P. G. Rayley

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AIR PUBLICATION 1530 B

Pilot's Notes

PILOT'S NOTES

THE BLENHEIM IV AEROPLANE

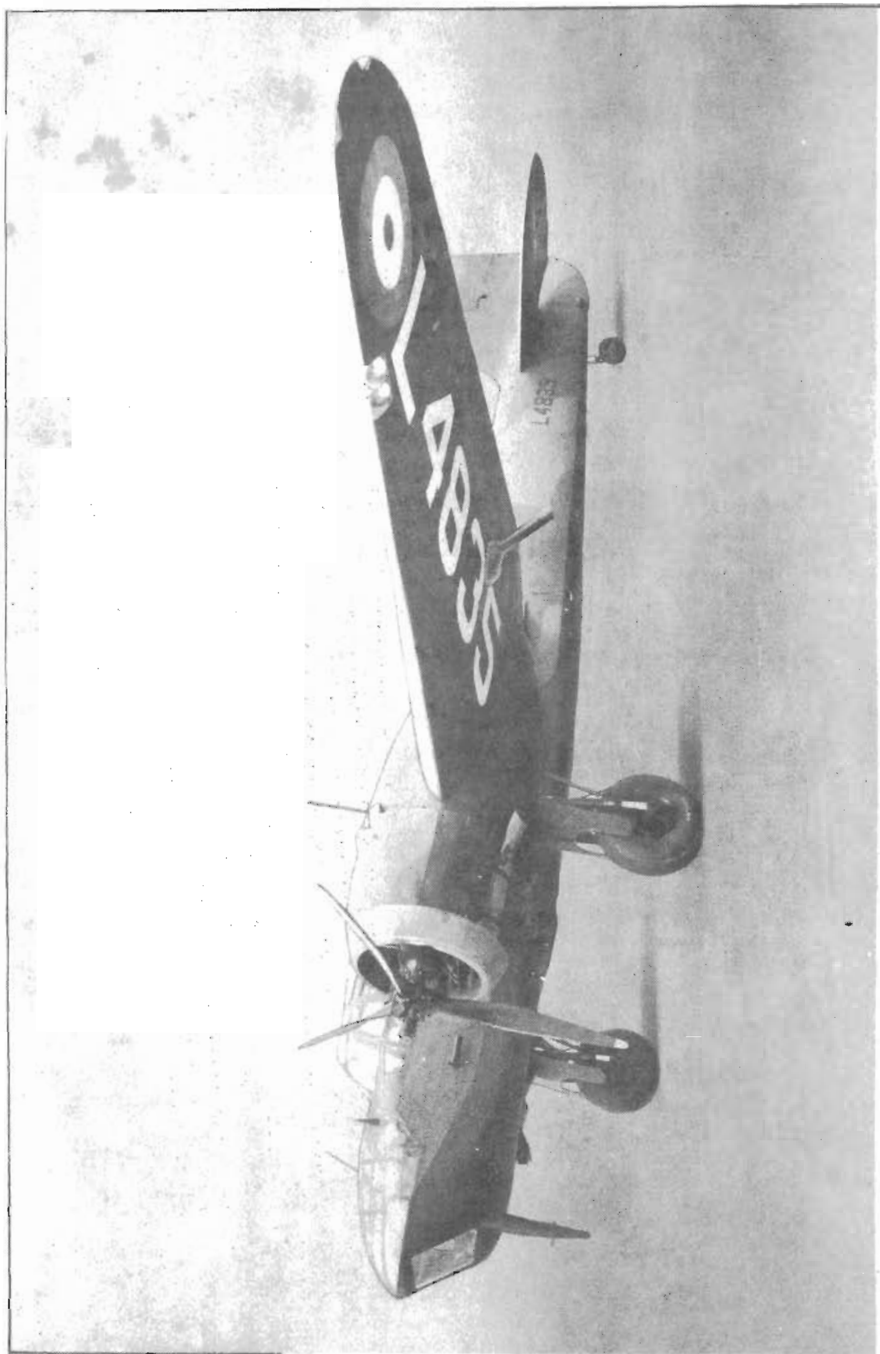
TWO MERCURY XV ENGINES

This handbook is promulgated for the information and guidance of all concerned

By Command of the Air Council

A.W. STREET

AIR MINISTRY



The Blenheim IV aeroplane

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A.P.1530B VOL.I
FRONTISPIECE

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Volume I

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AMENDMENT CERTIFICATE

Incorporation of an amendment list in this publication should be certified by inserting the amendment list number, initialling in the appropriate column and inserting the date of incorporation.

Holders of the Pilot's Notes will receive only those amendment lists applicable to the preliminary matter, introduction and sections 1 and 2.

Amendt. List No.										
Prelimy. matter										
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Section 1										
Section 2										
Section 3										
Section 4										
Section 5										
Section 6										
Section 7										
Section 8										
Section 9										
Section 10										
Section 11										
Section 12										
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Continued overleaf

Note to official users

Air Ministry Orders and Volume II leaflets as issued from time to time will affect the subject matter of this publication. It should be understood that amendment lists are not always issued to bring the publication into line with the orders or leaflets and it is for holders of this book to arrange the necessary linking-up.

Where an order or leaflet contradicts any portion of this publication, an amendment list will generally be issued, but when this is not done the order or leaflet must be taken as the overriding authority.

LIST OF SECTIONS

(A detailed Contents List is given
at the beginning of each Section)

INTRODUCTION

(Note.- This Introduction and Sections 1 and 2 are also issued separately as "Pilot's Notes").

1. The Blenheim IV is an all-metal low-wing monoplane fitted with two Mercury XV engines and variable-pitch airscrews. It is designed and equipped for day-bombing duties and accommodation is provided for a crew of three, consisting of pilot, bomb aimer or navigator and gunner or wireless operator.

2. The fuselage is of monocoque construction throughout, alclad being used for the skin, stringers and formers. The main plane is a two-spar stressed-skin cantilever structure with alclad covering and spars having alclad webs and laminated booms of high-tensile steel; it is constructed in three portions, the port and starboard outer planes and the centre plane, and is tapered in chord and thickness. The centre plane is built into and forms an integral part of the fuselage, the spars being continuous through the fuselage. The fin and tail plane are cantilever structures constructed mainly of alclad, and the rudder, elevators and ailerons have a tubular spar, alclad plate ribs and fabric covering.

3. An inward-opening door on the roof forward of the gun turret and a short ladder inside provide the means of entry to the rear cabin and turret, and the pilot's cockpit and the bomb-aiming station can be entered through a sliding hood over the pilot's seat. Footrests and handgrips and a non-slip walkway on the main plane are provided on the port side. The nose of the aeroplane is covered with transparent panelling and the pilot with his controls and equipment is accommodated on the port side forward of the main plane front spar. At a lower level and extending from the front spar right up to the nose, is the equipment for the bomb aimer or navigator, which includes two folding seats. Emergency exits on each side of the pilot are provided in the transparent panelling. A seat for the gunner is incorporated in the gun turret, which is of the hydraulically-operated Bristol type, and the wireless equipment is located aft of the turret.

4. The alighting gear consists of two retractable undercarriage units, one under each engine nacelle, and a non-retractable castering tail wheel unit. The undercarriage units are operated hydraulically and, when retracting, swing backwards and upwards into the engine nacelles leaving a small segment of the tyre protruding. Electrical and mechanical indicators and a buzzer in the pilot's cockpit indicate the position of the units. Each undercarriage unit has two Vickers oleo-pneumatic shock-absorber legs and the tail wheel unit has a single Dowty oleo-pneumatic leg. Dunlop pneumatically-operated brakes, with differential control by means of a relay valve connected to the rudder controls, are fitted to the undercarriage.

5. The ailerons and elevators are operated by means of a control column with a spectacle-type handwheel, and the rudder by pendulum-type pedals, pivoted at the top. A ground adjusted trimming tab is fitted to each aileron and, for directional and longitudinal trimming, tabs

controllable by the pilot are inset in the trailing edges of the rudder and elevators; the rudder tab, in addition to its trimming function is arranged to give an automatic servo action. Mk.IV auto-controls are fitted and dual controls may be installed side-by-side with the main controls. Hydraulically-operated split-trailing-edge flaps extend from the fuselage sides to the ailerons.

6. The two Mercury XV engines are installed in nacelles at the outboard ends of the centre plane. Long-cord cowlings are fitted over the engines, the exhaust collector forming the leading edge, and controllable gills that govern the flow of cooling air are fitted round the trailing edge. Fuel is carried in two main and two long range tanks, the main tanks being fitted between the spars of the centre plane, on each side, the long range tanks being similarly fitted in the outer planes. The fuel is supplied to the engines by engine-driven pumps but there is a sufficient head of fuel for gravity supply. Each engine has a separate oil tank and oil cooler mounted in the nacelle. The engines may be started either electrically or by hand.

7. The armament consists of a fixed Browning gun, mounted in the port plane and controlled pneumatically from a pushbutton on the pilot's control column, a Lewis gun in the gun turret and various alternative bomb loads. The main bomb load is carried under the fuselage in cells in the centre plane; the cells have spring-loaded doors that are opened by the weight of the falling bomb. Practice bombs can be carried on light-series carriers secured to the bottom of the fuselage aft of the main bomb cells, and flares can be carried in small cells at the centre plane roots.

8. A 12-volt 500-watt generator driven by the port engine provides for lighting and general services, including two landing lamps in the leading edge of the port outer plane, bomb release and fuzing, pressure head and gun heating, camera motor, undercarriage indicators etc. Two accumulators are provided, one for engine starting on the starboard floor of the front fuselage and the other for the general services on the port side forward of the turret. Other equipment includes an F.24 camera, G.22 camera gun, signal pistol, oxygen apparatus, valise-type dinghy, first-aid outfit etc.

SECTION 1

CONTROLS AND EQUIPMENT

IN PILOT'S COCKPIT

SECTION 1

CONTENTS

.S./2

LIST OF ILLUSTRATIONS

SECTION 1

CONTROLS AND EQUIPMENT

IN PILOT'S COCKPIT

Introductory

1. The layout of the flying and other controls and equipment in the pilot's cockpit is illustrated and referenced in figs.1 - 6 at the end of this Section; a key to the items referenced is given facing each illustration. Explanatory notes, where necessary, on the function and operation of particular items are given in this Section.

Fuel and oil

2. The fuel and oil to be used with the Mercury XV engines are:-

Fuel	(Outer tanks	100 octane fuel
	(Main tanks	Specification D.T.D.230 (Stores Ref.34A/59)
Oil	....	Specification D.T.D.109 (Stores Ref.34A/32 and 33)

Aeroplane controls

3. Control column.- Aileron control is obtained by rotation of the spectacle-type handwheel at the top of the control column (12); elevator control is obtained in the normal manner. The handwheel incorporates a brake operating lever (19) and a spring-loaded catch (18) for retaining the lever in the "on" position for parking is fitted near the lever pivot point. The catch is engaged by operating the brake lever, pressing down the catch and releasing the lever; the catch is then held in position but will spring out of the way when the brake lever is pressed down. In connection with parking, attention is drawn to A.M.O. A.114/38 in which are listed precautions to be observed when parking aeroplanes with differentially-controlled brakes. The button (22) on the handwheel controls the firing of the fixed gun in the port outer plane.

4. Rudder control.- The rudder is controlled by pendulum pedals (9), pivoted at the top. For leg reach, the pedals are adjustable by means of a handle (78) at the bottom of the instrument panel.

5. Trimming tab controls.- The trimming tabs are controlled by handwheels on the right-hand side of the seat at the forward edge; the larger, outboard wheel (5) is for the elevator tabs and the smaller, inboard wheel (6) is for the rudder tabs.

The elevator tab handwheel should be rotated forwards to the position marked NOSE DOWN to counteract slight tail heaviness, and vice versa, and the rudder tab handwheel rotated forwards to the position marked TURN STARBOARD to counteract any slight tendency of the aeroplane to turn to port, and vice versa. In the case of the elevators, when the wheel is rotated forwards, the trimming tabs are raised and the air striking the tab exerts a downward force on the elevators and relieves the pilot from the prolonged effort of holding the control column slightly forward. The rudder tab operates in a similar manner but in addition, has a servo action, the control linkage in the rudder being arranged to move the tab, at any setting, in the opposite directio to the rudder movement. Indicators (26) and (27) at the starboard side of the instrument panel show the position of the tabs; the starboard indicator (26) is for the elevator tabs.

6. Undercarriage and flaps (hydraulic) controls.- Raising and lowering of the undercarriage units and of the flaps are controlled from spade-grip push-pull handles on the right-hand side of the pilot's seat. The forward handle (49) controls the undercarriage and is shielded by a hinged cover to prevent its inadvertent use; the after handle (51) controls the flaps. In addition there is a selector handle (53) controlling a valve that directs fluid either for the operation of the turret or for the operation of the undercarriage and flaps.

7. The turret cannot be in operation at the same time as the undercarriage and flaps and before the undercarriage and flaps controls are operated, the selector handle must be pushed fully down. The undercarriage and flaps can then be lowered by pushing down their control handles or raised by pulling them up. When none of the three services is required to be in operation the selector handle should be in the central or off position, thus returning the fluid direct to the return circuit. The flaps handle has also a central or off position but this should be used as little as possible, especially when the flaps are in the raised position. An off position is not provided for the undercarriage handle.

