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ROYAL CANADIAN AIR FORCE

AIRCRAFT OPERATING INSTRUCTIONS

CANUCK 3D

(This EO replaces EO 05-25DA-1 dated 15 Feb 59 and all revisions issued thereto)

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

15 MAR 60

LIST OF RCAF REVISIONS

DATE	PAGE NO.	DATE	PAGE NO.

NOTES TO USERS

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

2 PART 1 - DESCRIPTION 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 members.

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

9 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.

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

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Frontispiece - Canuck 3D Aircraft

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PART 1

DESCRIPTION

INTRODUCTION

GENERAL

1 The Canuck 3D is a high altitude, long range, day and night, dual flight trainer, powered by two Orenda 8 gas turbine jet propulsion engines.

AIRFRAME

2 The fuselage, wings, empennage and control surfaces are of all metal construction. The inwardly retracting main wheels are attached to the centre section and the rearward retracting nose wheel is located in front of the pressurized cockpits. The flying controls are assisted by hydraulic boosters. Serrated edge speed brakes are fitted on the top and bottom surfaces of each wing.

ENGINES

3 The Orenda 8 has a 10-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 engine is equipped with an automatic fuel system compensated for altitude, and a self-contained lubrication system. The electric starter is energized by a 27.5 volt DC ground supply. An acceleration control is fitted to the flow control unit in the fuel system.

DIMENSIONS

4 The overall dimensions of the aircraft are as follows:

(a)	Wing span without tip tanks	52 feet
(b)	Overall wing span with tip tanks	57 ft 6 in
(c)	Length	52 ft 3 in
(d)	Height (to top of canopy)	10 ft 3 in
(e)	Height (to top of fin)	14 ft 6 in
(f)	Maximum Gross Landing Weight	27,960 lbs.

4A Fuel Remaining for Landing at Maximum Landing Weight - The maximum weight of fuel (JP-4) remaining, for various aircraft configurations on landings are as follows:

(a) Clean - 4,960 lbs.

(b) Tip tanks - 4,590 lbs.

NOTE

These figures are based on an aircraft basic weight including crew of 23,000 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 twelve interconnected flexible cells in each wing which comprise the wing tanks and in three flexible cells in the fuselage which comprise the fuselage front and rear tanks. The forward cell in the fuselage forms the fuselage front tank, while the two rear cells form the fuselage rear tank.

6 A booster pump is fitted in each fuselage tank and a transfer pump is fitted in each wing tank. The fuel from the left wing tank is transferred into the fuselage rear tank, which feeds the left engine. The fuel from the right wing tank is transferred into the fuselage front tank, which feeds the right engine.

7 During an emergency a tank selection system allows either engine to be fed from any tank.

8 Wing tip tanks may be fitted for long range operations. Fuel is transferred by compressed air from the left wing tip tank into the fuselage rear tank and from the right wing tip tank into the fuselage front tank.

FUEL TANK CAPACITIES

9 The fuel quantities given are for usable, JP4 fuel.

Each wing tank	300 Imp gal (360 U.S. gal)

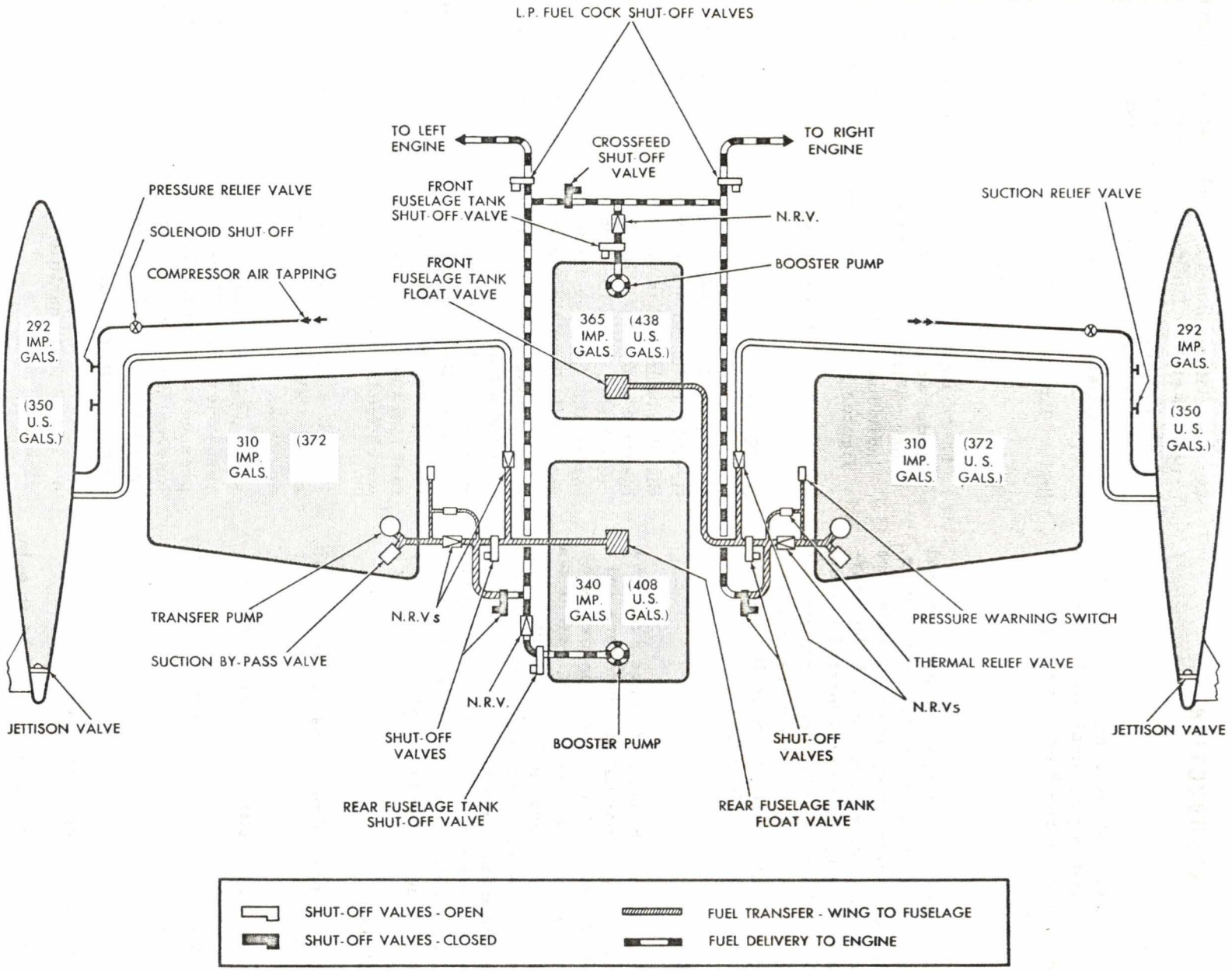

Fig. 1-1 Fuel System Diagram

Fuselage front tank	357 Imp gal (428 U.S. gal)
Fuselage rear tank	336 Imp gal (403 U.S. gal)
Each tip tank	290 Imp gal (348 U.S. gal)
Total without tip tanks	1293 Imp gal (1552 U.S. gal)
Total with tip tanks	1873 Imp gal (2248 U.S. gal)

SEQUENCE OF USING FUEL

10 During normal operation including starting and taxying, each engine is supplied from its respective system i.e. left engine - fuselage rear tank; right engine - fuselage front tank. When the fuel level in each tank has dropped to 140 usable gallons and with the wing transfer pumps switched on, fuel from the wing tanks transfers into the fuselage tanks to maintain the 140 gallon level. Warning lights operated by pressure switches indicate when the transfer operation is complete.

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

12 If wing tip tanks are used the contents of these must be transferred before the contents of the wing tanks. With the tip tank transfer switches on, compressed air from the engine compressors is supplied to the wing tip tanks and forces fuel into the fuselage tanks to maintain their level at 140 gallons of usable fuel. When the wing tip tanks are empty two warning lights illuminate. The tip tank transfer switches should then be selected off.

CAUTION

When the tip tank transfer switches are selected on, the wing transfer pumps must be switched off.

NOTE

The "140 gallon level" is an approximation. The actual level may be 130-140 gallons for the front tank and 140-160 gallons for the rear tank.

FUEL SYSTEM CONTROLS

13 A high pressure and a low pressure cock are fitted for each engine. The LP cock control switches are mounted at the rear of the LH console, and are in the ON position when the plastic guard is closed.

14 The HP cock levers are mounted outboard of the throttle box and have two positions, OFF (down) and ON (up).

15 A crossfeed switch is fitted on the LH console immediately aft of the throttle box and has three positions, LH TANKS ONLY CROSSFEED, NORMAL, RH TANKS ONLY CROSSFEED. On each crossfeed position the crossfeed pressure cock is open, permitting a common supply to both engines.

16 Two rotary switches on the LH console marked TANK SELECTION, have two positions, NORM and WING. On NORM the fuel is supplied from the fuselage tanks, and on WING the fuel is supplied from the wing tanks only. The tank selection switches are fitted with a guard which locks the switches at NORM.

FUEL TANK PUMPS

17 Switches for the fuselage tank booster pumps and wing tank transfer pumps are located on the LH console aft of the throttle box.

NOTE

A five-position switch and test ammeter socket located on the throttle box outboard of the HP cocks are for use during ground servicing only.

WING TANK PRESSURE WARNING LIGHTS

18 A warning light fitted immediately outboard of each wing tank contents indicator,

in both cockpits, is illuminated when the transfer operation from the respective wing tank is complete. The light may also illuminate when the tanks are low and the aircraft is diving or rapidly decelerating.

CAUTION

When the warning lights illuminate in normal level flight, the wing tank transfer pumps must be switched OFF since they are fuel lubricated and will seize if allowed to run dry.

FUEL BOOSTER PUMP PRESSURE INDICATOR

19 A dual pressure indicator on the main instrument panel in both cockpits shows the booster pump fuel pressure to the engine driven pumps.

FUEL CONTENTS INDICATORS

20 Six fuel contents indicators are mounted at the top of the main instrument panel in the front cockpit. From left to right these are as follows:

Left Wing EMPTY, HALF, FULL

Rear Fuselage 80 - 340 Imp gal
0 - 75 Imp gal

Front Fuselage 0 - 170 Imp gal
180 - 360 Imp gal

Right Wing EMPTY, HALF, FULL

21 Only the four fuselage tank contents indicators are duplicated in the rear cockpit.

TIP TANK WARNING LIGHTS

22 Two warning lights for left and right tip tanks, located on the main panel of the front cockpit outboard of the wing tank fuel pressure warning lights, are illuminated when the transfer operation from the tip tanks is complete.

TIP TANK SWITCHES

23 Two tip tank air pressure shut-off switches, located between fixed metal guards on the LH console adjacent to the cross-feed switch are marked TIP TANK FUEL TRANSFER. They control the supply of air from the engine compressors to the tip tanks. The switches are selected ON when it is desired to transfer the tip tank contents to the fuselage tanks, and must be selected OFF when the tip tank warning lights illuminate.

TIP TANK FUEL JETTISON

24 The TIP TANKS FUEL JETTISON switches are located on the LH console immediately outboard of the tank selection switches. They are protected by spring-loaded plastic guards and may be selected ON or OFF.

25 When it is necessary to jettison the contents of the wing tip tanks, switching on the fuel jettison switches releases the contents of a high pressure air bottle fitted in the fin of each tip tank. The air pressure then blows off the rear end of the tip tanks allowing the fuel to escape to atmosphere.

OIL SYSTEM

GENERAL

26 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 13.5 Imp pints (16.20 US pints) is fitted on the outboard side of each engine.

OIL PRESSURE INDICATOR

27 A dual indicator is mounted at the lower right corner of the main instrument panel in both cockpits.

OIL TEMPERATURE INDICATOR

28 A dual indicator is mounted adjacent to the oil pressure indicator on the main panel in both cockpits.

HYDRAULIC SYSTEM

GENERAL

29 The hydraulic system, which is fed by a pump on each engine, connected in parallel and supplied by a pressurized reservoir, operates the following:

Landing gear
Main gear up-locks
Landing flaps
Speed brakes
Control hydro-boosters
Brakes

30 Normal system pressure is 1900-2300 psi and is shown on a hydraulic pressure gauge mounted on the LH side panel of both cockpits. A relief valve fitted in the power line relieves at 2700-2950 psi.

POWER PACK

31 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 14.

WARNING

Do not use the power pack in the air for any other malfunction.

32 Control of the power pack is by means of a spring-loaded switch marked HYDRAULIC TEST PUMP, located on the LH console in the front cockpit, outboard of the emergency landing gear control.

CAUTION

A maximum time limit of ten 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 out without regular cooling periods provided ground crews ensure that the pack does not become more than warm to the touch of the hand.

PNEUMATIC SYSTEMS

LOW PRESSURE PNEUMATIC SYSTEM

33 The low pressure pneumatic system, supplied by air bled from the engine compressors, operates the following:

Canopy seal) via pressure
Hydraulic reservoir) reducing
Tip tanks) valves
Anti-g suits - via pressure regulating valves.

ANTI-G SUIT CONTROLS

34 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 of HI or LO can be made at the crew member's discretion, but the suit will only be inflated when "g" is experienced.

CANOPY SEAL

35 Low pressure air is automatically supplied to the canopy seal as the plunger on the inflation valve is depressed when the canopy is locked in the CLOSED position. Releasing the canopy lock shuts off the supply and vents the seal to atmosphere.

HIGH PRESSURE PNEUMATIC SYSTEM

36 An air bottle charged to 1980 psi is fitted in both the landing gear and flap circuits to provide one DOWN operation for each service only. A pressure indicator and charging valve are located adjacent to each bottle in the nose-wheel well.

ELECTRICAL SYSTEM

GENERAL

37 The 27.5 volt DC power supply is provided by a generator on each engine, connected in parallel, and by two 12 volt batteries connected in series.

MASTER POWER SUPPLY SWITCH

38 The MASTER POWER SUPPLY SWITCH fitted on the RH side panel in the front cockpit has three positions FLIGHT-OFF-GROUND. On FLIGHT, the aircraft batteries are connected into the circuit and on GROUND the power supply is provided by an external source through the external supply receptacle mounted on the RH fuselage outer skin below the pilot's cockpit.

GENERATOR PANEL

39 Generator control switches are located on the RH console in the front cockpit. Two GENERATOR ON-OFF toggle switches and two GENERATOR FAILURE RESET push button switches are provided.

40 An OVER-TEMPERATURE WARNING light is fitted forward of each generator toggle switch; a GENERATOR FAILURE warning light is fitted forward of each generator reset button. (See Part 3, paras 29, 30 and 31).

41 Two overtemperature warning lights are fitted in the rear cockpit, located on the decking above the main panel. There are no generator switches in the rear cockpit.

A-C SUPPLIES

42 A 400 cycle inverter, with a duplicate for emergency use, provides 115 volts for operation of the C2 compass and attitude gyro indicators, and 26 volts to operate the fuel and oil pressure indicators, landing flap position indicators and turn and bank indicators.

43 A MAIN INVERTER FAILURE WARNING light is fitted on the forward RH console in the front cockpit. A similar indicator is fitted above the main instrument panel in the rear cockpit. The lights are controlled by the supply to the emergency inverter relay. Change-over to the emergency inverter is automatic should the main inverter fail and is indicated by the illumination of the warning light in both cockpits.

FUSE BOX AND CIRCUIT BREAKER PANEL

44 A fuse box and circuit breaker panel are fitted in the rear cockpit only. Fitted on the panel is a voltmeter and ammeter, operated by a selector switch marked VOLT-AMP SELECT.

ENGINE STARTING SERVICES

45 A supply of 24 volts for operation of the ignition circuit is provided by the aircraft batteries and an external 27.5 volt energizer provides the power supply for the engine starters, through a ground supply socket on each engine.

WARNING AND INDICATING LIGHTS

46 All standard red and amber warning lights and green indicating lights may be rotated for day and night use and incorporate a "press to test" switch. This does not apply to the fire extinguisher warning lights. The landing gear warning light is "bright" only. The tip tank warning lights may be tested only when the air pressure shut-off switches are ON.

AIR CONDITIONING SYSTEM

GENERAL

47 The cabin pressurization, ventilation and temperature control is automatic once initial selection is made. The control switches fitted at the rear of the RH console include an air conditioning control switch marked NORMAL-ALL OFF-EMERGENCY VENTILATION, a temperature setting rheostat switch, and a manual override switch marked AUTO-HEAT-COOL. 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.

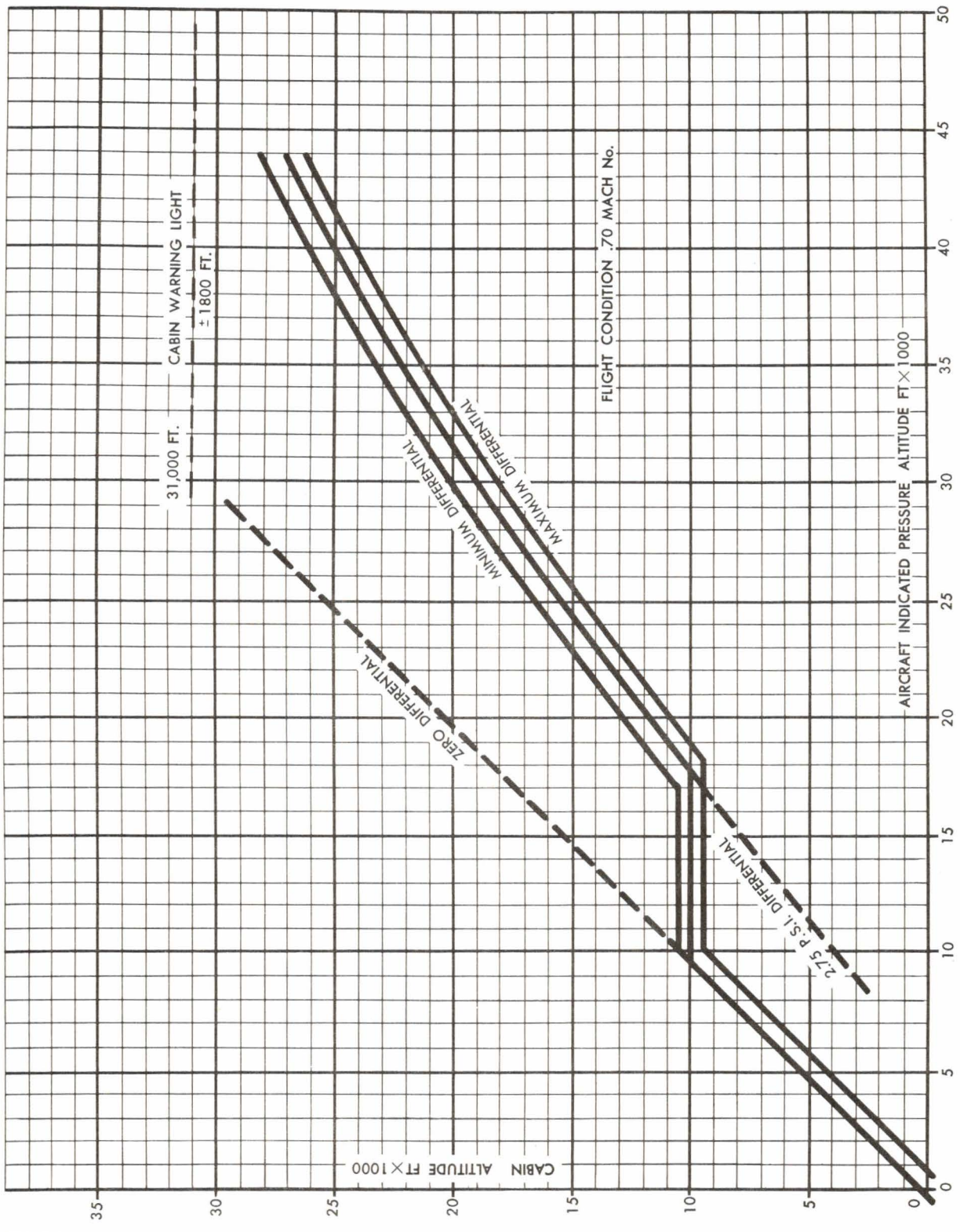

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Fig. 1-2 Cockpit Pressurization Curve

NORMAL OPERATION

48 With the air conditioning control switch selected to NORMAL and the manual override switch on AUTO, compressed heated air is bled from each engine compressor, through the refrigeration unit and into the cabin through a controllable louvre. Floor outlets in both cockpits are controlled by a lever on the LH wall in the pilot's cockpit. The normal air conditioning system can only be used when the engines are running.

49 Cabin pressure remains at the same value as the outside air up to 10,000 feet. From this altitude a pressure regulator controls the cabin pressure at the 10,000 ft atmospheric value, and continues to control it at this value until the aircraft reaches 10,000 feet. Above 18,000 feet, a pressure differential of approximately 2.75 psi between cabin and atmosphere is maintained up to the aircraft's ceiling. A warning light, marked CABIN PRESSURE WARN, fitted on the RH side panel in the front cockpit will illuminate if at any time the cabin altitude reaches 31,000 feet (± 1800 feet). Cabin pressure altitude is shown on a gauge fitted on the main panel in the front cockpit.

CABIN VENTILATION

50 EMERGENCY VENTILATION 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 dual blower supplies outside air to the cabin duct. The dual blower does not pressurize the cabin.

SWITCHING OFF

51 The air conditioning and ventilation may be shut off by first selecting EMERGENCY VENTILATION for six seconds and then selecting ALL OFF. This procedure is necessary to ensure that the shut-off valve is fully closed, thereby preventing the continued supply of hot air from the engine compressors. When ALL OFF is selected the dumping valve remains closed and the ventilation blower is inoperative.

FLYING CONTROLS

GENERAL

52 The flying controls are of conventional design, utilizing the divided type control column and parallel pedal rudder bar. With the ailerons neutral the control column handgrip is off-set approximately 13° to the right. Manual control is assisted by hydraulic boosters. The controls are duplicated in the rear cockpit.

FLYING CONTROL BOOSTERS

53 Hand operated levers are fitted to the side of the LH console in both cockpits and are interconnected. They are marked CONTROL BOOSTER DOWN-OFF and control a rotary cut-off valve to permit the boosters to be disengaged from the flying controls in the event of hydraulic failure. The levers are normally in the up, 'ON' position and are witness wired in this position.

54 A warning light fitted on the main panel in both front and rear cockpits is marked BOOST PRESS and gives warning of decreasing hydraulic pressure. If this light comes on, the control lever should immediately be pushed down to the OFF position to gain manual control and to prevent the controls from locking.

55 A green indicating light is fitted at the bottom of the main panel in the front cockpit and at the top right of the main panel in the rear cockpit. They are marked BOOSTER TEST and when a bulb is pressed it will illuminate if all hydro-booster units are properly engaged.

