Research Notes on the

Supermarine Spitfire

Compiled by John Griffin

Part 1/3

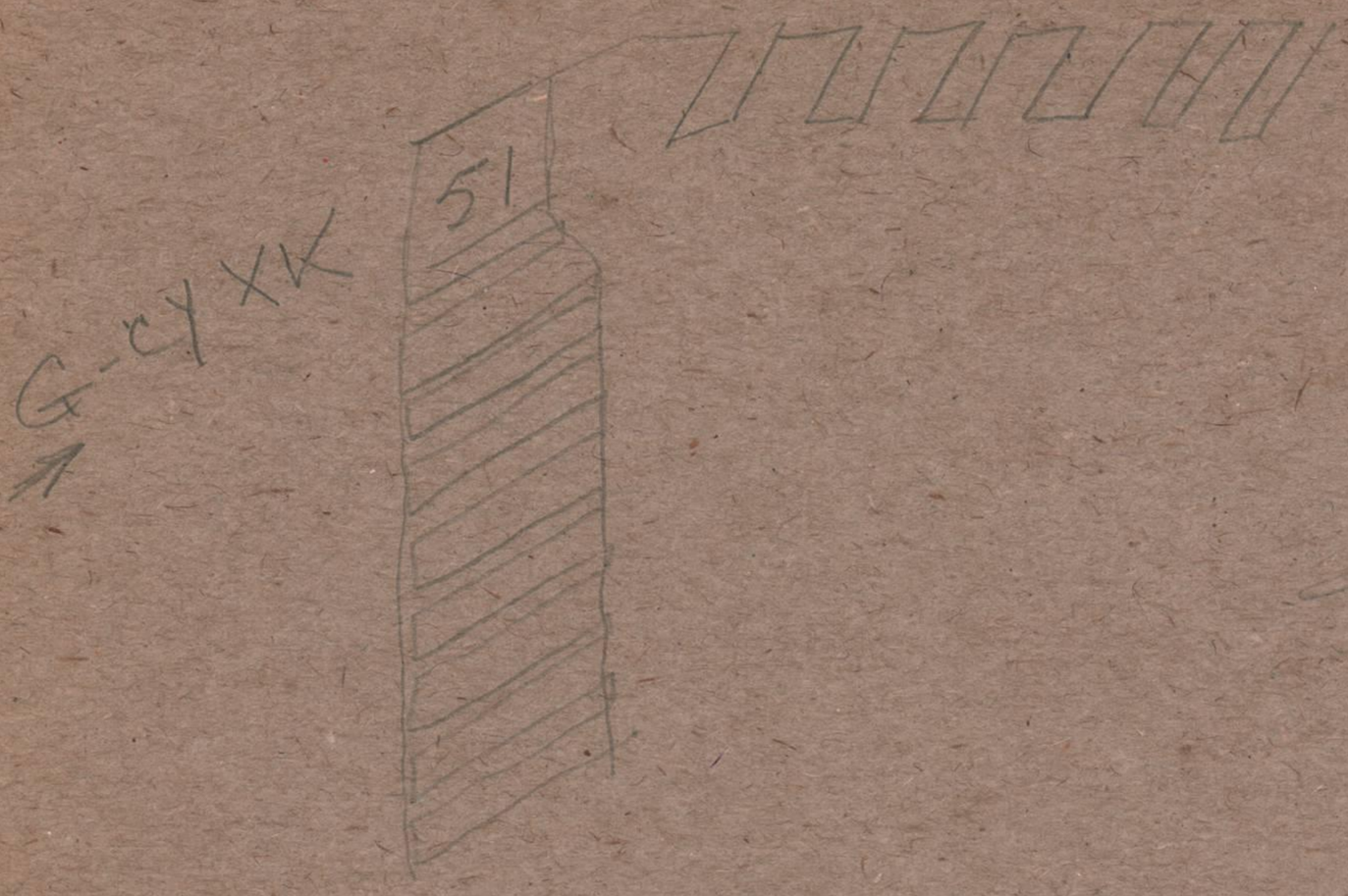
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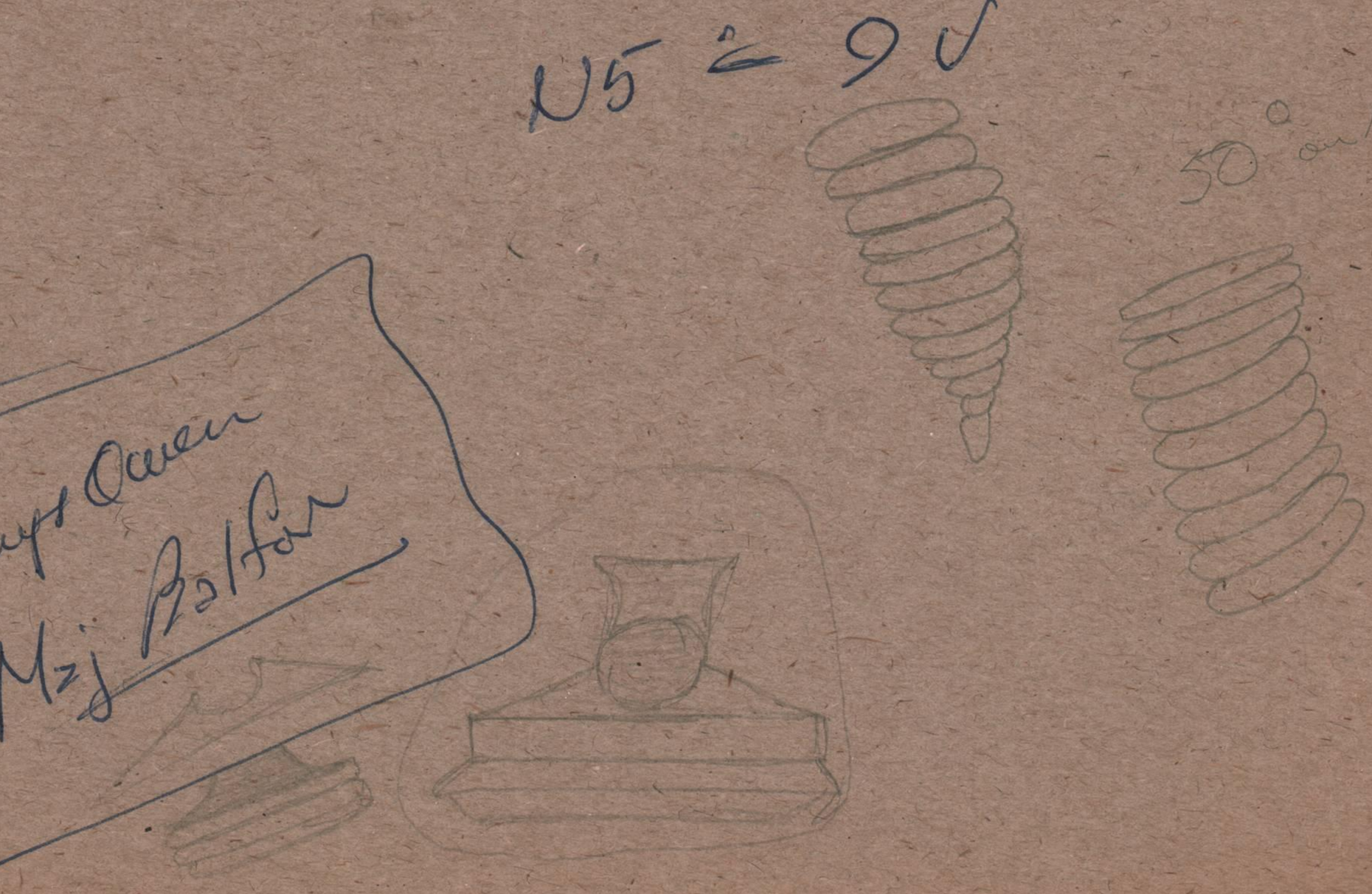
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60 Lloyd Dunsmore

Doug Peck-Vancouver



Please note address. 17, Park Hill,
Old Harlow,
Essex,
ENGLAND.

22nd March 1971.

R.F.Corley, Esq.,
490, Albertus Ave,
Peterborough,
Ontario,
CANADA.

Dear Mr Corley,

Thank you very much for your letter of the 25th February, only just received, please forgive the delay but we have had a mail strike over here since mid January.

It was very pleasant to hear from someone in Canada, in particular in connection with Spitfires, for I have not had any contacts in your country since the early 1960's.

I shall be pleased to help you with the Spitfire queries and have answered them to the best of my knowledge and information available, on the attached sheet.

I wonder if, either you or Mr Griffin or Ellis could help me with some information on Spitfires and Seafires that are and have been in Canada. I have almost all the is to know about the three 'Museum' aircraft NH.188, TE.214 & P.8332 from both RCAF, RAF and Museum sources, but of course if you have any other details I would be very pleased to hear of them.

There have been many other Seafires and a few Spitfires in Canada over the years and the disposition of the former has always been of interest to me. We have yet to find out the exact list of serials and of course what has happened to them. I will comment more on this point later in this letter.

I have the feeling that some of the RCN Seafires have found their way to the USA, in the same way of some Sea Furys and a photo of one of these is in the "Aero Series" on the Spitfire by Ed Maloney. I would very much like to get to the bottom of the whole RCN Seafire question, and would welcome any details you might be able to give me.

IRISH AIR CORPS SPITFIRES.

The Six aircraft were bought by the IAC from Vickers Armstrongs Ltd in 1951 having been converted at South Marston from ex RAF Stock Mark IX airframes, and had the serials in batch 158-163. The Type designation V.S.509 Spitfire Trainer 9 or Tr.9. Designation T.Mk.IX or T.Mk.9 are not correct.
~~158~~X

158, c/n CBAF.7722 Ex RAF LF.Mk.IXc MJ.627. Bought from IAC 1963 by Film Aviation Services at Biggin Hill Kent. Unconverted and in parts only stored and sold Sept 1964 to Mr T.A.Davies, having been registered G-ASCZ by F.A.S.Ltd Feb 1964 when idea of rebuild to flying stated planned. Delivered Biggin Hill-Elstree where a/c put into store for Mr Davies flying Mk.Ix G-ASJV. Dec 1967 a/c delivered by road to store at Bossington House Hampshire under joint ownership of T.A.Davies/J.S.Fairey.

159 c/n CBAF.7269. Ex RAF LF.Mk.IXc MJ.772. Bought from IAC 1963 by Film Aviation Services Ltd at Biggin Hill. Unconverted and sold March 1964 to Compagnie Generale d/Exploitation Aerienne and airfreighted April 1964 Southend-Ostend, as part payment for HF.Mk.IXc Spitfire OO-ARB, later to become G-ASSD of F.A.S.Ltd. 159 bought from COGEA 65 by N.A.W.Samuelson Esq of London and freighted to Elstree for a rebuild by Simpsons Aero Services Ltd. 8-11-66 registered G-AVAV and test flown 7-67 by T.A.Davies. 1968/69 used in Battle of Britain film on lease to Spitfire Productions Ltd and belly landed 7/68. rebuilt 1969 at Bovingdon, and used 5/5/69 in London Shannon leg of Daily Mail Transatlantic Air Race. 1969 sold to W.J.D.Roberts Esq and rebuilt at Shoreham costing £10,000, forist flown 30.12.70 at Shoreham.

160. Crashed Eire in 1967.

161. c/n CBAF.9590. Ex RAF LF.Mk.IXc PV.202. Bought 1968 as part of a 3 aircraft sale for £5130 by N.A.W.Samuelson and freighted to London for store as spares for G-AVAV/G-AWGB. 69/70 sold to W.J.D.Roberts and stored near Tunbridge Wells in Kent.

162. c/n.CBAF.8643. Ex RAF LF.Mk.IXc ML.407. All details as for 161

163. c/n.CBAF.11432. Ex RAF LF.Mk.IX6.TE.308. Built as low rear fuselage Mk.XVI type aircraft on mixed Mark IX/XVI production line, with an 'e' type of wing, fitted with 'c'. type wing on conversion to Tr.9. Bought from IAC 1968 by N.A.W.Samuelson, and registered G-AWGB 4/4/68 Overhauled for ferry flight at Baldonnel Dublin by Simpsons Aero-Services Ltd and flown Baldonnel-Speke-Elstree 8/5/68 and Elstree-Henlow 9/5/68 for rebuild on lease to Spitfire Productions Ltd for use in the Battle of Britain Film as camera aircraft. 1970 sold by Mr Samuelson to W.J.D.Roberts Esq with No.159, 161 and 162, and flown Elstree-Shoreham. Sold 1970 to Mr Don Plumb of Canada and shipped by Sea, registered CF-RAF to Mr Plumb.

WINDSOR

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G.P.Trant
22-3-71.

COGEA Spitfires.

OO-ARA HF.Mk.IXb Bought 1964 by TA.Davies as G-ASJV,now owned by A.C.Swire.

OO-ARB HF.Mk.IXc Bought 1964 by Film Aviation Services Ltd,sold to Comfederate Air Force and flown in UK as G-ASSD,used in film and now in USA as N.1882.

OO-ARC. HF.Mk.IXc.Bought 1961 by Trans Global Aviation Supply Co Ltd and sold 1961 to Mr J.D.Patterson who registered CF-NUS,later in Military Mks as MH.188 AU-H.1964 presented to Canadian National Aeronautical Collection.

OO-ARD LF.Mk.IXb.Bought 1962 by Rousseau Aviation of Dinhard France, and stored as OO-ARD.Bought 1966 by Spitfire Productions Ltd and rebuilt to Flying condition as G-AVDJ at Elstree.Bought from S.P.Ltd by W.C.Edwards and freighted to Big Spring Texas USA.

OO-ARE HF.Mk.IXc.Bought 1961 by Tran s Global Aviation Supply Co Ltd and damaged during Air Race in UK as -ARE.Sold as static Museum piece to Taskers Of Andover(1932)Ltd for exhibition of 'Queen Mary' in private Museum.Bought in auction sale for £6300 in 1969 by T.H.Pasteur of Scotland,and sold again as MH.238 in 1970 to Roger Baker of the Confederate Air Force,to beregistered N.238.

OO-ARF.F.Mk.IXc.Bought 1963 by Cliff Robertson and air-frieghted by CL.44.D N.449 T to USA and registered N.93081 and in 1964 re-registered N.521R to Clif Robertson. At Santa Ana California.

OO-ARA/B/D/F were used in the film "The Longest Day".
OO-ARA/B/D were used in the film "The Battle of Britain".
OO-ARB was used in "The Night of the Generals",The Trip Across" and"Van Ryans Express"
OO-ARA.was used in"Operation Crossbow"

Mark VIII

The Two seat Spitfire to VS.Type No.502 was planned and a registration G-AKBD was allocated on the 14th July 1947 to Vickers Armstrongs Ltd and the c/n was given as 6S.730847.The RAF Serial Number of the aircraft involved has not been found,and although this conversion was planned and an aircraft allocated no actual work was carried out and the registration was cancelled on the 31st May 1948.

It has been reported that this second two seat Mark VIII aircraft was sold overseas,but it is thought that this is being confused with a two seat Mark 9 G-ALJM which was sold in Egypt in 1949.It is thought that more information on this subject will be found in due course.

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G.P.Trant.
22.3.71.

The Spitfires/Seafires I have listed in Canada are as follows:-

P.8332	Mk.IIb	Canadian War Museum, Ottawa.
NH.188	Mk.IX	National Museum of Canada Uplands.
TE.214	Mk.XVI	Canadian War Museum. Ottawa.
CF-RAF	Tr.9.	Windsor, Ontario.
	Vb	Ex Lyn Garrison, now Don Campbell Kapascuing.
unknown		Owned by Monty Armstrong in Canada.
Unknown		Owndd by Bob Diemart
PR.451	F.XV	Seafire RCN base Tecumseh Calgary.
Unknown		Seafire, thought SR.464 on display in Canada.

I have full details on the first three aircraft, and only lack a Canadian photo of CF-RAF, but of the other aircraft I have very little as you will see from the listing, any information would be of very great help.

I shall be pleased to help in any way I can with other Spitfire information, and look forward to hearing in due course,

Yours sincerly,

Graham.P.Trant.

(*c*) In either case the flap control should immediately be returned to the **UP** position in order to allow sufficient pressure to build up, so that a landing can be made with the brakes working but without flaps.

NOTE.—As a safeguard pilots should always check the pneumatic pressure supply after selecting flaps DOWN.

60. **First-aid outfit.**—The first-aid outfit is accessible through a hinged panel on the starboard side of the fuselage.

61. **Crowbar.**—A crowbar (29) for use in an emergency is stowed on the left-hand side of the cockpit.

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Spit F Mk XIV

PART I

DESCRIPTIVE

INTRODUCTION

1. The Spitfire F.Mk.XIV is fitted with a Griffon 65 engine (some early aircraft have a Griffon RG5SM engine), having two-speed two-stage supercharging and a Bendix-Stromberg carburettor. The propeller is a Rotol 35° five-blader. The aircraft is fully tropicalised and the controls, including the undercarriage, flaps and brakes, are identical with those on earlier Marks.

FUEL, OIL AND COOLANT SYSTEMS

2. **Fuel tanks** (*see* Fig. 4).—Fuel is carried in four tanks, two (one above the other) forward of the cockpit and one in each wing. The lower main tank and wing tanks are self-sealing. The top tank feeds into the lower tank and fuel in the wing tanks is transferred to the top tank by means of air pressure, through a transfer valve controlled by the pilot. It is delivered to the carburettor, through a filter, by an engine-driven pump. The de-aerator in the carburettor is vented to the top tank.
The tank capacities are as follows:

Top tank	36 gallons
Bottom tank	49 gallons
2 Wing tanks (13 gallons each) ..	26 gallons
Total	111 gallons

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An auxiliary drop tank of 30, 45 or 90 gallons capacity can be fitted under the fuselage. To meet the possibility of engine cutting due to fuel boiling in warm weather at high altitudes the tanks can be pressurised (operative above 20,000 feet). Pressurising, however, impairs the self-sealing of tanks and should, therefore, be turned off in the event of a tank being holed.

57. **Forced landing.**—In the event of having to make a forced landing, the glide may be lengthened considerably (provided oil pressure has not been lost) by moving the propeller speed control fully back and gliding at about 140 m.p.h. I.A.S. Just before touch-down, however, the lever should be moved fully forward in order to shorten the landing run. With flaps UP the approach should be made on a gentle turn. The cockpit hood should be opened and the door put on the catch. The drop tank (if fitted) should be jettisoned, but only in straight flight.

58. **Ditching**
(*See* A.P.2095, Pilot's Notes General)

(i) In general, the pilot should if possible abandon the aircraft by parachute.

(ii) In the event of having to ditch, the auxiliary drop tank (if fitted) should be jettisoned, but only in straight flight, and the following procedure should be observed:
(*a*) The cockpit hood should be jettisoned.
(*b*) Flaps should be lowered in order to reduce landing speed as much as possible.
(*c*) The undercarriage should be retracted.
(*d*) Safety harness should be kept on, with straps tight, and the R/T plug disconnected.
(*e*) The engine, if available, should be used to help make the touch-down in a tail-down attitude at as low a speed as possible.
(*f*) Ditching should be along the wave crests or wave tops.

59. **Failure of pneumatic system**

(*a*) If the flaps fail to lower when the control is moved to the DOWN position, it is probably due to a leak in the pipe line, resulting in complete loss of air pressure and consequent brake failure.
(*b*) Alternatively, if a leak develops in the flap control system the flaps will lower, but complete loss of air pressure will follow and the brakes will become inoperative. (In this case a hissing sound may be heard in the cockpit after selecting flaps DOWN.)

PART IV

EMERGENCIES

55. **Undercarriage emergency operation**

(i) If the lever jams and cannot be moved to the fully down position after moving it out of the gate, return the lever to the fully forward position for a few seconds, to take the weight of the wheels off the locking pins and allow them to turn freely, then move it to the DOWN position.

(ii) If, however, the lever is jammed so that it cannot be moved either forward or downward, it can be released by taking the weight of the wheels off the locking pins either by pushing the control column forward sharply or inverting the aircraft. The lever can then be moved to the DOWN position.

(iii) If the lever springs into the gate and the indicator shows that the undercarriage is not locked down, hold the lever fully down for a few seconds. If this is not successful, raise and then lower the undercarriage again.

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(iv) **If the undercarriage still does not lock down, ensure that the lever is in the DOWN position (this is essential) and push the emergency lever (68) forward and downward through 180°.** (The CO_2 cylinder will lower only the main wheels, not the tailwheel.) It should not be returned to its original position and no attempt must be made to raise the undercarriage until the emergency bottle has been replaced.

NOTE.—If the CO_2 cylinder has been accidentally discharged with the undercarriage selector lever in the up position, the undercarriage will not lower unless the pipeline from the cylinder is broken, either by hand or by means of the crowbar.

56. **Hood jettisoning**

The hood may be jettisoned in an emergency by pulling the rubber knob inside the top of the hood in a forward and downward movement, and pushing the lower edge of the hood outboard with the elbows.

3. **Fuel cocks.**—The cock control for the main tanks is a lever (24) fitted below the engine starting pushbutton; the pressurising cock (65) is on the right-hand side of the cockpit, to the right of the seat. The transfer valve selector cock (41), for admitting pressure to either wing tank, is below and slightly forward of the throttle quadrant. It is important that this cock be turned to the NORMAL position after use or pressurising of the main tanks will not be effective. The cock control (75) and jettison lever (73) for the auxiliary drop tank are mounted together on the right-hand side of the cockpit, below the undercarriage control unit. The jettison lever is pulled up to jettison the drop tank, but cannot be operated until the cock control is moved forward to the OFF position.

4. **Fuel pumps.**—A hand wobble pump (78) for raising fuel pressure before starting is fitted just below the signalling switch box (79). On later aircraft this pump is replaced by an electric booster pump, operated by a switch (49) on the electrical panel. A test pushbutton (48) is also provided. The electric pump, if fitted, should be left on in flight.

NOTE.—The fuel cut-off lever must be in the fully aft position before the pump is operated with the engine stationary.

5. **Fuel contents gauge and warning light.**—The contents gauge (20) on the right-hand side of the instrument panel has two dials, one for the top tank and another for the bottom tank. A red mark (at 60 gals.) on the former indicates the level of fuel at which fuel should be transferred from the wing tanks. The fuel pressure warning light (21), below the oil pressure gauge, comes on when pressure drops to 10 lb./sq.in.; it is switched off by the undercarriage indicator switch.

6. **Oil system.**—Oil is supplied by a tank of 9 gallons oil capacity, and 3 gallons air space, housed between the upper fuel tank and the fireproof bulkhead. The tank is pressurised to 2½ lb./sq.in. and the oil passes through a filter before entering the engine. A cooler is fitted inside the fairing of the port wing radiator and oil pressure (19) and temperature (18) gauges are fitted on the instrument panel.

7. **Engine coolant system.**—The system is thermostatically controlled, the under-wing radiators being by-passed until the coolant reaches a certain temperature. The header tank is mounted above the reduction gear casing and is fitted with a relief valve. The radiator flaps are fully automatic and are designed to open at a coolant temperature of 115° C. A pushbutton on the electrical panel is fitted for ground testing, and there is a coolant temperature gauge (17) on the instrument panel.

MAIN SERVICES

8. **Hydraulic system.**—Oil is carried in a reservoir on the fireproof bulkhead and passes through a filter to an engine-driven pump for operation of the undercarriage and tailwheel.

9. **Electrical system.**—A 12-volt generator supplies an accumulator which in turn supplies the whole of the electrical installation. A voltmeter (11) across the accumulator is fitted at the top of the instrument panel and a red light (53) on the electrical panel, marked **POWER FAILURE**, is illuminated when the generator is not charging the accumulator.

NOTE.—If the electrical system fails or is damaged the supercharger will be fixed in M ratio and the radiator flaps will remain closed.

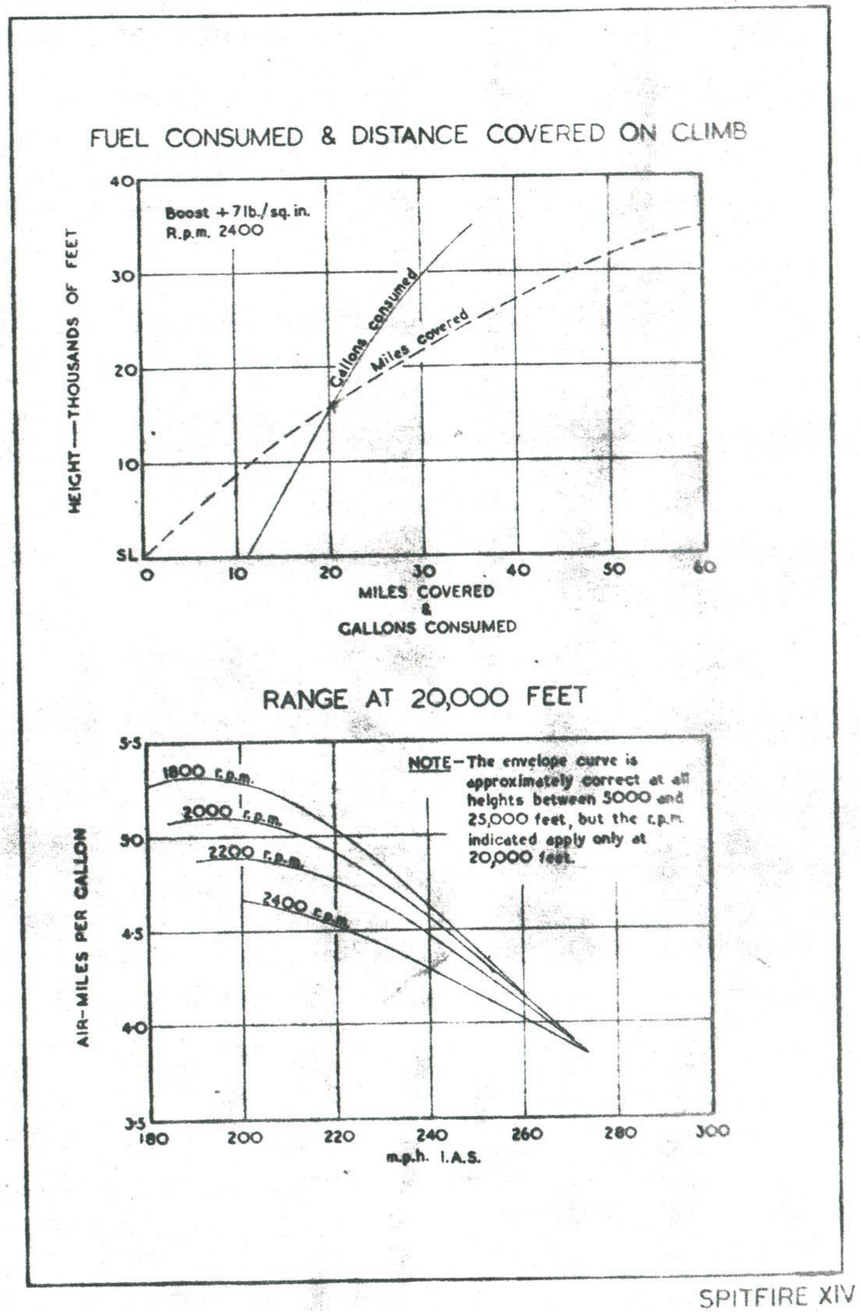
10. **Pneumatic system.**—An engine-driven air compressor feeds two storage cylinders for operation of the flaps, radiator flaps, supercharger operating ram, brakes and guns. The cylinders each hold air at 300 lb./sq.in. pressure.

NOTE.—If the pneumatic system fails, the supercharger will be fixed in M ratio, but the position of the radiator flaps will depend on the nature of the failure. The flaps and brakes will also be inoperative (*see* para 59).

AIRCRAFT CONTROLS

11. **Flying controls.**—The control column is of the spade-grip pattern and incorporates the brake lever (28) and gun and cannon firing control. The rudder pedals (42 & 76) have two positions and are adjustable for leg reach by rotation of star wheels (43) on the sliding tubes.

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(ii) *Cruising.*—Set the supercharger override switch to AUTO and the propeller speed control to 1,800 r.p.m. and obtain the desired speed by adjusting boost up to +7 lb./sq.in. If the desired speed cannot be obtained, increase r.p.m. as necessary up to 2,400. The recommended speed for maximum range is 200–210 m.p.h. I.A.S.

54. **Fuel capacities and consumption**

(i) *Normal fuel capacity:*

Top tank	36 gallons
Bottom tank	49 gallons
Two wing tanks (13 gallons each)	26 gallons
Total ..	111 gallons

(ii) *Long-range fuel capacities:*

With 30-gallon drop tank	141 gallons
With 45-gallon drop tank	156 gallons
With 90-gallon drop tank	201 gallons

(iii) *Fuel consumption (approx. galls./hr.):*

(*a*) Weak mixture (as obtained at +7 lb./sq.in boost and below) and M ratio at 5,000 feet:

Boost lb./sq.in.	R.p.m.			
	2,400	2,200	2,000	1,800
+7	88	85	80	—
+4	74	71	67	60
+2	65	63	59	52
0	57	55	51	46
−2	50	47	43	41

NOTE.—For every 5,000 feet increase in height *add* 4 gal./hr.

(*b*) Weak mixture (as obtained at +7 lb./sq.in. boost and below) and S ratio at 20,000 feet:

Boost lb./sq.in.	R.p.m.			
	2,400	2,200	2,000	1,800
+7	95	92	87	—
+4	82	78	74	70
+2	73	70	66	63
0	66	63	59	56
−2	59	56	52	49

(*c*) Rich mixture (as obtained above +7 lb./sq.in. boost) and M ratio at 5,000 feet:

Boost lb./sq.in.	R.p.m.	Gals. hr.
+18	2,750	180
+12	2,750	130
+9	2,600	103

12. **Trimming tabs.**—The elevator trimming tabs are controlled by a handwheel (55) on the left-hand side of the cockpit, the indicator (27) being on the instrument panel. The rudder balance-trimming tab is controlled by a small handwheel (54) and is not provided with an indicator. The aircraft tends to turn to starboard when the handwheel is rotated clockwise.

13. **Undercarriage control.**—The undercarriage selector lever (74) moves in a gated quadrant on the right-hand side of the cockpit.

To raise the undercarriage the lever must be moved downwards and across, to disengage it from the gate, and then moved forward to the full extent of the quadrant. When the undercarriage operation is completed the lever will automatically spring into the forward gate.

To lower the undercarriage, the lever must be held forward for about two seconds, then pulled back in one movement to the full extent of the quadrant. When the undercarriage is down, the lever will spring into the rear gate.

The lever must never be moved into either gate by hand as this will cut off the hydraulic pressure. An indicator in the quadrant shows DOWN, IDLE or UP, depending on the position of the hydraulic valve. UP and DOWN should show only during the corresponding operation of the undercarriage, and IDLE when the lever is in either gate. If, when the engine is not running, the indicator shows DOWN, it should return to IDLE when the engine is started; if it does not, probable failure of the hydraulic pump is indicated. For emergency lowering of the undercarriage *see* para. 55.

14. **Undercarriage indicator.**—The electrically operated visual indicator (6) has two semi-transparent windows on which the words UP on a red background and DOWN on a green background are lettered; the words are illuminated according to the position of the undercarriage. The master switch (4) incorporates a sliding bar which prevents the ignition switches from being switched on until the indicator is illuminated. The master switch also operates the tailwheel indicator light (5) and the fuel pressure warning light.

15. **Flap control.**—The split flaps have two positions only, up and fully down. They are controlled by a finger lever (9) on the instrument panel.

16. **Wheel brakes.**—The brake lever is fitted on the control column spade grip and a catch for retaining it in the on position for parking is fitted below the lever pivot. A triple pressure gauge (2), showing the air pressures in the pneumatic system cylinders and at each brake, is mounted on the instrument panel.

17. **Flying control locking struts.**—Two struts (63) are stowed on the right-hand side of the cockpit, aft of the seat. The longer strut and the arm attached to it lock the control column to the seat and to the starboard datum longeron, and the shorter strut, attached to the other strut by a cable, locks the rudder pedals. The controls should be locked with the seat in its highest position.

ENGINE CONTROLS

18. **Throttle.**—The throttle lever (34) is gated at the take-off position. The mixture control is fully automatic and there is no pilot's control lever. The short lever (40) on the inboard side of the quadrant is a friction adjuster for the throttle and propeller control levers; forward movement increases the friction damping or locking.

NOTE.—The throttle box is of a new type, having a larger range of travel of the throttle lever, and in comparison with that on earlier Marks the lever must be advanced considerably more for a corresponding increase of boost.

19. **Propeller control.**—The speed control lever (39) on the throttle quadrant varies the governed r.p.m. from 2,750 down to below 1,800. Speeds below this figure should, however, not be used except in the event of a forced landing when it is necessary to lengthen the glide.
Later aircraft will have the throttle and propeller speed control interconnected. Such aircraft will retain the propeller speed control lever in the cockpit, but in addition to its normal function the lever will effect the interconnection. With the interconnection in operation (the

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(ii) *Restrictions:*

(*a*) Take-off with three bombs or a drop tank and bombs fitted should be made from a smooth runway.

(*b*) Spinning and aerobatics are not permitted and violent manœuvres must be avoided when any bomb load is carried, or when a 90-gallon drop tank is carried. Spinning is not permitted with any drop tank.

(*c*) Before commencing dive-bombing, the 90-gallon drop tank (if carried) must be jettisoned.

(*d*) The angle of dive when releasing a bomb or bombs must not exceed 60°.

(*e*) Except in an emergency the fuselage bomb or drop tank should be jettisoned before landing with wing bombs fitted.

NOTE.—For restrictions when jettisoning a drop tank *see* Para. 32 (i).

51. **Position error corrections.**

From	130	160	180	210	240	260	300	340	380	m.p.h. I.A.S.
To	160	180	210	240	260	300	340	380	420	
Add	4	2	0	—	—	—	—	—	—	m.p.h.
Subtract	—	—	0	2	4	6	8	10	12	

52. **Maximum Performance**

(i) The speeds for maximum rate of climb are as follows:

From S.L. to 22,000 feet	175 m.p.h. I.A.S.
At 27,000 feet	160 m.p.h. I.A.S.
At 32,000 feet	145 m.p.h. I.A.S.
At 37,000 feet	130 m.p.h. I.A.S.
At 42,000 feet	115 m.p.h. I.A.S.

For intermediate heights reduce speed by 3 m.p.h. per 1,000 feet.

(ii) On a combat climb the supercharger will automatically change to S ratio at 14,500 feet, but under normal climbing conditions (2,600 r.p.m. and +9 lb./sq.in. boost) the maximum rate of climb is obtained by delaying the gear change until the boost has dropped to +5 lb./sq.in. To do this, fly with the over-ride switch in the M.S. position until this boost is reached.

(iii) Use of the air-intake filter considerably reduces the full throttle height.

53. **Economical Flying**

(i) *Climbing.*—Climb at 2,400 r.p.m. and +7 lb./sq.in. boost at the speeds recommended for maximum rate of climb. (*See* Para. 52.)

PART III

OPERATING DATA

49. **Engine Data:** Griffon 65 and Griffon RG.5.SM.

(i) *Fuel.*—100 octane only.

(ii) *Oil.*—See A.P.1464/C.37.

(iii) *Engine limitations*

		R.p.m.	Boost lb./sq.in.	Temp. °C. Clnt.	Oil
MAX. TAKE-OFF TO 1,000 FEET	M	2,750	+12	—	—
MAX. CLIMBING 1 HR. LIMIT	M, S	2,600	+ 9	125	90
MAXIMUM CONTINUOUS	M, S	2,400	+ 7	105 (115)	90
COMBAT 5 MINS. LIMIT	M, S	2,750	+18	135	105

NOTE.—The figure in brackets is permitted for short periods.

IMPORTANT.—Combat boost must not be used at less than 2,600 r.p.m. and preferably only at 2,750 r.p.m.

OIL PRESSURE:
- NORMAL .. .. 60–80 lb./sq.in.
- MINIMUM .. .. 45 lb./sq.in.

MINM. TEMP. FOR TAKE-OFF:
- OIL .. .. 15° C.
- COOLANT: .. .. 60° C.

FUEL PRESSURE .. .. 16–18 lb./sq.in.

50. **Flying limitations**

(i) *Maximum speeds:*
- Diving .. .. 470 m.p.h. I.A.S.
- Undercarriage down .. .. 160 m.p.h. I.A.S.
- Flaps down .. .. 160 m.p.h. I.A.S.

propeller speed control lever moved to the Auto. fully aft position) r.p.m. will rise progressively with boost when the throttle is opened; the corresponding r.p.m. for a given boost at low altitudes will then be as follows:

Boost (lb. sq.in.)	R.p.m.
Up to − 4	1,800
At − 7	2,350
At − 9	2,500
At −12	2,750
At −18	2,750

The r.p.m., however, may be increased above these minimum values by operating the propeller speed control in the normal way; with it set to MAX. REVS. (fully forward) the propeller will be in fully fine pitch and r.p.m. will be governed at 2,750.

20. **Supercharger controls.**—The two-speed two-stage supercharger automatically changes to S ratio at about 14,500 feet on the climb. An override switch (14) is fitted on the instrument panel by means of which M ratio may be selected at any height. There is a pushbutton (47) on the electrical panel for testing the gear change on the ground, and a red light (15) on the instrument panel, next to the override switch, comes on when S ratio is engaged, on the ground or in flight.

21. **Radiator flap control.**—The pushbutton (46) for testing the radiator flaps is on the electrical panel.

22. **Fuel cut-off control.**—The fuel cut-off is operated by moving the spring-loaded lever (37) on the outboard side of the throttle quadrant to the fully aft position and engaging it in the gate.

23. **Cylinder priming pump and cock.**—A Ki-gass, Type K.40, pump (77) for priming the engine is fitted immediately forward of the undercarriage control quadrant. The priming selector cock (59) just aft of the wobble pump is marked MAIN, GROUND and ALL OFF. The first position is used for priming with normal fuel from the main fuel tanks, and the GROUND position for priming with High Volatility fuel from an outside source in cold weather. In flight the cock must be in the ALL OFF position.

24. **Ignition switches.**—These (3) are on the left-hand side of the instrument panel. They cannot be moved to the on position until the undercarriage indicator switch is switched on.

25. **Cartridge starter.**—The Coffman starter breech control is a pull-grip toggle (22) below the right-hand side of the instrument panel. The magazine for the starter holds five cartridges which are fired by the engine-starter pushbutton (23). This also operates the booster coil.

26. **Hand starting.**—No provision is made for hand starting of the engine.

27. **Carburettor air intake control.**—The NORMAL INTAKE (aft position of control lever (44)) is not filtered and is used at all times except for take-off and landing on sandy or dusty aerodromes, or when flying through sand storms, when the FILTER IN OPERATION position should be used. Filtered air is then taken from the engine bay.

28. **Oil dilution.**—The pushbutton (45) for operating the solenoid valve is on the electrical panel.

OPERATIONAL EQUIPMENT AND CONTROLS

29. **Guns and cannon.**—The machine guns and cannon are fired pneumatically by means of the pushbutton (1) on the control column spade grip. The compressed air supply is taken from the same source as the brake supply, the available pressure being shown on the gauge.

30. **Bomb release controls.**—The bomb master switch (32) and fusing switch (31) are mounted together on the left-hand side of the cockpit, just forward of the door. The bomb release pushbutton (38) is incorporated in the top of the throttle lever.

OTHER CONTROLS

31. **Cockpit door.**—The cockpit door is provided with a two-position catch (30) which allows it to be partly opened and so prevent the hood from sliding shut when taking-off and landing, and in the event of a forced landing. It will be found that the catch operates more easily when the aircraft is airborne than when on the ground.

48. **Beam approach**

Aircraft Type Spitfire XIV	Preliminary Approach	Inner Marker on Q.D.R.	Outer Marker on Q.D.M.	Inner Marker on Q.D.M.
Indicated height* (ft.)	1,500	1,000	700–800	150
Action	Reduce speed	Lower u/c.	Lower flaps	Throttle back slowly and commence hold-off
Resultant change of trim	Slight nose down and left yaw	Nose down	Initially nose up. Finally slight nose down	Slight nose down
I.A.S.	170	160	115–120	110
R.P.M.	2,400	2,400	2,750	2,750
Boost (Level flight) (approx.)	−4	−4	−2	—
Boost (−500 ft./min.) (approx.)	−5	−5	−4	—

* Altimeter adjusted for Q.F.E. and touch-down error as follows:
At take-off, with no flap, the altimeter reads −50 feet.
At touch-down, with flaps down, the altimeter reads −80 feet, so *add* 2·7 millibars to Q.F.E. to give zero reading at touch-down.

OVERSHOOT
Open up to +6 boost.
Retrim
Raise u/c.
Raise flaps at 400 feet after trimming nose heavy.

Aircraft can be held straight on rudder at +6 boost.

45. **Approach and landing**

(i) Approach speeds in m.p.h. I.A.S. at 8,375 lb.:

		(flaps up)
Engine assisted	100	(110)
Glide	110	(115)

NOTE.—In all cases speed may be reduced by 5 m.p.h. when cannon ammunition or considerable fuel has been expended.

(ii) The angle of glide is rather steep and the rate of descent rapid; it is important, therefore, to maintain speed constant, particularly after increasing r.p.m. Very little engine is required to stop sink, but if the engine is throttled right back or has failed the rate of descent is rapid. If the engine has failed, the propeller speed control can be used to regulate the rate of descent (provided oil pressure has not been lost).

46. **Mislanding**

(i) On opening up, the aircraft can be held straight by the rudder; it is not necessary, therefore, to use the trimming tab.

(ii) Raise the undercarriage.

(iii) Climb at about 160 m.p.h. I.A.S. with flaps fully down.

(iv) Raise flaps at a safe height of about 300–400 feet.

(v) Retrim.

47. **After landing**

(i) Raise the flaps before taxying.

(ii) To stop the engine, idle for ½ minute at 800–900 r.p.m., then move the fuel cut-off control to the fully aft position. If fitted with an electric booster pump switch it off.

(iii) Turn OFF the fuel cock and switch OFF the ignition.

(iv) *Oil dilution.* (See A.P.2095)

The correct dilution period for this aircraft is:

Atmospheric temperature *above* —10° C: 1 minute

Atmospheric temperature *below* —10° C: 2 minutes

PART II

HANDLING

32. Management of fuel system

A.L.2 Part II Para. 32 (i)

32. Management of Fuel System (for P.R. Mk. XIX aircraft, *see* pages 2A and 2B)

(i) *Flying restrictions:*

(*a*) When fitted with a 90-gallon drop tank the aircraft is restricted to "straight" flying until the tank is jettisoned.

