AIR PUBLICATION 1530 C

Pilots Notes

PILOT'S NOTES

BLENHEIM V AEROPLANE

TWO MERCURY XV OR 25 ENGINES

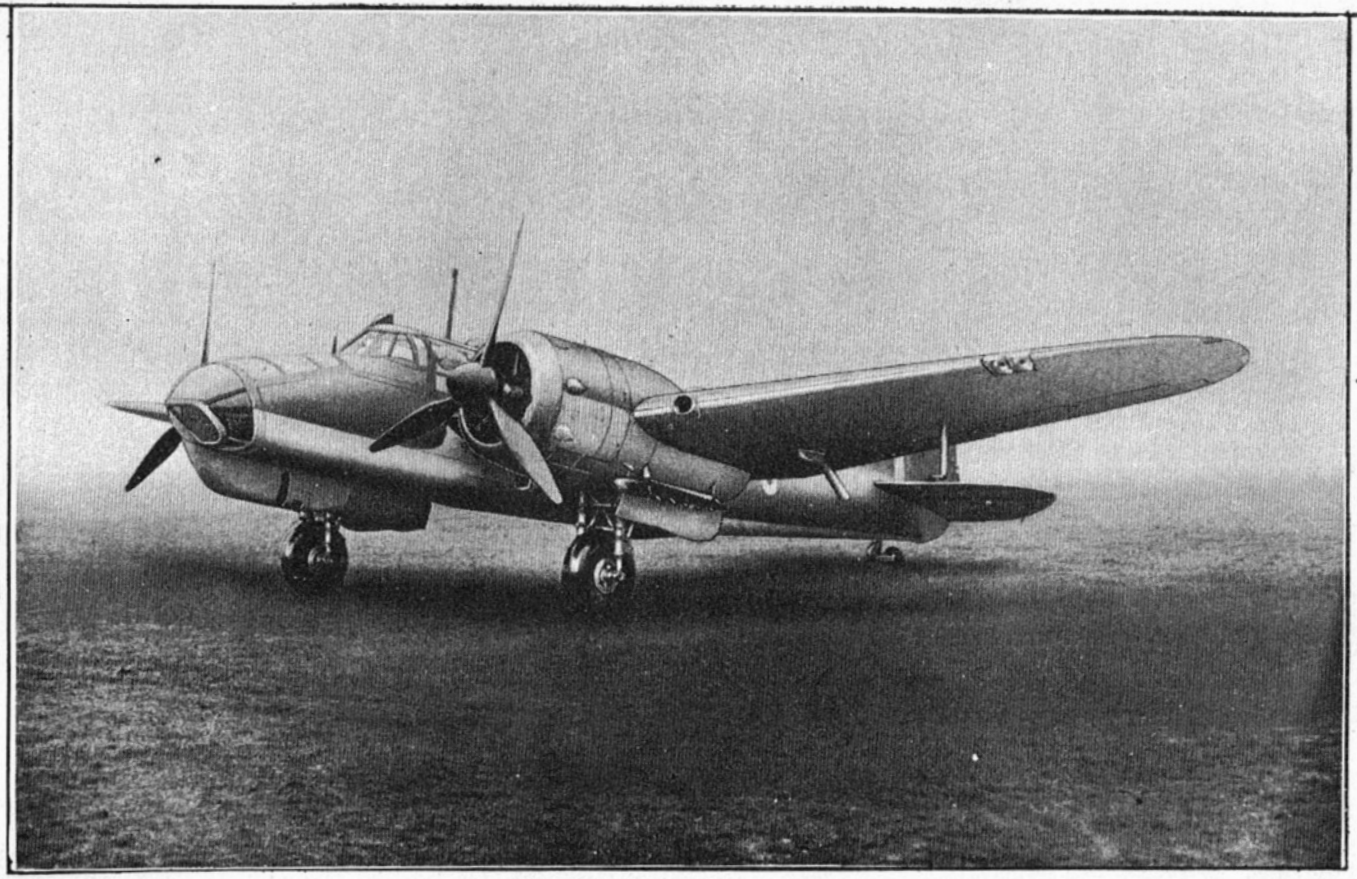
Prepared by direction of the

Minister of Aircraft Production

A. C. Poulett

Promulgated by order of the Air Council.

AIR MINISTRY



BLENHEIM V

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AIR PUBLICATION 1530C
Volume 1
Pilot's Notes

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Amendt. List No.	4						10	11B		
Prelimy. matter										
Leading Partics										
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Section 1	✓						✓	✓		
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LIST OF SECTIONS

June 1942
Issued by A.L.No.4

AIR PUBLICATION 1530C
VOLUME I
and PILOT'S NOTES

BLENHEIM V

SECTION I

PILOT'S CONTROLS & EQUIPMENT
- LIST OF CONTENTS -

Issued by A.L.No.4.

- LIST OF ILLUSTRATIONS -

SECTION 1

PILOT'S CONTROLS AND EQUIPMENT

INTRODUCTION

1. This aeroplane is a medium bomber fitted with Mercury XV or 25 engines and de Havilland 20° constant speed propellers.

MAIN SERVICES

2. Fuel System:- The capacities are as follows:-

Two 140 gallon inner tanks	280 gallons
Two 94 gallon outer tanks	188 gallons
Total normal capacity	468 gallons
Two 50 gallon overload tanks	100 gallons
	568 gallons

Two tank cocks select OFF, INNER or OUTER tanks on each side, and a suction balance cock (normally OFF) allows the tanks on either side to be used to feed either or both engines. On later aeroplanes two 50 gallon auxiliary tanks can be fitted in the bomb cells. These are connected to a three way cock OFF, PORT and STARBOARD, and thence via a hand pump and isolating cock into the main suction balance pipe. They cannot be used for direct engine feed but are used for refilling the inner main tanks.

3. Hydraulic system:- A pump driven by the port engine operates main wheels, flaps and turret. A three position selector (71) allows operation of either wheels and flaps, or turret, the third position being neutral. An emergency handpump (69) will operate all services. There is also a cartridge-fired emergency system for undercarriage lowering.

4. Pneumatic system:- A compressor, driven by the starboard engine, charges a reservoir for brakes and gun firing. A triple pressure gauge (49) shows the reservoir pressure and the pressure at each wheel.

5. Electrical system:- The aircraft battery is charged by one generator driven by the port engine.

AEROPLANE CONTROLS

6. Flying controls:- The spectacle type handwheel is conventional. The rudder pedals are adjustable by a handle (23) under the instrument panel.

7. Dual controls:- These may be fitted at the navigator's rest seat.

8. Trimming tabs:- The elevator tab control (25) operates in the natural sense, the rudder tab control wheel (26) rotates forward for TURN STARBOARD and aft for TURN PORT. The indicators (47) are on the right of the instrument panel.

9. Vacuum change-over cock:- The engine-driven vacuum pump for operating the blind flying instruments is selected by the cock (29) on the left of the instrument panel.

10. Hydraulic selector:- A push-pull handle (71) is on the right side of the seat back. The selector may be moved from the DOWN position after the undercarriage locking pins have been inserted.

TURRET	- Up
OFF	- Central
FLAPS AND UNDERCARRIAGE	- Down

The selector must always be down when the aeroplane is on the ground.

11. Undercarriage:- The operating lever (17) is on the right of the instrument panel and has two positions only. The position indicator (9) is on the port wall of the cockpit. When the weight of the aeroplane is on the wheels the lever is locked in the DOWN position but may be released by pressing a thumb catch to the left.

12. Flaps:- The push-pull operating handle (70) is forward of the hydraulic selector, and has three marked positions. If partial lowering of the flaps is required select DOWN and return lever to OFF position when the indicator (6), mounted aft of that for the undercarriage shows the desired position.

13. Undercarriage and flaps emergency operation:-

(i) The handpump (69) forward of the hydraulic selector operates both undercarriage and flaps, The hydraulic selector must be down and the relevant operating lever set as required.

(ii) The cartridge-fired emergency system can be used for lowering but not raising the undercarriage only. A white fabric cover (73) behind the navigator's rest seat conceals a pull handle which fires cartridge (not fitted on some aeroplanes).

13A. Undercarriage indicator & warning horn:- The indicator (9) shows the position of each unit mechanically and also embodies a red and green light for each unit, controlled by a switch (51). This must be on before the ignition switches can be operated. The green lights show when the units are locked down and the red lights remain on (they cannot be switched off) while the units are locked up. A warning horn sounds if the throttles are shut more than two thirds of the cruising range with the undercarriage up.

14. Brakes:- The brakes are controlled conventionally by a lever (10) on the control wheel (with parking catch) and by the rudder pedals.

ENGINE CONTROLS

15. Throttle and mixture controls:- The throttles (63) are gated at CRUISING (weak mixture continuous) and RATED (climbing) positions. The single mixture lever (64) has two operating positions only, NORMAL and WEAK, and returns automatically to NORMAL when either throttle is closed or opened beyond the CRUISING gate.

16. High boost control:- A lever at the top of the instrument panel has two positions marked 5 LBS and 9 LBS (15). Moving the lever to 9 LBS raises the controlled boost to an extent depending on throttle setting and gives 9 lb./sq.in. at the TAKE-OFF throttle setting . The 9 LB position is to be used only with the throttle at TAKE-OFF position however.

17. Propeller speed control:- The two levers (62) controlling the de Havilland 20° constant speed propellers work in a quadrant whose after end is marked POSITIVE COARSE PITCH. The aft position of each lever holds the propeller in fixed coarse pitch at any r.p.m. At all other positions of the levers the propeller is under constant speed control. The lever is moved forward to increase, and back to decrease the governor controlled speed.

18. Air intake heat controls:- Two levers (53) are on the left of the seat back.

19. Cowling gill controls:- On early aeroplanes the gills are manually operated by two handwheels (74) to the right of the seat back. Later aeroplanes are fitted with electric gill motors controlled by switches on the port wall of the cockpit. On incorporation of Mod.No. 5170 opening of the electrically operated gills is restricted by a limit stop - see Section 2 para.10(i) Red lights at the switches show when the motors are working.

20. Slow running cut-out controls:- There are two knobs (54) below the air intake heat controls.

21. Fuel Cock and contents gauges:- The tank cocks and suction balance cock are operated by levers (85) and (84) above the back of the navigator's rest seat. Contents gauges (81) are mounted on a panel above the cocks, with a button (82) which must be pressed to obtain readings. When fitted the auxiliary tank cocks and handpump are mounted on the starboard side of the navigator's rest seat.

22. Engine priming pumps:- The pumps are in the nacelles and operated from the ground.

23. Starting magneto and booster coil switches:- On early aeroplanes starting magneto switches are mounted in the nacelles. On later aeroplanes booster coil switches are mounted next to the starter buttons.

24. Starter buttons:- The buttons are under a flap in the roof on the left of the pilot's entrance hatch.

25. Oil dilution:- The dilution switches are in the nacelles.

26. Engine instruments:- The usual engine instruments are fitted, but the cylinder temperature gauges (83) are on the fuel contents gauge panel.

DE-ICING EQUIPMENT

27. Carburettor de-icing:- A handpump (58) for spraying de-icing fluid into either or both carburettors, with a selector cock, is on the left of the pilot's seat. See A.P.2095/7 para 2(ii) for operating instructions.

28. Windscreen de-icing:- A pump (27) is fitted on the instrument panel.

29. Pressure head heater:- The switch (45) is at the bottom centre of the instrument panel.

OPERATIONAL EQUIPMENT AND CONTROLS

30. Gun and cine-camera control:- The wing gun and the cine-camera in the nose are fired by the button (11) on the control hand-wheel. The cine-camera footage indicator (21) and the master switch (22) are to the right of the cockpit.

31. Gun sights:- The sight consists of a ring sand-blasted on the port windscreen and a bead on a faired post forward of the windscreen.

32. F.24 camera:- The control unit for the F.24 camera in the rear fuselage is on a hinged mounting (16) to the right of the instrument panel. The pouch for the electrical lead is forward of the panel.

33. Bomb and flare release:- The bombs are fuzed and released electrically. There is a release button and navigator's hand bomb distributor can be cut out of the release circuit by disconnecting the plug (75) on the starboard fuselage side. When this plug is in. all the selector switches (3) must be OFF.

34. Main bomb control panel:- This is under the pilot's control and is fitted just forward of the throttle levers. The panel contains the following:-

(i) Master switch (2)

(ii) Selector switchbox (3) (The switches are numbered 17 to 32 to corresppnd with the bomb and flare stations).

(iii) Fuzing selector switchbox, nose and tail. (4)

(iv) Small bomb container jettison switches. (5)

(v) Instruction plate, giving bomb and flare loads, together with their respective stations.

Note:- Bombs and flares cannot be released until the master supply switch is ON.

35. Bomb steering indicator:- The indicator (38) is under the rear end of the starboard window.

36. Reconnaissance flares:- Four flares may be carried on the light series carriers under the rear fuselage.

37. Signal pistol:- The signal pistol is under the rear gunner's control.

38. D.F. loop visual indicator:- The indicator (40) is under the starboard direct-vision window. On the early aeroplanes the controls are operated by the rear gunner and on later aeroplanes by the navigator.

39. Syko cipher device:- This instrument is stowed in the well on the rear face of the front spar.

40. Beam approach:- The control for this installation is to the right of the cockpit, the visual indicator (31) being to the left of the blind flying panel. The installation in the rear fuselage is removed when desert equipment is carried.

41. Radio:- The following radio equipment is fitted:-

(i) T.R.9F - Remote control (77) for pilot or navigator.

(ii) T.1154/R.1155 - Under control of rear gunner.

(iii) R.1155 (for D.F.) - Under control of navigator.

(iv) R.3003 (or R.3061) - Under pilot's control (79) and (80).

42. R.1155 switches:- Aeroplanes equipped with R.1155 at the navigator's station have a circuit switch and an aerial switch to the right of the cockpit. The forward switch, marked SPECIAL, when at OFF, is for the T.R.9F in the normal circuit, when ON it is for the T.R.9F special circuit. The aerial switch (rear one) when at OFF is for the T.R.9F; when ON it is for the navigator's R.1155. Later, the aerial switch will be superseded by a separate aerial, fitted between the mast above the front spar and a mast to the rear of the nose, with a direct lead-in to the navigator's R.1155.

43. Intercommunication:- The pilot's telephone socket (67) is clipped to the front edge of the seat. On later aeroplanes a call light to the right of the cockpit replaces the emergency signalling unit (76) fitted to early aeroplanes.

44. Headlamp, navigation and signalling switchboxes:- The headlamp switch (46) and the navigation lamps switch (44) are on the instrument panel. The headlamp switch has three positions; SIGNALLING, OFF and INDEPENDENT. When in the SIGNALLING position the headlamp is under the control of the rear signalling switchbox (7) which operates all identification lamps. The selector switches (60) for the three downward identification lamps are below the arm-rest to port. The forward signalling switchbox (8) controls the formation-keeping lamps. Only the DOWNWARD key is wired.

45. Aldis lamp:- A switch and socket (24) are on the starboard side of the cockpit.

46. Landing lamps:- The lamps in the port wing are controlled by a switch (61) to the rear of the throttle controls. The switch has three positions; OUTBOARD, OFF and INBOARD. The dipping lever (65) is forward of the mixture lever.

47. Oxygen:- There is a standard oxygen regulator unit (48) on the right of the instrument panel, the socket (55) being to the left of the seat back. Later aeroplanes are fitted with an economizer behind the seat and the bayonet union is at the top right-hand side of the seat.

EMERGENCY EXITS AND EQUIPMENT

48. Fire extinguishers:- The Graviner system is controlled by an inertia switch, a gravity switch (inoperative when the undercarriage is up) and shielded push buttons (37) on the instrument panel. Hand fire extinguishers are carried behind the pilot, on the starboard side of the rear fuselage and in the nose.

49. Bomb jettisoning:- The bomb and flare load can only be jettisoned by the pilot. Jettison by lowering the spring-loaded flap (1) shielding the two jettison bars at the bottom of the selector switchbox and pushing the bar, or bars, as required upward into the switchbox. The forward bar controls switches 17 to 24 and the rear bar 25 to 32. There is a separate jettison switch (5) for the small bomb containers above the selector switchbox. With a mixed load of bombs and small bomb containers the latter must be jettisoned first.

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50. Fuel jettisoning:- The contents of the outer tanks can be jettisoned by raising a lever (52) to the left of the seat back. The jettison valves only operate so long as the main air pressure exceeds 70 lb./sq.in. After jettisoning turn off valves.

51. Destruction switches:- Two shielded push buttons (79) for R.3003 or R.3061 are on the starboard side of the cockpit.

52. First-aid:- The outfit is stowed on the starboard side of the rear fuselage.

53. Parachute exits:-

(i) Pilot and navigator:- Opening made by jettisoning under defence guns; alternatively the entry hatch in the roof. To jettison under defence guns:

(a) Release seat and kneeling pads by pushing red tubular handle (18) under seat up and aft.

(b) Pull aft on safety pin that holds end of leather lanyard; then pull lanyard upward to release guns.

(ii) Rear gunner:- Opening made by jettisoning camera hatch in rear fuselage.

54. Air/Sea rescue equipment:- Early aircraft carry an M or C type dinghy. Later aircraft carry an M type 3-seat dinghy in a valice stowed adjacent to the rear top hatch. The free end of the coiled or hanked cord stowed in a pocket on the valise must be attached to a strong point on the aircraft before throwing the valise overboard. A jerk on this cord releases the dinghy and after boarding the cord should be cut with knife provided in the dinghy.
A type 3 emergency provision pack is stowed below the rear top hatch.
K type dinghies are also provided as personal issue to each member of the crew.

