AIR PUBLICATION 1527A

Pilot's Notes

PILOT'S NOTES

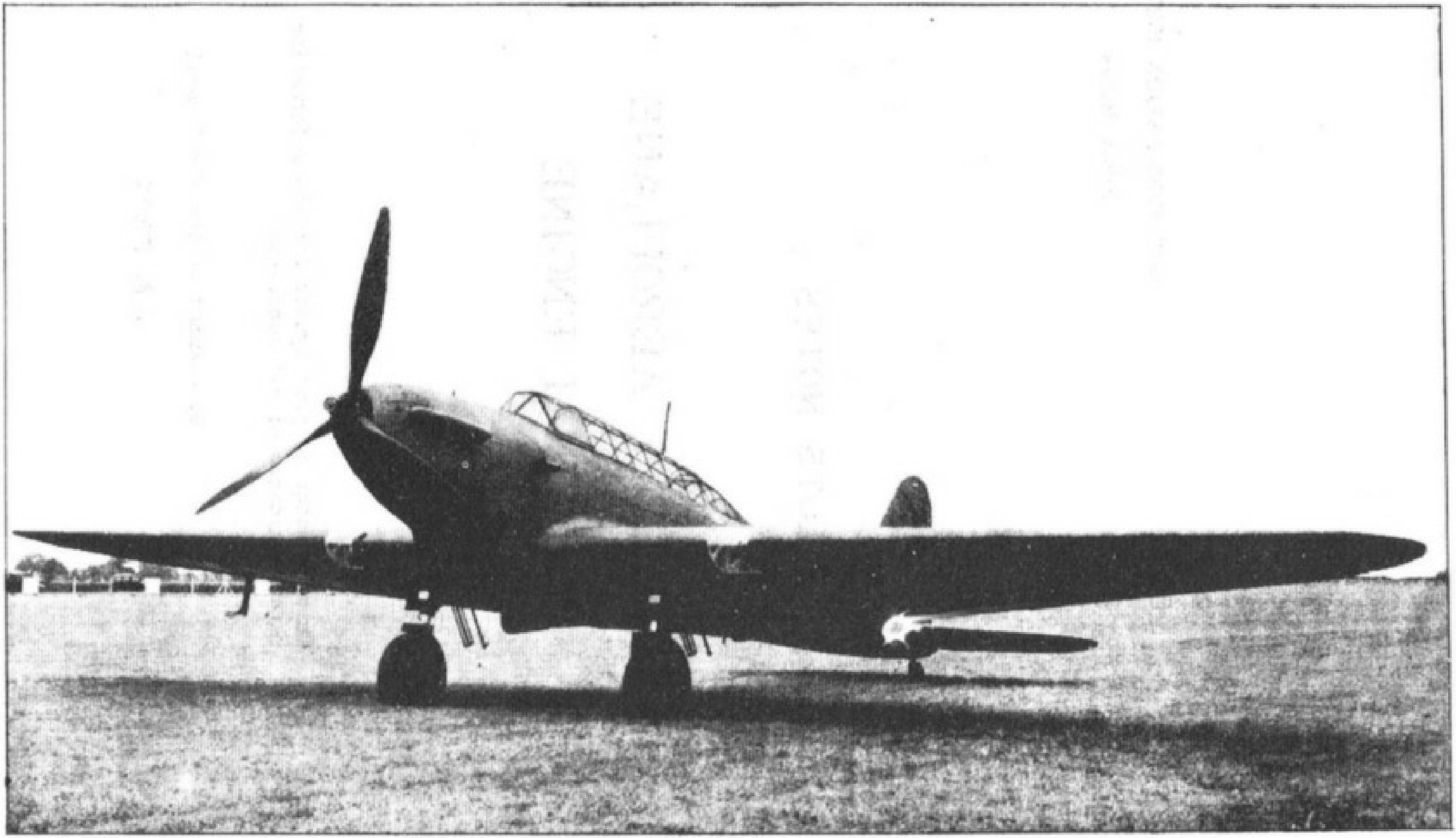
BATTLE I AEROPLANE
MERLIN I ENGINE

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

By Command of the Air Council

A.W. STREET

AIR MINISTRY



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LIST OF SECTIONS

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

Introduction

Section 2 - Handling and flying notes for pilot

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.

INTRODUCTION

1. The following introductory notes are complementary to the more technical descriptions given in handbooks and elsewhere. They are, as far as possible, shorn of technical detail and they are intended solely as a guide to the pilot in the handling of his controls and equipment.

Hydraulic system

2. The undercarriage, the flaps and the bomb doors and bomb carriers are operated hydraulically. The hydraulic system consists of an engine-driven pump, a hand-pump for use if the engine-driven pump fails, and three selector levers marked CHASSIS, FLAPS and BOMBS. Each selector lever has a central OFF position and two operative positions marked RAISE and LOWER.

3. The undercarriage selector lever is fitted with a safety catch to prevent accidental movement into the RAISE position.

Flaps

4. The flaps are of the split trailing edge type and are operated hydraulically. Their movement is shown on an indicator in the cockpit. Their aerodynamic effect is to give increased lift and thus reduce the stalling speed, but, being of the split trailing edge type, they also increase the drag greatly when lowered. They should always be used for landing because they give the following desirable characteristics:-

Slower gliding speed and steeper glide patch.

Slower landing speed and reduced run after landing.

5. The flaps should also be used (either fully down or half down) for slow flying, gliding and descending through low clouds at low speed. Their usefulness when taking off is not so marked. Their lift characteristics enable the aeroplane to become air borne at a slightly lower speed, but their drag, when fully lowered, very considerably reduces acceleration. With the flaps half down a compromise between lift and drag is reached whereby the take-off is slightly improved, but the improvement is not very marked. During the training period for which these notes are especially written, it is recommended that the take-off should be made with flaps fully up.

Amended by A.L. No.6

Trimming tabs

6. Recommended positions of rudder and elevator tabs for taking off and landing are given elsewhere under their appropriate headings.

7. The trimming tabs are intended for use as fine adjustments only and they must not be applied coarsely during manoeuvre.

8. The Battle normally recovers readily from a dive by the use of elevator control alone without recourse to the trimming tabs. In recovery from a dive at high speed the tabs should be used only as a last resort VERY GENTLY AND CAREFULLY if recovery is impossible otherwise.

Airscrew pitch control

9. Fine pitch must be used for taking off and for all speeds below about 100 m.p.h. A.S.I. At all higher speeds the airscrew should be in coarse pitch.

10. Before changing the airscrew pitch from coarse pitch to fine the engine must be throttled back so that the airspeed does not exceed 120 m.p.h. I.A.S.

Automatic mixture control

11. The mixture control lever in the cockpit has two positions, RICH and WEAK.

12. The rich position must be used for taking off and for all boost pressures above 2¼ lb./sq.in. For economical cruising at any height the mixture control lever should be set fully forward in the weak position and this may be done at any height provided the boost pressure does not exceed 2¼ lb./sq.in.

Automatic boost control

13. The automatic boost control limits the boost pressure to its rated maximum of 6¼ lb./sq.in. For use in emergency a cut-out control is fitted on the throttle quadrant and this cut-out eliminates the boost control entirely and gives the throttle full control of engine power.

