun operation is provided and 200 rounds of ammunition are carried for each gun.

135 The gun heaters should be in use at all times during flight to prevent condensation forming on the guns. To obtain gun heat the GUN HEATER INB'D and OUTB'D circuit breakers on the main C/B panel, and the GUN heater switch on the armament panel, must be ON.

ROCKET PODS

136 Each pod carries twenty-nine 2.75 inch Folding Fin, Air-to-Air rockets, and the pod is automatically jettisoned when all rockets are fired.

137 Two non-expendable launchers may be fitted for training purposes, in place of the combat pods. A switch, marked COMBAT/TRAINING, is mounted on the armament ground test panel. The TRAINING position must be used when training launchers are fitted, as these launchers are reloadable and are not intended to be automatically jettisoned at the end of the firing sequence. In an emergency

CAUTION

The switch must be set to COMBAT by the ground crew prior to flight when using combat pods, otherwise automatic jettisoning of the pods will not take place after firing.

138 Visual means of checking on the ground whether the rockets are armed or disarmed, is provided. An access panel is fitted in the underside of the wing at the tip. A red spur protrudes through a slot in the panel when the rockets are armed; the spur is not visible when the rockets are disarmed. A red arrow, with the words "ARMED WHEN RED TAB SHOWING", points to the slot.

NOTE

The rockets may be disarmed by opening the access panel and moving the lever assembly from the fully aft to the fully forward position.

CAMERAS

139 Two type AN-N6 cameras are fitted and provision is made for the fitment of three type AN-N9 cameras. One N6 camera is mounted on the A-4 gun-bomb-rocket sight to record target presentation, while the other N6 camera is located in the left-hand wing and records during firing. One N9 training camera may be fitted under each outer wing. A modified N9 camera forms part of the Visual Identification Pass equipment and it records the display presented on the radar operator's indicator.

FIRE CONTROL SYSTEM

140 An MG-2 Fire Control System is used to aim and fire the rockets when selected to automatic operation, and comprises radar and ballistic computer components, which provide lead collision course information.

NOTE

141 The lift accelerometer of the radar is electrically caged when the landing gear is down, and is uncaged when the landing gear is up, through actuation of the nose-wheel uplock switch. This safeguards the accelerometer against take-off and landing shocks.

CAUTION

The navigator must not use the DISCONN position on the radar set control while the aircraft is performing flight manoeuvres or landing procedures, without allowing 3-1/2 minutes for the roll and pitch control to come to a stop. During the waiting period after the switch has been set to 'disconnect', or in the event of electrical or pressurization failures, the aircraft should proceed in level flight to prevent damage to the roll and pitch control.

142 A toggle switch, fitted to the fuse panel in the rear cockpit, is marked WING CAMERA, TRAINING ON, NORMAL OFF. Camera lead collision course operation is possible in the TRAINING ON position with the Master Armament circuit breaker OFF, and the Armament Selector at ROCKET AUTO 1. In the NORMAL OFF position the camera is set to operate normally.

143 Presentation of a pursuit course attack may be obtained on the pilot's indicator by maintaining the Master Armament circuit breaker OFF, and the Armament Selector to CAMERA, GUNS or ROCKET MANUAL 1.

CHAFF DISPENSERS

GENERAL

143A The chaff dispenser installation consists of two streamlined dispensers, one installed on the outboard bomb rack under each wing; and two control panels, one fitted on each side console in the rear cockpit. The equipment is used to release from the aircraft strips of aluminum foil (chaff), which reflect radar signals and result in a distinctive presentation

mechanism, when operating, detaches the packages from the tape, cuts the tape and ejects the packages into the airstream. A hold-down pad clamps and holds the chaff when the mechanism is not in use.

143C Each dispenser control panel contains a rotary dispenser rate selector marked DISP RATE, with graduations from 1 to 10, and governs the interval between dispensing packages of chaff. A toggle switch marked DISP-OFF-HOLD selects the mechanism on or off. A green light, marked DISPENSING CHAFF, is fitted adjacent to each control panel.

OPERATION

143D To dispense chaff, the DISP RATE selector is set to the desired rate and the DISP-OFF-HOLD toggle switch is selected to DISP. Operating the switch will release the hold-down pad from the chaff and energize the motor to start dispensing chaff. The packages are separated from the tape and ejected into the airstream, where the packages separate and release the foil. At the same time, the tape is cut into small sections and ejected. The green DISPENSING CHAFF light illuminates when the drive motor is energized.

143E If it becomes necessary to terminate the operation before the complete load is dispensed, the switch can be moved to OFF, or alternatively to HOLD and then to OFF. When the switch is moved directly to OFF, the drive motor is de-energized and this selection is satisfactory for level flight. If other than level flight is anticipated, the switch should be selected to the spring-loaded HOLD position for approximately 5 seconds and then allowed to return to OFF. This will lower the hold-down pad onto the chaff packages and hold them securely.

143F If the toggle switch remains in the DISP position until the chaff is exhausted, an automatic cut-off switch will de-energize the drive motor and extinguish the DISPENSING CHAFF light when the last of the chaff leaves the dis-

COMMUNICATIONS EQUIPMENT

UHF EQUIPMENT

144 An AN-ARC552 radio provides UHF communications on 24 pre-set frequencies within the band 225 - 399.9 megacycles. A manual control is also provided whereby any desired frequency within this band may be selected. DO NOT ATTEMPT TO SELECT ON THE MANUAL CONTROL ANY FREQUENCY NOT WITHIN THE UHF BAND 225 - 399.9 mc's.

145 Fitted in the pilot's cockpit are the following controls and indicators:

(a) A radio set control panel marked UHF, fitted on the RH console.

(b) A channel selector rotary switch marked CHAN, fitted on the forward LH console.

(c) A channel indicator consists of two 'nixie' lights controlled by an adjacent toggle switch marked RADIO CHAN IND ON/OFF fitted on the LH side of the main instrument panel.

NOTE

For ground test purposes a UHF TEST panel is fitted on the RH console, and a BAIL OUT UHF/IFF TEST switch is fitted on the bulkhead to the left of the pilot's seat.

146 The UHF control panel has the following switches fitted:-

(a) A four position function selector switch which switches power to the system and allows the following selections to be made:

(1) OFF.

(2) T/R - Main transmitter/receiver is operative on the selected frequency.

(3) T/R + G - Main transmitter/receiver is operative on the selected frequency and the GUARD receiver is operative.

(4) ADF - This position is inoperative.

(b) A two position frequency mode selector switch allows the following selections to be made:

(1) PRESET - The main transmitter/receiver operates on one of the 24 preset frequencies or the guard frequency as selected on the UHF CHAN selector rotary switch.

(2) MANUAL - The main transmitter/receiver operates on the frequency set manually by the group of four MANUAL frequency selector switches.

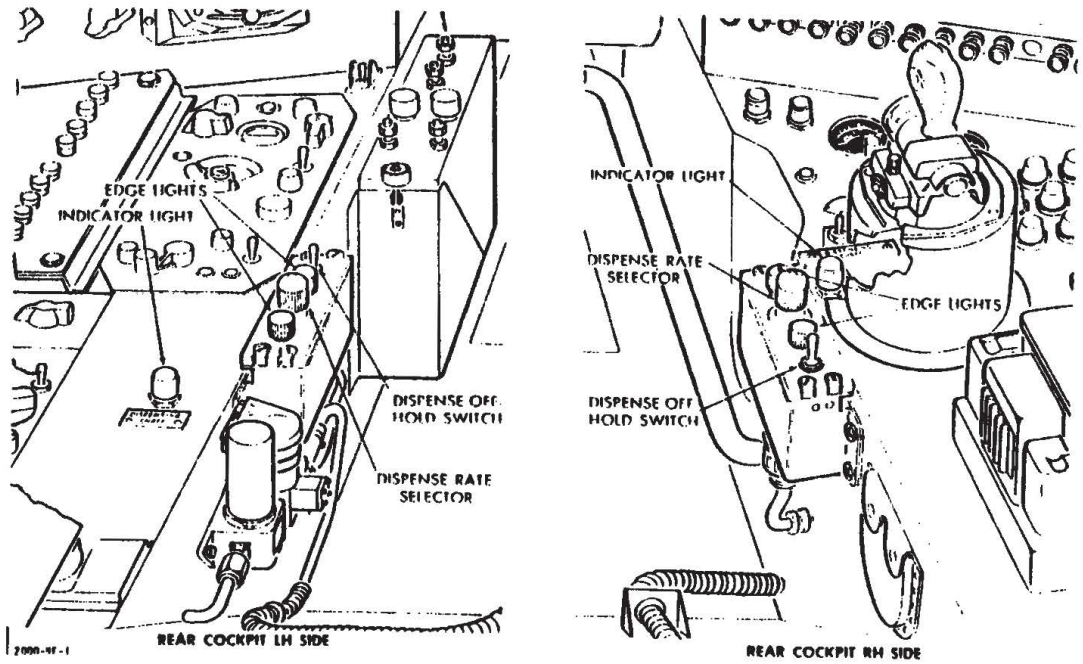


Figure 1-3A Chaff Dispenser Controls

(c) MANUAL frequency selector switches. When operated, digits appear in windows located above each switch and represent the frequency in megacycles.

(d) PASSIVE/ACTIVE transfer control switch. This switch operates in conjunction with a similar switch in the rear cockpit. When a particular switch is in the ACTIVE position that crew member has control of the UHF and the other crew member's switch will automatically be PASSIVE. However, the crew member with the PASSIVE selection may listen on the frequency in use, and also transmit on this frequency by using his "Press-to-Talk" switch. Either crew member may select from PASSIVE to ACTIVE to gain control of the system, and control will remain with that crew member until the other crew member selects ACTIVE.

(e) VOL control adjusts the UHF audio and is designed so that the audio level cannot be reduced to zero.

147 The UHF CHAN rotary selector switch on the LH forward console has marked positions from 1 to 23 and a position marked "G". The numbers represent preset frequency channels, and with the frequency mode selector switch on the UHF control panel set to PRESET, the main transmitter/receiver operates on the frequency of the channel selected, or if the "G" position is selected, it operates on the GUARD frequency.

148 The channel indicator consists of two 'Nixie' lights which display the digits of the channel to which the system is selected, provided the RADIO CHAN IND toggle switch is ON. "G" for GUARD or "M" for MANUAL are shown on the left-hand light, if selected. The "M" indication will be shown for a pilot's selection of MANUAL, or will indicate the navigator has control of the UHF.

149 Fitted in the rear cockpit are the following controls and indicators:

(a) A radio set control panel marked UHF located on the LH console. This control panel is similar to the pilot's except the PRESET/

(b) A warning light marked INVERTER UHF #2 ON is located on the LH console and illuminates if the standby UHF inverter is operating, indicating failure of the main (#1) UHF inverter.

150 When the rear occupant ejects, a switch located on the bulkhead is actuated and causes emergency operation of the IFF only. When the front seat occupant ejects a similar switch causes emergency operation of the UHF and IFF.

INTERCOMMUNICATION

151 Intercommunication is provided by an AN/AIC-10 set. It provides interphone between pilot and navigator and also affords a means of selection of the aircraft's radio facilities.

152 The pilot's control box is installed on the RH console and the navigator's box, which is identical to the pilot's, is installed on the LH console. There is a UHF-ADF muting switch in each cockpit. The navigator's switch, operated by the left foot, is located on the rear of the pilot's bulkhead close to the cockpit floor. The pilot may mute by depressing the lower thumb-button on the control column handgrip, see Figure 1-5. A "Press-to-Transmit" button is fitted in the RH throttle lever in the front cockpit and on the LH console in the rear cockpit.

153 The control box comprises the following switches:

(a) A series of five mixing toggle switches which allow for listening simultaneously on all channels which are selected to the ON position.

Switch 1 marked INTER - For interphone between pilot and navigator.

Switch 2 marked COMP - Radio Compass AN/ARN-6 aural reception

Switch 3 marked COMM - Command Radio - permits UHF reception from other aircraft or ground stations.

Switch 4 - unmarked and not connected - spare.

(b) A six position rotary switch gives the following selections:

Position 1 (Fully counter-clockwise) - spare.

Position 2 - spare.

Position 3 - spare.

Position 4 - Marked COMM - Provides a "live" microphone for interphone without interrupting command radio listening, provided the INTER mixing switch is on. When the PRESS TO TRANSMIT switch is closed, it permits call out on command radio.

Position 5 - Marked INTER - Provides "Press to Transmit" interphone operation.

Position 6 - Marked CALL - Spring-loaded in the fully clockwise position and returns to position 5 when released. When held in CALL position it overrides all other functions irrespective of switch positions and permits interphone without the use of PRESS TO TRANSMIT button.

154 The "Press to Transmit" button is used when the selector switch is in COMM position and it is desired to talk on command radio, and when the selector switch is in the INTER position for "Press to Transmit" interphone operation.

155 A volume control is fitted and adjusts volume of all incoming channels.

156 A toggle switch marked AUX LISTEN-NORMAL is wire-locked in the NORMAL position, but if reception at the station fails, a quick test of the amplifier may be made by breaking the locking wire and listening with the switch on AUX LISTEN; thus cuts out the amplifier. This facility is available for emergency listening in flight. When used, mixing is inoperative and one channel only may be selected by a toggle switch, for listening. If more than one switch is on, the only audible channel will be that given by the first (from the left) of the row of mixing switches that are on. not connected to any audio source. Inadvertent rotation of the selector switch past the COMM position to either normally unused position will result in interruption of the talk facility.

158 Numerous combinations of switch positions are possible but only a few need be considered as useful in service. A commonly used switching arrangement is given below:

(a) Mixing switch on INTER.

(b) Rotary switch to COMM.

(c) Volume control with the white line at between the 12 and 2 o'clock position as viewed from the side. Under this arrangement interphone is available at all times without any other operation, command radio is available for listening; and by pressing the "Press to Transmit" button, transmission on command radio is available.

NOTE

The above position of the volume control will provide maximum efficiency. Movement past this position may be used for radio reception during abnormal atmospheric conditions or weak signal strength. The volume of the UHF and Radio Compass should then be adjusted individually as desired.

159 The muting switch in the rear cockpit, when operated, grounds the UHF and radio compass audio, leaving only the interphone.

NOTE

Headphones and microphones for use with AIC-10 system are as follows:

Headset H-75/AIC
Microphone M-32/AIC

NAVIGATION EQUIPMENT

RADIO COMPASS AN/ARN-6

160 The radio compass receiver is mounted on the LH console in the rear cockpit. The

The pilot's control box is mounted on the RH console adjacent to the UHF controls and the indicator is fitted on the main instrument panel. A similar control box and indicator are provided for the navigator.

161 Control may be gained from either cockpit by turning the OFF-COMP-ANT-LOOP-CONT switch to the spring-loaded position of CONT (Control) and releasing.

162 Control of the radio compass receiver is indicated by illumination of the frequency dial of the respective control box.

R-THETA SYSTEM

163 An R-Theta Computer, and a Ground Speed and Interception Computer are mounted on the navigator's LH instrument panel. The complete system forms a dead reckoning method of navigation which supplies the aircraft's ground position in the form of range and bearing from base or destination. The aircraft's true track is indicated and interception steering information can also be shown.

164 The system is controlled by the navigator who manually sets into the GSIC the wind speed, wind direction and magnetic variation. The GSIC continuously carries out a solution of the triangle of velocities; that is it performs the addition of air speed and wind speed vectors, and taking into account magnetic variation, extracts ground speed and true track data. These are transmitted to the R-Theta computer as electrical signals. The R-Theta computer processes true track and ground speed data with respect to time so as to determine continuously the aircraft's ground position, and displays range, true bearing and true track. Controls for adding arbitrary vectors, and for resetting range and bearing, are located on the face of the navigator's computer.

165 The R-Theta computer shows the true bearing of the aircraft from a chosen reference point, with the double arrows always pointing towards this point. The single pointer indicates the aircraft's true track. The range

EMERGENCY EQUIPMENT

ENGINE FIRE DETECTION AND EXTINGUISHING SYSTEM

166 Each engine has its own independent fire detection system consisting of eleven temperature sensitive detectors mounted at critical points, electrically connected to a warning light fitted above the main instrument panel.

NOTE

The Ground/Flight switch must be in the FLIGHT position for the warning light to illuminate.

167 The fire extinguisher system is operated by pushing the warning light located under a cover marked FIRE LIFT FLAP AND PUSH.

168 The system operates automatically by means of an impact switch upon a deceleration of 6g.

FIRST AID

169 Two sets of shell-dressings are carried. One set is fitted on the LH side of the pilot's seat, and the other is fitted on the LH side of the navigator's seat.

BAIL-OUT SIGNAL

170 A switch, protected by a guard and marked BAIL-OUT SIGNAL, is fitted in the pilot's cockpit, on the rear of the LH console. The bail-out signal switch controls a warning light marked BAIL OUT fitted on the ADF compass loop base in the navigator's cockpit.

EJECTION SEATS

171 The pilot and navigator are each provided with an automatic ejection seat which allows safe ejection at ground level at airspeeds above 90 knots. Each seat has an overhead firing handle, and an emergency firing handle located at the front of the seat pan. The firing of either seat by means of the over-

marked CAUTION - FRONT AND REAR SEAT EJECTION IS INTEGRATED WITH CANOPY JETTISON. Leg restraint straps are fitted.

172 The ejection gun and drogue gun of each seat are operated by explosive cartridges. Separate cartridges are used to jettison the canopy. All cartridge firing is initiated mechanically, no electrics being involved. Safety pins are provided for the ejection guns and drogue guns and for the sears of the canopy jettison mechanism. The emergency firing handle is made safe by means of a locking mechanism fitted to the front of the seat pan.

NOTE

Due to the limited space between the canopy and the top of the rear seat, safety pins cannot readily be inserted into the sears of the seat firing mechanism or the canopy firing unit of the rear seat. In first line servicing the face screen handle pin is used to lock the overhead firing handle of this seat.

173 The following safety devices are provided for each seat:

(a) A three safety pin assembly consisting of:

(1) A quick-release safety pin, used to lock the face screen handle to the extended headrest.

(2) A spring-type safety pin, used to safety the sear of the ejection gun. (See NOTE para 172).

(3) A spring-type safety pin, used to safety the sear of the cockpit canopy jettison system. (See NOTE para 172).

(b) A quick-release pin, which is used to safety the drogue gun.

(c) An emergency firing handle locking mechanism which is integral with the seat pan and consists of a safety plate and finger catch. raised the safety plate can be rotated downwards, in the direction of an arrow, to unlock the emergency firing handle.

174 The safety pins, with attached warning discs, are removed and stowed by the ground crew when the occupants have completed the fastening of parachute and safety harnesses and connected all necessary equipment prior to flight. The emergency firing handle safety lock must be released by the seat occupant.

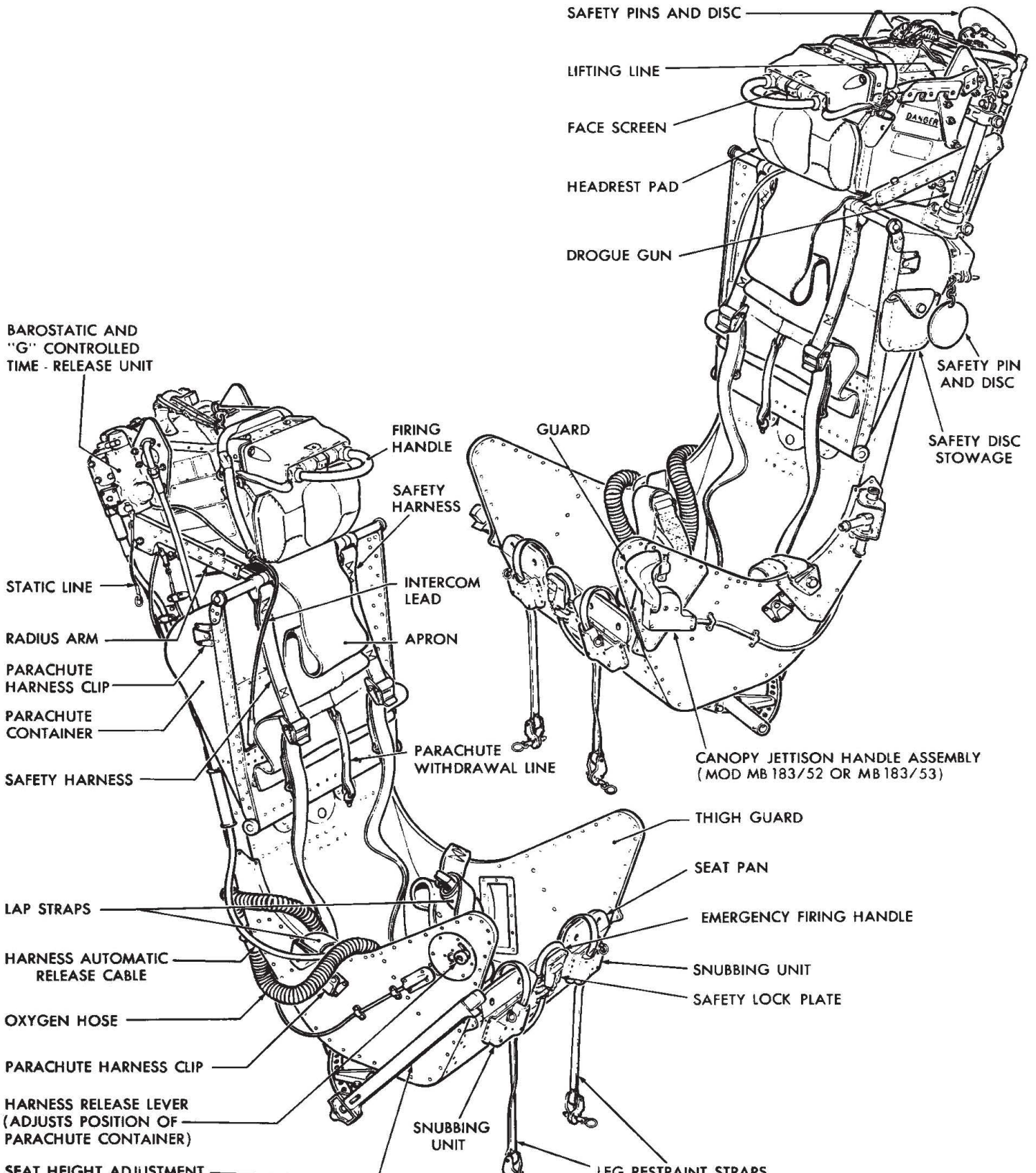
175 The firing cables of both the overhead and emergency firing handles are connected to the sear of the cockpit canopy jettison system located on the guide rail. When either firing handle is pulled the sear of the cockpit canopy jettison system is withdrawn. The cockpit canopy jettisons during the one second delay of the ejection gun. Should the canopy fail to jettison, the seat will eject through the canopy. The penetrators fitted to the top of the seat assist in penetrating the canopy.

176 Should seat ejection have to be carried out when the canopy is not in place, the crew should eject by use of the emergency firing handle. At speeds of approximately 300 knots and above, the force of the airstream may result in injury to the arms if an attempt is made to operate the overhead firing handle.

177 During the first foot of upward movement of the seat, the leg restraining straps automatically draw the occupant's legs together and backwards, and retains them against the front face of the seat pan until seat/occupant separation takes place.

178 When the seat has moved upwards approximately seven feet, a lanyard controlling a chaff dispenser pulls the dispenser cover from the bottom of the seat and disperses the chaff.

179 Approximately one-half second after the seat and occupant have been ejected, the drogue gun fires and extracts the duplex drogue from a compartment behind the headrest. A small controller drogue is deployed first, causing the seat to take up a horizontal straight line


SAFETY PINS AND DISC
LIFTING LINE
FACE SCREEN
HEADREST PAD
DROGUE GUN
BAROSTATIC AND "G" CONTROLLED TIME - RELEASE UNIT
FIRING HANDLE
GUARD
SAFETY HARNESS
SAFETY PIN AND DISC
SAFETY DISC STOWAGE
STATIC LINE
INTERCOM LEAD
RADIUS ARM
APRON
PARACHUTE HARNESS CLIP
PARACHUTE CONTAINER
PARACHUTE WITHDRAWAL LINE
SAFETY HARNESS
CANOPY JETTISON HANDLE ASSEMBLY (MOD MB 183/52 OR MB 183/53)
THIGH GUARD
SEAT PAN
LAP STRAPS
EMERGENCY FIRING HANDLE
HARNESS AUTOMATIC RELEASE CABLE
SNUBBING UNIT
SAFETY LOCK PLATE
OXYGEN HOSE
PARACHUTE HARNESS CLIP
HARNESS RELEASE LEVER (ADJUSTS POSITION OF PARACHUTE CONTAINER)
SNUBBING UNIT
SEAT HEIGHT ADJUSTMENT
LEG RESTRAINT STRAPS

180 Provided ejection takes place below the height set on the barostat (See NOTE following), an automatic time release mechanism will operate after a one and one-quarter second delay provided the 'g' force along the seat axis is insufficient to operate the 'g' controller. The 'g' controller is fitted to prevent parachute canopy damage which would result if the canopy were deployed at high airspeeds. It delays operation of the time delay mechanism until the deceleration is below 4g.

NOTE

Time release units fitted to ejection seats differ, with a consequent variation in barostat tolerances and height settings. All barostats are set to operate the time release mechanism at a minimum height of 15,500 feet, but on some early units the maximum limit may be as high as 19,400 feet.

181 If ejection occurs at a higher altitude than that to which the barostat is set, the barostat prevents the time release mechanism from operating until the seat and occupant have fallen to this set altitude. An emergency oxygen bottle is carried on the survival pack for use at high altitudes.

182 When the time release unit operates, it unlocks the seat safety harness and the leg restraining straps. The drogue line is released from the seat and allows the drogue to pull a lifting line. The lifting line disconnects the headrest pad and pulls on an apron which is clipped to the seat behind the parachute pack. The apron pushes the parachute pack from its container and pushes the occupant forward in the seat. A parachute withdrawal line attached to the apron withdraws the parachute from the pack. When the parachute develops, two straps attached to the parachute harness are unclipped from the side of the seat pan, allowing the seat to fall free. Further information on the ejection seat is contained in EO 55-50-2C.

183 At the end of each flight and before the occupants leave the aircraft, the seats must be made safe as in para 173.

NOTE

GQ MIR 143 (RCAF Ref. 15A/344) back type parachute packs (24 foot canopy) are mandatory in order to obtain safe ground level ejection.

184 A safety clip is secured to the RH parachute harness lifting web. The clip, when fitted to the parachute harness quick-release box, provides an additional safeguard against premature release of the box.

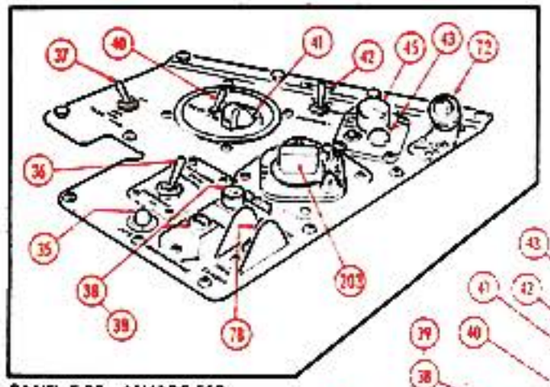
185 When the rear seat occupant ejects, a switch located on the bulkhead is actuated and causes emergency operation of the IFF. When the front seat occupant ejects, a similar switch causes emergency operation of the UHF and IFF.

PILOT'S COCKPIT LAYOUT

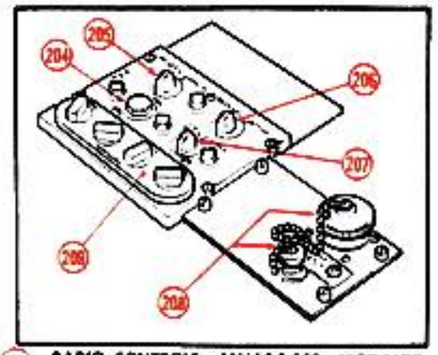
1 Anti-g Suit Connection
2 CONTROL BOOSTER DOWN-OFF Lever
3 Anti-g Supply Connection
4 Rudder Trimmer Hand-wheel and Indicator
5 BAIL OUT SIGNAL Operating Switch
6 BAIL OUT VHF and IFF Test Switch
7 ENGINE STARTING LEFT-RIGHT Switch
8 G VALVE HI-LO Regulator
9 VHF HOMER System OPERATING Switches (EO 05-25E-6A/65 Pre-EO 05-25E-6A/406)
10 LP COCK Switch RH
11 LP COCK Switch LH
12 FUEL PUMP TEST SOCKET
13 FUEL PUMP TEST Switch AF-LW-LF-RF-RW-OFF
14 AUXILIARY TANK PUMP Indicator Light
15 TIP TANKS TRANSFER ON-OFF Switch LH
16 TIP TANKS TRANSFER ON-OFF Switch RH
17 TIP TANKS FUEL JETTISON ON-OFF Switch
18 TIP TANKS EMPTY Warning Light LH
19 TIP TANKS EMPTY Warning Light RH
20 AUXILIARY TANK PUMP Switch ON-OFF
21 TANK SELECTION Switch NORM-WING LH
22 TANK SELECTION Switch NORM-WING RH
23 Auxiliary Red Flood Light
24 Console Red Light
25 Tank Selection Switch Guard
26 FUEL TANK PUMP ON-OFF Switch WING LH
27 FUEL TANK PUMP ON-OFF Switch FUSELAGE LH
28 FUEL TANK PUMP ON-OFF Switch FUSELAGE RH
29 FUEL TANK PUMP ON-OFF Switch WING RH
30 EMERG FLAP DOWN Control
31 Engine Throttle Lever LH
32 CANOPY DECLUTCH PULL Handle
33 Console Red Light
34 Landing Gear Emergency Selection Lever EMERG U/C DOWN
35 JATO Control Button
36 ELEVATOR TRIM Switch NORMAL-
39 UNDERCARRIAGE UP Button
40 AIR CONDITIONING AUTO-HEAT-COOL Switch
41 AIR CONDITIONING COOL-HEAT Rheostat Switch
42 CABIN AIR NORMAL-OFF-EMERGENCY Switch
43 Radar Indicator Control Panel Light
44 ELEV TRIM Position Indicator
45 RADAR - GYRO ERECT (PUSH) and HORIZON CENTRE Control
46 GUNSIGHT DIMMER DIM-BRIGHT Switch
47 LANDING FLAP Position Indicator
48 LANDING GEAR Position Indicator
49 FLIGHT LIMITATIONS Label
50 RUDDER PEDALS PULL TO ADJUST Control
51 CANOPY JETTISON Switch (Pre EO 05-25E-6A/413)
52 Caution Label - Int. Canopy Jettison
53 Rate of Climb Indicator
54 Turn and Bank Indicator
55 Altimeter
56 MACH NUMBER Indicator
57 Airspeed Indicator
58 RADIO CHANN IND ON-OFF Switch
59 Windshield
60 FIRE Warning Light LH Engine Extinguisher LIFT FLAP AND PUSH
61 GYRO COMP
62 Attitude Gyro Indicator
63 BOOSTER TEST Indicator Light
64 GENERATOR Fail Warning Light LH
65 GENERATOR Fail Warning Light RH
66 FUS TANK LOW LEVEL Warning Light RH
67 FUS TANK LOW LEVEL Warning Light LH
68 AUTO TRIM Warning Light
69 Micro-switch Canopy Closed LH
70 GYRO ERECTION Push Button Switch
71 Gunsight
72 Landing Gear Warning Light U/C WARNING
73 Hydraulic Pressure Gauge
74 Clock
75 CABIN PRESSURE Gauge
76 IN'BD GUNS HOLDBACK-RELEASE Switch
77 OUT/BD GUNS HOLDBACK-RELEASE Switch
78 CANOPY OPEN-CLOSE Switch
79 Engine Throttle Lever RH

82 DRAG FLAPS OPEN-CLOSED Switch
83 FLAPS UP - 25° - 60° Landing Flaps Control Lever
84 Re-light Switch LH
85 LANDING LIGHTS EXTEND-STOP-RETRACT Switch
86 LANDING LIGHTS ON-OFF Filament Switch
87 Re-Light Switch RH
88 Throttle Friction Nut
89 CONTENTS GAUGE Switch FUSELAGE-TOTAL-WING TANKS RH
90 CONTENTS GAUGE Switch FUSELAGE-TOTAL-WING TANKS LH
91 CROSSFEED Selector Switch LH TANKS ONLY-NORMAL-RH TANKS ONLY
92 CAMERA-GUNS-ROCKET Selection Switch
93 BOMB WIND SCALE
94 YAW DAMPER ADJUSTMENT
95 JATO MASTER ON-OFF Switch
96 Panel Red Light
97 Autopilot Release Button
98 Guns and Rockets Firing Trigger Switch
99 Floor Heating Duct
100 UHF-ADF Muting Button
101 Nose-wheel Steering Button
102 Manual Elevator Trim Switch
103 Sight Selector Unit
104 SIGHT FILAMENT No. 1 - No. 2 Switch
105 GUN HEATER ON-OFF Switch
106 BOMB-ROCKETS Selector Switch
107 AUTO-MANUAL BOMB RELEASE Switch
108 BOMBS JETTISON Switch
109 ROCKET PODS JETTISON Switch
110 Spare
111 5" ROCKETS JETTISON Switch
112 JATO JETTISON Switch
113 Frequency Card Holder (EO 05-25E-6A/295)
114 BOMB ARMING Switch NOSE/TAIL OFF-TAIL
115 5" RX ARMING Switch ON-OFF
116 Gunsight Reflector Glass
117 Magnetic Standby Compass
118 Gunsight Recorder Camera
119 VHF HOMING Indicator (EO 05-25E-6B/65) (Pre- EO 05-25E-6A/406)
120 BOOST PRESS Warning Light and Shield
121 Micro-switch Canopy Closed RH
122 Pilot's Flight Indicator
125 Deleted
126 WING TANK FUEL PRESS Warning Light RH
127 ENGINE FUEL PRESS Warning Light RH
128 FIRE Warning Light RH Engine Extinguisher LIFT FLAP AND PUSH
129 EMERGENCY INVERTER Warning Light
130 PER CENT RPM LH Engine Indicator
131 PER CENT RPM RH Engine Indicator
132 EXH TEMP Gauge LH
133 EXH TEMP Gauge RH
134 FUEL QUANTITY Gauge LH
135 FUEL QUANTITY Gauge RH
136 Standby Magnetic Compass Deviation Card
137 Gyrosyn Compass Deviation Card
138 ACCELEROMETER
139 Gyrosyn Compass with Tip Pods Deviation Card
140 CABIN PRESSURE Warning Light
141 J2 COMPASS SLAVING Switch GYRO COMPASS-GYRO ONLY
142 J2 Compass RECYCLE Push Button Switch
143 Radio Call Sign Card Holder
144 OIL PRESS PSI Gauge LH
145 OIL PRESS PSI Gauge RH
146 GROUND-OFF-FLIGHT Switch
147 RADIO COMPASS
148 Aircraft Registration Placard
149 BLINKER-OXYGEN FLOW Indicator
150 AIRFRAME ICING WARNING LIGHT
151 ENGINE ICING WARNING LIGHT
152 AUTOPILOT Function Selector Panel
153 DAMPER ON-OFF Switch
154 AUTO TRIM ON-OFF Switch
155 POWER ON-OFF Switch
156 ATTACK ON-OFF Switch
157 BREAKAWAY ON-OFF Switch
158 ALTITUDE ON-OFF Switch
159 LOCALIZER ON-OFF Switch
160 APPROACH ON-OFF Switch
161 MANUAL DE-ICING A/F Push Button
162 MANUAL DE-ICING ENG Push Button
163 Panel Red Light
164 NAV LIGHTS FLASH-OFF-STEADY Switch
165 W/SCREEN DE-ICE PITOT HEAT ON-OFF Switch
166 AUTOPILOT FLIGHT Controller Panel
167 PITCH Control
168 TURN Control