Key to Fig. 1.

1. Bomb jettison bars (FLAP OVER)
2. Bomb master switch
3. Bomb selector switches
4. Bomb fuzing selector switches (nose and tail)
5. Small bomb container jettison switches
6. Flap position indicator
7. Signalling switchbox (identification lamps)
8. Signalling switchbox (formation-keeping lamps)
9. Undercarriage position indicators
10. Brake lever
11. Gun and cine-camera firing button
12. Bomb-firing button
13. Direct-vision window
14. Rear-view mirror
15. Boost over-ride
16. F.24 camera remote control (hinged mounting)
17. Undercarriage operating lever
18. UNDER DEFENCE GUNS, EMERGENCY RELEASE
19. Air thermometer
20. AXE STOWAGE
21. Cine-camera footage indicator wedge plate
22. Cine-camera master switch
23. Rudder pedal adjusting handle
24. Aldis lamp switch and socket
25. Elevator trimming-tab handwheel
26. Rudder trimming-tab handwheel

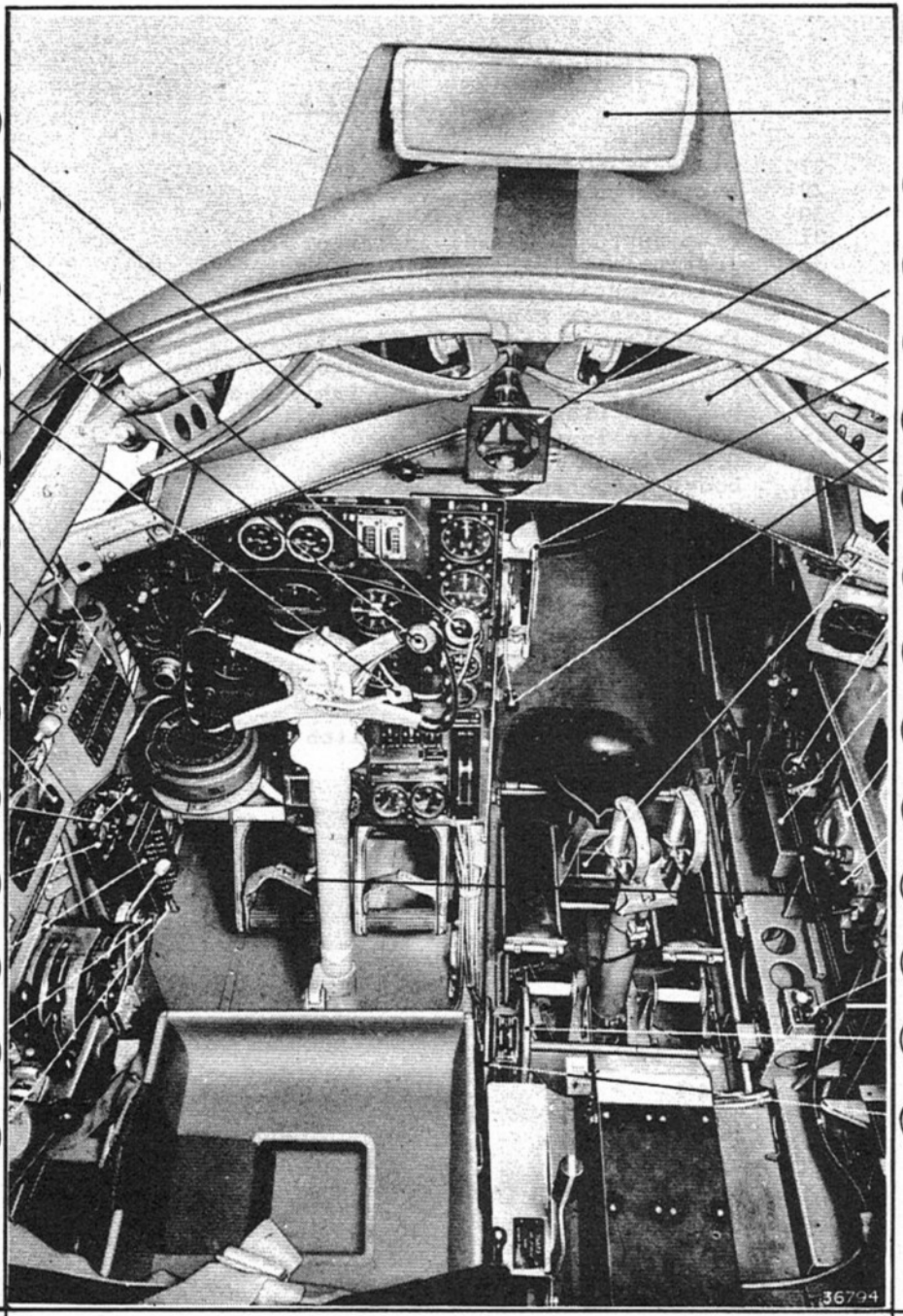


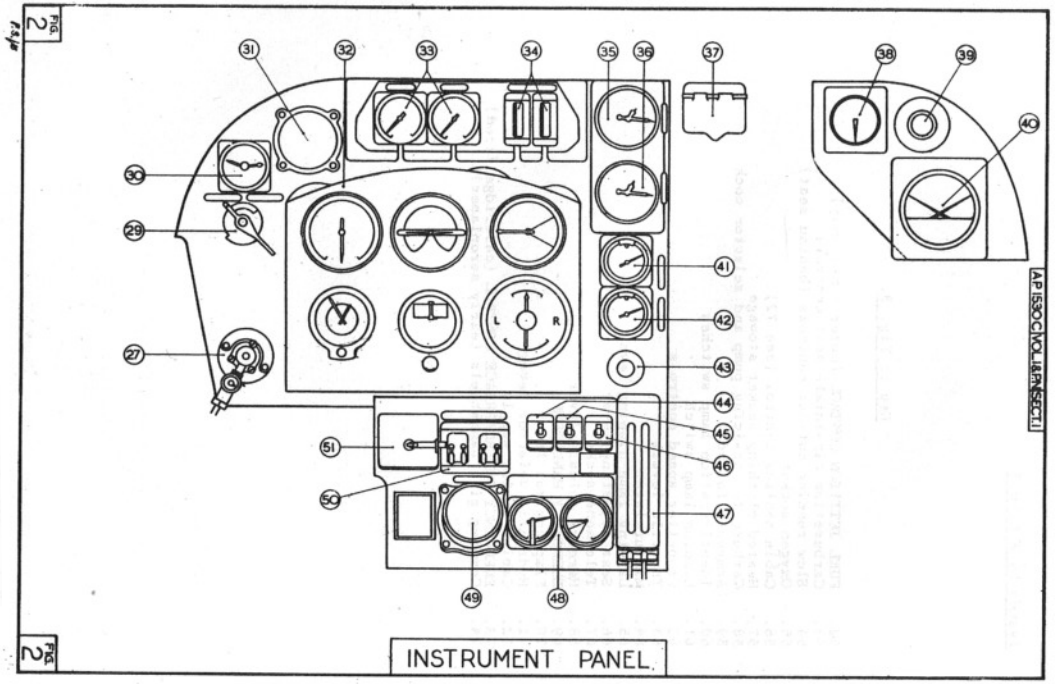
FIG. 1

PILOT'S COCKPIT - GENERAL

FIG. 1

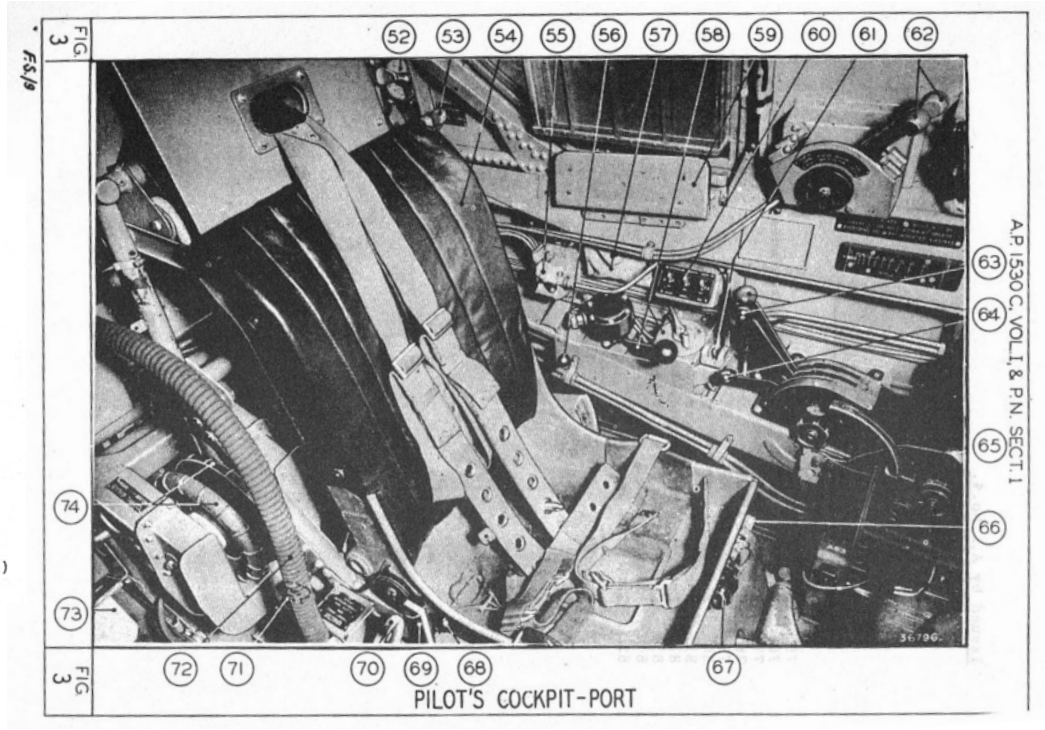
Key to Fig. 2.

27. Windscreen de-icing handpump
29. Suction pump change-over cock
30. Clock
31. Beam approach visual indicator
32. Instrument flying panel
33. Oil temperature indicators
34. Oil pressure gauges
35. Engine speed indicator (port)
36. Engine speed indicator (starboard)
37. FIRE EXTINGUISHER BUTTONS (shielded)
38. Bomb steering indicator
39. Cold air louvre
40. D.F. visual indicator
41. Boost gauge (port)
42. Boost gauge (starboard)
43. Watchholder
44. Navigation lamp switch
45. Pressure head heater switch
46. Headlamp switch
47. Rudder and elevator tab indicators
48. Oxygen regulator
49. Triple pressure gauge
50. Ignition switches
51. Undercarriage indicator switch



Key to Fig. 3.

52. FUEL JETTISON CONTROL (outer tanks only)
53. Carburettor air-intake heat controls
54. Slow running cut-out controls (behind seat)
55. Oxygen socket
56. Cabin heating control (see 72)
57. Heated clothing socket stowage
58. Carburettor de-icing pump and selector cock
59. Armrest (folded)
60. Identification lamp switches
61. Landing lamp switch
62. Propeller speed controls
63. Throttle levers
64. Mixturelever
65. Landing lamp dipping lever
66. Seat adjusting lever
67. Telephone socket
68. Harness release lever
69. EMERGENCY HAND PUMP
70. Flap control lever
71. Hydraulic selector lever
72. Cabin heating supply
73. EMERGENCY UNDERCARRIAGE CONTROL (cartridge fired)
74. Cowling gill handwheels (early aeroplanes).



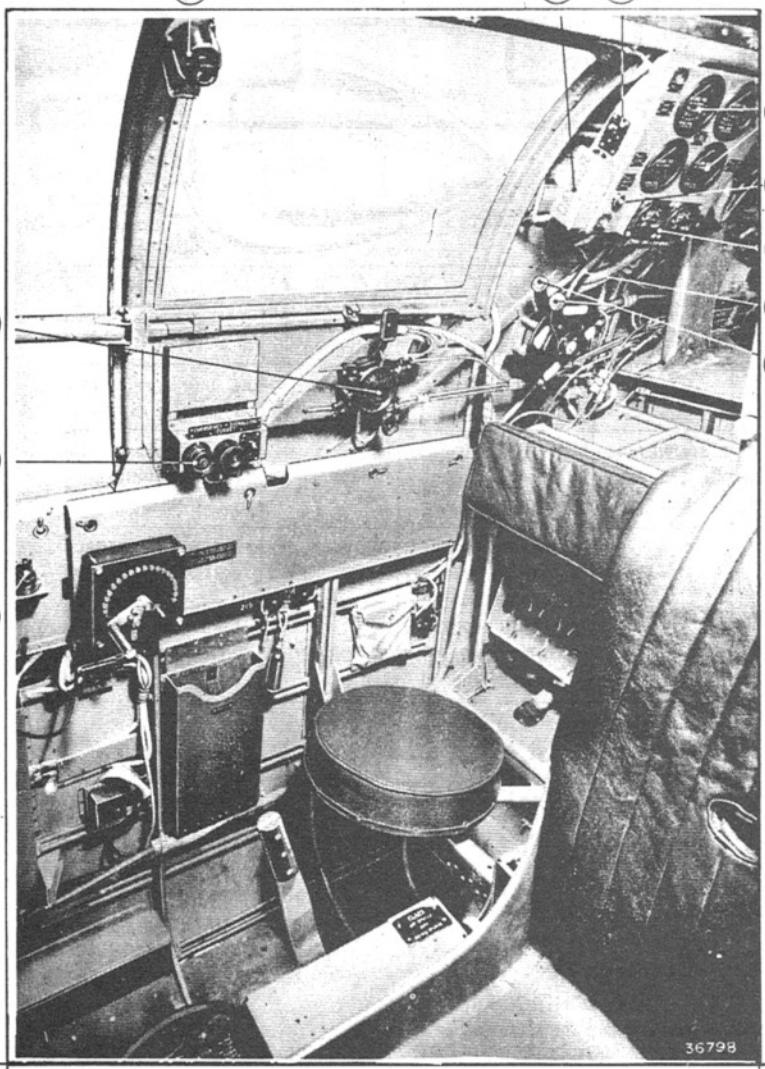
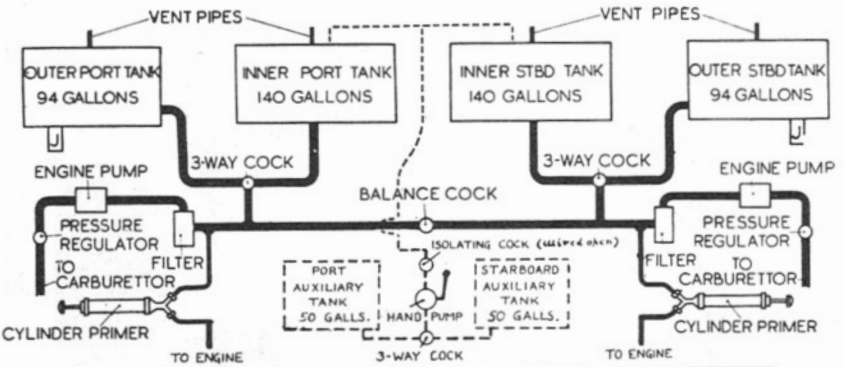


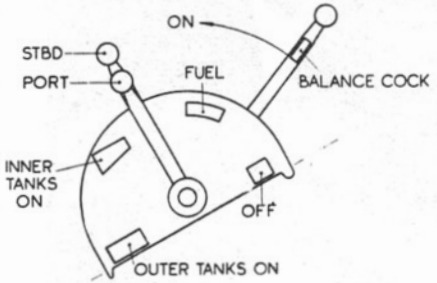
FIG. 4 PILOT S COCKPIT - STARBOARD FIG. 4

75. Bomb distributor sockets
76. EMERGENCY SIGNALLING (early aeroplanes)
77. T.R.9F remote control
78. Dimmer switch
79. R.3003 DESTRUCTOR SWITCHES
80. R.3003 master switch
81. Fuel contents gauges
82. Fuel contents gauges, button switch
83. Cylinder temperature gauges
84. Balance cock lever
85. Tank cock levers



USE OF COCKS

CONDITIONS.	MAIN 3-WAY COCKS	BALANCE COCK	REMARKS
NORMAL	ON	OFF	USE TANKS IN PAIRS INNER OR OUTER
IF ENGINE PUMP ON ONE SIDE FAILS.	EITHER BOTH INNER TANKS ON OR BOTH OUTER TANKS ON	ON	REMAINING PUMP CAN DRAW FROM EITHER TANK.
LEAKING TANK	① DAMAGED TANK ON ALL OTHER TANKS OFF ② DAMAGED TANK OFF OPPOSITE TANK ON ③ OTHER PAIR OF TANKS ON	① ON ② ON ③ OFF	PRESERVES LATERAL TRIM OF AEROPLANE OBSERVE INSTRUCTIONS GIVEN IN GENERAL NOTE BELOW



FUEL COCK CONTROLS

NOTE:- MAIN 3-WAY COCKS ARE SELECTIVE I.E. THEY CAN ONLY SELECT INNER OUTER OR OFF

IMPORTANT

IT IS IMPORTANT TO KEEP A CHECK OF THE CONTENTS OF ALL TANKS DURING FLIGHT. ANY TANK THAT IS EMPTYING SHOULD BE TURNED OFF BEFORE IT IS COMPLETELY EXHAUSTED TO PREVENT AIR BEING SUCKED INTO THE FUEL SYSTEM.