56 An accumulator fitted in the hydro-booster hydraulic circuit provides a reserve of pressure during the operation of the landing gear and flaps. In the event of failure of the main hydraulic pressure it allows sufficient time for the control lever to be

depressed to the OFF position before the accumulator charge is fully spent.

CONTROL LOCKS

57 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 "on" position during this operation.

TRIM TAB CONTROLS

58 Elevator, rudder and aileron trim tab handwheels are located on the LH console aft of the throttle box in the front cockpit and operate in the natural sense. Position indicators are fitted adjacent to their respective handwheels.

59 In the rear cockpit, only elevator and rudder trim tab handweels are fitted.

RUDDER PEDAL ADJUSTMENT

60 A handle is fitted below the LH edge of the main panel in both cockpits and is marked RUDDER PEDALS PULL TO ADJUST. When pulled it releases a locking pin allowing the pedals to spring towards the occupant. When the desired position is reached the handle should be released and pushed in and the pedals moved slightly to ensure positive re-engagement of the locking pin.

LANDING FLAPS

61 The landing flaps selector lever is installed on the rear face of the throttle box in both cockpits and may be selected DOWN, STOP or UP to obtain the desired flap setting. An emergency flap control is located adjacent to the landing flap selectors and permits one DOWN operation only; a safety catch is fitted to prevent inadvertent operation. Operation of the emergency flap control overrides the position of the normal selector.

62 A landing flaps indicator is mounted on the LH side of the main instrument panel in each cockpit.

LANDING GEAR CONTROLS

63 The landing gear can be operated from either cockpit by a toggle lever marked UNDERCARRIAGE UP-DOWN, fitted to each LH console. The toggle levers are mechanically interconnected. Safety micro-switches fitted to the main landing legs prevent the landing gear from being retracted by the toggle levers when the weight of the aircraft is on the main wheels.

64 In an emergency the landing gear may be retracted when the weight of the aircraft is on the main wheels by the operation of a switch marked UNDERCARRIAGE EMERGENCY RETRACTION, located on the LH side panel in each cockpit. The switch overrides the position of the toggle selector lever.

65 In an emergency, the landing gear can be lowered by air pressure. A control lever is mounted in each cockpit outboard of the normal up-down lever. These levers are marked UNDERCARRIAGE EMERGENCY and are protected by spring-loaded guards.

LANDING GEAR POSITION INDICATOR

66 A landing gear position indicator fitted on the main instrument panel of both cockpits incorporates a dimmer switch and alternative filaments 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.

67 A red landing gear warning light marked U/C WARNING, located at the forward end of the LH console in the front cockpit and on the LH side panel in the rear cockpit, will illuminate when the LH throttle lever is less than one third open with the landing gear not locked down.

EMERGENCY LOWERING (LANDING GEAR AND FLAPS)

68 A panel mounted on the RH side of the rear cockpit pressure bulkhead is marked EMERGENCY LOWERING. It carries buttons for manually operating the "down" solenoid of the hydraulic selector valve in the event of failure of the electrical selection system. Two push buttons for retracting the services during ground servicing are also provided. These buttons are protected by a cover to prevent accidental retraction.

BRAKES

69 The brakes are controlled by toe-operated extensions fitted to the rudder pedals. In the event of hydraulic pump failure, an emergency accumulator in the system will provide a reserve power supply for brake operation. An indicator on the rear cockpit bulkhead shows the pressure available in the accumulator.

70 The parking brake is applied by pulling the lever fitted on the LH console wall, irrespective of the position of the brake pedals. A button is provided in the end of the lever to engage the ratchet.

71 Foot brake controls are fitted to the rudder pedals in the rear cockpit, but no parking brake lever is fitted in this cockpit.

SPEED BRAKES

72 The speed brake selector switch, identified DRAG FLAPS, is fitted on the forward face of the RH throttle lever in both cockpits, and has two positions, OPEN and CLOSED.

73 An amber light is fitted in each cockpit marked DRAG FLAP WARNING. Both lights will illuminate when a DRAG FLAPS selector switch is moved to the OPEN position and will provide an indication on the ground or during flight of the position or selection of the drag flap selector switch.

74 A two position toggle switch marked BOTH DRAG FLAP - REAR ONLY is located on the LH forward console in the rear cockpit, and a green indicating light is located adjacent to this switch. A red warning light marked DRAG FLAP POWER TRANSFER is mounted on the LH forward console in the front cockpit.

CAUTION

If the aircraft is flown solo, the drag flap power transfer switch must be selected to the BOTH DRAG FLAP position, and the drag flap selector switch in the rear cockpit must be in the CLOSED position before starting.

75 If the switches are not in the above positions, indication will be given in the front cockpit by the illumination of the DRAG FLAP POWER TRANSFER warning light. In addition, the amber DRAG FLAP WARNING light will illuminate.

76 With the switch in the BOTH DRAG FLAP position, selection of the drag flaps may be made from either cockpit.

77 With the switch in the REAR ONLY position, the green light adjacent to this switch and the red warning light DRAG FLAP POWER TRANSFER will illuminate and indicate to both pilots that drag flap operation can be affected from the rear cockpit only.

ENGINE CONTROLS

THROTTLE CONTROLS

78 Two conventionally operated throttle levers are installed in a quadrant on a throttle box, mounted on the LH console in each cockpit. A friction nut is fitted on the side of the throttle box. The throttle levers are mechanically interconnected.

ENGINE STARTING CONTROLS

79 Controls for engine starting comprise:

Ground/Flight Switch (Front Cockpit only)
Engine Start Switch (Front Cockpit only)
Re-light buttons, in the ends of the HP fuel cock levers. (Both cockpits).

OTHER CONTROLS

SLIDING CANOPY

80 The canopy is opened or closed by rotating the crank handle beneath the RH canopy rail in the front cockpit. A crank handle is fitted at the same location in the rear cockpit, enabling opening and closing of the canopy from this cockpit.

81 The canopy may be locked in an intermediate position when taxying by engaging the front cockpit crank handle in the slotted locking plate and pressing the PRESS TO LOCK button fitted on the handle. It is unlocked by pressing the PRESS TO UNLOCK button. When the canopy is fully closed the crank handle should not be engaged with any of the slots in the locking plate.

CAUTION

The canopy must not be opened in the air.

82 Two locking claws are fitted externally on the canopy and rails and are manually operated to lock the canopy in the closed position. The left-hand lock is fitted with a cam which actuates the canopy seal inflation valve. Two levers in the front cockpit operate the locking claws from this cockpit. They are interconnected with two levers in the rear cockpit to enable the occupant to unlock the canopy in an emergency.

83 A T-shaped handle is fitted above the canopy operating crank handle in the rear cockpit, marked PULL TO DISENGAGE FRONT CANOPY DRIVE. The handle is normally witness-wired. Should the front cockpit crank handle be engaged in a slot of the locking plate, and an emergency exists, pulling the handle disengages the front cockpit canopy drive mechanism. The canopy may then be opened by operating the levers to open the locks and turning the crank handle.

84 The canopy may be jettisoned by operating a spring-loaded switch protected by a guard, located in both cockpits on the LH side of the decking below the windshield and marked CANOPY JETTISON. The operation of either switch fires an explosive link fitted at the rear end of each canopy rail, which allows the canopy to move upward and backwards. The airstream then blows the canopy clear of the aircraft.

85 Canopy jettison is integrated with rear seat ejection (see para 134).

SEAT ADJUSTMENT

86 The seats may be moved up or down by depressing the button in the end of the adjustment lever on the RH side of the seat. Ensure that the ratchet pawl is engaged on releasing the button.

HARNESS LOCK

87 Safety harness locks are fitted to both seats and can be released by pulling back the control lever which projects from the RH thigh guard. When released the lock will re-engage in the fully back position when the occupant leans back in the seat.

TARGET TOWING CONTROLS

88 The aircraft is not normally equipped externally for target towing, but the following switches are fitted at the rear of the RH console in the front cockpit.

(a) MASTER ON-OFF switch.

(b) RH STREAMING, OFF, LH STREAMING switch.

(c) TARGET TOWING RELEASE SELECT rotary switch.

(d) DROGUE and CANISTERS JETTISON switch.

INSTRUMENTS

FLIGHT INSTRUMENTS

89 The standard blind flying instrument panel fitted in both cockpits comprises:

Airspeed indicator
Attitude Gyro indicator
Rate of climb indicator
Altimeter
Gyrosyn compass
Turn and bank indicator

90 The gyrosyn compass indicator in the front cockpit is provided with a synchronizing knob and annunciator window. The window shows a dot or a cross depending on the direction of misalignment of the indicator needle; or will show all clear if aligned correctly. Adjustment is carried out during the pre-flight check by pushing in and turning the knob. If the annunciator window shows a cross, the knob must be turned in the direction shown by the cross arrow until the null position is indicated by the window showing "all clear". If a dot shows at the window, the knob must be turned in the direction of the dot arrow until the window is clear.

NOTE

If the knob is turned in the wrong direction, a false null is established and the indication on the face of the instrument will be in error by 180 degrees.

91 The knob, when turned without depressing, controls the course index pointers and may be rotated to any pre-selected heading.

92 The gyrosyn compass indicator in the rear cockpit is a repeater from the indicator in the front cockpit. The knob on the rear cockpit indicator adjusts the course index pointers only.

93 Fitted on the main panels in both cockpits are an outside air temperature indicator, a clock and a radio compass indicator. An accelerometer is fitted on the RH side panel in the front cockpit and on the main panel in the rear cockpit. A magnetic standby compass is attached to the edge of the glare shield in the front cockpit.

NOTE

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

94 A C2 COMPASS SLAVING switch is fitted on the RH side panel of the front cockpit 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.

ENGINE INSTRUMENTS

95 The following engine instruments are located on the main panel in both cockpits.

Percentage RPM LH and RH indicators
Jet pipe temperature - dual indicator
Oil temperature - dual indicator
Fuel pressure - dual indicator
Oil pressure - dual indicator

96 A centre-bearing oil scavenge temperature indicator is fitted at the rear of the RH console in the front cockpit.

LIGHTING EQUIPMENT

EXTERNAL LIGHTS

97 The EXTERNAL LIGHTS master switch must be ON before any external light circuits can be operated. This is located, with other light switches, on the inclined panel of the RH console in the front cockpit. The identification lights are controlled by a DIM-BRIGHT switch, an OFF-STEADY-MORSE switch and a Morse KEY. The navigation lights are controlled by a FLASH-OFF-STEADY switch.

98 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 in both cockpits. The extend/retract switches should always be returned to the STOP position after use in order that control may be effected from either cockpit.

COCKPIT LIGHTS

99 Three dimmer switches controlling PANEL RED lights, CONSOLE RED lights and PANEL ULTRA-VIOLET lights are located below the external light switches on the RH console in the front cockpit, and on the forward RH console in the rear cockpit. The map lights incorporate an integral dimmer switch.

DE-ICING AND ICE-DETECTION EQUIPMENT

AIRFRAME ICE DETECTION

100 Formation of ice on the aircraft is detected by an ice detector head which protrudes from the fuselage below the front cockpit. When ice covers the holes in the detector a warning light in both cockpits marked ICE WARNING - AIRFRAME flashes. The light in the front cockpit is located on the RH console aft of the oxygen regulator, while the light in the rear cockpit is mounted to the right and above the main panel. Heating elements are fitted in the pitot head and in the fuel pressure head in each engine intake. These are controlled by a switch marked PITOT HEAT ON-OFF located aft of the ice warning light in the front cockpit.

101 Windscreen de-icing and de-misting is controlled by an ON-OFF switch marked W/S DE-ICE & DE-MIST fitted on the forward RH console panel of the front cockpit. The W/S DE-ICE and IFF INVERTER switch must be ON in order to obtain windscreen de-icing and de-misting.

102 Aircraft prior to 18133 have the ice warning light and pitot heat switch fitted outboard of the generator switches, while aircraft 18133 and subsequent have them inboard of the generator switches.

ENGINE DE-ICING

103 The aircraft are not fitted with engine ice detection or engine de-icing, although aircraft 18133 and subsequent have an ice detection switch and an ice warning light combined with a push button switch located on the forward RH console of the front cockpit. These controls are normally disconnected but in any event the engine manual de-icing push button switch should not be pressed, as loss of cockpit pressurization would result if the switch was still connected.

OXYGEN EQUIPMENT

104 A high pressure automatic demand oxygen system is fitted, the supply being from four cylinders located in the rear centre section. When fully charged the cylinders contain oxygen at a pressure of 1800 psi. A regulator is fitted on the RH console in each cockpit and comprises the following:

(a) OXYGEN CYLINDER PRESSURE indicator - recording the available container pressure in psi.

(b) OXYGEN FLOW INDICATOR - "blinks" when oxygen is demanded by crew member's breathing.

(c) NORMAL - 100% OXYGEN Control - On NORMAL position allows cabin air to mix with oxygen, and is automatically compensated for high altitudes. On 100% OXYGEN, allows pure oxygen only into the mask.

(d) SAFETY PRESS control - cuts out the "demand" function and allows oxygen under pressure to flow direct to the mask.

105 A flexible tube fitted with a quick-release connector is attached to each seat. An oxygen hose plug is fitted in the rear cockpit on the underside of the RH canopy deck. The oxygen hose should be connected to this plug to prevent oxygen leakage at high altitude when the aircraft is flown solo.

COMMUNICATIONS EQUIPMENT

RADIO CIRCUIT BREAKERS

106 Fitted on an inclined panel located at the rear of the LH console, in the rear cockpit, are three toggle switch type circuit breakers. These are marked VHF, ADF and INTER and must be ON for the AN/ARC-502 VHF, ARN-6 Radio Compass and AIC-10 Interphone to operate.

VHF AN/ARC-502

107 The AN/ARN-502 set provides voice and MCW communication on any one of 24 pretuned frequencies within the band 100 to 156 Mc/s. The channel selector and volume control are located together on the RH console, in both front and rear cockpits. The panel is marked VHF COMMAND and also includes an ON-OFF switch and a D/F TONE push button switch. The D/F TONE switch may be used to transmit a tone modulated continuous wave, thus enabling a direction-finding ground station to obtain a fix on the aircraft. It may also be used as a morse dey. (See para 142 for automatic operation of the VHF on seat ejection).

108 A PRESS TO TRANSMIT switch is located on the RH throttle lever in both cockpits. A press button switch and a green indicating light marked VHF TRANSFER CONTROL mounted on the RH console inboard of the VHF COMMAND panel in both cockpits enable the occupant of either cockpit to select control of the VHF. Illumination of either green light indicates control is in that cockpit.

NOTE

A VHF Test plug and jack is fitted adjacent to the VHF transfer control in the rear cockpit. This facility is for ground servicing only.

INTERCOMMUNICATION

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

110 A control box, identified INTER, is fitted on the RH consoles of both front and rear cockpits.

111 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 instructor.

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

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

Switch 4 - unmarked and not connected - spare.

Switch 5 - 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 the PRESS TO TRANSMIT button.

112 The "Press to Transmit" button is used when the selector switch is in the 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.

113 A volume control is fitted and adjusts volume on all incoming channels.

114 A toggle switch marked AUX LISTEN-NORMAL is wire-locked in the NORMAL position, but if reception at the station fails, a test of the amplifier may be made by breaking the locking wire and listening with the switch on AUX LISTEN; this 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.

115 Inadvertent operation of the two "spare" toggle switches will have no effect, as they are not connected on 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.

116 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 on 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 VHF and Radio Compass should then be adjusted individually as desired.

NOTE

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

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

RADIO COMPASS ARN-6

117 The radio compass receiver and loop antenna are mounted in the nose section of the aircraft, while the sense antenna is composed of metal strips fitted on the inside of the canopy and is only connected when the canopy is closed.

118 A control box marked RADIO COMPASS is located on the RH console in both front and rear cockpits. Control of the radio compass 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. Illumination of the frequency dial of the respective control box will indicate that control of the radio compass is in that cockpit.

119 The radio compass indicator is mounted on the main instrument panel in both cockpits.

OPERATIONAL EQUIPMENT AND CONTROLS

IFF AN/APX-25

120 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.

121 Two control panels are provided in the front cockpit on the rear of the RH console. The C1158/APX (Mod) control panel is marked IFF and the C1128/APX-25 coder control panel is marked SIF.

122 The IFF panel is the operational control for either system and comprises the following controls:

(a) A MASTER rotary selector, having the following positions in addition to OFF:

(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.

(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) position of 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 VHF (or UHF) transmitter is energized.

123 The SIF control panel 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, giving 64 possible codes. Mode 2 coding control is not accessible in flight, but must be pre-set on the ground.

IFF INVERTER

124 Control of the inverter for the IFF is by an ON-OFF switch marked W/S DE-ICE and IFF INVERTER located on the forward RH console in the front cockpit. The inverter also supplies the windscreen de-ice and de-mist circuit.

EMERGENCY EQUIPMENT

ENGINE FIRE DETECTION AND EXTINGUISHING SYSTEM

125 Each engine has its own independent system consisting of eleven temperature sensitive detectors mounted at critical points on the installation and electrically connected to a combined warning light and discharge switch fitted above the main panel of both cockpits. Operation of a discharge switch releases the contents of the applicable methyl-bromide container into the affected engine nacelle.

NOTE

The Ground/Flight switch must be in the FLIGHT position for the fire detection warning lights to illuminate and also to operate the fire extinguishers. The inertia switch will operate the extinguishers upon a deceleration of 6g, irrespective of the position of the Ground/Flight switch.

FIRST AID

126 Two sets of shell dressings are carried. One is fitted on the pressure bulkhead on the LH side of the front seat, and the other is fitted on the LH side of the rear cockpit.

BAIL-OUT SIGNAL

127 A spring-loaded switch, protected by a guard and marked BAIL OUT, is fitted in both cockpits. In the front cockpit the switch is located on the main instrument panel adjacent to the bail-out warning light. In the rear cockpit the switch is located below and aft of the canopy jettison switch.

128 A BAIL OUT warning light is fitted in both cockpits above the main instrument panel. Operating either switch will illuminate both BAIL OUT warning lights.

EJECTION SEATS

129 The front and rear seat occupants are each provided with an automatic ejection seat which allows safe ejection at ground level at airspeeds above 90 knots. Ejection of the rear seat is integrated with the canopy jettison system. A label, marked CAUTION-ONLY REAR SEAT EJECTION IS INTEGRATED WITH CANOPY JETTISON, is installed in each cockpit. Leg restraint straps are fitted.

130 The ejection gun and drogue gun of each seat are operated by explosive cartridges, while the canopy is jettisoned by the firing of two electrically operated explosive links. The guns of both seats and the sear of the canopy jettison switch on the rear seat guide rail are made safe by means of safety pins. 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 seats, safety pins cannot readily be inserted into the sears of the seat firing mechanism or the canopy jettison switch of the rear seat. In first line servicing the face screen handle pin is used to lock the overhead firing handle of this seat.

131 The following safety devices are provided for each seat:

(a) A three safety pin assembly for the rear seat, and a two safety pin assembly for the front seat, consisting of:

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

(2) A spring-type safety pin, used to safety the sear of the seat firing mechanism.

(3) A spring-type safety pin, used to safety the sear of the cockpit canopy jettison switch (rear seat only).

(b) A quick-release safety 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. The handle is locked safe when the safety plate is in an upright position. The top of the plate is marked LIFT CATCH AND PUSH DOWN BEFORE FLIGHT. When the finger catch is raised the safety plate can be rotated downwards, in the direction of an arrow, to unlock the emergency firing handle.

132 The safety pins, with attached warning discs, are removed and stowed by the ground crew when the occupants have completed the fastening of parachutes and safety harnesses and connected all necessary equipment prior

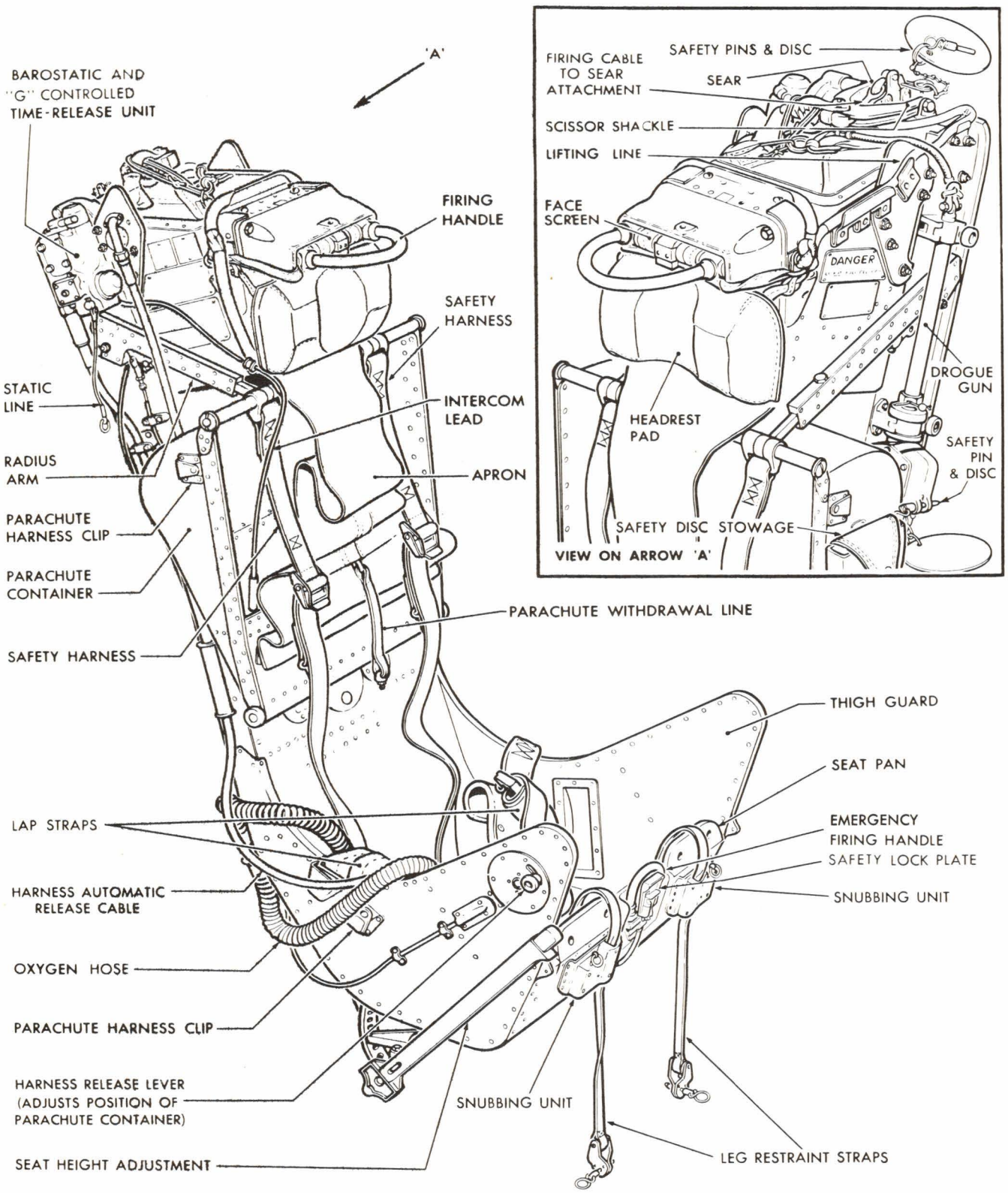


Fig. 1-3 Automatic Ejection Seat

to flight. The emergency firing handle safety lock must be released by the seat occupant.