172 Map Light
173 OXYGEN CYLINDER PRESSURE Gauge
174 AUTOMATIC PRESSURE DEMAND OXYGEN REGULATOR, NORMAL-100% OXYGEN-TEST MASK
175 AUX FLOOD LIGHTS ON-OFF Switch
176 STANDBY COMPASS LIGHT ON-OFF Switch
177 VHF TEST PANEL)
178 VHF COMMAND Channel Selector) Pre - EO 05-25E-
179 D F TONE Push Button Switch) 6A/406 (Mod
180 VHF COMMAND ON-OFF Switch) 1633)
181 CONSOLE LIGHTS OFF-DIM-BRIGHT Switch
182 INSTRUMENT PANEL LIGHTS OFF-DIM-BRIGHT Switch
183 AIC-10 INTER Phone Panel
184 GROUND TEST AC LIGHTS, TEST-NORMAL Panel
185 INTER Mixing Switch.
186 COMP Mixing Switch
187 COMM Mixing Switch
188 Spare
189 Spare
190 INTER VOL Control
191 CALL-INTER-COMM Selector Switch
192 INTER Amplifier Switch NORMAL-AUX LISTEN
193 Frequency Card Holder (Pre- EO 05-25E-6A/295)
194 VHF COMMAND VOLUME Control (Pre- EO 05-25E-6A, 406)
195 Harness Lock Release
196 Seat Adjustment Lever
197 Oxygen Mask Supply Connection
198 Interphone Jack
199 Ejection Seat Firing Handle
200 Oxygen Connection
201 Interphone Connection
202 CANOPY JETTISON LEVER - Gas Operated (EO 55-50-6A/41)
203 UHF CHAN Rotary Switch)
204 UHF VOL Control Switch)
205 Frequency MODE Selector) EO 05-25E-
206 CONTROL TRANSFER Switch) 6A/406 (Mod
207 Function Selector Switch) 1633)

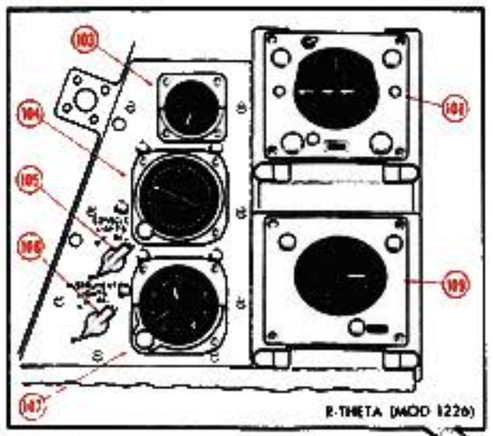


PANEL E 23 - AN/ARC 552 - MOD 1633



RADIO CONTROLS - AN/ARC 552 - MOD 1633

PANEL E 51 - AN/ARC 552 - MOD 1633


R-THETA (MOD 1226)

NAVIGATOR'S COCKPIT LAYOUT

1 Edge Light)
2 Edge Light) (EO 05-25E-6B/87)
3 G-VALVE HI-LO Regulator and Guard
4 DISPENSE RATE Selector LH)
5 DISPENSE-OFF-HOLD Switch LH) (EO 05-25E-6B/87)
6 DISPENSING CHAFF Light LH)
7 MG-2 TEST Switch (Mod 1536)
8 Hydraulic Reservoir Filler Cap
9 Radio Compass Control Panel
10 Manual Frequency Selectors
11 Function Selector Switch
12 UHF-VOLUME Control Switch
13 CONTROL TRANSFER Switch
14 INTER VOL Control
15 CALL-INTER-COMM Selector Switch
16 INTER Amplifier Switch NORMAL-AUX-LISTEN
17 AIC 10 INTER Control Panel
18 INTER Mixing Switch
19 COMP Mixing Switch
20 COMM Mixing Switch
21 Spare
22 Spare
23 PANEL LIGHTS OFF-BRI Rheostat Switch
24 PRESS TO TRANSMIT Button
25 RADAR INVERTER ON-OFF Switch
26 RADAR INVERTER Fail Warning Light
27 RADIO CONTROL Panel
28 Limiter and Caging Unit
29 Map Light
30 API Spotlight
31 Circuit Breaker Panel
32 CONSOLE LIGHTS OFF-DIM-BRIGHT Switch
33 CANOPY DECLUTCH PULL Handle
34 INSTRUMENT LIGHTS OFF-DIM-BRIGHT Switch
35 Outside Air Temperature Gauge
36 RADIO COMPASS
37 Air Position Indicator
38 Altimeter
39 True Airspeed Indicator
40 INVERTER UHF NO. 2 - ON Warning Light (EO 05-25E-6A/425)
41 Windshield
42 Caution Label - Integrated Canopy Jettison
43 CANOPY JETTISON Switch (Pre- EO 05-25E-6A/413)
44 Leg Guard LH and RH
45 Radar Set Control
46 Indicator UNLOCK Lever
47 Floor Heating Duct
48 Harness Lock-Release Lever
49 ALTERNATOR OVER-TEMP Warning Light LH
50 ALTERNATOR OVER-TEMP Warning Light RH (non-operative when EO 05-25E-6B/56 embodied)
51 GENERATOR FAIL RESET Button
52 VOLT/AMP SELECTOR Switch BUS-LEFT-RIGHT

53 ADF Compass Loop
54 BAIL OUT Warning Light
55 Vizor
56 Camera Scope Recorder and VIP Head (EO 05-25E-6A/355)
57 Indicator Release Control
58 Operator's Indicator
59 Aircraft Registration Label
60 Main Circuit Breaker Panel
61 Radio Call Sign Holder
62 VOLTMETER
63 Antenna Hand Control
64 AMMETER
65 Circuit Breaker Panel Light
66 SPARE FUSE BOX
67 Map Light
68 Console Red Light
69 Fuse Panel
70 Oxygen Hose Stowage Plug
71 ARMAMENT CB PANEL
72 SIF MODE 3 Code Selector
73 SIF MODE 1 Code Selector
74 IFF MODE 2 - OUT Switch
75 IFF MASTER Switch
76 AUTOMATIC PRESSURE DEMAND OXYGEN REGULATOR NORMAL 100% OXYGEN - TEST MASK
77 IFF I/P - OUT - MIC Switch
78 IFF MODE 3 - OUT Switch
79 Camera Training Switch (EO 05-25E-6A/287)
80 DC GENERATOR Switches
81 Emergency Brake Accumulator Pressure Gauge
82 Interphone Connection
83 Range Servo Unit
84 EMERGENCY U/C DOWN Push Button
85 Gunsight Amplifier
86 RADAR INDICATOR RED FILTER Stowage (EO 05-25E-6B/87)
87 Blinker Oxygen Flow Indicator
88 Oxygen Cylinder Pressure Gauge
89 DISPENSE-OFF-HOLD Switch RH
90 DISPENSE RATE Selector RH
91 DISPENSING CHAFF Light RH
92 Edge Lights
(89, 90, 91, 92: EO 05-25E-6B/87)
93 Oxygen Supply Connection
94 Oxygen Mask Supply Connection
95 Seat Adjustment Lever
96 Interphone Jack
97 Ejection Seat Firing Handle
98 VHF/ADF Muting Switch
99 Canopy Jettison Lever - Gas Operated (EO 55-50-6A/42)
100 Anti-G Suit Connection
101 Pilot's Indicator Power Supply
102 CANOPY OPEN-CLOSE Switch
103 Outside Air Temperature Gauge
104 RADIO COMPASS
105 CONSOLE LIGHTS OFF-DIM-BRIGHT Switch
106 INSTRUMENT LIGHTS OFF-DIM-BRIGHT Switch
107 Altimeter
108 R-Theta Computer
109 GSI Computer

PART 2

HANDLING

PRELIMINARIES

BEFORE ENTERING THE AIRCRAFT

1 Check RCAF Form L14A for fuel, oil, hydraulic and oxygen quantities, and signatures completed throughout by tradesmen concerned. Note unserviceabilities, if any.

NOTE

If the total fuel load carried is less than 800 gal (1056 US gal), ensure that each fuselage tank contains 140 gal usable (168 US gal) and that the balance is divided evenly between the wing tanks. If the total load is more than 880 gal (1056 US gal) but less than 1096 gal (1315 US gal) ensure that the wing tanks are filled first and that the balance is divided evenly between the fuselage tanks. If the total load is more than 1096 gal (1315 US gal) put the remainder in the auxiliary tank.

2 Ascertain the aircraft weight at take-off, the outside air temperature and the existing pressure altitude of the airfield above sea level. From fig 3-1 or 3-2 check the "engine fail at take-off" capabilities of the aircraft under these conditions, allowing if necessary for aircraft configuration.

3 Carry out the visual checks as shown on fig 2-1.

SOLO FLYING

4 If the aircraft is to be flown with the rear cockpit unoccupied, check in the rear cockpit.

(b) DC generator switches ON.

(c) Oxygen hose fitted to oxygen stowage plug.

(d) All loose articles or equipment removed or stowed.

(e) Relevant circuit breakers pressed into "on" position.

(f) Safety pin and disc in position in ejection gun sear and safety pin in position in canopy jettison switch sear. Alternatively, the overhead firing handle may be locked by inserting the face screen pin.

(g) Emergency firing handle safety device locked.

(h) Safety pin and disc in position in the safety lock of the drogue gun.

(j) Radar indicator locked in the stowed position.

(k) IFF control switches set as required.

AFTER ENTERING THE AIRCRAFT

EJECTION SEAT CHECKS (Fig 2-2)

5 Make the following checks:

NOTE

The rear seat should be occupied first and the front seat last. This is a safety measure in case the occupant of the rear set inadvertently grasps the ejec-

1723-4F-1

(a) Check ejection seat for security of attachment to the aircraft as follows:

WARNING

The complete check for the security of attachment of the seat to the aircraft is of vital importance. Cases of inadvertent ejection of aircrew have occurred by movement of the seat when the top latch has not been correctly engaged below the breech collar of the ejection gun.

(1) Ensure that the red guide line on the top face of the top latch has disappeared from view. If the red line is visible the top latch is not properly engaged.

(2) Check that the top of the ejection gun breech housing is flush with the upper face of the top seat beam.

(c) Ensure that the drogue gun shackle is securely attached to the drogue gun piston and that the drogue gun static rod is connected to the aircraft structure. Check that the drogue gun is cocked. The shank of a rivet should protrude approximately 1/16 inch above the face of the cover plate plug located on the drogue gun body. If the gun is not cocked the rivet will be flush with the face of the cover plate plug.

(d) Check that the drogue withdrawal line is not trapped under the lifting line.

(e) Check that the time release mechanism static line is connected to the aircraft structure.

(f) Fasten and adjust parachute harness.

NOTE

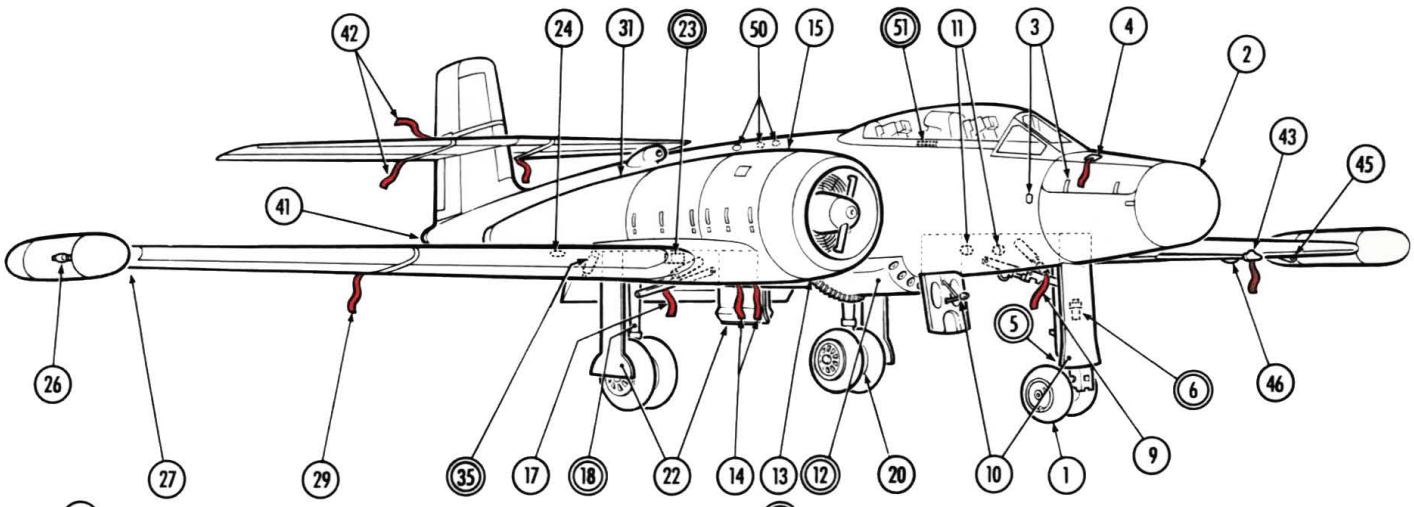
The safety clip must be inserted in the parachute harness quick release box.

(g) Attach the leg restraint straps as follows, see fig 2-3:

(1) Check that the calf straps are buckled to the legs so that each metal D-ring faces inboard and to the rear.

(2) Check that the strap attached to the right-hand floor bracket passes through the right-hand snubbing unit on the seat pan, then pass the free end through the D-ring of the calf strap attached to the left leg. Pass the lug of the LH shoulder strap through the loop in the free end of the leg restraining strap, then connect the lug to the release box. Ensure that there is no slack under the release box.

(3) Check that the calf strap attached to the left-hand floor bracket passes through the left-hand snubbing unit on the seat pan, then pass the free end through the D-ring of the calf strap attached to the right leg. Pass the lug of the RH shoulder strap through the loop



(○) DENOTES ITEMS LOCATED ON THE AIRCRAFT DIAGRAM ABOVE.

(◎) DENOTES ITEMS DETAILED ON THE OPPOSITE PAGE.

STARTING AT THE NOSE OF THE AIRCRAFT MAKE THE FOLLOWING VISUAL CHECKS:—

(A) NOSE.

(1) NOSE WHEEL ALIGNED FORE AND AFT.

(2) CONDITION AND SECURITY OF RADOME.

(3) RADAR NOSE, FAIRINGS AND ACCESS PANEL SECURE.

(4) RADAR COOLING DUCT COVER REMOVED.

(◎5) NOSE WHEEL STRUT EXTENSION.

(◎6) ANTI-SHIMMY DAMPER INDICATOR.

7 ANTI-SHIMMY DAMPER AND NOSE WHEEL STEERING COMPONENTS NO HYDRAULIC LEAKS.

8 TIRES FOR CUTS AND CREEP.

(9) NOSE WHEEL GROUND LOCKS REMOVED.

(10) NOSE LEG FAIRING AND DOOR MECHANISM UNDAMAGED.

(11) EMERGENCY AIR BOTTLE PRESSURES (1980 PSI NORMAL).

(B) FORWARD FUSELAGE, RH NACELLE AND RIGHT WING LEADING EDGE.

(◎12) GUN PACK SECURE AND LOCKED.

(13) ROCKET POD COMBAT TRAINING SWITCH AS REQUIRED (EO 05-25E-6A 211)

(14) GENERATOR AND ALTERNATOR INTAKE COVERS REMOVED (RH ALTERNATOR INTAKES BLANKED OFF EO 05-25E-6B 56)

(15) COWLINGS FOR DAMAGE AND SECURITY.

16 ENGINE INTAKE COVER REMOVED. ENGINE FOR SUPERFLUOUS OIL.

(17) MAIN GEAR LOCKS REMOVED.

(◎18) MAIN LEG EXTENSION NORMAL.

19 NO HYDRAULIC LEAKS.

(20) BRAKES FOR CONDITION.

21 TIRES FOR CUTS AND CREEP.

(22) LANDING GEAR FAIRING AND DOOR UNDAMAGED.

(◎23) PRESSURE REFUELLING SWITCH TO OFF.

(24) FUEL FILLER CAP FOR SECURITY.

25 DE-ICER BOOTS FOR DAMAGE AND SECURITY.

(27) ROCKETS DISARMED INDICATOR

28 AILERON AND FLAP FOR DAMAGE, NO HYDRAULIC LEAKS.

(29) AILERON GROUND LOCKS REMOVED.

30 WING SKIN CONDITION NO LOOSE PANELS OR FUEL LEAKS.

(31) REAR NACELLE FOR DAMAGE AND SECURITY.

32 JET PIPE COVERS REMOVED.

33 NO JET PIPE ALUMINIZATION.

34 DOWNWARD IDENT LIGHT UNDAMAGED (IF FITTED).

(◎35) CENTRE SECTION FLAP JACKS SECURE AND LOCKS REMOVED.

(◎36) BATTERY ACCESS PANEL SECURE.

(D) EMPENNAGE.

37 SKIN FOR DAMAGE.

38 DE-ICER BOOTS FOR DAMAGE AND SECURITY.

39 NO HYDRAULIC LEAKS.

40 ALL PANELS SECURE.

(41) NAVIGATION LIGHT IN REAR CONE UNDAMAGED.

(42) RUDDER AND ELEVATOR GROUND LOCKS REMOVED.

(E) LEFT WING TRAILING EDGE LH EXHAUST PIPE, AFT FUSELAGE.
CHECK AS UNDER (C).

(F) FORWARD FUSELAGE, LH NACELLE AND LEFT WING LEADING EDGE.
CHECK AS UNDER (B).

(43) REMOVE PITOT TUBE COVER.

44 TUBE FOR DAMAGE AND SECURITY.

(45) GUN CAMERA FAIRING SECURE (NOTE: N9 CAMERA MAY BE FITTED IN EACH WING WHEN EO 05-25E-6A/277 INCORPORATED)

(46) LANDING LIGHT FULLY RETRACTED.

OTHER ITEMS.

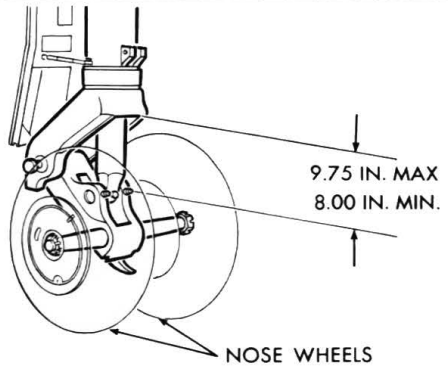
47 WHEEL CHOCKS IN POSITION.

48 100 YARDS JET EXHAUST CLEARANCE.

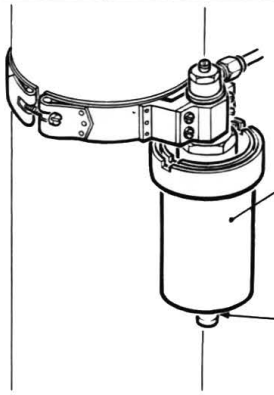
49 ENERGIZER PLUGGED IN AND FIRE EXTINGUISHER AVAILABLE.

(50) FUSELAGE FILLER CAPS SECURE.

(5)



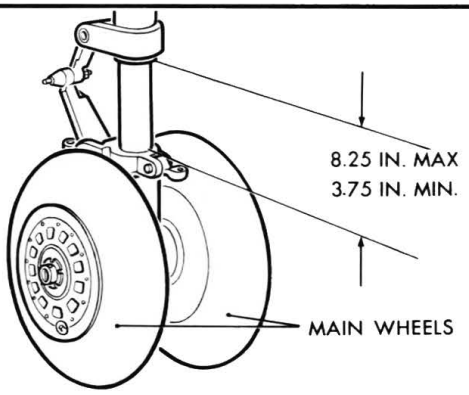
(6)



THE RECUPERATOR IS LOCATED ON THE NOSE WHEEL LEG, BEHIND THE FAIRING.

(12)

(18)



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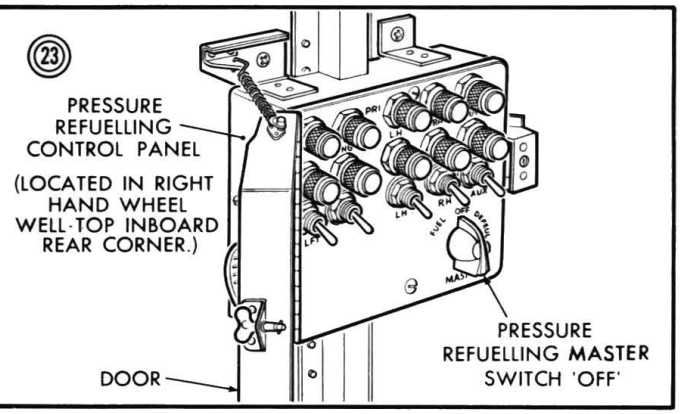

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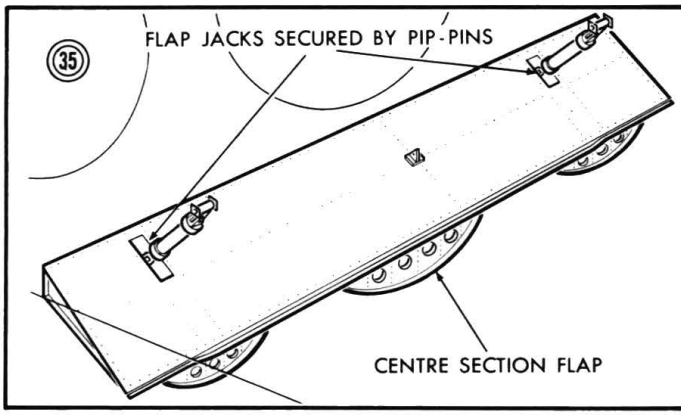
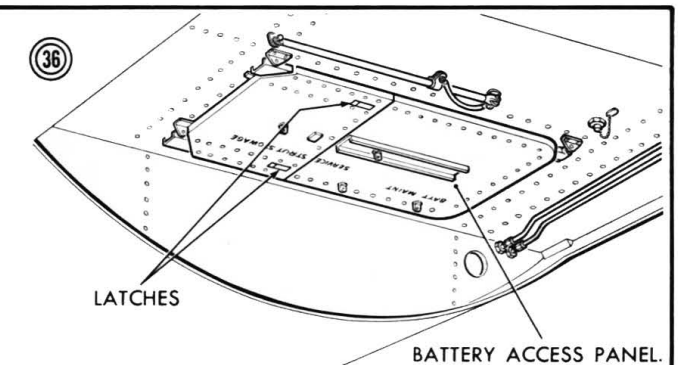
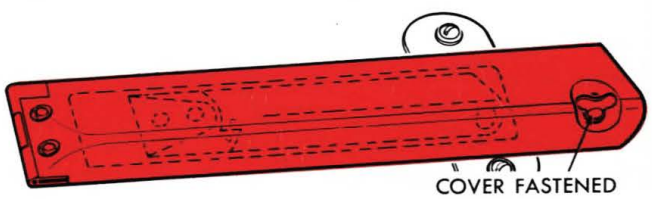


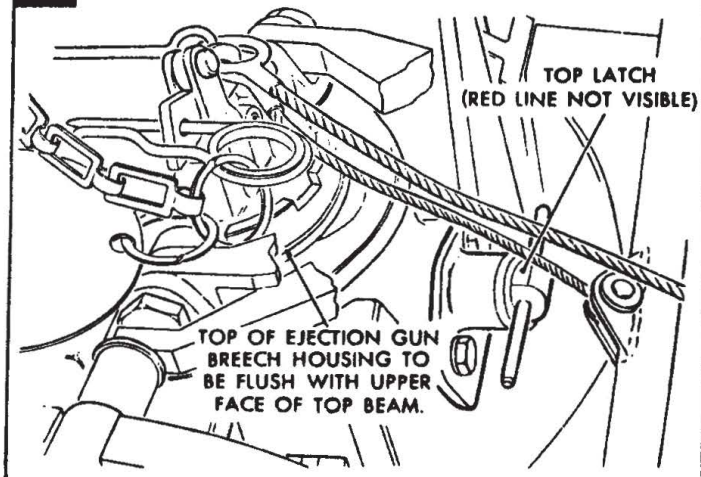
(36)



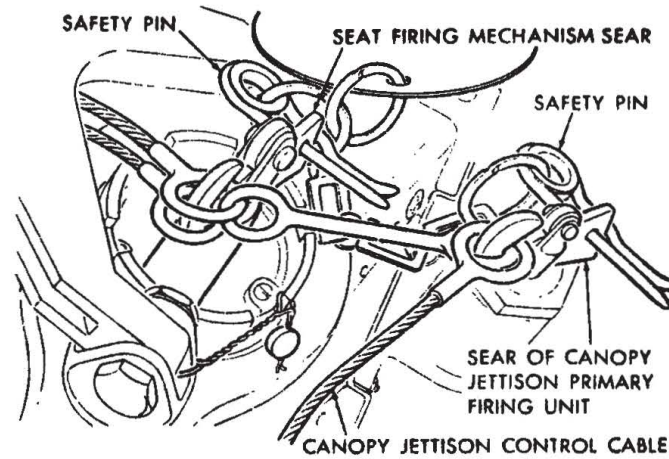
(51)



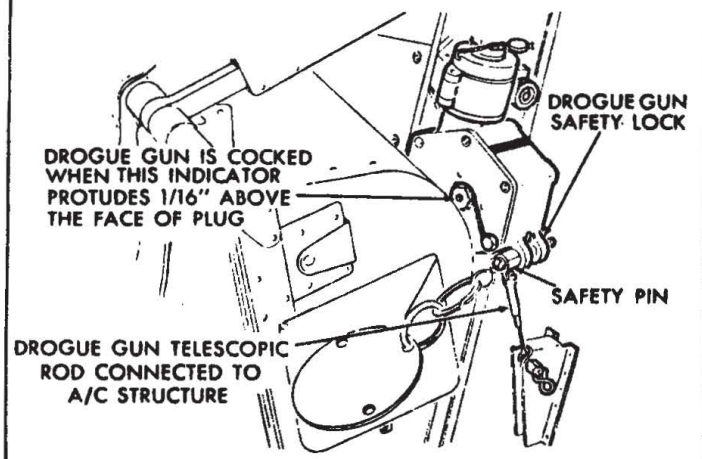
1 CHECK FOR SECURITY OF ATTACHMENT OF THE SEAT TO THE AIRCRAFT



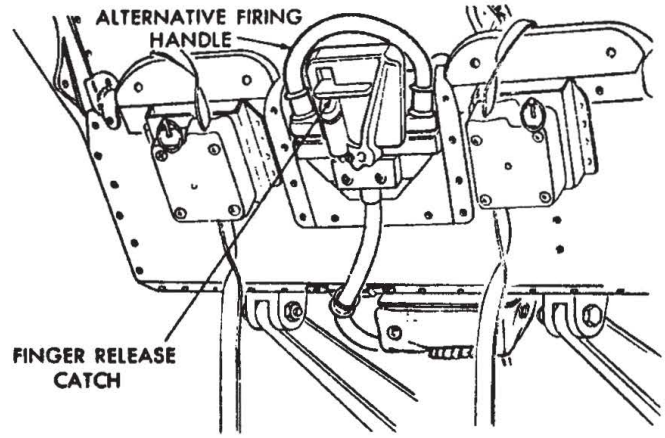
2 SAFETY PINS IN POSITION - TOP OF SEAT



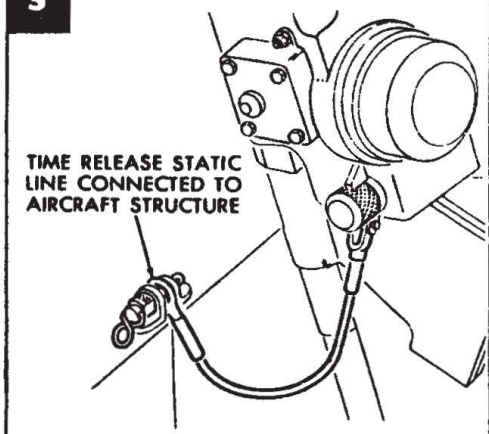
3 DROGUE GUN CHECK



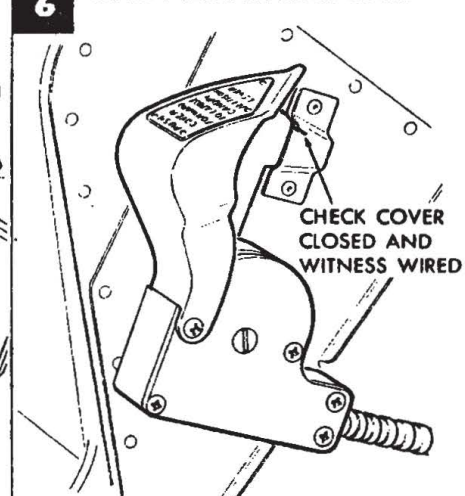
4 ALTERNATIVE FIRING HANDLE SAFETY LOCK - MOD MB183/56.
(ON PRE-MOD SEATS THE FIRING HANDLE IS LOCKED WITH A SAFETY PIN).



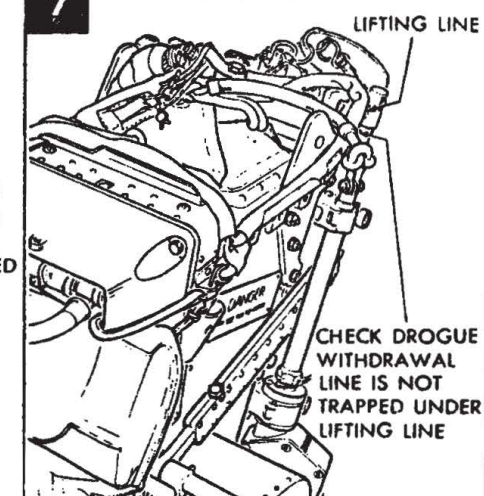
5 TIME RELEASE STATIC LINE.



6 CANOPY JETTISON LEVER COVER



7 DROGUE WITHDRAWAL LINE



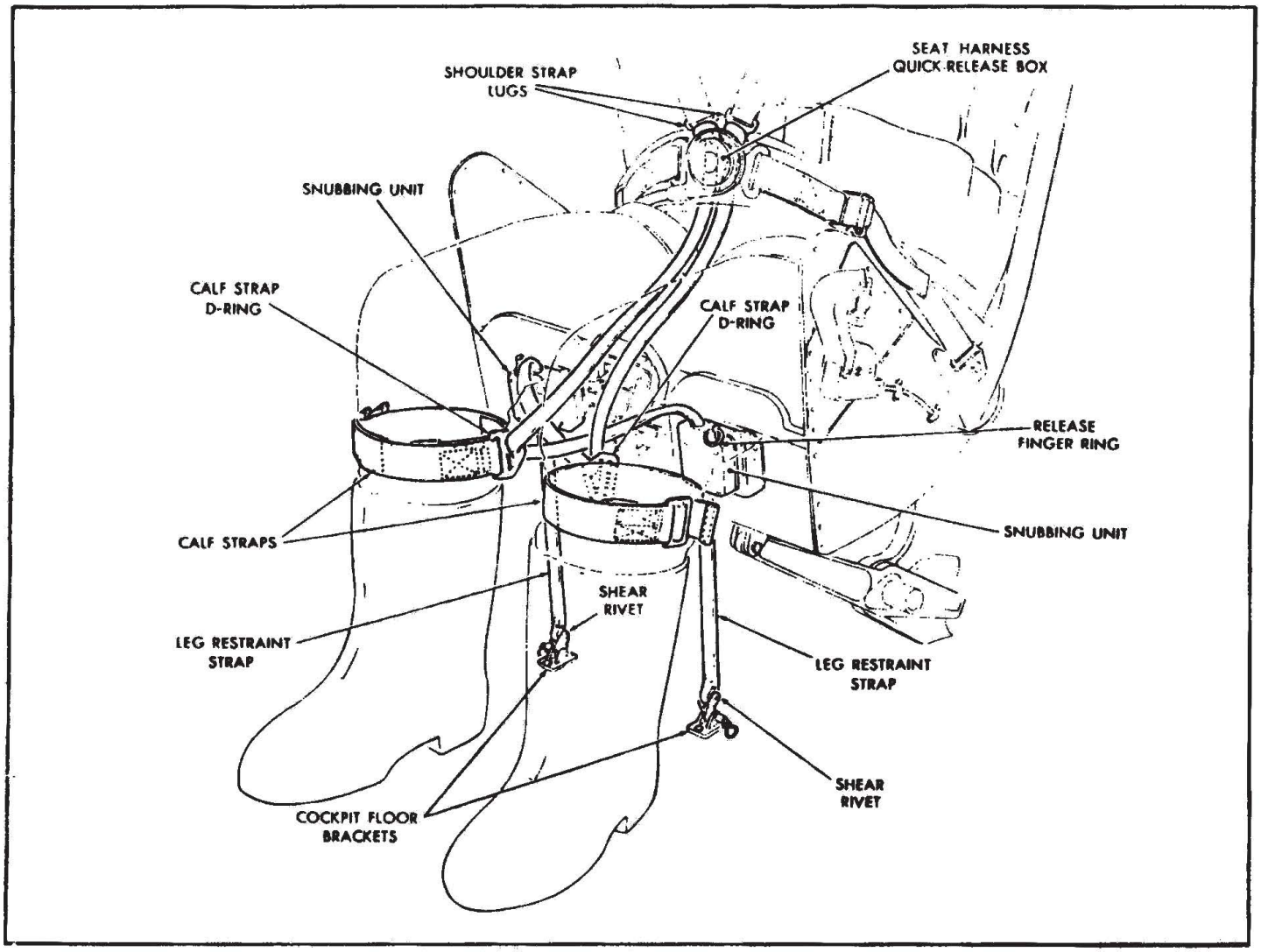


Figure 2-3 Leg Restraint System

WARNING

It is essential that the leg restraining straps are not inadvertently threaded through the emergency firing handle as this could result in accidental firing of the seat. This cannot occur if the straps are connected before unlocking the emergency firing handle.

(4) Carry out the following TIGHT HARNESS checks:

a. TIGHTEN harness properly to minimize body movement in the seat.

b. Check that seat safety harness release box is positioned below and clear of parachute harness quick release box.

WARNING

It is ESSENTIAL that the seat harness be tight to prevent injury should ejection become necessary.

(5) Check freedom of leg movement. Pull on the pull-rings of the snubbing units and adjust the straps, if necessary.

(h) Adjust seat height in order to position the head correctly in relation to the headrest and adjust rudder pedals for reach.

(j) Plug in connection - R/T, oxygen, anti-g suit (if used). Set anti-g valve as required.

(k) Check that the following safety pins are removed and stowed:

(1) The three safety-pin assembly (i.e. cockpit canopy jettison, seat firing mechanism, and face screen handle pins).

(2) Drogue gun pin.

(m) Release the safety lock of the emergency firing handle.

(n) Check that the canopy jettison lever cover is closed and is witness wired.

(p) Check that the emergency oxygen bottle safety pins have been removed.

PRELIMINARY COCKPIT CHECK

6 Make the following checks:

(a) Remove any loose items not belonging to the aircraft.

(b) All cicuit breakers identified in red - ON.

(c) All other individual electrical services and switches - OFF.

(d) Ground/Flight switch to GROUND.

(e) Cabin Air NORMAL, Air Conditioning - AUTO.

(f) Select the elevator trim emergency switch to EMERGENCY OFF and operate the elevator trim button on the control column. Check that no movement of the trim tabs occurs. Return the emergency switch to NORMAL.

(g) Trim tab controls - full free movement in the correct sense. Set to Zero.

