PART I

DESCRIPTIVE

NOTE.—Throughout this publication the following conventions apply:—

(a) Words in capital letters indicate the actual markings on the controls concerned.

(b) The numbers quoted in brackets after items in the text refer to the illustrations in Part VI.

(c) Unless otherwise stated, all airspeeds and mach numbers quoted are "indicated".

1. **Introduction**

(a) The Sea Venom F.A.W.20 is a two-seat, all-weather fighter, powered by a Ghost 103 turbo-jet engine, developing approximately 4,850 lb. static thrust at sea level.

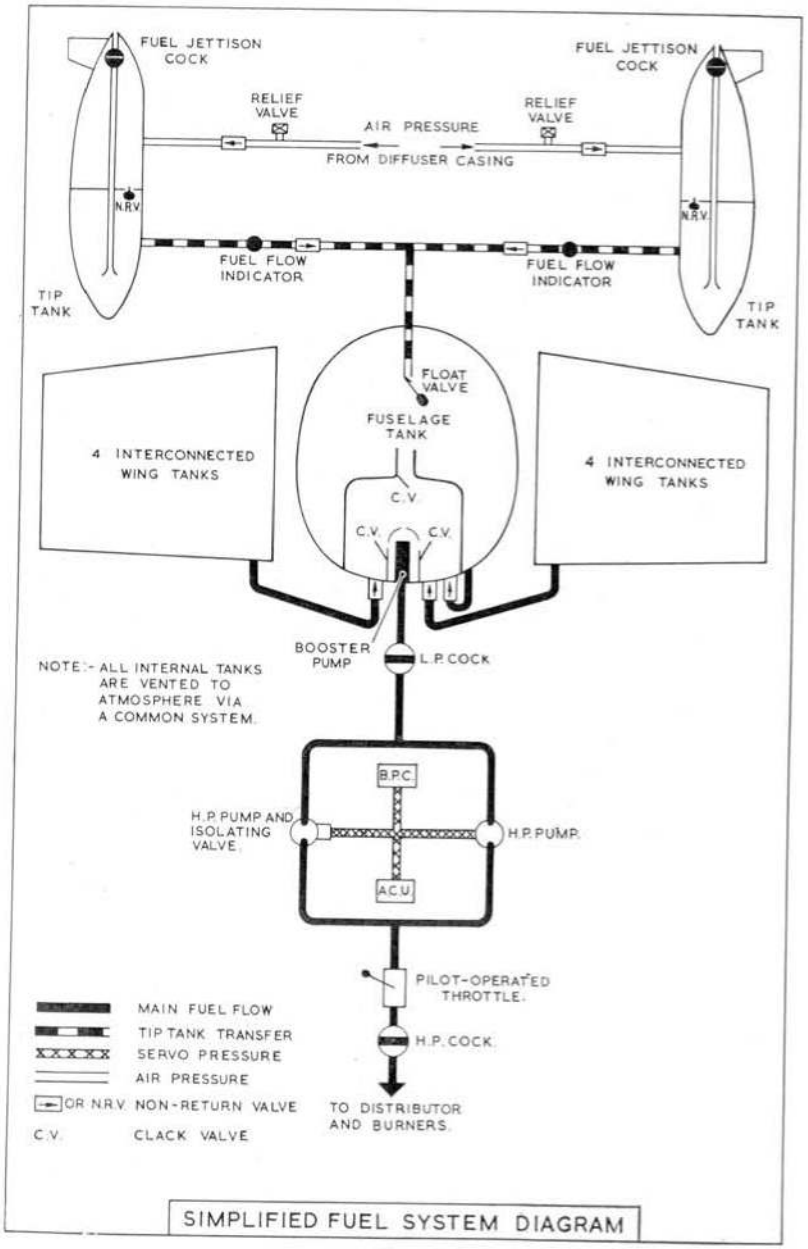
(b) The armament consists of four 20 mm. guns and provision is made for the carriage of R.P.s. A.I. Mk. 10 is fitted.

(c) The aircraft is fully equipped for carrier operation, with folding wings, arrester hook and R.A.T.O.G. The cockpit is pressurised and has an air conditioning unit. Ejection seats are not fitted.

FUEL AND OIL SYSTEMS

2. **Fuel tanks**

(a) Nine internal fuel tanks are carried, one in the fuselage, one in each wing root and three in each inner wing. Wing-tip tanks are fitted; the fuel from these tanks is jettisonable but the tanks themselves are not.



SIMPLIFIED FUEL SYSTEM DIAGRAM

(b) The tank capacities are as follows:—

	Gallons	*lb. AVTUR (8 lb./gall.)*
Fuselage tank	92	736
Two wing-root tanks (2×57½) ..	115	920
Six wing tanks	106	848
Total internal capacity	313	2,504
Two wing-tip tanks (2×75) ..	150	1,200
Total capacity	463	3,704

All internal tanks are pressure-vented to atmosphere via a common outlet. Transfer from the wing-tip tanks is by air pressure and from the wing tanks by gravity.

(c) *Collector box*

The collector box in the base of the fuselage tank contains enough fuel to keep the engine running up to the limit of ten seconds under negative G loading or when flying in attitudes near the vertical.

(d) *Unusable fuel*

Between 10 and 22 gallons of fuel (80 to 175 lb.) are unusable, depending on the aircraft attitude, the amount increasing as the tail-down attitude increases.

