ROYAL AIR FORCE YEARBOOK 1977

USA & CANADA $1.75

FIFTY PENCE



633 7/77
L 1.500
INTERCONTINENTAL
MILANO

ROYAL AIR FORCE YEARBOOK 1977

INTRODUCTION
by the Chief of the Air Staff, Air Chief Marshal Sir Neil Cameron GCB, CBE, DSO, DFC. ADC

AS YOU KNOW, this is Her Majesty The Queen's Silver Jubilee Year, the highlight for the Royal Air Force being the Royal Review of the Service at Finningley and the presentation to us by Her Majesty of Her new Colour. A great deal has happened to the Service during Her 25 years' reign and we now have an air force refined and reshaped to fit it for a European and NATO rôle. At the same time, cuts in the amount of money available for defence overall have forced further change upon us. Practising judicious housekeeping, we have fought hard and sacrificed much in order to retain our combat front line, especially over the difficult years since the Defence Review. In this we have been successful, so that today we have a Service which may not be large in numbers, but is of high quality. This quality has its roots in our aircraft and in the professional and dedicated people who fly and support them.

Turning our minds to the new equipment we shall have in the future, the introduction of the Tornado is the event we most eagerly anticipate and I believe it will join the Hurricane, Spitfire, Lancaster and Hunter as one of the great aircraft in the history of our Service. It will start to appear before the end of the decade. The air defence version will follow rather later and will be armed with a new missile — Skyflash. Because Tornado will be able to operate at night and in all weathers, it will greatly enhance the all-round air capability of Allied Command Europe. We are also extremely proud of our new training aircraft, the Hawk, deliveries of which have now begun.

Finally, the country must not forget that the threat posed by the Soviet Air Force is growing daily in both quality and quantity. In my view, proper appreciation of this calls for an air-minded nation competent to appreciate the value of air power in the part we shall continue to play alongside our allies in NATO in the maintenance of peace. We very much hope that you will support the Royal Air Force by joining us during the year at the various displays and open days throughout the country.



CONTENTS

THE RAF AND THE DEFENCE SITUATION TODAY Page 3
by Air Chief Marshal Sir Christopher Foxley-Norris

AIRCRAFT OF THE ROYAL AIR FORCE, 1977 Pages 4-16

MOSQUITOES HAD THE ANSWERS Page 19
by Maurice A Smith

THE YEAR OF THE HAWK Page 27
by Wg Cdr Ian CH Dick

RAF TRAINERS, 1918-1977 Pages 32-33

COMBAT OVER DIEPPE — VICTORY OR DEFEAT? Page 37
by W J A Wood

THE PART-TIMERS Page 45
by E A 'Chris' Wren

EVOLUTION OF RAF BOMBERS Page 51
by H F King

PRUNE IS ALIVE AND WELL . . . Page 65
by Bill Hooper

The views expressed in RAF Yearbook 1977 are those of the authors alone and should not be taken as an expression of official policy.

RAF YEARBOOK 1977

Edited by WILLIAM GREEN and GORDON SWANBOROUGH.

Artwork by JOHN WEAL, AVIAGRAPHICA, KEITH FRETWELL, W J A WOOD and DENNIS PUNNETT.

Cover artwork by WILF HARDY.

Designed and created by PILOT PRESS LTD, PO Box 16, Bromley, Kent, for the RAF Benevolent Fund.

Published by the ROYAL AIR FORCE BENEVOLENT FUND on behalf of that fund and the Royal Air Forces Association.

Distributed by DUCIMUS BOOKS LTD, De Worde House, 283 Lonsdale Road, London, SW13 9QW.

Printed by WM CAPLE & COMPANY LTD, Chevron Press, Leicester, England.

THE ROYAL AIR FORCE AND THE DEFENCE SITUATION TODAY



by Air Chief Marshal Sir Christopher Foxley-Norris, GCB, OBE, DSO, MA, RAF Rtd

THE statement of the further Defence cuts made in the mini-budget towards the end of 1976 was followed by yet another in a series of Defence White Papers, the theme of which has consisted largely of explanations of why such cuts are necessary and how they are to be implemented. This recent programme amounts to the fourth in the successive major reductions in defence budgets inflicted on the armed forces in 1976, in 1975, and, let us not forget, in 1974 before the present government came into power. Cinderella could not perhaps derive much comfort from the fact that both of her elder sisters were unpleasant to her; but it was nevertheless a fact, with variations to taste and dependent on family circumstances at the time.

The analogy of family circumstances is an appropriate one. When hard times descend upon us every item of family expenditure comes under scrutiny as a potential area for saving, whether it be food, clothing, heating, travel or insurance. The armed forces may be appropriately regarded as the nation's insurance against some of the various forms of external unpleasantness that threaten us. Whether insurance should bear a fair share of any cuts that have to be made can be logically argued either way. On the one hand it may be held that it is almost lunatic to fill your house with necessities, comforts and even luxuries; and then take no measures (or no adequate measures) to guard against loss or theft. On the other hand it is equally indefensible to spend so much on insurance that you finish up with a house that is admirably guarded but empty of some of the essentials of life — a position that seems to be facing Egypt at the time of writing. Perhaps the only common ground that is not in dispute is that, when heavy cuts do have to be made in the family budget, it would be both illogical and insupportable that an unfair proportion of them should fall on insurance expenditure.

One grain of comfort at least that can be derived from a closer study of these latest in the series of reductions proposed is that they are apparently designed only to be temporary. The wording refers to a short-term, *ad hoc* reduction amounting to one hundred million pounds in this year's defence budget and two hundred million pounds in the following year. These reductions, however unwelcome, should apparently be viewed in the context of the temporary restrictions involved in the terms of the International Monetary Fund loan; and not within the general programme of economies imposed by our overall financial depression. On this assumption, what we are now faced with is not a steepening angle of the seemingly inexorable, irreversible downward graph of resources made available to national defence; but rather a sharp dip from which we can hope to climb out to the previously planned plateau — however sloping even that may have been. Defence planners therefore may have an easier, albeit still highly unpalatable task in trying to cope with additional but temporary shortages rather than an added long-term problem; which is not to deny however that even such temporary measures must inevitably have repercussive and unwelcome effects on long-term programmes.

Depressing trend

That particular aspect apart, it would be hypocritical to pretend that the current downward trend of defence budgets is anything but depressing for anyone who has the interests of the country's security, and therefore of its security forces, at heart. In saying so I am not, and would not be justified in, discussing the political pros and cons of recent cuts, once they have been decided upon and published. It is however fully appropriate in the *RAF Yearbook* to analyse their effects; the best way to absorb them; and any ray of light or hope for the future that may emerge from such an analysis.

Let us be clear firstly about one fact. At the stage of progressively diminishing defensive capability we have now reached, any, repeat any further cuts must be to a greater or lesser extent damaging. To pretend or claim otherwise is to show oneself either dishonest or ill-informed, or perhaps both. A year ago, while still Chief of Defence Staff, Field Marshal Sir Michael Carver told — and indeed was allowed to tell — the British public that further reductions would cut



SEPECAT JAGUAR

Single-seat tactical strike fighter

Power Plant: Two 4,620 lb (2100 kg) dry and 7,140 lb (3240 kg) reheat Rolls-Royce Turboméca RT 172 Adour 102 turbofans.

Performance: Max speed (est), M=1·1 at 1,000 ft (305 m) or 820 mph (1320 km/h), M=1·6 at 32,810 ft (10000 m) or 1,057 mph (1700 km/h); cruise with max ordnance, M=0·65 at 39,370 ft (12000 m) or 430 mph (690 km/h).

Weights: Normal take-off, 23,000 lb (10430 kg); max take-off, 32,600 lb (14790 kg).

Dimensions: Span, 28 ft 6 in (8,69 m); length, 50 ft 11 in (15,52 m); height, 16 ft 0½ in (4,89 m); wing area, 260·3 sq ft (24,18 m²).

Armament: Two 30-mm Aden cannon and up to 10,000 lb (4536 kg) of ordnance on five external hardpoints.

Notes: The Anglo-French Jaguar equips Nos 14, 17 and 31 Squadrons (Bruggen) in RAF Germany, to be joined this year by No 20. At home, strike Jaguars equip Nos 6 and 54 Squadrons (Coltishall); No 2 Squadron (Laarbruch) and No 41 (Coltishall) fly Jaguars in the tactical strike/reconnaissance rôle. Training is by No 226 OCU (Lossiemouth).

(Above) A SEPECAT Jaguar GR Mk 1 of No 2 Squadron, from RAF Laarbruch, West Germany, carrying a reconnaissance pod on an air recce mission near the Dutch border. Jaguars of No 2 Squadron are also seen in the heading picture on page 3, together with Phantom FGR Mk 2s that have now been assigned to the interceptor rôle at RAF Wildenrath. (Below) A Harrier GR Mk 3 operating in RAF Germany, with laser-ranging and marked target-seeking equipment in the nose and RWR on the fin.



HAWKER SIDDELEY HARRIER

Single-seat V/STOL strike and reconnaissance fighter

Power Plant: (GR Mk 3) One 21,500 lb (9760 kg) st Rolls-Royce Bristol Pegasus 103 vectored-thrust turbofan.

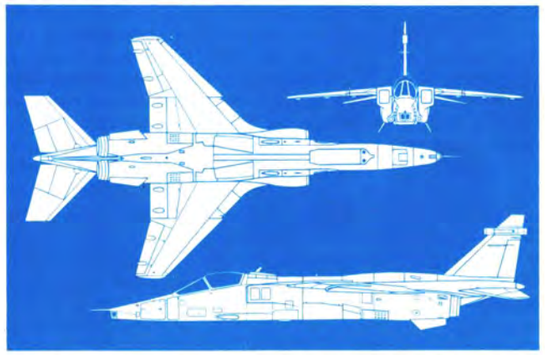
Performance: Max speed, M=0·95 at 1,000 ft (305 m) or 720 mph (1160 km/h), with typical external ordnance, M=0·85-0·87 or 640-660 mph (1030-1060 km/h); cruise, M=0·8 at 20,000 ft (6096 m) or 560 mph (900 km/h); tactical radius (hi-lo-hi) with two 100 Imp gal (455 l) drop tanks, 400 mls (644 km); max ferry range, 2,070 mls (3330 km).

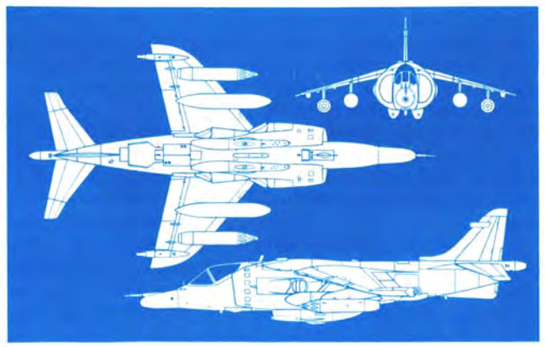
Weights: Max take-off (VTO), 18,000 lb (8165 kg), (STO), 23,000+ lb (10433+ kg).

Dimensions: Span, 25 ft 3 in (7,70 m); length, 45 ft 7¾ in (13,91 m); height, 11 ft 3 in (3,43 m); wing area, 201·1 sq ft (18,68 m²).

Armament: Provision for two 30-mm Aden cannon and up to 5,000 lb (2268 kg) of ordnance on five external hardpoints.

Notes: The Harrier serves with No 1 Squadron and 233 OCU (Wittering) at home and Nos 3, 4 and 20 Squadrons (Gutersloh) in RAF Germany, but No 20 will disband soon. A current mod programme introduces laser target marking equipment in the nose and RWR on the fin.





into the muscles and sinews of defence. In doing so he highlighted the fallacy of a cliché too often used and too often accepted (remarkably even by Winston Churchill in particular) that the military animal consists only of some teeth and a tail. It does not; nor has such an animal ever existed. Rather, like any similar creature, it has a head equipped with teeth; probably a tail (which is, incidentally, often a very necessary appendage) and certainly a spine and a system of muscles. The theory that the strength and effectiveness of the teeth, ie, the fighting units, remains unimpaired whatever cuts are made elsewhere on the body is wholly insupportable.

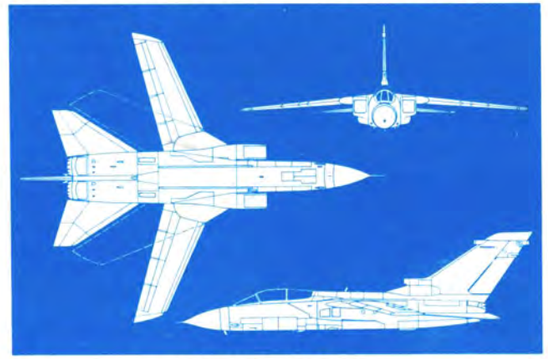
Those cuts can only be made, after perhaps a little initial paring of fat, in the spine and muscles on which the teeth depend for their operation. Surely no one can believe, or should be asked to believe, that cuts in logistics; in fuel; in general supplies; in spares; in training facilities; in mobility equipment; in communications; even in efficient organisational aids such as computers, can be anything but damaging to all or any of the Services. The damage may not be immediate in effect; it may not be clearly apparent to the casual eye (but remember that the eyes of our potential enemies are by no means casual; they will not be deceived, far less deterred by a full shop-window with an empty store room behind it); but sooner or later it will be, inevitably must be, harmful in the strictest sense.

The second claim that can no longer be sustained, although for a time it may have had some justification, is that cuts in the Royal Air Force or indeed any of our armed forces can be made without reducing our capability to perform our major military function, the continued contribution to and support of the deterrent and fighting strength of NATO. There was a time a few years ago when NATO could be spared the full repercussions and impact of cuts in our defence budgets by the simple process of applying them elsewhere, ie, outside the geographical area of NATO's direct interest. But all practicable reductions in our commitments and withdrawals from our far-flung bases in the Far East, the Indian Ocean, the Middle East, the oceans of the world and all our traditional areas of influence have by now been made. There is no more fat left for paring. Indeed, one may take leave to doubt if this is an appropriate description, for those who observed with equanimity, almost with glee, the dismemberment of our imperial span and its associated forces have been among the first to advocate the sending of British troops to help to resolve the Rhodesian impasse (what troops? and in what aircraft?); and the consequent halving of our air transport force seems to take little account of the continuing need to re-inforce BAOR and our other NATO allies in emergency.

Even conceding the need for and acceptability of this process, it is clearly apparent that there are today two fallacies involved in assuming that our defence forces can be reduced without impairing our contribution to NATO.

The first lies in the point already made, the myth that logistic cuts can be imposed and accepted without coincidental and consequent reductions in fighting capability. An obvious illustration lies in the damaging effect of any trimming of training programmes. Until now, one of the major advantages our armed forces have enjoyed has lain in the high quality of their professional performance, based in turn on a strict and intense programme of training. For example, it is known that our aircrew flew more monthly hours and on more realistic exercises than their opposite numbers in the Warsaw Pact. If reductions in fuel, spares or even the available aircrew themselves are to be inflicted, this margin of qualitative superiority will be drastically eroded, or indeed may disappear. Again, if we have to accept cuts in the air transport force and its operating potential, the essential flexibility to provide prompt mobility, both strategic and tactical, cannot but be affected.

The second fallacy lies in the fact that, when we talk of



PANAVIA TORNADO

Tandem two-seat multi-purpose fighter

Power Plant: Two 8,500 lb (3855 kg) dry and 15,000 lb (6800 kg) reheat Turbo-Union RB 199-34R Mk 101 turbofans.

Performance: Max speed, M=1·1 at sea level and 2·2 above 36,000 ft (10980 m); ceiling, over 50,000 ft (15250 m); radius of action, hi-lo-hi with external stores, up to 750 mls (1200 km).

Weights: Empty equipped, about 28,000 lb (12700 kg); max take-off, 55,000 lb (25000 kg).

Dimensions: Max span, 45 ft 8 in (13,90 m); min span, 28 ft 3 in (8,60 m); length, 54 ft 9½ in (16,70 m); height, 18 ft 8½ in (5,70 m); wing area, 323 sq ft (30,0 m²).

Armament: Two 27-mm Mauser cannon internally and various ordnance combinations on three fuselage and up to four wing pylons; total external load, 17,000 lb (7700 kg).

Notes: RAF plans to acquire 220 Tornado IDS (interdictor-strike) aircraft to replace Vulcans and Buccaneers, with initial deliveries to a tri-national OCU at Cottesmore in 1979. Starting 1983, 165 Tornado ADV (air defence version) will replace Phantoms.

(Below) Panavia Tornado prototype 02 (the first of the test aircraft to fly in Britain), carrying bombs during preliminary weapon-carrying trials. By early 1977, ten Tornado prototype and pre-series aircraft were in flight test status in the UK, Germany and Italy and production had begun to meet an entry-into-service target date of 1979.





McDONNELL DOUGLAS PHANTOM

Two-seat (FG Mk 1) interceptor and (FGR Mk 2) all-weather multi-purpose fighter

Power Plant: Two 12,250 lb (5556 kg) dry and 20,515 lb (9305 kg) reheat Rolls-Royce RB.168-25R Spey Mk 202 turbofans.

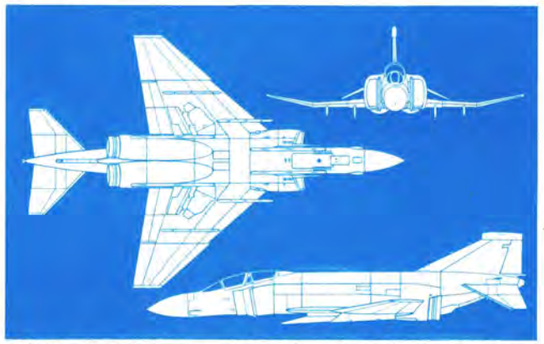
Performance: Max speed M=1·2 at 1,000 ft (305 m) or 910 mph (1464 km/h), M=2·1 at 40,000 ft (12190 m) or 1,386 mph (2230 km/h); tactical radius (hi-lo-hi) with six 1,000-lb (453,6-kg) bombs and two 308 Imp gal (1400 l) drop tanks, 550 mls (885 km); max ferry range, 2,500 mls (4023 km).

Weights: Normal take-off (est), 49,000 lb (22225 kg); max overload, 58,000 lb (26310 kg).

Dimensions: Span, 38 ft 4¾ in (11,70 m); length, 57 ft 11 in (17,65 m); height, 16 ft 3½ in (4,96 m); wing area, 530 sq ft (49,20 m²).

Armament: Max of approx 16,000 lb (7250 kg) of ordnance.

Notes: Phantom FGR Mk 2s serve in the air defence rôle in Nos 19 and 92 Squadrons (Wildenrath), RAF Germany, and provide the primary UK air defence force in Nos 29 (Coningsby), 111 (Leuchars) and 23 and 56 Squadrons (Wattisham). Ex-Naval Phantoms FG Mk 2s equip No 43 Squadron (Leuchars). Training is by 228 OCU (Coningsby).



(Above) A McDonnell Douglas Phantom FGR Mk 2 of No 111 Squadron, one of the UK-based Home Defence squadrons of Strike Command that has recently re-equipped from Lightnings to Phantoms. The fin-top fairing carries RWR.

NATO, we seem commonly to refer only to the Central Front. Admittedly this is where our own major land and air commitment now lies, comprising the British Army of the Rhine and Royal Air Force, Germany. But too many people forget that NATO also has flanks; that these flanks are vulnerable; and that our withdrawal or abnegation of support capability has already inevitably weakened the whole defensive posture and capability of NATO.

On the southern, Mediterranean flank two years ago we had operational squadrons based both in Malta and Cyprus (the latter of course were formally assigned to CENTO but they also unquestionably added to the potential effectiveness of NATO). In partnership with the Royal Navy, we were able to patrol and reconnoitre the Mediterranean Sea and the North African littoral, an area of growing Soviet influence and presence. In war, we would have had the ability to contribute to NATO's capacity in strategic bombing, in reconnaissance, in tactical transport, in anti-shipping and anti-submarine operations, and in air defence. Now we have either already abandoned our operational presence or have declared our imminent intention to do so, coincidentally with the Royal Navy also abrogating its traditional base and its fleet in being in the Mediterranean. Coming at a time when NATO's southern flank is already patently weakened by the political rift between Greece and Turkey, our action cannot be seen or represented as anything other than very harmful to NATO's actual and potential position in the whole area.

Again, the effective abandonment of our amphibious rôle and the drastic reductions in our air transport force have undeniably affected our ability to come to the aid of our NATO allies on the northern flank in time of crisis. The seriousness of this situation is accentuated by the national policy of those allies, Denmark and Norway, which prevents the stationing of foreign forces on their soil in peacetime. Their security under threat or actual attack therefore depends very heavily on the prompt and speedy arrival of outside re-inforcements, with an ability to operate in the amphibious rôle with appropriate air support. The effect of our national defence cut-backs in these respects is therefore just as damaging on NATO's northern flank as it is on its southern.

Finally, we cannot ignore or fudge the fact that one of our main responsibilities, assigned and accepted, to NATO is in helping to maintain the freedom of the seas, in particular against the ever-growing submarine menace. This activity is vital to the survival of both NATO and our own country in particular, in war as in peace. At a time when the Royal Navy's forces and capability in this rôle have been avowedly considerably weakened, the reduction by one quarter of the already minimal Nimrod force announced in the 1975 Defence White Paper must inevitably add notably to the problems facing NATO and ourselves, and to our difficulty in solving them.

So — there is no denying that our nation's armed forces have suffered sadly, at least quantitatively, as part of our national economic decline; that the RAF has sustained at least as heavy a share of the reductions as either of its sister Services; and that our ability to meet our commitments to both national and international security has consequently been impaired. A dark picture indeed. Where, if at all, can we find grounds for hope or optimism?

Firstly, we may derive some comfort from the fact that we have been this way before; that this is not the first time in living memory that our armed forces have been brought down to inadequate size and suffered severe limitations on equipment. Between 1919 and 1936, not so much under economic pressures but due to a mistaken belief that threats to our national security were neither major nor imminent, the RAF, together with the Navy and the Army, was deprived of both the men and the material required to maintain a realistic front-line. Manpower cuts effectively eliminated career and promotion prospects; World War I aircraft like the D.H.9a continued to equip squadrons ten years after that contest was over; and even when they were replaced, the improvement in the performance and capability of the replacements was often not easy to detect. Yet the Service survived; maintained its morale, enthusiasm and professional standards; and was available to form the basis and the cadre for the emergency expansion that in the nick of time preceded World War II.

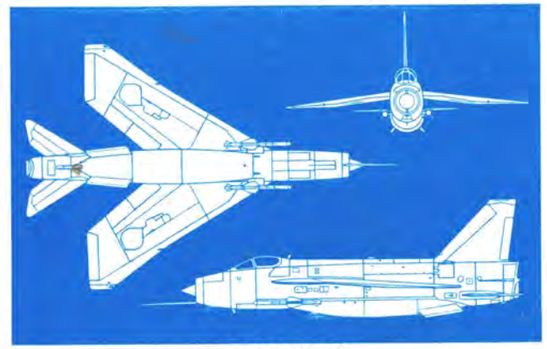
If we did it then, we can do it again. But unhappily it will be more difficult next time, for two simple reasons. It will take longer and will cost more. Between 1936 and 1939 it was possible to more than double the size of the RAF because its aircraft were easy and quick to produce, relatively simple and not very expensive; and the ground and aircrews to man them could be trained in a matter of months. Neither of these considerations applies today. A major re-equipment and expansion of the RAF in the late 1970s or 1980s would not only be enormously expensive but would also require a five to ten year time-scale; and again the men, particularly the aircrew, to operate such an expanded force would take not months but years to train, and themselves constitute a very expensive end-product. Would the time and money needed for such a programme ever be available in the event? It seems at least questionable.

We may deduce then that past history teaches us not to despair, but to carry on, to wait and to hope for a revival; but this time our masters will not be able to leave so late the decision to trigger that revival if it is to come in time.

Further grounds for at least some degree of optimism may be found in the fact that by far the greatest cause for the present unhappy lot of the armed forces derives from the nation's overall economic plight. Only a tiny minority of voters or parliamentarians believe that reductions in the defence budget, and therefore in our national security, are desirable in themselves and of themselves. A much larger number regard them as undesirable but unavoidable repercussions of our current financial straits — repercussions whose effect should be remedied when and if it becomes economically feasible. Thus, should the forecast upturn in our national economy finally and actually materialise, it may logically be expected that action will be taken to restore the defence cuts and to repair our security fences. Rightly or wrongly (almost certainly wrongly), the money available for defence is usually considered and discussed in terms of a percentage of the gross national product. Should that GNP expand and increase, then defence allocations should automatically become larger, even without a larger actual percentage being conceded.

Finally, some consolation at least can be derived from our current distress if all concerned — those who inflict defence cuts and those who suffer them — regard such cuts as contingency *ad hoc* measures aimed at our present expenditures rather than as long-term calculated policy decisions designed to vary and detract from our overall political/military concepts. The Air Force Board is treating 1977 as the year of air power. As long as the realities and the vital importance of air power as a component in our national security policy are recognised, and current economy measures are regarded as temporary and restorable, we need not worry excessively. Only if such measures were presented and

continued on page 10



BAC LIGHTNING

Single-seat interceptor fighter

Power Plant: Two 11,100 lb (5035 kg) st dry and 16,300 lb (7393 kg) st reheat R-R Avon 301 turbojets.

Performance: Max speed (est), M=2·27 or 1,500 mph (2415 km/h) at 40,000 ft (12190 m); max climb (at 38,500 lb/17464 kg) 50,000 ft/min (254 m/sec); time from brakes-release to M=0·9 at 40,000 ft (12190 m), 2·5 min.

Weights: Empty equipped (with gun pack and AAMs), 29,600 lb (13 426 kg); normal loaded, 38,500 lb (17464 kg); max overload (est), 45,000 lb (20412 kg).

Dimensions: Span, 34 ft 10 in (10,61 m); length (over probe), 55 ft 3 in (16,84 m); height, 19 ft 7 in (5,97 m); wing area, 474·5 sq ft (44,08 m²).

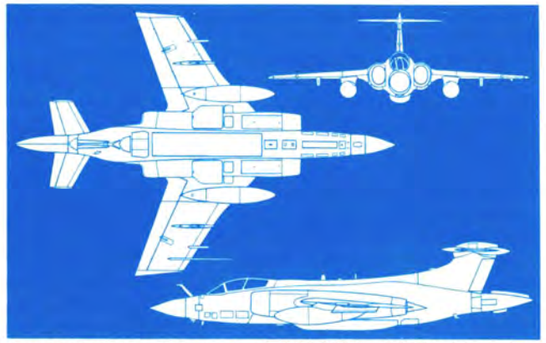
Armament: Two HSD Red Top IR-homing AAMs and (optional) ventral pack with two 30-mm Aden cannon.

Notes: For long the mainstay of UK home defence, the Lightning, in its F Mk 3 and F Mk 6 versions, is now retained only by Nos 5 and 11 Squadrons (Binbrook) and has been phased out of RAF Germany. The Lightning Training Flight is also at Binbrook.

Two squadrons continue to fly BAC Lightning F Mk 3As and F Mk 6s for home defence duties in the UK, and have recently adopted the camouflage finish shown (below) on a T Mk 5 continuation trainer of No 11 Squadron.







HAWKER SIDDELEY BUCCANEER

Two-seat strike and reconnaissance aircraft

Power Plant: Two 11,100 lb st (5035 kgp) Rolls-Royce RB.168-1A Spey Mk 101 turbofans.

Performance: Max speed (est), M=0·85 at 250 ft (75 m) or 645 mph (1040 km/h); M=0·92 at 30,000 ft (9145 m) or 620 mph (998 km/h); typical low-altitude cruise, M=0·75 at 3,000 ft (915 m) or 570 mph (917 km/h).

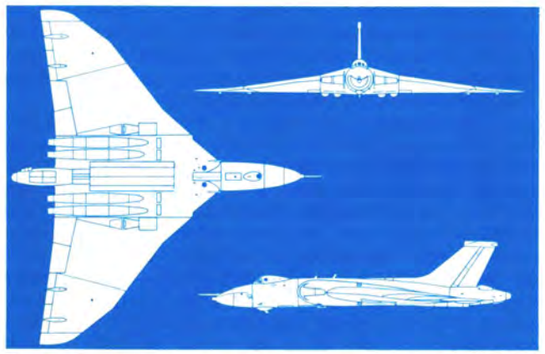
Weights: Max take-off, 59,000 lb (26 762 kg).

Dimensions: Span, 44 ft 0 in (13,41 m); length, 63 ft 5 in (19,33 m); height, 16 ft 3 in (4,95 m); wing area, 514·7 sq ft (47,82 m²).

Armament: Max ordnance load of 16,000 lb (7257 kg) including four 1,000-lb (453,5-kg) bombs internally. Three Martel ASMs may be carried on wing pylons.

Notes: RAF versions of the Buccaneer are the S Mk 2A and S Mk 2B, the former lacking Martel ASM capability. Royal Navy uses S Mk 2C and S Mk 2D versions. Buccaneers equip Nos 12 (Mk 2B) and 208 (Mk 2A) Squadrons (Honington) in Strike Command and Nos 15 and 16 Squadrons (Laarbruch) in RAF Germany. Training is by No 237 OCU.





HAWKER SIDDELEY VULCAN

Long-range tactical medium bomber

Power Plant: Four 20,000 lb (9072 kg) st Rolls-Royce Bristol Olympus 301 turbojets.

Performance: Max speed (est), M=0·98 at 40,000 ft (12192 m) or 645 mph (1038 km/h); max cruise, M=0·95 at 55,000 ft (16,750 m) or 627 mph (1010 km/h); high-altitude tactical radius, 2,300 mls (3700 km), with low-level attack, 1,725 mls (2780 km); service ceiling, 65,000 ft (19812 m).

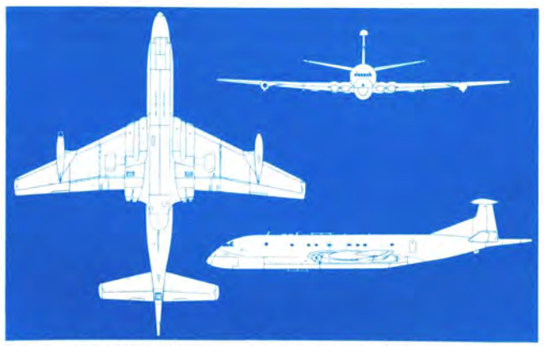
Weights: Max take-off, 180,000+ lb (81 646+ kg).

Dimensions: Span, 111 ft 0 in (33,83 m); length, 99 ft 11 in (30,45 m); height, 27 ft 2 in (8,28 m); wing area, 3,964 sq ft (368,3 m²).

Armament: Internal weapons bay can accommodate 21 1,000-lb (453,5-kg) HE bombs or similar loads.

Notes: Six squadrons using Vulcan B Mk 2s in nuclear and conventional bombing rôle are Nos 9, 44, 55 and 101 (Waddington) and 35 and 617 (Scampton). Also at Scampton are No 27 Squadron with Vulcans in the long-range strategic reconnaissance rôle and No 230 OCU.





HAWKER SIDDELEY NIMROD

Long-range maritime patrol aircraft

Power Plant: Four 12,160 lb (5515 kg) st Rolls-Royce RB.168-20 Spey Mk 250 turbofans.