FIG. 5

FUEL SYSTEM (SIMPLIFIED)

FIG. 5

FIG. 6

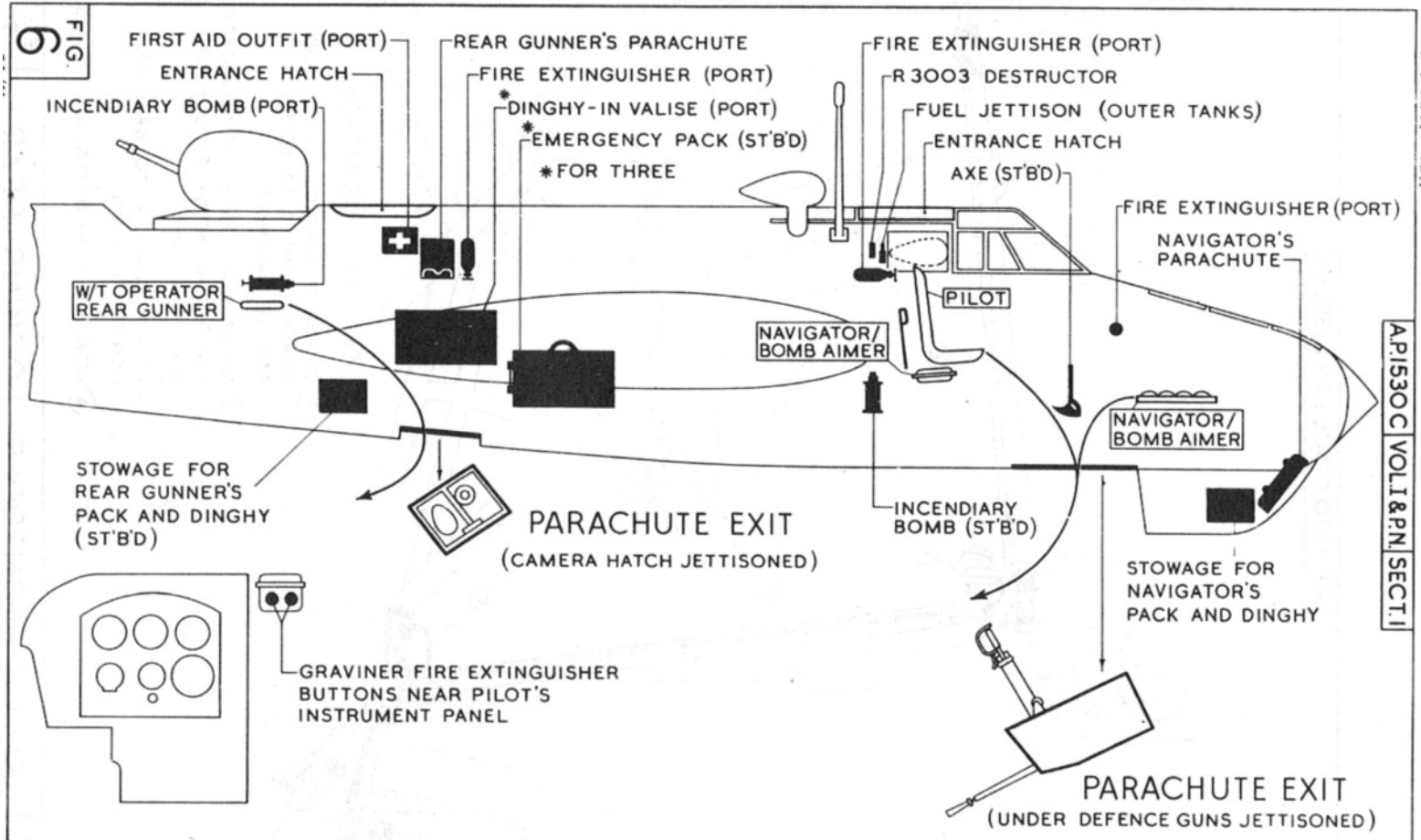
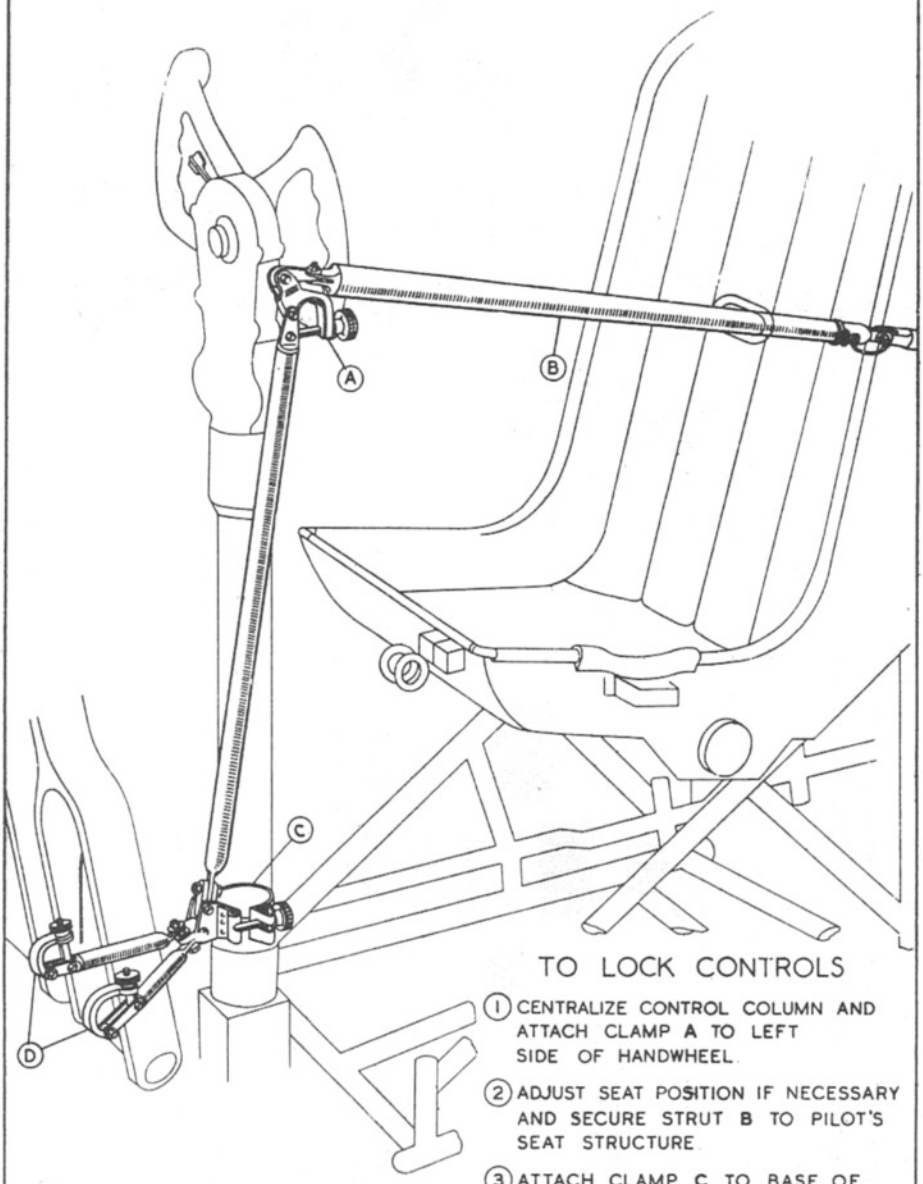


FIG. 6

EMERGENCY EXITS AND EQUIPMENT



TO LOCK CONTROLS

1. CENTRALIZE CONTROL COLUMN AND ATTACH CLAMP **A** TO LEFT SIDE OF HANDWHEEL.
2. ADJUST SEAT POSITION IF NECESSARY AND SECURE STRUT **B** TO PILOT'S SEAT STRUCTURE.
3. ATTACH CLAMP **C** TO BASE OF CONTROL COLUMN.
4. ATTACH CLAMPS **D** TO RUDDER PEDALS.

FIG. 7 — FLYING CONTROLS LOCKING GEAR — FIG. 7

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

1. ENGINE DATA, MERCURY XV or 25

(i) Fuel:- 100 octane (or 87 octane with reduced take-off power; see (v) below).

(ii) Oil:- See A.P.1464/C.37.

(iii) The principal engine limitations with 100 Octane fuel are:-

	R.P.M.	BOOST lb./sq.in.	Temp. °C. Cylr.	Oil Inlet
MAX.TAKE OFF TO 1000 FT. 3 MINS LIMIT	2,750	+9		
MAX.CLIMBING ½ HR LIMIT	2,650	+5	210	80(90)
MAX.RICH CONTINUOUS	2,400	+3½	190	70(90)
MAX.WEAK CONTINUOUS	2,400	+1½	190	70(90)
MAX.ALL OUT ½ HR LIMIT	2,750	+9	235	90(100)

Note:- Oil temperatures in brackets are for Mercury 25.

ALL PRESSURE: NORMAL 80 lb./sq.in.
EMERGENCY MINM. (5 MINS) 70 lb./sq.in.

OIL TEMPERATURE FOR TAKE-OFF: MINIMUM 5°C.

FUEL PRESSURE: RANGE -2½ to 3½ lb./sq.in.

(iv) The following limitations must also be observed:-

Diving:- maximum boost +5 lb./sq.in.
maximum r.p.m. 3,120
2,750 r.p.m. may be exceeded only for 20 seconds with throttle not less than one third open

(v) Restrictions when using 87 octane fuel:-

TAKE-OFF	R.P.M.	Boost lb./sq.in.
TO 1,000 FT.	2,650	+5
ALL OUT 5 MINS LIMIT	2,750	+5

Revised by A.L.No.18/C.

2. FLYING LIMITATIONS

(i) Maximum speeds in m.p.h. I.A.S.:

Diving	325
Undercarriage down	140
Flaps down	125

(ii) Maximum weights:-

Take-off and straight flying only with outer wing tanks full	17,500 lb.
Take-off with outer wing tanks empty	17,000 lb.
Landing and all forms of flying	17,000 lb.

Note:- With the C.G. more than 47 ins. aft the aircraft is unstable in all conditions of flight, especially at less than 150 m.p.h. I.A.S. at full load; the navigator should therefore, remain at his station in the nose whenever possible.

(iii) Bomb clearance angles for 500 lb. G.P. bomb:-

Dive	55°
Climb	40°
Bank	10°

3. MANAGEMENT OF FUEL SYSTEM

(i) Normal system:- Balance cock should be off except when it is required to feed an engine from a tank on the other side. It is preferable to use inner tanks first as outer tank fuel only can be jettisoned.

(ii) Using auxiliary tanks:- Fly on inner main tanks until about 30 gallons has been used from each tank. Then transfer fuel from either auxiliary tank as follows:-

(a) On unmodified aircraft (handpump feeds into cross-balance).

Set: Balance cock - ON
Isolating cock - ON
3-way cock auxiliary - STB'D or PORT

Pump: until feel of pump indicates that air is being sucked when stop pumping immediately to prevent engine failure due to air locks.

Set: Isolating cock - OFF
3-way cock - OFF
Balance cock (after contents of tanks have equalized) - OFF

(b) On aircraft embodying MOD.No.5273 the isolating c cock should be wired open and the hand pump delivers direct into the tops of the inner main tanks above fuel level, therefore:-

Set: Balance cock - OFF
3-way cock (auxiliary) - PORT or STB'D

Pump: Until tank is exhausted - no harm can result from pumping air.

Set: 3-way cock

(c) With either system repeat drill (a) or (b) to transfer contents of the other auxiliary tank.

(d) With system MOD.5273, after completing transfer, if contents of tanks are unequal; run both engines from the fuller tank only (suction balance cock ON) until levels equalize; then open other tank cock and close balance cock.

Note:- Auxiliary tanks should be filled by disconnecting at the 3-way cock and connecting to bowser nozzle with a suitable hose. Before flight set 3-way cock to PORT or STB'D and, with engines off, give a few strokes with the hand pump to ensure that fuel is being pumped.

4. PRELIMINARIES

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

(ii) Switch on undercarriage indicator and check that undercarriage is locked down.

(iii) If to be used, check auxiliary fuel feed - see para 3, Note.

5. STARTING ENGINES AND WARMING UP

(i) Set the controls as follows:-

(a) Fuel cocks to inner tanks, balance cock off.
(b) Throttle $\frac{1}{2}$" open.
(c) High boost control to 5 LBS.
(d) Mixture control NORMAL
(e) Propeller speed controls fully back
(f) Carburettor air intake heat control to COLD
(g) Gills open

(ii) High volatile fuel (Stores ref. 34A/111) should be used if an external connection is fitted at air temperatures below freezing. Instruct the ground crew to work the priming pump until the suction and delivery pipes are primes; this may be judged by a sudden increase in resistance.

(iii) If the engine is fitted with the original three nozzle priming system, the following number of strokes should be given before turning:

Air temperature °C	+30	+20	+10	0	-10
Normal Fuel:	1	2	3	5	
High volatile fuel:				1	3

If the engine is fitted with the seven nozzle priming system introduced by Mod.E.982, no priming should be given before turning.

(iv) Switch on ignition and booster coil switches (if fitted), or instruct the ground crew to switch on the starter magneto.

(v) Press the starter button for each engine in turn, for periods of not more than 20 seconds, with a 30 seconds wait between each, while the ground crew prime the engine as rapidly and vigorously as possible. The engine should start after the following number of strokes if cold:-

Air temperature °C	+30	+20	+10	0	-10
Normal fuel:	2	$2\frac{1}{2}$	4	10	
High volatile fuel:				2	7

At air temperatures below freezing it may be necessary for the ground crew to continue priming after the engine has fired.

(vi) When the engine is running satisfactorily, the ground crew will switch off the starting magneto (if fitted) and screw down the priming pumps. Switch off the booster coil switch (if fitted).

(vii) After about a minute, open up to a fast tick-over.

(viii) Set the propeller speed control slowly fully forward.

6. TESTING ENGINES AND INSTALLATIONS

While warming up:-

(i) Check the hydraulic system by lowering and raising the flaps.

After warming up:-

(ii) Open up to max. weak continuous boost and check operation of propellers.

(iii) Open the throttle fully and check boost (+5 lb./sq.in.

(iv) If using 100 octane fuel, with throttle fully open move high boost control to 9 LBS for just long enough to check that boost is 9 LBS/sq.in. and r.p.m. 2,600 to 2,700. Return high boost control before throttling back.

(v) Open up to max. rich continuous boost and test each magneto in turn. The drop should not exceed 100 r.p.m.

7. TAXYING

(i) Before taxying, see that the ground crew remove and hold up the undercarriage locking pins and stow them in the aeroplane.

(ii) Check brake pressure, 100 lb./sq.in.

8. FINAL PREPARATIONS FOR TAKE-OFF

The drill of vital actions is as follows:-

H - Hydraulic selector	-	Down
T - Trimming tabs	-	Rudder NEUTRAL Elevator slightly nose heavy (indicator one inch below NEUTRAL)
M - Mixture	-	NORMAL
P - Pitch	-	Propeller speed controls fully forward
Fuel	-	Check contents and cock settings.
Flaps	-	20° down
Gills	-	CLOSED
Boost control	-	9 LBS position (with 100 octane fuel).

9. TAKE-OFF

(i) There is a slight tendency to swing to the right.

(ii) The aeroplane should be eased off the ground by a steady backward pressure on the control column. At 16,000 lb. the speed should be 90 m.p.h. I.A.S.

(iii) Safety speed is 140 m.p.h. I.A.S.

(iv) After reaching safety speed, move the high boost control to the 5 LBS position, and reduce to climbing boost and r.p.m.

(v) When both undercarriage and flaps are up, set hydraulic selector to central (or up for turret operation). This prevents over-heating of the Engin Hydraulic Pump.

10. CLIMBING

(i) For continuous climbing at maximum boost the gills may have to be opened to the limit stops if these are fitted. On aeroplanes with electric gill operation but no limit stops the full opening is unnecessarily wide and causes buffeting, as well as loss of climb and ceiling.

(ii) The speed for maximum rate of climb is 130 m.p.h. I.A.S. up to 10,000 feet. Above this height reduce speed by 1 m.p.h. per 1,000 feet.

11. GENERAL FLYING

(i) Stability:- The aeroplane is rather unstable. longitudinally. Refer to para 2(ii).

(ii) Change of trim:-

Undercarriage down	Nose down slightly
Flaps down	Nose down

(iii) Flying at very low temperatures:- When flying in extremely low temperatures the propeller may become sluggish. Sluggish operation will be minimized by cruising in POSITIVE COARSE PITCH. Alternatively the mechanism should be exercised every quarter of an hour by moving to maximum r.p.m. slowly pulling the lever fully back, and then returning to the required r.p.m.

12. USE OF WARM & COLD INTAKE

(i) WARM intake should be used:

(a) For all flying at less than +3½ lb./sq.in. in boost unless the atmospheric temperature exceeds +15°C when COLD air should be used irrespective of boost.

(b) For all flying (irrespective of boost and atmospheric temperature) in conditions of high humidity, in or just below clouds, in rain, snow or sleet (WARM air may be used for warming up in very cold weather.)

(ii) COLD intake should be used for all other conditions including:
(a) Starting at all times
(b) Take-off
(c) Landing except in conditions at (i)(b).