3. **Fuel contents gauge**

A two-scale Pacitor-type, electrically-operated fuel contents gauge (41), at the top right of the instrument panel, shows the combined contents of all the internal tanks. When the button to the left of the gauge is pushed, the gauge will then indicate the contents of the fuselage tank only. There is no gauge for the tip tanks but, when tip-tank transfer ceases, the fuselage tank gauge reading will probably drop rapidly to 30–40 gallons (240–320 lb.). Post-Mod. N.209, the fuel contents gauge is calibrated in pounds, instead of gallons; this type of gauge is more accurate.

4. **Fuel transfer system**

All fuel is transferred to the fuselage tank and from there to the engine. The sequence is as follows:—

(a) *Tip tanks*

Transfer commences by air pressure, tapped from the engine diffuser casing, when the level in the fuselage tank has fallen by approximately 15 gallons (120 lb.). When transfer is taking place, the appropriate magnetic indicators (49) show black. When transfer pressure is insufficient or when transfer is complete, they should show white.

NOTE.—Unless Mod. N.327 has been incorporated, to relieve excessive pressure in the fuel venting system, the indicators may remain black whether transfer is complete or not.

(b) *Internal wing tanks*

When the level in the fuselage tank has fallen sufficiently, 30–40 gallons (240–320 lb.) remaining, transfer starts from the internal wing tanks, by gravity only.

5. **Booster pump**

(a) A booster pump in the base of the fuselage tank delivers fuel through the L.P. cock to the two engine-driven H.P. fuel pumps. If the booster pump fails, fuel bypasses the pump by gravity. A low pressure warning light (50), at the right-hand side of the instrument panel, comes on when the pump delivery pressure falls below $1\frac{1}{2}$ lb./sq. in., or when the pump is switched off.

(b) The booster pump is controlled by a switch (62) marked FUEL PUMP SWITCH, at the right-hand side of the instrument panel. The circuit breaker (at 65) is on the starboard side of the cockpit and the test socket (81) to the rear on the starboard side.

6. **L.P. cock**

The L.P. cock lever (21) is on the underside of the engine control box and is marked FUEL OFF (down and aft) and FUEL ON (forward and up). The L.P. cock should be closed in the event of an engine fire but, except in an emergency, must not be used to stop the engine, as the H.P. pumps will be damaged and the fuel system aerated. It should always be closed after stopping the engine, to prevent fuel by-passing the H.P. cock and seeping into the combustion chambers.

7. **Wing-tip tanks fuel jettison switch**

The guarded jettison switch (11) on the port shelf is marked TIP TANK FUEL–JETTISON/CLOSE. When put to JETTISON, two ports, one at the aft end of each wing-tip tank, are opened and fuel is driven out by air pressure from the engine, through pipes which communicate with *the front compartments* of the tanks only. The ports can be closed at any time, so that partial jettisoning of the fuel load is possible. It takes approximately one minute for the full load to be jettisoned. The jettison switch must always be set to JETTISON when transfer from the tip tanks is complete and at any time when the tanks are empty.

8. **Oil system**

Oil is carried in the engine sump, the capacity of which is 16 pints. An oil temperature gauge (63) is at the bottom of the instrument panel. In addition to the sump capacity, four pints of oil are contained in the system, over-filling of which may cause high oil temperatures and/or a visible loss of oil in flight.

ENGINE CONTROLS

9. **Ghost Mk. 103 engine**

(a) *General*

The engine is a centrifugal turbo-jet engine, developing 4,850 lb. static thrust at sea level. The main systems include:—

A two-shot cartridge starter system (see para. 10)
A relighting system (see para. 11)
A self-contained oil system

(b) *High-pressure fuel system, isolating valve and H.P. cock*

(i) The engine-driven H.P. fuel pumps are duplicated, as a safety device, but either is capable of supplying the engine up to maximum power.

(ii) To ensure correct and equal fuel delivery from each pump at a given throttle setting, their output pressure is servo-controlled by a barometric control unit (B.P.C.). However, should this fail, or should there be a leak in the servo-line, *both* pumps would then go to

zero delivery. To prevent this happening, one pump can be isolated from the other so that at least one of them will continue to deliver fuel to the engine. The isolating valve is controlled by a switch (51), marked FUEL PUMP EMERGENCY, beside the FUEL PUMP SWITCH.

(iii) To prevent a rich extinction when the throttle is opened quickly, an acceleration control unit (A.C.U.) —sometimes referred to as an air/fuel ratio control (A.F.C.)—temporarily overrides the B.P.C. and ensures that an acceptable air/fuel mixture is maintained under these conditions.

(iv) *H.P. fuel cock lever*

The H.P. fuel cock lever (12), on the engine control box, controls the fuel flow from the throttle to the distributor. A catch secures the lever in the ON (up) position. This lever must always be used to stop the engine and must also be closed if the engine fails.

(c) *Throttle control*

The throttle lever (14) is in a quadrant, marked SHUT–THROTTLE–OPEN, on the throttle box on the port side of the cockpit. The lever incorporates a G.G.S. range control and a V.H.F. press-to-transmit button. A friction damper (15) is on the inboard side of the box and is rotated clockwise to tighten.

10. **Starting system**

(a) The engine is started by a cartridge system. The engine STARTER MASTER switch (57) on the starboard control panel must be ON to energise the firing circuit. The cartridge is fired by pressing in the STARTER button (58) next to the master switch; the button is then held in electro-magnetically for 20–30 seconds and during this time the high energy ignition system is in operation. During a normal start, the turbo-starter brings the engine r.p.m. up to approximately 1,500, when light-up should occur. The engine should then accelerate up to the normal idling r.p.m. of 3,000 ± 200.

(b) The starter system contains two cartridges; the second one is auto-selected as the starter button resets. Four spare cartridges are stowed in the aircraft, two in each flap compartment.

