EO 05-55A-1

ROYAL CANADIAN AIR FORCE

PILOT'S OPERATING INSTRUCTIONS

HARVARD

(This EO replaces EO 05-55A-1 dated 1 Apr 53, Revised 6 Oct 55)

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1 FEB 57

LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO

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NOTES TO USERS

1 This Publication is divided into four parts:

PART 1: DESCRIPTION - provides a description of the controls and equipment with which the pilot should be acquainted.

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

PART 3: EMERGENCY HANDLING - concerns the handling of the aircraft by the pilot under emergency or abnormal conditions.

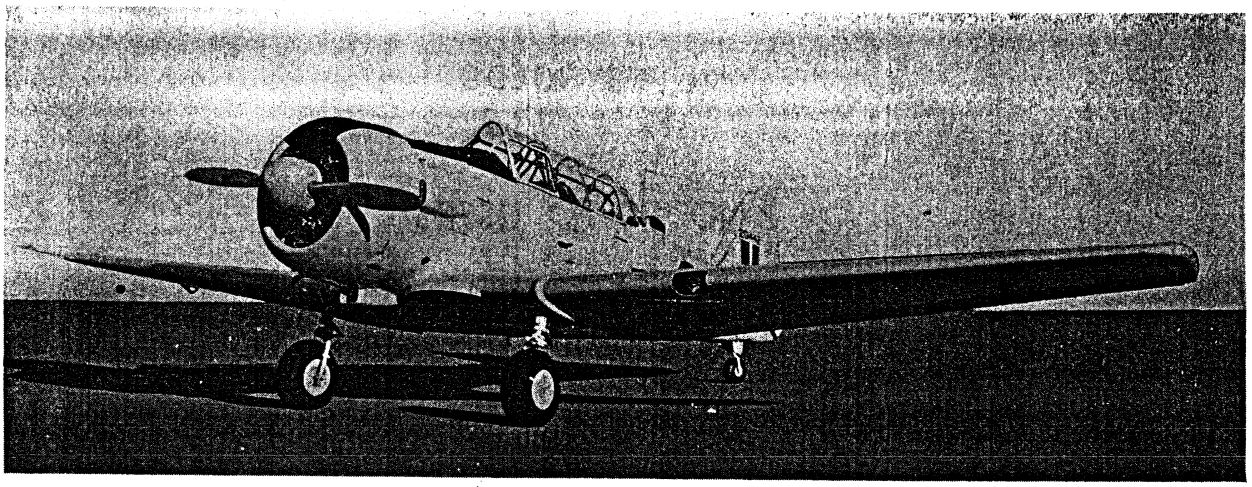
PART 4: OPERATING DATA - deals with flying and engine limitations, and includes information on fuel consumption, range, and endurance under various conditions of flight.

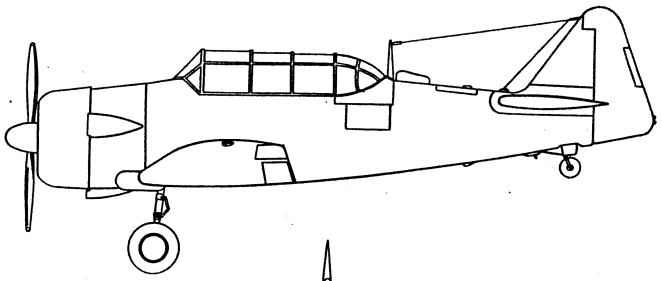
2 These notes are complementary to Pilot's Operating Instructions General, EO 05-1-1, a thorough knowledge of the contents of which is assumed.

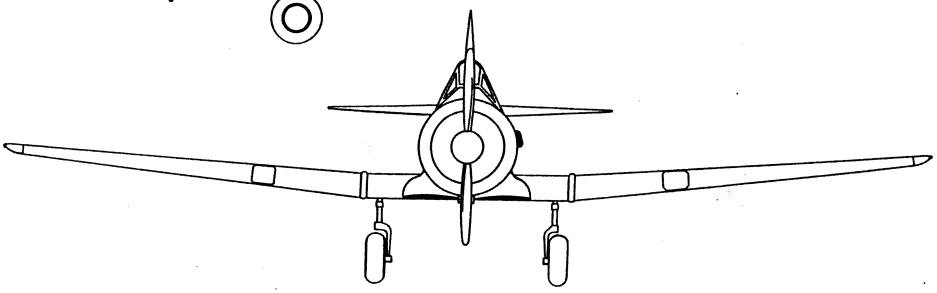
3 Words in capital letters in the text indicate actual markings on the controls concerned.

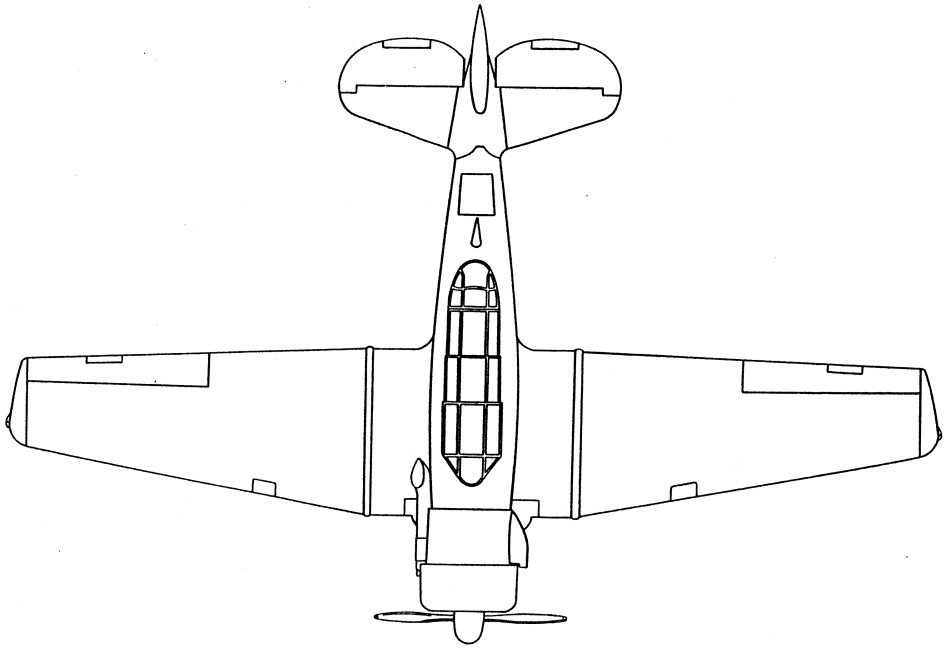
4 A record of Revisions is on page "A". The holder of this book is to ensure that revisions which have been promulgated are incorporated in this book.

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









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PART I
DESCRIPTION

INTRODUCTION

1 General. The Harvard is a single-engine, two seat tandem, low wing monoplane of metal construction with the exception of the fabric-covered control surfaces.
(a) The Harvard 2 is a standard trainer with provision for the installation of machine gun, cine-camera and light series bomb racks.
(b) The Harvard 2A is a fully equipped armament-trainer with the installation of the same equipment plus the addition of RP rails.
(c) The Harvard 4 is a straight trainer with no provision for any form of armament.

2 Airframe. The fuselage is composed of a welded steel tubular frame covered forward with detachable side panels of aluminum alloy. The frame incorporates a pylon between the cockpits to protect the pilot should the aircraft overturn.

3 The hydraulically-operated, inwardly retracting undercarriage is housed in the wing root and beneath the fuselage. The split type trailing edge flaps extend in three sections from aileron to aileron.

4 Engine. The aircraft is powered by a Pratt & Whitney R1340-S3H1 or R1340-AN-1 Wasp air-cooled, nine cylinder, supercharged radial engine, rated at 550 BHP, and having standard aircraft engine-driven accessories.

5 Propeller. The aircraft is equipped with a Hamilton Standard Propeller which has a constant speed range from 11° low pitch (FINE PITCH) to 27° high pitch (POSITIVE COARSE PITCH).

6 Operational Equipment:
(a) Harvard 2. VHF (SCR 522 4-channel), radio compass, intercom., and magnesyn compass.
(b) Harvard 2A. VHF (SCR 522 4-channel), radio compass, intercom., magnesyn compass, four RP rails, two light series bomb carriers capable of holding four 11½ lb. practice bombs each, a .303 Browning machine gun and 250 rounds of ammunition in the starboard wing, a cine-camera gun in the port wing, and a gyro gun-sight in the front cockpit.
(c) Harvard 4. VHF (ICA67 10-channel), radio compass, intercom., and magnesyn compass.

LEADING PARTICULARS

		Har. 2, 2A & 4	Har. 4 (With Aux. Cells)
7	Dimensions.		
(a)	Span	42' - 1/4"	42' - 1/4"
(b)	Length	28' - 11 7/8"	28' - 11 7/8"
(c)	Height (tail down)	9' - 9 2/3"	9' - 9 2/3"
8	Weight.		
(a)	Tare Weight (approx.)	4075 lbs.	4088 lbs.
(b)	Max. permissible wt.	5750 lbs.	5750 lbs.
(c)	Max. permissible wt. aerobatic	5490 lbs.	5490 lbs.
9	Fuel and Oil Tank Capacities.		
(a)	RH Tank (fuel)	42.5 Imp. gals.	42.5 Imp. gals.
(b)	LH Tank (fuel)	42.5 Imp. gals. (Includes 14.5 Imp. gals. reserve)	42.5 Imp. gals.
(c)	RH Fuel Cell (Auxiliary)		12.5 Imp. gals.
(d)	LH Fuel Cell (Auxiliary)		12.5 Imp. gals.
(e)	Total Fuel Capacity	85 Imp. gals.	110 Imp. gals.
(f)	Oil Capacity	8.5 Imp. gals.	8.5 Imp. gals.

FUEL SYSTEM

10 General.

(a) The Harvard 2, 2A and 4 fuel system incorporates two fuel tanks, two fuel gauges, an emergency hand fuel pump, carburettor air temperature indicator, carburettor air-mixing chamber, a fuel pressure warning light, two fuel selector valves, and a priming pump.
(b) Harvard 4 aircraft, number 20318 and subsequent, have a fuel system which incorporates two main fuel tanks, two auxiliary fuel cells, two fuel gauges, an emergency hand fuel pump, carburettor air temperature indicator, carburettor air-mixing chamber, two fuel selector valves, a priming pump and fuel low-quantity warning system.

11 Fuel Tanks.

(a) Harvard 2, 2A & 4. The two fuel tanks are located in the center section of the mainplane and provide a total fuel capacity of 85 Imp. gals. This is normally sufficient for 3.90 hours cruising. Each tank has a total capacity of 42 .5 Imp. gals., and the port tank includes in its total capacity of 42 .5 Imp. gals. a RESERVE of 14.5 Imp. gals. by the incorporation of a standpipe in the tank.
(b) Harvard 4 (With Aux. Cells). The two main fuel tanks are located in the wing center section. Two auxiliary fuel cells are located in the wing outer panels, one in each outer wing root. Each main tank with its interconnected fuel cell has a total capacity of 55 Imp. gals. The combined tanks and cells provide a total fuel capacity of 110 Imp. gals. This is normally sufficient for 5.3 hours cruising. Fuel tank low level warning lights are incorporated in lieu of a reserve system.

12

(a) Harvard 2, 2A & 4. A four-position selector control is located on the left side of each cockpit. The control positions are marked:
OFF, RIGHT ON, LEFT ON,
RESERVE ON.
(b) Harvard 4 (With Aux. Cells). A three-position selector control is located on the left side of each cockpit. The positions are marked:
58 GALS.IMP. 58 GALS.IMP. OFF
LEFT RIGHT

13 Primer.

(a) Harvard 2 & 2A. The engine primer pump is located on the upper starboard corner of the front instrument panel.
(b) Harvard 4. The engine primer pump is located on the auxiliary instrument panel to starboard of the center line.
(c) Operation. The operation of the engine primer pump is identical on all Harvard aircraft. The primer pump is locked by pushing in and turning to starboard. To prime the engine for starting, push in and turn to port; then pump to prime, using the hand fuel pump to obtain pressure.

14 Wobble Pump. The wobble pump, or hand fuel pump, is mounted on the port side of the cockpit between the elevator and rudder trim controls. It is used to supply pressure for priming and starting the engine, and can be used to supply fuel pressure if the engine-driven fuel pump fails.

15 Pressure Gauge.

(a) Harvard 2 & 2A. The fuel pressure gauge is incorporated in the engine combination gauge unit, which is located on the upper starboard side of the main instrument panel. The normal operating pressure is 4-6 psi.
(b) Harvard 4. The fuel pressure gauge is incorporated in the engine combination gauge unit, which is located on the lower starboard side of the main instrument panel. The normal operating pressure is 4-6 psi.

16 Warning Signal.
(a) Harvard 2, 2A & 4. A red fuel pressure warning light is installed on the instrument panel of both cockpits, and indicates when the fuel pressure drops below 2 3/4 psi.
(b) Harvard 4 (With Aux. Cells). Fuel quantity low level warning light assemblies, in place of pressure warning lights, are installed on the instrument panels of both cockpits, and indicate when the fuel level drops to 10-12 Imp. gals. in each main tank.

17 Contents Gauges. Direct reading fuel gauges are located on the front cockpit floor on each side of the seat. The fuel gauges can be seen from either seat, and the fuel gauge lights can be switched on from either cockpit.

OIL SYSTEM

18 Oil Tank. The oil tank is located under the top engine cowling forward of the fireproof bulkhead.

19 Oil Temperature and Pressure Gauge.

(a) The Harvard 2 & 2A oil temperature and pressure gauges are incorporated in the engine combination gauge unit on the upper starboard side of the instrument panel.

(b) The Harvard 4 oil temperature and pressure gauges are incorporated in the engine combination gauge unit on the lower starboard side of the instrument panel.

20 Oil Cooler Shutters. Oil temperature is maintained by the pilot by regulating the position of the oil cooler shutter. In the Harvard 2 or 2A, the control for the shutter is located at the bottom center of the front cockpit. In the Harvard 4, the control is located in the front cockpit to port of the center line of the auxiliary instrument panel.

21 Oil Dilution System.

(a) Harvard 2 & 2A. The oil dilution switch is located on the electrical panel in the front cockpit.

(b) Harvard 4. The oil dilution switch is mounted on the console on the starboard side of the front cockpit.

(c) Operation. The operation is the same on all Harvard aircraft.

HYDRAULIC SYSTEM

22 General.

(a) Harvard 2 & 2A. The hydraulic system operates the retractable undercarriage and wing flaps. It includes an engine-driven pump, an emergency hand-pump, a hydraulic power control, a pressure gauge and selector controls for the undercarriage and flaps.

(b) Harvard 4. The installation on this aircraft is similar to that on the Harvard 2 & 2A except that the hydraulic power control is not operated by a separate manual control. It is linked mechanically to the selector control, so that power is supplied automatically when the service is selected.

23 Engine-driven Pump.

(a) Harvard 2 & 2A. The engine-driven hydraulic pump supplies the pressure for the hydraulic system, which normally operates between 750 and 1000 psi.

(b) Harvard 4. The engine driven hydraulic pumps supplies the pressure for the hydraulic system which operates normally through a range of 800 to 1000 psi.

24 Hand Pump. A hand-pump is installed in the front cockpit only, and provides pressure in the event of failure of the engine-driven pump.

25 Pressure Gauge.

(a) Harvard 2 & 2A. The hydraulic pressure gauge is mounted on the port side of the front cockpit and shows the output hydraulic pressure delivered to the hydraulic system lines from the engine-driven pump, or the hydraulic hand-pump if used. The hydraulic pressure gauge will not show pressure until after the power control has been pushed or the hand-pump has been used. The pressure gauge should return to zero after approximately two minutes. If the pressure gauge does not show pressure or, after showing pressure, does not return to zero within the normal time, the system should be inspected.

(b) Harvard 4. The hydraulic pressure gauge is mounted on the lower port side of the instrument panel. The hydraulic pressure gauge will not show pressure until a service has been selected, except in the flap LOCK position.

26 Power Control.

(a) Harvard 2 & 2A. The pilot-operated hydraulic power control governs flow to the selected service (i.e., flaps or undercarriage). The power control handles are located on the port side of the front cockpit, aft of the undercarriage lever, and on the port side of the rear cockpit forward of the trim tab control. The control is marked PUSH. The control should be operated after making the undercarriage selection, and may be operated before or after making the flap selection. It is not

OIL SYSTEM.

18 Oil Tank. The oil tank is located under the top engine cowling forward of the fireproof bulkhead.

19 Oil Temperature and Pressure Gauge.

(a) The Harvard 2 & 2A oil temperature and pressure gauges are incorporated in the engine combination gauge unit on the upper starboard side of the instrument panel.
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(b) Harvard 4. The engine-driven hydraulic pump supplies the pressure for the hydraulic system, which normally operates at ~~1000 psi~~ through a range of 800-1000 psi.

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necessary to hold the power control in the engaged position, as it will normally disengage after two minutes.

(b) Harvard 4. Hydraulic power control is mechanically linked to the flap and undercarriage selectors, so that power is automatically applied to the desired service simultaneously with the selection of the service.

NOTE

In the flap LOCK position, pressure will be maintained in the system to hold the flaps in the selected position.

ELECTRICAL SYSTEM

27 General

(a) Harvard 2 & 2A. The electrical system, a direct current, 12-volt system incorporating single wiring, is composed of battery, generator, relays, voltage regulator, ignition booster coil, rheostats and fuse panels. A 50-ampere generator charges a 12-volt, 68 ampere-hour battery that supplies the following services:

(1) Engine starter and booster coil.
(2) Cockpit, flight and engine instrument lights.
(3) Undercarriage warning horn and position lights.
(4) Landing and navigation lights.
(5) Fuel gauge lights.
(6) Identification lights.
(7) Pitot head heater.
(8) Radios.
(9) Magnesyn compass.
(10) All armament equipment.

(b) Harvard 4. The electrical system is a direct current, 24-volt system incorporating single wiring, except where two-conductor circuits are necessary to prevent deflection of the magnetic compass. The system is composed of battery, generator, relays, voltage regulator, ignition induction vibrator, rheostats and circuit breakers. A 50-ampere generator charges a 24-volt, 34 ampere-hour battery that supplies the following services:

(1) Engine starter and induction vibrator.
(2) Ultra-violet rheostat controlled instrument lights and cockpit console lights.
(3) Down-lock position lights and undercarriage warning horn.
(4) Landing and navigation lights.
(5) Fuel gauge lights.
(6) Identification lights.
(7) Pitot head heater.
(8) Radios.
(9) Magnesyn compass.
(10) Fuel low-level warning lights.
(11) Gyro solenoid lights.

28 Ignition System

(a) Harvard 2 & 2A. The ignition switch is located on the port side of each cockpit next to the instrument panel. The ignition switch must be in the on position before the starter, fuel pressure warning or outside air temperature indicator will function. The starter will neither energize nor engage until the ignition switch is on. The ignition switch has four positions: OFF, LEFT, RIGHT and BOTH.

(b) Harvard 4. The ignition switch is located on the port side of the panel in both front and rear cockpits. No other services pass through this circuit, but the circuit is controlled by a battery master switch, which is located in the front cockpit console. Unlike the Harvard 2 & 2A, it is possible to energize and engage the starter if only the master switch is turned on.

29 Starting System

General. An inertia starter is provided for starting the engine, which may be energized electrically or by hand crank.

(a) Harvard 2 & 2A. The starter pedal is located on the floor between the rudder pedals in the front cockpit. Pressure on the heel portion of the starter pedal will energize the inertia flywheel of the starter. When the starter is engaged, by pressing on the toe portion of the pedal, current is cut off from the energizer and the starter is dependent on the momentum it has achieved to turn the engine.

(b) Harvard 4. This starter is a combination electric inertia and direct cranking type. The starter toggle switch is located on the electrical console in the front cockpit. The starter is energized by placing and holding the toggle in the ~~OFF~~ AFT position; energized and engaged in the forward position. Thus the starter is energized throughout the cranking operation.

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cessary to hold the power control in the engaged position, as it will normally disengage ter two minutes.

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NOTE

In the flap LOCK position, pressure will be maintained in the system to hold the flaps in the selected position.

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) Undercarriage warning horn and position lights.
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(b) Harvard 4. This starter is a combination electric inertia and direct cranking type. The starter toggle switch is located on the electrical console in the front cockpit. The starter is energized by placing and holding the toggle in the AFT position; energized and engaged in the forward position. Thus the starter is energized throughout the cranking operation.