NOTE

The elevator trim button should be released when maximum trim is indicated. This prevents excessive slipping of the actuator clutches. See Part 1 para. 63.

(h) Flying control booster lever - witness wired in the up position.

(j) Flap lever - UP.

(k) All switches on Autopilot panel - OFF.

(m) Emergency flap lever - locked up.

(n) Landing gear button. DOWN selected, lights green - check alternative filaments and dimmer switch.

(p) Emergency landing gear lever - locked forward.

(q) Fuel contents registered correctly.

(r) Aircraft altimeters - set.

(s) Operate the BAIL-OUT signal switch and check with the navigator that the BAIL-OUT warning light illuminates. Return the switch to OFF.

(t) If wing tip tanks are fitted check that the ASI has been set for a limiting speed of 410 knots.

(u) Oxygen - Supply of 1800 psi if the aircraft is fitted with tip tanks. Supply of 1000 psi minimum if the aircraft is not fitted with tip tanks. Mask fits. Test mask. Blinker flow indicator, flow on NORMAL and 100%. Check emergency oxygen bottle supply of 1800 psi minimum.

(v) W/Screen De-ice/Pitot heat switch - ON

(w) Rocket pot jettison switch to AUTO position.

NOTE

A positive selection to auto position must be made. Flicking down switch guard will not necessarily always actuate switch to auto position. This action required since auto selection is the only safety device to prevent pod jettison immediately weight of aircraft comes off the main wheels.

STARTING PROCEDURE

PRELIMINARIES

7 In order to check the operation of both hydraulic pumps always start and stop the RH engine first.

CAUTION

Engines must not be started if the oil or fuel temperature is less than -40°C.

WARNING

All personnel must be kept clear of both intake and jet pipe.

NOTE

Orenda 11 engines have a comparatively slow ignition rate and it is possible to open the throttle from the cut-off to idle position between sparks. If this occurs, light up may be accompanied by a loud rumbling noise and some flame. The slow spark rate may also cause a difference in light up time between the LH and RH engines. The above condition is in no way detrimental to the operation of the engines.

PROCEDURE FOR STARTING

8 Adopt the following sequence:

(a) Fire extinguisher in position. 28 volt 1000 ampere ground starting energizer switched to jet engine starting.

(b) Parking brake ON.

(c) Throttles in the cut-off position.

(d) LP cock - ON, Crossfeed switch - NORMAL, Tank selector switches - NORM.

(e) Fuselage tank booster pumps - ON. Auxiliary tank transfer pump - OFF. Wing tank transfer pumps - ON.

(f) Ground/Flight switch - FLIGHT.

(g) Signal the ground crew to engage the energizer.

(j) When the engine rpm reaches 10-12%, open the throttle lever to the idle position.

(k) Check the exhaust temperature; a temperature rise within 3 seconds indicates "light up".

(m) Check the oil pressure.

(n) Check hydraulic pressure build up.

(p) Repeat starting procedure for the LH engine.

(q) Generator switches ON.

(r) Have the occupant of the rear cockpit check the generators by switching the volt/amp selector to LEFT and RIGHT generators in turn. The voltmeter on both selections should read 27.5 volts. The ammeter readings on both selections should be approximately the same.

NOTE

The radar inverter should be off for the above check; otherwise a difference in the ammeter readings will be noted.

9 The exhaust temperature on starting may exceed the idling limitation, but should soon settle down to the correct figure. The engine will accelerate until correct idling rpm and exhaust temperature is obtained and should run in this condition without any throttle adjustment. Do not open the throttle until idling speed has been obtained.

10 If the requirements of an operational scramble call for faster starting, proceed as follows:

(a) Start the first engine using the normal procedure.

(b) When the first engine has reached self-sustaining rpm select the Ground/Flight switch OFF, allow a definite pause at OFF, and then re-select to FLIGHT.

CAUTION

After starting the first engine, do not move the ENGINE STARTING switch from its spring-loaded centre off position until the Ground/Flight switch has been moved to OFF and back to FLIGHT.

PROCEDURE FOR STARTING USING THE C-26 ENERGIZER

11 Aircraft may be started at U.S.A.F. bases using the C-26 energizer. A two position toggle switch is fitted, adjacent to the external supply receptacles, and is marked C-26 START in the up position and NORMAL in the down position. The pilot must place this switch in the up position (C-26 START) prior to entering the aircraft.

12 If a landing is anticipated at a U.S.A.F. base, these instructions should be available in order that the pilot can instruct the ground crew in the correct starting procedure.

13 To start the engines, the energizer operator will proceed as follows:

(a) Turn on generators No. 2 and No. 3.

(b) Set voltage regulator to BUS.

(c) Set current limiter switch to 1200 amps.

(d) Set all other energizer switches to OFF.

(e) Ensure that energizer full throttle gives 28 to 30 volts on the voltmeter.

(f) Set energizer throttle to idle and turn off generators No. 2 and No. 3.

(g) Check that the switch on the forward wall of the receptacle well is at C-26 START.

(h) Connect the plug of the energizer ground

(a) Ground/Flight switch to FLIGHT

(b) Signal "ready" to the energizer operator.

(c) After the energizer operator has signalled that operation para 15(a) and (b) are completed, hold engine start switch in for a maximum of 5 seconds and release.

(d) When the engine rpm reaches 10-12%, open the throttle lever to the idle position.

15 The energizer operator, at the signal from the pilot, para 14(b), will proceed as follows:

(a) Switch on generators No. 2 and No. 3.

(b) Advance energizer throttle slowly until jet starter engagement is obtained, then slowly advance throttle, taking approximately 8-10 seconds to reach full throttle.

(c) When jet engine light up occurs, switch off No. 2 and No. 3 generators and return the throttle to the idle position.

(d) At a signal from the pilot, repeat operations (a) to (c) to start the other engine.

16 When both engines have been started the energizer operator will:

(a) Ensure that generator switches No. 2 and No. 3 are OFF.

(b) Remove energizer plug from aircraft receptacle.

(c) Set C-26 Start/Normal switch to NORMAL.

(d) Button up receptacle well door.

NOTE

The C-26 energizer may be used to supply power for ground checks and

WET START

17 If during the normal starting sequence, no rise in temperature is observed within 10 seconds of opening the throttle lever to the idle position, a wet start has occurred and the following procedure should be carried out:

(a) Bring the throttle back from idle to the cut-off position immediately.

(b) Allow the engine to complete the starting cycle then switch OFF the Ground/Flight switch.

(c) When the engine has stopped rotating, close the low pressure fuel cock.

(d) Investigate the cause of failure to light up and when this has been rectified, motor the engine to blow out excess fuel before restarting is attempted.

(e) Motor the engine as follows:

(1) Ensure that the fuel is on, the appropriate booster pump is on, and that the low pressure fuel cock is open.

(2) Ensure that the throttle is in the cut-off position.

(3) Select the Ground/Flight switch to GROUND.

(4) Select the engine start switch to the appropriate engine for approximately, but not exceeding, 45 seconds.

NOTE

The energizer operator must follow the procedure laid down in EO 05-25E-2.

HOT START

18 If during the normal starting sequence, the exhaust temperature exceeds 850°C, the engine must be stopped immediately, and the cause investigated before attempting to restart.

NOTE

CAUTION

A maximum of five operations of the starter motor in quick succession is permissible, after which a minimum cooling period of 30 minutes, under normal temperature conditions, is required before attempting another start. Before repeating the cycle of five consecutive starts a cooling period of 90 minutes is required. The engine must come to rest between each motoring cycle or start.

GENERAL COCKPIT CHECK

19 Before taxying out for flight the following checks must be made:

(a) Canopy - closed. Check that the white scribed lines coincide.

(b) Harness - locked.

(c) Flying controls - booster lever up and witness wired. Check the controls for freedom of movement over their entire range. Move the aileron control over its entire range four to five times and check hydraulic pressure for indication of a pump failure. On both these checks the hydraulic pressure gauge must not fluctuate more than 300 psi and should return to 1900 - 2300 psi. BOOST PRESS warning light out. Press BOOSTER TEST light and check that it illuminates.

(d) Trim - Elevator zero; Rudder zero.

(e) Fuel -
Check Contents
Crossfeed - NORMAL
Tank Selection Switches - NORM
Fuselage tank booster pumps - ON
Auxiliary tank transfer pump - OFF
Wing tank transfer pumps - ON

(f) Landing flaps - check operation to 25°,

(g) Speed brakes - check operation and return switch to CLOSED.

(h) Landing light - check functioning if required. Switch off and retract.

(j) Cabin air - EMERGENCY, Air conditioning - AUTO, Temperature control - as required.

(k) Check - Oil pressure) Within
Exhaust temperature) limits

(m) J2 Compass slaving switch - GYRO COMPASS. Check heading.

(n) Gyros -
Attitude gyro indicator erected. Check that the OFF indicator is no longer visible. If necessary press gyro erection button after gyro has run up for 30 seconds.
Turn and bank indicator erected. Check that the OFF indicator is no longer visible.

(p) Generators -
Switches ON
Warning lights out

(q) Armament switches - OFF.

(r) Intercom, UHF and radio compass switches ON, controls set as required.

(s) Radar switches) Set as
IFF switches) required.
Sight head caging lever - caged.

(t) Switches -
Ground/Flight switch - FLIGHT.
W/Screen de-ice - pitot heat switch ON.
Autopilot power switch ON. All other switches on the autopilot panel OFF.

(u) Light switches - as required.

GROUND CHECK OF AUTOPILOT

20 With the engines running, the autopilot

(b) POWER switch ON.

(c) Allow 3 minutes for the gyros to reach operating speed.

(d) TURN control in "detent".

(e) ENGAGE the autopilot.

(f) The aileron, elevator and rudder controls should be engaged. Check as follows:

(1) Rotate the TURN Control to the left and check that the control column moves to the left. Repeat this check to the right. Return control to detent.

(2) Rotate the PITCH Control forward and check that the control column moves forward. Repeat this check to the rear.

(3) Check that the rudder has locked in. This should occur when the rudder pedals are within one inch of the neutral position providing the yaw damper trim knob is set in mid position. Move the rudder pedals slightly to engage, if necessary.

(g) Overpower all the controls. Check that they return to the neutral position upon release.

(h) Auto-trim switch ON. Check the operation of the auto-trim control by applying a slight forward pressure on the control column and check that the elevator trim indicator shows a correcting movement of the trim tabs. Apply further pressure and check that the AUTO-TRIM warning light illuminates. Repeat these checks to the rear. Select the elevator emergency switch to EMERGENCY OFF and by pressure on the control column check that no movement of the trim tabs occurs. Return the switch to NORMAL. Zero the trim indicator by means of the control column.

NOTE

The trim tabs must not be allowed to

(j) Disengage the autopilot by pressing the disengage switch on the control column, and check that the ENGAGE switch snaps down and that all the controls are free. Check that the elevator trim is at zero. Auto-trim switch OFF.

TAXYING PROCEDURE

GENERAL

21 When the chocks have been removed, the engines should be opened up slowly and smoothly. Considerable time lag will be noticed between throttle movement and power at low rpm.

CAUTION

Damage to the roll/pitch control gyro unit of the radar can occur during the five minute critical period it is gaining speed after switching to OPER or STBY. During this period the aircraft should not be moved on the ground, taken off or subjected to any unusual flight manoeuvres. If a "scramble" take-off is ordered and the five minute waiting period is not practical then the take-off should be made with the radar at 'disconnect' and it should only be switched on when the aircraft is airborne. The artificial horizon of the pilot's indicator may not erect correctly if turns are made during the erection process. The GYRO ERECT-PUSH control should be operated, but is limited to five minutes at any one time and should not be operated again until ten minutes has elapsed.

NOSE-WHEEL STEERING

22 Steer the aircraft when it is moving slowly forward, by pressing the nose-wheel steering actuation button at the top left of the control column, and applying very light pressure on the appropriate brake pedal. Further pressure on the brake pedal will apply brake, brake pedal should be released, otherwise the nose-wheel will continue turning to its maximum angle. Release of the brake pedal, application of both brake pedals, or release of the push button will de-energize the system and allow normal castoring action of the nose-wheels.

NOTE

Steering must not be activated while the aircraft is stationary.

TAKE-OFF PROCEDURE

VITAL ACTIONS BEFORE TAKE-OFF

23 The following drill of vital actions is to be carried out immediately before take-off:

(a) Check that the canopy is fully closed.

(b) Throttles - set tension.

(c) Check flying controls over their full range, and trimmers for take-off.

(d) Press BOOSTER TEST light and check that it illuminates.

(e) When lined up on the runway, check the engine instruments at low power and if temperatures and pressures are satisfactory open the throttles fully and release the brakes. Check maximum rpm and exhaust temperatures.

CAUTION

If the brakes do not hold at 85% rpm, abandon the flight.

TAKE-OFF

24 For normal take-off, proceed as follows:

(a) Ease back gently on the control column until the nose-wheel lifts, which may be at a

(b) The aircraft will become airborne with very little further elevator movement at 115-140 knots depending on the aircraft weight.

NOTE

It is emphasized that the airspeed at nosewheel lift off may approach 140 knots under certain all-up-weights and runway conditions.

JATO TAKE-OFF

25 Normally, the JATO circuit breakers are removed and therefore the electrical circuit is inoperative. If JATO is operative, proceed as follows:

(a) Carry out the drill of cockpit checks and vital actions the same as for a normal take-off. Flaps 25° down.

(b) JATO master switch ON.

(c) When lined up on the runway, check the engine instruments at low power and if temperatures and pressures are satisfactory open the throttles fully and release the brakes. Check maximum rpm and exhaust temperatures.

CAUTION

If the brakes do not hold at 85% rpm, abandon the flight.

(d) Press the JATO firing button at the required number of seconds from release of brakes. (See fig 4-9).

(e) Ease back gently on the control column until the nose-wheel lifts at approximately 5 knots earlier than normal take-off for that weight, then ease forward slightly to maintain a positive nose up attitude.

(f) The aircraft will become airborne with very little further elevator movement at approximately 15 knots earlier than a normal take-off.

NOTE

There is very little change in aircraft trim when JATO is fired but the increasing acceleration is very noticeable and speed builds up rapidly.

(h) Proceed as in para. 27 for actions after take-off.

JATO JETTISONING

26 Due to the large increase in drag, the empty JATO bottles should be jettisoned in the approved area, as soon as possible after take-off. Jettison procedure is as follows:

(a) Raise flaps.

(b) Keep speed below 200 knots.

(c) Maintain a minimum height of 200 feet, as there is a marked nose down change in trim at release.

(d) Lift the guard and operate the JATO JETTISON switch.

ACTIONS AFTER TAKE-OFF

27 The following actions are to be taken after take-off:

(a) When safely airborne, brake the wheels and retract the landing gear.

(b) Check that the landing gear is locked up - lights out.

(c) Raise the flaps, if used, when a safe altitude is reached.

(d) Switch auxiliary tank switch from OFF to ON.

(e) Check fuel and oil pressures and exhaust temperatures.

(f) Reduce power to climbing rpm.

(g) Check that the auxiliary tank pump green light is on, and check contents of fuselage tanks to ensure that fuel is being transferred.

(h) Cabin air - NORMAL.

FUEL SUPPLY AFTER TAKE-OFF

28 Provided the system is functioning normally, the fuel supply is automatic from the time the auxiliary tank pump switch is selected ON after take-off; but if a landing has to be made with fuel in the auxiliary tank, then this tank must be selected OFF. Moreover, any malfunction of the auxiliary tank switch or failure of auxiliary fuel to transfer may interfere with transfer of fuel from the wing tanks. Therefore, if any doubt exists as to fuel feeding from the wing tanks, ensure that the auxiliary tank switch is selected to the OFF position. (See also Part 3 para 30).

CAUTION

When wing tank empty warning lights illuminate, the wing tank transfer pumps must be switched off in order to prevent damage to pumps due to dry running.

FLYING WITH WING TIP TANKS FITTED

29 When wing tip tanks are fitted the following procedure should be followed:

(a) Before Take-off:

Ensure that the wing transfer pumps and the wing tip tank transfer switches are switched OFF.

(b) After Take-off:

When the auxiliary tank pump green light is extinguished, switch the tip tank transfer switches to - ON. When the tip tanks empty lights illuminate, switch the tip tanks to - OFF. Switch the wing tank transfer switches to - ON.

FLYING CHARACTERISTICS

GENERAL

sluggish and slow to accelerate. At low airspeeds, particularly with flaps and landing gear down, relatively high power is required to maintain level flight and the aircraft is less responsive to the controls.

31 At low airspeeds, turns or manoeuvres involving high "g" loads should be avoided because of the high rate of sink which precedes the stall. High power is required to overcome this sinking, especially on levelling out from a steep approach with flaps and landing gear down, as these cause a very high drag.

STABILITY

32 The aircraft is stable at all altitudes up to approximately Mach 0.8 True, when the "tuck-under" tendency occurs, i.e. a pull force on the control column is required to maintain level flight above the trim speed. At high altitudes stick forces become lighter, resulting in an apparent ioss of stability, and friction in the control circuits is more noticeable, requiring greater attention in the control of the aircraft.

33 Stick forces required for manoeuvres will decrease with altitude up to approximately Mach 0.8 True, but will increase appreciably above this Mach number.

AILERON CONTROLS

34 The ailerons are effective down to the stall but require coarse operation to pick up a wing or counteract bumps at low speed. Self-centring is not noticeable below approximately 300 knots IAS. Above this speed the response to stick movement is immediate.

ELEVATOR CONTROLS

35 The stick forces generally are light, and above 250 knots IAS the elevators are sensitive to small stick movement. They are effective at the stall if large control movements are applied.

TRIMMER CONTROLS

37 The trimmer controls are effective throughout the speed range, but their use should be restricted to below the aircraft's limiting airspeed.

WARNING

Do not use the elevator trim control for trimming into, or while executing manoeuvres, at Mach numbers above .78 (ind).

FLAPS

38 On extension of the landing flaps there is a slight nose-down change in trim. Flaps may be lowered 25° for bad weather flying, and in the airfield circuit before lowering the landing gear, but the increased drag will result in a higher fuel consumption.

SPEED BRAKES

39 The speed brakes will decelerate the aircraft rapidly with traces of mild buffeting. When the speed brakes are opened or closed at airspeeds above 400 knots, a momentary change in pitch may be experienced. They commence closing by air pressure above 400 knots IAS approximately. Their effectiveness falls off rapidly as IAS is reduced.

WARNING

If the speed brakes are extended at IMNs above .90 some loss of control may occur.

LANDING GEAR

40 Retraction and extension of the landing gear causes no appreciable change in trim but extension causes a large increase in drag.

to build up to at least 200 knots IAS before the climb is commenced.

42 The following climbing speeds using 97.5% rpm are recommended.

Altitude	IAS
Sea Level	400 kts
10,000 ft	350 kts
20,000 ft	300 kts
30,000 ft	250 kts
40,000 ft	200 kts
45,000 ft	175 kts

EXHAUST TEMPERATURE LIMITATION DURING CLIMB

43 During a climb at constant throttle setting, on aircraft fitted with Orenda 9 engines, engine rpm and exhaust temperature will rise with increasing altitude. Above 30,000 feet the temperature rise may be as high as approximately 1°C per thousand feet. The throttle setting must be adjusted throughout the climb to keep within rpm and exhaust temperature limitations. It should be noted that even if rpm are kept constant, exhaust temperature will still continue to rise slightly with increase of altitude. On aircraft fitted with Orenda 11 engines, the rise in exhaust pipe temperature during a climb at constant throttle setting will only be slight. Engine rpm will rise and must be adjusted throughout the climb to keep within rpm and exhaust temperature limitations.

STALLING

44 With the aircraft in landing configuration there is very little warning of the approach of the stall. At the stall a gentle buffeting of the tailplane and lateral instability become noticeable, followed by a marked shuddering of the aircraft and the dropping of a wing. Stalling produces a high rate of sink, but recovery in all cases is orthodox.

45 Between maximum aircraft weight and empty weight, the stalling speed will vary by

Landing gear and flaps up - 115 - 125 knots IAS.

Landing gear and flaps down - 100 - 105 knots IAS.

SPINNING

46 The aircraft is not cleared for intentional spinning but recovery is satisfactory with throttles back, landing gear retracted, flaps up, and speed brakes closed. At extreme altitudes, about 10,000 feet will be lost during recovery. At lower altitudes, 5,000 feet will be lost.

47 If a spin is experienced, recovery action should be taken as follows:

(a) Apply full opposite rudder immediately.

(b) Ease the stick slowly forward and close the throttles.

(c) Retract the landing gear, flaps and speed brakes, if they are extended.

(d) Keep the ailerons neutral..

NOTE

The aircraft usually will stop spinning before the elevator neutral stick position is reached.

WARNING

Should the aircraft start to spin at extreme altitude, the spin should be continued down to 35,000 feet before starting recovery procedure, otherwise the operational limitations for diving will probably be exceeded.

If the aircraft is spinning at/or below 7,000 feet, abandon the aircraft.

See EO 05-1-1, Part 4, Section 6, Page 114A, para. 3 for Warning regarding the implications of altimeter errors.

SLOW FLYING

48 In bad visibility and whenever slow flying is necessary, reduce speed to 175 knots IAS and lower 25° landing flap. Handle gently to avoid high "g" forces.

FLYING IN TURBULENT AIR CONDITIONS

49 In very turbulent air, gust loads on the aircraft may be as high as 6 "g", therefore if "g" is already being applied in these conditions the "g" limitations for the aircraft may be exceeded. When flying in turbulent conditions, avoid carrying out manoeuvres which involve large accelerations.

50 Maintain airspeed in the medium speed range since at low airspeeds sudden gusts may cause the aircraft to stall, whilst the effect of gusts when flying at high speeds will accentuate the "g" loading.

FLYING IN HEAVY PRECIPITATION

51 Flying in heavy precipitation should be avoided. Contraction of the stator case due to the cooling effect of the moist air may cause the stator blades to rub on the compressor rotor and result in internal disintegration of the engine.

52 If heavy precipitation is encountered power should be reduced to approximately 85%

to reduce the amount of cool moist air entering the engine and the area of heavy precipitation vacated as quickly as possible.

FLYING WITH ASYMMETRIC POWER

53 At speeds above 170 knots IAS, the effect of asymmetric power is hardly noticeable except when using very high engine power.

AEROBATICS

54 Aerobatics are permissible and are easily executed but the "g" limitations in fig 4-4 must not be exceeded. See WARNING Part 1 para 122. All flick manoeuvres are prohibited. Coarse use of the controls should be avoided. High "g" should not be pulled when the aircraft is buffeting. It is recommended that not more than maximum climbing rpm (97.5%) be used to avoid exceeding the exhaust temperature limitations.

SLOW ROLL

55 Recommended speed for this manoeuvre is 300-350 knots IAS at power for that speed; it may be found necessary to use some rudder on coming out of the roll to reduce a slight tendency to barrel out.

UPWARD ROLL

56 Recommended speed is 350-380 knots IAS using 97% rpm, depending on the steepness of the climb.

HALF ROLL OFF THE TOP

57 Use a speed of about 400 knots IAS at 97% rpm. Pull up gently to 3 "g" avoiding any buffet. Allow the nose to come down on the horizon and roll out at 150-220 knots IAS.

LOOP

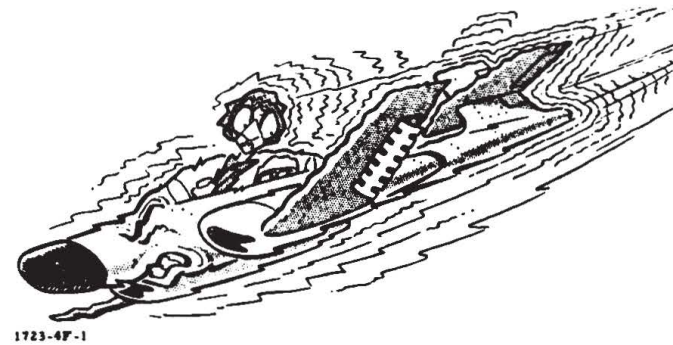
58 Use a speed of about 400 knots IAS at 97% rpm, pull up gently and when inverted at the top of the loop, throttle back to idling rpm.

INVERTED FLYING

59 There is no provision for supplying fuel to the engines during a prolonged period of inverted flight, but a collector tank in each fuselage tank provides a reserve for approximately ten seconds in this flight condition, and when negative "g" is experienced. See Caution Part 4 para 9.

DIVING

60 Do not dive the aircraft from level flight at high Mach numbers, because the speed will build up very rapidly in the dive and probably cause the maximum Mach number to be exceeded. This may occur in shallow dives at angles of 10° - 20°. The speed brakes commence closing by air pressure above 400 knots IAS approximately.



WARNING

If the limiting Mach number is exceeded the aircraft will tuck nose down and sharp wing dropping may be experienced. Further increasing the Mach number will cause a nose down pitch and a marked reduction in elevator effectiveness. Recovery should be effected at as high an altitude as possible as follows:

(a) Close the throttles and extend the speed brakes.
(b) Do not adjust the elevator trim.

ENGINE HANDLING

GROUND RUNNING

61 Ground running of the engines is to be restricted to 20 minutes at any one time, due to lack of cooling air to the generators with the aircraft stationary. Cooling periods of at least 30 minutes are required between runs.

62 DELETED

63 The minimum allowable oil pressure stated in Part 4 para 2(c) for idling rpm (i.e. 2 psi) is applicable only when the aircraft is on the ground. Normally, the idling oil pressure will be higher than this figure, although the engine may safely be operated at 2 psi ground idle indefinitely without engine damage.

64 If the minimum oil pressure is noted on the ground, the system should be checked by slowly increasing engine speed to 93% rpm. The oil pressure should gradually increase with engine speed, and at 93% rpm the oil pressure must not be less than 15 psi. If a pressure below this is indicated, the engine should be shut down immediately and the cause investigated.

65 In flight, the idling rpm increases with an increase in altitude, with a resultant increase in oil pressure above the minimum for ground idle. Should an unusually low oil pressure be encountered during flight, the check described in para 64 should be carried out. If the oil pressure is below 15 psi at 93% rpm, the engine should be throttled back or shut down, the action depending upon the severity of the oil pressure loss. If the engine is throttled back the pressure should be closely monitored.

66 The maximum allowable fluctuation of oil pressure is ± 2 psi at any engine speed. Fluctuation of pressure in excess of this figure must be reported and the engine placed unserviceable.

EFFECT OF FUEL TEMPERATURE ON GOVERNED RPM

67 With JP4 fuel a lowering of the fuel temperature from standard (15 °C) will cause a small decrease in maximum rpm; while an increase above standard temperature will cause a small increase in maximum rpm. The variations are as follows:

Fuel Temperature	% Change in governed rpm from 100%
30 °C	+ .6%
15 °C	0
0 °C	- .4%
-15 °C	-1.2%
-30 °C	-2%

68 Unless the variations at maximum rpm are greater than +.5% or -1%, no engine adjustments need be carried out.

IDLE SPEED

69 The engines should not be allowed to idle below minimum idle rpm owing to the possible failure of compressor blades due to vibration.

ENGINE OVERSPEEDING AND EXHAUST TEMPERATURE LIMITATION

70 Transient involuntary overspeeding of an engine is permissible providing 102% rpm and 750 °C JPT is not exceeded.

71 Deliberate overspeeding is not permitted. If overspeeding and JPT limits are exceeded an entry must be made in the appropriate section of the RCAF Form L14.

71 If the overspeed ... , DELETED ... section ...

ACCELERATION

72 At sea level under normal temperature conditions, the engines should accelerate from 38.5% to 97% rpm in a maximum of 12 seconds, following a one second opening of the throttle. During acceleration there should be no audible surge and the exhaust pipe temperature should not exceed 790°C. After deceleration the rpm should be allowed to stabilize before attempting a further acceleration.

73 During high ambient temperatures when a rapid acceleration is carried out to maximum rpm, the rpm may oscillate above and below the governed speed. This is due to an instability of the fuel pump governor caused by lower fuel requirements in less dense air. Three oscillations, if of a magnitude not greater than 1.5% are not considered excessive. If the condition persists for more than 3 cycles, the throttle settings should be reduced to restore stability, but it should not be necessary to reduce rpm more than 2%. Full opening of the throttle should then be possible without further instability.

74 The throttles may be opened rapidly throughout the rpm range below 25,000 feet. Above this altitude care must be taken when opening the throttles up to 65% rpm, and only a slow, smooth progressive movement should be used. Above 65% rpm the throttles may be opened rapidly at will.

ACCELERATION (ORENDA 11)

75 After acceleration to maximum rpm it may take approximately two minutes for the exhaust temperature to stabilize.

THROTTLE MOVEMENT (ORENDA 11)

76 At the higher altitudes and higher rpm

ENGINE OPERATION IN SUB-ZERO CONDITIONS

77 When aircraft have to remain in the open in temperatures of -18°C (0°F) or below, the following precautions should be observed:

(a) Lubricating oil MIL-O-6081B, grade 1010 may be used for all temperatures above -30°C. However, if temperatures are likely to be consistently below -18°C, Grade 1005 oil should be used. The overlap in the range of operating temperatures will prevent frequent oil changes.

(b) Prior to starting, engine heaters must be used to supply warm air to the intakes for at least one hour.

(c) If the engines cannot be heated the ground crew must check that the engine compressor is not frozen by means of hand turning.

(d) A normal starting procedure may be attempted and personnel should check for any unusual noises during starting or ground running. If it is snowing, check the engine intake for ice formation.

(e) After starting, when using Grade 1005 oil, the engine must be allowed to idle for at least one minute and then the throttle should be opened very slowly until maximum rpm are obtained. During this procedure it is essential that the maximum oil pressure does not exceed 50 psi, with a minimum of 2 psi at idling rpm.

(f) If Grade 1010 oil is being used at temperatures below -30°C, the idling period must be increased to five minutes before increasing rpm. The same oil pressure restrictions apply.

78 Cold soaking an aircraft may cause sticking of the fuel flow distributor causing incomplete combustion which will be indicated by considerable smoke emitting from the tail pipe when the engine is throttled back from high rpm. This may cause flame-out at altitude.

AUTOPILOT OPERATION

(a) Check that the autopilot AC and DC circuit breakers on the radio C/B panel are ON.

(b) Check that the POWER switch is ON (See NOTE sub-para (g)).

(c) Trim the aircraft for "hands off" straight and level flight, normal climb, or normal descent by means of the control column trim switch.

(d) Position the TURN control in "detent".

(e) Check that the YAW DAMPER ADJUSTMENT knob arrow is aligned with the reference mark at approximately the 12 o'clock position.

(f) Select the engage switch to ENGAGE.

(g) Auto-trim switch ON.

NOTE

Normally, the POWER switch is selected ON when the aircraft is on the ground. If this had not been done, then the aircraft must be flown level for at least one minute after selecting the POWER switch on in order that the vertical gyro will be near vertical when it uncages.

80 If the autopilot is ready for engagement a solenoid will hold the switch in the engage position against the return spring. It will return to the disengage position if it is not ready for engagement. The rudder servo may not lock in if there is an imbalance, but should lock in when the rudder pedals are moved slightly.

81 Pressure should not be applied to the control column when engaging the auto-trim. Any pressure imposed by the pilot will be corrected for by the auto-trim, which may instinctively cause the pilot to apply further pressure on the control column, thus causing a further correction by the auto-trim control.

WARNING

feet above ground level. If the autopilot is used below 10,000 feet, its operation should be very closely monitored. The autopilot must not be used when the airspeed is in excess of MACH .78 indicated.

DIRECTIONAL CONTROL

82 To change the course of the aircraft proceed as follows:

(a) Gently rotate the TURN control out of "detent" in the required direction. Particular attention should be paid to the rate of movement of the control knob when flying at altitude as the rate of movement determines the rate at which bank is applied. The degree of movement determines the angle of bank and rate of turn.

(b) When the new heading is obtained gently rotate the new control to "detent". The aircraft will maintain this heading. See CAUTION Part 1 para 90.

PITCH CONTROL

83 A controlled descent or climb is made as follows:

(a) ALTITUDE switch OFF.

(b) Rotate the PITCH control, forward to descend or backwards to climb, until the desired angle is obtained.

(c) Level the aircraft at the new altitude by means of the pitch control.

(d) Select the altitude switch ON, if required.

NOTE

Large changes of altitude at high rates of climb or descent may necessitate a waiting time at the new altitude of as long as five minutes before selecting

ALTITUDE CONTROL

84 To engage and operate the ALTITUDE control proceed as follows:

(a) Check that the aircraft is trimmed in straight and level flight at the required altitude.

(b) Select the ALTITUDE switch ON.

NOTE

The number of corrections which can be made after each engagement of the altitude control is limited. It may be found that after approximately 45 minutes of flight it will no longer maintain the selected altitude. If this occurs the control should be recentred by switching the ALTITUDE switch to OFF for approximately four minutes. The autopilot should be re-trimmed before re-engaging the altitude control.

(c) When altitude is changed the ALTITUDE switch must first be returned to the OFF position. If the autopilot is used without the altitude switch ON, then the aircraft will be maintained at a constant pitch attitude but not necessarily at a constant altitude.

NOTE

The rate of climb indicator should be at zero before engaging the altitude control, as any correcting action necessary by the control when it is first engaged will shorten the time during which it will operate before it requires recentring.

DISENGAGEMENT

85 The autopilot can be disengaged in the following ways:

(a) By depressing the release button on the control-column handgrip. The engage switch on the flight controller will automatically return to disengage.

(c) By placing the power switch to OFF. The engage switch will automatically return to disengage.

WARNING

If the autopilot cannot be disengaged by the above methods, the autopilot AC and DC circuit breakers on the radio circuit breaker panel in the rear cockpit should be pulled.

NOTE

If the autopilot is disengaged by methods (a) or (b) above and with the yaw DAMPER switch on the function selector in the "ON" position, only the aileron and elevator controls will be free. The rudder servo will be disengaged when the damper switch is returned to OFF, the landing gear is lowered, or the power switch is returned to OFF.

86 When the autopilot is disengaged by any means the following switches are automatically returned to OFF.

(a) ENGAGE switch.

(b) ALTITUDE switch.

(c) ATTACK switch.

(d) LOCALIZER switch.

(e) APPROACH switch.

ENGAGING YAW DAMPER INDEPENDENTLY

87 To engage the yaw damper in flight proceed as follows:

(a) Check that the autopilot AC and DC circuit breakers on the radio C/B panel are ON.

(b) Trim the aircraft for straight and level flight, normal climb or descent, with landing

(d) Check that the YAW DAMPER ADJUSTMENT has the arrow at approximately the 12 o'clock position, or lined up with the reference mark.

(e) Select the DAMPER switch on the function selector panel ON.

(f) Move the rudder pedals slightly to lock in the rudder servo, if necessary.

(g) Centre the ball of the turn and bank indicator by means of the yaw damper adjustment knob, if necessary.

CAUTION

In order to prevent the yaw damper from locking-in off centre, the power switch must be ON for at least 2 minutes before selecting the yaw damper switch ON.

LANDING PROCEDURE

REJOINING THE CIRCUIT

88 When rejoining the circuit reduce speed to below 200 knots IAS using the speed brakes as necessary.

VITAL ACTIONS BEFORE LANDING

89 Make the following checks:

(a) Fuel -
Check contents. For touch-and-go landings or for a landing with fuel remaining in the auxiliary tank, the auxiliary tank switch must be selected OFF.

(b) Brakes -
Check hydraulic pressure, 1900-2300 psi.

(c) Harness -
Locked.

(e) Speed Brakes -
Closed.

(f) Flaps -
Set as required.

(g) Hydraulic pressure -
1900-2300 psi.

(h) Canopy -
Fully closed.