11. **Relighting control**

An engine relighting pushbutton is incorporated in the end of the H.P. cock lever. It should be pressed to energise the igniter plugs when relighting in flight and may be used as an audible check that the high energy ignition is functioning, before starting up. The relight system will operate regardless of the position of the engine starter master switch.

12. **Engine instruments**

The following engine instruments are provided:—

R.P.M. indicator
J.P.T. gauge
Oil temperature gauge (63)

13. **Engine fire-warning light and extinguishers**

(a) *Fire warning*

There is a combined fire-warning light and extinguisher pushbutton (45) above the starboard coaming. Pre-Mod. N.779, the button is pulled out to test the light; post-Mod. N.779 a separate adjacent pushbutton is provided for testing the light. The light is operated by flame switches in the engine; these switches are of the resetting type and the light will go out when the fire is extinguished.

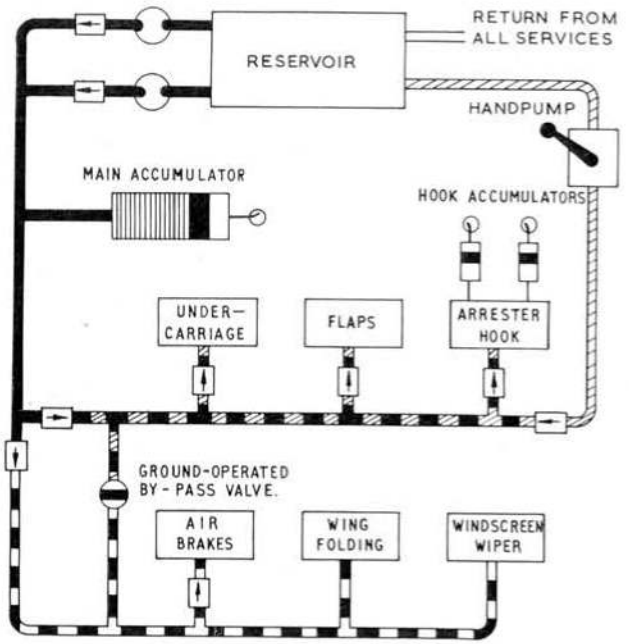
(b) Two fire-extinguisher bottles, one in each flap shroud, are operated by pressing the extinguisher button. The contents of the extinguishers are discharged from spray nozzles on either side of the diffuser casing. The cockpit pressure control must be OFF before the system is operated. The system will operate irrespective of the position of the Ground/Flight switch.

MAIN SERVICES

14. **Hydraulic system**

(a) Two engine-driven hydraulic pumps on separate shafts provide pressure at 2,500 lb. for the operation of the:—

Undercarriage
Flaps
Airbrakes
Wing folding
Arrester hook
Windscreen wiper



SIMPLIFIED HYDRAULIC SYSTEM DIAGRAM

(b) The main accumulator, if fully charged, will provide enough pressure for the one-way operation of the flaps, the undercarriage and the arrester hook. The correct air pressure for this accumulator is 1,250 lb./sq. in.

(c) Two subsidiary damper accumulators (air pressure 1,700 lb./sq. in.) are connected to the arrester hook circuit. These absorb the fluid displaced by the partial retraction of the hook during deck landing.

(d) If complete hydraulic failure occurs, the handpump between the seats can be used to provide pressure for the operation of the undercarriage, flaps and arrester hook. On the ground it may also be used to operate the airbrakes, wingfold circuit and winsdcreen wiper, after opening a valve in the port gun bay. The handpump will not charge the accumulator. Unless Mod. N.335 is incorporated, operation of the handpump must not be continued after the required service has reached the selected position.

15. **Pneumatic system**

(a) The pneumatic system is used to provide air pressure for the brakes, the hood seal, the anti-G system (if fitted) and the R.A.T.O.G. jettison mechanism.

(b) An engine-driven compressor charges an air-bottle below the cockpit. A ground charging connection is on the pneumatic panel beside the bottle.

(c) The main air bottle pressure is 450 lb./sq. in. A pressure-maintaining valve operates to conserve all available pressure for the brakes, if the main supply pressure falls below 250 lb./sq. in. A pressure-reducing valve in the supply to the brakes reduces the pressure to 220 lb./sq. in. It is further reduced to 150 lb./sq. in., by the brakes relay valve. Further pressure-reducing valves reduce the pressure at the hood seal to 10 lb./sq. in., and at the anti-G valves to 10–20 lb./sq. in.

(d) The main supply pressure and the pressure at each wheel brake are shown on a triple-pressure gauge (18) on the port shelf.

16. **Electrical system**

(a) *Battery supply*

A battery master (GROUND/FLIGHT) switch (88) is on the starboard shelf. When set to GROUND, it disconnects the two 12-volt batteries from the electrical system.

(b) *D.C. generators*

(i) There is one 3 kW., 24-volt, D.C., engine-driven generator. The generator field circuit breaker (67) is on the starboard shelf and must be in for starting and at all times while the engine is running.

(ii) There is a generator failure warning light (35) on the left of the instrument panel. The light should go out when the engine r.p.m. reach approximately 3,500.

(iii) Mod. N.420 introduces a voltmeter (64) on the main instrument panel. The voltmeter shows the generator output or, when the generator is not charging, the battery voltage. When the voltmeter reading falls to 21, no electrical services will be available.

(c) *External D.C. supply*

Ground testing of the electrical services may be carried out with an external battery plugged in to one of the two external sockets on either side of the fuselage under-surface. (The sockets are similar in purpose and are so placed for convenience on a flight deck.) The Gr ound/ Flight switch must remain at GROUND all the time when an external source or its adaptor, is connected, otherwise chattering of the relay will cause damage.