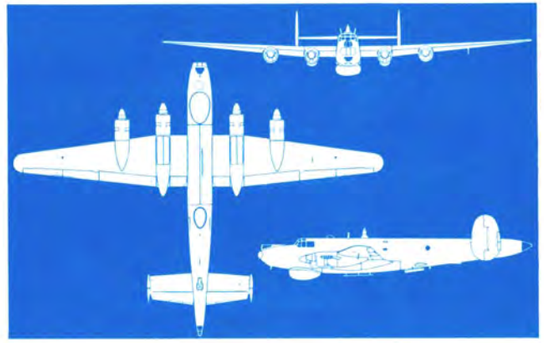
Performance: Max speed, 575 mph (926 km/h); max transit speed, 547 mph (880 km/h); econ transit speed, 490 mph (787 km/h); typical ferry range, 5,180-5,755 mls (8340-9265 km).

Weights: Max take-off, 177,500 lb (80510 kg); max overload, 192,000 lb (87090 kg).

Dimensions: Span, 114 ft 10 in (35,00 m); length, 126 ft 9 in (38,63 m); height, 29 ft 8½ in (9,01 m); wing area, 2,121 sq ft (197,05 m²).

Armament: Ventral weapons bay accommodating homing torpedoes, mines, depth charges, etc, plus four ASMs under wings.

Notes: Nimrod MR Mk 1 is RAF's principal maritime patrol aircraft, operated by Nos 120, 201 and 206 Squadrons (Kinloss), No 203 Squadron (Luqa) and No 42 Squadron and No 236 OCU (St Mawgan). Eleven of 46 Mk 1s to be converted to AEW rôle, others to be updated to improved MR Mk 2 standard. Three Nimrod R Mk 1 serve with No 51 Squadron (Wyton) in electronics recce rôle.





AVRO (HAWKER SIDDELEY) SHACKLETON

Airborne early warning

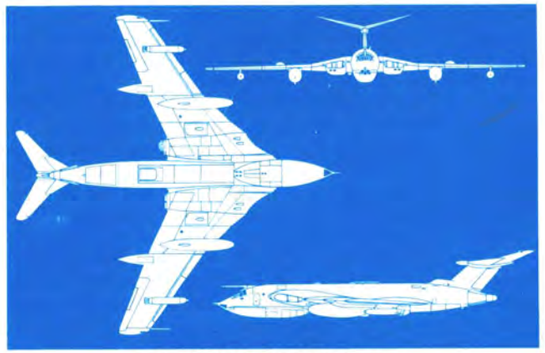
Power Plant: Four 2,450 hp Rolls-Royce Griffon 57A piston engines.

Performance: Max speed (est), 260 mph (418 km/h) at 10,000 ft (3048 m); patrol speed, 200 mph (322 km/h) at 10,000 ft (3048 m); initial climb, 900 ft/min (4,5 m/sec); patrol endurance, up to 10 hrs.

Weights: Empty equipped, 56,500 lb (25628 kg); normal loaded, 98,000 lb (44452 kg).

Dimensions: Span, 120 ft (36,58 m); length, 92 ft 6 in (28,19 m); height, 16 ft 9 in (5,11 m); wing area, 1,421 sq ft (132 m²).

Notes: Pending the introduction of new AEW aircraft as part of a unified NATO force, the RAF continues to operate one squadron (No 8, Lossiemouth) of these elderly aircraft, 12 of which were converted from original MR Mk 2C maritime reconnaissance versions by Hawker Siddeley at Baginton. They are the only piston-engined aircraft now in front-line service with the RAF.





HANDLEY PAGE VICTOR

Flight refuelling tanker

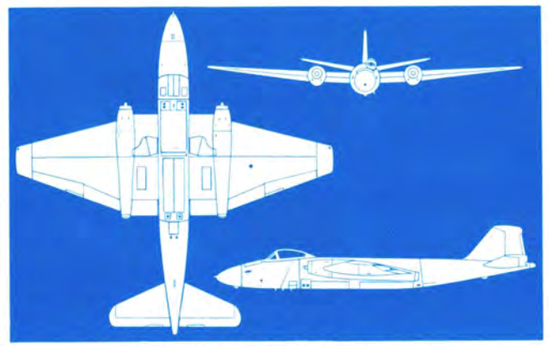
Power Plant: Four 20,600 lb (9345 kg) st Rolls-Royce Conway 201 (R.Co 17) turbojets.

Performance: Max speed over 600 mph (966 km/h) above 40,000 ft (12192 m); service ceiling over 50,000 ft (15250 m): unrefuelled range, 4,600 mls (7400 km).

Weights: Max take-off, 223,000 lb (101150 kg).

Dimensions: Span, 117 ft 0 in (35,69 m); length, 114 ft 11 in (35,02 m); height 28 ft 1½ in (8,58 m); wing area, 2,200 sq ft (204,38 m²).

Notes: All Victor bomber and reconnaissance versions have been phased out and the K Mk 1/1A flight refuelling tankers have been replaced by K Mk 2 conversions of B and SR Mk 2s, a total of 24 of which has been made by Hawker Siddeley at Woodford. Total fuel capacity is 127,000 lb (57650 kg). Victor tankers are operated by Nos 55 and 57 Squadrons (Marham) to refuel aircraft of Strike Command. Training is by No 232 OCU.





ENGLISH ELECTRIC CANBERRA

Photo-reconnaissance, training and support

Power Plant: (T Mk 17) Two 7,400 lb (3357 kg) st Rolls-Royce Avon 109 or (PR Mk 9) 10,050 lb (4560 kg) st Avon 206.

Performance: Typical max speed, 518 mph (834 km/h) at sea level and 580 mph (933 km/h) at 20,000 ft (6096 m); typical cruise, 402 mph (647 km/h) at 20,000 ft (6096 m); initial climb, 3,400 ft/min (17,2 m/sec); range up to 2,000 mls (3218 km).

Weights: Normal take-off, approx 52,000 lb (23586 kg); max take-off, 56,250 lb (25515 kg).

Dimensions: Span, 63 ft 11½ in (19,50 m); span (PR Mk 9) 67 ft 10 in (20,67 m); length, 65 ft 6 in (19,96 m); length, (PR Mk 9) 66 ft 8 in (20,32 m); height, 15 ft 8 in (4,77 m); wing area, 960 sq ft (89,19 m²); wing area (PR Mk 9) 1,045 sq ft (97,08 m²).

Notes: PR Mk 9 and PR Mk 7 reconnaissance versions are used by No 39 Squadron (Wyton) and PR Mk 7 by No 13 (Luqa); T Mk 17 ECM trainers used by No 360 (Wyton); TT Mk 18 and T Mk 19 targets used by No 7 (St Mawgan) and B Mk 2, E Mk 15 and T Mk 19 by No 100 (Marham); B Mk 6 used by No 51 (Wyton). Training is by No 231 OCU (Marham) on B Mk 2 and T Mk 4.



BAC VC10

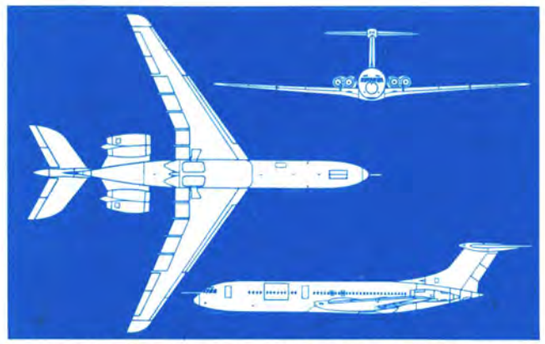
Long-range personnel and freight transport

Power Plant: Four 21,800 lb (9888 kg) st Rolls-Royce Conway R.Co 43 (Mk 250) turbojets.

Performance: High speed cruise, 581 mph (935 km/h) at 31,000 ft (9450 m); long range cruise, 550 mph (886 km/h) at 38,000 ft (11 600 m); range with max payload, 4,720 mls (7600 km); range with max fuel, 7,127 mls (11 470 km).

Weights: Operating weight empty, 150,000 lb (68 040 kg); max take-off, 323,000 lb (146 510 kg).

Dimensions: Span, 146 ft 2 in (44,55 m); length, 158 ft 8 in (48,36 m); height, 39 ft 6 in (12,04 m); wing area, 2,851 sq ft (264,9 m²).



Accommodation: 125 passengers for scheduled flights, or up to 150 troops or max of 78 stretchers or nine stretchers and 61 seated casualties, or assorted freight loads up to a maximum of 54,000 lb (24494 kg).

Notes: The VC10, with its side loading freight door and in-flight refuelling facility, remains the principal strategic transport in Strike Command's No 38 Group, but the strength of No 10 Squadron (Brize Norton) has been reduced to 11 aircraft.

SITUATION TODAY ——— continued from page 7

accepted in any influential quarter as a diminution of the principles of air power and of its application would there be real cause for concern — indeed, for alarm.

Apparently we must cut our coat according to the cloth allowed us, for the time being. During that period we must attempt as far as possible to replace quantity with quality. We must try to maintain the essential operational elements of air power. We must retain the ability to reconnoitre by every available means so as to acquire the vital intelligence whose possession is half the battle; we must ensure, for example through electronic counter measures, the ability to penetrate hostile defences as nearly unscathed as possible, and to prevent the enemy sharing the same penetrative ability against our own defences; we must command and control what forces we are allowed with the utmost efficiency, so as to derive the greatest and promptest utilisation from them; we must assess and allot our priorities so that only matters essential to our survival are granted resources; we must ensure that our weapons are designed exclusively for the purposes indicated in our national and international strategy and in our projections of probable forms of warfare; and that these weapons can be despatched with the high terminal accuracy which is probably the most critical measure of economy and cost-effectiveness in the whole spectrum of military activity. In short, we must get the best out of every man and every machine, however few.

And we must keep our chins up. We have been mucked about before, and by experts, but we have not gone under; and the capacity to survive and to succeed still depends largely upon ourselves; on our morale; our professional dedication; and our sense of humour. This last has so often been a saving grace for the British in times of adversity, from Ancient Pistol in Shakespeare to Old Bill in World War I and on to Pilot Officer Prune in World War II. And even now a place is being found for humour, and a joke is not far to seek. Admittedly the current joke is not a new one, indeed is an old chestnut that has often been trotted around the course; but it remains genuinely ridiculous and will bring a smile to the most tightly gritted teeth and to the stiffest of upper lips.

I refer, of course, to recent suggestions that the Royal Air Force be absorbed into the Navy and the Army. Anything for a laugh, some people — perhaps we should be grateful to them for at least that!□



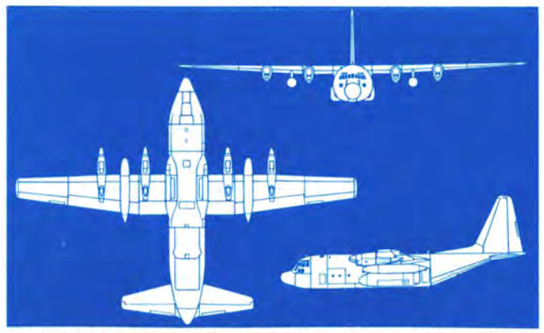
LOCKHEED HERCULES

Medium-to-long-range transport

Power Plant: Four 4,050 eshp Allison T56-A-7A turboprops.

Performance: Max speed, 384 mph (618 km/h); max cruise, 375 mph (603 km/h); econ cruise, 340 mph (547 km/h); max payload range (5% reserves and 30 min at s/l), 2,450 mls (3943 km); max fuel range (same reserves), 4,770 mls (7675 km).

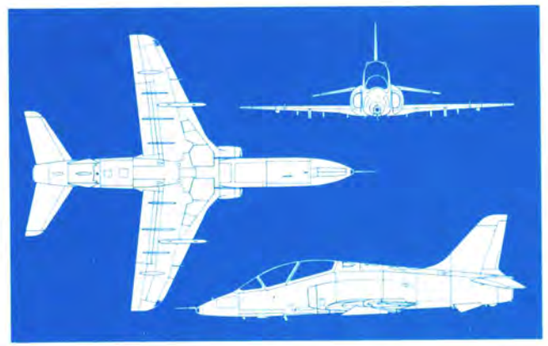
Weights: Empty equipped, 72,367 lb (32825 kg); normal take-off, 155,000 lb (70310 kg); overload, 175,000 lb (79380 kg).



Dimensions: Span, 132 ft 7 in (40,41 m); length, 97 ft 9 in (29,78 m); height, 38 ft 3 in (11,66 m); wing area, 1,745 sq ft (162,12 m²).

Accommodation: Flight crew of four and max of 92 fully-equipped troops, 64 paratroops or 74 casualty stretchers and two medical attendants.

Notes: RAF acquired 66 Hercules C Mk 1s for tactical duties and 48 of these are maintained in four squadrons — Nos 24, 30, 47 and 70 (Lyneham) — plus No 242 OCU at the same base. A single example was converted to W Mk 2 for weather reconnaissance by Met Research Flight (Farnborough).



HAWKER SIDDELEY HAWK

Tandem two-seat multi-purpose trainer

Power Plant: One 5,340 lb (2422 kg) Rolls-Royce Turboméca RT. 172-06-11 Adour 151 turbofan.

Performance: Max speed, 647 mph (1041 km/h), max Mach No., 1·16; time to 30,000 ft (9145 m), 6 min 20 sec; service ceiling, 48,000 ft (14 630 m); endurance (clean), 2 hr; ferry range with drop tanks, 1,957 mls (3150 km).

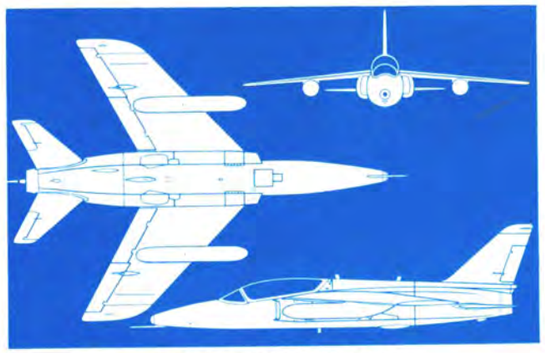


Weights: Normal loaded (advanced trainer), 11,100 lb (5035 kg), (weapons trainer), 12,000 lb (5443 kg).

Dimensions: Span, 30 ft 10 in (9,40 m); length (over probe), 39 ft 2½ in (11,96 m); height, 13 ft 5 in (4,10 m); wing area, 180 sq ft (16,70 m²).

Armament: One fuselage centreline and two wing hard points for ordnance for weapons training rôle.

Notes: Production of 175 Hawk T Mk 1s is underway for RAF, to replace the Gnat and Hunter, and eventually the Jet Provost. First Hawks delivered to No 4 FTS (Valley) end-1976 and others will go to the Tactical Weapons Unit, Brawdy, to replace Hunters.



HAWKER SIDDELEY GNAT

Advanced trainer

Power Plant: One 4,230 lb (1920 kg) st Bristol Siddeley Orpheus 101 turbojet.

Performance: Max speed, 636 mph (1026 km/h) at 31,000 ft (9450 m); initial climb, 9,850 ft/min (50,0 m/sec); service ceiling, 48,000 ft (14600 m); range with drop tanks, 1,180 mls (1900 km).

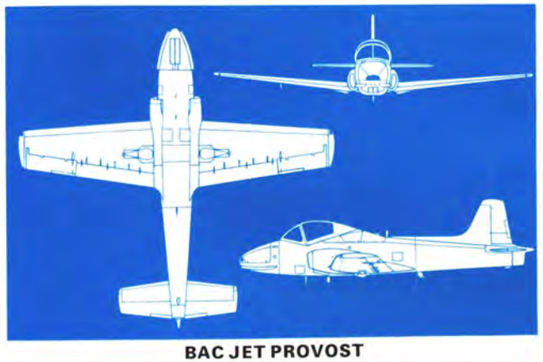


Weights: Basic weight, 5,613 lb (2546 kg); normal loaded, 8,250 lb (3742 kg); max take-off, 9,350 lb (4240 kg).

Dimensions: Span, 24 ft 0 in (7,32 m); length, 31 ft 9 in (9,65 m); height, 10 ft 6 in (3,2 m); wing area, 175 sq ft (16,26 m²).

Accommodation: Pilot and instructor in tandem.

Notes: Replacement of the Gnat T Mk 1, as the RAF's standard advanced trainer, by the HS Hawk has begun but Gnats — 105 of which were originally acquired by the RAF — will continue in service for some time to come, principally at No 4 FTS (Valley) and CFS (Valley). The Gnat is also the mount for the Red Arrows (Kemble) aerobatic team and is expected to remain so until 1980.



BAC JET PROVOST

Basic trainer

Power Plant: (T Mk 3A) One 1,750 lb (794 kg) st Rolls-Royce Viper 102 or (T Mk 5A) 2,500 lb (1134 kg) st Viper 201 turbojet.

Performance: (T Mk 5A) Max speed 440 mph (708 km/h) at 25,000 ft (7620 m); initial climb 3,550 ft/min (18 m/sec); service ceiling 34,500 ft (10500 m); max range with tip tanks, 900 mls (1450 km) at 35,000 ft (10670 m).



Weights: Normal take-off, full internal fuel, 7,629 lb (3460 kg); max take-off, full fuel and tip tanks, 8,524 lb (3866 kg); max overload, 9,200 lb (4173 kg).

Dimensions: Span, 35 ft 4 in (10,77 m); span (over tip tanks) 36 ft 11 in (11,25 m); length, 33 ft 8½ in (10,27 m); height, 10 ft 2 in (3,10 m); wing area, 213,7 sq ft (19,80 m²).

Notes: T Mk 5 is distinguished from T Mk 3 by having pressurised cockpit. Conversion programme on 177 aircraft to introduce new radio and navigation equipment and revised instrument panel layouts completed by BAC at Warton in 1976. Now in service with RAF College, CFS, No 1 FTS (Linton-on-Ouse), No 3 FTS (Leeming), No 6 FTS (Finningley), CATCS (Shawbury) and TWU (Brawdy).

Ferranti. On target since 1943.

Ferranti have been associated with the RAF especially since the action-packed days of World War II when our Edinburgh factory was set up to manufacture gyro gunsights for a variety of contemporary aircraft from the Lancaster to the Typhoon.

The ISIS weapon aiming system we are currently supplying for the Hawk is a recognisable descendant of these early sights.

But of course there are many other systems Ferranti are making for the RAF and allied air forces.

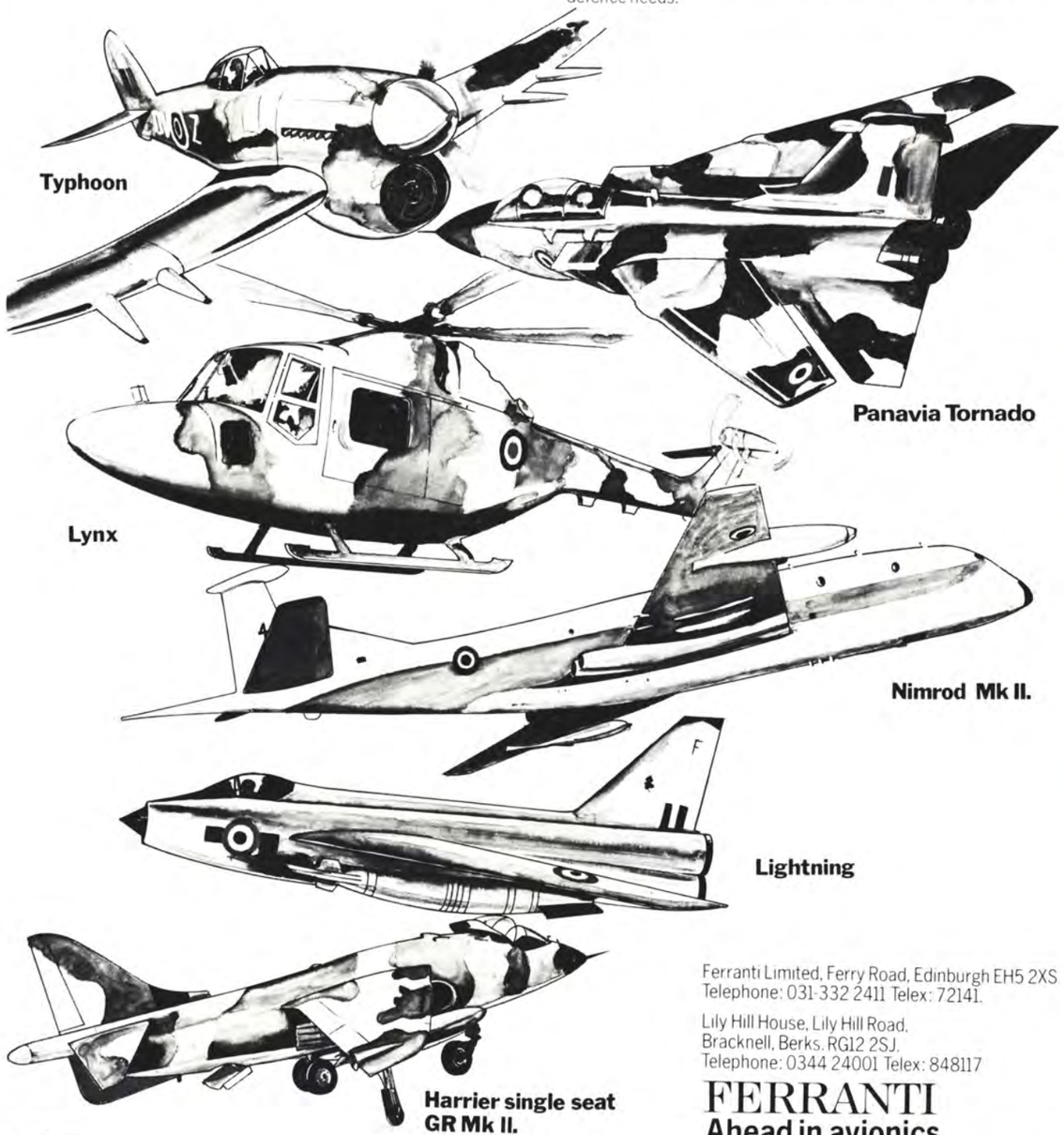
Our Inertial Navigation/Attack System (INAS) has proved a major success with Harrier and Phantom. A more advanced version still – our Digital Inertial Navigation System – has been chosen for Tornado and Nimrod Mk.II.

Our Laser Ranger and Marked Target Seeker is being installed in Harrier and Jaguar and a variant is on order for Tornado. Cockpit displays include a combined radar and moving map display chosen for Tornado, and the Universal Head Down Display (UNIHEDD).

For naval aircraft Ferranti are now supplying Seaspray search and tracking radar for the Lynx, and Blue Fox search and strike radar and the heading and attitude reference system for the Sea Harrier.

Ferranti gyroscopes, cockpit instruments and electrical power systems equipment are also found in most RAF aircraft, including Harrier, Jaguar, Hawk as well as Tornado.

Ferranti are constantly keeping their sights on changing defence needs.

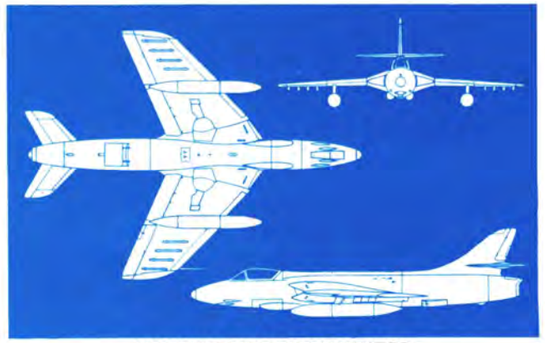


Ferranti Limited, Ferry Road, Edinburgh EH5 2XS
Telephone: 031-332 2411 Telex: 72141.

Lily Hill House, Lily Hill Road,
Bracknell, Berks. RG12 2SJ.
Telephone: 0344 24001 Telex: 848117

FERRANTI
Ahead in avionics

FG 614 rb

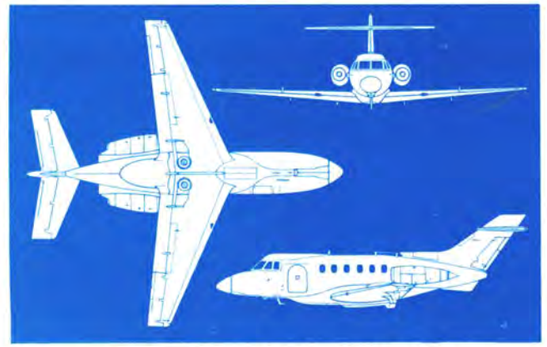


HAWKER SIDDELEY HUNTER
Advanced and continuation trainer

Power Plant: (FGA Mk 9) One 10,150 lb (4600 kg) st Rolls-Royce Avon 203 or 207 turbojet.
Performance: (FGA Mk 9) Max speed, 710 mph (1144 km/h) at sea level, 620 mph (978 km/h) at 36,000 ft (10,973 m); best range cruise, 460 mls (740 km/h); initial climb, about 8,000 ft/min (40,7 m/sec); service ceiling, approx 50,000 ft (15250 m); range (clean) 490 mls (789 km).



Weights: (FGA Mk 9) Empty, 13,270 lb (6020 kg); max take-off, 24,000 lb (10885 kg).
Dimensions: Span, 33 ft 8 in (10,26 m); length, 45 ft 10½ in (13,98 m), (T Mk 7) 48 ft 10½ in (14,90 m); height, 13 ft 2 in (4,26 m); wing area, 349 sq ft (32,43 m²).
Armament: Four 30 mm Aden cannon and four wing pylons.
Notes: The last two operational Hunter squadrons, Nos 45 and 58, disbanded in 1976. Single-seat F Mk 6As and FGA Mk 9s and two-seat T Mk 7s continue in service as trainers at 4 FTS (Valley) and the Tactical Weapons Unit (Brawdy), with Buccaneer Wing (Laarbruch) and IAM (Farnborough).

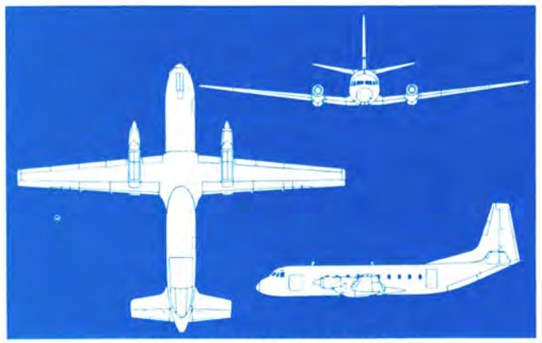


HAWKER SIDDELEY DOMINIE AND HS.125
Navigation trainer and communications aircraft

Power Plant: Two 3,000 lb (1360 kg) st Rolls-Royce Bristol Viper 301 turbojets.
Performance: Typical operating speed, 368 mph (593 km/h) at 35,000 ft (10680 m); initial climb, 4,000 ft/min (20,3 m/sec); service ceiling, 40,000 ft (12000 m).



Weights: Basic weight, 10,100 lb (4581 kg); max take-off, 21,200 lb (9615 kg).
Dimensions: Span, 47 ft 0 in (14,33 m); length, 47 ft 5 in (14,45 m); height, 16 ft 6 in (5,03 m); wing area, 353 sq ft (32,8 m²).
Accommodation: (Dominie) Two pilots and four seats in cabin; (HS.125) Two pilots and up to seven passengers.
Notes: The Dominie is used at No 6 FTS (Finningley) to train Navigators, AEO and Engineer aircrew and at the RAF College (Cranwell). Communications versions of the HS.125 executive jet are in service with No 32 Squadron (Northolt) in two forms — the CC Mk 1 (civil Series 400) and the CC Mk 2 (civil Series 600) — and lack the Dominie's ventral fuel tank.



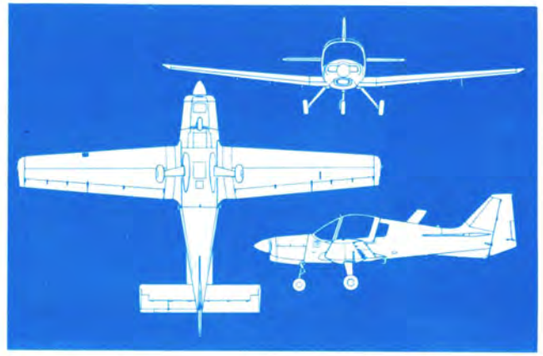
HAWKER SIDDELEY ANDOVER
Calibration and transport aircraft

Power Plant: Two 3,245 eshp Rolls-Royce Dart 301 turboprops.
Performance: Max cruise, 265 mph (426 km/h) at 15,000 ft (4570 m); initial climb, 1,180 ft/min (6 m/sec); max payload range, 282 mls (454 km); max fuel range, 1,158 mls (1865 km).
Weights: Basic operational, 28,650 lb (12996 kg); max take-off, 50,000 lb (22680 kg).



Dimensions: Span 98 ft 3 in (29,95 m); length, 78 ft 0 in (23,77 m); height, 30 ft 1 in (9,15 m); wing area, 831·4 sq ft (77,2 m²).
Notes: Thirty-one Andover C Mk 1s were delivered by 1968 as tactical transports, in which rôle the type was retired during January 1975 in line with defence economies. Six have been modified for radio and radar calibration duties, replacing Argosy E Mk 1s in No 115 Squadron (Brize Norton), and No 241 OCU (Brize Norton) provides crew conversion facilities. As communications/transports, Andover 1s are used by No 32 Squadron (Northolt), a few Andover C Mk 2 and CC Mk 2 versions of the HS 748 also being used in this rôle by Queen's Flight and No 32 Squadron.





SCOTTISH AVIATION BULLDOG

Side-by-side two-seat primary trainer

Power Plant: One 200 hp Lycoming IO-360-A1B6 four-cylinder horizontally-opposed engine.

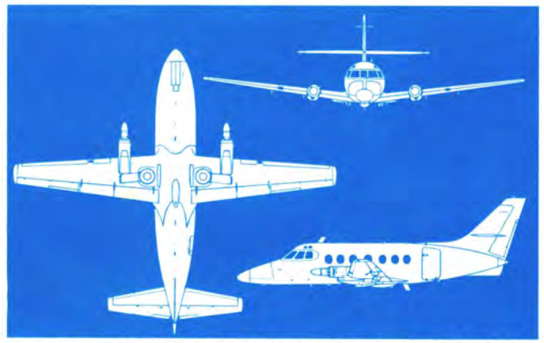
Performance: Max speed, 150 mph (240 km/h) at sea level; max cruise, 138 mph (222 km/h) at 4,000 ft (1 220 m); econ cruise, 121 mph (194 km/h), max range, 628 mls (1 010 km); initial climb, 1,100 ft/min (5,58 m/sec).

Weights: Empty, 1,420 lb (644 kg); max take-off, 2,350 lb (1 065 kg).

Dimensions: Span, 33 ft 0 in (10,06 m); length, 23 ft 2½ in (7,07 m); height, 7 ft 5¾ in (2,28 m); wing area, 129·4 sq ft (12,02 m²).

Notes: The Bulldog T Mk 1 serves as the RAF's primary trainer, a total of 132 having been acquired over the past few years. The type — derived from the original Beagle Pup civil lightplane — equips the RN Elementary Flying Training Squadron of No 3 FTS (Leeming), CFS (Leeming) and the 16 University Air Squadrons, having replaced the latter's de Havilland Chipmunks.