NOTE.—This restriction does not apply when fitted with a 30- or 45-gallon drop tank.

(*b*) Drop tanks should be jettisoned only in straight flight and at a speed of not more than 300 m.p.h. I.A.S.

Main fuel system:

(*a*) Start and warm up on the main tanks.

(*b*) Take-off on the main tanks and when the contents of the top tank drop to the red mark on the contents gauge, fuel should be transferred from one of the wing tanks. The transfer valve selector cock should be turned to NORMAL after three minutes.

(*c*) Repeat the above procedure with the second wing tank after an interval of two minutes and then turn the selector cock to NORMAL after three minutes. It is important to leave the transfer selector cock in the NORMAL position, or pressurising of the main tanks will not be effective.

When fitted with a drop tank:

(*d*) Start, warm up and take-off on the main tanks and change over to the drop tank at a safe height (say 2,000 feet). Turn OFF the main tanks.

(*e*) At low altitudes the drop tank should not be completely emptied. At a safe height, when the fuel pressure warning light comes on, turn OFF the drop tank and turn ON the main tanks, and if maximum range is required, or in other special circumstances, jettison the tank.

(*f*) If a tank has to be jettisoned before it is empty, first turn ON the main tanks and then turn OFF the drop tank.

NOTE.—It is necessary to ensure that the drop tank cock is in the fully OFF position when the tank is empty or has been jettisoned; otherwise, air may be sucked into the main fuel system.

33. **Preliminaries**

(i) Check contents of fuel tanks and see that the wing tank selector cock is in the NORMAL position. If fitted with a drop tank, check that the cock is OFF.

(ii) Check that the undercarriage selector lever is down; switch on indicator and see that DOWN and tailwheel light show green. Check voltmeter: 12 volts minimum.

(iii) Test operation of flying controls.

(iv) In order to avoid damage to the propeller the ground immediately below it should be cleared of any small stones or rubble before starting the engine.

34. **Starting the engine and warming up**

NOTE.—The tail must be tied down if a full run-up is intended. Ensure that there are no aircraft or personnel behind.

(i) Set main fuel cock ON.

(ii) Set the controls as follows:

Throttle	1 inch open
Propeller control	Fully forward
Idle cut-off	Fully aft
Priming selector cock ..	MAIN (GROUND for H.V. fuel)
Supercharger override switch	AUTO

(iii) High volatility fuel (Stores ref. 34A/111) should be used for priming at temperatures below freezing. Work the Ki-gass priming pump until the fuel reaches the priming nozzles; this may be judged by a sudden increase in resistance.

(iv) Switch on the booster pump or operate the wobble pump until the fuel pressure warning light goes out.

NOTE.—Neither the booster pump nor the wobble pump must be operated unless the cut-off valve is closed or the engine is running. The wobble

41. **Spinning**

(i) Spinning is permitted and recovery is normal, but the loss of height involved may be very great and the following limits are to be observed:
(*a*) Spins are not to be started below 10,000 feet.
(*b*) Recovery is to be initiated before two turns are completed.

(ii) A speed of 180 m.p.h. I.A.S. should be attained before starting to ease out of the resultant dive.

(iii) Spinning is not permitted when fitted with a drop tank or when carrying a bomb.

42. **Diving**

(i) The aircraft should be trimmed into and out of the dive.

(ii) Any tendency to yaw should be corrected by use of the rudder trimming tab.

(iii) When carrying a bomb the angle of dive must not exceed ~~40°~~ 60°.

43. **Aerobatics**

(i) The following speeds (m.p.h. I.A.S.) are recommended:

Loop	320–350
Roll	220–250
Half-roll off loop	350–400
Upward roll	350–450

(ii) Flick manœuvres are not permitted.

44. **Check list before landing**

(i) Reduce speed to 160 m.p.h. I.A.S. and open the cockpit hood.

U—Undercarriage ..	..	DOWN (Check indicator)
Tailwheel ..	..	Green light on
P—Propeller control ..		Fully forward
Interconnection (if fitted)		MAX. REVS.
Supercharger ..	..	Red light out
Carburettor air intake ..		~~NORMAL~~ (aft)
F—Flaps ..	.. ..	DOWN

(ii) Check brake pressure (80 lb./sq.in.) and pneumatic supply pressure (220 lb./sq.in.).

NOTE.—The undercarriage operation takes considerably longer with engine off than with engine on.

38. **Climbing**

(i) The recommended speed for a normal climb is 180 m.p.h. I.A.S. from sea level up to 22,000 feet, reducing by 3 m.p.h. per 1,000 feet above this height.

(ii) On a combat climb the supercharger will automatically change to S ratio at 14,500 feet, but under normal climbing conditions (2,600 r.p.m. and +9 lb./sq.in. boost) the maximum rate of climb is obtained by delaying the gear change until the boost has dropped to +5 lb./sq.in. To do this, fly with the over-ride switch in the M.S. position until this boost is reached.

(iii) Use of the air intake filter considerably reduces the full throttle height.

(iv) The fuel tank pressure cock should normally be kept OFF, but should be turned ON if the fuel pressure warning light comes on.

39. **General flying**

(i) *Stability.*—The aircraft is stable laterally and longitudinally in all conditions of flight. Changes of power and speed cause changes in directional trim which require adjustment of the rudder trimming tab.

(ii) *Change of trim:*

Undercarriage down	Nose down
Flaps down	Initially nose up
	Finally no change
Flaps up	Strongly nose down

(iii) In bad visibility near the ground, flaps should be lowered and the propeller control set to give 2,400 r.p.m. Speed may then be reduced to 160 m.p.h. I.A.S.

40. **Stalling**

(i) The stalling speeds (engine off) in m.p.h. I.A.S. at 8,375 lb. are as follows:

Undercarriage and flaps up	85
Undercarriage and flaps down	75

(ii) *High speed stall :*

If excessive " g " is applied in a turn (either left or right) or in recovery from a dive there is considerable buffeting and the aircraft flicks over to the right. Recovery is immediate if the control column is eased forward.

pump may be operated again, if necessary, after the engine has started and the fuel cut-off control has been moved forward.

If a booster pump is fitted, the cut-off control must be *immediately* returned to the fully aft position if the engine stops.

(v) Load the cartridge starter. The following types of cartridge should be used.

At air temperatures *above* +10°C.: No. 4, Mk. I

At air temperatures *below* +10°C.: No. 5, Mk. I.

(vi) Immediately before attempting to start, switch ON the ignition and give the following number of strokes if the engine is cold:

Air temperature °C.:	+30	+20	+10	0	−10	−20
Normal fuel:	1	1	2½	5		
High volatility fuel:			1	2	3	

Leave the priming pump plunger out and press the cartridge starter pushbutton. As soon as the engine fires release the fuel cut-off control. (Keep the button pressed until the engine is running steadily, as it also controls the booster coil.) If the engine cuts after a few seconds, give one sharp stroke of the priming pump and continue to prime until the engine is running satisfactorily.

(vii) Screw down the priming pump and turn OFF the priming selector cock.

(viii) If the engine fails to fire on one cartridge, no further priming should be given except for half a sharp stroke as each subsequent cartridge is fired.

NOTE.—If the engine is overprimed and fails to start, operate the fuel cut-off control and fire one cartridge with it in the fully aft position (switch off the booster pump if fitted). Failing this have the engine cleared by turning through two or three revolutions.

(ix) Open up slowly to 1,000 r.p.m., then warm up at this speed.

35. **Testing the engine and installations**

While warming up:

(i) Check temperatures and pressures.

(ii) Press the radiator test pushbutton and have ground crew check that shutters open.

After warming up to at least 15°C. oil temperature and 60°C. coolant temperature:

NOTE.—The following comprehensive checks should be carried out after repairs, inspection other than daily, or otherwise at the pilot's discretion (when the tail must be tied down). Normally they may be reduced in accordance with local instructions (the tail need not be tied down).

(iii) Open up to +4 lb./sq.in. boost and exercise and check operation of the two-speed supercharger by operating the test pushbutton. R.p.m. should fall when S ratio is engaged and the red light should come on.

(iv) At +4 lb./sq.in. boost, exercise and check operation of the constant-speed propeller. R.p.m. should not be reduced below 1,800. Check that generator is charging; the power failure light should be out and the voltage 14 or over.
Check operation of the interconnection device by opening up to +4 lb. sq.in. boost with the propeller speed control lever at MAXIMUM REVS. (fully forward). Move the lever to the AUTOMATIC position, when r.p.m. should fall to 1,800. Return to the MAX. REVS. position.

(v) With the propeller control fully forward, open the throttle to the gate and check take-off boost and static r.p.m. which should be 2,750 at take-off boost.

(vi) Throttle back to +9 lb./sq.in. boost and test each magneto in turn. The drop should not exceed 100 r.p.m.

(vii) Before taxying, check brake pressure (80 lb./sq.in.) and pneumatic supply pressure (220 lb./sq.in.).

36. **Check list before take-off**

T —Trimming tabs	Elevator: Neutral Rudder: *Fully left* (handwheel fully back)
P —Propeller control	Fully forward
Interconnection (if fitted)	MAX. REVS.
F —Fuel	Check contents of main tanks Main tank cock—ON Transfer cock—NORMAL Drop tank cock—OFF Booster pump (if fitted)—ON
F —Flaps	UP
Supercharger	Override switch—AUTO Red light—Out
Carburettor air intake	~~NORMAL (air)~~ engine. see page 27

NOTE.—It is particularly important on this aircraft to clear the engine before take-off.

37. **Take-off**

(i) Open the throttle slowly up to +9 lb./sq.in. boost only. This is important, as otherwise there is a strong tendency to swing right in the initial stages and tyre wear is severe on runways (note that the swing is opposite to that of Merlin marks). +12 lb./sq.in. boost may be used on becoming airborne, but +9 lb./sq.in. is sufficient for a normal take-off.

(ii) Care must be taken not to get the tail too high as there is very little clearance between the propeller and the ground.

(iii) After raising the undercarriage see that the red indicator light—UP—comes on and the tailwheel light goes out. It may be necessary to hold the lever hard forward against the quadrant until the red indicator light does come on. Failure of the wheels to lock up will spoil the airflow through the radiators and oil cooler and result in excessive temperatures.

(iv) If the interconnection is fitted set the propeller speed control lever to AUTOMATIC and then adjust it to give the desired r.p.m. for climbing.

SEAFIRE

SUMMARY OF TESTS

The two aircraft under test were standard operational Seafires Mark XV. Nos. P.R.494 and P.R.499. Both were fitted with Griffon Mk VI engines Nos. 40744/502315 and 40774/502244 respectively.

It was intended that tests should be carried out on one aircraft at a time, the other being retained in a serviceable condition in order to be ready to take over testing in the event of the first becoming unserviceable.

Both aircraft were flown to R.C.A.F. Namao from R.C.N.A.S. Dartmouth. On arrival at Namao, P.R. 499 was immediately put on a 40 hour inspection and P.R. 494 was put unserviceable to repair damage sustained by the undercarriage when landing at Ottawa, and damage to the propeller accumulated by continual landings and take-offs at rough strips between Ottawa and Winnipeg.

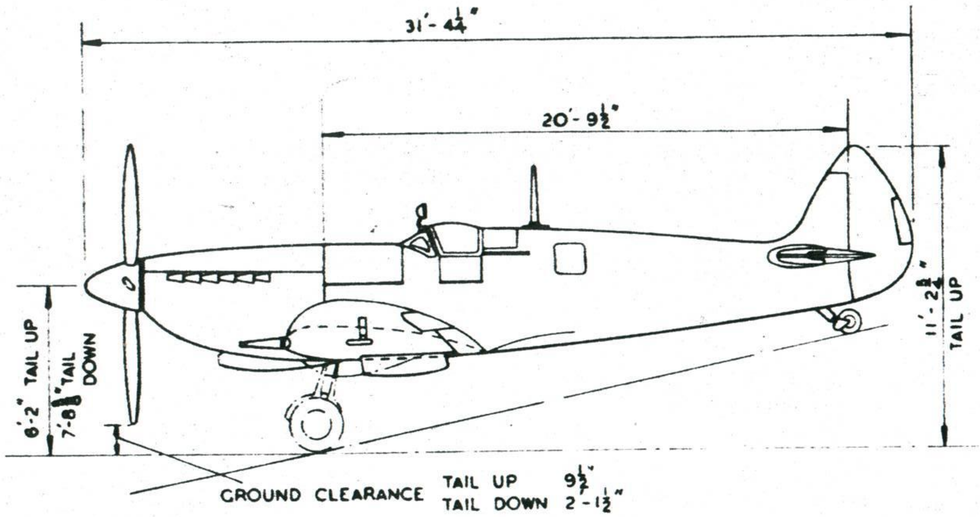
Both aircraft were ready for winter testing by the beginning of December. On the 14th of January, P.R. 499 was flown to Fort Nelson to carry out firing, and shortly after leaving Fort St. John, one of the re-fuelling points, the pneumatic system failed. The aircraft returned to Fort St. John where it was found that the compressor quill drive had sheared. The compressor was removed and the mounting blanked off. The pneumatic system was then recharged externally and the aircraft flown on to Fort Nelson. While fitting the new compressor, it was found that the auxiliary gear box oil pump drive had failed and it was decided to remove the serviceable gear box from P.R. 494 at Namao and fit it to P.R. 499, none other being available.

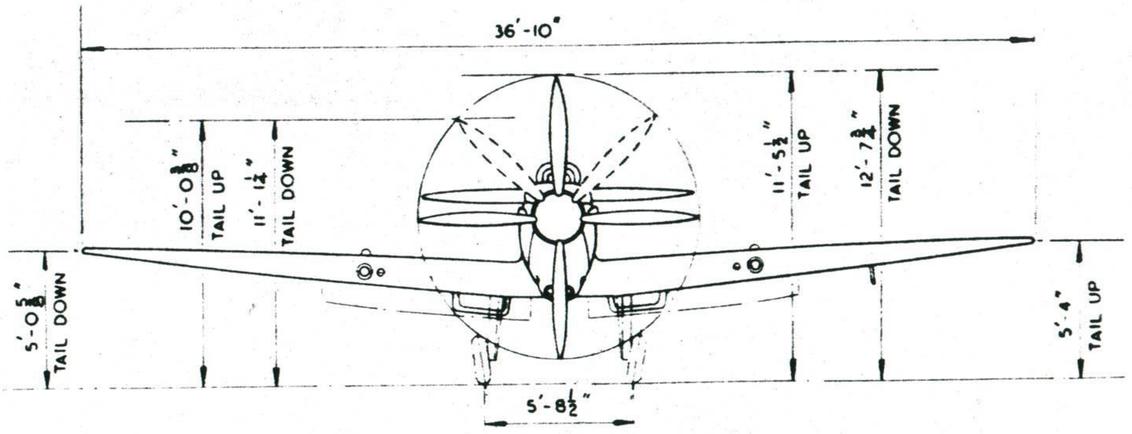
While carrying out oil dilution on P.R. 499, the oil cooler burst and since P.R. 494 was already unserviceable, the oil cooler from that aircraft was fitted to P.R. 499.

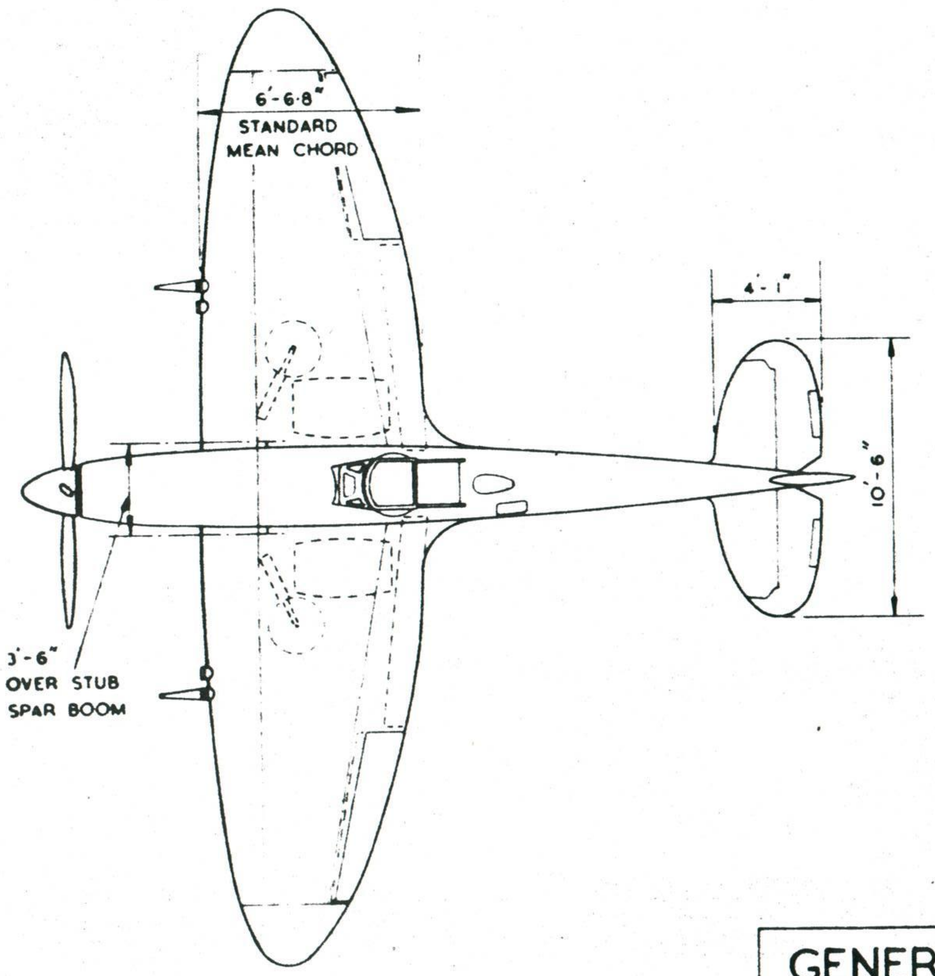
P.R. 499 was thus made serviceable in time to complete two air firing trips and to return to Namao on the 18th of February.

P.R. 499 flew up to Fort Nelson again on the 1st of March to complete the air firing programme and returned to Namao on the 9th of March.

Winter Exper. Estab.







SUPERMARINE SPITFIRE MK. IX

(ROLLS ROYCE MERLIN ENGINE)

GENERAL ARRANGEMENT

W. Harvey

ORIGIN OF SPECIES—I

On December 19 Mr. Joseph Smith, C.B.E., F.R.Ae.S., A.I.A.E., Chief Designer at the Supermarine Works of Vickers-Armstrongs Ltd., at a meeting of the Royal Aeronautical Society in London, told for the first time the story of the origin of the Spitfire, its development and of its Naval version, the Seafire. Under present conditions we are unable to publish the paper in full. It has therefore been condensed to about half its original size, and will appear in two parts.

ALWAYS, the Spitfire and its family will be regarded as a classic example of British aeronautical achievement, proved and tested beyond doubt over 11 years of production and Service use. Originally designed by the late R. J. Mitchell in 1935, the prototype Spitfire first flew in 1936; since when over 22,000 have been manufactured in 33 different types. This remarkable aircraft remained a front-line fighter throughout the whole period of the War, and even to-day large numbers of Spitfires and Seafires are still on order for the Services.

In his lecture before the Royal Aeronautical Society, on December 19, Mr. J. Smith, C.B.E., F.R.Ae.S., A.I.A.E., chief designer of Vickers-Armstrongs Supermarine Works, gave, for the first time, a detailed account of the technical and design problems involved during the development of the Spitfire. "One of the main achievements in the development of the machine," said Mr. Smith, "was the enormous increase in power, accommodated without material alteration in the size of the aircraft," and he paid tribute to "the whole-hearted co-operation of the Rolls-Royce design team, without which the development life of the Spitfire and Seafire might have been seriously curtailed."

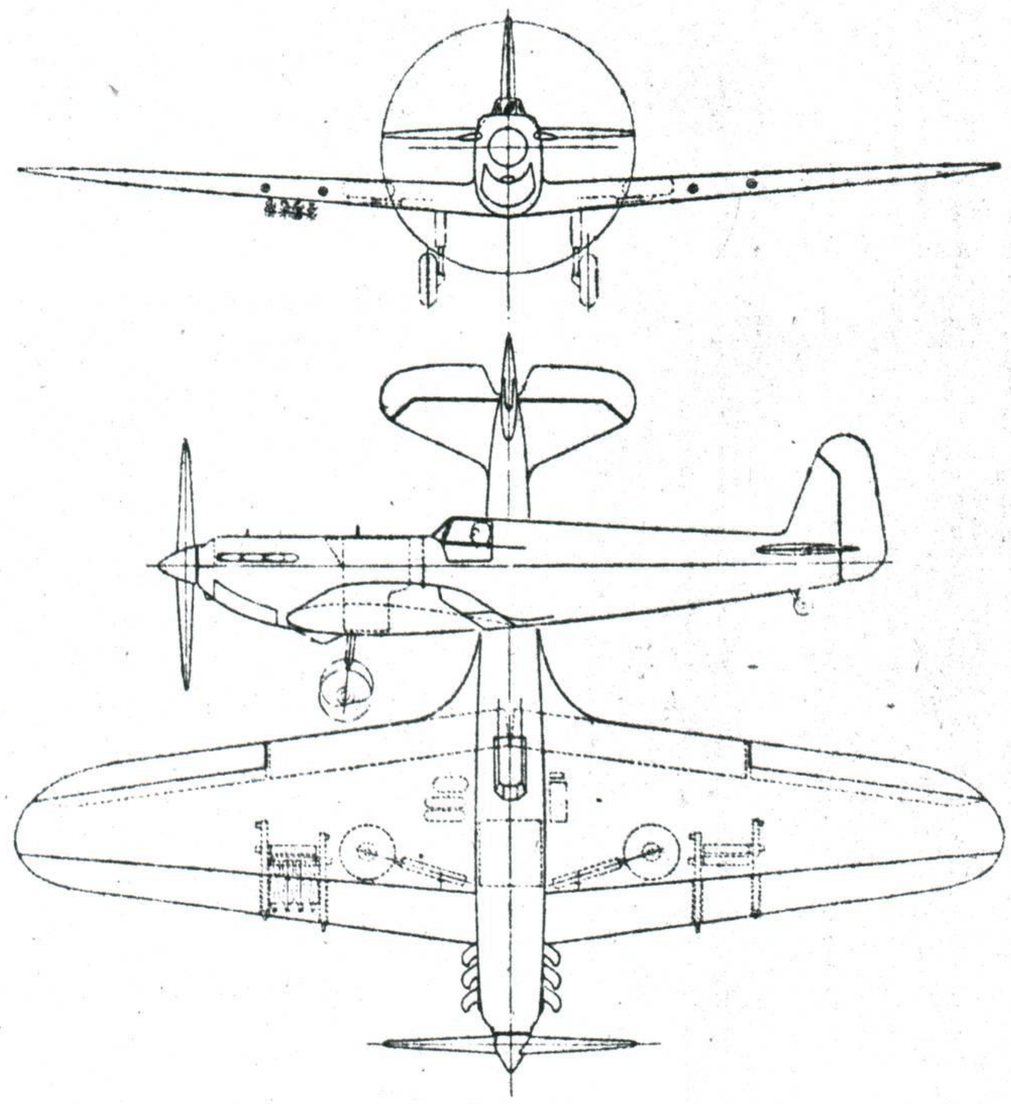
Comparison between Spitfire Mk. I and Seafire 47.

	Spitfire	Seafire 47
Weight, normal	5,280 lb.	10,300 lb.
Weight, overload	—	12,500 lb.
Wing area	242 sq. ft.	244 sq. ft.
Wing loading	24 lb./sq. ft.	42.2 lb./sq. ft.
Maximum horse power ..	1,050	2,350
Power plant weight	2,020 lb.	3,650 lb.
Maximum Speed	362 m.p.h.	452 m.p.h.
Maximum rate of climb ..	2,500 ft./min.	4,800 ft./min.
Time to 20,000 ft.	9.4 minutes	4.8 minutes
Weight of fire/sec.	4.0 lb.	12.0 lb.
Fuel capacity, internal ..	85 gallons	154 gallons
Range including allowance for take-off, climb and 15 minutes combat..	395 miles	405 miles
Maximum range	575 miles	1,475 miles
Rate of roll at 400 m.p.h. ..	14.0 degrees/sec.	68 degrees/sec
Permissible C.G range, percentage mean chord ..	2.7	11,5
Factored wing loading ..	240 lb./sq.ft.	464 lb./sq. ft.
Maximum diving speed ..	450 m.p.h.	500 m.p.h
Structure weight, %	33.0	31.0
Energy absorption of undercarriage	8,300 ft./lb.	26,600 ft./lb.
Undercarriage stroke ..	4.9 inches	9.0 inches

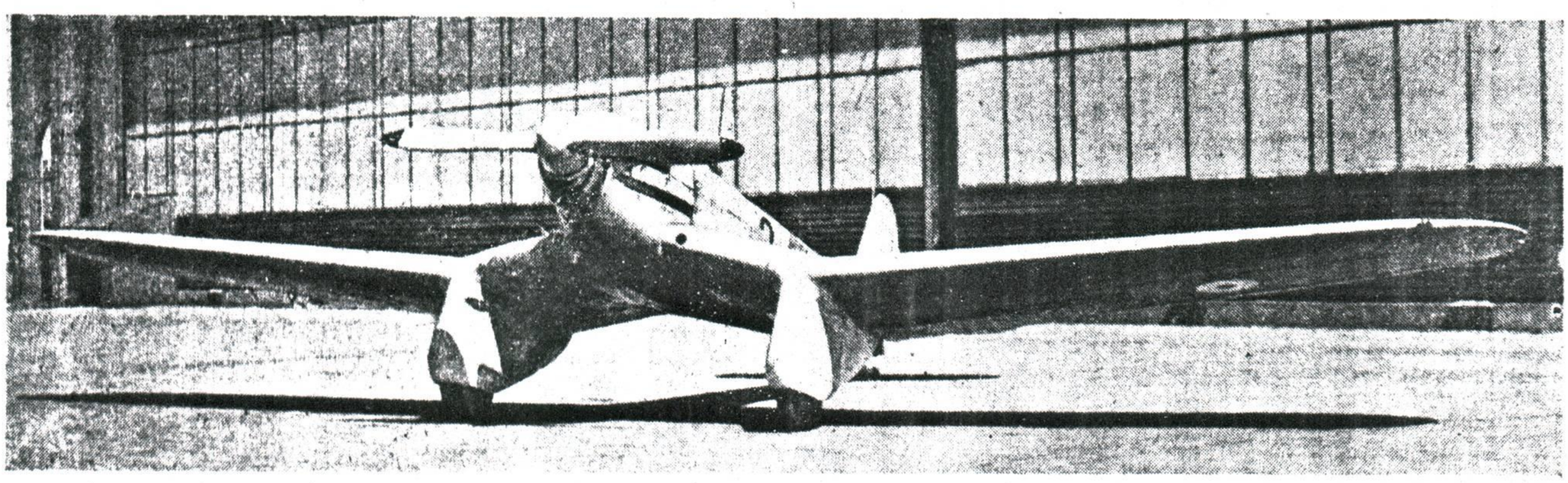
After giving a short review of the early development by Supermarines of high-speed aircraft leading to the Schneider Trophy winner of 1931, the lecturer said that a natural outlet of this valuable experience was its application to a high-performance fighter. A design was consequently produced to the Air Ministry's F7/30 specification.

Although the estimated performance of this machine was achieved, it was felt that a considerable improvement could be made by certain drastic alterations. The experience gained, however, was of the greatest value, and work was begun almost immediately on a further project, a design which ultimately became the Spitfire. The steam-cooled Goshawk engine was retained, but the machine took the form of a low-wing monoplane with greatly reduced wing area and with the pilot's cockpit totally enclosed.

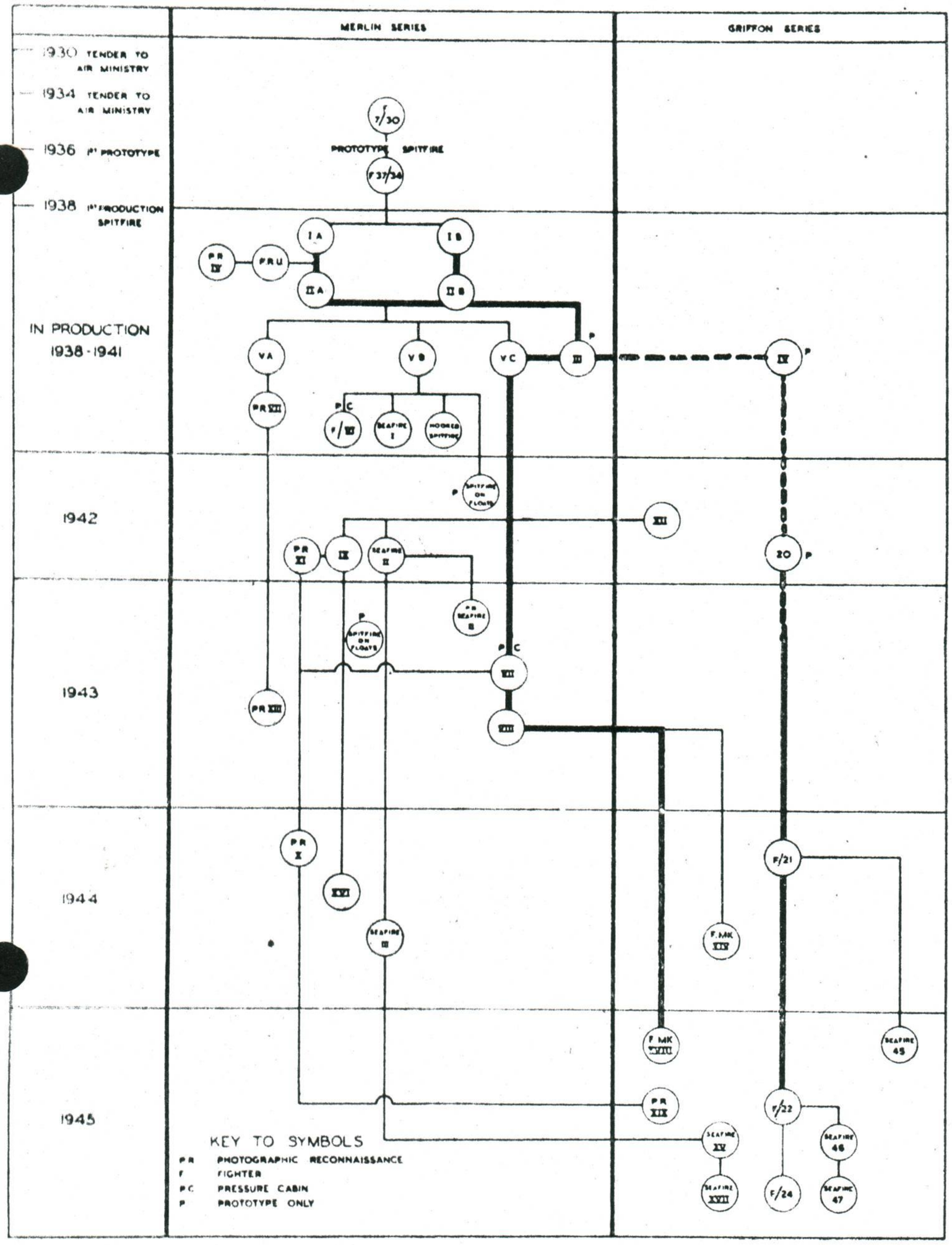
This design was submitted to the Air Ministry and accepted, with certain modifications. A period of intensive work followed, influenced by three major considerations—the necessity for retracting the undercarriage, the advent of the Rolls-Royce Merlin engine (known originally as the P.V.12), and the Air Ministry requirement for the machine to be fitted with eight machine-guns. The advantages to be gained by the first two considerations were obvious, and the wisdom of the third was apparent even in those days, and so these were incorporated in the final design. At the same time, investigations into various forms of main plane construction revealed advantages to be gained from the use of one main spar at 25 per cent. of the chord with a torsion-box formed by the portion of the wing forward of the spar. The 14-gauge flush-riveted covering of this box gave a good form to the most important part of the aerofoil section, and the position of the main spar suited the new arrangement of the chassis and the radiator and gun installation.



The Supermarine design which ultimately became the Spitfire.



FONS ET ORIGO.—The Supermarine F.7/30, a fighter design based on the Schneider Trophy machines.



The Family Tree of the Spitfire.

The radiator was mounted aft of the main spar, and the ducting arrangement, an innovation, was based on a scheme developed by Meredith of the R.A.E. It is interesting to note that, apart from spinning tests, the radiator installation was the only part of the original machine tested in the wind-tunnel. The thickness/chord ratio of the wing was cut down to 13 per cent. at the root and 6 per cent. at the tip, the wing area was reduced from 255 to 242 sq. ft., and the plan form made elliptical. Apart from the engine mounting, stressed skin construction was used throughout, and the structure weight attained of 1,900 lb. was very low indeed. It has, in fact, rarely been improved upon.

Development of the Spitfire Family

During the period 1938-1940, many extensive investigations were carried out by Supermarines on the problem of fighter development. In this work, numerous factors had to be considered and their relative influence on the problem as a whole taken into account.

Outlining the more important of these factors, Mr. Smith went on to say that new designs were prepared and fully considered in relation to them, but the conclusion reached was that it would be very difficult to improve upon the aerodynamic and structural efficiency of the Spitfire, and that the development of the type was the best course to follow. By fitting new and more powerful engines, heavier armament, cleaning up the basic design still further, and by periodically strengthening the airframe, their view was that the machine could be kept abreast of requirements.

The main line of development was, of course, the purely fighter type, but the early introduction of photographic reconnaissance aircraft and, later, the Seafire, gave rise to other separate types. The introduction of the Griffon engine as a replacement for the Merlin made a further main division, and, finally, there existed several interim types which bridged the gaps between one mark and its developed successor.

Marks I, II and V were mainly distingushed by engine changes with a progressive increase in power and rated altitude of the Merlin. The Mark VI was a development of the Mark V with the addition of a pressure cabin, and extended wing-tips. Then, in the Mark VII, came an extensive redesign which included the fitting of a two-stage Merlin engine, the strengthening of the airframe, the redesign of the cooling system and the incorporation of an improved pressure cabin and a retractable tail-wheel. The Mark VIII was an unpressurized version of the Mark VII. Meanwhile, the Merlin 61 engine was fitted to a Mark V machine and the interim type known as the Mark IX was born.

At a very early stage in the development programme, the firm decided to "clean up" the general design of the Service machine. A retractable tail-wheel was fitted, the windscreen shape improved, a jettisonable hood added, and a new wing designed to which could be fitted either eight .303-in. Browning guns, four Hispano guns, or various combinations of both. The wing-tips were clipped. This improved machine was fitted with a two-speed blower Merlin XX engine and called the Mark III. Although giving a substantially increased performance, the Air Ministry decided against its adoption, possibly on grounds of production, and only two aircraft were built. The design work, however, paved the way for further development, and all the new features embodied in this design were incorporated into later marks.

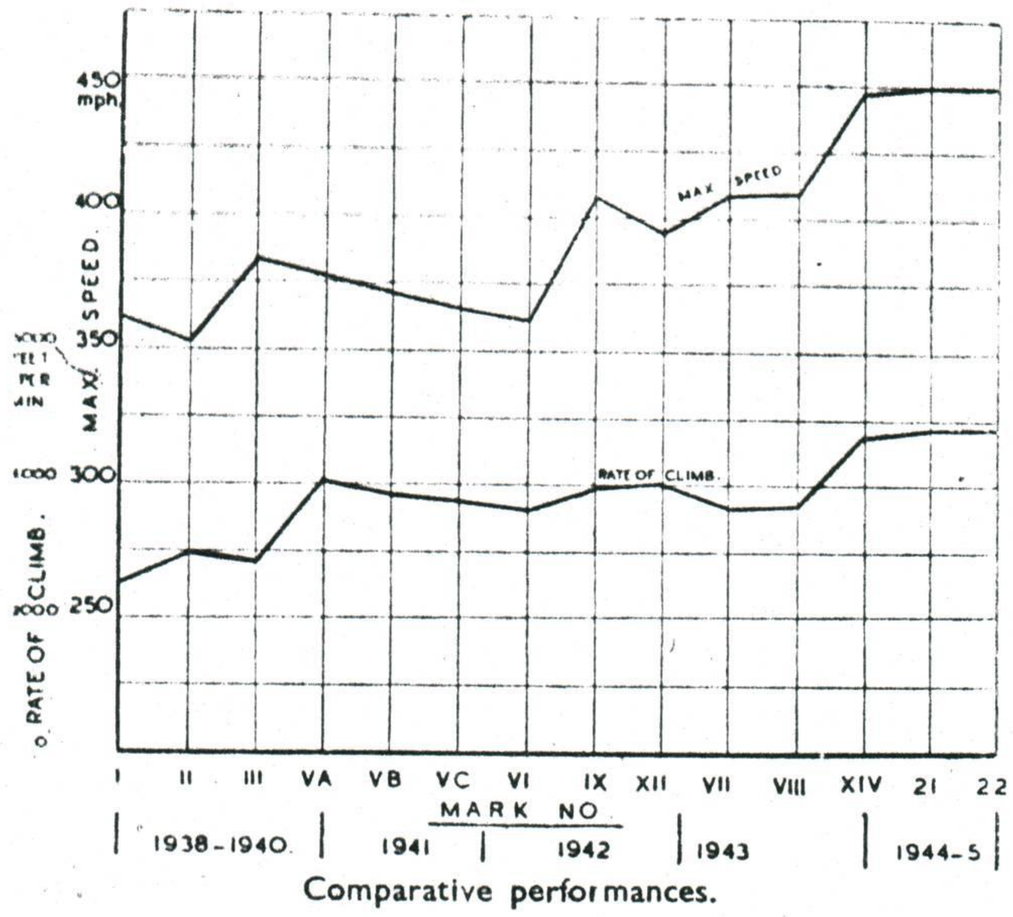
By this time, advance information from Rolls-Royce on the Griffon engine had been obtained, and design work had begun on the conception of a Spitfire powered by the new engine. A completely redesigned airframe was produced, to be powered by a single-stage Griffon II engine. This machine was known initially as the Mark IV, but was subsequently renamed the Mark XX before the prototype flew in 1942. This work was carried out in parallel with the production of large numbers of Merlin-engined aircraft, Marks I to IX, so that when, late in 1942, the necessity arose for a low-altitude fighter of high performance, the experience was available; consequently an interim type using the Mark V airframe and powered by a single-stage Griffon II engine, given clipped wings, a retractable tail-wheel and a strengthened fuselage, went into service as the Mark XII.

Meanwhile, the fully developed version was designed having a completely new wing carrying four Hispano guns, a longer undercarriage, a slightly wider track, a larger fin and rudder and fitted with a Griffon 61 two-stage engine; this was the Spitfire Mark 21.

While this new airframe was being put into production, Griffon two-stage engines were being flown in Mark VIII airframes to gain experience. The performance obtained with this combination was so satisfactory that it was decided to produce another interim type, which became the Mark XIV. This Mark was later fitted with strengthened wings and undercarriage and increased fuel tankage to become the Mark XVIII.

Some further modifications were carried out to the Mark 21, including a rear vision hood, a completely new empennage and the fitting of a 24-volt electrical system, giving the Mark 22. Later, the introduction of rear fuselage tanks to this mark resulted in the Mark 24.

The P.R.U. and Seafire branches of the family are less difficult to follow, being in most cases specialized versions of



Comparative performances.

existing marks of Spitfire. The important developments in relation to these types were, the integral leading edge fuel tanks and camera installations for photographic reconnaissance and folding wings, catapult spools and arrester hooks for Seafires.

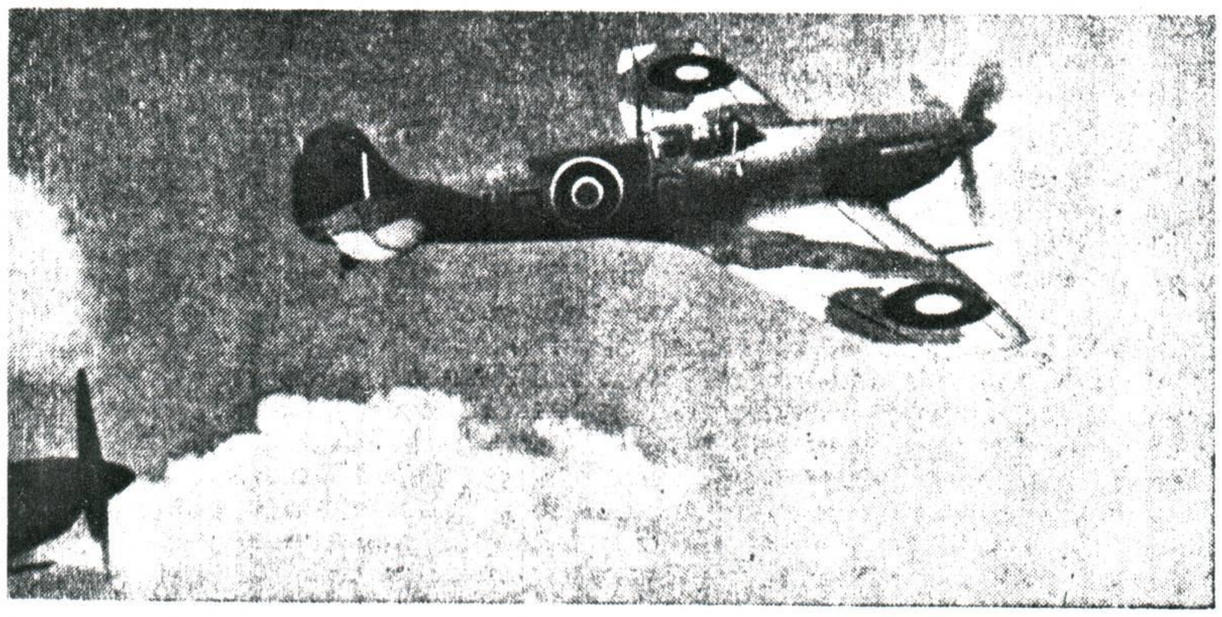
One further matter remains to be cleared up, namely, the suffix letters which follow the numbers in Marks I, II and V. These refer to the armament fitted to the wings. "A" means eight .303-in. machine-guns, "B" means two 20 mm. Hispano guns plus four .303-in. machine-guns, and "C" means the universal armament wing originally designed for the Mark III.