(d) *Flight instruments A.C. supply*

(i) Current for the A.C.-operated flight instruments is provided by one of two inverters run off the D.C. supply. The circuit breakers (at 65) for the two inverters are on the starboard panel and are labelled INVERTER A and INVERTER B; they must be made before the inverters will operate. Inverter A (the main inverter) is switched on by the FLIGHT INSTRUMENTS master switch (48) on the instrument panel and Inverter B (the stand-by inverter) by the switch (at 87) on the starboard panel.

(ii) If Inverter A fails a torque switch operates and automatically connects the supply from Inverter B to the flight instruments. There is no indication in the cockpit that automatic changeover has taken place.

(iii) An instruction panel on the starboard wall of the cockpit gives the drill for starting up the inverters. In addition to the stated drill, inverter A may be reset by switching off the FLIGHT INSTRUMENTS master switch for one second and then switching it on again.

(e) *Radar A.C. supply*

A 1.2 kW alternator provides alternating current for the radar equipment. It is controlled by the A.C. SUPPLY switch (at 87) on the electrical panel.

(f) *Emergency D.C. supply*

In the event of electrical failure, a 24-volt alkaline battery provides power for the emergency lamp on the port side of the cockpit. Post-Mod. N.352, this battery also supplies emergency power for the turn and slip indicator. The endurance of the battery is approximately 1 hour with both services in use.

AIRCRAFT CONTROLS

17. **Flying controls**

The flying controls are conventional. The rudder pedals can be adjusted for length by lifting them and then sliding them forward or aft into the required slot.

18. **Trimming controls**

(a) *Elevator*

The elevator is fitted with a spring balance tab and a geared-cum-trimming tab which is controlled by a hand-wheel (20) on the engine control box. The indicator (13) is on the back of the box.

(b) *Ailerons*

(i) The ailerons have spring-balance tabs. The starboard aileron has a ground-adjustable trimming tab and the port aileron an electrically-operated trimming tab controlled by a spring-loaded switch (17) on the port shelf. The switch works in the natural sense and should be held over to trim out lateral stick forces. No indicator is fitted.

(ii) Later aircraft are fitted with variable-ratio gearing on the ailerons, adjusted by a knob on the forward face of the control column. Anti-clockwise movement of the knob selects HIGH (high speed), clockwise movement selects LOW (low speed). Any intermediate setting may be selected. When at LOW, use of approximately only 50% of stick movement available at HIGH is possible. A stud, moving in a slot at the rear of the control column, gives an indication of the position of the knob.

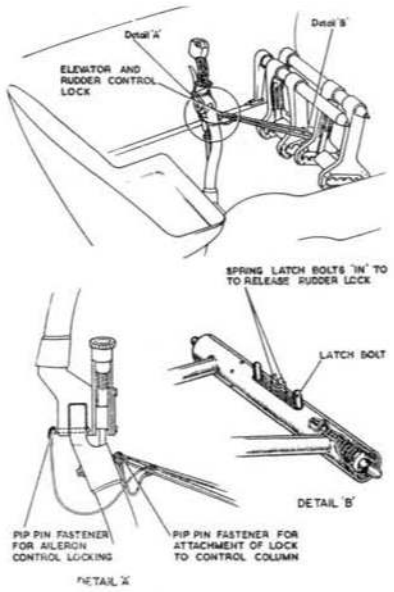
(c) *Rudder*

A ground-adjustable trimming tab is fitted to each rudder. A spring in the rudder circuit supplements the aerodynamic forces in centralising the rudder.

19. Flying controls locking gear

(a) *Internal*

A single triangular bar assembly secures the pedals and prevents fore and aft movement of the control column. The quick-release pin secured to this assembly is inserted through the hinge of the upper portion of the column to prevent aileron movement. The spring bolts which lock the rudder pedals are released by pulling the two latch bolts towards each other. When not in use, the locking gear is stowed behind the pilot's seat.



(b) *External*

Clamping blocks are provided for the ailerons. They must be removed before wing folding and before removing the internal locks.

20. Undercarriage

(a) *Normal operation*

The undercarriage selector lever (33) is on the left of the instrument panel and is pulled *out and up* to select UP. *When selecting* DOWN, *the lever must always be moved fully down into its slot.* With the lever thus set, with the weight of the aircraft on the undercarriage, it is held in the down position by a solenoid-operated plunger.

(b) *Position indicator*

A standard undercarriage position indicator (30) is next to the lever.

Indications are:—

Undercarriage locked up	..	No lights
Undercarriage unlocked	..	Three red lights
Undercarriage locked down	..	Three green lights

A red light (29), just to the right of the indicator, comes on only if any of the three wheels are not locked down and the throttle is less than a quarter open. The light is extinguished when *all* the wheels are locked down.

(c) *Emergency operation*

If the engine-driven hydraulic pumps fail and accumulator pressure is exhausted, the handpump to the right of the pilot's seat can be used to operate the undercarriage after normal UP or DOWN selection. Up to 115 strokes may be necessary to lower the undercarriage fully and lock it down. To prevent possible inadvertent dumping of hydraulic fluid through the flaps pipelines, it is recommended that the flaps selector lever is set to neutral as soon as hydraulic failure is suspected.

(d) *Undercarriage emergency override*

The undercarriage can be retracted in emergency, when the aircraft is on the ground, by first operating the guarded switch (19) on the port shelf and then using the normal undercarriage selector.

(e) *Undercarriage safety locks*

Safety locks, each with a red flag, may be inserted in the radius rods of the main undercarriage struts. Stowage for these locks is provided in the starboard gun-bay door. Mod. N.854 deletes this stowage.