8. In the event of failure of the engine-driven hydraulic pump (or failure of the port engine, by which the pump is driven) the undercarriage and flaps can be operated by means of a hydraulic hand pump which is worked by a handle (3) on the right-hand side of the seat.

9. Undercarriage position indicators and warning buzzer.- The up and down positions of each undercarriage unit are indicated by red and green lamps at the ends of the indicators (71) and the movement of each unit is shown by a pointer moving along a slot between the lamps. When the undercarriage is fully retracted a red lamp at the forward end of the indicator for each unit is illuminated. Immediately the locks for the retracted position are released the red lamps go out and the downwards travel of the undercarriage units is indicated by the pointers. When the undercarriage units are fully down the green lamps are illuminated. The switch (29) for the indicator lamps is fitted on the instrument panel.

10. An electrical warning buzzer in the nose of the aeroplane sounds if the throttle levers are moved back more than two-thirds

of the way from the full-open position with the undercarriage retracted. The buzzer remains in operation with the throttle levers in this position so long as the undercarriage remains fully retracted. The throttle buzzer switches are interconnected electrically with those for the top undercarriage switches so that the red lamps and the buzzer go out of action simultaneously.

11. Undercarriage ground safety links.- In order to prevent inadvertent retraction of the undercarriage when the aeroplane is on the ground, ground safety links are provided for fitting to the radius rod knee joints on the undercarriage. A red streamer is fitted on each link to enable the pilot to see from the cockpit if the link has been left in position, before taking-off.

12. Flaps position indicator.- A mechanical indicator (66) on the port side of the cockpit shows the position of the flaps by means of a pointer moving along a slot.

Engine controls

13. Throttle and mixture controls.- Two throttle control levers (64) and two mixture control levers (63) are fitted on the port side of the cockpit. The gate markings and positions for the levers vary according to whether type A.V.T.85E or A.V.T.85MB carburettors are fitted to the engines. In order to prevent movement of the levers owing to vibration, a friction adjuster for the stiffness of the controls is fitted at the side of the quadrant.

14. Fuel cock controls.- The fuel cocks and the cocks on the balance pipes between the suction and delivery pipes for each engine, are controllable by means of M.R.C. cables led from two handwheels and two levers mounted as a unit on the starboard side of the cockpit, immediately aft of the navigator's seat (see figs.4 and 6). The handwheels (104 and 103) which are painted red and green for port and starboard respectively, control the fuel cocks, and the two levers (105 and 106) marked S and D for suction and delivery respectively, control the balance cocks. When the levers are in their forward position the cocks are ON. When the outer tanks are empty and isolated from the fuel system, an engraved plate indicating these conditions is bolted to the existing bracket immediately above the fuel control unit.

15. Fuel jettison control.- The fuel in the outer (long range) tanks is to be jettisoned prior to landing. The outer tanks are provided with jettisoning cocks and fuel escape pipes, the port escape pipe being shown in the frontispiece, under the port outer wing. The jettisoning cocks are pneumatically operated by the fuel jettison control lever (98) which is mounted at the top of the control bank, on the port side, behind the pilot's seat (see figs.3, 5 and 6). When this lever is moved to the ON position both outer tank cocks are opened and remain open until the lever is returned to the OFF position, or until the air pressure in the system is reduced to 70 lb./sq.in.

When this figure is reached a cut-off valve automatically closes and retains sufficient pressure in the pneumatic system to ensure correct functioning of the brakes. It is important, after jettisoning the fuel, that the jettison cocks should be closed before the actual landing is made. The reason for this is that although the fuel may have stopped flowing from the jettison pipes, in the air, fuel remaining in the tanks may find its way out of the pipes when the tail touches the ground, with a possible danger of fire.

16. Fuel priming pumps and starting magneto switches.- The fuel priming pump and the starting magneto switch for each engine are mounted in the engine nacelles.

17. Air-intake shutter controls.- The air intake shutter control levers are mounted second from the top of the control bank on the port side behind the pilot's seat (see figs.5 and 6) and have red and green knobs (99) for port and starboard respectively. They control the supply of either hot or cold air to the carburettors and should be pushed down to supply hot air.

18. Carburettor cut-out controls.- The carburettor cut-out controls (see figs.5 and 6), which are mounted second from the bottom of the control bank on the port side behind the pilot's seat, have red and green knobs (100) for port and starboard respectively and are shielded by a spring-loaded cover to prevent their inadvertent use. When the controls are pulled the fuel supply for slow running is cut off thus enabling the engines to be stopped after the magnetos are switched off.

19. Boost control.- An over-ride lever (97) for the automatic boost control unit is mounted on the right side (see figs.1 and 2) of the pilot's instrument panel. The operation of this lever permits the employment of a boost pressure of + 9 lb./sq.in. for the purpose of take-off.

20. Airscrew pitch controls.- The airscrew pitch controls are mounted at the bottom of the control bank on the port side of the pilot's seat (see figs.5 and 6), and have red and green knobs (101) for port and starboard respectively. The controls should be pulled out to put the airscrew in coarse pitch.

21. Cowling gills controls.- The opening and closing of the cowling gills that govern the flow of cooling air for the engines are controlled by a handwheel (54) on the right-hand side of and behind the pilot's seat (see fig.3). To close the gills the handwheel should be rotated forwards.

Seating, exits etc.

22. Pilot's seat.- The pilot's seat (7) is constructed to take a seat-type parachute and has hinged armrests, the right-hand rest (56) being arranged to hinge back and the left-hand rest (59) to hinge upwards. The seat can be adjusted for height by means of a long lever on the left-hand side of the seat; the lock for fixing the seat at any desired height can be released by twisting the grip at the end of the lever.

23. Bomb-aimer's seat.- This seat (2) is mounted in the nose of the fuselage, on the starboard side (see figs.1 and 2) and is hinged along its starboard edge, the seat folding upwards. It is secured in its folded position by a spring-loaded trigger positioned along its aft edge.

24. Safety harness release control.- In order to allow the pilot to lean forward without undoing his safety harness (55), a lever (52) on the right-hand side of the seat is connected, behind the seat, to a catch on a spring-loaded drum on which the ends of the safety harness shoulder straps are wound. This type of safety harness is not yet fitted to all Blenheim aeroplanes.

25. Cockpit hood.- Exit from the cockpit can be made by sliding back the hood over the pilot. The hood is secured in the closed position by a catch lever at the forward end.

26. EMERGENCY EXIT WINDOWS.- On each side of the pilot there is a window (92) that can be opened upwards and outwards and used as an emergency exit. To open the window, press in the catch lever (91) and lift it up. The windows should be opened only in an emergency. A part of the emergency window on the port side can be slid backwards.

27. Bomb-aimer's hinged window.- A hinged window (see fig.1) is provided in the bomb-aimer's compartment, in the nose of the fuselage, on the starboard side, and is secured by a latch at each front and rear bottom corner. This window (112) hinges upwards and inwards, a catch on the underside of the roof securing it in the open position.

28. Direct-vision window.- This window (113) is fitted on the port side of the pilot's cockpit (see fig.3), and is operated by means of the crank handle, bevel gear and screw mechanism (114) mounted immediately below its left-hand bottom corner. The window, opening upwards and outwards, is secured in its closed position by means of a hand operated scalloped nut and a screw which is engaged in a pivoted guide block, the crosshead at the outboard end of the screw engaging in a double hook fitting attached to the bottom right-hand corner of the window.

29. Bomb-aimer's emergency exit.- A removable panel in the floor, in the nose of the fuselage, on the starboard side (see fig.1), and immediately below the bomb-aimer's seat (2) provides means of exit for the bomb-aimer, in emergency. This panel (115) is secured by a spring-loaded bolt which can be operated either from inside or outside the aeroplane, by means of T handles housed in recesses in the upper and lower surfaces of the panel, at its starboard edge.

30. Sun blinds.- Fittings for sun blinds are provided on the roof of the cockpit.

Operational equipment

31. Vacuum change-over control.- The artificial horizon, the direction indicator and the turn indicator on the instrument flying panel are operated either by a venturi on the outside of the fuselage or by a vacuum pump on the port engine. In the event of failure of the pump or of the port engine, the venturi can be selected by means of the change-over cock control (21) on the port side of the instrument panel. The vacuum available is shown on the gauge (20) above the cock control.

32. Bomb and flare release controls.- The bombs are released and fuzed electrically. The main (or bomb-aimer's) firing switch is in a canvas pocket positioned at the forward end of the bomb-aimer's compartment, on the starboard side of the starboard window panel whilst the pilot's firing switch is mounted on the port side of the cockpit, immediately aft of the pilot's bomb switch panel.

33. The pilot (and the bomb-aimer when occupying the cockpit) can jettison the whole bomb load as the control panel, which is mounted on the port side of the cockpit, in line transversely with the control column, is within easy reach of both of them. The panel contains:-

(i) Master supply switch
(ii) Selector switchboxes
(iii) Jettison switch
(iv) Fuzing switches (nose-and-tail)
(v) Flares switch in jettison lead

When flares are carried, the flares switch (73) must be in the OFF position to prevent the flares from being released if the bombs are jettisoned. Until the master switch (76) is placed in the ON position, bomb releasing cannot take place.

34. To ensure correct assembly of the electrical circuit, each selector switch is numbered and the number is repeated at the plug connector for the bomb carrier. The wiring system provides for stations 1, 2, 3 and 4 practice bombs to be under the same control switches as stations 1, 2, 3 and 4 sighter bomb or flares. When a bomb is chosen on the selector switch the indicator lamp on the jettison switch is illuminated showing that

(a) The release circuit is electrically sound, and that
(b) The electro-magnetic release is cocked

The lamp will remain illuminated until the bomb is released.

35. Fuzing gear.- The fuze wires attached to the bombs register with slots in the fuzing units mounted at both ends of the bomb carrier and are retained by a pendulum hook which is electrically operated. The position of the nose-and-tail fuzing boxes in the No.1 and No.2 carriers varies for each particular size of bomb and care must be taken that these fuzing boxes are correctly set.

36. Landing lamp controls.- Each landing lamp in the leading edge of the port main plane has a completely independent electrical circuit and is controlled by a switch (61) on the port side of the cockpit. In the central position of the switch knob, both lamps are off and, when the switch knob is moved inboard or outboard, the inboard or outboard lamp is illuminated respectively. The lever (67) on the inboard side of the throttle and mixture control quadrant, controls the dipping of both lamps; to dip the lamp beam the lever should be pushed forward. As the lamp is spring-loaded towards the dipped position, a gate for holding the lever in the aft position is provided on the lever quadrant.

37. Oxygen equipment.- A standard oxygen regulator unit (28) is fitted on the starboard side of the instrument panel and a bayonet union socket (57) for the low pressure supply to the oxygen mask is located forward of the airscrew pitch controls.

38. Wireless remote controls.- A standard controller (60) to provide the pilot with control over the wireless equipment is fitted on the port side of the cockpit. The upper lever of the controller, which operates the change-over switch of the wireless unit, should be pushed forward for "receive" and pulled back for "send"; the wireless unit can be switched off by moving the lever to the central or off position. The lower lever, which operates the tuning circuit of the receiver should be pre-set before taking-off but can subsequently be used for any fine-tuning adjustment that may be necessary. The serrated central knob on the controller is a remote volume control; it should be turned clockwise to increase the volume, and vice versa. In some cases, according to the type of wireless unit fitted, only the send-receive control is connected up. The combined microphone and telephone socket is fixed to the front edge of the pilot's seat.

39. Signal pistol.- The signal pistol is mounted on the starboard side of the cockpit and fires through a tube (1) extending to the lower surface of the fuselage. Stowage for cartridges is provided on the starboard side forward of the main plane spar.

40. Signalling switchboxes.- The identification switchbox (85) provides for independent or simultaneous use of the upward and downward identification lamps through the morsing key or, alternatively, a steady illumination from either or both lamps, and the identification switchbox (88) for morsing or steady illumination from the formation-keeping lamps; on the switchbox (88), only the down switch should be used. The spring pressure on the key may be adjusted by disengaging the lock at the upper left-hand corner and turning the ring until the required pressure is obtained when the lock should be released to engage in one of the slots.

Flying control locking gear

41. The flying control locking gear is stowed on the port side

of the fuselage above the main plane rear spar. The procedure for locking the flying controls is as follows:-

(i) Hold the control column in the central position.

(ii) Attach the gear by means of the bracket between the two longer struts to the left-hand portion of the wheel.

(iii) Secure the aft end of the strut to the eye attachment on the fixed structure behind the pilot's seat.

(iv) Fix the hinged clamp to the bottom of the control column.