13. ECONOMICAL CRUISING

(i) Fly in weak mixture at 1,900 r.p.m. and highest obtainable boost up to +1½ lb./sq.in. provided that this gives at least 140 m.p.h. I.A.S.

(ii) Otherwise increase r.p.m. to give 140 m.p.h. I.A.S.

Note: At 1,900 r.p.m. the generator may cut out and the warning light or voltmeter must be watched and r.p.m. raised slightly if necessary.

14. FUEL CONSUMPTIONS

(i) Weak mixture at 10,000 feet: total approximate consumptions in gals/hour:-

Boost lb/sq.in.	R.p.m. 2,400	2,200	2,000	1,900
+1	75	70	65	
0	69	65	61	58
-1	66	62	58	54
-2	61	57	53	49
-3	56	52	48	45

(ii) Rich mixture: total approximate consumptions:-

Boost lb/sq.in.	R.p.m.	Gals/hour
+5	2,650	146
+3½	2,400	112
+1½	2,400	90

Amended by A.L.No.10/A.

15. STALLING

The approximate stalling speeds at 16,000 lb. are

Flaps and undercarriage up 80 m.p.h. I.A.S.
" " " down 70 m.p.h. I.A.S.

16. SPINNING AND AEROBATICS

Spinning and aerobatics are not permitted.

17. DIVING

Normally the propeller may be left under constant speed control: but if the engine is to be throttled back the propeller must be set to POSITIVE COARSE PITCH.

18. APPROACH AND LANDING

(i) The drill of vital actions is as follows:-

H - Hydraulic selector	- Down
U - Undercarriage	- DOWN
M - Mixture	- NORMAL
P - Propeller	- Propeller speed controls fully forward
Flaps	- Down

(ii) Speeds for approach at 16,000 lb.-

(a) Engine assisted	95 m.p.h. I.A.S.
(b) Glide	100 m.p.h. I.A.S.

19. MISLANDING

(i) Open throttles fully. If necessary, then set high boost control to +9 lb./sq.in. position.

(ii) Raise the undercarriage immediately.

(iii) Climb at 120 m.p.h. I.A.S.

20. AFTER LANDING

(i) Gills - OPEN

(ii) Raise the flaps, leaving the hydraulic selector down.

(iii) Set the propeller speed controls fully back and open up engine sufficiently to change pitch to coarse.

(iv) Stop engines by pulling slow running cut outs; switch off ignition after engine has stopped.

(v) See that the undercarriage safety pins are replaced.

21. OIL DILUTION

See A.P. 2095/4 - The oil dilution period is 4 minutes.

22. POSITION ERROR

The corrections for position error are as follows:-

From to	110 130	130 150	150 170	170 190	190 220	220 260	m.p.h. I.A.S.
Add Subtract	4	2	- -	2	4	6	m.p.h.

23. ENGINE FAILURE

Set the propeller of the failed engine to positive coarse pitch. The aircraft will not maintain height on one engine except when quite light. The best speed for maintaining height is 100 m.p.h. I.A.S.

24. UNDERCARRIAGE & FLAP EMERGENCY OPERATION

Should the undercarriage fail to come down on normal operation act as follows:-

(i) Check that the hydraulic selector is - DOWN

(ii) If the cartridge-fired system is fitted:-

(a) Attempt to lower flaps with the hand-pump -
Set the undercarriage selector - UP
Set the flap selector - DOWN
Operate hand-pump
Return the flap selector - NEUTRAL

Amended by A.L.No.11/B.

(b) Attempt to lower the undercarriage with the hand-pump -

Set the undercarriage selector - DOWN
Operate hand-pump

If this fails:-

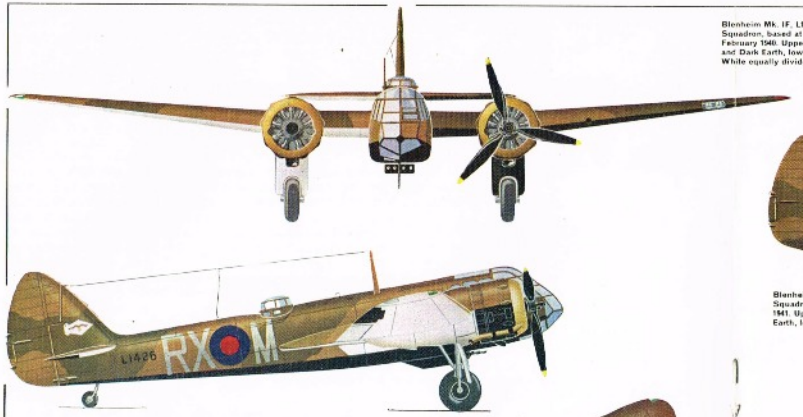
(c) Use the cartridge-fired system:-
Tear white fabric strip and pull handle

(d) Further operation of the undercarriage is impossible, and it should not be attempted. If the wheels are down, gas pressure should hold them down even if the locks are not engaged.

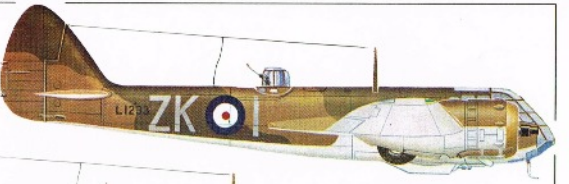
(iii) If no cartridge-fired system is fitted, the hand-pump is the only alternative to the engine pump - so:-

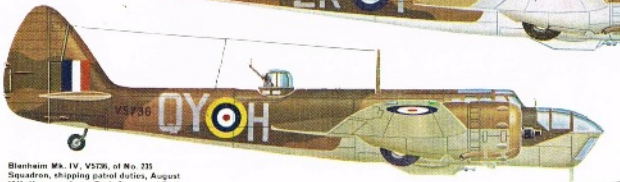
(a) Attempt to lower the undercarriage with the hand-pump before the flaps (as, if the system be damaged, there may be insufficient fluid left for both) -
Leave the undercarriage selector at DOWN
Operate hand-pump

(b) Attempt to lower the flaps:-
Set the flap selector lever - DOWN
Operate hand-pump.

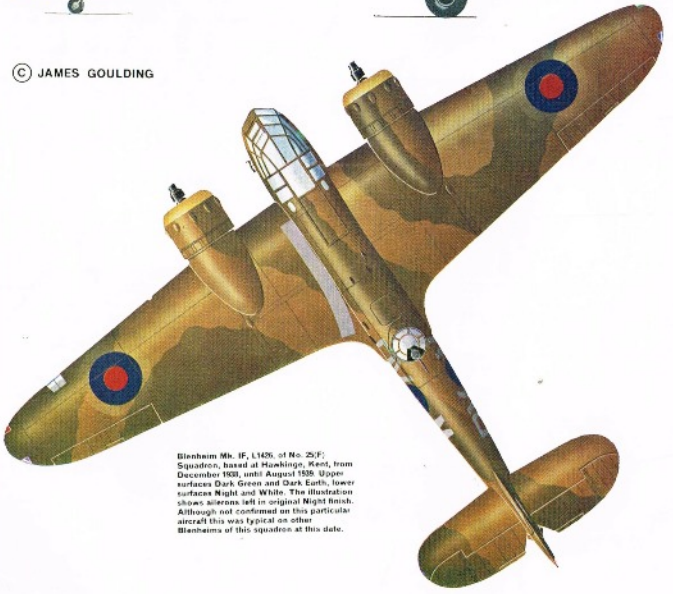


Blenheim Mk. IF, L1233, of No. 25(F) Squadron, based at North Weald in February 1940. Upper surfaces Dark Green and Dark Earth, lower surfaces Night and White equally divided on centre line.

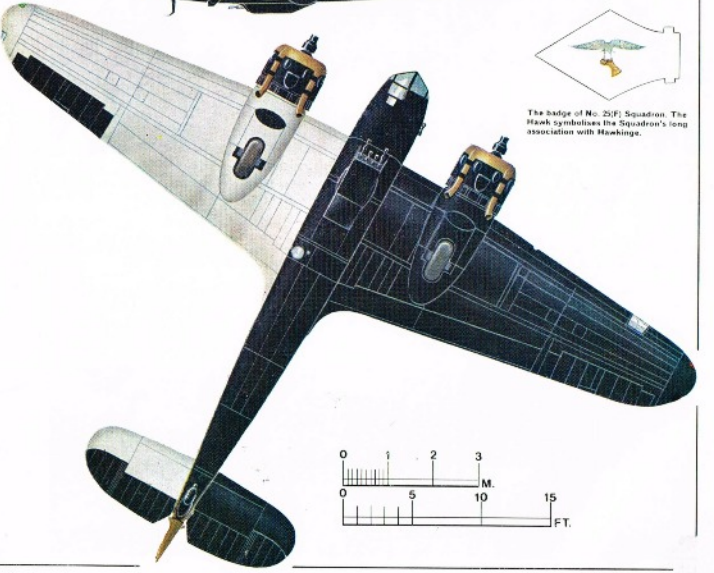




Blenheim Mk. IV, V5736, of No. 235 Squadron, shipping patrol duties, August 1941. Upper surfaces Dark Green and Dark Earth, lower surfaces Sky.



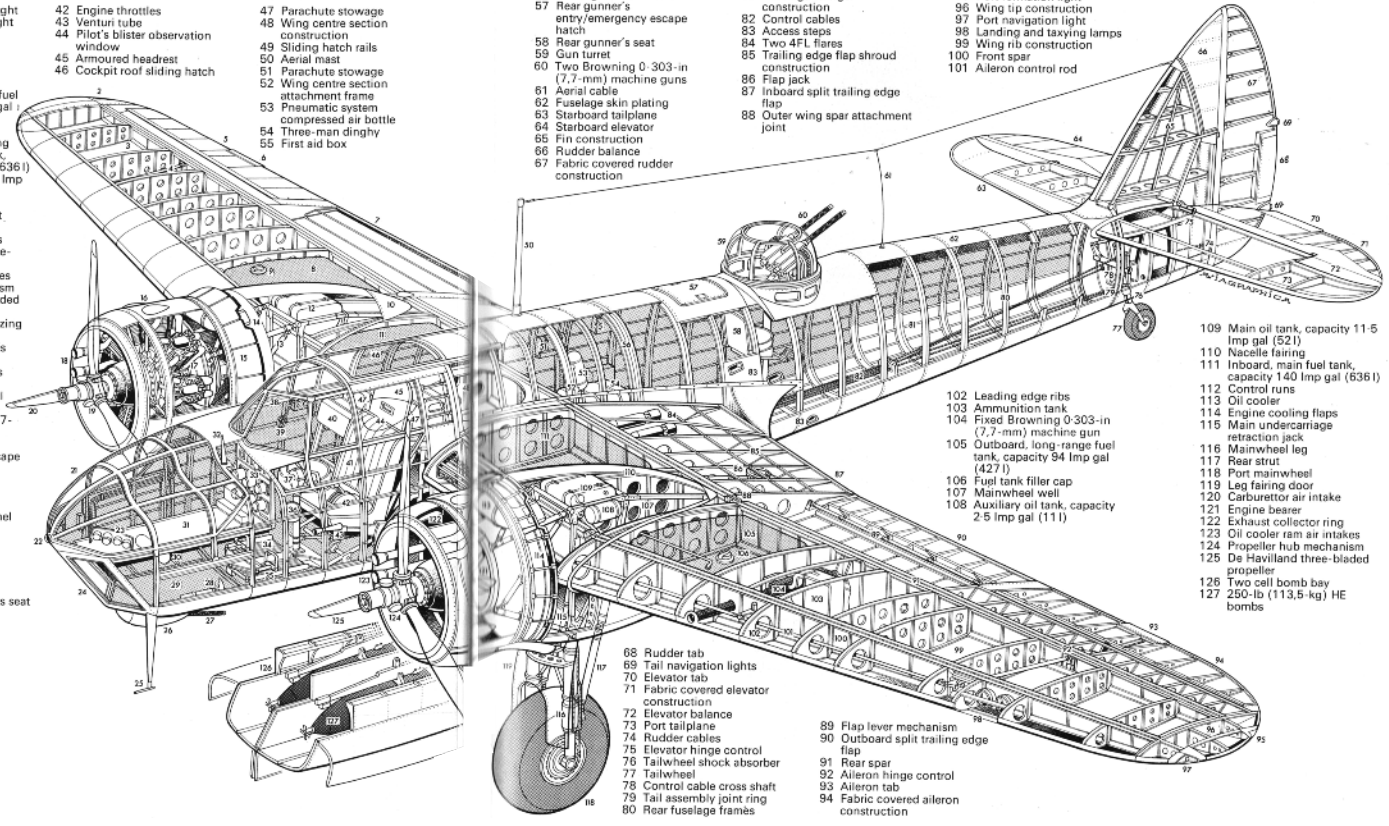
Blenheim Mk. IF, L1426, of No. 25(F) Squadron, based at Hawkinge, Kent, from December 1938, until August 1939. Upper surfaces Dark Green and Dark Earth, lower surfaces Night and White. The illustration shows ailerons left in original Night finish. Although not confirmed on this particular aircraft this was typical on other Blenheims of this squadron at this date.

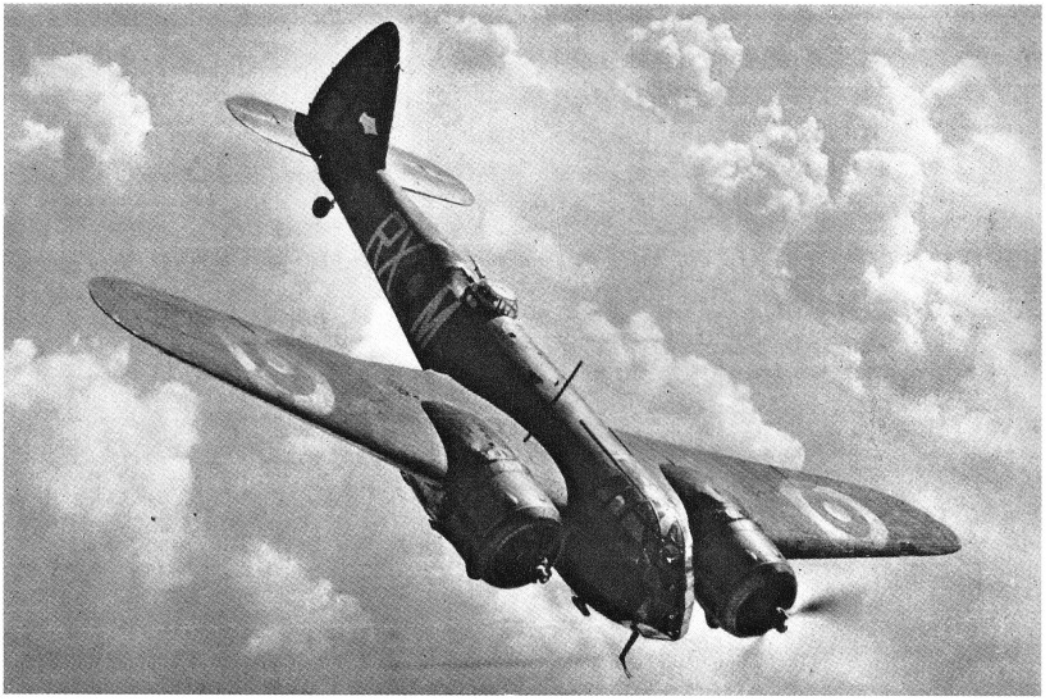


The badge of No. 25(F) Squadron. The Hawk symbolises the Squadron's long association with Hawkinge.