14. The cut-out is sealed in the closed position and the lever can only be moved by breaking the seal.

15. The cut-out must never be employed at ground level or for take-off unless 100 octane fuel is used.

Radiator

16. The radiator temperature is controlled by a small vertical crank handle in the cockpit. A pointer indicates the position of the shutter.

Undercarriage

17. The undercarriage is hydraulically operated and is fitted with an additional hand gear for lowering it in emergency if the hydraulic system fails.

The indicator lights work as follows:-

GREEN LIGHTS.	Wheels fully down.
RED LIGHTS.	Wheels retracting or lowering.
LIGHTS OUT.	Wheels fully retracted.

18. An additional red light marked WHEELS lights up when the warning horn sounds.

Fuel system (see fig.1 in A.P.1527A, Vol.I)

19. The total capacity of the fuel tanks is 212 gallons, D.T.D.230. The port tank, 106 galls. is mounted in the port stub plane and the starboard tank, 106 galls. is mounted in the starboard stub plane.

20. A transverse bulkhead divides each tank into a front and a rear compartment. These compartments are connected by an aperture fitted with a flap valve which normally allows free passage of the fuel into the rear compartment from which the engine pump takes its supply.

21. PILOTS ARE WARNED THAT IF THE NOSE IS DEPRESSED IN A PROLONGED DIVE OR GLIDE A TANK MAY APPEAR TO RUN DRY ALTHOUGH THERE IS STILL FUEL IN THE FORWARD COMPARTMENT.

22. Fuel is drawn from the rear compartment of each tank by the engine pump. The main cock is mounted on the dashboard in the cockpit and provides three positions. ALL TANKS OFF - PORT TANK ON - STARBOARD TANK ON.

23. As the engine pump is higher than the tanks when the aeroplane is on the ground, it is necessary to charge the engine pump with fuel before starting up. This is done by a semi-rotary hand pump which is

reached from the ground through the bomb-aimer's trapdoor. This pump and also the priming pump in the cockpit draw their supply from the starboard tank. For this reason it is essential to use the starboard tank for starting up.

Auxiliary fuel tank

24. This is no longer fitted.

Oil and coolant systems

25. The oil tank capacity is 15 gallons (air space 2 gallons) and the coolant system capacity is 13½ gallons of glycol mixture.

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

SECTION 2

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Fuel system diagram 1

SECTION 2

HANDLING AND FLYING NOTES FOR PILOT

Preparation for flight

1. Ensure that the total weight and the disposition of the load are in accordance with the weight sheet summary.

> <u>Warning</u>.- The danger which may arise from the carriage of non-standard loads is explained in paras. 34 to 36. It is of the greatest importance that these paragraphs should be read and understood.

Preliminaries

2. On entering the cockpit proceed as follows:

(i) See that all three hydraulic selector levers are in their central OFF positions and ensure that the safety catch on the undercarriage selector is up in the safety position.

(ii) Switch on the undercarriage indicator lamps and check that both green lights are working.

(iii) Test flying controls for free movement.

(iv) Test hydraulic hand-pump by setting flap selector lever fully forward and pumping the flaps down by hand-pump. Then set flap selector lever back to the flaps up position and pump them fully up again. Check that the selector lever returns to the neutral position at the end of each pumping operating.

(v) Check the tightness of the friction adjustment on the throttle to ensure that the throttle lever cannot vibrate back during take-off.

(vi) Check the contents of each fuel tank.

Starting the engine

<u>Note</u>.- For full details of the Merlin II engine reference should be made to A.P.1590B.

3.
(i) Turn main fuel cock to STARBOARD TANK. This is necessary because the priming system is fed from the starboard tank only.

(ii) Fitter should then prime the fuel pumps as follows: Turn on both cocks on the hand-pump inside the bomb-aimer's trapdoor and operate this hand-pump until the fuel pressure gauge in the pilot's cockpit reads 5 lb./sq.in. Then cease pumping and turn both cocks off.

(iii) Unscrew priming pump in pilot's cockpit and give 5 strokes for a cold engine (2 strokes if hot) and then screw up priming pump again.

(iv) Set throttle $\frac{1}{4}$ inch open and mixture control to rich.

(v) Ensure that all personnel are clear of the airscrew.

(vi) Press starter button and suck in for one revolution before switching on.

(vii) Switch on starter and main switches. The action of turning on the main switches will automatically turn on the undercarriage indicator lights if these have been forgotten.

Warming up

4. As soon as the engine starts proceed as follows:-

(i) Turn off starter switch.

(ii) Turn main fuel cock to PORT TANK. This is necessary because the starting and priming systems are fed from the starboard tank and a start will not be possible if the starboard tank is emptied first; even though the port tank may still be full.

(iii) Close radiator flap and run the engine at a fast tick-over until radiator temperature reaches 60°C and oil temperature reaches at least 15°C.

Checking engine and installation

<u>During warming up</u>

5. (i) Test hydraulic system by lowering the flaps fully and then raising them again.

(ii) Check oil, fuel and brake pressures.

<u>During running up</u>

6. (i) Open radiator flap sufficiently to prevent overheating.

(ii) Set airscrew pitch to FINE.

(iii) Run up steadily to full throttle and check the following gauge readings:-

Merlin II   Boost $6\frac{1}{4}$ lb./sq.in.
R.P.M. 2600

(iv) Test magnetos separately at full throttle but do not run the engine longer than necessary at full boost.

Taxying out

7. The Battle handles satisfactorily on the ground, but, having a large keel surface, it is not easy to taxi across wind. Do not use the brakes more than is necessary as the brake drums readily overheat if they are used continuously.

Brake pressure failure during taxying

8. If, for any reason, the brake pressure fails when taxying, apply full brakes IMMEDIATELY and stop the aeroplane while there is still some pressure left. Do not taxi without effective brakes unless there are at least 3 men at the tail to steer and stop the aeroplane.

Immediate actions prior to take-off

9. On reaching the most suitable position on the aerodrome for taking off, bring the aeroplane to rest facing across the line of take-off and go through the cockpit drill of vital actions. All of this drill (with the possible exception of the radiator flap setting) may be done before taxying out if this is considered more convenient BUT IT MUST BE CHECKED IMMEDIATELY BEFORE TAKING OFF.

Delay prior to take-off

10. If the take-off is delayed for any reason, the engine should be cleared by running it up to zero boost against the brakes. Whilst doing this, the wheels or brakes may slip slightly but the tail will not lift if the elevator control is held fully back.

Final preparation for take-off
Drill of vital actions

11. (i) Sliding hood open.

(ii) Trimming tabs. Elevators set to 4.
Rudder set to 2 (starboard bias).

(iii) Mixture control RICH.

(iv) Airscrew pitch FINE.

(v) Flaps fully up. (or $\frac{1}{2}$ down. See introductory note on flaps).

(vi) Radiator flap OPEN to prevent overheating.

Take-off

12. (i) Take off at full throttle, $6\frac{1}{4}$ lb./sq.in. boost.

(ii) There is a slight tendency to swing left as the aeroplane becomes air-borne but it is easily corrected with right rudder.

Immediate actions after take-off

13. (i) Immediately the aeroplane is finally clear of the ground raise the undercarriage.

Note.- The safety catch must be pressed before the selector lever can be moved to the RAISE position.

(ii) As soon as the airspeed passes 100 m.p.h. A.S.I. change pitch to COARSE, otherwise the r.p.m. will exceed the maximum permissible figure of 2850.