Technical Development I—Performance

Mr. Smith then turned to a discussion of the technical aspects of the problem under separate headings. There is little doubt that the chief reason for the continued success of the Spitfire was the progressive increase in speed and rate of climb. So far as climb is concerned, efforts were mainly directed to reducing weight and choosing the right compromise in propeller design and engine gear ratio to suit the next stage of engine development. Extended wing-tips, in some cases, were fitted.

The increase of power was continuous and the untiring efforts of Rolls-Royce resulted in more than doubling the power of the Spitfire, from a maximum of 1,050 h.p. on the Mark I to 2,350 h.p. on the Seafire 47.

Increased power necessitated increased cooling, and progressive changes were made to the cooling arrangements in the wing, culminating, at the introduction of the two-stage engine, in the use of duplex radiators, one side combining glycol and oil coolers, and the other side glycol and inter-coolers.



SPITFIRE L.F. MK. VB.—With clipped wings and the lower-rated Merlin 45M, 50M, or 55M power plant, the L.F. Mk. VB was used as a low-altitude fighter and fighter-bomber. The aircraft pictured above was flown by the late Wing Commander Ian Gleed, D.S.O., D.F.C.

SPITFIRE F. MK. V.—Right, a development of the Mks. I and II aircraft which were used in the Battle of Britain, the Spitfire V differed mainly in being powered by a new Merlin, the 45 series. One of the better-known variants was this Mk. VB, armed with two 20 mm. Hispano cannon and four 0.303 in. Browning machine-guns in the wings.

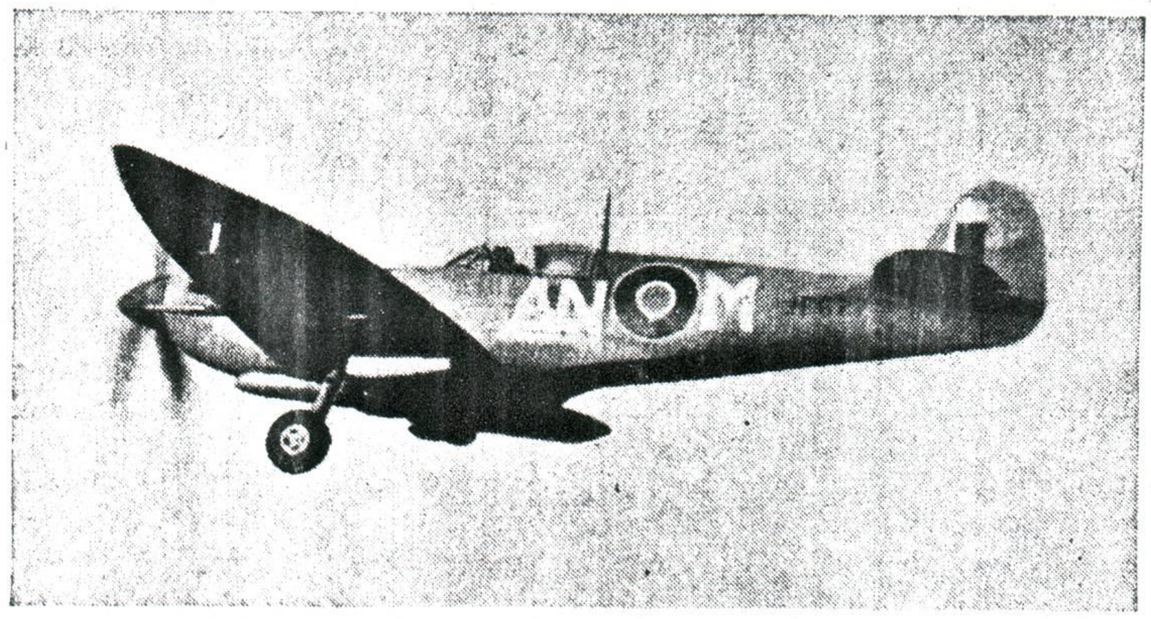
"Aeroplane" photograph

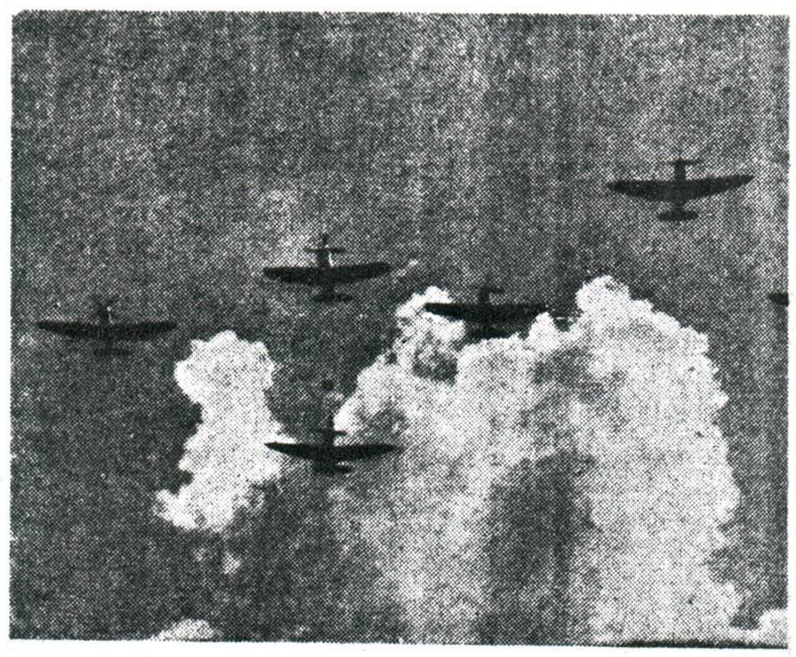
The conversion of engine power to thrust was a further problem and several alternative designs were prepared, some by Supermarine and some by the Airscrew Company of Weybridge, for the original Spitfire. It was chiefly by airscrew development that the initial speed was increased from 336 to 349½ miles per hour for the Martlesham prototype trials. Soon after production commenced, the de Havilland three-blade two-pitch airscrew became available, giving valuable improvement in take-off and rate of climb, and these came into service in the Battle of Britain. At about this time, Supermarine, acting upon a suggestion from Rolls-Royce and using experience gained with fixed-pitch airscrews, designed some Jablo blades with faired roots for the Rotol propeller, which gave increased speed.

As the power of the Merlin engine advanced an increase in propeller "solidity" became necessary. With restrictions upon the diameter due to ground clearance, four-bladed airscrews were required, followed by five-bladers for the more powerful Griffon engine. In the meantime, Supermarine were attracted to the idea of a contra-rotating propeller, as, theoretically, performance was to be gained, also practical experience with torque and gyroscopic effects suggested great advantages in aircraft control due to their elimination.

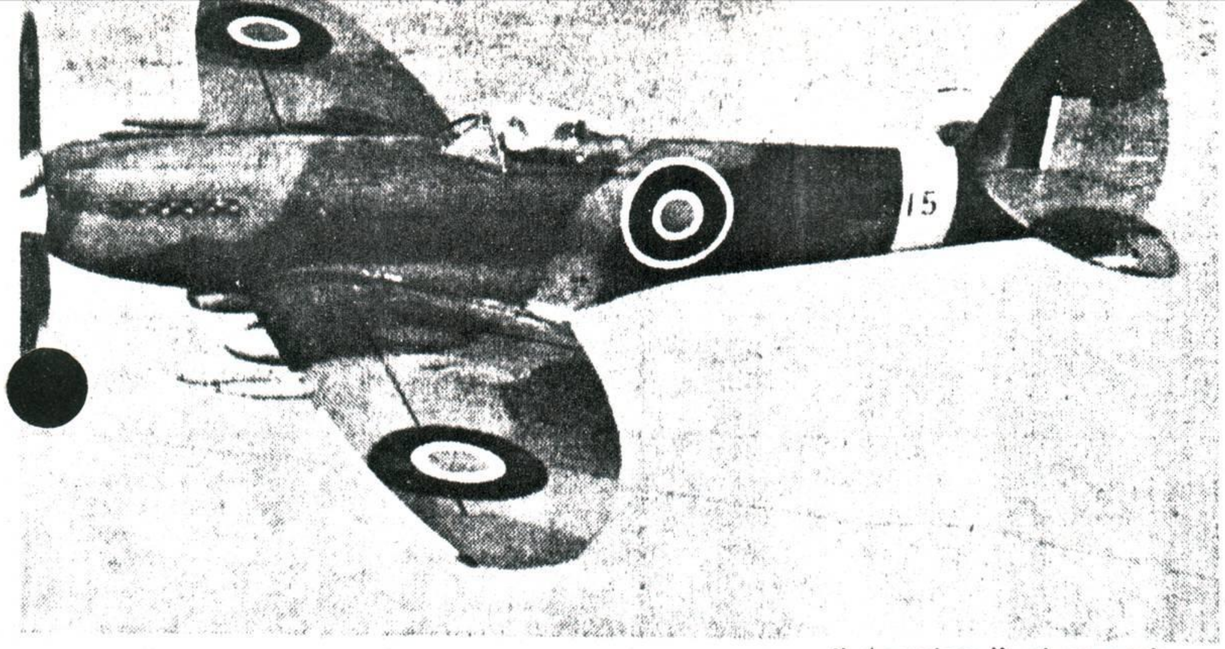
It will be appreciated that this proposal provided the airscrew and engine manufacturers with a major experimental problem, and the implications, from a production point of view, were extensive. However, in due course Rolls-Royce produced the gear and Rotols and de Havilland propellers.

It is of interest to record that altogether 13 types of propeller have been fitted to the Spitfire, and without the extensive development of this important component the continuous increases in performance could not have been achieved.





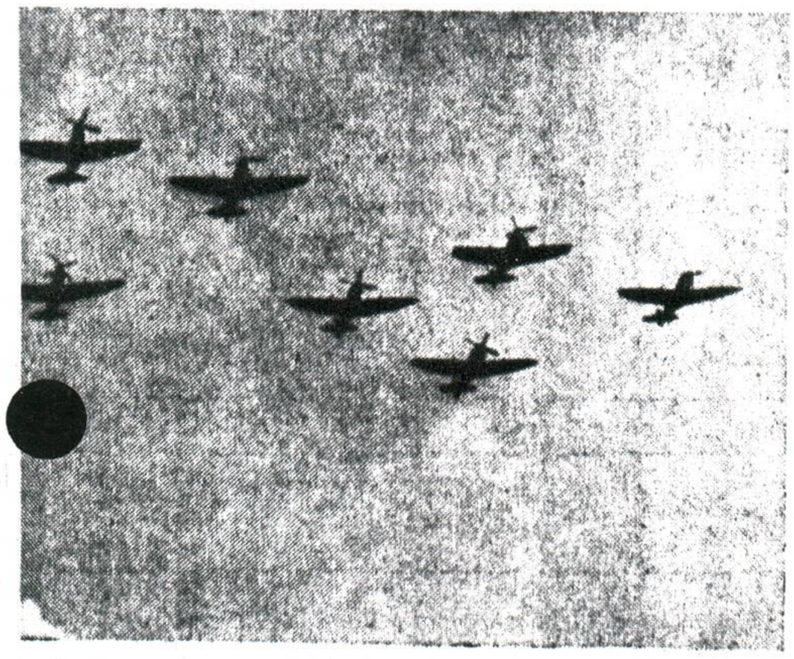
SPITFIRE H.F. Mk.VIII. — Above, with the port undercarriage leg just beginning to rise, this Spitfire VIII has "high-altitude" extended wing-tips fitted to Spitfires during and after 1942. The aircraft shown was the equipment of a Canadian fighter squadron in Great Britain.



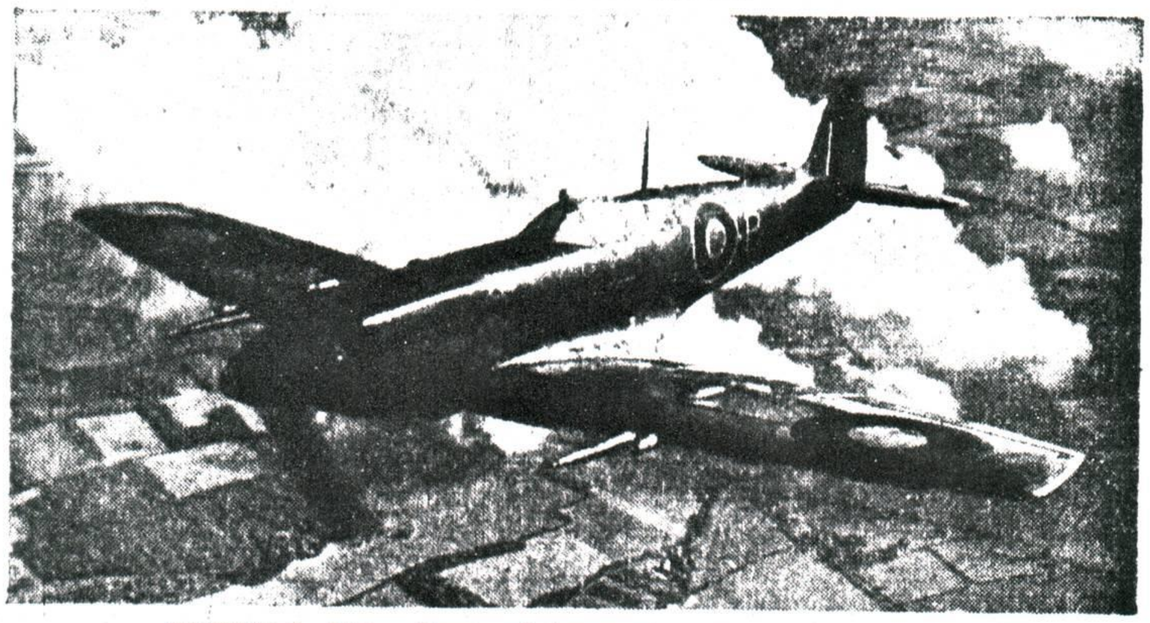
"Aeroplane" photograph

SPITFIRE 22.—Above, one of the latest Spitfire series, the Mk. 22 features a redesigned wing and a rear-view cockpit. The aircraft illustrated has a 45-gallon belly drop-tank, and the newer type of fin. Maximum speed is more than 450 m.p.h. The engine is a Rolls-Royce Griffon, driving a five-blade normal, or six-blade counter-rotating airscrew.

Thus the maximum possible power was continuously applied, and in parallel with this change every effort was made to reduce drag. The prototype aircraft was extremely clean, so that improvement was a matter of detail only, although the incorporation of these improvements involved considerable research work to get them into practical form. It is, of course, extremely difficult to measure the improvement in speed which each of these refinements gave, but the following figures are a fairly reliable indication of the order of the gains.



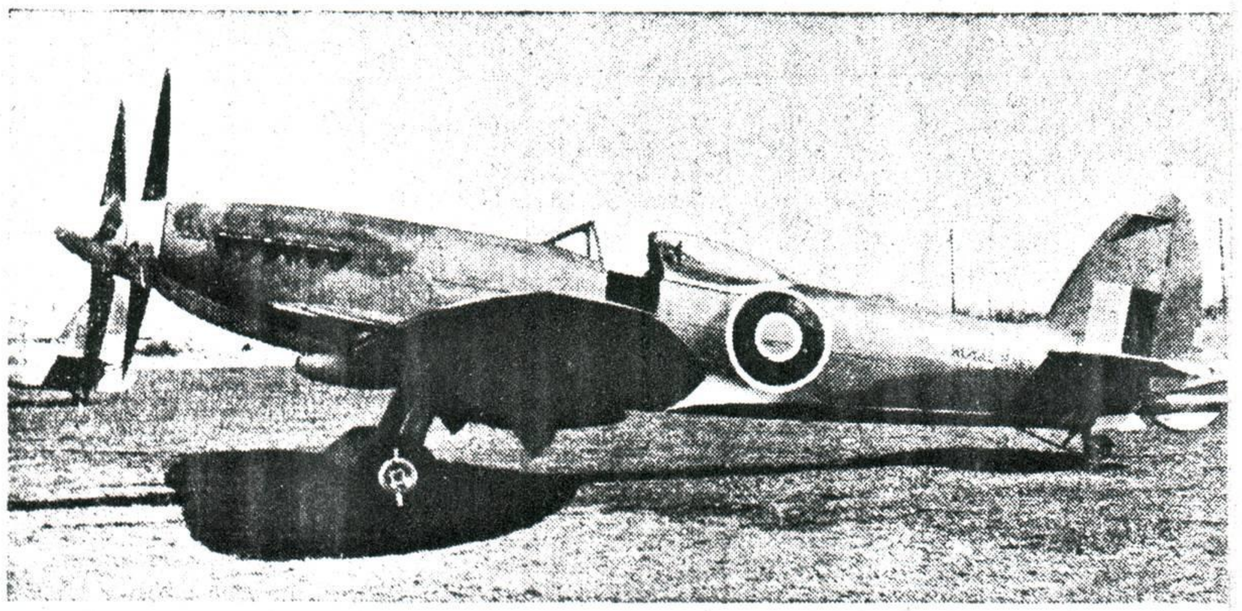
SPITFIRE IX.—During 1943, the Spitfire V was superseded by the higher-flying Mk. IX. This version tackled the Fw 190, which was then proving to be, with its companion Me 109G, something of a thorn in our side. The Spitfire IX was powered by a Merlin 60 Series engine, with a two-stage, two-speed supercharger.



SPITFIRE XII.—Derived from the experimental Mk. III, the Spitfire XII was the first production Spitfire to use the Rolls-Royce Griffon engine. It was developed for low-level fighting and ground attack, and was armed with four 20 mm. Hispano cannon.

Refinement Carried Out.	Speed Increase. m.p.h.
Retractable tail-wheel	5
Propeller root fairings	4
Chassis door panel	3
Whip aerial	0.5
Plain ailerons	6
Curved windscreen	6
Multi-ejector exhausts	4
Improved finish and wax polish	9
Clipped wing tips	1
Rear view hood and deletion of mirror	1

SEAFIRE 46.—Below, an interim version of the latest series of Seafires, fitted with a Griffon motor and a counter-rotating six-blade airscrew. The ultimate model is the Mk. 47, which features power-folding wings. Full naval equipment, including a "sting" arrester-hook, is fitted to both variants.



In changing over to the Griffon engine, the opportunity was taken to drop the nose of the aircraft, and this gave an improvement to the shape of the forward portion of the machine; also it slightly improved the pilot's view over the nose. Pilot's view aft had never been considered adequate for operational purposes on the earlier Spitfires, and an external mirror had to be fitted. To meet this criticism, on later marks the aft portion of the fuselage was redesigned and a canopy fitted which was completely external to the fuselage contour.

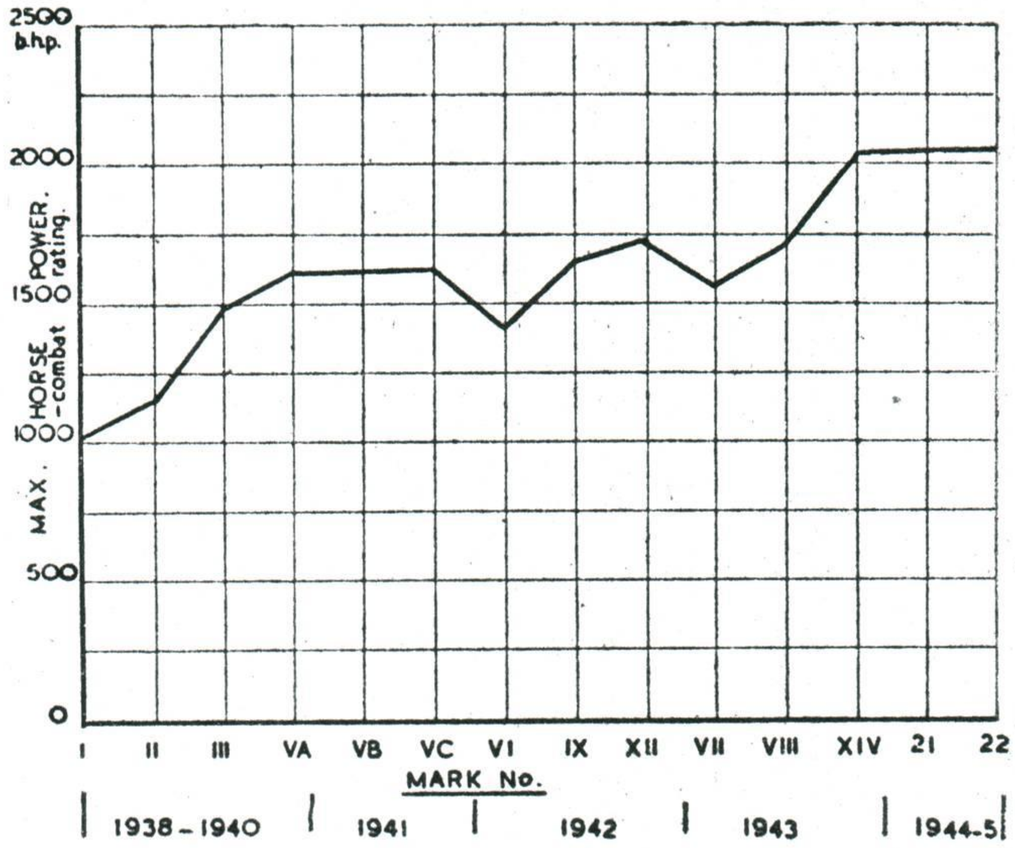
Technical Development II—Control and Stability

The aileron was the first to receive attention. Although very effective at low and moderate speeds it was found to become heavy and less responsive when, as inevitably happened, pilots dived the machine to its limit during combat.

As operational speeds increased still further, the effect of torsional stiffness of the wings on aileron effectiveness became a serious factor, and in designing the wing for the Mark 21 a theoretical reversal speed of 825 m.p.h. was catered for, as against 580 m.p.h. with earlier types. An increase in wing stiffness of 47 per cent. was obtained by ensuring rigid load-carrying joints at all points of access to the torsion box, and by increasing the gauge or wing plating and modifying the structure at various points on the wing.

Quantitative data obtained from flight trials on a Spitfire Mk. V with plain ailerons fitted with a balance tab had previously indicated that aileron properties comparable with those of a metal-covered Frise type could be achieved, with a reduction in drag due to the elimination of the gap. Ailerons of this type with area increased to 6 per cent. of the total wing area, as against 5 per cent. on earlier marks were fitted to the stiffer Mark 21 wing and gave a high rate of roll with reasonable stick forces at high speeds. [*See table overleaf.*

(To be concluded.)



Increase in power.

DEVELOPMENT OF THE SUPERMARINE

SPITFIRE FIGHTERS AND BOMBERS

A table included in the lecture given by Mr. Joseph Smith, C.B.E.,

	ENGINE INSTALLATION							FUSELAGE AND	
Mark	Engine	Airscrew*	Air intake	Exhaust manifold	Radiator type and frontal area	Intercoolant radiator	Oil cooler and area	Fuselage	Windscreen
1a and 1b	Merlin II or III	3-blade D.H. 2P., 2-blade A.FP. or 3-blade D.H.	Temperate	Triple ejector, plain or fishtail ends	Serck, 1.88 sq. ft., or Morris QA, 1.85 sq. ft.	Nil	Serck, 0.2 sq. ft.	Light-alloy monocoque	External bullet-proof screen or plain Perspex
II	Merlin XII	3-blade (J) R	No change	No change	No change	Nil	Serck, 0.35 sq. ft.	No change	No change
III	Merlin XX	3-blade (J) R.	No change	No change	SerckWS 6450, 1.45 sq. ft.	Nil	Serck, 0.35 sq. ft.	Strengthened	Internal bullet-proof screen
Va and Vb	Merlin 45 series	3-blade R. or 3-blade D.H.	Temperate or tropical	No change	Morris QCV, 1.88 sq. ft., or Morris QCY, 2.04 sq. ft.	Nil	No further change	As Mk. I, with reinforced longerons	No further change
Vc and tropical	Merlin 45 series	No further change	Temperate or tropical	No change	No change	Nil	No change	No further change	No further change
VI	Merlin 47 series	4-blade (J) R.	Temperate	No change	Morris QCV, 1.88 sq. ft.	Nil	No further change	Pressurized cabin. Bulkheads fore and aft of cabin	Special non-sliding hood
VII	Merlin 61 series	4-blade (H) R.	Temperate	Multi-ejector	Two Morris QCP, each 1.24 sq. ft.	Morris QCR, 0.72 sq. ft.	Morris QCQ, 0.6 sq. ft.	Basically as Mk. VI strengthened to take increased engine loads	Double-glaze, sliding
VIII	Merlin 61 series	No further change	Tropical	No further change	No further change	No further change	No further change	Strengthened	As Mk. V
IX	Merlin 61 series	No further change	Temperate or tropical	No further change	No further change	No further change	No further change	As Mk. V, strengthened	As Mk. V.
XII	Griffon III or IV	4-blade (J) R.	Temperate	No further change	Morris QCY, 2.04 sq. ft.	Nil	Serck, 0.35 sq. ft.	Mk. V, strengthened, with special attachments at Fr. 5 for Griffon engine	No further change
XIV	Griffon 65	5-blade R.	Tropical	No further change	Morris QFG and QFJ, each 2.45 sq. ft.	Morris QFH, 2.45 sq. ft.	Morris QFK, 2.45 sq. ft.	Mk. VIII, strengthened, special attachments for Griffon engine	No further change
XVI	Merlin 266	4-blade R.	Temperate or tropical	No further change	Two Morris QCP, each 1.24 sq. ft.	Morris QCR, 0.72 sq. ft.	Morris QCP, 0.6 sq. ft.	As Mk. V	As Mk. V
XVIII	Griffon 65	5-blade R.	Tropical	No further change	Morris QFG and QFJ, each 2.45 sq. ft.	Morris QFH, 2.45 sq ft.	Morris QFK, 2.45 sq. ft.	Mk. VIII still further strengthened	As Mk. XIV
21	Griffon 61 or 64	5-blade R.	Tropical	No further change	Morris QEW and QEY each 2.45 sq. ft.	Morris QEV, 2.45 sq. ft.	Morris QEZ, 2.4 sq. ft.	Redesigned to suit increased loads	No further change
22	Griffon 61 or 64	No further change	Tropical	No further change	Morris QGD and QGE, each 2.45 sq. ft.	Morris QGC, 2.45 sq. ft.	Morris QGF, 2.45 sq. ft.	As Mk. 21	Rear vision hood
24	Griffon 61 or 64	No further change	Tropical	No further change	As above	As above	As above	As Mk. 21	Rear vision hood

SPITFIRE PHOTOGRAPHIC RECONNAISANCE

Mark	Engine	Airscrew*	Air intake	Exhaust manifold	Radiator type and frontal area	Intercoolant radiator	Oil cooler and area	Fuselage	Cameras
PR. IV	Merlin 45, 46, 50, 55A, 55 or 56	3-blade D.H.	Temperate or tropical	Triple ejector	Morris QCY, 2.04 sq. ft.	Nil	Serck, 0.347 sq. ft. S.799-3C-525R	Light-alloy monocoque with camera installation	2 vertical F.24, 1 oblique F.24
PR. VII	Merlin 45 or 46	No change	Temperate	No change	Morris QCV, 1.85 sq. ft.	Nil	No change	No change	2 vertical F.24, 1 oblique F.24
PR. X	Merlin 64	4-blade R.	Tropical	Multi-ejectors	2 Morris QCP, each 1.20 sq. ft.	Morris QCR, 0.714 sq. ft.	Morris QCQ, 0.6 sq. ft.	Pressure cabin	Universal
PR. XI	Merlin 61, 63, 63A or 70	4-blade (H) R.	Temperate or tropical	No further change	No further change	No change	Morris QCR, 0.6 sq. ft.	Special P.R. type for universal camera installation	Universal
PR. XIII	Merlin 32	3-blade D.H.	Temperate	Triple ejector	Morris QCV, 1.85 sq. ft.	Nil	Serck, 0.347 sq. ft. S.799-3C-525R	As Mk. I with reinforced longerons	2 vertical F.24, 1 oblique F.24
PR. XIX	Griffon 65 or 66	5-blade R.	Tropical	Multi-ejector	Morris QFJ and QFG, each 2.46 sq. ft.	Morris QFH, 2.46 sq. ft.	Morris QFK, 2.46 sq. ft.	Pressure cabin	Universal

SEAFIRE

Mark	Engine	Airscrew*	Air intake	Exhaust manifold	Radiator type and frontal area	Intercoolant radiator	Oil cooler and area	Fuselage	Windscreen
Seafire I	Merlin 45, 50, 55, 46, 50A or 56	3-blade R. or 3-blade D.H.	Temperate or tropical	Triple ejector, plain or fishtail ends	Morris QCY, 2.04 sq. ft.	Nil	Serck, 0.347 sq. ft. S.799-3C-528R	Light-alloy monocoque. Arrester hook and slinging points	Internal bulletproof screen
Seafire II	Merlin 32, 45 or 46	4-blade R.	No change	No change	No change	Nil	No change	As Mk. I, with reinforced longerons. Arrester hooks, slinging points and catapult spools	No change
Seafire III	Merlin 45, 50, 55, 46, 50A or 56	4-blade R.	No change	No change	No change	Nil	No change	As Seafire II	No change
Seafire XV	Griffon VI	4-blade R.	Tropical	Multi-ejector	Morris QCP, 1.24 sq. ft. Morris QCV, 1.85 sq. ft.	Nil	Morris QCQ, 0.6 sq. ft.	As Seafire II, strengthened. Later a/c had sting hooks	No change
Seafire XVII	Griffon VI	4-blade R.	Tropical	No further change	No further change	Nil	No further change	As Seafire XV, with sting hook and accelerator hooks	Rear view hood and curved screen
Seafire 45	Griffon 61	5-blade R.	Tropical	No further change	Morris QGD and QGE each 2.45 sq. ft.	Morris QGC, 2.45 sq. ft.	Morris QGF, 2.45 sq. ft.	As Spitfire Mk. 21, with sting hook	As Seafire XV
Seafire 46	Griffon 87	2-3-blade R contra-rotating	Tropical	No further change	No further change	No change	No further change	As Spitfire Mk. 22, with sting hook	As Spitfire Mk. 22. Rear-view hood with flat screen
Seafire 47	Griffon 87	2-3-blade R. contra-rotating	Tropical	No further change	No further change	No change	No further change	As Mk. 46. Accelerator hooks	Rear-view hood with curved screen

* R. = Rotol. D.H. = de Havilland A. = Airscrew Co. (J) = Jablo. (H) = Hydulignum. All airscrews are constant-speed, except where stated as two-pitch(2P.) or fixed pitch (FP.).

SPITFIRE AND SEAFIRE MARK BY MARK

F.R.Ae.S., A.I.A.E., to the Royal Aeronautical Society on December 19

UNDERCARRIAGE		WINGS					CONTROLS		
Tailwheel	Undercarriage	Wings: Span	Wings: Area	Wing tips	Armour	Armament†	Ailerons	Rudders	Elevators
		ft. ins.	sq. ft.		lb.				
Fixed	Outwardly retractable oleo unit	36 10	242	Standard	—	Mk. 1a, 8 B. Mk. 1b, 4 B., 2 H.	Frise type, fabric covered	Horn balanced type, fabric covered	Light-alloy construction, fabric covered
No change	No change	36 10	242	Standard	73	As above	No change	No change	No change
Retractable	Strengthened and wheel moved 2 ins. forward	30 6	220	Clipped	88	8 B.	No change	No change	No change
		36 10	242	Standard	88	4 B. and 2 H., or 8 B., or 4 H.			
Fixed	As for Mk. I	36 10	242	Standard	129	8 B.	Later a/c had metal covering	No change	No change
					152	2 H. and 4 B.			
Fixed	As for Mk. III	36 10	242	Standard	193	Universal	No further change	No change	No change on early aircraft. Later types had extended horn
Fixed	As for Mk. Vc	40 2	248½	Extended	152	2 H. and 4 B.	No further change	No change	As Mk. I
Retractable	As for Mk. Vc	40 2	248½	Extended	202	2 H. and 4 B.	Reduced span	Large chord of increased area	Extended horn balance
Retractable	As for Mk. Vc	36 10 or 40 2	242 or 248½	Standard	202	2 H. and 4 B., 4 H.	Reduced span	No further change	No further change
Fixed	As for Mk. Vc	36 10	242	Standard	202	2 H. and 4 B.	As Mk. Vc	No further change	No further change. Metal-covered on later a/c
Fixed, later retractable	As for Mk. Vc	32 7	231	Clipped	180	2 H. and 4 B.	As Mk. Vc	No further change	As Mk. I
Retractable	As for Mk. Vc	36 10 or 32 7	242 or 231	Standard or clipped	180	2 H. and 4 B.	As Mk. VIII	Increased area, fin and rudder	Extended horn balance
Fixed	As for Mk. Vc	36 10	242	Standard	202	2 H. and 2 0.5-in. B.	As Mk. Vc	As Mk. VII	Extended horn balance, meta covered
Retractable	As Mk. V, strengthened	36 10 or 32 7	242 or 231	Standard or clipped	180	2 H. and 2 0.5-in. B.	As Mk. VIII	Increased area, fin and rudder	Extended horn balance
Retractable	Strengthened and extended. Fairing flaps fitted	36 11	244	Special Mk. 21 type	190	4 H.	Plain, balanced tab. Extended span	No further change	Extended horn balance with rounded horn
Retractable	As Mk. 21	36 11	244	Special Mk. 21 type	190	4 H.	As Mk. 21	Further increase in area of fin and rudder	Increased area of tailplane and elevator
Retractable	As Mk. 21	36 10	244	Special Mk. 21 type	190	4 H.	As Mk. 21	As Mk. 22	As Mk. 22

Windscreen	Tailwheel	Undercarriage	Wings: Span	Wings: Area	Wing tips	Armour	Ailerons	Rudders	Elevators
			ft. ins.	sq. ft.		lb.			
Plain Perspex	Fixed	Outwardly retractable oleo unit	36 10	242	Standard	85	Frise type, metal covered	Horn balanced type, fabric covered	Light-alloy construction, fabric covered. Extended horn
Internal bulletproof screen	Fixed	No change	36 10	242	Standard	129	No change	No change	No change
As Spitfire Mk. VII (F)	Retractable	No change	36 10	242	Standard	85	No change	Increased area as Spitfire Mk. XII (F)	No change
Plain Perspex	Fixed, later retractable	No change	36 10	242	Standard	85	No change	No further change	No change
Internal bulletproof screen	Fixed	No change	36 10	242	Standard	152	No change	As PR. IV	No change
As Spitfire M. VII (F)	Retractable	No change	36 10	242	Standard	85	Reduced span	Horn balanced type, fabric covered. Increased area as Spitfire Mk. XIV	No change

Tailwheel	Undercarriage	Wings: Span	Wings: Area	Wing tips	Armour	Armament†	Ailerons	Rudders	Elevators
		ft. ins.	sq. ft.		lb.				
Fixed	Outwardly retractable oleo unit	36 10	242	Standard	161	2 H. and 4 B.	Frise type, metal covered	Horn balanced type, fabric covered	Light-alloy construction, metal covered
Fixed	Strengthened	36 10	242	Standard	202	2 H. and 4 B.	No change	No change	Later aircraft had extended horn. Metal covered
Fixed	As Seafire II	36 10	242	Standard shape, folding	202	2 H. and 4 B.	No change	No change	No further change
Retractable	As Seafire II	36 10	242	As Mk. III	180	2 H. and 4 B.	No change	Large chord rudder as Spitfire Mk. XII	No further change
Retractable	As Seafire XV, with long-stroke oleo legs	36 10	242	As Mk. III	164	2 H. and 4 B.	No change	No change	No further change
Retractable	As Spitfire Mk. 21	36 11	244	Special Mk. 21, Non-folding	190	4 20-mm. H.	Plain ailerons with geared tabs	Horn balanced type, fabric covered. Increased area as Spitfire Mk. XIV (F)	Metal covered with rounded extended horn
Retractable	As Seafire 45	36 11	244	As. Mk. 45	190	4 20-mm. H.	As Seafire 45	Fabric covered, increased area as Spitfire Mk. 22 (F). Horn balanced with anti-balance trimmer tab	Increased area. Metal covered
Retractable	Strengthened and with long-stroke oleos	36 11	244	As Mk. 45, folding	190	4 20-mm. H.	As Seafire 45	As Seafire 46	As Seafire 46

† B. = Browning. H. = Hispano. PR. VII had eight B. guns and PR. XIII had four B. guns.

ORIGIN OF SPECIES—II

A condensed version of the lecture given by Mr. Joseph Smith, C.B.E., F.R.Ae.S., A.M.I.A.E., Chief Designer of the Supermarine Works of Vickers-Armstrongs Ltd., at a meeting of the Royal Aeronautical Society in London on December 19. The first part appeared last week.

(Continued from page 745.)

THE maintenance of a reasonable standard of fore-and-aft control and stability provided a problem which was continuous throughout the development of the aircraft. On a small fighter such as the Spitfire it is probably true to say that every single modification affected this feature. Among remedies were small increases in area of elevator horns, fitment of inertia weights in the elevator control system, slight alterations to elevator section and metal skinning of elevators. Major factors which affected this characteristic were the fitment of heavier and more powerful engines, the use of airscrews of higher solidity,

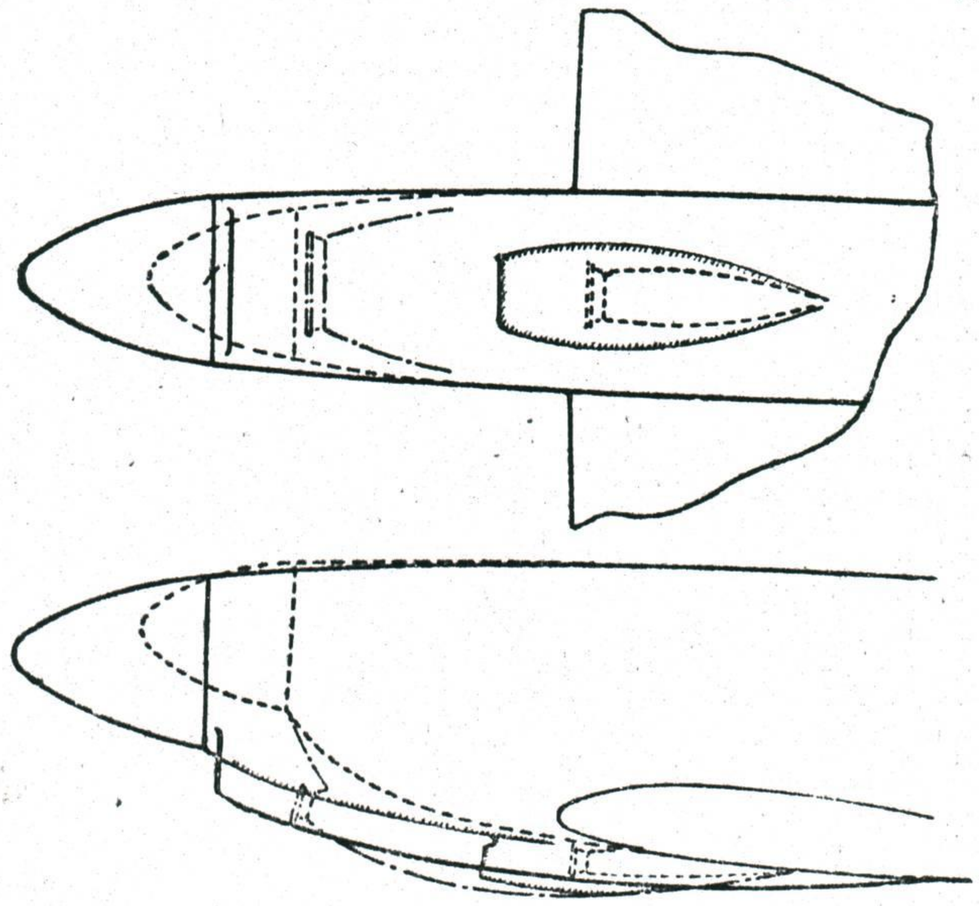
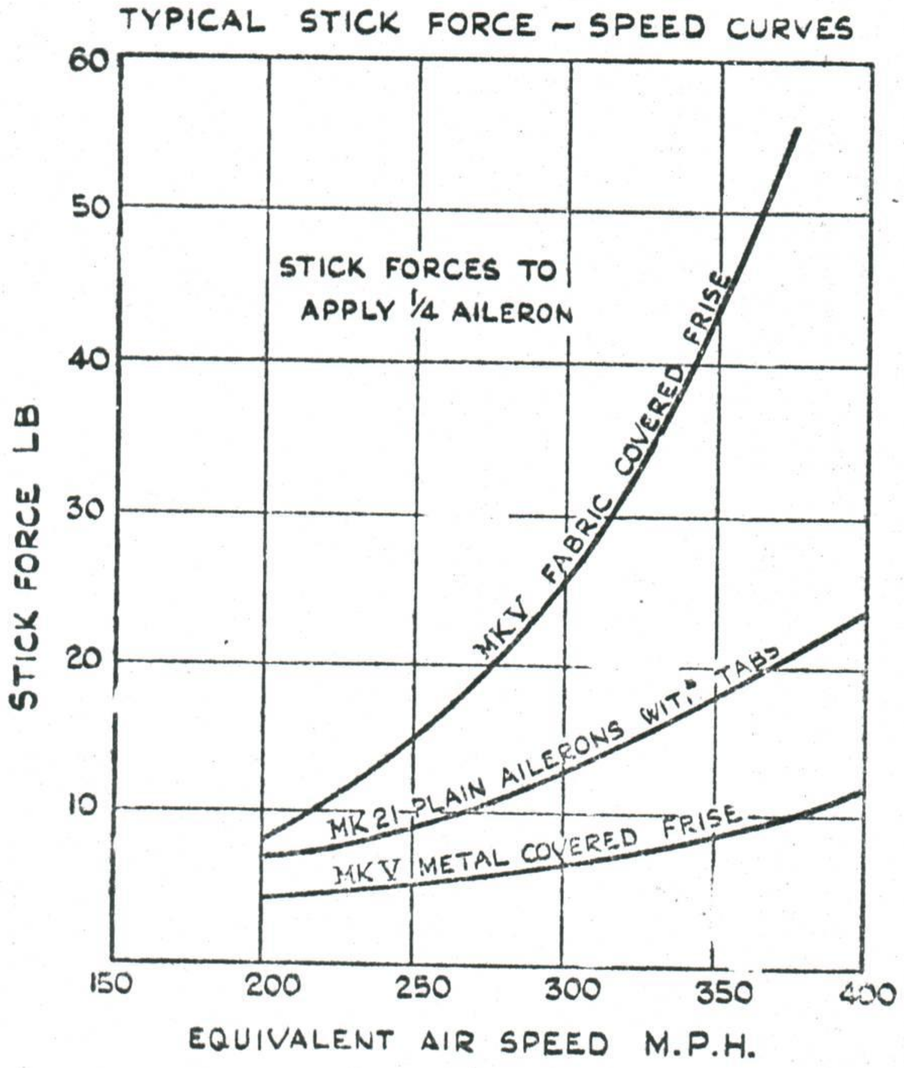
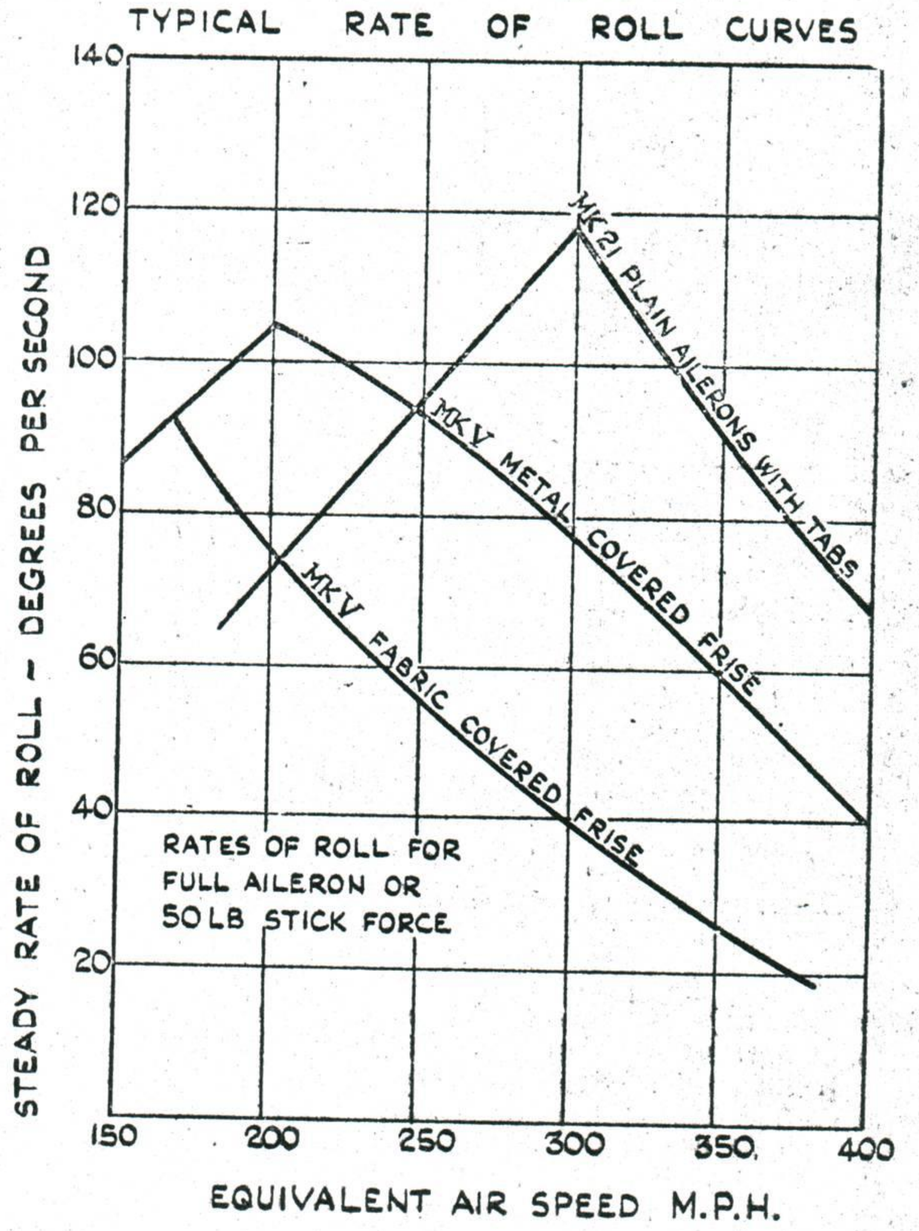


Diagram of the various types of air intake used.

increases in fuel capacity, and changes in the operational altitude of the aircraft; and to cater for these, tailplanes and elevators of increased area had to be used.