Bristol Blenheim Mk IV Cutaway Drawing Key

1 Starboard navigation light
2 Starboard formation light
3 Wing rib construction
4 Aileron control rod
5 Starboard aileron
6 Aileron tab
7 Starboard outer flap
8 Outboard, long-range fuel tank, capacity 94 Imp gal (427 l)
9 Fuel tank filler cap
10 Starboard nacelle fairing
11 Main, inboard fuel tank, capacity 140 Imp gal (636 l)
12 Oil tank, capacity 11·5 Imp gal (52 l)
13 Engine bearers
14 Oil cooler exhaust duct
15 Engine cooling flaps
16 Cowling blister fairings
17 Bristol Mercury XV nine-cylinder radial engine
18 Oil cooler ram air intakes
19 Propeller hub mechanism
20 De Havilland three-bladed propeller
21 Nose compartment glazing
22 Cabin air intake
23 Navigator/bombardier's instrument panel
24 Bomb aiming windows
25 Pitot tube
26 Rearward firing, ventral machine gun cupola
27 Browning 0·303-in (7,7-mm) machine gun
28 Fireman's axe
29 Nose compartment escape hatch
30 Fire extinguisher
31 Chart table
32 Fixed foresight
33 Back of instrument panel
34 Foot boards
35 Rudder pedals
36 Compass
37 Control column
38 Windscreen panels
39 Pilot's gunsight
40 Navigator/bombardier's seat
41 Pilot's seat
42 Engine throttles
43 Venturi tube
44 Pilot's blister observation window
45 Armoured headrest
46 Cockpit roof sliding hatch
47 Parachute stowage
48 Wing centre section construction
49 Sliding hatch rails
50 Aerial mast
51 Parachute stowage
52 Wing centre section attachment frame
53 Pneumatic system compressed air bottle
54 Three-man dinghy
55 First aid box
56 Fuselage double frame
57 Rear gunner's entry/emergency escape hatch
58 Rear gunner's seat
59 Gun turret
60 Two Browning 0·303-in (7,7-mm) machine guns
61 Aerial cable
62 Fuselage skin plating
63 Starboard tailplane
64 Starboard elevator
65 Fin construction
66 Rudder balance
67 Fabric covered rudder construction
68 Rudder tab
69 Tail navigation lights
70 Elevator tab
71 Fabric covered elevator construction
72 Elevator balance
73 Port tailplane
74 Rudder cables
75 Elevator hinge control
76 Tailwheel shock absorber
77 Tailwheel
78 Control cable cross shaft
79 Tail assembly joint ring
80 Rear fuselage frames
81 Fuselage stringer construction
82 Control cables
83 Access steps
84 Two 4FL flares
85 Trailing edge flap shroud construction
86 Flap jack
87 Inboard split trailing edge flap
88 Outer wing spar attachment joint
89 Flap lever mechanism
90 Outboard split trailing edge flap
91 Rear spar
92 Aileron hinge control
93 Aileron tab
94 Fabric covered aileron construction
95 Port formation light
96 Wing tip construction
97 Port navigation light
98 Landing and taxying lamps
99 Wing rib construction
100 Front spar
101 Aileron control rod
102 Leading edge ribs
103 Ammunition tank
104 Fixed Browning 0·303-in (7,7-mm) machine gun
105 Outboard, long-range fuel tank, capacity 94 Imp gal (427 l)
106 Fuel tank filler cap
107 Mainwheel well
108 Auxiliary oil tank, capacity 2·5 Imp gal (11 l)
109 Main oil tank, capacity 11·5 Imp gal (52 l)
110 Nacelle fairing
111 Inboard, main fuel tank, capacity 140 Imp gal (636 l)
112 Control runs
113 Oil cooler
114 Engine cooling flaps
115 Main undercarriage retraction jack
116 Mainwheel leg
117 Rear strut
118 Port mainwheel
119 Leg fairing door
120 Carburettor air intake
121 Engine bearer
122 Exhaust collector ring
123 Oil cooler ram air intakes
124 Propeller hub mechanism
125 De Havilland three-bladed propeller
126 Two cell bomb bay
127 250-lb (113,5-kg) HE bombs





Fighter Command Blenheims

NO fighter versions of the Blenheim were built as such on the production lines at the Bristol Aircraft Company at Filton, or at any of the other factories producing this twin-engined bomber. All were converted by the Royal Air Force into fighters by the attachment of a gun pack housing four ·303 Browning machine guns, which was installed beneath the bomb bay. The gun packs were manufactured by the Southern Railway's Ashford Works, in Kent, and delivered to the R.A.F. as individual sets ready for installation.

Some 200 Mk. I bombers were converted, the type being designated Mk. IF. A similar conversion programme was carried out on later Mk. IV bombers, the resulting modified version in this instance being known as the Mk. IVF.

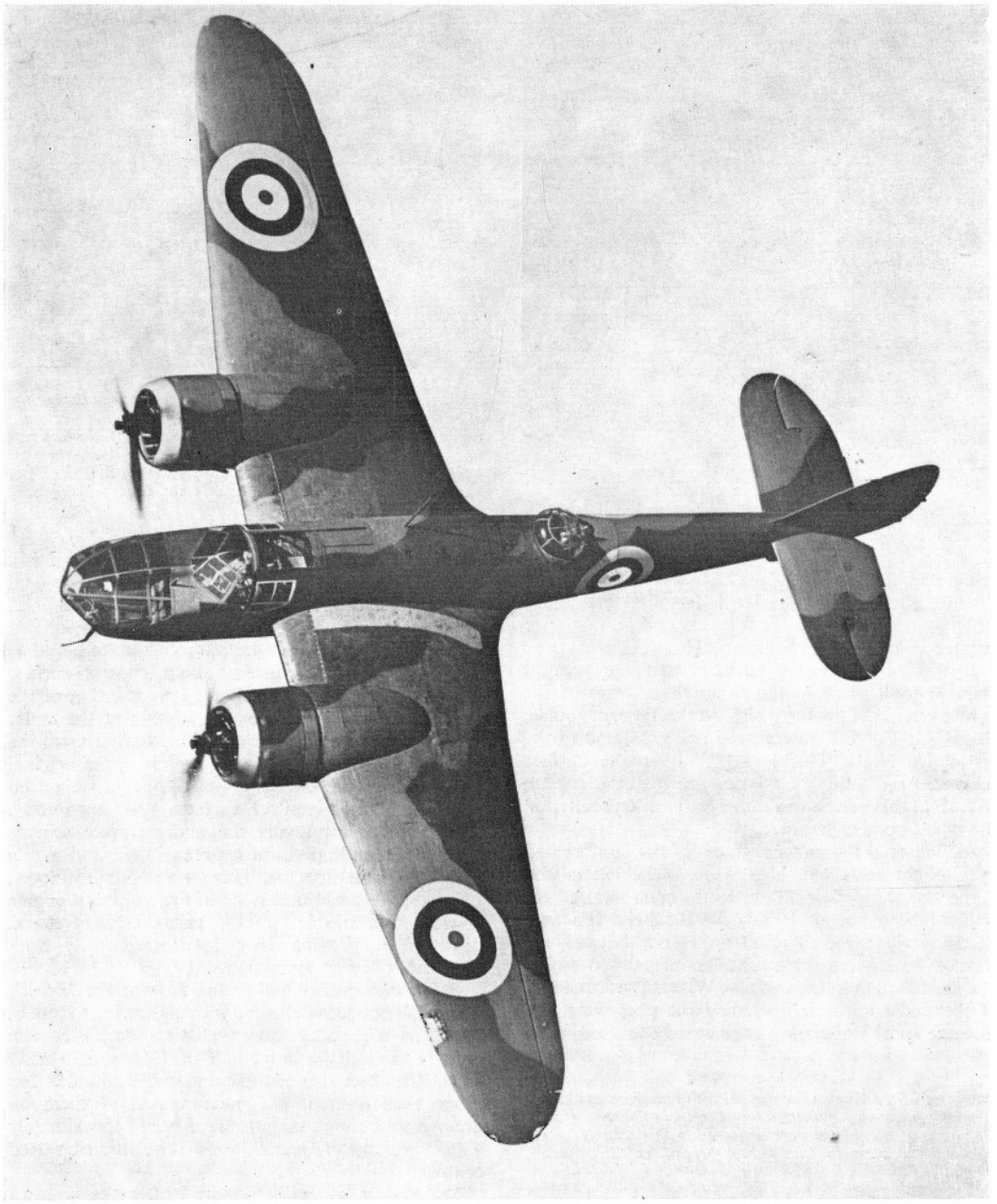
Blenheim Mk. IF fighters first entered service with an operational squadron in September 1938 when No. 600 Squadron of the Auxiliary Air Force received the new fighter as a replacement for Hawker Demons. The squadron was then stationed at Hendon.

In December 1938 four more ex-Demon squadrons, Nos. 23, 25, 29 and 604 were re-equipped with the Bristol twin-engined fighter. Thereafter, more Blenheim fighter squadrons became operational and by the outbreak of war in September 1939 some seven squadrons had been re-equipped, with a further eight soon after.

Blenheim fighters were converted from bomber versions in store at R.A.F. Maintenance Units. The upper surface camouflage pattern and finish, painted in Dark Green and Dark Earth in A and B scheme patterns was, therefore, that of the bomber version. As deliveries of the converted fighters coincided with the International Crisis over Czechoslovakia, full war emergency markings were applied—such as the conversion of all roundels to Type B and the substitution of squadron numbers by code letters.

When delivered the upper wing Type A.I roundels had been 66·5in. in diameter overall, consisting of seven ring widths of 9·5in. each. Conversion of this roundel to a Type B by the usual method of using the existing Blue ring as a marker and enlarging the Red centre resulted in a Blue overall diameter of 47·5in. with a Red centre of 19in. Later batches of Blenheims were delivered with Type B upper wing roundels of 66·5in. diameter overall, with a Red centre of 26·5in. diameter.

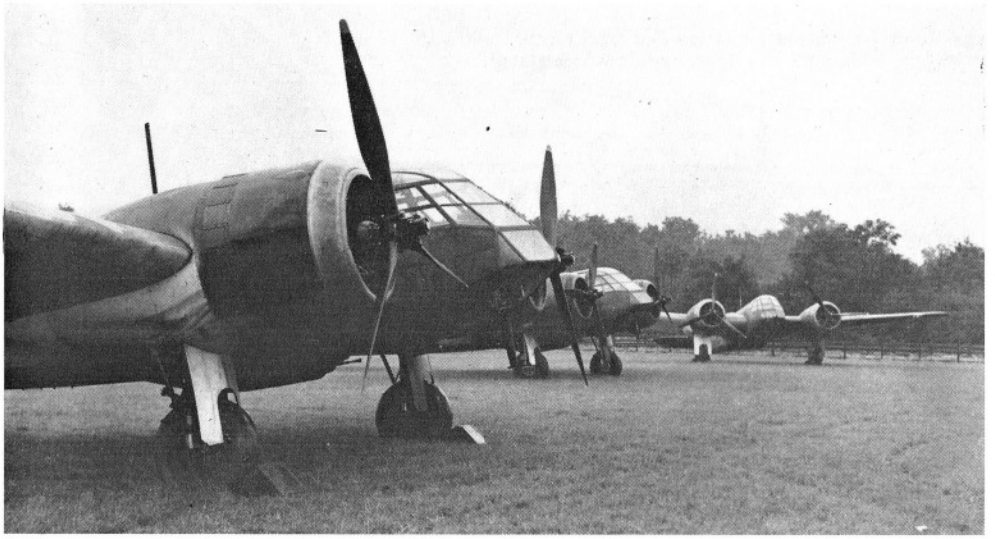
The fuselage roundel had been a Type A.I of 45·5in. diameter when the initial batches of Blenheim bombers were delivered, consisting of seven ring widths of 6·5in. each. Conversion of this roundel, by the same method, resulted in a 32·5in. diameter Blue ring with a 13in. diameter Red centre. There were, however, some instances where the position of the roundel was moved more aft to make the accom-



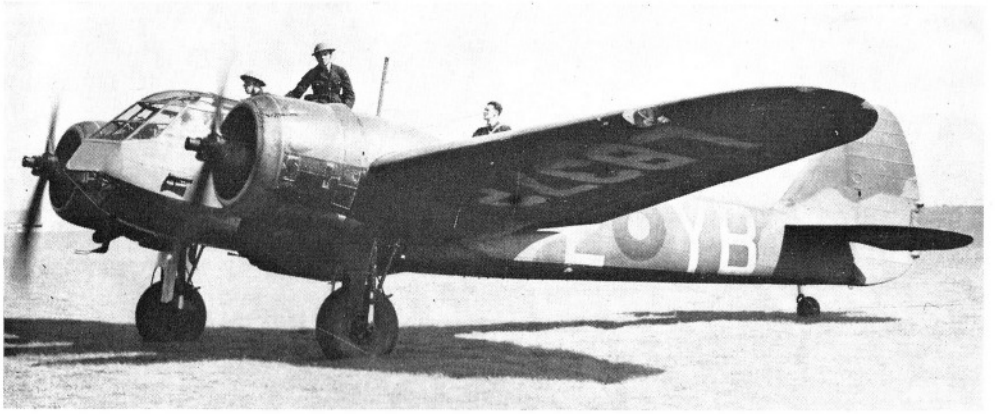
Blenheim Mk. IV bomber in the initial delivery scheme. Upper surfaces—Dark Green and Dark Earth, under surfaces Night with White serial letters and numerals. 66·5in. diameter Type A.I roundels on upper surfaces and 45·5in. diameter Type A.I on fuselage sides. Walk-way position painted in Medium Sea Grey.

The unusually large fillet at the trailing edge of the wing and fuselage intersection used in the design of the Blenheim, caused problems in the positioning of squadron code and aircraft letters. It was normal practice on fighter aircraft to place the code and aircraft letters on either side of the fuselage roundel to read the same way on either port or starboard sides. The squadron code letters were, therefore, placed forward of the roundel, for example, on the port (left hand) side and aft of the roundel on the starboard side.

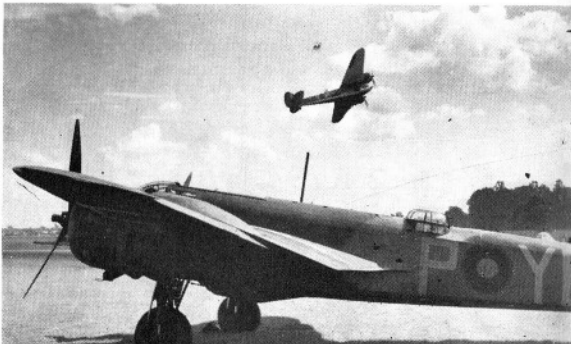
Although there were exceptions to this rule, the most commonly used form was to position these letters forward of the fuselage roundel on the port side. On the Blenheim the position of the fuselage roundel had already been fixed at the production



Blenheim Mk. IF fighters of No. 604(F) Squadron. On each aircraft the White starboard under surface finish has only been applied as far as the wing root. The starboard engine cowlings remain in the original Night finish. (Flight.)



Above: L8372, YB-L, of No. 29(F) Squadron taken during the Air Defence Exercises held in July 1939. The aircraft has the standard bomber under surface finish, except for a White wing and tailplane. (*via P. R. J. Moyes.*)



Right: Blenheim Mk. IFs of No. 29(F) Squadron. The aircraft in the foreground still has White underwing serials on the port side. The Night finish on the ailerons and elevators of the aircraft taking off can be clearly seen. The 32·5in. diameter fuselage roundel was converted from the original Type A.I. (Aeroplane.)

Blenheims of No. 25(F) Squadron being refuelled. These aircraft took part in the attack on the seaplane base at Borkum. (via P. R. J. Moyes.)

stage, and this left insufficient room for squadron code letters to be placed forward. Attempts by some squadrons to do this (an example is No. 25(F) Squadron) resulted in letters being painted around the fillets, which was undesirable.

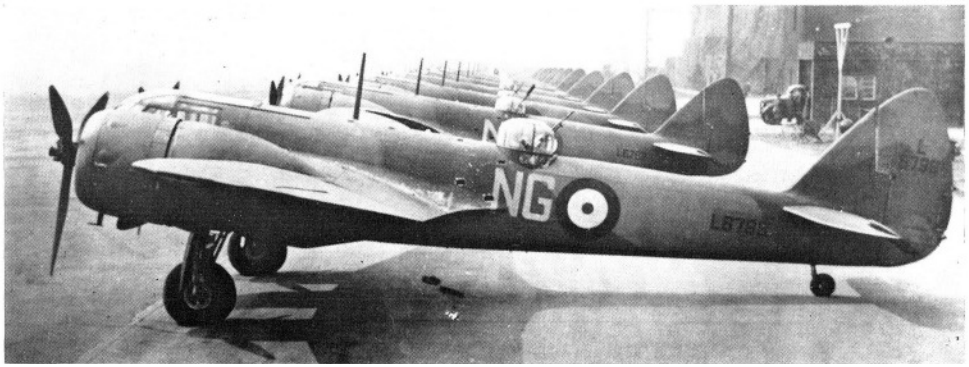
In view of the problem most squadrons eventually painted the two squadron code letters aft of the roundel on both sides of the fuselage. One squadron at least, however, (No. 248), repainted the fuselage roundel further aft on the port fuselage side to permit the two code letters to be placed in the forward position. The roundel on the starboard side was not moved from its original position.

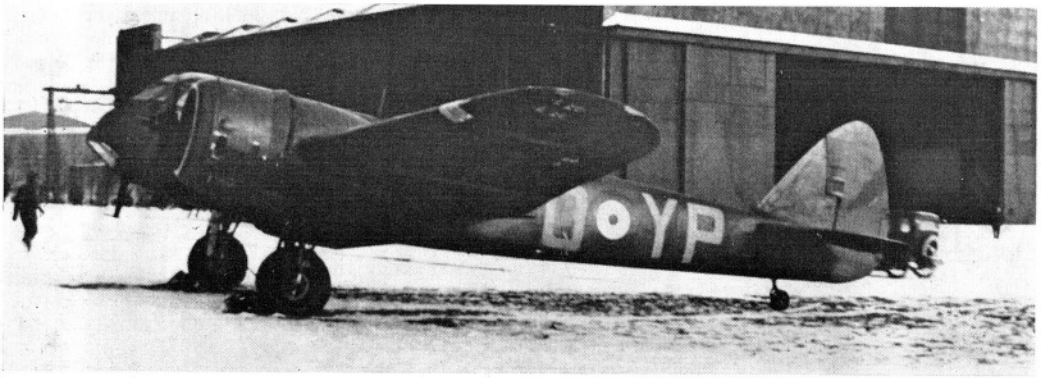
Photographs of Blenheim IFs of No. 604 Squadron show rather dark lettering, much darker than the usual grey letters used, and it is possible that these were painted Red to distinguish A-Flight. Other aircraft were possibly painted in other Flight colours, but this is not confirmed. This was a period when experimentation in markings was taking place, but the use of colours other than Medium Sea Grey for code letters was very unusual. As the photographs mentioned were taken during the 1939 Air Defence Exercises, it is possible that these unofficial coloured code letters were only added for this occasion.