(iii) Allow the aeroplane to accelerate to 140 m.p.h. A.S.I. in a very gentle climb before assuming the normal climbing angle.

(iv) If the take-off has been made with flaps half down, do not raise them until a safe altitude (about 300 feet) is reached. The airspeed should be not less than 95 m.p.h. when the flaps are raised.

Engine failure during take-off

14. If the engine fails immediately after taking off, act as follows.-

(i) Maintain speed.

(ii) Make sure that the undercarriage has <u>started</u> to come up. There is no time to do more, but ensure that the selector lever is in the RAISE position so that the undercarriage will be unlocked and will collapse on landing.

(iii) Lower the flaps fully, if possible.

(iv) Land straight ahead, only changing direction if absolutely necessary to avoid obstructions.

Climbing

15. (i) The recommended climbing speed at full throttle is 146 m.p.h. A.S.I. up to 12,000 feet.

(ii) Maximum coolant temperature during climb 120°C.

(iii) Maximum oil temperature during climb 90°C.

(iv) Oil pressure 60-75 lb./sq.in.

Cruising

16. Engine limitations for maximum continuous cruising are as follows:-

(i) With mixture control RICH

2600 r.p.m. at $4\frac{1}{2}$ lb./sq.in. boost.

(ii) With mixture control WEAK

2600 r.p.m at 0 to $2\frac{1}{4}$ lb./sq.in. boost (N.B. the boost must not exceed $2\frac{1}{4}$ lb./sq.in. with mixture control set to WEAK).

(iii) Recommended coolant temperature for cruising 95°C.

Normal oil pressure 60-75 lb./sq.in.
Normal oil temperature 15°C. to 90°C.

(iv) Emergency limits are as follows:-

Coolant temperature maximum 130°C.
Oil temperature maximum 95°C.
Oil pressure minimum 45 lb./sq.in.

General flying characteristics

17. Attention is drawn to the following:-

(i) Rudder bias to starboard is required at speeds up to about 140 m.p.h. A.S.I. Thereafter, less bias is necessary, and at high speeds slight port bias is required. The requirements vary slightly in individual aeroplanes.

(ii) The aeroplane can readily be trimmed to fly straight with the foot off the rudder.

(iii) Flying limitations;-

Maximum speed for lowering undercarriage	- 130 m.p.h. I.A.S.
Maximum speed for lowering flaps	- 120 m.p.h. I.A.S.
Maximum diving speed	- 340 m.p.h. I.A.S.
Maximum speed for changing the airscrew pitch from COARSE to FINE	- 120 m.p.h. I.A.S.

Stalling

18. Approximate stalling speeds are as follows:-

Undercarriage UP	Flaps UP	69 m.p.h. A.S.I.
Undercarriage DOWN	Flaps DOWN	59 m.p.h. A.S.I.

(i) These speeds are to be taken as a guide only. They apply to one individual Battle aeroplane in which the figures were taken with full fuel tanks and with two passengers but without operational equipment load.

(ii) The Battle normally drops the left wing sharply at the stall and pilots may practise it at a safe height to check the figures in individual aeroplanes with varying loads. Remember that the immediate action to regain control and to prevent a spin is "Control column forward and rudder as necessary". Aileron control should not be applied at the stall as it may have reversed effect.

Spinning and aerobatics

19. Spinning and aerobatics are not permitted.

Gliding

20. (i) Gliding may be done at any safe speeds down to the minima given below. With flaps and undercarriage up the glide path is flat and considerable distances can be covered for a given loss of height. With flaps and undercarriage down the glide path is steep, the rate of descent is rapid and the nose must be held correspondingly low in order to maintain a given gliding speed.

(ii). Recommended safe minimum speeds are as follows:-

(a) FLAPS DOWN

Engine assisted glide	85 m.p.h. A.S.I.
Glide without engine	90 m.p.h. A.S.I.

(b) FLAPS UP

If, for any reason, the flaps are not or cannot be lowered add 10 m.p.h. to the above speeds.

(iii) It is immaterial whether the undercarriage is up or down as its position does not govern the safe minimum figure but merely alters the rate of descent at any given speed.

(iv) The speeds given above are recommended safe speeds and they are purposely liberal. Pilots need not add on an extra margin except during gliding turns.

(v) Watch the radiator temperature when gliding and close the flap if necessary to prevent over-cooling.

Diving

21. (i) The maximum permissible speed is governed by two separate limitations imposed on the airframe and the engine respectively:-

(a) the speed of the aeroplane must not exceed 340 m.p.h. A.S.I. under any conditions of flight.

(b) the engine r.p.m. must not exceed 3600 with the throttle 1/3rd open. If the throttle is less than 1/3rd open the limit is 3000 r.p.m.

(ii) When diving the flaps must be up and the airscrew in coarse pitch.

(iii) The Battle recovers readily from a dive by the use of elevators alone and the trimming tabs should not be used except as a last resort if, for any reason, recovery is impossible without them. (See introductory note on trimming tabs).

(iv) See Introduction, para.21.

Approach and landing

Approach

22. (i) Reduce speed to about 120 m.p.h. A.S.I.

(ii) Open the sliding roof.

(iii) Check the brake pressure (not less than 120 lb./sq.in.) to ensure that brakes will be available after landing.

Then go through the following drill of vital actions:-

(iv) Lower the undercarriage.

(v) Airscrew pitch to FINE (throttle back to avoid excessive r.p.m.)

(vi) Mixture control to RICH.

(vii) Reduce speed to about 90 m.p.h. A.S.I. and lower flaps fully. Adjust elevator tabs (not further back than $5\frac{1}{2}$ on the scale, otherwise the aeroplane will be unpleasantly tail heavy if the throttle has to be opened fully to go round again).

(viii) Make a normal approach with engine at 85 m.p.h. A.S.I. and do not throttle back until flattening out is completed.

Landing

23. Landing is straightforward and very easy. The recommended approach speed of 85 m.p.h. A.S.I. is liberal and provides a short period of float when holding off. The brakes are satisfactory and, provided the aeroplane is landed in the correct three-point attitude, they may be applied firmly shortly after landing. When the aeroplane has come to rest at the end of its landing run the flaps should be raised before starting to taxi.

Approach without engine

Note.- Recommended safe speed 90 m.p.h. A.S.I.

24. This type of approach will apply in case of total engine failure and in forced landing practice. The glide path without engine is steep and it is necessary to start flattening out in good time so that the glide path may describe a gentle curve to ground level. If this is not done the final movement of the elevator control will have to be uncomfortably rapid and will be correspondingly difficult to judge accurately. Regular practice is necessary to accustom pilots to this steep glide path and in order that this important part of training shall not be neglected a convenient method for practising the final glide and landing without engine is as follows:-

(i) With undercarriage down, flaps fully down, airscrew in fine pitch, airspeed about 95 m.p.h. A.S.I., fly in, at a height of about 600 feet, to a position within comfortable gliding distance of the aerodrome.

(ii) Close the throttle at 600 feet, put the nose down to maintain a gliding speed of 90 m.p.h. A.S.I., and set elevator trimming tabs to $5\frac{1}{2}$ on the scale.

(iii) Make a straight final glide at 90 m.p.h. A.S.I. and flatten out and land.