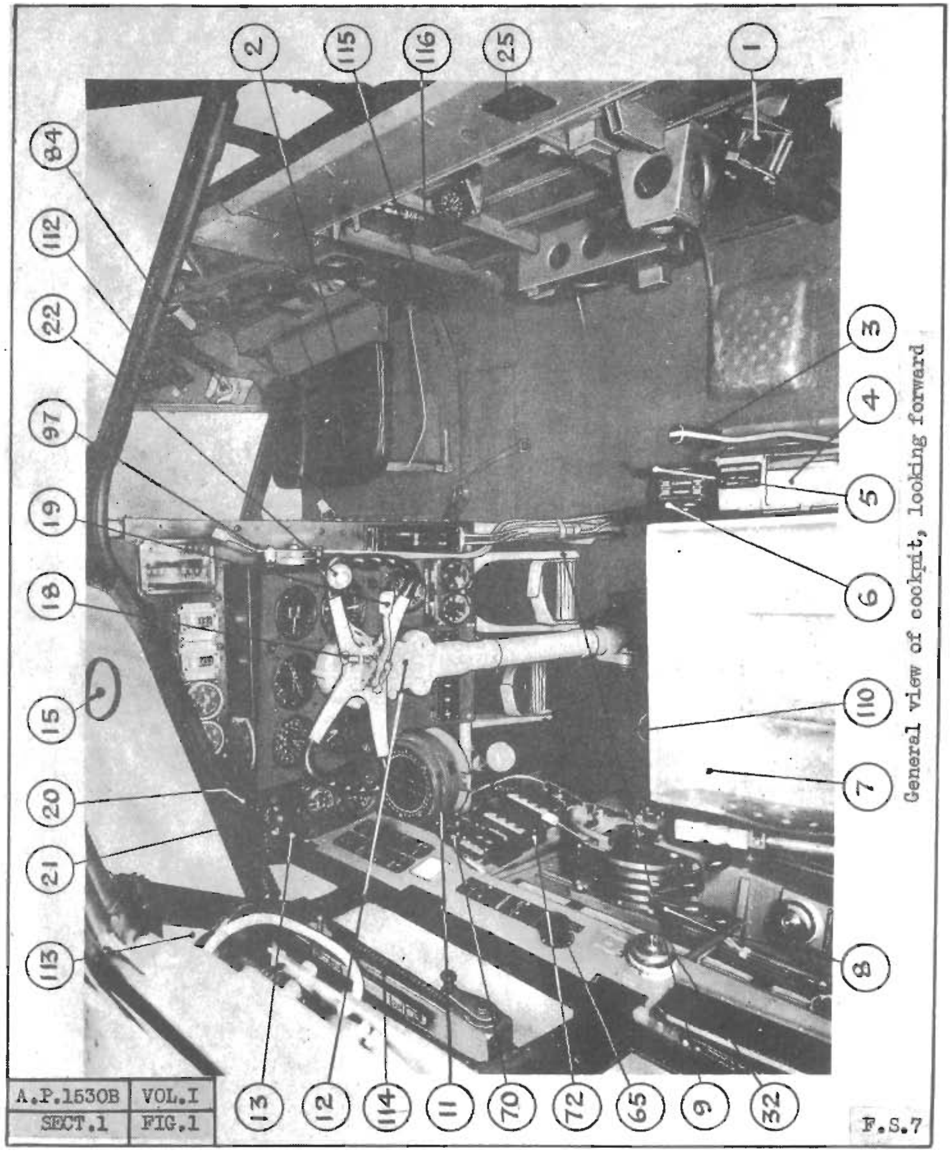
(v) Fix the C-clamps to the rudder pedals.

Miscellaneous equipment

42. Fire extinguishers.- A fire extinguisher is fitted above the main plane front spar behind the pilot and another is fitted on the starboard side forward of the entrance hatch.

43. First-aid outfit.- A first-aid outfit is stowed on the starboard side forward of the entrance hatch.

44. Camera gun loading handle.- A loading handle for the G.22 camera gun, which can be mounted under the nose of the fuselage, is fitted on the right-hand side of the seat. The handle changes the film and sets the shutter; an indicator showing the number of exposures made is fitted at the side of the handle.



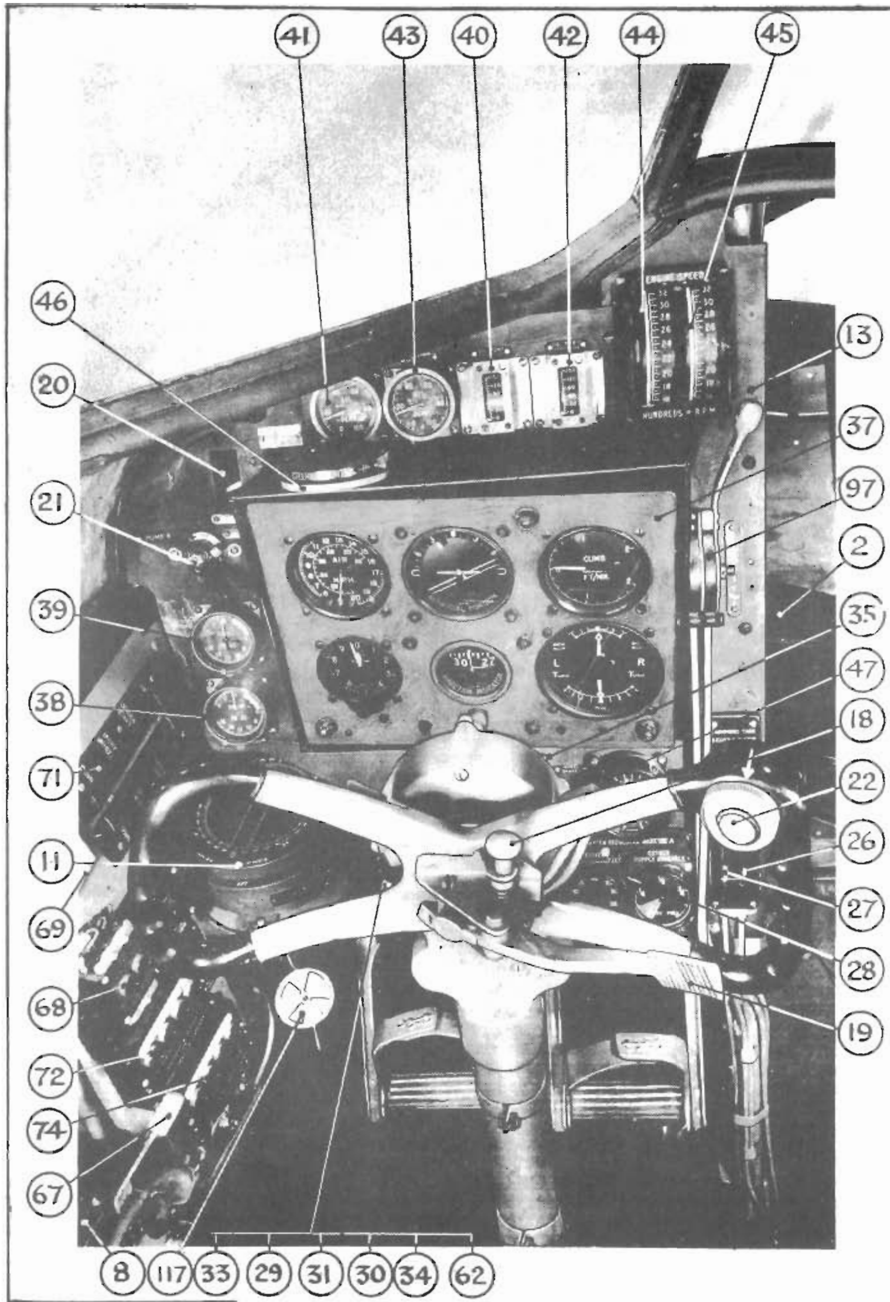
General view of cockpit, looking forward

Key to fig.1

General view of cockpit, looking forward

Note.- Fig.1 is intended to give a general idea of the layout of the cockpit. To avoid obliterating the illustration with reference marks, not all the items shown are referenced, but only the primary items, or those that do not appear or are not quite in their proper perspective in figs. 2 - 6. Obvious items, such as the control column and seat, where they also appear in figs. 2 - 6 are not again referenced.

1. Signal pistol firing tube
2. Bomb-aimer's seat
3. Hydraulic hand-pump handle
4. Shield over undercarriage control handle
5. Elevator trimming tab handwheel
6. Rudder trimming tab handwheel
7. Pilot's seat
8. Engine control quadrant (see fig.3, items 63 and 64)
9. Rudder pedals
11. Compass
12. Control column
13. Instrument panel (see fig.2)
15. Bead sight
18. Brake operating lever parking lock
19. Brake operating lever
20. Vacuum gauge
21. Vacuum change-over, venturi to pump
22. Gun firing button
25. Engine data plate
32. Head lamp switch
65. Bomb firing switch
70. Bomb jettison switch
72. Flare and practice bomb selector switches
84. Bomb-aimer's bomb firing switch (in pocket)
110. Pilot's telephone and microphone socket (see fig.6)
112. Hinged window in bomb-aimer's compartment
113. Direct-vision window in cockpit
114. Direct-vision window operating mechanism
115. Bomb-aimer's emergency exit
116. Bomb-aimer's (or navigator's) oxygen socket



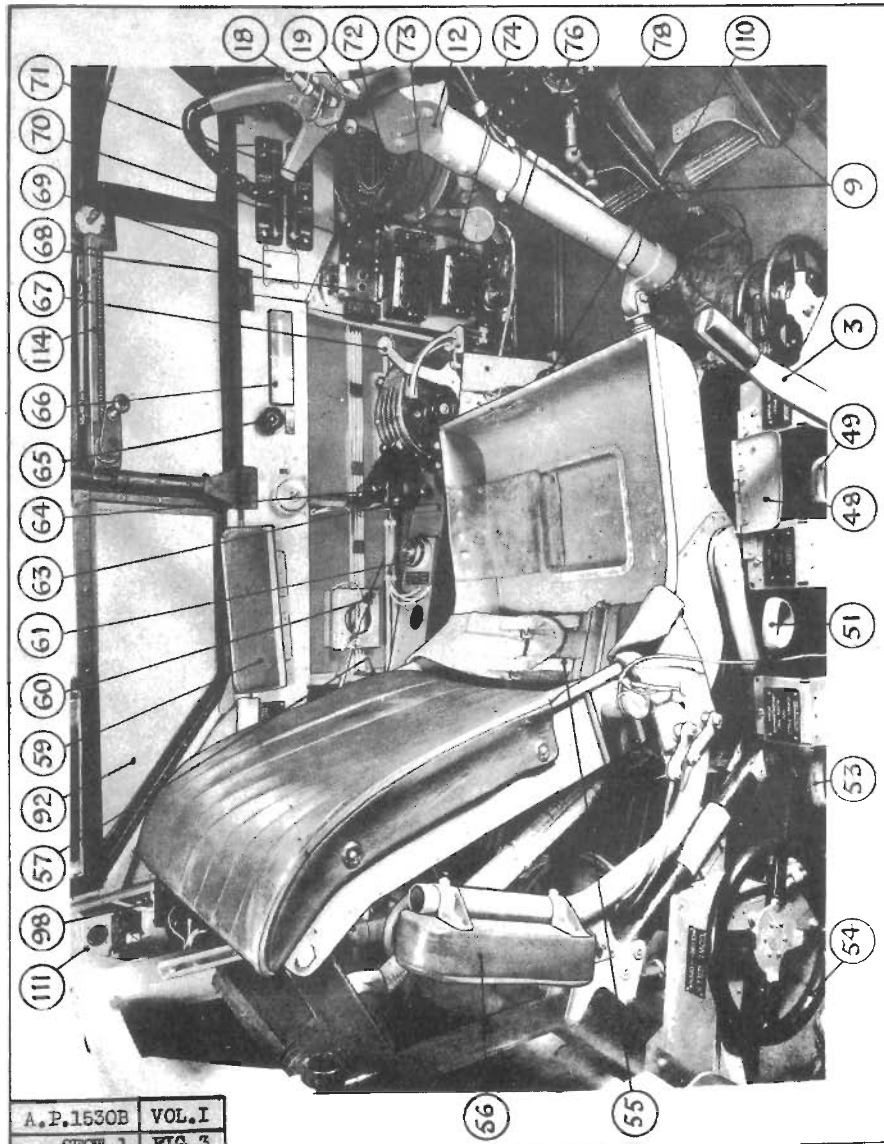
Instrument panel in cockpit

A.P.1530B	VOL.I
SECT.1	FIG.2

Key to fig.2

Instrument panel in cockpit

2. Bomb-aimer's seat
8. Engine control quadrant (see fig.3, items 63 and 64)
11. Compass
13. Instrument panel
18. Brake operating lever parking lock
19. Brake operating lever
20. Vacuum gauge
21. Vacuum change-over, venturi to pump
22. Gun firing button
26. Elevator trimming tabs position indicator
27. Rudder trimming tab position indicator
28. Pilot's oxygen regulator
29. Undercarriage indicator lamps switch (on panel)
30. Auto-controls cut-out switch (on panel)
31. Fixed gun heating switch (on panel)
33. Navigation lamp switch (on panel)
34. Auto-controls mains switch (on panel)
35. Engine magneto switches (positioned centrally below instrument-flying panel)
37. Instrument-flying panel
38. Boost pressure gauge, starboard engine
39. Boost pressure gauge, port engine
40. Oil pressure gauge, port engine
41. Oil temperature gauge, port engine
42. Oil pressure gauge, starboard engine
43. Oil temperature gauge, starboard engine
44. Engine speed indicator, port engine
45. Engine speed indicator, starboard engine
46. Auto-controls steering lever
47. Brake triple pressure gauge
62. A.S.I. pressure head heating switch (on panel)
67. Landing lamp control lever
68. Bomb nose-and-tail fuzing switches
69. Compass card holder
71. Undercarriage position indicators
72. Flare and practice bomb selector switches
74. Bomb selector switch
97. Boost control over-ride for take-off
117. Ventilation tube