Seven Blenheim fighter squadrons were operational before the outbreak of war. These were No. 23 (MS), No. 25 (RX), No. 29 (YB), No. 64 (XQ), No. 600 (MV), No. 601 (YN), and No. 604 (WQ). All the code letters quoted in brackets were those employed by these squadrons up to the outbreak of war. The wartime code letters of Blenheim fighter squadrons appear on page 168.

Blenheim Mk. IF of No. 25(F) Squadron photographed early in 1940. This aircraft is shown in the coloured illustration on pages 156. (via P. R. J. Moyes.)

A photograph of Blenheims of No. 604(F) Squadron taken early in 1940. The difficulty of painting the two squadron code letters forward of the roundel on the port side can be seen. The size of the code letters is comparatively small, but they still have to be partially painted over the fillet. (I.W.M.)





Blenheim Mk. IF, Q-YP, of No. 23(F) Squadron. The upper surface finish is Dark Earth and Dark Green with equally-divided Night and White undersides. The photograph was taken in early 1940.

Although individual aircraft serial letters and numerals were often painted out completely, there were many instances where these were retained. This was the result of some confusion over official policy towards carrying serial numbers. The situation was not cleared up until the issue of a directive, in advance of an amendment to A.M.O. A.154, on 21st November, 1939, which authorised serial numbers to be carried on the rear of the fuselage. These were usually painted in Black and were 8in. high.

In pre-war days squadrons were permitted to carry their crest inside the standard 'spearhead' frame on the fin, with the proviso that it could be easily removed at a moment's notice. No. 25(F) Squadron was one that did carry the crest in this manner on their Blenheims.

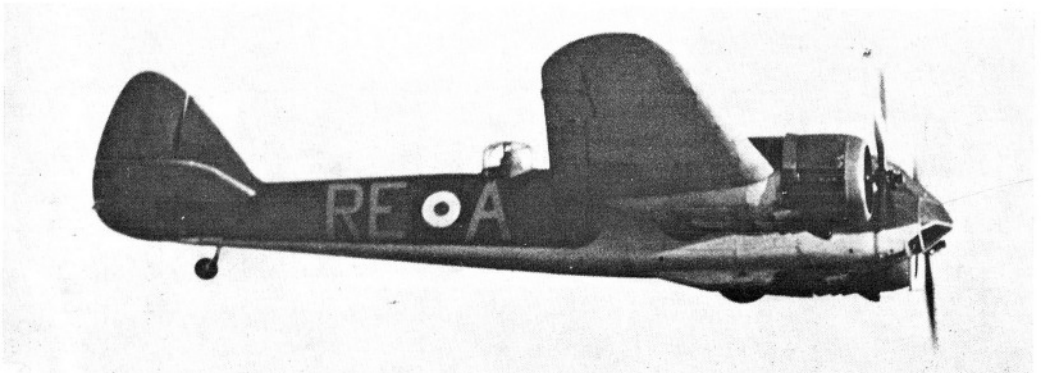
When the Blenheim fighter squadrons went to war on 3rd September, 1939, the overall markings remained unchanged, except for a complete change of squadron code letters. The upper surface finish was Dark Green and Dark Earth in A and B-scheme patterns, with Type B upper wing and fuselage roundels in the sizes stated earlier in these columns.

Generally, the under surface finish was now Night and White, equally divided down the aircraft's centre line and no roundels, or serials were carried under the wings. The underside of the cowling on the starboard (White) side was often left in Night as before. Some aircraft did retain the original Night finish on their starboard ailerons, but eventually the plain division into Night and White sides of the aircraft became the general standard of underside finish on Blenheim fighters.

The first authorisation for a change of markings since the outbreak of war was made on 30th October, 1939, when the Air Ministry sent telegram A.949/32 to all Commands ordering Type A roundels to be painted on upper wing surfaces. This telegram was followed by two others, A.726/39 and A.345/39 on 5th and 10th November respectively. The cause of these hurried telegrams had been the shooting down of a coastal reconnaissance aircraft of the R.A.F. by fighters through mis-identification.

However, there was much confusion about which types of aircraft were to carry the Type A wing roundels. It was not known if the order applied only to coastal reconnaissance aircraft. The doubts were cleared up by the issue of a clarifying notice regarding camouflage and markings to be carried by various classes of aircraft that was sent to all Commands on 21st November, in advance of an official amendment to the existing A.M.O. A.154.

View of RE-A of No. 229(F) Squadron, taken during a low-level, high-speed pass over its home base.



As a result of this notice it was made clear that only general reconnaissance aircraft would carry Type A wing upper surface roundels, all others retaining the existing Type B. It is not known if any Blenheim fighters had their upper wing roundels converted to Type A before clarification of the original directive, but it is unlikely.

Although it was usual to act quickly on any new directive regarding markings, the evidence suggests that most squadrons interpreted the order as applying only to general reconnaissance units. Certainly, there is no photographic evidence of many R.A.F. aircraft of all types carrying Type A upper wing roundels at this period, although coastal reconnaissance types did carry them for a time after the directive.

One very important markings change which was promulgated by the order of 21st November, was that all aircraft would carry Type A fuselage roundels instead of Type B, and that all types, except fighters and night bombers, would carry Type A roundels under the wing tips.

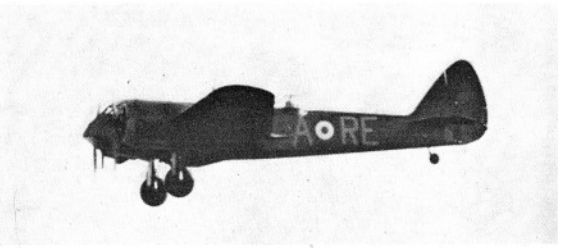
Conversion of the fuselage roundel on the Blenheim resulted in a Type A of 32·5in. diameter overall, modified by painting a White ring of 19·5in. diameter and reducing the Red centre to 6·5in. diameter. The under surface finish was not affected by these changes.

These markings continued in use until a further change took place on 1st May, 1940, when Signal X.485 was sent to all Commands. This Signal ordered the painting of an additional outer ring of Yellow to be added to the fuselage roundel, thus bringing it back to the original production standard, and the addition of fin stripes of Red, White and Blue. The additional 6·5in. wide ring added to the roundel on the Blenheim resulted, in effect, in a Type A roundel of 45·5in. diameter. Narrower Yellow rings were permitted where space was limited, but there is no evidence of this smaller ring ever being used on Blenheim fighters.

As Blenheim Mk. I bombers were no longer in production all conversions to the fighter version were made to existing stocks in Maintenance Units, and consequently any changes to markings were made as and when ordered at squadrons or the M.U.s. The Blenheim Mk. IV bomber, however, was still in full production and some of the markings changes were made on production lines.

During 1939 and 1940 Blenheim bombers of the Mk. IV type were being delivered with Type B, Type A and Type A.I fuselage roundels, and conversions of these to the fighter role were made. The national insignia painted on these aircraft were often of correct type for the particular period, and this version of the Blenheim was, therefore, less subject to markings conversions than the Mk. I. But the Mk. IVF was still, of course, subject to all of the markings changes made when applicable, and eventually all those delivered with Type B and Type A fuselage roundels were converted to Type A.I.

The official policy regarding size of fin stripes was that they should be the same width as the existing Blue ring of the fuselage roundel, as was the width of the newly-introduced Yellow outer ring. Adherence to this policy resulted in rather narrow Red, White and Blue stripes of 6·5in. width in the case of the

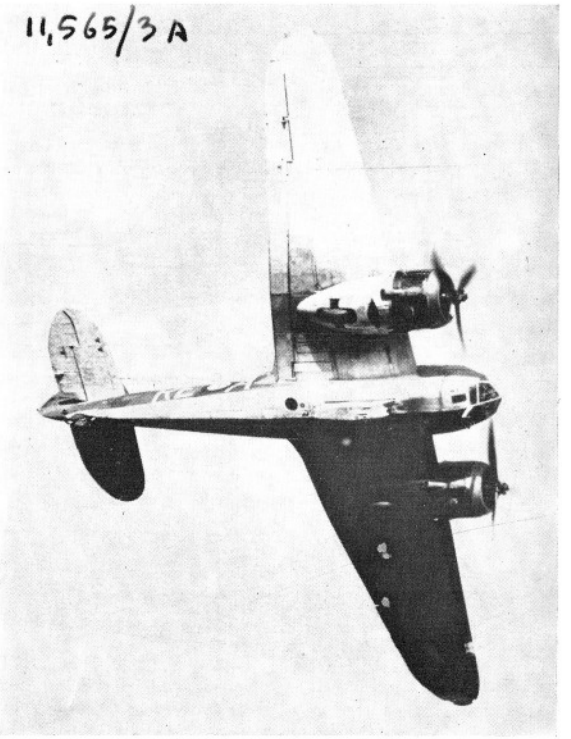


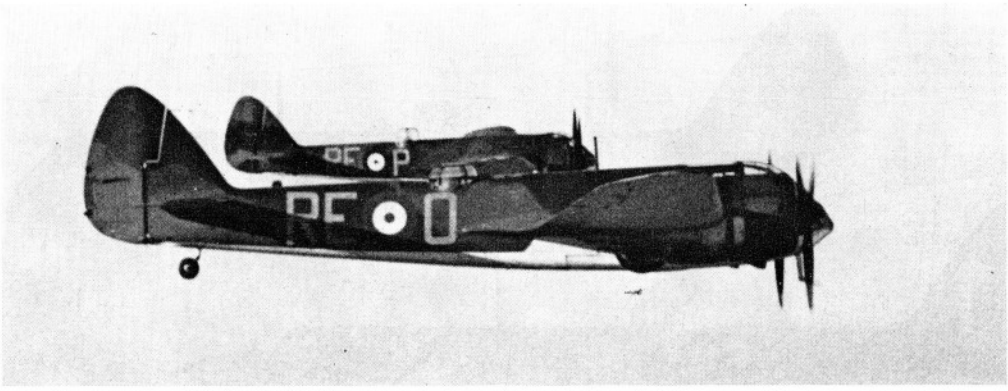
Another view of RE-A Blenheim Mk. IF of No. 229(F) Squadron landing. (Aeroplane.)

Blenheim. Photographs of Blenheim fighters taken at this period are scarce, but photographs taken of the bomber variants, to which the fighter variants usually conformed, showed a variety of fin stripe styles.

Some squadrons did use the narrow 6·5in. wide stripes but the majority adopted more conspicuous interpretations. Some used 8 and 9in. wide stripes, whilst others divided the base of the fin into three sections and painted vertical stripes over the entire area. It was this individual interpretation by squadrons that led eventually to the adoption by the Air Ministry of a standard form of fin flash.

The equally-divided Night and White under surface scheme, except for the Night painted starboard engine cowling.

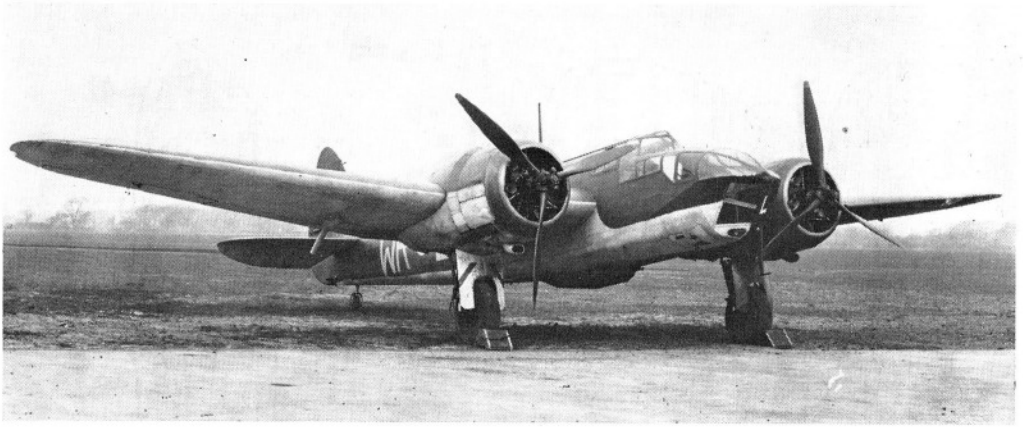




Blenheim Mk. IFs of No. 229(F) Squadron, taken in early 1940. Upper surfaces are Dark Green and Dark Earth. Under surfaces, Night and White equally-divided on centre line, but engine cowlings in Night. Medium Sea Grey code letters.

Above: Blenheim Mk. IF of No. 248 Squadron, Coastal Command, in early 1940. The roundel has been repositioned further aft to accommodate the forward placing of the squadron code letters. Roundel on starboard (right hand) side was in the usual position, with the letters WR aft. (I.W.M.)

Below: A Blenheim Mk. IV bomber in the early 1940 delivery colour scheme. Some of these aircraft were converted into long-range fighters and repainted with White starboard undersides and port serial painted out in Night.



Blenheim Mk. IVF of No. 248 Squadron. The under surfaces are equally-divided Night and White. Note the trace of the original Night under surface finish on the nose. The code and aircraft letters are Medium Sea Grey. The aircraft letter 'L' is painted in White on the over-painted left hand bomb-aimer's window. (I.W.M.)

The German invasion of France, Belgium and the Low Countries began on 10th May, 1940, and in anticipation of combat over the Continent British fighters were ordered to carry under wing roundels by the sending of Signal X.479 on 15th May. These roundels were to be Type A, but the roundel on the Night painted port wing was to be outlined by a narrow ring of Yellow. These roundels on the Blenheim were approximately 40in. diameter, composed of 8in. ring widths, but there were individual variations.

During 1939 experiments in under surface colour schemes had been carried out. Aluminium, Sky Blue and a new colour, Sky, were tried out to determine a satisfactory colour for use in clear sky and light cloud up to 10,000ft. Of these colours Sky was to prove the most successful and it was adopted for general use on under surfaces of day flying aircraft from 6th June, 1940.

On fighter aircraft it replaced the 'black and white' scheme, and in the first months of its use no under wing roundels were used. Although it was officially authorised for use from 6th June, its introduction on individual aircraft depended entirely on available paint supplies of the new colour. Owing to the initial scarcity of the paint some home mixing of individual interpretations of the new colour took place. Due also to the supply of the new colour the 'black and white' scheme continued in use on some aircraft for a period.

On 23rd July, 1940, a meeting was held at the Air Ministry to discuss aspects of camouflage and markings, and to evolve and establish some standards for the future. As a result of this meeting a new

Blenheim Mk. IVF of No. 248 Squadron. The upper wing roundels are the standard production size Type B of 66·5in. diameter. (I.W.M.)

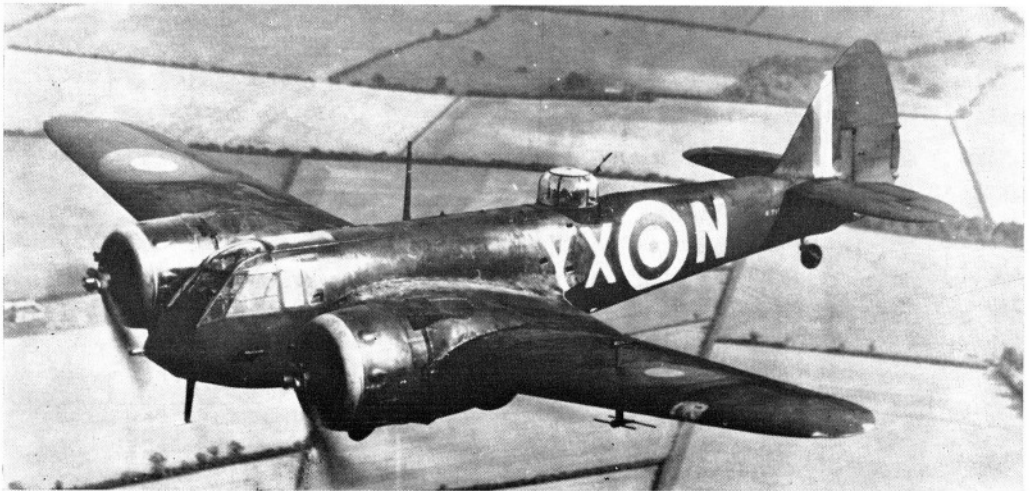
standard fin flash, consisting of Red, White and Blue stripes of 8in. width and 27in. height was adopted. The use of under wing roundels (Type A) was also confirmed by this meeting. Notification of these changes was made to all Commands on 11th August.

The notification made it clear that the application of the new fin stripes was to be made as and when it was convenient and was not to interrupt normal duties, especially flying. The old type fin stripes, therefore, often remained in use on individual aircraft until long after the original authorisation of the use of the new fin flash, in some instances well into 1941.