30 Location of Main Switches

(a) Harvard 2 and 2A. All switches and rheostats for the operation of the general electrical equipment are mounted on shielded panels on the lower port side of the instrument panel in each cockpit. In the front cockpit, the electrical panel includes an ammeter and a generator main line switch which is normally left in the "on" position. The rear cockpit panel carries only the rear cockpit lighting, fuel gauges, switches and rheostats.

(b) Harvard 4. On this aircraft all switches and rheostats are located on the console, on the starboard side of the cockpit, with the exception of the ultra-violet instrument lights, which have built-in rheostats, and the landing lights and horn cut-off switches, which are located on a panel below and at the port side of the instrument panel.

(c) Harvard 2, 2A and 4. The ammeter shows the generator output, and the reading varies with the number of electrical services in use. The ammeter may read as low as 5 amperes if the battery is fully charged, and no services are being used, or as high as 50 amperes with all electrical services "on".

WARNING

Operation in excess of 50 amps will overload the system. If the battery is low and numerous services are being used, the ammeter will exceed 50 amps. In this case switch "off" some of the services (e.g. radio compass, radio), if expedient, to allow the battery to become more fully charged.

31 Armament Switches (Harvard 2A Only). On this aircraft the selector switches for gun, camera, gyro gun-sight, RP, bomb master switch and armament master switch are located in the switch box on the lower port side of the front instrument panel. The bomb selector switches and jettison switch are located in three small boxes on the starboard side of the lower panel. The camera over-run switch is located on the lower panel to starboard of center.

32 Location of Bulbs and Fuses.

(a) Harvard 2 & 2A. Spare bulbs are located in a box mounted on the aft bulkhead of the baggage compartment. Spare fuses for lighting circuits are located in the light distribution box in the front cockpit and in the switch box in the rear cockpit.

(b) Harvard 4. A spare bulb box holding one spare lamp for every three lamps or fraction thereof is located on the rear of the control shelf in the front cockpit. No spare fuses are carried as this aircraft is equipped with circuit breakers in place of fuses.

33 External Power Supply Sockets.

(a) Harvard 2 & 2A. An external electrical power supply socket is fitted to the port side of the fuselage level with the rear cockpit pilot's seat. Access to the socket is gained through a hinged door. The socket requires a two prong external power supply plug. The spring loaded cover of the socket must be given a half turn to allow insertion of the plug. This disconnects the internal power supply while the external source is in use. The external power supply switch, located in the front cockpit switch box cover, must be in the ON position for external power source and in the OFF position for internal source.

(b) Harvard 4. An external electr power supply plug is located similar to that on the Harvard 2 & 2A. The plug requires a three hole external power supply socket. The socket is engaged directly without turning and must be pressed in to the limit of its travel before power is supplied. When external power is supplied the battery master switch should be OFF.

BRAKE SYSTEM

34 Wheel Brakes. The hydraulically-operated brakes are controlled by toe pressure on the rudder pedals and may be applied from either cockpit.

35 Parking Brake.

(a) Harvard 2 & 2A. The brakes may be locked on for parking by applying toe pressure on the rudder pedals and pulling out the parking brake knob mounted on the starboard side of the instrument panel in the front cockpit. To release the parking brake, press on the toe brakes from either cockpit, and the parking brake will automatically release.

(b) Harvard 4. Parking brake operation is identical with that of the Harvard 2 & 2A except that the parking brake knob is located below the instrument panel in the front cockpit.

30 Location of Main Switches.

(a) Harvard 2 & 2A. All switches and rheostats for the operation of the general electrical equipment are mounted on shielded panels on the lower port side of the instrument panel in each cockpit. In the front cockpit, the electrical panel includes an ammeter and a generator main line switch which is normally left in the ON position. The ammeter shows the generator output, and the reading varies with the number of electrical services in use. The ammeter may read as low as 5 amperes if the battery is fully charged, and no services are being used, or as high as 50 amperes with all electrical services ON. The rear cockpit panel carries only the rear cockpit lighting, fuel gauges, switches and rheostats.

WARNING

Operation in excess of 50 amps will overload the system. If the battery is low and numerous services are being used, the ammeter will exceed 50 amps. In this case switch OFF some of the services (e.g., radio compass, radio), if expedient, to allow the battery to become more fully charged.

(b) Harvard 4. On this aircraft all switches and rheostats are located on the console, on the starboard side of the cockpit, with the exception of the ultra-violet instrument lights, which have built-in rheostats, and the landing gear and horn cut-off switches, which are located on a panel below and at the port side of the instrument panel.

31 Armament Switches (Harvard 2A Only). On this aircraft the selector switches for gun, camera, gyro gun-sight, RP, bomb master switch and armament master switch are located in the switch box on the lower port side of the front instrument panel. The bomb selector switches and jettison switch are located in three small boxes on the starboard side of the lower panel. The camera over-run switch is located on the lower panel to starboard of center.

32 Location of Bulbs and Fuses.

(a) Harvard 2 & 2A. Spare bulbs are located in a box mounted on the aft bulkhead of the baggage compartment. Spare fuses for lighting circuits are located in the light distribution box in the front cockpit and in the switch box in the rear cockpit.

(b) Harvard 4. A spare bulb box holding one spare lamp for every three lamps or fraction thereof is located on the rear of the control shelf in the front cockpit. No spare fuses are carried as this aircraft is equipped with circuit breakers in place of fuses.

33 External Power Supply Sockets.

(a) Harvard 2 & 2A. An external electrical power supply socket is fitted to the port side of the fuselage level with the rear cockpit pilot's seat. Access to the socket is gained through a hinged door. The socket requires a two prong external power supply plug. The spring loaded cover of the socket must be given a half turn to allow insertion of the plug. This disconnects the internal power supply while the external source is in use. The external power supply switch, located in the front cockpit switch box cover, must be in the ON position for external power source and in the OFF position for internal source.

(b) Harvard 4. An external electrical power supply plug is located similar to that on the Harvard 2 & 2A. The plug requires a three hole external power supply socket. The socket is engaged directly without turning and must be pressed in to the limit of its travel before power is supplied. When external power is supplied the battery master switch should be OFF.

BRAKE SYSTEM

34 Wheel Brakes. The hydraulically - operated brakes are controlled by toe pressure on the rudder pedals and may be applied from either cockpit.

35 Parking Brake.

(a) Harvard 2 & 2A. The brakes may be locked on for parking by applying toe pressure on the rudder pedals and pulling out the parking brake knob mounted on the starboard side of the instrument panel in the front cockpit. To release the parking brake, press on the toe brakes from either cockpit, and the parking brake will automatically release.

(b) Harvard 4. Parking brake operation is identical with that of the Harvard 2 & 2A except that the parking brake knob is located below the instrument panel in the front cockpit.

VACUUM SYSTEM

36 General.

(a) Harvard 2 & 2A. The gyro-controlled instruments are operated by an engine-driven vacuum pump. A suction gauge is installed on each instrument panel and should normally read between 4.25″ and 4.75″ of mercury.
(b) Harvard 4. The installation is similar to that on the Harvard 2 & 2A, with the addition of a switch on the front console operating a vacuum control valve which stops vacuum to the directional gyro and gyro horizon in the rear cockpit only. This switch is used when engaging in aerobatics. An amber light in the top starboard side of both panels indicates, when lit, that the rear cockpit vacuum instruments are isolated.

FLYING CONTROLS

37 General. The flying controls are of the conventional type for single-engine aircraft with control column and rudder pedals. Standard installation is with dual controls, with a removable control column in the rear cockpit. The rudder pedals are adjustable for reach by means of triggers on the pedals, which are released by the foot.

38 Trim Tab Controls. The rudder trim tab and elevator trim tab controls are located on the port side of the cockpit. They are duplicated in the rear cockpit. The ailerons have booster tabs which can be adjusted only on the ground.

39 Control Locking Gear. The handle for locking and unlocking the control surfaces is located on the floor slightly forward and to port of the control column in the front cockpit. The controls can be locked in one position only: that is, the rudder pedals neutral with the control column centralized laterally and full forward.

40 Flap Selector Lever.

(a) Harvard 2 & 2A. The wing flaps are hydraulically controlled by a three-position (UP, LOCK, DOWN) flap lever which is mounted on the lower port side of each cockpit just inboard of the undercarriage selector lever. The flap position indicator, calibrated in degrees, is located on the port side of each cockpit forward of the trim tab control wheels.
(b) Harvard 4. The flap selector lever in the front cockpit is mounted aft of the undercarriage selector lever and automatically applies the required hydraulic power when moved. In the front cockpit, the flap position indicator is located in a box on the port side below the instrument panel. It is calibrated in degrees. In the rear cockpit, the flap selector lever and flap position indicator are located as in the Harvard 2 & 2A.

41 Undercarriage Selector Lever.

(a) Harvard 2 & 2A. The undercarriage selector lever (marked LAND. GEAR) is located on the lower port side of each cockpit. It has three positions, UP, DOWN and EMERGENCY. The undercarriage lever in the front cockpit has a safety catch which prevents accidental moving of the lever from the DOWN position. Because of the safety catch, the undercarriage lever, in the front cockpit, must be moved inward before it can be moved to the UP position. This also prevents raising of the undercarriage from the rear cockpit, but it may be lowered from both cockpits.
(b) Harvard 4. The installation on this aircraft is similar to that on the Harvard 2 & 2A except that there is no EMERGENCY device which, on the earlier models of aircraft, advances the locking pins mechanically in the event of hydraulic failure.

42 Undercarriage Lights and Warning Horn.

(a) Harvard 2 & 2A. The undercarriage warning system consists of red and green indicator lights, a throttle position warning horn and visual undercarriage position indicators. An accurate indication of the locking of the undercarriage in the down position is given by the green indicator lights which are controlled by both the oleo legs and the down-lock pins. The red indicator lights are on at all times with an UP selection and will remain on until the oleo legs are fully lowered and the down-lock pins fully extended. The undercarriage down-lock pins can be observed from the front cockpit through two perspex windows mounted in the wings. The undercarriage warning horn incorporates a manual cut-out button on the electrical panel.

(b) Harvard 4. The undercarriage signal system consists of a warning horn, green down-lock indicator lights, and a mechanical position indicator. The warning horn is mounted in the nose-over structure of the fuselage frame. In the front cockpit, the down-lock indicator lights, mechanical indicators and warning horn cut-out switch are mounted on a box on the lower port side of the instrument panel. In the rear cockpit, the layout is identical with that on the Harvard 2 & 2A except that there are two green down-lock indicator lights, mounted on the fuselage structure below the port side of the instrument panel. As in the Harvard 2 & 2A, the undercarriage can be lowered but not raised from the rear cockpit.

43 Tail Wheel Control - The Harvard 2, 2A and 4 tail wheel is interconnected with the rudder pedals and is steerable through 30° when taxiing.
(a) The Harvard 2 and 2A, modified to EO 05-55A-6B/14, and the Harvard 4 have a de-clutching device incorporated. This is actuated by centralizing the rudder and pushing the control column fully forward. The tail wheel will then be free to rotate through 360 degrees.

ENGINE CONTROLS

44 Throttle Control. This is of the conventional type mounted on the port side of the cockpit just below the sliding hood.
(a) Harvard 2 & 2A. The throttle includes a push-to-speak button and a twist-grip (not connected in the Harvard 2) for operating the gyro gun-sight.
(b) Harvard 4. Similar to the Harvard 2 & 2A except that the twist-grip for the gyro gun-sight is not fitted.

45 Mixture Control. The mixture control is mounted on the throttle quadrant with the throttle control. It is manually operated with the RICH setting in the fully backward position and the LEAN setting in the fully forward position. The LEAN setting incorporates a slow running cut-out device for shutting down the engine. Intermediate settings are used for leaning-out the mixture in flight.

46 Carburettor Air Temperature Control.
(a) Harvard 2 & 2A. The carburettor air temperature control is located in the front cockpit just below the electrical panel. It moves in a notched quadrant and may be set for any desired temperature. It is not duplicated in the rear cockpit.

(b) Harvard 4. The operation of the carburettor air temperature control is similar to that on the Harvard 2 & 2A except that the control is located on the shelf on the port side.

47 Propeller Speed Control. The propeller speed control is located in the throttle quadrant in each cockpit. When the control is full aft, it is in the POSITIVE COARSE PITCH position. In all other positions the propeller is under constant speed control. The constant speed range is from approximately 2250 rpm (FINE PITCH) to 1400 rpm.

48 Throttle Quadrant Friction Nut. A small knurled wheel, mounted on the inboard side of the forward cockpit engine control quadrant, imposes a frictional load on the controls as desired, by rotating the wheels to prevent slipping of the engine controls.

FLIGHT AND ENGINE INSTRUMENTS

49 General. The front and rear instrument panels are divided into two groups as follows:
(a) Flight Instruments: air speed indicator, sensitive altimeter, rate of climb indicator, turn and bank indicator, directional gyro, artificial horizon. The directional gyro and artificial horizon can be locked by means of caging knobs.
(b) Engine Instruments: manifold pressure gauge, tachometer, cylinder head temperature gauge, carburettor air temperature gauge, engine combination gauge unit (oil temperature and pressure gauges and fuel pressure gauge), outside air temperature gauge and vacuum gauge. The manifold pressure gauge drain cock is on the left side of the front cockpit, forward of the throttle quadrant.

LIGHTING SYSTEM

50 Interior.
(a) Harvard 2 & 2A. Lighting in the aircraft is divided into three groups; flight instrument lights, engine instrument lights, and cockpit lights. Rheostats for these lighting groups are located on the electrical panel in each cockpit.
(b) Harvard 4. Lighting arrangement in this aircraft consists of two groups. Cockpits and instruments are lighted by two ultra-violet movable lamps which have built-in rheostats.

They are mounted on either side of the coaming. The console and the shelf are lighted by independent red or white lights.

51 Exterior. Outside lighting is divided into three groups.
(a) Identification Lights. Both upward and downward identification lights are provided. A combination three-position switch and Morse key is located on the starboard side of the front cockpit.
(b) Navigation Lights.
(1) Harvard 2 & 2A. The switch for standard navigation lights is located on the electrical panel in the front cockpit.
(2) Harvard 4. This aircraft carries standard navigation lights similar to the Harvard 2 & 2A. All navigation lights operate on a flasher device, and a dimmer switch is incorporated in the system.
(c) Landing Lights.
(1) Harvard 2 & 2A. The switches for the two landing lights are mounted on the main panel.
(2) Harvard 4. In addition to the two landing lights, a passing light is incorporated in the port landing light assembly. The landing lights switches are in the front cockpit on the sub-panel, above the flap position indicator, and the passing light switch is on the right console in the front cockpit. There are two lights on the underside of the leading edge of the wing center section which are actuated automatically at all times by the undercarriage position indicator, to indicate to ground observers during night landings that the undercarriage is fully down and locked.

HEATING AND VENTILATION SYSTEM

52 Cold Air. Cold air ventilation is controlled by a valve located on the floor in the front cockpit between the rudder pedals. The cold air valve is operated by rotating the notched wheel with the foot, which opens or closes the valve. For added ventilation the sliding canopy may be locked open at any of its intermediate positions. In addition, a small air scoop is located in the rear cockpit in the port side of the fuselage. It is operated by a push-pull handle attached to the inside of the scoop.

53 Heating System. Heating of both cockpits (as well as the fixed gun compartment in the Harvard 2 & 2A) is controlled by a heat control lever mounted on the starboard side of the front cockpit beside the pilot's seat. Excessive (strenuous) forcing of the heater control lever into the OFF position should be avoided. Repeated slamming of the lever can result in damage to the diagonal truss member of the fuselage frame.

DE-ICING EQUIPMENT

54 Windshield Defroster. The cockpit heat control also provides air for defrosting the windshield.

55 Pitot Head Heater Switch
(a) Harvard 2 & 2A. The pitot head heater switch is located in the front cockpit electrical panel.
(b) Harvard 4. The pitot head heater switch is on the console in the front cockpit.

ARMAMENT EQUIPMENT (Harvard 2A Only).

56 Armament Selector Panel. The armament selector panel forms the port side of the main electrical panel in the front cockpit. It accommodates the following switches: gun selector switch, bomb selector switch, camera gun selector switch, rocket master switch, RP single and salvo selector switch, and the armament master switch. A rheostat for the gyro gun-sight is located on the rear of the port sideshelf in the front cockpit.

57 Gyro Gun-Sight. A gyro gun-sight MK 4E is fitted to the top of the coaming in the front cockpit. The unit is complete except for the rheostat, which is fitted on the shelf (see paragraph 56).

58 Browning .303 Machine Gun. A Browning .303 machine gun is installed in the starboard outer wing section. Provision is made to carry approximately 250 rounds of ammunition. The gun selector switch is on the armament selector panel, and the firing button is mounted on the control column in the front cockpit. The gun is operated electrically. Empty rounds are jettisoned through the ejector chute.

59. Camera Gun. A 16 mm GSAP camera gun is fitted in the port wing of the aircraft. The camera operates whenever the camera selector switch is ON and the control column firing button is pressed.

They are mounted on either side of the coaming. The console and the shelf are lighted by independent red or white lights.

51 Exterior. Outside lighting is divided into three groups.

(a) Identification Lights. Both upward and downward identification lights are provided. A combination three-position switch and Morse key is located on the starboard side of the front cockpit.

(b) Navigation Lights.

(1) Harvard 2 & 2A. The switch for standard navigation lights is located on the electrical panel in the front cockpit.

(2) Harvard 4. This aircraft carries standard navigation lights similar to the Harvard 2 & 2A. All navigation lights operate on a flasher device, and a dimmer switch is incorporated in the system.

(c) Landing Lights.

(1) Harvard 2 & 2A. The switches for the two landing lights are mounted on the main panel.

(2) Harvard Mk.4. Two landing lights are controlled by two switches located in the front cockpit on the panel above the flap position indicator. There are two lights on the underside of the leading edge of the wing center section which are actuated automatically [redacted] to indicate to ground observers during night landing that the undercarriage is fully down and locked.

HEATING AND VENTILATION SYSTEM

52 Cold Air. Cold air ventilation is controlled by a valve located on the floor in the front cockpit between the rudder pedals. The cold air valve is operated by rotating the notched wheel with the foot, which opens or closes the valve. For added ventilation the sliding canopy may be locked open at any of its intermediate positions. In addition, a small air scoop is located in the rear cockpit in the port side of the fuselage. It is operated by a push-pull handle attached to the inside of the scoop.

53 Heating System. Heating of both cockpits (as well as the fixed gun compartment in the Harvard 2 & 2A) is controlled by a heat control lever mounted on the starboard side of the front cockpit beside the pilot's seat. Excessive (strenuous) forcing of the heater control lever into the OFF position should be avoided. Repeated slamming of the lever can result in damage to the diagonal truss member of the fuselage frame.

DE-ICING EQUIPMENT

54 Windshield Defroster. The cockpit heat control also provides air for defrosting the windshield.

55 Pitot Head Heater Switch.

(a) Harvard 2 & 2A. The pitot head heater switch is located in the front cockpit electrical panel.

(b) Harvard 4. The pitot head heater switch is on the console in the front cockpit.

ARMAMENT EQUIPMENT (Harvard 2A Only).

56 Armament Selector Panel. The armament selector panel forms the port side of the main electrical panel in the front cockpit. It accommodates the following switches; gun selector switch, bomb selector switch, camera gun selector switch, rocket master switch, RP single and salvo selector switch, and the armament master switch. A rheostat for the gyro gun-sight is located on the rear of the port sideshelf in the front cockpit.

57 Gyro Gun-Sight. A gyro gun-sight MK 4E is fitted to the top of the coaming in the front cockpit. The unit is complete except for the rheostat, which is fitted on the shelf (see paragraph 56).

58 Browning .303 Machine Gun. A Browning .303 machine gun is installed in the starboard outer wing section. Provision is made to carry approximately 250 rounds of ammunition. The gun selector switch is on the armament selector panel, and the firing button is mounted on the control column in the front cockpit. The gun is operated electrically. Empty rounds are jettisoned through the ejector chute.

60 The camera gun is fitted with an over-run control to enable the camera to continue operating after releasing the firing button. The switch for operating the control is on the over-run unit on the starboard side of the main instrument panel.

61 RP Projector. A four beam (two beams per wing) rocket projector installation, to accommodate either MK 1 or MK 3A beams, is fitted on the aircraft. The installation is wired to permit single or salvo firing of the rockets. The RP single and salvo selector and rocket master switches on the armament selector panel must be ON before the rockets can be fired by pressing the control button.

62 There is an RP auto selector switch on the port side of the cockpit under the front side coaming. It should be set to "1" before commencing to fire, otherwise the rockets will not fire in order.