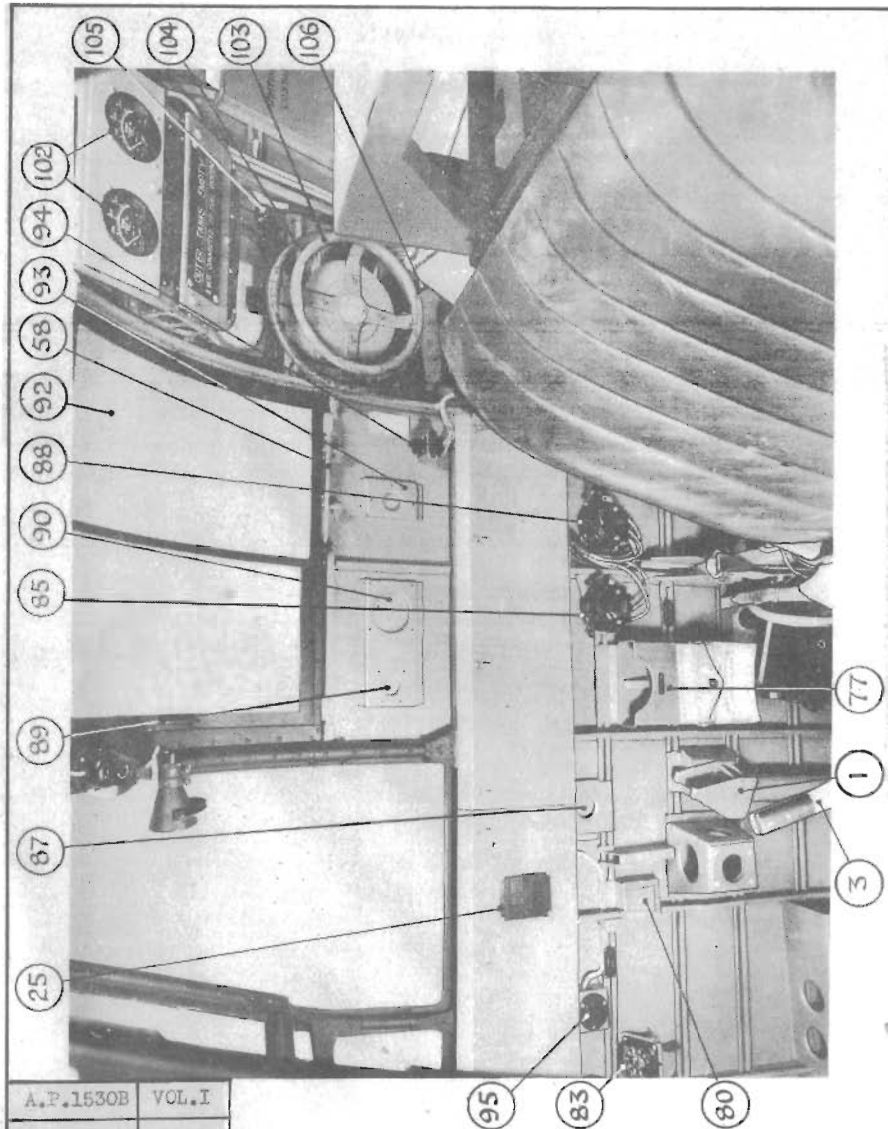
Pilot's cockpit, port side

A.P.1530B VOL.I SECT.1 FIG.3

Key to fig.3

Pilot's cockpit, port side

3. Hydraulic handpump handle
9. Rudder pedals
12. Control column
18. Brake operating lever parking lock
19. Brake operating lever
48. Shield for undercarriage control handle
49. Undercarriage control handle
51. Flaps control handle
53. Turret or flaps-undercarriage selector handle
54. Cowling gills control handwheel
55. Safety harness
56. Armrest, starboard (shown hinged up)
57. Oxygen socket (hidden by seat; see fig.5)
59. Armrest, port (shown hinged up)
60. Wireless remote control (front end)
61. Landing lamp switch
63. Mixture control levers
64. Throttle control levers
65. Bomb firing switch
66. Flaps position indicator
67. Landing lamp control lever
68. Bomb nose-and-tail fuzing switches
69. Compass card holder
70. Bomb jettison switch
71. Undercarriage position indicators
72. Flare and practice bomb selector switches
73. Flare switch
74. Bomb selector switch
76. Bomb release master switch
78. Handle for rudder pedal leg-reach adjustment
92. Emergency exit window
98. Fuel jettison control lever
110. Pilot's telephone and microphone socket (see fig.6)
111. Socket for supply to turn regulator system (position for)
114. Direct-vision window operating mechanism



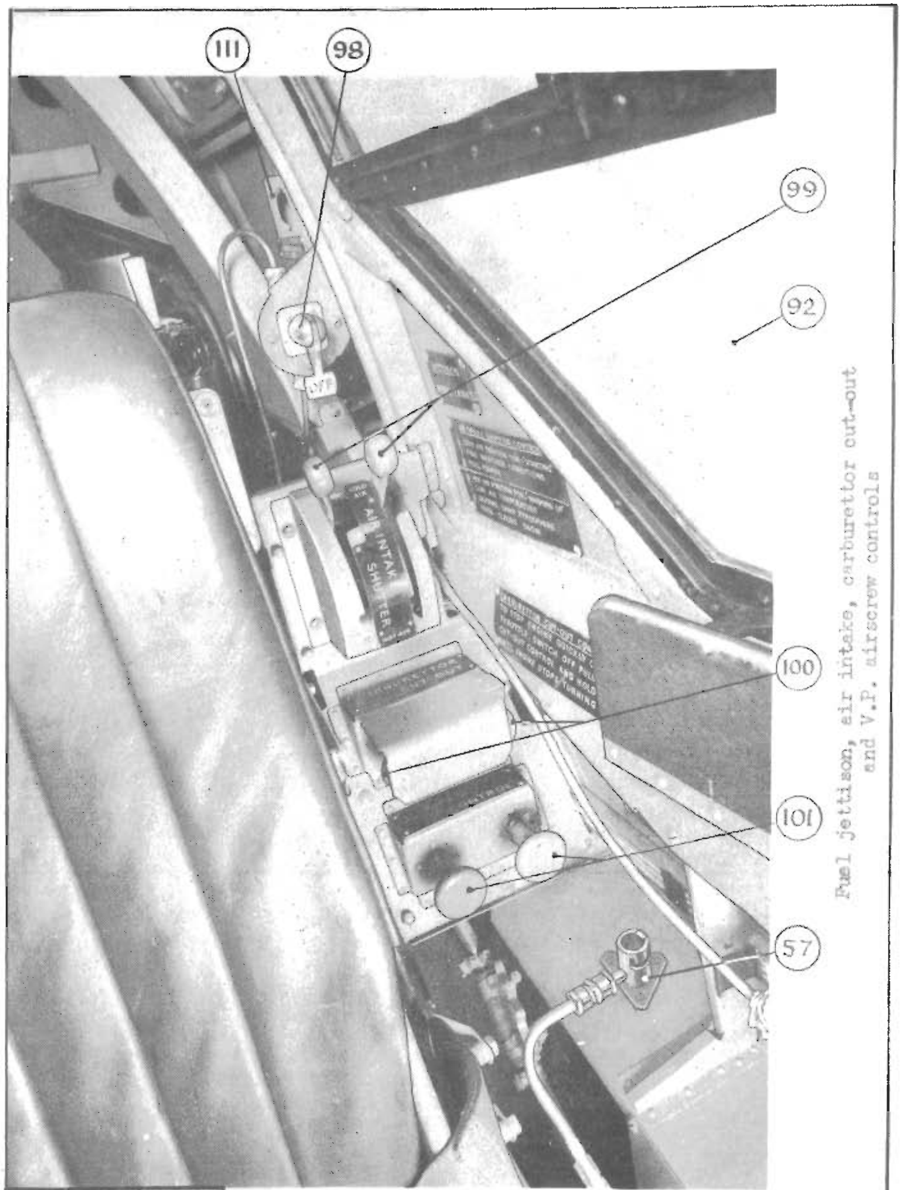
Fuel cock controls in pilot's cockpit

A.P.1530B	VOL.I
SECT.1	FIG.4

Key to fig.4

Fuel cock controls in pilot's cockpit

1. Signal pistol firing tube
3. Hydraulic handpump handle
25. Engine data plate
58. Lever for opening starboard emergency exit window
77. Case for maps
80. Wedge for dual engine controls
83. Air temperature gauge
85. Formation-keeping lamps signalling switchbox
87. Auto-controls clutch lever (position for)
88. Identification lamps signalling switchbox
89. Auto-controls control cock (position for)
90. Auto-controls attitude control (position for)
92. Emergency exit window, starboard
93. Auto-controls speed lever (position for)
94. Auto-controls re-setting switch
95. Camera supply socket
102. Engine temperature gauges
103. Fuel control cock control handwheel - port
104. Fuel control cock control handwheel - starboard
105. Fuel suction balance cock control lever
106. Fuel delivery balance cock control lever



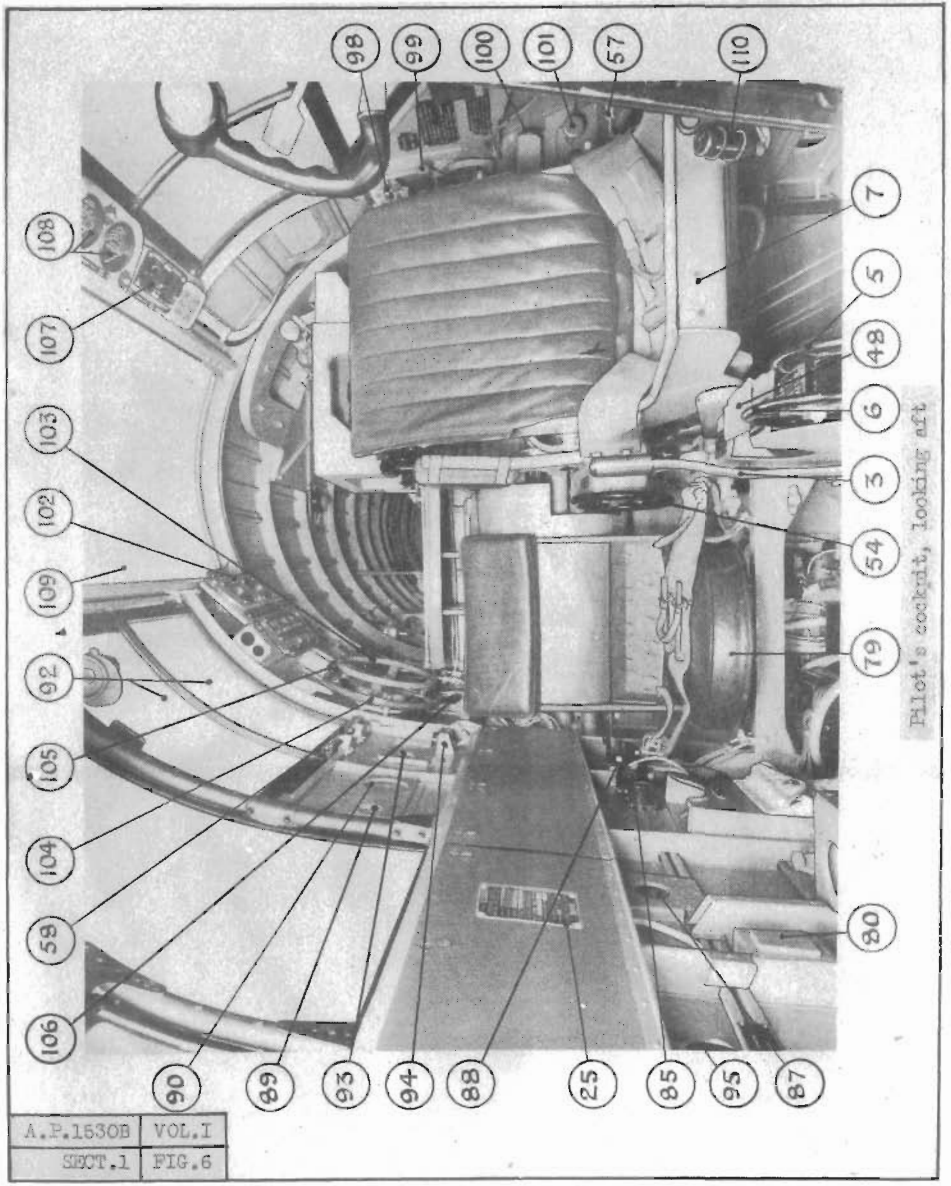
Fuel jettison, air intake, carburettor cut-out and V.P. airscrew controls

A.P.1530B	VOL.I
SECT.1	FIG.5

Key to fig.5

Fuel jettison, air intake, carburettor cut-out
and V.P. airscrew controls

57. Pilot's oxygen socket
92. Emergency window
98. Fuel jettison control lever
99. Air intake shutter control levers
100. Carburettor cut-out controls
101. V.P. airscrew controls
111. Socket for supply to turn regulator system (position for)