One further aspect of this problem that may be mentioned was the effect of expendable load such as fuel and ammunition. The impossibility of positioning all such loads on the aircraft





C.G. will be understood, and C.G. movement as high as 9 ins., or 11.5 per cent. of the mean chord, had to be contended with.

A very careful check had also to be kept for any deterioration in directional control and stability of the machine due to modification. Increases in areas of rudder horns, fitment of anti-balance tabs, metal skinning of rudders, and rudders of increased area were among the steps tried out and used.

The use of larger and more powerful engines resulted in lengthening the nose of the aircraft and necessitated the use of airscrews of higher solidity and to counteract the destabilizing effect of this additional forward side area substantial increases in the vertical areas aft had to be provided.

Technical Development III—Armament

At the time of its appearance, the original armament of eight .303-in. Browning guns, with 300 rounds of ammunition, was good for the type, but the need for the greater hitting power of the 20 mm. Hispano gun soon became apparent. The wing layout had to be redesigned to accommodate one of these weapons on either side, and four of the .303-in. Brownings were retained outboard. Arrangements were made on the firing control so that the Browning and Hispano guns could be fired together or separately. Only 60 rounds of 20 mm. ammunition could be carried, as the drum-type magazine was the only one available; it also necessitated the fitting of blisters to the wing surfaces.

The next step was the production of a wing which could be fitted with either eight machine-guns, four machine-guns and two Hispano, or four Hispanos. This "universal" wing was fitted to Marks Vc, VII, VIII, IX, XII and XIV, and allowed for any variation in policy or the supply of guns. By this time the belt feed was available, allowing ammunition capacity to be increased to 160 rounds per gun.

The next change was the fitting of two .5-in. Browning guns instead of the four .303-in. guns, together with two 20 mm. Hispanos on the Marks IX, XIV, XVI and XVIII. Finally, it became evident that 20 mm. ammunition was the only really effective type, and the fitting of four 20 mm. Hispano guns was made standard on Marks 21, 22 and 24, together with the provision of 140 rounds per gun.

As the use of the machine by the Services was developed, so the need for armour protection of the pilot arose. The first requirement put forward very early in the production of the

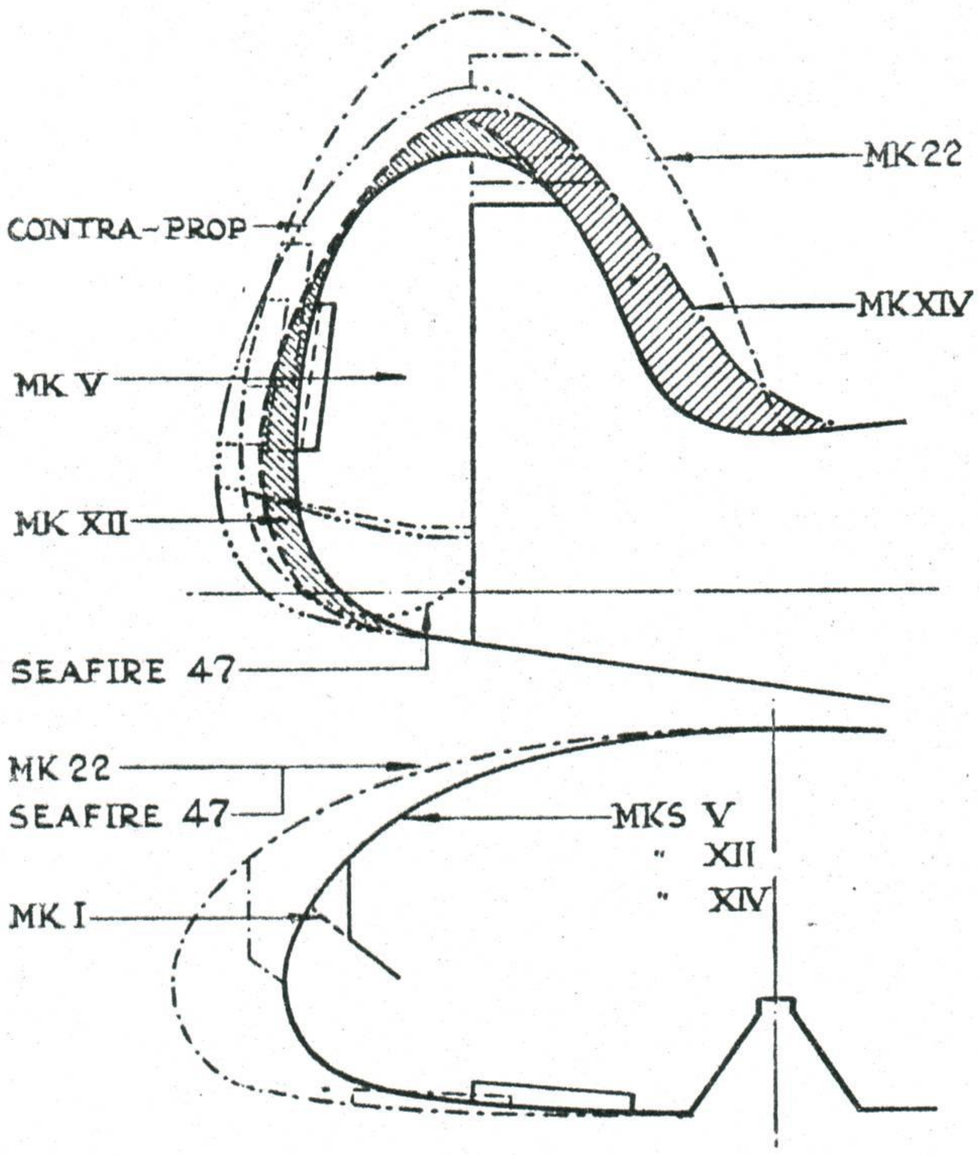


Diagram showing relative tailplane and elevator and rudder areas.

Mark I was the provision of a bullet-proof windscreen, made by fixing externally to the front of the windscreen a 1¾-in. thick bullet-proof panel. Also at a very early stage, 6 mm. plate was introduced behind the pilot's head. Later, 4 mm. plate was added behind the pilot's seat, together with forward protection for the glycol header tank and the top fuel tanks. As the enemy changed to heavier calibre weapons, the density of the armour plate was increased, and the protection extended to other parts of the aircraft.

The protection behind the pilot's seat was later increased to two 6 mm. plates with a 6-in. air space between, deflection plates were added under the pilot's seat and on the forward face of the ammunition magazine, and the bullet-proofing of the windscreen extended to the side panels. Light alloy deflector plates were used throughout over the petrol tank bay, and later, in the vicinity of the 20 mm. guns.

	Mk. I	Mk. 24
Weight of ammunition	185 lb.	375 lb.
Weight of armour	nil	190 lb.
Weight of guns	195 lb.	580 lb.

Technical Development IV—Range

In considering the range of the Spitfire it must be remembered that the aeroplane was originally designed as an interceptor fighter operating from home bases. Its fuel capacity of 85 gallons only allowed for take-off, a climb to altitude, 1.65 hours cruising and 15 minutes combat at full bore. In the course of development the engine power was doubled, and in the final fighter version of the Spitfire the petrol tank capacity was approximately double that of the original aircraft. The fighting range was actually increased, a feat which required some ingenuity in view of the fact that the size of the aircraft remained virtually constant.

The steps taken may be divided into four stages. First, the expansion of the original main tanks to the limit of space, followed by the introduction of fabric tanks in the leading edges of the wings, the use of subsidiary tanks in the fuselage immediately aft of the pilot's cockpit, and the use of drop tanks.

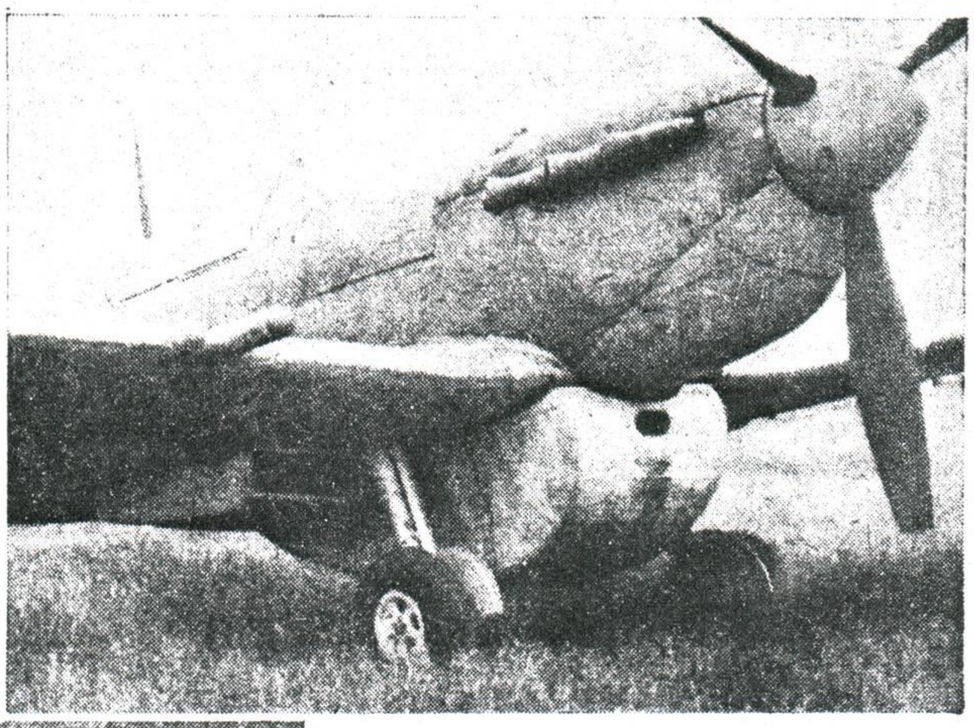
The expansion of the main tank was confined to the lower tank and was made possible by the use of welded construction, the material in this case being magnesium. The capacity was increased by 10 gallons. Wing tanks of 36 gallons total capacity were later introduced by fitting strictly tailored Mareng bags into the spaces between the ribs in the leading edge forward of the main spar. Finally, as far as fixed fuel capacity was concerned, additional tanks were fitted behind the pilot on the later types.

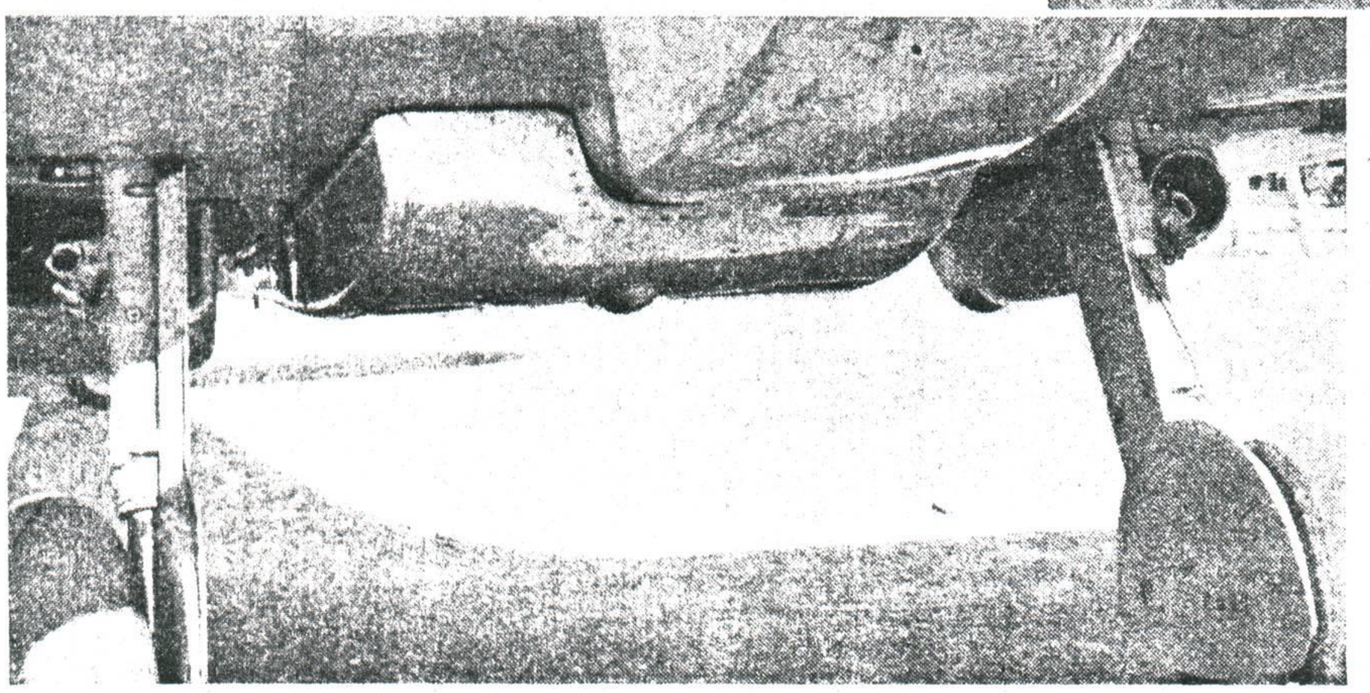
When it became necessary for Spitfires to operate from bases distant from the scene of operations, drop tanks which could be jettisoned on meeting enemy aircraft, were developed and fitted. A slipper type of tank of 30 gallons capacity was first used and a number of snags were experienced before satisfactory jettisoning was obtained.

Various sizes of tanks were produced, including a 90-gallon and a 170-gallon variety. The 90-gallon tank made a very dramatic entry into Spitfire life by enabling these fighters to get through to Malta and play their part in the relief of the Island. They were taken by carrier to within 800 miles of the Island, and then flown off the deck.

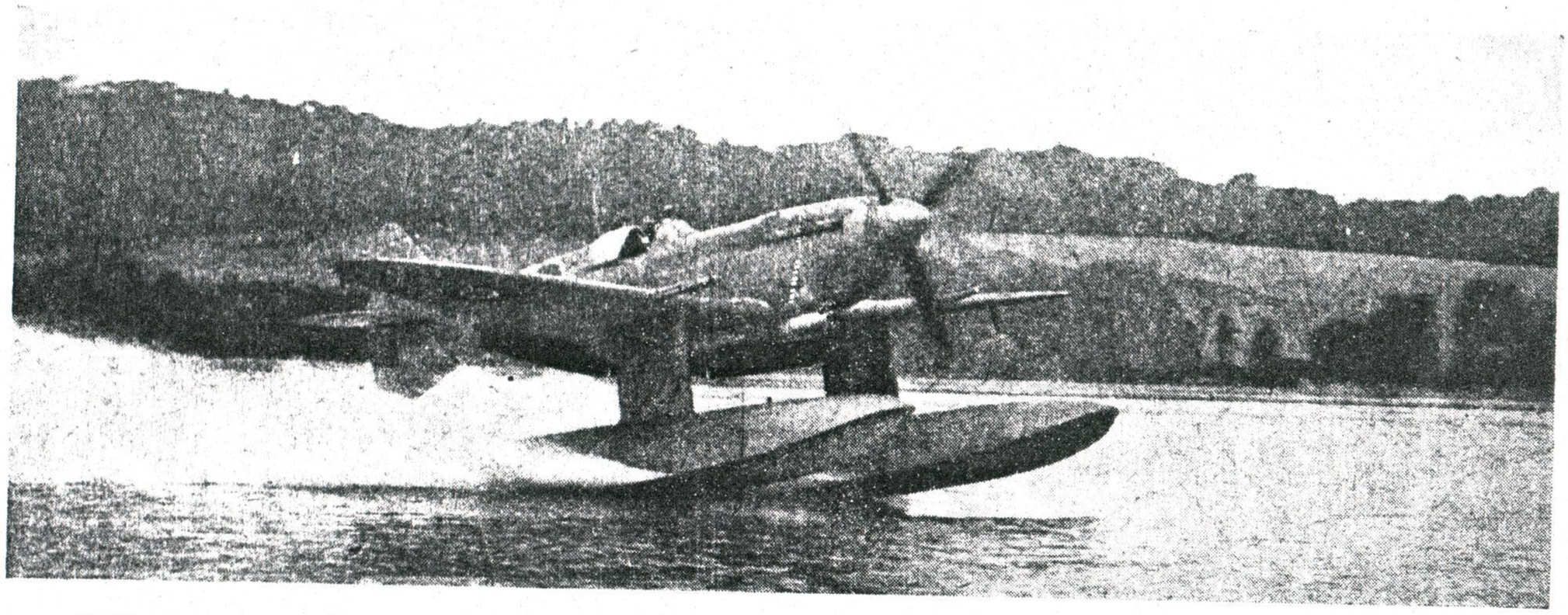
During the period of sweeps over occupied France, tens of thousands of 30-gallon tanks were consumed, and over 300,000 drop tanks for Spitfires were actually manufactured. In order to reduce drag, later types of drop tank were streamlined in shape, supported by short struts away from the fuselage. They were attached and released by the standard means, and were of 45 and 90 gallons capacity.

In addition to the above steps taken to increase the range of fighter types, a long-range P.R. aircraft was developed. The additional fuel capacity was housed literally in the leading edges of the wings. The original structure lent itself very well to this purpose, and with surprisingly little modification was converted into integral tanks of 133 gallons total capacity. The result was an unarmed aircraft capable of Spitfire speed with a range of well over 2,000 miles and a consumption in propelling 3½ tons through the air of nine miles per gallon.





BELLY TANKS.—Carriage of sufficient fuel has always been a problem with single-motor fighters, and during the War a number of different drop-tanks were fitted to the many variants of the Spitfire. (Above) The deep 170-gallon slipper tank, which was used mainly for ferrying duties, and (left) is the 30-gallon slipper tank installation, used to a great extent operationally.



SPITFIRE FLOATPLANE.—Developed from the Marks I, V and IX, three types of Spitfire floatplane were built. The original conversion, a Spitfire I, was fitted with Blackburn Roc floats. Production of this particular version did not proceed, although a limited number of Mk. IX conversions were manufactured.

Technical Development V—Structural Efficiency

Obviously as power and speed increased, the loads to be carried became greater, and to maintain low drag any form of external wing reinforcement was ruled out. The resulting problems were solved mainly by the use of materials of higher strength than those originally used, and also by the local application of thicker sections. The main spar booms which consisted of a series of duralumin tubes telescoped inside each other and stopped off at intervals, were open to modification in two ways. First, the relative lengths of tubes were increased, and later the material of the tubes was changed to a higher grade light alloy. The final development used on the Mark XVIII aircraft was the use of an extruded section in DTD.364 machined on the taper. This was not used on the Mark 21 series because of production considerations.

The stressed-skin construction made it possible to strengthen the structure by increasing the gauge of the skin covering, a procedure which was adopted in particular in various stages on the fuselage.

The introduction of the Griffon engine brought a complete change of engine mounting, from a built-up tubular structure to a semi-cantilever beam type mounting, fabricated from light-alloy extrusions and sheet.

The final stages required the use of steel longerons in the fuselage and steel reinforcements for the centre-section spar booms. The undercarriage was strengthened in stages by thickening the oleo cylinder and the pintle in the wing and by strengthening the attachments to the main spar.

These structural changes were accommodated without increasing the percentage structure weight.

Technical Development VI—Special Duties

Apart from the Seafire, normal Service use called for special jobs. The result was that many of the later marks had three variations: the standard aircraft known as "F," fitted with a medium altitude rated engine, the "H.F." type, with a high-altitude engine and increased wing span, and the "L.F." type, for low-altitude work. Three types of wing were available, known as standard, extended or clipped, allowing a total variation of wing span of 7 ft. 7 ins. or 23 per cent. A still further type of machine known as the F.R. had a low-altitude engine, normal armament and a slightly increased fuel capacity to give greater range. Cameras were also fitted.

The original photographic reconnaissance machine was developed further. Various combinations of cameras were installed, and a universal camera installation finally adopted. Armed versions for low-altitude work were also introduced.

As enemy opposition in the air lessened and finally disappeared, the Spitfire was largely used for ground strafing. First bombs and later rockets were fitted under the fuselage and wings; the 20 mm. Hispanos were used to good effect.

In 1941 the threat of high-altitude bombing by the enemy had to be faced. It was decided to pressurize the cockpit, and the matter being one of great urgency, the prototype was constructed by the direct modification of a completed Vb aircraft. It was fitted with a special high-altitude Merlin 47 engine incorporating a Marshall cabin blower capable of producing 90 cubic ft. of air a minute. The wing span was increased by using the extended tips, and a four-bladed Rotol airscrew was fitted.

On the resulting aircraft a differential cabin pressure of 2 lb./sq. in. was attained, which reduced the apparent altitude from 40,000 ft. to 28,000 ft. The increased span and special engine and airscrew resulted in a higher ceiling. The new Spitfire Mk. VII was produced later as a pressure cabin machine, and incorporated many improvements over the earlier type.

After mentioning the original conversion of a Spitfire Mk. I to a seaplane which did not go into service owing to the early termination of the Norwegian campaign for which it was intended, the lecturer said that the requirement was not, however, allowed to drop, and in 1942 a second float-plane was produced, built around the Mark V. The floats designed by Supermarine had a reserve buoyancy of 90 per cent. and were mounted on cantilever struts attached to the mainplane spars at a distance of 5 ft. from the centre-line of the aircraft. Additional fin area was fitted under the stern of the fuselage to counteract the destabilizing effect of the floats, and the air intake was extended forward to obviate the entry of spray. The handling characteristics of this machine both in the air and on the water were good, and the speed of the standard machine was only reduced by 30 m.p.h.

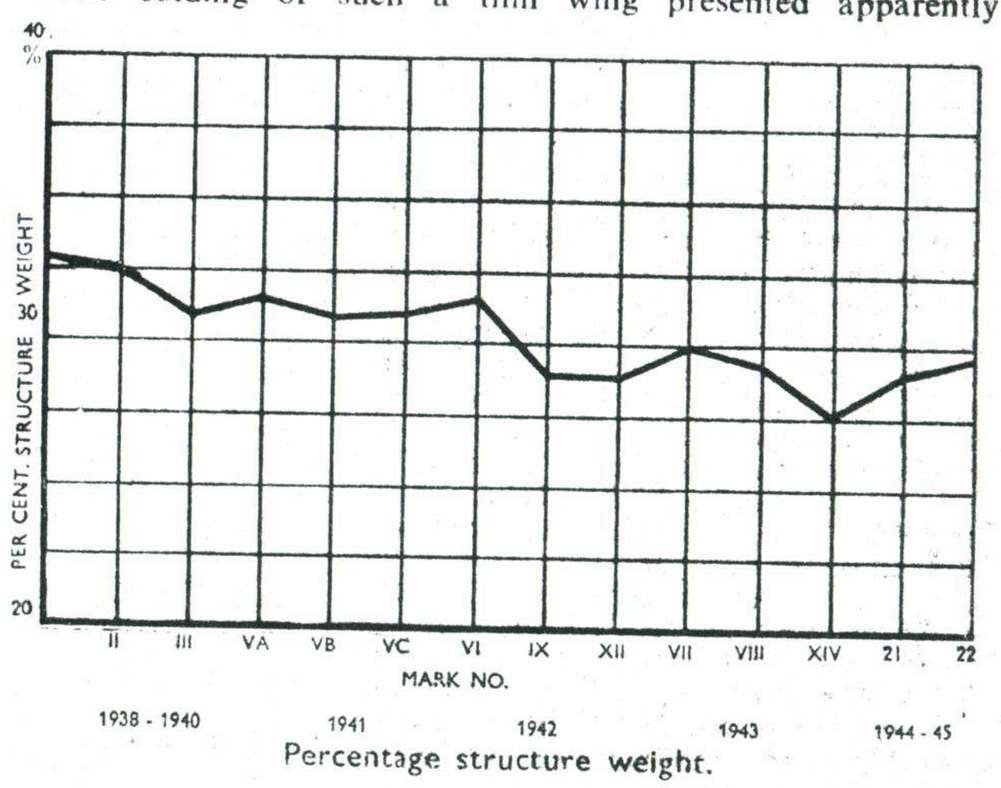
Subsequently a Mark IX was converted, using the same design of float, and a limited number of these conversions were manufactured.

More recently a still further conversion of the Spitfire has been carried out. By moving the existing pilot's cockpit forward it has been possible to build a second cockpit into the fuselage, and by providing a duplicate set of controls a high-performance trainer has resulted (as illustrated in a Clark drawing in THE AEROPLANE on November 22 last).

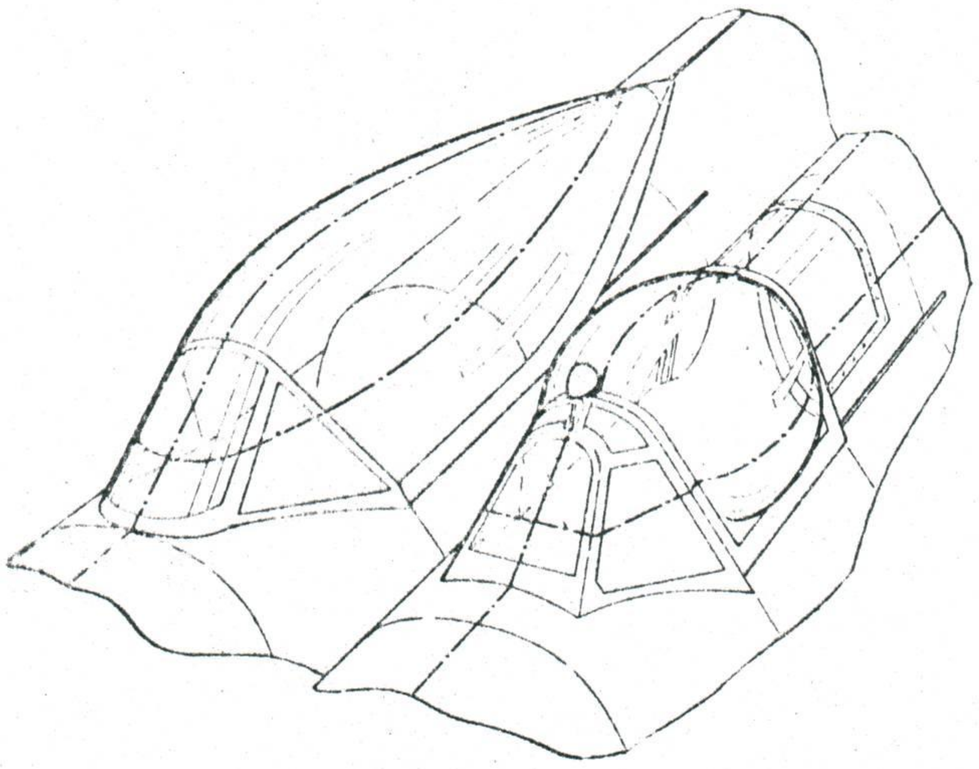
Technical Development VII—Naval Problems

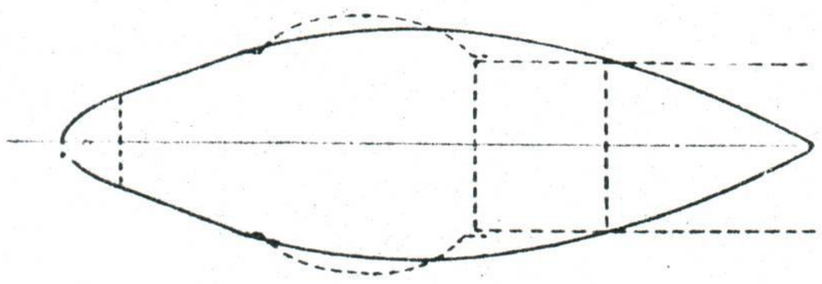
Towards the end of 1941 a Spitfire Vb was fitted with an arrester hook in the form of an A-frame hinged to the underside of the rear fuselage. Another machine, this time a Vc, was similarly treated and given in addition catapult spools. A number of both types was built, but their successful operation from carriers raised the much greater problem of wing folding in order to utilize to the full the available hangar space.

The folding of such a thin wing presented apparently



Percentage structure weight.





Comparison of standard and rear view hoods.

insoluble problems if excessive weight increase and loss of stiffness were to be avoided. Finally, after considering and investigating several schemes it was found possible to introduce two straight fore and aft folds. The wing was hinged and arranged to lift vertically from a point near the root but outboard of the radiator, and a second fold situated at the wing-tip joint turned downwards.

The increase in weight was only 125 lb. and the decrease in torsional rigidity when tested was found to be 10 per cent. This was considered to be satisfactory, and the folded width of the aircraft was 13 ft. 6 ins. as against the normal span of 36 ft. 10½ ins. The prototype aircraft was a directly modified Vc, and was known as the Seafire III. With the introduction of the Griffon engine the Seafire XV was produced.

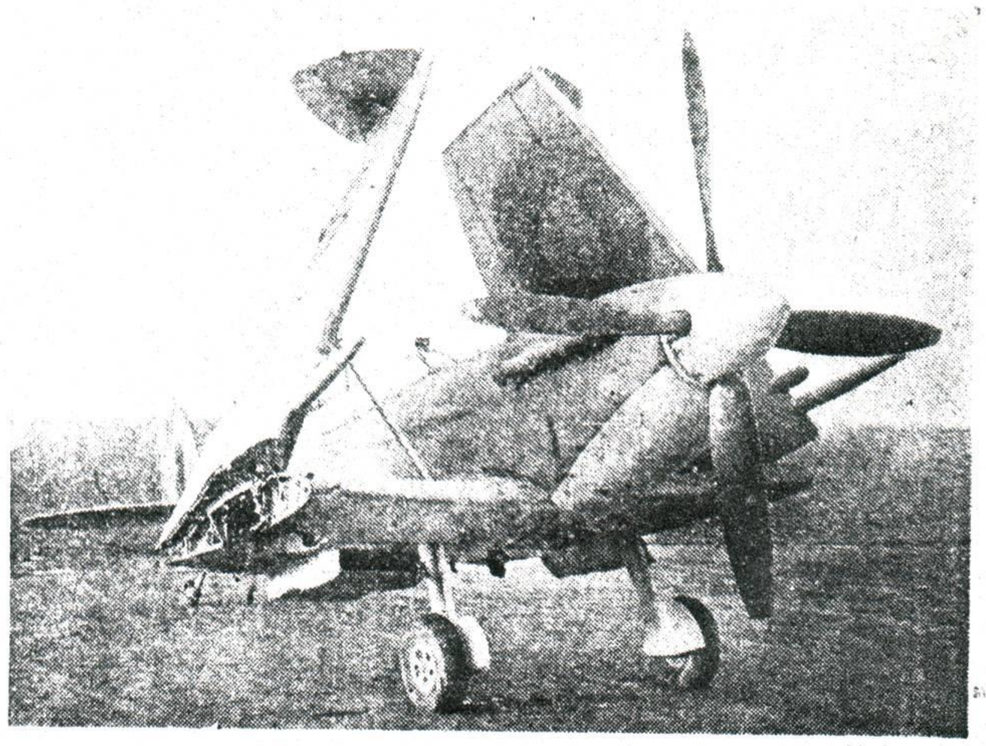
Deck landing characteristics were improved by fitting a new form of arrester hook known as the sting hook, so called from its appearance when lodged in the extreme tail.

On a later version of the Seafire, the Mark XVII, a rear-vision hood was incorporated and also an undercarriage giving greatly improved shock-absorbing characteristics. Another feature brought in on this type was the curved front for the pilot's windscreen, achieved by fixing a curved plate-glass panel in front of the bullet-proof screen.

Conversions of the latest type of Spitfires are now being produced for the Royal Navy. The basic type used is the Mark 21 series, and the latest naval versions incorporate such features as contra-rotating propellers, increased flap areas and long-stroke undercarriages.

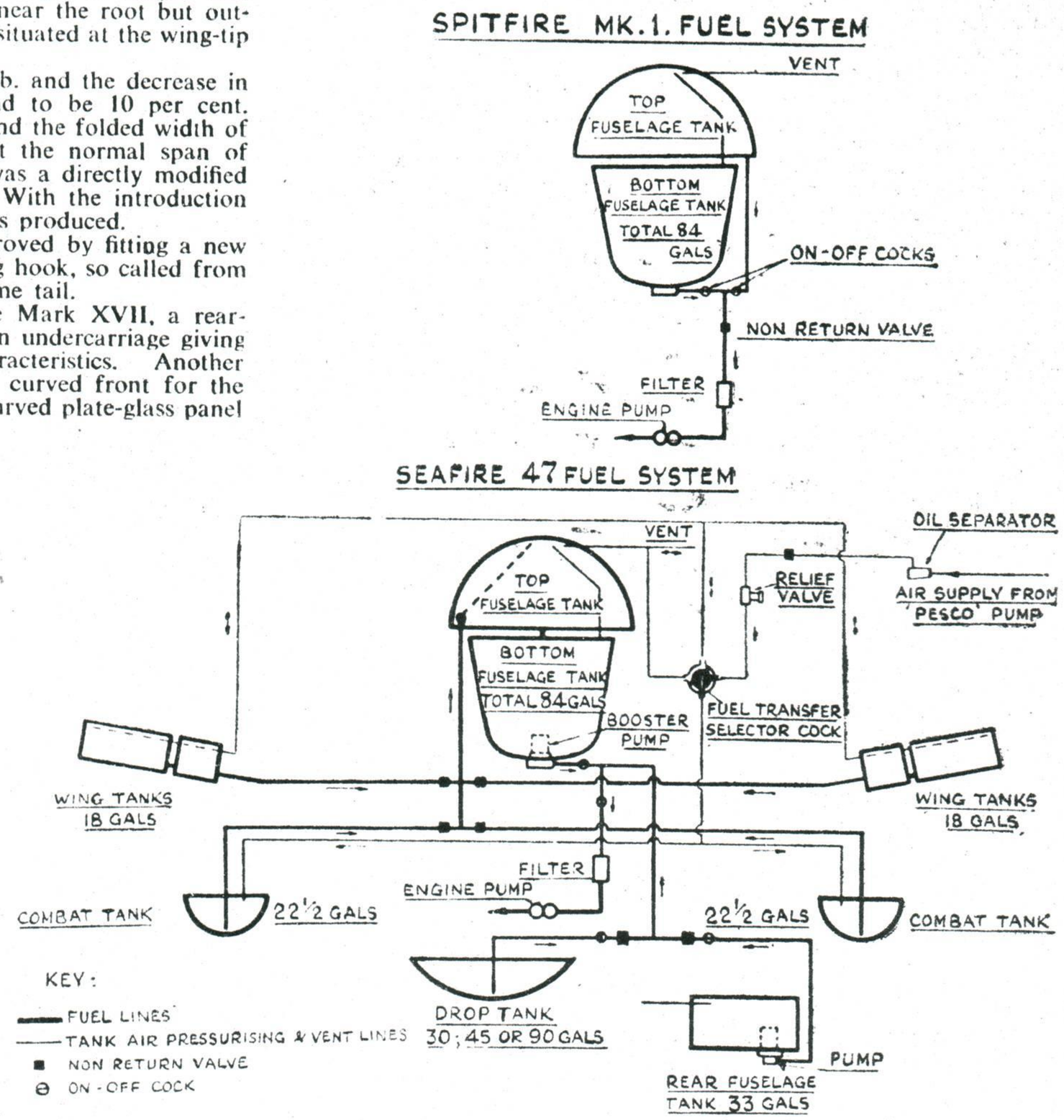
Conclusion

Mr. Smith concluded his most interesting and instructive lecture with a short summary of the outstanding points. "In summarizing the factors," he said, "which allowed the solution of the technical development problems facing the firm over a period of 10 very busy years, several general impressions emerge First, the Spitfire was superbly served by its power plant, and the alliance of a new airframe with engines which were only at the start of their development life was taken full advantage of. Also, the close co-operation between Rolls-Royce, the airscrew firms and ourselves, enabled advance provision to be made for engine changes. Secondly, the sound basic design of the aircraft with its outstanding simplicity enabled major modifications to be incorporated without materially altering the original concep-



Seafire III with wings folded.

tion. Although very few details remained unaltered by the time the Mark 24 was built, the layout and design principles on which the aircraft was based persisted throughout. During the two major redesigns, those of the Mark VIII and the Mark 21, careful consideration was given to suggested fundamental changes, but the advantages to be gained were too nebulous to warrant departure from the tried and proved Spitfire layout. Thirdly, the continuous improvement in aerodynamic cleanliness, the maintenance of ease of control and structural efficiency were in the hands of a design team working continually over a period of 10 years on the improvement of a type which they had originated. Finally, the co-operation received from officials and officers of the Ministries and Services concerned was at all times whole-hearted and extremely helpful, and without it no progress could have been made."



This diagram shows the complication of the Seafire 47 fuel system compared with the original simple system used in the Spitfire Mk. I.