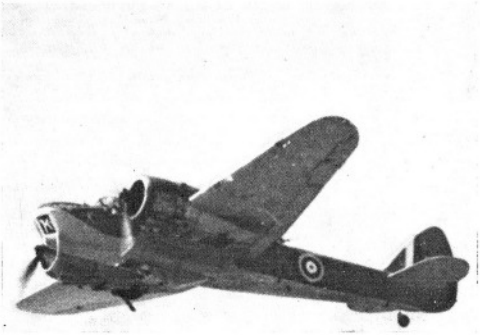
For most of its operational career the Blenheim fighter was employed mainly as a night fighter, although some were used by Coastal Command units for long range shipping protection patrols. For most of the period from 1939 until late 1940, Blenheim IFs and IVFs used for night fighting continued to have day fighter camouflage. But on 22nd November, 1940, it was ordered that night fighters would be painted in Special Night (R.D.M.2) overall and carry

A Blenheim Mk. IF, L1210, in use with a Fleet Air Arm Unit, No. 771 Squadron. It is probably finished in Extra Dark Sea Grey and Dark Slate Grey on upper surfaces, with Sky under surfaces. (*R.C. Jones.*)

Blenheim Mk. IF of No. 54 O.T.U. photographed on 7th September, 1941. The overall finish is Special Night (*R.D.M.2*). *The starboard roundel is the 66·5in diameter Type B, but that on the port wing has been painted smaller for some reason, possibly connected with the A.I. radar aerials. On 25th May, 1941, it was ordered that the code letter of O.T.U. aircraft of Fighter Command should be outlined in Yellow, and this could account for the larger letter 'N' on this aircraft.*



Crew entering a Blenheim Mk. IF, probably of No. 29(F) Squadron. Upper surfaces are Dark Green and Dark Earth. Under surfaces are Sky. Medium Sea Grey code letters and aircraft letters (X-RO).



A Blenheim Mk. IVF of an unknown Coastal Command Squadron. The colours are Dark Earth/Dark Green/Sky. The photograph was taken after 1st May, 1941, when the order to remove underwing roundels had been given (see underside views on page 165). Note the three positions of the aircraft letter 'K'. The standard 24in. × 27in. fin flash has still not been added.

the same national insignia and markings as they appeared on night bombers.

The overall Special Night finish was applied to Blenheim fighters on night fighting duties, but those operating by day on coastal protection work continued to have day fighter camouflage.

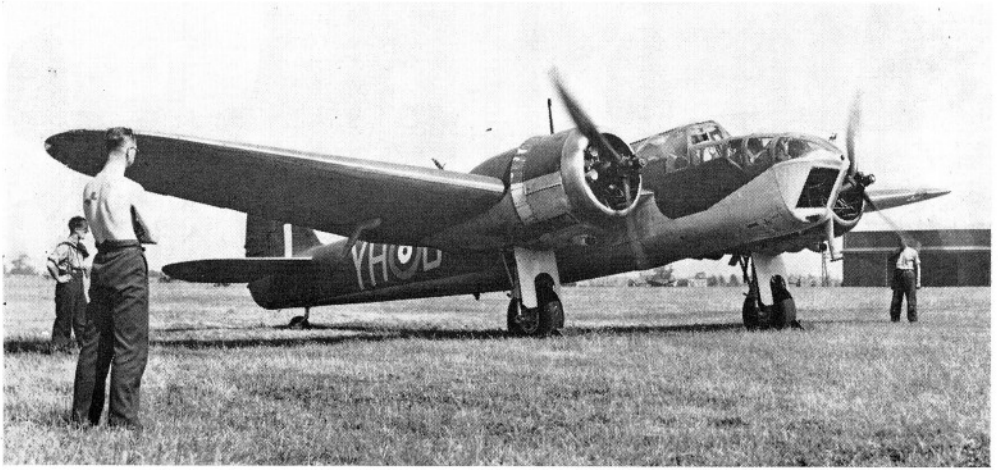
The upper wing roundels on Blenheim night fighters were Type B of 66·5in. diameter, as before. Fuselage roundels were generally 45·5in. diameter Type A.I consisting of 6·5in. ring widths. The existing fin flashes were usually left in position, although in some instances during re-painting the new standard fin flash may have been applied. Squadron code and aircraft letters were painted as before in Medium Sea Grey, and the fuselage serial was in Red, as a general rule. Initially Type A under wing roundels may have been used, as on the Hurricane on night fighting duties, but these were soon discarded.

Some night fighter squadrons modified their fuselage roundels by painting out the Yellow outer ring in Medium Sea Grey and converting the remainder of the roundel into a Type B. It is not known if any Blenheim squadrons introduced these modified roundels, but it is very likely that they did.

On 27th November, 1940, Fighter Command re-introduced the 'Black' port wing marking on day fighters. As the majority of Blenheim fighter squadrons were operating in the night fighter role it is unlikely that any were painted in this revived scheme. All other Blenheim fighters painted in day flying camouflage were operating with Coastal Command squadrons and were also, therefore, unaffected by this Order.

Although the Special Night (R.D.M.2) finish continued in use from late 1940 and during 1941, there

A Blenheim Mk. IV bomber in the late 1940 delivery scheme. Many of these Blenheims were converted for use with Coastal Command fighter squadrons. (Central Press.)



was considerable dissatisfaction among night fighting squadrons about the effectiveness of the colour. At night, especially during conditions of bright moonlight, the all-Matt Black finish made the attacking night fighter stand out as a sharp silhouette, and enemy bomber crews and gunners were very often forewarned of the night fighter's approach.

Early in 1941 experiments were being carried out on new colour schemes for night fighters, both at experimental establishments and at squadron level. During January and February 1941, an interesting experiment was carried out at the Fighter Interception Unit at Ford, in Sussex, and the results obtained were to lead to the eventual end of the all-black colour schemes.

As black was proving much too dark, the old night bomber colour Nivo or Dark Green were considered to be possible improvement in view of their lighter tone. In order to test this out a Blenheim Mk. I was painted with one wing Special Night and the other, initially, in Nivo and later in Dark Green. The Greens were found to be far superior, being much less visible, but at close range they, too, produced too much of a silhouette effect. The result of these experiments eventually led to the adoption of a two-tone camouflage finish for night fighters.

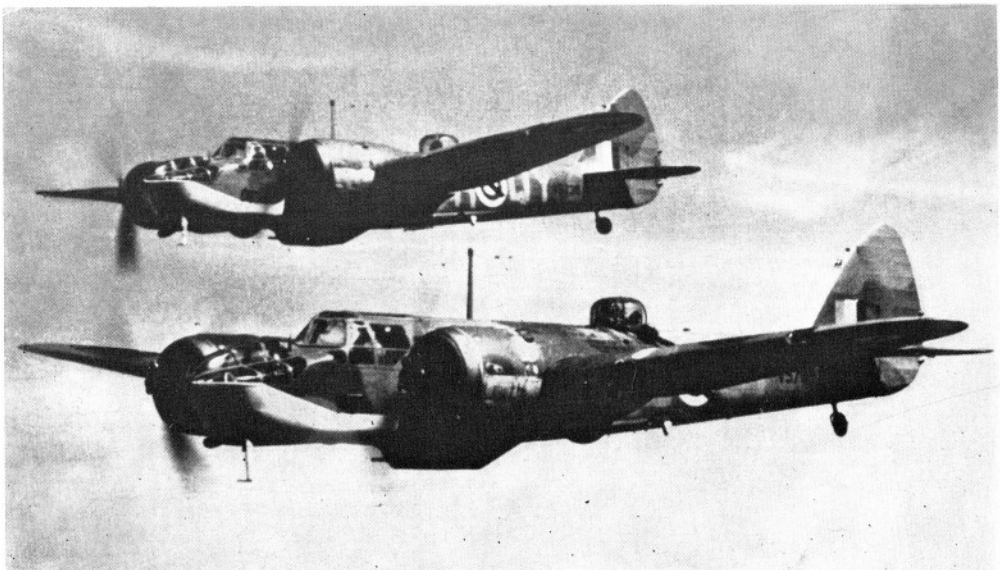
During night trials the Blenheim was flown at various distances from an accompanying aircraft and the comparison between the black and green wings were noted. It is known that at this particular period some individual squadron aircraft, certainly Hurricanes and Havocs, were painted in Dark Green—either completely overall or on the upper surfaces—for experimentation into improved night fighter colour schemes. It is, therefore, possible that some Blenheims were also used for these experiments. From

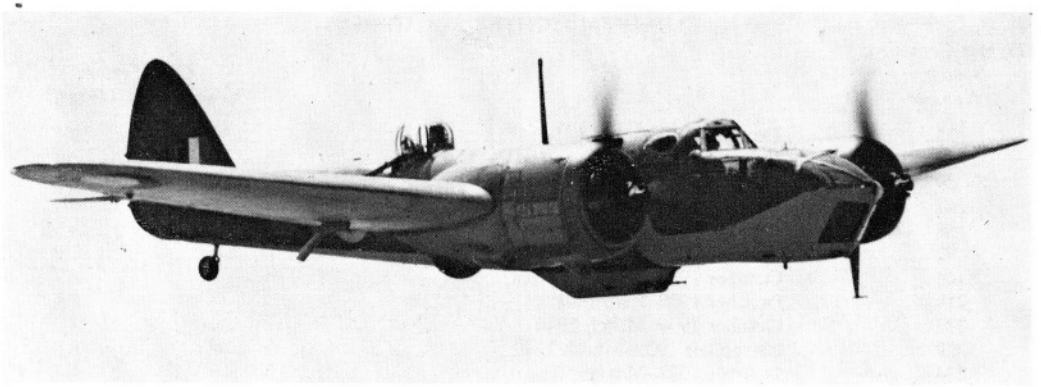
Blenheim Mk. IVFs of a Coastal Command unit in early 1941. Upper surface finish is Dark Green and Dark Earth, under surfaces are Sky. The under gun pack appears to have been left in natural metal, unpainted. Later finish of these aircraft on upper surfaces was probably Temperate Sea Scheme (Extra Dark Sea Grey and Dark Slate Grey). (Flight.)

these tests it was concluded that a Grey would be more suitable for night fighting, and Medium Sea Grey and Dark Green were subsequently adopted.

One change to the 'all-black' scheme occurred during early 1942. The R.D.M.2 finish always suffered from lack of adhesion to the primed surfaces of the aircraft. The usual undercoat in later years was ordinary Night finish, to which R.D.M.2 adhered better than any other undercoat used. R.D.M.2 was officially abandoned on 19th October, 1942, but there is evidence that ordinary (smooth) Night was already much in use before this date. It is probable that some squadrons applied a second coat of Night to their aircraft and left off the final coat of R.D.M.2. Neither

Blenheim Mk. IVFs of No. 235 Squadron. (*via P. J. R. Moyes.*)





Another Blenheim Mk. IVF of No. 235 Squadron. The gun pack is well shown. (Aeroplane, *via P. J. R. Moyes.*)

black was effective for night fighting, so there was little point in perservering with R.D.M.2.

A major change in national markings took place in mid-May 1942, with the adoption of the less reflective, standard roundels and fin flash. After many months of experimentation and careful design work the Type C and C.I roundels and standard fin flash were evolved. These were designed to give uniform reflectivity over all the colours used, and in consequence the White and Yellow, where used, were much reduced in total area.

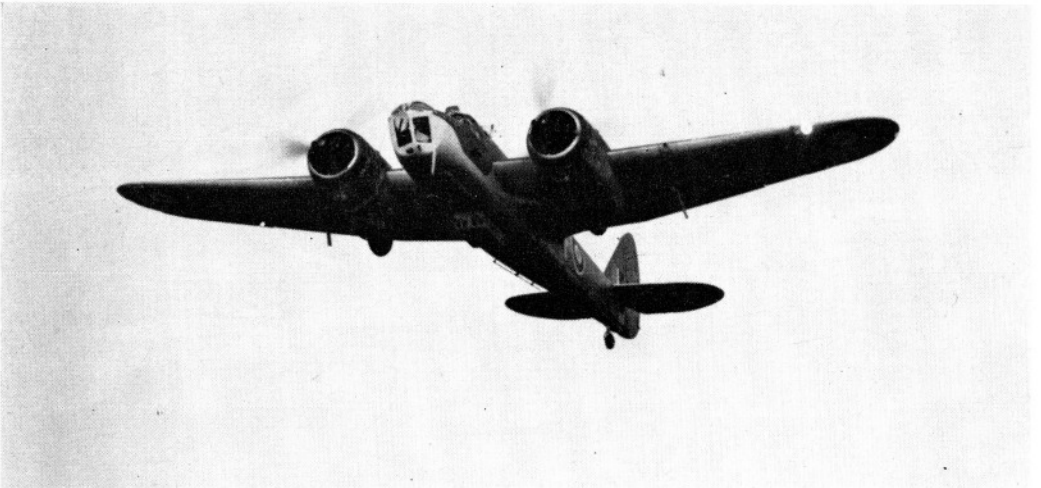
The fuselage roundel size used on the Blenheim was 36in. overall and was composed of the following sizes Yellow ring, 36in., Blue, 32in., White, 16in. and Dull Red, 12in. diameters. The standard fin flash used was 24in. square, using 11in. wide Dull Red and Blue bands, with a 2in. White band separating them. The upper wing roundel remained a Type B. No under wing roundels were carried with the Night finish.

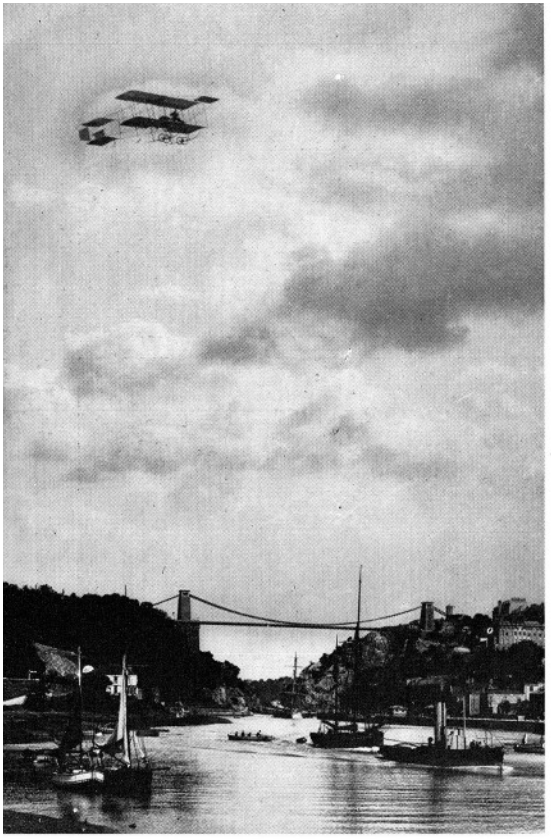
The colour of code and aircraft letters changed to Dull Red with the introduction of the new markings. The size of code and aircraft letters also became standardised at this period, and they were 24in. high.

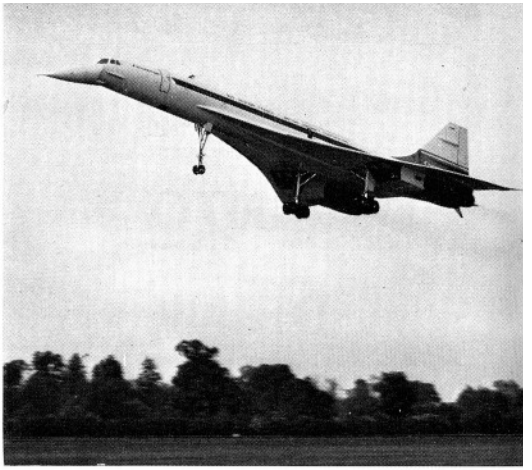
Blenheim night fighters were, by 1942, largely obsolescent as Beaufighters and Mosquitoes took over their duties. A few still remained in the squadrons when the new standard night fighter finish of overall Medium Sea Grey, with an upper surface pattern of disruptive Dark Green, was adopted in October 1942. No photographs appear to exist showing Blenheim fighters painted in this new scheme, and it is, therefore, not possible to confirm that it was ever used on the type.

Although some Blenheim fighter squadrons operated in standard Fighter Command finish in the early days of Coastal Command, these eventually were painted in the Temperate Sea Scheme colours of Extra Dark Sea Grey and Dark Slate Grey, with Sky under surfaces. Coastal Command camouflage scheme are, however, outside the scope of this volume.

A Blenheim Mk. IVF of a Coastal Command unit, possibly non-operational. The upper surface scheme is probably Extra Dark Sea Grey and Dark Slate Grey, with Sky Undersides. The fuselage roundel is the standard 36in. diameter C.I and the fin flash is the standard 24in. square. The under wing roundels are still Type A. The photograph was taken after May 1942.







Ancient and modern. LEFT: A Bristol Boxkite flies over the Avon Gorge and the famous suspension bridge at Clifton, Bristol, in November 1910. RIGHT: Concorde 002 takes off from Filton on a test flight in 1969.

F. G. CLARK

60 years of Bristol aircraft

SIXTY years ago last February an aircraft factory was set up in two sheds in the village of Filton in south Gloucestershire, not far from Bristol. This small works, a former tramcar depot, was the seedbed of a tradition. It was the birthplace of a company and a name—" Bristol "—that are honoured and respected by aviation men the world over. Today, work still goes on in the two sheds but they are now surrounded by a vast complex of factories, offices, laboratories, testbeds, airfield and other facilities spreading over hundreds of acres of ground on the northern outskirts of Bristol. Here, some 25 000 people earn their living with the two companies, British Aircraft Corporation and Rolls-Royce, which now embody the " Bristol " tradition.

Neither the Bristol tradition nor the huge plants at Filton and Patchway would exist save for the imagination and drive of the man who began it all in 1910, Sir George White. A wealthy Bristol business-man and a practical visionary who had already exploited the possibilities of tramways and motor buses both in Bristol and elsewhere, he was a descendant in spirit of the city's merchant venturers of the past. He was quick to see the potential of the aeroplane, not merely as a sporting vehicle but as a revolutionary form of military and civil transport. Many enthusiastic pioneers of those days " went into aviation ". Sir George went into the aviation business, and with a world market as his target he named his company the British and Colonial Aeroplane Company Limited.