63 Light Series Bomb Carrier. There are two four-bomb light series bomb carriers, one suspended from each wing inboard of the rocket installations. The bomb selector switch is on the armament control panel, and the single and salvo bomb selector switches are on the starboard side of the instrument panel, with the bomb jettison switch.

COMMUNICATIONS EQUIPMENT

64 General. All aircraft are fitted with the following communications equipment, located as described below: Intercommunications, Radio Compass, VHF.

65 Intercommunications.

(a) Harvard 2 & 2A. For pilot-to-pilot communication, an intercommunications jackbox is installed on the starboard side of each cockpit. The operating switch is located immediately aft of the front pilot's jackbox.
(b) Harvard 4. All audio controls are mounted on the consoles, and the intercom. amplifier switch is located on the rear console only.

66 Radio Master Switch.

(a) Harvard 2 & 2A. A radio master switch is mounted at the bottom center of the front pilot's instrument panel. This switch must be in the ON position before any of the communications equipment can be operated.
(b) Harvard 4. The radio master switch is located in the front console. This switch must be in the ON position before any of the communications equipment will operate.

67 Radio Compass

(a) Harvard 2 & 2A. The radio compass MN 31 consists of the following: a control box, two radio compass indicators, a radio compass loop installed on top of the fuselage aft of the rear cockpit, a loop dehydrator in the baggage compartment and a receiver mounted under the rear cockpit seat. The control box is located immediately forward of the front pilot's jackbox. The indicator is mounted on the lower portion of the instrument panel.
(b) Harvard 4. This aircraft is fitted with an AN/ARN6 radio compass incorporating two radio compass indicators ID91A. The dehydrator is built into the loop. A control box C149 is built into both front and rear consoles.

68 VHF RW 5 FEB 63

(a) Harvard 2 & 2A. These aircraft are equipped with an SCR522 four-channel transmitter-receiver which is mounted above the baggage compartment behind the rear cockpit. The control box is installed on the control shelf on the lower port side of the front cockpit. Facilities have been incorporated to permit the VHF and radio compass to be heard simultaneously if desired. Transmit - receive and intercommunication control has been moved to the throttle. Operation is as follows:

(1) VHF. Switch to LIAISON. To receive VHF, have throttle switch in the neutral position. To transmit, push the throttle switch up.

(2) VHF and Radio Compass. Operation as for VHF. Place MIX switch in ON position.

(3) Radio Compass. Switch to Radio Compass. Turn MIX switch to OFF position.

(4) Intercommunications. Push throttle

switch down. A side tone will be heard in both transmit and intercom positions of the throttle switch.

(b) Harvard 4. This aircraft is equipped with an ICA67 ten-channel transmitter-receiver located above the baggage compartment behind the rear cockpit. The control, consisting of a rotary selector switch, is mounted on both consoles. They are mechanically linked. An emergency radio switch equipped with a green cover marked EMERGENCY RADIO is located in both front and rear cockpits on the radio console directly below the Voice Range Filter. The switch is normally in the OFF position and is used only in the event that the isolation amplifier fails. Failure is evidenced by a complete loss of all radio facilities. Output of the VHF and the intercom may be redirected past the failed isolation amplifier by switching the emergency radio switch to ON. These facilities will then be available but with reduced volume and clarity. The radio compass will not be heard under this condition.

69 Frequency Chart Installation.

(a) Harvard 4. A frequency chart card holder is located on the starboard side of the auxiliary panel in the front cockpit, and on the cockpit trim strip on the starboard side in the rear cockpit.

COMPASSES

70 Magnesyn.

(a) Harvard 2 & 2A. The master unit for the magnesyn compass is located in the baggage compartment. Repeater units are installed in each instrument panel. The master switch is mounted by the repeater in the front cockpit.

(b) Harvard 4. The magnesyn compass master unit is located in the ballast weight compartment aft of the baggage compartment. The master switch is mounted on the front console.

71 Standby.

(a) Harvard 2 & 2A. A P11 compass is mounted on the forward end of the starboard shelf of the front cockpit.

WARNING

All electrical equipment must be OFF when the P11 compass is swung.

(b) Harvard 4. A B16 compass is installed in each instrument panel adjacent to the magnesyn compass repeater.

WARNING

Except for the battery master switch, which must be ON, all other electrical equipment must be OFF when the B16 compass is swung.

NOTE

The P11 and B16 standby compasses are unreliable when the identification lights are ON, having an error of 5-20 degrees.

EMERGENCY EQUIPMENT

72 First Aid Kit.

(a) Harvard 2 & 2A. A first aid kit is mounted in clips on the baggage compartment wall.

(b) Harvard 4. A first aid kit is carried on the upper deck of the aft fuselage above the baggage compartment, to port of the transmitter-receiver.

73 Signal Pistol.

(a) Harvard 2 & 2A. A signal pistol, when carried, is stowed in a flare mounting on the starboard side of the front cockpit. It is fired from this position as the chute extends to the undersurface of the wing center section.

(b) Harvard 4. The signal pistol on this aircraft is designated for ground use only. The pistol is stowed in clips attached to the wall of the baggage compartment.

74 Signal Cartridges.

(a) Harvard 2 & 2A. Spare signal cartridges are carried on a panel aft of the P11 compass on the starboard side of the front cockpit.

(b) Harvard 4. On this aircraft, spare cartridges are stowed in a small compartment set in the forward wall of the baggage compartment, and are only accessible on the ground.

59 Camera Gun. A 16 mm GSAP camera gun is fitted in the port wing of the aircraft. The camera operates whenever the camera selector switch is ON and the control column firing button is pressed.

60 The camera gun is fitted with an over-run control to enable the camera to continue operating after releasing the firing button. The switch for operating the control is on the over-run unit on the starboard side of the main instrument panel.

61 RP Projector. A four beam (two beams per wing) rocket projector installation, to accommodate either MK 1 or MK 3A beams, is fitted on the aircraft. The installation is wired to permit single or salvo firing of the rockets. The RP single and salvo selector and rocket master switches on the armament selector panel must be ON before the rockets can be fired by pressing the control button.

62 There is an RP auto selector switch on the port side of the cockpit under the front side coaming. It should be set to "1" before commencing to fire, otherwise the rockets will not fire in order.

63 Light Series Bomb Carrier. There are two four-bomb light series bomb carriers, one suspended from each wing inboard of the rocket installations. The bomb selector switch is on the armament control panel, and the single and salvo bomb selector switches are on the starboard side of the instrument panel, with the bomb jettison switch.

COMMUNICATIONS EQUIPMENT

64 General. All aircraft are fitted with the following communications equipment, located as described below: Intercommunications, radio and VHF. A radio master switch is located in the foreward console. This switch must be in the ON position before any of the communications will operate.

65 Intercommunications.

(a) For pilot communications an interphone amplifier Type 3611B is provided between the front and rear cockpit. Simultaneous or selective monitoring of VHF and radio compass signals is provided by use of two isolation amplifiers AM-142/AIC (one for each cockpit).

(b) To provide VHF and Radio Compass Monitoring facilities the VHF and Radio Compass switches on the console are turned ON and in this way both signals may be monitored simultaneously. Interphone communication is carried on by pressing forward the Press to Talk switch on the control column in front cockpit, by pressing down on throttle switch in either cockpit, or by moving the intercom switch on right console in either cockpit to the intercom lock position. When intercom is selected in the front cockpit, the VHF volume is muted (cut down in volume) in the front cockpit only. When intercom is selected in the rear cockpit VHF volume is cut out in front cockpit and muted in the rear cockpit.

66 Radio Compass

(a) The aircraft is fitted with an AN/ARN6 radio compass incorporating two radio compass indicators ID91A. The dehydrator is built into the loop. A control box C149 is built into both front and rear consoles.

67 VHF.

(a) The aircraft is equipped with an ICA67 ten-channel transmitter-receiver located above the baggage compartment behind the rear cockpit. The control, consisting of a rotary selector switch, is mounted on both consoles. They are mechanically linked. An emergency radio switch equipped with a green cover marked EMERGENCY RADIO is located in both front and rear cockpits on the radio console directly below the Voice Range Filter. The switch is normally in the OFF position and is used in the event that the isolation amplifier fails. Failure is evidenced by a complete loss of all radio facilities. Output of the VHF and the intercom may be redirected past the failed isolation amplifier by switching the emergency radio switch to ON. These facilities will then be available but with reduced volume and clarity. The radio compass will not be heard under this condition.

(b) A transmit light is located in both cockpits, which illuminates during VHF transmissions. This light also illuminates at half brilliance when radio master switch is on but VHF selection is off or when VHF circuit breaker is open.

68 D E L E T E D.

69 Frequency Chart Installation.

(a) Harvard 4. A frequency chart card holder is located on the starboard side of the auxiliary panel in the front cockpit, and on the cockpit trim strip on the starboard side in the rear cockpit.

COMPASSES

70 Magnesyn.

(a) Harvard 2 & 2A. The master unit for the magnesyn compass is located in the baggage compartment. Repeater units are installed in each instrument panel. The master switch is mounted by the repeater in the front cockpit.

(b) Harvard 4. The magnesyn compass master unit is located in the ballast weight compartment aft of the baggage compartment. The master switch is mounted on the front console.

71 Standby.

(a) Harvard 2 & 2A. A P11 compass is mounted on the forward end of the starboard shelf of the front cockpit.

WARNING

All electrical equipment must be OFF when the P11 compass is swung.

(b) Harvard 4. A B21 compass is installed in each instrument panel adjacent to the magnesyn compass repeater.

WARNING

Except for the battery master switch, which must be ON, all other electrical equipment must be OFF when the B21 compass is swung.

NOTE

The P11 and B21 standby compasses are unreliable when the identification lights are ON, having an error of 5-20 degrees.

EMERGENCY EQUIPMENT

72 First Aid Kit.

(a) Harvard 2 & 2A. A first aid kit is mounted in clips on the baggage compartment wall.

(b) Harvard 4. A first aid kit is carried on the upper deck of the aft fuselage above the baggage compartment, to port of the transmitter-receiver.

73 Signal Pistol.

(a) Harvard 2 & 2A. A signal pistol, when carried, is stowed in a flare mounting on the starboard side of the front cockpit. It is fired from this position as the chute extends to the undersurface of the wing center section.

(b) Harvard 4. The signal pistol on this aircraft is designated for ground use only. The pistol is stowed in clips attached to the wall of the baggage compartment.

74 Signal Cartridges.

(a) Harvard 2 & 2A. Spare signal cartridges are carried on a panel aft of the P11 compass on the starboard side of the front cockpit.

(b) Harvard 4. On this aircraft, spare cartridges are stowed in a small compartment set in the forward wall of the baggage compartment, and are only accessible on the ground.

75 Emergency Exits.

(a) Harvard 2 & 2A. Both side panels on the front and rear sliding hoods can be jettisoned. The release handles are mounted in the center bar of each panel and are marked EMERGENCY RELEASE HANDLE.
(b) Harvard 4. The cockpit enclosure sliding sections incorporate large side glass panels which may be pushed out by either crew member for emergency exit.

76 Fire Extinguishers.

(a) Engine Fire Extinguisher, Harvard 2 & 2A. The handle operating the engine fire extinguisher is mounted in the lower starboard corner of the front cockpit instrument panel.
(b) Engine Fire Extinguisher, Harvard 4. The operating handle is located in the extreme starboard side of the auxiliary panel.
(c) Hand Fire Extinguisher, Harvard 2, 2A & 4. A hand fire extinguisher is mounted on a spring-loaded door on the port side of the rear cockpit. This door is easily opened by a button marked "PUSH". It is readily accessible from either inside or outside the aircraft.

MISCELLANEOUS EQUIPMENT

77 Baggage Compartment. A baggage compartment forms a portion of the fuselage aft of the rear cockpit. The door to the compartment is on the port side of the aircraft.

CAUTION

When baggage is carried in the Harvard 2 or 2A, precaution must be taken to prevent damage to the magnesyn compass transmitter installed in the baggage compartment. See Part 4, paragraph 2, for further restrictions concerning the carrying of baggage.

78 Mooring Rings. Mooring rings for attachment to the wings when picketing the aircraft are mounted on the wall of the baggage compartment.

79 Hand Crank. An engine hand crank is located on the wall of the baggage compartment.

80 Relief Tubes. A relief tube is supplied for each cockpit and is installed under the seats.

81 Blind Flying Hood. An instrument flying hood is provided in the rear cockpit for simulated instrument flying practice. To operate the hood, pull it forward and lock it down with a locking catch which is provided on the coaming over the instrument panel. In the rear cockpit, the hood release is located on the locking catch, and in the front cockpit the hood release is located on the cockpit trim strip on the port side just forward of the throttle quadrant.

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STONEY CREEK

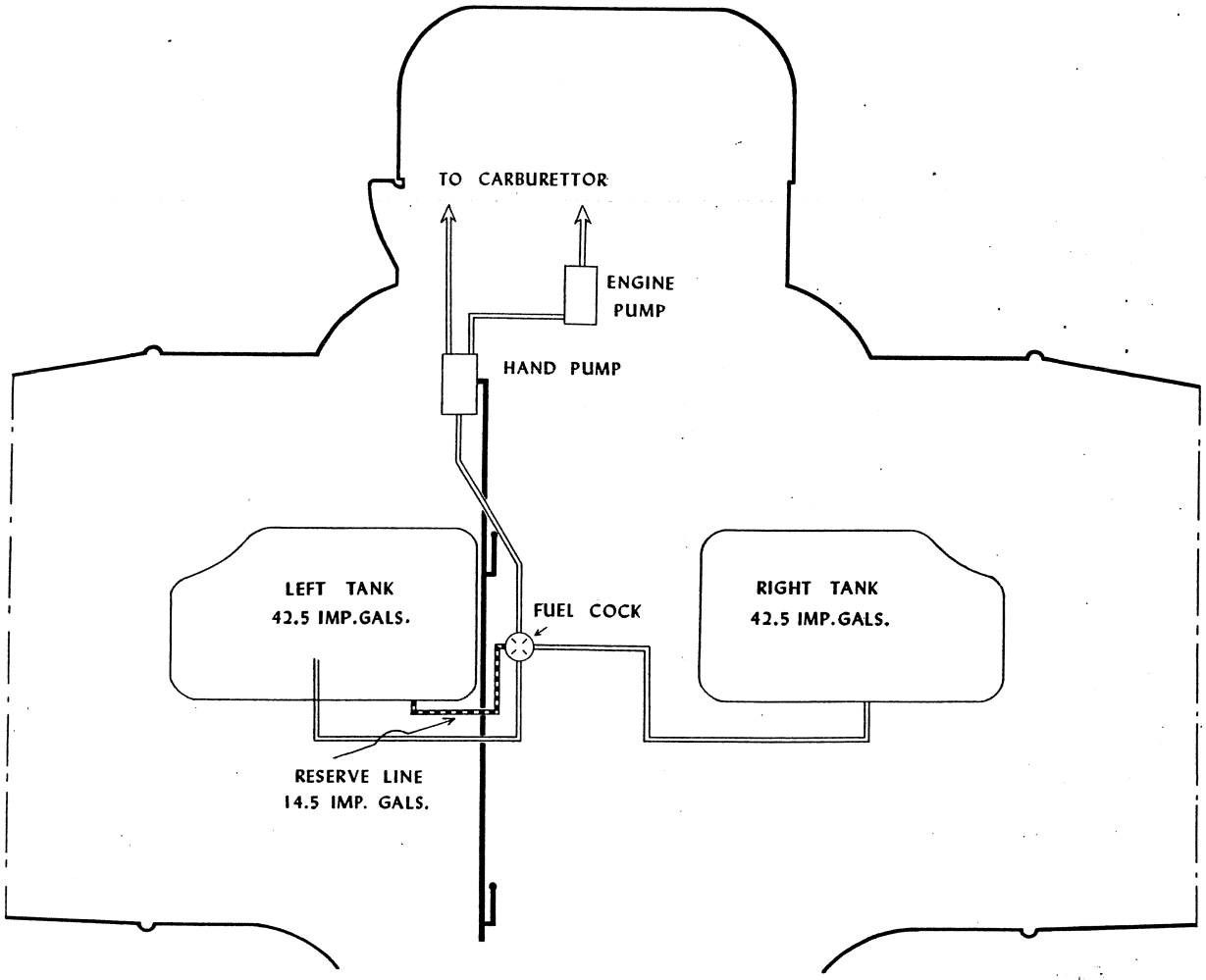

Figure 1 Fuel System Diagram

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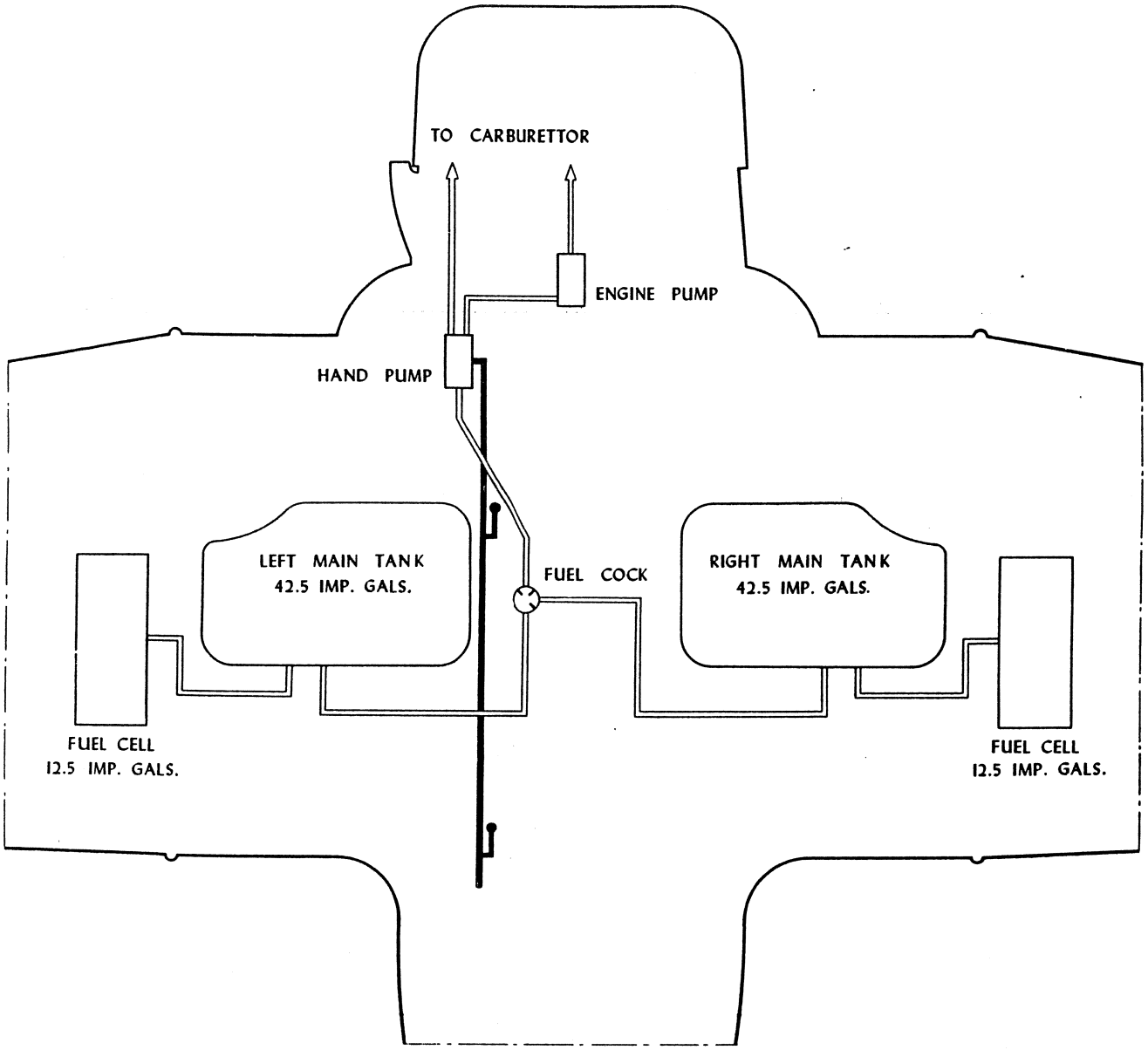

MAIN TANKS	85 IMP. GALS.
AUX. CELLS	25 IMP. GALS.
INSTALLATION	6 IMP. GALS.
TOTAL FUEL CAPACITY	116 IMP. GALS.