INITIAL AND FINAL APPROACH

90 The circuit speed should not be higher than 200 knots IAS. Maintain a minimum speed of 150 knots IAS for turns. Avoid making steep turns.

91 On the final approach extend full landing flap and maintain fairly high power, since the aircraft tends to sink rapidly. Allowing the speed to fall progressively with power, cross the airfield boundary at 125 knots IAS (at normal landing weight) and the end of the runway at 120 knots IAS.

NORMAL LANDING

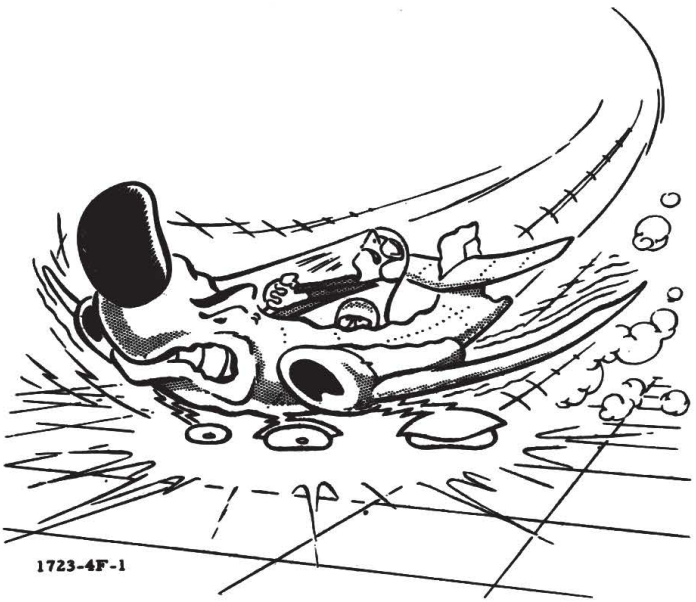
92 Make a normal tricycle landing, holding the nose wheel clear of the ground. Any sharp backward movement of the control column should be avoided after cutting the power since the attitude of the aircraft in the final approach should approximate that of touchdown. The touchdown speed should be approximately 110 knots IAS. Hold the nose in the touchdown position easing the stick back until the nose wheel drops gently. Apply the brakes evenly and gently to stop.

WARNING

If, due to malfunctioning of the fuel system, a landing must be made with one wing tank full and the other empty, increase the normal landing speed by 10-15 knots. This will allow an extra margin of control at touchdown, since

CAUTION

Should a steep approach be made, a sufficient speed margin must be maintained to permit the "flare-out" without a premature stall.



USE OF BRAKES

93 The brakes should be used to slow the aircraft gradually, taking advantage of the full length of the runway. If this practice is not followed, excessive tire and brake wear will result.

94 When taxying at speeds of 10 mph or less, on ice or snow, a locked wheel condition could occur. This is characteristic of the system and is not necessarily indicative of a failure.

CAUTION

The brakes must not be applied until the main wheels are rotating. Landing with brakes on will result in tire blow outs.

is encountered during the final stages of the landing run, the foot brakes should be released momentarily and then re-applied more gently. If "walking" persists, short alternative applications of the brakes should be tried. The hand brake may be used as a last measure to stop walking, bearing in mind that harsh use of this brake will cause inefficient braking, heavy tire wear, and ultimately tire blow out. Directional control will also be lost.

MISLANDING

96 The aircraft will climb away with the landing gear and flaps down.

(a) Increase power smoothly to maintain airspeed above 150 knots.

(b) Check that the speed brakes are closed, retract the landing gear and raise the flaps to the 25° position.

(c) Allow airspeed to build up to 170 knots.

(d) Raise the flaps.

CROSS-WIND LANDING AND TAKE-OFF

97 Normal cross-wind technique for a tricycle landing gear aircraft is recommended. Allow the nose wheel to make contact earlier on landing, and to remain on the ground longer during take-off.

ACTION AFTER LANDING

98 On completion of the landing run make the following checks:

(a) Raise the flaps for taxying.

(b) Pitot Heat/W-Screen De-ice switch OFF.

(c) Gun Heater switch OFF.

END OF FLIGHT PROCEDURE

necessary. Proceed as follows, stopping the RH engine first:

(a) RH engine throttle - cut off.

(b) RH engine fuel booster and transfer pump switches - OFF.

(c) When the RH engine has stopped, operate the flying controls. Correct hydraulic pressure indicates normal operation of LH engine pump.

(d) Proceed as above for stopping the LH engine.

ACTION BEFORE LEAVING THE COCKPIT

100 Proceed as follows:

(a) Switch off all electrical services individually.

(b) Ground/Flight switch - OFF.

(c) Engage the safety lock of the emergency firing handle. (Both seats).

(d) Ensure that the safety pins and warning discs are replaced, front seat first, in the following locations:

(1) Front Seat
- Ejection gun sear
- Canopy jettison sear
- Drogue gun safety lock

(2) Rear Seat
- Face screen handle lock
- Drogue gun safety lock

(e) Lock controls through the hydro-booster gust lock if required.

(f) Apply the parking brake, if required.

CAUTION

Do not park the aircraft with the parking brake on if the brakes have been excessively overheated. The heat should be allowed to dissipate before the parking brake is applied.

FITTING AND REMOVAL OF THE PARACHUTE

101 A quick-release coupling is inserted into the parachute withdrawal line. Disconnecting the coupling allows the parachute to be removed from the seat, one half of the coupling and withdrawal line remaining with the seat and the other half of the coupling and withdrawal line remaining with the parachute.

PART 3

EMERGENCY HANDLING

ENGINE FAILURE PROCEDURE

ENGINE FAILURE DURING TAKE-OFF

1 The ability of the aircraft to climb away should an engine failure occur immediately after take-off depends upon the aircraft weight, outside air temperature and the airfield pressure altitude. Fig 3-1 is applicable to aircraft fitted with Orenda 9 engines and fig 3-2 to aircraft fitted with Orenda 11 engines. They show the maximum aircraft weight at which a 100 feet per minute climb away is possible, and cater for the drag conditions of the landing gear remaining down, and for the landing gear plus 25° flap remaining down. In both cases the immediate action of raising the landing gear will improve the rate of climb away.

NOTE

The graphs apply to aircraft with tip pods. For tip tank, square tip or chaff dispenser configurations, adjust the maximum safe aircraft weight as shown. The result is the maximum safe aircraft weight for that particular configuration.

2 Should the actual aircraft weight be above the maximum indicated on the graph (or above the calculated safe weight if the configuration is other than tip pods) for the particular conditions, then climb away is not possible due to insufficient thrust from one engine.

WARNING

Under all conditions, the take-off must be aborted should an engine fail before the aircraft is airborne.

3 If an engine failure occurs immediately after take-off, and it is known that flight can be maintained, proceed as follows, applying about 10° of bank towards the live engine:

(b) If conditions permit, hold the aircraft down to increase speed as follows. (See NOTE below).

(1) For flaps-up take-off -15 to 20 knots above unstick speed.

(2) For 25° flap take-off - 25 to 30 knots above unstick speed.

(c) Correct any tendency to yaw by use of rudder.

(d) Climb to safe altitude at this speed and raise flaps, if used.

NOTE

If conditions do not permit holding the aircraft down to increase speed, a climb-away at unstick speed may be carried out. In this case the speed must be increased by 25 - 30 knots before raising the flaps (if used) when a safe altitude is reached.

ONE ENGINE FAILURE IN FLIGHT

4 If an engine fails in flight proceed as follows:

(a) Close the relevant throttle to cut-off position.

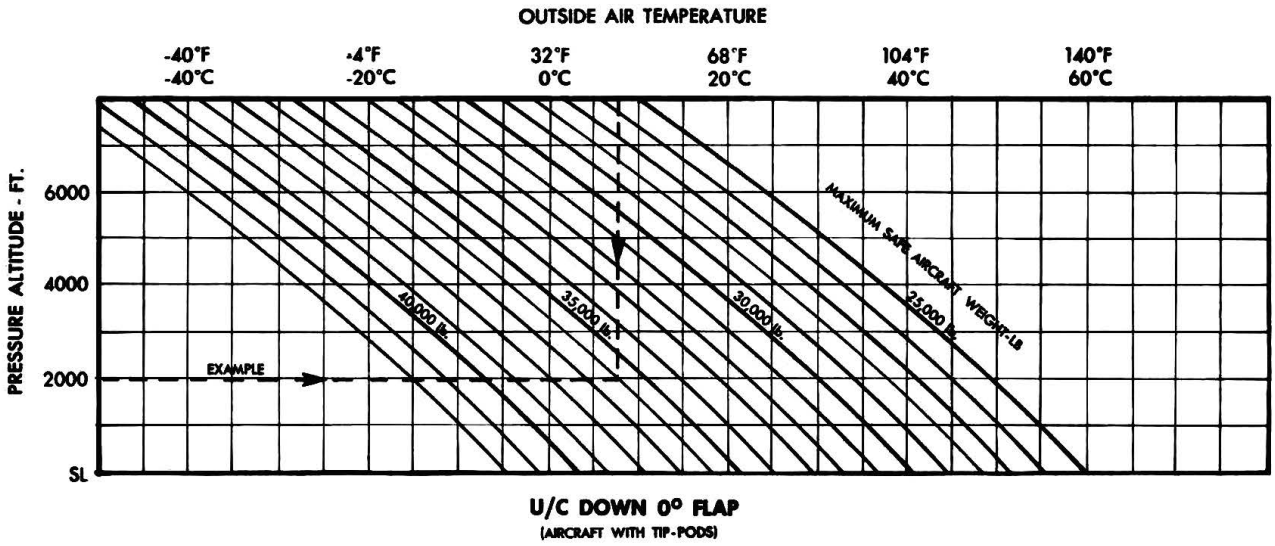
(b) Switch the radar inverter to OFF and the radar master switch to DISCONN. Switch off all other unnecessary electrical circuits.

(c) Instruct the navigator to check the generator output.

(d) If conditions permit, carry out the relight procedure in para 9 or 10.

(e) If relight is inadvisable adjust the trim for asymmetric flight.

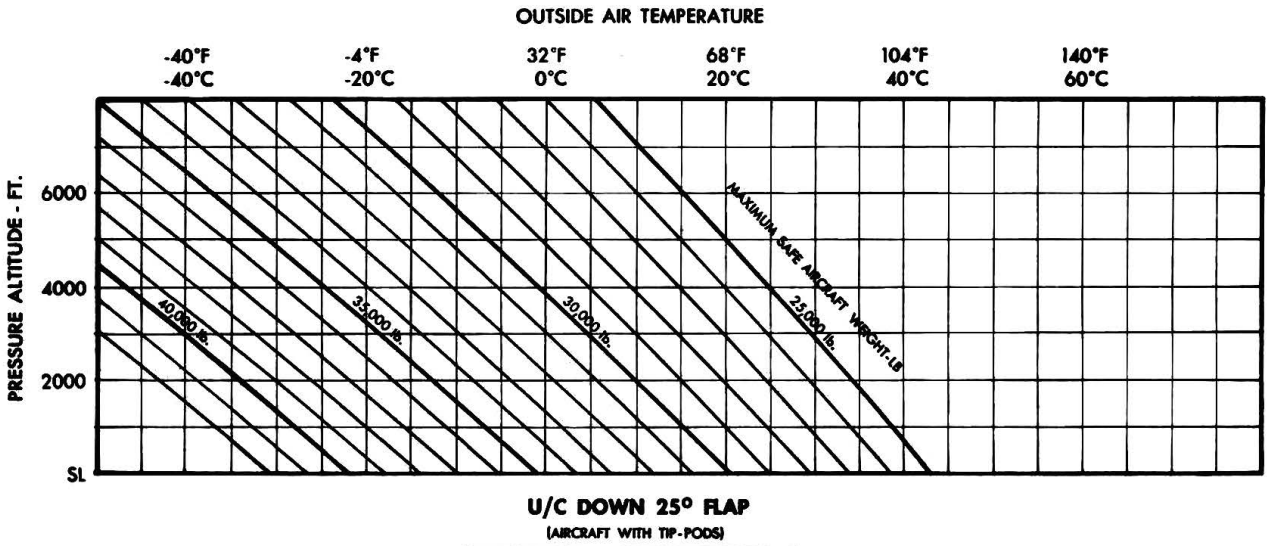
AIRCRAFT WITH ORENDA 9 ENGINES



U/C DOWN 0° FLAP
(AIRCRAFT WITH TIP-PODS)

EXAMPLES:
FOR THE GIVEN O.A.T. AND PRESSURE ALTITUDE, A/C CANNOT CLIMB AWAY USING 0° FLAP IF THE TAKE-OFF WEIGHT IS ABOVE: 36,000 LB. (A/C WITH TIP-PODS)
38,500 LB. (A/C WITH TIP-TANKS)
35,000 LB. (A/C WITH SQUARE TIPS)
35,400 LB. (A/C WITH CHAFF DISPENSERS)

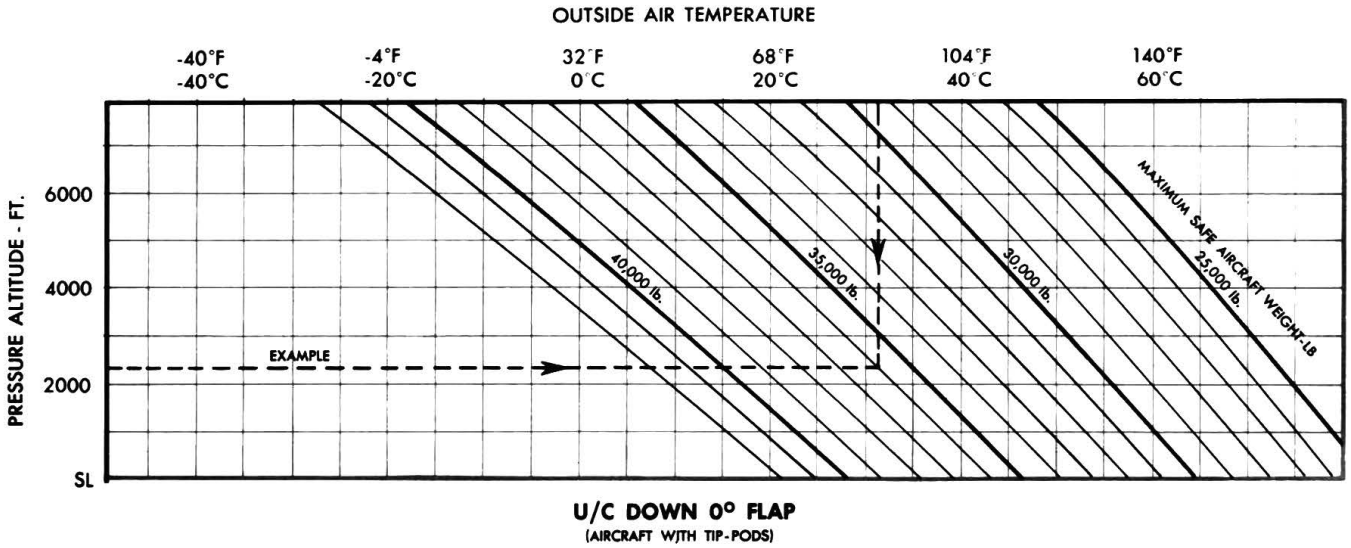
NON-STANDARD CONFIGURATIONS
TIP-TANKS - ADD 2500 LB
SQUARE TIPS - SUBTRACT 1,000 LB.
CHAFF DISPENSERS - SUBTRACT 600 LB.
} FROM
THE MAXIMUM SAFE A/C WEIGHT CALCULATED FROM THE GRAPH



U/C DOWN 25° FLAP
(AIRCRAFT WITH TIP-PODS)

CHARTS BASED ON
1. UNSTICK SPEED OF 1.15 X STALLING SPEED
2. CLIMB AWAY OF 100 FPM WITH U/C DOWN OR U/C AND FLAPS DOWN

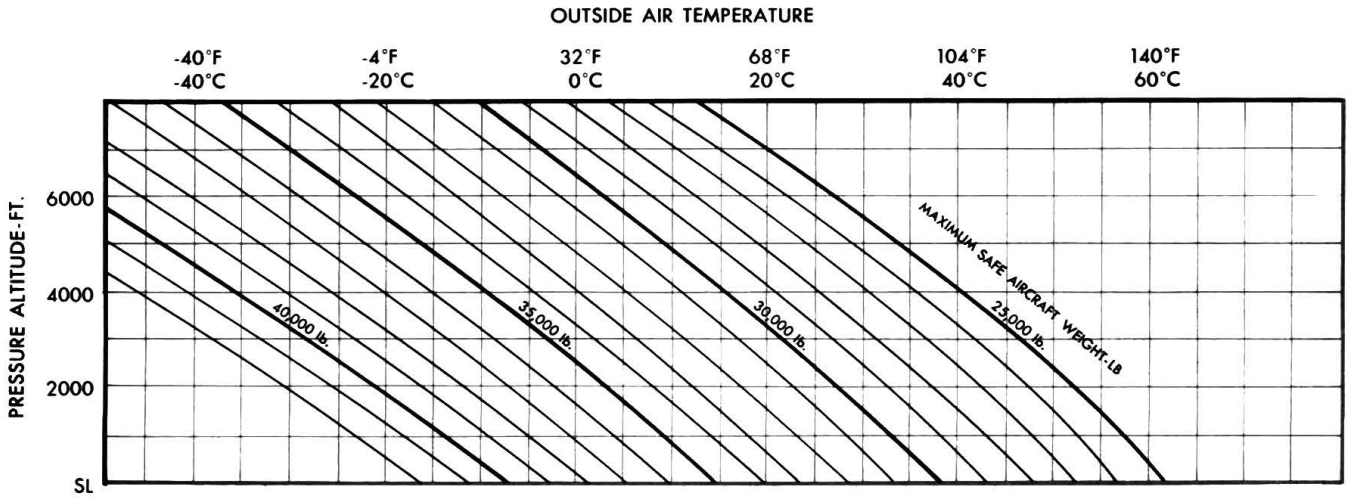
AIRCRAFT WITH ORENDA 11 ENGINES



U/C DOWN 0° FLAP
(AIRCRAFT WITH TIP-PODS)

EXAMPLES:
FOR THE GIVEN O.A.T. AND PRESSURE ALTITUDE, A/C CANNOT CLIMB AWAY USING 0° FLAP IF THE TAKE-OFF WEIGHT IS ABOVE: 36,000 LB. (A/C WITH TIP-PODS)
38,500 LB. (A/C WITH TIP-TANKS)
35,000 LB. (A/C WITH SQUARE TIPS)
35,400 LB. (A/C WITH CHAFF DISPENSERS)

NON-STANDARD CONFIGURATIONS
TIP-TANKS - ADD 2,500 LB
SQUARE TIPS - SUBTRACT 1,000 LB. } FROM
CHAFF DISPENSERS - SUBTRACT 600 LB.
THE MAXIMUM SAFE A/C WEIGHT CALCULATED FROM THE GRAPH



U/C DOWN 25° FLAP
(AIRCRAFT WITH TIP-PODS)

CHARTS BASED ON
1. UNSTICK SPEED OF 1.15 X STALLING SPEED
2. CLIMB AWAY OF 100 FPM WITH U/C DOWN OR U/C AND FLAPS DOWN

TWO ENGINE FAILURE IN FLIGHT

5 If fuel is still available and with no mechanical defects in the engines:

(a) Close the throttles to cut-off position.

(b) Switch the radar inverter to OFF and the radar master switch to DISCONN. Switch off all other unnecessary electrical circuits.

(c) Descend quickly to the relight altitude. Maintain a minimum of 16% rpm. Use speed brakes for the descent and conserve hydraulic pressure by minimum use of the flying controls. While descending, check fuel transfer pumps and all circuit breakers.

(d) Relight engines in turn. (See para 7, 8, 9 and 10).

6 If it is not possible to relight either engine by the time the aircraft has descended to 5,000 feet above ground, the pilot will decide whether to proceed with a landing or bail out. A landing will be advisable only if an airfield or other similarly large flat area is visible and within easy gliding distance. It is recommended that the landing be made wheels-up unless it is certain that it can be completed on a suitable runway. If a landing is to be attempted proceed as follows:

(a) Close the throttle to cut-off position.

(b) Select a landing field within easy gliding distance. For optimum range during descent maintain 180 knots IAS, which will give approximately two nautical miles for every 1,000 feet loss of height.

(c) Switch off the fuel pumps.

(d) Switch the radar inverter to OFF and the radar master switch to DISCONN. Switch off all other unnecessary electrical circuits.

(e) Select the flying control booster lever to the OFF position.

(g) Increase the approach and landing speed by 10-15 knots above normal.

(h) Use emergency air extension for landing gear and flaps. (See para 14 and 18).

EMERGENCY RELIGHT IN THE AIR

GENERAL

7 On Orenda 9 engines do not attempt to relight an engine above 20,000 feet when using 3GP23A fuel or above 12,000 feet when using 3GP22A fuel. When long reach igniter plugs are fitted the maximum relight altitude is 25,000 feet. If the first relight attempt is unsuccessful, descend to a lower altitude and try again.

8 Orenda 11 engines will relight up to an altitude of 35,000 feet.

RELIGHT PROCEDURE (ORENDA 9)

9 Adopt the following sequence of operations.

(a) Windmill the engine for at least 30 seconds with the throttle lever in the cut-off position to dry out surplus fuel.

(b) Adjust the airspeed in order to obtain a windmilling speed of 13% to 20% rpm, depending upon altitude.

(c) Press and hold the relight button.

(d) When the relight button has been held for three seconds, move the throttle lever to the idle position. If required, the throttle may be opened up to 1/2 in ahead of the idle position.

(e) Release the relight button when relight is obtained.

(f) When relight is obtained, and rpm have increased steadily to idling speed and temperatures have settled down, open the throttle to the desired position and resume normal flight.

(g) If a relight is not obtained within 30 seconds move the throttle to the cut-off posi-

RELIGHT PROCEDURE (ORENDA 11)

10 Adopt the following sequence of operations:

(a) Windmill the engine for at least 30 seconds with the throttle lever in the cut-off position to dry out surplus fuel.

(b) Adjust the airspeed to approximately 210 knots IAS, to obtain a windmilling speed of 18% to 25% rpm, depending upon altitude.

(c) Press and hold the relight button.

(d) When the relight button has been held for three seconds, move the throttle lever to the idle position.

(e) Release the relight button when relight is obtained.

(f) When rpm have increased steadily to idling speed and temperatures have settled down, open the throttle to the desired position and resume normal flight.

(g) If a relight is not obtained within 30 seconds move the throttle to the cut-off position and make a further attempt after the engine has been windmilled for at least 30 seconds.

LANDING WITH ASYMMETRIC POWER

SINGLE ENGINE LANDING

11 A normal left or right-hand circuit can be made irrespective of which engine has failed. The following procedure is recommended:

(a) At 1500 feet on the downwind leg at 180 knots IAS, lower 25° flap.

(b) Lower landing gear at 170 knots IAS, increasing the rpm on the good engine to 90-95% rpm to maintain height, at normal landing weight.

(c) When it is certain that the runway can be reached without power, cut the throttle and

NOTE

Hydraulic services will take considerably longer to operate. Sufficient time should therefore be allowed for extending landing gear and flaps.

MISLANDING

12 The decision to go round again must be taken early, since considerable delay in response to throttle opening will be experienced. Proceed as follows:

(a) Increase power smoothly to maintain airspeed above 150 knots.

(b) Check that the speed brakes are closed, retract landing gear and raise the flaps to the 25° position.

(c) Allow airspeed to build up to 170 knots.

(d) Raise flaps.

LANDING GEAR EMERGENCY PROCEDURES

EMERGENCY EXTENSION OF LANDING GEAR

13 If no red or green lights appear after the landing gear has been selected down, and hydraulic pressure is normal, a fault in the selector circuit is indicated. The following procedure should then be adopted:

(a) Maintain the normal U/C DOWN selection.

(b) Check the landing gear indicator by operating the CHANGE LAMP switch.

(c) Instruct the navigator to pull out the U/C ACT circuit breaker on the main circuit breaker panel and to depress the EMERGENCY U/C DOWN button on the pressure bulkhead. The button must be maintained depressed until the landing gear green lights appear.

CAUTION

After landing do not move the U/C ACT

14 If the above procedure fails or if the navigator cannot depress the EMERGENCY U/C DOWN button, proceed as follows:

(a) Maintain the normal U/C DOWN selection and U/C ACT circuit breaker off.

(b) Operate the EMERG U/C DOWN lever on the LH console in the pilot's cockpit. The emergency air system provides for one down operation only.

WARNING

The pilot should be prepared to select the flying CONTROL BOOSTER lever DOWN-OFF if the hydraulic pressure gauge shows a steadily dropping pressure.

NOTE

It may be necessary to reduce IAS to 140 knots to allow the nose wheel to lock down.

15 If red lights or a combination of red and green lights appear after the landing gear has been selected down, and hydraulic pressure is normal, a fault in the light circuit or a mechanical fault is indicated. The following procedure should then be adopted:

(a) Check the landing gear indicator by operating the CHANGE LAMP switch.

(b) Instruct the navigator to select the TEST HYD circuit breaker on the main circuit breaker panel ON.

(c) Maintain the U/C DOWN selection and hold the HYD TEST PUMP switch on the LH forward console to the ON position.

CAUTION

To prevent overheating of the power pack do not hold the HYD TEST PUMP switch ON for more than ten seconds after the hydraulic pressure gauge

(d) If the landing gear green lights do not appear, fly close to the control tower to check if the landing gear appears to be down. If it does not appear to be down, re-select U/C UP to retract the gear, and make a wheels-up landing.

WARNING

In the above case do not use the emergency air system as it has less pressure than normal hydraulic pressure. If the normal system pressure will only partially lower the gear, emergency air pressure will not lower it fully, and once emergency air is used the gear cannot be raised for a wheels-up landing.

(e) If the main landing gear locks down but nose wheel stays up or shows unsafe the aircraft can be landed safely and with the minimum of damage on the main wheels only. This method is preferable to a wheels-up landing.

16 If hydraulic pressure is not available, proceed as follows:

(a) Make the normal U/C DOWN selection.

(b) Check the emergency brake accumulator pressure at the gauge located on the pressure bulkhead of the navigator's cockpit, to ensure availability of brakes on landing.

(c) Operate the EMERG U/C DOWN lever. The emergency air system provides for one down operation only.

NOTE

It may be necessary to reduce IAS to 140 knots to allow the nose wheel to lock down.

EMERGENCY RETRACTION OF LANDING GEAR

17 If it is desired to retract the landing gear when the weight of the aircraft is on the

LANDING FLAP EMERGENCY PROCEDURE

EMERGENCY LOWERING OF FLAPS

18 If the landing flaps cannot be lowered by normal operation of the FLAPS control lever, proceed as follows:

(a) Maintain the normal FLAP 60° selection.

(b) Instruct the navigator to pull out the LAND FLAP circuit breaker on the main circuit breaker panel.

(c) Operate the EMERG FLAP DOWN lever located on the throttle box. The emergency air system provides for only one down operation of full flap.

WARNING

The pilot should be prepared to select the flying CONTROL BOOSTER lever DOWN-OFF if the hydraulic pressure gauge shows a steadily dropping pressure.

WARNING

The wings should be level before selecting emergency flaps as the flaps may not fully extend at normal operating speeds. They will open progressively as speed is reduced but may lower at an uneven rate, causing a marked rolling tendency. This condition can produce high lateral stick forces if a "boost out" landing is being carried out.

BRAKE EMERGENCY PROCEDURES

EMERGENCY OPERATION OF THE BRAKES

19 Should the main hydraulic pressure fail, sufficient pressure to effect a safe landing is supplied by the main brake accumulator. A separate emergency accumulator is incorporated in the system and its pressure is shown on the gauge fitted on the rear bulkhead in the navigator's compartment, which should nor-

20 When landing after a hydraulic system failure, the brakes should be applied sparingly, pumping should be avoided and every effort should be made to complete the landing run with a single application of the brakes. If a heavy braking force is applied the Maxaret units will cycle and cause a rapid depletion of the main brake accumulator.

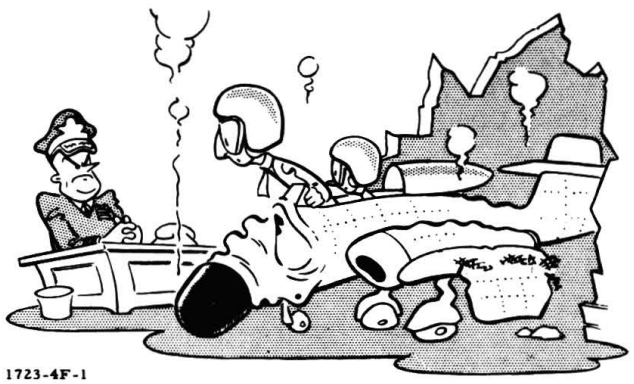
21 In the event of loss of brake action through the depletion of the main accumulator, or failure of one or both foot motors, braking must be completed using the Emergency/Parking brake. This applies brake pressure to both sets of wheels evenly and consequently does not provide directional control. When using the hand brake, it too should be used without pumping in order to prevent depletion of the emergency accumulator.

CAUTION

The Emergency/Parking brake is very powerful and should be used carefully to avoid locking the aircraft wheels.

CAUTION

After completion of the landing run do not taxi the aircraft.



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ENGINE THRUST AT IDLE RPM

22 Engine thrust at idle rpm is comparatively high. When maximum deceleration is

RUNWAY BARRIER

PROCEDURE FOR RUNWAY BARRIER ENGAGEMENT

23 The following procedure is to be adopted when the runway barrier is to be used:

(a) Immediately after touchdown ensure that the nose wheel is on the ground. Engagement is extremely unlikely unless the nose wheel is able to trip the engaging mechanism.

(b) Attempt to line up the ground run to engage the cable at mid-point. Successful engagement is possible in an off centre approach.

(c) Desirable engaging speed is not lower than 30 knots and not higher than 130 knots.

24 There will be a noticeable delay between engagement of the nose wheel and appreciable deceleration.

WARNING

Do not use brakes during engagement unless necessary to counteract a turning tendency caused by engagement of one leg only.

25 There are no restrictions on the position of dive brakes, flaps or external stores.

FLYING CONTROLS EMERGENCY PROCEDURE

FLYING CONTROL BOOSTER FAILURE

26 If the BOOST PRESS warning light on the main panel illuminates, indicating a failure of the main hydraulic pressure, immediately depress the control booster lever to the OFF position to gain manual control. Reduce speed to 200 knots to lighten the load on the controls and trim out any out-of-trim forces. Any out-of-trim condition is more noticeable when flying out-of-boost. The boost pressure warning light will remain illuminated while the control booster is OFF. To prevent glare,

WARNING

Failure to depress the control booster lever under this condition will result in locking of the controls, and their remaining locked until the lever is depressed. No attempt should be made to re-engage the flying control boosters in the air.

NOTE

An additional indication of failure of the hydraulic pressure may be a progressive increase in the amount of manual effort required to operate the flying controls. Surging of the controls may also be experienced.

WARNING

When deboosting the pilot should be prepared to experience large control forces. After deboosting, considerable manual force may be required to obtain even small angles of bank, rates of roll, or to initiate any change in attitude. The force required will increase with an increase in airspeed. A nose-up change of trim may also be experienced due to aileron upfloat when deboosting, however this can be easily controlled by the pilot.

"OUT-OF-BOOST" LANDING

27 When landing with control boosters disengaged a flat approach should be carried out to avoid excessive control column forces which would be encountered if attempting a normal "flare-out". The aircraft should be trimmed to maintain the desired approach speed and the power adjusted to govern the rate of descent. A pronounced nose-heavy tendency should be expected when the main wheels contact the runway. Extreme caution should be exercised if an overshoot is carried out with the control boosters disengaged. Heavy nose-up loads should be expected with the application of power, retraction of landing gear and retraction

AUTO TRIM WARNING

28 With the autopilot engaged and the auto-trim switch ON, the AUTO TRIM warning light will illuminate if for any reason the loading on the elevator control cables builds up to a predetermined amount. On receiving this warning, proceed as follows:

(a) Immediately select the elevator trim emergency switch to EMERGENCY OFF.

(b) Slow the aircraft to below 200 knots.

(c) Select the AUTO TRIM switch OFF.

(d) Check the trim indicator for position of the trim tabs.

(e) Hold the control column trim switch in the direction which will reduce the out-of-trim load, (i.e. to bring the trim-tabs to the 1° nose-up position).

(f) Momentarily select the elevator trim emergency switch to NORMAL and check the trim indicator for a movement to bring the trim tabs in the required direction.

WARNING

If the indicator does not show a correcting movement of the trim tabs in the desired direction, immediately select EMERGENCY OFF to avoid the trim tabs moving further out-of-trim.

(g) If the indicator shows a movement in the correct direction leave the elevator trim emergency switch at NORMAL and trim the aircraft 1° NOSE-UP.

(h) Disengage the autopilot when required.

NOTE

If the aircraft cannot be trimmed manually, return the elevator trim emergency switch to EMERGENCY OFF. The aircraft must then be flown in an out-of-trim condition at reduced speed. The autopilot can be disengaged when nearing the airfield. Exercise care and be prepared for a pronounced out-of-trim load on the control column upon disengagement.

MALFUNCTION OF THE MANUAL ELEVATOR TRIM

29 If a malfunction of the manual elevator trim is suspected with the autopilot not engaged, then the ELEVATOR TRIM-NORMAL/EMERGENCY OFF switch on the left-hand console should immediately be selected to EMERGENCY OFF. No attempt should be made to use the elevator trim button since intermittent operation could result in a dangerous trim condition.

FUEL SYSTEM FAILURES

FUEL SYSTEM BOOSTER/TRANSFER PUMP FAILURE

30 The illumination of an engine fuel pressure warning light may be caused by one or more of the following: failure of fuselage booster pump, no fuel in fuselage tank, line blockage, ruptured fuel line or fuel leak. Recommended course of action to be taken depends on the cause and it is VITAL that the pilot attempts to isolate the reason for the warning light illuminating. Table 1 shows the recommended action to be taken. Procedure after action taken depends on the flight plan, and the amount of fuel remaining in the tanks. Figure 3-3 shows the emergency fuel selection.

WARNING

If the auxiliary tank transfer pump fails, or the green indicating light does not go out when the auxiliary tank is empty, then the auxiliary pump must be switched off in order to obtain transfer of fuel from the wing tanks.

NOTE

The fuel remaining in the auxiliary tank after a pump failure will cause an undesirable distribution of weight and any manoeuvres resulting in high "G" forces should be avoided.

TABLE 1

INDICATION	RECOMMENDED ACTION
Engine fuel pressure warning light illuminates.	(a) Check contents of fuel gauge, switch to appropriate tanks. (b) Switch off suspected fuselage booster pump and have navigator observe the ammeter. An operative pump will show an increased load or needle flicker. In addition, pilot can usually hear pump cut in and out in headset. If pump inoperative, switch to opposite cross-feed. (c) A line blockage above pressure sensing point. Result probably a drop in rpm or flameout. Switch to opposite cross-feed or wing direct. (d) Ruptured fuel line or fuel leak. Leave cross-feed normal. Check for venting, monitor fuel gauges for differential, check for evidence of fire. Shut down engine (LP cocks OFF). Do not relight. NOTE If a fuel leak cannot be determined and engine is required for recovery, continue engine operation but shut down completely before landing. DO NOT reduce speed before affected engine shut-down.
Wing tank fuel pressure warning light illuminates before wing tanks is empty.	Switch suspected wing transfer pump off and have navigator observe ammeter for change in load or needle flicker. If pump inoperative switch to opposite side of cross-feed.

31 If it is required to use the fuel from a tank with a pump that has failed it may be necessary to descend to a lower altitude in order to obtain the desired rpm. Prolonged running of an engine operating on suction from a tank with an inoperative pump may lead to engine fuel pump failure.