Flat power approach

25. This is the type of approach to be used by experienced pilots when landing in restricted areas. The aim should be to make the approach path very flat and to fly in at low speed so that there will be minimum float on throttling back. Recommended safe speed for practice is 75 m.p.h. A.S.I. but this speed will vary with the loading, the ability and experience of the pilot and with local conditions. When approaching at these low speeds, two considerations are of paramount importance:-

(i) the speed must be dead accurate and must NEVER be allowed to drop too low.

(ii) the engine must not be throttled back until the aeroplane is flying level within 2 or 3 feet of the ground.

Landing across wind

26. The landing speed of the Battle is considerably higher than that of the old type biplane and the drift when landing across wind is therefore not so great as it was in the older types with slower landing speeds. But, as the drift, cannot be counteracted by landing with one wing down to the extent that was possible with the older and slower types, the limiting strength of wind for a safe cross-wind landing is about the same and the same general principles apply. The following points should be noted:-

(i) Land as nearly into wind as possible.

(ii) Keep the windward wing slightly down until near the ground.

(iii) Use rudder to check the tendency to weathercock straight into wind after landing.

Procedure after landing

27. Before taxying in:-

(i) Raise the flaps. This should not be done until the aeroplane has come to rest otherwise the landing run will be prolonged.

(ii) Open the radiator flap to prevent overheating when taxying.

On reaching the apron, go through the following drill before stopping the engine:-

(iii) Change pitch to COARSE. This may be done while taxying in so as to avoid the necessity of opening up the engine on the tarmac.

(iv) Turn off the fuel and allow the engine to exhaust the fuel in the float chambers. Until a slow running cut-out is fitted to the Merlin this is the most satisfactory way of stopping the engine.

(v) At the first sign of irregular running, turn off the ignition switches. The final running should be done with the engine throttled right back so that the oil can settle in the sump and thence be withdrawn by the scavenge pump.

(vi) Turn off undercarriage indicator lights.

Undercarriage EMERGENCY operation

28. (i) If the engine driven hydraulic pump fails, the hand pump may be used to lower the undercarriage, flaps and bomb doors and carriers by moving the appropriate selector lever to the operating position and then operating the hand pump.

(ii) If the undercarriage circuit of the hydraulic system has failed, the hand pump will not lower the undercarriage, though it may still operate the flaps and bomb gear. The undercarriage must then be lowered by means of the emergency crank handle as follows:-

(a) Set the undercarriage hydraulic selector lever in the neutral off position. (See Note 1 below.)

(b) Unhook the emergency crank handle, set it in position and insert the pin.

(c) Wind the crank handle forwards. It will probably be stiff to rotate, but 25 to 28 turns will lower the undercarriage fully.

Note.1. When this emergency crank handle is operated, its first movement opens a pressure release valve in the undercarriage circuit of the hydraulic system. Therefore it is important to set the undercarriage selector lever to its neutral position otherwise the hand pump cannot build up hydraulic pressure to operate the flaps and bomb gear.

Note.2. If the pilot, inadvertently or otherwise, moves the emergency crank handle, the undercarriage pressure will be released and therefore the hydraulic system cannot operate the undercarriage again until the release valve is re-set. This re-setting is a very simple operation, but it cannot be done in the air.

Flying in rain and bad visibility

29. Reduce the speed and open the sliding roof. The airscrew may be left in coarse pitch provided that the engine continues to run smoothly, but if the speed is reduced below about 110 m.p.h. A.S.I. it is advisable to change to fine pitch. If it is necessary to reduce speed below 100 m.p.h. A.S.I. the flaps may be lowered halfway, but the pilot should remember that acceleration is poor when the flaps are lowered and that care is required when raising them again to ensure that adequate margins of height and speed are maintained.

Forced landing owing to engine failure

30. The principles of forced landing are exactly the same as those which apply to any other type of aeroplane. The cardinal points to remember in the Battle are as follows:-

(i) The flaps can be pumped down quite rapidly and they may well be left up in the early stages of the approach so as to prolong the glide.

(ii) When once the flaps are lowered they must not be raised again in an attempt to extend the glide.

(iii) Recommended safe gliding speeds are as follows:-

100 m.p.h. A.S.I. in the early stages before flaps are lowered.

90 m.p.h. A.S.I. when the flaps are lowered.

Position error table

31.

At 60	m.p.h.	A.S.I.	add	10	m.p.h.
90	"	"	"	5.4	"
100	"	"	"	4.4	"
120	"	"	"	2.5	"
140	"	"	"	0.9	"
160	"	"	subtract	0.4	"
180	"	"	"	1.2	"
200	"	"	"	1.5	"
210	"	"	"	1.4	"

Amended by A.L.No.4

Abandoning by parachute

32. Immediately prior to the "Abandon Aircraft" signal being given, the Captain must ensure that the undercarriage is retracted.

33. On receipt of the "Abandon Aircraft" signal from the Captain the crew should abandon the aeroplane as follows:-

(i) The wireless operator is to abandon the aeroplane through the rear gun cockpit, opening the hood and climbing out head first to port or starboard, facing the tail.

(ii) The navigator is to abandon the aeroplane through the hatch at the prone bomb-aiming position, marked PARACHUTE EXIT, removing the bomb sight and dropping through the hatch feet first, facing aft.

(iii) When the Captain is satisfied that all the crew have abandoned the aeroplane, he is to leave the aeroplane from either the port or starboard side of the pilot's cockpit, climbing out head first, facing the tail.

DANGER OF CARRYING NON-STANDARD LOADS

34. When any load is carried other than the normal crew and military load, it is of the greatest importance to ensure that it is disposed of in such a way that the balance of the aircraft is not disturbed. Serious accidents have occurred on a number of types of aircraft due to tail heaviness from additional load carried in the after portion of aircraft.

35. As a rough rule, no additional load should be carried aft of a point approximately one-third of the wing chord behind the leading edge at the wing root, unless it is balanced by an approximately equal load the same distance forward of this point.

36. Wherever possible, however, the C.G. position should be determined by the data provided and the loading should be adjusted to bring the C.G. within the range notified in the Weight Sheet Summary as the safe range for the particular aircraft.

Attention is drawn to A.M.O.A. 254/1936.

BOMB CLEARANCE ANGLES

37. The maximum angles from the horizontal at which any bomb may be released without fouling the aeroplane structure are:-

	Bombs	Flares
Dive	80°	30°
Climb	30°	18°
Bank	10°	10°

The clearance angle in yaw at the maximum angle of dive is $2\frac{1}{2}°$. A margin of safety within these limits must be allowed in practice.

NOTES ON THE MERLIN I, II AND III ENGINES

38. For full details of the Merlin I, II and III engines see A.P. 1590A and A.P.1590B. The following should be carefully noted:-

(i) Limiting operational conditions:-

	Maximum boost	Maximum r.p.m.
Take-off (up to 1,000 ft. or for 3 mins.)	+ $6\frac{1}{4}$ lb./sq.in.	2,850 (Merlin I or II) 3,000 (Merlin III) (Minimum r.p.m. 2,080)
Climb	+ $6\frac{1}{4}$ lb./sq.in.	2.600
Maximum continuous cruising (RICH)	+ $4\frac{1}{2}$ lb./sq.in.	2,600
Maximum continuous cruising (WEAK)	+ $2\frac{1}{4}$ lb./sq.in.	2,600
All-out level (5 minutes limit)	+ $6\frac{1}{4}$ lb./sq.in.	3,000
Dive (20 seconds limit)	+ $6\frac{1}{4}$ lb./sq.in.	3,600

(ii) Oil pressure:-

Normal	60 lb./sq.in.
Emergency minimum	45 lb./sq.in.