SCOTTISH AVIATION JETSTREAM

Multi-engined pilot trainer

Power Plant: Two 940 eshp Turboméca Astazou XVI.

Performance: Max speed, 285 mph (459 km/h) at 12,000 ft (3657 m); max cruise, 278 mph (448 km/h) at 12,000 ft (3657 m); max fuel range (5% reserves plus 45 min hold), 1,382 mls (2224 km); initial climb, 2,500 ft/min (12,7 m/sec); service ceiling, 26,000 ft (7928 m).

Weights: Typical empty equipped, 8,741 lb (3973 kg); max take-off, 12,550 lb (5692 kg).

Dimensions: Span, 52 ft 0 in (15,85 m); length, 47 ft 1½ in (14,37 m); height, 17 ft 5½ in (5,32 m); wing area, 270 sq ft (25,08 m²).

Accommodation: (T Mk 1) Two pilot seats with dual controls and four passenger seats.

Notes: The Jetstream T Mk 1 began to replace the Varsity in 1974 as a multi-engine pilot trainer but was almost immediately withdrawn as an economy measure. During 1977, eight Jetstreams returned to operational status at No 3 FTS (Leeming).





WESTLAND/AEROSPATIALE PUMA

Troop and assault transport helicopter

Power Plant: Two 1,320 shp Turboméca Turmo IIIC4.

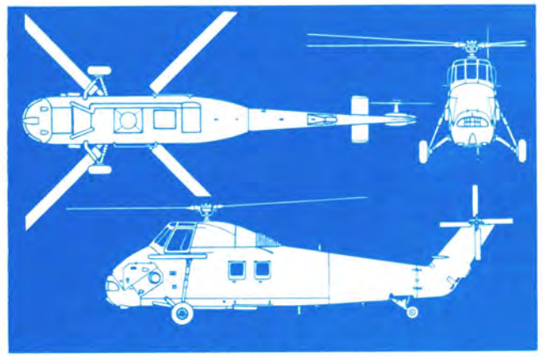
Performance: Max speed, 174 mph (280 km/h) at sea level; max cruise, 165 mph (265 km/h); initial climb, 1,400 ft/min (7,1 m/sec); max range, 390 mls (630 km).

Weights: Empty, 7,561 lb (3430 kg); max take-off, 14,110 lb (6400 kg).

Dimensions: Rotor diameter, 49 ft 2½ in (15,0 m); fuselage length, 46 ft 1½ in (14,06 m); height, 16 ft 10 in (5,14 m).

Accommodation: Crew of two plus up to 20 troops, or six stretchers plus four seated casualties.

Notes: Westland built 40 of this French-designed medium transport helicopter for the RAF at its Hayes works as the first step in the Anglo-French joint helicopter production programme that also embraces the Gazelle and the Lynx. It is operated by Nos 33 and 230 Squadrons (Odiham) as part of No 38 Group, with conversion training undertaken at the same base by No 240 OCU.





WESTLAND WESSEX

Troop transport and assault helicopter

Power Plant: Two 1,350 shp Bristol Siddeley Gnome 112 and 113 turboshafts.

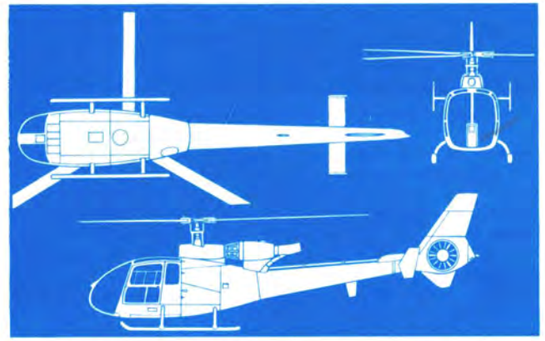
Performance: Max speed, 132 mph (213 km/h); max cruise, 126 mph (204 km/h); initial climb, 1,650 ft/min (8,37 m/sec); service ceiling, 12,000 ft (3658 m); range, 310 mls (500 km).

Weights: Empty, 8,100 lb (3674 kg); disposable load, 5,400 lb (2449 kg); max take-off, 13,500 lb (6123 kg).

Dimensions: Rotor diameter, 56 ft 0 in (17,07 m); fuselage length, 56 ft 7½ in (17,26 m); overall height, 16 ft 2 in (4,31 m).

Accommodation: Crew of two or three and up to 16 troops.

Notes: The Wessex is a UK production version of the Sikorsky S-58. Principal RAF version is the HC Mk 2 troop transport, which equips No 18 Squadron (Gutersloh) in RAF Germany and No 72 Squadron plus No 240 OCU (Odiham) at home and No 28 (Kai Tek) in Hong Kong. In the search and rescue rôle, No 22 Squadron has Wessex detachments at Manston, Leuchars and Valley. Two Wessex HCC Mk 4 are used by the Queen's Flight.





WESTLAND/AEROSPATIALE GAZELLE HT Mk 3

Helicopter pilot trainer

Power Plant: One 590 shp Turboméca Astazou IIIA turboshaft.

Performance: Max cruising speed, 164 mph (264 km/h); economical cruising speed, 144 mph (233 km/h); initial rate of climb, 1,770 ft/min (9,0 m/sec); service ceiling, 16,400 ft (5000 m); range with max fuel, 416 mls (670 km).

Weights: Empty, 1,946 lb (883 kg); max take-off, 3,750 lb (1 700 kg).

Dimensions: Rotor diameter, 34 ft 5½ in (10,50 m); fuselage length, 31 ft 3¼ in (9,53 m); overall height, 10 ft 2⅝ in (3,15 m).

Accommodation: Pilot and instructor side-by-side, optional provision for three passengers in rear of cabin.

Notes: Second in the trio of Anglo/French helicopters produced jointly by Westland and Aérospatiale, the SA 341 is of French design origin, assembly of the RAF, RN (Gazelle HT Mk 2) and British Army (AH Mk 1) versions being Westland's responsibility. Fourteen HT Mk 3s replace Bell 47 Sioux at No 2 FTS (Shawbury) for helicopter pilot training.

GLOSTER METEOR

In service as the RAF's first operational jet fighter in 1945, the Meteor remains on the active list 32 years later, two examples (one single-seat F Mk 8 and one two-seat T Mk 7) being based with the Tactical Weapons Unit at Brawdy for use as target-tugs.

Power Plant: Two 3,500 lb st (1 587 kgp) Rolls-Royce Derwent 8 turbojets.

Performance: Max speed, 598 mph (962 km/h); time to 30,000 ft (9 144 m), 6·5 min; service ceiling, 43,000 ft (13 106 m).

Weights: Empty, 10,684 lb (4 846 kg); max, 15,700 lb (7 121 kg).

Dimensions: Span, 37 ft 2 in (11,3 m); length, 44 ft 7 in (13,5 m); height, 13 ft 0 in (3,9 m); wing area, 350 sq ft (32,5 m²).



HANDLEY PAGE HASTINGS

Four of these venerable aircraft remain in RAF service, some 30 years after the type became operational. Originally transports, these now serve in a specialised crew training rôle at No 230 OCU (Scampton). Power is supplied by four 1,675 hp Bristol Hercules 106 piston engines.

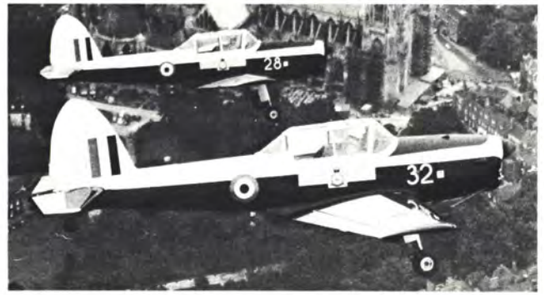
Power Plant: Four 1,675 hp Bristol Hercules 106 piston engines.

Performance: Max speed, 348 mph (560 km/h); range, 1,690 mls (2 720 km).

Weights: Empty, 48,472 lb (21 986 kg); max take-off, 80,000 lb (36 320 kg).

Dimensions: Span, 113 ft (34,46 m); length, 81 ft 8 in (24,9 m); height, 22 ft 6 in (6,86 m); wing area, 1,408 sq ft (130,8 m²).





DE HAVILLAND CHIPMUNK

For long the RAF's primary trainer, the Chipmunk has been replaced in that rôle, and in the University Air Squadrons, by the Scottish Aviation Bulldog. Powered by a 145 hp DH Gipsy Major 8 piston engine, it continues in service with the Air Experience Flights for the benefit of ATC and CCF units.

Power Plant: One 145 hp de Havilland Gipsy Major 8 piston engine.

Performance: Cruising speed, 119 mph (191 km/h); initial climb, 840 ft/min (4,3 m/sec); range, 280 mls (445 km).

Weights: Empty, 1,425 lb (647 kg); max take-off weight, 2,100 lb (953 kg).

Dimensions: Span, 34 ft 4 in (10,46 m); length, 25 ft 5 in (7,75 m); height, 7 ft 0 in (2,13 m); wing area, 172 sq ft (15,98 m²).

DE HAVILLAND DEVON

Military version of the Dove, the Devon continues to serve the RAF in the communications rôle, for which purpose it is used by No 207 Squadron (Northolt) with detachments at Wyton and Turnhouse. The Devon C Mk 2 is powered by two 380 hp Gipsy Queen 70 piston engines.

Power Plant: Two 380 hp de Havilland Gipsy Queen 70 piston engines.

Performance: Cruising speed, 179 mph (288 km/h); initial climb, 920 ft/min (4,67 m/sec); range, 660 mls (1 050 km).

Weights: Empty, 5,878 lb (2 667 kg); max take-off, 8,800 lb (3 992 kg).

Dimensions: Span, 57 ft 0 in (17,40 m); length, 39 ft 3 in (11,96 m); height, 13 ft 4 in (4,06 m); wing area, 335 sq ft (31,1 m²).





HUNTING PEMBROKE

Fourteen of these twin-engined communications aircraft remain, after a re-sparring programme by BAC some years ago. They serve only in RAF Germany, operating with No 60 Squadron (Wildenrath). Engines are two 550 hp Alvis Leonides 127 piston engines.

Power Plant: Two 550 hp Alvis Leonides 127 piston engines.

Performance: Cruising speed, 165 mph (266 km/h); range (no reserves), 1,160 mls (1 850 km).

Weights: Empty, 9,136 lb (4 150 kg); max take-off, 13,500 lb (6 125 kg).

Dimensions: Span, 64 ft 6 in (19,6 m); length, 48 ft 0 in (14,0 m); height, 16 ft 0 in (4,90 m); wing area, 400 sq ft (37,2 m²).

WESTLAND SEA KING HAR Mk 3

Fifteen of these Westland-built derivatives of the Sikorsky S-61 are on order for the RAF and will become the Service's largest helicopter when delivered from early 1978 onwards. They will be deployed in the search-and-rescue rôle at a number of sites around the UK, probably including Coltishall, Boulmer, Lossiemouth and Brawdy.

Power Plant: Two 1,660 shp Rolls-Royce Gnome H.1400-1 turboshaft engines.

Performance: Cruising speed, 129 mph (208 km/h); initial rate of climb, 2,020 ft/min (10,3 m/sec); engine-out service ceiling, 4,000 ft (1 220 m).

Weights: Empty equipped weight, 12,376 lb (5 613 kg); max take-off weight, 21,000 lb (9 525 kg).

Dimensions: Rotor diameter, 62 ft 0 in (18,90 m); length, 55 ft 9¾ in (17,01 m); height, 15 ft 11 in (4,85 m).





WESTLAND WHIRLWIND

These elderly helicopters are operated in the search-and-rescue rôle by No 202 Squadron with detachments of HAR Mk 10s at various sites around the UK. Some serve in the same rôle with No 84 Squadron in Cyprus and a few HC Mk 10s and one HCC Mk 12 are used for communications by No 32 Squadron (Northolt). HAR Mk 10s are used in the training rôle by No 2 FTS (Shawbury).

Power Plant: One 1,050 shp Rolls-Royce Bristol Gnome H 1000.

Performance: Cruising speed, 103 mph (167 km/h); initial climb, 1,220 ft/min (6,2 m/sec); range with 10 passengers, 108 mls (174 km); max ferry range, 515 mls (834 km).

Weights: Empty equipped, 4,760 lb (2 159 kg); max take-off, 8,000 lb (3 630 kg).

Dimensions: Rotor diameter, 53 ft 0 in (16,15 m); length, 44 ft 2 in (13,46 m); height, 15 ft 7½ in (4,76 m).

TORNADO

The most comprehensive airborne weapon system yet devised for defence

The massive initial production commitment for 809 Tornado multi-role combat aircraft provides an economic base which ensures that, for a decade and more ahead, Tornado will be both the most comprehensive and the most cost-effective solution to national defence needs.

- all-weather, day-and-night operation
- against land, sea and air targets
- multi-mission capability
- long range and endurance
- comprehensive weapon options
- high accuracy of weapon delivery
- automatic terrain-following
- fully autonomous navigation system
- minimised airfield requirements
- 2-engine configuration, 2-crew operation

PANAVIA

Panavia Aircraft GmbH, München, Arabellastrasse 16, Germany

AERITALIA
BRITISH AIRCRAFT CORPORATION
MESSERSCHMITT-BOLKOW-BLOHM

PRODUCT OF EUROPE

PVA 25



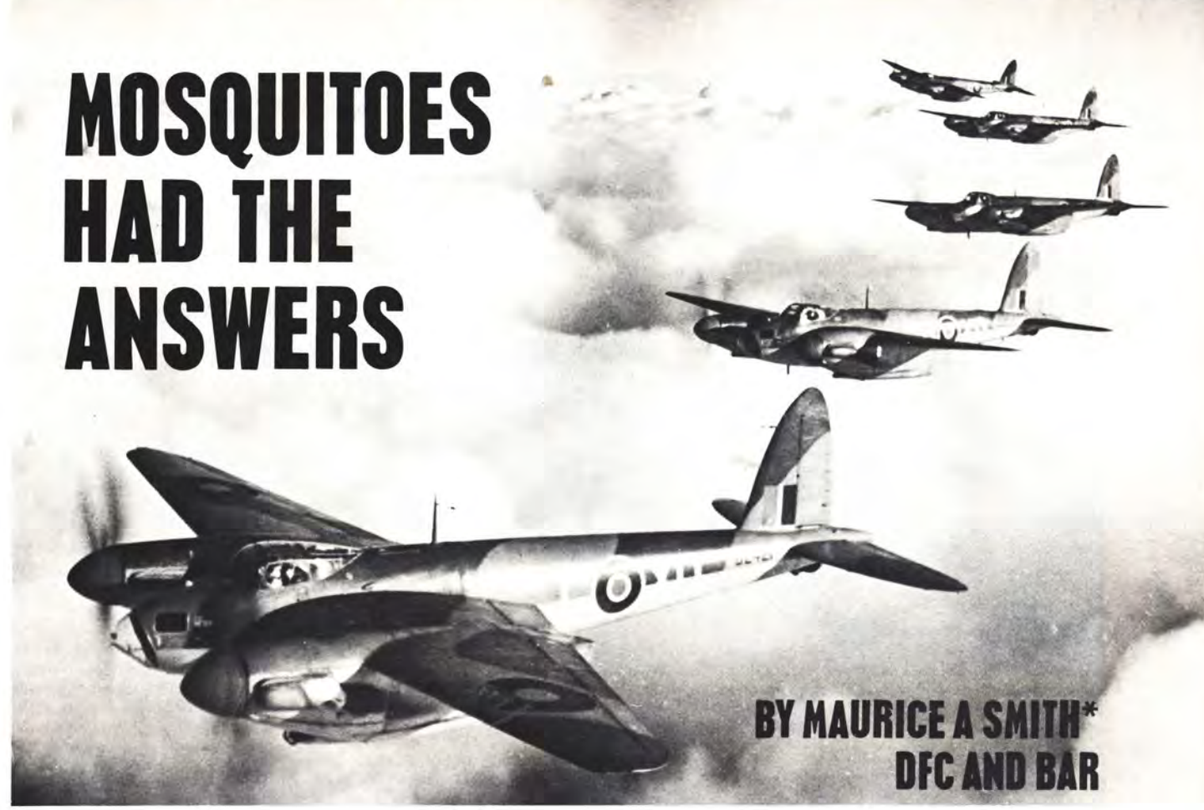
gives the RAF "a new order of capability"

For two years in succession, No. 14 (Jaguar) Squadron has won the annual RAF Germany Navigation and Bombing Competition, last year with a second Jaguar squadron – No. 17 – as runner-up. Jaguar's record in service is convincing proof that – in the words of Sir Denis Smallwood as Air Officer Commanding, RAF Strike Command – the Anglo-French aircraft "brings a new order of capability to the Royal Air Force". And, with the re-equipment of No. II (AC) Squadron and No. 41 Squadrons with reconnaissance pods, that same order of improved capability is being extended into the realm of air photographic reconnaissance.

Designed and built by
S.E.P.E.C.A.T.

BRITISH AIRCRAFT CORPORATION
100 PALL MALL, LONDON S.W.1.
AVIONS MARCEL DASSAULT / BREGUET AVIATION
B.P.32 92 VAUCRESSON FRANCE

MOSQUITOES HAD THE ANSWERS



BY MAURICE A SMITH*
DFC AND BAR

One pilot's recollections of the Mosquito B Mk IV, XX and 25 in wartime

NAME almost any flying job in wartime and the Mosquito will have tackled it: so many memories of its exploits and so many pilots with a tale to tell. Few would disagree that the Mossie was an outstanding aircraft and a favourite with those who flew it. The reliability of its twin Merlins was also outstanding.

As an example of sustained action to help win the war, the "milk run" to Berlin must rate very highly and the pilots who flew that run deserve the highest praise. Almost every night for over two years, and almost regardless of weather and moon conditions, these small wooden aircraft (span 54 ft 2 in/16,52 m) hoisted an overload of high explosives, sometimes in slightly bulging bellies to take a 4,000-lb (1816 kg) cookie, from airfields in England's Eastern Counties and set off on the long, hostile flight to Berlin or other German cities. The crew of two men, remote and self-dependent, had no defences other than alertness and the agility of the aircraft. They were vulnerable to fighter attacks and often to predicted flak as well. Five hours of night flying in such circumstances, with no auto- or co-pilot to take over and give the captain a break, plus the need to hold a steady, exposed bombing run on arrival over "the big city", called for real determination and endurance. Some may say that even this was not as tough as special low level daylight raids like the epic Oslo Gestapo HQ attack made in September 1942. As one-off bursts of courage and destructive enterprise, these highly effective strikes were certainly further outstanding examples of Mosquito magic.

How accurate are the stories and memories of flying Mosquitoes in wartime? I can offer only one pilot's opinion and this might be summed up by saying that crews grew to love, trust and respect the Mossie although, by the time it was loaded and hung with all the extras, it was not always quite so perfect to fly as mellowed memory may suggest. To express another personal opinion, the early bomber versions with their "vee" windscreens and longer noses seemed preferable to their fighter and fighter bomber relations with flat screens — and they looked better, too. The much later PR types had performance and altitude advantages, with their 2-stage supercharging, but a brief brush with a Mk 34 suggested that they were heavier to control and could be embarrassingly nose-heavy on the ground. Maximum weight of this later version was 25,500 lb (11577 kg), compared with about 22,000 lb (9988 kg) for the original Mk IV bomber.

Those who want all the intimate details of Mosquito development, geneology and operational service should turn to the Martin Sharp and Michael Bowyer book *Mosquito* (Faber), and to the recently published history of 8 Group, *Pathfinder Force*, by Gordon Musgrove (Macdonald & Jane's). Even these meticulous tomes gloss over one very small facet of Mossie operations, however: namely, their employment for target marking in 5 Group and this happens to be the one of which I had some experience. The procedure of 5 Group when required to make night attacks on small, precision targets with a limited number of Lancasters, called for low-level marking by Mosquitoes, employing a dive bombing technique to give positive identification and as near pinpoint accuracy as possible — "using the rapier rather than the bludgeon", as someone later put it. In other respects, the flying requirements were fairly typical of night operations in Bomber Command.

Conversion

In 1944, I was taken off main force Lancasters of No 619 Squadron and soon afterwards sent to Warboys for a Mosquito conversion course. You might think that this would take a week or two, with ground school included. Not so. It is a measure of the confidence in Mossies and their good, predictable handling that I was returned to Coningsby next day, clutching a copy of *Pilot's Notes*, after one familiarisation flight as passenger in LR567 (a T Mk III) and two local solo flights in DK291, (a Mk IV) and LR527 (another Mk III). Total time was 3 hrs 55 mins. Five nights later, having been joined at 54 Base HQ Coningsby by my ex-Lancaster navigator, we set off on our first trial night operation in the rôle of reserve Controller. The target

**Wg Cdr Maurice Smith served in the RAF with No 5 Group, Bomber Command, latterly as Pathfinder Master Bomber, and is now Editorial Director of "Flight International" and "Aeroplane Monthly".*



"Almost every night for over two years, and almost regardless of weather and moon conditions, these . . . aircraft . . . set off on the long hostile flight to Berlin or other German cities." The normal load of the Mosquito B Mk IV (above) comprised four 500-lb (227-kg) bombs in the fuselage, taken to the aircraft in prepared bomb trains (below left).



was Bergen, where the Germans had use of the docks and where a variety of shipping had collected.

Among the reasons for introducing Mossies for this kind of Pathfinder work were their manoeuvrability and good visibility for low-level searching at night and, more particularly, because the Lancasters used previously had proved slow and vulnerable with the result that several very experienced and valuable crews had been lost. With 100-Imp gallon (455-l) drop tanks fitted, the Mossies had just sufficient range and endurance, carrying a maximum of 652 Imp gals (2 964 l) of fuel, to reach targets deep in Germany and remain in the target area for up to 15 minutes if need be. They could also carry the required variety of target indicators in their bomb bays.

Comfortable cockpit

It was while doing some flying instruction prior to joining Bomber Command that I learnt to appreciate the advantages of being in direct contact with a pupil, in side-by-side seating, as compared with tandem. In the Mosquito it was good to have my navigator sitting beside me and to feel the support of his physical presence. In fact, his seat was set a bit further back than mine and the staggered effect gave more elbow room. Once we were installed and sorted out, there was more space than one might think.

Cockpit size and comfort are relative and the effect of being without five of the six crew I had flown with for so many ops in Lancasters was traumatic (except that we didn't know the word then). To start with, my navigator Leonard Page was not very happy plotting on a board on his knees, and he had to become very skilled at balancing the loose items, avoiding my right elbow and rummaging in his nav-bag by feel. Anything dropped was probably lost. A hand torch backed up the dim cockpit lighting in case of difficulty.

Our rather bulky main navigational aid, Gee, was extremely important to us but when we started operating deeper into Germany we ran beyond its range. We tried, with limited success, another longer range radar device in the form of Loran in addition to Gee. The visual display was about the same size, and it was carried on a locally-designed swinging mounting on a central post. It kept the navigator busy so that he worried less when we ran out of other aids, and occasionally it gave us a valuable position line. With all this in front of the navigator's seat, it was well nigh impossible to crawl into the nose, and it was much more difficult to climb in or out of the door-hatch in the floor.

With glass panels in a bomber-Mossie's nose, searchlight beams could find a way through and be so dazzling that the pilot couldn't read his instruments. We therefore rigged up a canvas blind which could be untied if we ever needed to lie in the nose for visual bomb-aiming. An extra job for the navigator was to select the stores in the bomb bay according to requirements, eg, red or yellow target indicators or whatever else we carried at the four stations. We were discouraged from carrying 500 lb (227 kg) HE bombs to fill any spare spaces.

Today we would consider the cockpit arrangements rather crude, with a variety of panels dotted around more or less haphazardly. The instruments were not well lit and many of the levers were clumsy though readily recognisable by shape and colour. During periods of intense operational activity, pilots spent so much time in the cockpits of their aircraft that they became totally accustomed to them and it was a relief from the apprehension of the build-up periods for us to settle back on our parachute packs and get strapped in for action. We practised cockpit drills blindfold to be sure we could reach out accurately to every switch and lever without looking.

That first serious night flight to Bergen in a loaded Mossie, weighing about 20,500 lb (9307 kg) for take off, came as a mild shock. Gee was the only Navaid and there was no way to check our position visually between the English and Norwegian coasts, separated by 500 mls (805 km) of wintery North Sea. The night take-off was to be made at near to full load so appreciably more engine power was needed to taxi the Mossie from the tarmac and steer it round the perimeter track. One could almost feel the aircraft bearing the extra weight, with undercarriage legs compressed and tyres like doughnuts. Brakes were checked but barely needed because steering was mainly by differential use of the throttles. The aircraft had been fully checked and run-up during the afternoon but we still went through the drills again to confirm that all instruments were still indicating correctly — DR compass and controls set, pitot heat on, and fuel contents and tank selection double checked. Since we operated alone from 54 Base HQ at Coningsby — the two resident Lancaster PFF (Pathfinder Force) Squadrons, Nos 83 and 97, having left earlier — we were cleared to line up at once. To maintain radio silence, green or red signals from an Aldis lamp were used (preferably not beamed directly into the pilot's eyes). The enemy would not in fact have learnt much from the call of a single aircraft which might have been on a training flight, so we could have used VHF radio, checking all four channels on both the primary and reserve sets for transmission and reception, before leaving the tarmac.

Into the air

With brakes on, engines at fast idle around 1400 rpm and all ready to go, the radiator flaps were re-checked open, flaps down at 15 deg and pitch levers pressed against the full fine stops. Then we started to roll. Rolls-Royce Merlins are responsive and the throttles on Mosquitoes varied in feel. Some could be stiff and jerky but on this night KB122 "T", a B Mk 20 from Canada, was good and power could be brought in smoothly and quickly without worrying about swing so long as rudder and engine were used almost in anticipation to prevent it. If a swing were allowed to develop at all before about 50 kt (92 km/h) when the rudder became effective, it was harder to correct. The Mossie did not have to be heaved off like a Lancaster: it was ready to fly off at about 105 kt (194 km/h), with slightly nose heavy take-off trim setting to raise the tail. Changes in trim on the climb more or less cancelled out: Undercarriage up — nose up, then flaps up — nose down. Next, on easing back on power and pitch, rad flaps closed — nose down. By this time the aircraft had been settled in a steady climb at 155 kt (287 km/h), 2,850 rpm and +9 lb sq in boost and could be fine-trimmed to hold this.

At full take-off power, there was a good deal of noise from the engines pulling lustily at no more than arms length from the crew, with a great droning and, at night, fine mauve flames flecked with orange from unshrouded stub-pipes. Rolls-Royce still maintain that their "horses" pulled harder than those of other engine manufacturers!

From memory, it seems we always had to climb up through thick cloud. Although we often saw and heard ice, we never bothered much about the absence of de-icing equipment. The Mossie climbed fast, at least by Lancaster standards, and unless otherwise briefed we prepared to level off at 16,000-18,000 ft (4880-5490 m) on top of the weather. For the first 8,000 ft (2440 m) or so the throttles could be moved open as boost fell but once the gate was reached, there was no more to come without excessive rpm — except by going "through the gate" in an emergency, of course. The supercharger switch was flipped from MOD to AUTO and the second speed could then engage itself at once or when ready, according to the type of Merlin engine.

Fuel from a Mosquito's drop tanks was transferred to the outer wing tanks by air pressure from the outlet side of the port engine vacuum pump. This was initiated as early in a flight as possible because there was no cross-feed from the outer tanks or from the drop tanks, with a capacity of 50 or 100 Imp gal (227 or 454 l). We used to have occasional troubles with particular aircraft and tanks that transferred fuel only when they were in the right mood. Operation of the petrol cocks was another job for the navigator, who had the contents gauges on his side panel.

A pilot was concerned about rpm, boost, and fuel consumption, but did not think much in terms of cruising or maximum speeds; in much the same way, racing drivers today must watch rpm like a hawk but seldom know what speed they are doing. I therefore do not remember much about cruising air speeds; ground speeds were more interesting and sometimes the navigator would call out a figure — if it was encouragingly quick, thanks to a tail wind. The air speed indicator usually looked rather depressing down at around 180-210 kts (333-389 km/h) on what the newspapers called a "400 mph Bomber". Rule-of-thumb conversion said add 1 mph (1,6 km/h) per 1,000 ft (305 m) per 60 mph (97 km/h) to the indicated speed, so at 18,000 ft (5490 m), 180 kt (333 km/h) IAS could have been 234 (377) true. Since, on that first night, we flew more or less direct from Coningsby to Bergen, listened and watched for 12 minutes, then flew straight back to Peterhead, (which was our diversion field when fog closed our home base) in an airborne time of 3 hr 50 mins, we must have averaged at least 260 mph (418 km/h) overall.

The contrast between the Mosquito and the Lancaster in time taken for a given sortie was considerable, exaggerated by the need for the Main Force Bombers to zig-zag about much more to upset the defences and keep them guessing about the target as long as possible. We occasionally saw other aircraft on the way home but hardly ever when going out. Unless we were sure that they were friendly, we did some rapid height and direction changing — the equivalent of bomber evasive action — to throw off anyone who might be stalking us. Places like Flensburg would sometimes put up a sudden accurate burst of predicted heavy flak since we had no close company and no window protection. If we failed to see the ground



Mosquitoes flew regularly with their bomb-loads "sometimes in slightly bulging bellies to take a 4,000-lb (1 816-kg) cookie, from airfields in England's Eastern Counties". The deepened fuselage of a modified Mosquito B Mk IV is seen (below) and a 4,000-lb (1 816-kg) bomb is being loaded (above right).



flashes in advance and make a quick change of direction, this could be pretty frightening for a minute or two.

At 20,000 ft (6100 m) or over, with a full load, the Mosquito felt a bit unstable fore and aft, by my standards. It was completely controllable but needed completely controlling to fly an accurate course at steady height. This added somewhat to the strain, although on the way home with light load it was a lot easier. Sometimes it paid to lose height over the Dutch coast and fly back under the weather and ice. We had some very bumpy rides as a result but were spared the cloud boring, ice and possible diversions which we all hated. It was always unpleasant letting down through cloud over a blacked-out countryside when you were tired. We had no approach aids as we know them today and no positive identification of position until we could see the tiny ring of Drem lights round an airfield and read its identification beacon. Normally we homed on a Gee lattice line. In rough air, Merlin 21 engines in Mk IV Mosquitoes did not take kindly to negative *g*, as a result, one or both engines would hiccup when bounced severely and this caused twitches of yaw to add to the discomfort, which was always harder on the navigator than the pilot.

At a time when single-engine flying with a twin was considered pretty fraught, the Mosquito set high standards, and if the rules were followed there was no cause to panic if you lost an engine. As the individual aircraft got older and were made heavier with equipment, the single engine performance deteriorated. Fitters' ladders were bound to scuff leading edges while servicing was under way and engine nacelle panels fit less well after months in service, so adding to the drag. About the only thing you could not do was change your mind on a single-engine final approach after the wheels and flaps were down. You had to decide early, leaving enough height and time to get the wheels and flaps up, with speed of at least 135 kt (250 km/h) remaining, before pouring on full power from the good engine to climb out again. Many a Mosquito came home safely on one engine from very far into enemy territory.