PL 372



PL 374

Photos W. Harvey





July 1965





R-40



PL375

PL375



PL382



PL 362



PL364

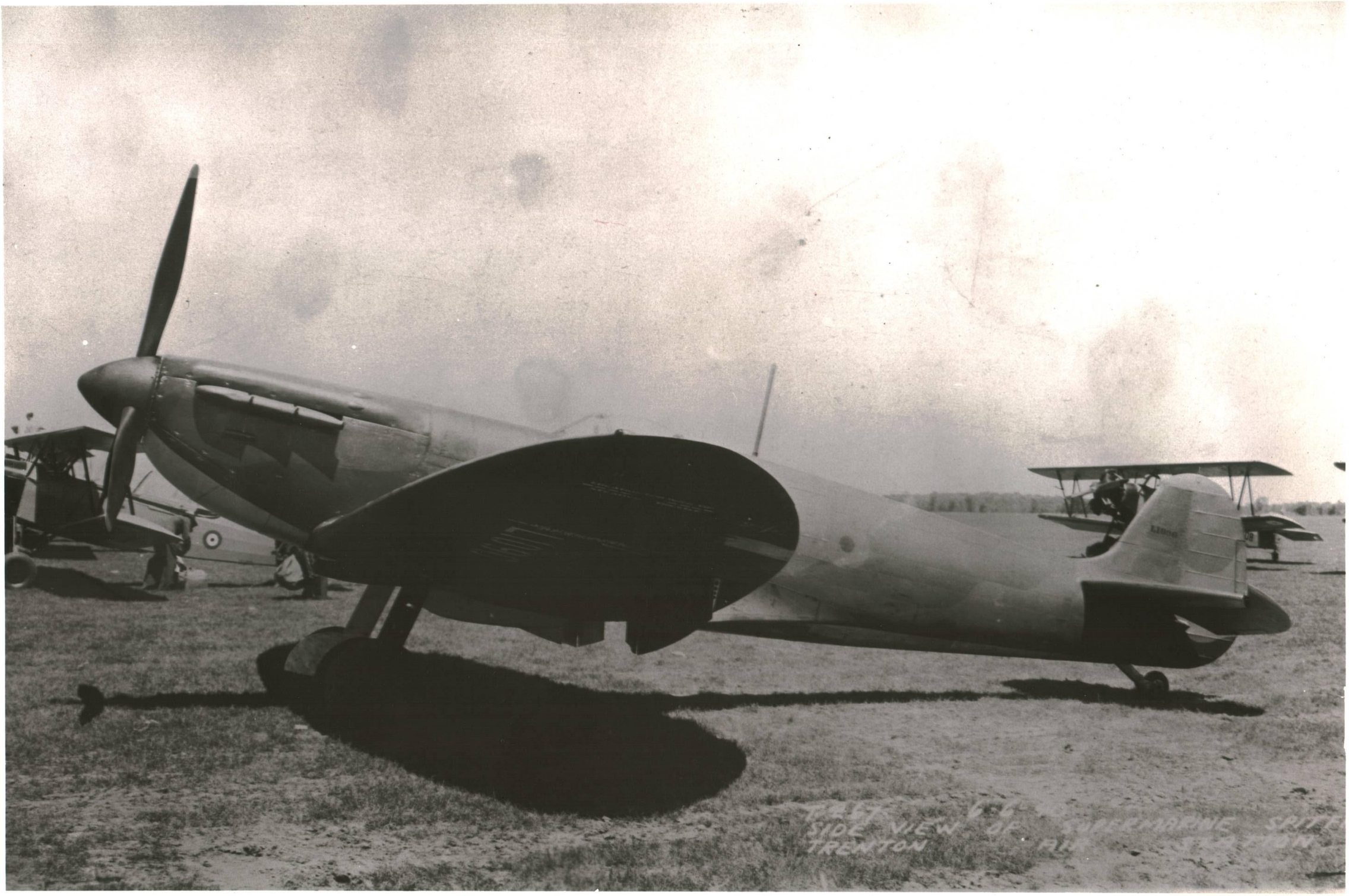
W. Rowe Photo
CY-SG





Spitfire I - L-1090 - from batch K-9787-L1096
310 a/c ordered from Vickers on June 3/36
Deliveries from July 1938
L-1090 - had Merlin III
eg K9787 - K9960 had Merlin II
K9961 - L1096 had Merlin III

K. Molson copy.



Supermarine Spitfire L1090

6 June 1940
Trenton, Ont.

Photo
H. Tate

copy neg on file

Master Photo

Spitfire Mk. XIV TZ138

Edmonton 1946



Spit XIV TZ-138

H. o Tate photo

from W. Wheeler



Spitfire MkXIVe TZ 138



W.E.E.



KB428

Master Photo Book



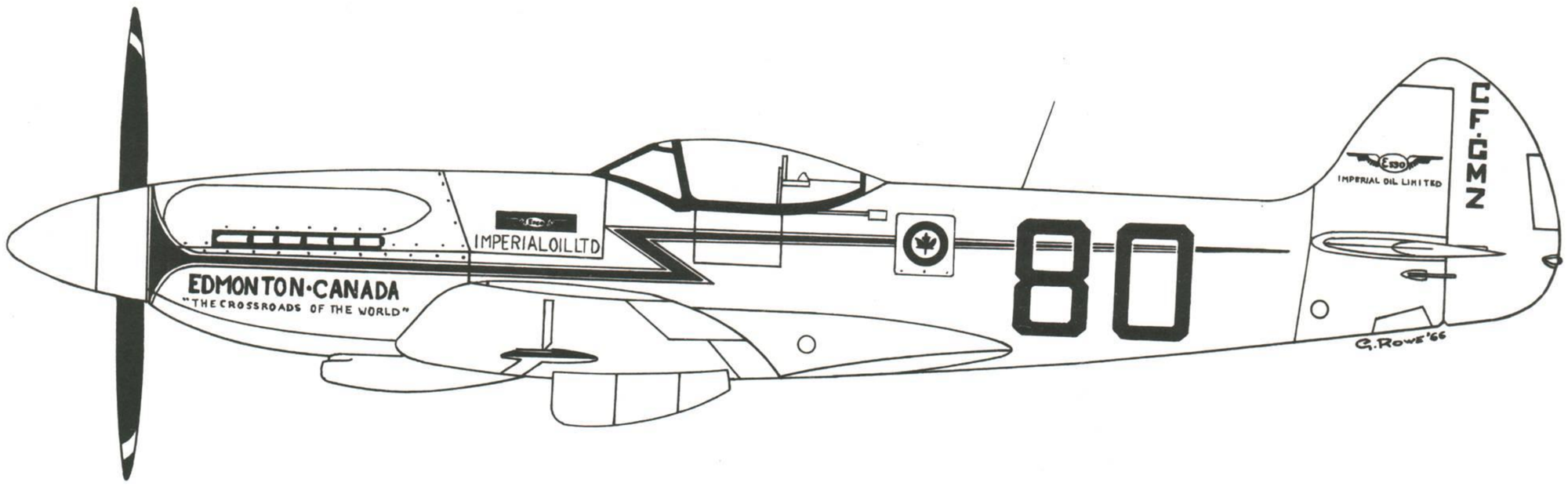
Photo :-
W. Wheeler

Spitfire XIV W.E.E

Photo
E. Rowe.



Spit XIV CF-GMZ ex TZ138


IMPERIAL OIL LTD
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"THE CROSSROADS OF THE WORLD"
80
IMPERIAL OIL LIMITED
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G.ROWE '66

CATZ136

Robert Murray

From: "Lee Walsh" <walshlee@hotmail.com>
To: <mala@istar.ca>
Sent: December 11, 1999 1:45 AM
Subject: Spitfires in the RCN - Reply

Dear Bob;

Many thanks for the reply. I wish I had this server many years ago. It would have saved alot of postage and legwork.

As for the article I am working on, I hope to put a manuscript together this month or in the Spring on next year. I am returning to school next semester and I don't think I am going to have much time to work on it. I hope to submit it to the Canadian Aviation Historical Society and a few British Magazines, that is when I can solve some of the remaining mystery eg The Rockcliffe Trio.

For the past nine, almost ten years, I have been tracking down stories, people, photos, and documents pertaining to these Spitfires that were in Canada from 1940 to 1947. The ones that came into the country after the 1950s; well I will leave that to some other brave soul. This project has been enough for me

I can now say for sure that the following Spitfires were in Canada during these dates for testing, victory bond drives, and by pure accident. But one Spitfire I am still having a problems with and hope to solve it by months end. I just got a name that might be able to answer some questions concerning this Spitfire.

As for the record cards, I have a complete set of all of them and i warn you of some errors. Some years ago I went after the story of the Spitfire that was sent to the L school in Halifax. After a very long search I found two people that knew about the Spitfire being delivered to the School. Only a handful knew about and most of which are all dead know. I went out on a limb and called Terry Burchell, the school's CO at the time. I asked all about the Spitfire, including the colour of it. Of the three Spitfires at Rockcliffe [R7143, X4555, X4492] R7143 stood out the most, it was finished in bare metal. Before it came over to Canada it was converted and tested extensive at various locations across the UK. It was painted in a high altt. pink paint scheme before it was stripped off.

Terry went on to say that he remembers Barry Hayter flying this Spit from Ottawa to Halifax. X4555 I guess was to make the trip but it was unable to fly, much like X4492. All three were not in the best of shape as they had been in unit storage at No. 9 TG for awhile. He said that the aircraft was silver and had no paint - thus R7143 made the journey to Stadacona. What happened to it is a mystery and a detective case I hope to soon close. Where X4555 and X4492 went remains a mystery as well. Hence this plea for help on this server.

JG480 was the forth Spitfire to go the RCN in July 1946. I found the complete story of it from Capt Vernon Howland in Halifax. He was the CO at

the Supply School and had asked HQ for parts for training. What he got was an ex-[W]inter [E]perimental [E]stablishment RCAF Spitfire that had gone surplus the month before. Instead of being shipped back to England the Ministry of Aircraft Production surplused dozens of test aircraft. It stayed at he school for a while, where Vernon would start her up every now and then. When he left it to left the school, the new CO ordered it to be cut up at Naden or Boundry Bay. Have lots of photos.

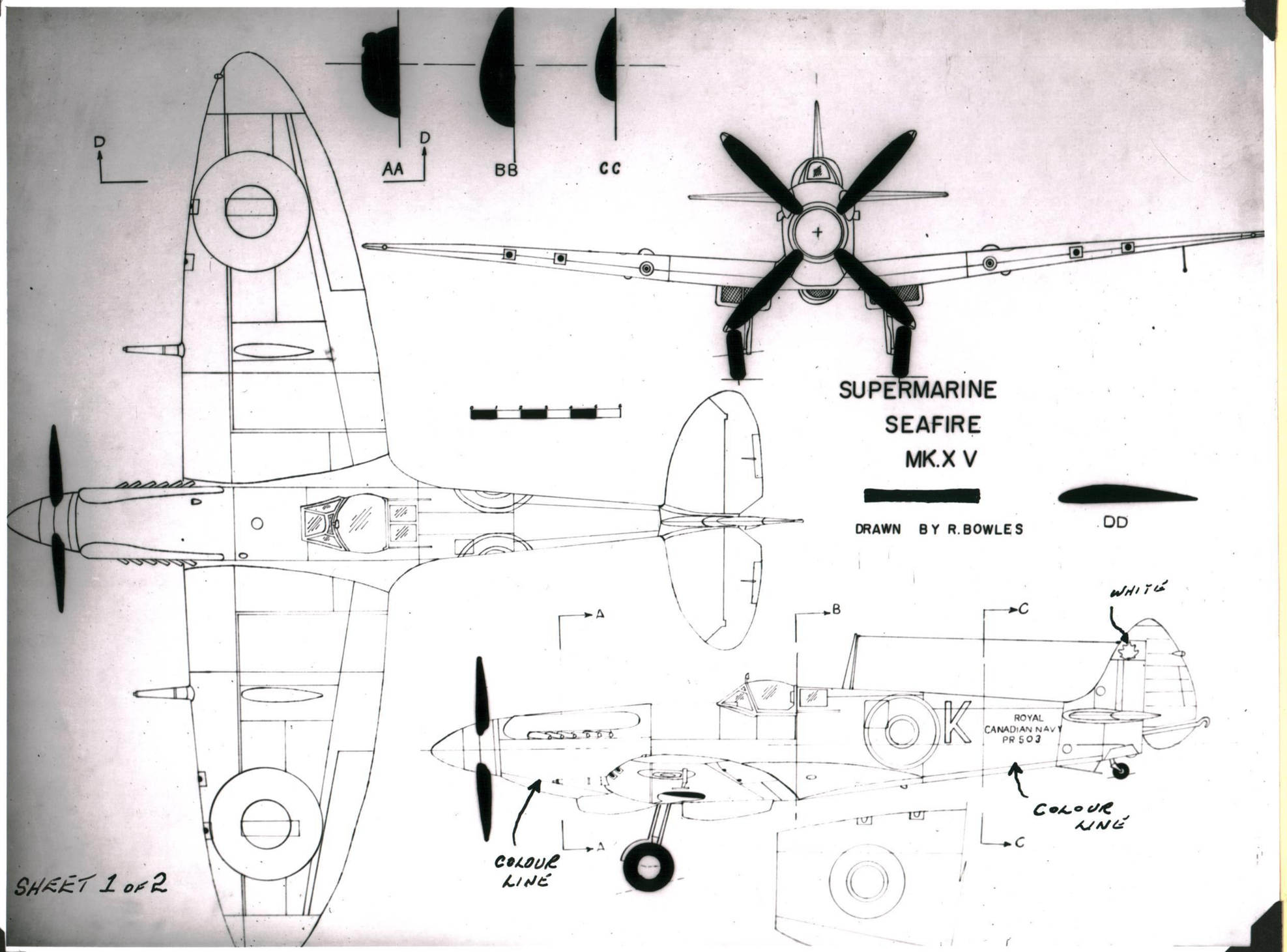
As for the other Spitfires I can confirm in Canada [dates are rough as I don't have my notes with me!!!!!]

MK I L1090 May 1940 testing at Uplands with XP-40
MK IIb P8332 1942 flown in Canada, instruction airframe A166 C.Borden
MK VII X4555 Spring 43 flew in B o Brit with No. 92 Sqd Aug 1940
MK VII R7143 Spring 43 No. 13 Sqd Rockcliffe
MK VI X4492 photo lunar eclipse 44/45 @35,0ft new record T. Percival
ER824* Three bound for North Africa when ship blown off course and dam
ES117 arrives in Nfld X-MAS eve 1942. Three taken off ship and to be
ER??? Scrapped at Torbay. Of three Unit builds one and flies it[*]
Returned to UK. Other three buried, email last month from
airport manager "I found a prop - metal" might be MK V Tropical
prop unit? Still waiting for update
JG480 1945 flies as cold weather test bed with WEE Flight in N.
Ont/Alberta. TZ138 replaces her surplused to RCN July 1946.
Scrapped in 1949.
TZ138 1946 the most traveled RCAF Spitfire. Tested until 1949/WEE
flight pilot Ken Brown buys TZ and races it at Cleveland Sept 49.
His partner sells the plane with no permission to US buyer
[breach of contract] month latter. No RCAF action taken on
James McArthur [partner] Go trough some 20 owners, some Cdn and is
now in California. made her first flight in nearly 30 years Jan 5
1999. Legal Title still in Ken Brown's name - White Rock, BC.
Sent letter to Museum of Flying Van Nuys CA and no response -
brought forth the legal title and I think I may have scared them?
VN332 1947 never tested and no RCAF rec survive. Not taken on charge
but was sold to Northwest Airlines pilot Wally Fairbroher MN in 1950
less then five hrs on engine/AF. Was to race it but sold in 2 years
later to buyer in NJ. He crashed in later when flying at high
altt. Oxygen sys failed and he crashed at Teterboro NJ. No
date, no records still working on this mystery plane. Some CAL
contacts may have some photos and some info on this Spitfire.

This sums up the piles of paper I have on these Spitfires. The real effort is to pound out a manuscript in the weeks to come. What is important now that I try and find any RCN people that know anything about R7143, X4555, and X4492 and their RCN careers. If the NAM needs any info just call me and leave a message or email me and a will mail them a suit case of pic and info. Just need a contact. Might be in Ottawa next week for research in the PAC on wellington so I might be able to meet with someone. Hope this helps...

Regards,

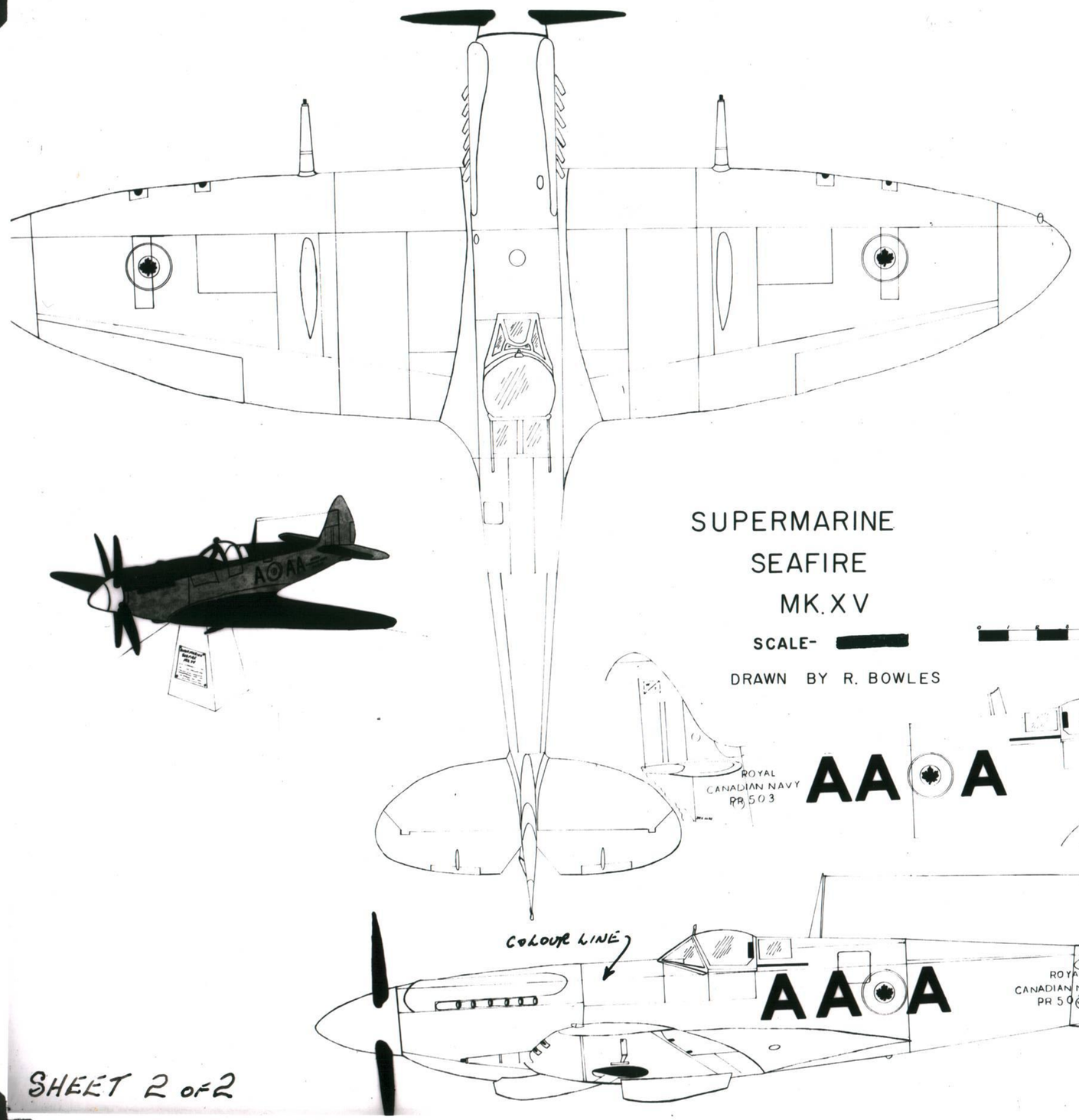
Photos:
R. Bowles

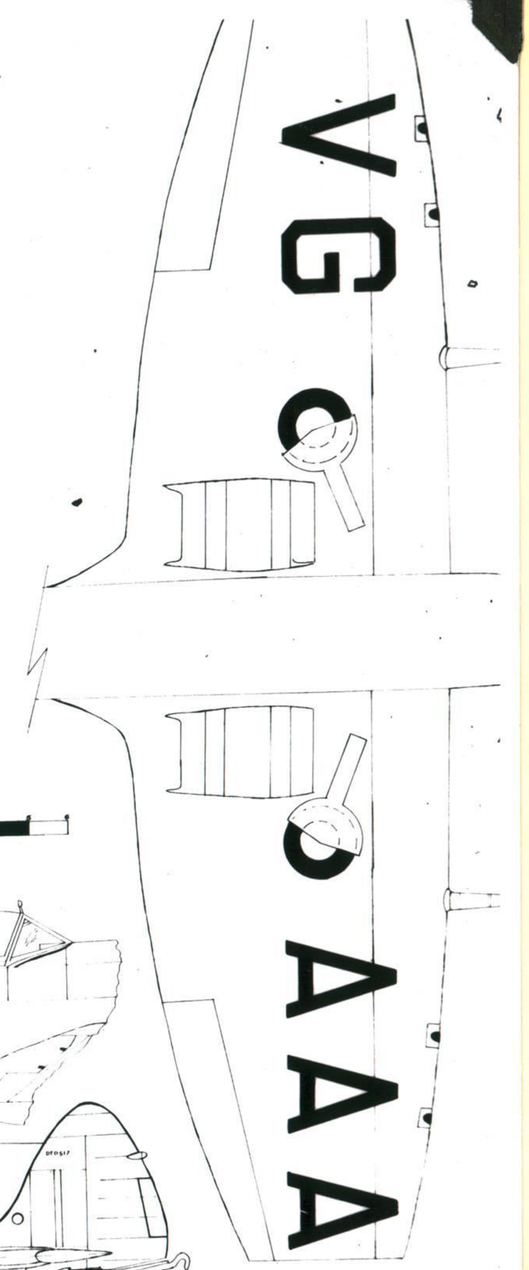


Notes by Bowles:- Shows the original British colours
Top - Matt Slate Grey (Humbrol 31)
Bottom - Matt Duck Egg Blue (Humbrol 23)
Letter K - White
RCN & PR503 - Black

spinner - white
RCN & Serial stenciled eg [illegible]

Drawings:
R. Bowles

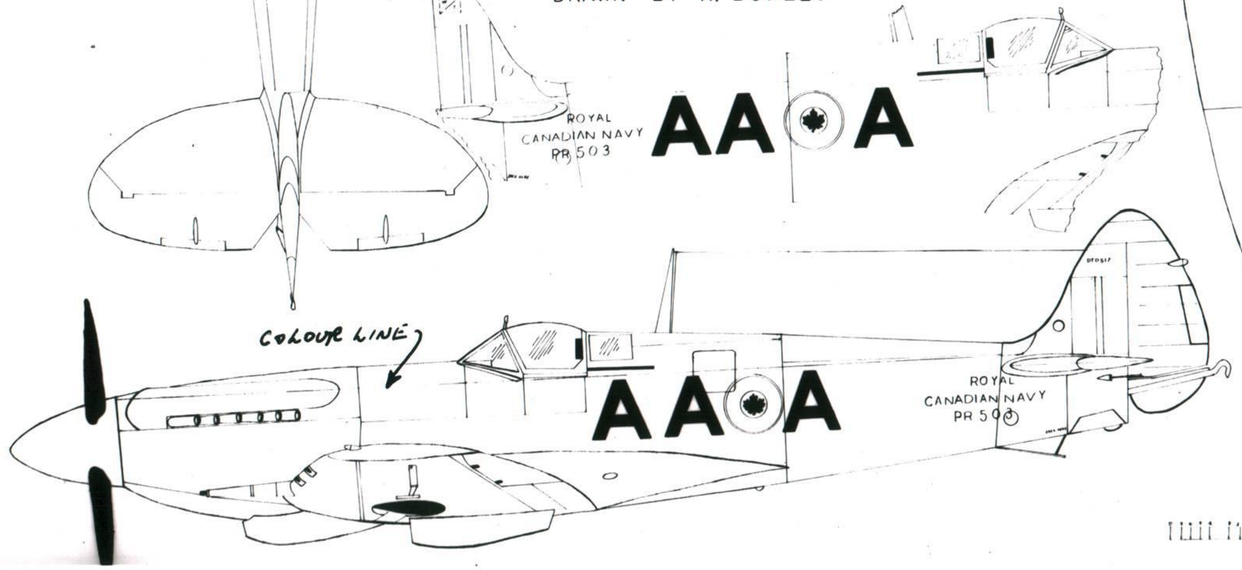




SUPERMARINE
SEAFIRE
MK. XV

SCALE-

DRAWN BY R. BOWLES



SHEET 2 of 2

Notes by Bowles:-

Top - Dark Grey
Bottom - Light Grey } same as used today
Letters - Black

Spinner - white
RCN + Serial stenciled eg [illegible]

Markings measured before paint removed.