(iii) Oil inlet temperatures:-

Minimum for opening up	15°C.
Maximum for continuous cruising	90°C.
Maximum for climbing	90°C.
Emergency maximum	95°C.

(iv) Coolant temperatures

Minimum for opening up	70°C.
Maximum for continuous cruising	95°C.
Emergency maximum	120°C.

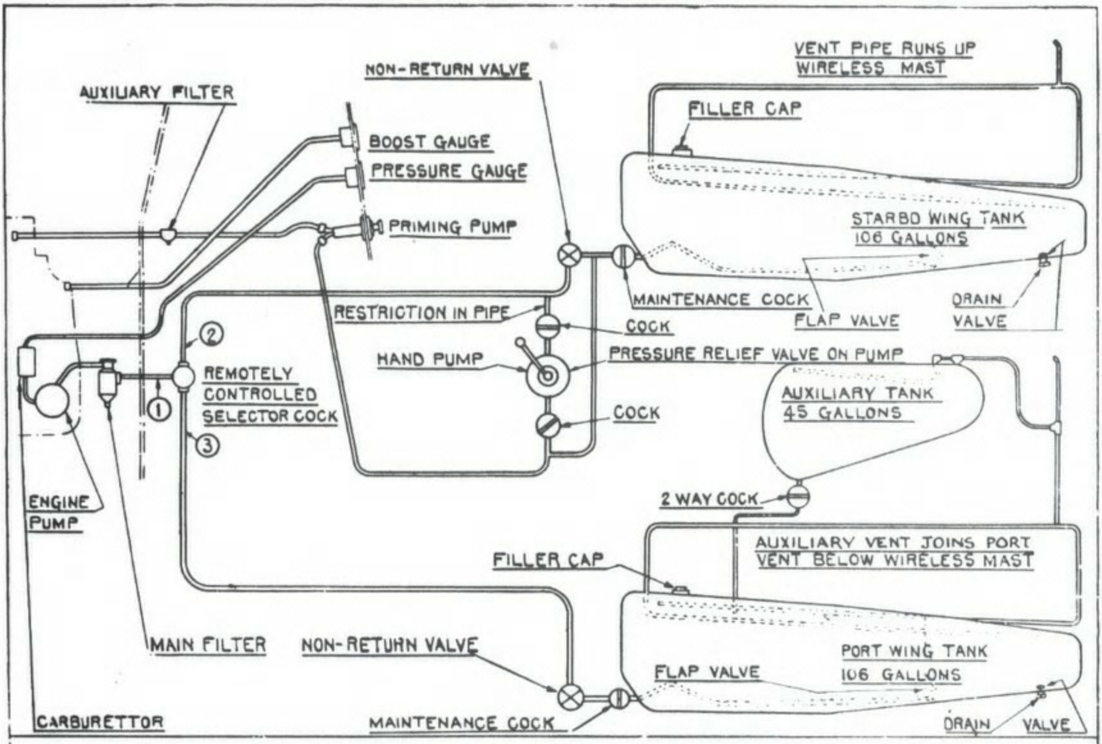
FUEL AND OIL CAPACITIES AND CONSUMPTIONS

39. (i) Fuel and oil capacities.- See Introduction.

(ii) Fuel consumptions.- To be added later by amendment.

USE OF DE-ICING EQUIPMENT

40. Windscreen de-icing equipment.- To spray the windscreen with de-icing fluid, release the pump and allow it to spring outwards. When operated once a minute the pump delivers fluid at the rate of 2 pints an hour; when operated 3 times a minute its delivery is 5 pints an hour. At a continuous flow of 2 pints an hour enough fluid is carried to cover about one-third of the range of the aeroplane. Economy is therefore essential.



FUEL CIRCULATION ARRANGEMENTS

1. WITH SELECTOR COCK OPEN TO PIPES 1 & 2 SUPPLY FROM STBD WING TANK TO ENGINE PUMP HAND PUMP & PRIMER

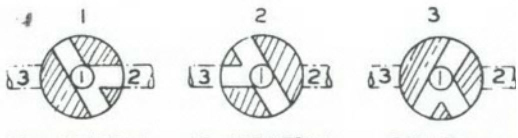
2. WITH SELECTOR COCK OPEN TO PIPES 1 & 3 SUPPLY FROM PORT WING TANK TO ENGINE PUMP ONLY

3. NO SUPPLY FROM SELECTOR COCK TO ENGINE

FOR ENGINE PRIMING & STARTING ARRANGEMENTS

(1) MUST BE USED & NOT ARRANGEMENT (2) OR (3)

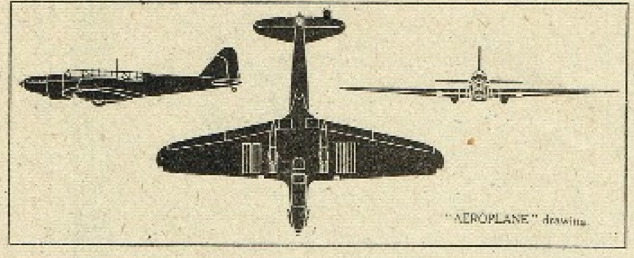
POSITIONS OF CONTROL COCK



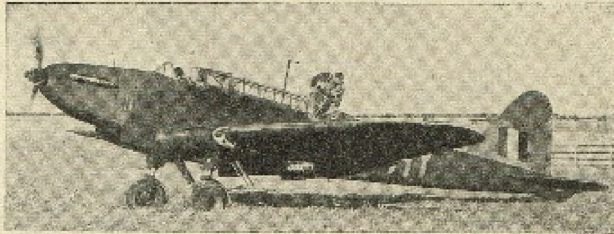
DELIVERY FROM STARBOARD TANK | DELIVERY FROM PORT TANK | BOTH TANKS OFF.