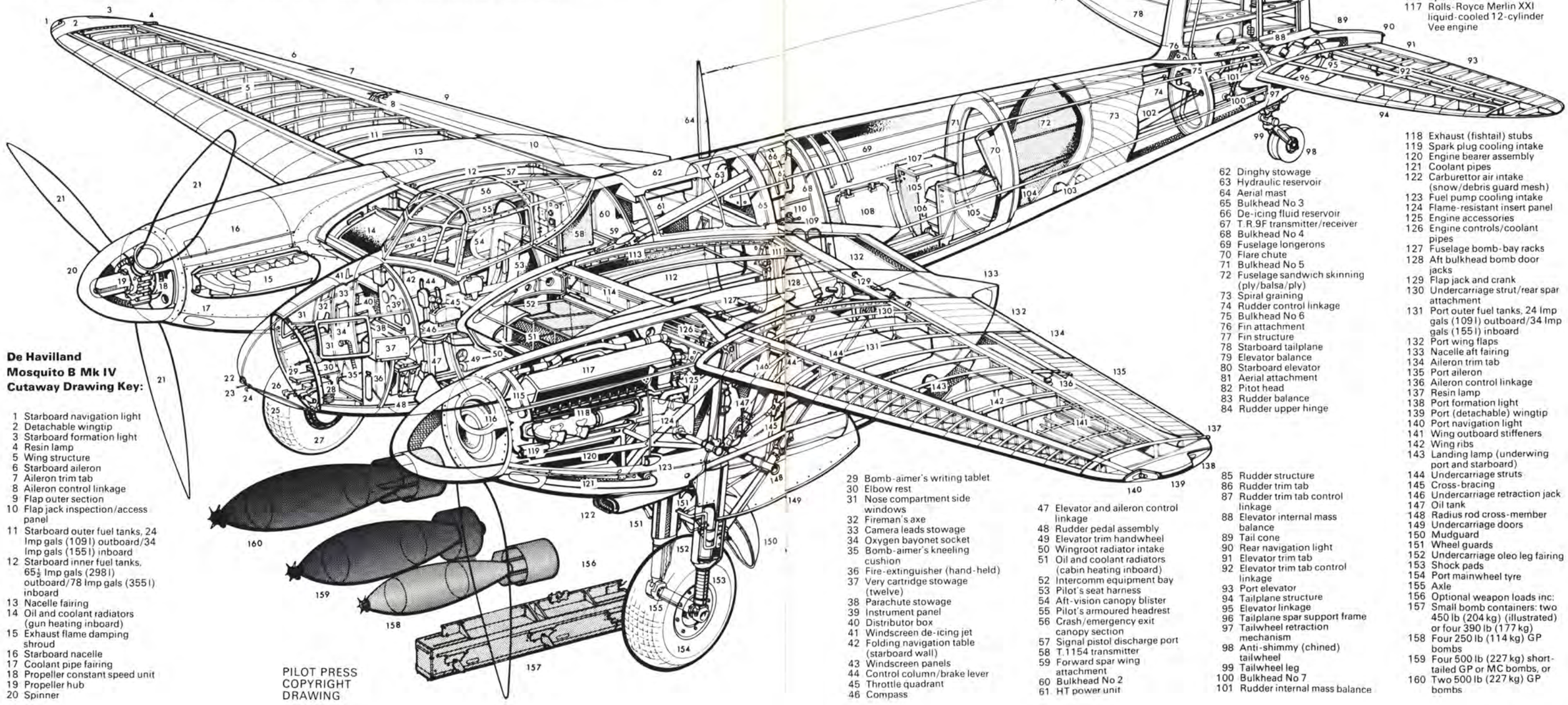
With both engines running, he would have been a very careless chap who stalled a lightly loaded Mossie by mistake; even so, anyone who did would probably have recovered quite easily because there was a warning shudder followed, usually, by no more than a straight and gentle sink.

As a matter of habit, we put our Mosquitoes down on the runway like fighters, maybe because it was the style at the time but more likely because they handled so well and the high, steep approach suited them. Flaps went down to 25 deg at 175 kt (324 km/h) and the undercarriage could be lowered at 155 kt (287 km/h). We liked to have a few knots in hand — at least 140 kt (259 km/h) turning in and 125 kt (231 km/h) over the hedge. The flaps gave plenty of drag (and therefore needed to come up quickly on an overshoot) and idling paddle-bladed Merlins were like air brakes but would pick up and check the aircrafts' descent instantly.

It was easy to round-out and put a Mossie down on three points and it was not normal practice at that time to wheel them on. One needed to concentrate right to the end of the landing run because of a tendency for the aircraft, just occasionally, to dart off line and need some very quick correction. Obviously, a gusty or cross wind increased the chances of this happening.

Night target marking

Earlier, a particular form of night target marking was mentioned which required indicators to be put on the spot, using a dive bombing technique. Mosquitoes were excellent for this and we had complete faith in the strength and handling of the aircraft. A typical night attack for a member of the 5 Group Marker Force involved a flight to the target, to arrive precisely on time under a spread of parachute flares. These were ignited by barometric fuses after being dropped "blind" by Lancaster Pathfinders using H_2S radar, from about 20,000 ft (6100 m). The Mosquitoes whirled around (2,800 rpm and +9 lb/sq in) underneath the flares, at 1,000-1,500 ft, (305-458 m) looking for the marking point which the crews had memorized from maps during briefing. Bomb doors would be open and red TIs selected, as the Mossie was allowed a speed of 300 mph (483 km/h) with bomb doors open. Having spotted the marking point (which was not



De Havilland
Mosquito B Mk IV
Cutaway Drawing Key:

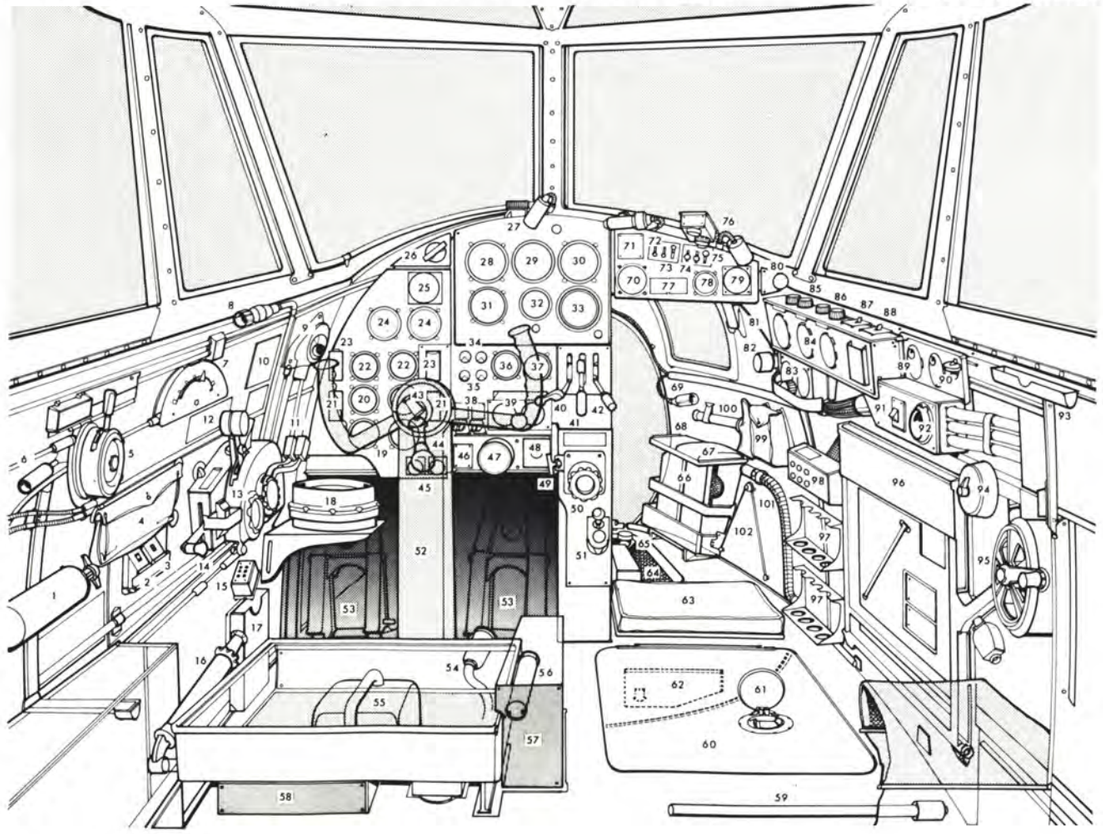
1 Starboard navigation light
2 Detachable wingtip
3 Starboard formation light
4 Resin lamp
5 Wing structure
6 Starboard aileron
7 Aileron trim tab
8 Aileron control linkage
9 Flap outer section
10 Flap jack inspection/access panel
11 Starboard outer fuel tanks, 24 Imp gals (109 l) outboard/34 Imp gals (155 l) inboard
12 Starboard inner fuel tanks, 65½ Imp gals (298 l) outboard/78 Imp gals (355 l) inboard
13 Nacelle fairing
14 Oil and coolant radiators (gun heating inboard)
15 Exhaust flame damping shroud
16 Starboard nacelle
17 Coolant pipe fairing
18 Propeller constant speed unit
19 Propeller hub
20 Spinner
21 Three-blade de Havilland hydromatic propeller
22 Navigation headlamp
23 Air thermometer
24 Bomb-aimer's windscreen de-icing jet
25 Bomb-aimer's heated (optically flat) window
26 Bombsight
27 Starboard mainwheel
28 Bomb selector switch panel
29 Bomb-aimer's writing tablet
30 Elbow rest
31 Nose compartment side windows
32 Fireman's axe
33 Camera leads stowage
34 Oxygen bayonet socket
35 Bomb-aimer's kneeling cushion
36 Fire-extinguisher (hand-held)
37 Very cartridge stowage (twelve)
38 Parachute stowage
39 Instrument panel
40 Distributor box
41 Windscreen de-icing jet
42 Folding navigation table (starboard wall)
43 Windscreen panels
44 Control column/brake lever
45 Throttle quadrant
46 Compass
47 Elevator and aileron control linkage
48 Rudder pedal assembly
49 Elevator trim handwheel
50 Wingroot radiator intake
51 Oil and coolant radiators (cabin heating inboard)
52 Intercomm equipment bay
53 Pilot's seat harness
54 Aft-vision canopy blister
55 Pilot's armoured headrest
56 Crash/emergency exit canopy section
57 Signal pistol discharge port
58 T.1154 transmitter
59 Forward spar wing attachment
60 Bulkhead No 2
61 HT power unit
62 Dinghy stowage
63 Hydraulic reservoir
64 Aerial mast
65 Bulkhead No 3
66 De-icing fluid reservoir
67 T.R.9F transmitter/receiver
68 Bulkhead No 4
69 Fuselage longerons
70 Flare chute
71 Bulkhead No 5
72 Fuselage sandwich skinning (ply/balsa/ply)
73 Spiral graining
74 Rudder control linkage
75 Bulkhead No 6
76 Fin attachment
77 Fin structure
78 Starboard tailplane
79 Elevator balance
80 Starboard elevator
81 Aerial attachment
82 Pitot head
83 Rudder balance
84 Rudder upper hinge
85 Rudder structure
86 Rudder trim tab
87 Rudder trim tab control linkage
88 Elevator internal mass balance
89 Tail cone
90 Rear navigation light
91 Elevator trim tab
92 Elevator trim tab control linkage
93 Port elevator
94 Tailplane structure
95 Elevator linkage
96 Tailplane spar support frame
97 Tailwheel retraction mechanism
98 Anti-shimmy (chined) tailwheel
99 Tailwheel leg
100 Bulkhead No 7
101 Rudder internal mass balance
102 Control cables
103 Ventral identification lamps (green/amber)
104 Fuselage lower longeron
105 Aft camera mounting boxes
106 F.24 camera
107 Camera heating cable stowage
108 Aft entry/access door
109 Oxygen bottles (port and starboard)
110 Bomb winch
111 Rear spar attachment
112 Centre-section fuel tanks (two), 68 Imp gals (309 l) each
113 Double wing upper skin (interleaved stringers)
114 Forward spar
115 Coolant header tank
116 Spinner
117 Rolls-Royce Merlin XXI liquid-cooled 12-cylinder Vee engine
118 Exhaust (fishtail) stubs
119 Spark plug cooling intake
120 Engine bearer assembly
121 Coolant pipes
122 Carburettor air intake (snow/debris guard mesh)
123 Fuel pump cooling intake
124 Flame-resistant insert panel
125 Engine accessories
126 Engine controls/coolant pipes
127 Fuselage bomb-bay racks
128 Aft bulkhead bomb door jacks
129 Flap jack and crank
130 Undercarriage strut/rear spar attachment
131 Port outer fuel tanks, 24 Imp gals (109 l) outboard/34 Imp gals (155 l) inboard
132 Port wing flaps
133 Nacelle aft fairing
134 Aileron trim tab
135 Port aileron
136 Aileron control linkage
137 Resin lamp
138 Port formation light
139 Port (detachable) wingtip
140 Port navigation light
141 Wing outboard stiffeners
142 Wing ribs
143 Landing lamp (underwing port and starboard)
144 Undercarriage struts
145 Cross-bracing
146 Undercarriage retraction jack
147 Oil tank
148 Radius rod cross-member
149 Undercarriage doors
150 Mudguard
151 Wheel guards
152 Undercarriage oleo leg fairing
153 Shock pads
154 Port mainwheel tyre
155 Axle
156 Optional weapon loads inc:
157 Small bomb containers: two 450 lb (204 kg) (illustrated) or four 390 lb (177 kg)
158 Four 250 lb (114 kg) GP bombs
159 Four 500 lb (227 kg) short-tailed GP or MC bombs, or
160 Two 500 lb (227 kg) GP bombs

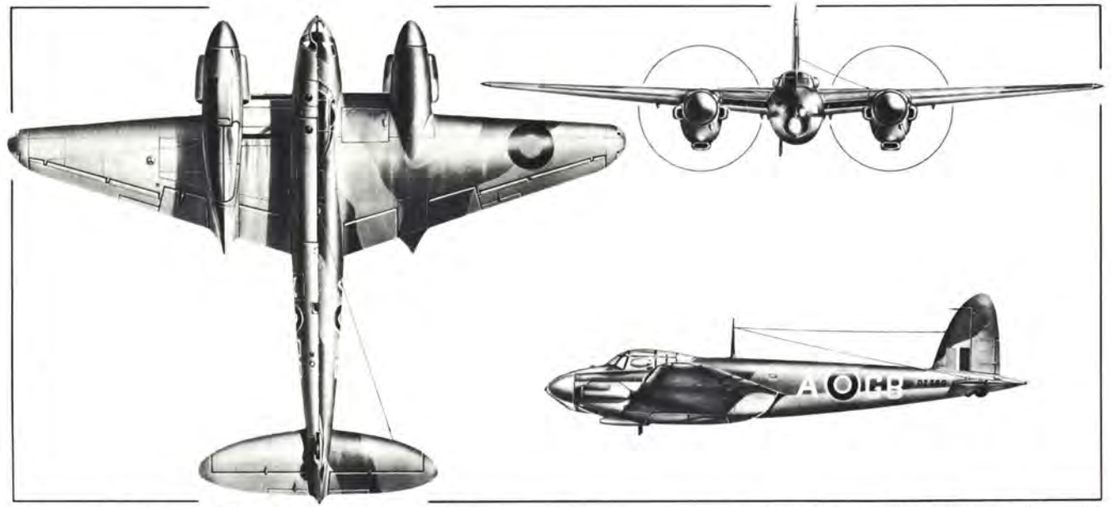
normally the target proper), the Mossies could be tweaked round, fighter style, and dived to drop accurately and be up and away again before the light flak could be trained on them — sometimes, orange-red tracer from the ground would wave about looking like water from a fiery hose. Pilots used to circle and dive with radiator flaps closed, then flick them open at the bottom of the dive to give just the right nose-up trim change as they brought in full power for the climb out.

The reason behind the marking point being placed up wind and away from the target was to prevent the coloured indicators from being blown out or obscured by the bombs dropped by the first few waves of bombers and so becoming invisible to those that followed. The Main Force bomb aimers were briefed either to allow for so many seconds overshoot or to set a false error on their bomb sights to bring their sticks of bombs across the target.

De Havilland Mosquito B Mk IV Cockpit Drawing Key:

1 Fire extinguisher
2 TR9F (beam approach) switch
3 TR9F (IFF distress) switch
4 Pilot's personal effects
5 TR9F radio controller
6 Intercom plug
7 Elevator trim tab indicator
8 Pilot's bomb release button
9 Cabin cold air control
10 Engine data plate
11 Propeller speed control levers
12 Throttle levers
13 Supercharger gear change switch
14 Mixture control lever
15 TR1143 push-button unit
16 Seat adjustment lever
17 Map case
18 Compass
19 Coolant temperature gauges (partially obscured by control column)
20 Oil temperature gauges (starboard gauge obscured by control column)
21 Oil pressure gauges (obscured by control column)
22 Boost pressure gauges
23 Fuel pressure warning lights
24 RPM indicators
25 Steering indicator
26 Boost control cut-out
27 Panel light and dimmer switch
28 ASI
29 Artificial horizon
30 Rate of climb/descent indicator
31 Altimeter
32 Directional gyro
33 Turn and bank indicator
34 Engine electric starter buttons
35 Booster-coil buttons
36 Undercarriage position indicator
37 Flaps position indicator (partially obscured by control column)
38 Magneto switches
39 Mk VIII oxygen regulator
40 Bomb doors selector lever
41 Undercarriage selector lever
42 Flaps selector lever
43 Parking brake control (mounted on control yoke)
44 Brake control (mounted on control yoke)
45 Landing light switches (obscured by control column)
46 Electrical services master switch
47 Triple pressure gauge
48 Bomb container jettison control
49 Bomb jettison control handle
50 Aileron trim tab control and indicator
51 Windscreen de-icing pump
52 Control column
53 Rudder pedals
54 Sanitary tunnel and
55 Tank (underseat)
56 Torch stowage
57 Incendiary bomb stowage
58 First-aid box (underseat)
59 Hydraulic pump handle stowage
60 Crew entry door
61 Drift sight mounting
62 Entry ladder stowage
63 Observer's kneeling cushion
64 Fuse box
65 Bomb door indicator switch
66 Emergency oxygen bottles
67 Elbow rest
68 Writing tablet
69 Intercom plug
70 Beam approach indicator
71 Clock
72 Radiator flap switches
73 Navigation lights switch
74 Pitot head heater switch
75 Immersed fuel pump switch
76 Panel light and dimmer switch
77 Propeller feathering buttons
78 Air temperature gauge
79 Voltmeter
80 Generator warning light
81 Inspection lamp stowage
82 High-pressure oxygen master valve
83 Mk VIII oxygen regulator
84 Fuel contents gauges (forward gauge: outer tanks; middle gauge: centre tanks; rear gauge: inner tanks)
85 Fire-extinguisher buttons
86 IFF detonator buttons
87 IFF switch
88 Navigation headlamp switch
89 Identification switchbox and key
90 Air recognition lights switchbox
91 Identification lights selector switch
92 Watch holder
93 Pencil tray
94 Observer's GP/VHF changeover switch
95 Trailing aerial winch
96 Folding navigation table
97 Signal cartridge holders (8)
98 Distributor box (camera)
99 Leads stowage (camera)
100 Fireman's axe
101 Observer's oxygen supply bayonet socket
102 Stowage for Syko instrument





A Mosquito B Mk IV, DZ360, in the markings of No 105 Squadron, the first unit to operate the bomber version of de Havilland's "Wooden Wonder".

Heating and ventilation were quite good in a Mossie and it was possible, if you wanted a quick blast of fresh air, to open the quarter panes in the screen. However, anything "thrown out" of these small windows in flight was thrown firmly back! Oddly enough, Canadian Mossie XXs and 25s smelled differently from home-built Mk IVs; we thought it was something to do with electrical insulation and paint. We preferred stuffiness to noise and draught, and only had oxygen masks on for part of the time, so we got to know the smells quite well. For maximum alertness on ops, however, we used to take off with low oxygen supply right from the ground. In case we should become complacent, our favourite Mossie B Mk 25, KB533 "M", Canadian-built with Packard Merlins, would sometimes produce hot electrical smells which worried us no end, and on one occasion there was no fooling. Although we did not know it at the time, a faulty voltage regulator had caused our batteries to boil in their inaccessible trays in the rear fuselage. We just smelled something very hot and discouraging. Since we were a long way from home, — peering down through a smoke screen near Leipzig, in fact — we thought it best to switch off the generator and electrics and see what happened. The instruments were sufficiently luminous to fly by and the navigator had his torch and plot. The smell got no worse, maybe a bit less, so later on and nearer home, we tried again, but power faded fast. We saved the last drop for identification and a call for landing instructions.

For the record, the last day raid by Mosquitoes of Bomber Command in the European war was against Wesel on 6 March 1945. It was led by Oboe Markers of No 109 Squadron, 8 Group. The last night raid of the war was against the submarine refuelling base at Tonsberg on 25 April, when Mosquitoes of No 627 Squadron, 5 Group, did the marking.

Happiness was . . .

Happiness was a low-level, training cross-country on a nice sunny day. It happened infrequently but it showed the Mossie at its attractive and contrasting best. Excellent control, beautiful aileron response, good view, speed. We saw the seals around the sand-bank bombing ranges north of the Wash and waved to coastal ships from their own altitude. It was almost worth being diverted to the spartan welcome of Peterhead, north of Aberdeen, for the wave-crest flight home down the East coast next day.

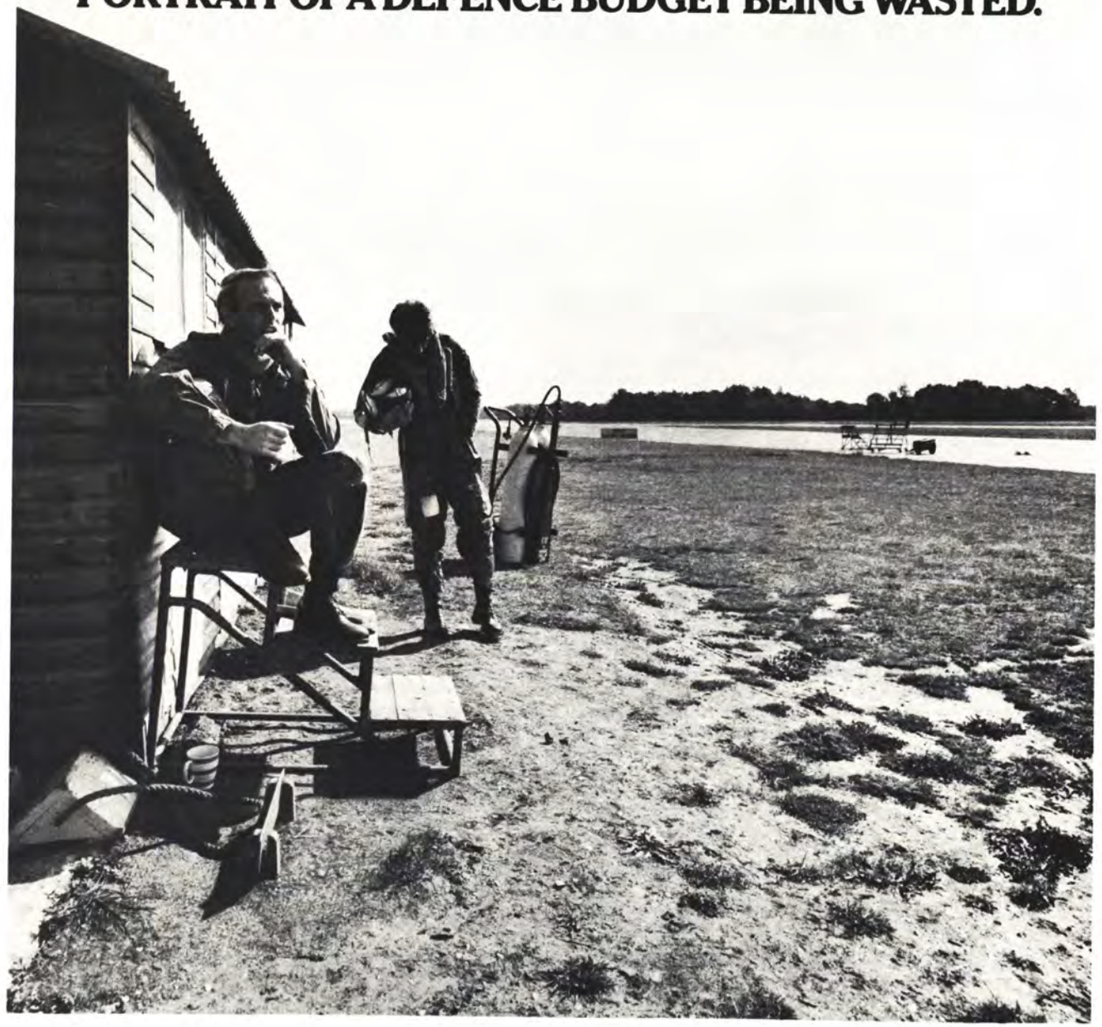
Legally or otherwise, we all at some time tried aerobatics on almost every type of aircraft we flew — although I never got a Lanc on its back intentionally! Bomber Mosquitoes would roll nicely and loop with ease, but such manoeuvres could be bad for the instruments and navigation equipment, so having proved the point with a borrowed training aircraft, we were content with a few wing-overs amounting to half rolls, when practising dive bombing.

How good it is to know that a number of Mossies are cared for today and back in flying condition again. Sometimes, still, you think you hear the sound of a pair of Spitfires overhead and on looking up, you are happy to see instead a Mosquito. The "3-ply balsa and glue" wooden wonders have lasted well. □

"Oddly enough, Canadian Mossie 20s and 25s smelled differently from home-built Mk IV; we thought it was something to do with electrical insulation and paint." Illustrated here is a B Mk XX prior to delivery from the Canadian production plant in Toronto.



PORTRAIT OF A DEFENCE BUDGET BEING WASTED.



The simple fact is Hawk will deliver more flying for your money.

Because Hawk is both trainer and ground-support fighter, a combination that makes operational and economic sense, and maintains pilot morale.

Fly it for basic instruction right through to squadron continuation training.

Fly it equipped for front-line combat duty.

Fly Hawk instead of doubling-up your aircraft strength. Especially as Hawker Siddeley designed it to need minimal maintenance, and for that to be simple.

If money matters to you, fly Hawk.



More flying for your money.

HSHAWK

HAWKER SIDDELEY AVIATION

Kingston upon Thames, England

THE YEAR OF THE HAWK

By Wg Cdr Ian C H Dick, MBE, AFC, RAF, of the Air Staff at HQ RAF Training Command and a former leader of the "Red Arrows" display team.



AS WELL AS being Silver Jubilee Year, 1977 is the year of the Hawk for RAF Training Command. The world will be watching us as we introduce this newest jet trainer well ahead of its contemporary rivals. The Hawk is due to replace two other well known aircraft — the Hunter and the Gnat — both currently used by the RAF in the training rôle, and, whilst it may not have either the classical elegance of the Hunter or all the nimble agility of the Gnat, the Hawk is certainly proving to be a tremendously versatile aircraft and an effective advanced trainer — qualities which mark it as another Hawker Siddeley thoroughbred.

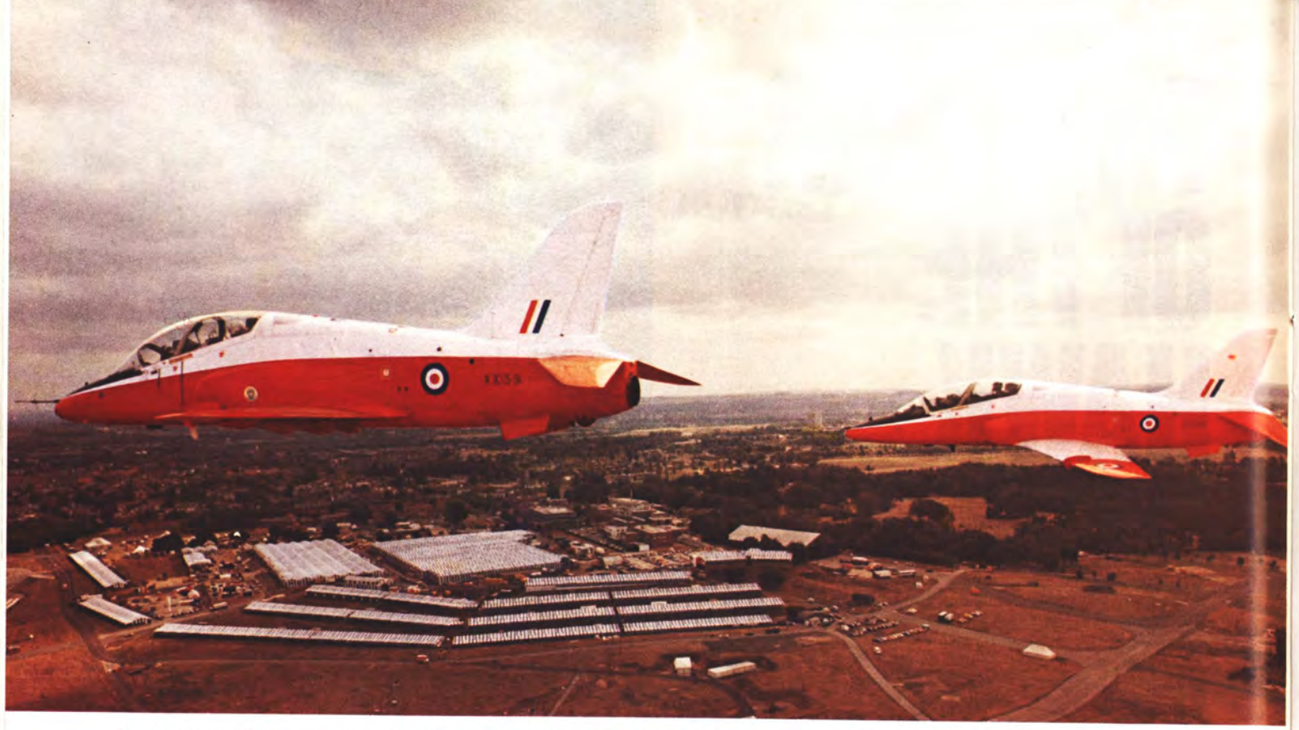
Already, the Hawk has been released to service with the RAF, and the delivery of aircraft has been steadily progressing at RAF Valley which is the home of No 4 Flying Training School — the advanced training school for fast-jet pilots. On present plans, the first student will have started training by mid-1977. How will he find the Hawk as an aeroplane? And how will the instructors find it as an advanced trainer? Being on the Air Staff at Headquarters Training Command and having flown in the aircraft myself, I have my own ideas of the answers to these questions; but perhaps the man best qualified to give an authoritative view is Squadron Leader Wally Black, who is from the staff of the Central Flying School and in charge of the Hawk Project Team which is responsible for introducing the aircraft to flying training at RAF Valley. This article has been produced in collaboration between us, therefore, with the aim of describing the features of the Hawk and explaining its effectiveness as an advanced trainer.