Figure 1A - Fuel System Diagram
Harvard 4 Aircraft Fitted with Auxiliary Fuel Cells

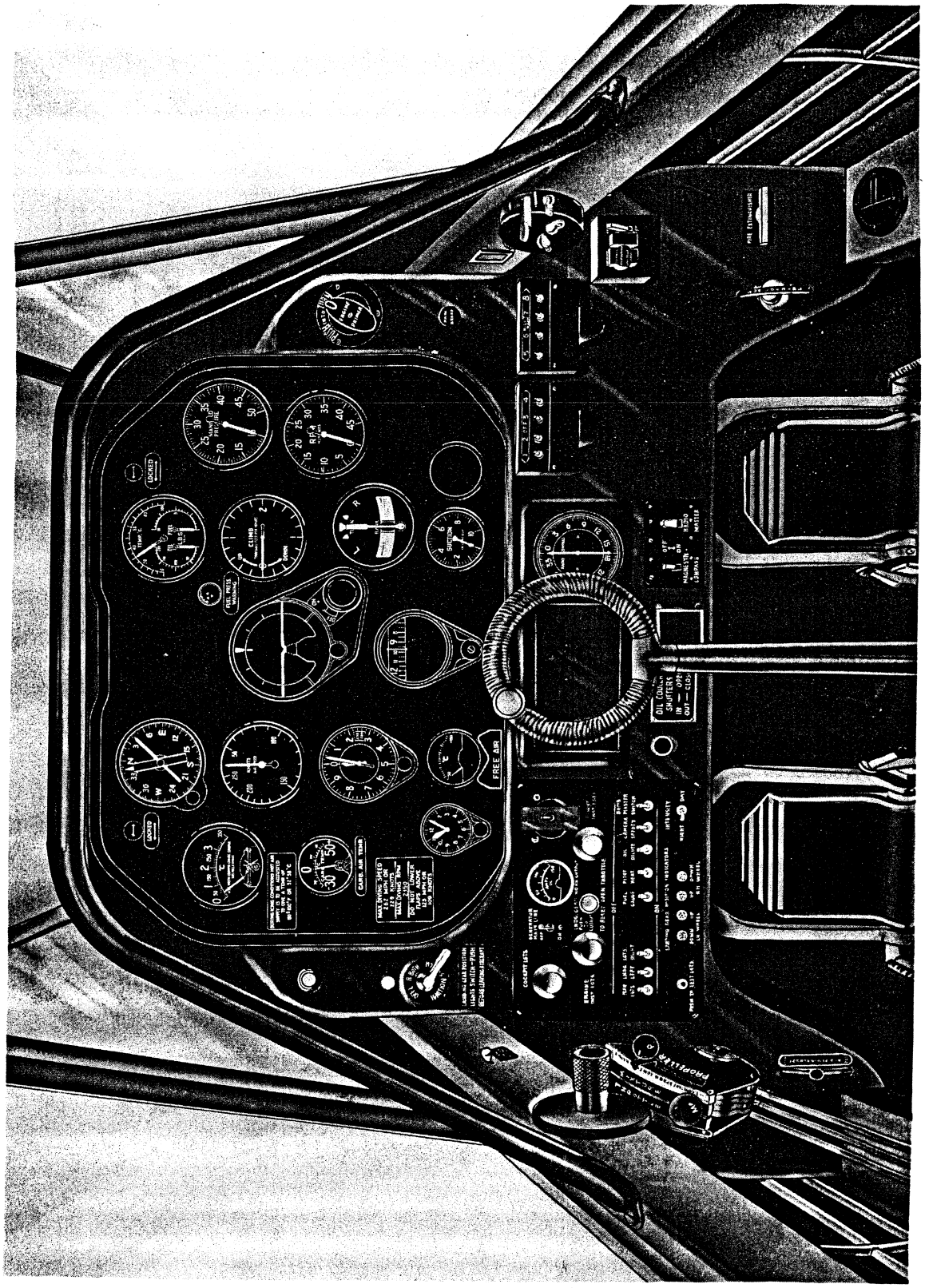

Figure 2 - Harvard 2 - Front Cockpit Panel

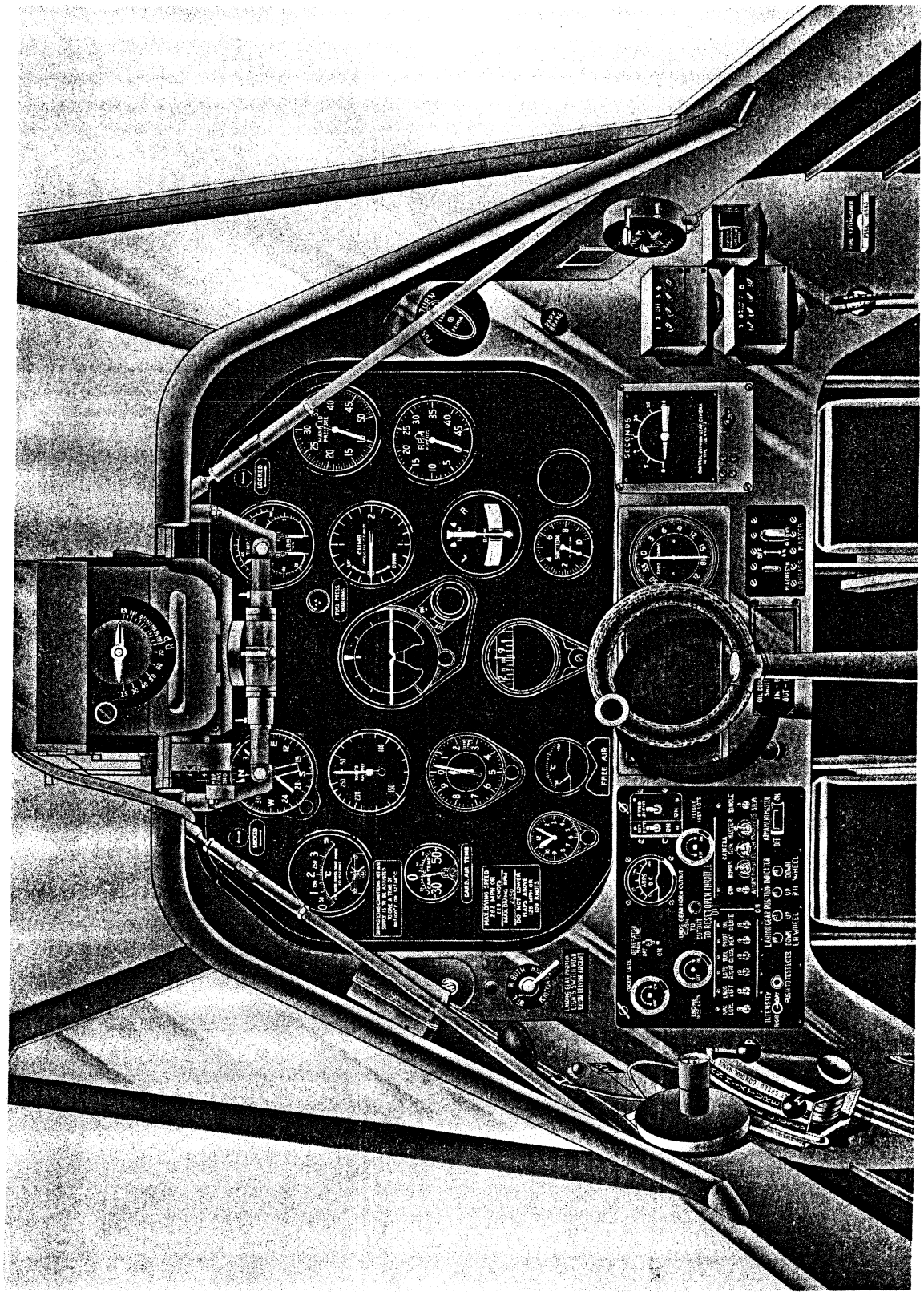

Figure 3 - Harvard 2A - Front Cockpit Panel

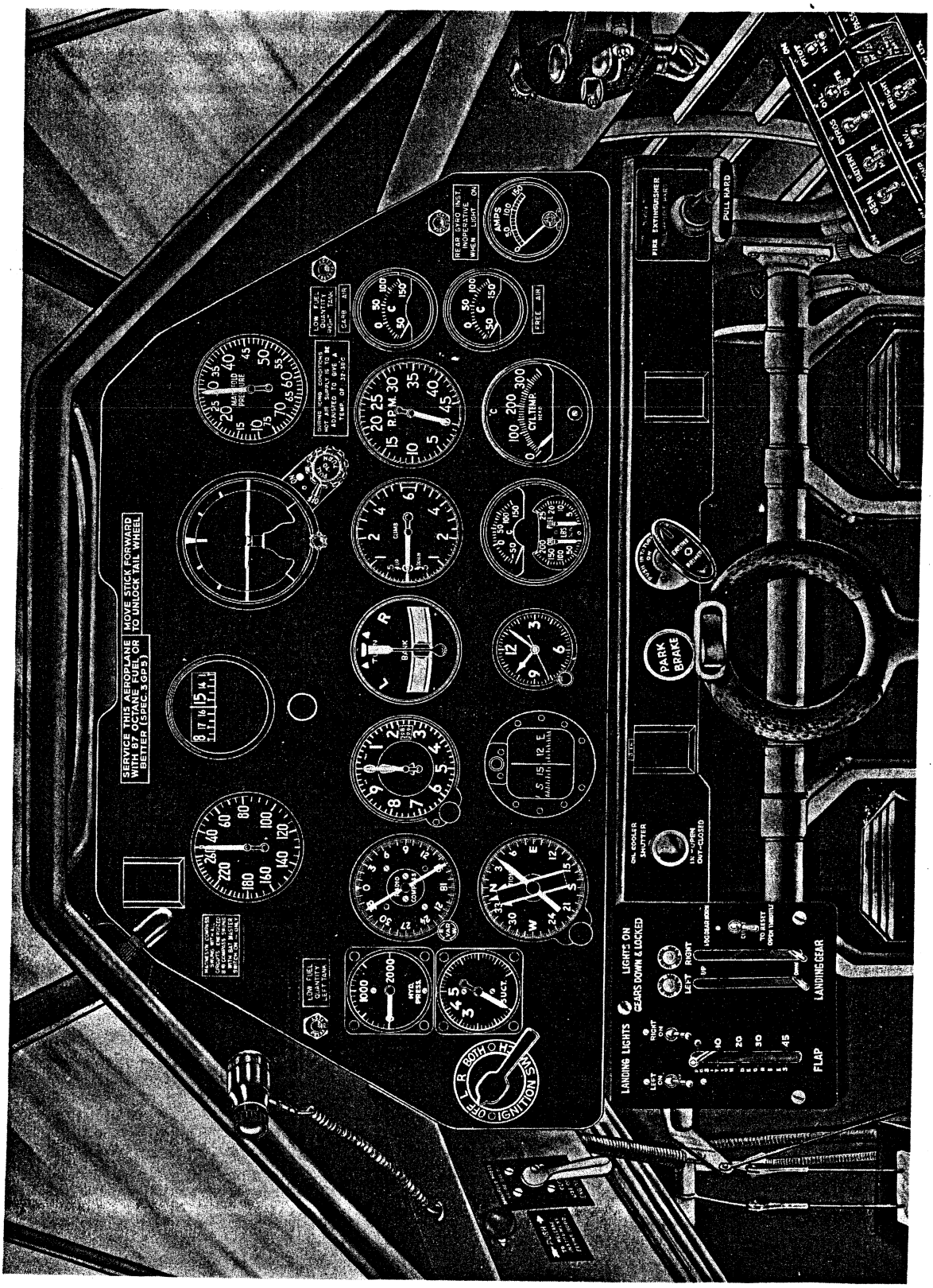

Figure 4 - Harvard 4 - Front Cockpit Panel

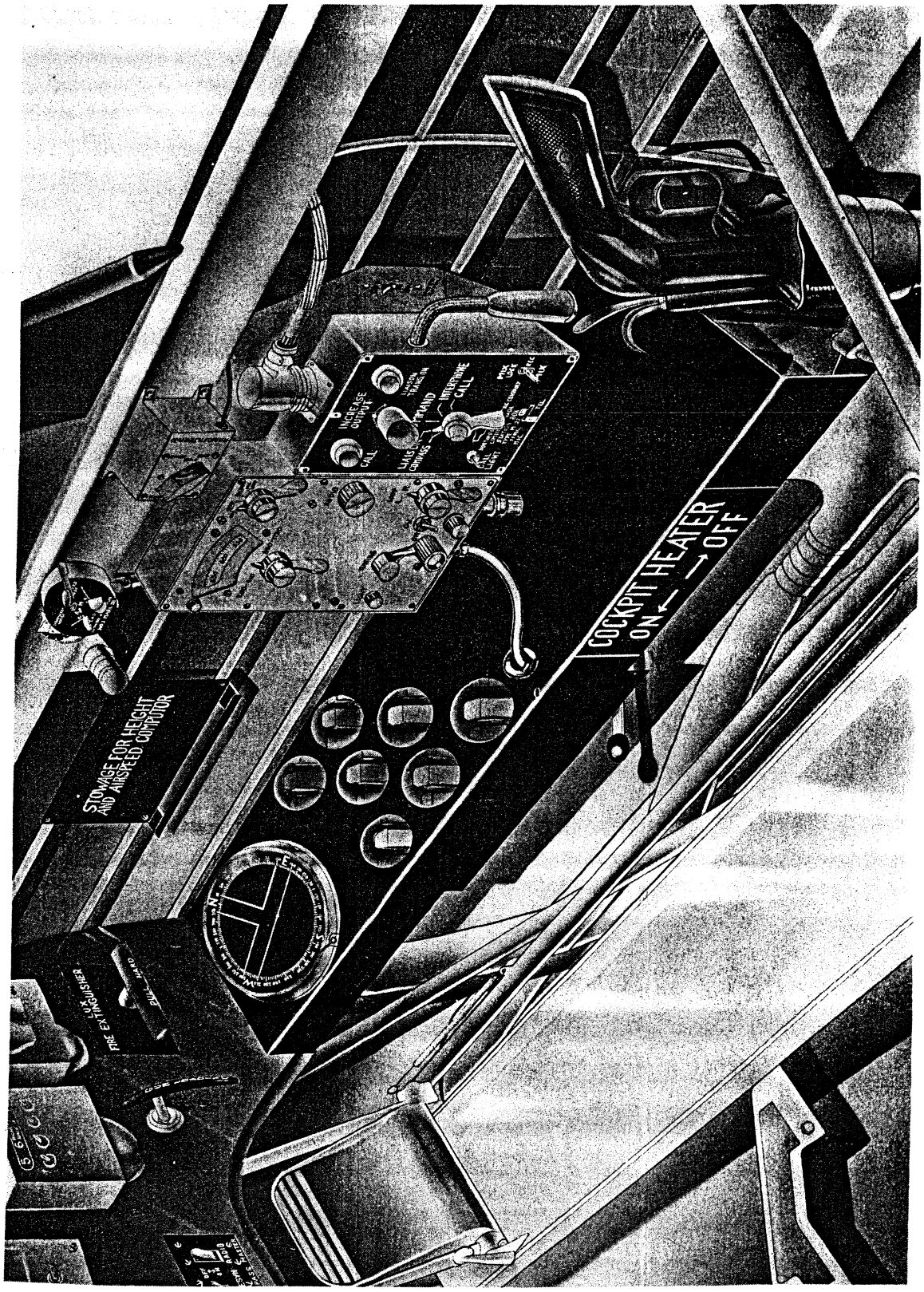

Figure 5 - Harvard 2 & 2A - Front Cockpit Starboard

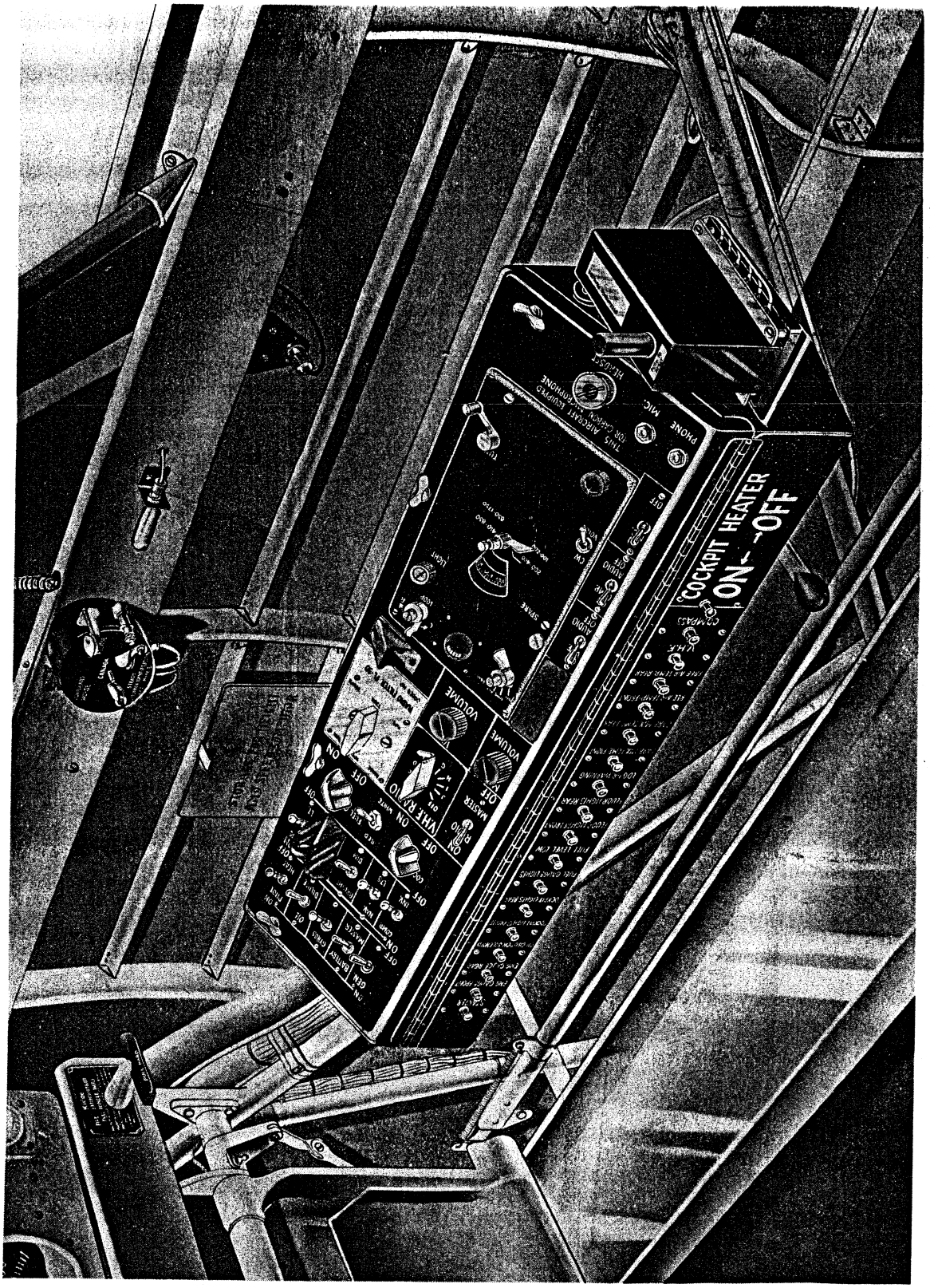