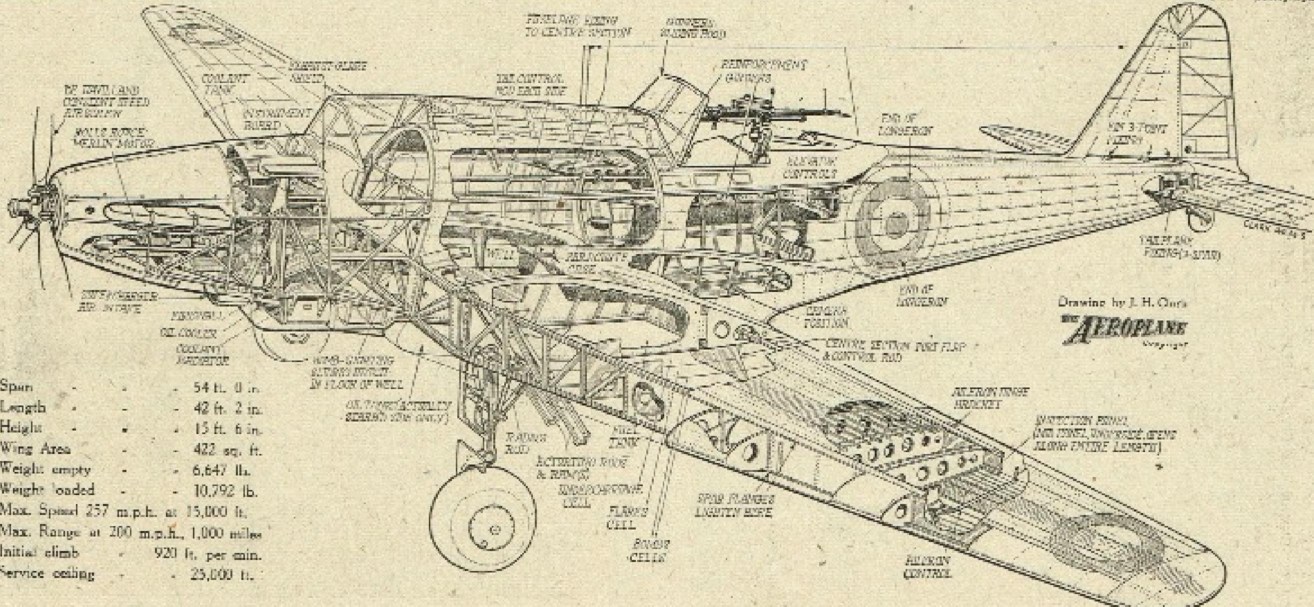
FUEL SYSTEM FIG 1

THE FAIREY BATTLE I BOMBER (one 1,030 h.p. Rolls-Royce Merlin III motor)



"AEROPLANE" drawing.





Drawing by J. H. Clark

THE AEROPLANE Copyright

Span - - -	54 ft. 0 in.
Length - - -	42 ft. 2 in.
Height - - -	15 ft. 6 in.
Wing Area - -	422 sq. ft.
Weight empty - -	6,647 lb.
Weight loaded - -	10,792 lb.
Max. Speed 257 m.p.h. at 15,000 ft.	
Max. Range at 200 m.p.h., 1,000 miles	
Initial climb -	920 ft. per min.
Service ceiling - -	25,000 ft.

WHAT WERE THEY LIKE TO FLY? No. 17

THE UGLY FAIREY

This aeroplane was not my idea of a front line bomber, says Sqdn. Ldr. D. H. Clarke, DFC, AFC

IT WAS born too late; it died early—but not early enough! Before it died it killed far too many fully-trained aircrew. After it died nobody regretted, nobody wept—nobody even noticed. Only those who flew it on ops.—and survived—heaved a sigh of relief, but they were flying bigger and better bombers by then and couldn't care less.

And let's face it—almost *any* bomber was better than the hideously ugly Fairey Battle which was neither good to fly nor nice for ops. It lumbered and wallowed behind its spinnerless variable-pitch airscrew incapable of reaching its designed top speed; in fact, doubt was often expressed as to whether the darned thing *had* been designed, or whether the pre-war Hitler panics had caused the Air Ministry to rush into an order for once. I can only describe this ill-named aircraft thus: it was no Fairy and it just couldn't Battle—except hopelessly.

Oh, it was built all right; certainly it was hulking-strong: the wing section near the wing roots was thick enough to conceal a 1,000 lb. bomb. But the only thing in the wing which was offensive was one .303 machine gun—*one!* Plus another one for the poor devil of a rear gunner. And these were our front line *bombers* in France—fighting their way to and from targets against ME109's and 110's!

The pilot's cockpit was comfortable enough, I suppose: it was roomy and had quite good forward visibility for an in-line engine, but the rear vision was poor. The rear gunner wasn't much better off; he had a tilting hood which screened his back from the slipstream, but because the backdraught curled in and slapped him full in the face, this was a useless gadget. The single rear gun had a poor arc of fire and the mighty rudder and tail plane effectively blocked most of it.

Strange Experience

What is left? Well, the bomb aiming position was good fun—for a pilot who wanted to have a close-up view of what an undercart looked like when an aircraft landed. I used to enjoy doing this. As you lay face down looking through the oil-stained perspex panel and bomb-aiming gap, you had the short oleos and large wheels in full view. As the runway, or grass, came closer and closer and the surface blurred to streaky grey or green, you could swear that the bloke flying the kite was going to boob. Then, with no sense of stall, the wheels would meet the ground, smoke (on tarmac) would erupt briefly, and the oleos would contract smoothly as they took the weight of the monster from its supporting cushion of air. That was always a fascinating performance. But I should have hated to have had to aim bombs from that hole: the hot, oily stench from the engine made any stay in the prone position a sheer impossibility.

In a way, I flew Battles on ops., but only on cissy stuff—nothing to compare with the courage of those Expeditionary boys whose futile gallantry halted the Nazi advance for mere hours. How quickly we forget the real heroes of any war: the men who take the first brunt of warfare—ill-equipped, poorly briefed, vaguely controlled—and do their damnedest to close the politician-folly gaps!

My ops. consisted of flying due south from the Isle of Wight—south, over the Channel towards France. We flew at various prearranged heights on this LRCX (Long Range Calibration Exercise) and the back-room boys at Ventnor and other RDF stations would correct their multitudinous devices as they picked up the faint blip of our solitary Battle on their flickering green screens. There were panics, of course, and we were attacked by a variety of aircraft (mostly Allies) and some ack-ack (all ours), but we survived this operational flying in unarmed Battles without (a) injury, (b) victory, (c) thanks. No, that's a lie: the back-room boys were always grateful *providing* we had done *exactly* what they required; the only snag which often prevented this was the fact that there was a war on!

Flour Attack

Then there was my non-operational (but highly hazardous) beat-up on Salisbury Plain when the Army asked us to "attack any personnel visible within the following pin-points." I was supplied with flour bombs and camera guns and I rather hogged the opportunity.