The Hawk as an Aircraft

Although beauty is in the eye of the beholder, the professional is more likely to be attracted to the Hawk's flying characteristics than its physical appearance. Lack of sharply swept wings and a dolphin-like profile deny the Hawk the sharp, sleek fighter-like appearance of its predecessors. Nevertheless, looks are not everything, and these particular features give the Hawk two of its outstanding characteristics: an undeniably good lifting wing and a superb view from the rear cockpit. As I walked towards the Hawk for the first time, a clear impression surfaced through the excited anticipation of my impending flight. Here was an aircraft designed from the outset as a trainer



Entering service with the Royal Air Force in the middle of 1977, the Hawker Siddeley Hawk is the first designed-for-the-job advanced trainer to enter production in the UK for more than two decades. Shown (right) is the prototype Hawk in company with three of the types that it will wholly or partly replace in service – the Hunter T Mk 7, the Jet Provost T Mk 5 and the Gnat T Mk 1. The heading photograph shows four Hawks engaged in development flying from HSA's Dunsfold test centre.



The Hawk was first flown on 21 August 1974 and in addition to the single prototype, some 10 of the 175 production Hawk T Mk 1s ordered by the RAF were used during 1975 and 1976 on development flying, leading to initial release to the RAF by the end of 1976. In their service rôle as advanced trainers for fast-jet pilots, the Hawks replace Gnats at No 4 FTS, RAF Valley in the first instance, wearing the standard white and red colours of Training Command aircraft.







not only with features to make training straightforward and effective but also with the ability to be developed and employed in a number of operational rôles.

External checks are simple and quickly completed. The ascent into either cockpit is normally by way of ground steps although the aircraft steps can be used. Pre-entry cockpit checks are important particularly with regard to the Miniature Detonating Cord (MDC) and ejection seat pins. Strapping in is not unduly complicated or involved, and the excellent leverage of the straps is a noteworthy point and enables the pilots to strap in tightly and securely. The seat is very comfortable, and two-hour sorties can be completed without any discomfort or fatigue being felt in any way.

As the hood is closed and pre-start checks begun, a number of features are readily apparent. First, there is the superb view, particularly from the rear cockpit; here, at last, we have a tandem seat trainer with as good a view for the instructor as for the pupil. From the rear cockpit, one does, it is true, have to look through the MDC in the hood over the student's head, but one soon adjusts to this, and it is certainly no hindrance to good lookout. Next, one becomes aware of the well appointed layout of the cockpit. There is plenty of room, and everything falls readily to the eye; when one looks for a gauge or instrument, it happens to be in the place where one would expect to find it. The whole cockpit environment is very comfortable and suitable for training, and instructors and students alike are bound to enjoy this aspect of the Hawk.

The usual left to right cockpit checks are required before starting the engine, and the point is reached when the student will first appreciate that this aircraft, unlike previous types he will have flown, has a twin-spool/by-pass engine. The starting system is entirely integral, so no external power supplies are required. Engine start-up procedure is slightly more complicated than in the current jet trainers, however, and involves starting the computer-controlled Gas Turbine Starter (GTS), operating the start sequence which allows the GTS to turn the engine and checking for 15 per cent rpm to be reached before opening the HP cock for engine light-up. Once idling rpm is stabilised, the GTS shuts itself down automatically.

Taxying the aircraft requires a little practice. Direction is maintained or altered by holding the rudder central and applying differential toe-braking as required. Initially, one tends to use too much brake, which inevitably leads to a rather jerky, zig-zag course



The Hawk's cockpits are roomy by training standards. This illustration of the first cockpit in RAF configuration containing most of the non-flying controls. The instructor in the rear cockpit has all flying controls and essential instruments duplicated.

along the taxiway. The pedal travel required for effective braking is not very great and only light toe pressure is therefore necessary to achieve the desired result — a knack which requires a little time to learn and master. By doing as many checks as possible in dispersal, pre-take-off checks have been kept to a minimum, so saving valuable time at the marshalling point.

During the take-off run, rudders quickly become effective at around 50 kts (93 km/h) and make directional control simple. With a much wider tracked undercarriage than the Gnat, the Hawk experiences no significant or comparable effect from crosswind during either take-off or landing, and it is during take-off that one quickly discovers how well the flying controls are harmonised: they are just as one would expect a good aircraft to be. Light back pressure on the control column gets the nosewheel comfortably off the runway at about 90 kts (167 km/h) and there is no difficulty in holding the right attitude. With a very small attitude change at 120 kts (222 km/h), the aircraft leaves the runway cleanly and is easily controlled whilst the undercarriage and flaps are retracted at a safe height.

As the aircraft climbs away from the airfield, it is immediately apparent that although the attitude seems very flat, the ground is receding at an unexpectedly high rate. This is the first indication received by the first-time Hawk pilot of the efficiency of the wing; it is literally lifting one into the sky. Acceleration, too, is as good as if not better than that of the Gnat, and the climbing speed of 350 kts (648 km/h) is quickly reached and is anticipated by about 20 kts (37 km/h) for adopting the climbing attitude of 12 deg or so. In these conditions, the initial rate of climb is better than that of either the Gnat or the Hunter — yet another tribute to the efficiency of the wing.

Manoeuvring at Altitude

About 10 minutes after brakes-off, the Hawk can reach 40,000 ft (12190 m) and it is here that the student will be introduced to the effects of compressibility and learn about high level manoeuvring. As the aircraft accelerates from Mach=0·9 to 0·92, differential travel of the shock waves over the wings produces a difference between their centres of pressure, resulting in a roll which requires about half-aileron to hold and correct. A familiar but mild "cobblestone" effect is felt between about Mach=0·86 and 0·93 and minor, random pitch changes can be discerned when accelerating or decelerating between Mach=0·8 and 0·95. When recovering from high Mach number, the Hawk tends to tuck-in with centre of pressure movement during deceleration, but no rolling effect is evident because the shock waves move forward more quickly in this case.

Successful high level manoeuvring — particularly maximum rate turning — requires careful handling if optimum performance is to be obtained — it is all too easy to enter the buffet and lose speed. However, from the training viewpoint, such demands are welcome as they offer a challenge to the student and a useful training yardstick for the instructor. Get it right, and the Hawk has a surprisingly good rate of turn at high level. For best performance, the aircraft should be turned, just off the buffet nibble, at Mach=0·75 to 0·78. In this configuration, the aircraft will turn tightly with a rate of descent of no more than 4,000 ft/min (20,3 m/sec) — a better performance than achieved by either the Gnat or the Hunter. Get it wrong, by killing Mach with buffet or incorrect pitch attitude, and one loses turning performance very quickly. Moreover, to regain speed in this situation, it is not simply a matter of releasing back pressure slightly on the control column; one really has to unload to recover the situation.

The handling techniques for entering a maximum rate turn from high and low Mach numbers call for skill and good judgment from all pilots; but this is not the Hawk's only challenge. As height is reduced, so the handling characteristics change. At around 17,000 ft (5185 m), the best turning performance Mach number begins to equate to the 360 to 370 kts (666-685 km/h) required for a 6 *g* turn, and one has to adapt from the high level to the medium level techniques. Here, at the lower levels, one begins to notice the lack of induced drag from the wing; excess thrust, too, is good, and an excellent rate of turn can be maintained through 360 deg with very little loss of height. For best manoeuvring at the lower heights, speed should be kept up above 300 kts (555 km/h) and a delicate touch is needed to keep the aircraft just out of the buffet nibble — a fine sense of judgment.

Despite this requirement for a certain sensitivity, the Hawk is beautiful to handle and acceleration up to Mach=0·88 (about 450 kts/833 km/h) at 10,000 to 15,000 ft (3050-4575 m) is an effortless exercise involving barely any attitude or trim changes. There are no noticeable compressibility effects on the tailplane up to Mach=0·98, which is the maximum speed at which the Hawk has been flown in Training Command. At medium level, 95 per cent range speed is about 300 kts (555 km/h) and it is here that one begins to realise another outstanding feature of the aircraft: the remarkably low fuel consumption. Consequently, range and endurance figures are appreciably better than for contemporary trainers. The Hawk is easily capable of flying for 1¼ to 1½ hours on a typical instructional sortie with enough fuel remaining at Decision Height for a 250-mile (460-km) diversion — a significant asset from the flying training point of view.

The Hawk can be flown through a wide repertoire of aerobatics with spirited pleasure and few, if any, problems. Generally speaking, best performance is achieved by staying out of the buffet, although below 10,000 ft (3050 m) very marginal buffet in the right places will help tighten up an aerobatic sequence. With plenty of excess power and such an excellent wing, producing little induced drag, it is too easy to gain height, and power changes are necessary during aerobatics to match datum speeds and heights. Inverted flying is fully catered for in the Hawk, and tail effectiveness is more than ample for negative *g* enthusiasts. The Hawk is beautifully safe with no aerodynamic vices to worry about during aerobatic exertions. However, from the engine handling point of view, high rates of yaw should be avoided at low indicated air speeds.

The Hawk in a Spin

Low speed handling and spinning are perfectly straightforward and present no problems. The clean stall symptoms are easily recognised and recovery is similar to the Jet Provost and, unlike the procedure with Gnat or Hunter, involves unstalling the wing and re-establishing

In due course, armed Hawks will replace the Hunters of the Tactical Weapons Unit at RAF Brawdy. It is presumed that the insignia of Nos 63, 79 and 234 Squadrons, at present carried by the TWU Hunters (below), will be transferred to the Hawks.





In the RAF weapons training rôle, the Hawk will carry a ventral gun pod and two wing pylons for rocket pods or bombs, but the aircraft is structurally able to carry four wing pylons and has already been flown with a variety of weapon loads as shown in these illustrations, including (above) four Matra rocket pods, (below right) five 1,120-lb (510-kg) bombs and (lower right) gun pod, two Sidewinder AAMs and two drop tanks.

lift rather than blasting the aircraft out with thrust. When gear and flaps are down, stall buffet is detectable through the airframe buffet and recovery is straightforward and thoroughly safe. Indeed, the Hawk is very docile in the stall and, although there is some lateral instability, control is immediately regained once the stick is moved forward. As in aerobatics, correct engine handling is important when opening the throttle at low IAS.

The Hawk is reluctant to spin or depart from controlled flight even with gross mishandling of the controls. Nonetheless, students will be taught this exercise because of the valuable teaching points to come out of it. Once established in a spin, the characteristics are predictably safe although they can vary considerably. For example, airspeed can fluctuate and oscillatory motion can develop to differing degrees along all axes; nevertheless, the recovery procedure of centralising the controls is immediately effective no matter how the aircraft is spinning. As with stall recovery, careful engine monitoring is essential during the spin and subsequent recovery. The important teaching point for the student is that the Hawk spins differently from the Jet Provost and the next aircraft he flies will probably spin differently again; the punchline is that, whatever the differing spin characteristics, the student must know the correct recovery procedure for the aircraft he flies.

The Hawk flies comfortably at low level throughout the useful speed range of 220 to 500 kts (407-926 km/h). Lookout is excellent from both cockpits, and instrumentation is adequate for accurate pegging of speed and heading. Owing to the sensitive efficiency of the wing and its low loading, turbulence can unsettle the aircraft and lead to a rough ride even at medium levels, where such disturbance is felt as a mild vibration. This feature makes steady formation flying a challenge, which will particularly affect the "Red Arrows" when, as is planned, they re-equip with the Hawk at the end of the decade. However, the aircraft responds quickly and positively to small control movements, and so accurate position keeping is not likely to prove too great a problem. More significant for the "Red Arrows" is the slightly slower throttle response because of the twin-spool engine. The present remarkably crisp formation changes of the team rely, to a great extent, on the unusually snappy response of the Gnat's engine. Future "Red Arrows" pilots will, therefore, need to anticipate to a greater extent their power changes. Nevertheless, the Hawk is generally pleasing to fly in formation throughout the speed range. Selection of the services presents no problems, and formation circuits, approaches and landings are straightforward. Tailchasing can prove a challenge — particularly when it tightens up — as one is seeking the best turning performance to hold a good position whilst avoiding too much buffet. The aircraft appears to ride slipstream surprisingly well.

There is nothing unusual or difficult about flying the Hawk in the circuit. The instructor, overwhelmed by his unprecedented view from the rear cockpit, takes a little time to adjust to the apparent nosedown attitude on the approach. Otherwise, circuit flying follows a standard pattern with a downwind speed of 190 kts (352 km/h), decreasing to 150 kts (278 km/h) by the end of the downwind leg and 130 kts (241 km/h) straight in at the end of the final turn; the threshold speed is



110 kts (204 km/h) plus one knot (1,85 km/h) for every 100 kilograms (220 lb) of fuel. With the relatively slow acceleration of the engine, it is important that rpm are kept up around 70 per cent during the approach to land, but this requirement is helped by the powerful drag force produced from extending full flap. On rolling or overshooting, the lifting power of the wing with full slotted flaps is an experience to behold; the additional flap lift is supreme, and an impressive 1,000 ft (3051 m) of height can be gained by the end of a 2,000-yd (1830-m) runway. This is clearly where the flaps come into their own — as a low speed aid; they are not designed for use in manoeuvring over 200 kts (370 km/h).

Instrument flying is a simple process in the Hawk. The radar pattern is initially flown at 230 kts (426 km/h) which is 30 kts (56 km/h) above the flap and undercarriage limiting speeds but is more appropriate to advanced training. With gear and mid-flap selected, the speed is decreased to 150 to 160 kts (278-296 km/h) and this is tapered to 130 to 140 kts (240-259 km/h), depending on weight, by Decision Height. Having landed the aircraft, stopping it — unassisted by any brake parachute — requires the same knack of braking technique used for taxying. Climbing out of the Hawk after one's first sortie, there is the compelling urge to get back in and do it all again. The Hawk is undoubtedly a superb aircraft to fly, but how does it perform as a trainer?

The Hawk as a Trainer

As with most modern military aircraft, training on the Hawk is supplemented by the use of a simulator. Although the Hawk simulator is very sophisticated in many respects, it does not have a visual capability, as this was not considered a cost effective facility for the advanced stage of flying training. However, the simulator is an

continued on page 34

RAF TRAINERS 1918-1977



(Above) The Avro 504, in its earlier K sub-series, was the RAF's first *ab initio* trainer. The later Avro 504N served into the mid-thirties, the example illustrated being in the markings of the Oxford University Air Squadron.



(Above) Most famous and most used of all RAF trainers, the DH 82 Tiger Moth was a Service derivative of the equally notable Moth lightplane. Most RAF pilots in World War II learned to fly on Tiger Moths, typical war-time finish for which is shown here.



(Above) Derived from the Hawker Hart bomber, the Hart Trainer served as an advanced trainer from 1933 onwards, usually in the overall yellow finish shown.



(Above) The RAF's first monoplane trainer, the Miles Magister was used in large numbers at Elementary Flying Training Schools throughout World War II. R1853 depicted served at No 15 EFTS in 1940.



(Above) To complement the Magister as an advanced trainer, Miles developed the Master, over 2,000 being built for the RAF during World War II. Depicted is the first production Mk I, N7408.



(Above) North American's noisy Harvard served as a standard equipment at RAF Flying Training Schools for more than 16 years, from 1938 to 1955. N7033 is shown as flown at No 2 FTS; many were later operated in natural metal finish.



(Above) Entering service soon after WW II ended, the Percival Prentice was the first basic RAF trainer with side-by-side seating. VR230 was used by No 3 FTS at Feltwell.



(Above) The Gloster Meteor T Mk 7 was the RAF's first jet trainer, used from December 1948 onwards. WF881 operated with No 203 AFS at Driffield. (Right) The de Havilland Vampire T Mk 11 replaced the Harvard in 1952 at Flying Training Schools, such as No 5 FTS represented by WZ453.



FREWELL



(Left) Last piston-engined basic trainer to enter RAF service, the Provost replaced the Prentice in 1953 and served until 1961. Illustrated is WV475 as used by No 6 FTS at Tern Hill.

(Right) Designed to be powered by a turboprop engine, the Boulton Paul Balliol was used only in piston-engined (Merlin) T Mk 2 form by the RAF, equipping 7 FTS at Cottesmore.





(Left) The Canadian-designed de Havilland Chipmunk T Mk 10 followed in the Tiger Moth tradition, some 735 being delivered to the RAF as elementary trainers from 1950 to 1953. A few remain in service in 1977 with AEFs.

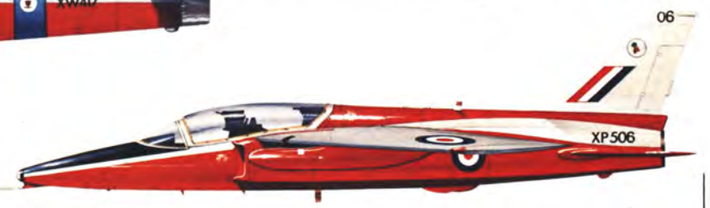


(Above right) The Hawker Hunter T Mk 7 served the RAF as an advanced trainer from 1958 onwards and the type is still used at 4 FTS Valley, as illustrated, and by the Tactical Weapons Unit at Brawdy.



(Left) The BAC (originally Hunting) Jet Provost replaced the piston-engined Provost as a basic trainer in 1959 and the T Mk 3A and T Mk 5A versions remain in large-scale service in 1977. XW417 is illustrated in RAF College markings.

(Right) The Folland-designed Hawker Siddeley Gnat T Mk 1 was the RAF's standard advanced trainer from 1962 until 1977, when its replacement by the Hawk began. Principal user is No 4 FTS.





(Left) The Beagle-designed Scottish Aviation Bulldog entered service in 1973 and is used by the Primary Flying Grading Squadron at 2 FTS (as illustrated) and to equip 16 University Air Squadrons.

(Right) Entering service in 1977, the Hawker Siddeley Hawk has been developed to replace the Gnat as an advanced trainer and, in due course, the Hunter in the weapons training rôle.



NOT TO SCALE

HAWK ——— ***continued from page 31***

excellent training vehicle for checks, emergency drills and instrument procedures, and many of the training points are reinforced by experience in it. Most of the Hawk's systems management and emergency drills are simpler to cope with than the Gnat. There are no complications associated with flying the aircraft in manual following a hydraulic failure, and the Ram Air Turbine (RAT) simplifies hydraulic emergencies. The aircraft is easily handled throughout all emergencies and practice forced landings are a straightforward exercise to fly. The relighting drills cover three contingencies: the "hot" relight speaks for itself, the unassisted relight involves diving the aircraft to get the engine rpm sufficiently high for a cold relight attempt, and the assisted relight uses the GTS in exactly the same way as starting the engine.

As a training aeroplane, the Hawk's first noticeable advantage over its predecessors is that less conversion time is needed to learn how to fly it. The Gnat takes a lot of time and practice to master its unique handling intricacies whereas the same level of flying proficiency is more quickly achieved in the Hawk because it is simpler to understand and easier to fly in the elementary respects. This saving in conversion time and continuation training means that more syllabus hours than before can be devoted to the essence of advanced flying training: that is, the applied exercises such as low-level navigation, close and advanced formation, which all teach the student how to operate rather than how to fly the aircraft. A similar advantage will apply at RAF Brawdy where the Tactical Weapons Unit (TWU) introduces the ex-Valley student to basic weapons and tactical flying prior to Operational Conversion Unit (OCU) training.

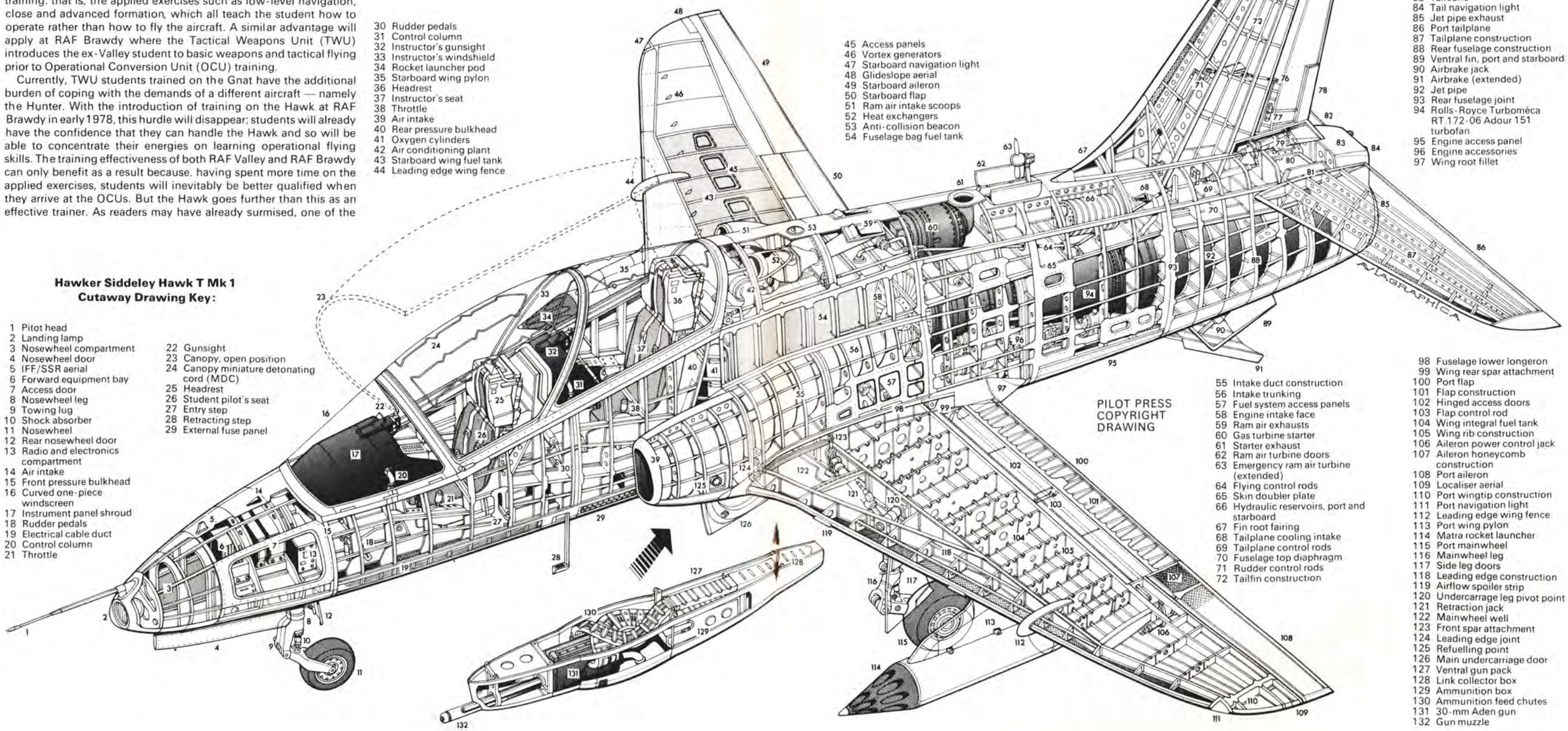
Currently, TWU students trained on the Gnat have the additional burden of coping with the demands of a different aircraft — namely the Hunter. With the introduction of training on the Hawk at RAF Brawdy in early 1978, this hurdle will disappear; students will already have the confidence that they can handle the Hawk and so will be able to concentrate their energies on learning operational flying skills. The training effectiveness of both RAF Valley and RAF Brawdy can only benefit as a result because, having spent more time on the applied exercises, students will inevitably be better qualified when they arrive at the OCUs. But the Hawk goes further than this as an effective trainer. As readers may have already surmised, one of the aircraft's outstanding features is that it is easy to fly where one wants it to be easy and is demanding to fly accurately where one wishes it to be a challenge. Consequently, the balance of training is greatly improved, and emphasis can be rightly placed on learning the skills applicable to later training and operational needs. This characteristic of the Hawk contributes significantly to the effectiveness of flying training because it matches the RAF's training philosophy, and that is to relate training precisely to the operational needs.

Also contributing to this philosophy is the Hawk's increased range and endurance which, compared with either the Gnat or the Hunter, expand its training capabilities markedly and the limitations imposed by hour-long sorties apply no more. Composite sorties lasting up to 1½ hours have been designed to include a number of exercises which involve flying farther afield than before both by day and at night. Thus, flying demands and cockpit workload (to the right degree) can be applied to the students. This feature of the Hawk is of great training benefit; not only because it teaches students operating skills to the right level of proficiency, but also because captaincy and airmanship qualities can be developed and tested to a far greater extent.

It is important to bear in mind here that the requirements which have determined current flying training call as much for qualities of mental agility and quick thinking as they do for physical aptitude and co-ordination. Put another way, the modern, effective trainer is not necessarily one with a high performance in terms of speed, height or aerodynamics. It is more an aircraft with the potential to produce high cockpit workloads and demanding systems management. Therefore, lack of experience on markedly swept-wing aircraft for ex-Hawk students is not seen as a shortfall in training prior to the OCU level. The mystique surrounding swept-wing operations has now largely disappeared, since few modern fighters display the classic swept-wing flying characteristics of, for example, the Lightning. Taking the RAF's present front line aircraft such as the Buccaneer, Harrier, Jaguar or Phantom, it would be hard to find a greater cross-section of high- and low-speed handling qualities. Clearly, it is not possible for an advanced trainer to cater for this wide variety of aircraft performance, and it will be up to the OCUs to provide the relevant type training.

The final asset offered by the Hawk as a trainer is its development potential. Should the needs of the front line so dictate, the Hawk can, without much difficulty or expense, be modified to incorporate an Angle of Attack Indicator, a simple Head Up Display and offset TACAN with which to simulate Inertial Navigation System (INAS) management. In this way, it would be possible to relate the training given at the earlier stages even more precisely to the requirements of the front line squadrons.

I hope that this article has left the reader with the clear impression that the Hawk is not only a superb aircraft but also an excellent trainer. Its exceptional cockpit environment, coupled with its workload potential and easy yet challenging handling characteristics, makes it the ideal training vehicle in which to teach the student exactly what the RAF wants him to learn. As one staunch supporter of the Gnat said as he climbed out of the Hawk after his first sortie — "Don't bother to wrap it up — I'll take two now!" □



Hawker Siddeley Hawk T Mk 1
Cutaway Drawing Key:

1 Pitot head
2 Landing lamp
3 Nosewheel compartment
4 Nosewheel door
5 IFF/SSR aerial
6 Forward equipment bay
7 Access door
8 Nosewheel leg
9 Towing lug
10 Shock absorber
11 Nosewheel
12 Rear nosewheel door
13 Radio and electronics compartment
14 Air intake
15 Front pressure bulkhead
16 Curved one-piece windscreen
17 Instrument panel shroud
18 Rudder pedals
19 Electrical cable duct
20 Control column
21 Throttle
22 Gunsight
23 Canopy, open position
24 Canopy miniature detonating cord (MDC)
25 Headrest
26 Student pilot's seat
27 Entry step
28 Retracting step
29 External fuse panel
30 Rudder pedals
31 Control column
32 Instructor's gunsight
33 Instructor's windshield
34 Rocket launcher pod
35 Starboard wing pylon
36 Headrest
37 Instructor's seat
38 Throttle
39 Air intake
40 Rear pressure bulkhead
41 Oxygen cylinders
42 Air conditioning plant
43 Starboard wing fuel tank
44 Leading edge wing fence
45 Access panels
46 Vortex generators
47 Starboard navigation light
48 Glideslope aerial
49 Starboard aileron
50 Starboard flap
51 Ram air intake scoops
52 Heat exchangers
53 Anti-collision beacon
54 Fuselage bag fuel tank
55 Intake duct construction
56 Intake trunking
57 Fuel system access panels
58 Engine intake face
59 Ram air exhausts
60 Gas turbine starter
61 Starter exhaust
62 Ram air turbine doors
63 Emergency ram air turbine (extended)
64 Flying control rods
65 Skin doubler plate
66 Hydraulic reservoirs, port and starboard
67 Fin root fairing
68 Tailplane cooling intake
69 Tailplane control rods
70 Fuselage top diaphragm
71 Rudder control rods
72 Tailfin construction
73 UHF/VHF aerial
74 Dielectric fin tip
75 Rudder honeycomb construction
76 Rudder hinge control
77 Trim tab control
78 Rudder tab
79 Tailplane power control jack
80 Tailplane centre section
81 Deflector plate
82 Starboard tailplane
83 Tailcone
84 Tail navigation light
85 Jet pipe exhaust
86 Port tailplane
87 Tailplane construction
88 Rear fuselage construction
89 Ventral fin, port and starboard
90 Airbrake jack
91 Airbrake (extended)
92 Jet pipe
93 Rear fuselage joint
94 Rolls-Royce Turboméca RT.172-06 Adour 151 turbofan
95 Engine access panel
96 Engine accessories
97 Wing root fillet
98 Fuselage lower longeron
99 Wing rear spar attachment
100 Port flap
101 Flap construction
102 Hinged access doors
103 Flap control rod
104 Wing integral fuel tank
105 Wing rib construction
106 Aileron power control jack
107 Aileron honeycomb construction
108 Port aileron
109 Localiser aerial
110 Port wingtip construction
111 Port navigation light
112 Leading edge wing fence
113 Port wing pylon
114 Matra rocket launcher
115 Port mainwheel
116 Mainwheel leg
117 Side leg doors
118 Leading edge construction
119 Airflow spoiler strip
120 Undercarrage leg pivot point
121 Retraction jack
122 Mainwheel well
123 Front spar attachment
124 Leading edge joint
125 Refuelling point
126 Main undercarriage door
127 Ventral gun pack
128 Link collector box
129 Ammunition box
130 Ammunition feed chutes
131 30-mm Aden gun
132 Gun muzzle



Peacekeeper.

THE CHALLENGE

The Royal Air Force is a fighting force. But never having to fight would be the greatest victory of all. However, in a violent and threatening world, the possibility of aggression cannot be ignored and we must show our willingness to resist.

THE TASK

As an Aircrew Officer, you might for example join a Phantom Squadron of the Interceptor Alert Force. There are aircraft and crews on alert 24 hours a day, every day of the year. Your job, in peacetime, to intercept and identify intruders approaching our airspace. When the order to scramble is given, an instant response is required.

THE WIDER ISSUES

As you progress through the RAF you will be expected to broaden your responsibilities. You will also begin to appreciate the wider issues confronting the RAF in its role as part of NATO's air defence system.

In times of peace the country's defences must always be ready, because preparedness is the only effective deterrent.

WHAT TO DO

If the challenge of a career as an RAF aircrew officer appeals to you, talk to your careers adviser or go along to your local RAF Careers Information Office – address in the phone book – and make an appointment to see the officer in charge. Or you can write to: Group Captain H. E. Boothby, OBE, ADC, BA, RAF, Officer Careers (982 457/1), London Road, Stanmore, Middlesex HA7 4PZ.

You should have 5 or more acceptable GCE O-levels, or equivalent, at grade C or above, and subjects must include English Language and Maths; or equivalent. If you can offer A-levels or a degree so much the better. The age limits are 17-23½. Formal application in the UK only.

ONLY SO MANY CAN BECOME THE FEW.