Figure 6 - Harvard 4 - Front Cockpit Starboard

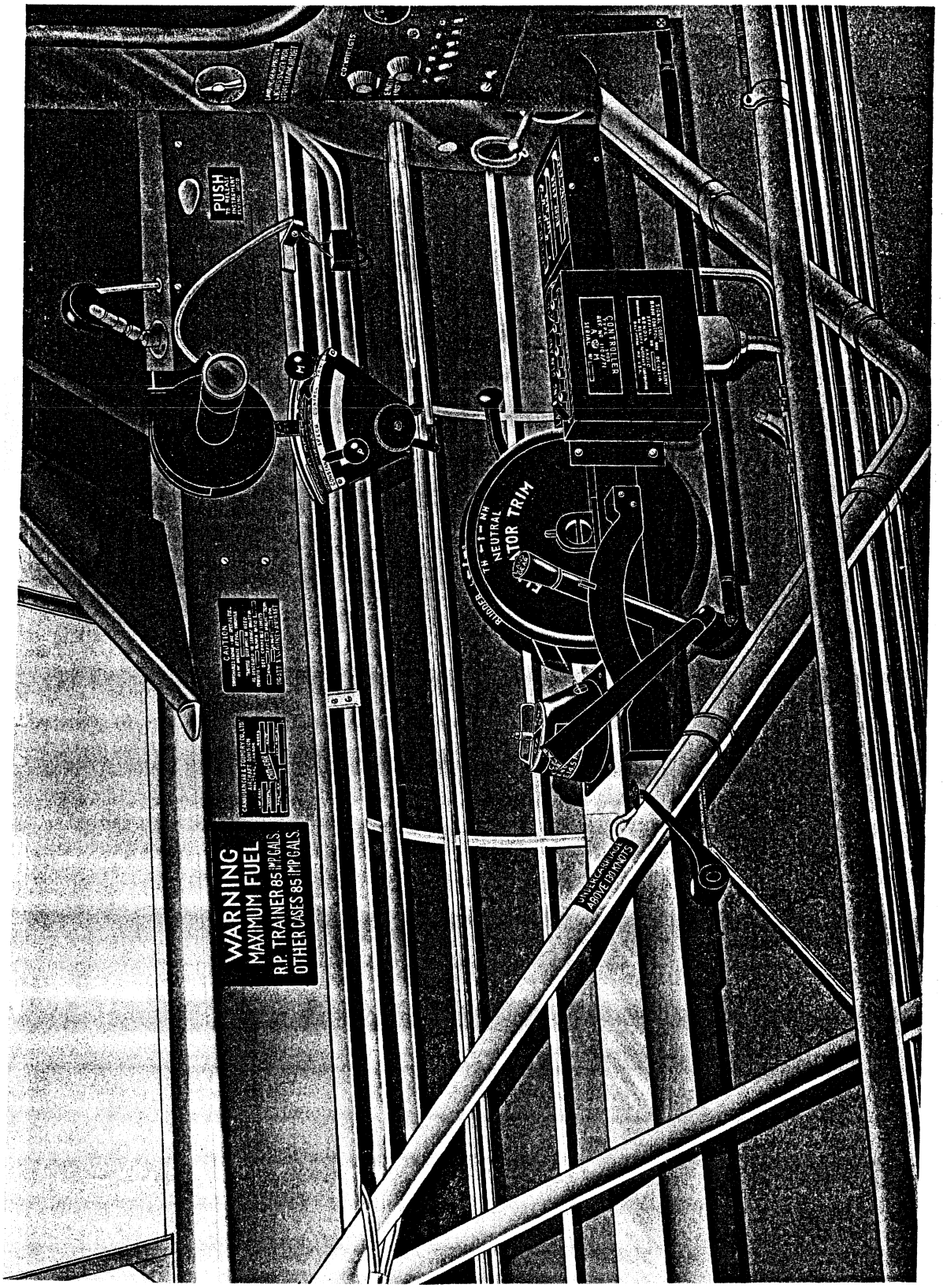

Figure 7 - Harvard 2 - Front Cockpit Port

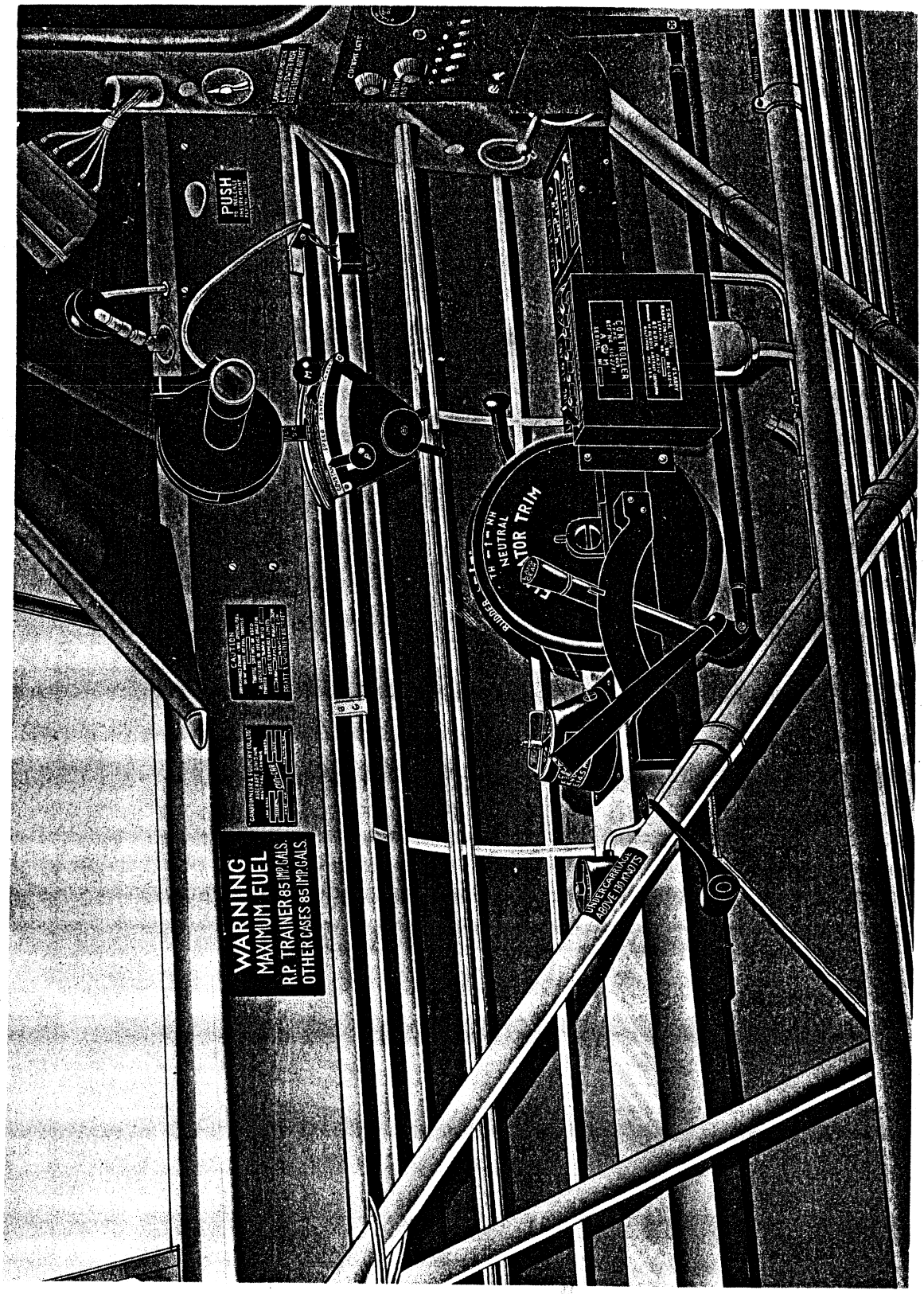

Figure 8 - Harvard 2A - Front Cockpit Port

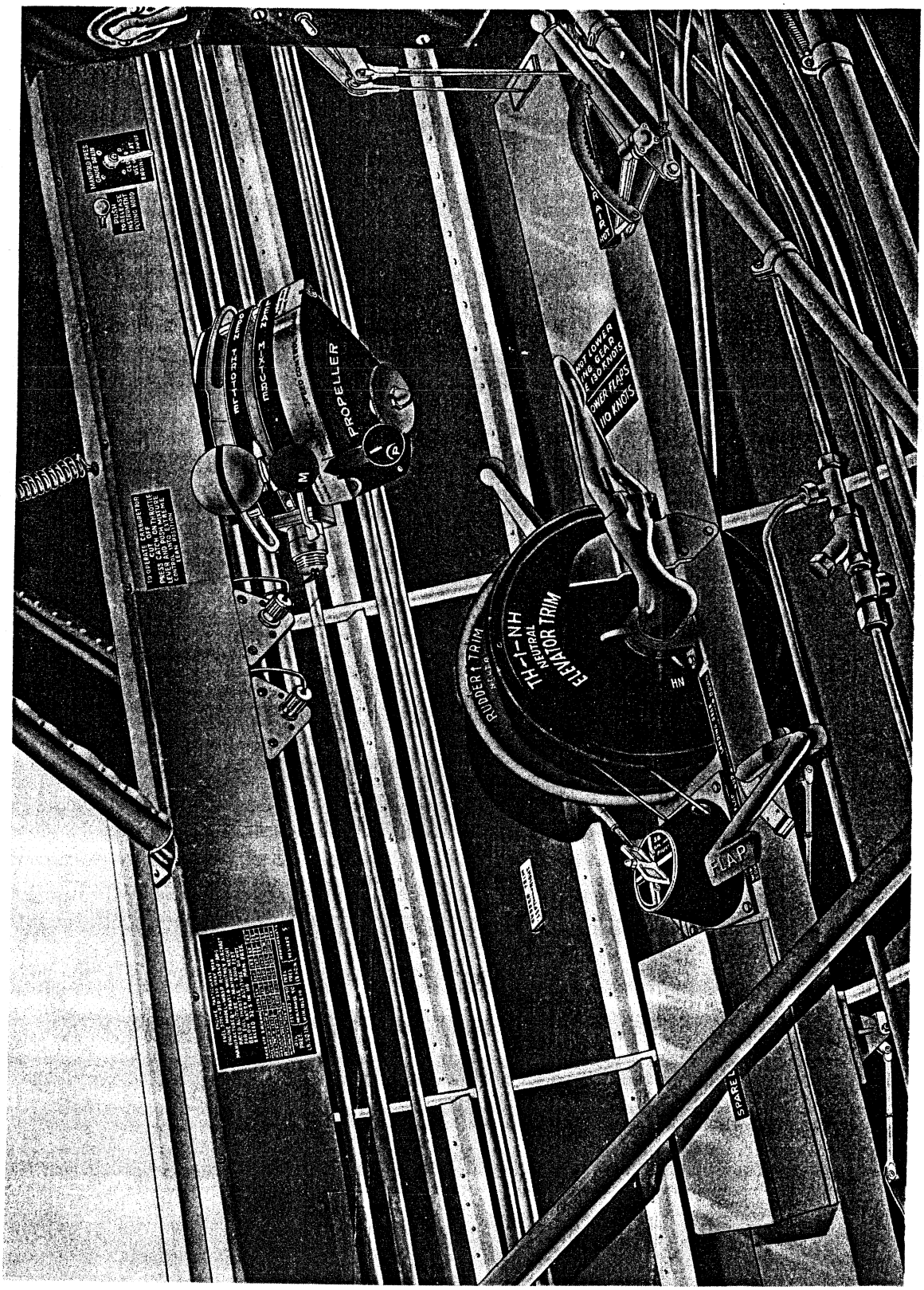

Figure 9 - Harvard 4 - Front Cockpit Port

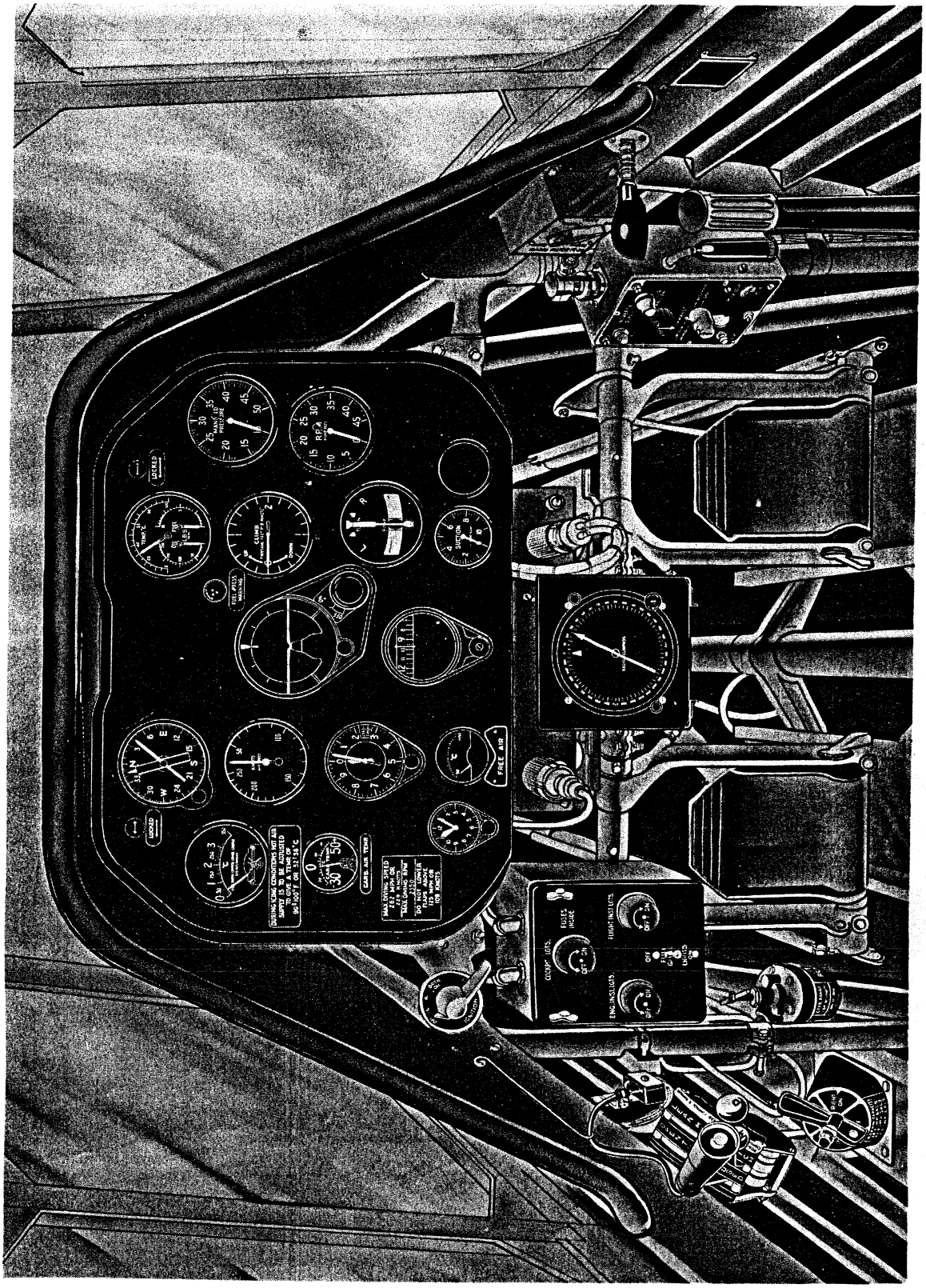

Figure 10 - Harvard 2 & 2A - Rear Cockpit Panel

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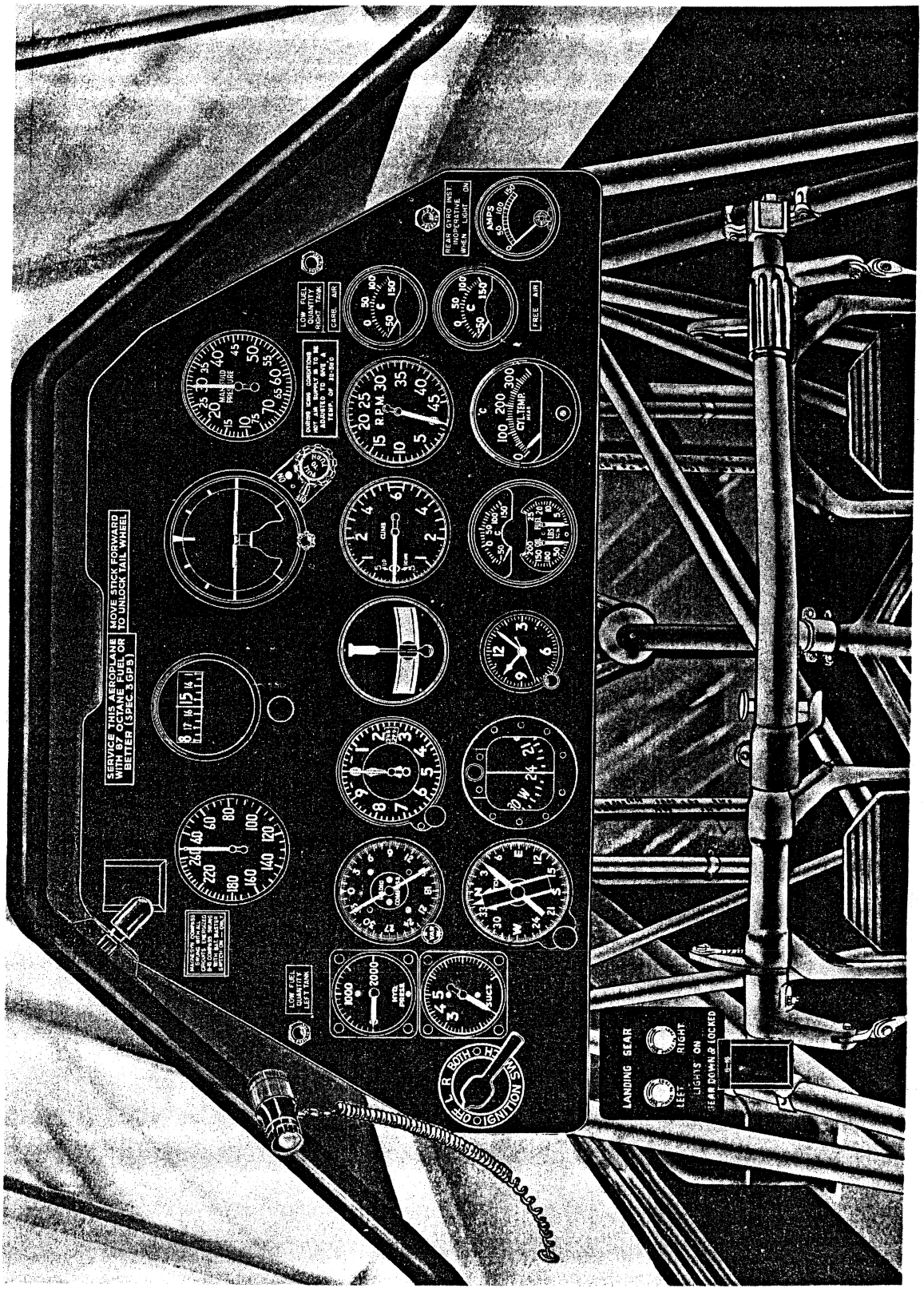