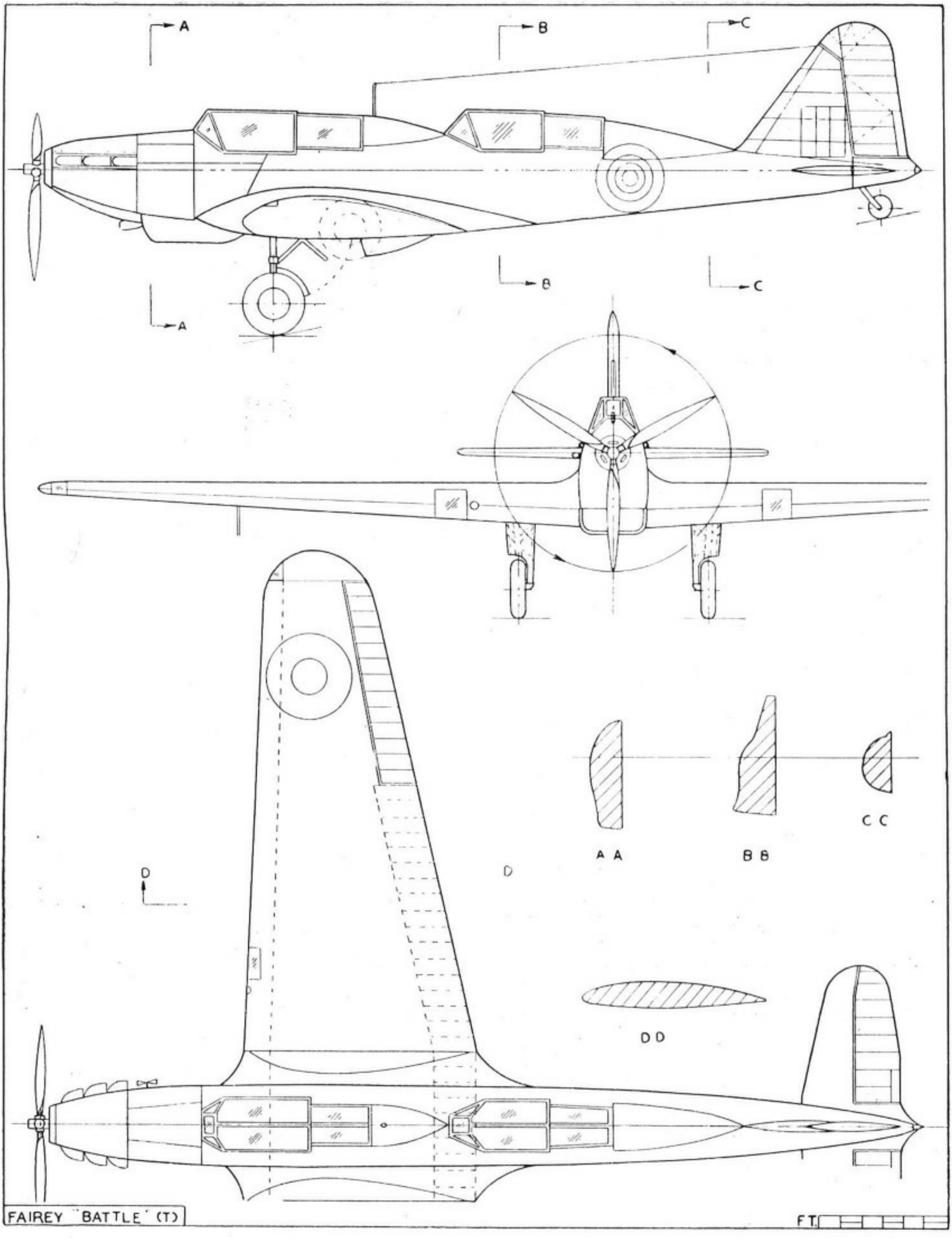
I started the job in a Battle and hastily switched to a Skua—the former called for too much herculean effort and I could never have kept it up. You could low-fly the Battle all right because it was heavy enough to ignore bumps, but I didn't possess the Popeye forearm which was absolutely necessary to heave the thing round obstructions.

Perhaps this is not fair criticism since the Battle was not designed for this sort of work, but neither was the Skua and *she* kept the Army ducking. I hope it taught them (as it was intended to) that movement could be easily spotted from the air and that diving and strafing aircraft represented a considerable hazard. (They never learned, though, that putting bits of twigs on their tin-hats only made them look like soldiers with bits of twigs on their tin-hats—but camouflage arguments have no place here.) Certainly I learned something about the difficult art of low-flying strafing which undoubtedly helped me on many future occasions.

Shortly after came Dunkirk and I flew on Operation Flash—previously described in "Ghost Fighters over Dunkirk." There were two of us, Cliff Rendle and myself, and our job was to tow lighted flares up and down the Belgian and Dutch coastline to look for E-boats. We were accompanied by bomb-laden Ansons or Swordfish whose job was to clobber this possible interference to our "organised withdrawal." The funny part is that we did, in fact, prang one enemy ship.

Cliff flew a Battle on that show and I picked my favourite Skua. Afterwards we each swore that we only survived because of the suitability of our respective aircraft. I suppose one can say it's an ill slipstream that doesn't blast a bit of good—even if it's from a variable-pitch spinnerless airscrew.

After all, we did both survive! ●


A
B
C
A A
B B
C C
D
D D
FAIREY "BATTLE" (T)
FT.

Manufacturers : Fairey Aviation Co., Ltd. (of Hayes, Middlesex) at the Stockport factory, Cheshire.

Purpose : Two-seat advanced single-motor trainer and target-towing aircraft.

Power Plant : One Rolls-Royce Merlin III liquid-cooled Vee motor, maximum level power, 1,030 h.p. at 3,000 r.p.m. at 16,250 ft. ; cruising rating, 728 h.p. at 15,000 ft. ; take-off, 890 h.p. at 3,000 r.p.m. at sea level.

Construction : Wings—Two-spar type with stressed-skin covering. Split trailing edge flaps. Fabric-covered ailerons. Fuselage—Metal monocoque with " Z "-section stringers and stressed-skin covering. Tail unit—Light alloy structure with stressed-skin covering. Fabric-covered control surfaces. Undercarriage—Backwards retracting type with two cantilever oleo legs. Portion of lower wheel exposed when in the fully retracted position. This enables a forced landing to be made with the wheels up with little risk of extensive damage. Lockheed actuation. The target-towing versions have an additional housing beneath the lower rear fuselage for the drogue cable stowage. De Havilland constant-speed three-bladed airscrew.

Dimensions : Span, 54 ft. Length, 42 ft. 1¾ in. Height, 15 ft. 6 in.

Areas : Wings, 422 sq. ft.

Weights : Empty, 6,650 lb. Loaded, 10,700 lb.

Loadings : Wings, 25·4 lb./sq. ft. Power, 12 lb./h.p.

Tankage : Fuel, ~~290~~ gallons. 212 G

Performance : Maximum speed, 240 m.p.h. at 17,500 ft. ; operating speed, 190 m.p.h. ; initial climb, 900 ft./min. ; service ceiling, 25,000 ft. ; range at operating speed, 950 miles ; endurance, 5 hours.

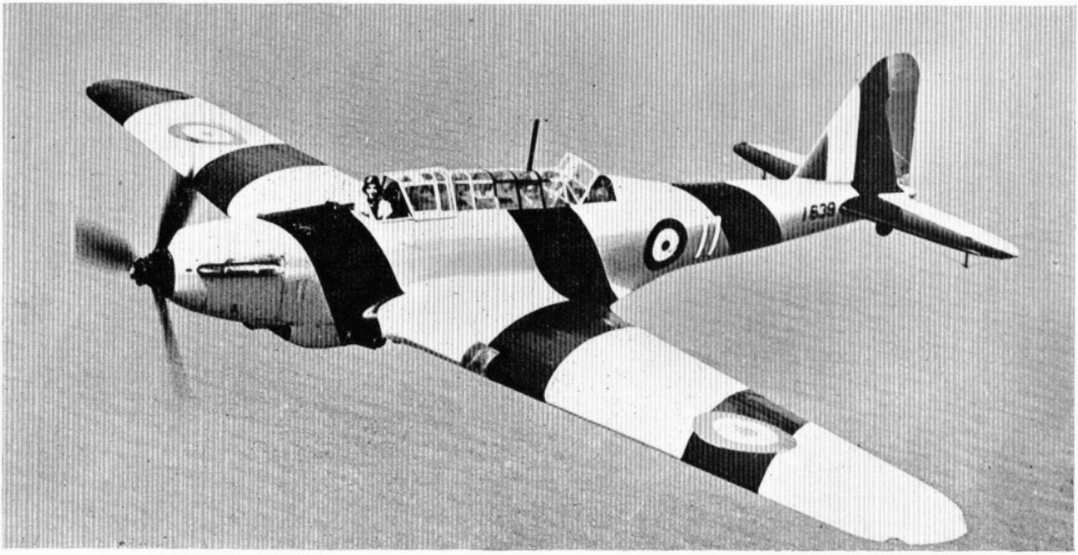


Photo by courtesy of Sport & General, Ltd.