COMBAT OVER DIEPPE

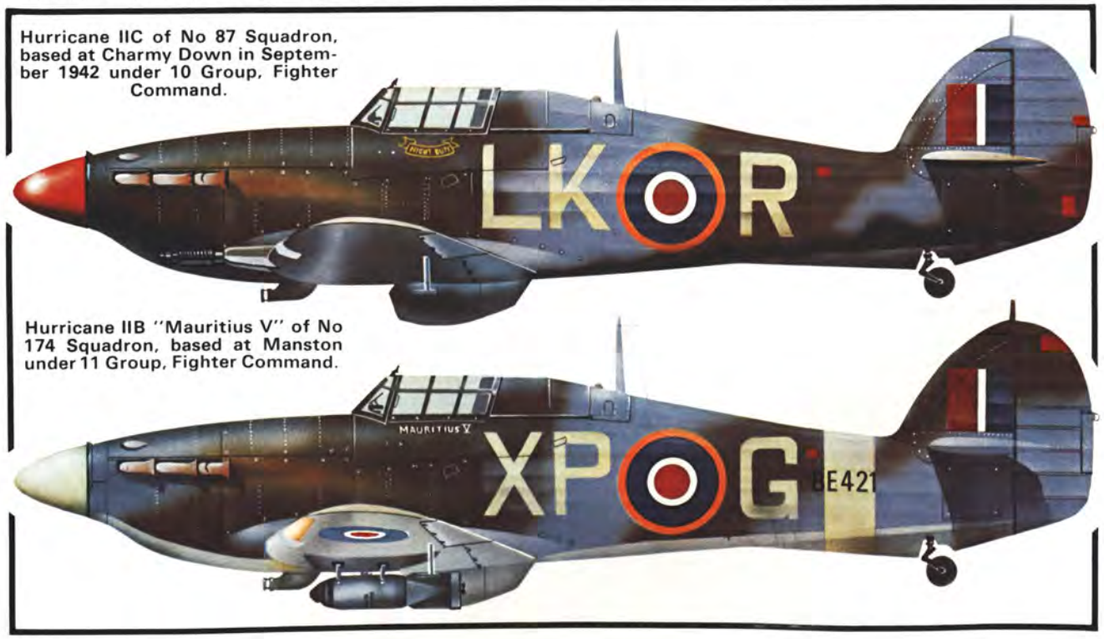
VICTORY OR DEFEAT?

BY W J A WOOD

AS THE PILOTS of No 43 "Fighting Cocks" Squadron, RAF, clambered into the cockpits of their Hurricane IIc fighters in the early hours of Wednesday, 19 August 1942, the sun was still well below the eastern horizon, more than an hour away from casting the first shafts of orange light across the grassy expanse of Tangmere aerodrome. Helped by the dim rays of torches held by solicitous groundcrew, each equipment-laden pilot strapped himself in and ran through the familiar start-up checks before a muffled order sent the first Rolls-Royce Merlin XX engine bellowing into life. Within seconds of the first, others started to an accompaniment of a bedlam of noise, acrid smoke and flickering exhaust flames before the leader swung his aircraft along the narrow perimeter track and lined-up into the gentle westerly breeze.

By 04.25 hours (British Summer Time) the last Hurricane was airborne: the leader ordered his pilots into low-level battle formation as they skimmed the flat expanse of Selsey Bill, and then eased down into the darkness above the gently heaving Channel. Each pilot knew that so long as he kept below 500 ft (150 m) his aircraft would remain undetected by the watchful eyes of the German radar stations scattered the length and breadth of the hostile French coast. But at this very early hour there was little chance of interception by German fighters — the formidable Focke Wulf Fw 190s — based in their lairs at Abbeville, St Omer, Triqueville and Cherbourg: indeed, with the exception of a few drowsy pilots rostered for the unpopular stint of dawn readiness and who were still *en-route* to their respective airfields, the *Luftwaffe* day-fighter defences of Northern France were still sound asleep.

But this mission was no ordinary night-intruder sortie for No 43



Hurricane IIC of No 87 Squadron, based at Charmy Down in September 1942 under 10 Group, Fighter Command.

Hurricane IIB "Mauritius V" of No 174 Squadron, based at Manston under 11 Group, Fighter Command.



Focke-Wulf Fw 190s were prominent in the Luftwaffe *forces put up to oppose the Dieppe landings. Typical scenes at Fw 190 bases in the autumn of 1942 are depicted here, showing (above)* Stab/*JG 26 and (below left) 6./JG 26.*



Squadron for, together with No 418 Squadron, RCAF, it was to spearhead the air assault on the Dieppe coastal gun batteries in support of the most ambitious land-sea combined operation by British and Commonwealth forces to date. It was still dark when, some twenty-five minutes after leaving Tangmere, the Hurricanes breasted the cliffs of the eastern Dieppe headland and with 20-mm cannons barking dived to the attack into the face of accurate and surprisingly alert German flak. Although the pilots had been briefed that this attack was one of major importance, none could suspect that the day's fighting in the air over Dieppe would result in probably the greatest single air battle of the Second World War.

Encouraged by the results of the brilliant and daring Commando raid on St Nazaire in March 1942, the British Combined Chiefs of Staff had drawn up plans for a similar, but far more ambitious, seaborne raid upon a French port. Air cover for this raid was deemed essential and accordingly the target had to lie within the limited combat radius of Spitfires and Hurricanes flying from Southern England. The small numbers of troop and tank landing craft available at the time precluded any attempt at a full-scale invasion — or the opening of the Second Front so vehemently called for by Stalin and some elements of the American administration. German defences were too strong. However, the British considered that a "reconnaissance in force" to test the mettle of German defences and to discover what resistance would have to be met in the endeavour to seize a sea-port were both feasible objectives.

The small French sea-port town and peacetime holiday resort of Dieppe was selected as a suitable target for an assault: it lay only 70 nautical miles (112 km) across the Channel, was within easy range of RAF day fighters, and represented a reasonable sea crossing for the invading forces, which could be carried there and back within a day's sailing. Code-named OPERATION RUTTER, the Dieppe raid was sanctioned in principle by the Chiefs of Staff Committee on 13 May with the date fixed for the assault being 4 July 1942. Massive and detailed preparations were then undertaken and by the appointed date all was ready. But bad weather now intervened and the landing force remained embarked aboard their ships until 8 July, when the continuation of foul weather forced the cancellation of the raid.

Despite this setback it was decided to proceed with plans for another raid on Dieppe in one month's time. Meanwhile the unusually large concentration of vessels anchored at Portsmouth, Newhaven and at ports in the Isle of Wight, had succeeded in attracting the attentions of *Luftwaffe* reconnaissance, resulting in a number of low-level raids by Junkers 88s and Dornier 217s.

Tactical surprise was to be the keystone of the entire Dieppe venture, but there was now no doubt that the Germans knew that something important was afoot, and it was the opinion of several high-ranking British commanders that the security of the raid had been compromised irrevocably. Indeed, when General Bernard Montgomery was told of the intention to proceed with the postponed operation he argued that it should be cancelled for all time, but was over-ruled by Churchill.

Suitable tidal conditions are vital in the execution of any seaborne landing, and the tides affecting the Dieppe sector were next forecast to be favourable within the period 18-23 August. Therefore the morning of the 18th was selected for the Dieppe raid — now re-named OPERATION JUBILEE and a photocopy of the previous plan except for the substitution of Commandoes for paratroops with the task of seizing certain coastal batteries. The plan gave instructions down to the minutest detail for assault, withdrawal and evacuation: it all looked very impressive, but there remained the disturbing aspect of security. How much did the Germans know of the impending operation?

It would appear from the evidence of post-war records and the testimonies of German prisoners-of-war taken during or shortly after the Dieppe raid, that the *Oberkommando der Wehrmacht* (OKW) had no prior knowledge of where or when the raid would take place. Thus, the worst fears of the British were never realised, despite the fact that thousands of Canadian troops and Commandoes knew of the objective weeks before the event. However, the mass of shipping scattered along the southern coast did not go unnoticed and, convinced that an invasion was imminent, OKW ordered the highest state of alert for units and commands stationed in Northern France. Reserve infantry and *Panzer* regiments, recuperating from a tour on the Russian Front, were moved to the Lille-Amiens sector within easy rail journey of the coast. Along the coastal defences of Northern France, *Wehrmacht* units were ordered to stand-to by day and by night: troops and gun-crews had to sleep by their posts ready to go into action in an instant. This special precaution was ordered for the period 1–19 August, with special reference to the 17–18 August made, it is thought, solely because of the favourable state of the tides between these dates. These special alerts did not apply to *Luftwaffe* units in France: personnel were allowed out on late pass in the usual way — although they had to be armed — and slept in their billets away from the aerodrome. To counter a suspected British move, all the Germans could do was to step up their readiness in case of invasion over a wide area; but if OPERATION JUBILEE remained tentatively within cloak of security, then that same cloak was tattered and the light shone through.

The Plan

Dieppe lies in a mile-wide gap at the mouth of the river Arques, almost acentre of an 11-mile (17,6 km) stretch of cliff-bound coastline bordered by the villages of Berneval to the east and Quiberville to the west. The beaches are mostly shingle at high-tide, and extend for some 1,500 yards (1 365 m) west of the harbour mole backed by the lawns and wide promenade of Dieppe town. The port of Dieppe is dominated by two flanking headlands of high ground, and of these the most overbearing is the eastern headland. To the south of the town lies the airfield of Dieppe-St Aubin which, during the war, served as a relief landing ground for the *Luftwaffe*.

By 1942, the strengthening of the so-called Atlantic Wall by the Todt labour organisation was well under way, but still far from completion. Ports and coastal approaches, even as early as 1942, were well defended from sea attack by coastal batteries of varying calibre: in addition, the German anti-aircraft or flak defences were formidable.

In the Dieppe sector itself, RAF Photographic Reconnaissance units had plotted six heavy-calibre gun batteries, sited to give enfilade fire to the sea approaches to the harbour. These guns were either 150-mm or 88-mm, and included several captured French 75-mm howitzers; each gun was sited in its individual pit, with ammunition dumps to the rear, and the entire battery was defended by carefully sited flak positions. The locations of the batteries were around the villages of Quiberville, Varengeville-sur-Mer, Pourville (which included a "Freya" radar station), Puys and Berneval. These were code-named "Hess", "Hitler", "Hindenburg", "Bismark", "Rommel" and "Goebbels" by British Intelligence for the purposes of OPERATION JUBILEE. Army Intelligence also referred to the German defending force, the 1st Regt of the 302 Inf Div, as a "low category unit". However, unobserved by both PRU and Intelligence was the presence in and around the cliffs overlooking Dieppe of numerous camouflaged machine-gun nests, copious use of barbed-wire and mine-fields.

The tactical plan of JUBILEE called for the seizure of the coastal batteries, the investment of Dieppe town and the destruction of its harbour facilities, the capture of St Aubin airfield and the 302nd Division's HQ at nearby Arques-la-Bataille. The assault was planned to commence about one hour prior to sunrise (05.50 hours) and to terminate with the orderly evacuation of troops from the beaches at 11.00 hours. It was a tall order.

Despite the extreme hazard of the operation the Combined Chiefs of Staff were confident that although heavy casualties could be anticipated all could be achieved through the combination of surprise and violent assault. The key to the success of the whole plan, however, rested upon the immediate neutralisation of the "Bismarck" batteries at Puys and the defended areas located on the dominating eastern headland. If the assault on this objective failed in the hands of the crack Royal Regiment of Canada, then the entire town and its neighbouring areas would remain under the withering hail of enfilade fire from the headland. Thus the failure of one part of the operation could render the remainder of the plan entirely fallible.

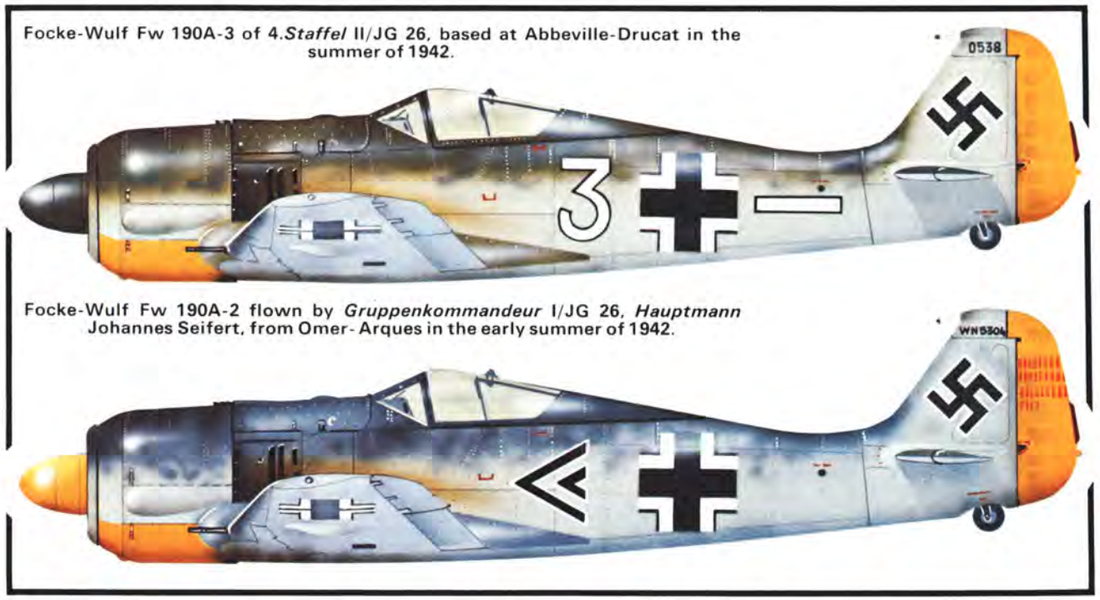
By mid-August 1942 all items of the elaborate plan were once again complete. Both weather and tidal conditions now boded fair for OPERATION JUBILEE, and the embarkation order was given on 17 August. Under cover of smoke screens, 24 tank landing ships took on the new Churchill medium tanks of the 14th Canadian Battalion while the last of the 6,086 officers and men, Canadians and Royal Marine Commandoes, embarked. Tactical command of the land and sea phases of the operation would be directed from the HQ ship, the destroyer HMS *Calpe,* by Maj Gen F N Roberts MC and Capt J Hughes-Hallet respectively.

The Air Plan

Active German fighter airfields lay within close range of Dieppe, while the bomber forces of *Fliegerkorps* IX and *Luftflotte* 3 remained within 1–1½ hour's flying time from the beaches: it was of paramount importance, therefore, that RAF Fighter Command furnished an aerial umbrella over Dieppe at all times, and that a maximum effort was made to keep the *Luftwaffe* at bay. Air Marshal Trafford Leigh-

Among the Spitfire squadrons that helped to provide massive air support for Operation Jubilee was No 306 "Torun" Squadron, part of the No 1 Polish Fighter Wing. No 306 received Spitfire IXs — as depicted here — shortly after the Dieppe operation, during which it was flying Mk Vs.





Focke-Wulf Fw 190A-3 of 4.*Staffel* II/JG 26, based at Abbeville-Drucat in the summer of 1942.

Focke-Wulf Fw 190A-2 flown by *Gruppenkommandeur* I/JG 26, *Hauptmann* Johannes Seifert, from Omer-Arques in the early summer of 1942.

Mallory, CB, DSO, then the AOC No 11 Fighter Group, was designated Air Force Commander for OPERATION JUBILEE and for one day an unprecedented number of squadrons would be under his direct control.

Due to the ability of Fighter Command's radar network to see far into enemy airspace over Northern France, all air operations in support of JUBILEE were to be controlled from No 11 Group's Operations Room at RAF Uxbridge. The Air Force Commander would be in constant W/T radio link with the commanders and staff aboard HMS *Calpe,* while he would exercise control over his squadrons in the usual manner — by telephone link to Sector Stations and thence to the squadron dispersals. Thus any request for specific air support could be arranged with immediate effect.

Throughout August, the fighter and fighter-bomber units now at Leigh-Mallory's disposal had been carefully conserved to ensure the maximum serviceability for JUBILEE and all available squadrons based in the United Kingdom were moved down to airfields in No 11 Group. Their various rôles and part they would play in the Dieppe operation are best summarised in the No 11 Group order of the day, as follows:

AIR SUPPORT. This task consisted of Fighter Cover operations and general protection of the assault forces over Dieppe and surrounding area throughout the entire period of the operation. Fighter Cover, itself, would vary in strength from two to six Spitfire squadrons patrolling Dieppe according to the phase of the operation. The two most hazardous phases — the landing and withdrawal — would warrant maximum Fighter Cover. For the task, No 11 Group could operate 50 squadrons of Spitfires, including three from the US 31st Fighter Group. Of these units, however, only five were equipped with either the new Spitfire Mk IX or the high-altitude Mk VI, the remainder being mounted on the older Mk Vb, now widely acknowledged as being markedly inferior to the Fw 190A-3 fighter — the latest mark of this breed on standard issue to the *Jagdgruppen* in Northern France.

CLOSE SUPPORT. The bombing and low-level strafing attacks on selected targets in support of the landing, consolidation and withdrawal would be conducted by units equipped with the Hawker Hurricane II. Six night-intruder units with Hurricane IIb and IIc aircraft were drawn from Nos 10 and 12 Groups, and were joined by two specialised fighter-bomber units — Nos 174 and 175 Squadrons. The Boston IIIs of No 418 RCAF Squadron would also give support during the opening phases while it was still dark. In retrospect, although the Close Support squadrons fought valiantly and suffered heavy casualties, it can be seen that neither their numbers nor the calibre of their armament were of sufficient strength to subdue or neutralise the German defences.

Also listed as Close Support units were three squadrons of smoke-laying aircraft (Bostons and Blenheim IVs) which would be used during the landing and withdrawal. Two Squadrons of Boston III medium-bombers of No 2 Group, Bomber Command, were also on hand for tactical bombing of selected targets.

RECONNAISSANCE. Tactical reconnaissance would be needed over the entire theatre of operations including the distant lines of approach of possible *Wehrmacht* reinforcements. This task was allotted to four Mustang I squadrons of Army Co-operation Command*; operating in pairs and ranging far into enemy territory, the AAC Squadrons were to suffer at the hands of flak and the Fw 190s, sustaining the highest loss rate of JUBILEE — 2·25 pilots missing per squadron. Even RAF Coastal Command played a part in the operation: radar-equipped Hudson V patrol-bombers swept the Channel approaches for enemy surface craft prior to the arrival of the JUBILEE convoys.

STRATEGIC. As considerable German fighter reaction was expected from the nearby airfield of Abbeville-Drucat, a bombing attack on this base by 24 Fortresses of the 97th Bomb Group, USAAF, was timed to coincide with the withdrawal from the beaches. This was to be the only effort at pre-empting the *Luftwaffe*'s striking power by attacking it on the ground.

Air Intelligence predicted that German air opposition to OPERATION JUBILEE would be prompt and intense. It was correctly estimated that the *Luftwaffe* could call upon approximately 260 front-line single-engined fighters stationed at bases stretching from Texel to Brest. The long-range bomber force, consisting mostly of Junkers 88A-4s and Dornier 217E-4s, was located at bases in Holland and Belgium, and in Northern France; some 120 were available at Soesterberg, Eindhoven, Deelen-Arnhem and Gilze-Rijn, while a further 100 were stationed nearer at hand at Creil, Beauvais-Tille, Chartres and Chateaudun.

In the early stages of JUBILEE, the RAF estimated, the German fighters based at Abbeville-Drucat, Beaumont-le-Roger and Cherbourg (about 120 strong) would be the first to arrive on the scene; these would be followed later by those based further afield at St Omer and Courtrai. But assuming a ratio of 3:1 in favour of the RAF, Leigh-Mallory was confident that any German threat from the air could be contained, and in this he was later proved to be correct.

At the time the German fighter force stationed in Northern France consisted of two crack *Geschwader* each with an establishment of about 125 aircraft; they were the JG 2 "Richthofen" and JG 26 "Schlageter" *Jagdgeschwader,* and both had been in almost daily action against RAF Fighter Command since the Battle of Britain in 1940. The formation leaders and pilots were picked men, their aircraft were mostly Fw 190s, and they were backed by a good fighter-control network. In August 1942, their dispositions and numbers were as follows:

*No 39 Wing: Nos 26, 238, 400 and 414 Squadrons.

Unit	*Type*	*Base*	*IE*
Jafü 3			
Stab JG 2	Fw 190A-2	Triqueville	5
I/JG 2	Fw 190A-2	Triqueville	30
II/JG 2	Fw 190A-2	Beaumont-le-Roger	25
III/JG 2	Fw 190A-2	Cherbourg-Maupertus	40
Jafü 2			
Stab JG 26	Fw 190A-3	St Omer-Wizernes	5
I/JG 26	Fw 190A-2	St Omer-Fort Rouge	30
II/JG 26	Fw 190A-3	Abbeville-Drucat	40
III/JG 26	Fw 190A-3	Wevelghem	45
5./JG 2*	Fw 190A-2	Ligescourt	12
11./JG 2*	Bf 109G-1	Ligescourt	12
11./JG 26	Bf 109G-1	Norrent-Fontes	12
Fighter-Bombers			
10.(Jabo)/JG 2	Fw 190A-2	St André-de-l'Eure	12
10.(Jabo)/JG 26	Fw 190A-2	St Omer-Wizernes	12

**Operating under JG 26 control*

All these units were to be in action against the RAF during the course of OPERATION JUBILEE, and despite relatively low combat losses, by the evening of the day of the landing only 70 of the 230 single-engined fighters that had been available to *Luftflotte* 3 were serviceable. To replace the losses in Fw 190s, the last eighteen aircraft were released from the *Luftwaffe* Forwarding Centre at Wevelghem-Courtrai. By the morning of the 20th, the serviceability of JG 2 and JG 26 had risen to 194 aircraft as the result of repairs and additional aircraft brought forward during the night. If JUBILEE had been extended over a period of several days, the operational strength of German bomber and fighter units would have been reduced considerably as there were no further *Luftflotte* reserves available.

Meanwhile the operation had suffered yet another postponement: on the night of 17 August the weather worsened slightly ... 'Winds will increase from SSW early in the forecast period becoming moderate to fresh, and veering WSW early tomorrow ... Rain and poor visibility will spread across the area during the night — sea smooth becoming moderate — swell slight'. Nevertheless, after this final agonising 24-hour delay, JUBILEE finally got underway. Under cover of darkness and in complete radio silence, 252 ships, ranging in size from destroyers to cutters, weighed anchor and set course southwards across the Channel, through the mine-fields swept clear by the 9th and 13th Flotillas, to arrive undetected some 8 miles (13 km) off Dieppe shortly before 03.00 hours on the morning of 19 August.

Already in the barracks and messes on aerodromes within No 11 Group, Fighter Command, the pilots, ground crews and duty personnel were dressing, grumbling and trudging across the grass to an early and unwelcomed breakfast. On the notice board of each Squadron crew-room there was pinned the signal from Leigh-Mallory, the Air Force Commander. It read ...

"We are about to take part in the first assault delivered by combined forces of the three Services against the Continent of Europe in this war.

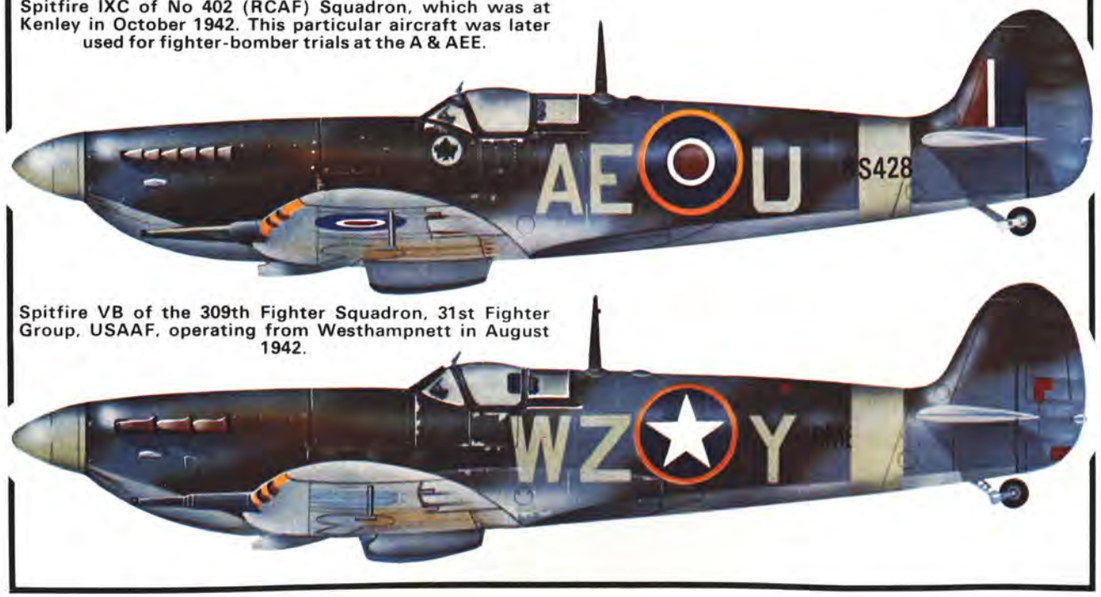
"It is an honour to take part in so momentous an operation, the success of which will make history, will raise the confidence and uplift the hearts of all those fighting for the Allied Cause.

"The safety of the expedition from the onslaughts of the enemy Air Force rests in our hands. The responsibility is great, but I am confident that every pilot will do his damndest to destroy any enemy aircraft that may attempt to attack either our ships or our fighting men.

"Good Luck to you All".

The Battle Opens

As soon as the raiding forces emerged from the minefields, the ships began to take up their pre-arranged stations with the HQ ship *Calpe* and her attendant destroyer HMS *Fernie* as the focal points. The remaining six RN destroyers fanned out to the east and west to give radar warning of any enemy seaborne interference, and further support to the landings with their 4·5-inch guns. The convoy was organised in thirteen different groups, each with its clearly defined task. At 03.00 hrs, the landing ships carrying the troops destined for the assault on Puys and Pourville (Blue and Green beaches) lowered their landing craft. The vessels carrying Nos 3 and 4 RM Commandos, earmarked for the outlying coastal batteries at Quiberville, Varengeville and Berneval, were already on the move following in the wake of their pathfinder gun-boats. As the flanking forces cleared the convoy and steered into the gloom of dawn, the groups for the primary assault on Red and White, the Dieppe beaches, moved into position on the centreline. By 03.30 hours all units taking part in the initial surprise assault were heading for the distant enemy shore. The only flaw in what would have been a perfect preamble to the assault was the loss of 20 valuable minutes when the landing craft carrying the Royal Regt of Canada formed up behind the wrong gunboat. As the objective of this unit was the subjugation of "Bismarck" and the



Spitfire IXC of No 402 (RCAF) Squadron, which was at Kenley in October 1942. This particular aircraft was later used for fighter-bomber trials at the A & AEE.

Spitfire VB of the 309th Fighter Squadron, 31st Fighter Group, USAAF, operating from Westhampnett in August 1942.

Combat Claims and Casualties, 19 August 1942 Royal Air Force and 8th USAAF

Units	*Sorties flown*	*Claims*	*Personnel lost*		*Aircraft*
			Pilots	*Crew*	*Lost*
Hurricanes and Spitfires	2,399	87½-45-143*	57	—	88
Mustang (Tac-Recce)	72	½-0-0	9	—	10
Boston (No 2 Group)	62		1	3	1
Blenheims and Bostons Smoke-laying	50	0-1-0	3	7	7
Hudson ASV (Coastal Cmd)	7				
USAAF (B-17s)	24				
Total:	2,614	88-46-143	70	10	106

Losses of the Luftwaffe Forces

Units	*100% Destroyed*	*90-80%*	*70-25%*	*Personnel*
Bombers	22	2	14	19 crews missing
Fighters				
JG 2	11	1	10	8 pilots missing
JG 26	6	1	1	6 pilots missing
Total:	39	4	25	

important eastern headland, the error seemed doubly ominous.

Then, at 03.47 hrs — discovery! Star shells rent the night sky as the silence was shattered by the stutter of MG fire; disaster had overtaken the lead gun-boat of No 3 Commando, for without warning it blundered into five armed enemy trawlers. Within minutes the gun-boat was afire and her attendant landing craft immediately scattered into the gloom. There followed a short interval wherein frantic radio messages were passed to the defending Germans on shore before the first heavy guns started firing; by 04.00 hours the Dieppe defences were on full alert.

The crews manning the "Hess" battery were among the first to spot RAF fighters sweeping over the Dieppe coast, at 04.50 hrs; these, the Hurricanes of No 43 Squadron, turned over the town and in the face of an increasing hail of light flak, dived towards the enemy positions on the eastern headland. Other close support fighters soon arrived and attacks were sustained without interval until 07.00 hrs. But it is unlikely that the determined efforts of the first close support squadrons were either noticed or appreciated by the troops now wading ashore through the unremitting flail of enemy machine-gun fire. Almost without exception, the landing craft surging through the shallows were met by concentrated enemy fire, at best enabling their parties to scramble ashore with heavy casualties, and at worst rendering their decks a tragic, lifeless shambles. JUBILEE was proving to be no 'reconnaissance in force' but a tragic misjudgement of the enemy's defences, with consequent appalling casualties.

At the time of the first landings, only a few close support squadrons were overhead: this had been considered sufficient for the task because of the element of surprise, but with surprise now gone the Germans were able to put up a strong resistance aided by searchlights and star-shells with very little interference from the air. In the first attacks, No 43 Squadron lost only one pilot, Sgt Wicks, while one of No 418's Bostons returned with a wounded pilot and observer. At daybreak, however, the close support operations were stepped up in intensity and the casualties began to mount. Escorted by Spitfires, the Hurricanes of Nos 3, 174, 245 and 253 Squadrons commenced their attacks on enemy positions at 05.15 hrs. Led by Sqn Ldr A E Berry, No 3 Squadron made two attacks on Red Beach, singling out the 37-mm flak post situated on the roof of the Casino on the promenade: flak was intense, and Sgt S D Banks failed to return.

Flying its first mission of the day that would cost heavy casualties, No 174 "Mauritius" Squadron left Ford airfield at 04.40 hours. Led by its CO, Sqn Ldr Fayolle (Free French), the Squadron had been briefed for a low-level attack on the "Hitler" battery: the nature of this attack had been accepted with incredulity by the squadron's pilots in view of the fact that their Hurricane IIb's had been loaded with two 500-lb (230-kg) GP bombs fitted with fuses for instantaneous impact, instead of delayed-action, thus rendering a low-level attack into an operation as dangerous to themselves as it was to the enemy. En-route to Dieppe, the CO spotted the burning ships lying offshore and correctly assumed that all surprise was now lost; he then elected to make for altitude and execute dive-bombing attacks — much to the relief of all concerned! Climbing to between 2,000 and 4,000 ft (610–1 200 m), the Squadron dived on "Hitler" at 05.15, placing most of its eighteen 500 lb (230 kg) and four 250 lb (114 kg) bombs on target. The Hurricanes quitted the area on the "deck" after their dive while being subjected to concentrated light flak, in particular some brilliantly coloured stuff from St Aubin airfield, but their first mission resulted in the tragic loss of the CO, shot down by a marauding Fw 190 off Worthing on the return.

The Spitfire VBs of Nos 71, 129 and 340 Squadrons were the first to tangle with German fighters, Fw 190s, which appeared over Dieppe at 05.30 hrs: these German fighters were in all probability from I/JG 2, based at Triqueville to the south of the Seine estuary. However, the initial brushes were in the nature of sparring matches with few casualties to either side: the three Squadrons mentioned claimed one Fw 190 probably destroyed and two damaged for the loss of Fg Off Jones of 129 Sqdn, while No 611's Spitfire IXs claimed the first confirmed victory of the day at 05.47 hrs but losing F/Sgt Violbeaux in the process. Most of the RAF's initial casualties fell to flak, with No 245 Squadron being particularly badly hit: Sqn Ldr H H B Mould and Plt Off Gutch were wounded, and Flt Lt Bennett and Plt Offs Barton and Scott were shot down.