Pilot's cockpit, looking aft

A.P.1530B VOL.I SECT.1 FIG.6

Key to fig.6

Pilot's cockpit, looking aft

3. Hydraulic handpump handle
5. Elevator trimming tab handwheel
6. Rudder trimming tab handwheel
7. Pilot's seat
25. Engine data plate
48. Shield for undercarriage control handle
54. Cowling gills control handwheel
57. Oxygen socket (see fig.5)
58. Lever for opening starboard emergency exit window
79. Navigator's seat
80. Wedge for dual engine controls
85. Formation-keeping lamps signalling switchbox
87. Auto-controls clutch lever (position for)
88. Identification lamps signalling switchbox
89. Auto-controls control cock (position for)
90. Auto-controls attitude control (position for)
92. Emergency exit window
93. Auto-controls speed lever (position for)
94. Auto-controls resetting switch
95. Camera supply socket
98. Fuel jettison control lever
99. Air intake shutter control levers
100. Carburettor cut-out controls
101. V.P. airscrew controls
102. Engine temperature gauges
103. Fuel control cock control handwheel, port
104. Fuel control cock control handwheel, starboard
105. Fuel suction balance cock control lever
106. Fuel delivery balance cock control lever
107. Fuel contents selector switch
108. Fuel contents indicators
109. Sliding roof
110. Pilot's telephone and microphone socket

SECTION 2

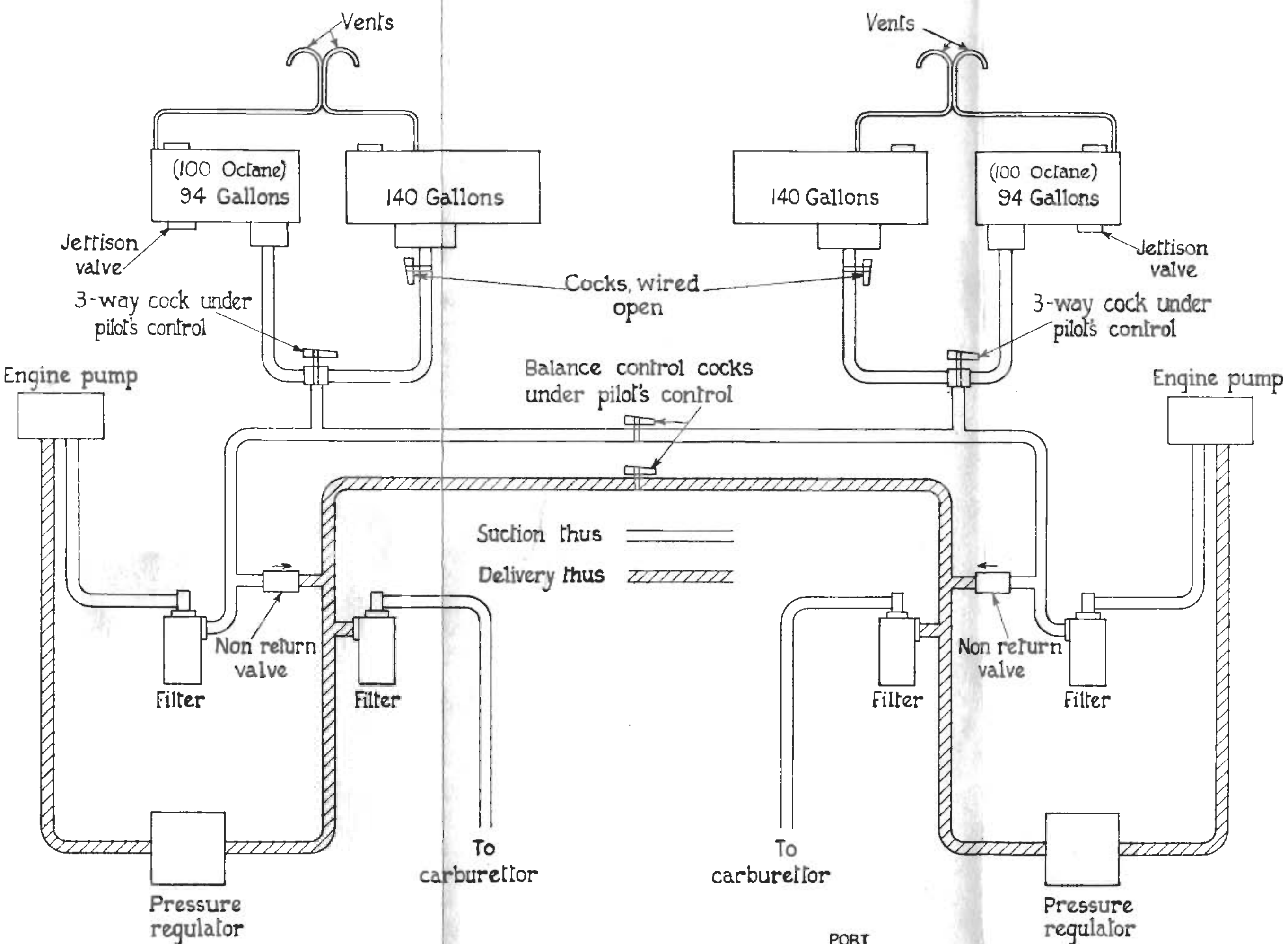
HANDLING AND FLYING NOTES

FOR PILOT

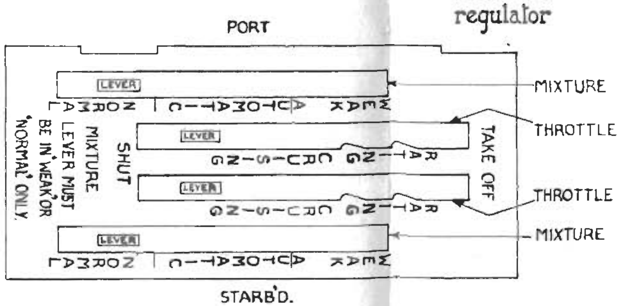
SECTION 2

LIST OF CONTENTS

LIST OF ILLUSTRATIONS



Condition	3-way fuel control cock	Balance cocks Delivery	Balance cocks Suction	Remarks
TAKE OFF long range 100 oct^ne	Both ON to outer tanks	OFF	OFF	Each outer tank supplies its own engine
Normal a.	Both ON to outer tanks	OFF	OFF	Each outer tank supplies its own engine
Normal b.	Both ON to main tanks	OFF	OFF	Each main tank supplies its own engine
To use one main tank	Corresponding cock ON to main tank. Other cock OFF to both outer and main tanks	OFF	ON	One main tank supplies both engines
If engine pumps fail on one side a	Both ON to outer tanks	ON	ON	It is essential to open the delivery balance cock so that one pump can feed both engines
If engine pumps fail on one side b	Both ON to main tanks	ON	ON	If supply from both main or both outer tanks is desired the suction balance cock is also opened
If one engine fails a	Both ON to outer tanks	OFF	ON	If supply from both outer tanks is desired
			OFF	If supply from other outer tank is desired
If one engine fails b	Both ON to main tanks	OFF	ON	If supply from both main tanks is desired
			OFF	If supply from other main tank is desired



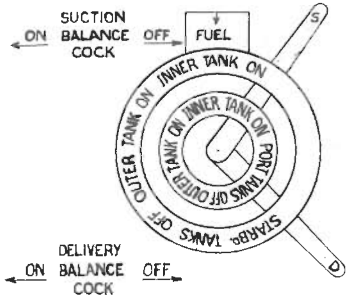


FIG. 1	A.P.1530B. VOL. I
	SECT. 2.

FUEL SYSTEM DIAGRAM

F.S/3.

SECTION 2.

HANDLING AND FLYING NOTES FOR PILOT

INTRODUCTORY NOTES

1. The information given in this paragraph is complementary to the description of the equipment included in Section 1:-

(i) Hydraulic system.- This system is employed to operate the retractable undercarriage and the flaps. An engine-driven pump, mounted on the port engine, is employed to work the system normally but a hand operated pump is provided for use in the event of the normal pump failing, or if it is desired to operate the hydraulic system whilst the port engine is stationary.

(ii) Flaps.- These are of the split trailing edge type and can be set at any position over their range of movement. The effect with the flaps fully down, is (a) to increase drag and so steepen the gliding angle for approach and (b) to increase the lift coefficient and so reduce the stalling speed.

Note.- With this aeroplane normally loaded (up to 12,500 lb.) the use of flaps for the take-off is not vitally important but when loaded for long range (14,500 lb.) 15° of flaps down must be used.

(iii) Tab trimmers.- Trimming tabs are provided on the elevator and rudder. They are powerful in operation but a very fine adjustment can be obtained by means of the controls. They must not be used for manoeuvring as large stresses can be set up without being apparent on the flying controls. The elevator tabs should not be used to assist recovery from a dive except in emergency when they must be used very slowly and carefully.

(iv) Variable-pitch airscrews.- The airscrews are of the two pitch type, i.e. Fine and Coarse. Fine pitch is always used for take-off, for climbing on one engine and when approaching to land. Coarse pitch is used for all other conditions of flight, except when throttled well back when fine pitch may give smoother running.

(v) Mixture control.- The mixture control of each engine is automatic. Each mixture control lever has two effective positions only, i.e. NORMAL (automatic rich) and WEAK (automatic weak). The adjustment of the mixture strength to meet varying conditions of altitude is effected by the automatic unit on the engine. The control lever must be kept in the NORMAL position when the boost pressure is more than + $1\frac{1}{2}$ lb./sq.in. At and below this pressure the control should be moved fully forward to the WEAK position; the control lever is returned automatically to the NORMAL position by the closing movement of the throttle lever.

(vi) High boost control.- This aeroplane is provided with an over-ride boost control which when operated allows the automatic boost to be increased from the normal maximum of + 5 lb./sq.in. to over-ride maximum of + 9 lb./sq.in. It is for use during take-off when the aeroplane is loaded for long range flight (14,500 lb.). The control is operated by means of a lever on the right of the instrument panel which when in the down position gives + 9 lb./sq.in. boost and when up gives the normal boost of + 5 lb./sq.in.

(vii) Cowling gills.- Fully closed, the gills allow enough air to pass the cylinders to give adequate cooling during normal flight. For ground running they must be fully open. For climb, high speed and warm atmosphere. partly open. To reduce drag, cowling gills should be kept closed as much as possible, provided cylinder temperatures are within the limits laid down for a condition of flight.

(viii) Undercarriage.- The undercarriage when down causes high drag, thereby steepening the gliding angle. It also causes turbulent air-flow and speed should not exceed about 130 m.p.h. A.S.I. reading with the undercarriage down.

(ix) Fuel system.- Particulars of the fuel system are given in fig.1. It should be noted that the outer tanks in each wing are provided for use only when the aeroplane is used for long range purposes. A jettisoning device is fitted to each of the outer tanks, both being operated from a single control in the pilot's cockpit.

(x) Jettisoning fuel.- The time taken for the fuel to jettison from the outer tanks is approximately four minutes. The fuel can be seen leaving the jettison pipes at the trailing edge of each wing; it is important not to yaw the aeroplane during the operation, otherwise the tail will be drenched with fuel. No attempt to land this aeroplane with the full load (14,500 lb.) must be made; jettisoning the outer tanks reduces the load by about 1,400 lb., well within the maximum permissible for landing.

Note.- After jettisoning and before landing, the jettison cocks should be closed otherwise the remains of the fuel in the tanks will drain out when the tail is down on landing, with consequent risk of fire.

FITNESS OF AEROPLANE FOR FLIGHT

2. Note the following:-

(i) Ensure that the total weight and disposition of the load are in accordance with the Weight Sheet Summary.

(ii) Long range load (14,500 lb.).- Check the following:-

(a) Tyre pressures, undercarriage - 50 lb./sq.in.
Tyre pressures tail wheel - 45 lb./sq.in.

(b) Oleo pressure, undercarriage - 525 lb./sq.in.
Oleo pressure, tail strut - 410 lb./sq.in.

(c) Outer tanks contain 100-octane fuel.

PRELIMINARIES

3. On entering the cockpit make the preparations as follows:-

(i) See that the hydraulic selector lever is DOWN and that the undercarriage operating lever is DOWN.

(ii) Switch on the undercarriage indicator lamps and check that the undercarriage is locked; green lights give this indication.

(iii) Check the contents of the fuel tanks.

(iv) Test the movement of the flying controls.

(v) Set the carburettor air intake heat controls to COLD.

(vi) Set the cowling gills fully open.

(vii) Set the airscrew controls to FINE pitch.

STARTING THE ENGINES AND WARMING-UP

4. Notes and limiting operation conditions concerning the Mercury XV engine are given in para.40. It is recommended strongly that the pilot be in his seat ready for flight before the engines are started; this will ensure that unnecessary running of the engines before take-off is avoided.

(i) Set the fuel cock control wheels as required. If the aeroplane is loaded for long range flight, the run-up and take-off must be made with the fuel supply from the outer tanks (100 octane) with the others turned OFF.

(ii) Instruct ground crew to prime engines and switch on starting magnetos. Six to eight full pumps are required to prime a cold engine but only two or three if hot.

(iii) Set throttle levers forward approximately ½ in. on the quadrant; the levers should not be opened further than this or fuel will be pumped into the air intake, with risk of fire.

(iv) Ensure that all personnel are clear of the airscrews.

(v) Switch on main magneto switches.

(vi) Press the starter button of each engine in turn; the starter should not be used continuously for periods of more than 10 seconds. The left hand should be kept on the throttle lever during the start and if the engine "spits back" through the carburettor, the throttle levers should be pulled right back and then slowly opened to give a fast tick-over.

(vii) Warm up the engines at a fast tick-over until the oil temperatures are at least 5°C. and cylinder temperatures about 100°C.