133 The ejection gun is fired by pulling out a large handle coloured red, immediately above and forward of the headrest pad. The handle is attached to a face screen which is pulled down over the occupant's face. Attached to the screen is a cable which is connected to a sear in a time delayed firing body of the ejection gun. A cable from the emergency firing handle is also connected to the sear of the ejection gun. When the screen is pulled out and right down over the face, the cable withdraws the sear and, after a one second delay, the gun is fired.

134 On the rear seat, the firing cables are also connected to the sear of a cockpit canopy jettison switch located on the guide rail. When the rear seat face screen or the emergency firing handle is pulled, the sear of the cockpit canopy jettison switch is withdrawn and then the sear of the time-delayed firing body is withdrawn. The cockpit canopy jettisons during the one second delay of the ejection gun. Should the canopy fail to jettison when the overhead firing handle (or the emergency firing handle) is pulled, the ejection gun will fire after the one second delay and the seat will eject through the canopy. The penetrators fitted to the top of the seat assist in penetrating the canopy.

135 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, an attempt to operate the overhead firing handle may result in injury to the arms through the force of the airstream. During the first foot of upward movement of the seat, the leg restraining straps automatically draw the occupants legs together and backwards, and retain them against the front face of the seat pan until seat separation takes place.

136 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 which causes the seat to take up a horizontal straight line position during initial deceleration. A larger drogue is then deployed which further decelerates the seat and reduces the opening shock on the parachute.

137 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. However, 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.

138 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.

139 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 the line then pulls on 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, which allows the seat to fall free. Further information on the ejection seat is contained in EO 55-50-2C.

140 At the end of each flight and before the occupants leave the aircraft, the seats must be made safe as in Part 2 para 76.

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.

141 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.

AUTOMATIC OPERATION OF VHF AND IFF ON SEAT EJECTION

142 Upon the ejection of either seat from the aircraft, a switch located on the bulkhead is actuated and causes emergency operation of the IFF. At the same time the distress channel of the VHF set is energized and causes an MCW signal to be transmitted. Provided the IFF and VHF had previously been selected on, the signals transmitted will enable ground stations to obtain a fix on the aircraft's position.

143 A test push button switch, marked BAIL OUT VHF and IFF TEST is fitted on the bulkhead to the left of the front seat. Testing should be carried out according to Telecommunication Confidential Orders.

BAIL-OUT MARKER

144 A bail-out marker, composed of strips of foil, is fitted under the seat pan of each ejection seat. Upon ejection the foil is released into the airstream and allows ground radar stations to obtain a fix on the area of ejection.

FRONT COCKPIT LAYOUT

1 Oxygen Hose
2 Mic-Tel Connection
3 Oxygen Supply Connection
4 Mic-Tel Socket
5 Ejection Seat Firing Handle
6 Anti-g Suit Connection
7 Anti-g Supply Connection
8 ELEVATOR TRIM Handwheel and Indicator
9 RUDDER TRIM Handwheel and Indicator
10 AILERON TRIM Handwheel
11 G VALVE HI-LO Control
12 BAIL OUT VHF and IFF TEST Switch
13 FLOOR AIR DISTRIBUTION ON-OFF Lever
14 ENGINE STARTING Button
15 LP FUEL COCK Switch RH
16 LP FUEL COCK Switch LH
17 RIGHT TANK SELECTION Switch NORM-WING
18 LEFT TANK SELECTION Switch NORM-WING
19 TIP TANKS FUEL JETTISON Switch RH
20 TIP TANKS FUEL JETTISON Switch LH
21 Tank Selector LH TANKS ONLY CROSS-FEED - NORMAL - RH TANKS ONLY CROSSFEED
22 CONTROL BOOSTER DOWN-OFF Lever
23 TIP TANKS FUEL TRANSFER RH
24 TIP TANKS FUEL TRANSFER LH
25 Relight Button RH
26 FUEL TANK PUMPS Switch RIGHT WING
27 FUEL TANK PUMPS Switch FUSELAGE FWD
28 FUEL TANK PUMPS Switch FUSELAGE AFT
29 FUEL TANK PUMPS Switch LEFT WING
30 LANDING FLAP UP - STOP-DOWN Lever
31 Throttle Friction Nut
32 DRAG FLAP OPEN-CLOSE Switch
33 PRESS TO TRANSMIT Button
34 EMERG FLAPS Lever
35 Throttle Lever RH
36 Parking Brake Lever
37 EMERGENCY UNDERCARRIAGE Lever
38 UNDERCARRIAGE UP-DOWN Selector Lever
39 U/C WARNING Light
40 Standby Magnetic Compass Deviation Card Holder
41 Console Red Light
42 Fuel Pump TEST SOCKET
43 HP FUEL COCK Lever RH
44 FUEL PUMP TEST Switch LW-AF-FF-RW
45 Relight Button LH
46 HP FUEL COCK Lever LH
47 LANDING LIGHT EXTEND - STOP - RETRACT Switch
48 LANDING LIGHT ON-OFF Switch
49 Throttle Lever LH
50 Console Red Light
51 HYDRAULIC TEST PUMP Switch
52 Emergency Canopy Unlocking Cable LH
53 Ultra-violet Light
54 Canopy Seal Inflation Valve
55 Canopy Locking Handle LH
56 HYD. PRESS Gauge
57 DRAG FLAP WARNING Light
58 UNDERCARRIAGE EMERGENCY RETRACTION Switch
59 CANOPY JETTISON Switch
60 Clock
61 LANDING GEAR Position Indicator
62 LANDING FLAP Indicator
63 CABIN PRESSURE Gauge
64 TIP TANK EMPTY Warning Light LH
65 WING TANK FUEL PRESS Warning Light LH
66 FIRE LIFT FLAP AND PUSH Warning Light LH
67 REAR FUSELAGE FUEL 0-75 IMP GALS Indicator
68 REAR FUSELAGE FUEL 80-340 IMP GALS Indicator
69 WING FUEL E-1/2-300 IMP GALS Indicator LH
70 BAIL OUT Warning Switch
71 BAIL OUT Warning Light
72 Frequency Card Holder
73 Hydro BOOST PRESS Warning Light
74 Airspeed Indicator
75 Altitude Gyro Indicator
76 Rate of Climb Indicator
77 Turn and Bank Indicator
78 Gyrosyn Compass Indicator
79 Altimeter
80 Magnetic Standby Compass
81 Aircraft Serial Number
82 Radio Call Sign Holder
83 Windshield Glare Shield
84 FRONT FUSELAGE FUEL 0-170 IMP GALS Indicator
85 FRONT FUSELAGE FUEL 180-360 IMP GALS Indicator
86 WING FUEL E-1/2-300 IMP GALS Indicator
87 FIRE LIFT FLAP AND PUSH Warning Light and Switch RH
88 WING TANK FUEL PRESS Warning Light RH
89 Map Light and Switch
90 TIP TANK EMPTY Warning Light RH
91 RPM PER CENT Indicator LH
92 RPM PER CENT Indicator RH
93 Jet Pipe Temperature Dual Indicator
94 Oil Temperature Dual Indicator
95 Flight Limitations Label
96 C2 COMPASS SLAVING Switch GYRO COMPASS-GYRO ONLY
97 Accelerometer
98 Canopy Operating Crank
99 Canopy Locking Handle RH
100 Ultra Violet Light
101 Console Red Light
102 MAIN INVERTER FAILURE WARNING Light
103 W/S DE-ICE and IFF INVERTER ON-OFF Switch
104 ENGINE ICE WARNING and PRESS FOR MANUAL De-icing Push Button Switch
105 ICE WARNING Light AIRFRAME
106 GENERATOR FAILURE Warning Light LH
107 GENERATOR OVERTEMP WARN Light LH
108 GENERATOR OVERTEMP WARN Light RH
109 GENERATOR FAILURE Warning Light RH
110 ENGINE ICE DETECTION ON-OFF Switch
111 PITOT HEAT ON-OFF Switch
112 GENERATOR Failure RESET Push Button LH
113 GENERATOR ON-OFF Switch LH
114 GENERATOR ON-OFF Switch RH
115 GENERATOR Failure RESET Push Button RH
116 IDENT LTS Morse KEY
117 IDENT LTS STEADY-OFF-MORSE Switch
118 IDENT LTS BR
119 NAV LTS FLAMP
120 EXTERNAL LT
121 ULTRA-VIOLE DIM-BRIGHT
122 PANEL RED L Switch
123 CONSOLE REDing Dimmer Swit
124 Console Red Lg Light
125 Emergency Ca
126 INTER Mixing
127 COMP Mixing RH
128 COMM Mixing
129 Spare
130 Spare or
131 INTER VOL Co
132 CALL-INTER-
133 INTER AmplifiRO AUX LISTEN
134 IFF Master Swi
135 MODE 3 and O
136 MODE 2 and I/
137 DESTRUCT Sw
138 Target Towing ING Switch
139 CABIN AIR NO EMERGENC
140 Manual Overric FOR Switch witch
141 Cabin Tempera Rheostat ight
142 Engine Scaveng Indicator
143 DROGUE and C Switch
144 Target STREAM
145 CANISTER and SELECT TAR
146 VHF COMMAN
147 D/F TONE Pus
148 VHF TRANSFE
149 VHF CONTROL
150 VHF COMMAN
151 Oxygen Connect
152 VHF COMMAN
153 VHF TEST Jacl
154 RADIO COMPA
155 Radar Caging B
156 Bombs/Rockets
157 Spare
118 IDENT LTS BRIGHT-DIM Switch
119 NAV LTS FLASH-STEADY-OFF Switch
120 EXTERNAL LTS ON-OFF Switch
121 ULTRA-VIOLET INSTRUMENT LIGHTS DIM-BRIGHT Dimmer Switch
122 PANEL RED LTS DIM-BRIGHT Dimmer Switch
123 CONSOLE RED LTS DIM-BRIGHT Dimmer Switch
124 Console Red Light
125 Emergency Canopy Unlocking Cable RH
126 INTER Mixing Switch
127 COMP Mixing Switch
128 COMM Mixing Switch
129 Spare
130 Spare
131 INTER VOL Control
132 CALL-INTER-COMM Selector Switch
133 INTER Amplifier Switch NORMAL - AUX LISTEN
134 IFF Master Switch STDBY-LOW-NORM-EMERGENCY
135 MODE 3 and OUT Selector Switch
136 MODE 2 and I/P Selector Switch
137 DESTRUCT Switch
138 Target Towing MASTER ON-OFF Switch
139 CABIN AIR NORMAL-ALL OFF - EMERGENCY VENTILATION Switch
140 Manual Override AUTO-HEAT-COOL Switch
141 Cabin Temperature COOL-HEAT Rheostat
142 Engine Scavenge Oil Temperature Dual Indicator
143 DROGUE and CANISTER JETTISON Switch
144 Target STREAMING LH-RH Switch
145 CANISTER and DROGUES RELEASE SELECT TARGET TOWING Switch
146 VHF COMMAND ON-OFF Switch
147 D/F TONE Push Button Switch
148 VHF TRANSFER Push Button Switch
149 VHF CONTROL Indicating Light
150 VHF COMMAND VOLUME Control
151 Oxygen Connection
152 VHF COMMAND Channel Selector
153 VHF TEST Jacks
154 RADIO COMPASS Control Panel
155 Radar Caging Button
156 Bombs/Rockets Release Button
157 Spare
158 NORMAL- 100% OXYGEN Selector
159 OXYGEN CYLINDER PRESSURE Indicator
160 SAFETY PRESS Control
161 W/S DE-ICE and DE-MIST ON-OFF Switch
162 OIL PRESSURE Dual Indicator
163 MASTER POWER SUPPLY Switch FLIGHT - OFF-GROUND
164 CABIN PRESSURE WARNING Light
165 FUEL PRESSURE Dual Indicator
166 Guns/Camera Trigger
167 Gyrosyn Compass Light
168 Spare
169 Gyrosyn Compass Deviation Card Holder
170 BOOSTER TEST Indicator Light
171 Radio Compass Indicator
172 RUDDER PEDALS - PULL TO ADJUST Handle
173 Floor Heating Outlet
174 Outside Air Temperature Indicator
175 Integrated Canopy Jettison Caution Label
176 DRAG FLAP POWER TRANSFER Light
177 Seat Back Adjustment
178 Seat Height Adjustment Lever
179 MODE 2 - OUT Selector Switch
180 I/P-OUT-MIC Selector Switch
181 Security Identification Feature MODE 1 Control
182 Security Identification Feature MODE 3 Control
183 Plug buttons

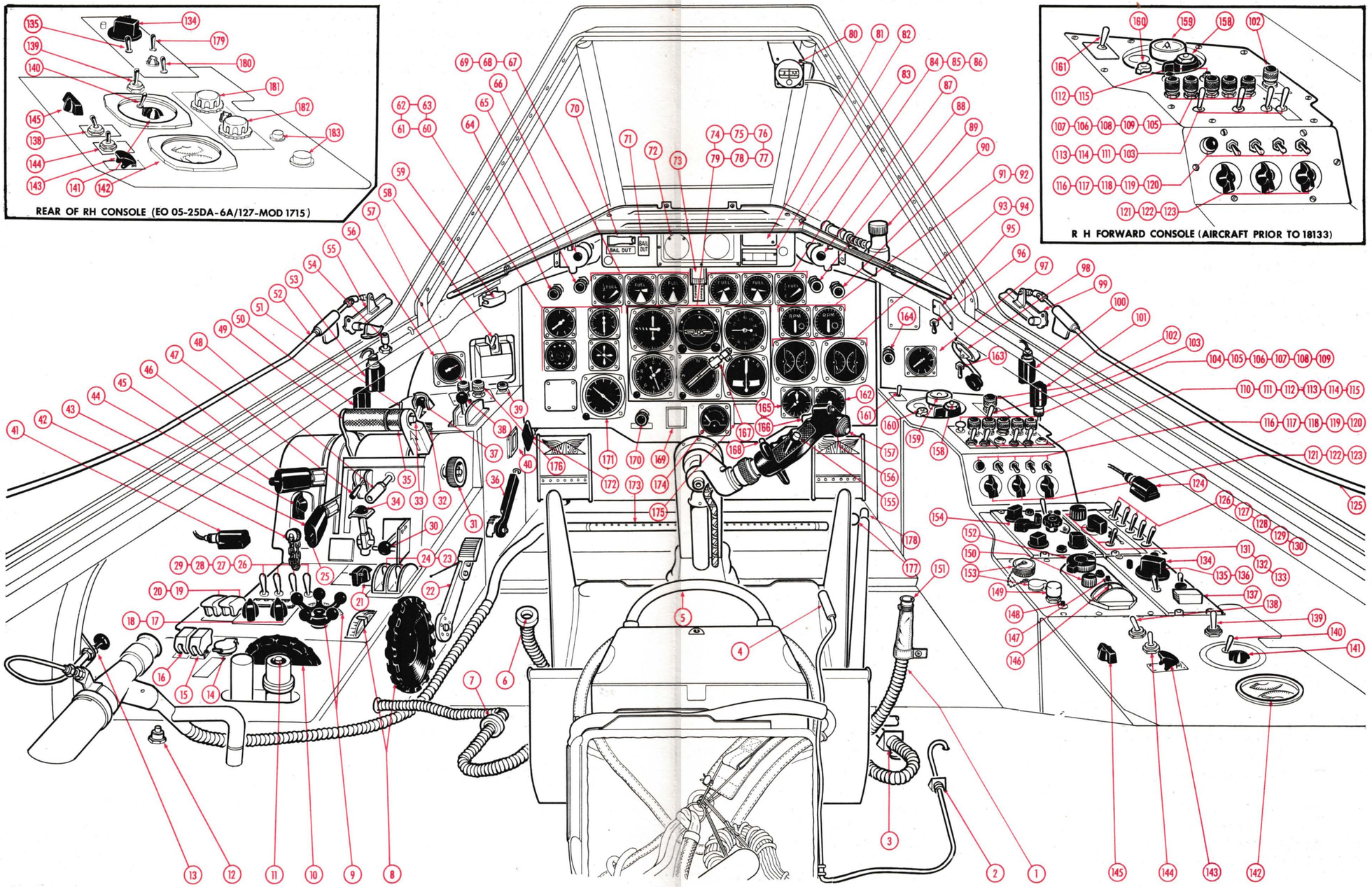


Fig. 1-4 Front Cockpit Layout

REAR COCKPIT LAYOUT

1 Anti-g Connection
2 BOOSTER SYSTEM ACCUMULATOR Pressure Gauge
3 EMERGENCY BRAKE SYSTEM ACCUMULATOR Pressure Gauge
4 Hydraulic Reservoir Filler Cap
5 Radio Circuit Breaker Panel
6 G VALVE HI-LO Control
7 RUDDER TRIM Indicator and Handwheel
8 Relight Button RH
9 HP FUEL COCK RH
10 Relight Button LH
11 HP FUEL COCK LH
12 Console Red Light
13 Air Distribution Louvre
14 Throttle Lever LH
15 Throttle Lever RH
16 IFF ON-OFF Circuit Breaker
17 EMERG. U/C Lever
18 Emergency Canopy Unlock Lever
19 Console Red Light
20 Ultra-violet Light
21 LANDING FLAP Indicator
22 LANDING GEAR Position Indicator
23 HYD. PRESSURE Gauge
24 Integrated Canopy Jettison Caution Label
25 U/C WARNING Light
26 UNDERCARRIAGE EMERGENCY RETRACTION Switch
27 RUDDER PEDALS PULL TO ADJUST Handle
28 Windshield
29 BAIL OUT Warning Switch
30 CANOPY JETTISON Switch
31 RADIO COMPASS
32 Accelerometer
33 Outside Air Temperature Gauge
34 Clock
35 WING TANK FUEL PRESS Warning Light LH
36 FRONT FUSELAGE FUEL Indicator 180 - 360 IMP GALS
37 FRONT FUSELAGE FUEL Indicator 0 - 170 IMP GALS
38 Hydro BOOST PRESS Warning Light
39 REAR FUSELAGE FUEL Indicator 0 - 75 IMP GALS
40 REAR FUSELAGE FUEL Indicator 80 - 340 IMP GALS
41 FIRE Warning Light LH Engine Extinguisher LIFT FLAP AND PUSH
42 Aircraft Serial Number
43 MAIN INVERTER FAILURE WARNING Light
44 BAIL OUT Warning Light
45 GENERATOR OVERTEMP WARNING Light LH
46 Radio Call Sign Holder
47 GENERATOR OVERTEMP WARNING Light RH
48 ICE WARNING Light AIRFRAME
49 FIRE Warning Light RH Engine Extinguisher LIFT FLAP AND PUSH
50 Altimeter
51 GYROSYN COMPASS
52 Turn and Bank Indicator
53 Rate of Climb Indicator
54 Attitude Gyro Indicator
55 Airspeed Indicator
56 WING TANK FUEL PRESS Warning Light RH
57 RPM PER CENT LH Engine Indicator
58 RPM PER CENT RH Engine Indicator
59 BOOSTER TEST Indicator Light
60 Jet Pipe Temperature Dual Indicator
61 Oil Temperature Dual Indicator
62 FUEL PRESSURE Dual Indicator
63 OIL PRESSURE Dual Indicator
64 VOLTMETER
65 BUS-LEFT-RIGHT VOLT/AMP SELECTOR Switch
66 AMMETER
67 Canopy Drive Disengaging Handle
68 Canopy Operating Crank
69 Ultra-violet Light
70 Emergency Canopy Unlocking Lever RH
71 Map Light
72 Console Red Light
73 Oxygen Hose Stowage Plug
74 Circuit Breaker Panel (Fuel Tanks)
75 Console Red Light
76 SPARE FUSES Box
77 CONSOLE RED LIGHTS DIM-BRIGHT Dimmer Switch
78 PANEL RED LIGHTS DIM-BRIGHT Dimmer Switch
79 ULTRA/VIOLET INSTRUMENT LIGHTS DIM-BRIGHT Dimmer Switch
80 INTER. VOL Control
81 CALL-INTER-COMM Selector Switch
82 INTER Amplifier Switch NORMAL-AUX LISTEN
83 RADIO COMPASS Control Panel
84 VHF COMMAND Channel Selector
85 VHF COMMAND VOLUME Control
86 VHF CONTROL Indicating Light
87 VHF TRANSFER Push Button Switch
88 VHF COMMAND ON-OFF Switch
89 INTER Mixing Switch
90 COMP Mixing Switch
91 COMM Mixing Switch
92 Spare
93 Spare
94 OXYGEN CYLINDER PRESSURE Indicator
95 NORMAL - 100% OXYGEN Selector
96 SAFETY PRESS Control
97 C2 Compass Amplifier
98 Fuse Panel
99 Seat Height Adjustment Lever
100 Seat Back Adjustment
101 Oxygen Connection
102 U/C and FLAPS EMERGENCY DOWN Buttons
103 Interphone Quick Release Connector
104 Oxygen Supply Connection
105 Mic-Tel Socket
106 Ejection Seat Firing Handle
107 Circuit Breaker Panel
108 Radio Frequency Card Holder
109 DRAG FLAP BOTH - REAR ONLY Switch
110 DRAG FLAP Indicating Light
111 UNDERCARRIAGE DOWN -UP Lever
112 DRAG FLAPS OPEN-CLOSED Switch
113 PRESS TO TRANSMIT Button
114 Throttle Tension Nut
115 LANDING LIGHTS ON-OFF Switch
116 LANDING LIGHTS EXTEND-STOP-RETRACT Switch
117 EMERG. FLAPS Lever
118 FLAPS UP-STOP-DOWN Lever
119 CONTROL BOOSTER DOWN-OFF Lever
120 ELEVATOR TRIM Indicator and Handwheel
121 Flight Limitations Label
122 DRAG FLAP WARNING Light