21. **Flaps**

(a) *Normal operation*

The flaps selector lever (22) is on the rear face of the engine control box. There are three positions on the selector lever quadrant, UP-neutral-DOWN. Any degree of flap movement may be obtained by selecting UP or DOWN and then returning the lever to neutral after the required position is reached. The lever should be returned to neutral when the flaps are fully down, if it is necessary in emergency to conserve accumulator pressure, but may be left in the UP position when the flaps are fully up.

(b) *Position indicator*

A flaps position indicator (31) is fitted at the left-hand side of the instrument panel. It is connected to the right-hand flap only and may give a false reading for intermediate flap settings on the ground. When the flaps are under air load, the indication is correct.

(c) *Emergency operation*

The flaps may be operated by the handpump after normal selection, if the engine-driven pumps fail and the accumulator is exhausted.

22. **Airbrakes**

(a) *Normal operation*

The airbrakes are selected by a lever (16) extending from the top of the engine control box. The lever is marked OUT (aft)—DIVEBRAKES—IN (forward). No intermediate settings are available.

(b) *Emergency operation*

The airbrakes cannot be operated in flight by the handpump.

23. **Arrester hook**

(a) *Normal operation*

The arrester hook is hydraulically operated and is controlled by a lever (25) on the rear face of the engine control box. The selector lever is retained by a catch in the up position. The hook is lowered by gravity, and raised and held in the up position by hydraulic pressure.

(b) *Indicator*

A green hook-indicator light (23) is adjacent to the selector lever. Pre-Mod. N.236 the light *goes out* when the hook is lowered and the undercarriage is locked down. Post-Mod. N.236, the light *comes on* when the hook is lowered.

(c) *Deck approach light*

Mod. N.383 introduces a deck approach light on the nosewheel fairing. The associated CARRIER/AIRFIELD switch is on the starboard shelf. When set to CARRIER, the light comes on when both hook and undercarriage are lowered. When set to AIRFIELD, it comes on when the undercarriage is locked down but will go out if the hook is lowered.

(d) *Emergency operation*

To lower the arrester hook, select down in the normal way; to raise, select up and use the handpump.

24. **Wheel brakes**

The pneumatic wheel brakes are operated by a lever on the control column which incorporates a parking catch; differential braking is controlled by the rudder bar. The available pressure in the system and at each wheel brake is indicated on the triple-pressure gauge (18) on the port shelf. The maximum pressure at each wheel brake is 150 lb./sq. in. Maxaret units are not fitted.

25. **Wing folding and spreading**

(a) The wings are folded and spread by hydraulic power direct from the engine-driven pump. They may also be folded by operating the handpump, provided the by-pass valve is opened (see paragraph 14 (d)). They are automatically locked in the spread position by hydraulically-operated bolts at the front and rear spar attachments. Selection is by means of a SPREAD/FOLD lever (2) to the rear of the port side of the cockpit.

(b) *Safety devices*

(i) *Folding*

The lever is positively held in the SPREAD position until a similar LOCKED/UNLOCKED (3) lever immediately outboard is moved to UNLOCKED. This action withdraws a *locking pin* manually, allowing the hydraulically-operated wing bolts to move. It also mechanically raises and illuminates indicators which protrude from the upper wing surface. The position of the four hydraulically-operated wing bolts can be checked by means of two magnetic indicators (10) on the port shelf. Provided that electrical power is available, the appropriate indicator will show *white* when either of the two locking bolts on one side are not fully home.

(ii) *Spreading*

The LOCKED/UNLOCKED lever must not be moved to LOCKED until the wings are spread and the hydraulically-operated locking bolts are fully home, with the appropriate cockpit indicators showing black.

NOTE.—The magnetic indicators will show white whenever there is an electrical power failure.

26. **Mach number warning device**

A "stick shaker" device gives warning at high altitudes of the onset of compressibility. It should operate at 0.83M to 0.84M at 40,000 ft. and above, giving an oscillation backwards and forwards of about one quarter of an inch. The guarded switch (89) is on the starboard panel and is marked STICK SHAKER. It may be switched off when desired.

27. **R.A.T.O.G.**

(a) *Selection*

The R.A.T.O.G. master and safety switches (44) and yellow warning light (46) are grouped together above the instrument panel, on the right. When the safety switch (at the bottom) is moved to the left, the yellow warning light comes on; this indicates that the firing circuit inertia switch is open. The R.A.T.O.G. is then selected by closing the master switch; as this is done, two amber lights come on, one on either side of the nose of the aircraft.

(b) *Firing*

The rockets are automatically fired during catapult operation (at 2.4G) by the closing of the inertia switch. A sliding switch, for firing the rockets manually, is on the control column.

(c) *Jettisoning*

The R.A.T.O.G. attachments are jettisoned electro-pneumatically by a guarded switch (7) on the port shelf.

28. **Flight instruments**

(a) *A.S.I. and associated instruments*

(i) A pressure-head on the port tail fin provides pressure for the A.S.I., V.S.I., altimeter and machmeter.

(ii) The pressure-head is electrically heated and the controlling switch (at 87) is on the starboard shelf.

(b) *Turn and slip indicator*

The turn and slip indicator is electrically operated. On Pre-Mod. N.352 aircraft, the supply is fed through two fuses connected in parallel and through a relay. If the normal supply fuse fails, the supply will be routed through the alternative fuse. On Post-Mod. N.352 aircraft, the indicator may be operated by the emergency battery, after putting on the switch beside the generator warning light. The instrument has an OFF flag to indicate power failure.