Luftwaffe Reaction

That the Germans were still unaware of the scale and magnitude of the Dieppe raid was indicated by the tardy reaction of the *Luftwaffe*. The assault had been underway for over an hour when, at 05.30, the reconnaissance unit 1.(F)/123 based at Paris-Buc, was briefed to patrol the Dieppe area and report its findings. One Junkers Ju 88D-5 aircraft of this unit eventually arrived over the beaches at around 07.00 hrs, but finding the British fighter cover so considerable the crew elected to make their stay as brief as possible, and after one hurried flight over the ships the Ju 88 made off with all speed.

Apart from the elements of Hptm Erich Leie's I/JG 2, most *Luftwaffe* units seem to have received the alert warning at or shortly after 06.00 hrs. The Dornier Do 217-equipped II/KG 2, stationed at Eindhoven, was ordered to stand-to shortly after this hour, but it was not until 07.15 that three of their aircraft (5./KG 2) got airborne with orders to attack British shipping: none of these aircraft returned.

Of the German fighter force, Hptm Johannes Seifert's I/JG 26 put up 26 Focke-Wulfs from St Omer at 06.18, rendezvoused with the Messerschmitts of 11.Staffel, and set course for Dieppe: twenty minutes later they were in combat with numerous Spitfires. Most of I Gruppe's pilots were to fly as many as four sorties in the morning alone, with duties varying from bomber-escort and *Frei Jagd* (free chase) missions to air-sea rescue patrols. Fourteen confirmed kills were claimed by I/JG 26 for the loss of two pilots; the "Abbeville Boys" — II/JG 26 — claimed 12, while Hptm Josef Priller's III/JG 26 scored 14 kills. Overall losses within the *Geschwader* were extremely light in view of the tempo of operations: six pilots were killed in the course of 377 sorties lasting from first light until 21.21 hrs.

Of the 112 British aircraft claimed destroyed by the Germans during OPERATION JUBILEE, the major share fell to the *Jagdgruppen*. The combat claims of the *Richthofen Jagdgeschwader* are not known, but may be taken to be on a par with JG 26. Several of JG 2's more experienced pilots claimed remarkable successes: Egon Mayer, the *Staffelkapitän* of 7./JG 2, claimed his 50th victory, while Hptm Siegfried Schnell and Lt Josef Wurmheller, both of 9./JG 2, claimed five and seven victories respectively — the latter nursing a broken leg and concussion suffered in a recent crash.

At the time when the Luftwaffe was scrambling from its fighter bases the land situation had become so desperate that Maj Gen Roberts decided to send in his reserves: at 06.00 the Fuseliers Mont Royal proceeded to land on Red and White beaches but, like their predecessors, were soon pinned down by withering fire. The only success of the entire raid was the capture at 06.20 of the "Hess" battery by Lord Lovat's No 4 Commando.

German fighters started arriving *en masse*: they came from different directions in formations ranging from pairs to *Gruppen* strength of thirty or more. The RAF now fought at a disadvantage: radar control from No 11 Group was of little assistance due to the mass of aircraft milling in the small area of sky over Dieppe, the weather — fine at first but then with increasing cloud cover — added to the smoke from fires on land, hampered visibility. At this stage, No 242 Squadron's Hurricanes were attacking ground targets when their escort, Norwegian-manned Spitfires of Nos 331 and 332, were engaged at 8,000 ft (2 440 m) over Dieppe by 20+ Fw 190s and Bf 109Gs: the combat took place at 06.50 and the Norwegians acquitted themselves well, claiming 5-4-5* for the loss of three Spitfires, one pilot being picked up by the ever-present rescue launches. Their antagonist was probably II/JG 26, which downed its first kill at 06.43 hrs.

The withdrawal to the beaches for evacuation started at around 07.30 hrs, with desperate troops fighting their way out of the town in a series of gallant rear-guard actions. Overhead, No 403 RCAF Squadron jousted with Fw 190s, shooting down two but losing Plt Offs J E Gardiner, L A Walker and N Monchier. At 08.00 hrs, the Belgians of No 350 Squadron observed a group of bomb-carrying Fw 190s running in to attack the destroyers lying offshore: the grey camouflage of the 190s made them extremely difficult to see, but the Squadron dived in and a general mêlée ensued. Flt Lt Yves du Monceau shot one down into the sea 2 miles (3,2 kms) west of Dieppe, and Plt Offs Plas and Picard sent another into a field: Plt Off Marchal failed to return. The US 308th Squadron was also engaged at this time, losing Lt Ingrams.

The inexperienced American pilots of the 31st Fighter Group, recently converted to Spitfire VBs in lieu of their Bell P-39 Airacobras, fared badly in combat with battle-tried German pilots during JUBILEE: flying 123 sorties, the 31st lost eight Spitfires including five pilots missing for claims of 1-3-2. To Lt Samuel S Junkin went the credit of downing the USAAF's first confirmed victory in Europe, an Fw 190, but he too was shot down and survived a dunking in the Channel. The American insignia on the 31st's Spitfires caused some confusion to the Germans: Oblt Rolf Hermichen of 3./JG 26 claimed an Airacobra although this type did not see action over Dieppe.

Dogfights over Dieppe

Due to the threat posed by enemy E-Boats which had been reported in the Channel, No 11 Group despatched two Hurricane squadrons to search for these at 07.52 hrs: they patrolled the mouth of the Somme at zero feet but found nothing. Numerous dogfights were in progress in the Dieppe area as the autonomous 12 Group Wing (Nos 411,485 and 610 Squadrons), led by Wg Cdr P G Jameson DFC, swept in at 11,000 ft (3 360 m) and was immediately engaged by 50+ Fw 190s and Bf 109Gs. The leader of No 610 Squadron was Sqn Ldr J E 'Johnny' Johnson, DFC, later to rise to Fighter Command's second highest scoring fighter pilot, and his exploits during OPERATION JUBILEE were to earn him the Bar to his Distinguished Flying Cross.

When the enemy gaggle came down out of the sun, Johnson ordered the break and No 610 Squadron swung around to face the attack. In the ensuing combat Johnson shot down an Fw 190, followed by a Bf 109G-1, and then shared in the destruction of another 190, proving that the recent lack of activity in No 12 Group had done nothing to blunt the mettle of this able ex-wingman of the legendary Wing Commander Douglas Bader. The majority of Johnson's combats had been against Messerschmitt 109Fs during the previous summer, before the full potentialities of the Focke-Wulf had come to fruition, but after his third combat over Dieppe he found himself alone and then encountered a lone Fw 190. Each pilot spotted the other at the same time, and after some wary sparring in which they each searched for an opening, both pulled into a tight, gruelling turning circle. In theory, the Spitfire could easily out-turn the Fw 190, but on this occasion Johnson was alarmed to find the German had no difficulty in holding his rate of turn, and was actually gaining ground. There followed the most incredible display of evasive aerobatics which culminated in the Fw 190 latching firmly onto the incredulous RAF pilot. The battle lasted for over twenty minutes, with Johnson trying every trick, flying down village streets,

**Figures for destroyed, probably destroyed and damaged, respectively.*

"The object of all military management

is to increase the power of both material and manpower resources without adding to the cost of either"...

Lord Trenchard

The flexibility which the air-to-air refuelling systems developed by

FR

bring to the strategic and tactical use of air power in our opinion makes a significant contribution to this aim.

Flight Refuelling Limited,
Wimborne, Dorset, England.
Telephone Wimborne (020125) 2121
Telex 41247
Cables Refuelling Wimborne

turning round church steeples and flying under high-tension cables, in an effort to shake off his pursuer. On his own admission this was the toughest fight of his outstanding career, and he managed to survive the ordeal only by deliberately flying into the teeth of naval AA fire from British ships lying offshore. Johnson's combats of this morning were synonymous with the experiences of others in their intensity and violence, and go some way in quantifying the scale of RAF losses during JUBILEE.

At 08.25 hrs, all German forces in the West were put on the highest state of alert. It was later learned that OKW was convinced at the time that had the Dieppe assault succeeded in establishing a bridgehead, a much larger British force would have been sent to drive on to Paris. However, although it was admitted that the raid took the Germans by surprise, and that there was a great deal of confusion to start with, it was claimed that the situation was soon well in hand.

The decision by the British commanders to start the evacuation was made at 09.00 hrs, but by now all semblance of an orderly plan — so precisely tabulated and detailed — had dissolved into a series of desperate attempts to extricate as many troops from the carnage as time allowed. In answer to a Sitrep from the Air Force Commander at 09.56 the harrassed staff aboard HMS *Calpe* could only reply ... 'Situation too obscure to give useful report. Air co-operation faultless. Enemy air opposition now overhead. Have you any questions?'

The Bombers React

Enemy fighters were now maintaining a standing patrol of 20-30 directly overhead the beaches. At 10.00 hrs the first Dorniers and Junkers 88s, escorted by Fw 190s, arrived and started attacking the stationary vessels lying off the smoke-laden beaches. The bombers participating came from KG 2, II/ and IV/KG 40, III/KG 53, I/KG 77 and *Kampfgruppe* 106. To counter this move, No 11 Group immediately stepped up the number of Spitfire squadrons on patrol to nine, thus cutting the reserves to the bone.

The experiences of two Ju 88 crews of I/KG 77 who took part in the fighting during the morning and afternoon are of interest. The first relate that they had only recently been posted to the 3.*Staffel* from KG 51 in Russia. When they arrived at Creil on 24 July, a general air of expectancy of invasion was apparent in this unit, and numerous precautions were being taken. One *staffel* (squadron) was always on duty, and at night both flying and ground personnel of the duty *staffel* had to sleep in their clothes with weapons and iron rations handy. There were no such precautions for those off duty, however, and on the night of 18/19 August late passes were issued as usual and all was peaceful.

On the morning of the 19th the first alarm was given at a few minutes past six o'clock. All available crews stood to immediately and were briefed by the *Gruppenkommandeur* shortly afterwards. They were told that enemy landings had been made about 6 mls (10 km) either side of Dieppe, and were ordered to attack ships, barges and troops disembarking. Eight Ju 88A-4s of 3/KG 77 took-off from Creil on this raid, each carrying ten 50-kg (110-lb) bombs, with each of the two other *Staffeln* operating a similar number of aircraft. This particular crew missed the first sortie because their pilot was absent for dental treatment, but flew on the second sortie which departed at 11.00 hrs. Four Ju 88s set off this time, each carrying 50-kg (110-lb) and 250-kg (550-lb) bombs fitted with sea fuzes, and were escorted to the target by four Fw 190s. The pilot singled out a landing craft for his target, but missed with his salvo because of difficulty in controlling his aircraft — it was not fitted with diving-brakes.

The second crew of the *Gruppe* (flying Ju 88: 3Z+DH) were in their billet away from the aerodrome when the first warning was given at about 06.30 hrs, and their pilot, who had failed to hear the warning, was still in bed when transport arrived at 08.00 to fetch the crew to the aerodrome. One hour later the crew took-off in their Ju 88 bound for Dieppe.

The pilot climbed gradually, and reached the coast at about 6,000 ft (1840 m). There was 7-8/10ths cloud at about 3,000 ft (920 m), and the Junkers was therefore well above the cloud base. On reaching the target area the aircraft was nevertheless subjected to intense and very accurate AA fire. The pilot took violent evasive action and dived down below cloud; a number of ships were then seen lying about 6 mls (10 km) off Dieppe. The AA fire became even more intense and the pilot hurriedly singled out a transport to attack. The preliminary run was made, and the bombs were seen to drop well astern of the target. Immediately afterwards, the aircraft was attacked from different angles by four Spitfires and sustained about a dozen

continued on page 68





THE PART-TIMERS

The Auxiliary Air Force — proud to bear the added title 'Royal' since 1947 — was set up as a reserve force in 1925, played a vital rôle in the defence of Britain during WW II and continues today in the spirit of voluntary service and comradeship. This short account of the RAuxAF yesterday and today is contributed by E A Chris Wren, who served with the Auxiliary's No 604 (County of Middlesex) (Fighter) Squadron, during 1932–39, then with the RAF until 1946. Since then, his work as an aviation journalist and cartoonist has kept him in close touch with both the RAF and RAuxAF.

IF HOLLYWOOD had written the scenario for the Battle of Britain, you'd have said that really they'd gone too far — all that impossible drama, so many things going right just in time for the outnumbered goodies to clobber the all-conquering (up to then) baddies. Nevertheless, history confirms the truth of the improbable story and lists the factors which combined during the glorious summer of 1940 (even the weather was too good to be true) to stop the unstoppable.

Those of us who are old enough are now familiar with most of the names on the list: the Royal Air Force, "the Few", the Spitfire, Hurricane, Merlin, eight-gun armament, constant-speed propellers, 100-octane fuel, radar, and the valiant support of those who served on the ground.

But there is one vital piece of the amazing jig-saw which is rarely listed — the Auxiliary Air Force, whose contributions to the war effort, including the part it played in the Battle of Britain, won for it the prefix "Royal". Fourteen of the 66 fighter squadrons that the RAF was able to throw against the enemy in the crucial 1940 "Battle" were supplied by the AAF which, a week before the 1939 declaration of war, had been embodied in the RAF. As well as taking a substantial share of the strain in the B of B, the AAF's officers and airmen, 20 squadrons of them in all (several thousand trained men), contributed significantly to the Allies' air power throughout the World War II, justifying the decision, made in the mid-twenties, to establish an Auxiliary Air Force.

There was an even lesser known force — the balloon barrage element of the AAF, 47 squadrons of which, at nation-wide ground sites, put up hundreds of balloons to help protect cities, harbours and other vital targets against attack. The "balloonists" had an uncomfortable, often dangerous, never glamorous job and we in the flying squadrons did not envy them.

"If you want peace, prepare for war"

The intention of setting up RAF reserve forces had been included in the Air Force Constitution Act of 1917, the act which led to the merging of the Royal Naval Air Service with the Royal Flying Corps and the subsequent birth, on 1 April 1918, of the Royal Air Force. Eight months later, World War I ended and for the following 10 years or so, another "war to end wars" seemed out of the question — but the decade of the dictators was looming.

There is a good Latin motto, which my AAF squadron adopted: *Si vis pacem, para bellum* — "If you want peace, prepare for war". Great Britain wanted peace so fervently that she didn't prepare for war until it was almost too late. However, Marshal of the RAF Lord Trenchard, "Father of the Royal Air Force", with the support of a group of influential aviators led by Lord Edward Grosvenor, an ex-RNAS pilot, overcame opposition to the establishment of a "yeomanry of the air" and in 1923 the Government accepted the recommendation of the Salisbury Committee of the Committee of Imperial Defence, that the Home Defence Air Force should be organised "in part on a regular and in part on a territorial or reserve basis". The Auxiliary Air Force was subsequently officially formed by an Order in Council dated 9 October 1924.

Under the Auxiliary Air Force and Air Force Reserves Act, provision was made for raising seven Special Reserve squadrons (numbered 500 and up) and six Auxiliary squadrons (numbered 600 and up), with 20 Auxiliary squadrons as the long-range target. In fact, the battle order in 1939, when the Special Reserves had been incorporated in the AAF, was 20 squadrons.

In May 1925, No 502 (Ulster) Squadron made history when it

Early AAF equipment is represented (below) by this de Havilland D.H. 9A of No 601 (County of London) Squadron at Northolt in 1926, with the unit's well-known winged sword badge on the fuselage. The heading photograph (by courtesy of Charles E Brown) depicts Hawker Demons of No 604 Squadron, about 1937.





(Above) By 1932, three AAF Squadrons were resident at RAF Hendon. Flying Westland Wapitis at the RAF Display there in that year, they were (left to right in the formation, trailing red, white and blue smoke) Nos 604 (County of Middlesex), 600 (City of London) and 601 (County of London). (Below left) A Hawker Horsley bearing the markings of No 504 (County of Nottingham) Squadron, AAF.



began forming at Aldergrove as the first Special Reserve unit of Lord Trenchard's far-seeing plan. Northern Ireland having provided the first SR squadron, Scotland raised the first AAF squadron when No 602 (City of Glasgow) Squadron set up shop at Renfrew in September 1925. Not surprisingly, the first English unit was No 600 (City of London) Squadron. Others followed quickly — there was no shortage of volunteers. One of them, John Parkes of No 601 (County of London) Sqn, was the first Auxiliary pilot to get his RAF wings. He rose to eminence in the post-war aircraft industry and to this day, at the age of 74, owns and flies his own aeroplane, a vintage Leopard Moth.

The prime requirement for setting up one of these volunteer squadrons was a suitable RAF airfield near a substantially populated recruitment area. Each squadron had, eventually, an establishment of about 20 selected Regular NCOs and airmen, led by an Adjutant and Asst Adjutant who were responsible for the training and efficiency of the volunteers in the air and on the ground and for the basic running of the squadron. All the other officers, including the CO, together with over a hundred airmen, were volunteers.

Practical training was given at the airfield, in the hangars, workshops and offices, while classroom training, drill and sociable entertainment were carried on at the squadron's Town Headquarters, usually a suitable large and adapted house in the nearby city or town.

Conditions of Employment

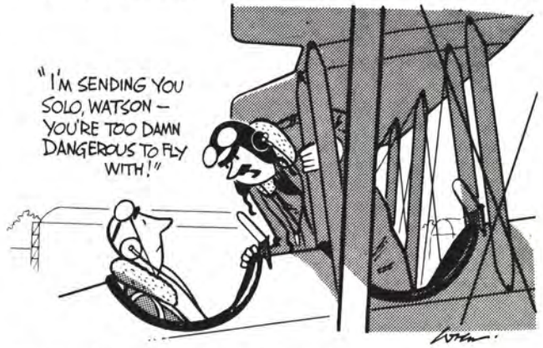
A would-be Auxiliary pilot had to hold a private pilot's licence to be accepted into a squadron and he had to be able to take time out from his work and private life to attend courses and flying training to win his RAF wings. He also needed to be moderately well off, as his Service income was far less than his outlay. Officers and airmen had to sign on for a minimum of four years, and to attend a minimum number of parades and lectures and at least one week of the two that were allotted for the annual summer camp.

Provided an airman put in the required number of attendances, he received (when I joined) an annual bounty of no less than £3, rising to £5 in later years. If this seems pretty parsimonious, which I suppose it was, I must tell you that during the Golden Thirties, when I was a young commercial artist, I was running a car and a girl friend or two on less than £5 a week. In due course, and grudgingly, travelling expenses were also granted to the part-timers.

But we Auxiliaries felt that any financial return was a bonus. It was really like being a member of a super flying club, with the added glamour (and, sometimes, discomfort) of being a part-time member of the Royal Air Force. We flew the same types of aircraft as the Regulars, and had to achieve and maintain high standards; in their civilian occupations, some of the airmen were already trained in engineering or radio or as clerks and were easily able to slot into similar RAF trades.

The Aircraft

From soon after their inauguration until just before World War II, most of the AAF squadrons were each equipped with about 10 single-engined, two-seat combat aircraft (D.H.9, Wapiti, Demon and others), one dual-control trainer version of the combat type, and two or three elementary trainers (Avro 504N, Tutor, Moth). So there was plenty of passenger flying and not a little "on-the-side" dual



instruction for the ground crewmen, some of whom also trained as air gunners.

Although equipment varied between squadrons, that of my own unit, No 604 (County of Middlesex) Squadron, was broadly representative of the majority: Formed (in 1930) with D.H.9As, we soon received 90-mph (144-km/h) Wapitis which in 1935 were replaced by the shapely, twice-as-fast Hawker Demons — but still open cockpit biplanes, typical of much of our air power even in 1938, when Chamberlain wisely made a deal with Hitler at Munich.

Our air forces were given a year's breathing space to re-equip with the new-generation aircraft, such as the Bristol Blenheim Mk I which 604 and other squadrons received in mid-1938. They came to us as bombers and we turned them into instant fighters by installing four additional forward-firing 0·303-in (7,7-mm) Brownings in a "punt" under the bomb compartment, in which were the ammunition boxes.

The Browning fired 1,200 rounds a minute — 20 a second; that meant *100 a second* from the Blenheim IF's five guns (one in the port wing was standard); *160 a second* from the Spitfire and Hurricane's

eight guns! Having seen and heard, on the butts and on sea-targets, what such fire-power means, I was glad I was going to be on the right side if there was a war. But these Blenheims, these graceful, sinister, darkly-camouflaged killers with their fearful power of destruction, made me suddenly realise that the Auxiliary Air Force was not, after all, just a splendid, free flying club with beautiful, silver biplanes from which we birdmen stuck out our helmeted and goggled heads into a thundering slipstream and, like the man said, "... danced the skies on laughter-silvered wings".

I, we, the squadron, the AAF, the "Week-end Fliers", existed as part of a vast, and growing, war machine. This had been the remote purpose behind all those carefree days at Hendon, Tangmere, Hawkinge, North Weald, in Scotland, at displays, aerobatics, formating, firing practice, drills, ceremonies, parties, pubs — all in such splendid company, many of whom now rest in graves in England, Europe, Africa and beyond.

When the Auxiliaries were called away from their homes and families and their work and play on 24 August 1939, not one man in 604 Squadron was absent, a record similar to those in the other part-time squadrons, I'm sure. Just before that day, Air Chief Marshal Sir Hugh Dowding, AOC-in-C of Fighter Command, had written in a memorandum:

"I calculate that by January 1940, I shall have 25 Regular squadrons equipped with modern fighters, plus 14 Auxiliary squadrons in various states of efficiency. Of these, six will be nearly





as efficient as Regulars, five will be semi-efficient, and the remainder of little value."

The assessment undoubtedly reflected the professional's innate suspicion of part-timers but was probably largely accurate. However, Britain had 10 months' grace before the attack was to be launched and our Forces, including the AAF, made the most of it. When the test came, our state of preparedness was very different.

First Blood

During the "Sitzkreig" (play on the term "Blitzkreig" — "Lightning war"), when there was only desultory action, the Auxiliaries shared defence and attack with the RAF. The first two German aircraft to be destroyed over the UK in World War II fell to Auxiliary pilots flying Spitfires — the very first on 16 October 1939, to Edinburgh's No 603; the second, only minutes later, to the Glasgow Squadron. Actions like these helped to prepare the part-timers for the big show, the Battle of Britain. From that conflict, the Auxiliaries emerged with honour and with some 700 enemy aircraft claimed as destroyed — a figure increased to 900 by June, 1941. The gap between "the professionals" and "the week-end fliers" was closed, in the air, on the ground and in the pubs.

Inevitably, the tragedies and the fortunes of war gradually changed the make-up of the Auxiliary squadrons, for which recruiting had stopped when we were embodied. Dead and wounded personnel were replaced, and promotions and postings began to disperse Auxiliary officers and airmen to other squadrons and stations. Nevertheless, several squadrons retained their pre-war flavour and spirit. One of these was 604, which was chosen to develop and use airborne radar

Squadrons of the AAF had been brought to a high state of operational efficiency by the Spring of 1940, when they were thrown into the Battle of Britain to fly and fight alongside the Regular squadrons on an equal footing. By the end of that Battle, the AAF squadrons such as No 610 (County of Chester), whose Spitfire IIs are shown (below) in August 1940, had claimed a total of 700 enemy aircraft destroyed.





Volunteer personnel of the RAuxAF help to man three Maritime HQ Units responsible for monitoring the movements of surface and below-surface vessels around Britain's shores. The Synthetic Operations Room in the Town HQ of No 1 (County of Hertford) MHU is illustrated.

in night fighters, led by, among others, John Cunningham. A superb pilot, working with de Havillands, he had joined the squadron in 1935, aged 18, and with Jimmy Rawnsley, an Auxiliary air gunner, as his radar operator, he clobbered 20 German night raiders. The two men finished the war as Group Captain and Squadron Leader respectively, with eight decorations between them to mark their outstanding valour. Other Auxiliaries — Max Aitken, Whitney Straight, Rory Chisholm, "Cocky" Dundas among them — are high on the list of "ace" fighter pilots.

The part-timers, air and ground crews, operated in all theatres of war and in all Commands. In North Africa, No 602 beat up Rommel's tanks; in Holland, No 613's Mosquitoes made the pinpoint attack on Gestapo headquarters in The Hague; No 605 was the first to destroy a V1 "Buzz-bomb"; No 616 was the first in the RAF to receive jet-powered aircraft — Meteors. And let us here pay tribute to the ground crews who in hangar, workshop and office and in the field, put in their 12-hour day (and night) and seven-day week, with no overtime pay. The "other" AAF operated approximately 1,500 barrage balloons throughout Great Britain and in the Middle East, India and Burma.

In recognition of the AAF's distinguished wartime service, the prefix "Royal" was granted in December 1947. To avoid confusion with the Royal Australian Air Force, the Royal Auxiliary Air Force is abbreviated to RAuxAF.

At the war's end, the balloon squadrons were disbanded but the flying squadrons were re-established in their part-time rôle, equipped with the latest Spitfires and the new jets — Meteors and Vampires. For some ten years it was like old times, except that there was very little flying for non-aircrew. On the other hand, improved aircraft performance allowed annual camp to be held in such suntraps as Malta.

End of the Line

Alas, the bleak hand of economics then reached out to end the good life. In March 1957, the flying squadrons were disbanded and with them went a large slice of the best in the British character — voluntary service, to the point of death, for one's country. However, the "aerial yeomanry" of Trenchard and Lord Grosvenor had amply justified the foresight and faith of their sponsors, and perhaps there is no place for the part-time, front-line aviator in the demanding world of today's supersonic, advanced-technology weapons systems, although the Americans have *two* part-time air forces — the Air Reserves and the Air National Guard.

The great disbandment was not the end of the RAuxAF — it continued as an organisation of fighter control and radar reporting units until they in turn were stood down and a change made to the present form, three Maritime Headquarters Units: No 1 (County of Hertford), No 2 (City of Edinburgh), and No 3 (County of Devon).

They monitor the movements of potentially hostile surface and below-surface vessels in peacetime, and co-operate with Nimrod long-range maritime reconnaissance and anti-submarine aircraft of No 18 Group to keep this country's vital sealanes clear of enemy interference in wartime. The men and women volunteers receive a thorough training in communications, in the operation and control of RAF aircraft far out over the oceans, and in the guidance of ships of the Royal Navy into attack positions. The spirit of voluntary service, allied to comradeship and the social pleasures, still continues in the RAuxAF.

My own golden memories are preserved in a corner of what is left of the old Hendon airfield on the north-west outskirts of London. There, the elegant superstructure of the RAF Museum covers two World War I hangars which for some ten years were the homes of 600 and 604 squadrons, and are now the basis of the Museum's exhibition hall. Surrounded by historic aircraft, we surviving elders can look up at the enduring wooden beams from which the damned sparrows and blackbirds used to chirrup and mess up the silvered fabric and the trim RAF roundels down below on our taut and shining biplanes and, briefly, on our camouflaged Blenheims.

Now, the feathered birds are kept out but the wood and fabric and metal ones are exquisitely preserved, along with my memories of the yeomen of the air, the week-end fliers, the part-timers — the Auxiliaries. □

"Not many of us left now," says ex-Flt Lt Chris Wren, author of this article, to his son, Flt Lt Chris Wren, RAF, pointing to a Hawker Hind — nearest relative in the RAF Museum to the Hawker Demons of Wren Senior's No 604 Squadron, which from 1930 to 1939 occupied one of the two Hendon hangars that form the basis of the Museum building.



THE MARK OF PRECISION

Louis Newmark Limited

Electronic and precision engineers, horological specialists

Design and manufacture of in-flight equipment selected for the following RAF aircraft: PUMA WESSEX · HAWK MRCA PHANTOM

Training aids for: HARRIER NIMROD

Sole importers of AVIA Swiss watches

Newmark House 143-149 Gt. Portland St. London W1N 6BP



If you're making the leap into colour, and most of us are now, make sure you choose a set which incorporates our new 20AX colour TV system.
Use of the latest techniques gives greatly improved picture quality...
...Simple design means better reliability – and less to go wrong...
...And quick warm-up time means a picture within five seconds.
Add this to a new slimline 110° picture tube and you've got the most advanced TV Colour System in the world.
Mullard don't make complete TV sets – but the 20AX Colour system certainly helps setmakers make better sets!
Remember! Ask for a set which has the 20AX Colour TV System.

Mullard

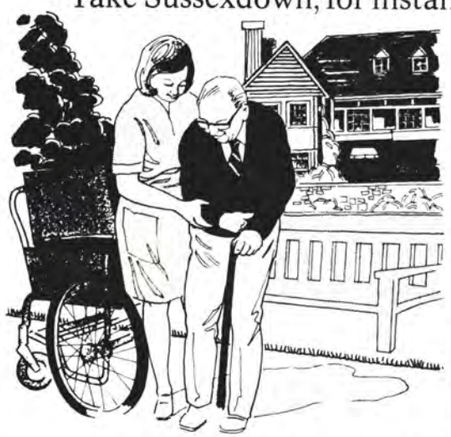
Mullard manufacture and market electronic components under the **Mullard, Philips** and **Signetics** brands.

The things we do...

The Royal Air Forces Association always strives to provide the best in welfare services for those who have served, or are serving, in the Royal Air Forces.

Take Sussexdown, for instance,





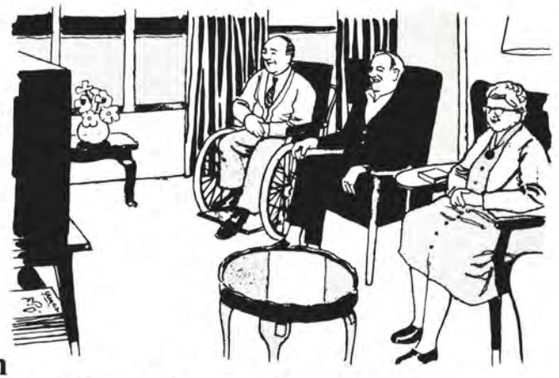
the Association's home for the permanently and badly disabled who are alone with no family to look after them. And Richard Peck House, its convalescent home by the sea for men and women, and members of their families, who need care and attention after illness.

Then there are all the other welfare services, from pensions to housing, and from employment to legal matters, in which the Association's specialists are always ready to help, working in close harmony with the RAF Benevolent Fund.

with the help of people like you.

It is all made possible through the enthusiastic efforts of the members of the Association—there are more than 109,000 throughout the world—and the support of people like you. The fact that you have purchased this Year Book has helped!

Sussexdown alone costs over £3,500 a week to run with its expert medical and nursing facilities. But with the help of people like you we will continue to provide the best we can for those who really deserve it.



For their sake, please don't stop.

The Royal Air Forces Association
Central Headquarters 43 Grove Park Road London W4 3RU



EVOLUTION OF RAF BOMBERS



SIXTY YEARS OF OFFENSIVE AIRCRAFT DEVELOPMENT REVIEWED BY H F KING

ANY ACCOUNT of the development of bombers for, and in, the Royal Air Force must, in the beginning, touch upon the types of aircraft inherited by that Service when, on 1 April 1918, it was brought into existence by amalgamating the Royal Naval Air Service and the Royal Flying Corps. By naming those immortal air arms in the order given, one accords due precedence to the Senior Service; and this is doubly justified, in the present instance, for it was in the RNAS that strategic bombing and low-level strike, as we know the terms today, had their true beginnings and first achieved fulfilment.