In its medium bomber version, the Battle I has figured in some glorious chapters of service history and will be remembered for its wonderful performance during the German advance into the Netherlands, Belgium and France, in May, 1940, and its devastating attacks on the invasion ports in the late summer and autumn of the same year. Battle squadrons of the A.A.S.F. which had been employed on reconnaissance and photographic duties throughout the first winter of the War were at once thrown against the German mechanised columns and amongst the many courageous low-flying attacks in the face of severe anti-aircraft fire and swarms of fighters, the most outstanding is the attack on the Maastricht Bridge by five Battles of No. 12 (B) Squadron. Only one machine returned; F./O. Garland and Sgt. Gray who led the formation were each posthumously awarded the Victoria Cross. Other squadrons equipped with the Battle serving in France were :—Nos. 88, 103, 105, 114, 142, 150, 218, and 226.

Some Battles were returned to the Fairey factory for conversion, and the Battle (T) emerged with the separate cockpit covers in place of the long " greenhouse " of the bomber in a manner resembling the original Vickers Wellesley.

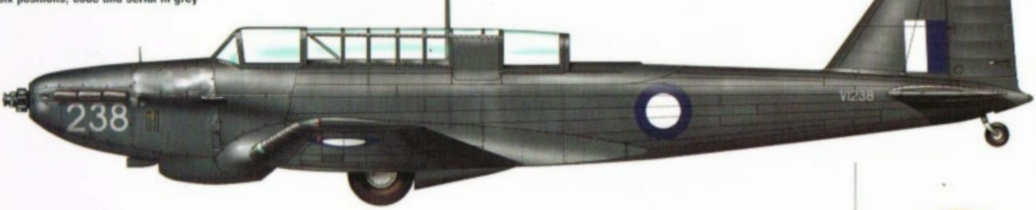
A Merlin III motor is fitted to the Battle (T) and dual control has been incorporated, the instructor occupying the rear cockpit.

Another use of the Trainer Battle is target-towing. Target-towing Battles are " on charge " at most Armament Training Schools and a number of them do not have the divided cockpits but retain the old type, as shewn above.

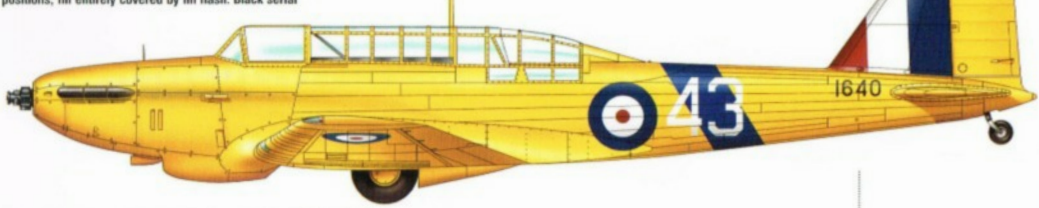
A Battle (T) with divided cockpits in service at one Flying Training School has the serial number P6750 on the sides of the fuselage and beneath the wings. Trainers from another School are numbered L5004 and L5258, the former machine having the identification marking " 4 " and the other the letter " B." A Battle I forming part of the equipment of an operational unit had the serial number L5596 and was duck-egg blue underneath with no markings. On the fuselage the squadron letters RH appeared behind the roundels and the individual letter of the machine was A.

Fairey Battle Target Tug, L5734, No.5 Bombing and Gunnery School (RAAF), summer 1942. Yellow overall with diagonal black stripes, black horizontal tail surfaces with yellow moving areas; 'A' type roundels on fuselage sides and under wings, 'B' type above wings. Serial repeated in black under wings, with yellow areas where serial overlaps black bands

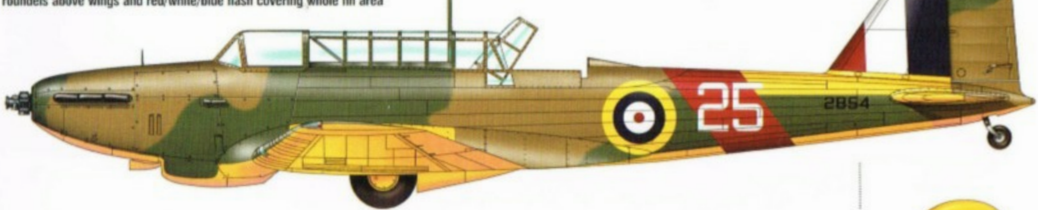
Fairey Battle, V1238/238, West Sale Air Gunnery School (RAAF), December 1942. Black overall with standard blue/white roundels in six positions; code and serial in grey



Fairey Battle Mk I, 1640/43, No.1 Bombing and Gunnery School (RCAF), Jarvis (Ontario, Canada). Yellow overall with a blue diagonal band around the fuselage; white code '43'. 'A' roundels in six positions; fin entirely covered by fin flash. Black serial



Fairey Battle Mk I, 2854/25, No.8 Bombing and Gunnery School (RCAF), Lethbridge, Alberta, Canada. Dark Green/Dark Earth upper surfaces with yellow undersides, rectangular patches on top of the wings, rear fuselage decking and fixed area of horizontal tail surfaces; white '25' superimposed on a red diagonal band around rear fuselage. 'B' type roundels above wings and red/white/blue flash covering whole fin area



Fairey Battle (T), 1955/60, RCAF. Yellow overall with white diagonal band on rear fuselage; code and serial in Ident Blue (bright). Markings in bright ident colours

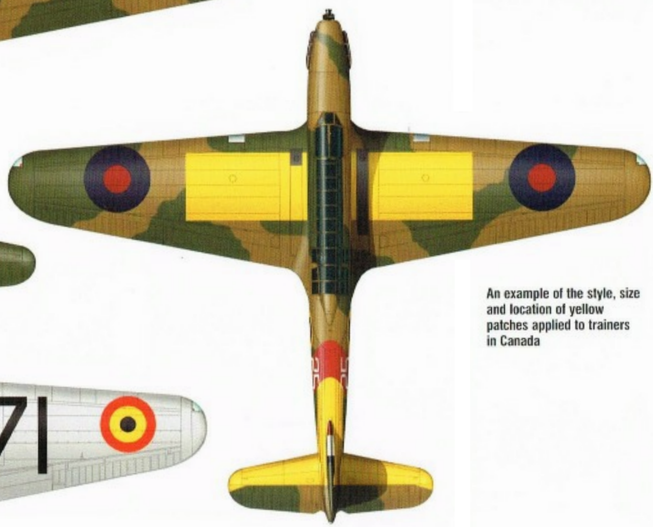
Scale 1:72 Colour Art © Richard J. Caruana

Underwing serials in Bright White on Night undersurfaces

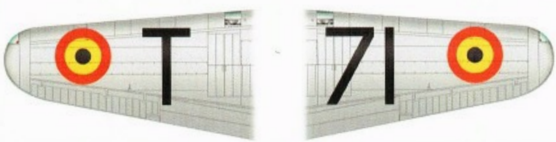
RAF upper camouflage pattern with Type A1 roundels

Upper camouflage pattern with Type B roundels

Belgian Air Force upper camouflage pattern and roundel position



An example of the style, size and location of yellow patches applied to trainers in Canada



Belgian Air Force underwing roundels and codes

Scale 1:144 Colour Art © Richard J. Caruana