Within a few months, Bristol Boxkite biplanes were coming off a well-organised production line in the Filton factory at the rate of two a week. At the 1910 autumn manoeuvres on Salisbury Plain, the Boxkite operated successfully—and, in the view of some military men, unsportingly—in the aerial reconnaissance role. In November of that year the company landed its first export order—eight Boxkites for Russia. To cater for the growing numbers of aspiring pilots the company opened its own training establishments, and many men who later became famous as war aces or leaders in aviation first learned to fly at the Bristol schools at Larkhill and Brooklands.

Well before the first World War, Sir George White and his colleagues were trying to convince the British Government of the Boxkite's military value, and so began a dialogue with Whitehall that has gone on ever since.

From 1914 onwards, the development of the company followed a clearly discernible pattern. Periods of explosive expansion in wartime were succeeded by periods of difficult readjustment to the lesser, and less urgent, demands of peacetime.

The first Bristol aircraft to be ordered quantity for service in the first World War was the Scout, a single-seat biplane with a top speed of about 100mph. It did sterling work as a reconnaissance, training and communications aircraft but it was not designed for offensive operations.

Zeppelin raids and the growing ascendancy of the more

heavily-armed German aircraft over the Western Front pinpointed the need for a genuine fighter. Filton's answer was the two-seat Bristol Fighter, one of a long line of successful designs by the great F. S. Barnwell and among the most famous military aircraft ever produced. It immediately proved its worth in air battles over France, and its feats in that and other theatres of war carried the name of "Bristol" to the far corners of the earth. In total, about 5 300 Fighters were built, many of them by motor manufacturers and other companies working under a forerunner ofthe later " shadow factory ' scheme.

In the final year of the war, the company produced 2 000 aeroplanes from its own factories. At the time of the Armistice, the payroll had risen to 3 000—compared with 200 in August 1914—and the original two modest sheds were now part of a factory with eight acres of floor space.

There now followed what was in many respects the most difficult decade in the history of the company, re-named in 1920 The Bristol Aeroplane Company. Problems of readjustment and survival were intensified by the general world-wide economic depression that succeeded the brief postwar boom.

Diversification was one of the expedients adopted to keep the nucleus of a skilled workforce in being at Filton. Aircraft manufacture was augmented by production of bus and coach bodies, and later of motor car bodies. Fortunately, the Fighter was selected by the RAF in 1919 as the standard army co-operation machine. Construction of new Fighters and the reconditioning of existing ones to meet this requirement brought a steady flow of work to the Filton shops.

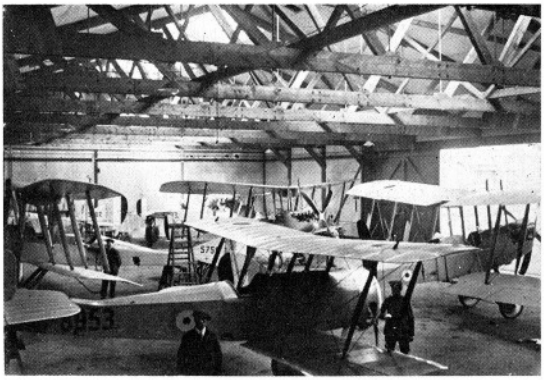
The Bristol board's decision in 1920 to acquire the Cosmos Engineering Company was to have far-reaching consequences. Led by Mr (later Sir Roy) Fedden, the small group of Cosmos engineers had designed the Jupiter and Lucifer air-cooled radial aero-engines and these types were developed to become the first of a long and distinguished line of Bristol engines. From the beginning, the products of the aero-engine department enhanced the reputation of " Bristol " and, as the result of a network of licence agreements in Europe and elsewhere, contributed substantially to the company's profitability. But in this brief account of Bristol's sixty years, attention is focussed mainly on the aircraft side of the business. The story of Bristol aero-engines requires separate treatment.

It was not until the end of the decade that the next name was added to the list of Bristol aircraft " classics ". This was the Bristol Bulldog which in 1929 won a fiercely-contested competition for adoption as the RAF's new single-seat day-and-night fighter. Manoeuvrability and maintainability were two qualities that endeared the Bulldog to pilots and ground crews alike. Nearly 450 Bulldogs were produced at Filton from 1929 to 1934, and a number of foreign air forces followed the RAF example in choosing the Bulldog.

In the 'twenties and 'thirties Bristol was closely associated with attempts on the world altitude record. The record changed hands nine times in the ten years 1928-38, and on six of these occasions the aircraft was powered by Bristol engines, Twice, in 1936 and 1937, the special Bristol Type 138 high-altitude monoplane captured the record for Britain. And—to look ahead for a moment—this was not the end of Bristol's success in this field, for in 1953 and 1955, an Olympus-powered Canberra, piloted by W. F. Gibb, set new altitude records.

British aviation's lean postwar years ended at last in 1935 when the British Government launched on the rearmament programme. Bristol, like all the other major British aviation companies, was encouraged to expand production and gear up for war. This decision had been left very late but one benefit of the delay was that the RAF was re-equipped with technically advanced types of aircraft.

One of these was the Blenheim light bomber whose place in aviation history is assured for all time. It had its origins



BE2D and Bristol Scout D biplanes ready to leave the production sheds at Filton in 1916.

in a twin-engined monoplane design, the Bristol Type 142. A prototype 142 had been ordered by the then Lord Rothermere as a private high-speed transport and was named by him the " Britain First ".

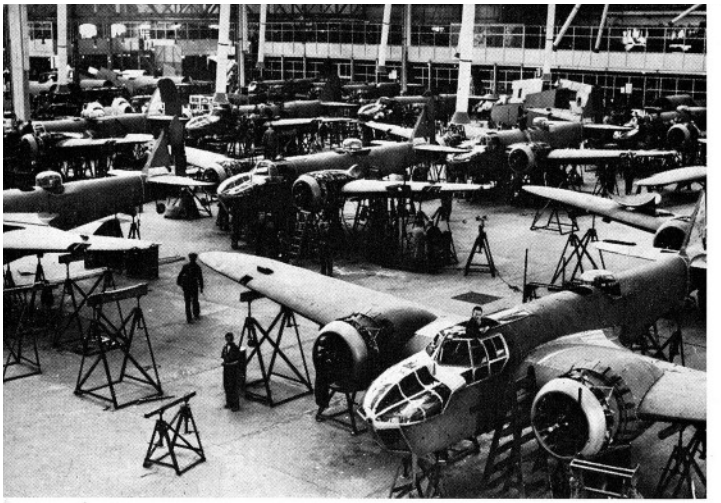
In its airworthiness acceptance trials the 142 demonstrated a top speed of 50mph faster than that of any fighter then in service. When the Air Ministry asked to retain the aircraft for evaluation as a bomber, Lord Rothermere generously presented it to the Air Council. Thereafter, the evolution of the 142 into the Blenheim proceeded rapidly.

The speed with which re-equipment decisions were being made and implemented at that time may be judged from the fact that within three months of the 142 acceptance trials in June 1935, Filton had received an order for 150 Blenheims. In the six months from June to December, the workforce grew from 4 200 to more than 8 200, and this expansion in manpower was matched by the expansion in productive capacity.

When war was declared in September 1939, the Bristol Aeroplane company could claim to have at Filton and Patchway the largest single aviation manufacturing unit in the world. The company occupied hundreds of acres of land, with buildings providing more than 2 500 000sq ft of covered floor space. Even the rate of growth indicated by these figures had been insufficient to meet all the demands imposed by the rapidly accelerating rearmament programme, and to augment the aviation industry's own efforts the Government enlisted the help of the automobile and other engineering industries. Bristol products, both aircraft and engines, were among the first to be chosen for production in the shadow factories, and the company played a leading part in the organisation of this complex and highly successful scheme.

Two figures give a measure of the massive contribution made by Bristol to the national war effort, either directly or through the shadow scheme; in all, more than 14 000 Bristol aircraft and well over 100 000 Bristol engines were manufactured.

The importance of Bristol's contribution was fully recognised by the enemy. In a daylight raid on the factories in September, 1940, 91 people were killed and more than 100 injured. This hastened the dispersal moves already under way and by 1942, by which time the payroll had risen to 52 000, over 100 dispersal premises were in use. These included hotels, tobacco stores, chocolate and cider factories and even a prison. [*continued on page 146*



LEFT: Bristol Blenheim IVs in production at Filton in 1938.

RIGHT: The last Bristol type was the 221, a much-modified version of the Fairey Delta 2 built to investigate the handling and control characteristics of the Concorde-type slender delta wing.

BELOW: Bristol's 100-ton bomber project of 1942. Wing span was 225ft, length 136ft 6in, and power plant comprised eight Bristol Centaurus engines buried in the wings. Final design study had a "butterfly" tail.

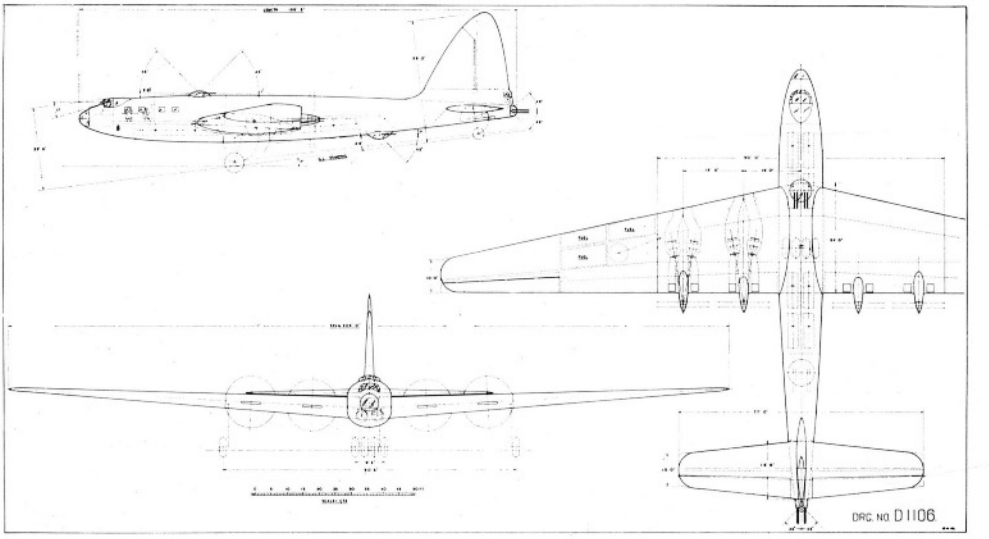
60 YEARS OF BRISTOL AIRCRAFT

concluded from page 142

Three aircraft types which together accounted for the great bulk of Bristol's wartime production were the Blenheim, the Beaufighter and the Beaufort. Like the Blenheim, the Beaufighter would be included in any list of classic British military aircraft.

Blenheims rendered valiant service as bombers and army co-operation aircraft in every theatre of war in which the RAF fought, and books could be—and have been—filled with their exploits. A Blenheim made the first aerial sortie of the war when, on September 3, 1939, an aircraft of 139 Squadron made a photographic reconnaissance flight over the German fleet in the Schillig Roads. On the following day, Blenheims and Wellingtons joined in a mast-height bombing of the pocket battleship, *von Scheer*.

Both the Beaufort and the Beaufighter owed much to the basic Blenheim design, and both were built in large numbers in Australia, mainly for service in the Far East. Until it was superseded as a front-line torpedo bomber by the Beaufighter, the Beaufort inflicted heavy losses on enemy shipping. Designed to meet the need for a well-armed fighter with long-range capability, the Beaufighter will possibly be best remembered for its successes in night operations over Britain in 1941 when it used early versions of airborne radar to detect and stalk enemy bombers. It was one of the most versatile military aircraft ever produced and, apart from the night-fighter role, it operated with great success as a torpedo



bomber and, armed with bombs and rockets, on intruder patrols against enemy transport, tanks and other key targets.

In the closing phases of the war, work was going ahead at Filton on a heavily armed derivative of the Beaufighter, to be named the Buckingham, but the war had ended before this type had been produced in any substantial numbers. Once again the company found itself having to cope with the problems of peacetime retrenchment and readjustment.

These problems had been foreseen and plans had been laid to meet them. As before, a policy of diversification was adopted, and the company turned over part of its design and production capacity to such varied projects as cars, factory-built houses (using aluminium supplies from the breaking up of wartime aircraft) and plastics products.

A helicopter department was set up and this later became a large self-contained division based at Weston-super-Mare, where the well-known Sycamore and Belvedere helicopters were manufactured.

An immediate civil aircraft project was to hand in the Type 170, a freighter derived from the Bombay military transport/bomber, an aircraft that had been designed by Bristol before the war and built by Short Brothers and Harland of Belfast. The Type 170, better known as the Bristol Freighter, or in the passenger version, as the Warfarer, was certainly no beauty but it proved itself a veritable workhorse of the air. More than 200 were built and served in all parts of the world, and many are in operation to this day. Many thousands of people had their first experience of air travel in flying with their cars in the capacious hold of the Freighter on car ferry services to and from the Continent. [*A detailed survey of the Type* 170 *appeared in the February, March, April and May* 1969 *issues of AIRCRAFT ILLUSTRATED.*—EDITOR.]

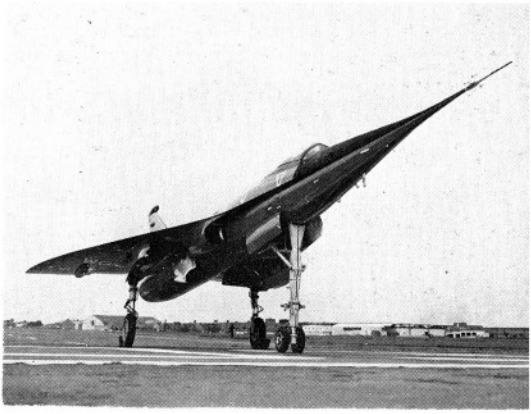
Far more ambitious was the Brabazon, a large transatlantic airliner project designed to meet one of the postwar requirements formulated by the Brabazon Committee. Filton's submission for an eight-engined 160-ton aeroplane drew extensively upon design studies that had been made in 1942 for a bomber of similar capacity. In 1945 the company was awarded a prototype contract.

Although, for economic and technical reasons, the Brabazon was never used in passenger service, the project was, in fact, a sound investment for Britain. Basic knowledge gained in the design and construction of this first big British airliner was invaluable not only to Bristol but to the entire British aviation industry.

Bristol applied this basic knowledge to good effect in the turboprop Britannia, the first turbine-powered airliner to provide a non-stop service over the North Atlantic. BOAC began Britannia services in February 1957 and for nearly ten years thereafter Britannias continued to operate in front-line airline service. One outstanding feature of the Britannia has been its superlative safety record—for example, not a single passenger was killed or injured in the 135 million miles covered by BOAC's Britannia fleet. Many of the 85 Britannias built at Filton and Belfast are still in operation today, notably with RAF Air Support Command.

The list of Bristol aircraft ends with two pure research types, the 188 and the 221. Both have furnished valuable information on the structural and aerodynamic problems associated with supersonic flight. The stainless steel 188 highlighted the difficulties of working in this somewhat intractable material and the experience gained undoubtedly helped to influence the choice of aluminium alloy as the main structural material for the Concorde. The 221, a much-modified version of the Fairey Delta 2, has been used to investigate the handling and control characteristics of the Concorde-type slender delta wing.

A postwar development of great significance was the company's entry into the guided missile field. After intensive research, involving rocket-range tests in this country and Australia, the Bloodhound surface-to-air guided weapons system was adopted by the RAF. It was a major export success, and in its Mark 2 version the Bloodhound is still in operational service.



Bristol's Guided Weapons team had to design and produce much of the advanced electronic test instrumentation required in the course of development of Bloodhound. The highly specialised skills acquired in this work were later exploited in a variety of successful commercial applications.

Even more significant was the company's work in the development of supersonic transports. In the late fifties the Bristol aircraft design team, under Dr A. E. Russell's leadership, were awarded important Ministry of Supply contracts for design and feasibility studies in this field and Bristol played a principal role in the evolution of British SST proposals. These activities were taken over by British Aircraft Corporation, and Filton remains the British design and production centre for the Concorde, the Anglo-French supersonic airliner that will halve present flight times on long air journeys and introduce a new concept in world travel.

In the 50 years up to 1960, the Bristol company produced 15 000 aircraft of 85 different designs, and in addition some 8 000 Bristol aircraft were built under licence in other countries. In its thirty years of engine production, about 157 000 Bristol engines were manufactured.

Some of the people behind these impressive figures—men like the aircraft designers, Barnwell and Russell, the aero-engine designers, Fedden and Hooker, and the test pilot, Uwins—bear names that are renowned in the world of aviation. But there have been many others—distinguished designers, experienced production engineers, able administrators, enterprising salesmen, devoted workers at all levels—who have contributed to Bristol's successes and achievements.

As a result of the aviation industry mergers of the early sixties and of later developments, the Bristol Aeroplane Company is now no longer in active operation. The Filton aircraft works now house the Filton Division of British Aircraft Corporation and the Bristol Works of the Corporation's Guided Weapons Division. Its former aero-engine works are now the Bristol Engine Division of Rolls-Royce. The helicopter division is part of the Westland Aircraft group.

Helicopters apart, " Bristol " and all that it stood for are thus part of the strength, part of the breadth of experience, of BAC and Rolls-Royce, and the pioneering traditions of Bristol—the " name " and the city—are in good hands.