TESTING ENGINES AND INSTALLATIONS

5. Throttles should not be opened fully for more than a few seconds and only long enough to make the necessary checks.

<u>During warming-up</u>

(i) Instruct ground crew to switch OFF starting magnetos and check fuel pressures 2½ - 3 lb./sq.in.

(ii) Test operation of engine driven hydraulic pump by putting the flaps DOWN and returning to UP.

<u>During running-up</u>

For each engine in turn, check:-

(i) Static r.p.m. at + 5 lb./sq.in. boost: 2,300 - 2,400
Static r.p.m. at + 9 lb./sq.in. boost: 2,500 - 2,600

<u>Note</u>.- The change-over to high boost must only be made with the throttle in the TAKE-OFF position. With the boost control in the high boost position the subsequent throttling down must be made with no pause between full throttle and slow running.

(ii) Oil pressure: The oil pressure may be well over 100 lb./sq.in. while the oil temperature is low but will become normal 80 lb./sq.in. when the temperature rises to normal.

(iii) Test magnetos and sparking plugs. This should be done at + 5 lb./sq.in. boost and full throttle (not at + 9 lb./sq.in. boost). The drop in r.p.m. should not exceed about 100. If the engine misfires or runs roughly or the r.p.m. drop exceeds about 100, no flight must be made.

(iv) Check pressure in the air cylinder for brakes; minimum for taxying 100 lb./sq.in.

(v) Ensure that the safety pins are removed from the radius rods of each undercarriage unit.

TAXYING OUT

6. Before opening up the engines for taxying see that the parking brake is released. Taxying is normal and changes of direction should be made by means of the rudder and engines where possible. During prolonged taxying check the cylinder temperatures and the pressure for the brakes.

<u>Note</u>.- <u>Clearing engines after slow-running</u>.- If the take-off has been delayed for any reason, each engine should be cleared in turn by running-up (against the brakes) to about zero boost. Engines should not tick-over for more than two or three minutes without being cleared.

FINAL PREPARATION FOR TAKE-OFF - DRILL OF VITAL ACTIONS

7. On reaching take-off position, stop across wind facing the aerodrome circuit so that approaching aircraft can be seen and then check the following drill of vital actions; some of these may be made before or during taxying out but must be checked in correct sequence <u>before every take-off</u>:-

(i)	Hydraulic selector	- DOWN
(ii)	Tabs	- Neutral
(iii)	Mixture control	- NORMAL (fully back)
(iv)	Pitch	- Fine (pushed in to rear)
(v)	Gills	- One-third open for long range load (14,500 lb.)
	Gills	- Fully closed for normal load (12,500 lb.)
(vi)	Flaps	- 15° for long range load (14,500 lb.)
(vii)	Boost control	- DOWN - for long range load, + 9 lb./sq.in.
	Boost control	- UP - for normal load.+ 5 lb./sq.in.

Note.- Use of the flaps should be avoided if possible for take-off but in case of heavy load or short run, 15° of flaps should be used.

TAKING-OFF

8. On reaching the take-off position stop across wind and after checking drill of vital actions, search the sky for approaching aircraft, then turn into wind and take-off without delay, opening both throttles together, taking only about two or three seconds in so doing. With the aeroplane loaded to 14,500 lb. (long range load) the take-off run is about 600 yards in still air.

9. There is a slight tendency to swing to the right, during the take-off, which should be corrected by the use of the rudder. The aeroplane should not be "pulled-off" too quickly but the tail should be raised almost to flying position, the nose held at a constant attitude and the aeroplane allowed to take itself off. After take-off proceed as follows:-

Immediate action

(i) Raise the undercarriage as soon as the aeroplane is finally clear of the ground.

(ii) Hold the aeroplane down almost to level flight to gather speed as quickly as possible.

(iii) Change airscrew pitch to COARSE at about 120 m.p.h. A.S.I. reading, then climb gently until the speed reaches 150 m.p.h. A.S.I.

(iv) If the take-off has been made at + 9 lb./sq.in. boost, move the high boost lever UP to give + 5 lb./sq.in. boost; this must be done before throttling back to the RATED position.

(v) If flaps have been used for the take-off, raise them at a safe height (300 - 400 ft.).

Subsequent action - The remaining actions can be done at leisure but without undue delay.

(vi) Check oil pressures

(vii) Check oil and cylinder temperatures and adjust cowling gills as required.

(viii) Place hydraulic selector lever in NEUTRAL.

(ix) Throttle the engine back and adjust mixture control as required.

(x) If flying with a long range load, change over the fuel supply so that the engines are fed from the inner tanks only (see fig.1). The fuel so consumed will help to lighten the load should it be necessary to make a forced landing or fly on one engine, when in either case the fuel in the outer tanks must be jettisoned.

ENGINE FAILURE DURING TAKE-OFF

Failure of one engine

10. General rule

If still on the ground, remain on the ground.
If airborne, remain airborne.

(i) If one engine fails before take-off, and there is ample room, throttles should be pulled back and the aeroplane stopped. But if it is too late to stop short of the aerodrome boundary, raise the undercarriage and switch off the ignition.

(ii) If one engine fails immediately after take-off it is easy to climb and make a circuit of the aerodrome, provided the correct action is taken. If the pilot is alert, he can detect the failure instantly (before swing becomes apparent) by the heterodyne beat as the engines go out of phase. If an engine fails, proceed as follows:-

Immediate action

(iii) Keep straight with rudder (instant and coarse application before swing can develop). Keep the nose "down" to level flight. Keep full throttle.

(iv) Make sure the undercarriage is up or rising (it may be necessary to use the hand-pump; the passenger should do this) and gather speed as quickly as possible, in absolutely level flight, just clearing obstacles comfortably, to at least 120 m.p.h. A.S.I. reading.

DO NOTHING ELSE AT THIS STAGE

Subsequent action

(v) When speed reaches 120 m.p.h. A.S.I. start to climb gradually by carefully raising the nose until speed is reduced to about 110 m.p.h. (keeping full throttle). - Never less than 105 m.p.h. A.S.I.

(vi) Apply full rudder bias ("Wheel forward to Starboard" and vice versa) and climb to at least 1,000 feet. A gentle turn may be started at a safe height of 500 feet or so. Turns should be made towards the live engine - it is safer to do so.

(vii) Fly round to the lee side of the aerodrome and get into a favourable position for the approach, well beyond gliding distance to allow time for lowering the undercarriage. If, for any reason, some distance must be flown after gaining adequate height, it is less tiring to change to coarse pitch and throttle down slightly.

(viii) Turn towards the aerodrome and lower the undercarriage. When nearly within gliding distance lower the flaps fully.

(ix) Approach straight towards the edge of the aerodrome, keeping just beyond gliding distance all the way down, regulating the glide path by use of the good engine. It is vital not to overshoot. Do not get too close and risk overshooting nor get too flat, or it may be difficult to keep straight if full throttle has to be used with the flaps down.

(x) Flatten out, then close the throttle and land

Failure of both engines

(xi) If both engines fail (the chances of this are remote) raise the undercarriage, lower the flaps and land straight ahead.

FAILURE OF ONE ENGINE DURING CRUISING FLIGHT

11. The Blenheim IV will maintain height on one engine, at the normal full load of 12,500 lb., provided cowling gills are fully closed and flaps up. The drag of the gills and flaps cause loss of height. Note the following:-

(i) At cruising and high speeds, the result of sudden failure of one engine is quite mild, and the resulting yaw can easily be corrected, even with feet off the rudder, by a little opposite bank.

(ii) Speed will eventually drop to about 125 m.p.h. A.S.I. if height is not lost, but surplus speed lasts several minutes. Full rudder bias should then be applied.

Action

(iii) Keep in coarse pitch.

(iv) Fully close the cowling gills.

(v) Throttle down the good engine almost to the minimum needed to maintain height (about 1,950 r.p.m. at 120 m.p.h.). If the aeroplane will climb at this power, the engine may be throttled down even more to nurse it and avoid overheating.

(vi) The suction balance cock should be opened so that both tanks will feed the live engines.

(vii) Turns should be made towards the good engine. The reason why it is better to turn towards the good engine is that it is safe and, coming out of the turn, is easier. If a turn is made towards the dead engine, the tendency will be to skid outwards if adequate pressure on the rudder to counteract the pull of the good engine is not maintained. Considerable opposite aileron will then be needed to prevent overbanking and if speed is reduced, for any reason, the aeroplane will get very near the spinning point.

CLIMBING

12. The aeroplane may be climbed in coarse pitch at full throttle (+ 5 lb./sq.in. boost) if necessary, but this is uneconomical.

(i) Watch the engine temperatures and if these approach the limiting figures, which are only allowed for a comparatively short duration of a climb, the cowling gills should be opened a little. These limits are:-

Oil temperature ....80°C
Cylinder head temperature ....200°C

(ii) The best climbing speed at full throttle is about 150 m.p.h. A.S.I. up to 10,000 ft. It should then be reduced uniformly. The following approximate figures are easy to remember and indicate the rate of reduction:-

10,000 ft.	150 m.p.h. A.S.I.
15,000 ft.	140 m.p.h. A.S.I.
20,000 ft.	130 m.p.h. A.S.I.

THE ENGINES IN CRUISING FLIGHT

13. The engines should normally be run at the lowest speed necessary for the occasion; the aeroplane has a good reserve of power and will fly with engines throttled down to less than 1,600 r.p.m. This will reduce maintenance and economise fuel.

(i) The absolute limit of engine speed in level flight (for not more than 5 minutes) is 2,750 r.p.m. at + 5 lb. boost, but maximum cruising r.p.m. should only be exceeded in emergency.

(ii) Limits for continuous cruising.-

(a) Mixture control NORMAL 2,400 r.p.m. + $3\frac{1}{2}$ lb. boost

(b) Mixture control WEAK 2,400 r.p.m. + $1\frac{1}{2}$ lb. boost

Note.- This is a suitable condition for long distance cruising at high speed, but gives considerably less than maximum range and economy.

(iii) Economical cruising.- The lowest fuel consumption is obtained by using the control in the weak mixture setting, and throttling down the engine to the lowest speed at which the aeroplane will fly with the engines running smoothly.

(iv) The best economy (most miles per gallon).- This on a long-distance flight is obtained at a slightly higher speed than (iii) above.

(v) At 15,000 feet the greatest range is obtained at a speed of about 110 m.p.h. A.S.I. Such a low speed is impracticable in disturbed air, so at low altitudes about 130 m.p.h. A.S.I. is the best speed for extended range. This is useful in an emergency such as when fuel is running short.

(vi) Cowling gills must be fully closed for economical cruising.

(vii) Engine temperatures.- Never exceed the limits of oil and cylinder temperatures laid down.

(viii) Synchronizing engines.- Run the engines at the same speed by eliminating "heterodyne" beat. The boost gauges give a rough guide, but the revolution indicators are not accurate enough for this purpose.

(ix) Mixture controls.- Always use the mixture controls when cruising steadily for any length of time.

GENERAL FLYING

14. The controls of this aeroplane are very positive and effective, and well harmonized, almost ideal for the type of aeroplane. The elevator becomes very heavy in a steep turn, which is a good feature as it indicates to the pilot that he is increasing the stresses on the structure. The rudder is fairly heavy and is amply effective, but it is not used in normal flying.

(i) Stability.- Directional stability is exceptionally good, but stability in pitch and roll is about neutral, that is, the aeroplane is very steady in straight and level flight, but will not usually maintain a straight and level course for more than a few seconds "hands off". It will very slowly drop or raise the nose and roll into a turn.

(ii) Turning.- This aeroplane is turned by aileron and elevator control. The slight amount of yaw required is obtained automatically owing to the fact that any tendency to sideslip is converted into steady yaw by the effective fin area.

(a) The correct incidence corresponding to the angle of bank will be exactly obtained if the nose is kept on the horizon by elevator control, while the bank is kept constant by the ailerons. Rudder control is not required. This eliminates the need for careful co-ordination of hand and foot, and is particularly valuable in flying by instruments.

(b) If the maximum angle of bank for a sustained turn at a particular speed is exceeded for more than a few seconds, stalling incidence will be reached. This would require great force on the elevator control, unless the aeroplane is trimmed tail heavy. The tab trimmer must not be used in this way, therefore steep turns at low speed must not be done.

(iii) Change of trim.-

Effect of putting flaps down	- Nose down
Undercarriage up	- Nose down
Gills open	- Nose down
Pitch to fine	- Nose down
Throttles closed	- Nose down

(iv) Rudder trimming tab.- The rudder trimming tab is a fine adjustment, though it is also required in case of one engine failing. It can be used to correct any tendency to yaw during flight, also to trim if the aeroplane is right or left wing low.

(v) Elevator trimming tab.- The elevator trimming tab must be used frequently during straight flying to compensate for change of trim due to variation of throttle setting or other reasons. It must not be used for manoeuvring, as great stresses can be put on the aircraft without being apparent. It should not be used for recovery from a dive except as a last resort in emergency, when it should be used with the greatest care. The control for the tab should be set partly back for landing, not because it makes the elevator more effective, but makes it lighter when flattening-out to land.

(vi) Slow flying.- Flying at slow speeds down to the stall should be practised at a safe height, in order that the pilot may become familiar with the feel of the controls. Feet should be put on the rudder control at low speed, as it might have to be used if the aeroplane stalled.

FLYING BY INSTRUMENTS

15. It has already been mentioned that this aeroplane should be flown without use of rudder control, as perfect co-ordination of controls is thereby achieved automatically without the pilot's assistance. This is particularly important when flying by instruments, as the extra mental concentration required of the pilot is almost eliminated.