(c) *Artificial horizon*

The artificial horizon operates whenever alternating current is available, provided that the flight instruments master switch and the main inverter circuit breaker are both on. A Mk.3C instrument is introduced by Mod. N.412 and a Mk. 4 by Mod. N.720. Both instruments have fast-erection buttons and OFF flags to indicate power failure.

(d) *Mk. 4B gyro compass*

A Mk. 4B compass indicator (36) is at the bottom of the pilot's instrument panel. The master indicator is behind the pilot and the control unit (82) is on the starboard wall. Alternating current is required to operate the system and the flight instruments master switch and main inverter circuit breaker must both be on.

(e) *E2A stand-by compass*

An E2A magnetic stand-by compass (32) is at the forward end of the cockpit port wall.

(f) *A.Y.F. radio altimeter*

The radio altimeter indicator (34) is on the left of the pilot's instrument panel.

(g) *Air position indicator and air mileage unit*

The A.P.I. and A.M.U. are behind the pilot's seat.

(h) *Air temperature gauge*

There is an air temperature gauge to starboard of the radar crate.

(j) *Accelerometer*

An accelerometer may be fitted on a bracket above the instrument panel.

COCKPIT EQUIPMENT

29. **Access to cockpit**

The cockpit is reached by a retractable footstep on the port side of the fuselage; this footstep normally retracts as the weight of the foot is removed. Alternatively, the cockpit may be entered by a ladder which can be locked in a ferrule on either side of the cockpit.

30. **Hood operation**

(a) *Opening the hood from outside*

The flush-fitting external release handle is housed centrally just aft of the hood. A pushbutton on the handle is pressed to make the handle spring out of its housing; the handle is then turned anti-clockwise through 90° to release the hood lock (some force may be necessary). The hood can then be raised by hand; a mechanism balances the hood in any position, making movement up or down easy. When fully open, it is locked by a spring-loaded catch acting on the hood strut.

NOTE.—To prevent damage to the hood locking mechanism, care must be exercised to avoid snatching when opening the hood in high winds.

(b) *Closing the hood from inside*

The spring-loaded catch on the hood strut is released by pulling forward the knob (74), marked HATCH STRUT RELEASE, on the starboard wall of the cockpit. The hood may then be lowered by hand; it is locked, when closed, by pulling back and up the large handle, at the top centre of the windscreen. When this is done, a locking catch, next to the internal handle, should snap forward on to the handle; if it does not, it should be pushed forward. The locking catch, when fully forward, inflates the hood seal in addition to preventing any inadvertent operation of the handle.

31. **Hood jettisoning**

NOTE.—Explosive or manual hood jettisoning also lowers the gunsight if electrical power is available.

(a) *Explosive jettisoning*

The hood may be jettisoned explosively by pulling up the handle (61) on the cockpit floor, forward and to the right of the pilot's seat. When the handle is pulled up, a trigger is operated by Bowden cable, a cartridge fired and the hood jettisoned. The trigger is made inoperative by inserting a locking pin in a socket on the bulkhead behind the pilot's seat, to port of the hinge mechanism; the pin has a red pennant attached to it. When not in use, the pin and pennant are stowed in a canvas bag behind the pilot's seat on the cockpit port wall.

(b) *Manual jettisoning*

If the explosive mechanism fails, either through the Bowden cable breaking, or the cartridge failing to fire, the hood can be jettisoned manually as follows: the ring handle just to the right of the hinge mechanism is pulled out—this releases the rear end of the hood, which may then be opened normally at the front by releasing the locking lever and pushing the internal handle down and forwards. Care must be taken to keep the hand unclenched to avoid snatch on the wrist when the hood suddenly lifts.

WARNING.—Attempts to jettison manually, by first opening the hood in the normal way and then pulling the ring handle, must never be made.

32. Oxygen system and pressure-breathing equipment

(a) *Supply*

Oxygen is carried in three Mk. 5C cylinders, two behind the cockpit bulkhead and one in the nose of the aircraft. The charging point is accessible through the starboard ammunition loading door. The supply is taken to the pilot's Mk. 11D regulator (54), on the right-hand side of the instrument panel, and thence to the observer's Mk. 11E regulator (70) on the starboard wall. From the regulators, supply lines pass to the selector valves marked P.B. and ECON., on the cockpit floor, to the right of the pilot's seat. From the valves, the supply is directed to the pressure-breathing waistcoats and oxygen masks (when pressure-breathing equipment is used) or to the economisers and then to the masks, via flexible tubes, depending on the position of the selector valves.

(b) *With pressure-breathing equipment*

Turn on the oxygen and put the selector valve to P.B. The oxygen then by-passes the economiser and flows directly to the type J oxygen mask. The flow selector lever on the regulator is used in the normal way to vary the flow according to the cockpit altitude.

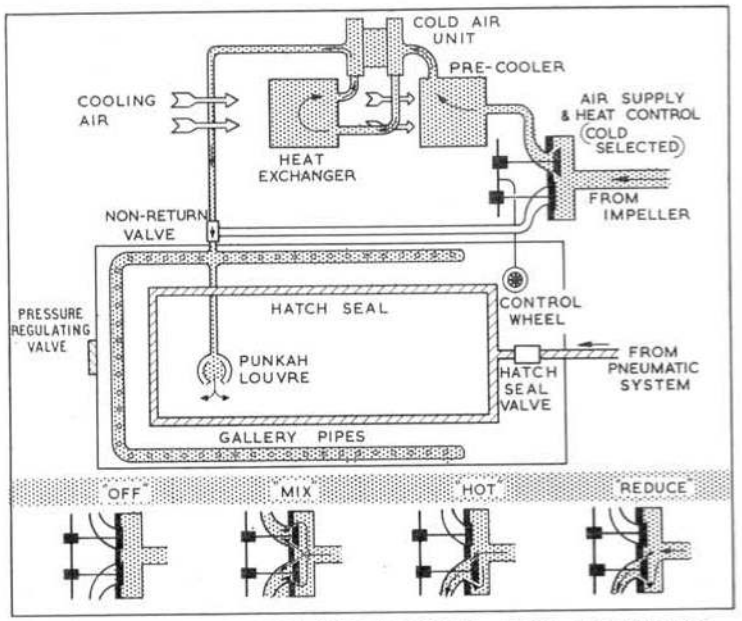
(c) *Without pressure-breathing equipment*

After turning the oxygen on and setting the selector valve to ECON., the oxygen flows through the economiser and thence to the mask.