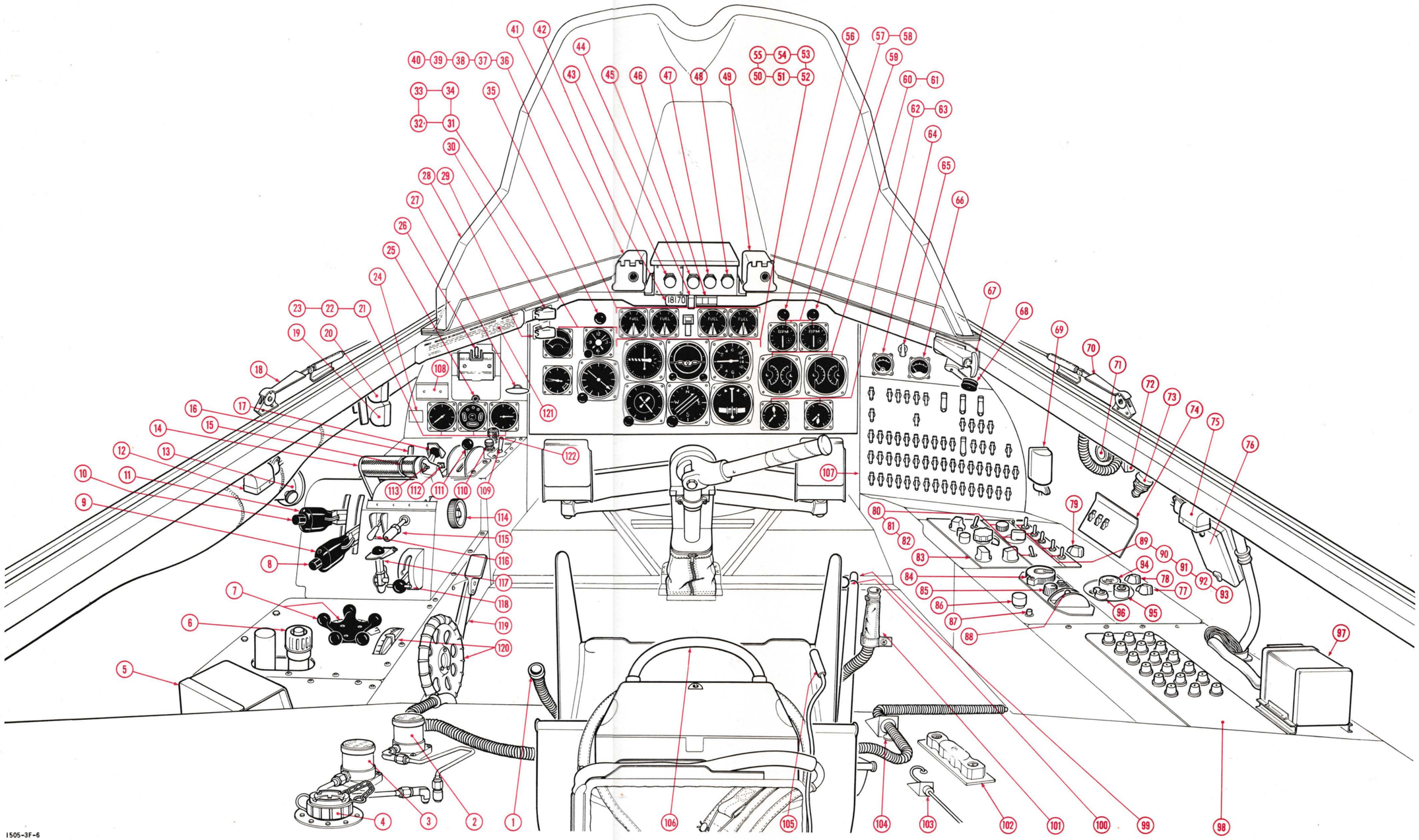


Fig. 1-5 Rear Cockpit Layout

PART 2

HANDLING

PRELIMINARIES

BEFORE ENTERING THE AIRCRAFT

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

NOTE

If the total fuel load carried is less than 920 Imp gal (1104 US gal), ensure that each fuselage tank contains 150 Imp gal (180 US gal) with the balance in the wing tanks. If the total fuel load is more than 920 Imp gal (1104 US gal) but less than 1325 Imp gal (1590 US gal), ensure that the wing tanks are filled first and the balance contained in the fuselage tanks.

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 check the "engine fail at take-off" capabilities of the aircraft under these conditions.

3 Make the following visual checks:

(a) Nose -

Nose wheel aligned fore and aft

Condition of nose fairing

Radar access door secure

Cover removed from ice detector

Nose wheel strut extension

Tires for cuts and creep

No hydraulic leaks

Ground lock removed

Fairing doors undamaged

Emergency air bottle pressures

Nose wheel shimmy damper, check indicator

(b) Forward Fuselage, RH Nacelle and Right Wing Leading Edge -

Gun bay fairing secure

Engine air intake cover removed

Starter bullet for security

Cowlings for damage, distortion, security

Engines for superfluous oil

Main wheel locks removed

Main leg extension normal

No hydraulic leaks

Brakes for undue wear

Tires for cuts and creep

Leading edge boot for damage and security

Fairing doors undamaged

Filler cap for security

(c) Right Wing Trailing Edge, RH Jet Pipe and Aft Fuselage -

Navigation light cover for damage

Aileron and flap for damage, security

No hydraulic leaks

Outer wing skin condition

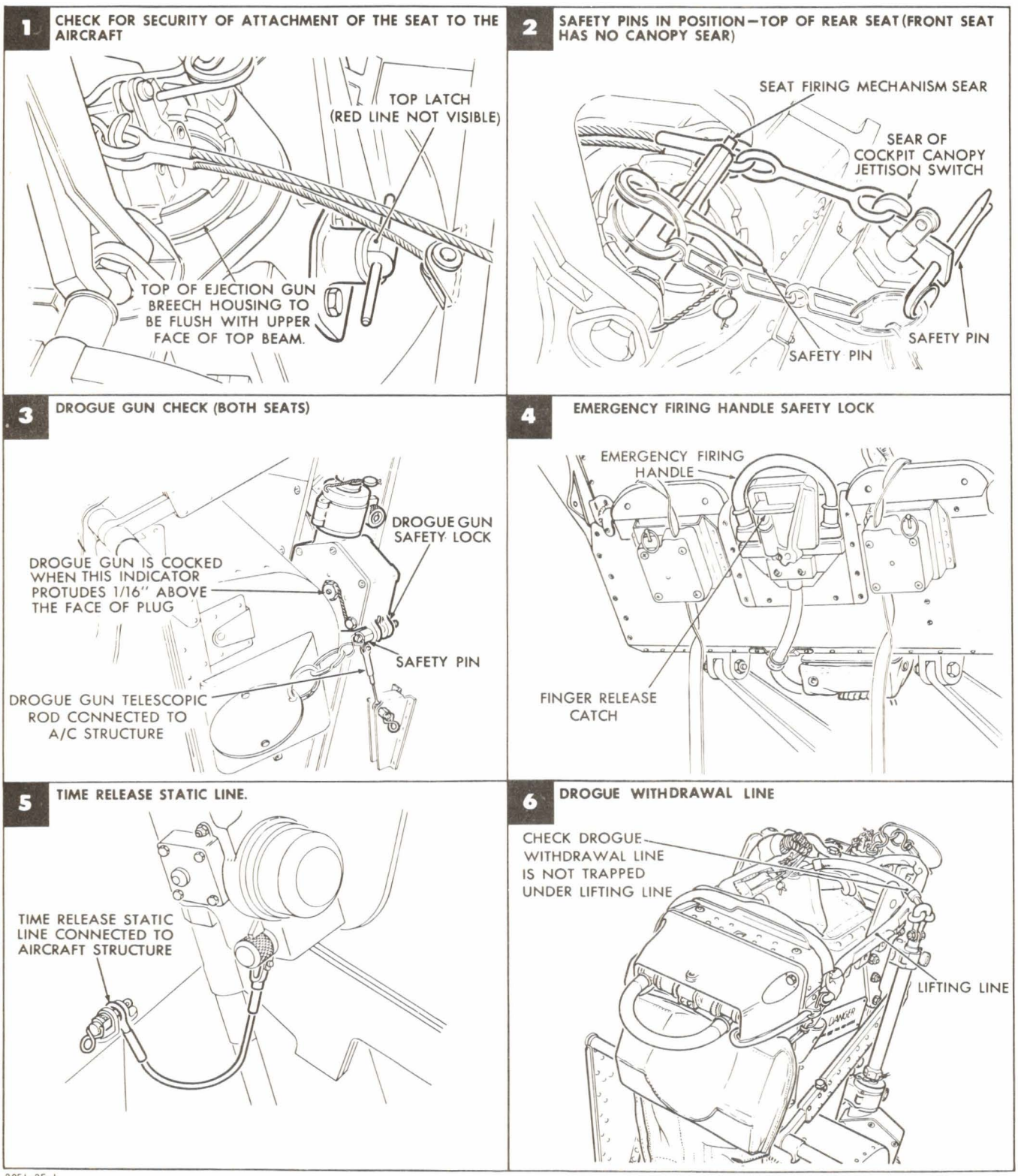


Fig. 2-1 Pre-flight Ejection Seat Checks

No loose panels or fuel leaks.

Rear engine cowlings for damage, cracks, security.

Jet pipe covers removed.

No jet pipe aluminization.

Downward identification light undamaged.

Centre section flap jacks secured.

Radio access panel secure.

(d) Empennage -

Skin for damage.

Leading edge boot for damage and security.

No hydraulic leaks.

All panels secure

Navigation light in rear cone undamaged.

(e) Aft Fuselage, Left Wing Trailing Edge, LH Jet Pipe -

Check as under (c).

(f) Forward Fuselage and Left Wing Leading Edge -

Check as under (b).

Pitot tube for cracks, damage, security.

Remove pitot tube cover.

Landing light fully retracted.

(g) Wheel chocks in position.

(h) Jet exhaust - clearance at rear 100 yards.

(j) Ground starting energizer and fire extinguisher standing by.

(k) Fuselage filler caps secure.

SOLO FLYING

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

(a) Seat harness and leg restraint straps, parachute harness and emergency oxygen bottle secured.

(b) Oxygen hose fitted to oxygen stowage plug.

(c) All relevant circuit breakers ON.

(d) Drag flap power transfer switch set to BOTH and drag flap selector switch set to CLOSED.

(e) Landing gear emergency retraction switch witness wired in the OFF position.

(f) Hydro-booster control lever witness wired in the UP position.

(g) Landing-light extend/retract switch at STOP.

(h) Throttle tension nut slackened.

(j) Safety pin and disc in position in ejection gun sear and safety pin in position in canopy jettison switch sear.

(k) Emergency firing handle safety lock in position.

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

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

AFTER ENTERING THE AIRCRAFT

5 Make the following checks: (front and rear seat occupants as applicable).

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 seat inadvertently grasps the ejection seat firing cable on the front seat, when entering the aircraft. When leaving the aircraft on landing this procedure should be reversed.

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

(b) Check ejection seat for security of attachment to the aircraft as follows: (Fig 2-1).

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 beam. This ensures that the latch is correctly engaged.

(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. An indicator 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 indicator will be flush with the face of the cover plate plug. (See Fig. 2-1).

(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. (See Fig. 2-1).

(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. 2-2).

(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 RH floor bracket passes through the RH 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 LH floor bracket passes through the LH 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 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.

WARNING

Is 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 re-

lease box is positioned below and clear of parachute 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 R/T, oxygen and anti-g suit connections. Set anti-g valve as required.

(k) Check that the following safety pins are removed and stowed: (Fig. 2-1).

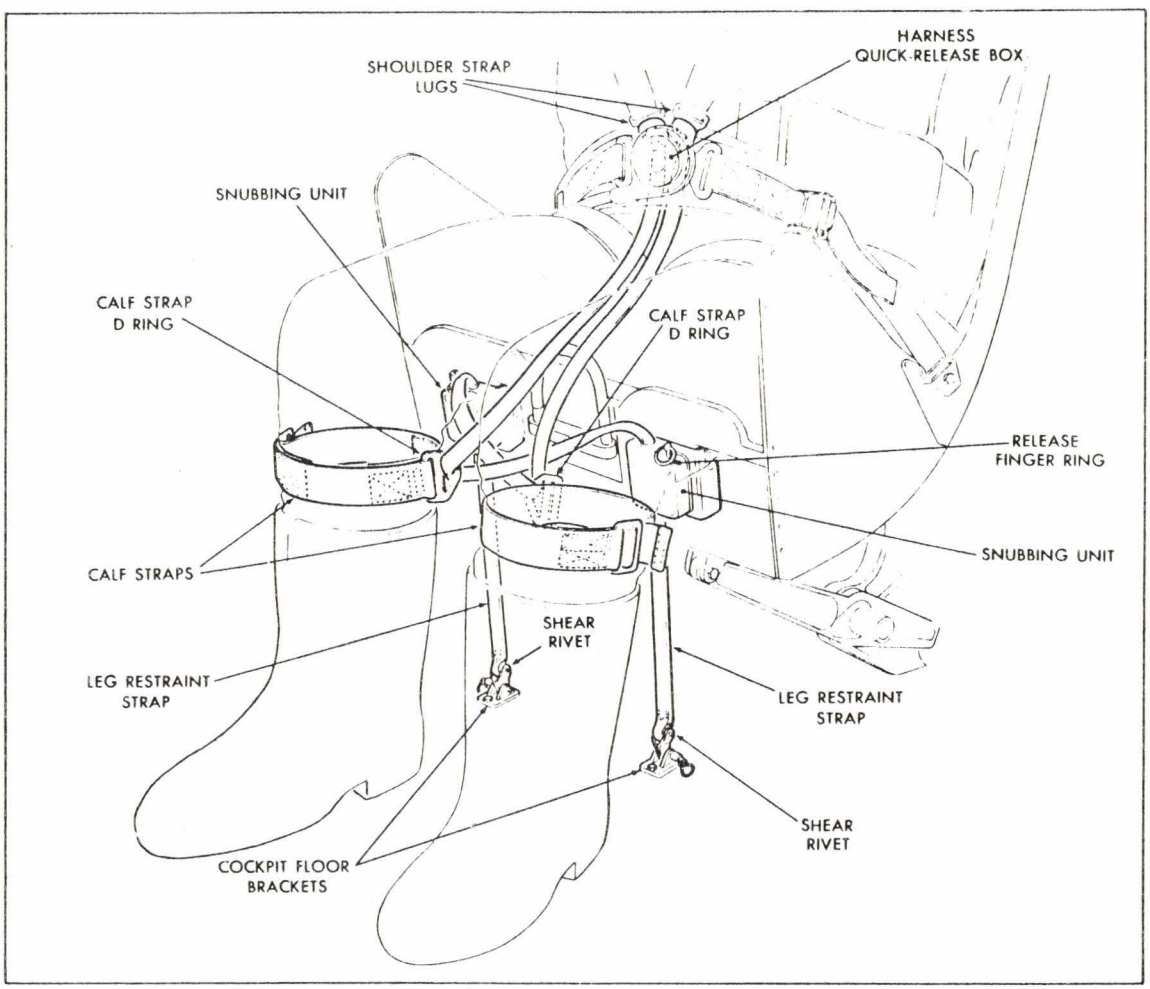


Figure 2-2 Leg Restraint System

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

(2) The two safety-pin assembly for the front seat (i.e. seat firing mechanism and face screen handle pins).

(3) Drogue gun safety pin (Both seats).

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

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

(p) All individual electrical services and switches - OFF.

(q) Master power supply switch on GROUND if using ground battery.

(r) Circuit breakers - Rear seat occupant to switch on as required.

NOTE

The INVERTER FAILURE WARNING light may illuminate. Should this occur, attempt to reset the automatic change over relay by operating the MASTER INVERTER circuit breaker in the rear cockpit off and on. Should the warning light fail to go out, the aircraft is unserviceable.

(s) Trim tab controls - full free movement, ground crew to note travel and neutral settings.

(t) Flying control booster lever - up (on).

(u) Flap lever - DOWN.

(v) Emergency flap lever - locked UP.

(w) Landing gear DOWN selected. Lights green - check alternative filaments and dimmer switch.

(x) Emergency landing gear lever - locked forward.

(y) Landing gear emergency retraction switch, witness wired OFF.

(z) Check both BAIL OUT switches independently and note that the operation of either switch illuminates both BAIL OUT warning lights.

(aa) Fuel contents - registered correctly.

(ab) Aircraft and cabin altimeters - set.

(ac) If wing tip tanks are fitted check that the A.S.I. has been set for a limiting speed of 400 knots.

(ad) Oxygen

Supply of 1800 psi if the aircraft is fitted with wing tip tanks.

Supply of 1000 psi minimum if the aircraft is not fitted with wing tip tanks.

Mask fits.

Blinker indicator; flow on NORMAL, 100% and SAFETY PRESSURE.

Check emergency oxygen bottle supply of 1800 psi minimum.

STARTING PROCEDURE

PRELIMINARIES

6 Observe the following:

(a) Ensure that the adjacent ground area is free from debris.

(b) 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 intakes and jet pipes.

PROCEDURE FOR STARTING

7 Adopt the following sequence:

(a) Fire extinguisher in position. 28 volt 1000 ampere ground starting energizer plugged into the RH engine.

(b) Parking brake ON.

(c) Master power supply switch - FLIGHT.

(d) Throttles - closed.

(e) HP fuel cocks - OFF.

(f) LP cock switches - ON; crossfeed switch - NORMAL; tank selection switches NORM.

(g) Fuselage tank booster pumps - ON.

(h) Signal ground crew to engage energizer.

(j) Hold engine start switch in until 3% rpm is indicated, or for a maximum of 5 seconds. Release the switch.

(k) When the engine rpm reaches 10 - 12% open HP fuel cock.

(m) Check jet pipe temperature - a temperature rise within three seconds indicates "light up".

(n) Check oil and fuel pressures.

(p) Switch on appropriate generator; increase in fuel inlet pressure indicates generator operation.

(q) Repeat starting procedure for other engine.

(r) Check generator operation by switching off generator on engine first started before switching on second generator.

NOTE

The JPT may exceed the idling limitation but should soon settle down to the correct figure. The engine will accelerate until correct idling RPM and JPT are attained and should run under these conditions without any throttle adjustment. Do not open the throttle until idling speed has been obtained.

(s) IFF and W/S de-ice inverter switch - ON.

(t) W/S de-ice and de-mist switch - as required.

FAILURE TO START

WET START

8 If during the normal starting sequence, no rise in temperature is observed within 10 seconds of opening the HP fuel cock, a wet start has occurred and the following procedure should be carried out.

(a) Close the HP fuel cock immediately.

(b) Allow the engine to complete the starting cycle.

(c) When the engine has stopped rotating, switch OFF the LP fuel cock.

(d) Switch OFF the master power supply switch.

(e) Investigate the cause of failure to "light up" and when this has been satisfactorily ascertained and rectified, motor the engine for one complete starting cycle to blow out excess fuel before restarting is attempted.

HOT START

9 If, during the normal starting sequence, the exhaust temperature exceeds 750°C for more than five seconds, the engine must be stopped immediately, and the cause investigated before attempting to restart.

NOTE

All hot starts where a temperature of 850°C is exceeded, must be recorded in Form L14A.

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

10 Before taxying out for flight the following checks must be made: (Front and rear cockpits as applicable).

(a) Canopy locked closed or locked in an intermediate position, as required.

(b) Harness locked.

(c) Artificial horizon - erected.

(d) C2 compass - Slaving switch on GYRO-COMPASS.

- Adjust knob of front cockpit indicator so that annunciator window shows "all clear". (See Part 1 Para 90).

- Check heading

(e) Flying control 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 neither of these checks should the hydraulic pressure gauge 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.

(f) Landing flaps - check operation up to 30° and fully UP. Operation must be smooth and rapid, pressure returning to 1900 - 2300 psi after selection is completed. Select 0° or 25° flap as desired for take-off and return selector to the stop position.

(g) Speed Brakes - Selector switch in rear cockpit to BOTH. Check operation and return operating switch to closed. Selector switch to BOTH or REAR ONLY as required.

NOTE

Check that the DRAG FLAP WARNING amber light in each cockpit illuminates when the speed brakes are operated. Check also, if the selector switch is at REAR ONLY, that the red DRAG FLAP POWER TRANSFER light in the front cockpit illuminates and that the green REAR ONLY light in the rear cockpit illuminates.

(h) Check -

Fuel and oil pressures Oil temperature Jet pipe temperature Bearings scavenge oil temperature	within limits

(j) Generator switches - ON, warning lights out.

(k) Check MAIN INVERTER FAILURE WARNING light out.

(m) Light switches as required.

(n) Landing light switches - EXTEND - RETRACT. Check functioning and switch OFF.

(p) Air conditioning controls - cabin air EMERGENCY VENTILATION.

Air conditioning - AUTO.

(q) IFF switches - set as required.

(r) Intercom, VHF and Radio Compass switched ON - Controls set as required. Carry out radio ground checks.

(s) Fuel - check contents.

LP cocks ON

Crossfeed - NORMAL

Tank selection switches - NORM

HP Cocks - ON

Fuselage booster pumps - ON

Wing transfer pumps - ON

Tip tank shut-off switches - OFF

(t) Switches -

Master power supply - FLIGHT

Pitot heat - ON

W/S de-ice and de-mist - ON

TAXYING PROCEDURE

11 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.

TAKE-OFF PROCEDURE

VITAL ACTIONS BEFORE TAKE-OFF

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

(a) Canopy - Fully closed and locked. Check visually that the canopy release levers are resting on their stop pins and check canopy for security by attempting to wind back on the canopy operating crank.

NOTE

With the canopy closed it should not be possible for the crank handle in the front cockpit to engage with a slot in the locking plate.

(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

13 For normal take-off proceed as follows:

(a) Ease back gently on the control column until nose wheel lifts, which may be at a speed approaching airborne speed depending on the aircraft weight. When the nose lifts, ease forward slightly to prevent excessive nose up attitude.

(b) The aircraft will become airborne with very little further elevator movement at 115/135 knots IAS depending on the aircraft weight. No attempt should be made to pull the aircraft off the ground at lower speeds.

ACTIONS AFTER TAKE-OFF

14 Proceed as follows:

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

CAUTION

Up to 8 seconds may elapse from the time the 'up' selection is made until the landing gear is locked up. Care must be taken during this period not to exceed the maximum landing gear raising IAS of 170 knots. The selection of a relatively steep angle of climb after safe single engine speed has been reached will normally ensure positive retraction of the landing gear.

(b) Check landing gear locked UP - lights out.

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

(d) Check fuel and oil pressures, oil inlet, bearing scavenge oil, and jet pipe temperatures.

(e) Reduce power to climbing rpm.

(f) If wing tip tanks are fitted switch wing transfer pumps OFF and wing tip tanks ON.

(g) Cabin air - NORMAL.

FLYING CHARACTERISTICS

GENERAL

15 The aircraft responds immediately to variations in power above 250 knots IAS but below this speed is comparatively 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.

16 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 landing flaps and gear down as these cause a very high drag.

STABILITY

17 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 loss of stability, and friction in the control circuits is more noticeable, requiring greater attention in the control of the aircraft.