Method

(i) Keep feet off the rudder controls. Fly at a steady attitude by the indication of the artificial horizon, and keep a straight course by the indication of the directional gyro.

(ii) Use the airspeed-indicator, altimeter and compass as fine adjustments.

(iii) It is better to keep feet clear of the rudder, but if the air is very bumpy it may be more comfortable to put the toes on the rudder to steady it. Do not interfere with the directional stability of the aeroplane by using the rudder, but keep it central.

(iv) If the directional gyro spins, as it may in bumps, cage and reset it. It is best to set this to 0 rather than to the reading of the course.

(v) The Reid and Sigrist turn indicator should not be used, except to recover after loss of control; this, however, should never happen.

(vi) Turns by instruments.- This aeroplane is particularly easy to turn in cloud-flying with the aid of the artificial horizon and the directional gyro, if rudder control is not used.

(a) Do not use the Reid and Sigrist turn indicator except to refer to the "turn rate" if desired; it is unnecessary to do more than regulate the angle of bank.

(b) Turns are made as in normal visual flying, by ailerons and elevator.

(vii) Failure of instruments.- There are about eight instruments of use during cloud flying, all complementary to one another. Even if one or two of them fail it will always be possible to keep full control by the remainder.

(a) The possibility of failure is remote, except in the case of the gyro instruments, artificial horizon, directional gyro and Reid and Sigrist turn indicator. These become useless if the air pressure which drives them fails but as there are two alternative air supplies, venturi suction and engine-driven pump, this is very unlikely.

(b) Very steep turns and other manoeuvres may upset the artificial horizon and directional gyro, but the Reid and Sigrist turn indicator will function correctly during the most violent manoeuvres. Therefore it should only be used in emergencies, the other two being much better as long as they are in working order.

(viii) Vacuum change-over tap.- Keep the two-way cock of the vacuum change-over control to PUMP, so that icing up of the venturi, if it happens, will not affect the instruments.

(ix) Recovery after loss of control.- It follows from the preceding remarks that the only possible cause of loss of control in cloud is inattention to instruments. The immediate action to be taken if full control is lost is as follows:-

(a) Take feet off the rudder pedals (if not already clear of them).

(b) Use aileron control to stop any turn with the aid of the Reid and Sigrist turn indicator, i.e. centralize the turn pointer by aileron control.

(c) Then, keeping straight by ailerons, assume level flight by elevator control with the aid of the altimeter and airspeed indicators).

(d) Do not touch the elevator trimming tab control.

STALLING

16. Though the stall more usually occurs at low speed, it may occur at any speed if the control column can be brought far enough back to put the aircraft at stalling incidence. Note the following:-

(i) This aeroplane has a violent stall both with flaps up and fully down, if anything, worse with flaps down. One wing and the nose go down with a flick, as if to spin, with almost vertical bank if immediate action is not taken to unstall.

(ii) With engines throttled down, the aeroplane will stall easily with flaps up and the control column nearly right back but with flaps down the violent flick will only happen on certain aeroplanes; if, however, engines are running faster than idling, the violent flick can always be reproduced.

(iii) No warning of a stall should ever be relied upon. Stalling should be practised at a safe height, so that the pilot may be better able to avoid stalling unintentionally; feet must be placed on the rudder pedals for this practice.

(iv) The immediate action to prevent spin and regain control from a stall is, "control column forward and rudder as necessary."

(v) Use of aileron control near the stall should be avoided, as it often has reversed effect and induces a spin; use the rudder to keep level. Note the A.S.I. reading at stalling point.

SPINNING

17. Deliberate spinning is prohibited.

(i) If a spin starts owing to misuse of controls, the standard method of recovery must be used, i.e. apply full opposite rudder, followed by pushing the control column steadily forward, until the rotation stops.

(ii) If a spin were to happen in cloud, use the standard method of recovery with the aid of the Reid and Sigrist turn indicator; endeavour to centralize the turn pointer by means of the rudder.

GLIDING

18. Gliding may be carried out at any speed up to that when it becomes a dive, and down to the necessary margin of about 25% above stall. Lowering either the flaps or the undercarriage, or both, steepens the gliding angle and causes a considerable change of attitude, the nose being lower at a given speed. Also, the rate of descent is much increased.

(i) Long distance gliding.- With flaps and undercarriage up the glide is very flat, and long distances can be covered, when gliding at the optimum gliding speed (about 130 m.p.h. A.S.I.), for a comparatively small loss of height.

(ii) Approach glide.- Before lowering flaps, the minimum gliding speed should be about 90 - 100 m.p.h. A.S.I., or more if turns are done. With flaps down, the correct gliding speed for the final glide before flattening-out is about 85 m.p.h. A.S.I. This will allow gradual smooth flattening-out with little float.

(iii) Gliding turns.- Speed should be increased if turns have to be done, especially at low altitude or with flaps down, when the controls are a little sluggish unless the airspeed is about 100 m.p.h. A.S.I. Gliding turns with steep bank or near the ground should not be made.

(iv) Engine-assisted glide.- Opening up the engines to a fast tick-over will flatten the glide-path and attitude of the aeroplane, and reduce the rate of descent. This method of gliding enables the pilot to regulate the glide-path by the amount of the engine power used. Airspeed should be about 75 to 80 m.p.h. A.S.I., according to the load, rather less than that suitable for the glide without engines.

DIVING

19. The maximum speed permitted is 285 m.p.h. A.S.I. Note the following:-

(i) Engine r.p.m. must not exceed 2,750 at less than one-third throttle opening. At more than one-third throttle, engine r.p.m. may exceed this figure slightly, but 3,100 is permitted for a momentary period only.

(ii) When diving, flaps must be fully up and airscrews in coarse pitch.

(iii) Elevator tabs should not be used to assist recovery from a dive, except as a last resort in emergency, and then only with very slow and careful movement.

(iv) The rate of descent is very great, so ample height for recovery must be allowed.

(v) If the aeroplane is put into a 45° dive from a speed of 150 m.p.h., A.S.I. (throttles one-third open) the height loss is 3,000 ft. in 18 seconds and the airspeed reaches 280 m.p.h. A.S.I.

APPROACH AND LANDING

General remarks

20. The landing should always be made with flaps fully down, as these reduce the stalling speed, the float, and help to stop the run on the ground, especially if there is much wind. There are several different ways of carrying out the approach and landing of this aeroplane. The four standard methods are:-

(i) The engine-assisted approach and landing (normal method, and for landing with one engine).

(ii) Approach and landing without use of engines (for forced landing without engines).

(iii) Final glide and landing without engine after approach with engine (a convenient method of practising landings without engine).

(iv) Flat power approach (for accurate landing in short space).

Note.- The approach and landing at night are similar to (i) the engine-assisted approach, but on a slightly flatter path.

Preliminary approach

21. High speed may be maintained until the aeroplane nears the aerodrome. A convenient method is to throttle down "to the hooter", i.e. throttle back as far as possible without sounding the under-carriage hooter. Any non-vital preparations for landing should now be made, such as closing the cowling gills, caging the directional gyro and so on. Then throttle right back, raise the nose and climb to reduce speed, and, as the speed drops below about 150 m.p.h. A.S.I., carry out the drill of vital actions for landing. Then enter the aerodrome circuit at not more than 120 m.p.h., A.S.I.

Drill of vital actions for landing

22. A convenient catchword is applied to this drill - S.U.P. and Flaps

That is:-

S. - Selector - DOWN (push hard to ensure it is down).
U. - Undercarriage DOWN (watch the indicator).
P. - Pitch to - FINE (watch the airscrews).

Lower flaps (this should actually be delayed until the end of the circuit).

Note.- Having carried out this drill (except lowering of flaps) without pause, and watched the indicator studs to the end, the pilot must look out of the window, see that the port wheel is fully down, and say "O.K. port" - the passenger (if any) beside him will look at the starboard wheel and say "O.K. starboard". Up to this point the approach is the same for all methods.

23. Engine-assisted approach and landing.- This is the normal method. Proceed as dollows:-

(i) Complete the circuit, slightly beyond gliding distance on the leeward side, then turn towards the aerodrome at about 1,000 ft. and lower the flaps fully at 100 m.p.h., A.S.I. (watch the flap indicator) and approach in level flight slightly across wind.

(ii) When almost within gliding distance, throttle back enough to keep the aeroplane gliding straight towards the edge of the aerodrome just beyond gliding distance all the way down, and turn into wind for the final straight approach. Regulate the "glide-path" by use of throttles and maintain a constant speed of 75 - 80 m.p.h., A.S.I.

(iii) Trim slightly tail-heavy with elevator tabs (this is not essential, but asists landing).

(iv) For the last 200 feet or so, when the aeroplane is landing comfortably into the aerodrome, the throttles should be set to give about double idling r.p.m. (to a very fast tick-over), and not altered again until closed for landing. Put both hands on the control column, especially if gusty.

(v) Flatten out smoothly with engines running at this speed, and then close the throttles fully and hold the aeroplane just clear of the ground, easing the control column steadily back until it is fully and firmly back, when the aeroplane will make smooth contact with the ground, all three wheels together.

24. General remarks about landing which apply to all methods:-

(i) Hold the control column firmly back to prevent the elevators flapping, and, if wheel brakes are used, to help keep the tail on the ground. Keep straight with rudder, and do not use the brakes unnecessarily. Apply them smoothly and if the tail lifts, release them and try again.

(ii) Do not swing until nearly all speed is lost, it is bad for the tyres. It may be useful in emergency, however, and a sharp swing can be done without any tendency to capsize.

(iii) After coming to rest, look down to the flaps control and raise the flaps (watch the indicator).

25. Three-point landing.- It is important to land tail-down (that is, three-point) with control column fully back. If held off reasonably close to the ground, the aeroplane will not land appreciably tail-first and even if the tail-wheel does make smooth contact with the ground before the main wheels, it is no strain on it. In fact less strain is induced than if the aeroplane comes down wheels first and then drops its tail, which results in severe bouncing of the tail. After a three-point landing and with full use of the brakes, the pilot can be certain of stopping the aeroplane within about 300 yds, but if a wheel-landing

is made the run will be of definite length, and use of the brakes is dangerous until the tail is on the ground.

26. Landing-point.- Always make a mental note of the point on the aerodrome short of which the landing (tail down) must be made. If the landing is not made before this point (a touch of the wheels is not a landing) the throttle must be opened fully and another circuit made. IF IN DOUBT GO ROUND AGAIN.

27. Mis-landing.- In case of an unsuccessful attempt to land, the aeroplane will climb satisfactorily with flaps and undercarriage down, but:-

(i) Raise the undercarriage immediately.

(ii) Do not raise the flaps until a safe height (about 500 feet) is reached. Put the nose down slightly and increase speed to about 100 m.p.h. A.S.I.; then raise the flaps. Flaps may be raised a little at a time if the handle is "levered up" just above the neutral position.

(iii) Mislanding should be avoided, as failure of one engine during the take-off with flaps down would necessitate immediate closing of throttles and landing, whatever the state of the ground ahead.

28. Approach and landing without use of engines;- This is necessary in case of forced landing without engines.

Note.- Forced landing - For further details concerning the method of preliminary approach to a field, see para.37 - Forced landing.

(i) Having carried out the drill of vital actions for landing (with the exception of lowering flaps, which is left till later) fly to such a position that a half circuit of the aerodrome is required to bring the aerodrome into position to land.

(ii) Shut off the engines and glide at about 100 m.p.h., A.S.I. turning in at the same time and keeping the landing point in view, if possible, just in front of the inner engine. Concentrate on judging the angle of approach and watch the landing point. Turn into wind for the final glide with a little surplus height, but not lower than about 500 ft., then, when quite sure of gliding into the aerodrome fully lower the flaps.

(iii) Depress the nose to maintain a gliding speed of not less than 85 m.p.h. A.S.I. and trim with the elevator trimming tab. Trim by setting the indicator stud quickly to a point half way up and not by feel.

(iv) Start to flatten-out in good time, almost imperceptibly at first, and continue to make a smooth curve until the aeroplane is floating just above the ground. Make a three-point landing with control column fully back, as already described. The surplus

speed used in this method enables a wide easy curve to be made when flattening-out, with little float before landing.

29. Final glide and landing without engine after approach with engine.- This is a convenient method of practising landings without engine. It must not be regarded as the normal method, but may be used, by pilots thoroughly accustomed to the aeroplane, in favourable conditions.

(i) The preliminary approach is the same as that for the engine-assisted approach, i.e. drill of vital actions, turn in and lower flaps. Continue to approach with engines, losing height gradually so that gliding distance is reached at about 600 ft., if necessary fly level at 600 ft. until in a position for the final glide.

(ii) Then close throttles, put the nose down to a glide at 85 m.p.h., A.S.I. and put the elevator trimming tab half way up and complete the flattening-out, landing exactly as the gliding method already described.

(iii) A height of 600 ft. is chosen to start gliding because it is more difficult to judge the point at which to close the throttles if higher up, and there is not enough time to settle down to a steady glide if much lower.

(iv) If engine power is needed at any time during the final glide, owing to under shooting or other reasons, revert to the engine-assist approach and use engines until after the flattening-out is completed. The reason for this is, if engines were shut off, for example, at 100 ft., and the nose put down to maintain speed, the increase in rate of descent and steep angle make it difficult to flatten-out smoothly.