NOTE.—The economiser will be damaged if pressure-breathing equipment is used with the selector valve in the ECON. position. The ECON. position must always be used when wearing an H-type mask. The selector should be wire-locked in the required position.

33. Cockpit air conditioning

(a) Cockpit pressurising, heating and cooling is controlled by movement of the wheel (24) on the port shelf. The wheel rotates through 270° and has five marked positions: OFF–COLD–MIX–HOT–REDUCE.



COCKPIT PRESSURISATION AND HEATING

(b) *Pressure*

With the hood seal control on (i.e., with the hood handle lock in the forward position) and the wheel set other than OFF, the cockpit pressure is automatically controlled by a valve which allows a steady build-up of differential cockpit pressure above approximately 12,000 feet until, at 35,000 feet, the full differential pressure is reached. The cockpit pressure is indicated on an altimeter (53) at the bottom right of the instrument panel. A warning light (52) beside the altimeter comes on when the cockpit altitude falls below the allowable minimum for a given true altitude. The table below shows the cockpit altitudes corresponding to the minimum pressures. When the control is at REDUCE the amount of air entering the cockpit will be reduced.

Actual altitude (ft.)	Equivalent altitude (cockpit)	Approx. cockpit altitude at which light comes on
20,000	14,100	18,000
30,000	18,800	22,000
40,000	24,000	28,000
50,000	28,000	32,000

(c) Air for pressurising enters the cockpit through a louvre (68) and also through holes in the gallery pipe for windscreen and hood demisting. The amount of air passing to the windscreen can be controlled by adjusting the louvre.

34. **Windscreen de-icing**

The windscreen de-icing system is controlled by a hand-operated pump (59) below the starter master switch. The pump handle is released by rotating it anti-clockwise. As the handle comes out under pressure the windscreen is sprayed. Pressure is raised again by pushing the handle in.

35. **Direct-vision panel**

A direct-vision panel is fitted in the port quarter of the front windscreen and is opened by turning a screw knob at the top. When the panel is open, it lies at an angle across the top of the cockpit; in this position it presents a hazard to the pilot in a crash landing. It can, however, be removed and handed to the observer—no stowage is provided.

36. **Windscreen wiper**

A hydraulically-operated windscreen wiper may be fitted. It is controlled by an OFF–ON–PARK knob (28) below the instrument panel, on the left.

37. **Anti-G equipment**

Anti-G equipment may be fitted but must not be used.

38. **Seats, headrests and harness adjustment**

(a) *Seats*

The pilot's seat can be raised or lowered by a lever on the right of the seat; a plunger at the top must be depressed before the lever can be moved. The observer's seat is not adjustable.

(b) *Headrests*

Both the pilot's and observer's headrests can be adjusted fore-and-aft, after releasing locking pins at the sides of the mounting tubes. When the hood is jettisoned, the pilot's headrest goes with it, the observer's headrest stays with the aircraft. In Pre-Mod. N.382 aircraft, in the forward position the observer's headrest fouls the observer's parachute as he attempts to abandon the aircraft and, as there is no means of retracting the headrest in flight (either by the pilot or observer), it must be at the fully back position before take-off.

(c) *Harness release*

Pre-Mod. N.219 the pilot's harness release lever is on the front left-hand side of the seat. Post-Mod. N.219 the lever (9) is on the cockpit port wall. The observer's release lever (72) is on the starboard wall.

(d) *Harness stowage clips*

Mod. N.310 introduces harness stowage clips. The pilot's is on his seat frame and the observer's is on the starboard shelf.

39. **Internal lighting**

(a) *Ultra-violet lamps*

The instrument panel ultra-violet lamps are controlled by the centre dimmer switch (4) on the port shelf.

(b) *Red lamps*

The instrument panel red lamps are controlled by the forward dimmer switch (5) on the port shelf; the master switch adjacent to the dimmer switch must be on before the lamps will come on. The port shelf red lamps are controlled by the rearmost dimmer switch (1) and the observer's red lamps by the dimmer switch (83) behind the starboard shelf.

(c) A socket (71) is provided for inspection and chartboard lamps. The supply is controlled by a switch (69) on the starboard shelf.

(d) *Emergency lamp*

This is controlled by a switch (38) at the top of the instrument panel. Power is supplied from a separate dry battery.

Modified aircraft are fitted with two emergency lamps, a red lamp for the E2 compass and an amber lamp for the main instrument panel. The power supply is a separate 24-volt battery, which also provides an emergency supply to the turn and slip indicator. (See para. 16 (f).)

40. **External lighting**

(a) A circuit breaker (66) marked EXTERNAL LIGHTS protects the circuit.

(b) *Navigation lights*

The navigation lights are controlled by a DIM–off or morse–BRIGHT switch (85) on the starboard shelf. A pushbutton beside the switch is used for morsing.

(c) *Downward identification light*

The MORSE–off–ON switch (86) for the downward identification light is on the starboard shelf. A pushbutton beside the switch is used for morsing.