Photos
W. Harvey



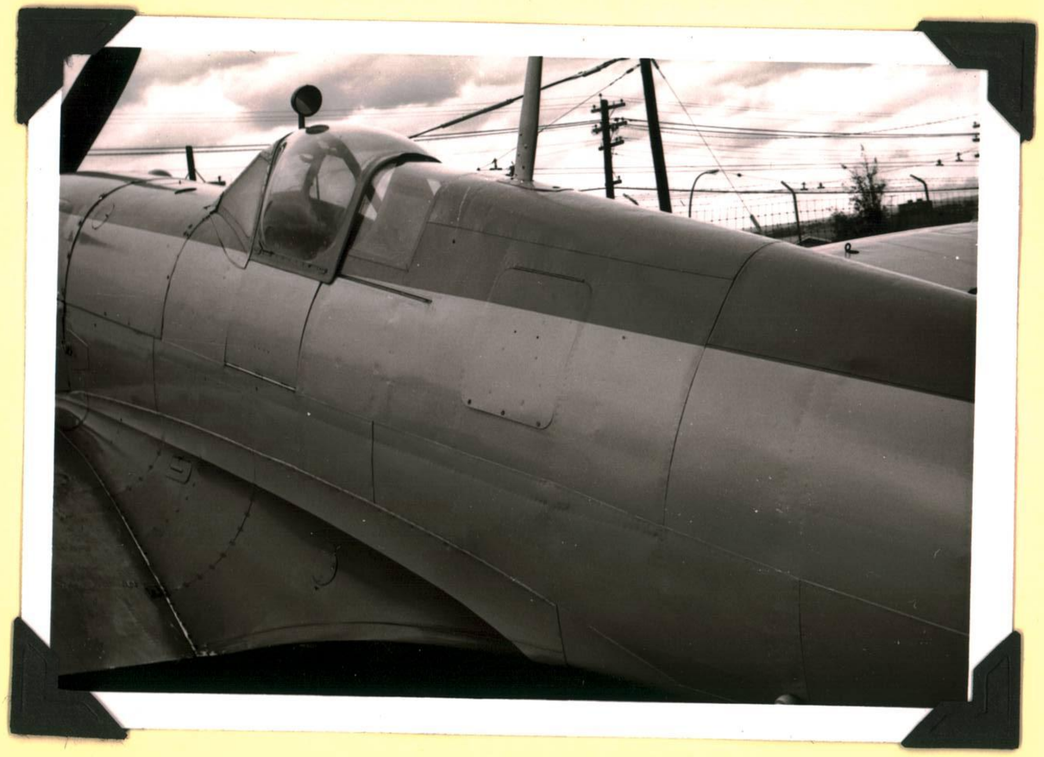


HMCS Tecumseh Calgary 1965 July





Photos W. Harvey





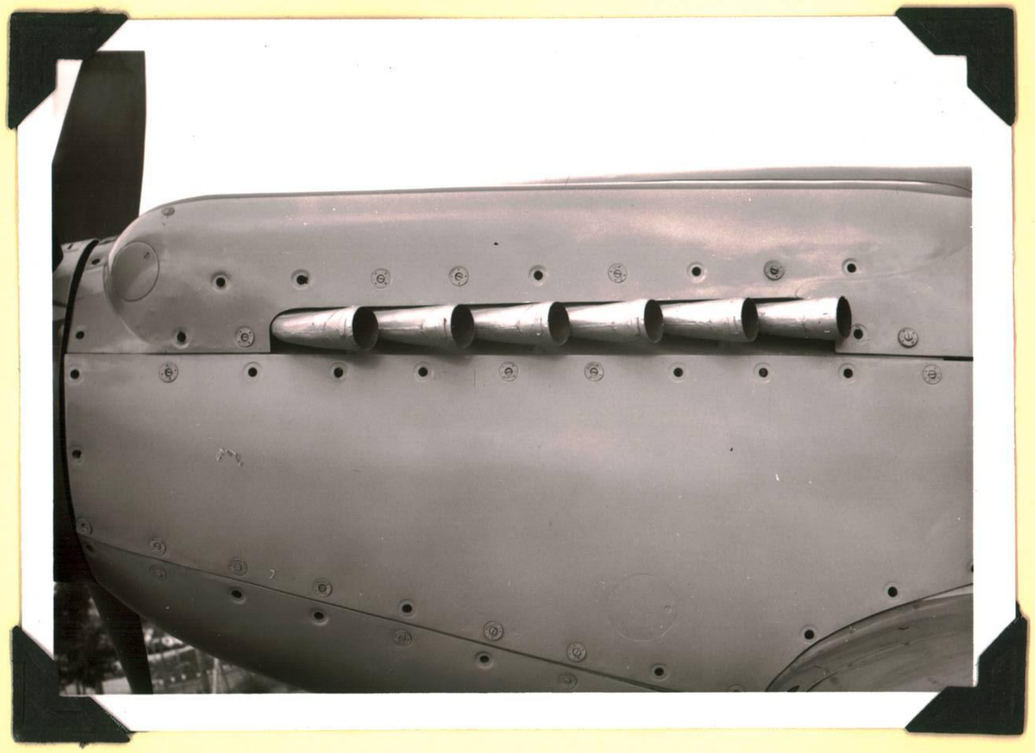
July 1965



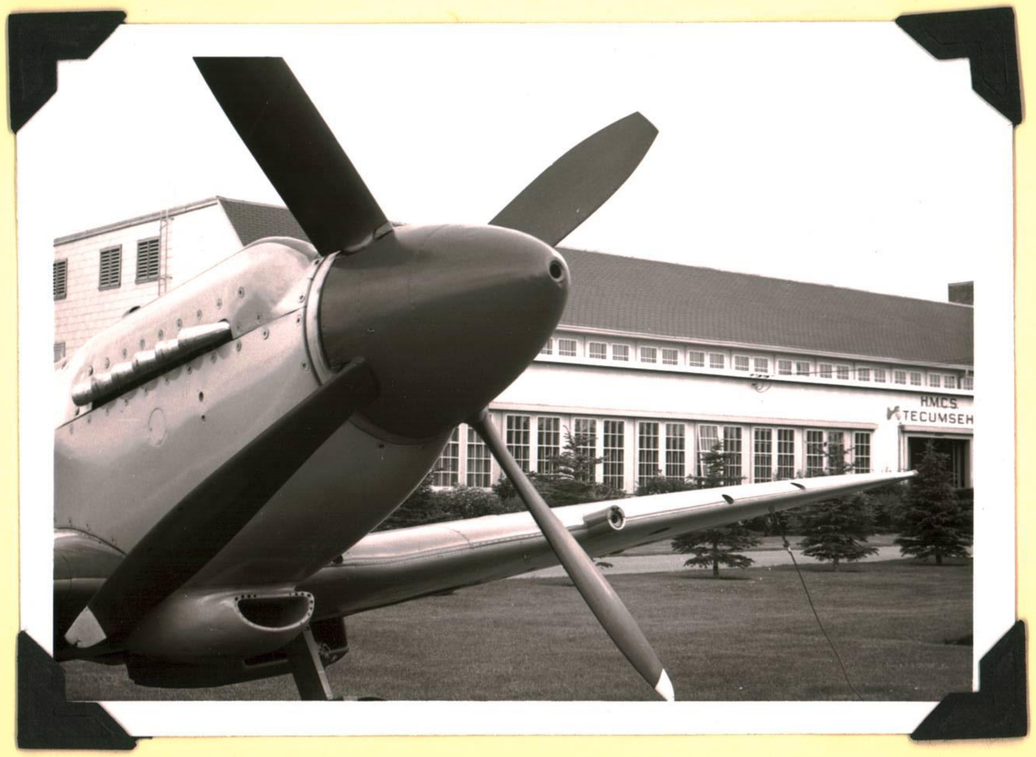


Photos W. Harvey

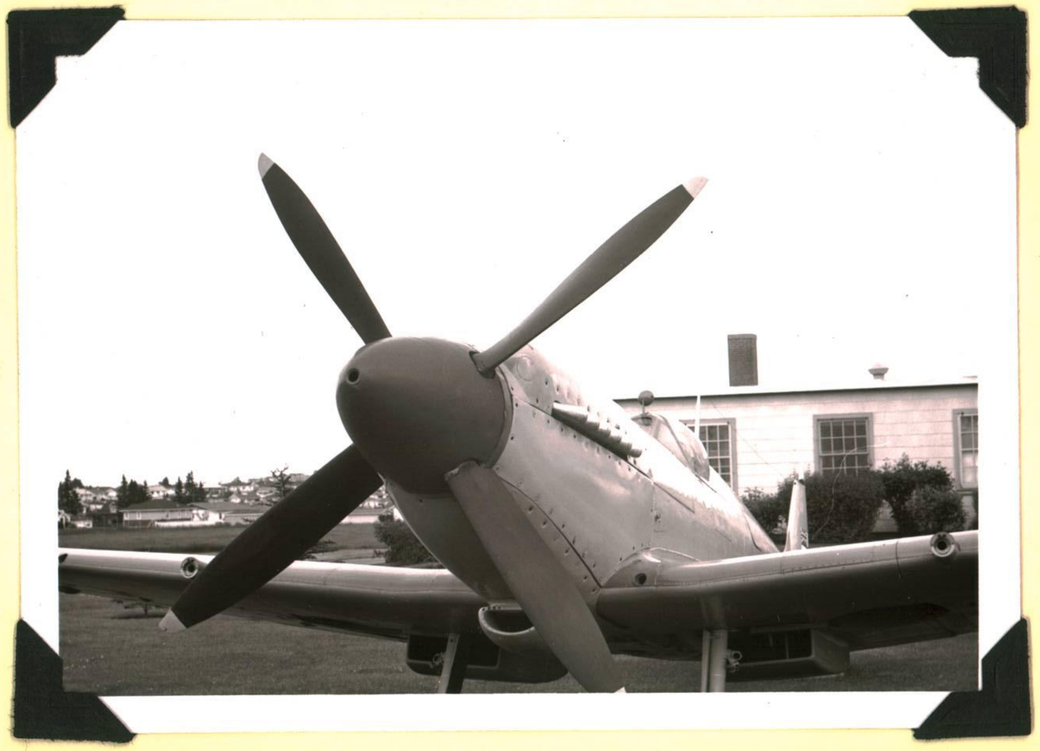




July 1965









Photos
W. Harvey

July 1965



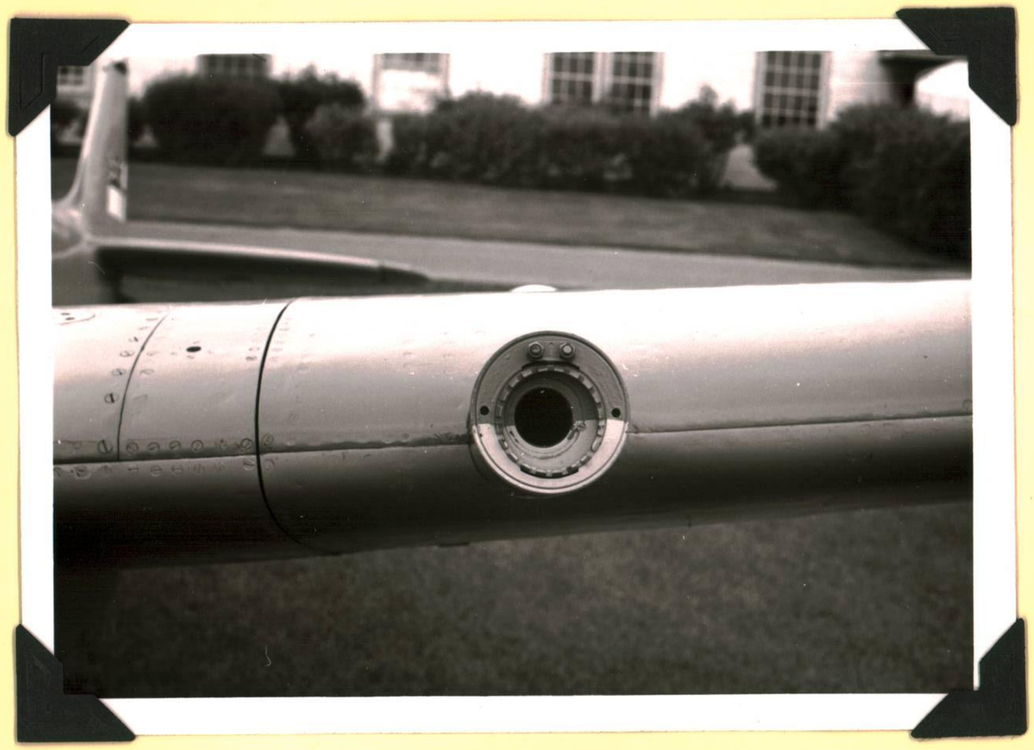


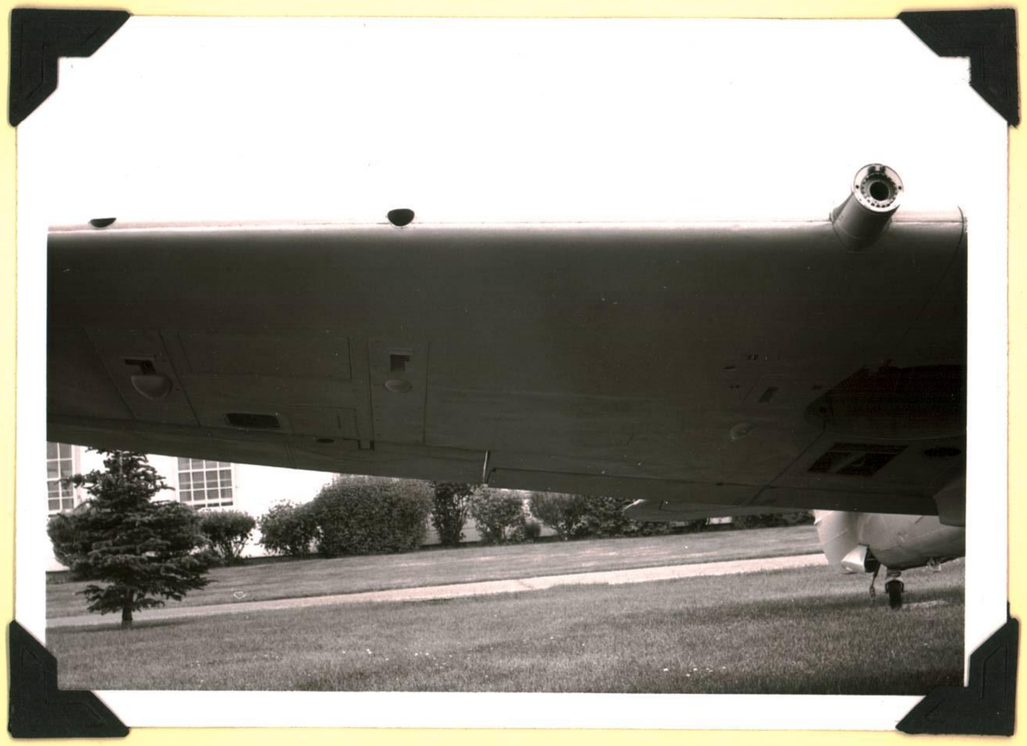
Photos W. Harvey

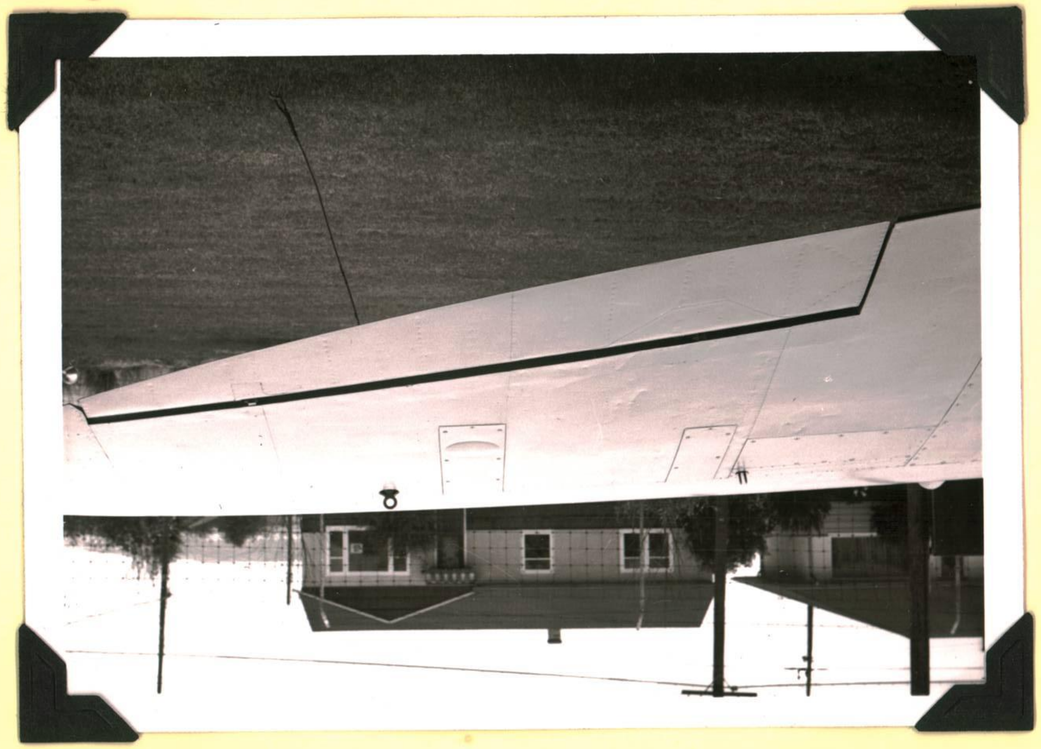


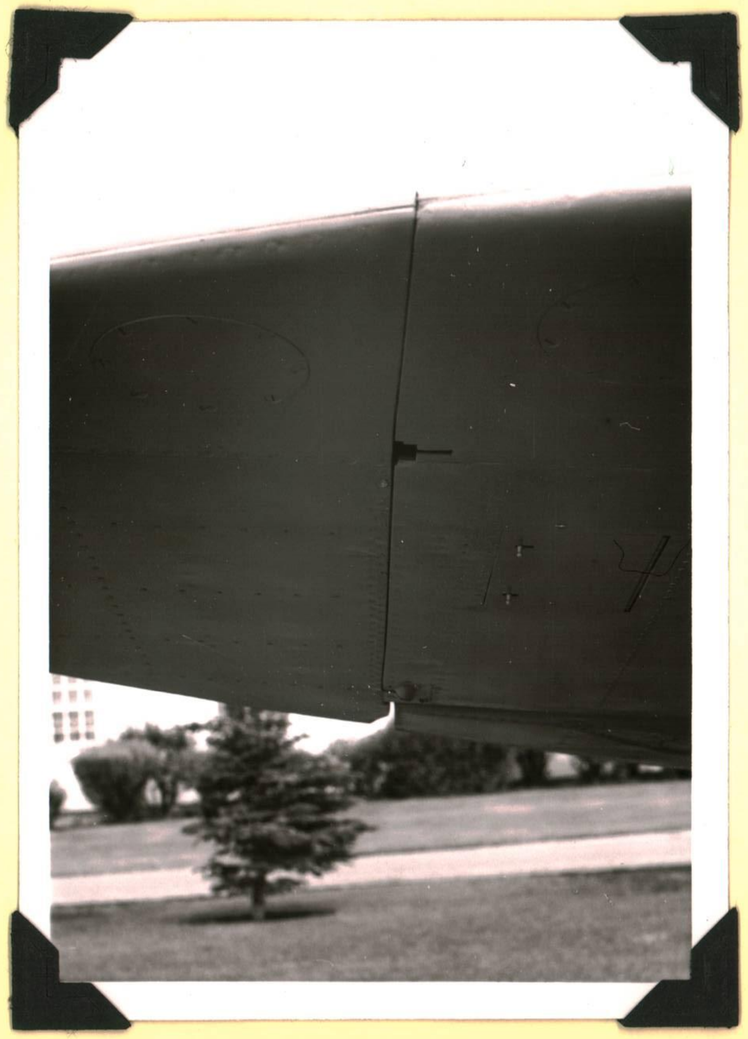


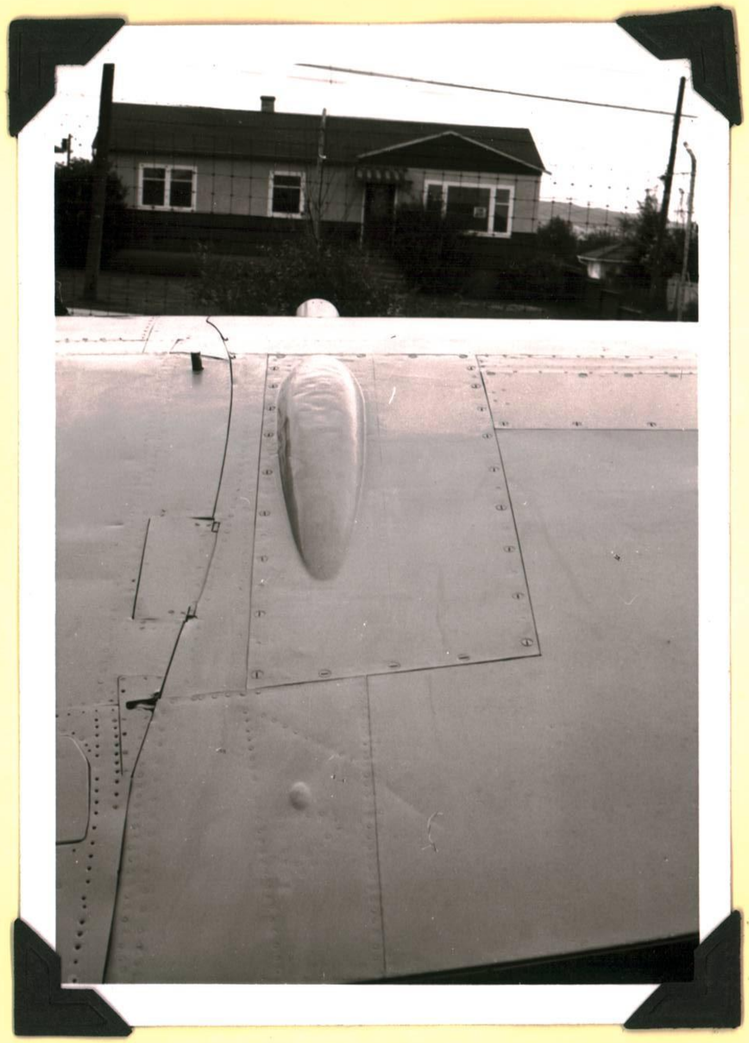
July 1965











Photos
W. Harvey

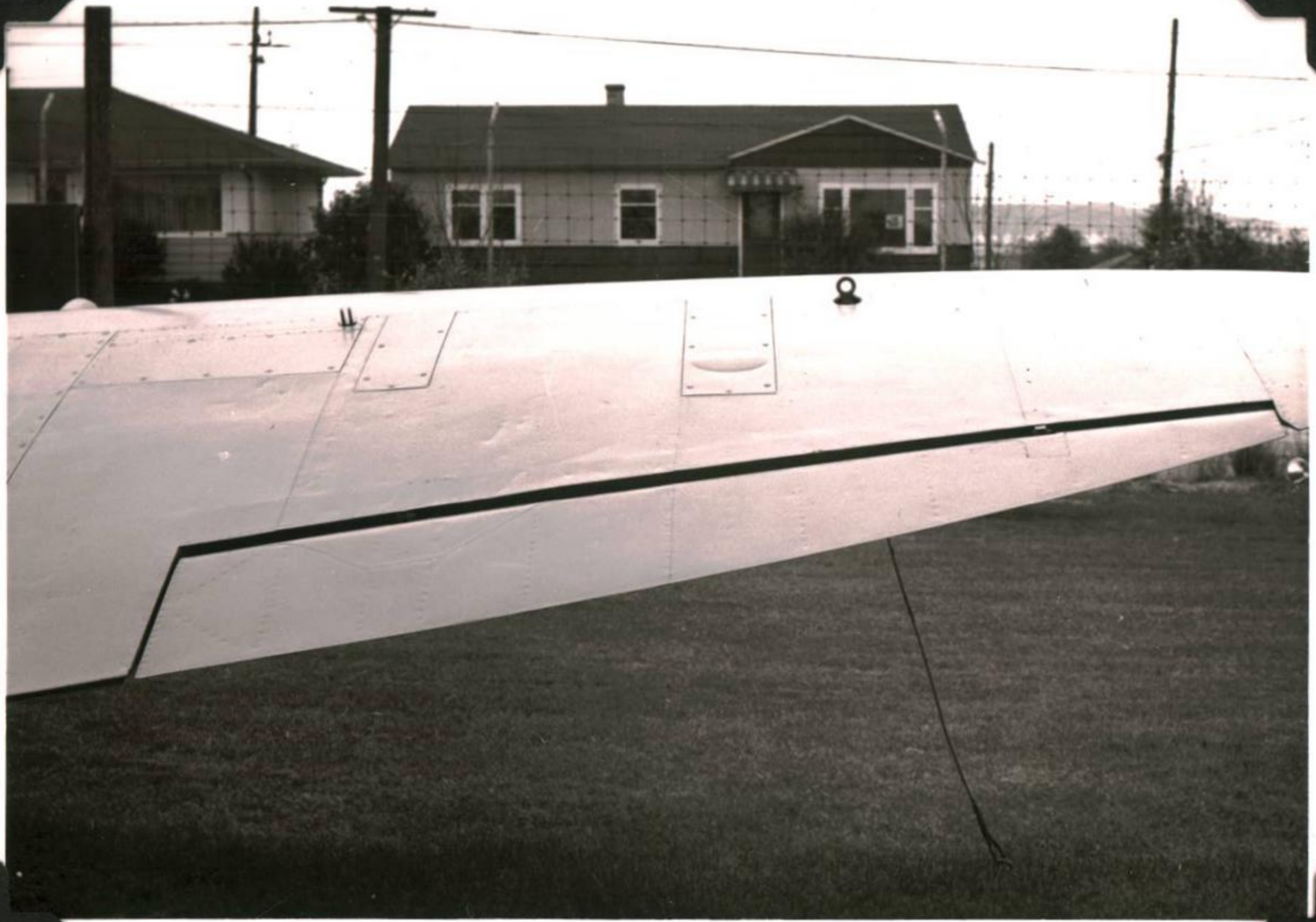
July 1965

Access Panel.

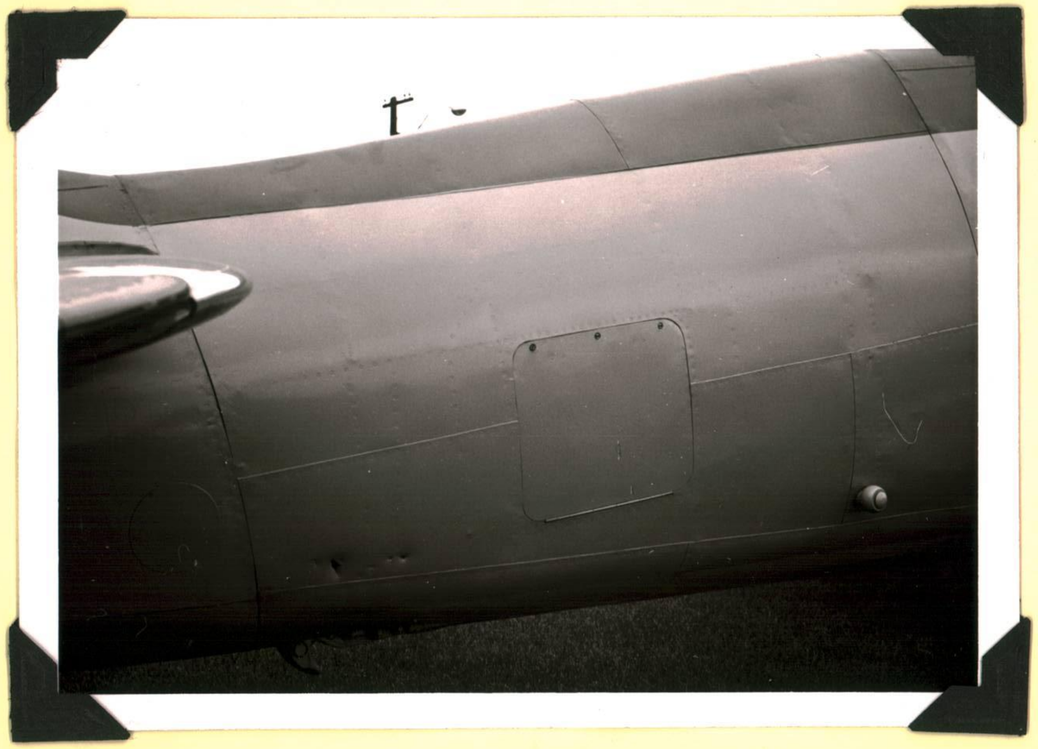


RCAF.info note –

I have inverted the upside down photo from the previous page and you can find in on the next page.

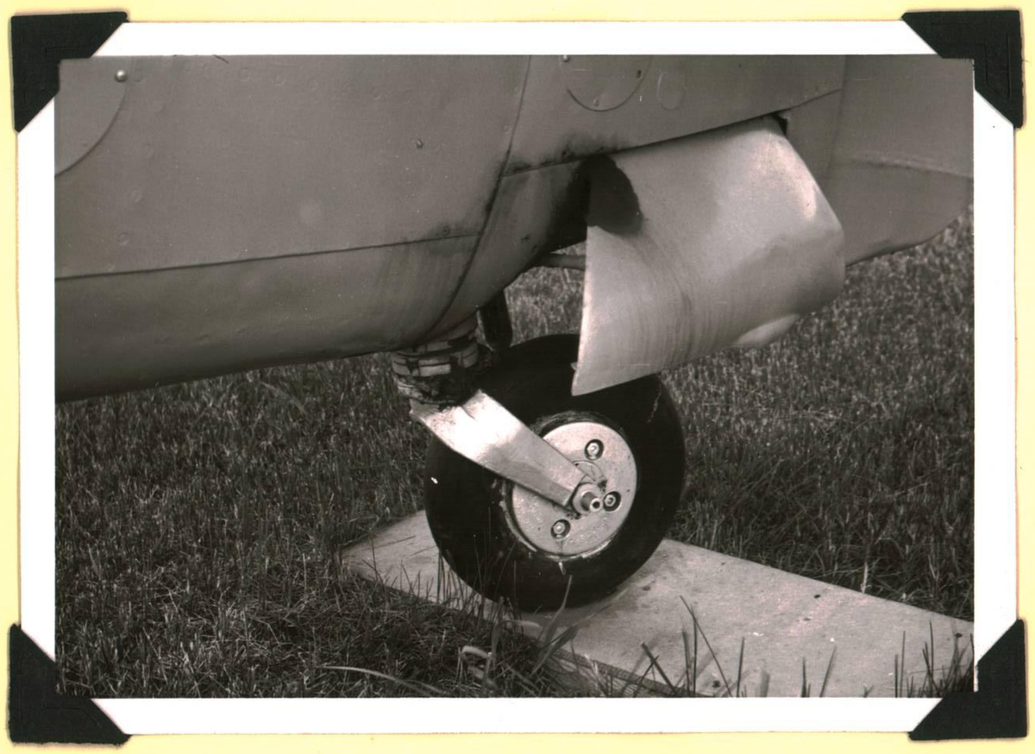


Photos w. Harvey





July 1965





Photos W. Harvey





July 1965





Robert Murray

From: "Lee Walsh" <walshlee@hotmail.com>
To: <mala@istar.ca>
Sent: December 11, 1999 2:00 AM
Subject: Spitfires in Canada 1940 to 1947

Dear Bob:

Just sent you a reply earlier and I think I just lost it, hmmm an hour of typing I hope you got it. If not here are the s/nos.

L1090, x4555, x4492, R7143, P8332, JG480, TZ138, VN332, ES117, ER824 and ER???. I don't have my note but if the NAM is looking for some info I guess I the person to talk to. Nine years of searching I have amassed a large box of goodies concerning these 11 Spitfires. Just need a contact name at NAM. Might be in Ottawa to tie up some research for a day, but not sure when. You and call me or just email me at the above address. I really hope you got my email

Regards
Lee
416-977-3425

>From: "Robert Murray" <mala@istar.ca>
>To: <walshlee@hotmail.com>
>Subject: spitfires in the RCN
>Date: Fri, 10 Dec 1999 16:20:17 -0500
>
>Lee,
>
>Agree that JG 480 went to the west coast but according to aircraft record
>cards, held at the National Aviation Museum(NAM), X4555 not R1743 went to
>Stadacona.
>
>Also NAM only holds eight Spitfire record cards serial numbers L1090,
>P8332,
>R 7143, X 4492, X4555, JG480, TE214 and TZ138.
>
>If you hold 11 serial numbers I would appreciate having the other three
>numbers so NAM could chase them down.
>
>A letter containing the eight aircraft record cards
>was mailed to you this afternoon.
>
>Bob Murray
>

Get Your Private, Free Email at http://www.hotmail.com

Robert Murray

From: "Lee Walsh" <walshlee@hotmail.com>
To: <mala@istar.ca>
Sent: December 11, 1999 8:26 PM
Subject: NAM - Spitfires

Dear Bob;

If you need a summary sheet for the history of each aircraft just let me know. Some of these Spits will not show up in RCAF records ie the Torbay Trio [ER824]. I do get the odd inquiry about these aircraft being in Canada and I usually reply by sending a package of the summary sheets. Pass on your your snail mail address and I will mail you a set on Sunday or Monday. I am mailing a few out so I can just add you to the list...

As for Barry Hayter, I tracked down his son a while ago and was sadly informed that Barry passed away some time ago of brain cancer. His log book showed no entry of the flight in R7143. I was hoping I could have the opportunity to talk to him, but I guess not.

As for John Griffin, I would love to see any photos he might have of any of the Spitfires. I literally spent two days going through every neg at the NAC looking for photos and I only touched the tip of the iceberg.

I might have some new info come in this week concerning the three Spitfires that were at Rockckliffe in 1947. just found John Wiseman living in Barrie, Ontario. He was the CO of No. 13 Sqd when they were being transferred to the RCN. Crossing my findgers on this one as I have been looking for clues about the transfer for a LONG time.

I am trying to remember if I came across your name from a CNAG contact. I think it may have been Ralph Fisher in Vancouver. He told me to contact Mr. Ron Bosquet in Ottawa and ask him if he could help me find anyone that may have know anything about RCN Spitfires. I wrote a while ago but I haven't heard back. Do you know him at all?

Keep me posted if you need any more info. Are you writing any books, material or is it just for archives sake?

Lee

Get Your Private, Free Email at http://www.hotmail.com

Robert Murray

From: "david tate" <mardave@sprint.ca>
To: <navairgen@nsdev.org>
Sent: December 10, 1999 12:27 PM
Subject: Re: [NAVAIRGEN] [help]Spitfires in the RCN 1947 to ?

Lee
Scottie Grant,Bob Murray and myself have been doing research on RCN aircraft.I tkink Scottie has some info on the Spitfires.
You can contact him @ 18 Deerfield Dr. Apt.410 Nepean Ont.
K2C 4L1 Phone # (613) 226 4909
Dave Tate
-----Original Message-----
From: Lee Walsh <walshlee@hotmail.com>
To: navairgen@nsdev.org <navairgen@nsdev.org>
Date: Friday, December 10, 1999 1:00 AM
Subject: [NAVAIRGEN] [help]Spitfires in the RCN 1947 to ?

>Dear Navairgener's; Thursday Dec 9/99
>
>Need your help solving these mystery of the RCN Spitfires!
>
>I have been working on an article concerning the 11 Spitfires that the RCAF
>were using between 1940 and 1947. A few years ago I came across some RCAF
>records that stated four Spitfires were transferred to the RCN in 1946-7.
>Doing some leg work I have managed to find the following:
>
>1)Spitfire JG480: Retired in Edmonton and sent to the Supply & Secret.
>School at HMCS NADEN, Capt Vernon Howland CO. Scrapped in 1949-50 by the
>new CO, but where? Anyone have any tidbits of info or better yet photos?
>
>2)Spitfire R7143: Retired in Ottawa and was to be sent to the "L" School @
>HMCS STADACONA in the Fall of 1947, Terry Burchell CO. She was flown to
>Dartmouth by Barry Hayter and then towed over to the school. Installed on
>the 2nd or 3rd floor and used for training. It was removed latter but
when?
> Terry spoke of some photos but I have had no luck finding any. Looking
>for any RA's EA's and/or anyone that has any information on this silver
>Spitfire being at this school. Need stories and photos.
>
>3 & 4) Spitfires X4492+X4555 were retired in Ottawa in 1947, along with
>R7143. The Director of Naval Services is to have taken ownership but
>RCAF/RCN records indicate little if no final diposition of these two
>Spitfires. I have no leads, anyone help?
>
>I am running out of leads so I thought I would try my luck with this
server.
>If you can help with any stories(large or small) and help me finding photos
>I would greatly appprecaite it. Thanks in advance.
>
>[P.S. forward this message to your friends if you can...]
>

>Lee W Walsh
>82 Beverley Street, Apt #6
>Toronto, Ontario, Canada
>M5T 1Y1
>(416) 977-3425
>walshlee@hotmail.com
>
>
>_____
>Get Your Private, Free Email at http://www.hotmail.com
>

R.C.A.F. Spitfires

Spitfire L-1090 Merlin III

19-2-40 N° 1 Depot on Transfer Order # 201

9-5-40 Ottawa

30-5-40 N° 1 T.C.

6-6-40 Ottawa

20-6-40 N° 1 Depot

25-6-40 Ship from Ottawa to England - CNR Box Car 653186

Spitfire V R-7143 Merlin XLV

26-2-43 N° 3 T.C. Rockcliffe (AWE) On loan from Air Ministry for high altitude tests being made on behalf of R.A.F.

10-9-44 "C" crash at Rockcliffe

15-7-46 9(T) Group

2-9-47 R.C.N.

Spit V X-4492 Merlin XLV

7-4-43 N° 3 T.C. - Loan to HMCS Stadacona.

Spit V X-4555

7-4-43 N° 3 T.C. - Loan to HMCS Stadacona.

Spit II B P-8332

20-3-41 Taken on strength by R.A.F

10-4-41 " " " 222 Sqn R.A.F

26-6-41 Taken off operations and sent to Canada where it was given training number and sent out on display.

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME — T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) — T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS: — EFFECTIVE DATE WRITTEN-OFF

AIRCRAFT RECORD CARD

FIRST ENTRY AT No. 1 Aircraft Depot — DATE 19/2/40 — TRANSFER ORDER No. 201

TRANSFERS DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
9.5.40	RCAF stn Ottawa	T.O. 388			
30.5.	No. 1 T.C.	T.O. 389			
6.6.	RCAF stn Ottawa	T.O. 484			
20.6	No. 1 (S) Depot- Ottawa	T.O. 595			
25.6	Departed Ottawa in CNR car No. 653086 to England	T.O. 596			

REMARKS BR. AIR MINISTRY AIRCRAFT.
THIS AIRCRAFT NOT BROUGHT ON CHARGE TO R.C.A.F. SINCE IT WAS IN THIS COUNTRY ONLY FOR TEST PURPOSES — RETURNED TO ENGLAND WITH OWN ENGINE.

ENGINE TYPE MERLIN III — UNITS 1 — AIRSCREW TYPE (CODE) — REF. No.

BATCH No. — QUAN. IN BATCH — LEDGER FOLIO — SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
	SPITFIRE (WR-II-07)	1940	S.E. FIGHTER	L 1099

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME — T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) — T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS:

EFFECTIVE DATE WRITTEN-OFF

AIRCRAFT RECORD CARD

FIRST ENTRY AT No. 1 Aircraft Depot DATE 19/2/40 TRANSFER ORDER No. 201

TRANSFERS DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
9.5.40	RCAF Stn Ottawa	T.O. 388			
30.5.	No. 1 I.C.	T.O. 389			
6.6.	RCAF Stn Ottawa	T.O. 484			
20.6	No. 1 (S) Depot - Ottawa	T.O. 595			
25.6	Departed Ottawa in CNR Car No. 653086 to England	T.O. 596			
	653086				

REMARKS Br. Air Ministry Aircraft.
THIS AIRCRAFT NOT BROUGHT ON CHARGE TO R.C.A.F. SINCE IT WAS IN THIS COUNTRY ONLY FOR TEST PURPOSES — RETURNED TO ENGLAND WITH OWN ENGINE.

L-1090

ENGINE TYPE MERLIN III — UNITS 1 — AIRSCREW TYPE (CODE) — REF. No.

BATCH No. — QUAN. IN BATCH — LEDGER FOLIO — SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
	SPITFIRE	1940	S E FIGHTER	L 1090

1090	SPITFIRE (MK I - OFF)	1940	S E FIGHTER	L 1090
REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.

OVERHAUL DATA

	REASON	DONE BY	REQ'N No.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

ACCIDENT RECORD

	DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
1										
2										
3										
4										
5										
6										
7										
8										

REMARKS

REMARKS:

Salvage

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME — T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) — T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS:

EFFECTIVE DATE WRITTEN-OFF

AIRCRAFT RECORD CARD

FIRST ENTRY AT No 1 T.C. (R.A.S) DATE 7.5.42. TRANSFER ORDER No. 673

TRANSFERS DATE	TO	AUTHORITY	DATE	TRANSFERS TO	AUTHORITY
8 June 47	S.L. R.C.A.F. 6 K.D. (Mountain View)	T.O. XC 12170	5 Jul 62	WR 6 RD	QTO 395
			5 Jul 62	ADC Stn Uplands	QTO 395
20 Nov 47	C.A.C. (2 T.S. Camp Borden)	T.O. XC 12622	29 Apr 63	WR 6 RD	QTO 165
3 Dec 53	Recategorized to "B" category	QTO-1813	29 Apr 63	ADC Stn Uplands	QTO 165
3 Dec 57	WR 6 RD	QTO 110	6 Feb 64	AMC Stn Rockcliffe Museum	QTO 866
1 Dec 57	JR 6 RD	QTO 110			
17 Jul 59	AFHQ AV Det Cde 429 CNE	QTO 437	11 Jan 65	Downgraded from A class to B class Equipment. CFHQ D45 3714 18 Dec 64	QTO 880
17 Jul 59	JR 6 RD	QTO 437			CFB Rockcliffe
7 Apr 60	WR 6 RD	QTO 122	25 Feb 69	Transferred to Dept of Public Works of Canada, attn Director National Museum of Canada, attn B.V.C. MacKenzie Secretary General	IV 6434)
12 May 60	JR 6 RD	QTO 232			
7 July 60	WR 6 RD	QTO 352			
3 Oct 60	JR 6 RD at Mountain View (ex T.S.)	QTO 599			

REMARKS

call CFHQ letter 4132-5-1 (DSR) 6 Dec 1968

29

mentain

43545

ENGINE TYPE	UNITS	AIRSCREW TYPE (CODE)	REF. No.
BATCH No.	QUAN. IN BATCH	LEDGER FOLIO	SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
(R 8332) No 106	SPITFIRE I (LUSTRUCTIONAL)	1942	S.E. FIGHTER	

(P 8332) AM 100	SPITFIRE	(INSTRUCTIONAL)	1942	S.E. FIGHTER	
REGISTRATION No.	MAKE & MODEL		YEAR	TYPE	MANUFACTURERS No.

OVERHAUL DATA

	DATE	REASON	DONE BY	REQ'N No.	COST	HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
1	3 Dec 57	for touch up and holding at Mountain Home	WR 6 RD					
2	7 May 60	for work on project 6AE-336	WR 6 RD	← 7 Apr 60				
3	7 July 60	for work as outlined on AF 30 8 July	WR 6 RD	← 7 July 60				
4	7 Jul 62	Project WDMP	WR 6 RD					
5	29 Apr 63	S+O 165 30 Apr 63	WR 6 RD	WDQS				
6								
7								
8								
9								
10								
11								
12								

ACCIDENT RECORD

	DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
1										
2										
3										
4										
5										
6										
7										
8										

B. S. LTD. **AIRCRAFT RECORD CARD** PAT'D 1920

REMARKS

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS: EFFECTIVE DATE WRITTEN-OFF

R.C.A.F. E. 293D — 6M.-1-43 (9029) H.Q. 885 — E-293

AIRCRAFT RECORD CARD

FIRST ENTRY AT "3 T.C. DATE 7.4.43 TRANSFER ORDER No. 161

TRANSFERS DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
15.1.45	No. 1 A.C.	T.O. 17864 (B5)			
15 July 46	No 9 T Group	T.O. MC 12331			
11 Oct 46	Spec # 9 (T) Group	T.O. MC 13122			
9 Jan 47	SK # 9 (T) Group	T.O. MC 13375			
1 Feb 47	R.C.N. (Stadacona) Halifax. (Indefinite loan)	T.O. MC 13445	# S.E.D. to clear loan & dispose of remarks & forward a print of same & copy of the loan voucher to the Deputy Minister of Air & Civil Aviation Mr. P.S. Conway.		
1 Aug 47	Director of Naval Air Services Royal Can Navy	T.O. MC 12436			

REMARKS: 7/4/43:- On loan to R.C.A.F. Stn., Rockcliffe (H.W.E.) for high altitude tests on behalf of the R.A.F.

#2/47 - Indefinite loan to RCN (HMS Stadacona) loan acct is to be carried by S.E.D.

X4555

17837/3724

ENGINE TYPE MERLIN XLV UNITS 1 AIRSCREW TYPE (CODE) REF. No.

BATCH No. QUAN. IN BATCH LEDGER FOLIO SPECIFICATION No.

REGISTRATION NO.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
X 4555	SPITFIRE V	1943	S E FIGHTER	

X 4555	SPITFIRE	1943	S E FIGHTER	
REGISTRATION NO.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS NO.

OVERHAUL DATA

DATE	REASON	DONE BY	REQ'N NO.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

ACCIDENT RECORD

DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
1									
2									
3									
4									
5									
6									
7									
8									

B. S. LTD.

AIRCRAFT RECORD CARD

PAT'D 1920

REMARKS

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS: EFFECTIVE DATE WRITTEN-OFF

AIRCRAFT RECORD CARD

FIRST ENTRY AT No. 3 P.D. Rockcliffe (H.W.E) DATE 26.2.43. TRANSFER ORDER No. 5879.

TRANSFERS DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
15.1.45	No. 1 A.C.	T.O. 17864 (15)			
15 July 46	No 9 T Group	T.O. MC 12331			
11 Oct 46	Apdal * 9 (T) Group.	T.O MC 13122			
9 Jan 47	SK No 9 (T) Group	TO MC 13375			
2 Sept 47	Legal Com. Pool	T.O. MC 12449			

REMARKS 26/2/43:- ON LOAN FROM AIR MINISTRY TO ROCKCLIFFE (H.W.E.) FOR HIGH ALTITUDE TESTS TO BE MADE ON BEHALF OF R.A.F.

X 4492

ENGINE TYPE MERLIN XLV UNITS 1 AIRSCREW TYPE (CODE) REF. No.

BATCH No. QUAN. IN BATCH LEDGER FOLIO SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
X 4492	SPITFIRE V *	1943	S E FIGHTER	

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
X 4492	SPITFIRE V	1943	S.E. FIGHTER	

OVERHAUL DATA

DATE	REASON	DONE BY	REQ'N No.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
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ACCIDENT RECORD

DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
1									
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B. S. LTD. **AIRCRAFT RECORD CARD** PAT'D 1920

REMARKS

2 Sept 42 - Supplem to R.C.A.F. Requirements. One priced receipted copy of the voucher is to be forwarded to the office of the Deputy Minister D.N.D. attention Mr. P.S. Carey. Shipment to be made transportation charges collect.

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE NO.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME — T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) — T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS: — EFFECTIVE DATE WRITTEN-OFF

R.C.A.F. E. 233B — 3M-5-42 (2220) H.Q. 885 — E-233

AIRCRAFT RECORD CARD

FIRST ENTRY AT # 8. R.D. (W. W.) DATE 21. 3. 44. TRANSFER ORDER No. 19391

TRANSFERS DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
12.44	# 2 T.C. (W.E. + T.F.)	T.O. 12495	1/12/44	No. 2 Air Command	T.O. 17327(10)
5.7.44	Stored Reserve, # 2 T.C.	T.O. 14592	1		J.B.
20.7.44	No. 2 T.C.	T.O. 14863	Aug 47	Director of Naval Air Services	
1/12/44	No. 2 Air Command	T.O. 17327(10)		Royal Can Navy H.Q	T.O. MC 12435
25-9-45	Stored Reserve 2 A.C.	T.O. 15138			
2.1.46	N WAC	T.O. MC 16054			
12 July 46	converted to Instructional	T.O. MC 12572			
12 July 46	Indefinite Loan - Naval Training Establishment Supply + Secretarial School Esquimalt B.C Loan acct - by 2 E.D.	T.O. MC 12573			

REMARKS: 21/3/44:- THIS AIRCRAFT ARRIVED AT HALIFAX 7 MARCH, 1944 ON S.S. INDOCHINOIS. IT HAS BEEN CONSIGNED TO W.R. No. 8 R.D.P.O. FOR ASSEMBLY, PRIOR TO BEING ALLOTTED TO THE W.E. & T.F. AT GIMLI.
21/3/44:- ON LOAN TO THE AIR MINISTRY, ENGLAND.
25-9-45 - Serviceable

A 1273

ENGINE TYPE	UNITS	AIRSCREW TYPE (CODE)	REF. No.
MERLIN LXVI	1		

BATCH No.	QUAN. IN BATCH	LEDGER FOLIO	SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
(JG 480) A517	SPITFIRE VIII INSTRUCTIONAL	1944	S E FIGHTER	

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS: EFFECTIVE DATE WRITTEN-OFF

R.C.A.F. E. 233B — 3M-3-42 (2220) H.Q. 995 — E-233

AIRCRAFT RECORD CARD

FIRST ENTRY AT # 8. R.D. (W. Dp.) DATE 21. 3. 44. TRANSFER ORDER No. 19391

TRANSFERS 21pg. DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
12.4.44	#2 T.C. (W.E. + T.F)	T.O. 12495	~~1/12/44~~	~~No. 2 Air Command~~	~~T.O. 17327(10)~~
5.7.44	Stored Reserve, #2 T.C.	T.O. 14592	1		J.H.P.
20.7.44	No. 2 T.C.	T.O. 14863	May 47.	Director of Naval Air Services	
1/12/44	No. 2 Air Command	T.O. 17327(10)		Royal Can Navy H.Q	T.O. MC 12435
25.9.45	Stored Reserve 2 A.C.	T.O. 15138			
2.1.46	NWAC	T.O. MC 16054			
12 July 46	converted to Instructional	T.O. MC 12572			
13 July 46	Indefinite Loan - Naval Training Establishment Supply & Secretarial School Esquimalt B.C Loan acct - by 2 E.D.	T.O. MC 12573			

REMARKS: 21/3/44:- THIS AIRCRAFT ARRIVED AT HALIFAX 7 MARCH, 1944 ON S.S. INDOCHINOIS. IT HAS BEEN CONSIGNED TO W.R. No. 8 R.D.P.O. FOR ASSEMBLY, PRIOR TO BEING ALLOTTED TO THE W.E. & T.F. AT GIMLI.

21/3/44:- ON LOAN TO THE AIR MINISTRY, ENGLAND.

25.9.45 - Serviceable

(JG-480) A-517 Spit VIII

A 1273

ENGINE TYPE MERLIN LXVI UNITS 1 AIRSCREW TYPE (CODE) REF. No.

BATCH NO. QUAN. IN BATCH LEDGER FOLIO SPECIFICATION NO.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS NO.
(JG 480) A517	SPITFIRE VIII INSTRUCTIONAL	1944	S E FIGHTER	

(G-AWG) A58 | SPITFIRE V11B | INSTRUCTIONAL | 1944 | S.E. FIGHTER | [illegible]

REGISTRATION NO. | MAKE & MODEL | | YEAR | TYPE | MANUFACTURERS No.

OVERHAUL DATA

DATE	REASON	DONE BY	REQ'N No.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
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ACCIDENT RECORD

DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
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B. S. LTD. — PAT'D 1920

AIRCRAFT RECORD CARD

REMARKS

1 Aug 47

Engine #2 [illegible] th Class Log Book Ledger Card and to forward a Proved pre-complete Copy of the Above voucher & thereto to Deputy Director Office Middle East The R.A.F. Pay Org. Asch. A.P.C. Class 830 2-3-(45 &) Air Publication 2.3.3.16

16 July 47

1 Aug 47

#2 SD to clear loan ledger and to forward a pre-dated receipted copy of the issue voucher of the Deputy's Ministers Office advising Mr. F.E. Conroy. Auth: AFHQ AERO letter 630-2-3 DES 16 July 47 M2t HQ 31-3-46

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE NO.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

REMARKS:

EFFECTIVE DATE WRITTEN-OFF

R.C.A.F. E. 233A — 10M-1-43 (3029) H.Q. 885 — E-233

AIRCRAFT ~~ENGINE~~ RECORD CARD

FIRST ENTRY AT North West Air Command DATE 11 Feb 46 TRANSFER ORDER No. TO MC16445

TRANSFERS (NWAC Flt Edmonton)

DATE	TO	AUTHORITY
21 July 49	Aydel NWAC (NWAC Flt Edmonton)	TOA-MX 12199
30 Jun 50	Nav Assts Comp	TO - 1074

TRANSFERS

DATE	TO	AUTHORITY

REMARKS: 11.2.46: Received from the United Kingdom on Loan on Initial Entry. (Confirming MC's letter 1038-1-8(SSO/S1-2) d 11 Feb 46.)

ENGINE TZ 138 Spitfire XIV

~~AIRCRAFT~~ TYPES IN WHICH USED					5672/50
Griffon 65					

BATCH NO. QUAN. IN BATCH LEDGER FOLIO 1946 SPECIFICATION NO.

REGISTRATION NO.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS NO.
[illegible]	[illegible]			

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
[illegible]	SPITFIRE XIV (Lond)	1946		

OVERHAUL DATA

DATE	REASON	DONE BY	REQ'N No.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
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ACCIDENT RECORD

DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	AIRCRAFT TYPE	NUMBER	DISPOSAL	DATE SERV.
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B. S. LTD.

AIRCRAFT ENGINE RECORD CARD

PAT'D 1920

REMARKS

1 Sept 47 A.f.a.g. + S.2-1030 - T.50. - Fitment - Std.
1 Mar 48 " " 150.15 " " - Condition Good

REMARKS:

RECORD OF WRITE-OFF

APPLICATION RC'D FROM	DATE	FILE No.	DATE APPROVED	APPROVED BY	APPROVAL SENT TO	DATE	T. O. No.

DISPOSAL PARTICULARS

AIRFRAME T. O. No.

ENGINE/S (QUOTE SERIAL NOS.) T. O. No.

AIRSCREW/S (QUOTE SERIAL NOS.)

ACCESSORIES

REMARKS:

EFFECTIVE DATE WRITTEN-OFF

AIRCRAFT RECORD CARD

FIRST ENTRY AT No. 3 O.S. Rockcliffe DATE 26.2.43. TRANSFER ORDER No. 5879

TRANSFERS (H.W.E) DATE	TO	AUTHORITY	TRANSFERS DATE	TO	AUTHORITY
15.1.45	No. 1 A.C.	T.O. 17364 (T5)			
15 July 46	No 9 T Group	T.O. MC 12331			
11 Oct 46	Aphal #9 (T) Grp.	To MC 13122			
9 Jan 47	SR # 9 (T) Group	TO MC 13375			
2 Sept 47	Royal Can. Navy	T.O. MC 12419			

REMARKS 26/2/43:- ON LOAN FROM AIR MINISTRY TO ROCKCLIFFE (H.W.E.) FOR HIGH ALTITUDE TESTS TO BE MADE ON BEHALF OF R.A.F.

R-7143

ENGINE TYPE MERLIN XLV UNITS 1 AIRSCREW TYPE (CODE) REF. No.

BATCH No. QUAN. IN BATCH LEDGER FOLIO SPECIFICATION No.

REGISTRATION No.	MAKE & MODEL	YEAR	TYPE	MANUFACTURERS No.
R 7143	SPITFIRE V	1943	S E FIGHTER	

8 7143	SPITFIRE V	A	1943	S E FIGHTER	
REGISTRATION No.	MAKE & MODEL		YEAR	TYPE	MANUFACTURERS No.

OVERHAUL DATA

DATE	REASON	DONE BY	REQ'N No.	COST		HOURS SINCE NEW	DATE COMPLETED	ALLOTMENT
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ACCIDENT RECORD

DATE	CATEGORY	PLACE	TIME	REPORT REFERENCE	DATE	RANK & NAME OF PILOT	No. IN CREW	DISPOSAL	DATE SERV.
10-9-441	"C"	Rockcliffe		"NIL"	10.9.44				
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B. B. LTD. **AIRCRAFT RECORD CARD** PAT'D 1920

REMARKS

2 Sept 42 - Surplus to RCAF Requirements. One pro forma receipted copy of the vouchers is to be forwarded to the office of the Deputy Minister D.N.D. attention Mr. P.S. Corcoran. Shipment is by road, transportation charges collect.

175 Elm Street, Apt #306
Toronto, Ontario, Canada
M5T 2Z8

July 26, 1993

Dear Mr. Wahlroth;

I am writing to you today for your help. I am currently researching an article on the 11 Spitfires that were in Canada during the 1940s.

At the moment I am trying to locate people that have any recollect -ion of the 3 Spitfires that flew with No. 13 Photo Squadron at Rockcliffe. I have very little and almost no material on these Spitfires while they were in Canada. Even less when it comes the their careers in the Royal Canadian Navy. I do know that they were on loan to the R.C.A.F. for high altitute tests flying. They flew with No. 13 for awhile and in 1945 they went to No. 9 Training Group (location?). While there they were awaiting disposal, but the Air force found a use for these long range Spitfires. They flew Air Search and Rescue duties for awhile before they were Trans -ferred to the R.C.N.

To date I have only found some material on X4555 going to Halifax to be installed in the electrical school at H.M.C.S. Stadacona. What happened to X4492 and R7143 is still a mystery to me and I have had no luck in any leads. Some people that I have talked to belive that the remaining two may have been reduced to parts for the R.C.N.'s Seafire fleet. I haven't found anyone that can confirm that story, not yet at least.

But I wanted to ask you if you can help me with getting your story as well as the story of these 3 Spitfires down on paper. I would be interested in reading everthing you can write about that concerns your days at No. 13 Squadron. So I hope you can help me with some questions I hope you can help me with. I have been trying to find answers to them for a long time.

Sincerely,

Lee Walsh

1) Can you tell me more about the type of high altitute and photo -graphy testing that was conducted with these three Spitfires? Was that all they were used for when they were with No. 13 Sqd.? Did they fly anywhere else in Canada, possibly for Victory Bond drives etc.?

2) Why was the Squadron formed, was it to train pilots for overseas P.R. Squadrons in Europe? What was the R.C.A.F.'s objectives for this Squadron?

3) How did pilots, like youself, earn your ratings for these Spitfires? Did you ever fly Spitfires anywhere else? Can you tell me haow many other pilots flew these Spitfires while they were at Rockcliffe?

4) How long did you fly with No. 13 Sqd's No. & photo wing? How were you appointed there?

5) Do you know anything about some of the personnel markings that were on X4492? They didn't come out to well on the photocopy? Can you tell me more about the painting, who painted it?

6) Do you know anything about thes aircraft going to No. 9 Training Grp? They were used for Air Search and Rescue for a year or so, do you know anything about this?

7) In 1947 the R.C.N. took ownership of these three Spitfires. One went Halifax and the fianl disposition of X4492 and R7143 is unknown? Did you ever hear what happened to them? When was the last time you saw them?

8) Did you ever take any pictures of the Spitfires or of yourself/ sqd mates? Do you still have your log books from this period?

9) Do you still have contact with any other No. 13 pilots of groundcrew?

1 Ravenrock Lane, Halifax N.S. B3M 2Z

23 September 1992

Dear Lee,

Since receipt of your letter of 31 August I have made some enquiries among my former colleagues of the Electrical Branch about X4555. I have found three who recall the arrival of this aircraft at the L School in 1947.(I was in the UK serving with the RN at the time). It is true that several windows and part of a wall had to be removed and both wings were removed. One of them said that all the paint was removed from it and it was bare aluminum while in the school. Another said that a naval pilot heard at the bar of the Bytown Mess that a Spitfire was in Ottawa awaiting delivery to Halifax. Over few drinks this fellow offered to fly it to Halifax. He did via various adventures en route. Anyway it was agreed that the best man to tell you what happened to it is:

Mr.L.W.Smith
RR 3 Bridgetown N.S.
BOS 1C0

He is a former Air Electrical Officer (I do not know him). None of my informants were at the L School when the aircraft was removed, probably in the early '50s

Yours Sincerely,

Vernon.

June 22, 1992

CANADIAN NAVAL AVIATION TECHNICAL HISTORY PROJECT

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SPITFIRES IN THE RCN

Dear Lee,

I am not the author of the article you refer to in Leo's book on the Seafire, nor as you will see from the letter head, the author of "Seafire to Sea King". That distinction belongs to Leo Pettipas.

However, I did arrange for the transfer of Spitfire X4555 to "Stadacona" for HMC Electrical School in 1950 or thereabouts. It was used in the training of junior air electrical trades in installation, maintenance and inspection work on aircraft. In order to place it in the instructional room on the third floor of the building, some fairly drastic surgery was required on the windows and one wing had to be removed. It was then hoisted up by a mobile crane from the Dockyard and bull dozed into place. Eventually the hydraulic seals gave way in the oleos, flooding the floor with hydraulic fluid. The OIC, Commander Burchell, now Rear Admiral (Retired), could probably fill in some details on its subsequent disposal.