NOTE

At the end of the flight, note on the Form

WING TIP TANK FUEL JETTISON

32 Jettison the fuel from the tip tanks by lifting the guard of the TIP TANK FUEL JETTISON switch and selecting the switch to ON. This action jettisons the fuel from both tip tanks.

33 Fuel jettison can be carried out at any airspeed and altitude with tip tanks either pressurized or unpressurized. It requires an average of 3-1/2 minutes in straight and level

IN FLIGHT HANDLING CHARACTERISTICS - ASYMMETRIC TIP TANK FUEL LOAD AND WITH FLIGHT CONTROLS IN BOOST

34 In normal flight, from 150 kts to .81MN, no excessive handling difficulties will be encountered when operating with a full asymmetric tip tank fuel load.

35 Control effectiveness and response decrease as the airspeed is decreased. This is accompanied by an increase in aileron force and control travel until, at 135 to 140 kts, full aileron travel is required to hold up the full tip tank; 25° flap, landing gear down, dive brakes in.

36 Landing with full tip tank asymmetric fuel load is not recommended. If such a condition exists, the tip tank fuel should be jettisoned prior to landing. If this is not possible, the following landing technique should be used.

37 A flat, straight in approach, using 25 of flap should be made, keeping aileron movement to a minimum. During the approach the airspeed should not be decreased below 150 kts until the aircraft is over the button of the runway. The aircraft should then be flown onto the runway before full aileron travel is required (135-140 kts) to hold up the full tip tank.

38 Overshoot action must be initiated early and the airspeed kept at 150 kts or greater.

IN FLIGHT HANDLING CHARACTERISTICS - ASYMMETRIC TIP TANK FUEL LOAD AND WITH FLIGHT CONTROLS OUT OF BOOST

39 Asymmetric tip tank fuel loads in an "out of boost" condition, create high stick forces and, if not rectified, may force the occupants to abandon the aircraft.

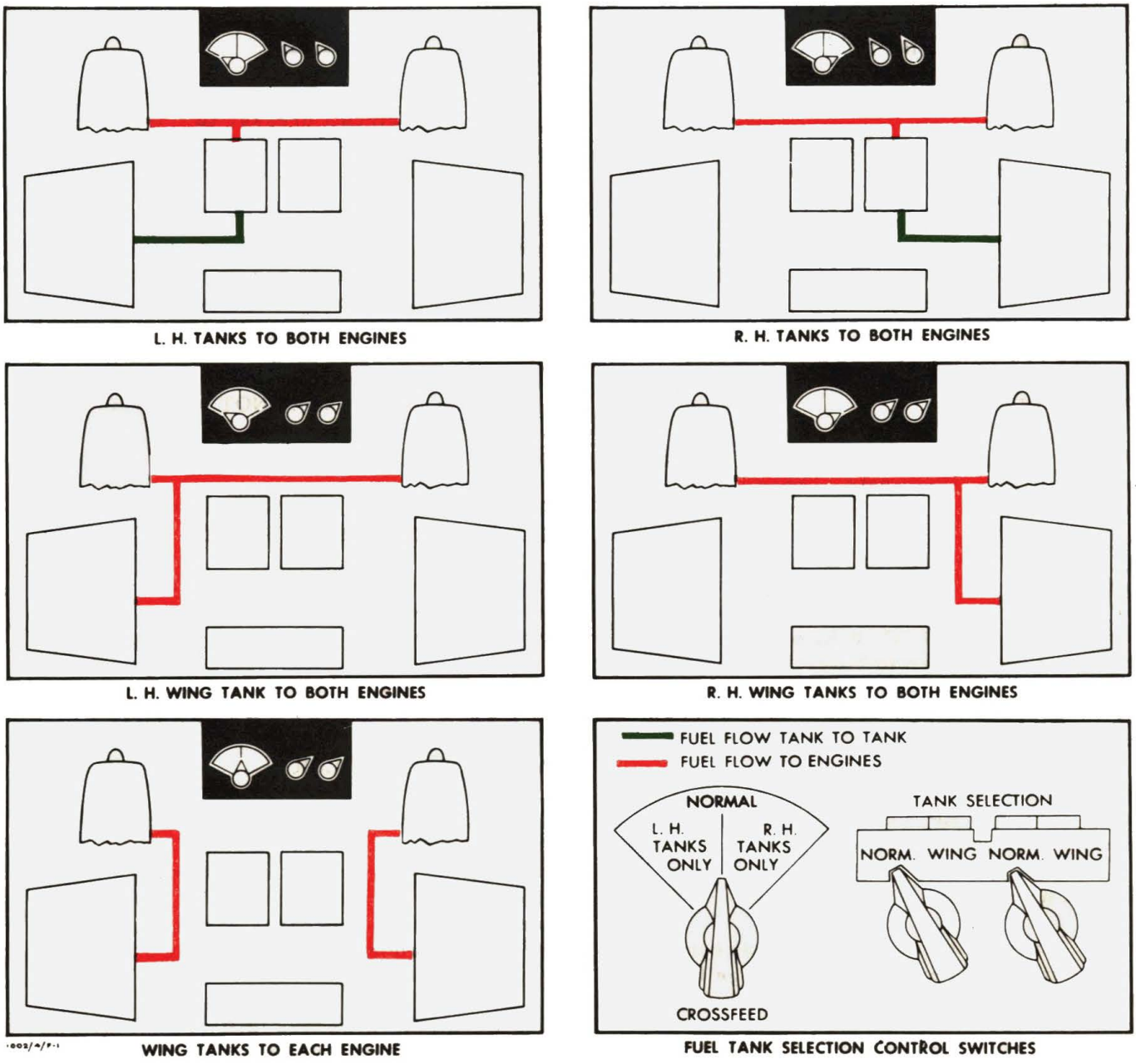


Figure 3-3 Emergency Fuel Feeds

40 If an asymmetric fuel load exists in flight, and it becomes necessary to "deboost", a high mach number should be maintained until fuel jettison has been completed, even then loss of control of the aircraft due to high stick forces may ensue. The occupants should be prepared to abandon the aircraft.

41 If an asymmetric tip tank fuel load is noticeable in high speed flight, in an out necessary before the airspeed is reduced, otherwise excessive stock forces will be encountered. It may be necessary to abandon the aircraft if fuel jettison fails.

NOTE

Crossfeeding internal fuel from the heavy wing will help counteract the adverse forces caused by an asymmetric

EMERGENCY DE-ICING

AIRFRAME AND ENGINE

42 Although the MANUAL AIRFRAME and MANUAL ENGINE emergency de-icing push buttons remain in the cockpit, the de-icing systems are normally disconnected. For procedure to adopt if icing conditions are encountered see EO 05-1-1 (Aircraft Operating Instructions - General).

ACTION IN THE EVENT OF FIRE

ENGINE FIRE

43 If either of the engine fire detection warning lights illuminate, carry out the following drill.

(a) Retard throttle to idle.

(b) If warning light does NOT go out, stopcock engine, shut off LP cock, operate fire extinguisher and return to base.

(c) If warning light goes out, check for evidence of fire.

(d) If evidence of fire found, stopcock engine, shut off LP cock, operate fire extinguisher and return to base.

44 If no evidence of fire is found:

(a) It is possible that an overheat condition did exist due to exhaust gas leakage into the engine nacelle therefore shut down engine and return to base.

(b) If conditions make single engine operation hazardous the affected engine may be operated at a recommended reduced power setting of 70%.

CAUTION

When either engine fire extinguisher is operated the particular bottle discharges its entire contents into the engine nacelle. Do not therefore attempt to relight an engine on which the extinguisher system is exhausted.

NOTE

The operation of a fire extinguisher may cause the circuit breaker to trip. This should not be taken as an indication that the bottle has failed to discharge.

When an engine is shut down in flight and certain atmospheric conditions and airspeed exist, vapour forms on the upper lip of the engine intake cooling. This blue-white vapour will persist as long as the required conditions for its formation are met and it should NOT be mistaken for smoke.

AUTOMATIC OPERATION OF ENGINE FIRE EXTINGUISHER SYSTEMS

45 An impact switch installed in the rear fuselage is set to trigger both engine systems automatically at a deceleration of 6 "g".

CABIN PRESSURE EMERGENCIES

CANOPY SEAL FAILURE

46 At any altitude above 12,500 feet, failure of the canopy seal produces rapid decompression which may result in a cabin altitude greater than the aircraft altitude. This pressure differential increases with airspeed and may be equivalent to approximately 3,000 feet at maximum speed.

47 Resultant pressure differential will be less with the cabin pressure on, but the amount will depend on the degree of canopy failure and the ability of the pressurization system to compensate for pressure lost.

LOSS OF COCKPIT PRESSURIZATION

48 If cockpit pressurization is lost at high altitudes the following action must be taken immediately.

(a) Tighten mask until it holds the pressure delivered by the regulator. It may be necessary to support the mask with one hand.

(b) Open the speed brakes and descend to an altitude not exceeding 35,000 feet. Remain below this altitude.

WARNING

If the mask is not tight, conscious time at 48,000 feet cockpit altitude is approximately 15 seconds. With a perfectly fitted mask, the conscious time is approximately 10 minutes.

GENERATOR EMERGENCIES

49 A GENERATOR fail warning light will illuminate if a generator circuit breaker opens. It may be reset by depressing the FAIL RESET button, but if the warning light remains illuminated the failed generator should be switched off and the load on the operating generator reduced as much as possible.

ALTERNATOR EMERGENCIES

50 Should the ALTERNATOR OVER-TEMP warning light illuminate, the circuit breaker on the main circuit breaker panel marked ALTERNATOR should be pulled "off".

51 The warning light will remain illuminated until the alternator temperature has dropped, when it will go out. If it does not go out the LH engine should be shut down, but this decision rests with the pilot and depends upon flight conditions.

52 If the circuit breaker marked ALTERNATOR should trip without previous illumination of the alternator over-temperature warning light, one attempt only should be made to reset the circuit breaker. There is no necessity to shut down the engine in this case unless there are definite indications of fire.

NOTE

In any case of alternator failure, the fire extinguisher is not to be operated unless an engine fire detection warning light illuminates or an engine is seen to be on fire.

CANOPY JETTISON

GENERAL

53 The canopy may be jettisoned at any speed, or when the aircraft is stationary. In addition, it will jettison at any position from closed to ten inches open.

JETTISON PROCEDURE

54 To jettison the canopy proceed as follows:

(a) Warn the occupant of the other seat to keep his head down.

(b) Push forward the canopy jettison lever cover.

(c) Raise the latch on the canopy jettison lever handle and pull the lever fully to the rear.

CANOPY DECLUTCH IN THE AIR

55 If the canopy fails to jettison, the following procedure should be adopted:

(a) Warn the occupant of the other seat to keep his head down.

(b) Pull the canopy declutch handle.

WARNING

This method of jettisoning the canopy should only be adopted under conditions of extreme emergency as the canopy may strike the empennage when released.

CRASH LANDING

56 A main wheels down landing is preferred (see para 15(e)) however if circumstances dic-

tate a normal wheels-up landing can be made. Proceed as follows:

(a) Jettison the canopy, see paras 53, 54 and 55, or retain the canopy according to the situation.

NOTE

Generally the canopy should be jettisoned. In some situations, however, such as in rain, snow or instrument conditions jettisoning the canopy might

hamper the pilot during the approach and landing. Many crash landings also take place on prepared surfaces where little damage results and the aircrew have no difficulty getting out of the aircraft. The decision to jettison the canopy must therefore be made by the pilot.

(b) Switch yaw damper to OFF.

(c) Lower flaps fully.

(d) Check security of safety harness.

(e) Switch Ground/Flight switch OFF. Instruct navigator to switch off generators.

(f) Pull throttles back to cut-off position immediately before touch-down.

EMERGENCY EXIT FROM THE AIRCRAFT ON THE GROUND

57 Figure 3-4 shows the sequence of operations to be followed in an emergency when the aircraft is on the ground and the canopy has not been jettisoned.

RELEASE OF CREW MEMBERS IN AN EMERGENCY ON THE GROUND

GAINING ACCESS TO COCKPITS

58 In the event of an emergency which prevents the crew escaping from the aircraft unassisted, the rescuer should first release the canopy as follows:

(a) Operate the CANOPY OPEN push button switch on the left-hand side of the fuselage below the windshield and open the canopy fully, if possible.

(b) If method (a) fails, operate the external declutch handle. This is located on the left side of the fuselage at the rear of the canopy. The handle is protected by a hinged cover marked CANOPY EMERGENCY RELEASE - LIFT COVER, ROTATE HANDLE, PUSH BACK CANOPY.

(c) Slide the canopy backwards manually.

(d) If the above procedure fails, break the top of the canopy.

HARNESS RELEASE

59 Release the occupants from their safety harness and parachute harness as follows:

(a) If circumstances permit, switch OFF the Ground/Flight switch and make the ejection seats safe by removing the safety pins from their stowages on the LH side of the seats and placing them in the firing sears at the top rear of each seat and in the safety locks of the drogue guns. If the seats are not safetied, great care must be exercised that the seat firing handles, cables to the sears or the drogue gun static lines, are not inadvertently pulled.

(b) Release the safety harness by rotating the release lever on the harness quick-release fitting upwards until the arrow points to UNFASTEN. The straps should then be placed clear of the occupant.

NOTE

If the quick-release fitting fails to release the safety harness, the left thigh strap can be pulled right through its buckle, thus if the shoulder straps are slackened, the wearer can be slipped out of the harness.

(c) Release the parachute harness by turning the front plate of the quick-release fitting in the direction of the arrow until rotation ceases. A smart blow on the face of the fitting will then release the harness straps, which should be placed clear of the occupant.

(d) Pull the oxygen and R/T connections apart at their quick-release connectors and remove the occupant.

NOTE

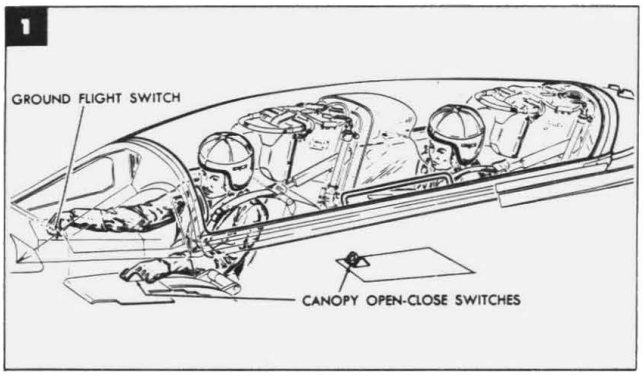
The above method of release applies equally to either cockpit.

ABANDONING THE AIRCRAFT

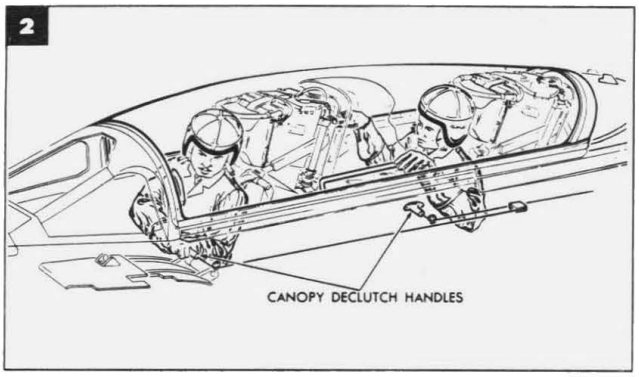
GENERAL

60 Issue 10 ejection seats provide safe ejection from ground level at airspeeds of 90 knots or above. For low altitude ejections, the aircraft should, if possible, be in straight and level flight, or climbing. If the aircraft

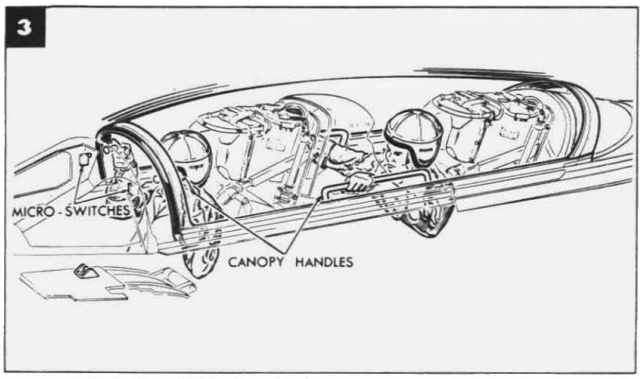
is descending, more than the minimum height will be required. Tests have shown that an ejection carried out from ground level allows the parachute to develop fully at a height which provides the occupant with a vertical descent of 35 feet.



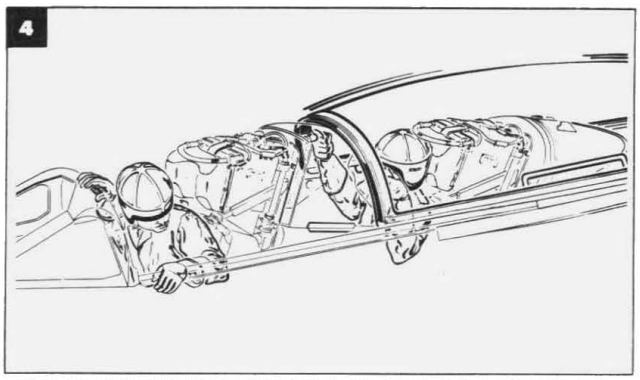
SELECT GROUND FLIGHT SWITCH "OFF" AND HOLD CANOPY OPEN-CLOSE SWITCH "OPEN" RELEASE SEAT AND PARACHUTE HARNESS WHILE OPENING OR ATTEMPTING TO OPEN THE CANOPY ELECTRICALLY.



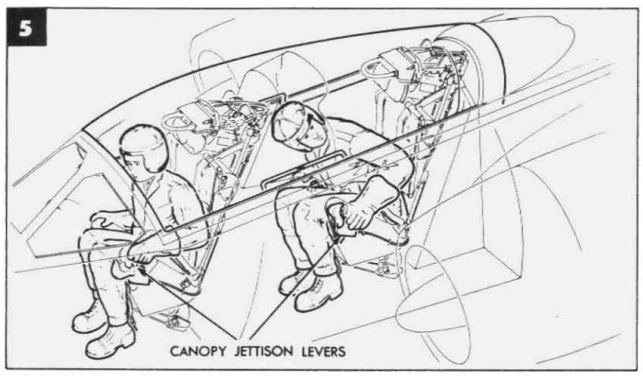
IF THE CANOPY WILL NOT OPEN ELECTRICALLY, PULL THE CANOPY DECLUTCH HANDLE IN EITHER COCKPIT AND. . . .



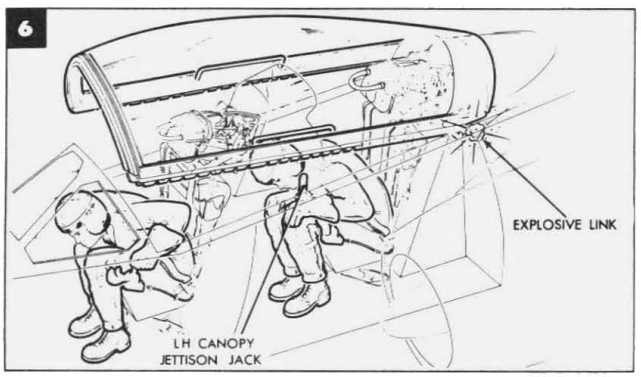
. . . . PULL THE CANOPY OPEN



THE NAVIGATOR PULLS THE CANOPY OPEN CLEAR OF THE REAR COCKPIT.

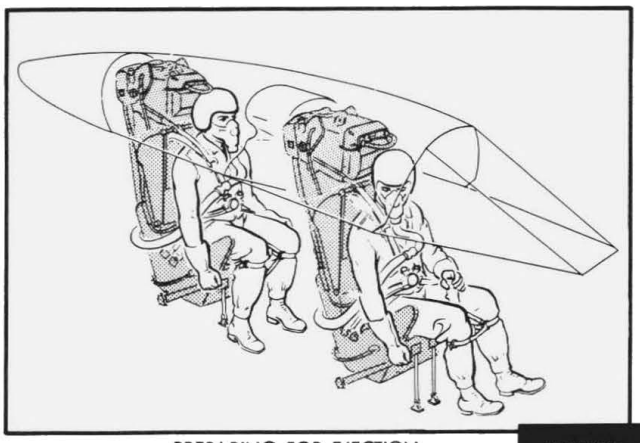


IF THE CANOPY WILL NOT DECLUTCH, SIGNAL PERSONS OUTSIDE THE AIRCRAFT TO STAND CLEAR AND OPERATE THE CANOPY JETTISON LEVER ON EITHER SEAT TO JETTISON CANOPY.

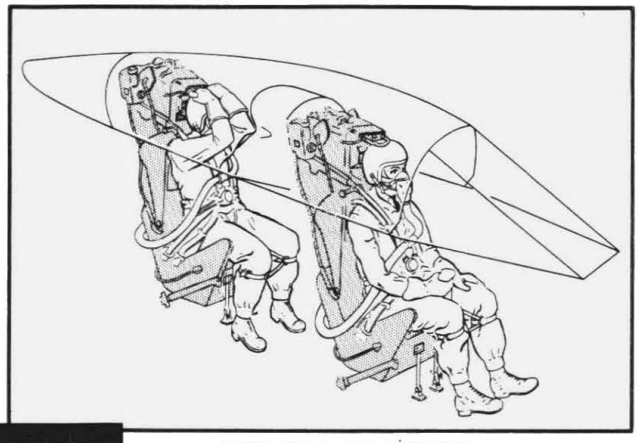


THE OCCUPANTS SHOULD KEEP THEIR HEADS DOWN UNTIL THE CANOPY HAS BEEN JETTISONED AND HAS COME TO REST.

NOTE: IF NECESSARY, THE CANOPY MAY BE JETTISONED AS THE FIRST ACTION.

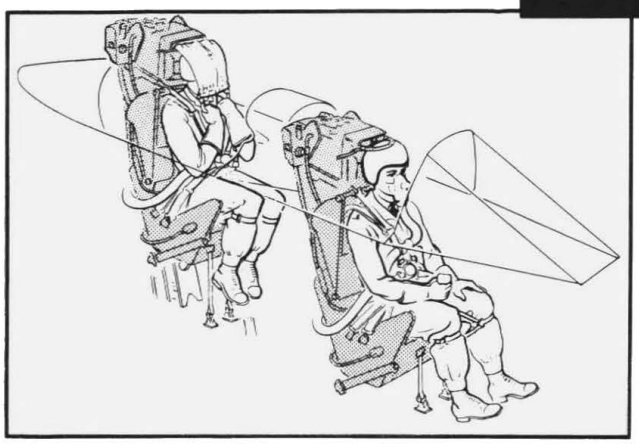


PREPARING FOR EJECTION

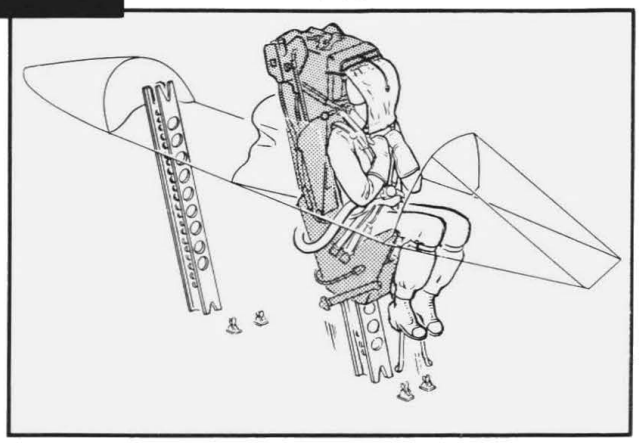


PREPARING FOR EJECTION

METHOD OF EJECTION

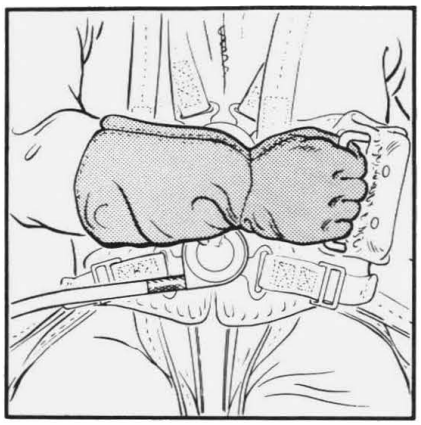


NAVIGATOR EJECTING

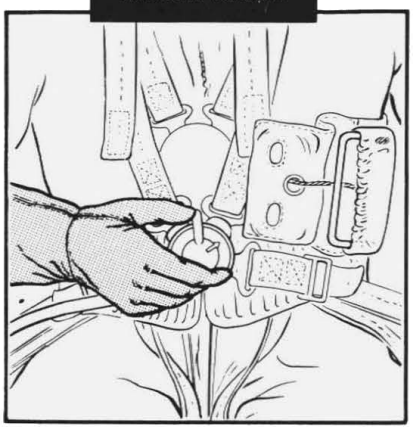


PILOT EJECTING

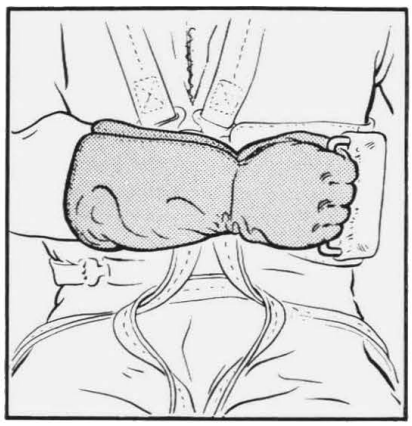
MANUAL RELEASE



1. PULL ON THE OUTER D-RING
2. DISCONNECT THE MAIN OXYGEN SUPPLY IF LEAVING THE AIRCRAFT



3. UNFASTEN THE SEAT SAFETY HARNESS
4. RELEASE PARACHUTE HARNESS RESTRAINING STRAPS



5. LEAVE THE AIRCRAFT OR SEAT
6. PULL THE RIPCORD D-RING

61 The aircraft should not be abandoned by the ejection seats when it is in an inverted position unless absolutely necessary owing to a possible risk of injury. The present safety harness does not give adequate negative 'g' restraint.

PILOT PRELIMINARIES

62 If it becomes necessary to abandon the aircraft, carry out the following procedure:

(a) Reduce airspeed, if possible.

(b) Order the navigator to eject.

or

If intercommunication has failed, operate the BAIL-OUT switch.

(c) Adjust the seat height so that the head is correctly located on the headrest.

NAVIGATOR

63 After receiving the order to eject, either verbally or by illumination of the BAIL-OUT warning light, proceed as follows:

(a) Acknowledge a verbal order.

(b) Ensure that the radar indicator is in the stowed position.

(c) Adjust the seat height so that the head is correctly located on the headrest.

(d) Ensure that the safety harness is locked in the fully back position and that harness is TIGHT.

(e) If above 12,000 feet, pull the knob to operate the emergency oxygen bottle.

(f) Position the head firmly against the headrest.

(g) Grasp the firing handle keeping the elbows close together and with the thumbs outward.

(h) Maintain the head hard back against the headrest and the arms and hands close to the chest, then pull the firing handle and face screen down over the face.

(j) The firing handle is spring-loaded and will release with a slight jerk, and a further downward pull will be required to release the firing pins. The canopy will jettison immediately, and one second later seat ejection will occur, so ensure that the firing handle is held close to the body.

(k) If the seat firing pin is not released by the normal full extension of the face blind, apply a further force by means of a slight forward push with the head.

NOTE

If, for any reason, the canopy fails to jettison, the ejection gun will fire after a one second delay and the seat and occupant will eject through the canopy. Canopy cleavers are fitted to the seat and will shatter the canopy on contact. Ejection will continue in the normal manner.

PILOT

64 After the navigator has left the aircraft, proceed as follows:

(a) Ensure that the safety harness is locked in the fully back position and that harness is TIGHT. Adjust seat height so that the head is firmly positioned on the headrest.

(b) If above 12,000 feet, pull the knob to operate the emergency oxygen bottle.

(c) Grasp the firing handle keeping the elbows close together and with the thumbs outward.

(d) Keeping the head hard back against the headrest and the arms and hands close to the chest, pull the firing handle and face screen firmly down over the face. The firing handle is spring-loaded and will release with a slight jerk, and a further downward pull will be required to release the firing pin. Ejection will occur immediately, so ensure that the firing handle is held close to the body.

(e) If the firing pin is not released by the normal full extension of the face blind, apply a further force by means of a slight forward push with the head.

ALTERNATIVE EJECTION PROCEDURE

65 The alternative ejection procedure is recommended when the aircrew is physically unable to grasp the face blind handle with both hands while maintaining his arms in the correct position. The procedure is as follows:

(a) Interlock the arms by bringing one arm across the chest and grasping the opposite elbow.

(b) With the free hand grasp the overhead firing handle, ensuring that the thumb of the hand faces outwards.

(c) As the blind is drawn over the face but before the sear is pulled, grasp the blind firing handle with the other hand and complete the blind extension as in the two-handed procedure.

EMERGENCY FIRING HANDLE

66 The emergency firing handle should only be used under the following conditions:

(a) If the canopy is not in place and the airspeed cannot be reduced below 300 knots IAS.

(b) If the overhead firing handle cannot be operated for any reason.

67 To operate the emergency firing handle, maintain the head hard back against the headrest and grasp the handle with both hands, one hand over the other. Pull the handle upwards and immediately it reaches its full extension, maintain the grip on the handle, and clamp the hands between the thighs to avoid flailing of the limbs. Maintain the head hard back against the headrest. The positioning of the hands between the thighs will also ensure that the elbows do not contact the cockpit decking during ejection.

MANUAL RELEASE

68 If for any reason the seat does not eject or, when ejected, the automatic gear does not function, provision is made to disconnect the parachute pack from the seat and enable the occupant to operate the parachute manually as follows:

(a) Pull on the outer D-ring.

(b) Disconnect the main oxygen supply if leaving the aircraft.

(c) Unfasten the seat safety harness.

NOTE

Should the quick-release box fail to release, the left thigh strap can be pulled right through its buckle, thus if the shoulder straps are slackened, the occupant can slip out of the harness.

(d) Release parachute harness restraining straps.

(e) Leave the aircraft or seat.

(f) Pull the ripcord D-ring.

DITCHING

69 Reference should be made to EO 05-1-1 Aircraft Operating Instructions - General.

70 Model ditching tests show that using full flap and a minimum speed, tail down landing, the aircraft ditches satisfactorily.

71 A dinghy may or may not be carried in the emergency-survival pack, depending on whether a maritime type (with dinghy) or inland type (without dinghy) is fitted. The type of pack fitted must be taken into consideration when deciding upon a ditching.

72 Before ditching the aircraft carry out the following operations:

(a) Release the two quick-release connectors which hold the emergency seat pack to the parachute harness.

(b) Release the parachute harness, oxygen and R/T connections.

(c) Ensure that the seat safety harness is locked in the fully back position.

73 The landing gear should be up, the canopy jettisoned, and the flaps fully lowered. Ditching should, if possible, be made along the wave

NOTE

Forces that may be expected when ditching in calm water are approximately 3g; and in rough water with three-foot waves, approximately 10g. Aircraft configurations with or without tip pods or tip tanks makes little difference to the ditching characteristics. Ditching with up to 10° of roll or yaw were found to be satisfactory.

74 A flat approach should be carried out and touch-down made at minimum speed and a minimum rate of descent. The flaps will break back immediately upon contact with the water and will not effect the subsequent behaviour of the aircraft.

75 After touch-down the pilot's view will be clear for the major part of the run, but at the very end, at a speed of approximately 6 knots, the nose of the aircraft will drop in badly and the windscreen will be covered with green water. Water will enter the cockpit at this stage, if it is ditched with the canopy already jettisoned. It is recommended, however, that the canopy be jettisoned in the air due to the uncertainty of the degree of buoyancy of the full scale aircraft once it comes to rest.

76 The following procedure should be adopted after ditching:

(a) Release seat safety harness.

(b) Climb from the aircraft holding the emergency pack.

(c) Inflate the life-jacket. The lanyard attachment from the life-jacket to the emergency pack will prevent loss of the pack.

(d) When in the water pull the pack by means of the lanyard until the cable release on the pack can be operated. This will actuate the air bottle and inflate the dinghy. The other items of the survival pack will remain attached to the inside of the dinghy.

PART 4

OPERATING DATA

FUEL AND OIL SPECIFICATIONS

1 Recommended Fuel and Oil Specifications are:

Fuel: Aviation Kerosene
3-GP-23A (MIL-F-5616 Grade JP-1)
or Wide Range Distillate
3-GP-22B (MIL-F-5624C Grade JP-4)

Oil: MIL-0-6081B Grade 1010
MIL-0-6081B Grade 1005 (Cold Weather operation -30°C and below)

ENGINE LIMITATIONS (ORENDA 9)

2 The principal limitations are:

(a) Engine RPM and exhaust temperatures: (See Part 2 para 43).

	Engine RPM *	Ex Temp Max *	Max Time Limit
Maximum	99%-100%	720°C	5 min static 15 min flight
Military Climb	97.5%	690°C	30 min
Normal Cruise	93%	645°C	Unrestricted
Idle	34%-37%	645°C	Unrestricted

* Either RPM or exhaust temperature may be the limiting factor, depending on atmospheric conditions.

(b) Maximum transient exhaust temperatures:

Starting 850°C
Acceleration 790°C
Max Transient 850°C

NOTE

For conditions governing the above oil pressure limits see Part 2 para 63.

(d) Oil Consumption
Maximum 2 pts/hr

(e) Oil Temperature
Starting Minimum -40°C(-40°F)

(f) Fuel Pressure
Minimum 3 psi

(g) Fuel Temperature
Starting Minimum -40°C(-40°F)
Starting Maximum +43°C(+109°F)

ENGINE LIMITATIONS (ORENDA 11)

3 The principal limitations are:

(a) Engine RPM and exhaust temperatures: (See Part 2 para 43).

	Engine RPM *	Ex Temp Max *	Max Time Limit
Maximum	99%-100%	720°C	5 min static 15 min flight
Military Climb	97.5%	685°C	30 min
Normal Cruise	93%	625°C	Unrestricted
Idle	35%-39%	545°C (nominal)	Unrestricted

* Either RPM or exhaust temperature may be the limiting factor, depending on atmospheric conditions.

NOTE

AIRSPEED INDICATOR

- 510 KNOTS I. A. S. - MAXIMUM ALLOWABLE AIRSPEED
- 200 KNOTS I. A. S. - MAXIMUM AIRSPEED LOWERING LANDING GEAR AND FULL FLAPS

NOTE

170 KNOTS MAXIMUM AIRSPEED RAISING LANDING GEAR

MACH. NUMBER INDICATOR

- .82 (.85 TRUE) - MAXIMUM MACH. NUMBER

HYDRAULIC PRESSURE

- 2800 P. S. I. MAXIMUM
- 1900 - 2300 P.S.I. NORMAL

EXHAUST TEMPERATURE

- 720°C MAXIMUM PERMISSIBLE IN FLIGHT
- 400° - 645°C DESIRABLE (OPERATING)

R. P. M. PER CENT

OIL PRESSURE

- 2 P. S. I. (MIN.) IDLING
- 15-25 P.S.I. NORMAL

(b) Maximum transient exhaust temperatures:

Starting 850°C
Acceleration 790°C
Max Transient 850°C

(c) Oil Pressure

Maximum) at 93%	25 psi
Minimum) rpm	15 psi
Idling Minimum	2 psi

(d) Oil Consumption

Maximum	1.5 pts/hr

(e) Oil Temperature

Starting Minimum	-40°C(-40°F)

(f) Fuel Pressure

Minimum	3 psi

(g) Fuel Temperature

Starting Minimum	-40°C(-40°F)
Starting Maximum	+43°C(+109°F)

FLYING LIMITATIONS

MAXIMUM PERMISSIBLE SPEEDS

4 The principal limitations are:

		IAS Kts.
Below 3,300 ft. indicated		510
With Tip Tanks fitted	*	410 or Mch .82
With JATO fitted		250
Lowering Landing Gear		200
Raising Landing Gear		170
Landing Flaps down 60°		200
Landing Flaps down 25°		250
Extending Landing Light		200
Mach No above 3,300 ft. Indicated		.82(.85 True)

* Lowest limit to apply

WEIGHTS

CROSSWIND LANDING AND TAKE-OFF

6 The maximum safe cross-wind component, for take-off weights up to 36,500 lb and for landing weights up to 31,000 lb, is 25 knots.