Figure 11 - Harvard 4 - Rear Cockpit Panel

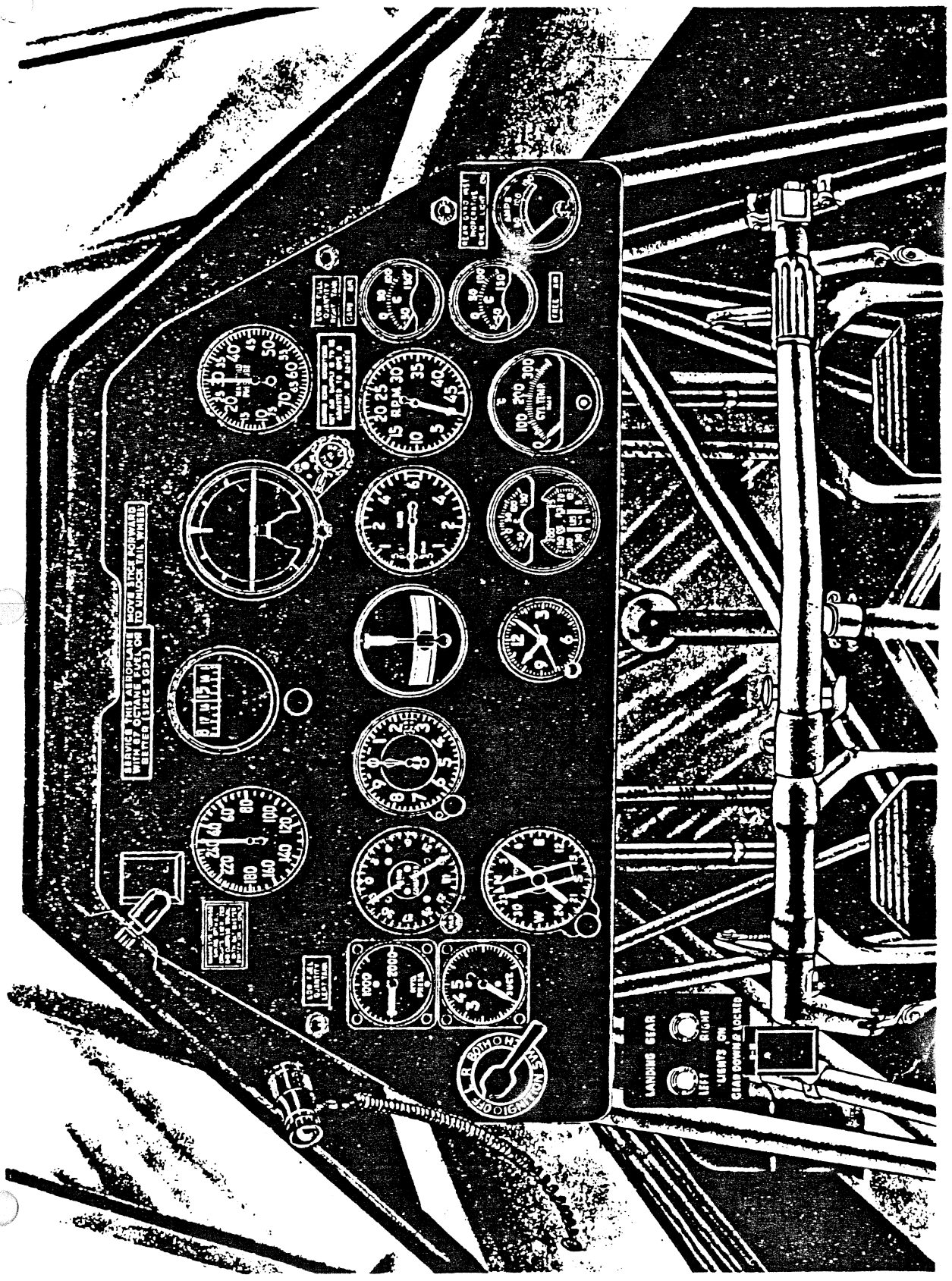

Figure 11 (Issue 1) Harvard 4 - Rear Cockpit Panel

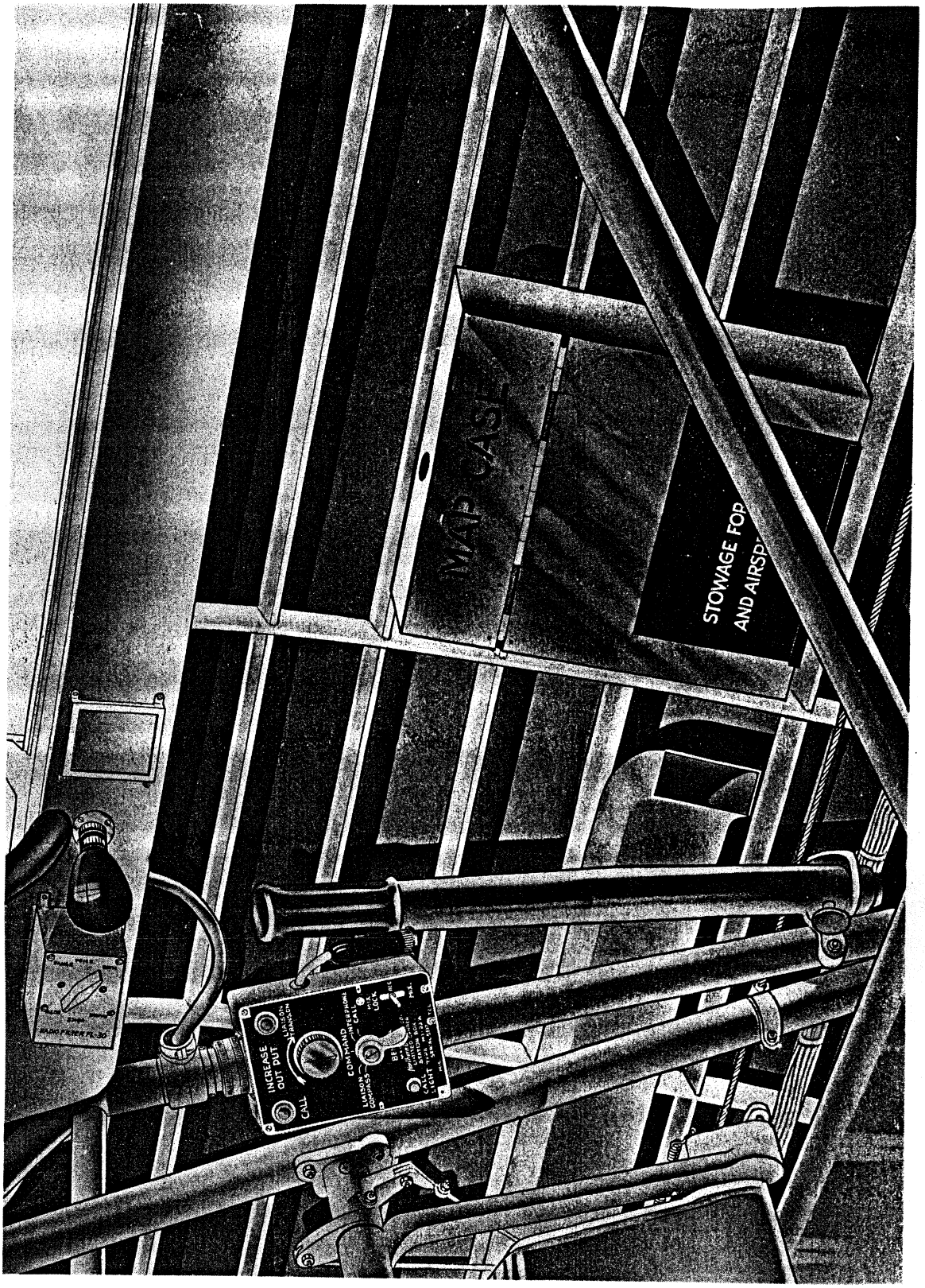

Figure 12 - Harvard 2 & 2A - Rear Cockpit Starboard

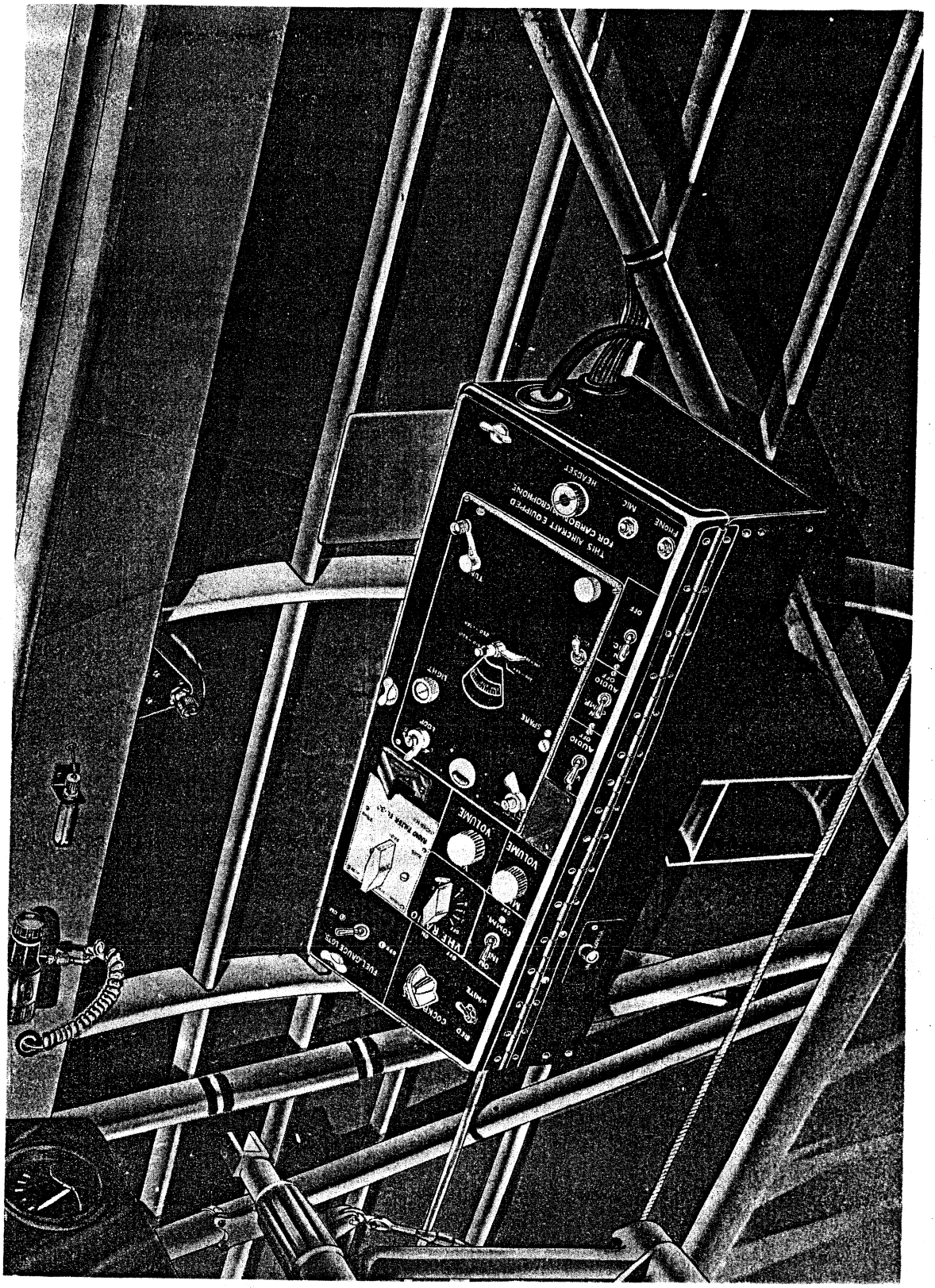

Figure 13 - Harvard 4 - Rear Cockpit Starboard

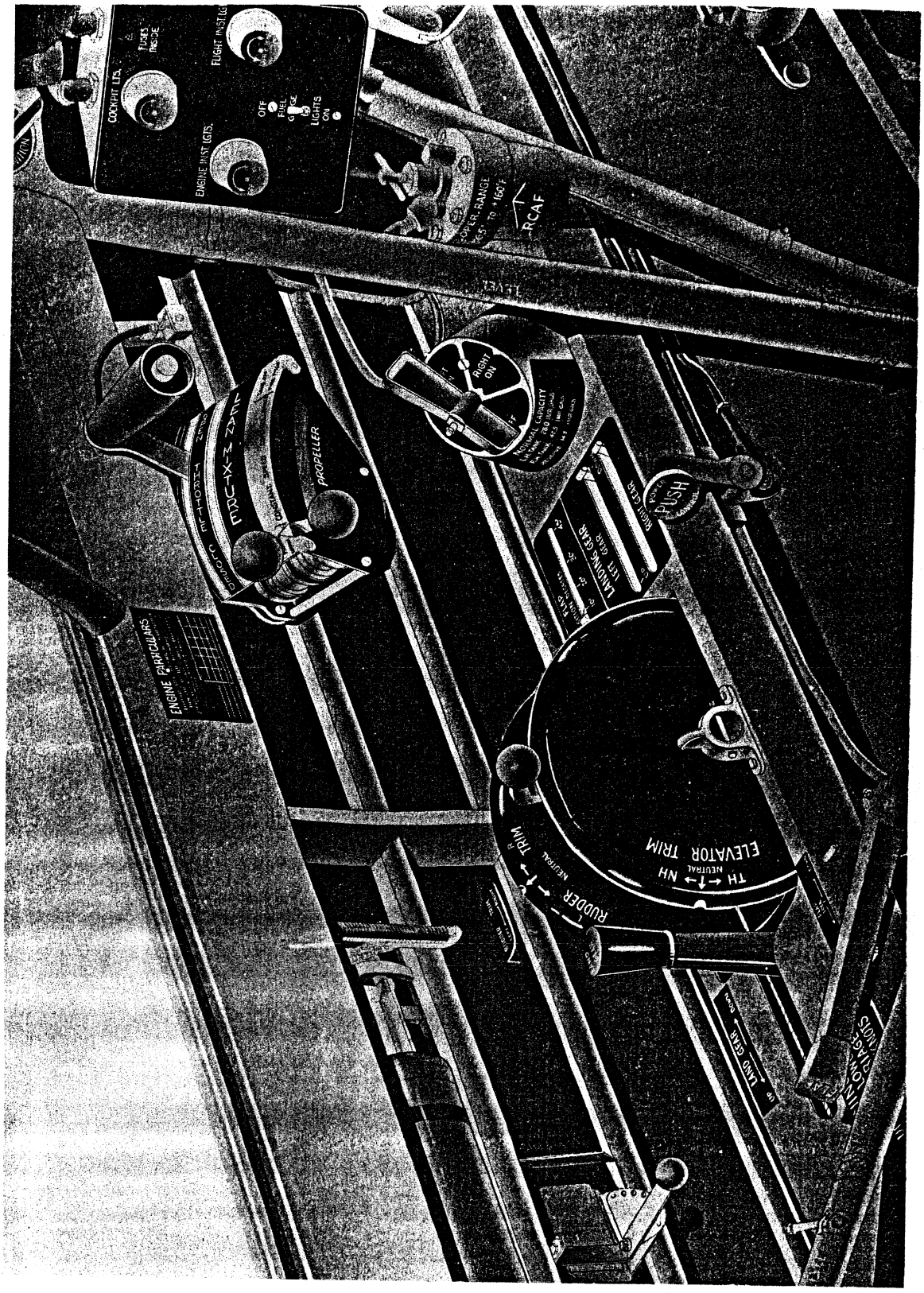

Figure 14 - Harvard 2 & 2A - Rear Cockpit Port

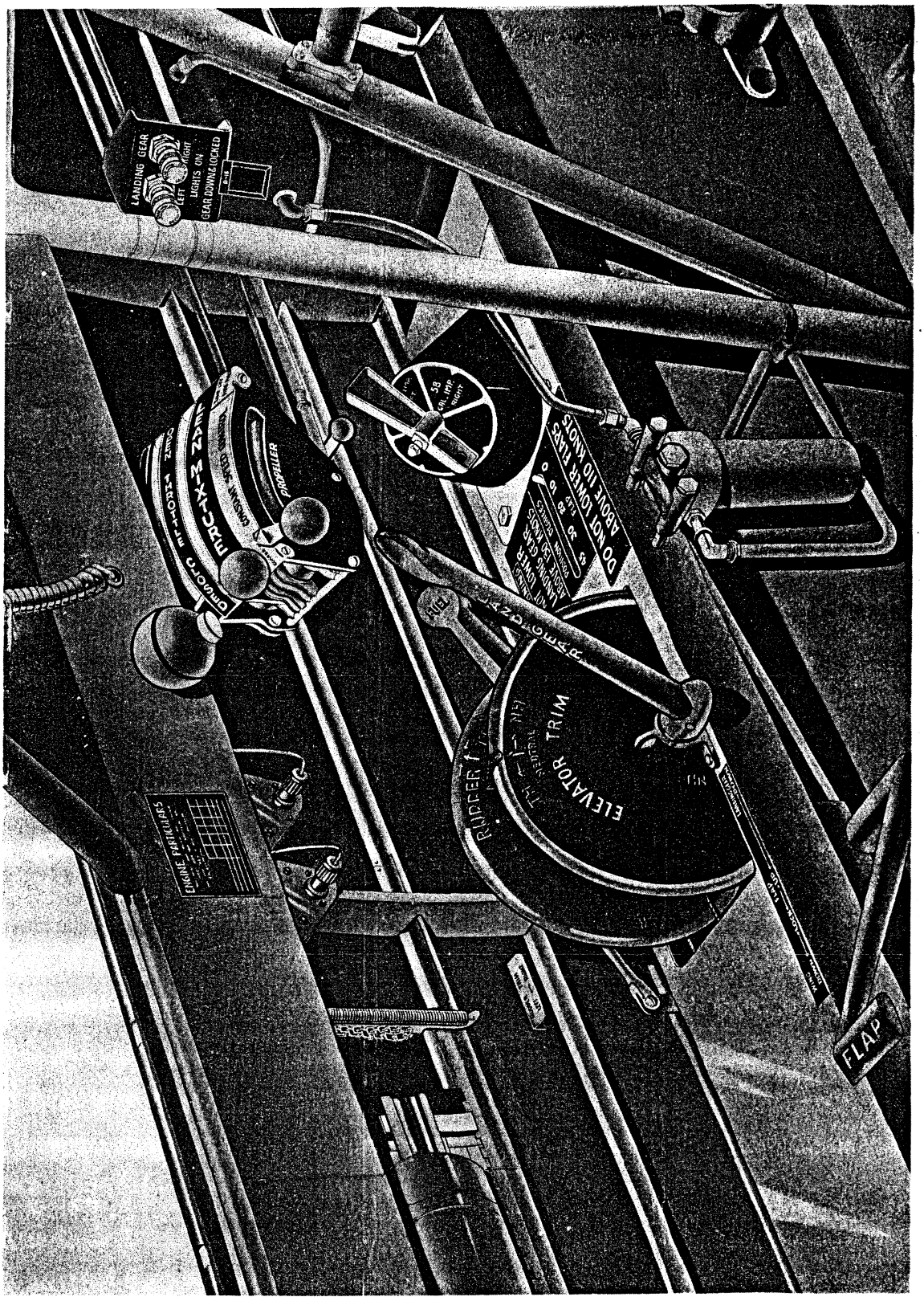

Figure 15 - Harvard 4 - Rear Cockpit Port

PART 2

HANDLING

PRELIMINARIES

Before Entering Aircraft

1 Check Form L.14A for fuel and oil quantities and signatures completed throughout by mechanics concerned. Note minor unserviceabilities, if any.

2 External pre-flight check:-

(a) Controls unlocked, undercarriage down, switches "OFF", emergency maps.

(b) Flaps lowered by hand pump, fuel contents.

(c) Undercarriage pins, fuel cap, flaps, port wing and control surfaces.

(d) Bonding wires throughout.

(e) Aileron hinges and split pins in all bolts, navigation light.

(f) Port wing leading edge and under surfaces.

(g) Port undercarriage, oleo, tire and chock, undercarriage up-lock.

(h) Hydraulic brake line.

(j) Engine drain tubes.

(k) Engine and propeller for oil leaks. (Pull engine through 4 to 6 turns previous to first start of day).

(m) Cowling and bonding wires, oil scoop.

(n) Starboard undercarriage, oleo, tire and chock, undercarriage up-lock.

(p) Hydraulic brake line.

(q) Starboard wing leading edge and under surface.

(r) Pitot head, navigation light.

(s) Starboard wing and control surfaces.

(t) Aileron hinges and split pins in all bolts, flaps.

(u) Fuel cap, undercarriage pins.

(v) Fire extinguisher red (black MK. 2).

(w) Antennae, grounding wire.

(x) Static holes starboard side (Mk. 4).

(y) Tail surfaces, tire, oleo, rudder cables, bonding wires.

(z) Static holes port side (Mk. 4).

(aa) Baggage compartment:-

(1) Crank, Verey pistol, cartridges, forced landing instructions, Form L.36.

(ab) Hand fire extinguisher locked in position and contents.

(ac) First aid kits:-

(1) Baggage compartment (Mk. 2).

(2) Upper deck aft fuselage rear cockpit (Mk. 4).

3 Rear cockpit for solo flying:-

(a) Control column stowed.

(b) Harness secure, no loose articles.

(c) Gyros caged.

PART 2

HANDLING

PRELIMINARIES

Before Entering Aircraft

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2 External pre-flight check:-

(a) Controls unlocked, undercarriage down, switches "OFF", emergency maps.

(b) Flaps lowered by hand pump, fuel contents.

(c) Undercarriage pins, fuel cap, flaps, port wing and control surfaces.

(d) Bonding wires throughout.

(e) Aileron hinges and split pins in all bolts, navigation light.

(f) Port wing leading edge and under surfaces.

(g) Port undercarriage, oleo, tire and chock, undercarriage up-lock.

(h) Hydraulic brake line.

(j) Engine drain tubes.

(k) Engine and propeller for oil leaks. (Pull engine through 3 turns previous to first start of day.) 4-6

(m) Cowling and bonding wires, oil scoop.

(n) Starboard undercarriage, oleo, tire and chock, undercarriage up-lock.

(p) Hydraulic brake line.

(q) Starboard wing leading edge and under surface.

(r) Pitot head, navigation light.

(s) Starboard wing and control surfaces.

(t) Aileron hinges and split pins in all bolts, flaps.

(u) Fuel cap, undercarriage pins.

(v) Fire extinguisher red (black MK. 2).

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3 Rear cockpit for solo flying:-

(a) Control column stowed.

(b) Harness secure, no loose articles.

(c) Gyros caged.

(d) Radio cord secure.

(e) Intercom and Mic switch "OFF", ARC "OFF".

(f) Hood closed.

4 Pre-start check:-

(a) Fasten harness.

(b) Adjust rudder and seat.

(c) Controls for correct sense and movement.