30. Power approach.- This is an emergency method for accurate landing in a short space. It is an approach, almost flat for the last 200 - 300 yds, with nearly enough engine power for level flight.

(i) The preliminary approach is the same as that for the engine-assisted approach, i.e. drill or vital actions, turn in and lower the flaps. Then approach, under-shooting by several hundred yards, almost closing the throttles if necessary. When 200 or 300 yds. short of the landing ground the aeroplane should be low down, clearing obstacles by a comfortable margin, with the engines opened up to fly in almost flat, and speed reduced to about 70 m.p.h., A.S.I. Speed should not be more than 75 m.p.h. A.S.I. (or float will be too long) and NEVER LESS THAN 65 m.p.h. Concentrate attention between the air-speed reading and the ground, using the throttles to regulate the glide.

(ii) After crossing the boundary, come down close to the ground and then fully close the throttles and land.

(iii) It is very important not to close throttles until the aeroplane is close to the ground, as the margin over stalling speed is only about 20% and there will be practically no float.

31. General remarks about the approach.- Note the following:-

(i) Varying the angle of glide.- It is not possible to vary the angle of glide, without use of engines, once the flaps are down, because an effective sideslip cannot be done, and raising the flaps, once they are down, does not give a flatter glide owing to the initial loss of lift.

(ii) Side-slipping.- An attempt to sideslip slightly increases the gliding angle, but only very little bank can be maintained, and its usefulness is almost negligible.

(iii) Gliding.- Judge the gliding speed of about 85 m.p.h., A.S.I. not only by the A.S.I. reading, but also by the position of the windscreen panels in relation to the horizon. On a gusty day, or when there is a large wind-gradiant, glide even faster (add about 5 or 10 m.p.h.) if necessary to land without use of engines.

(iv) Relation between stalling speed and approach speeds.- The figures given here are based on a stalling speed (flaps down) of about 60 m.p.h. A.S.I.:-

(a) Glide without engines	85 m.p.h.	(Stall + 40%)
(b) Engine-assisted glide	75-80 "	(Stall + 33%)
(c) Power approach	70 "	(Stall + 20%)

(v) The pilot should always know the flaps-down stalling speed of the aeroplane he is flying, because if it is abnormal for any reason, such as instrument error, the difference must be allowed for in the approach speed.

32. Landing across wind.- If a landing has to be made in a long and narrow aerodrome or field, with a wind across it, and there is the slightest doubt about the amount of room to land into wind, a cross-wind landing using the full length of the ground should be made. Note the following:-

(i) Owing to the high landing speed (about 75 m.p.h. true speed) and wide-track undercarriage, the aeroplane may safely be landed across wind, as drift is less than in the case of slow aeroplanes.

(ii) Drift cannot be fully counteracted, as landing with one wing down is not easy or advisable. Therefore cross-wind landing in a high wind should not be made.

(iii) Drift may be partly counteracted in two ways:-

(a) By keeping one wing slightly down, into wind, before flattening-out.

(b) By making a slight and very careful yaw by rudder towards the direction the aeroplane is drifting just before landing. This will point the aeroplane along its flight path and eliminate drift.

33. Landing.- This aeroplane can be stopped in less than 400 yds. with any load in a light wind, on level ground, provided a fully tail-down (three-point) landing is made, with the flaps down and the wheel-brakes used. Lightly loaded, in more favourable conditions, it can, of course, be stopped in a much shorter distance. Note the following:-

(i) The following factors which add to this basic distance must be allowed for:-

(a) Downward slope of ground (if any).

(b) Tree-height obstacles.

(c) Inaccurate approach

(d) Fast or wheel-landing.

(e) Defective brakes.

(ii) With great care it is possible to land in a space about 500 yds. long, provided brakes are effective, and there are no obstacles to a low and absolutely accurate power approach.

(iii) For a pilot with little or no experience of this aeroplane, the available landing space should be not less than 700 yds. with clear approaches, or 1,000 yds. if the approach must be over trees on the boundary. Even a gentle slope down adds greatly to the length of landing run.

PROCEDURE AFTER LANDING

34. After raising flaps taxy in towards the apron, in accordance with aerodrome traffic rules in force.

(i) Open the cowling gills while taxying if temperatures are high.

(ii) Change the airscrews to coarse pitch if the aeroplane is being put away. If they have not fully changed after taxying, open up the engines until the pitch changes.

(iii) Close the throttles for about a minute to allow oil to settle in the sump, whence it can be removed by the scavenge pump.

(iv) Stop engines by pulling out carburettor cut-outs. Then switch off ignition switches and turn off the fuel.

(v) Switch off indicator lights for the undercarriage.

(vi) See that undercarriage safety links are replaced.

UNDERCARRIAGE EMERGENCY OPERATION

35. A hand-pump is provided for use if the oil pump on the port engine fails. Pumping by hand is also necessary if the port engine stops, but as long as it is rotating the engine pump will continue to function, even though slowly.

Note.- If it is found that only one side of the undercarriage can be locked down, a landing should not be attempted until it is unlocked again, as the aeroplane should only be landed with the undercarriage as follows:-

(i) Fully down and locked.

(ii) Fully up, or unlocked on both sides.

FLYING IN RAIN AND BAD VISIBILITY

36. When flying in conditions of bad visibility open the port side window panel. Attention is drawn to the following:-

(i) If landmarks are being followed it is better to keep these on the port side, so that they can be seen through the open window, and, for the same reason, flying in formation is best in echelon right.

(ii) When flying in rain or snow, window panels may become opaque, even if outer visibility is good.

(iii) It is advisable, in order to make navigation easier, and to obviate the risk of collision with suddenly rising ground, greatly to reduce speed.

(iv) In extreme cases flaps should be lowered, partly or fully, and the airscrews put into fine pitch to reduce vibration, as the engines may not run smoothly at very low r.p.m. Speed should not be reduced below about 80 m.p.h., A.S.I. At slow speeds engine temperatures must be carefully watched and gills opened as may be necessary.

(v) There is nothing to be gained by lowering the undercarriage, unless a precautionary landing is decided upon, because it causes form of "tail buffetting". If a landing becomes necessary, the undercarriage should only be lowered if the pilot is able to select a landing ground suitable for a safe landing.

FORCED LANDING OWING TO ENGINE FAILURE

37. If one engine has failed.- The usual type of forced landing on

a twin-engined aeroplane is that in which one engine is available, the other having failed:-

(i) In normal conditions this aeroplane will easily maintain height on one engine, even partly throttled down, provided the undercarriage and flaps are up and the cowling gills closed.

(ii) When flying on one engine, coarse pitch should be used at all times, except when climbing or coming in to land. Fine pitch gives more power for climbing, but rudder against the full power of one engine cannot be held for more than a few minutes.

(iii) With undercarriage down height can just be maintained on one engine with the airscrew in fine pitch.

38. Approach and landing.- This is carried out mainly by the same method as for the normal engine-assisted approach. Proceed as follows:-

(i) Fly to the leeward side of the selected landing ground, if possible about 2,000 ft. above ground level and going far enough out to allow turning in against the live engine; if too close, the aeroplane would merely circle the landing ground owing to the wide radius of turn.

(ii) Fly towards the landing ground and carry out the landing drill, i.e. Selector, Undercarriage, Pitch, but keep flaps up until later.

(iii) Get into position just beyond gliding distance and then fully lower the flaps.

(iv) Make an engine-assisted approach, regulating the angle of glide by means of the live engine, keeping just beyond gliding distance all the way down, at a speed of about 85 - 90 m.p.h., A.S.I., flatten-out and then close the throttle and land.

(v) Concentrate on two essentials during the final approach:-

(a) That it is VITAL NOT TO OVERSHOOT, as it is impossible to make a second attempt, when commited to a landing.

(b) Not to get too flat by undershooting, as it is very difficult to keep straight if full engine power is used with flaps fully down.

(vi) Second attempt.- If the aeroplane gets badly out of position, make up your mind in good time (well above 500 ft.) to try again, before becoming commited to a landing. Put the nose down to gather speed, (about 90 m.p.h., A.S.I.) at the sacrifice of a little height, and raise flaps. Do this first, while still at a safe height, and because they come up quickly. Then open to full throttle with the airscrew in fine pitch, fly at about 90 m.p.h. A.S.I. and raise the undercarriage, increasing speed as it comes up, to about 110 m.p.h. Climb up to at least 1,000 ft., and carry out the approach and landing correctly.

(vii) Total engine failure.- The principles of forced landing this aeroplane are the same as those which apply to most modern types, the first actions being to maintain ample gliding speed, select a landing ground, glide towards it and then try to rectify the trouble. If a landing is inevitable, switch off ignition and turn off the fuel. Certain features of this aeroplane, however, call for particular care in the subsequent procedure:-

(a) As an effective side-slip cannot be done, other methods of regulating the glide-path must be used.

(b) S-turns may be used down to about 2,000 - 3,000 ft. Below this height the approach may be regulated to some extent by gliding across wind and gradually turning in to land, close or wide, early or late, according to whether the glide-path tends to undershoot or overshoot the near side.

(c) Flaps should be up at this stage. Glide at about 100 m.p.h., A.S.I.

(d) A further adjustment of the gliding angle is provided by the flaps, lowering of which may be delayed until the last 300 - 400 ft; they may be lowered progressively, but it must be remembered that once lowered no advantage is gained by raising them.

(e) Maintain speed as flaps are lowered.

(viii) Undercarriage.- The question of whether or not to lower the undercarriage is decided by the size and surface of the landing ground, bearing in mind that a skid landing does less damage than turning over. IF IN DOUBT, LAND WITH UNDERCARRIAGE UP. As the undercarriage is an effective airbrake when down, it should be left up to extend the initial glide towards suitable country, if necessary, whether it is to be lowered finally or not, but it must be lowered in good time. It can easily be raised again, if the pilot decides on a skid landing, as it will collapse on touching the ground, provided both sides are unlocked.

(ix) Flaps.- If possible, flaps should be fully lowered for landing, to reduce landing speed and float, which would be excessive. especially if the undercarriage were up.

(x) Landing.- A normal tail-down landing is made exactly as described in para.28.

POSITION ERROR TABLE

39. A.S.I. correction

60	add about 15 m.p.h.		(Stall flaps down)
100	add	13.5 "	

120	add	10.5 m.p.h.
140	add	8.5 "
160	add	7.0 "
180	add	6.0 "
200	add	5.5 "
220	add	5.0

NOTES CONCERNING THE MERCURY XV ENGINE

40. The following data should be carefully noted:-

(i) Limiting operational conditions:-

Take-off on 100 octane fuel (long range load 14,500 lb.) (Up to 800 - 1,000 ft. or for 2 minutes)	Maximum r.p.m. at maximum boost (9 lb./sq.in.)	2,750
Take-off on 87 octane fuel (normal max. load 12,500 lb.) (up to 1,000 ft. or for 3 minutes)	Maximum r.p.m. Minimum r.p.m. at maximum boost (5 lb./sq.in.)	2,650 2,050
Climb	Maximum r.p.m. at maximum boost (+5 lb./sq.in.)	2,650
Maximum cruising Mixture control NORMAL (Rich)	Maximum r.p.m. at maximum boost (+3½ lb./sq.in.)	2,400
Economical cruising Mixture control WEAK (Throttle lever in cruising range)	Maximum r.p.m. at maximum boost (+1½ lb./sq.in.)	2,400
Maximum level (5 minute limit)	Maximum r.p.m. at maximum boost (+5 lb./sq.in.)	2,750
Maximum dive (20 seconds limit)	Momentary maximum r.p.m. at maximum boost (+5 lb./sq.in.)	3,120

(ii) Oil pressures

Normal	80 lb./sq.in.
Emergency minimum (5 minute limit)	65 lb./sq.in.

(iii) Oil inlet temperatures

Minimum for opening up	5°C
Maximum for continuous cruising	70°C
Maximum for climbing	80°C
Emergency maximum (5 minute limit)	85°C

(iv) Cylinder temperatures

Maximum climb	200°C
Maximum cruising	180°C
Maximum level (5 minute limit)	240°C

FUEL CAPACITY AND CONSUMPTIONS

41. Note the following:-

(i) Effective fuel capacity

Normal load (12,500 lb.) - Two tanks in centre main plane

Port tank	- 140 gallons
Starboard tank	- 140 gallons
Total effective capacity	- 280 gallons

Long range load (14,500 lb.) Four tanks

Two inner tanks 140 galls each	- 280 gallons
Two outer tanks (100 octane) 94 galls.each	- 188 gallons
Total effective capacity	- 468 gallons

(ii) Fuel consumption.- The following information will be found useful in determining endurances:-
Maximum consumptions per engine at the altitudes indicated:-

Take-off (+9 lb./sq.in. boost (100 octane)	88½ galls. per hour at sea level.
Climbing (+5 lb./sq.in. boost)	82 galls. per hour at 13,000 ft.
Maximum cruising (mixture control NORMAL)	58 galls. per hour at 4,500 ft. (approx.)
Economical cruising (mixture control WEAK)	40 galls. per hour at 10,000 ft. (approx.)
All-out level flight (+5 lb./sq.in. boost)	84 galls. per hour at 14,000 ft.

These are being listed for the benifit for people interested in British or Commonwealth Aircraft

While it did cost me a great sum of money to aquire these documents, all I ask in return is some credit.

~JimSan