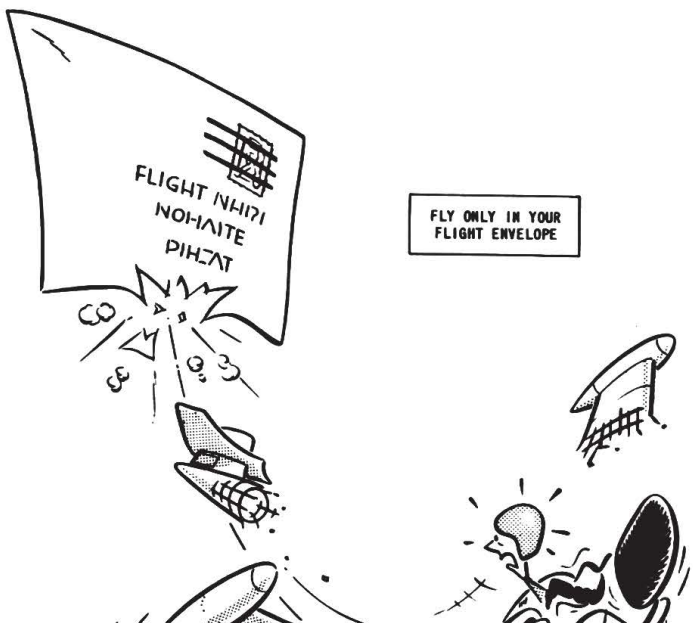
FLIGHT MANOEUVRE ENVELOPES

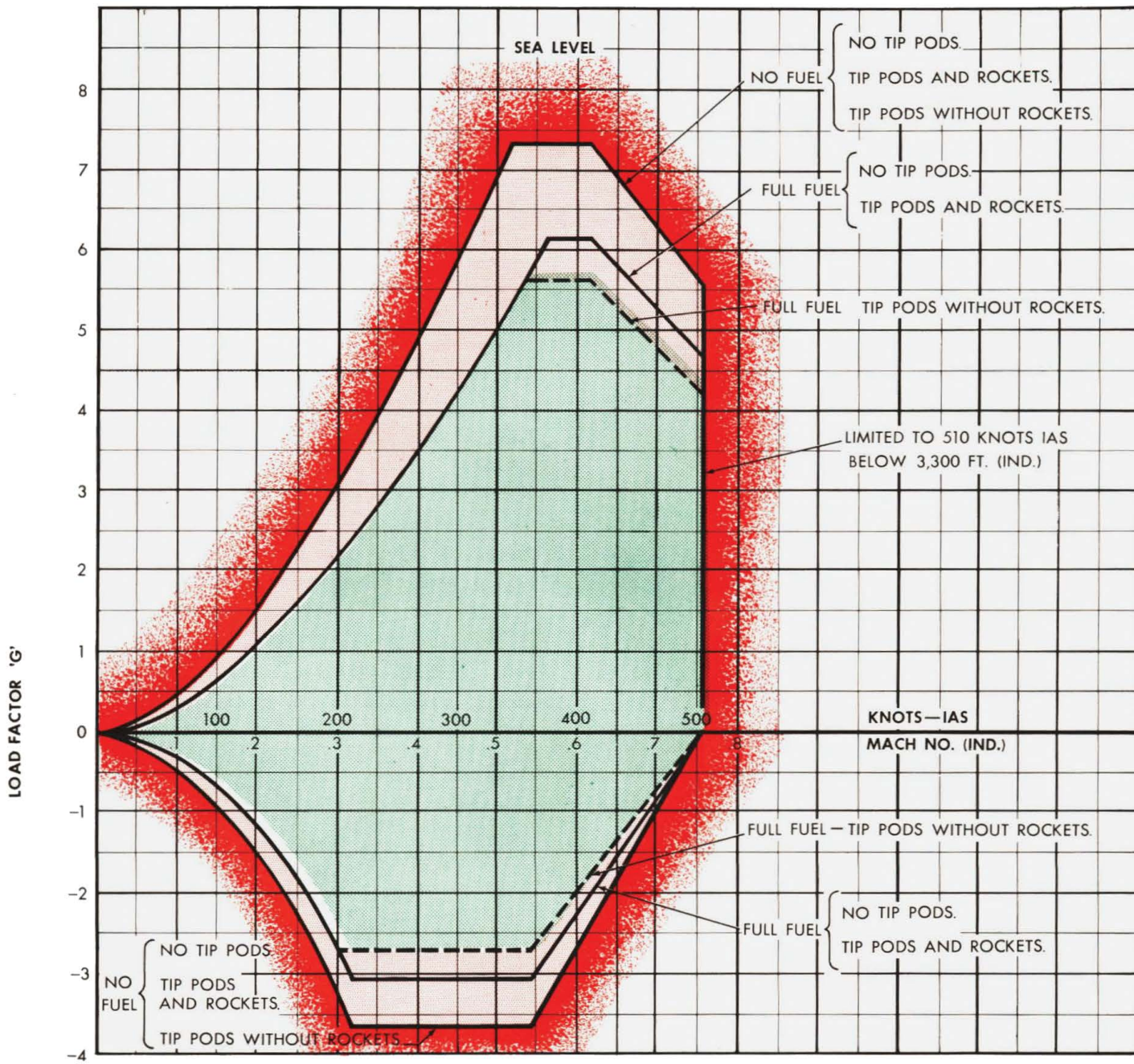
7 The flight manoeuvre envelopes shown on Figs 4-2 and 4-3 apply only at sea level and 3,300 feet altitude respectively. Above 3,300 feet the 'g' loading that can be imposed before the stall gradually decreases with increase in altitude. The coloured areas on the two flight envelopes indicate as follows:

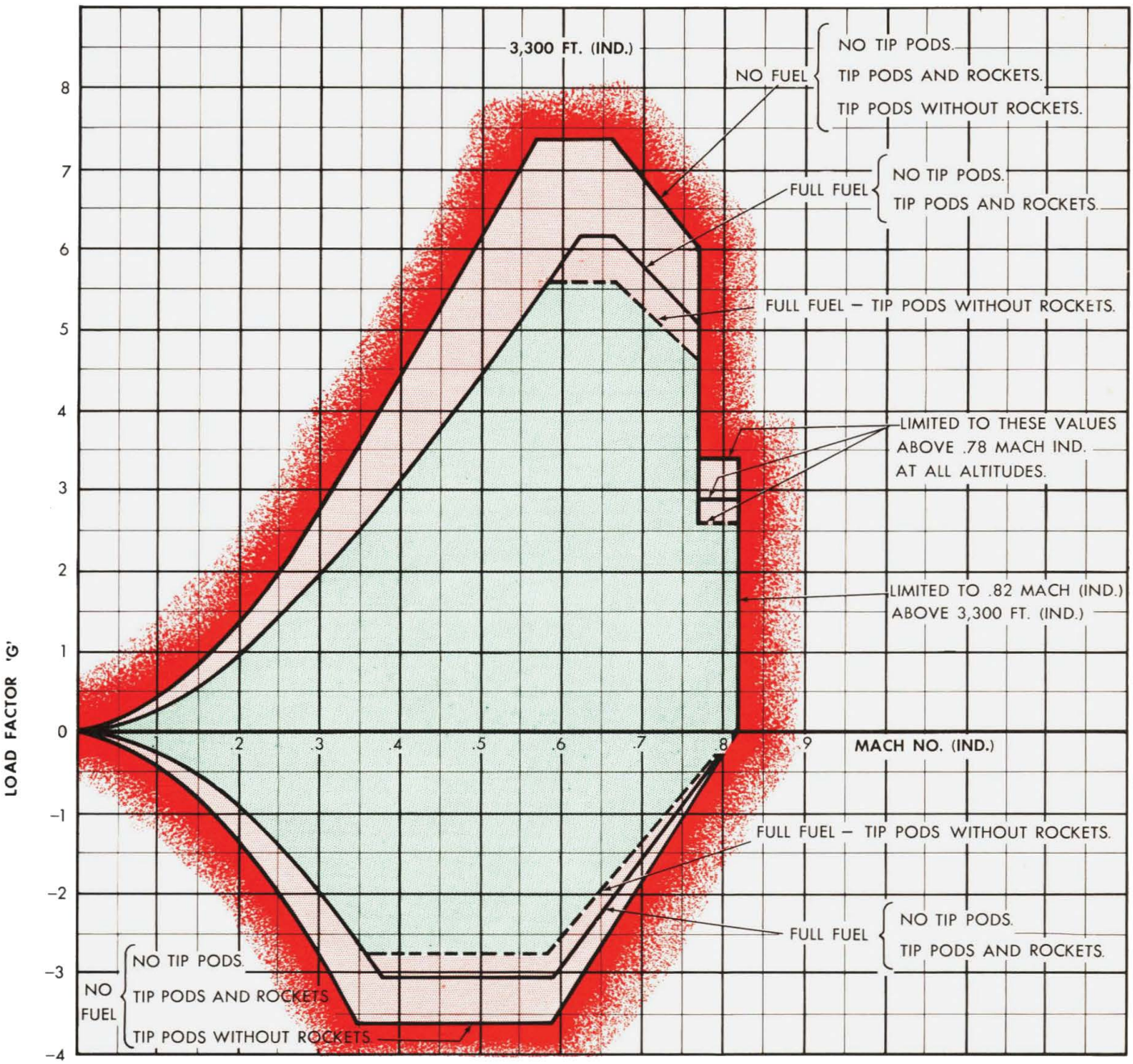
(a) Green - The area in which no flight restrictions apply, irrespective of aircraft weight or configuration.

(b) Pink - The area in which it is safe to fly provided the aircraft configuration and weight are as shown.

(c) Red - The area of complete prohibition, irrespective of aircraft weight or configuration, owing to risk of structural failure.




SEA LEVEL
NO FUEL
NO TIP PODS.
TIP PODS AND ROCKETS.
TIP PODS WITHOUT ROCKETS.
FULL FUEL
NO TIP PODS.
TIP PODS AND ROCKETS.
FULL FUEL TIP PODS WITHOUT ROCKETS.
LIMITED TO 510 KNOTS IAS
BELOW 3,300 FT. (IND.)
LOAD FACTOR 'G'
8
7
6
5
4
3
2
1
0
−1
−2
−3
−4
100
200
300
400
500
KNOTS—IAS
.1
.2
.3
.4
.5
.6
.7
.8
MACH NO. (IND.)
FULL FUEL — TIP PODS WITHOUT ROCKETS.
FULL FUEL
NO TIP PODS.
TIP PODS AND ROCKETS.
NO FUEL
NO TIP PODS.
TIP PODS AND ROCKETS.
TIP PODS WITHOUT ROCKETS.
COMPLETE PROHIBITION
PARTLY RESTRICTED DEPENDING ON AIRCRAFT WEIGHT AND CONFIGURATION
NO RESTRICTIONS



COMPLETE PROHIBITION

PARTLY RESTRICTED DEPENDING ON AIRCRAFT WEIGHT AND CONFIGURATION

NO RESTRICTIONS

1787-25E-1

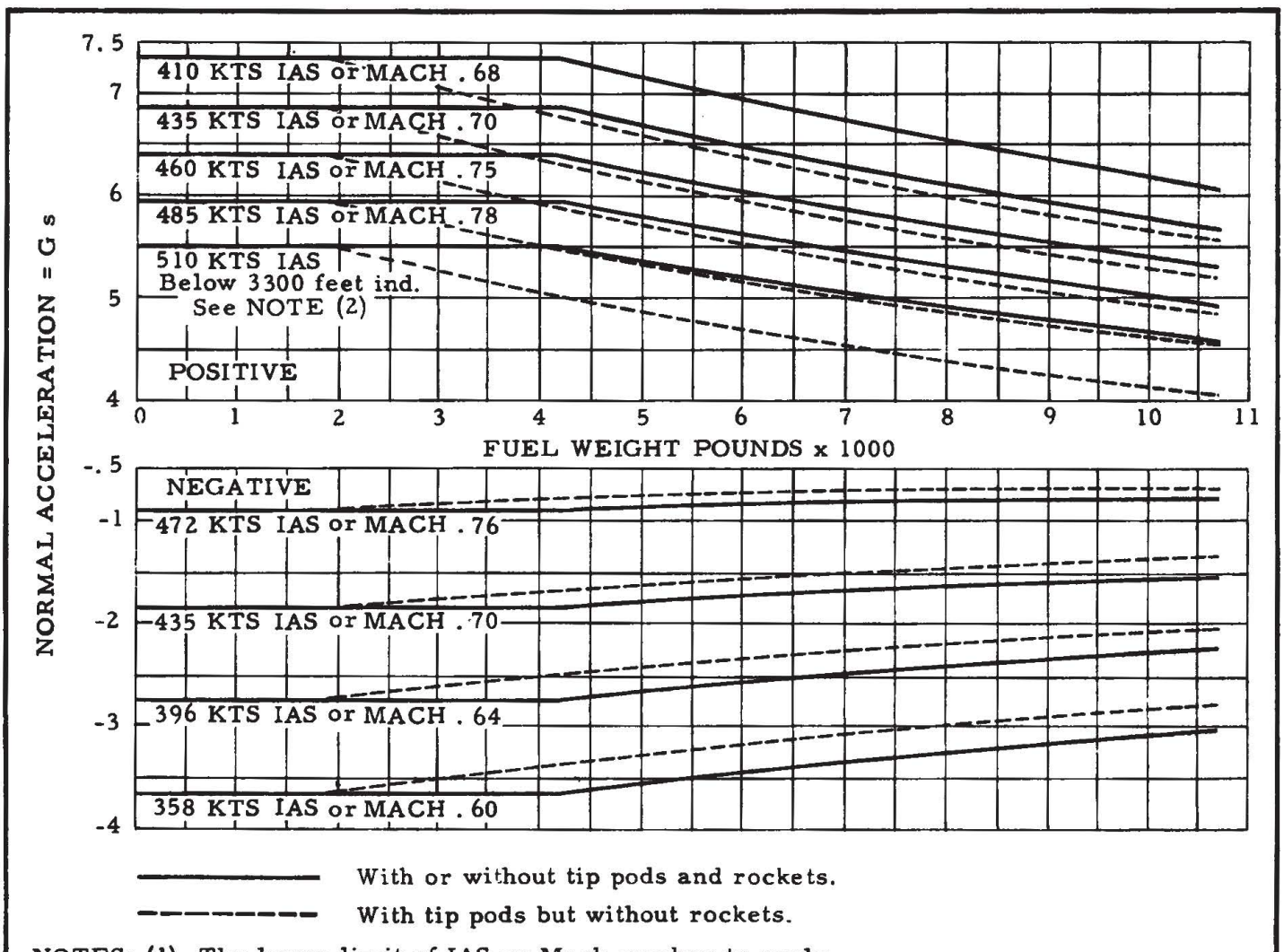
WARNING

Bumpy or turbulent flight conditions impose 'g' loading on the structure even in straight and level flight, and the 'g' loading increases as the airspeed increases. Care must be exercised that any pilot-imposed 'g' plus gust imposed 'g' does not raise the load factor beyond the flight envelope limits. (See Part 2 paras 49 and 50).

8 The flight manoeuvre envelopes illustrated should be read in conjunction with the "G" Limits Chart. Interpolation for aircraft weight may be made on the "G" Limits Chart, while interpolation for airspeed must be made on the appropriate flight manoeuvre envelope.

"G" LIMITS

9 "G" limits for the aircraft under normal combat conditions i.e. with gun ammunition and with or without tip pods and rockets, are shown on fig 4-4. These limits also apply if each pod contains a minimum of 19 rockets or 360 lbs. of ballast. Also shown are limits for the aircraft with tip pods but without rockets fitted. With tip tanks fitted the "g" limits are as follows:



NOTES: (1) The lower limit of IAS or Mach number to apply

computing equivalent airspeed (EAS), and the combined correction to apply to indicated airspeed (IAS) can be obtained from the airspeed correction table (Fig. 4-5).

NOTE

Indicated airspeed (IAS) is the instrument reading corrected for instrument error. Calibrated airspeed (CAS) is indicated airspeed (IAS) corrected for installation error. Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility error. True airspeed (TAS) is equivalent airspeed corrected for atmospheric density.

FLIGHT PLANNING

GENERAL

12 A series of charts on the following pages presents performance of the Canuck 4 aircraft with two Orenda 9 or Orenda 11 engines. These charts are based on ICAN standard atmosphere. The Orenda 11 figures are based on a static thrust of 7200 lbs at 7800 rpm at sea level. Fuel quantities are given in pounds to correspond with the readings of the fuel contents indicators, and the tables have been based on JP4 fuel with a specific gravity of .78. The marking "Configuration No External Load" indicates aircraft with or without loaded rocket pods, and no bombs.

NOTE

On the climb, descent, combat allowance and flight operation instruction charts, to compensate for individual aircraft the fuel requirements quoted are 5% conservative.

TAKE-OFF CHARTS

13 Ground run distances and total distances to clear a fifty foot obstacle, for both normal take-off and JATO are tabulated in figs 4-7, 4-8 and 4-9. A hard dry surface runway and no wind are the only conditions considered. The charted distances assume the use of normal take-off technique.

CLIMB CHARTS

14 From the climb charts (Figs 4-10 to 4-15) can be determined the best climb speed, fuel consumed and time to altitude for either take-off or climbing rpm. No allowance is included in the chart for fuel consumed during warm up and take-off, the fuel requirements listed being for the climb only. An estimated allowance for these conditions is included at the bottom of the chart however, and this must be added to the climb requirements where necessary. Fuel required for an in-flight climb from one altitude

COMBAT ALLOWANCE CHART

AIRCRAFT CANUCK 4

ENGINES ORENDA 9 or 11

PRESSURE ALTITUDE FEET	FUEL CONSUMPTION LBS. PER MINUTE			
	MAXIMUM THRUST (715°C-JPT)		93% R.P.M.	
	9 ORENDA	11	9 ORENDA	11
45,000	65	65	-	-
40,000	85	85	70	70
35,000	110	110	90	85
30,000	135	130	105	105
25,000	160	160	125	120
20,000	185	180	145	130
15,000	215	215	165	155
10,000	250	245	190	180
5,000	285	270	210	205
SEA LEVEL	325	310	235	230

BASED ON: FLIGHT TEST DATA

DATA AS OF: APRIL, 1957

BASED ON: 3GP22B(JP4) FUEL

NOTE Consumptions are at HALF FUEL WT. and MAX. LEVEL SPEED

1710-4F-4

Fig. 4-6 Combat Allowance Chart

DESCENT CHARTS

15 The descent charts (Figs 4-16, 4-17 and 4-18) provide for an economical descent without flaps or speed brakes, and with the engines at idling rpm.

MAXIMUM CONTINUOUS POWER CHART

16 Fig 4-19 shows fuel consumption at various altitudes when using 93% rpm. IAS values with corresponding TAS values are shown. It should be noted that the indicated air speeds given are those obtainable with a 93% rpm setting, but some indicated air

TAKE-OFF DISTANCES

AIRCRAFT CANUCK 4 — **ENGINES** ORENDA 9

FEET

CONFIGURATION NO EXTERNAL LOAD (With or without tip pods) — **HARD SURFACE RUNWAY - NO WIND**

GROSS WEIGHT LB.	PRESSURE ALTITUDE FT.	−45°C		−25°C		−5°C		+15°C		+35°C		+55°C	
		GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.
				0° FLAP-MAXIMUM THRUST (715°C - JPT)									
32,000	S.L.	1400	1800	1700	2150	2150	2700	2550	3200	3200	4050	3850	5000
	2,000	1650	2050	2050	2550	2500	3200	3000	3800	3850	4900	4600	6000
	4,000	2000	2500	2400	3000	3050	3800	3650	4650	4600	5900	5600	7400
	6,000	2250	2800	2800	3500	3500	4400	4250	5400	5400	7000	6450	8700
34,500	S.L.	1650	2050	2050	2050	2550	3200	3050	3900	3850	4900	4600	6000
	2,000	1950	2400	2400	3000	2950	3600	3650	4650	4600	5900	5500	7250
	4,000	2350	2900	2850	3550	3600	4500	4300	5500	5600	7200	6700	8950
	6,000	2700	3350	3450	4300	4150	5250	5000	6450	6400	8400	7700	-
37,000	S.L.	1900	2350	2350	2950	2950	3700	3600	4550	4500	5750	5450	7150
	2,000	2300	2850	2750	3450	3500	4400	4150	5300	5300	6850	6400	8550
	4,000	2750	3400	3350	4200	4200	5300	5050	6500	6450	8450	7950	-
	6,000	3150	3900	3900	4850	4900	6100	5900	7650	7600	-	9300	-
39,500 (With Tip Tanks)	S.L.	2250	2800	2700	3350	3450	4300	4150	5300	5300	6850	6300	8400
	2,000	2600	3250	3200	4000	4000	5050	4850	6250	6200	8100	7500	-
	4,000	3150	3900	3850	4800	4900	6200	5900	7700	7550	-	9300	-
	6,000	3600	4500	4500	5650	5700	7250	6850	9000	8850	-	-	-
42,000 (With Tip Tanks)	S.L.	2500	3150	3150	3950	3900	4950	4800	6200	6000	7850	7350	9950
	2,000	3000	3750	3700	4650	4650	5900	5700	7400	7100	9400	8800	-
	4,000	3550	4450	4450	5550	5550	7100	6900	8950	8600	-	-	-
	6,000	4200	5250	5200	6600	6600	8500	8150	-	-	-	-	-
				25° FLAP - MAXIMUM THRUST (715°C - JPT)									
32,000	S.L.	1300	1700	1550	1950	1900	2450	2300	3000	2900	3900	3500	4850
	2,000	1500	1900	1800	2300	2300	2950	2650	3500	3500	4500	4100	5800
	4,000	1800	2300	2200	2800	2700	3500	3300	4400	4200	5800	5100	7500
	6,000	2050	2600	2500	3200	3200	4200	3850	5200	4900	6900	6000	9150
34,500	S.L.	1450	1900	1800	2300	2300	2950	2750	3600	3450	4650	4200	5900
	2,000	1750	2250	2150	2750	2650	3450	3250	4400	4100	5650	5000	7200
	4,000	2100	2650	2500	3300	3200	4200	3900	5300	5000	7050	6150	9300
	6,000	2400	3100	2950	3900	3800	5000	4500	6200	5900	8650	7200	-
37,000	S.L.	1750	2250	2100	2700	2700	3500	3250	4350	4100	5650	5000	7300
	2,000	2050	2600	2450	3200	3100	4100	3800	5150	4900	6900	5950	9100
	4,000	2450	3100	3050	4050	3800	5050	4600	6350	5950	8700	7350	-
	6,000	2850	3650	3500	4600	4400	5950	5450	7800	7100	-	8600	-
39,500 (With Tip Tanks)	S.L.	2000	2550	2400	3100	3100	4050	3750	5100	4800	6750	5800	8850
	2,000	2350	3000	2850	3700	3650	4850	4400	6100	5700	8300	7000	-
	4,000	2850	3650	3500	4600	4400	5950	5400	7650	7100	-	8600	-
	6,000	3200	4200	4050	5400	5250	7200	6350	9450	8300	-	-	-
42,000 (With Tip Tanks)	S.L.	2150	2800	2850	3700	3550	4750	4400	6000	5450	7950	6800	-
	2,000	2700	3500	3300	4350	4150	5650	5300	7400	6550	-	8200	-
	4,000	3200	4150	4000	5300	5050	7000	6300	9250	7950	-	-	-
	6,000	3800	4950	4700	6350	6050	8600	7550	-	9650	-	-	-

AIRCRAFT CANUCK 4

TAKE-OFF DISTANCES

FEET

ENGINES ORENDA 11

CONFIGURATION NO EXTERNAL LOAD (With or without tip pods) — **HARD SURFACE RUNWAY - NO WIND**

GROSS WEIGHT LB.	PRESSURE ALTITUDE FT.	−45°C		−25°C		−5°C		+15°C		+35°C		+55°C	
		GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.
				0° FLAP MAXIMUM THRUST (715°C - JPT)									
32,000	S.L.	1330	1720	1590	2060	1900	2460	2300	3000	2810	3700	3450	4610
	2,000	1560	2010	1860	2400	2220	2880	2690	3510	3300	4360	4070	5470
	4,000	1820	2350	2180	2810	2600	3380	3160	4140	3890	5170	4810	6540
	6,000	2140	2750	2560	3310	3070	3990	3730	4910	4610	6180	5720	7870
34,500	S.L.	1570	2020	1870	2410	2230	2890	2700	3530	3310	4380	4090	5500
	2,000	1830	2350	2180	2820	2610	3390	3170	3160	3900	5190	4830	6560
	4,000	2140	2760	2560	3310	3070	4000	3730	4920	4620	6180	5730	7880
	6,000	2510	3240	3010	3900	3620	4730	4420	5860	5480	7420	6810	9540
37,000	S.L.	1820	2340	2170	2800	2590	3370	3150	4130	3880	5150	4800	6510
	2,000	2120	2730	2540	3280	3040	3960	3700	4830	4570	6120	5680	7800
	4,000	2480	3200	2980	3860	3580	4680	4370	5790	5420	7330	6740	9420
	6,000	2920	3780	3510	4570	4230	5560	5190	6930	6450	8830	8010	1490
39,500 (With tip tanks)	S.L.	2090	2670	2500	3210	2990	3860	3640	4740	4500	5930	5580	7520
	2,000	2440	3130	2920	3760	3510	4550	4290	5610	5320	7060	6610	9010
	4,000	2860	3670	3440	4430	4140	5380	5080	6680	6310	8460	7840	10870
	6,000	3370	4330	4060	5250	4910	6410	6030	7990	7500	10190	—	—
42,000 (With tip tanks)	S.L.	2380	3050	2850	3670	3420	4430	4180	5460	5180	6870	—	—
	2,000	2790	3570	3340	4310	4030	5230	4930	6480	6130	8200	—	—
	4,000	3270	4200	3940	5090	4760	6210	5850	7740	7270	9850	—	—
	6,000	3870	4970	4670	6050	5650	7410	6960	9290	8650	11920	—	—
				25° FLAP MAXIMUM THRUST (715°C - JPT)									
32,000	S.L.	1170	1550	1400	1870	1680	2240	2030	2750	2510	3450	3100	4380
	2,000	1370	1820	1640	2180	1960	2640	2390	3250	2950	4100	3660	5270
	4,000	1610	2130	1920	2570	2310	3120	2820	3870	3500	4930	4360	6430
	6,000	1890	2510	2270	3040	2740	3720	3350	4650	4160	5980	5220	7980
34,500	S.L.	1380	1830	1650	2190	1970	2650	2400	3270	2970	4130	3680	5300
	2,000	1610	2140	1930	2580	2320	3130	2830	3890	3510	4940	4370	6450
	4,000	1890	2520	2270	3050	2740	3720	3350	4650	4170	5990	5230	7980
	6,000	2230	2980	2680	3620	3240	4450	3980	5610	4980	7350	6290	10120
37,000	S.L.	1600	2130	1920	2560	2300	3110	2820	3860	3490	4910	4340	6400
	2,000	1870	2490	2250	3020	2710	3690	3320	4610	4130	5920	5180	7890
	4,000	2200	2940	2650	3580	3210	4400	3940	5540	4920	7250	6220	9950
	6,000	2600	3500	3150	4280	3810	5290	4690	6750	5910	9030	7490	13020
39,500 (With tip tanks)	S.L.	2100	2810	2210	2930	2670	3570	3270	4440	4060	5660	5090	7420
	2,000	2470	3320	2600	3470	3150	4240	3860	5310	4820	6850	6090	9170
	4,000	2920	3950	3080	4120	3720	5060	4590	6400	5770	8410	7310	11580
	6,000	3460	4730	3650	4930	4430	6100	5500	7820	6950	10490	—	—
42,000 (With tip tanks)	S.L.	2110	2790	2540	3380	3070	4130	3760	5160	4690	6640	—	—
	2,000	2480	3290	2990	4000	3620	4910	4460	6200	5600	8110	—	—
	4,000	2930	3900	3540	4770	4290	5890	5320	7530	6720	10060	—	—
	6,000	3470	4650	4210	5720	5130	7150	6390	10490	8090	12760	—	—

BASED ON: 3GP22B(JP4)FUEL

NOTES: 1. Speed at Take-off = 1.15 x stalling speed.

1723-4F-1

TAKE OFF DISTANCES WITH JATO

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 9

CONFIGURATION
NO EXTERNAL LOAD

FEET

HARD SURFACE RUNWAY - NO WIND

GROSS WEIGHT LB	PRESS. ALT. FT.	−45°C			−25°C			−5°C			+15°C			+35°C			+55°C		
		JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.	JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.	JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.	JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.	JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.	JATO FIRING TIME (Sec.)	GND. RUN	CLEAR 50 FT.
32,000	S. L.	0	1100	1610	0	1200	1740	0	1380	1990	2	1640	2270	5	1990	2620	10	2370	3020
	2000	0	1230	1780	0	1360	1950	2	1560	2220	6	1990	2660	11	2460	3120	16	2920	3600
	4000	0	1370	1960	2	1630	2230	5	1900	2570	10	2410	3080	16	2920	3610	21	3500	4180
	6000	1	1550	2150	5	1910	2520	11	2460	3020	15	2900	3460	20	3440	4050	26	4090	4740
34,500	S. L.	0	1230	1780	0	1350	1930	2	1580	2200	6	1980	2580	10	2400	3020	15	2830	3450
	2000	0	1370	1960	2	1580	2180	5	1870	2480	10	2380	3020	15	2840	3540	20	3350	4080
	4000	1	1550	2150	5	1880	2490	9	2260	2880	15	2850	3530	20	3430	4180	26	4070	4860
	6000	4	1790	2400	9	2230	2880	14	2800	3460	21	3490	4180	27	4240	4990	34	5090	5940
37,000	S. L.	0	1370	1960	1	1530	2130	5	1860	2460	10	2340	2960	15	2840	3490	20	3350	4016
	2000	1	1530	2130	5	1850	2460	9	2280	2880	15	2840	3520	20	3430	4130	26	4130	4900
	4000	4	1780	2390	9	2220	2880	14	2750	3370	20	3420	4170	27	4180	4940	33	5060	5910
	6000	7	2110	2750	12	2550	3230	19	3270	3960	27	4170	4900	34	5150	5990	40	6200	7140
39,500	S. L.	1	1510	2110	4	1750	2350	8	2200	2810	14	2770	3450	20	3370	4080	25	4030	4740
	2000	3	1730	2350	8	2190	2830	14	2750	3390	20	3360	4060	27	4150	4870	33	5010	8850
	4000	7	2050	2700	13	2620	3300	19	3280	3980	26	4090	4810	33	5060	5840	39	6110	7250
	6000	11	2480	3140	16	2960	3660	24	3850	4560	33	5010	5750	40	6240	7150	45	7600	8800

DATA AS OF: 10 MAY 54

BASED ON: 3GP22A (MIL-F-5624A, Grade JP-4) Fuel

BASED ON: ESTIMATED DATA

NOTES:

1 Take-off with 25° flaps and 100% RPM.

2 JATO firing time from start of run, is such that if an engine failure should occur at unstick (1.2 x Stalling Speed), the JATO thrust will last to clear 150 feet.

3 Columns -5°C, +15°C and +35°C are calculated with the JATO propellant at ambient temperature.

Columns -45° and -25° are calculated with the JATO propellant at -17.8°C, which is the minimum allowable.

Column +55°C is calculated with the JATO propellant at +54.4°C, which is the maximum allowable.

Fig. 4-9 Take-off Distance Chart - with JATO (Orenda 9)

CLIMB CHART
(TWIN ENGINE)

AIRCRAFT
CANUCK 4

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD
(With or without tip pods)

ENGINES
ORENDA 9

GROSS WEIGHT
32,000 LB

PRESSURE ALTITUDE FEET	IAS KNOTS	97.5 % R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LBS.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	400	0	0	0	7900
5,000	375	170	0.5	5	7200
10,000	350	335	1.5	10	6500
15,000	325	495	2.0	15	5700
20,000	300	655	3.0	20	5000
25,000	275	815	4.0	30	4200
30,000	250	975	5.5	40	3400
35,000	225	1155	7.0	50	2600
40,000	200	1375	9.5	65	1500
45,000	175	1710	14.5	100	500

PRESSURE ALTITUDE FEET	IAS KNOTS	MAXIMUM THRUST (715°C-JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LBS.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	400	0	0	0	9100
5,000	375	165	0.5	5	8200
10,000	350	315	1.0	10	7300
15,000	325	470	2.0	15	6400
20,000	300	620	3.0	20	5500
25,000	275	775	4.0	25	4600
30,000	250	935	5.0	35	3700
35,000	225	1110	6.5	45	2700
40,000	200	1310	9.0	60	1700
45,000	175	1670	14.0	95	550

Warm up, taxi, take-off and acceleration to climb allowance.	800	6.0	5

NOTE: (1) Multiply nautical units by 1.15 for conversion to statute units.
(2) Start to climb weight is the gross weight less 800 lbs. for the above charts.

DATA AS OF May 1955

BASED ON: FLIGHT TEST DATA

CLIMB CHART
(TWIN ENGINE)

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 9

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD
(With or without tip pods)

GROSS WEIGHT
37,000 LB

PRESSURE ALTITUDE FEET	97.5 % R.P.M.				
	IAS KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LBS.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	400	0	0	0	6700
5,000	375	200	1.0	5	6100
10,000	350	400	1.5	10	5500
15,000	325	590	2.5	15	4800
20,000	300	775	3.5	25	4100
25,000	275	970	5.0	35	3400
30,000	250	1175	6.5	45	2700
35,000	225	1405	9.0	60	1900
40,000	200	1720	12.5	85	850

PRESSURE ALTITUDE FEET	MAXIMUM THRUST (715° C - JPT)				
	IAS KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LBS.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	400	0	0	0	7600
5,000	375	185	0.5	5	6900
10,000	350	370	1.5	10	6100
15,000	325	555	2.5	15	5300
20,000	300	735	3.5	20	4500
25,000	275	925	4.5	30	3700
30,000	250	1125	6.0	40	2900
35,000	225	1345	8.0	55	2000
40,000	200	1640	11.5	75	1000

Warm up, taxi, take-off and acceleration to climb allowance.	800	6.0	5	

NOTE (1) Multiply nautical units by 1.15 for conversion to statute units.

(2) Start to climb weight is the gross weight less 800 lbs. for the above charts.

DATA AS OF MAY 1955

BASED ON: FLIGHT TEST DATA

CLIMB CHART

(TWIN ENGINE)

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 11

CONFIGURATION
(With or without tip pods)

GROSS WEIGHT
32.000 LB.