I recall a note in one issue of the NOAC "Starshell" reporting on one other Spitfire assigned to the Supply School in Esquimalt. This was apparently the JG480 shown in your list.

I am sending your letter and attached list of the ten Spitfires to Douglas Cooke, a former Air Electrical Officer - see the letter head for addresses. He and Ed L'Heureux, a former air stores officer may be able to help you on these two and possibly other aircraft. None of us were aware at the time that X4555 had flown in the Battle of Britain. It is a bloody shame that more thought was not given to history and the museums when these magnificent old machines were scrapped, the Seafire as well as the Spitfire.

The story of some of these ten aircraft is part of the history we are now trying to salvage under our editor, Leo Pettipas. Please send him anything you may have or later develop that will shed light on the life of these hookless Seafires in the RCN.

If I have learned anything in such projects, it is that 90% of success is the result of simply dogged, unyielding persistence. Keep plugging.

With very best wishes,

Ralph E. Fisher

COPY

Douglas Cooke & Ed L'Heureux

Leo Pettipas

Mark F. I A
Serial No. X4555
Contract and order: No 19713/39, dated June 9, 1940
Order: 3rd order,
Engine: Merlin III

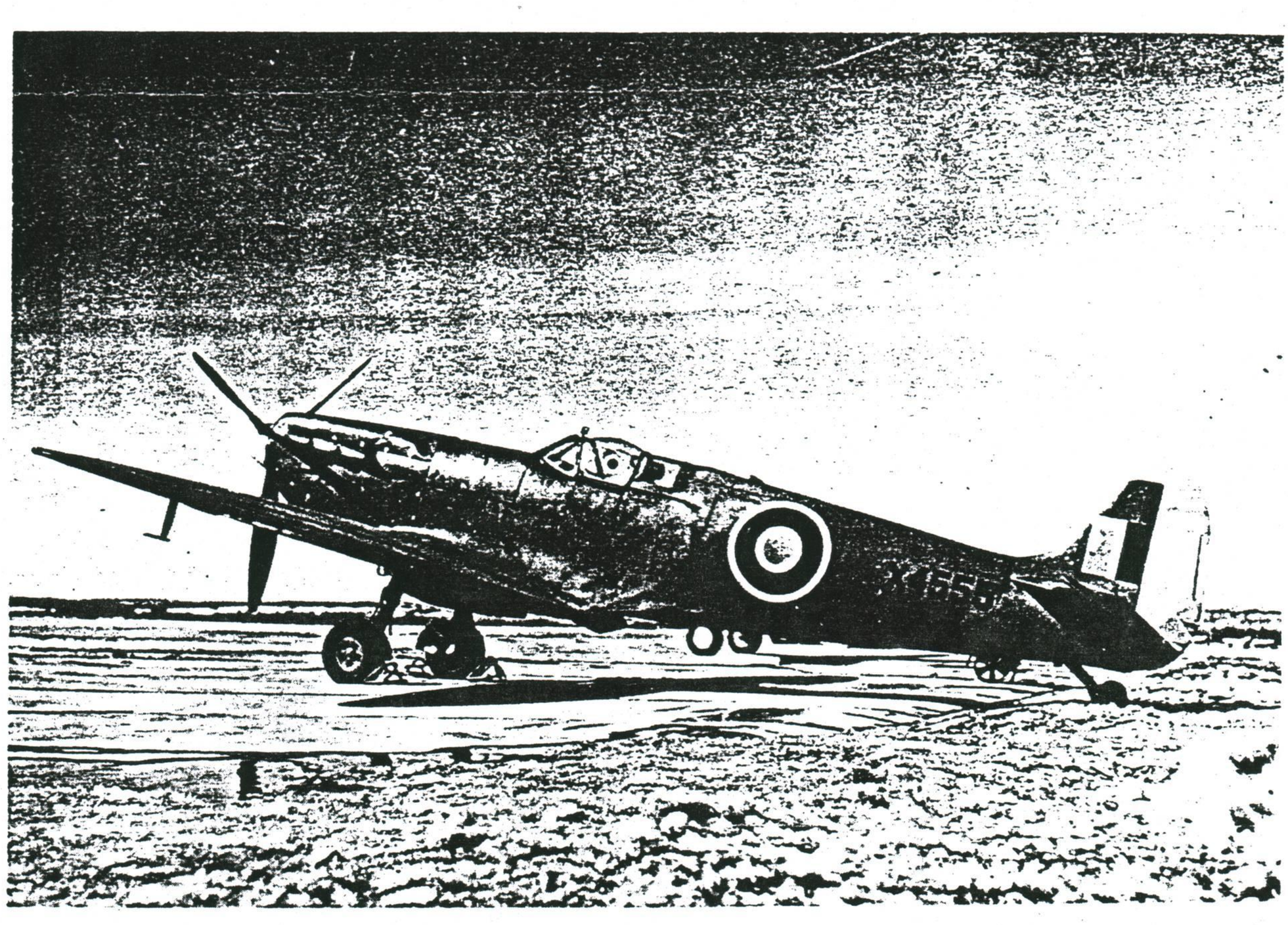
-First flight taken on September 25, 1940.
-Taken on charge by the R.A.F. September, 1941.
-No. 6 Maintenance Unit, September 26, 1940.
-No. 92 " East India" squadron, code QJ-?, September 28, 1940. Based at Biggin Hill. Note: Battle of Britain July 1 to October 31, 1940.
-Accident on operations, category "C2" (flying battle), November 1, 1940
-At General Aircraft Ltd. aircraft service section, November 7, 1940.
-No. 37 Maintenance Unit, February 16, 1941.
-No. 132 "City of Bombay" squadron, code FF-?, July 11, 1941.
-Scott Avia, December 11, 1941.
-Repaired aircaft awaiting action, February 21, 1942.
-No. 12 Maintenance Unit, February 24, 1942.
-Heston Aircraft Ltd., converted to Mk. P.R. IV, **Type "?"** with Merlin 45, April 29, 1942.
-No. 6 Maintenance Unit, June 15, 1942.
-No. 1 Photo Reconnaissance Unit at Benson, converted to Mk. P.R. VIIa **Type "G"**, November 15, 1942.
-No. 47 Maintenance Unit, January 3, 1943.
-On the S.S. *Tom Couston*, March 10, 1943.
-Taken on charge by the R.C.A.F. on February 26, 1943.
-No. 3 Training Command, April 7, 1943. On loan to the R.C.A.F. Station Rockcliffe for high altitude tests on behalf of the R.A.F.
-Assigned to No. 13 sqdn's #7 Photo Wing along with R7143 and X4492
-No. 1 Air Command, January 15, 1945.
-Category "D" at Rockcliffe. F/L R.L. Reid on a practice flight nosed the aircraft over at the end of R27. February 25, 1945.
-No. 9 Training Group, July 15, 1946.
-Awaiting disposal at No. 9 Training Group, October 11, 1946.
-Air Search and Rescue at No. 9 Training Group, January 9, 1947
-Struck off charge, September 2, 1947.
-Transferred to the Royal Canadian Navy, sent to the Air Electrical School at H.M.C.S. Stadacona, February 4, 1947.

(Montreal)

Canada

Do you know if I can find him?

X4555
Mark: P.R.VII, Type"G"
Photographed at Rockcliffe.
Date unknown.
DND/PAC RL24338



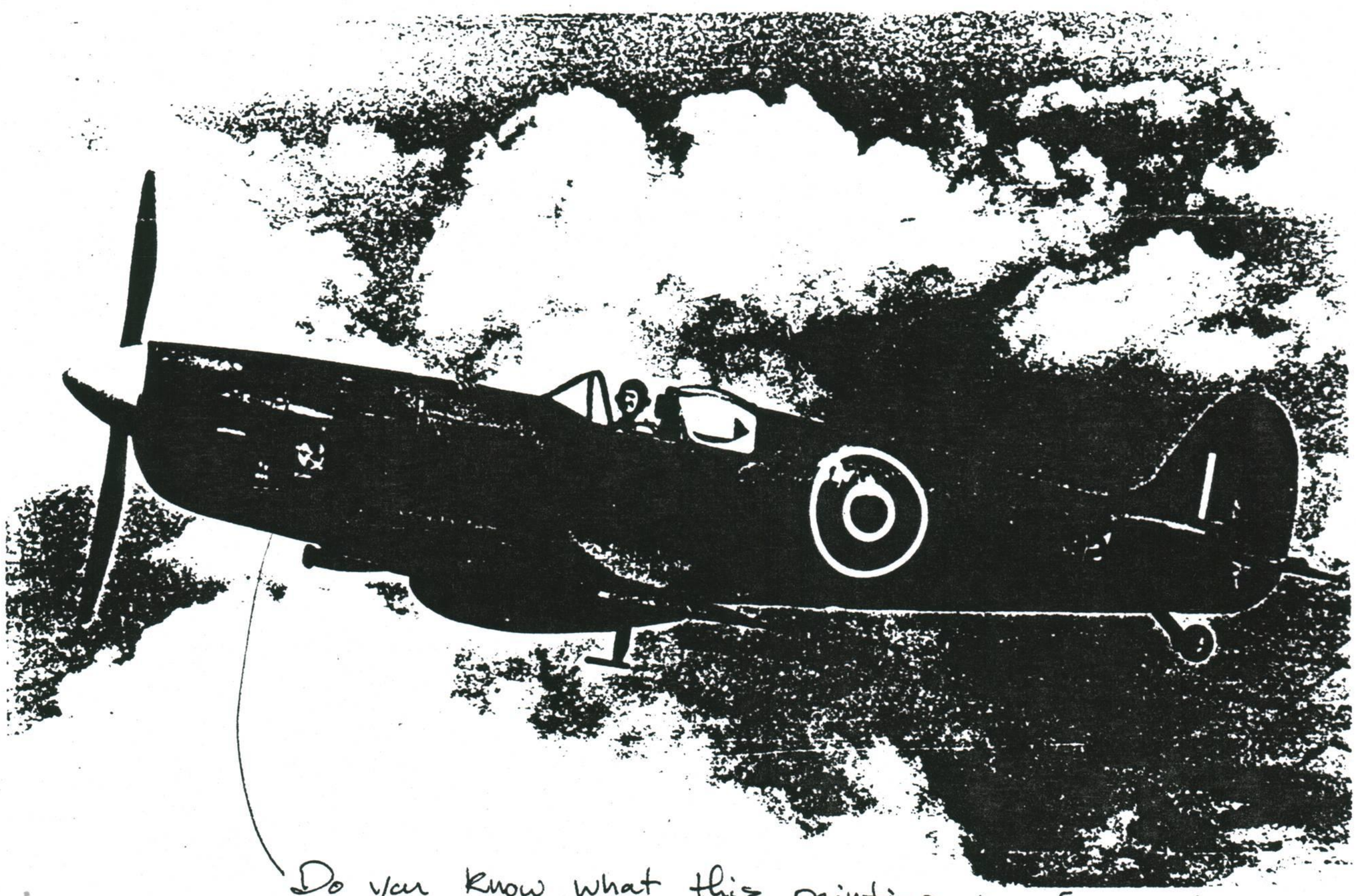
Mark F I A
Serial No. X4492
Contract : No B19713/
Order: 3rd order,
Engine: Merlin III

-Built at the Eastleigh factory, No. 1246.
-First flight was taken on July 14, 1940.
-At the Royal Aircraft Establishment located at Farnborough, September 17, 1940.
-Photographic Development Unit at Heston Aircraft Limited, converted to Mk P. R. IV, **Type D** ("W" camera arrangement), November 14, 1940
-At Rolls Royce Hucknall factory converted to Mk F.Va with Merlin 45. Jan/Feb/Mar, 1941.
-No. 1 Photo Reconnaissance Unit at R.A.F. Stn. Benson, April 29, 1941.
-No. 8 Maintenance Unit at R.A.F. Stn. Little Rissington, converted to Mk. P. R. VII, November 15, 1941.
-At Boscombe Down, converted to Mk. P. R. VI, **Type "C"** with Merlin 47. Later brought up to **Type "F"** standards. January 21, 1942
-No. 140 squadron at R.A.F. Stn. Benson, code ZW-? , February 12, 1942
-Heston Aircraft Ltd., flying accident, category "B" April 22, 1942
-Awaiting collection, June 20, 1942.
-No. 9 Maintenance Unit, June 21, 1942.
-No. 140 Squadron at R.A.F. Stn. Benson, no date
-No. 12 Maintenance Unit, July 27, 1942.
-At R.A.F. Stn. Benson. October 29, 1942.
-No. 47 Maintenance Unit at R.A.F. Stn. Sealand, December 5, 1942.
-Manchester Docks, January 9, 1943.
-To Canada on the S.S. *Manchester Progress*, January 13, 1943

Canada

-Arrived, February 10, 1943. Moved to No. 3 T.C. on the 17th. (Montreal)
-Taken on charge by the R.C.A.F. on February 26, 1943.
-No. 3 Training Command at Rockcliffe, February 26, 1943.
-Assigned to No. 13 Sqdn's #7 photo wing along with **R7143** and **X4555** at Rockcliffe, Ontario.
-No. 1 Air Command, January 15, 1945.
-Was at No. 13 P.R. Squadron to photograph the full lunar eclipse on July 9, 1945, aircraft flown by **Lt. T. Percival.** ← Do you know if I can find him?
-No. 9 Training Group, July 15, 1946.
-Awaiting disposal at No. 9 Training Group, October 11, 1946.
-Air Search and Rescue duties at No. 9 Training Group, January 9, 1947
-Struck off charge on September 2, 1947
-Transferred to the Royal Canadian Navy on September 2, 1947

X4492
Mark: P.R. VII, Type F
Photographed in Canada
Date unknown
Via Peter Arnold



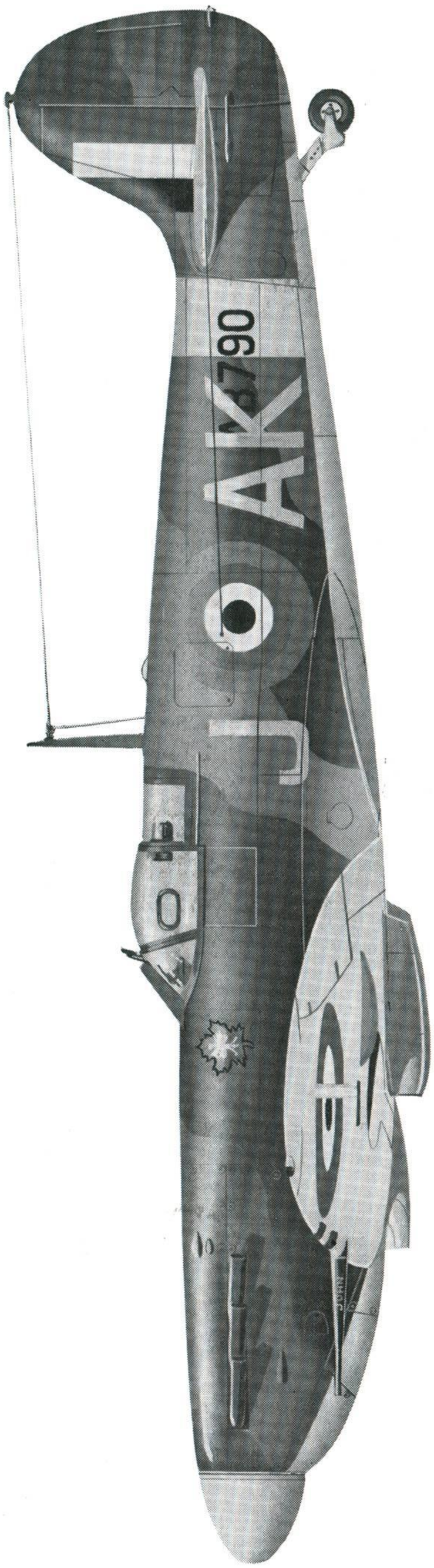
Do you know what this painting is of on the nose of this Spitfire?

PROFILE PUBLICATIONS

The Supermarine Spitfire V Series

NUMBER 166

RETAIL PRICE
UNITED KINGDOM TWO SHILLINGS
UNITED STATES & CANADA 50 CENTS



THOMAS

Starboard (right hand) cannon marking.

Wg. Cdr.'s pennant.

I.F.F. aerials not always fitted.

Wg. Cdr. Kent's personal insignia, indicating his Canadian nationality and Polish unit.

Port (left hand) cannon marking.

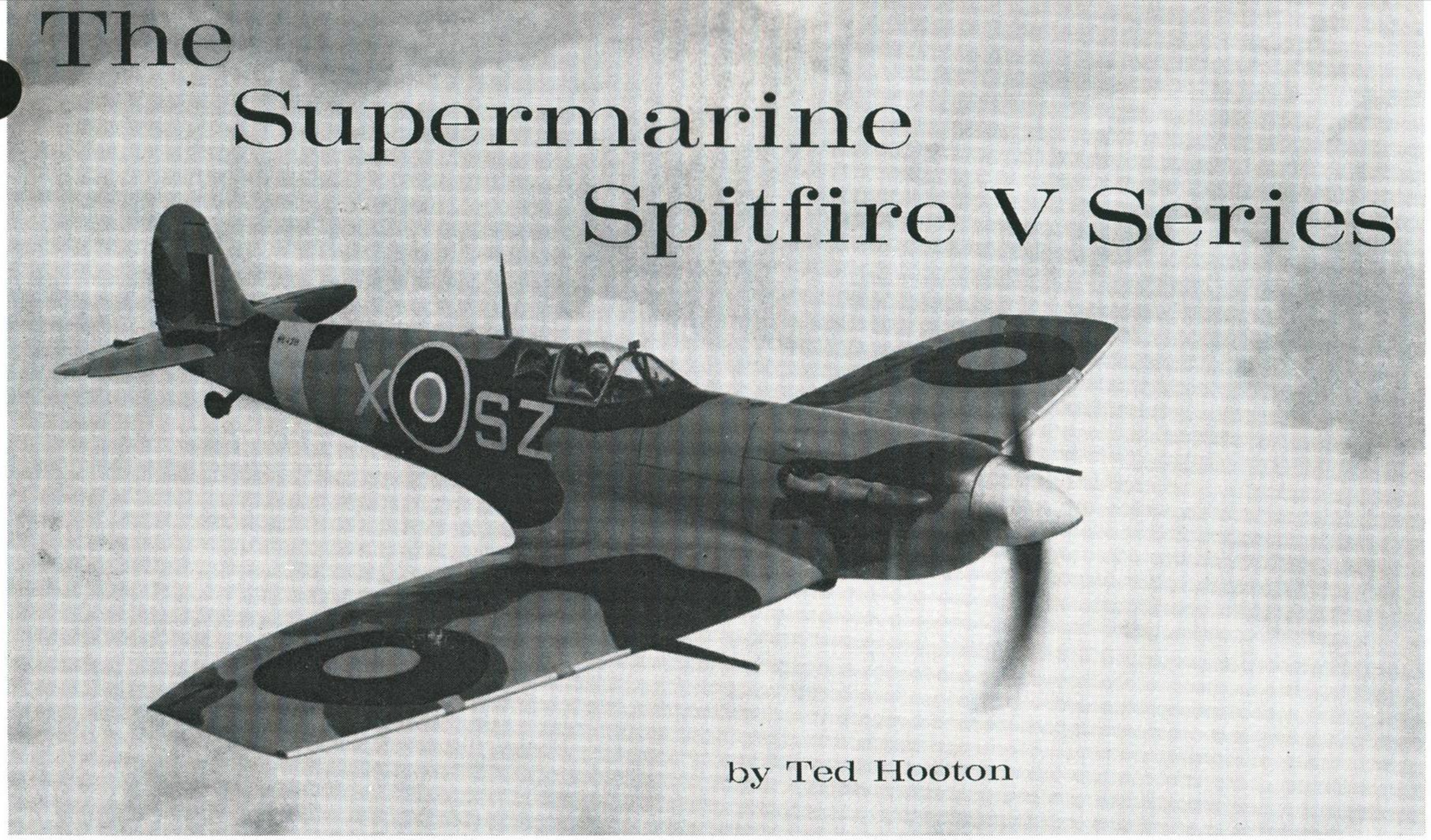
SUPERMARINE SPITFIRE VB, AB790, flown by Wing Commander John A. Kent as Wing Leader of the Polish Wing at Northolt, Middlesex, U.K. in June, 1941. At that time the Wing was made up of Nos. 303 "*Kosciuszko*", 308 "*Krakowski*" and 315 "*Deblinski*" Squadrons.

© JAMES GOULDING

0 5 10 FT.

The H.F. wire aerial was later replaced by a V.H.F. aerial utilising the same mast.

The Supermarine Spitfire V Series



by Ted Hooton

Fine flying study of BL479, *a highly-polished Mk. V*B *of No. 316 (Polish) Sqn. in 1943.* (Photo: Charles E. Brown)

With the exception of the first two variants of the Spitfire (the Marks I and II, described in *Profile* No. 41), it is a remarkable fact that the most used and, generally, the most successful variants of this fighter were those originally developed as "stop gap" types. During World War II it was not always possible to allow time for development and production of the best aircraft, and under the pressure of combat conditions, short-cuts were inevitable. Such was the case with the Spitfire Mk. V.

During the Battle of Britain in 1940 the Spitfire I had barely maintained superiority over the German Messerschmitt Bf 109E, and the few Spitfire II's that took part had but a small increase in performance over the Mk. I. Therefore, in October 1940, the Air Staff of the Royal Air Force turned to the question of a replacement aircraft. The intended successor to the earlier Marks was the Mk. III, which had been under development since 1939, and had already flown. This aircraft had a number of significant features including a new wing design, a retractable tailwheel, and a Rolls Royce Merlin XX engine. As a first step 1,120 Mk. III's were ordered in October.

However, it was realized that it would take some time to tool up for production of the new aircraft and thus, as an interim measure, Rolls-Royce were asked to install the new Merlin 45 engine into the basic Mk. I airframe to produce the Spitfire V (the Mk. IV designation having already been allocated to a Griffon-engined version of the Mk. III). There was no true prototype of the Mk. V but two converted Mk. Is, *N3053* and *R6889*, were used for the initial period of flight testing. Subsequently, further conversions were ordered, and the first Spitfire V to enter service (a Mk. VB, *R6923*, originally a Mk. IB), was delivered to No. 92 Squadron early in December.

As with all Spitfires (except the IIC) the suffix letter indicated the type of wing, the "A" wing having eight ·303 Browning machine guns, and the "B" two 20 mm. cannon and four machine guns. At that time the cannon was a subject of lively controversy in Fighter Command because of a prolonged history of gun stoppages, but modifications had been made, and No. 92 Squadron's early successes with their existing IB's and the new VB convinced the Air Staff that the VB, rather than the VA, should be built in quantity. Only ninety-four of the latter variant were produced.

In the course of events the Spitfire III was to be cancelled, and some of the special features of that version were incorporated into the Mk. V, of which a total of 6,464 fighter versions were built between 1941 and 1943. In addition, over one hundred were converted from Mk. I airframes. The aircraft saw service with more than one hundred and forty squadrons of the R.A.F. and was supplied to nine foreign countries, including the United States. It was employed on all battle fronts during the war and, in many cases, was instrumental in turning the tide of the air war in favour of the Allied forces.

1941—R.A.F. ON THE OFFENSIVE

In the first few months of 1941, the Spitfire V went into service with Nos. 41, 54, 64, and 91 Squadrons. During May, the first Messerschmitt Bf 109F was encountered in combat, and the Spitfire V was publicly announced. By this time production was under way; Supermarine, having already completed seventy-eight in the R-serial batch, were beginning on the first complete run of 450 aircraft, starting with *W3109*. Many of this batch incorporated a new, integral, bullet-proof windscreen originally planned for the Spitfire III. The Castle Bromwich factory, having completed eighty Mk. V's in the P series, was beginning a complete run of 500 aircraft from *AB778*.

These aircraft were rapidly introduced into the squadrons, and by the summer the R.A.F. was on the offensive over the Low Countries of Europe. The offensive took the form of fighter sweeps and daylight bombing by Blenheims and Stirlings, the Spitfire V's providing escort cover. By September, twenty-seven squadrons were equipped with the Mk. VB



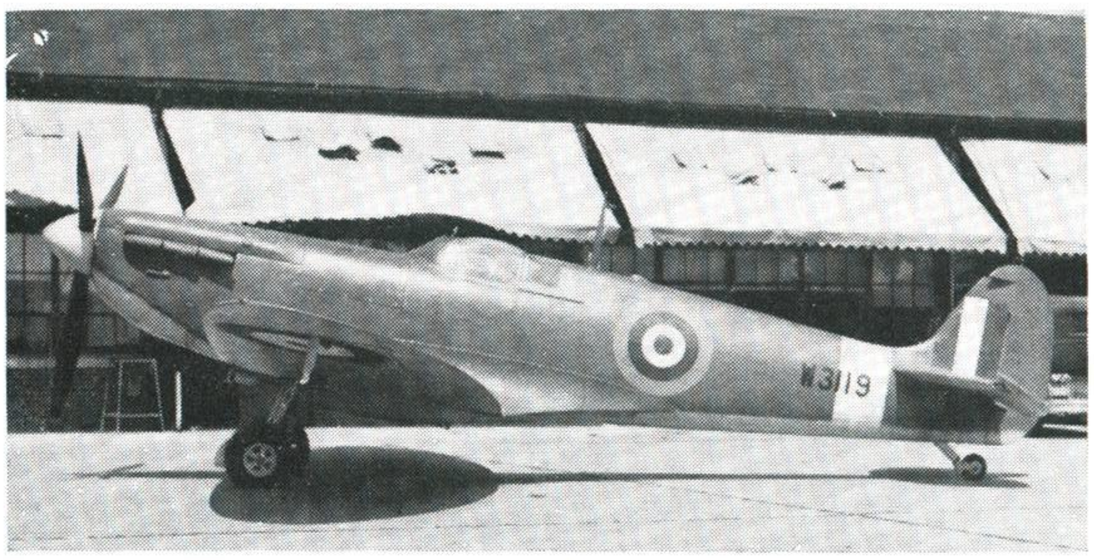
No. 92 Squadron, R.A.F., early in 1941. Aircraft QJ-J *in the foreground is Mk. V*B, R7161, *originally a Mk. I presentation aircraft dedicated "Mombasa".* (Photo: Imp. War Mus.)

and a few VA's, and in December this figure rose to forty-six, including fifteen Commonwealth and Allied squadrons, plus Nos. 71 and 121 "Eagle" Squadrons, composed of American volunteers.

The original design of the Spitfire had been as a short-range home-defence fighter. The sweeps and escort operations, however, required a much longer range capability, and in 1941 the first trials were made with external, jettisonable fuel tanks. These tanks were of the "slipper" type fitting flush to the underside of the fuselage. After some initial jettisoning problems were overcome, both 30 and 45 gallon tanks were built in large quantities for the Mk. V and subsequent variants. Another concern was the problem of the high aileron-stick forces that were necessary to bank the aircraft at high speeds during combat. After many experiments with aileron servotabs, revised aerofoil shapes, and months of wind tunnel testing at the National Physics Laboratory, the problem was rather simply resolved early in 1941, by replacing the original fabric covering with metal. Also a sharper trailing edge was incorporated, and the new ailerons were introduced on the Spitfire V production lines by the summer, as well as being retroactively fitted to earlier aircraft.

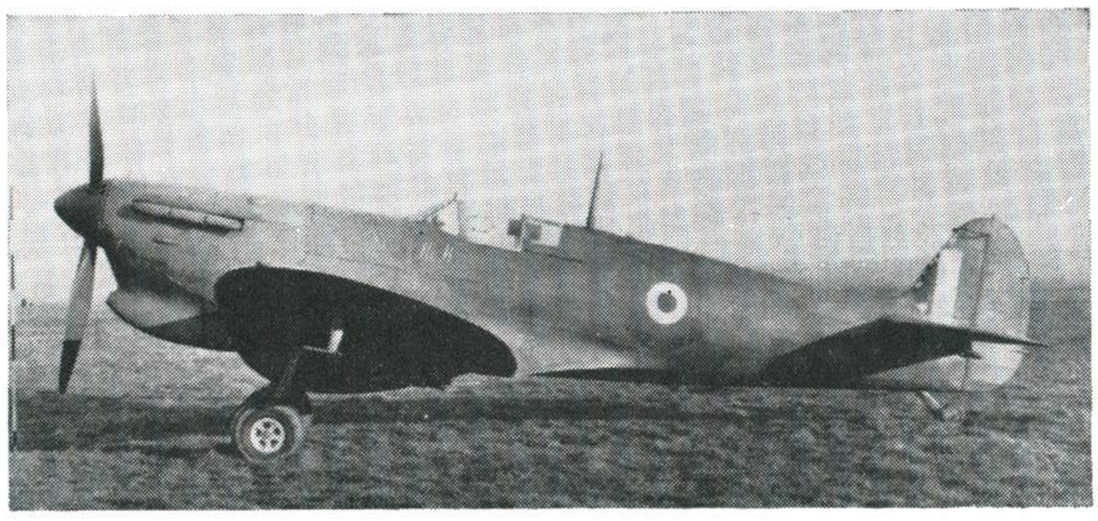
The first models of the Spitfire VC came off the Supermarine production line later in the year. The "C" or universal wing was originally designed in 1940 for the Mk. III to give a choice of armament between "A" type, "B" type, or a new combination of four 20 mm. cannon. Actually, most Mk. VC's in service retained the "B" type armament, the outer cannon positions being covered by short fairing stubs, but the new wing did allow for 120 shells for each cannon, instead of the previous number of 60. An additional feature was a strengthened undercarriage with the wheels set two inches further forward. This helped to reduce a common Spitfire fault: nosing over when taxiing on soft or rough airfields. The new wing was tested on a Mk. VB, *W3237*, which was then redesignated as a Mk. III, but with the cancellation of that version, the wing became available for the Spitfire V.

An early Mk. VC, *AA963*, was shipped to the U.S.A. in 1942. However, it was not the first to go because, at the request of General Arnold of the U.S.A.A.F., two VA's (*R7347* and *W3119*) were delivered to Wright Field during the summer of 1941. In December, *W3119* was transferred to the NACA at Langley for detailed measurement of its flying qualities, and this was followed by an installation of special engine exhaust stacks for test purposes.





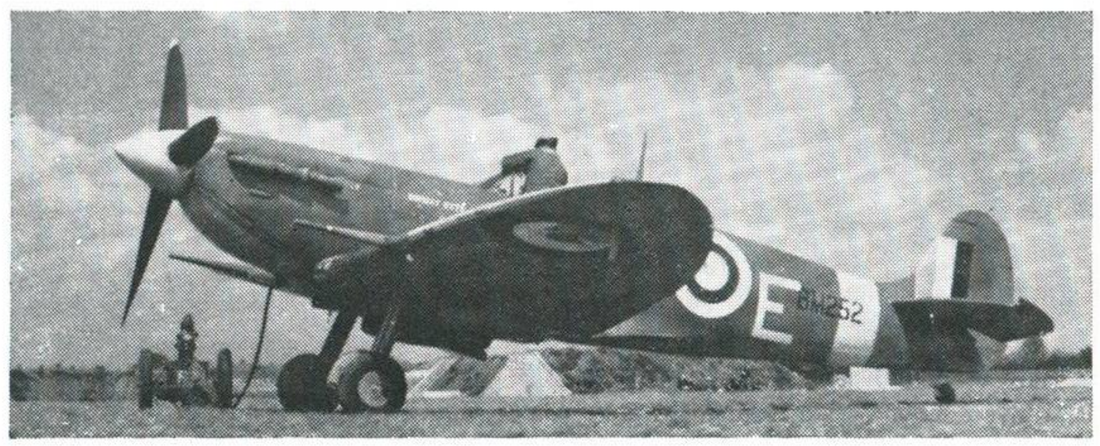
(Left) *Spitfire V*A, W3119, *in front of Hangar No. 4, Wright Field, Ohio in July 1941.* (Photo: Official U.S. Air Force). (Right) *An early production Spitfire V*B, W3821 "*Pemba III*", *built by Supermarine.* (Photo: Imp. War Mus.)





(Left) *First experimental installation of a tropical filter on Mk. V*A X4922 *in December 1941.* (Right) *The first production Spitfire V*C, AA873, *with four cannon installed.* (Photos: Imp. War Mus.)





(Left) *A Supermarine-built Mk. V*B, YO-E "*Jersey I*" *of No. 401 (Canadian) Squadron in the winter of 1941-42.* (Photo: Canadian Dept. of National Defence). (Right) *A Spitfire V*B *of No. 122 Squadron in 1942; the aircraft is* BM252 "*Bombay City*". (Photo: Imp. War Mus.)

1942—THE FOCKE WULF MENACE

By the beginning of 1942, over 1,700 Spitfire V's had been built. In January, Westland Aircraft built their first Mk. VB, *AR318*, and shortly afterwards, Supermarine phased out the VB in favour of the VC. Castle Bromwich followed suit in the autumn when they were producing eight to ten aircraft per day. Over 3,300 Mk. V's were built in 1942.

The early months of this year were marked by a series of disasters suffered by British forces in the Pacific, the North African desert, and the English Channel; all these events having an effect on the development and use of the Spitfire.

Prior to September 1941 the Spitfire's main opponent was the Messerschmitt Bf 109F. Although this aircraft had slightly superior fighting qualities above 20,000 feet, its armament was light, and generally the Spitfire V was the better of the two aircraft. Then, in September, the first of the new Focke-Wulf Fw190's were met in combat over France. With the exception of the smaller turning radius of the Spitfire, the Fw 190 was superior in all other respects. In February 1942, the Germans sailed their three capital ships, the *Scharnhorst*, *Gneisenau* and *Prinz Eugen* through the Channel to return to Germany. During the resulting air battle the Spitfires tangled with large numbers of Fw 190's and from then on there was absolutely no doubt that the Spitfire was outclassed by the *Luftwaffe's* new aircraft. The answer was the Spitfire Mk. IX, developed as another "stop-gap" using the Mk. VC airframe with the more powerful Merlin 61 engine. However, the Mk. IX took time to bring into service in large enough numbers, and by June there were more squadrons of Mk. V's in service than at any other period of the war: fifty-nine in the United Kingdom, and seven in the Mediterranean area.

In July Supermarine built their last VC, *BS305*, and in August forty-two squadrons of Spitfire V's were among the R.A.F. forces covering the first large-scale Allied landing on the French coast at Dieppe. During this raid the first U.S.A.A.F. Spitfires were in action; those of the 307th Squadron of the 31st Fighter Group. With the 308th and 309th Squadrons they had arrived in England in June and were quickly followed by the 2nd, 4th and 5th Squadrons of the 52nd F.G., all these units equipping with the Mk. VB. In September the three "Eagle" squadrons of the R.A.F. were transferred to the 4th F.G., and this Group retained its Spitfire V's until early 1943. More American units arrived in 1942. In October the 67th Observation Group reformed at Membury and, by the summer of 1943, all of their four squadrons (12th, 107th, 109th and 153rd) were using the Mk. VB. Finally, the 13th Reconnaissance Squadron of the 8th Air Force received a few for training purposes.

The Royal Navy was also supplied with VB's during 1942. These were intended for pilot training, some of the aircraft being modified by the addition of arrester hooks.

The Japanese campaigns in the Pacific resulted in the resurrection of the Spitfire floatplane project which originally dated back to early 1940. During 1942, new floats were designed by Supermarine and built by Folland, being fitted to a Mk. VB, *W3760*. After fitment of additional fin area, a small diameter four-blade propeller, and a tropical-type carburettor intake, the aircraft was a success. Folland then modified an additional two aircraft, *EP751* and *EP754*, which were both shipped overseas to Alexandria, Egypt, where they were flown but saw no action.

Other modifications were the fitting of target-towing hooks to some aircraft (e.g. *W3234* and *AB789*, both VB's of No. 315 Squadron). In addition to towing targets, the R.A.E. at Farnborough used a VB as a tug for a Hotspur glider. Later, Flight Refuelling Ltd. reversed the rôle when a Wellington was used to tow a Spitfire. This experiment was to test the practicability of long-range towing as a method for fast reinforcement of overseas bases.

OVERSEAS—1942 TO 1944

As long as there was a serious threat of German

*Spitfire V*B*'s of No. 485 (New Zealand) Squadron; note the blunt spinner of* AB918 "*Wellington I*" *in the foreground.* (Photo: Imp. War Mus.)





Early Mk. Vc AB248 *in foreground of a line-up of No. 91 (Nigerian) Sqn. in spring, 1942.* (Photo: Imp. War Mus.)



No. 332 (Norwegian) Squadron dispersal early in 1942; by December 1941 forty-six R.A.F. squadrons were equipped with the Spitfire V, including fifteen Commonwealth and Allied squadrons as well as Nos. 71 and 121 "Eagle" Squadrons, composed of American volunteers. In the foreground is Mk. VA R7127, *converted from a Mk. IA.*
(Photo: Flight International)

invasion of England, the Spitfire was retained for home defence. However, it was apparent in 1941 that the aircraft would eventually be required overseas. At that time the desert war in North Africa was the main concern, and the problems of sand ingestion causing engine wear had been well recognized. Therefore, a Mk. VA, *X4922*, was experimentally fitted with a Vokes tropical air filter over the carburettor intake. This modification was later applied to production aircraft intended for overseas operations, the first aircraft being *AB320*, a Supermarine-built VB (trop) which flew early in 1942, and most Mk. V's built after July were "tropicalised". Therefore, the great majority of Mk. VC's were thus equipped.

In March, enemy air attacks on the island of Malta reached such a pitch that Spitfires were essential to combat the *Luftwaffe* and *Regia Aeronautica*. Under the circumstances it was necessary to fly the aircraft in from carriers, and, with new 90 gallon slipper tanks, it was possible to extend their range to the maximum. During March thirty-four Mk. V's were flown in to supplement the few remaining Hurricanes of Nos. 126 and 185 Squadrons. Reinforcements followed in April and May, when the American carrier *Wasp* joined *H.M.S. Eagle* in despatching one hundred and twenty-six aircraft. These included three new squadrons for the island's defence—Nos. 249, 601 and 603—plus extra aircraft for the squadrons already there. Both the Mk. VB and VC were flown in and these supply missions were to continue until November.

Meanwhile, in the desert, the 8th Army was retreating into Egypt and No. 145 Squadron was transferred there from England. Their aircraft were flown in from Takoradi, West Africa, and by 1st June they were in action, being supported that month by No. 601 Squadron who flew in from Malta. On the island itself, No. 603 Squadron re-equipped with Beaufighters, its Spitfires being handed over to two new squadrons (Nos. 229 and 1435, the latter being a Flight number, although the unit operated as a squadron until the end of the war). In August, No. 92 Squadron was transferred to Egypt from England and joined Nos. 145 and 601 in 244 Fighter Wing. These squadrons found themselves opposed by the Bf 109F (and later the G model) and the Macchi C.202. Since most combat was at low altitudes, the Spitfires had little trouble with the 109F, although the 109G was somewhat faster than the Spitfire V. Against the M.C.202 it seemed that the two aircraft were fairly evenly matched; the Italian, while superior in climb at low altitudes, was seriously under-gunned.

One essential element of the desert air war was the repair and modification activities of 103 Maintenance



EP257, *a Spitfire VB Tropical probably of No. 229 Sqn., on Malta in 1942.* (Photo: Imp. War Mus.)

A group of Beaufighter and Spitfire pilots on Malta in October 1942; second from right is Sqn. Ldr. M. M. Stephens, C.O. of No. 229 Sqn. The Spitfire VC is the aircraft of Wg.-Cdr. P. P. Hanks. (Photo: Imp. War Mus.)

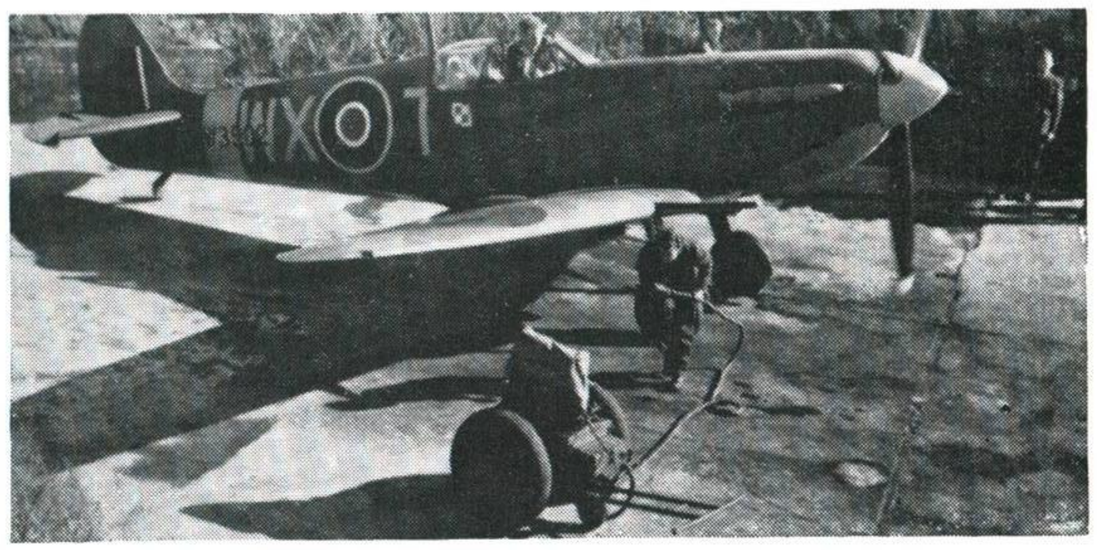


Unit at Aboukir. Besides turning out 140 reconditioned aircraft per month, they modified many aircraft for special duties, including Spitfire V's. The tropical filters then fitted were adequate but reduced the aircraft's maximum speed. To reduce drag and improve filtering, 103 M.U. designed a new and smaller unit that proved very successful and was fitted to many Mk. V's. To combat the high-flying Junkers Ju 86P reconnaissance aircraft, three Spitfire VC's were modified by reducing the weight in every way possible (including reduction of the armament to two ·5 inch machine guns) and improving the performance by use of extended wingtips (locally built), a four-blade propeller, and modified carburettors. These aircraft (*BP985*, *BR114* and *BR234*) were eventually successful against the Ju 86P but, at the altitudes above 40,000 feet, the physical strain on the pilots of the Special Performance Flight was rather severe. After the Spitfire VI arrived at Aboukir it was found that it did not have the required high-altitude performance, so one of the existing Mk. VC's was further modified with a Merlin 61 engine and two 20 mm. cannon in place of the ·5 inch machine guns.