18 Up to approximately Mach 0.8 True, stick forces required for manoeuvres will decrease with altitude. Above this Mach number they will increase appreciably.

FLYING CONTROLS

19 The flying controls are effective over the speed range. Rudder and elevators are light in comparison with the ailerons.

AILERONS

20 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 250 knots IAS; above this speed the response to stick movement is immediate.

ELEVATORS

21 The stick forces generally are light and above 200 knots IAS the elevators are sensitive to small stick movements. They are effective at the stall if large control movements are applied.

RUDDER

22 The rudder is effective at all speeds and when flying on asymmetric power.

TRIMMER CONTROLS

23 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

24 On extension of the landing flaps there is a slight nose-down change in trim. Flaps may be lowered 25° for bad weather flying but the increased drag will result in a higher fuel consumption.

SPEED BRAKES

25 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. The effectiveness of the speed brakes 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

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

CLIMBING

27 After take-off, when the landing gear is locked up, airspeed should be allowed to build up to at least 220 knots IAS before the climb is commenced.

28 The following climbing speeds are recommended, using 97.5% rpm:

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

JET PIPE TEMPERATURE LIMITATIONS DURING CLIMB

29 During a climb at constant throttle setting, engine rpm and jet pipe temperature will rise with increasing altitude, and above 30,000 feet the temperature rise may be as high as $1^{\circ}C$ per thousand feet. The throttle setting must be adjusted throughout the climb to keep within rpm and jet pipe temperature limitations. It should be noted that even if rpm is kept constant, jet pipe temperature will still continue to rise.

STALLING

30 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.

31 Stalling speeds at 28,000 pounds gross weight (power off) are:

Landing gear and flaps up 110-118 knots IAS.

Landing gear and flaps down 100-105 knots IAS.

SPINNING

32 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.

33 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 recovery procedure is commenced otherwise the operational limitations for diving will probably be exceeded.

If the aircraft is spinning at/or below 7000 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

34 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

35 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.

FLYING IN HEAVY PRECIPITATION

36 Flying into or around cumulonimbus activity must be avoided. The cooling effect of supercooled water causes the stator blades to rub on the compressor rotor and will result in internal disintegration of the engine. The amount of precipitation encountered in layer or small cumulus type cloud is not normally sufficient to cause engine failure.

37 If heavy precipitation is encountered power should be reduced to approximately 85% to decrease the amount of cool moist air entering the engine and the area of heavy precipitation vacated as quickly as possible.

38 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 WITH ASYMMETRIC POWER

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

AEROBATICS

40 Aerobatics are permissible and are easily executed but the flight limitations in Part 4, para. 3 must not be exceeded, and Part 1, para. 93 should be noted. 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 jet pipe temperature limitation.

SLOW ROLL

41 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

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

HALF ROLL OFF THE TOP

43 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.

LOOP

44 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. The aircraft can be eased out of the loop without any excess build up of "g" or airspeed. Seven to eight thousand feet should be allowed in the vertical plane using a 3 "g" pull-up or less.

ROYAL CANADIAN AIR FORCE

ADVANCE REVISION

Serial #1 dated 23 Jun 61
(Sheet 1 of 1)

The sheet of this Advance Revision is to be inserted in the EO as follows:

Sheet 1 facing page 39

Part 2, page 39, para. 53.

Delete para. 53 and Note and Heading "Exhaust Temperature Limitation".

Insert the following heading, new para. 53 and Note:

Engine Overspeeding and Exhaust Temperature Limitation.

53 Transient involuntary overspeeding of an engine is permissable providing 102% RPM and 750 °C JPT is not exceeded.

NOTE

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.

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

INVERTED FLYING

45 There is no provision for supplying fuel to the engines during a prolonged period of inverted flight, but a chamber in each fuselage tank provides a reserve for approximately 10 seconds in this flight condition, and when negative "g" is experienced.

DIVING

46 Do not dive the aircraft from level flight at high Mach numbers, because the speed will very rapidly build up in the dive and probably cause the maximum Mach number to be exceeded. This may occur even in shallow dives at angles of 10° - 20°. The speed brakes commence closing under the influence of 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 affected at as high an altitude as possible as follows:-

(a) Close the throttles and extend the speed brakes.

(b) Do not adjust elevator trim.

(c) Recover by means of a steady backward pressure on the control column and endeavour to avoid excessive buffeting or high 'g' loads.

ENGINE HANDLING

GENERAL

47 Under certain conditions, during flight or ground running, the engine can produce a rumbling noise due to turbulence in the primary zone of the combustion chamber. This should be accepted as an operating characteristic of the engine and is not, in itself, harmful to the engine.

48 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.

OIL PRESSURE LIMITS

49 The minimum allowable oil pressure stated in Part 4 para 2(b) 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.

50 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.

51 In flight, the engine 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 50 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 oil pressure loss. If the engine is throttled back the oil temperature, in addition to the pressure, should be closely monitored.

52 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.

EXHAUST TEMPERATURE LIMITATION

53 Should at any time the exhaust temperature exceed 850°C, this fact must be noted on the form L14A.

NOTE

If the above limitation is exceeded five times, the engine must be placed unserviceable for a "Hot-end" inspection.

OIL TEMPERATURE LIMITS

54 The Maximum Ring Main and Centre Bearing scavenge oil temperatures are for ground level static conditions. (See Part 4 para 2(d)). Under normal conditions of flight these temperatures will not be exceeded.

55 Where factors of high engine speed, high forward speed, and high outside air temperature are combined during flight, Ring Main and Centre Bearings scavenge oil temperatures up to 15°C over ground level static maximum temperatures are acceptable. When oil temperatures near these limits are encountered in flight they may be reduced by decreasing the engine speed as much as is practicable for short periods to suit the particular operating conditions.

ACCELERATION

56 An acceleration control unit on the engine allows the throttle to be opened rapidly throughout the rpm range below 30,000 feet. Above this altitude care must be taken in accelerating up to 65% rpm. At sea level, under normal temperature conditions the engine will accelerate from 38.5% to 97% rpm within 12 seconds, but should the jet pipe temperature exceed 790°C, or if there is any audible surge during acceleration the throttle must be closed immediately and the engine placed unserviceable.

57 As a check against over-fuelling, the minimum recommended time for acceleration from 40% rpm to 100% rpm is 8 seconds. Audible stalling of the compressor should not occur, and the jet pipe temperature immediately after acceleration must not exceed the limitation of 790°C.

FULL THROTTLE AT HIGH ALTITUDES

58 The governed speed of the engine increases with altitude. Consequently care must be taken when opening up to full throttle at high altitude to avoid exceeding the maximum rpm and exhaust temperature limitations.

IDLE SPEED

59 The engine should not be allowed to idle below 34% rpm owing to the possible failure of compressor blades due to vibration. It may be necessary under certain flight conditions to manually adjust the throttle levers to maintain the desired minimum of 34%.

EFFECT OF FUEL TEMPERATURE ON GOVERNED RPM

60 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	+ 0.6%
15°C	0
0°C	- 0.4%
-15°C	- 1.2%
-30°C	- 2.0%

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

ENGINE OPERATION IN SUB-ZERO CONDITIONS

62 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-0-6081B, 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 turn them over by hand, to check that the compressor is not frozen.

(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, observe the engine intake to check 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 opened very slowly until maximum rpm are obtained. During this procedure it is essential that the maximum oil pressure does not exceed 30 psi, with a minimum of 2 psi at idling rpm.

(f) If Grade 1010 oil is being used at temperatures below -25°C, the idling period must be increased to five minutes before increasing rpm. The same oil pressure restrictions apply

63 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.

ENGINE ICING

64 The jet pipe temperature should be watched carefully when operating in icing conditions as any abnormal build up of ice in the intake will cause the temperature to rise rapidly. If the jet pipe temperature rises sufficiently to indicate ice formation, the icing process may be delayed by reducing both engine rpm and airspeed or by changing altitude to escape the icing conditions.

LANDING PROCEDURE

REJOINING THE CIRCUIT

65 On rejoining the circuit reduce speed to below 200 knots IAS using the speed brakes as necessary. Select landing gear DOWN, increasing power to counteract the extra drag. When the landing gear is locked down, close the speed brakes.

NOTE

Check that the hydraulic pressure returns to normal when the operation is complete.

VITAL ACTIONS BEFORE LANDING

66 Make the following checks:

(a) Brakes -

Check the hydraulic pressure 1900 - 2300 psi.

Parking brake OFF.

(b) Landing Gear -

Gear down and locked, lights green.

(c) Fuel -

Check contents.

(d) Flaps -

Set as required.

(e) Speed Brakes -

Closed

(f) Safety Harness -

Locked

(g) If both cockpits are occupied check that the drag flaps control is selected so that the pilot has control of the drag flaps. (See Part 1 Para 74).

INITIAL AND FINAL APPROACH

67 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.

68 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 120 knots IAS (at normal landing weight) and the end of the runway at 115 knots IAS.

NORMAL LANDING

69 Make a normal tricycle landing, holding the nose wheel clear of the ground. Do not pull back the stick after cutting the power since the attitude of the aircraft in the final approach should approximate that of a touchdown. The touchdown speed should be approximately 100 knots IAS. Hold the nose in the touchdown position easing the stick back until the nose wheel touches at approximately 95 knots IAS. Apply the brakes evenly and gently to stop.

CAUTION

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

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 full aileron may be required to keep the aircraft level. Extra care must be taken when landing in bumpy or cross-wind conditions.

USE OF BRAKES

70 Avoid harsh braking which will cause skidding and excessive tire wear. The brakes should be used to slow the aircraft gradually, taking advantage of the full length of the runway.

71 Landings which involve heavy braking should not be made at intervals of less than 10 minutes. If excessive differential braking is used during prolonged taxying, this interval should be extended to 20 minutes.

MISLANDING

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

(a) Open the throttles to full take-off rpm.

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

(c) Allow speed to increase for a normal climb.

(d) Raise flaps.

CROSS-WIND TAKE-OFF AND LANDING

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

ACTION AFTER LANDING

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

(a) Raise landing flaps for taxying.

(b) Pitot head heater switch - OFF.

END OF FLIGHT PROCEDURE

STOPPING THE ENGINES

75 Ensure that the aircraft is parked in a position where fuel expelled from the dump valve will not be blown into the brake drums, thereby causing brake failure. Proceed as follows, stopping the RH engine first:

(a) Throttles - Closed. Run the engines at idling rpm for a minimum period of two minutes.

NOTE

If ground servicing is to be carried out, lower flaps.

(b) HP fuel cock. Right engine - OFF.

(c) Fuel booster and transfer pump switches. Right engine - OFF.

(d) When right engine has stopped operate the flying controls and check hydraulic pressure gauge for correct operating pressure, to check the left engine pump.

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

ACTION BEFORE LEAVING THE COCKPIT

76 Proceed as follows:

(a) Switch off all electrical services individually.

(b) Master power supply 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

- 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

77 A quick-release coupling facilitates removal and fitment of the parachute to the seat. The coupling makes connection between the seat part of the parachute withdrawal line and the parachute part of the line. Disconnecting the coupling allows the parachute to be removed from the seat.

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 shows the maximum aircraft weight at which a 100 feet per minute climb away is possible, and caters 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 in the normal configuration. For tip tanks configuration 2500 lb must be added to the 'maximum safe aircraft weight' obtained from the graph.

2 Should the actual aircraft weight be above the maximum indicated on the graph (or above the corrected safe weight if tip tanks are used) 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:

(a) Raise the landing gear.

(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 the 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 failure occurs in flight, proceed as follows:

(a) Close the relevant HP fuel cock immediately.

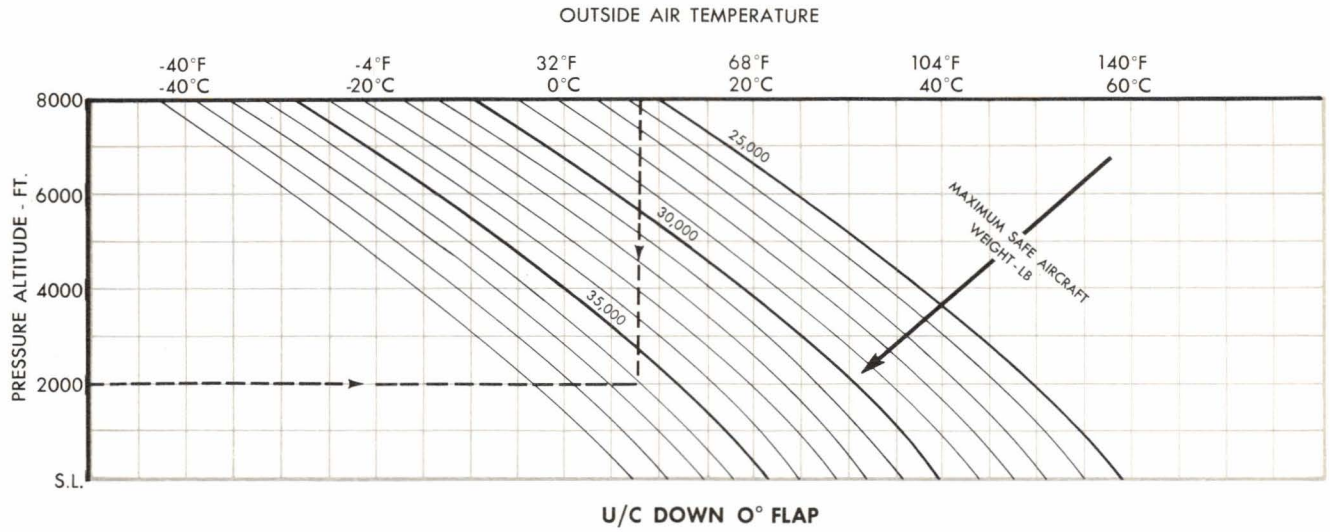
(b) Switch off all unnecessary electrical circuits.

(c) Rear cockpit occupant to check the generator output.

(d) If conditions permit, carry out the relight procedure in para 8.

(e) If relight is inadvisable, close the LP cock, and adjust trim for asymmetric flight.

(f) If fuel is needed from the failed side to reach base, select tanks alternately to equalize fuel load.



U/C DOWN O° FLAP

STANDARD CONFIGURATION EXAMPLE

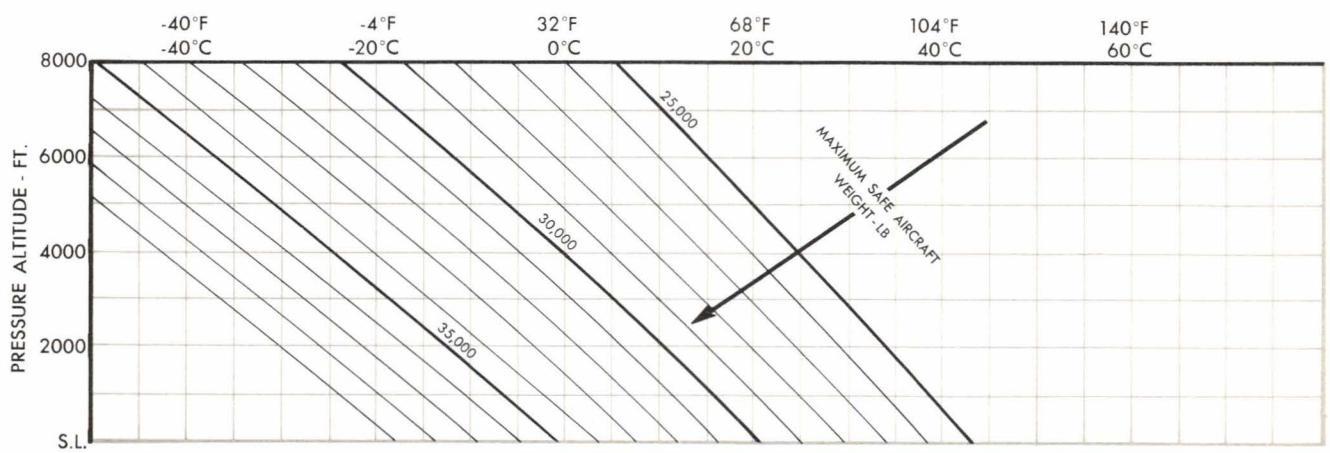
FOR THE GIVEN ELEVATION AND O.A.T. A/C CANNOT CLIMB AWAY IF TAKE-OFF WEIGHT IS ABOVE 36000 LB

TIP-TANK CONFIGURATION

WHEN TIP TANKS ARE FITTED, ADD 2500 LB TO MAXIMUM SAFE AIRCRAFT WEIGHT

EXAMPLE

FOR THE ABOVE ELEVATION AND O.A.T. A/C CANNOT CLIMB AWAY IF TAKE-OFF WEIGHT IS ABOVE 38,500 LB



U/C DOWN 25° FLAP

CHARTS BASED ON:

1 UNSTICK SPEED OF 1.15X STALLING SPEED

2 CLIMB AWAY OF 100 FPM WITH U/C DOWN OR U/C AND FLAPS DOWN

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Fig. 3-1 Engine Failure on Take-off - Maximum Weights for Continued Climb

TWO ENGINE FAILURE IN FLIGHT

5 If fuel is still available and the engines are not defective:

(a) Close the HP cocks and throttles.

(b) Switch off all unnecessary electrical circuits.

(c) Descend quickly to re-light 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 8.

6 If it is not possible to relight either engine by the time the aircraft has descended to 5,000 ft 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 it can be completed on a suitable runway. If a landing is to be attempted proceed as follows:

(a) Close the HP cocks and throttles.

(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 off all unnecessary electrical circuits.

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

(f) Jettison the canopy. Airspeed below 200 knots IAS.

NOTE

The explosive links of the canopy will fire with a low charge in the battery. If the links fail to fire, move the Ground/Flight switch to OFF to decrease the load on the battery and try again.

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

(h) Use emergency air extension for landing gear and flaps. See Part 3 Paras 15 and 18.

EMERGENCY RELIGHT IN THE AIR

GENERAL

7 Do not attempt to relight an engine above 20,000 feet when using 3-GP-23A fuel or above 25,000 feet when using 3-GP-22A fuel. If the first relight attempt is unsuccessful, descend to a lower altitude and try again.

RELIGHT PROCEDURE

8 Adopt the following sequence of operations:

(a) Windmill the engine for at least 30 seconds with the HP cock OFF, to dry out surplus fuel.

(b) Throttle - not more than half-an-inch open.

(c) Fuselage tank booster pump - ON.

(d) Adjust the airspeed in order to obtain 13% to 20% rpm (about 205 knots IAS).

(e) Check the Ground/Flight switch is at FLIGHT.

(f) Press and hold the relight switch.

(g) After three seconds select the HP fuel cock- ON.

(h) When relight is obtained, release the relight switch.

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

9 If a relight is not obtained within 30 seconds, select the HP fuel cock OFF and make a further attempt after the engine has been windmilled for at least 30 seconds.

LANDING WITH ASYMMETRIC POWER

SINGLE-ENGINE LANDING

10 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) Turn on to the final approach at 170 knots IAS with the nose fairly well down, select full landing flap, and approach fairly high.

(d) When it is certain that the runway can be reached without power, cut the throttle and make a normal landing.

NOTE

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

MISLANDING

11 The decision to go around 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 the landing gear and raise the flaps to the 25° position.

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

(d) Raise flaps.

MAIN SERVICE EMERGENCY PROCEDURES

LANDING GEAR EMERGENCY LOWERING

12 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) Switch off the U/C ACT'N circuit breaker on the main circuit breaker panel and depress the EMERGENCY U/C DOWN button on the pressure bulkhead of the rear cockpit. The button must be maintained depressed until the landing gear green lights appear.

CAUTION

After landing do not move the U/C ACT'N circuit breaker from its OFF position.

13 If the above procedure fails or if the occupant of the rear cockpit cannot depress the EMERGENCY U/C DOWN button, proceed as follows:

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

(b) Operate the UNDERCARRIAGE EMERGENCY lever, located forward of the throttles in both cockpits. 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.

14 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 be adopted:

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

(b) Select the TEST HYD circuit breaker on the main circuit breaker panel ON.

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

WARNING

To prevent overheating of the power pack do not hold the HYDRAULIC TEST PUMP switch ON for more than 10 seconds after the hydraulic pressure gauge reaches approximately 2950 psi. Do not use the power pack for any other malfunction.

(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, reselect 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 the emergency air is used, the gear cannot be raised for a wheels-up landing.

15 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 bulkhead of the rear cockpit, to ensure availability of brakes on landing.

(c) Operate the UNDERCARRIAGE EMERGENCY lever, located forward of the throttles in both cockpits. 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.

LANDING GEAR EMERGENCY RETRACTION

16 If it is desired to retract the landing gear when the weight of the aircraft is on the main wheels, push the UNDERCARRIAGE EMERGENCY RETRACTION switch forward in order to break the locking wire.

LANDING FLAP EMERGENCY LOWERING

17 If hydraulic pressure is normal and the landing flaps cannot be lowered by operation of the LANDING FLAP control lever, proceed as follows:

(a) Maintain the normal FLAP DOWN selection.

(b) Select the LAND FLAP circuit breaker OFF and then depress the EMERGENCY FLAP DOWN button on the pressure bulkhead of the rear cockpit. The button must be maintained depressed until the flaps are lowered to the desired position, and then released.

18 If the above procedure fails or if the occupant of the rear cockpit cannot depress the EMERGENCY FLAP DOWN button, proceed as follows:

(a) Maintain the normal FLAP DOWN selection and the LAND FLAP circuit breaker OFF.

(b) Operate the EMERG FLAPS lever, located on the throttle box in both cockpits. The emergency air system provides for one down operation of full flap 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.

WARNING

The wings should be level before making this selection 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.

EMERGENCY OPERATION OF BRAKES

19 Should the main hydraulic pressure fail, sufficient pressure to effect a safe landing is supplied by an emergency brake accumulator in the system. Before landing check the emergency brake accumulator pressure on the rear bulkhead of rear cockpit.

CAUTION

Brake accumulator pressure should normally read 1900-2300 psi, which is sufficient for one safe landing. The brakes should be applied with a slow, steadily increasing pressure. Do not pump the brakes as this will cause unnecessary loss of hydraulic pressure. A safe landing may be made with the accumulator pressure less than normal but the available number of brake applications will be reduced. Below 1500 psi there is no longer any brake action.

CAUTION

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

20 Failure of one or both footmotors necessitates the use of the Emergency/Parking brake.

CAUTION

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

21 The Emergency/Parking brake depends on hydraulic pressure for its operation; therefore if the emergency brake accumulator has been exhausted there will be no braking action from either the foot operated brakes or the Emergency/Parking brake. The rear cockpit has no parking brake lever fitted.

RUNWAY BARRIER PROCEDURE

22 The following procedure is to be followed when the runway barrier is to be used:

(a) Immediately after touchdown, ensure that the nose wheel is on the ground. Engagement is unlikely unless the nose wheel trips the engaging mechanism.