(d) *Landing lamp*

The landing lamp OFF–LOW–HIGH switch (84) is on the starboard shelf. After switching the lamp from OFF, there is a short delay before the light comes on, while the lamp extends. The lamp should not be extended at speeds above 175 knots.

RADIO AND RADAR

41. **V.H.F. (A.R.I.5491)**

(a) The V.H.F. installation, which provides airborne relay facilities, comprises two ten-channel sets, types T.R. 1934 and T.R. 1935, with a type 383 controller; whip aerials are on the starboard tail boom and under the port wing.

(b) The controller (26), which includes two channel-selectors and a selector switch, is on the port shelf. The selector switch is marked OFF–R.T.1–DUAL–REL–RT2.

(c) The pilot's R/T–MIX–BEACon switch (80) and the observer's R/T TELS–BEACON switch (77) are on the starboard wall of the cockpit.

(d) The pilot's press-to-transmit button is incorporated in the throttle lever and the observer's foot-operated muting switch (60) is on the cockpit floor.

(e) The pilot has a normal mic/tel socket on the side of his seatpan and a quick-release socket (8) on the cockpit port wall.

(f) A Naval modification introduces an interlock between the oxygen and the R/T. The R/T cannot be used until a switch marked MIC, on the oxygen regulator, has been put on (down); this switch cannot be put on until the oxygen is on.

42. **Z.B.X. (Homing beacon receiver)**

The beacon receiver is behind the pilot and the controller (73) is on the starboard wall. Signals can only be received by the pilot if the R/T–MIX–BEACon switch is set to MIX or BEAC and by the observer if his R/T TELS–BEACON switch is at BEACON or if the pilot's switch is at MIX.

NOTE.—Mod. N.248 introduces Green Salad as a replacement for Z.B.X. The indicator is on the bottom left-hand corner of the instrument panel and the controls are on the port shelf, in the position at present occupied by the signal discharger switch (27).

43. **Intercomm.**

Intercomm. is normally through a type A.1961 amplifier; this is controlled by the I/C ON–off switch (75) on the starboard wall. The NORMAL/EMERGENCY switch (76) should be at NORMAL. In emergency, one of the V.H.F. sets can be used for intercomm. by setting the NORMAL/EMERGENCY switch to EMERGENCY. When the switch is thus set, all conversation will be broadcast if the press-to-transmit switch is pressed. There is an external intercomm. plug on the underside of the wing, just outboard of the wing fold.

44. **A.I.10 (search radar)**

The scanner, modulator and R.F. unit are mounted within the nose of the aircraft. The indicator, synchroniser and control box are on the radar crate forward of the observer. The search radar takes 40 amps; therefore, when at engine idling r.p.m., the radar should be switched off, or the system will be overloaded. It should also be switched off immediately in the event of electrical failure.

NOTE.—Fading will occur if r.p.m. are reduced below 6,000. Approximately two minutes are required before the A.I. again becomes operative after increasing power.

45. **I.F.F.**

The controls (78, 79) are on the cockpit starboard wall and the F and D switches (6) are on the port shelf. The code selector unit is behind the pilot's seat.

ARMAMENT EQUIPMENT

46. **Gunsight**

(a) A retractable gyro gunsight Mk. 4E (37) is mounted above the instrument panel and is normally raised or lowered by means of a switch (40) beside the sight, provided that the circuit breaker (at 65) on the electrical panel is in. If the electrical system fails, it is possible to lower the sight by a lever (39) on the right of the sight; this control should only be used in an emergency, since servicing is necessary before the sight can be used again. The sight is automatically lowered when the hood is jettisoned, provided electrical power is available.

(b) *G.G.S. dimmer-selector control*

The control (56) is mounted on the starboard instrument panel; the range control is incorporated in the throttle lever.

(c) *G.G.S. master switch*

The G.G.S. guns/RP MASTER SWITCH (47) is to port of the radar crate. It has four positions:—OFF–GUNS–GUNS & BOMBS–GUNS & ROCKETS.

47. **Cameras**

(a) *G.G.S. recorder camera*

(i) A recorder camera can be fitted to the top of the gunsight. With the G.G.S. master switch at GUNS, the camera will operate each time the guns are fired, or when the camera button is pressed, provided the CAMERA GUN master switch (at 87) is on. When R.P.s are selected and the camera button is pressed, the camera will run until the R.P. button is pressed.

(ii) To prevent electrical failure of the sight, the recorder camera should be neither plugged in nor unplugged while the sight is in the raised position.

(b) *G.45 camera*

A G.45 camera is pod-mounted under the port wing and is operated by either the camera button or the gun button, provided the camera master switch is on. If the camera is to be operated by the gun button, the G.G.S. master switch must first be set to GUNS. A SUNNY/CLOUDY aperture switch (42) is above the instrument panel, on the right.

48. **Guns**

Four 20 mm. Hispano Mk. 5* guns are installed, two on each side of the nose, and are fired electrically by the trigger on the control column, after the safety catch has been released and the G.G.S. master switch has been set to GUNS. It is possible to fire the guns when the aircraft is on the ground.

49. **Rockets**

(a) Rockets may be carried under the wings, either in double tier stowage using No. 8 Mk. 4 saddles or in single tier stowage using No. 5 Mk. 2 saddles. Either 25 lb., 60 lb. or flare heads may be used.

(b) The rockets are fired by a button on the control column, after the safety catch has been released and the G.G.S. master switch has been set to GUNS & ROCKETS. There is a PAIRS/SALVO selector switch (43) above the instrument panel, to the right. The R.P. auto-distributor (55) is beside the radar crate.

(c) Rockets may be fired with the airbrakes out.