PRESSURE ALTITUDE FEET	IND. MACH NO.	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	.68	0	0	0	9,400
5,000	.68	120	0.5	5	8,700
10,000	.68	270	1.0	10	8,000
15,000	.68	420	2.0	15	7,200
20,000	.68	550	2.5	20	6,200
25,000	.68	670	3.0	25	5,200
30,000	.68	810	4.0	30	4,100
35,000	.68	960	5.5	40	3,000
40,000	.68	1130	7.0	55	1,800
45,000	.68	1460	13.0	80	500

PRESSURE ALTITUDE FEET	IND. MACH NO.	MAXIMUM THRUST (715°C - JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	.68	0	0	0	10,500
5,000	.68	150	0.5	5	9,800
10,000	.68	260	1.0	10	8,900
15,000	.68	400	1.5	10	8,000
20,000	.68	510	2.0	15	6,700
25,000	.68	640	3.0	20	5,500
30,000	.68	770	4.0	30	4,400
35,000	.68	910	5.5	40	3,200
40,000	.68	1070	7.0	50	1,900
45,000	.68	1370	11.0	75	500
Warm up, taxi, take-off and acceleration to climb allowance.		680	6.0	6.0	

NOTE 1. Multiply nautical units by 1.15 for conversion to statute units.

2. Start to climb weight is the gross weight less 680 lb. for the above charts.

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

CLIMB CHART

(TWIN ENGINE)

AIRCRAFT
CANUCK 4

CONFIGURATION
NO EXTERNAL LOAD (With or without tip pods)

ENGINES
ORENDA 11

GROSS WEIGHT
37,000 LB.

PRESSURE ALTITUDE FEET	97.5% R.P.M.				
	IND. MACH NO.	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	.68	0	0	0	8,000
5,000	.68	160	0.5	5	7,400
10,000	.68	340	1.5	10	6,700
15,000	.68	490	2.0	15	5,900
20,000	.68	640	3.0	20	5,100
25,000	.68	790	4.0	30	4,200
30,000	.68	960	5.5	40	3,200
35,000	.68	1140	7.0	50	2,200
40,000	.68	1410	10.0	60	1,100
42,000	.68	1620	13.0	90	500

PRESSURE ALTITUDE FEET	MAXIMUM THRUST (715°C-JPT)				
	IND. MACH NO.	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	.68	0	0	0	9,000
5,000	.68	170	0.5	5	8,200
10,000	.68	320	1.0	10	7,400
15,000	.68	480	2.0	15	6,500
20,000	.68	630	2.5	20	5,600
25,000	.68	770	3.5	25	4,500
30,000	.68	930	5.0	35	3,500
35,000	.68	1140	6.5	45	2,400
40,000	.68	1380	9.5	65	1,100
42,000	.68	1520	12.0	80	500
Warm up, taxi, take-off and acceleration to climb allowance.		680	6.0	6.0	

NOTE 1. Multiply nautical units by 1.15 for conversion to statute units.

2. Start to climb weight is the gross weight less 680 lb. for the above charts.

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4)FUEL

CLIMB CHART
(TWIN ENGINE)

AIRCRAFT
CANUCK 4

CONFIGURATION
TIP TANKS

ENGINES
ORENDA 11

GROSS WEIGHT
33,500

PRESSURE ALTITUDE FEET	I.A.S. KNOTS OR IND. MACH NO.	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LBS.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	390	0	0	0	7.400
5.000	390	190	0.5	5	6.700
10.000	.68	340	1.5	10	7.700
15.000	.68	470	2.0	15	6.800
20.000	.68	610	3.0	20	5.900
25.000	.68	760	4.0	25	5.000
30.000	.68	890	5.0	35	4.000
35.000	.68	1070	6.5	45	3.000
40.000	.68	1220	8.5	60	1.800
45.000	.68	1580	14.0	90	500

PRESSURE ALTITUDE FEET	I.A.S. KNOTS OR IND. MACH NO.	MAX. THRUST (715°C-JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LBS.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	390	0	0	0	8.200
5.000	390	170	0.5	5	7.100
10.000	.68	330	1.5	10	8.200
15.000	.68	480	2.0	15	7.400
20.000	.68	630	3.0	20	6.300
25.000	.68	720	3.5	25	5.300
30.000	.68	860	4.5	35	4.400
35.000	.68	1000	6.0	40	2.900
40.000	.68	1180	8.0	55	1.800
45.000	.68	1540	13.5	90	500
Warm up, taxi, take-off and acceleration to climb allowance.		620	6.0	4.5	

NOTE: (1) Multiply nautical units by 1.15 for conversion to statute units.

(2) Start to climb weight is the gross weight less 620 lb. for the above charts.

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

CLIMB CHART

(TWIN ENGINE)

AIRCRAFT
CANUCK 4

CONFIGURATION
TIP TANKS

ENGINES
ORENDA 11

GROSS WEIGHT
40,500 LB.

PRESSURE ALTITUDE FEET	97.5% R.P.M.				
	I.A.S. KNOTS OR IND. MACH NO.	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LBS.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	390	0	0	0	6,800
5,000	390	230	1.0	5	5,600
10,000	.68	420	1.5	10	6,500
15,000	.68	600	2.5	20	5,800
20,000	.68	760	3.5	25	4,900
25,000	.68	930	4.5	35	4,000
30,000	.68	1110	6.0	45	3,400
35,000	.68	1330	8.0	55	2,300
40,000	.68	1650	11.5	80	1,100
43,000	.68	2040	16.0	110	500

PRESSURE ALTITUDE FEET	MAX. THRUST (715°C-JPT)				
	I.A.S. KNOTS OR IND. MACH NO.	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LBS.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	390	0	0	0	6,800
5,000	390	230	1.0	5	5,500
10,000	.68	420	2.0	10	6,700
15,000	.68	590	2.5	20	5,800
20,000	.68	740	3.5	25	5,000
25,000	.68	900	4.5	30	4,100
30,000	.68	1080	6.0	40	3,100
35,000	.68	1280	7.0	55	2,100
40,000	.68	1580	11.5	75	700
41,000	.68	1680	13.0	80	500
Warm up, taxi, take-off and acceleration to climb allowance.		620	6.0	4.5	

NOTE: (1) Multiply nautical units by 1.15 for conversion to statute units.

(2) The start to climb weight is the gross weight less 620 lb. for the above charts.

DATA AS OF: APRIL, 1957.

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4)FUEL

DESCENT CHART

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 9

AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 27,000 LB					PRESSURE ALTITUDE FEET	AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 32,000 LB				
APPROXIMATE VALUES				I.A.S. KNOTS		I.A.S. KNOTS	APPROXIMATE VALUES			
RATE OF DESCENT F.P.M.	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT F.P.M.
	DIST. N.M.	TIME MIN.	FUEL LBS.				FUEL LBS.	TIME MIN.	DIST. N.M.	
2900	75	11.5	230	175	45,000	175	255	12.0	80	3000
3000	65	9.5	215	200	40,000	200	240	10.5	70	3000
3100	55	8.0	200	225	35,000	225	225	9.0	60	3000
3400	45	6.5	180	250	30,000	250	205	7.0	50	3200
3800	35	5.0	155	275	25,000	275	180	5.5	40	3500
4300	25	3.5	130	300	20,000	300	150	4.5	30	3800
4800	20	2.5	100	325	15,000	325	115	3.0	20	4200
5500	10	1.5	70	350	10,000	350	80	2.0	15	4700
6200	5	1.0	35	375	5,000	375	40	1.0	5	5300
6900	0	0	0	400	SEA LEVEL	400	0	0	0	6000

DATA AS OF: May 1955

BASED ON: FLIGHT TEST DATA

BASED ON: GRADE JP-4 FUEL

NOTES: (1) Idling R. P. M.

(2) Speed Brakes closed

(3) The above values apply to aircraft with or without Tip Pods.

1732-4F-2

Fig. 4-16 Descent Chart (Orenda 9)

MAXIMUM ENDURANCE CHART

17 Fig 4-20 shows fuel consumption at varying altitudes, both for aircraft with tip pods fitted and aircraft with tip tanks fitted. In each case the consumption is based on an aircraft weight at half fuel load. The IAS to obtain this consumption is shown.

LANDING CHART

18 The landing chart (fig 4-21) shows landing distances for aircraft fitted with Maxaret brakes. Distances are given for both ground run and total to clear a fifty foot

COMBAT ALLOWANCE CHART

19 The combat allowance chart (fig 4-6) gives the fuel consumption at take-off rpm and maximum cruising rpm at varying altitudes.

FLIGHT OPERATION INSTRUCTION CHARTS

GENERAL

20 The flight operation charts are provided to facilitate flight planning. These charts show the range of aircraft at maximum range airspeeds, and the procedure to obtain this range. These charts contain columns for each 5000

DESCENT CHART

(TWIN ENGINE)

AIRCRAFT
CANUCK 4 (With or without tip pods)

ENGINES
ORENDA 11

GROSS WEIGHT 27,000 LB.					PRESSURE ALTITUDE FEET	GROSS WEIGHT 32,000 LB.				
APPROXIMATE VALUES				IND MACH NO.		IND MACH NO.	APPROXIMATE VALUES			
RATE OF DESCENT F.P.M.	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT F.P.M.
	DIST. N.M.	TIME MIN.	FUEL LBS.				FUEL LBS.	TIME MIN.	DIST. N.M.	
2000	90	13.0	310	.68	45,000	.68	315	13.0	90	2700
2000	75	10.5	275	.68	40,000	.68	290	11.0	80	2200
2200	60	8.5	240	.68	35,000	.68	255	9.0	65	2200
2700	45	6.0	200	.68	30,000	.68	215	6.5	50	2600
3300	35	4.5	160	.68	25,000	.68	175	5.0	40	3100
4100	25	3.0	125	.68	20,000	.68	145	3.5	30	3800
5200	15	2.0	95	.68	15,000	.68	105	2.5	20	4500
6300	10	1.5	60	.68	10,000	.68	70	1.5	10	5500
7800	5	.5	30	.68	5,000	.68	35	.5	5	6700
9400	0	0	0	.68	S.L.	.68	0	0	0	8100

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4)FUEL

NOTES: 1. Idling rpm.
2. Speed brakes closed.

1709-4F-2

Fig. 4-17 Descent Chart (Orenda 11)

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 and one is for the maximum range obtainable by climbing to a higher altitude. The charted distances do not include fuel consumed and distance covered during warm-up, take-off and initial climb at the start of flight. However, fuel used and distance covered during let-down and for a five minute approach, or during in-flight climb to an optimum altitude are taken into account.

22 No allowances are made for navigational errors, combat, formation flying, landing or other contingencies. Such allowances must be

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. Under different wind conditions, ranges (in ground miles) are varied by the effect of wind on ground speed. Letdown distances are affected for the same reason. Recommended IAS also may change in order to maintain the most favourable ground miles per gallon. To facilitate range conputation 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. Range

DESCENT CHART
(TWIN ENGINE)

AIRCRAFT
CANUCK 4
CONFIGURATION
TIP TANKS

ENGINES
ORENDA 11

GROSS WEIGHT 26,500 LB.					PRESSURE ALTITUDE FEET	GROSS WEIGHT 33,500 LB.				
APPROXIMATE VALUES				I.A.S. KNOTS OR INDICATED MACH NO.		I.A.S. KNOTS OR INDICATED MACH NO.	APPROXIMATE VALUES			
RATE OF DESCENT F.P.M.	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT F.P.M.
	DISTANCE N.M.	TIME MIN.	FUEL LBS.				FUEL LBS.	TIME MIN.	DISTANCE N.M.	
1800	95	14.0	340	.68	45,000	.68	370	14.5	100	2500
1800	75	11.5	300	.68	40,000	.68	340	12.5	85	2000
2100	60	9.0	260	.68	35,000	.68	300	10.0	70	2100
2700	50	6.5	230	.68	30,000	.68	260	8.0	55	2500
3300	35	5.0	185	.68	25,000	.68	220	6.0	45	3000
4200	25	4.0	150	.68	20,000	.68	180	4.5	35	3600
5200	20	2.5	120	.68	15,000	.68	145	3.5	25	4300
6500	15	2.0	90	.68	10,000	.68	110	2.5	15	5400
5600	5	1.0	55	390	5,000	390	65	1.5	10	4500
4300	0	0	0	390	SEA LEVEL	390	0	0	0	3500

DATA AS OF: APRIL, 1957

BASED ON. FLIGHT TEST DATA

BASED ON. 3GP22B(JP4)FUEL

NOTES: (1) Idling rpm.

(2) Speed brakes closed.

2706-4F-1

Fig.4-18 Descent Chart (Orenda 11) - Tip Tanks

24 The recommended IAS values vary little with weight and should be followed to obtain optimum range.

25 With 1,800 lbs of expendable armament for guns and wing tip pods, and 10,000 lbs of fuel, the aircraft weighs approximately 37,000 lbs. The range figures given in the Flight Operation Instruction Charts (Figs 4-22 and 4-23) are based on this take-off weight and on a landing weight of 27,000 lbs, i.e. all fuel consumed and armament retained. If reserve fuel is carried or armament is fired, a corin range for every 1000 lbs change in weight varies with altitude and is 4% at 40,000 ft, decreasing by 1% for every 10,000 ft decrease in altitude.

26 A similar adjustment must be made to the range figures in the Flight Operation Instruction chart Fig 4-24, (aircraft with tip tanks configuration) if reserve fuel is carried.

PRE-FLIGHT RANGE PLANNING

27 Select the applicable flight operation

AIRCRAFT CANUCK 4

MAXIMUM CONTINUOUS POWER CHART (AT 93% R.P.M.)

ENGINES ORENDA 11

CONFIGURATION						
TIP PODS WEIGHT 32,000 LB.				TIP TANKS WEIGHT 33,500 LB.		
LB/HR	T.A.S. KNOTS	I.A.S. KNOTS	PRESSURE ALTITUDE FEET	I.A.S. KNOTS	T.A.S. KNOTS	LB/HR
13,900	(530)	(515)	SEA LEVEL	(515)	(530)	13,900
12,350	525	480	5,000	(485)	(525)	12,380
10,880	520	445	10,000	(450)	(525)	10,920
9,770	515	410	15,000	(415)	(515)	9,770
8,470	505	375	20,000	380	510	8,510
7,290	500	340	25,000	345	500	7,290
6,260	490	310	30,000	310	490	6,260
5,200	475	275	35,000	270	480	5,230
4,170	460	240	40,000	240	465	4,200

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4)FUEL

NOTE Bracketed speeds exceed aircraft limitations and are issued for reference only.

2704-4F-1

Fig.4-19 Maximum Continuous Power Chart (Orenda 11)

taxi, take-off, initial climb, and necessary reserves. Select a figure in the column equal to, or less than, the amount available for flight planning. Interpolate if desired.

28 To determine maximum range at a given altitude, move horizontally left or right to the desired altitude column. Multiply the range value thus obtained by the correct range factor, and add the distance covered in the initial climb to obtain the total range with a given wind at altitude. Fly according to the instructions in the lower half of the chart.

29 To fly a given distance, determine range factors for the effective winds and altitudes to be considered. From the desired distance, subtract the miles covered in climb. Divide the resultant figure by the range factor to obtain the in cruise and descent. Fly according to the instructions for the altitude so obtained.

30 If altitude, wind or external load does not remain reasonably constant, break the flight up into several sections and plan each section separately.

IN-FLIGHT RANGE PLANNING

31 To use the charts in flight, determine altitude, available fuel, and effective wind. Available fuel is equal to fuel on board minus necessary reserves.

32 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 altitude column.

MAXIMUM ENDURANCE CHART

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 11

CONFIGURATION				
TIP PODS WEIGHT 32,000 LB.			TIP TANKS WEIGHT 33,500 LB.	
LB/HR	I.A.S. KNOTS	PRESSURE ALTITUDE FEET	I.A.S. KNOTS	LB/HR
4870	215	SEA LEVEL	215	4900
3880	190	5,000	190	3960
3550	190	10,000	190	3600
3290	190	15,000	190	3360
3060	190	20,000	190	3120
2820	190	25,000	190	2840
2600	190	30,000	190	2640
2500	185	35,000	185	2490
2630	180	40,000	180	2440

DATA AS OF: APRIL, 1957
BASED ON: FLIGHT TEST DATA
BASED ON: 3GP22B(JP4)FUEL

2705-4F-1

Fig. 4-20 Maximum Endurance Chart (Orenda 11)

present altitude, refer to the instructions directly below. When changing charts refer to cruising instructions on the new chart at the altitude of flight.

34 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 new altitude of flight.

SAMPLE PROBLEMS BASED ON ORENDA 9 ENGINES AND JP4 FUEL

PROBLEM 1

35 A Canuck 4 to be ferried 635 nautical miles without wing tip tanks. General reserve of fuel to be carried 2,000 pounds (256 Imp gals).

36 The initial known data:

Operational weight empty i.e. no fuel	27,000 lbs

37 From the climb chart (fig 4-11) and the flight operation chart (fig 4-22) the following data is obtained:

(a)	Cruising altitude feet	25,000	30,000	35,000	40,000
(b)	Fuel capacity usable pounds	10,160	10,160	10,160	10,160
(c)	Reserve fuel pounds	2,000	2,000	2,000	2,000
(d)	Fuel used for warm up and take-off pounds	800	800	800	800
(e)	Fuel used climbing to altitude(climbing 97.5% rpm)	970	1,175	1,405	1,720
(f)	Available fuel for cruise, descent and five minutes approach. Sum of b-(c+d+e)	6,390	6,185	5,955	5,640
(g)	Cruise and descent air distance (interpolate as necessary)	660	711	744	724
(h)	Percentage adjustment of sub para (g) for a load of 2000 lbs of reserve fuel (see para 25)	33	43	52	58
(j)	Corrected range (g-h)	627	668	692	666
(k)	Range factor	.90	.90	.80	.80
(m)	Cruise and descent ground distance (jxk)	564	601	554	533
(n)	Nautical miles covered in initial climb	35	45	60	85
(p)	Nautical ground miles range (n+m)	599	646	614	618

38 Therefore the flight should be made at 30,000 feet. The cruise airspeed at 30,000 feet for a 40 knot headwind should be 255 knots; let down would begin 45 nautical miles from destination.

PROBLEM 2

39 Suppose that during descent at the end of this theoretical flight, the pilot has reached 15,000 feet when he learns that the field is closed and he must use an alternative airport 140 nautical miles further on. Fuel remaining is only 2100 pounds including the general reserve, (other than the five minute approach allowance). Reference to the flight operation instruction chart, and by interpolation, shows that with the existing headwind at an altitude of 15,000 feet the available range is 158 x 0.9 which is only 142 nautical miles. By climbing to 40,000 feet (optimum altitude) at 97.5% rpm the range, by interpolation, will be 210 nautical miles x the range factor. The range factor at 40,000 feet with an 80 knot headwind is 0.8 hence the distance which can be covered is 210 x 0.8 which is 168 nautical miles.

40 The cruising speed at 40,000 feet should be 215 knots IAS with a ground speed of 335 knots. Let-down would begin at 60 nautical miles from destination. Since the required distance is only 140 nautical miles, the reserve distance is 28 nautical miles (168-140). Ex-

SINGLE ENGINE PERFORMANCE CHARTS

GENERAL

41 A series of charts on the following pages presents performance of the Canuck 4 aircraft operating on one Orenda 9 or 11 engine only. These charts are based on I.C.A.N. standard atmosphere and are provided for emergency use in flight.

CLIMB CHARTS

42 These charts (Figs 4-31 to 4-36) are similar in form to those for two engines operating. The fuel used for warm up, take-off and acceleration to climb allowance is given for two-engines operating, while the body of the chart is for one-engine.

DESCENT CHARTS

43 These charts (Figs 4-37 to 4-39) are similar in form to those for two engines oper-

LANDING DISTANCE
FEET
WITH MAXARET BRAKES
(MINIMUM GROUND RUN)

AIRCRAFT
CANUCK 4

ENGINES
ORENDA 9 or 11

GROSS WEIGHT LB.	APPROACH IAS KNOTS	HARD SURFACE RUNWAY - NO WIND							
		AT SEA LEVEL		AT 2000 FT.		AT 4000 FT.		AT 6000 FT.	
		GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.	GROUND RUN	CLEAR 50 FT.
(24,500)	120	2020	3650	2150	3860	2300	4090	2360	4230
27,000	125	2230	4000	2370	4210	2530	4460	2670	4700
29,500	130	2440	4330	2580	4560	2760	4840	2910	5080
(32,000)	140	2640	4670	2800	4920	3000	5230	3160	5500

DATA AS OF: June 1955

BASED ON: FLIGHT TEST

BASED ON: GRADE JP4 FUEL

NOTES: 1. Full flap: Speed brakes closed

2. Approach Speed = 1.3 x Stalling Speed
Touchdown Speed = 1.1 x Stalling Speed

3. Bracketed weights are to assist in interpolation only

1738-4F-4

Fig.4-21 Landing Distance Chart

CRUISE PERFORMANCE

44 The optimum cruise charts (Figs 4-26, 4-28, 4-30) in conjunction with Cruise Performance at 93% RPM charts (Figs 4-25, 4-27 and 4-29) show maximum range that can be obtained with one engine operating. At the time of engine failure the operating engine is set for either a climb or descent depending on altitude and amount of available fuel. When the cruising altitude on the chart is reached a cruise-climb procedure is carried out at 93% RPM. The range figures given include climb, descent and approach allowance. They are a representative average of the optimum cruise charts and show winds and corresponding range factors.

NOTE

On the climb, descent and cruise performance charts, to compensate for variations of individual aircraft the fuel requirements quoted are 5% conservative.

SAMPLE PROBLEMS BASED ON ORENDA 9 ENGINES AND JP4 FUEL

PROBLEM 1

45 Suppose an engine failure occurs at 40,000 feet and the fuel remaining is 6000 pounds. There is a 40 knot headwind at 30,000 feet. Maximum range is required for this flight.

	Available fuel for cruise	6,000 pounds

From Cruise Charts (Fig 4-25 and Fig 4-26)

(a)	Cruise and descent air distance	770 nautical miles
(b)	Range factor	.90
(c)	Maximum range (770 x .90)	693 nautical ground miles
(d)	Letdown would begin 65 nautical miles from destination	

PROBLEM 2

47 During the descent at the end of a flight, when at 5000 feet it is learned that the field is closed and an alternative airport, 150 nautical miles away, must be used. Fuel remaining is 2000 pounds, and there is a 40 knot headwind at 30,000 feet.

48 By climbing immediately at 97.5% rpm to 32,000 feet (the start of 93% cruising altitude) and by cruising at 93% rpm, a range of 210 nautical miles with zero wind can be obtained.

(a)	Range factor	.90
(b)	Maximum range (210 x .90)	189 nautical ground miles
(c)	Letdown would begin 65 nautical miles from destination	

SUMMARY OF SINGLE ENGINE PERFORMANCE (ORENDA 9)

49 For emergency use the single engine performance charts can be summarized as follows (approximate figures):

(a) If below 30,000 feet climb (at 245 knots IAS at sea level decreasing by 1 knot for every 1000 feet gain in altitude) at 97.5% rpm until rate of climb drops to 300 feet per minute, and then cruise-climb at 93% rpm.

(b) If above 30,000 feet cruise-descend at 93% rpm. As the aircraft's weight and altitude decrease, it will eventually commence a cruise-climb.

NOTE

In most cases sub-para (a) will apply if an engine relight at 12,000 feet is attempted (see problem 2). Sub-para (b) could apply when an engine relight is considered impossible (see problem 1).

until between 20,000 feet and 25,000 feet no increase in range is gained. Above 25,000 feet two-engine flying gives the greatest range.

SUMMARY OF SINGLE ENGINE PERFORMANCE (ORENDA 11)

51 For emergency use the single engine performance charts can be summarized as follows (approximate figures):

(a) If below 30,000 feet climb (at 265 knots IAS at sea level decreasing by 2 knots for every 1000 feet gain in altitude) at 97.5% rpm until rate of climb drops to 300 feet per minute, and then cruise-climb at 93% rpm.

(b) If above 30,000 feet cruise-descend at 93% rpm. As the aircraft's weight and altitude decrease, it will eventually commence a cruise-climb.

52 At low altitudes greater range is obtained by flying on one engine. The increase obtained

1704-4F-4

AIRCRAFT
CANUCK 4

ENGINE(S) ORENDA 9

LIMITS	TIME LIMIT MINS.	% RPM	EXHAUST TEMP.	OIL PRESS PSI	FUEL PRESS PSI
Take-off and Combat	15	100	715	15-25	3-35
Climb	30	97.5	690	15-25	3-35
Cruise	None	93	645	15-25	3-35

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 37,000 LBS.

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT -- Select figures in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reserve, 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 appropiate cruising altitude section. (B) FLIGHT PLANNING -- From initial fuel on board subtract fuel required to take-off and climb to desired cruising altitude and all other necessary allowances.

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD
(WITH OR WITHOUT TIP PODS)
NUMBER OF ENGINES OPERATING: TWO

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 change), it is necessary to observe that 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 MAY 1955 , BASED ON FLIGHT TEST DATA

LOW ALTITUDE

IF YOU ARE AT S. L.			FUEL	IF YOU ARE AT 5000′			IF YOU ARE AT 10000′			IF YOU ARE AT 15000′			FUEL	IF YOU ARE AT 20000′		
RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 5000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 10000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 15000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 20000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
(500)	40	(1100)	10,000	(590)	40	(1120)	(680)	40	(1140)	(780)	40	(1150)	10,000	(890)	40	(1160)
400	40	890	8,000	470	40	910	540	40	920	630	40	940	8,000	720	40	950
300	40	660	6,000	350	40	680	400	40	700	470	40	710	6,000	540	40	720
190	40	410	4,000	230	40	430	270	40	450	310	40	460	4,000	360	40	480
90	40	150	2,000	110	40	170	120	40	180	130	40	200	2,000	170	40	210

CRUISING AT S.L. WT. 32,000 LB.					EFFEC-TIVE WIND	CRUISING AT 5,000′ WT. 32,000 LB.					CRUISING AT 10,000′ WT. 32,000 LB.					CRUISING AT 15,000′ WT. 32,000 LB.					EFFEC-TIVE WIND	CRUISING AT 20,000′ WT. 32,000 LB.				
	APPROXIMATE						APPROXIMATE					APPROXIMATE					APPROXIMATE					APPROXIMATE				
I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
405	8440	290	.65	0	120 HW	380	7450	295	.65	5	360	6460	300	.70	10	340	5600	305	.70	15	120 HW	315	4830	305	.70	25
380	7740	305	.75	0	80 HW	360	6860	315	.75	5	345	5970	320	.80	10	325	5300	330	.80	20	80 HW	310	4660	340	.80	25
360	7120	325	.90	0	40 HW	345	6320	335	90	5	330	5600	345	.90	10	315	5000	355	.90	20	40 HW	300	4490	370	.90	25
340	6650	345	1.00	0	0	325	5980	355	1.00	5	315	5320	370	1.00	15	300	4760	380	1.00	20	0	290	4310	395	1.00	30
320	6160	365	1.15	0	40 TW	310	5650	380	1.15	5	305	5090	395	1.10	15	295	4580	410	1.10	20	40 TW	285	4190	425	1.10	30

Fig. 4-22 Flight Operation Instruction Chart (Sheet 1 of 2) (Orenda 9)

HIGH ALTITUDE

AIRCRAFT CANUCK 4 ENG. ORENDA 9 CHART WT. LIMITS 37,000 LB. EXT. LOAD NONE NO. OF ENGINES OPERATING: 2

IF YOU ARE AT 25000'			FUEL	IF YOU ARE AT 30000'			IF YOU ARE AT 35000'			IF YOU ARE AT 40000'			FUEL	IF YOU ARE AT 45000'		
RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES BY		
BY CRUISING AT 25000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 30000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 35000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 40000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 45000'	OPT. ALT. 1000 FT.	DESCENDING AND BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
(1010)	40	(1170)	10,000	(1120)	40	(1180)	-	-	-	-	-	-	10,000	-	-	-
820	40	970	8,000	910	40	980	(980)	40	(990)	(1000)	40	(1000)	8,000	-	-	-
620	40	740	6,000	690	40	750	750	40	760	770	40	770	6,000	(710)	40	(780)
410	40	490	4,000	460	40	500	510	40	520	530	40	530	4,000	500	40	540
200	40	230	2,000	220	40	240	250	40	250	260	40	260	2,000	260	40	270

CRUISING AT 25,000' WT. 32,000 LB.					EFFEC-TIVE WIND	CRUISING AT 30,000' WT. 32,000 LB.					CRUISING AT 35,000' WT. 32,000 LB.					CRUISING AT 40,000' WT. 32,000 LB.					EFFEC-TIVE WIND	CRUISING AT 45,000' WT. 32,000 LB.				
	APPROXIMATE						APPROXIMATE					APPROXIMATE					APPROXIMATE						APPROXIMATE			
I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
290	4260	305	.70	30	120 HW	260	3830	305	.70	35	240	3480	300	.70	45	215	3450	300	.70	50	120 HW					
285	4140	340	.80	30	80 HW	260	3720	340	.80	40	240	3400	335	.80	50	215	3390	335	.80	60	80 HW					
280	4030	370	.90	35	40 HW	255	3630	370	.90	45	235	3350	370	.90	55	210	3340	370	.90	65	40 HW					
275	3920	405	1.00	40	0	255	3570	405	1.00	50	235	3310	410	1.00	60	210	3310	410	1.00	70	0					
270	3840	440	1.10	40	40 TW	255	3530	445	1.10	55	230	3290	445	1.10	65	210	3290	445	1.10	75	40 TW					
265	3780	470	1.20	45	80 TW	250	3500	480	1.20	55	230	3270	485	1.20	70	210	3270	485	1.20	85	80 TW					
260	3730	505	1.30	50	120 TW	250	3460	515	1.30	60	230	3250	525	1.30	75	205	3250	520	1.30	90	120 TW					

AT THIS WEIGHT NO CRUISE POSSIBLE AT OR BELOW MAXIMUM CONTINUOUS RPM

NOTES

1. MULTIPLY NAUTICAL UNITS BY 1.15 FOR CONVERSION TO STATUTE UNITS.
2. ALL DISTANCES AND SPEEDS ARE NAUTICAL UNITS.
3. CLIMB AT 97.5% RPM.
4. DIVIDE LB/HR. BY 8.20 TO OBTAIN GPH. OF 3GP23A-(MIL-F 5616)GRADE JP 1.
5. DIVIDE LB/HR. BY 7.80 TO OBTAIN GPH. OF 3GP22A (MIL-F-5624A) GRADE JP 4.

EXAMPLE

If you are at 10,000 feet with 8,000 pounds of available fuel, you can fly 540 nautical airmiles by holding 315 knots IAS. However, you can fly 920 nautical airmiles by immediately climbing to 40,000 feet using 97.5% RPM. At 40,000 feet cruise at 210 knots IAS and start letdown 70 nautical miles from home. With an 80 knot headwind, the range at 40,000 feet would be .80 × 920 or 736 nautical miles. Cruise at 215 knots IAS with this wind and start letdown 60 nautical miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — KNOTS
RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIR-MILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN KNOTS
IAS — INDICATED AIRSPEED IN KNOTS
LB/HR. — FUEL CONSUMPTION — POUNDS PER HOUR
RANGE — NAUTICAL MILES

FIGURES IN ( ) ARE TO ASSIST IN INTERPOLATION ONLY

Fig. 4-22 Flight Operation Instruction Chart (Sheet 2 of 2) (Orenda 9)

1714-4F-4

AIRCRAFT

CANUCK 4

(With or without tip pods)

ENGINE(S) ORENDA 11

LIMITS	TIME LIMIT MINS.	% RPM	EXHAUST TEMP.	OIL PRESS PSI	FUEL PRESS PSI
Take-off and Combat	15	100	715°	15-25	3-35
Climb	30	97.5	685°	15-25	3-35
Cruise	None	70-93	625°	15-25	3-35

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 37,000 LB.

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figures in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reserve, 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 appropiate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel required to 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 5 MINS. APPROACH FUEL.

EXTERNAL LOAD ITEMS

NONE

NUMBER OF ENGINES OPERATING: TWO

NOTES: Ranges shown at optimum altitudes are maximum. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA AS OF APRIL. 1957 BASED ON FLIGHT TEST DATA

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIR NAUTICAL MILES			FUEL IN POUNDS	IF YOU ARE AT 5000′ RANGE IN AIR NAUTICAL MILES			IF YOU ARE AT 10000′ RANGE IN AIR NAUTICAL MILES			IF YOU ARE AT 15000′ RANGE IN AIR NAUTICAL MILES			FUEL IN POUNDS	IF YOU ARE AT 20000′ RANGE IN AIR NAUTICAL MILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.		BY CRUISING AT 5000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 10000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 15000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.		BY CRUISING AT 20000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
540	40	1.275	10,000	(640)	40	(1.285)	(750)	40	(1.305)	(885)	40	(1.315)	10,000	(1.015)	40	(1330)
430	40	1.030	8.000	505	40	1.040	595	40	1.055	705	40	1.065	8.000	815	40	1080
315	40	755	6.000	370	40	770	440	40	785	520	40	800	6.000	605	40	810
200	40	465	4.000	235	40	485	280	40	495	335	40	510	4.000	390	40	525
85	40	160	2.000	100	40	175	120	40	190	150	40	200	2.000	170	40	215

CRUISING AT S.L WT. 32,000 LB.					EFFECTIVE WIND	CRUISING AT 5,000′ WT. 32,000 LB.					CRUISING AT 10,000′ WT. 32,000 LB.					CRUISING AT 15,000′ WT. 32,000 LB.					EFFECTIVE WIND	CRUISING AT 20,000′ WT. 32,000 LB.				
	APPROXIMATE						APPROXIMATE					APPROXIMATE					APPROXIMATE						APPROXIMATE			
I. A. S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST		I. A. S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I. A. S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I. A. S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I. A. S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
425	7.950	310	.7	0	120 HW	390	6.705	305	.7	5	365	5.630	305	.7	5	330	4.790	295	.7	15	120 HW	300	3.920	285	.7	20
410	7.595	335	.8	0	80 HW	385	6.420	335	.8	5	355	5.430	335	.8	10	325	4.575	325	.8	15	80 HW	300	3.860	325	.8	25
400	7.215	365	.9	0	40 HW	375	6.170	365	.9	5	345	5.200	365	.9	10	320	4.470	360	.9	20	40 HW	295	3.765	360	.9	25
390	6.980	395	1.0	0	0	365	5.925	395	1.0	5	335	5.020	395	1.0	10	310	4.310	390	1.0	20	0	290	3.680	395	1.0	30
380	6.740	425	1.1	0	40 TW	355	5.730	425	1.1	5	330	4.950	425	1.1	10	305	4.250	425	1.1	20	40 TW	285	3.580	435	1.1	30

1715-4F-2

HIGH ALTITUDE

AIRCRAFT CANUCK 4 (With or without tip pods) ENG. ORENDA 11 CHART WT. LIMITS 37,000 LB. EXT. LOAD NONE NO. OF ENGINES OPERATING: 2

IF YOU ARE AT 25000'			FUEL	IF YOU ARE AT 30000'			IF YOU ARE AT 35000'			IF YOU ARE AT 40000'			FUEL	IF YOU ARE AT 45000'		
RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES BY		
BY CRUISING AT 25000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 30000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 35000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 40000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 45000'	OPT. ALT. 1000 FT.	DESCENDING AND BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
(1.150)	40	(1.345)	10.000	(1.280)	40	(1.360)	(1.365)	40	(1.370)	(1.370)	40	(1.370)	10.000		40	
925	40	1.095	8.000	1.030	40	1.110	1.100	40	1.115	1.125	40	1.125	8.000		40	
695	40	825	6.000	770	40	840	835	40	844	865	40	865	6.000		40	
450	40	540	4.000	505	40	550	550	40	560	575	40	575	4.000	(540)	40	600
200	40	230	2.000	230	40	240	250	40	255	265	40	265	2.000	270	40	290

CRUISING AT 25,000' WT. 32,000 LB.					EFFEC-	CRUISING AT 30,000' WT. 32,000 LB.					CRUISING AT 35,000' WT. 32,000 LB.					CRUISING AT 40,000' WT. 32,000 LB.					EFFEC-	CRUISING AT 45,000' WT. 32,000 LB.				
	APPROXIMATE				TIVE		APPROXIMATE					APPROXIMATE					APPROXIMATE				TIVE		APPROXIMATE			
I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	WIND	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	WIND	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
280	3.450	290	.65	25	120 HW	265	3.260	300	.7	35	245	3.140	305	.7	45	225	3.135	315	.7	55	120 HW	AT THIS WEIGHT NO CRUISE POSSIBLE BELOW MAX. CONTINUOUS R.P.M.				
275	3.370	325	.75	30	80 HW	260	3.150	335	.8	40	240	3.045	340	.8	50	220	3.035	350	.8	65	80 HW					
275	3.285	360	.9	35	40 HW	255	3.065	365	.9	45	235	2.970	375	.9	60	215	2.955	380	.9	70	40 HW					
270	3.195	395	1.0	40	0	255	3.010	405	1.0	50	235	2.910	410	1.0	65	210	2.860	410	1.0	80	0					
265	3.145	435	1.1	45	40 TW	250	2.955	440	1.1	55	230	2.845	445	1.1	70	205	2.780	445	1.1	85	40 TW					
260	3.080	465	1.2	45	80 TW	245	2.905	475	1.2	60	225	2.795	475	1.2	75	200	2.720	475	1.2	95	80 TW					
260	3.025	500	1.3	50	120 TW	245	2.860	510	1.3	65	220	2.735	510	1.3	85	195	2.660	505	1.3	105	120 TW					

NOTES

1. MULTIPLY NAUTICAL UNITS BY 1.15 FOR CONVERSION TO STATUTE UNITS.
2. ALL DISTANCES AND SPEEDS ARE NAUTICAL UNITS.
3. CLIMB AT 97.5% RPM.
4. DIVIDE LB/HR. BY 7.80 TO OBTAIN GPH. OF 3GP22B GRADE JP 4.