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

(c) The desirable engaging speed is not less than 30 knots and not more than 130 knots.

23 There will be a noticeable delay between the engaging of the nose wheel and appreciable deceleration.

CAUTION

Do not use brakes during engagement except where necessary to counteract a turning tendency in the event of a one leg engagement.

24 There are no restrictions on the position of divebrakes, flaps or external stores.

FLYING CONTROL BOOSTERS FAILURE

25 If the BOOST PRESS warning light fitted on both cockpit main panels 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, the shield may be moved down to cover the light.

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 manual effort required to operate the flying controls. Surging of the controls may also be experienced.

CAUTION

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

26 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 of flaps if the aircraft is not trimmed progressively with the operation of these services.

CANOPY JETTISON

GENERAL

27 The canopy should normally be jettisoned at speeds above 140 knots but in an emergency during take-off or landing the canopy will jettison at a speed of 100 knots or more.

JETTISON PROCEDURE

28 To jettison the canopy proceed as follows:

(a) Ensure that the canopy is fully closed and locked.

(b) Adjust airspeed.

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

(d) Operate the switch marked CANOPY JETTISON.

WARNING

If an emergency arises while the aircraft is on the ground and the airspeed is less than 100 knots, the normal method of opening the canopy by means of the crank handle must first be attempted. Only if this method fails should the jettison switch be operated and the canopy pushed off.

ELECTRICAL SYSTEM EMERGENCIES

GENERATOR OVER-TEMPERATURE

29 A GENERATOR OVER-TEMPERATURE WARNING light will illuminate if a generator becomes overheated, in which case all non-essential services must be switched off.

CAUTION

If the affected generator is switched OFF without reducing the load, the remaining generator will also become overheated.

GENERATOR FAILURE

30 A GENERATOR FAILURE warning light will illuminate if, for any reason, the generator is isolated from the main bus.

31 The appropriate GENERATOR RESET push button should be depressed in an attempt to reset the circuit breaker, but if the warning light remains illuminated, the generator has failed and must be switched OFF. The load on the other generator must be reduced as much as possible by switching off all non-essential services.

INVERTER FAILURE

32 Should the main inverter fail, changeover to the emergency is automatic. Illumination of the EMERGENCY INVERTER amber light, one in each cockpit, will indicate that the emergency inverter is operating.

FUEL SYSTEM FAILURES

FUEL TANK BOOSTER PUMP FAILURE

33 If it is required to use the fuel from a tank in which the pump 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 L14A the length of time the engine was operated under this condition.

WING TIP FUEL JETTISON

34 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.

35 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 flight, plus an additional two minutes climbing at best climbing speed to drain the fuel.

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

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

37 Control effectiveness and response decrease as the air-speed 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, u/c down, dive brakes in.

38 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.

39 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.

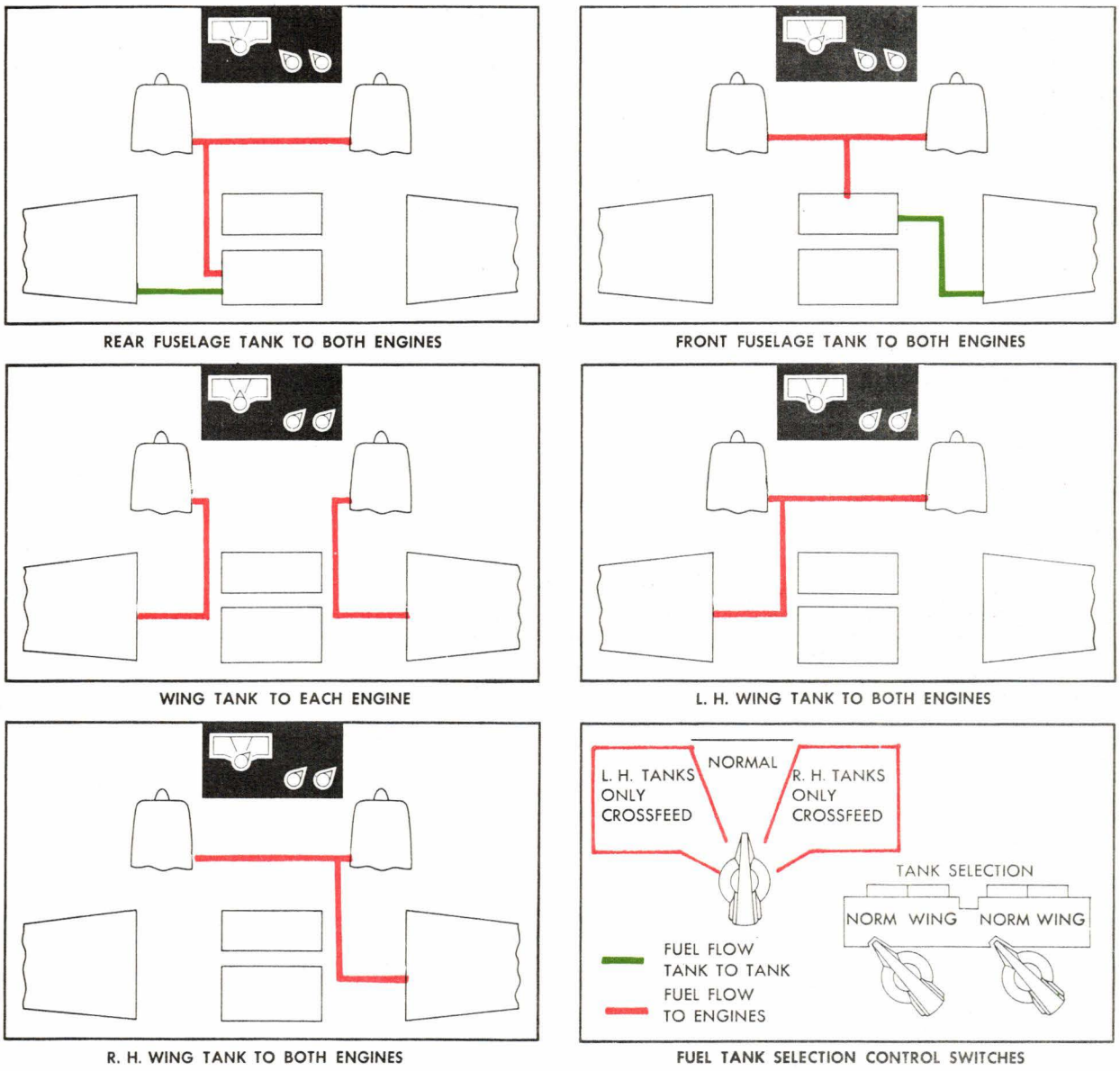

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Fig. 3-2 Emergency Fuel Feeds

40 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

41 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.

42 If an asymmetric fuel load exists in flight, and it becomes necessary to "de-boost", 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.

43 If an asymmetric tip tank fuel load is noticeable in high speed flight, in an out of boost condition, fuel jettison will be necessary before the airspeed is reduced, otherwise excessive stick forces will be encountered. It may be necessary to abandon the a/c if fuel jettison fails.

NOTE

Crossfeeding internal fuel from the heavy wing and the use of aileron trim will help counteract the adverse forces caused by an asymmetric wing tip fuel load.

ACTION IN THE EVENT OF FIRE

ENGINE FIRE

44 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, stop cock engine, shut off LP cock, operate fire extinguisher and land as soon as possible.

(c) If warning lights go OUT, check for evidence of fire.

(d) If evidence of fire is found, stop cock engine, shut off LP cock, operate fire extinguisher and land as soon as possible.

NOTE

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.

45 If no evidence of fire is found:

(a) It is possible that an overheated condition did exist due to exhaust gas leakage into the engine nacelle, therefore shut down engine and land as soon as possible.

(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 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 fire extinguisher system is exhausted.

AUTOMATIC OPERATION OF ENGINE FIRE EXTINGUISHER SYSTEM

46 An impact switch installed in the rear fuselage is set to trigger both engine extinguisher systems automatically at a deceleration of 6'g', irrespective of the position of the Ground/Flight switch.

RELEASE OF CREW MEMBERS IN AN EMERGENCY ON THE GROUND

GAINING ACCESS TO COCKPITS

47 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) Unlatch the red painted canopy locking claws located at each side of the forward end of the canopy. The canopy locking claws are marked in red letters PRESS DOWN HERE - SLIDE CANOPY AFT - FOR EMERGENCY RESCUE. An arrow points to the aft part of the claw, which should be forced downwards to release the locks,

(b) Slide the canopy backwards manually.

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

REMOVING THE OCCUPANTS

48 Release at least one side of the occupants oxygen mask to prevent suffocation, then 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 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.

(c) Release the safety harness by rotating the release lever on the harness quick-release fitting upward until the arrow points to UNFASTEN. The straps should then 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 applies equally to both cockpits. The sequence of releasing the parachute harness first and then the safety harness will prevent the occupant from falling forward in the seat until all straps are released.

FIRE

49 The cartridge in the ejection gun is well shrouded with metal and there is no danger of it being exploded by heat from a fire, while rescue operations are being carried out. If the heat became sufficiently great to explode the charge by this means, then no one could be close enough to the aircraft to effect a rescue, even if they were wearing an asbestos suit.

CABIN PRESSURE EMERGENCIES

CANOPY SEAL FAILURE

50 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 the airspeed and may be equivalent to approximately 3000 feet at maximum speed.

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

LOSS OF COCKPIT PRESSURIZATION

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

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

(b) Depress the SAFETY PRESS knob if the cabin altitude is above 35,000 feet and the oxygen regulator fails to deliver pressure oxygen.

(c) Open the speed brakes and descend to below 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.

CRASH LANDING

53 A normal wheels up landing is recommended. Proceed as follows:

(a) Jettison the canopy, minimum recommended speed 140 knots (see para 27), 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) Lower flaps fully.

(c) Check security of safety harness.

(d) Select HP cocks, generators, inverter OFF, and Ground/Flight switch OFF, immediately before touchdown.

CAUTION

The Ground/Flight switch must be in the FLIGHT position in order to obtain any engine fire indication and also to manually operate the fire extinguishing system.

ENGINE THRUST AT IDLE RPM

54 Engine thrust at idle rpm is comparatively high. When maximum deceleration is required as in the case of an aborted take-off, an overload landing or brake failure, the engines should be stopped as soon as possible.

ABANDONING THE AIRCRAFT

GENERAL

55 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 with an Issue 10 seat 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.

56 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.

CAPTAIN PRELIMINARIES

57 If it becomes necessary to abandon the aircraft, carry out the following procedure:

(a) Reduce airspeed, if possible.

(b) Ensure that the canopy is fully closed.

(c) Order the occupant of the other seat to prepare for ejection.

NOTE

The captain must ensure that the other occupant has fully understood this order and is preparing himself for ejection.

(d) If intercommunication has failed, operate the BAIL OUT switch.

REAR SEAT OCCUPANT (CAPTAIN OR PUPIL)

58 Proceed as follows:

(a) Adjust the seat height so that the head is correctly located on the headrest.

(b) Ensure that the safety harness is locked in the fully back position.

(c) If above 12,000 feet pull the knob to operate the emergency oxygen bottle.

(d) Position the head firmly against the headrest.

(e) Grasp the firing handle keeping the elbows close together and with the thumbs outwards.

(f) 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 firmly down over the face.

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) Lower flaps fully.

(c) Check security of safety harness.

(d) Select HP cocks, generators, inverter OFF, and Ground/Flight switch OFF, immediately before touchdown.

CAUTION

The Ground/Flight switch must be in the FLIGHT position in order to obtain any engine fire indication and also to manually operate the fire extinguishing system.

ENGINE THRUST AT IDLE RPM

54 Engine thrust at idle rpm is comparatively high. When maximum deceleration is required as in the case of an aborted take-off, an overload landing or brake failure, the engines should be stopped as soon as possible.

ABANDONING THE AIRCRAFT

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55 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 with an Issue 10 seat 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.

56 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.

CAPTAIN PRELIMINARIES

57 If it becomes necessary to abandon the aircraft, carry out the following procedure:

(a) Reduce airspeed, if possible.

(b) Ensure that the canopy is fully closed.

(c) Order the occupant of the other seat to prepare for ejection.

NOTE

The captain must ensure that the other occupant has fully understood this order and is preparing himself for ejection.

(d) If intercommunication has failed, operate the BAIL OUT switch.

REAR SEAT OCCUPANT (CAPTAIN OR PUPIL)

58 Proceed as follows:

(a) Adjust the seat height so that the head is correctly located on the headrest.

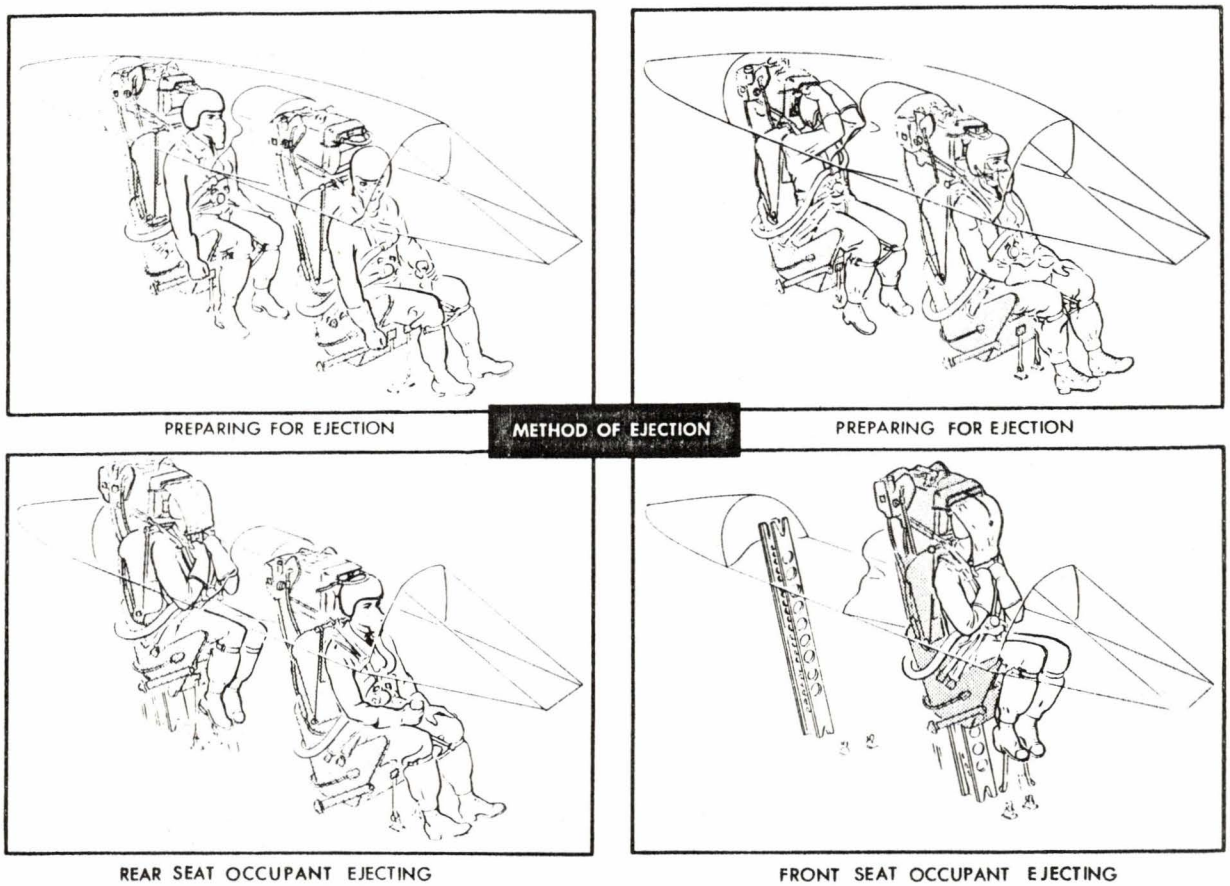
(b) Ensure that the safety harness is locked in the fully back position and that the harness is tight.

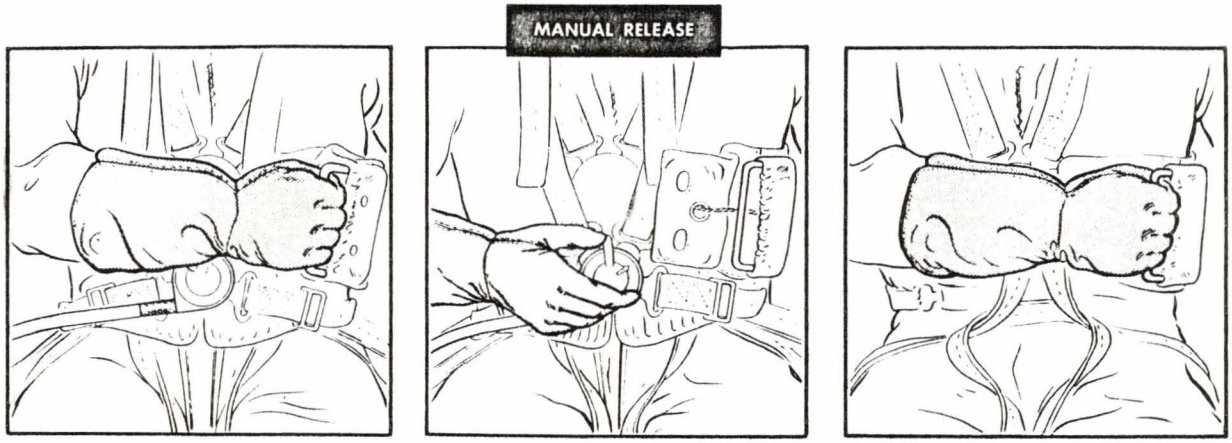
(c) If above 12,000 feet pull the knob to operate the emergency oxygen bottle.

(d) Position the head firmly against the headrest.

(e) Grasp the firing handle keeping the elbows close together and with the thumbs outwards.

(f) 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 firmly down over the face.





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

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Fig. 3-3 Abandoning the Aircraft

(g) 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.

(h) 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 penetrators are fitted to the seat and will shatter the canopy on contact. Ejection will continue in the normal manner.

FRONT SEAT OCCUPANT (CAPTAIN OR PUPIL)

59 After the rear seat occupant has left the aircraft, proceed as follows:

(a) Ensure that the safety harness is locked in the fully back position and that the 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 outwards.

(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

60 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

61 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.

62 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.

SOLO FLYING

63 If the aircraft is flown solo the pilot must jettison the canopy before operating his seat firing handle (see para. 28). Alternatively, ejection can be made through the canopy.

MANUAL RELEASE

64 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

65 Reference should be made to EO 05-1-1 Aircraft Operating Instructions - General.

66 Model ditching tests show that using a full flap and a minimum speed, tail down landing, the aircraft ditches satisfactorily.

67 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.

68 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.

69 The landing gear should be up, the canopy jettisoned, and the flaps fully lowered. Ditching should, if possible, be made along the wave crests and not across the waves.

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 tanks makes little difference to the ditching characteristics. Ditching with up to 10° of roll or yaw were found to be satisfactory.

70 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 or the aircraft.

71 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.

72 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

3GP23A (MIL-F-5616, Grade JP-1)

or 3GP22A (MIL-F-5624A, Grade JP-4)

Oil: MIL-O-6081B, Grade 1010

MIL-O-6081B, Grade 1005 (Cold weather operation -30°C and below)

ENGINE LIMITATIONS

2 The principal limitations are:

(a) RPM and JPT

Condition	Time Limit	RPM%	Max JPT °C
Take-off and Combat	5 min static 15 min flight	99-100	720
Climb	30 min	97.5	690
Cruise	None	93	645
Idle	None	34-37	645

(b) Oil Pressure

93% RPM

Maximum	25 psi
Minimum	15 psi

Idling

Minimum	2 psi

(c) Fuel pressure

Minimum	3 psi

(d) Oil temperature

Ring Main

Maximum	70°C
Starting Minimum	-40°C

Bearing Scavenge

Maximum	140°C

NOTE

The above oil temperature and oil pressure figures are for ground level static conditions. For conditions governing temperatures and pressures outside these limits see Part 2 para 49.

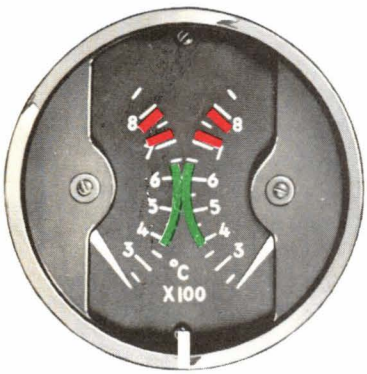
FLYING LIMITATIONS

3 The principal limitations are:

(a) Maximum Permissible Speeds:	IAS Kts
Below 3,100 ft Indicated	510
Landing Gear Down	200
Raising Landing Gear	170
Landing flaps down 25°	250
Landing flaps down 60°	170

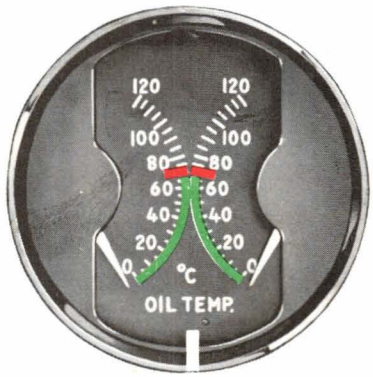
Mach No above 3,100 ft Indicated - .81 (.85 True)

Tip Tanks Fitted (all weights and altitudes)	400 knots IAS or MACH .81 ind. (Lowest limit to apply)



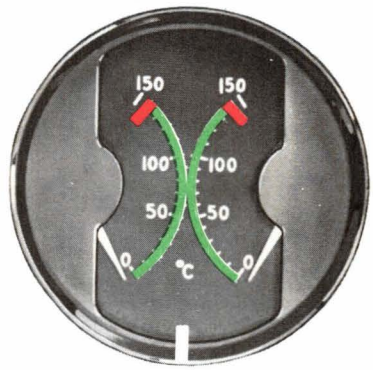
JET PIPE TEMPERATURE

- 720°C MAXIMUM FOR FLIGHT
- 790°C MAX. FOR ACCELERATION
- 400° - 645°C DESIRABLE



RING MAIN OIL TEMPERATURE

- 70°C MAXIMUM
- 0° - 70°C DESIRABLE



BEARING SCAVENGE TEMP.

- 140°C MAXIMUM
- 0° - 140°C CONTINUOUS

THERE IS A -40°C (-40°F) MINIMUM TEMPERATURE FOR STARTING -NOT SHOWN ON THE GAUGES

MACH. AIRSPEED INDICATOR

RED POINTER SET AT 510 KNOTS WHICH IS MAXIMUM SPEED BELOW 3100 FT. INDICATED ALTITUDE (=520 KNOTS E.A.S. BELOW 4200 FT. TRUE ALTITUDE)

170 KNOTS-MAXIMUM AIRSPEED FULL FLAPS MACHMETER SET AT .81 MAXIMUM SPEED ABOVE 3100 FT. INDICATED ALTITUDE (=.85 TRUE ABOVE 4200 FT. TRUE ALTITUDE.)