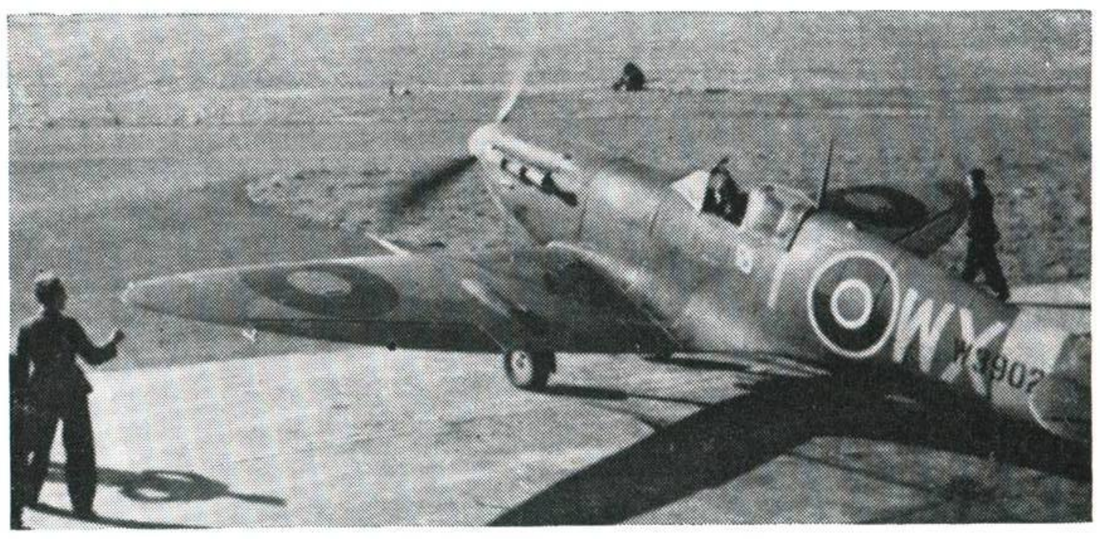
Clipped-wing Spitfires were also quite common in Egypt, 103 M.U. producing their own wooden tip-fairings, which were slightly more rounded than those used in the U.K. for the L.F.VB. For fighter-reconnaissance duties a number of VB's (e.g. *EP878*) were fitted with an oblique camera and in addition to the clipped-wing and cropped engine-supercharger blades, most fuselage and wing skin joints were taped over. A smooth camouflaged finish was then applied to achieve the maximum speed possible. These aircraft were used by No. 40 Squadron of the South African Air Force which moved forward with the 8th Army after their advance from El Alamein in November 1942.

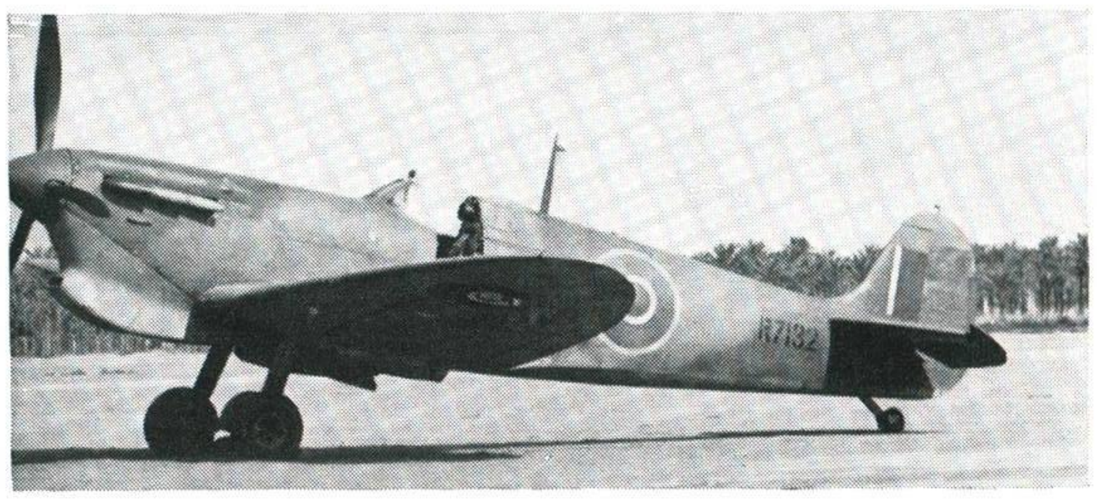
In the same month British and American forces landed in Algeria and Morocco. The first Spitfires to land were of No. 81 Squadron, R.A.F., and from the 31st F.G., U.S.A.A.F., the 308th and 309th Squadrons. Their Mk. V's were soon joined by those of the 307th, and the three squadrons of the 52nd F.G., plus seven R.A.F. units. By December the Allies were in some difficulties; operating conditions were primitive and aircraft serviceability was low and, in addition, the strong German counteraction included the Fw 190's of the *Luftwaffe*.

To meet the Army's needs a number of Spitfires were modified as fighter bombers carrying one 250 lb. bomb under each wing. Also, to improve manoeuvrability, some American pilots removed one machine gun from each wing to reduce weight. (Local modifications were much in evidence in the Mediterranean; some VC's in Malta had their 20 mm. cannon mounted in the outboard position rather than

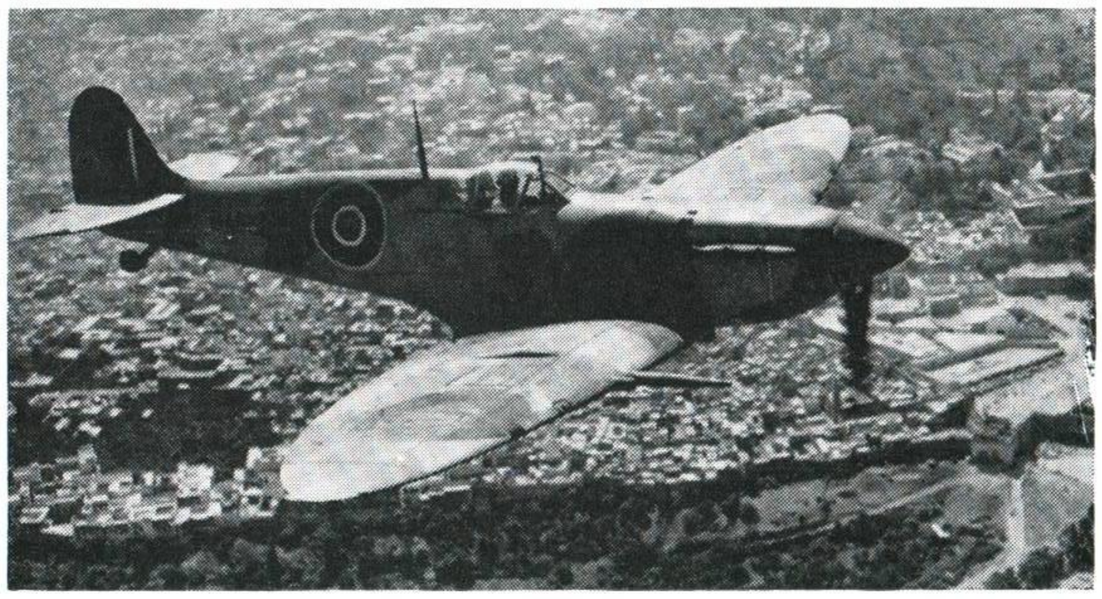


Prominent among the squadrons whose personnel were expatriates from occupied countries were the Polish units; here, an aircraft of No. 302 "Poznanski" (Polish) Sqn. is prepared for a sortie. (Photos: J. B. Cynk)





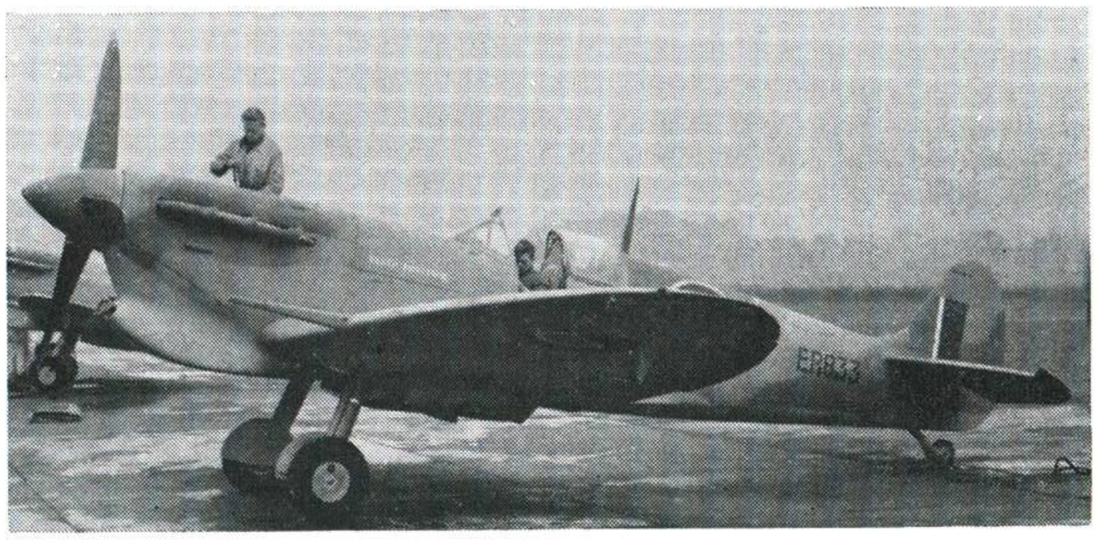
An unusual aircraft, R7132 *was originally a Mk. IA, converted to Mk. VA standard, and finally tropicalised. It is seen here at Abouqir, Egypt.* (Photo: T. P. M. Cooper-Slipper)

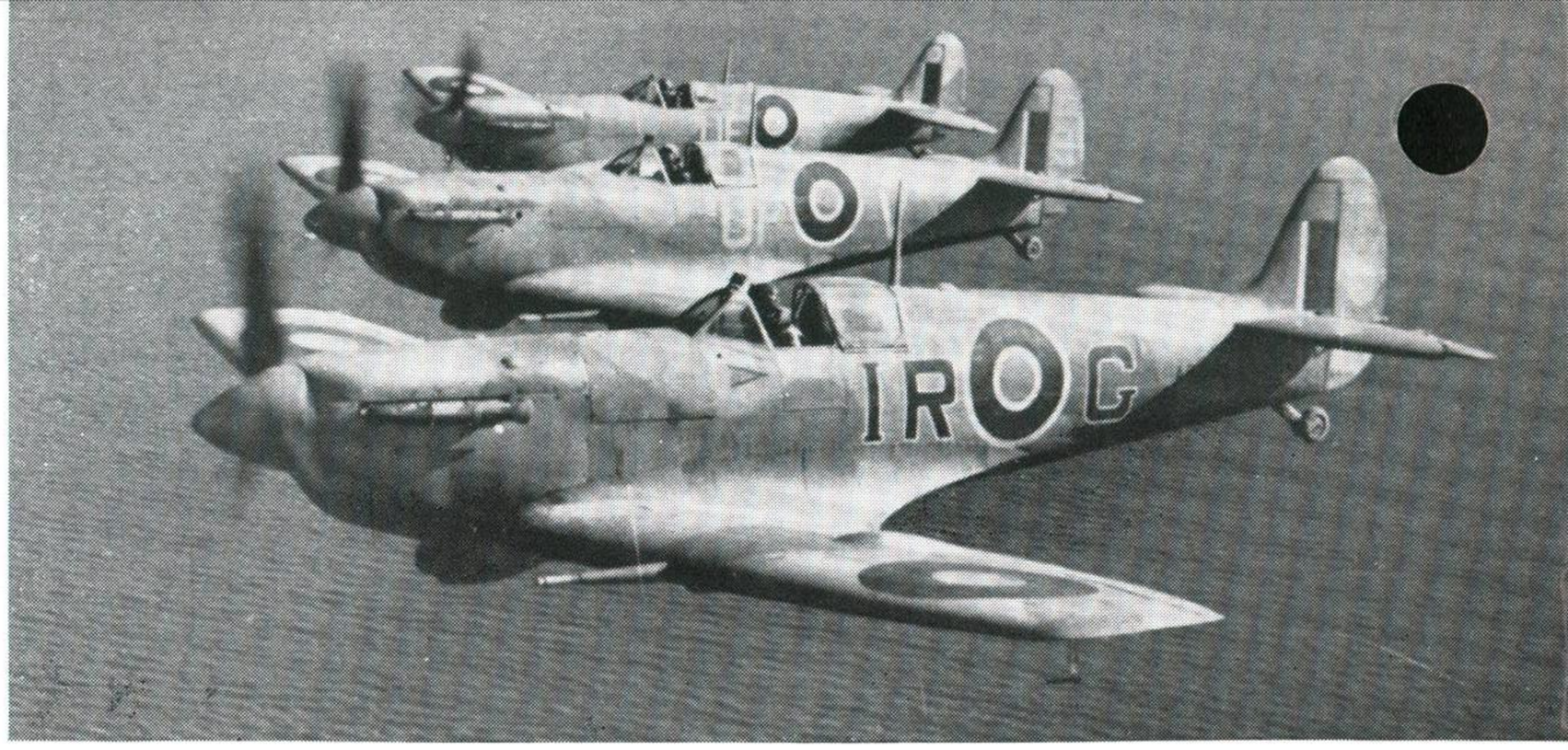


A late-production Spitfire VC, MA859, *on a delivery flight over Morocco; note the absence of a tropical filter.* (Photo: Imp. War Mus.)

(Left) *a Westland-built Mk. VC,* EE627, *in Sept. 1942; and* (right) *a late-production Mk. VB Tropical,* ER833 "*Benue Province*" *at Castle Bromwich in late autumn 1942.* (Photos: Imp. War Mus.)







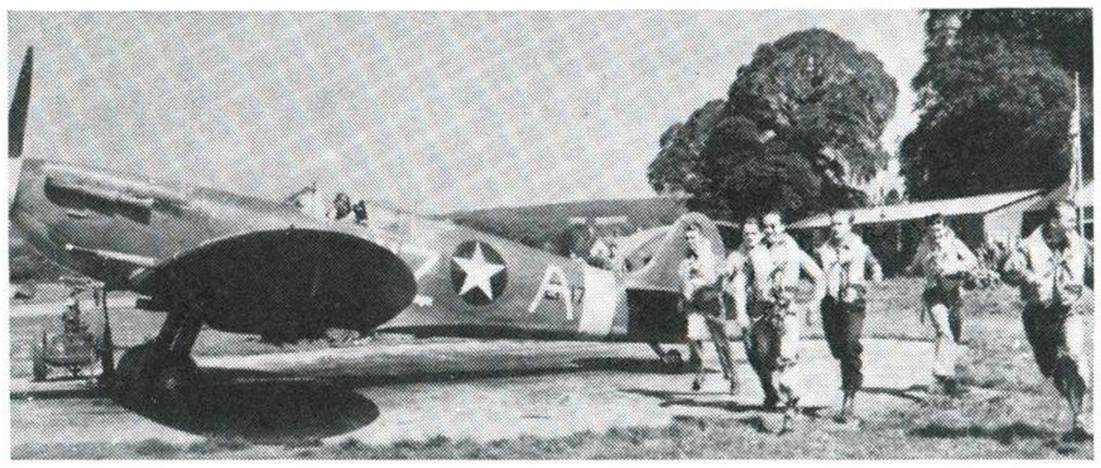
*Spitfire V*B*'s with Abouqir filters in the Middle East. Two aircraft from No. 601 Sqn. are led by (foreground) Wg.-Cdr. I. R. "Widge" Gleed in* AB502. *A veteran of the early fighting in France and the Battle of Britain, Gleed had at least 15 victories to his credit when he failed to return from a fighter sweep on 16th April 1943.*
(Photo: Imp. War Mus.)

the normal inboard location).

In February the first Spitfire IX's arrived in North Africa although, when the German Army surrendered in North Africa in May, there were twenty-three R.A.F. squadrons of Spitfire V's in the Mediterranean area. During this month the 31st F.G. began to re-equip with the Spitfire VIII and IX although, like many R.A.F. squadrons in the area, they also retained some Mk. V's, the 307th squadron still using a few during the invasion of Italy in September.

To give U.S.A.A.F. pilots some operational training before joining their squadrons, the Fighter Training Center was organized at Berrachid, Morocco, early in 1943 with the P-38, P-40 and Spitfire V. The Spitfire flight had about a dozen aircraft, one of which was the personal aircraft of the chief instructor. This Spitfire was probably the most colourful one ever flown, being a brilliant blue overall with red and white stripes over the engine cowling !

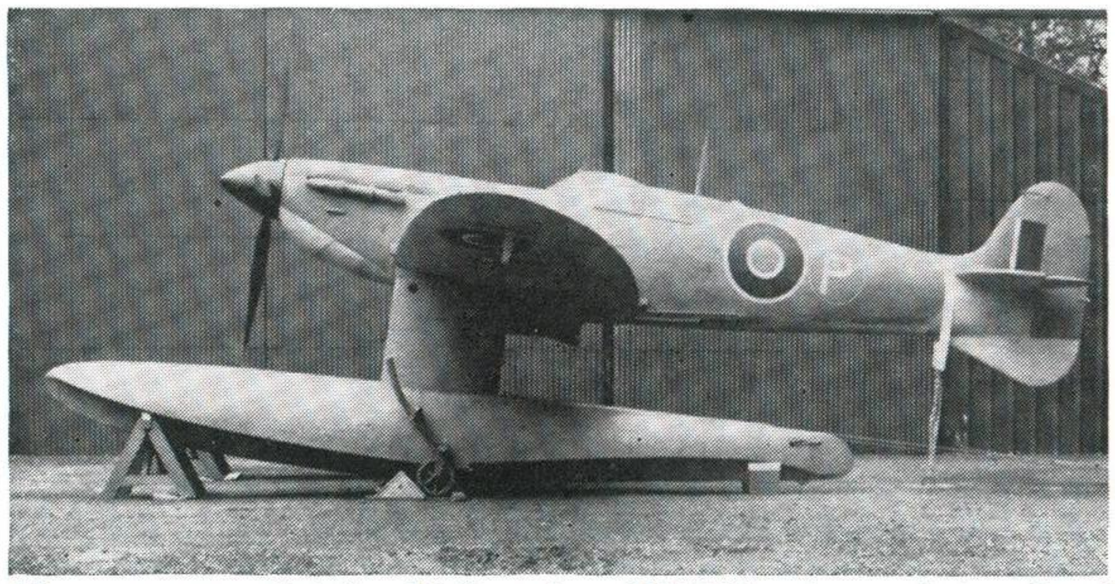
The Mk. V was in constant use through the Sicilian campaign and the invasion of Italy, although used more as a ground support aircraft. In the case of No. 2 Squadron S.A.A.F. their Mk. V*C* fighter-bombers mounted the full complement of four 20 mm. cannon. By 1944 the Polish, Greek, and French squadrons of the R.A.F. were using the aircraft, and in August of that year No. 352 (Jugoslav) Squadron equipped with the Mk. V*C*. Another unit was that of the Free French Air Force, *Groupe de Chasse* G.C.II/7. From December 1943 the R.A.F. squadrons began to



American pilots, thought to be of the 309th Fighter Squadron, run to their Spitfire V's on an English airfield—in this case Debden in Essex.

*A fighter-bomber Mk. V*C, JG871, *in North West Africa.*
(Photo: Imp. War Mus.)





The prototype Spitfire V floatplane W3760 *prior to being fitted with increased dorsal fin area.* (Photo: Imp. War Mus.)

re-equip with more modern aircraft, so that by March 1945 the Greek and Jugoslav squadrons were the only remaining units with the Spitfire V in the Mediterranean. Other countries had meanwhile received the aircraft.

After a direct request from Stalin to Churchill in October 1942, the Spitfire V*B* was supplied to the Russians from Middle East stocks. By March 1943 one hundred and forty-three had been transferred, and were put into immediate service. They saw action along the Black Sea coast of the Caucasus, and others were allocated to the defence of Moscow. Later in 1943 some *Luftwaffe* pilots of JG 52 were somewhat surprised to encounter twenty-five of the Spitfires in an engagement near Orel, 200 miles south of Moscow.

Portugal also received the Mk. V*B*, about fifty being supplied from October 1943. Then in 1944 a number of Mk. V*B*'s were sent to Turkey and finally, the Egyptian Air Force was given a few Spitfire V*C*'s towards the end of the war.

A common mishap with Spitfires; ER220 *is a tropical Mk. V*B *from No. 92 Sqn. at Abouqir for overhaul.*
(Photo: T. P. M. Cooper-Slipper)



THE FAR EAST

By the middle of 1942 the Australian continent was threatened by the Japanese, and No. 54 Squadron together with Nos. 452 and 457 (Australian) Squadrons of the R.A.F. were transferred from England. After some delays they were reformed as No. 1 Fighter Wing in the Darwin area. Their aircraft arrived in January 1943, being Mk. Vc's of the last batch built by Supermarine. The Wing was soon in action against the Japanese air forces, which started bombing attacks on Northern Australia in February. The Japanese escort fighter on these raids was the Mitsubishi *Zero-Sen* (Zeke) (see *Profile* No. 129) and, for the first time, the Spitfire could be outmanoeuvred by an opponent, although it had superior level and diving speeds. By June the Wing's aircraft were somewhat worn out, but the Japanese attacks had died down so that the remainder of the year was quiet. As replacement aircraft arrived, No. 2 Operational Training Unit received the Mk. Vc and began training pilots for the Spitfire VIII's that were delivered in 1944 when the three original squadrons relinquished their Mk. V's.

Meanwhile in Burma, Nos. 607 and 615 Squadrons received the Spitfire Vc in September 1943, followed shortly afterwards by No. 136 Squadron. They immediately established a much-needed air superiority over the Japanese, an additional opponent here being the Nakajima Ki-43 *Hayabusa* (Oscar) (see *Profile* No. 46) which, although being very manoeuvrable, was much slower, under-gunned, and very fragile. However, the Spitfire V's were soon replaced by Mk. VIII's, which began arriving in January 1944.



Spitfire VB's at Abadan prior to delivery to the Soviet Union, April 1943.
(Photo: Imp. War Mus.)



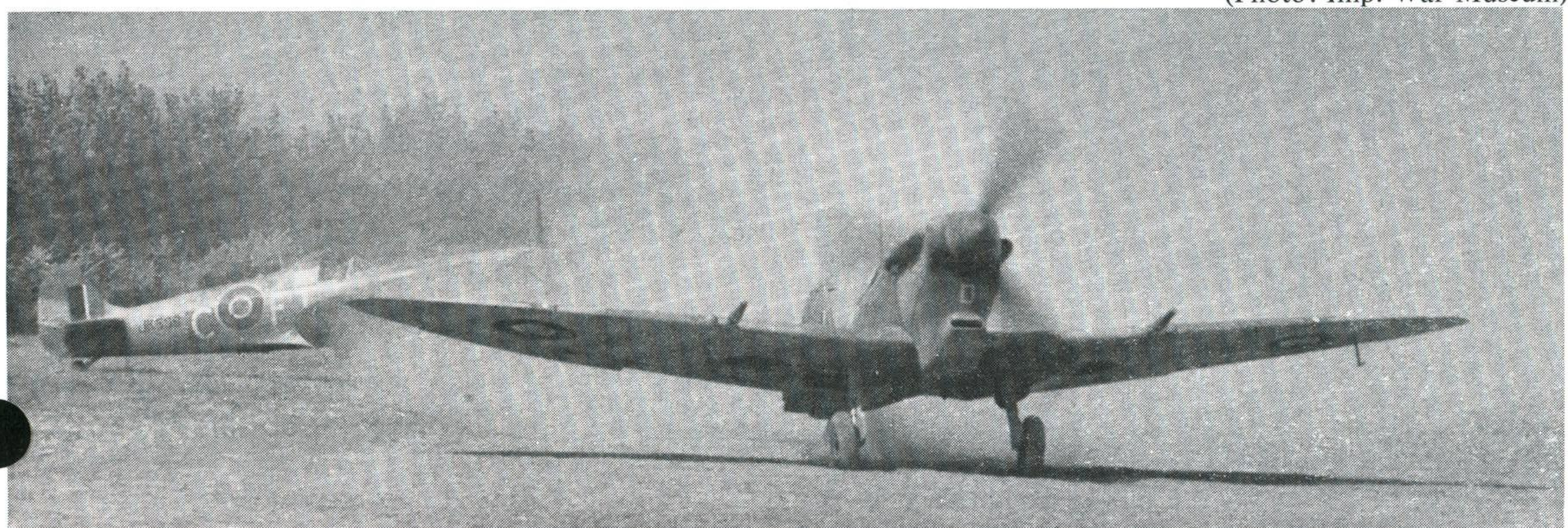
Spitfire VB BM*635 of the American 67th Observation Group in March 1943. It still carries the letters WZ-Y from its previous unit—the 309th Fighter Sqn., 31st Fighter Group.*
(Photo: Official U.S.A.F.)

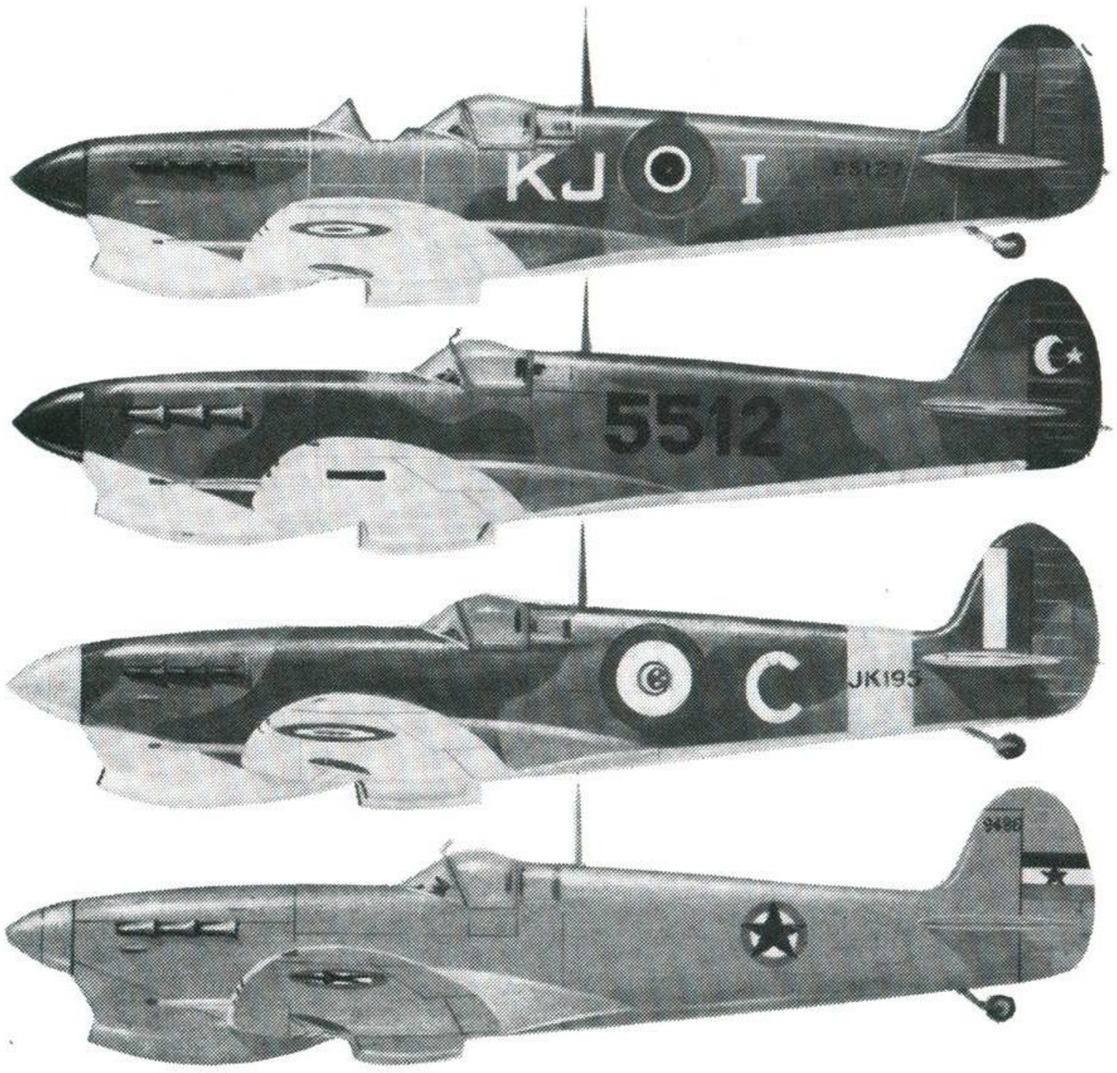
UNITED KINGDOM, 1943—1945

At home, production of the Spitfire Vc continued in 1943, Castle Bromwich producing their last aircraft, *MH646*, in August and Westland continuing until October, their last Mk. Vc being *EF753*. The final batches introduced metal-covered elevators featuring a modified horn-balance. Also, some of the 1,300 produced that year utilized the Merlin 50 series engine which had six exhaust stacks per side instead of the three of the Merlin 45. Nearly all these aircraft went overseas, the home squadrons using older aircraft.

In late 1942, some experiments were carried out to determine the maximum speed that could be attained with a Mk. V. One of the results of this testing was the clipped-wing, first flown on a Mk. VB, *W3248*. This modification increased the rate of roll to that of the Fw 190, and, fitted with a modified Merlin (45M, 50M or 55M), the new version was designated the Spitfire L.F. Mk. V. Most were of the "B" version, and all were converted from existing airframes at Maintenance Units. While the aircraft was, theoretically, more of a match for the Fw 190, it was heartily

Operating in the Naples area in 1943, the Spitfire Vc's of No. 43 Sqn. demonstrated the necessity for tropical filters.
(Photo: Imp. War Museum)





Top to bottom:
Spitfire Vc of No. 261 Squadron R.A.F.; Sicily, 1944. Used for liaison duties, second cockpit for batman. Serial E5127. *Colours: upper surfaces sand and stone, blue under-surfaces, dark brown spinner, red fin tip, white code KJ-I, black serial.*
Spitfire Vc of Turkish Air Force, 1942-3. Colours: upper surfaces dark sand and stone, blue under-surfaces, black spinner, red rudder, black code 5512, white crescent and star insignia, red square outlined in white—wing insignia.
Spitfire Vc of Egyptian Air Force, 1943. Colours: upper surfaces sand and stone, blue under-surfaces, sky spinner and fuselage band, white code C, black serial JK195. *Green and white national markings.*
Spitfire Vc of Yugoslavian Air Force; preserved aircraft, 1963. Colours: overall mid-grey; red, white and blue national markings, black code 9486 at top of fin.



One of a number of tropicalised Mk. VB's supplied to Turkey in 1944, flying in the colours of the Turkish Air Force.
(Photo: H. J. Nowarra)

Wg.-Cdr. Clive R. Caldwell, probably the most celebrated of all Australian fighter pilots, with one of the four Spitfire Vc's he flew as leader of No. 1 Fighter Wing at Darwin in 1942-43.
(Photo: via W. A. Musciano)



SPECIFICATION

Vickers-Armstrongs Supermarine Type 349 Spitfire Mk. V.
General: Span, 36 ft. 10 in. (L.F.V, 32 ft. 2 in.). Length, 29 ft. 11 in. (later production 30 ft. 2½ in.). Height, 11 ft. 5 in. (propeller vertical). Wing Area (gross), 242 sq. ft. (L.F.V, 231 sq. ft.). Wing Section, NACA 2213 (root), 2208 (tip). Fuel capacity, 85 Imp. gal. internal, plus 30, 40 or 90 Imp. gal. external fuel tank.

Weights, empty/normal loaded (lbs.): VA, 4,960/6,237. VB, 5,065/6,630 (30 gal. tank). Vc, 5,100/6,785 (30 gal. tank). L.F.VB, 5,050/6,615 (30 gal. tank).

Note: The Vc had a maximum limit of 8,600 lbs. for gentle manoeuvres only.

Engine: Rolls-Royce Merlin 45, 50, 55 (1,470 h.p. at 9,250 ft.); 46, 50A, 56 (1,415 h.p. at 14,000 ft.); 45M, 50M, 55M (1,585 h.p. at 2,750 ft.).

Fitment: Mk. VA, Merlin 45; VB, Merlin 45 or 46 and a few retrofits of the 50, 50A, 55, or 56; Vc, Merlin 45, 46, 50, 50A, 55 or 56; L.F.V, Merlin 45M, 50M, or 55M.

Armament: VA, eight ·303 in. Browning machine guns with 350 r.p.g. VB, two 20 mm. cannon with 60 r.p.g. and four ·303 in. machine guns with 350 r.p.g. Vc, normally "B" type but with 120 r.p.g. for cannon. Some with four 20 mm. cannon. No known examples with "A" type armament. L.F.V, "B" type with 60 or 120 r.p.g. for cannon, depending upon original version when converted. Bombs: VB and Vc, two 250 lb. bombs, or one 500 lb. bomb.

Performance: Maximum speeds: VA, 376 m.p.h. at 19,500 ft. VB, 369 m.p.h. at 19,500 ft. Vc, 374 m.p.h. at 13,000 ft. L.F.VB, 357 m.p.h. at 6,000 ft. Maximum range, 470 miles (internal fuel); 1,135 miles (with 90 gal. external tank) (Mk. Vc). Maximum rate of climb, 4,750 f.p.m. at sea-level (L.F.VB). Service ceiling, 37,000 ft. (Mk. Vc).

Note: All performance figures varied on most aircraft according to altitude, weight, aircraft age, pilot-handling, and in the case of range, the speed. Therefore only representative figures are given above.

Key to colour illustrations on facing page:

A.—Spitfire Vc flown by Wing Commander Clive R. Caldwell, Wi[illegible] Leader No. 1 Fighter Wing, Royal Australian Air Force (popularly know[illegible] as "the Churchill Wing"); Darwin, Australia, 1942-43. Serial *BS234.*

A1.—Wing Commander's pennant, under cockpit.

A2.—Wing.-Cdr. Caldwell flew four Spitfire V's from Darwin, two being maintained at "readiness" and two at "stand-by" at all times. The white fuselage band was applied to his aircraft for a brief period; the serials were *BS234, BS295, LJ394* and *LJ395.*

B.—Spitfire Vc flown by Wing Commander Caldwell as Wing Leader of No. 1 Fighter Wing at Darwin in 1943; one of the few Spitfires to be flown on operations in natural metal finish. Serial *BS295.*

C.—Spitfire VB of No. 303 "Kosciuszko" (Polish) Squadron, R.A.F.; United Kingdom, 1942. Note Polish insignia on cowling and squadron insignia under cockpit. Serial *AR335.*

C1.—No. 303 Sqn. R.A.F.; the insignia is that of the famous No. 111 "Kosciuszko" Sqn., Polish Air Force.

D.—Spitfire VB of No. 317 "Wilno" (Polish) Squadron, R.A.F.; U.K., 1943. Note non-standard fuselage roundel, and "Poland" lettered in white capitals under national insignia on cowling. Serial *W3790.*

D1.—No. 317 Sqn. R.A.F.; the insignia is that of No. 152 Sqn., Polish Air Force.

D2.—Poland, national insignia.

E.—Spitfire VB of No. 312 (Czecho-Slovak) Squadron, R.A.F.; U.K., 1944. Note Czech insignia under cockpit. Serial *EP660.*

E1.—Czechoslovakia, national insignia.

F.—Spitfire VB of No. 132 "City of Bombay" Squadron, R.A.F.; Normandy invasion, summer 1944. Serial *W3560.*

F1.—Turkey, national insignia; carried in four wing positions and in some cases two fuselage positions on Turkish Air Force Spitfire V's.

G.—Spitfire Vc specially lightened and modified to intercept high-flying Junkers Ju 86P-2 reconnaissance aircraft over Egypt in the spring of 1942. Notable points include four-blade Rotal airscrew, Abouquir filter, absence of radio mast, and armament of two ·50 calibre machine guns only; also note "Irene" painted in black script under cockpit. The aircraft was flown by Flying Officer G. W. H. Reynolds and based at Abouquir. Serial *BR114.*

G1.—Yugoslavia, national insignia; carried in four wing and two fuselage positions.

H.—Spitfire VB of No. 2 Squadron, South African Air Force, No. 7 S.A.A.F. Wing, No. 211 Group, Desert Air Force; N.A.T.A.F., Palermo, Sicily, August 1943. Serial obscured.

H1.—Adaptation of No. 7 S.A.A.F. Wing insignia.

I.—Spitfire VB of 5th Fighter Squadron, 52nd Fighter Group, U.S.A.A.F.; North Africa, winter 1942-43. Serial *ER120.*

J.—Spitfire VB of 20 Gruppo C.T., 51 Stormo C.T., Italian Co-Belligerent Air Force; Canne, Italy, October 1944.

J1.—51 Stormo C.T.

A1

A2

A

B

C1

C

D1

D2

D

E1

E

F1

F

G1

G

H1

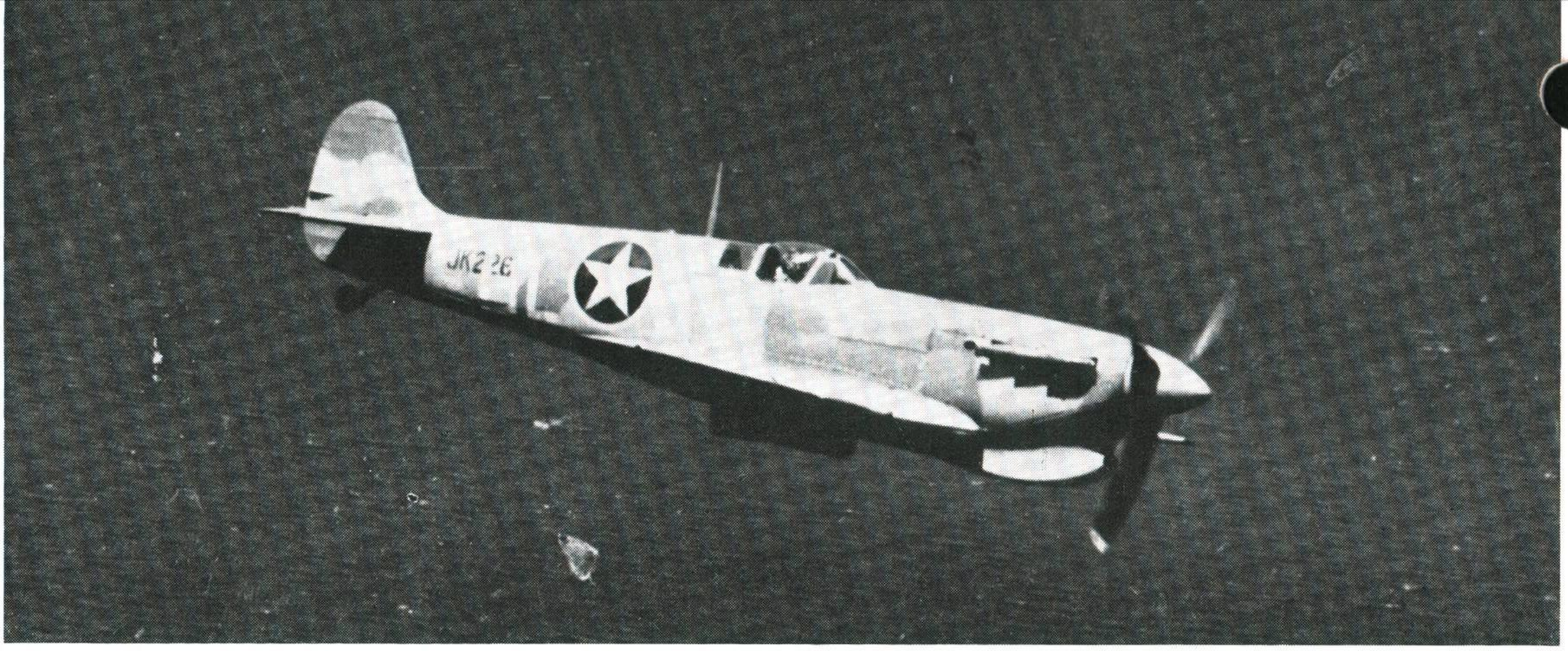
H

J1

I

J

©WARD



A tropical Mk. Vc, JK226 HL-AA of the 308th Fighter Sqn., 31st Fighter Group U.S.A.A.F. off the North West African coast.
(Photo: Imp. War Mus.)

disliked by most pilots who flew it. They referred to it as "clipped, cropped, and clapped," "cropped" referring to the supercharger blades of the "M" Merlins, and "clapped" to the age of the aircraft. It was also incorrectly designated the Mk. VD by some units. In an attempt to get maximum speeds, some squadrons (e.g., Nos. 316 and 611) polished their aircraft. They were used from the spring of 1943 mainly for ground strafing and low altitude escort for the U.S.A.A.F. medium bombers preparing for the Invasion of France, which was to come in June 1944. By that time only five fighter squadrons were using the Mk. V.

On D-Day, 6th June, two squadrons of Spitfire V's, Nos. 26 and 63, were part of the Air Spotting Pool, a composite R.A.F. and Royal Navy unit that provided gunfire direction for the warship bombardment of the French coast. Some of the Spitfires were flown by pilots of the U.S. Navy, since that service provided much of the bombardment.

By September no Mk. V's remained in front-line service but, by this time, the aircraft was in extensive use by second-line squadrons and Operational Training Units. A few Air Sea Rescue squadrons were partially equipped with the Mk. V during the latter half of 1944 and others were used for meteorological duties. Two squadrons, Nos. 595 and 667, continued to use some Mk. V's for anti-aircraft co-operation flights until after the war ended in May 1945.

One of the last experimental modifications was the conversion of a few Mk. VB's as pilotless "drone" aircraft for gunnery targets. The work was carried out in 1945 by M. L. Aviation Ltd., but none were actually flown in their pilotless rôle. Also in that year some seventy VB's were supplied to the French Air Force for training purposes.

In March 1948 the remaining Mk. V's in R.A.F. storage were scrapped, but a number of Portuguese Spitfires continued in use until the early 1950's.

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From October 1943 onwards, about fifty Mk. VB's were supplied to Portugal; some served into the early 1950's.
(Photo: Estado Maior de Forca Aérea)



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