(d) Check manifold pressure gauge for field barometric pressure.

(e) Check for loose articles.

(f) Brakes ON, switches OFF.

(g) Fuel selector on right tank.

(h) Contents right and left tanks.

(j) Pitch, full coarse.

(k) Throttle cracked.

(m) Mixture rich, carb heat cold.

OPERATION OF THE FUEL SYSTEM

Tank Selection

5 Fuel tank selection to be used as follows:

(a) Harvard 2, 2A and 4 - The fuel tanks may be used in any order, but if all are full the recommended order, which will also check the operation of the tanks, is:-

(1) Start and taxi on RESERVE and run up on RIGHT.

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(d) Radio cord secure.

(e) Intercom and Mic switch "OFF", ARC "OFF".

(f) Hood closed.

4 Pre-start check:-

(a) Fasten harness.

(b) Adjust rudder and seat.

(c) Controls for correct sense and movement.

(d) Check manifold pressure gauge for field barometric pressure.

(e) Check for loose articles.

(f) Brakes ON, switches OFF.

(g) Fuel Selector on.

(h) Contents right and left tanks.

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OPERATION OF THE FUEL SYSTEM

Tank Selection

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(a) Harvard 2, 2A and 4 - The fuel tanks may be used in any order, but if all are full the recommended order, which will also check the operation of the tanks, is:-

(1) Start and taxi on RESERVE and run up on RIGHT.

(2) When low flying, change from RIGHT to RESERVE when the right gauge shows ten gallons.

(3) At a safe height, the RIGHT fuel cock setting may be used until the fuel pressure warning light comes on. The RESERVE cock setting drains the reserve and left tanks.

CAUTION

Fuel must not be drawn from the left main tank by positioning the fuel cock to LEFT. Fuel must be drawn by selecting RESERVE only.

(b) Harvard 4 (with aux. cells) - The fuel tanks may be used in any order. Check the operation and quantity of fuel in each tank before take-off. A fuel level warning system of indicator lights on the front and rear instrument panels will light when the fuel level drops to 10-12 gallons in either main tank.

STARTING PROCEDURE

Starting Engine

6 To start the engine, proceed as follows:

(a) Have the engine turned by hand for approximately 4 to 6 turns to reduce the possibility of hydraulic shock damage.

(b) Operate the hand fuel pump until the fuel pressure registers 4 PSI on a slow, steady stroke, complete the stroke and prime the engine: 2 strokes if warm - 3 or more if cold, depending upon climatic conditions.

(c) Harvard 2 & 2A - After "all clear", turn switch to BOTH and energize starter until the hum becomes constant.

(d) Harvard 2 & 2A - After "contact", engage starter and keep engaged until the engine is running smoothly. Check oil pressure.

(e) Harvard 4 - After "all clear", energize starter until hum becomes constant.

(f) Harvard 4 - After "contact", engage starter. After engine has turned over approximately twice, turn switch to BOTH. Keep starter engaged until engine is running smoothly. Check oil pressure.

CAUTION

Harvard 4. Do not operate the starter for more than 30 seconds of continuous direct cranking. Allow a one minute cooling period before the starter is operated again.

(g) When the oil pressure has reached a minimum of 50 PSI set the propellor speed control in fully FINE PITCH.

(h) Warm up at an RPM sufficient to keep the generator charging.

(j) Oil shutters adjusted.

(k) Oil dilute as necessary.

Failure to Start

7 If the engine fails to pick up:

(a) Switch off the ignition.

(b) Have the propellor turned through several revolutions with the throttle open.

(c) Repeat starting procedure with less than original priming. If necessary, prime slightly while starter is engaged.

(d) Do not pump the throttle.

(e) If engine requires hand cranking, energize starter with the hand crank and engage in the usual manner.

(f) If the oil pressure does not show within 30 seconds while running at 600 RPM, shut down the engine.

WARMING UP PROCEDURE

Oil Cooler Shutter Check

8 During cold weather conditions oil cooler shutters to be closed until oil reaches desired temperature.

(2) When low flying, change from RIGHT to RESERVE when the right gauge shows ten gallons.

(3) At a safe height, the RIGHT fuel cock setting may be used until the fuel pressure warning light comes on. The RESERVE cock setting drains the reserve and left tanks.

CAUTION

Fuel must not be drawn from the left main tank by positioning the fuel cock to LEFT. Fuel must be drawn by selecting RESERVE only.

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(c) Harvard 2 & 2A - After "all clear", turn switch to BOTH and energize starter until the hum becomes constant.

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CAUTION

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(g) When the oil pressure has reached a minimum of 50 PSI set the propellor speed control in fully FINE PITCH.

(h) Warm up at an RPM sufficient to keep the generator charging.

(j) Oil shutters adjusted.

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Failure to Start

7 If the engine fails to pick up:

(a) Switch off the ignition.

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(e) If engine requires hand cranking, energize starter with the hand crank and engage in the usual manner.

(f) If the oil pressure does not show within 30 seconds while running at 600 RPM, shut down the engine.

WARMING UP PROCEDURE

Oil Cooler Shutter Check

8 The oil cooler shutters should be set to guard against too rapid a rise in oil temperature. In winter conditions they should be opened approximately one inch. This will

)ELETED

'ressure and Temperature Check

Engine oil and fuel pressures should be eading normal or higher within the first few econds of starting the engine. Oil and cylinder ead temperatures should be checked for a teady rise until the normal operating range s reached.

armac Checks

) Perform the following tarmac checks:-

) All necessary switches ON - battery, enerator, compass inverter.

) Radio switches, gyro switch.

) Circuit breakers in.

) Fuel to left tank (Mk. 2 to reserve nk).

) Flaps up - hydraulic pressure.

) Trim to take-off position.

) Pitch, mixture, throttle, tension.

) Carb heat control for movement.

Undercarriage and landing lights.

) MP drain cock (MK. 4).

) Mag switches, dead mag check.

) Instrument panel, check and set all struments as required.

Engine fire extinguisher.

) Engine primer.

) Ident and fluorescent lights.

) Compass deviation card.

Check radios.

(q) Check engine primer, compass and oil shutters.

(r) Check "DELETED" ation lights.

Check radios.

TAXIING INSTRUCTIONS

General

11 The brakes are very effective and must be used with caution. The sliding hood should be left open when taxiing and a zig-zag path should be followed to ensure a clear view ahead at all times. Where a declutching tail wheel is fitted, the aircraft should be taxiied with normal control stick action to maintain a steerable tail wheel. In the normally engaged position, the tail wheel may be turned 15 degrees to right or left with the rudder pedals. For sharp turns, centralize the rudder and push the control stick fully forward to unlock and obtain full swivelling action of the tail wheel.

RUN-UP AND ENGINE CHECKS

General

12 Position aircraft in a suitable location with parking brakes ON and perform the following engine checks:

(a) Idle engine at RPM sufficient to keep generator charging.

(b) Fuel selector valve to take-off tank.

(c) Check temperature and pressures within limits for run-up. Minimum oil temperature 40°C, minimum cylinder head temperature 120°C. Adjust throttle tension to prevent movement of the pitch lever.

(d) Check "all clear" ahead of and behind aircraft.

(e) Open up to 1500 RPM, check operation of constant speed unit, carburettor heat, generator, vacuum pump (suction), oil and fuel pressure, and cylinder head and oil temperatures.

(f) Open up to manifold pressure of field barometric minus 2" and check that the engine

prevent possible damage to the oil cooler.

Pressure and Temperature Check

9 Engine oil and fuel pressures should be reading normal or higher within the first few seconds of starting the engine. Oil and cylinder head temperatures should be checked for a steady rise until the normal operating range is reached.

Tarmac Checks

10 Perform the following tarmac checks:-

(a) All necessary switches ON - battery, generator, compass inverter.

(b) Radio switches, gyro switch.

(c) Circuit breakers in.

(d) Fuel to left tank (Mk. 2 to reserve tank).

(e) Flaps up - hydraulic pressure.

(f) Trim to take-off position.

(g) Pitch, mixture, throttle, tension.

(h) Carb heat control for movement.

(j) Undercarriage and landing lights.

(k) MP drain cock (MK. 4).

(m) Mag switches, dead mag check.

(n) Instrument panel, check and set all instruments as required.

(p) Engine fire extinguisher.

(q) Engine primer.

(r) Ident and fluorescent lights.

(s) Compass deviation card.

(t) Check radios.

(q) Check engine primer, compass and oil shutters.

(r) Check "DELETED" ...tion lights.

Check radios.

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General

12 Position aircraft in a suitable location with parking brakes ON and perform the following engine checks:

(a) Idle engine at RPM sufficient to keep generator charging.

(b) Fuel selector valve to take-off tank.

(c) Check temperature and pressures within limits for run-up. Minimum oil temperature 40 °C, minimum cylinder head temperature 120 °C. Adjust throttle tension to prevent movement of the pitch lever.

(d) Check "all clear" ahead of and behind aircraft.

(e) Open up to 1500 RPM, carry out preliminary magneto check, check operation of constant speed unit, carburettor heat, generator, vacuum pump (suction), oil and fuel pressure, and cylinder head and oil temperatures.

(f) Open up to manifold pressure of field

barometric minus 3 inches and check RPM at 2150 ± 50. Under these conditions, the propellor stays on the fine pitch stops and the CSU does not operate, so that engine RPM is a direct measure of engine power. In the case of a strong wind, it is necessary to turn the aircraft sideways to the wind in order to get a true RPM. Check temperatures and pressures.

(g) Make magneto checks at field barometric pressure minus 3 inches. Engines should attain 2150 ± 50 RPM. Switch ignition from BOTH to RIGHT and back to BOTH. Switch ignition from BOTH to LEFT and back to BOTH. Normal drop-off in either RIGHT or LEFT position is 50 to 75 RPM. Maximum drop-off in either RIGHT or LEFT position should not exceed 100 RPM. Maximum difference in drop-off between RIGHT and LEFT position should not exceed 40 RPM. When magnetos are checked at the power recommended above, the drop-off on the right magneto may be as high as 150 RPM. If this is the case, re-check the magnetos at 2200 RPM. At this higher power, if the drop-off on the right magneto, as well as on the left magneto, is less than 100 RPM, and the difference in drop between right and left is not more than 40 RPM, the check may be accepted as satisfactory.

(h) Retard throttle to check slow running. Maximum 700 RPM.

(j) Idle at RPM sufficient to keep generator charging.

TAKE-OFF PROCEDURE

Vital Actions Before Take-Off

13 Prior to take-off, complete the following checks:

H Hydraulics - check pressure (800-1000 PSI). Hood fully open or fully closed.

T Trim - trimming tabs, elevator at 11 o'clock, rudder at 3 o'clock. Check tension, and temperatures.

M Mixture - fully RICH. Carburettor air COLD.

P Propellor Pitch - control fully forward to FINE PITCH.

F Fuel - check contents, cock setting and fuel pressure (4-6 PSI).

F Flaps - UP. For shortest run, down 15°.

G Gills - adjust for desired oil temperature.

G Gyros - uncaged. DI synchronized with magnesyn compass.

S Switches - ON.

H Harness - adjusted and locked.

Take-Off

14 Advance throttle smoothly to full take-off power of 36 inches manifold pressure. Check slight tendency to swing to port.

Post Take-Off Check

15 Post take-off vital action check

U Undercarriage Up - Undercarriage indicates UP.

F Flaps UP at 80K.

P Power and Pitch.

M Mixture and carb heat adjusted as required during subsequent climb or cruise.

NOTE

The carburettor air temperature is to be maintained between 32° to 38°C during any continuous condition of flight, in proven icing conditions. In extreme cold (below -25°C) full carburettor heat should be used during take-off and landing to provide maximum fuel vaporization for safe engine performance. Significant icing is extremely unlikely under these conditions, as air moisture content is very low.

RPM is equal to the placarded RPM ±50 with allowances for temperature and wind. (1°C raise or fall from the standard temperature of 15°C will give a 1 RPM rise or fall). (1 MPH of wind will give a rise of 2 RPM). Under these conditions, the propeller stays on the fine pitch stops and the CSU does not operate, so that engine RPM is a direct measure of engine power.

(g) Make magneto checks at field barometric pressure minus 2 inches. Engines should attain placarded RPM ± 50 with temperature and wind allowance. Switch ignition from BOTH to RIGHT and back to BOTH. Switch ignition from BOTH to LEFT and back to BOTH. Normal drop-off in either RIGHT or LEFT position is 50 to 75 RPM. Maximum drop-off in either RIGHT or LEFT position should not exceed 100 RPM. Maximum difference in drop-off between RIGHT and LEFT position should not exceed 40 RPM. When magnetos are checked at the power recommended above, the drop-off on the right magneto may be as high as 150 RPM. If this is the case, re-check the magnetos at 2200 RPM. At this higher power, if the drop-off on the right magneto, as well as on the left magneto, is less than 100 RPM, and the difference in drop between right and left is not more than 40 RPM, the check may be accepted as satisfactory.

(h) Retard throttle to check slow running 450 - 500 RPM.

NOTE

For cold weather operation maximum slow running may be set at 650 to 700 RPM.

(j) Idle at RPM sufficient to keep generator charging.

TAKE-OFF PROCEDURE

Vital Actions Before Take-Off

13 Prior to take-off, complete the following checks:

H Hydraulics - check pressure (800-1000 PSI). Hood fully open or fully closed.

T Trim - trimming tabs, elevator at 11 o'clock, rudder at 3 o'clock Check tension, and temperatures.

M Mixture - fully RICH. Carburettor air COLD.

P Propellor Pitch - control fully forward to FINE PITCH.

F Fuel - check contents, cock setting and fuel pressure (4-6 PSI).

F Flaps - UP. For shortest run, down 15°.

G Gills - adjust for desired oil temperature.

G Gyros - uncaged. DI synchronized with magnesyn compass.

S Switches - ON.

H Harness - adjusted and locked.

Take-Off

14 Advance throttle smoothly to full take-off power of 32 inches manifold pressure. Check slight tendency to swing to port.

Post Take-Off Check

15 Post take-off vital action check.

U Undercarriage Up - Undercarriage indicates UP.

F Flaps UP at 80K.

P Power and Pitch.

M Mixture and carb heat adjusted as required during subsequent climb or cruise.

NOTE

The carburettor air temperature is to be maintained between 32° to 38°C during any continuous condition of flight, in proven icing conditions. In extreme cold (below - 25°C) full carburettor

FLIGHT CHARACTERISTICS

General

16 The aircraft is highly manoeuvrable and its handling qualities are good. Special attention is drawn to the stall, the spin, and aerobatics (especially for the Har. 2A armament trainer), which are fully described under their respective headings.

Stability

17 The aircraft is stable about all axes under normal conditions of flight.

Trim

18 The elevator trim tab must not be used for manoeuvring as great stresses may be placed on the structure of the airframe. Trim may be used to assist the landing, but it is not necessary. Rudder trim to the right to counteract the natural swing to port is required when climbing. A change of trim is effected by the following:

(a) Undercarriage down - Nose Heavy.

(b) Flaps down - Nose Heavy.

(c) Flaps up - Tail Heavy.

Climbing

19 The recommended climbing speed is 95 knots IAS from sea level to full throttle altitude. Reduce airspeed by $2\frac{1}{2}$ knots per 2000 ft above full throttle altitude.

Cruising

20 Normal cruise conditions at 105 to 130 knots are arrived at with engine settings of 1700-1800 RPM and up to 26 inches MP. The engine settings for maximum cruise are 2200 RPM and 32 inches MP. See Part 4-Operating Data. For R1340-S3H1 or AN1 engines. Select LEAN mixture by moving the mixture control lever slowly toward the LEAN position until the mixture control comes in contact with the stop on the throttle. The mixture control may remain there unless the engine is running roughly or the cylinder head temperature is unsatisfactory. In the latter cases, enrich the mixture until the engine is running smoothly. Do not exceed engine limitations for LEAN mixture as shown below.

Condition	RPM	Man. Press.
Max. Lean	2000	26 inches MP

C.H. Temp.	Carb. Air Temp.
232 °C	38 °C (max.)

Diving

21 When diving, both hoods should be closed, and flaps and undercarriage should be in the UP position. Maximum diving speed is 210 knots IAS for the maximum gross weight condition, and 225 knots IAS for the maximum acrobatic weight. The engine RPM should not exceed 2350. For a dive with the throttle closed, the propellor control must be set to POSITIVE COARSE PITCH before completely closing the throttle. Normally, leave the propellor speed control at moderate cruising RPM (1700-1800) and keep the throttle sufficiently open to give 10 to 20 inches MP.

Slow Flying

22 When flying in rain or poor visibility near the ground, lower flaps 15°, and set RPM to 2000, reducing IAS to 95 knots. Use carburettor air heat and pitot heat as required.

Stalls

23 There is slight buffeting just before the stall, but this cannot be relied on to give adequate warning. With flaps up or down, the aircraft drops a wing. With flaps down, the wing drops more quickly than with the flaps up. In both cases, if the stick is held back the aircraft will spin. Stalling speeds are as follows:

(a) Flaps and Undercarriage UP: 60-65 knots IAS.

(b) Flaps and Undercarriage DOWN: 55-60 knots IAS.

Pre-Spin, Stall, Low Flying and Aerobatic Check

24 Prior to spinning, stalling, low flying and aerobatics, perform the following check:

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Cruising

20 Normal cruise conditions at 105 to 130 knots are arrived at with engine settings of 1700-1800 RPM and up to 26.5 inches MP. The engine settings for maximum cruise are 2200 RPM and 32.5 inches MP. See part 4-Operating Data. For R1340-S3H1 or AN1 engines. Select LEAN mixture by moving the mixture control lever slowly toward the LEAN position until the mixture control comes in contact with the stop on the throttle. The mixture control may remain there unless the engine is running roughly or the cylinder head temperature is unsatisfactory. In the latter cases, enrich the mixture until the engine is running smoothly. Do not exceed engine limitations for LEAN mixture as shown below.

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(a) Flaps and Undercarriage UP: 60-65 knots IAS.

(b) Flaps and Undercarriage DOWN: 55-60 knots IAS.

Pre-Spin, Stall, Low Flying and Aerobatic Check

24 Prior to spinning, stalling, low flying and aerobatics, perform the following check:

H Hydraulics - undercarriage up and hood closed.

T Trim - trim for straight and level flight. Tension adjusted.

M Mixture - mixture adjusted, carburettor icing checked and carburettor heat COLD.

P Pitch - 2000 RPM.

F Fuel - sufficient quantity in selected tank.

F Flaps - flaps UP.

G Gills - adjusted.

G Gyros - caged (uncaged for low flying).

S Switches - radio compass OFF.

H Harness - secure.

Spins

25 The following precautions must be taken prior to the spin:

(a) Close both hoods to keep the canopy from blowing out.

(b) Adjust the pedals so that full rudder can be applied. If necessary lower the seat.

(c) Flaps and undercarriage must be UP.

(d) To avoid the possibility of flooding the intake with fuel, with consequent risk of fire, the engine controls should be set as follows:

(1) Carburettor heat COLD. (If carburettor icing conditions exist, the aircraft should not be spun).

(2) Throttle 12 inches MP.

(3) Propellor control - moderate cruising RPM up to 2000 RPM.

(4) Mixture control - fully LEAN. After recovery, the mixture control should be returned to RICH and then adjusted normally.

WARNING

Intentional spinning and aerobatics in Harvard 2A aircraft are prohibited unless the rocket rails, light series bomb carriers and machine gun are removed.

Starboard Spins

26 The aircraft generally flicks to starboard and there is considerable shuddering for about two turns. After this the spin becomes normal. Recovery is effected by applying full opposite rudder and moving the stick forward until the spin stops. When opposite rudder is applied, the rate of turn increases for $1\frac{1}{2}$ to 2 turns, and then stops suddenly. The rudder should be centralized immediately and the speed allowed to build up to approximately 120 knots before easing out of the dive.

Port Spins

27 Spin characteristics are similar to starboard spins but the flick and shuddering are less pronounced. Recovery procedure is the same.

NOTE

Intentional spins with the undercarriage and flaps down are prohibited, however, should a spin occur, normal recovery action should be taken immediately.

NOTE

Although spins in the armament trainer with rocket rails attached are prohibited, recovery from inadvertent spins can be made in the normal manner but may require $2\frac{1}{2}$ turns on a spin to starboard. The loss of height per turn is about 10% greater.

Incipient Spin From a Steep Turn

28 The aircraft generally flicks to starboard from either a starboard or a port turn if a stall occurs and will spin if the stick is held back. If a spin develops, recover as for a normal spin, closing the throttle to avoid

excessive loss of height during recovery.