FUEL PRESSURE

- 3 P.S.I. MINIMUM
- 5-25 P.S.I. NORMAL

35 P.S.I. MAXIMUM, (NOT SHOWN) ABOVE 25 P.S.I. THE POINTER WILL CONTINUE TO MOVE AROUND THE DIAL.

R.P.M. PER CENT

- 100% MAXIMUM
- 70%-93% CRUISING

HYDRAULIC PRESSURE

- 2800 P.S.I. MAXIMUM
- 1900 - 2300 P.S.I. NORMAL

OIL PRESSURE

- 2 P.S.I. (MIN.) IDLING
- 15 - 25 P.S.I. NORMAL
- 25 P.S.I. MAXIMUM

1506-3F-4

Fig. 4-1 Instrument Dial Markings

(b) Flight Manoeuvre Envelopes

The flight manoeuvre envelopes shown on Fig 4-2 and 4-3 apply only for sea level and 3,100 feet respectively. Above 3,100 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:

(1) Green - The area in which no flight restrictions apply. (See NOTE below - tip tanks restriction).

(2) Pink - The area in which it is safe to fly provided the aircraft weight is as shown.

(3) Red - The area of complete prohibition, irrespective of aircraft weight, owing to risk of structural failure.

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 34 and 35).

NOTE

With tip tanks fitted the "g" limits are + 2.5 and -1.0 at all weights and speeds.

(c) Maximum Weights:

Take-off Weight overload	39000 lb
Landing Weight	27960 lb
For Aerobatics	27960 lb

AIRSPEED CORRECTION TABLES

GENERAL

4 Airspeed installation error and compressibility error must be taken into account when computing equivalent airspeed (EAS) and the combined correction to apply to indicated airspeed (IAS) can be obtained from the Airspeed Correction Table (fig 4-4).

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

5 The flight planning charts present performance of the Canuck 3D aircraft with two Orenda 8 engines. These charts are based on I.C.A.N. standard atmosphere. Fuel quantities are given in gallons to correspond with the readings of the fuel contents indicators. On the climb, descent, combat allowance and flight operation instruction charts, to compensate for variations in individual aircraft the fuel requirements quoted are 5% conservative.

TAKE-OFF CHART

6 Ground run distances and total distances to clear a fifty foot obstacle are tabulated in fig 4-6. A dry hard surface runway and no wind are the only conditions considered. The charted distances assume the use of normal take-off technique.

CLIMB CHART

7 From the climb chart (fig 4-7) can be determined the best climb speed, fuel consumed, time to climb, distance covered, and rate of climb for either take-off or climbing rpm. No allowance is included in the table for fuel consumed during warm-up or take-off, the fuel requirements listed being for the climb only. An estimated allowance for these conditions is included in the notes however, and

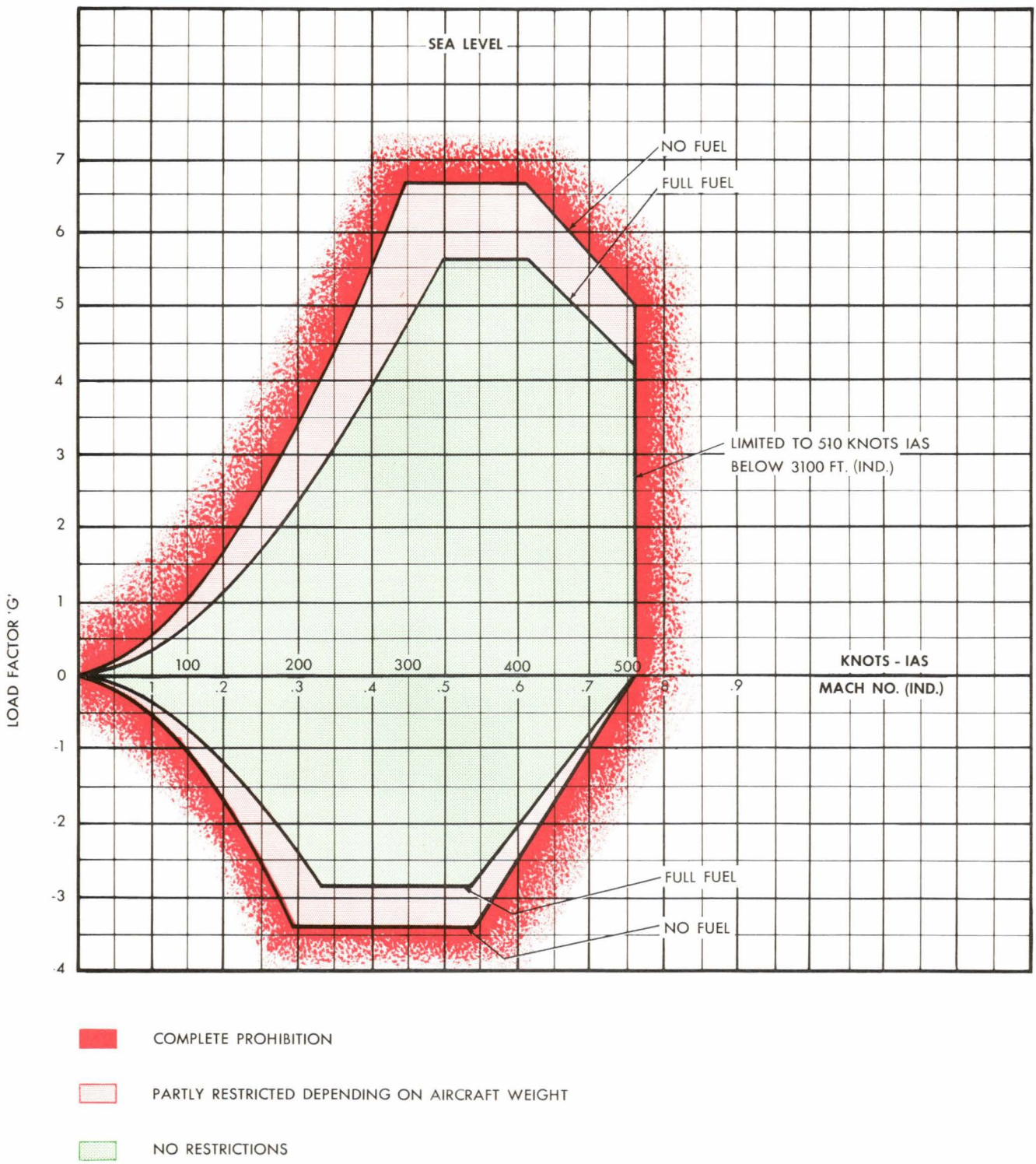


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Fig. 4-2 Flight Manoeuvre Envelope - Sea Level

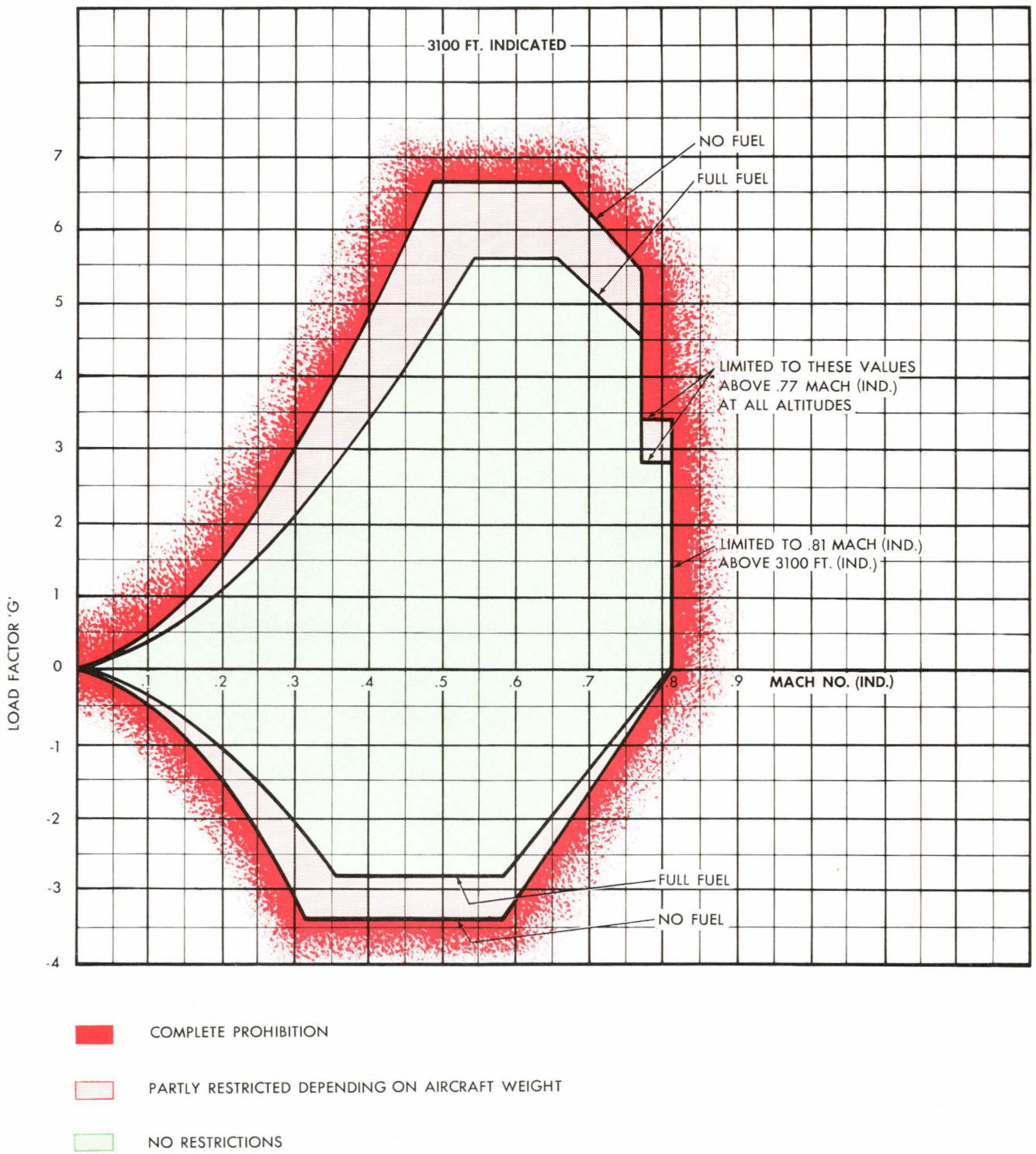

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Fig. 4-3 Flight Manoeuvre Envelope - 3100 Ft (Ind)

AIRSPEED CORRECTION TABLE

AIRCRAFT CANUCK 3D — KNOTS — **ENGINES** ORENDA 8

APPLY CORRECTION TO INDICATED AIRSPEED TO OBTAIN EQUIVALENT AIRSPEED

PRESSURE ALTITUDE FEET	IAS KNOTS									
	150	200	250	300	350	400	450	500	550	600
Sea Level	+2	+3	+4	+5	+6	+7	+9	+11	+15	+23
5,000	+2	+3	+3	+3	+4	+4	+4	+ 6	+12	
10,000	+2	+2	+2	+2	+1	+1	+1	+ 4		
15,000	+1	+1	+1	-1	-1	-3	-2			
20,000	+1	0	-1	-2	-5	-7				
25,000	0	-1	-3	-5	-8	-5				
30,000	0	-2	-4	-8	-9					
35,000	-1	-4	-7	-10						
40,000	-2	-5	-9							

NOTES: 1. These values are a combination of compressibility correction and installation correction.

DATA AS OF: 23-3-53

BASED ON: FLIGHT TEST DATA.

1708-3-F1

Fig. 4-4 Airspeed Correction Table

this must be added to the climb requirements where necessary. Fuel required for an inflight climb from one altitude to another is the difference between the tabulated values for the two altitudes. Time and air distance covered during an in-flight climb may be obtained in a similar manner.

DESCENT CHART

8 The Descent Chart (fig 4-8) provides for an optimum economical descent without flaps or speed brakes and with the engines throttled back to idling rpm.

LANDING CHART

9 Figure 4-9 shows landing distances, both ground run and total to clear a 50 foot obstacle for landings with full flaps and speed brakes closed. A dry hard-surface runway and no wind are the only conditions considered.

COMBAT ALLOWANCE CHART

10 The Combat Allowance Chart (fig 4-5) gives fuel consumption at take-off rpm and maximum cruising rpm at varying altitudes.

FLIGHT OPERATION INSTRUCTION CHARTS

GENERAL

11 The Flight Operation Instruction Charts (fig 4-10) are provided to facilitate flight planning. The charts show the range of the aircraft at maximum range airspeeds, and the procedure to obtain this range. The charts contain columns for each 5000 foot increase in altitude. On the line opposite available fuel in the upper half of the chart, ranges are shown for each initial altitude. In general, two range values are quoted for each altitude and fuel quantity. One is for continued flight at the initial altitude and one is for the maximum range obtainable by climbing to a higher altitude. The charted distances do not include

COMBAT ALLOWANCE CHART

AIRCRAFT CANUCK 3D

ENGINES ORENDA 8

PRESSURE ALTITUDE FEET	FUEL CONSUMPTION GALLONS PER MINUTE	
	Max. Thrust (JPT = 715°C)	93% R.P.M.
45,000	8	-
40,000	11	9
35,000	14	11
30,000	17	13
25,000	20	15
20,000	24	18
15,000	28	21
10,000	32	24
5,000	37	27
Sea Level	42	30

DATA AS OF: August 1955

BASED ON: JP4 Fuel

BASED ON: Flight Test Data

NOTE:

Fuel Consumptions are at Half Fuel Weight and Maximum Level Speed

1707-3F-1

Fig. 4-5 Combat Allowance Chart

fuel consumed and distance covered during warm-up, take-off and initial climb at the start of a flight. However, fuel used and distance covered during let down or during in-flight climb to an optimum altitude are taken into account. No allowances are made for navigational errors, combat, formation flight, landing or other contingencies. Such allowances must be made as required.

12 The lower half of each chart presents operating procedure to obtain the ranges quoted in the upper half. When altitude is changed, operating instructions in the column according to the new altitude must be used if the ranges listed are to be obtained.

13 Under different wind conditions, ranges (in ground miles) are varied by the effect of wind on ground speed. Let down 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 computation under wind conditions, the operating procedure in the lower half of each chart contains instructions for various winds at each altitude listed. Ground miles in a wind are obtained by multiplying chart air miles by the range factor found opposite the effective wind at the cruising altitude. Thus, range factors may be used to determine the best altitude for cruising when there is a known wind difference at different altitudes.

14 Although a wind may be from any direction with respect to the airplane course, it may be expressed as an effective wind. An effective wind has the same effect on the airplane ground speed as if it were a straight head wind or tail wind. In other words, the wind component in the direction of the airplane heading is the effective wind. For example, a 100 knot wind at 30 degrees to the course is an effective head wind of approximately 85 knots. If the airplane true airspeed is 485 knots the true ground speed is approximately 400 knots.

PRE-FLIGHT RANGE PLANNING

15 Select the applicable Flight Operation Instruction Chart. Determine the amount of fuel available for flight planning. Available fuel is equal to the total amount in the airplane before starting the engine, minus the amount needed for warm up, taxi, take-off, initial climb, and necessary reserves. Select a figure in the fuel column equal to, or less than, the amount available for flight planning. Interpolate if desired.

16 To determine maximum range at a given altitude, move horizontally right or left to the desired altitude column. Multiply the range value thus obtained by the correct range factor, and add the distance covered in initial climb

AIRCRAFT CANUCK 3D

TAKE-OFF DISTANCES

FEET

ENGINES ORENDA 8

CONFIGURATION NO EXTERNAL LOAD — **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								
28,000	S.L.	1040	1310	1300	1630	1690	2100	1940	2450	2350	3020	2830	3650
	2,000	1220	1530	1510	1890	1870	2350	2240	2850	2770	3540	3370	4340
	4,000	1430	1790	1790	2240	2190	2750	2630	3350	3290	4230	4000	5190
	6,000	1700	2120	2110	2640	2580	3250	3140	3990	3900	5060	4710	6190
31,000	S.L.	1310	1640	1600	2010	2000	2520	2400	3030	2970	3800	3600	4650
	2,000	1520	1900	1890	2360	2310	2910	2830	3590	3490	4480	4230	5500
	4,000	1800	2240	2230	2790	2740	3460	3330	4240	4160	5380	5030	6590
	6,000	2120	2640	2620	3280	3210	4070	3980	5060	4880	6370	5990	7950
34,000	S.L.	1600	1990	2000	2500	2420	3050	2960	3760	3650	4610	4440	5790
	2,000	1860	2320	2310	2890	2860	3610	3510	4450	4290	5550	5270	6940
	4,000	2210	2750	2720	3410	3370	4270	4120	5250	5110	6550	6260	8360
	6,000	2600	3240	3180	4000	3990	5070	4920	6300	6150	8090	7440	-
37,000	S.L.	1910	2380	2380	2980	2950	3720	3590	4560	4430	5730	5420	7170
	2,000	2270	2830	2760	3470	3450	4370	4230	5390	5270	6870	64[illegible]	8550
	4,000	2650	3310	3300	4140	4080	5190	5030	6460	6250	8270	7620	-
	6,000	3140	3920	3910	4930	4840	6200	6010	7790	7430	-	8960	-
					25° FLAP-MAXIMUM THRUST								
28,000	S.L.	920	1210	1130	1490	1400	1850	1720	2280	2120	2860	2580	3510
	2,000	1070	1400	1320	1740	1680	2230	2030	2700	2500	3380	3020	4180
	4,000	1280	1670	1610	2100	1990	2620	2420	3220	3000	4100	3620	5070
	6,000	1500	1960	1900	2480	2320	3080	2840	3820	3530	4900	4320	6160
31,000	S.L.	1170	1530	1450	1900	1780	2350	2180	2890	2660	3620	3250	4500
	2,000	1370	1780	1700	2220	2080	2740	2540	3400	3150	4330	3840	5440
	4,000	1610	2090	2020	2640	2470	3260	3010	4060	3760	5240	4630	6630
	6,000	1880	2450	2380	3110	2920	3850	3590	4880	4450	6320	5530	8360
34,000	S.L.	1410	1830	1770	2320	2180	2870	2680	3590	3320	4550	4040	5740
	2,000	1680	2180	2090	2730	2580	3430	3150	4270	3890	5450	4790	7030
	4,000	1980	2580	2460	3250	3050	4070	3740	5130	4680	6630	5810	8990
	6,000	2350	3070	2930	3940	3610	4890	4470	6250	5700	8460	6950	-
37,000	S.L.	1720	2230	2150	2820	2650	3520	3230	4330	4010	5640	4980	7300
	2,000	2020	2630	2500	3300	3140	4190	3830	5140	4830	6970	5970	9200
	4,000	2390	3130	3000	3970	3710	5010	4580	6410	5750	8670	7050	-
	6,000	2830	3720	3520	4870	4390	6050	5480	7840	6900	-	-	-

BASED ON: JP4 FUEL
DATA AS OF: August 1955
BASED ON: FLIGHT TEST DATA

NOTE: (1) Speed at Take-Off = 1.15 x Stalling Speed
(2) Speed at 50 Ft. = 1.22 x Stalling Speed

1705-3F-1

Fig. 4-6 Take-off Distance Chart

CLIMB CHART

AIRCRAFT
CANUCK 3D

ENGINES
ORENDA 8

AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD

GROSS WEIGHT
33000 lbs

PRESSURE ALTITUDE FEET	97.5 % R.P.M. IAS KNOTS	APPROXIMATE VALUES FROM SEA LEVEL FUEL GALS.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	400	0	0	0	7500
5,000	375	24	.5	5	6900
10,000	350	46	1.5	10	6300
15,000	325	68	2.5	15	5600
20,000	300	89	3.5	25	4700
25,000	275	113	4.5	30	3900
30,000	250	139	6.0	40	3000
35,000	225	163	8.0	55	2100
40,000	200	200	11.0	75	1100

PRESSURE ALTITUDE FEET	MAXIMUM THRUST (JPT 715°C) IAS KNOTS	APPROXIMATE VALUES FROM SEA LEVEL FUEL GALS.	TIME MIN.	DISTANCE N.M.	RATE OF CLIMB F.P.M.
SEA LEVEL	400	0	0	0	9000
5,000	375	22	.5	5	8200
10,000	350	43	1.0	10	7300
15,000	325	65	2.0	15	6300
20,000	300	86	3.0	20	5400
25,000	275	106	4.0	30	4500
30,000	250	129	5.0	35	3500
35,000	225	154	6.5	50	2500
40,000	200	184	9.5	65	1500

1. Warm up, taxi, take-off and acceleration to climb allowance.	103	6.0	5	

NOTES:

2. Multiply nautical units by 1.15 for conversion to statute units.
3. If 3GP23A (MIL-F-5616, Grade JP1) fuel is used subtract 5% from the above fuel consumption values.

DATA AS OF SEPT. 55

BASED ON: ESTIMATED DATA

BASED ON: 3GP22A (MIL-F-5624A, Grade JP4)

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

1709-3F-1

Fig. 4-7 Climb Chart

DESCENT CHART

AIRCRAFT
CANUCK 3D

ENGINES
ORENDA 8

AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 25000 LB.					PRESSURE ALTITUDE FEET	AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 30000 LB.				
APPROXIMATE VALUES				IAS KNOTS		IAS 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 GALS.				FUEL GALS.	TIME MIN.	DISTANCE N. M.	
2600	70	10.5	30	200	40,000	200	35	11.5	75	2500
2800	60	8.5	27	225	35,000	225	33	9.5	65	2600
3100	45	7.0	25	250	30,000	250	29	7.5	50	2800
3500	35	5.5	22	275	25,000	275	25	6.0	40	3100
4000	25	4.0	18	300	20,000	300	22	4.5	30	3500
4500	20	2.5	15	325	15,000	325	17	3.0	20	3900
5200	10	1.5	9	350	10,000	350	11	2.0	15	4400
6000	5	1.0	5	375	5,000	375	6	1.0	5	5000
6800	0	0	0	400	SEA LEVEL	400	0	0	0	5700

DATA AS OF: Sept 55

BASED ON: ESTIMATED DATA

BASED ON: 3GP22A (MIL-F-5624A, Grade JP-4)

NOTES:
1. If 3GP23A (MIL-F-5616, Grade JP-1) fuel is used, subtract 5% from above fuel consumption values.
2. Idling RPM.
3. Speed Brakes closed.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

1710-3F-1

Fig. 4-8 Descent Chart

to obtain total range with a given wind at altitude. Fly according to the instructions in the lower half of the chart.