EXAMPLE

If you are at 10,000 feet with 8,000 pounds of available fuel, you can fly 595 nautical airmiles by holding 335 knots IAS. However, you can fly 1,055 nautical airmiles by immediately climbing to 40,000 feet using 97.5% RPM. At 40,000 feet cruise at 210 knots IAS and start letdown 80 nautical miles from home. With an 80 knot headwind, the range at 40,000 feet would be .80 x 1,055 or 844 nautical miles. Cruise at 220 knots IAS with this wind and start letdown 65 nautical miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — KNOTS
RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIR-MILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN KNOTS
IAS — INDICATED AIRSPEED IN KNOTS
LB/HR. — FUEL CONSUMPTION — POUNDS PER HOUR
RANGE — NAUTICAL MILES

FIGURES IN ( ) ARE TO ASSIST IN INTERPOLATION ONLY

Fig. 4-23 Flight Operation Instruction Chart (Sheet 2 of 2) (Orenda 11)

2700-4F-1

AIRCRAFT
CANUCK 4
(WITH TIP TANKS)
ENGINE(S) ORENDA 11

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 40,500 LB.

EXTERNAL LOAD ITEMS
TIP TANKS
NUMBER OF ENGINES OPERATING: TWO

LIMITS	TIME LIMIT MINS.	% RPM	EXHAUST TEMP.	OIL PRESS PSI	FUEL PRESS PSI
Take-off and Combat	15	100	720°	15-25	3-35
Climb	30	97.5	685°	15-25	3-35
Cruise	NONE	93	625°	15-25	3-35

INSTRUCTIONS FOR USING CHART: (A) IN FLIGHT — Select figures in fuel column equal to, or less than, fuel available for cruise (fuel on board minus allowance for reserve, 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 appropiate cruising altitude section. (B) FLIGHT PLANNING — From initial fuel on board subtract fuel required to 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 5 MINS. APPROACH FUEL.

NOTES: Ranges shown at optimum altitudes are maximum. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA AS OF APRIL, 1957. BASED ON FLIGHT TEST DATA

LOW ALTITUDE

IF YOU ARE AT S. L. RANGE IN AIR NAUTICAL MILES			FUEL IN POUNDS	IF YOU ARE AT 5000′ RANGE IN AIR NAUTICAL MILES			IF YOU ARE AT 10000′ RANGE IN AIR NAUTICAL MILES			IF YOU ARE AT 15000′ RANGE IN AIR NAUTICAL MILES			FUEL IN POUNDS	IF YOU ARE AT 20000′ RANGE IN AIR NAUTICAL MILES		
BY CRUISING AT S. L.	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.		BY CRUISING AT 5000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 10000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 15000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.		BY CRUISING AT 20000′	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
745	40	1.910	14.000	890	40	1.935	(1.055)	40	(1.940)	(1.245)	40	(1.960)	14.000	(1.430)	40	(1.970)
635	40	1.655	12.000	760	40	1.680	905	40	1.695	1.070	40	1.710	12.000	1.235	40	1.725
525	40	1.390	10.000	625	40	1.410	750	40	1.430	890	40	1.450	10.000	1.030	40	1.460
415	40	1.110	8.000	495	40	1.135	595	40	1.150	705	40	1.160	8.000	825	40	1.180
305	40	810	6.000	365	40	835	435	40	845	520	40	865	6.000	610	40	880
190	40	490	4.000	230	40	510	280	40	530	335	40	545	4.000	395	40	560
80	40	150	2.000	100	40	170	120	40	190	145	40	210	2.000	170	40	225

CRUISING AT S.L. WT. 33,500 LB.					EFFEC-TIVE WIND	CRUISING AT 5,000′ WT. 33,500 LB.					CRUISING AT 10,000′ WT. 33,500 LB.					CRUISING AT 15,000′ WT. 33,500 LB.					EFFEC-TIVE WIND	CRUISING AT 20,000′ WT. 33,500 LB.				
I.A.S.	APPROXIMATE LBS./HR.	G. S.	RANGE FACTOR	LET DOWN DIST		I.A.S.	APPROXIMATE LBS./HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	APPROXIMATE LBS./HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	APPROXIMATE LBS./HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	APPROXIMATE LBS./HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
390	7.200	280	.7	0	120 HW	390	6.690	280	.7	5	365	5.735	305	.7	10	340	4.970	305	.7	15	120 HW	310	4.170	305	.7	25
390	7.200	320	.8	0	80 HW	385	6.575	340	.8	10	360	5.530	340	.8	10	335	4.735	340	.8	20	80 HW	305	4.040	335	.8	30
390	7.200	360	.9	0	40 HW	380	6.356	375	.9	10	355	5.395	375	.9	15	325	4.630	375	.9	20	40 HW	300	3.930	370	.9	30
390	7.200	400	1.0	0	0	375	6.180	405	1.0	10	345	5.270	405	1.0	15	325	4.535	405	1.0	25	0	295	3.835	405	1.0	35
390	7.200	440	1.1	0	40 TW	365	6.025	440	1.1	10	340	5.145	440	1.1	15	315	4.400	440	1.1	25	40 TW	295	3.760	440	1.1	40

Fig. 4-24 Flight Operation Chart (Sheet 1 of 2) (Orenda 11) - Tip Tanks

2701-4F-1

HIGH ALTITUDE

AIRCRAFT CANUCK 4 ENG. ORENDA 11 CHART WT. LIMITS 40,500 LB. EXT. LOAD TIP TANKS NO. OF ENGINES OPERATING: 2

IF YOU ARE AT 25000'			FUEL	IF YOU ARE AT 30000'			IF YOU ARE AT 35000'			IF YOU ARE AT 40000'			FUEL	IF YOU ARE AT 45000'		
RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			RANGE IN AIR NAUTICAL MILES			IN	RANGE IN AIR NAUTICAL MILES BY DESCENDING AND BY CRUISING AT OPT. ALT.		
BY CRUISING AT 25000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 30000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 35000'	OPT. ALT. 1000 FT.	BY CLIMBING AND BY CRUISING AT OPT. ALT.	BY CRUISING AT 40000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	POUNDS	BY CRUISING AT 45000'	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
1.400	40	1.740	12.000	1.575	40	1.750	1.715	40	1.765	1.780	40	1.780	12.000			
1.180	40	1.470	10.000	1.325	40	1.490	1.450	40	1.505	1.515	40	1.515	10.000			
940	40	1.190	8.000	1.065	40	1.210	1.175	40	1.225	1.230	40	1.230	8.000			
700	40	895	6.000	795	40	910	885	40	920	940	40	940	6.000	(930)	40	950
455	40	575	4.000	515	40	590	575	40	605	620	40	620	4.000	625	40	630
200	40	240	2.000	230	40	250	260	40	265	280	40	280	2.000	290	40	290

CRUISING AT 25,000' WT. 33,500 LB.					EFFEC-TIVE WIND	CRUISING AT 30,000' WT. 33,500 LB.					CRUISING AT 35,000' WT. 33,500 LB.					CRUISING AT 40,000' WT. 33,500 LB.					EFFEC-TIVE WIND	CRUISING AT 45,000' WT. 32,000 LB.				
	APPROXIMATE						APPROXIMATE					APPROXIMATE					APPROXIMATE					APPROXIMATE			
I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.	I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.		I.A.S.	LBS. /HR.	G. S.	RANGE FACTOR	LET DOWN DIST.
280	3.565	295	.7	30	120 HW	260	3.255	295	.7	40	240	3.145	300	.7	50	225	3.235	320	.7	60	120 HW	AT THIS WEIGHT NO CRUISE POSSIBLE BELOW MAX. CONTINUOUS POWER.				
280	3.430	330	.8	35	80 HW	255	3.135	330	.8	45	235	3.065	335	.8	55	220	3.115	350	.8	65	80 HW					
275	3.330	365	.9	40	40 HW	255	3.085	365	.9	50	235	2.985	370	.9	60	215	3.020	380	.9	75	40 HW					
270	3.300	405	1.0	45	0	250	3.050	405	1.0	55	230	2.930	405	1.0	70	210	2.905	410	1.0	85	0					
270	3.230	440	1.1	50	40 TW	250	2.985	440	1.1	60	230	2.870	440	1.1	75	205	2.830	445	1.1	90	40 TW					
265	3.175	475	1.2	55	80 TW	245	2.960	475	1.2	65	225	2.835	475	1.2	85	200	2.755	475	1.2	100	80 TW					
265	3.160	515	1.3	60	120 TW	245	2.930	515	1.3	70	220	2.795	510	1.3	90	195	2.720	510	1.3	110	120 TW					

NOTES

1. MULTIPLY NAUTICAL UNITS BY 1.15 FOR CONVERSION TO STATUTE UNITS.
2. ALL DISTANCES AND SPEEDS ARE NAUTICAL UNITS.
3. CLIMB AT 97.5% RPM.
4. DIVIDE LB/HR. BY 7.80 TO OBTAIN GPH. OF 3GP22B (MIL-F-5624) GRADE JP 4.

EXAMPLE

If you are at 10,000 feet with 8,000 pounds of available fuel, you can fly 595 nautical airmiles by holding 345 knots IAS. However, you can fly 1,150 nautical airmiles by immediately climbing to 40,000 feet using 97.5% RPM. At 40,000 feet cruise at 210 knots IAS and start letdown 85 nautical miles from home. With an 80 knot headwind, the range at 40,000 feet would be .80 x 1,150 or 920 nautical miles. Cruise at 220 knots IAS with this wind and start letdown 65 nautical miles from destination.

LEGEND

EFFECTIVE WIND — HW, HEADWIND, TW, TAILWIND — KNOTS
RANGE FACTOR — RATIO OF GROUND DISTANCE TO AIR-MILES FOR CORRESPONDING WINDS
G.S. — GROUND SPEED IN KNOTS
IAS — INDICATED AIRSPEED IN KNOTS
LB/HR. — FUEL CONSUMPTION — POUNDS PER HOUR
RANGE — NAUTICAL MILES

FIGURES IN ( ) ARE TO ASSIST IN INTERPOLATION ONLY

Fig. 4-24 Flight Operation Instruction Chart (Sheet 2 of 2) (Orenda 11) - Tip Tanks

EO 05-25E-1

RESTRICTED

AIRCRAFT
CANUCK 4
(With or without tip pods)

CRUISE PERFORMANCE

AT 93% R.P.M. (SINGLE ENGINE)

ENGINE
ORENDA 9

EFFECTIVE WIND (KNOTS)	CRUISING AT 93% R.P.M. APPROXIMATE VALUES									
	I.A.S. KNOTS			% R.P.M.	LB./HR.			G.S.	RANGE FACTOR	LETDOWN DISTANCE
	27,000 LB	32,000 LB	37,000 LB		27,000 LB	32,000 LB	37,000 LB			
120 H.W.	243	270	296	93	3130	3890	4710	248	0.65	35
80 H.W.	243	270	296	93	3130	3890	4710	288	0.80	40
40 H.W.	243	270	296	93	3130	3890	4710	328	0.9	45
0	243	270	296	93	3130	3890	4710	368	1.00	50
40 T.W.	243	270	296	93	3130	3890	4710	408	1.1	55
80 T.W.	243	270	296	93	3130	3890	4710	448	1.2	60
120 T.W.	243	270	296	93	3130	3890	4710	488	1.3	65

DATA AS OF: Sept. 1959

BASED ON: Avro Report No. C-100/AERO/548/554

BASED ON: JP4 Fuel

NOTE: Based on optimum altitudes shown on optimum cruise chart.

1721-4F-3

Fig. 4-25 Single Engine Cruise Performance at 93% RPM Chart (Orenda 9)

SINGLE ENGINE PERFORMANCE

OPTIMUM CRUISE

AIRCRAFT

CANUCK 4

NO EXTERNAL LOAD (With or without tip pods)

ONE ORENDA 9
OPERATIONAL WEIGHT EMPTY
(NO FUEL)
27,100 LB.

FUEL LB.	IF YOU ARE AT S. L. CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 5,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 10,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 15,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 20,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TC 93% R.P.M. CRUISING ALTITUDE	
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.
10,000	15,000	895	14,250	(910)	13,500	(925)	14,750	(945)	16,000	(960)
8,000	18,000	730	17,250	750	16,500	770	17,250	785	18,000	805
6,000	21,000	555	20,500	570	20,000	590	19,500	605	19,000	620
4,000	24,000	360	23,500	380	23,000	395	22,500	415	22,000	430
2,000	27,000	145	26,500	165	26,000	185	25,500	205	25,000	220

FUEL LB.	IF YOU ARE AT 25,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 30,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 35,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 40,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.			
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.		
10,000	17,000	(980)								
8,000	19,250	820	20,500	840	20,750	860	21,000	880		
6,000	20,500	640	22,000	660	22,600	675	23,225	695		
4,000	23,250	450	24,500	470	25,000	490	25,500	505		
2,000	26,000	240	27,000	260	27,000	280	27,000	300		

NOTES:

1. IF AN ENGINE FAILURE OCCURS, CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO THE START OF 93% R.P.M. CRUISING ALTITUDE (DEPENDING ON FUEL AVAILABLE) AND CRUISE AT 93% R.P.M. ONCE THE AIRCRAFT REACHES THE START OF 93% R.P.M. CRUISING ALTITUDE, AS FUEL IS USED THE AIRCRAFT WILL CLIMB SLOWLY TO APPROXIMATELY 27,000 FT., DUE TO THE DECREASE IN AIRCRAFT WEIGHT.
2. DESCENT, CLIMB AND APPROACH HAVE BEEN TAKEN INTO ACCOUNT IN THE ABOVE RANGE FIGURES.
3. BASED ON JP 4 FUEL.

Fig. 4-26 Single Engine Optimum Cruise Chart (Orenda 9)

CRUISE PERFORMANCE

AIRCRAFT — CANUCK 4 (With or without tip pods)

AT 93% R.P.M. (SINGLE ENGINE)

ENGINE — ORENDA : 11

EFFECTIVE WIND (KNOTS)	CRUISING AT 93% R.P.M. APPROXIMATE VALUES									
	I.A.S. KNOTS			% R.P.M.	LB/HR.					
	27,000 LB	32,000 LB	37,000 LB		27,000 LB	32,000 LB	37,000 LB	G.S.	RANGE FACTOR	LET DOWN DISTANCE
120 HW	215	250	265	93	2700	3330	3750	240	0.70	50
80 HW	215	250	265	93	2700	3330	3750	280	0.80	55
40 HW	215	250	265	93	2700	3330	3750	320	0.90	65
0	215	250	265	93	2700	3330	3750	360	1.00	70
40 TW	215	250	265	93	2700	3330	3750	400	1.10	80
80 TW	215	250	265	93	2700	3330	3750	440	1.20	85
120 TW	215	250	265	93	2700	3330	3750	480	1.30	90

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4)FUEL

NOTE: Based on optimum altitudes shown on optimum cruise chart.

1720-4F-2

Fig. 4-27 Single Engine Cruise Performance at 93% RPM Chart (Orenda 11)

SINGLE ENGINE PERFORMANCE

OPTIMUM CRUISE

AIRCRAFT

CANUCK 4

NO EXTERNAL LOAD (WITH OR WITHOUT TIP PODS)

ONE ORENDA 11
OPERATIONAL WEIGHT EMPTY
(NO FUEL)
26,900 LB.

FUEL LBS.	IF YOU ARE AT S. L. CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 5,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 10,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 15,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 20,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE	
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.
10.000	19500	963	19000	(980)	18700	(1000)	18500	(1017)	18600	(1035)
8.000	22100	782	21700	804	21200	825	20700	845	20000	864
6.000	24900	587	24500	606	24100	623	23600	640	23100	655
4.000	28000	365	27600	382	27200	400	26800	415	26200	430
2.000	24800 Descend	130	27500 Descend	145	29800 Descend	163	30000	180	29400	195

FUEL LBS.	IF YOU ARE AT 25,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 30,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 35,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 40,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 45,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.	
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.
10.000	19600	(1053)	21100	(1070)	21700	(1087)	22000	(1104)	-	-
8.000	21400	881	23400	897	24200	910	24000	922	24200	932
6.000	23400	668	25000	680	25700	690	26300	700	26000	703
4.000	25600	445	27000	456	28300	470	28300	480	28100	485
2.000	29000	210	29000	222	-	235	-	242	-	250

NOTES:

1. IF AN ENGINE FAILURE OCCURS, CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO THE START OF 93% R.P.M. CRUISING ALTITUDE (DEPENDING ON FUEL AVAILABLE) AND CRUISE AT 93% R.P.M. ONCE THE AIRCRAFT REACHES THE START OF 93% R.P.M. CRUISING ALTITUDE, AS FUEL IS USED THE AIRCRAFT WILL CLIMB SLOWLY TO APPROXIMATELY 31,500 FT., DUE TO THE DECREASE IN AIRCRAFT WEIGHT.

2. DESCENT, CLIMB AND APPROACH HAVE BEEN TAKEN INTO ACCOUNT IN THE ABOVE RANGE FIGURES.

3. BASED ON 3GP22B (JP4) FUEL.

Fig. 4-28 Single Engine Optimum Cruise Chart (Orenda 11)

CRUISE PERFORMANCE

AIRCRAFT CANUCK 4 | **CONFIGURATION** TIP TANKS | **AT 93% R.P.M. (SINGLE ENGINE)** | **ENGINE** ORENDA 11

EFFECTIVE WIND (KNOTS)	CRUISING AT 93% R.P.M. APPROXIMATE VALUES									
	I.A.S. KNOTS			% R.P.M.	LB/HR.					
	26,500 LB	33,500 LB	40,500 LB		26,500 LB	33,500 LB	40,500 LB	G.S.	RANGE FACTOR	LET DOWN DISTANCE
120 HW	215	245	275	93	2620	3340	4170	235	0.70	50
80 HW	215	245	275	93	2620	3340	4170	275	0.80	55
40 HW	215	245	275	93	2620	3340	4170	315	0.90	65
0	215	245	275	93	2620	3340	4170	355	1.00	70
40 TW	215	245	275	93	2620	3340	4170	395	1.10	80
80 TW	215	245	275	93	2620	3340	4170	435	1.20	85
120 TW	215	245	275	93	2620	3340	4170	475	1.30	90

DATA AS OF: APRIL, 1957
BASED ON: FLIGHT TEST DATA
BASED ON: 3GP22B(JP4)FUEL

NOTE: Based on Optimum Altitudes as shown on Optimum Cruise Chart

2710-4F-1

Fig. 4-29 Single Engine Cruise Performance at 93% RPM Chart (Orenda 11) - Tip Tanks

AIRCRAFT

CANUCK 4
CONFIGURATION
TIP TANKS

SINGLE ENGINE PERFORMANCE

OPTIMUM CRUISE

ONE ORENDA 11
OPERATIONAL WEIGHT EMPTY
(NO FUEL)
25,868 LB.

FUEL LB.	IF YOU ARE AT S. L. CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 5,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 10,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 15,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 20,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE	
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.
14.000	18040	1416	17800	1432	17335	(1446)	16800	(1458)	16700	(1480) *
12.000	20150	1242	20050	1258	19250	1270	19100	1283	19500	1302 *
10.000	22420	1043	22380	1066	21650	1085	21500	1100	21000	1125
8.000	24750	836	24720	857	24100	875	23800	890	23500	920
6.000	27120	615	27100	636	26500	655	26360	672	25980	702
4.000	29520	378	29500	400	28900	420	28750	440	28480	472
2.000	26000 Descend	136	29000 Descend	158	29680	178	31200	195	30920	224

FUEL LB.	IF YOU ARE AT 25,000' CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 30,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 35,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 40,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.		IF YOU ARE AT 45,000' DESCEND AT 93% R.P.M. AND CONTINUE TO CRUISE AT 93% R.P.M.	
	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.
14.000	17200	(1480) *	18350	(1485)	19800	(1487)	-	-	-	-
12.000	19500	1302 *	20400	1310	21700	1318	21050	1323	-	-
10.000	22300	1125 *	23000	1132	23380	1136	23050	1137	23050	1137
8.000	23900	920 *	24650	932	25200	941	25000	947	25000	949
6.000	25570	702	26500	715	27100	723	27050	730	26850	731
4.000	27980	472	28400	483	28840	495	29000	504	29200	510
2.000	30550	224	30000	237	31000	248	31100	258	31400	263

NOTES:

1. IF AN ENGINE FAILURE OCCURS, CLIMB AT 97.5% R.P.M. OR DESCEND AT 93% R.P.M. TO THE START OF 93% R.P.M. CRUISING ALTITUDE (DEPENDING ON FUEL AVAILABLE) AND CRUISE AT 93% R.P.M. ONCE THE AIRCRAFT REACHES THE START OF 93% R.P.M. CRUISING ALTITUDE, AS FUEL IS USED THE AIRCRAFT WILL CLIMB SLOWLY TO APPROXIMATELY 31,500 FT., DUE TO THE DECREASE IN AIRCRAFT WEIGHT.
2. DESCENT, CLIMB AND APPROACH HAVE BEEN TAKEN INTO ACCOUNT IN THE ABOVE RANGE FIGURES.
3. BASED ON 3GP228 (MIL-F-5624, GRADE JP 4) FUEL.

Fig. 4-30 Single Engine Optimum Cruise Chart (Orenda 11) - Tip Tanks

CLIMB CHART

AIRCRAFT
CANUCK 4

SINGLE ENGINE

ENGINE
ORENDA 9

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD (With or without tip pods)

GROSS WEIGHT
32,000 lb.

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	245	0	0	0	2030
5,000	240	315	2.6	10	1770
10,000	235	630	5.7	25	1480
15,000	230	970	9.5	40	1200
20,000	225	1360	14.3	65	900
25,000	220	1830	21.0	105	580

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	MAXIMUM THRUST (715°C-JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	245	0	0	0	2290
5,000	240	280	2.3	10	1980
10,000	235	565	5.0	20	1700
15,000	230	855	8.3	40	1390
20,000	225	1190	12.4	60	1050
25,000	220	1575	18.2	90	710
Warm up, taxi, take-off and acceleration to climb allowance.(2 engines)		800	6.0	5	

NOTES:
(1) Multiply nautical units by 1.15 for conversion to statute units.
(2) Start to climb weight is the gross weight less 800 lb. for the above charts.

DATA AS OF: Sept 1959
BASED ON: Avro Report No. C-100/AERO/548/554
BASED ON: JP4 Fuel

CLIMB CHART

AIRCRAFT
CANUCK 4

SINGLE ENGINE

ENGINE
ORENDA 9

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD (With or without tip pods)

GROSS WEIGHT
37,000 lb.

PRESSURE ALTITUDE FEET	97.5% R.P.M.				
	I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	245	0	0	0	1620
5,000	240	400	3.3	15	1380
10,000	235	820	7.3	35	1100
15,000	230	1290	12.7	55	830
20,000	225	1865	19.9	95	560
25,000	220	2645	32.0	155	320

PRESSURE ALTITUDE FEET	MAXIMUM THRUST (715°C-JPT)				
	I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	245	0	0	0	1890
5,000	240	350	2.9	10	1590
10,000	235	710	6.4	30	1310
15,000	230	1100	10.7	50	1000
20,000	225	1570	16.6	80	700
25,000	220	2230	26.0	130	380

Warm up, taxi, take-off and acceleration to climb allowance.(2 engines)	800	6.0	5

NOTES:
(1) Multiply nautical units by 1.15 for conversion to statute units.
(2) Start to climb weight is the gross weight less 800 lb. for the above charts.

DATA AS OF: Sept. 1959
BASED ON: Avro Report No. C-100/AERO/548/554
BASED ON: JP4 Fuel

CLIMB CHART

AIRCRAFT
CANUCK 4

SINGLE ENGINE

ENGINE
ORENDA 11

CONFIGURATION
NO EXTERNAL LOAD (With or without tip pods)

GROSS WEIGHT
32,000 LB.

PRESSURE ALTITUDE FEET	IAS KNOTS	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	265	0	0	0	2.400
5.000	255	260	2.0	10	2.100
10.000	245	530	5.0	25	1.800
15.000	235	790	8.0	40	1.500
20.000	225	1110	12.0	55	1.100
25.000	215	1470	17.0	85	700
26.500	210	1680	21.0	100	500

PRESSURE ALTITUDE FEET	IAS KNOTS	MAXIMUM THRUST (715°C-JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	265	0	0	0	2600
5.000	255	240	2.0	10	2400
10.000	245	460	4.5	20	2000
15.000	235	730	7.0	30	1500
20.000	225	1030	10.5	50	1100
25.000	215	1390	16.0	80	600
26.500	215	1470	17.5	85	500
Warm up, taxi, take-off and acceleration to climb allowance.		680	6.0	6.0	

NOTE 1. Multiply nautical units by 1.15 for conversion to statute units.

2. Start to climb weight is the gross weight less 680 lb. for the above charts

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

CLIMB CHART

AIRCRAFT
CANUCK 4

SINGLE ENGINE

ENGINE
ORENDA 11

CONFIGURATION
NO EXTERNAL LOAD (With or without tip pods)

GROSS WEIGHT
37.000 LB.

97.5% R.P.M.

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	265	0	0	0	1.900
5.000	255	330	3.0	15	1.600
10.000	245	660	6.0	30	1.400
15.000	235	1030	10.0	50	1.100
20.000	225	1460	15.0	75	700
22.500	220	1780	20.5	100	500

MAXIMUM THRUST (715°C-JPT)

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	265	0	0	0	2100
5.000	255	290	2.5	10	1900
10.000	245	580	5.5	25	1500
15.000	235	940	9.0	40	1000
20.000	225	1310	14.0	65	700
22.500	215	1620	18.0	85	500
Warm up, taxi, take-off and acceleration to climb allowance.		680	6.0	6.0	

NOTE 1. Multiply nautical units by 1.15 for conversion to statute units.

2. Start to climb weight is the gross weight less 680 lb. for the above charts.

DATA AS OF: APRIL, 1957
BASED ON: FLIGHT TEST DATA
BASED ON: 3GP22B(JP4)FUEL

CLIMB CHART
(SINGLE ENGINE)

AIRCRAFT
CANUCK 4

CONFIGURATION
TIP TANKS

ENGINE
ORENDA 11

GROSS WEIGHT
33,500 LBS.

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	265	0	0	0	2,200
5,000	255	280	2.5	10	1,900
10,000	245	560	5.0	25	1,700
15,000	235	860	8.5	40	1,300
20,000	225	1210	13.0	65	1,000
25,000	215	1600	19.0	90	600
26,000	211	1700	21.0	105	500

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	MAXIMUM THRUST (715°C–JPT) APPROXIMATE VALUES FROM SEA LEVEL			RATE OF CLIMB F.P.M.
		FUEL LB.	TIME MIN.	DISTANCE N.M.	
SEA LEVEL	265	0	0	0	2,400
5,000	255	260	2.5	10	2,200
10,000	245	520	5.0	20	1,800
15,000	235	820	8.0	35	1,300
20,000	225	1180	10.5	50	900
25,000	215	1620	18.0	85	600
26,000	215	1710	19.5	100	500
Warm up, taxi, take-off and acceleration to climb allowance.		620	6.0	4.5	

NOTES: (1) Multiply nautical units by 1.15 for conversion to statute units.
(2) The start to climb weight is the gross weight less 620 lb.

DATA AS OF: APRIL, 1957.

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B (JP4) FUEL

CLIMB CHART
(SINGLE ENGINE)

AIRCRAFT
CANUCK 4

ENGINE
ORENDA 11

CONFIGURATION
TIP TANKS

GROSS WEIGHT
40.500 LBS.

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	97.5% R.P.M. APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	265	0	0	0	1.600
5.000	255	380	3.5	15	1.400
10.000	245	780	7.0	35	1.100
15.000	235	1250	12.5	60	800
20.000	225	1840	21.5	95	500

PRESSURE ALTITUDE FEET	I.A.S. KNOTS	MAXIMUM THRUST (715°C-JPT) APPROXIMATE VALUES FROM SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	265	0	0	0	1.800
5.000	255	340	3.0	15	1.600
10.000	245	690	6.5	30	1.200
15.000	235	1150	11.0	50	800
20.000	225	1620	17.0	105	500
Warm up, taxi, take-off and acceleration to climb allowance.		620	6.0	4.5	

NOTES: (1) Multiply nautical units by 1.15 for conversion to statute units.
(2) The start to climb weight is the gross weight less 620 lb.

DATA AS OF: APRIL, 1957.

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4) FUEL

DESCENT CHART
SINGLE ENGINE

AIRCRAFT
CANUCK 4
(With or without tip pods)

ENGINE
ORENDA 9

AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 27,000 LB.					PRESSURE ALTITUDE FEET	AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD. - 32,000 LB.				
APPROXIMATE VALUES				I. A. S. KNOTS		I. A. S. KNOTS	APPROXIMATE VALUES			
RATE OF DESCENT F. P. M.	TO SEA LEVEL DISTANCE N. M.	TIME MIN.	FUEL LB.				TO SEA LEVEL FUEL LB.	TIME MIN.	DISTANCE N. M.	RATE OF DESCENT F. P. M.
3500	80.0	14.9	175	205	40,000	205	190	15.9	80.0	3400
3000	70.0	13.4	170	210	35,000	210	180	14.3	70.0	3000
2900	55.0	11.7	160	215	30,000	215	170	12.5	60.0	2700
2800	45.0	9.9	145	220	25,000	220	155	10.6	50.0	2600
2700	40.0	8.0	130	225	20,000	225	140	8.6	40.0	2500
2600	30.0	6.1	105	230	15,000	230	115	6.6	30.0	2400
2500	20.0	4.2	80	235	10,000	235	85	4.5	20.0	2300
2400	10.0	2.1	40	240	5,000	240	45	2.3	10.0	2200
2300	0	0	0	245	Sea Level	245	0	0	0	2000

DATA AS OF: Sept 1959

BASED ON: JP4 Fuel

BASED ON: Avro Report No. C-100/AERO/548/554

NOTES:

1. Idling R.P.M.
2. Speed Brakes Closed

1737-4F-2

Fig. 4-37 Single Engine Descent Chart (Orenda 9)

AIRCRAFT
CANUCK 4

CONFIGURATION
(With or without tip pods)

DESCENT CHART
SINGLE ENGINE

ENGINE
ORENDA 11

AIRCRAFT GROSS WEIGHT 27,000 LB.					PRESSURE ALTITUDE FEET	AIRCRAFT GROSS WEIGHT 32,000 LB.				
APPROXIMATE VALUES						APPROXIMATE VALUES				
RATE OF DESCENT F. P. M.	TO SEA LEVEL DISTANCE N. M.	TO SEA LEVEL TIME MIN.	TO SEA LEVEL FUEL LB.	I. A. S. KNOTS		I. A. S. KNOTS	TO SEA LEVEL FUEL LB.	TO SEA LEVEL TIME MIN.	TO SEA LEVEL DISTANCE N. M.	RATE OF DESCENT F. P. M.
3200	100	19.4	240	190	45.000	190	250	19.9	105	3800
2640	90	17.7	230	195	40.000	195	240	18.4	95	2700
2190	80	15.6	215	200	35.000	200	225	16.3	85	2190
2110	65	13.3	195	205	30.000	205	205	14.0	70	2100
2140	55	10.9	170	215	25.000	215	180	11.6	55	2090
2170	40	8.6	145	225	20.000	225	155	9.2	45	2090
2220	30	6.3	115	235	15.000	235	125	6.9	35	2190
2300	20	4.1	80	245	10.000	245	90	4.6	20	2080
2420	10	2.0	40	255	5.000	255	45	2.2	10	2200
2600	0	0	0	265	SEA LEVEL	265	0	0	0	2260

DATA AS OF: APRIL, 1957

BASED ON: 3GP22B(JP4)FUEL

BASED ON: FLIGHT TEST DATA

NOTES: 1. Idling rpm.
2. Speed brakes closed.

1718-4F-2

Fig.4-38 Single Engine Descent Chart (Orenda 11)

DESCENT CHART

AIRCRAFT

CANUCK 4

CONFIGURATION

TIP TANKS

SINGLE ENGINE

ENGINE

ORENDA 11

AIRCRAFT GROSS WEIGHT 26,500 LB.					PRESSURE ALTITUDE FEET	AIRCRAFT GROSS WEIGHT 33,500 LB.				
APPROXIMATE VALUES				I.A.S. KNOTS		I.A.S. KNOTS	APPROXIMATE VALUES			
RATE OF DESCENT F.P.M.	TO SEA LEVEL						TO SEA LEVEL			RATE OF DESCENT F.P.M.
	DISTANCE N.M.	TIME MIN.	FUEL LB.				FUEL LB.	TIME MIN.	DISTANCE N.M.	
2860	110	20.0	245	190	45,000	190	260	20.7	110	3060
2270	95	18.4	235	195	40,000	195	250	19.1	100	2540
1950	85	16.0	215	200	35,000	200	230	16.9	85	2120
1890	65	13.5	195	205	30,000	205	210	14.4	70	2010
1970	55	10.9	165	215	25,000	215	185	11.9	60	1980
2010	40	8.3	140	225	20,000	225	160	9.4	45	2000
2340	30	6.0	110	235	15,000	235	125	7.0	35	2170
2400	20	3.9	75	245	10,000	245	90	4.7	20	2120
2560	10	1.9	40	255	5,000	255	50	2.4	10	2160
2650	0	0	0	265	SEA LEVEL	265	0	0	0	2100

DATA AS OF: APRIL, 1957

BASED ON: FLIGHT TEST DATA

BASED ON: 3GP22B(JP4) FUEL

NOTES: (1) Idling rpm.

(2) Speed brakes closed.

2709-4F-1

Fig. 4-39 Single Engine Descent Chart (Orenda 11) - Tip Tanks