Inverted Spin

29 An inverted spin is the same in principle as a normal spin, but is preceded by inverted flight, such as occurs at top of loops and in half rolls at the top of a loop. All the loads are reversed and the pilot's weight is on the harness.

30 Recovery is effected by applying full opposite rudder, then moving the control column steadily back until the spinning stops. The rudder is then centralized and the aircraft may continue in inverted flight, or return to level flight by a half loop or half roll. Intentional inverted spinning is not permitted on this aircraft.

Sideslips

31 The aircraft can be sideslipped, but difficulty is experienced in maintaining a steady forward speed and direction because of the large fin area. Care must be taken that the airspeed does not drop below 80 knots, and recovery from a sideslip should be effected above 200 feet.

NOTE

PROHIBITED MANOEUVRES - The following aerobatics are not permitted in these aircraft: flick roll, flick half roll, vertical reverse, falling leaf, bunt, outside loop, inverted spin, inverted climbing following a half roll after flattening out from a dive, prolonged inverted flying, and spinning when carrying bombs or RPs. No aerobatics are permitted when carrying bombs or RPs.

Aerobatics

32 Aerobatics are quite easy to perform. All aerobatics are normally carried out with the following engine settings:

(a) Up to 28 inches MP.

(b) 2000 RPM.

(c) Mixture RICH. If engine runs rough, weaken mixture sufficiently to eliminate the roughness.

33 Aerobatics are normally performed at the following speeds.

(a) Looping Manoeuvres - 155 knots IAS.

(b) Rolling Manoeuvres - 140 knots IAS.

(c) Half-roll off the Top - 175 knots IAS.

NOTE

If a loop or roll off the top is tightened up to the point where stalling incidence is reached, the aircraft may flick to either side and spin.

Engine Overspeeding - In the event that the engine cuts out during any aerobatic manoeuvre, the following action must be taken to prevent overspeeding.

(a) Retard the throttle to idle.

(b) Recover with the lowest possible airspeed, aborting the manoeuvre if necessary.

(c) Place the aircraft in a normal climbing attitude.

(d) Slowly advance the throttle when the airspeed has dropped to 110 knots or lower.

LANDING PROCEDURE

Vital Actions Before Landing

34 Reduce speed to 130 knots or less and set power at 1750 RPM and 25" hg manifold pressure.

(a) Down Wind Check.

U Undercarriage - select DOWN - Check undercarriage lever locked down by performing a shake test. Visually check that gear indicator lights are green and indicators show wheels are down.

F Fuel - sufficient in tank selected and pressure within limits.

B Brakes - Check brake pedal action and ensure parking brake OFF.

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U Undercarriage - select DOWN.

F Fuel - sufficient in tank selected and pressure within limits.

B Brakes - check brake pedal action and ensure parking brake OFF.

U Undercarriage Indicators - Check indicators show wheels are down. Visually check locks and green lights.

M Mixture - full RICH. Carb. air heat COLD or as necessary to prevent icing.

(b) Cross Wind Check

U Undercarriage - test horn.

P Pitch - full FINE.

F Flaps - as required.

H Harness - locked. Hood closed or fully opened.

Approach and Normal Landing

35 The recommended approach speed is 80 knots IAS for either an engine-assisted or glide approach. The aircraft may be landed either in the three-point attitude or on the main wheels only. After a three-point landing, or when the tail is down after a wheel landing, the stick should be held back. This will assist in keeping the tail wheel in the steerable position. With the tail wheel locked, a ~~swing of~~ 15° to either side is possible. control within

Crosswind Landing

36 In a strong crosswind or in rough air conditions it is preferable to make a wheel landing with the flaps up.

Mislanding

37 In the event that it becomes necessary to take over-shoot action proceed as follows:

(a) Advance throttle to give 36 inches MP.

(b) Climb at 80 knots IAS.

(c) Raise the undercarriage.

(d) Raise the flaps.

NOTE

The flaps on the Harvard 2 aircraft may come up, when the control is moved even though the power control has not been actuated.

After Landing Check

38 After landing carry out the following check:

F Flaps - UP.

T Trim - set elevator trim at 11 o'clock and rudder at 3 o'clock positions. Loosen the throttle tension.

G Gills - adjusted.

C Carburettor Heat - COLD.

S Switches - unnecessary switches OFF.

END OF FLIGHT PROCEDURE

Oil Dilution

39 Oil dilution is to be used at least once daily regardless of the atmospheric temperature or season of the year. It is the responsibility of the maintenance personnel to carry out oil dilution on the aircraft. Pilots, however, should be familiar with the methods of carrying out oil dilution. For further information, refer to EO 10A-1-1K.

Stopping the Engine

40 After reaching the ramp, the engine is to be stopped using the following procedure:

(a) Parking brakes ON.

(b) Check temperature and oil dilute as required.

(c) Set throttle to 1400 RPM.

(d) Move the propeller control to POSITIVE COARSE PITCH and wait until the pitch changes and the RPM falls and remains constant.

(e) Check for grounded magnetos by turning ignition OFF and then to BOTH position.

(f) Move the mixture control lever fully forward to the LEAN position.

(g) After engine has stopped, switches OFF.

(h) Fuel OFF.

(j) Close throttle.

(k) Cage gyros.

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M Mixture - full RICH. Carb. air heat COLD or as necessary to prevent icing.

(b) Cross Wind Check.

U Undercarriage - test horn.

P Pitch - full FINE.

F Flaps - as required.

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Oil Dilution

39 Oil dilution is to be used at least once daily regardless of the atmospheric temperature or season of the year. It is the responsibility of the maintenance personnel to carry out oil dilution on the aircraft. Pilots, however, should be familiar with the methods of carrying out oil dilution.

(a) Cold Weather Dilution.

(1) Ground run at low power selection to reduce oil temperature below 50°C.

(2) Select setting of 1200 rpm.

(3) Hold oil dilution switch in the ON position for the time indicated in table.

(4) Operate propeller control twice through complete range, toward end of dilution period.

(5) Stop the engine, but as the engine "dies" release the dilution switch and observe that the fuel pressure returns to its normal value during the last few revolutions of the engine. Report a stuck oil dilution valve if the fuel pressure does not return to normal.

(b) Diluent Boil-Off.

(1) For normal operation a boil-off period is not required. If it is desired to reduce the diluent proceed as follows:

a. Check the L-14 to determine the duration of the previous dilution.

b. Start the engine carry out normal run up to attain a minimum of 50°C oil temperature.

c. Ground run 10 minutes for each minute of dilution duration.

(c) Anti-Sludge Dilution

(1) Dilute for 1 minute either during warm up or prior to stopping engine.

OIL DILUTION TABLE

Anticipated Next Start	Dilute	Boil-Off to 10%
Ambient Temperature	Minutes	Minutes
-10°C and above	1	Normal run
-10°C to -20°C	1-1/2	
-20°C to -30°C	2	
-30°C to -40°C	2-1/2	
-40°C to -50°C	3	

Stopping the Engine

40 After reaching the ramp, the engine is to be stopped using the following procedure:

(a) Parking brakes ON.

(b) Check temperature and oil dilute as required.

(c) Set throttle to 1400 RPM.

(d) Move the propeller control to POSITIVE COARSE PITCH and wait until the pitch changes and the RPM falls and remains constant.

(e) Check for grounded magnetos by turning ignition OFF and then to BOTH position.

(f) Move the mixture control lever fully forward to the LEAN position.

(g) After engine has stopped, switches OFF.

(h) Fuel OFF.

(j) Close throttle.

(k) Cage gyros.

(m) Turn radio and magnesyn compass OFF.

(n) Lock controls.

Before Leaving the Aircraft

41 If the aircraft is to be left standing for a long period, check the following.

(a) Chocks placed in front of and behind each main wheel.

(b) Parking brakes off.

(c) Engage the flying controls lock.

(d) Canopies closed.

Tie Down

42 Insert tie-rings, stowed in baggage compartment, in sockets on the lower surface of the wing panels near the tips and attach tie ropes or lines to the rings. Pass tie-rope through mooring shackle in wing center section at the front spar. The tail may be secured by passing ropes or lines through the lift tube aperture, or by lashing directly to the tail wheel assembly.

(m) Turn radio and magnesyn compass OFF.

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AL REYNOLDS
MUD ST., R.R. 1
STONEY CREEK

PART 3

EMERGENCY HANDLING

EMERGENCY TAKE-OFF

General

1 For take-offs from small airfields and short runways, line up the aircraft on the take-off path, apply the brakes, lower 15° flap, and then open up the throttle to 32" Hg. Release the brakes evenly and continue to open the throttle to a maximum of 36" Hg. Take-off straight ahead.

ENGINE FAILURE PROCEDURES

Failure During Take-Off

2 If the engine failure occurs on take-off, depress the nose immediately to maintain 80 knots IAS. Select undercarriage UP (if not already selected UP) and land straight ahead.

Failure in Flight

3 If the engine fails in flight, trim the aircraft to maintain a gliding speed of 90 knots IAS, flaps and undercarriage UP. At this speed the rate of descent is the least. Lowering of either the flaps or the undercarriage (or both) greatly steepens the gliding angle for a given speed, and the rate of descent is much increased. If the cause of the failure cannot be found, turn off the fuel and switches, place the propeller in POSITIVE COARSE PITCH, open the coupe top, and carry out the normal forced landing procedure for single engine aircraft.

MAIN SERVICES EMERGENCY PROCEDURE

Flaps

4 If the engine-driven pump fails, the flaps can be lowered by using the hydraulic hand pump. If both pumps fail, the flaps cannot be lowered.

Undercarriage - Harvard 2 & 2A

5 In the event of the undercarriage failing to release from the uplocks, or failing to lock fully down, an additional amount of movement is provided on the undercarriage selector quadrant. An emergency selection may be obtained by lifting the undercarriage selector lever handle and moving the lever forward to the end of the quadrant. This will further disengage the up-lock latches so as to fully release the retaining hooks on the oleo legs and will also manually force the down-lock pins from their housings. To ascertain whether the undercarriage is locked down after an emergency selection, the following procedure must be carried out:

(a) Return the selector lever to the DOWN position.

(b) Operate the hydraulic hand pump until strong resistance to pumping is felt and the hydraulic pressure gauge indicates a pressure of 1000 to 1200 psi.

(c) Move the selector lever to the EMERGENCY position to ensure that the down-lock pins are fully out of their housings and that the green lights come on. Should the green lights fail to come on and a visual check through the perspex windows indicates that the oleo legs are not locked, return the selector lever to the UP position to allow the down-lock pins to return to their housings. Repeat steps 1, 2 and 3 above. If this action fails to lock the undercarriage down, a wheels-up landing should be considered.

Undercarriage - Harvard 4

6 There is no EMERGENCY position of the undercarriage selector lever on this aircraft. After selecting the down position, visual inspection should be made through the inspection windows in the mainplane to see that the locking pins are engaged. If they are not, this may be corrected by rocking the aircraft from side to side to clear them. If this fails, raise the undercarriage and lower again. If this fails after several attempts, the wheels should be raised and Crash Landing Drill carried out before making a wheels-up landing.

Brakes

7 If the pressure in the brake system fails, there is no way in which braking action can be obtained on the wheels.

CRASH LANDING DRILL

General

8 In the event that a crash landing becomes necessary, the captain of the aircraft should ensure that both his and the other occupant's harness are secure and tight. The cockpit hood should be left open, flaps lowered if required, and the undercarriage left in the UP position depending on the terrain.

ACTION IN THE EVENT OF FIRE

Engine Fire in Flight

9 If the engine catches fire in flight:

(a) Close throttle.

(b) Propeller lever full back (POSITIVE COARSE PITCH).

(c) Turn off fuel. Wait until engine has slowed to minimum RPM.

(d) Switch off.

(e) Operate fire extinguisher.

(f) Make forced landing or abandon aircraft.

(g) Do not attempt to restart engine.

On Ground While Starting

10 If the engine catches fire while starting, immediately:

(a) Close the throttle.

(b) Stop the engine by moving mixture control to idle cut-off of full LEAN.

(c) Turn fuel cock OFF.

(d) Turn ignition switches OFF.

(e) Use ground or engine fire extinguisher if necessary.

ABANDONING THE AIRCRAFT

General

11 If the aircraft is under control at a safe height, trim it to fly at reduced speed before attempting to leave. Pull the cockpit hood open, and, if possible, step onto the walkway, assume a sitting position, and slide off the trailing edge. If there is insufficient time to carry out this procedure, simply dive downward over the side of the cockpit. If the hood cannot be opened, proceed as follows:

(a) Harvard 2 & 2A - Operate the emergency release handle and leave head first through the panel opening.

(b) Harvard 4 - Knock out either side large glass panel and leave head first through the panel opening. To knock out the panel, direct a sharp blow at the rear top corner of the panel in the front cockpit, and at the front top corner of the panel in the rear cockpit. Direct the blow, in both cases, from the corner specified towards the center of the panel.

(c) If the aircraft is in a spin, abandon it on the side away from the axis of spin.

PART 4

OPERATING DATA

INTRODUCTION

General

1 The information contained herein pertains to Harvard aircraft in general. Individual aircraft may show minor variations within design limitations of the aircraft.

LOADING INSTRUCTIONS AND LIMITATIONS

General

2 The following points are to be observed when considering the weight and balance of the Harvard aircraft.

(a) The limiting load factor or maximum g is 5.67g for a maximum weight of 5490 pounds for aerobatics and 4.9g for a maximum gross weight of 5750 pounds. When the all-up weight exceeds the maximum gross weight, fuel or load must be reduced as necessary.

(b) No baggage is to be carried when engaging in aerobatics.

(c) Harvard 2 & 2A - Since the CG in many cases is critically close to the rear limit, baggage should normally only be carried when the rear seat is not occupied. Baggage may be carried with the rear seat occupied only after it is determined that the gross weight and CG limitations will not be exceeded. In every case, when baggage is carried, the aircraft is restricted to gentle manoeuvres.

(d) Harvard 4 - Up to 30 lbs. of baggage may be carried in the baggage compartment on this aircraft at any time except during aerobatics.

NOTE

See EO 05-55A-8, Weight and Balance Data, for further loading instructions.

FLYING LIMITATIONS

General

3 Full use of ailerons can be made up to 165 knots IAS when no acceleration is applied. Aileron control remains light with speed and must not be abused when diving or pulling out of a dive.

Maximum Speeds

4 The following maximum speed limitations are not to be exceeded:

(a) Diving - 210 knots IAS at maximum gross weight; 225 knots IAS at maximum aerobatic weight.

(b) Undercarriage Lowering - 130 knots IAS.

(c) Undercarriage Locked Down - 145 knots IAS.

(d) Flaps Down - 110 knots IAS.

Inverted Flying

5 Inverted flying should not be carried out for periods exceeding five seconds, as complete loss of engine oil pressure ensues.

Prohibited Manoeuvres

6 The following manoeuvres are prohibited:

(a) Flick - roll.

(b) Flick half - roll.

(c) Vertical reverse.

(d) Falling leaf.

(e) Bunt.

(f) Outside loop.
(g) Inverted spin.
(h) Inverted climb following a half-roll after flattening out from a dive.
(j) Prolonged inverted flying.
(k) Aerobatics and spinning when carrying bombs and rockets.

AIRSPEED POSITION ERROR CORRECTION

PEC Table

7 The following are the corrections for the position error of the airspeed indicator pressure head:

(a) Harvard 2 & 2A:

IAS Knots		Correction Knots
70	Add	1
87	Add	2
104	Add	2½
122	Add	3½
139	Add	4½
156	Add	5

(b) Harvard 4:

70 -- 120	Add	0
120 -- 140	Add	1
140 -- 170	Add	2

ENGINE LIMITATIONS

Engine Data

8 The following are the limitations for which the engine has been tested and must not be exceeded except in an emergency.

(a)

	RPM	MP "Hg	Temp. °C Cyl. Head	Oil	Mixture
Max. Take-off (5 min. limit)	2250	36	260	85	Rich
Max. Rich continuous	2200	32	260	85	Rich
Max. Lean continuous	2000	26	230	85	Lean
Desired normal temps.			205	50--70	

(b) Oil Pressure:

(1) Maximum -- 90 psi
(2) Normal -- 70 to 90 psi
(3) Minimum cruising -- 50 psi
(4) Minimum idling -- 10 psi

(c) Oil Temperature:

(1) Minimum temperature for take-off 40°C.

(d) Cylinder Head temperature:

(1) Minimum temp. for take-off 120°C.

(2) Maximum temp. for take-off 260°C.

(3) Maximum for stopping engine 205°C.

(e) Fuel Pressure:

(1) Permissible range --4 to 6 psi
(2) Desired -- 5 psi.

FUEL CONSUMPTION

At High Power

9 Consumption at High Power:

Mixture	RPM	Manifold Press. "Hg	Imperial Gals./hr.
Rich	2250	36	56
Rich	2200	32	48
Rich	1925	29	30

Per Hour at Sea Level

10 Fuel Consumption in Imp. gal. per hour at sea level with manually-leaned mixture:

	Manifold Pressure "Hg				
RPM	29	26	24	22	
2000	25½	23	21	19	
1900	24	21½	20	18	Fuel
1800	22½	20	18½	17	Consumption
1700	21	19	17	--	Imp.Gals./hr.
1600	19½	17½	16	--	
1500	18	16½	--	--	

(f) Outside loop.
(g) Inverted spin.
(h) Inverted climb following a half-roll after flattening out from a dive.
(j) Prolonged inverted flying.
(k) Aerobatics and spinning when carrying bombs and rockets.

AIRSPEED POSITION ERROR CORRECTION

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7 The following are the corrections for the position error of the airspeed indicator pressure head:

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70	Add	1
87	Add	2
104	Add	2½
122	Add	3½
139	Add	4½
156	Add	5

(b) Harvard 4:

70 -- 120	Add	0
120 -- 140	Add	1
140 -- 170	Add	2

ENGINE LIMITATIONS

Engine Data

8 The following are the limitations for which the engine has been tested and must not be exceeded except in an emergency.

(a)	RPM	MP "Hg	Temp. °C Cyl. Head	Oil	Mixture
Max. Take-off (5 min. limit)	2250	36	260	85	Rich
Max. Rich continuous	2200	32	260	85	Rich
Max. Lean continuous	2000	26	230	85	Lean
Desired normal temps.			205	50--70	

(b) Oil Pressure:

(1) Maximum -- 90 psi
(2) Normal -- 70 to 90 psi
(3) Minimum cruising -- 50 psi
(4) Minimum idling -- 10 psi

(c) Oil Temperature:
Minimum for run up 40°C.
(1) Minimum temperature for take-off 40°C.
Max temp 85°C.

(d) Cylinder Head temperature:

(1) Minimum temp. for take-off 120°C.

(2) Maximum temp. for take-off 260°C.

(3) Maximum for stopping engine 205°C.

(e) Fuel Pressure:

(1) Permissible range -- 4 to 6 psi
(2) Desired -- 5 psi.

Overspeed and Overboost

8A Momentary overspeeding may occur during take-off or aerobatics, and may be disregarded if rpm remains below 2350. Any operation above 2350 rpm renders the engine unserviceable; land at the nearest base and report the malfunction;

8B The maximum manifold pressure for take-off is 36". If this is inadvertently exceeded at any time the engine must be considered unserviceable; land at the nearest base.

NOTE

All cases of overspeeding or overboosting must be entered in the Form L14, giving RPM, MAP, mixture control setting, duration, and any other relevant details.

FUEL CONSUMPTION

At High Power

9 Consumption at High Power:

MAXIMUM PERFORMANCE

Climb

11 Speeds for maximum rate of climb are:

(a) From sea level to full throttle altitude at 32" Hg and 2200 rpm--100 knots IAS.

(b) Above full throttle altitude, reduce airspeed by 2 1/2 knots per 2000 ft.

CRUISE CONTROL

General

12 The best throttle and propeller settings for range, descent and endurance are given below:

(a) Range - For maximum range use LEAN mixture. The recommended speed for maximum range is 110 knots IAS. At moderate altitudes up to full throttle altitude fly at 1500 rpm and adjust throttle to maintain height at the required speed, not exceeding 26" Hg. At or above full throttle altitude, the rpm must be increased to maintain speed up to a maximum of 2000 rpm.

(b) Descent - Enrich the mixture, maintain a minimum of 1500 rpm, and adjust the throttle to give 110 knots IAS at the required rate of descent.

(c) Endurance - Maintain 1500 rpm, lean mixture, and the smallest throttle opening at which height can be maintained. The best speed is approximately 90 knots IAS.

(d) Use carburettor heat as required.

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