17 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 miles to be covered in cruise and descent. Enter the chart as described in para 15. Move horizontally right or left to a range figure which exceeds the calculated air distance to be covered in cruise and descent. Fly according to the instructions for the altitude so obtained.

18 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

19 To use the charts in flight, determine altitude, available fuel, and effective wind. Available fuel is equal to fuel on board minus necessary reserves.

20 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.

21 From the ranges and wind factors listed, determine the altitude at which the flight will be continued. For continued cruising at the present altitude, refer to the instructions

directly below. When changing charts, refer to cruising instructions on the new chart at the altitude of flight.

22 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 JP-4 FUEL AND ORENDA 8 ENGINES

PROBLEM 1

23 To illustrate use of the charts for planning a flight, suppose a Canuck 3D aircraft must be ferried 800 nautical miles without wing tip tanks. For unexpected difficulties a general reserve of 300 Imperial gallons of fuel is considered necessary.

24 The initial known conditions are as follows:

Operational weight empty (i.e. no usable fuel)	23000 pounds
Required Range	800 nautical miles
Fuel capacity	1,295 Imperial gallons
General reserve	300 Imperial gallons
Effective winds	40 knots headwind below 35,000 ft. 80 knots headwind at 40,000 ft.

25 From the Climb Chart (fig 4-7) and the Flight Operation Chart for no external load (fig 4-10) the following data is obtained:

(a)	Cruising altitude, feet	30,000	35,000	40,000
(b)	Fuel capacity, Imperial gallons (para 24)	1,295	1,295	1,295
(c)	Reserve fuel, Imperial gallons (para 24)	300	300	300
(d)	Fuel used for warm up and take-off, Imperial gallons (fig 4-7)	103	103	103
(e)	Fuel used climbing to altitude, Imperial gallons (climbing at 97.5% rpm) (fig 4-7)	139	163	200
(f)	Available fuel for cruise, descent and approach, Imperial gallons b - (c + d + e)	753	729	692
(g)	Cruise and descent air distance, nautical miles (interpolate as necessary)	770	847	839
(h)	Range factor	.90	.90	.80

LANDING DISTANCE

AIRCRAFT CANUCK 3D

FEET

ENGINES ORENDA 8

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	2870	4500	3050	4760	3220	5010	3420	5290
27,000	125	3160	4930	3350	5195	3560	5490	3780	5810
29,500	130	3450	5340	3670	5650	3900	5980	4140	6310
(32,000)	140	3740	5770	3980	6100	4210	6440	4470	6810

DATA AS OF: August 1955

BASED ON: Flight Test

BASED ON: 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 Weight is to assist in Interpolation only.

1706-3F-1

Fig. 4-9 Landing Distance Chart

(j)	Cruise and descent ground distance, nautical miles (g x h)	693	762	671
(k)	Nautical miles covered in initial climb	40	50	75
(m)	Nautical ground miles range (j + k)	773	812	746

26 Therefore the flight should be made at 35,000 feet. The cruising airspeed at 35,000 feet for a 40 knot headwind would be 235 knots IAS. Let down would begin 55 miles from destination.

PROBLEM 2

27 Suppose that during the descent at the end of this theoretical flight, the pilot has reached 5000 feet when he learns that the field is closed and he must use an alternative airport some 200 nautical miles further on. Fuel remaining other than five minutes approach allowance is only the 300 Imp gals planned for general reserve. Reference to the Flight Operation Instruction Chart for no external load shows that with the existing headwind the available range at 5000 feet is only 109 nautical miles (122 x .90). However, by climbing immediately to 40,000 feet (optimum altitude) at 97.5% rpm, a range of 287 nautical miles with zero wind, or 230 (287 x .80) nautical miles with the existing 80 knot headwind can be obtained. Cruise conditions at 40,000 feet will be 215 knots IAS. Let down would begin 55 nautical miles from destination.

28 Since the required range is only 200 nautical miles, the difference between 230 and 200 is the landing reserve, which expressed in time is 5.28 minutes (30 + 340 knots G.S.

1711-3F-1

AIRCRAFT

CANUCK 3 D

ENGINE(S) ORENDA 8 — LOW LOSS SCREENS

LIMITS	TIME LIMIT MIN.	%RPM.	JET PIPE °C TEMP	OIL PRESS. PSI	OIL TEMP. °C	FUEL PRESS. PSI
Take-off and Combat	15	100	720	15-25	70	3-35
Climb	30	97.5	690	15-25	70	3-35
Cruise	None	70-93	645	15-25	70	3-35

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS 33000 OR LESS POUNDS

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. 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 the optimum cruising altitude on each chart; i.e., when changing charts, a climb may be required to obtain a maximum range. All range values include allowances for descent distance and fuel. Climb distance and fuel are included where climbs are indicated.

DATA AS OF 3-3-54 BASED ON ESTIMATED DATA

LOW ALTITUDE

IF YOU ARE AT S.L.			FUEL	IF YOU ARE AT 5,000′			IF YOU ARE AT 10,000′			IF YOU ARE AT 15,000′			FUEL	IF YOU ARE AT 20,000′		
RANGE IN NAUTICAL AIRMILES				RANGE IN NAUTICAL AIRMILES			RANGE IN NAUTICAL AIRMILES			RANGE IN NAUTICAL AIRMILES				RANGE IN NAUTICAL AIRMILES		
BY CRUISING AT S.L.	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	GALLONS	BY CRUISING AT 5,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	BY CRUISING AT 10,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	BY CRUISING AT 15,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	GALLONS	BY CRUISING AT 20,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
435	40	1260	1200	550	40	1270	665	40	1295	790	40	1315	1200	920	40	1325
365	40	1070	1000	450	40	1080	550	40	1100	645	40	1115	1000	760	40	1130
285	40	875	800	360	40	885	430	40	900	515	40	910	800	610	40	930
210	40	650	600	265	40	665	320	40	675	385	40	685	600	445	40	695
135	40	415	400	170	40	425	210	40	435	255	40	445	400	300	40	465
60	40	140	200	75	40	150	95	40	170	125	40	190	200	145	40	205

CRUISING AT S.L. A/C WT. 29,000 LB.					EFFECTIVE WIND	CRUISING AT 5,000′ A/C WT. 29,000 LB.					CRUISING AT 10,000′ A/C WT. 29,000 LB.					CRUISING AT 15,000′ A/C WT. 29,000 LB.					EFFECTIVE WIND	CRUISING AT 20,000′ A/C WT. 29,000 LB.				
	APPROXIMATE MEANS VALUES						APPROXIMATE MEANS VALUES					APPROXIMATE MEANS VALUES					APPROXIMATE MEANS VALUES						APPROXIMATE MEANS VALUES			
I.A.S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DWN DIST.	KNOTS	I.A.S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DWN DIST.	I.A.S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DWN DIST.	I.A.S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DWN DIST.	KNOTS	I.A.S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DWN DIST.
440	1230	330	.70	0	120 HW	410	1010	325	.70	5	380	845	325	.70	10	350	710	320	.70	15	120 HW	320	595	315	.70	20
425	1170	355	.80	0	80 HW	395	950	350	.80	5	370	805	350	.80	10	340	675	350	.80	15	80 HW	315	580	345	.80	20
410	1110	375	.90	0	40 HW	380	905	375	.90	5	360	760	380	.90	10	330	650	375	.90	20	40 HW	310	560	380	.90	25
390	1050	400	1.00	0	0	370	860	400	1.00	5	345	730	405	1.00	10	325	625	405	1.00	20	0	300	540	405	1.00	25
370	990	420	1.10	0	40 TW	355	820	425	1.10	5	330	705	425	1.10	10	315	605	435	1.10	20	40 TW	290	525	435	1.10	25
355	945	440	1.20	0	80 TW	340	785	450	1.20	5	320	675	455	1.20	10	305	585	465	1.20	25	80 TW	280	510	460	1.20	30
340	890	465	1.35	0	120 TW	325	755	470	1.35	5	310	655	480	1.35	10	295	565	490	1.35	25	120 TW	275	495	495	1.35	30

Fig. 4-10 Flight Operation Instruction Chart (Sheet 1 of 2)

1716-3F-1

HIGH ALTITUDE

AIRCRAFT CANUCK 3 D | ENG. ORENDA 8 LOW LOSS SCREENS | CHART WEIGHT LIMITS 33000 LB. OR LESS | EXT. LOAD NONE | NO. OF ENGINES OPERATING: 2

IF YOU ARE AT 25,000′			FUEL	IF YOU ARE AT 30,000′			IF YOU ARE AT 35,000′			IF YOU ARE AT 40,000′			FUEL	IF YOU ARE AT 45,000′		
RANGE IN NAUTICAL AIRMILES				RANGE IN NAUTICAL AIRMILES			RANGE IN NAUTICAL AIRMILES			RANGE IN NAUTICAL AIRMILES				RANGE IN NAUTICAL AIRMILES BY		
BY CRUISING AT 25,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	GALLONS	BY CRUISING AT 30,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	BY CRUISING AT 35,000′	OPT. ALT. 1000 FT.	BY CLIMBING TO & CRUISING AT OPT. ALT.	BY CRUISING AT 40,000′	OPT. ALT. 1000 FT.	BY CRUISING AT OPT. ALT.	GALLONS	BY CRUISING AT 45,000′	OPT. ALT. 1000 FT.	DESCENDING TO & CRUISING AT OPT. ALT.
(RANGE FIGURES INCLUDE ALLOWANCES FOR PRESCRIBED CLIMB, DESCENT TO SEA LEVEL AND FOR 5 MIN. APPROACH TIME)																
1050	40	1345	1200	1220	40	1355	(1350)	(40)	(1375)	(1380)	(40)	(1375)	1200			
885	40	1145	1000	1030	40	1155	1140	40	1170	(1180)	(40)	(1175)	1000			
710	40	940	800	820	40	950	930	40	960	970	40	970	800	930	40	970
530	40	710	600	625	40	730	705	40	735	750	40	750	600	705	40	750
350	40	480	400	410	40	495	465	40	510	505	40	505	400	475	40	505
170	40	220	200	200	40	230	220	40	235	240	40	240	200	240	40	240

CRUISING AT 25,000′ A/C WT. 29,000 LB.					EFFECTIVE WIND	CRUISING AT 30,000′ A/C WT. 29,000 LB.					CRUISING AT 35,000′ A/C WT. 29,000 LB.					CRUISING AT 40,000′ A/C WT. 29,000 LB.					EFFECTIVE WIND	CRUISING AT 45,000′ A/C WT. 29,000 LB.				
	APPROXIMATE MEANS VALUES						APPROXIMATE MEANS VALUES					APPROXIMATE MEANS VALUES					APPROXIMATE MEANS VALUES						APPROXIMATE MEANS VALUES			
I. A. S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DOWN DIST.	KNOTS	I. A. S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DOWN DIST.	I. A. S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DOWN DIST.	I. A. S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DOWN DIST.	KNOTS	I. A. S. KNOTS	GALS. /HR	GND SPEED KNOTS	RANGE FACTOR	LET DOWN DIST.
290	500	310	.70	25	120 HW	260	420	305	.70	35	240	380	295	.70	45	215	365	300	.70	50	120 HW	190	400	300	.70	60
285	485	340	.80	30	80 HW	255	405	340	.80	35	235	365	330	.80	50	215	365	340	.80	55	80 HW	190	400	340	.80	65
280	470	370	.90	30	40 HW	255	405	375	.90	40	235	365	365	.90	55	210	355	375	.90	65	40 HW	190	400	380	.90	75
275	455	405	1.00	35	0	250	390	410	1.00	45	230	350	405	1.00	60	210	355	415	1.00	70	0	190	400	415	1.00	80
270	440	440	1.10	40	40 TW	250	390	445	1.10	50	230	350	440	1.10	65	210	355	450	1.10	75	40 TW	190	400	455	1.10	90
265	430	475	1.20	40	80 TW	245	380	475	1.20	50	230	350	475	1.20	70	205	350	485	1.20	80	80 TW	185	390	490	1.20	95
260	425	505	1.35	45	120 TW	240	370	510	1.35	55	225	340	510	1.35	75	205	350	525	1.30	90	120 TW	185	390	530	1.30	100

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. IF 3GP23A (MIL-F-5616), GRADE JP-1 FUEL IS USED SUBTRACT 5% FROM ABOVE FUEL CONSUMPTION VALUES.

EXAMPLE

If you are at 10,000 feet with 800 gallons of available fuel, you can fly 430 nautical airmiles by holding 345 knots IAS. However, you can fly 900 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 430 × 900 or 720 nautical miles. Cruise at 215 knots IAS with this wind and start letdown 55 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
GALS./HR — FUEL CONSUMPTION — GALLONS PER HOUR
RANGE — NAUTICAL MILES

BASED ON 3GP22A (MIL-F-5624A GRADE JP-4) FUEL

DATA AS OF 3-3-54 | BASED ON ESTIMATED DATA | RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

Fig. 4-10 Flight Operation Instruction Chart (Sheet 2 of 2)

= .088 hour or 5.28 minutes). The corresponding fuel reserve is 32.6 gallons (5.28 minutes at 370 gallons per hour). In other words judging by this sample problem to obtain maximum range from the fuel available, climb immediately to the optimum altitude.

SINGLE ENGINE PERFORMANCE CHARTS

GENERAL

29 A series of charts on the following pages presents performance of the Canuck 3D aircraft operating on one engine only. These charts are based on I.C.A.N. standard atmosphere and are provided for emergency use in flight.

CLIMB CHART

30 This chart (fig 4-11) is similar in form to that 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 single engine operation.

DESCENT CHART

31 This chart (fig 4-12) is similar in form to that for two-engines operating. It shows IAS to be maintained for descent without using flaps or speed brakes and with the operating engine throttled back to idling rpm.

CRUISE PERFORMANCE CHARTS

32 The optimum cruise chart (fig 4-13) in conjunction with cruise performance at 93% rpm chart (fig 4-14) show maximum range that can be obtained with one engine operating. At the time of engine failure the operating engine should be set for either a climb or descent depending on altitude and amount of available fuel. When the cruising altitude shown on the chart is reached a cruise-climb procedure should be carried out at 93% rpm. The range figures given include climb, descent and approach allowance. The cruise performance chart (fig 4-14) is calculated at an aircraft weight of 29,000 pounds. It is a representative average of the optimum cruise chart and shows winds and corresponding range factors.

NOTE

On climb, descent and cruise performance charts, to compensate for variations of individual aircraft the fuel requirements quoted are 5% conservative.

SAMPLE PROBLEMS BASED ON JP-4 FUEL AND ORENDA 8 ENGINE

PROBLEM 1

33 To illustrate use of the charts, suppose an engine failure occurs at 40,000 feet and the fuel remaining is 600 Imperial gallons. There is a 40 knot headwind at 30,000 feet. Maximum range is required for this flight.

34 Since the engine failure occurred above the start of 93% rpm cruising altitude, set the engine to 93% rpm. The aircraft will descend to approximately 32,500 feet (the start of 93% rpm cruising altitude). As fuel is used up and maintaining 93% rpm, the aircraft will climb slowly to approximately 35,000 feet.

	Available fuel for cruise	600 Imperial gallons
	From Charts (Fig 4-11 and 4-12)	
(a)	Cruise and descent air distance	700 nautical miles
(b)	Range factor	.90
(c)	Maximum range (700 x .90)	630 nautical ground miles
(d)	Letdown would begin 67 nautical miles from destination.	

CLIMB CHART

AIRCRAFT
CANUCK 3D
AIRCRAFT CONFIGURATION
NO EXTERNAL LOAD

SINGLE ENGINE

ENGINE
ORENDA 8
GROSS WEIGHT
33,000 lb.

PRESSURE ALTITUDE FEET	97.5% R.P.M. I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL FUEL GALS.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	245	0	0	0	1940
5,000	240	42	2.7	10	1660
10,000	235	87	5.9	25	1400
15,000	230	133	9.8	45	1120
20,000	225	184	14.8	70	850
25,000	220	245	21.9	110	590
30,000	215	-	-	-	-

PRESSURE ALTITUDE FEET	MAX. THRUST (J.P.T. 715°C) I.A.S. KNOTS	APPROXIMATE VALUES FROM SEA LEVEL FUEL GALS.	TIME MIN.	DISTANCE N. M.	RATE OF CLIMB F. P. M.
SEA LEVEL	245	0	0	0	2270
5,000	240	38	2.4	10	1980
10,000	235	77	5.1	20	1690
15,000	230	117	8.4	40	1340
20,000	225	161	12.5	60	1070
25,000	220	211	17.9	90	780
30,000	215	-	-	-	-
Warm up, taxi, take-off and acceleration to climb allowance.(2 engines)		103	6.0	5	

NOTES:
1. Multiply nautical units by 1.15 for conversion to statute units.
2. If 3GP23A (MIL-F-5616, Grade JP1) fuel is used subtract 5% from the above fuel consumption values.

DATA AS OF: SEPT. 1955
BASED ON: ESTIMATED DATA
BASED ON: 3GP22A (MIL-F-5624A, Grade JP4)

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

1713-3F-1

Fig. 4-11 Single Engine Climb Chart

DESCENT CHART
SINGLE ENGINE

AIRCRAFT: CANUCK 3D

ENGINE: ORENDA 8

AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 25,000 LB.					PRESSURE ALTITUDE FEET	AIRCRAFT CONFIGURATION AND GROSS WEIGHT NO EXTERNAL LOAD - 30,000 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 GALS	I. A. S. KNOTS		I. A. S. KNOTS	TO SEA LEVEL FUEL GALS	TO SEA LEVEL TIME MIN.	TO SEA LEVEL DISTANCE N. M.	RATE OF DESCENT F. P. M.
2900	90	18.0	28	205	40,000	205	30	19.5	100	2810
2510	80	16.0	26	210	35,000	210	29	17.5	90	2420
2340	70	14.0	24	215	30,000	215	27	15.5	75	2220
2250	55	12.0	22	220	25,000	220	25	13.0	60	2090
2150	45	9.5	20	225	20,000	225	22	10.5	50	1980
2100	30	7.5	16	230	15,000	230	18	8.0	35	1930
2080	20	5.0	12	235	10,000	235	14	5.5	25	1880
2040	10	2.5	7	240	5,000	240	8	3.0	10	1820
1950	0	0	0	245	S.L.	245	0	0	0	1750

DATA AS OF: SEPT 55

BASED ON: 3GP22A (MIL-F-5624A, Grade JP-4) fuel

BASED ON: ESTIMATED DATA.

NOTES:
1. If 3GP23A (MIL-F-5616, Grade JP-1) fuel is used subtract 5% from the above fuel consumption values.
2. Idling RPM.
3. Speed Brakes closed.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

1712-3F-1

Fig. 4-12 Single Engine Descent Chart

PROBLEM 2

35 Suppose that 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, 100 nautical miles away, must be used. Fuel remaining is 200 Imperial gallons, and there is a 40 knot headwind at 30,000 feet.

36 By climbing immediately at 97.5% rpm to 34,500 feet (the start of 93% cruising altitude) and by cruising at 93% rpm, a range of 155 nautical miles with zero wind can be obtained.

(a) Range factor — .90

(b) Maximum range (155 x .90) — 139.5 nautical ground miles

(c) Letdown would begin 67 nautical miles from destination.

SUMMARY OF SINGLE ENGINE OPERATION

37 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 decreases to 300 feet per minute, and then cruise-climb (at 240 knots IAS) at 93% rpm.

1715-3F-1

AIRCRAFT
CANUCK 3D
NO EXTERNAL LOAD

SINGLE ENGINE PERFORMANCE

OPTIMUM CRUISE

ENGINE
ONE ORENDA 8
GROSS WEIGHT
33,000 POUNDS

FUEL GALLONS	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.
1200	25,000'	1105	24,500'	(1125)	24,000'	(1145)	23,500'	(1160)	23,000'	(1170)
1000	27,000'	935	26,500'	955	26,000'	975	25,500'	990	25,000'	1005
800	29,000'	755	28,500'	775	28,000'	795	27,500'	810	27,000'	825
600	31,000'	565	30,500'	585	30,000'	605	29,500'	620	29,000'	635
400	33,000'	365	32,500'	385	32,000'	405	31,500'	420	31,000'	435
200	30,000' & Descend	135	34,500'	155	34,000'	175	33,500'	195	33,000'	215

FUEL GALLONS	IF YOU ARE AT 25,000' CLIMB AT 97.5% R.P.M. TO 93% R.P.M. CRUISING ALTITUDE		IF YOU ARE AT 30,000' 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 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.	END OF DESCENT OR START OF 93% R.P.M. CRUISING ALTITUDE	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	ALTITUDE TO WHICH THE A/C WILL DESCEND AND START CLIMBING	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.	ALTITUDE TO WHICH THE A/C WILL DESCEND AND START CLIMBING	RANGE IN AIR MILES BY CRUISING AT 93% R.P.M.		
1200	23,000'	(1180)	—	—	—	—	—	—		
1000	25,000'	1020	25,000'	1035	28,000'	1050	30,500'	1070		
800	27,000'	840	27,000'	855	29,500'	870	31,500'	890		
600	29,000'	650	29,000'	665	31,000'	680	32,500'	700		
400	31,000'	450	31,000'	460	32,500'	475	33,500'	495		
200	33,000'	230	33,000'	245	34,000'	260	34,500'	280		

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 35,000 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 3GP22A (MIL-F-5624A, GRADE JP 4) FUEL.

DATA AS OF: 1.5.54.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED

BASED ON: ESTIMATED DATA

Fig. 4-13 Single Engine Optimum Cruise Chart

AIRCRAFT CANUCK 3D
WEIGHT = 29,000 LB.

CRUISE PERFORMANCE
AT 93% R.P.M.

ENGINE
ONE ORENDA 8

EFFECTIVE WIND (KNOTS)	CRUISING AT 93% R.P.M.					
	I.A.S.	APPROXIMATE VALUES				
		% R.P.M.	GALS./HR.	G.S.	RANGE FACTOR	LETDOWN DISTANCE
120 H.W.	245	93	390	265	.70	50
80 H.W.	245	93	390	305	.80	55
40 H.W.	245	93	390	345	.90	65
0	245	93	390	385	1.00	70
40 T.W.	245	93	390	425	1.10	75
80 T.W.	245	93	390	465	1.20	85
120 T.W.	245	93	390	505	1.30	90

1714-3F-1

Fig.4-14 Single Engine Cruise Performance at 93% RPM Chart

(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 (240 knots IAS).

NOTE

In most cases sub-para (a) will apply if an engine relight is attempted, (see problem 2). Sub-para (b) could apply when an engine relight is considered impossible, (see problem 1).

38 At low altitudes greater range is obtained by flying on one engine. The increase obtained by this method decreases as altitude increases 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.

RESTRICTED