These incontestable facts give courage to the present writer to advance yet another belief, which — though it may arouse dissension — may also afford (in these times of national negation) a measure of pride. The belief is simply this: that the world's first bomber — if by this expression we connote not merely an aeroplane from which bombs can be dropped by hand, but one for which a bomb-release and sighting system was designed and developed more or less in parallel — was *British*. The "private-venture" aeroplane concerned was the Sanders Biplane No 2, built in 1911, and with which were associated not merely retractable main-wheels but a 'bomb-dropping' device also — gimbal-mounted and used in conjunction with a "sighting telescope".

This brief allusion to a little-known aeroplane is no mere tentative toot on Britain's somewhat crumpled trumpet, but a reminder that a bomber is no better than its bombing capability, and that the aeroplane itself — no matter how perfect it may be as a flying machine — represents just a part of the effort and hardware involved. Nor will it be superfluous to add that (contrary to general belief) well before war came in 1914, considerable work had been done in Britain on bombs, bombsights, and associated gear. That no air force was truly *prepared* for bomb-dropping in August 1914 is a wholly different consideration, for reconnaissance was dominant in the minds of military planners — and who shall say they were wrong?

In not too long a time came the RAF; and now having, as it were, re-stated the dictum of Lord Trenchard that 'The RAF exists for Armament' we appraise the inherited types of aircraft earlier mentioned (not forgetting, in passing, those persistent pushers the F.E.2bs — true relics of a bygone age). The true inheritance is reducible to the de Havilland D.H.9A and D.H.10 (the fast-and famous 'Four', and the 'Nine' also, of which almost the reverse might be said, having quickly become obsolescent); the Handley Page O/400 and V/1500; and the Vickers Vimy.

Neither the twin-engined O/400 nor the giant V/1500 continued long in service, although the latter was notable as the RAF's first four-engined bomber (span 126 ft/38,43 m or 24 ft/7,32 m more than a Lancaster's); and although the D.H.10 and Vickers Vimy 'twins' worked hard, in the Middle East especially, only the 1919 Atlantic crossing by Alcock and Brown in a Vimy (very much an RAF effort, be it remembered) endures in the annals of world aeronautics. At a time when the RAF was being not merely decimated, but liquidated also, this 16-hour over-water flight was no passing glory; and only six months later (in December 1919) a foundation for the peacetime RAF was being laid in a memorandum entitled *The Outline of a Scheme for the Permanent Organization of the RAF*, drawn up by Sir Hugh Trenchard and presented to Parliament by Mr Winston Churchill.

It is well to remember here that in June 1918 Maj-Gen Trenchard (as he then was) commanded the new Independent Force, established for the strategic bombing of German military centres, and that among the 550 tons (559 tonnes) of bombs delivered by this force in five months were several of 1,650-lb (750-kg) — not merely one or two as commonly believed. No 207 Squadron alone dropped seventeen of these great bombs in about one month, and had the war gone on there would have been 3,300-lb (1 500-kg) bombs for the V/1500s. Also, by this culminating period, the famous Wimperis 'CSBS' (course-setting bombsight) was coming into use — and was to continue so until the next great war.

From the weapons, back to the aeroplanes — and among those under scrutiny the D.H.9A stands head and shoulders above the rest, both in its length of service (1918–1931) and in its overall







Depicted in the next column are four of the biplane bomber types used by the RAF in the period 1918-1938 and the Service's first monoplane bomber. From top to bottom, the photographs depict the de Havilland D.H.9A (No 8 Squadron), the Vickers Virginia Mk X (No 10 Squadron), the Fairey Fox IA (No 12 Squadron), the Fairey Hendon (No 38 Squadron) and the Boulton Paul Overstrand (No 101 Squadron).



Westland Wapiti IIAs (here in the markings of No 55 Squadron) served primarily overseas in the bombing rôle, although nine of the Auxiliary Air Force units flew the type from UK bases for several years.

usefulness. Even more than this: its essential characteristics were still apparent in the Westland Wapiti and Wallace, which (though their tasks were now lowly) soldiered on into World War II.

If ever an aeroplane epitomised the spirit, purpose, tradition — and sheer cussedness and doggedness — of the RAF it was the 'Ninak'; and the most surprising things about it were that it represented not only a partnership between two British firms, but an Anglo/American partnership also. Conceived as a fast day bomber, having the new and powerful (400 hp) American Liberty engine, it was an enlarged development of the D.H.9. The company chiefly responsible for the redesign entailed was not, in fact, de Havilland at all (or The Aircraft Manufacturing Co, as the firm then was) but Westland — the parent Airco being quite busy enough in bringing on the D.H.10.

The more pedantic students of military aircraft development might argue that the D.H.9A had, in fact, only a slightly longer Service career than, say, the O/400, in that for the greater part of its life-span it served not as a specialised bomber, but in a class familiar to the RAF as "GP", or "general purpose". This being so, it was often required to carry (again in Service parlance) everything except the kitchen sink — eg, not only bombs and guns, but a tropical radiator (it really was hot out there in Iraq, Egypt and India); extra petrol tankage; containers for emergency rations and water; and a spare wheel — for camel-thorn was not least among the hazards of an off-station landing. Picketing screws and bedding among the typical loads testified to the uncertainty as to where the night might be spent. Yet — all this apart — a full bomb load for a "clean" D.H.9A (typically two 230-lb/104-kg or four 112-lb/51-kg) remained standard for RAF single-engined bombers (except the "outsize" Aldershot and Horsley) until the Hawker Hind of the late 1930s — an immediate precursor of the twin-engined Bristol Blenheim.

Following the D.H.9A, the RAF's general-purpose types were the six following (the date connoting — as throughout this narrative — introduction into service). But, before the summary, one point for emphasis: although the GP types often acted as policemen or firemen, rather than aggressive combatants — the RAF having been given military control of Iraq as early as October 1922 — they also formed the equipment of officially designated bomber squadrons, and played a by no means passive part in the annual Air Exercises over the UK. And so we have:

WESTLAND WAPITI (1928) with Bristol Jupiter air-cooled radial engine. Apart from being a "metalised" development of the D.H.9A, the Wapiti had two interesting distinctions: first, it never formed the equipment of a single "Regular" squadron in the UK, although it was used by seven such squadrons overseas and by nine Auxiliary Air Force squadrons from Home bases; second, the "Auxiliary Waps" could be quickly distinguished by their shorter noses — having ungeared engines.

FAIREY IIIF (1928) with Napier Lion water-cooled "broad-arrow" form engine. A development in the Fairey Series III, introduced in 1917, and especially of the IIID, which served mostly with the Fleet Air Arm.

FAIREY GORDON (1931). Much the same as the IIIF, but with Armstrong Siddeley Panther radial engine.

WESTLAND WALLACE (1933). A cleaned-up and lengthened Wapiti, with the new Bristol Pegasus engine. Used only by Home-based Auxiliary squadrons.

VICKERS VINCENT (1934). A counterpart of the Vildebeest shore-based torpedo bomber, and likewise Pegasus-powered.

HAWKER HARDY (1934). A specially equipped variant of the Hart day bomber, similarly with unsupercharged Rolls-Royce Kestrel water-cooled engine.

Although the Vincent could carry, if required, about double the bomb load of any of the other types, a typical loading would be as earlier quoted for a "clean" D.H.9A — or, alternatively, several groups of four 20-lb (9-kg) bombs. Invariably there was a fixed, belt-fed Vickers machine gun for the pilot, and a free-mounted drum-fed Lewis for the air gunner. Mention of the famous Vickers "front gun" conveniently brings us to consider more specialised types of bomber, as they developed in the RAF; and first among these comes the Avro Aldershot (1924) which was remarkable because, although single-engined (Rolls-Royce Condor) its wing span was nearly 70 ft (21,35 m) — and even this did not dissuade the Directorate of Operational Requirements at the Air Ministry (with wartime memories still strong) from insisting on the pilot's time-honoured "pet Vickers". Another point about the Aldershot was that, like the even larger multi-engined "heavies", it could handle the 520-lb (236-kg) thin-case or 550-lb (250-kg) thick-case bombs of wartime pattern.

Our attention now having turned again to armament (as, indeed, it must if operational capability is given due consideration — that is "What bomb load for what range and with what chance of success by virtue of armament and/or speed?') it is of some importance to note that the bombs just mentioned did, in fact, weigh just about 520 lb (236 kg) and 550 lb (250 kg) respectively. Far from being a facetious observation, this is a matter to be pondered, having regard to the fact that bomb-weights (like gun-calibres) were generally nominal rather than actual: thus the time-honoured 230-lb (104-kg) bomb was really more like a 200-pounder (91 kg) while, conversely, the even more famous "20-lb (9-kg) Cooper" actually turned the scales at 24 lb (11 kg). Multiplied (as they were on bombers) these discrepancies could be significant; and as for range and speed, there will be more to add.

The Long-ranging Horsley

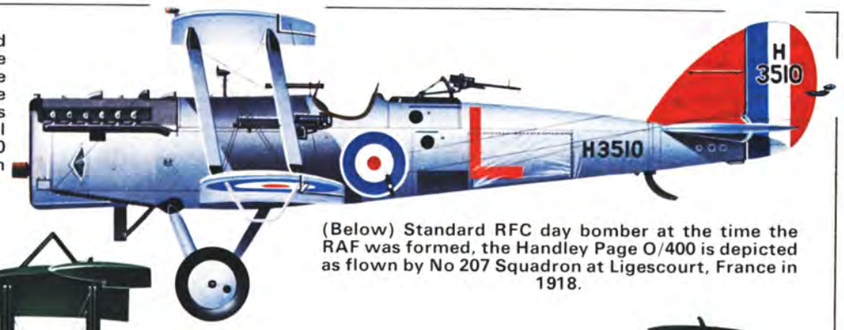
Reverting to the Aldershot and its big bombs, this had only a short stay in the RAF — unlike another large single-Condor type, the Hawker Horsley (1927) which, though smaller than the Aldershot (but nevertheless spanning 56·5 ft/17,23 m) was a champion weight-lifter. So true was this that not only would it take the 1,650-lb (750-kg) bomb, as delivered by twin-engined Handley Pages in 1918, but, alternatively, a torpedo, and it was issued accordingly to shore-based torpedo bomber squadrons — units of this de-nomination being a factor in RAF strategy from 1928 onwards, and

Handley Page O/400 Cutaway Drawing Key:

1 Twin 0·303-in (7,62-mm) Lewis guns
2 Rotatable Scarff ring
3 Gunner's cockpit (plywood construction)
4 Folding seat
5 Slat flooring
6 Entry hatch to gunner's cockpit
7 ASI pitot tube
8 Negative lens
9 Rudder pedals
10 Control wheel
11 Clear Pyralin windshield
12 Padded cockpit coaming
13 Pilot's seat
14 Observer's seat
15 Slat flooring
16 Light-bomb rack (manual)
17 Batteries
18 Trap-type forward entry door
19 Fabric lacing
20 Transparent panel
21 Plywood turtle-deck
22 Aluminium fairing
23 Steel propeller hub
24 Brass tip sheathing
25 Four-blade walnut propeller
26 Radiator filler cap
27 Radiator
28 360 hp Rolls-Royce Eagle VIII engine
29 Exhaust manifold
30 Nacelle bracing strut/control spar
31 Oil tank, 15 Imp gal (68 l) in each nacelle
32 Rigging lines
33 Streamlined steel struts
34 Double flying cable braces
35 Spruce/plywood inner strut
36 Double flying cable braces
37 Single landing cable brace
38 Single stagger cables
39 Spruce/plywood outer strut
40 Double flying braces
41 Outer aileron control horn
42 Cabane braces (four point)
43 Steel cabane
44 Inner aileron control horn
45 Solid end ribs
46 Wing dihedral break-line
47 Gravity-feed fuel tanks in leading edge, two of 12-Imp gal (54,5-l) capacity
48 Centre-section streamlined forward cabane strut
49 Centre-section streamlined aft cabane strut
50 Forward cylindrical fuel tank (held by web straps), capacity 130 Imp gal (591 l)
51 Filler cap
52 Cross member
53 Engine control pulley cluster
54 Centre-section main bomb-bay
55 Six volt wind-driven generator (port and starboard)
56 Perforated baffle plate
57 Air-driven fuel pumps
58 Aft fuel tank, capacity 130 Imp gal (591 l)
59 Solid rib at dihedral breakline
60 Upper gunner's seat
61 Transparent panels
62 Ammunition racks
63 Ventral gunner's hatch
64 Clear Pyralin panels
65 Gunner's slatted flooring
66 Plywood bulkheads
67 Single dorsal 0·303-in (7,62-mm) Lewis gun
68 Fabric lacing
69 Control cable pulleys
70 Fuselage frame
71 Multi-strand cable bracing
72 Elevator control cable
73 Interplane streamlined spruce strut
74 Starboard rudder
75 Fabric-covered upper tailplane
76 Elevator control horn
77 Fixed surface centre-section
78 Fabric-covered elevator
79 Port rudder spruce frame
80 Port lower elevator frame
81 Fabric-covered lower tailplane
82 Rudder hinge spar
83 Plywood tail covering
84 Rear navigation light
85 Interplane strut
86 Vertical stabilizer
87 Steel attachment point
88 Faired struts
89 Tailskid
90 Removable fabric panel
91 Lifting points (stations 10 and 12)
92 Port steel cabane
93 Rear upper mainplane spar
94 Forward upper mainplane spar
95 Plywood covering
96 Steel fitting
97 Solid drag strut
98 Wing structure
99 Port aileron structure
100 Port outer interplane struts (plywood-covered spruce)
101 Lower mainplane end rib
102 Wing structure
103 Leading-edge rib construction
104 Port inner interplane struts (plywood-covered spruce)
105 Hinge strut
106 Lower mainplane dihedral break-line
107 Steel tube engine nacelle support struts
108 Wing/fuselage attachment points
109 Wing root walkway
110 Fire extinguisher
111 Starboard undercarriage
112 Undercarriage forward strut
113 Port twin mainwheels
114 Faired rubber chord shock strut
115 Aft strut

PILOT PRESS
COPYRIGHT
DRAWING

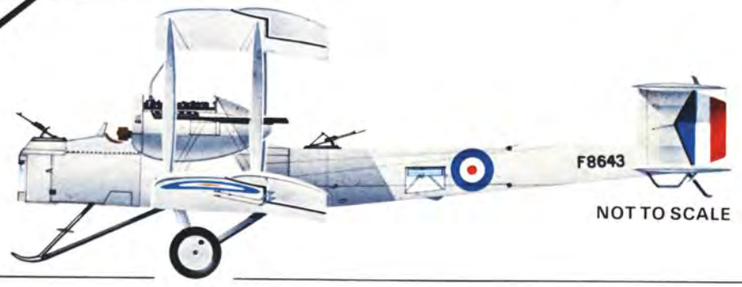
(Right) The de Havilland D.H.9A (colloquially, the "Ninak") entered service almost at the same moment that the RAF was founded, and served until the late 'twenties. H3510 was with No 8 Squadron in Iraq in 1926.



(Below) Standard RFC day bomber at the time the RAF was formed, the Handley Page O/400 is depicted as flown by No 207 Squadron at Ligescourt, France in 1918.



(Right) The Vickers Vimy served from late 1918 until 1931. F8643 illustrated was with No 70 Squadron in Heliopolis in 1921.



NOT TO SCALE





(Above) Hawker Horsley day-bomber, as operated in 1929 by No 33 Squadron at Netheravon.



(Above) The Fairey Fox I day-bomber served with only one squadron — No 12 — but had an impact upon RAF bomber evolution far greater than its numbers suggest.

NOT TO SCALE

(Above left) The RAF acquired some 450 Hawker Hart light day-bombers, used from 1930 onwards. K1422 was with No 57 Squadron at Upper Heyford in 1934.

even today having a surviving link in the Hawker Siddeley Buccaneer-equipped squadrons.

The Horsley's disposable load could otherwise be in the form of fuel; and so it came about that in May 1927 one of the new Hawkers, specially prepared as the trans-Atlantic Vimy had been, flew a distance of 3,420 miles (5500 km) in 34½ hrs. The flight ended when the Horsley had to make a forced landing, but even so, it set an unofficial world record which might have been accorded greater notice had not a young American named Lindberg beaten it almost immediately.

The range/load factor in bomber capability was to be re-emphasised by a Fairey Long-range Monoplane (to which the Hendon bomber owed a tangible debt) that broke the World's Long-distance Record in 1933; and likewise by a pair of special Vickers Wellesleys that brought off a similar trick in 1938, and were far more closely related to the immortal Wellington than the Fairey L.R. had been to the by no means immortal Hendon. In any case, this serves to show that the record-breaking business was not altogether a Schneider/Spitfire/fighter affair, as one is sometimes tempted to believe, but was closely related also to RAF bomber development.

There is something more to say about these seemingly "sporting" efforts — that some pretty deep thinking was going on among the boffins of those times, not in the industry alone but also at the too-often derided Royal Aircraft Establishment at Farnborough, which was continually seeking to improve our bombers' range. This quest was not limited to achieving greater aerodynamic and engine efficiency, but extended to the catapulting of 'heavies' to permit yet higher all-up weights. In 1931, for instance, the RAE was launching a Vickers Virginia by compressed air, and catapult-launch was originally intended, though not adopted, for some famous British bombers of World War II. During the 1920s and 1930s, in fact, Farnborough boffins were experimenting, at home and overseas, with the Larynx pilotless bomber or flying bomb (200 lb for 200 miles at 200 mph (91 kg/320 km/320 km/h), and, after a specimen had flown up the Bristol Channel, the men concerned were congratulated personally by the great "Boom" Trenchard.

Of matters such as these the public and the RAF knew little or



The Avro Lancaster is the most famous of all the bombers that have served with the RAF. The last airworthy Lanc maintained by the Battle of Britain Memorial Flight is seen here concluding its 1976 display season with a fly-past over the RAF College, Cranwell.

nothing; but less exotic developments command renewed attention, and earlier references to the Horsley and considerations of long range form a valuable link in our story for the reasons following.

The Horsley was a Service successor to the Fairey Fawn — a bomber that has become, a little unjustly perhaps, something of an Aunt Sally among historians because of its poor performance when matched against the far-famed Fairey Fox (the analogy being that the Fawn represented what the Service specified, and the Fox what Richard Fairey thought they ought to have). Truth to tell, there was not a vast difference between the Fawn and the IIIF and Gordon of later years — with two very prominent exceptions: both of them petrol tanks perched up on the top wing. Even these were not mere whimsical afterthoughts, but accorded with a current Air Ministry

NOT TO SCALE

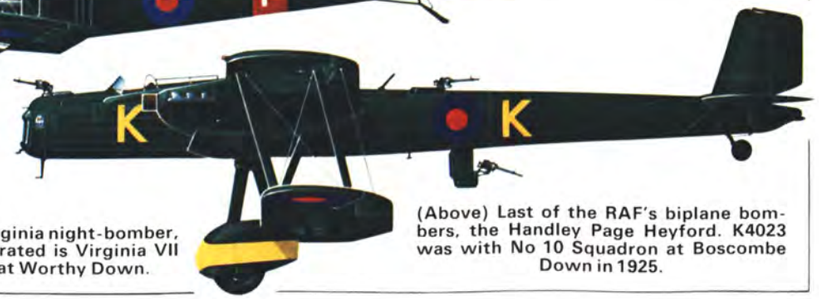


(Left) The Boulton Paul Overstrand, used by No 101 Squadron from 1935 to 1938 at Bicester, was the RAF's first bomber to have powered gun turrets.



(Above) The Handley Page Hyderabad night-bomber served from 1925 and is shown in the markings of No 99 Squadron at Bircham Newton in 1927.





(Above left) The Vickers Virginia night-bomber, in service 1924-1937. Illustrated is Virginia VII J7431 of No 7 Squadron at Worthy Down.

(Above) Last of the RAF's biplane bombers, the Handley Page Heyford. K4023 was with No 10 Squadron at Boscombe Down in 1925.

Vickers Wellington B Mk III Cutaway Drawing Key:

1 Forward navigation light
2 Two 0·303-in (7,7-mm) Browning machine-guns
3 Frazer-Nash power-operated nose turret
4 Turret fairing
5 Parachute stowage
6 Bomb-aimer's control panel
7 Nose turret external rotation valve
8 Bomb-aimer's window
9 Bomb-aimer's cushion (hinged entry hatch)
10 Parachute stowage
11 Rudder control lever
12 Fuselage forward frame
13 Camera
14 Elevator and aileron control levers
15 Bomb-bay forward bulkhead (canted)
16 Cockpit bulkhead frame
17 Pilot's seat
18 Control column
19 Nose compartment/cabin step
20 Instrument panel
21 Co-pilot's folding seat
22 Windscreen
23 Hinged cockpit canopy section (ditching)
24 Electrical distributor panel
25 Aerial mast
26 R.3003 controls mounting
27 Tail unit de-icing control unit
28 Armour-plate bulkhead
29 Wireless-operator's seat
30 Wireless-operator's desk
31 Motor generator (wireless installation) and HT battery stowage
32 Bomb-bay doors
33 T.R.9F wireless unit crate
34 Aldis signal lamp stowage
35 Navigator's desk
36 Navigational instrument and map stowage
37 Navigator's seat
38 Folding doors (sound-proof bulkhead)
39 Fire extinguisher (on leading-edge fuselage frame)
40 Flying-controls locking bar ("nuisance bar") stowage
41 Wing inboard geodetic structure
42 Cooling duct exit louvre
43 Flame-damper exhaust tailpipe extension
44 Engine cooling controllable gills
45 Bristol Hercules XI radial engine
46 Exhaust collector ring
47 Three-blade Rotol electric propeller
48 Three-piece engine wrapper cowl
49 Carburettor air intake scoop
50 Engine mounting bearers
51 Starboard oil tank
52 Starboard nacelle fuel tank, capacity 58 Imp gal (284 l)
53 Wing forward fuel tank train, capacity 52 Imp gal (236 l) inboard, 55 Imp gal (250 l) centre, 43 Imp gal (195 l) outboard
54 Twin-boom inboard wing spar
55 Wing aft fuel tank train, capacity 60 Imp gal (273 l) inboard, 57 Imp gal (259 l) centre, 50 Imp gal (227 l) outboard
56 Fuel filler caps
57 Spar twin/single boom transition
58 Pitot head piping
59 Cable cutters
60 Pitot head
61 Spar construction
62 Starboard navigation light
63 Starboard formation light
64 Aileron control rod stop bracket
65 Ball-bearing brackets
66 Starboard aileron
67 Aileron control rod
68 Aileron control articulated lever
69 Aileron trim tab control cable linkage
70 Aileron trim tab
71 Trim cables
72 Aileron control rod joint
73 Fuel jettison pipe
74 Flap operating shaft
75 Flap links
76 Flap trailing-edge
77 Aileron control rod adjustable joint
78 Dinghy stowage
79 Flotation gear CO_2 bottles
80 Fuel lines
81 D/F loop fairing
82 Dorsal identification light
83 Hand grips
84 Oxygen cylinders
85 "Floating"-spar centre-section carry-through
86 Reconnaissance flares
87 Wing forward pivot fixing
88 Spar/rib pick-up
89 Spar aperture
90 Rest bunk (stowed against port wall)
91 Sextant steadying frame
92 Astro-dome
93 Flap actuating cylinder
94 Flame float/sea marker stowage
95 Flap synchronising mechanism
96 Parachute stowage
97 Reconnaissance flare launching tube
98 Trailing-edge fuselage frame
99 Geodetic construction
100 Whip aerial
101 HF aerial
102 Beam gunner's heated-clothing/oxygen supply/intercom sockets
103 Starboard beam gun
104 Ammunition box
105 Gun mounting
106 Fuselage upper longeron
107 Tail turret ammunition boxes
108 Parachute stowage
109 Rudder tab control cables
110 Ammunition feed tracks
111 Roof light
112 Tail turret external rotation valve
113 Starboard tailplane lower geodetic panel
114 Tailplane spar
115 Elevator balance
116 Starboard elevator
117 Elevator trim tab
118 Trim tab control cables
119 Fin geodetic structure (lower section)
120 Fin de-icing overshoe
121 Fin upper section
122 Non-kink de-icing connector hose
123 Rudder mass balance weights
124 Rear navigation/formation lights
125 Rudder combined trim/balance tab
126 Rudder post
127 Tab actuating rod
128 Tab control cables
129 Rudder actuating lever
130 Tail turret entry door
131 Frazer-Nash tail turret
132 Four 0·303-in (7,7 mm) Browning machine-guns
133 Cartridge case ejection chute
134 Elevator tab
135 Port elevator
136 Elevator balance
137 Tailplane structure
138 Tail ballast weights
139 Elevator control lever
140 Tail main frame
141 Tailwheel well
142 Rearward-retracting tailwheel
143 Wheel fork
144 Tailwheel retraction mechanism and trunnion housing
145 R.3003 radio mounting
146 Tail turret ammunition boxes
147 Port beam gun
148 Trailing-aerial winch and outlet tube
149 Beam gunner's folding seat
150 Entry ladder (stowed)
151 Walkway
152 Two first-aid packs (internal/external access)
153 Elsan closet
154 Wing aft pivot fixing
155 Flap actuating cylinder
156 Bomb-bay aft bulkhead (canted)
157 Schrenk flaps
158 Fuel jettison pipes
159 Port aileron tab
160 Aileron hinge fairings
161 Port aileron
162 Port formation light
163 Port navigation light
164 Cable cutters
165 Wing geodetic upper panels
166 Retractable landing lights
167 Spar twin/single boom transition
168 Nacelle/rear spar attachment
169 Mainwheel door
170 Mainwheel retraction jack
171 Nacelle/rib pick-ups
172 Nacelle/main spar fixing
173 Main spar carry-through
174 Cabin heating header tank
175 Cabin heater installation
176 Carburettor air intake scoop
177 Controllable gill actuating shaft
178 Mainwheel shock-absorber cylinders
179 Brake cables (armoured flex piping)
180 Port mainwheel
181 Oil cooler air scoop
182 Engine mounting ring
183 Nacelle panel securing cables
184 Exhaust collector ring
185 Cowling support stays
186 Propeller hub
187 Three-blade Rotol electric propeller
188 Triple-cell bomb-bay: equipped with
189 Fourteen flotation bags (stowed)
190 Flotation bags (inflated)

safety policy. Moreover, the Fawn was officially classed as a two-three seater and was larger and heavier than the D.H.9A, and (though quite pleasant to fly) appeared as a retrograde step when compared with the clean-cut de Havilland day bomber of 1918. Yet, while there is no disputing that the hand of officialdom may have weighed too heavily on the Fawn's designers, Sir Richard Fairey (as he became) admitted in later years that, in laying out the Fox (1926) the maker may have had "too much his own way". So — both for logical and chronological order — let us examine the Fox.

Technically, this small, exquisitely clean biplane was remarkable for three reasons: first the small frontal area made possible by the Curtiss D.12 engine — American, like the cooling system and propeller; second, the suppression of every possible excrescence — even the defensive Lewis gun being retractable into the fuselage on a new type of Fairey mounting (one British feature, at least!); third, the ability — even with two externally-slung 230-lb (104-kg) bombs — to give RAF fighters the slip. If ever an aeroplane was aptly named, it was the Fox; but that there were red faces and sore heads — especially over the matter of the American power plant — will come as no surprise in these present times. There followed, however, a happy re-engining with the Rolls-Royce Kestrel — a direct forerunner of the Merlin, still so well remembered.

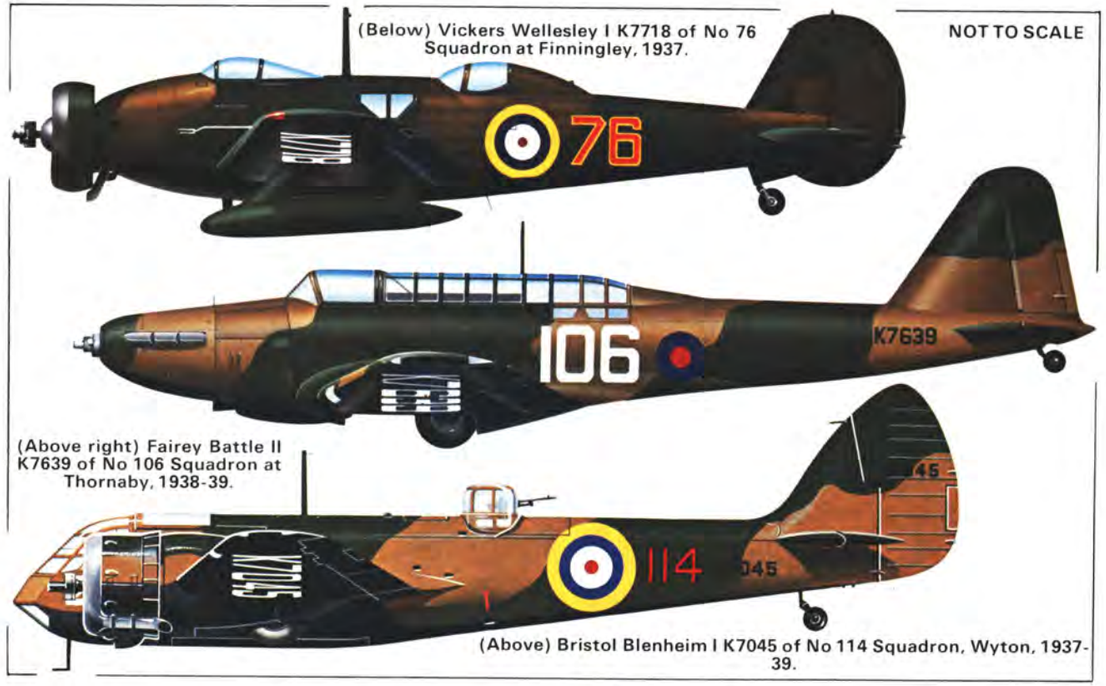
It was, in fact, the extremely clean 'entry' afforded by the Kestrel which in large degree gave the Fox's successor — the Hawker Hart (1930) — the high performance that enabled it to be adapted for many other duties, including (with supercharged engine) that of fighting. Aerodynamically, no great advance was discernible, though the Hawker system of metal construction (the Fox was timber-built) came as a joy to all concerned — groundcrew especially, for maintenance was easy.

Between the wars there was no more typical RAF day bomber than the Hart, and one can do no better service for the present reader, both in conveying condensed information and in arousing nostalgia, than to reproduce verbatim (except for some trifling editing) the actual Air Ministry description which introduced aircrew and ground tradesmen to the type. By the same means, an exact comparison can later be made with the most typical night bomber, the Vickers Virginia. Thus, of the Hart:

"The Hart is a two-seater biplane, high-performance day bomber, fitted with a Kestrel IB non-supercharged engine of 510 hp or Kestrel X (De-rated). The aeroplane is of metal construction, fabric-covered, and both steel and duralumin are used in the structure.

"The front of the pilot's cockpit houses a complete set of

PILOT PRESS COPYRIGHT DRAWING



(Below) Vickers Wellesley I K7718 of No 76 Squadron at Finningley, 1937.

NOT TO SCALE

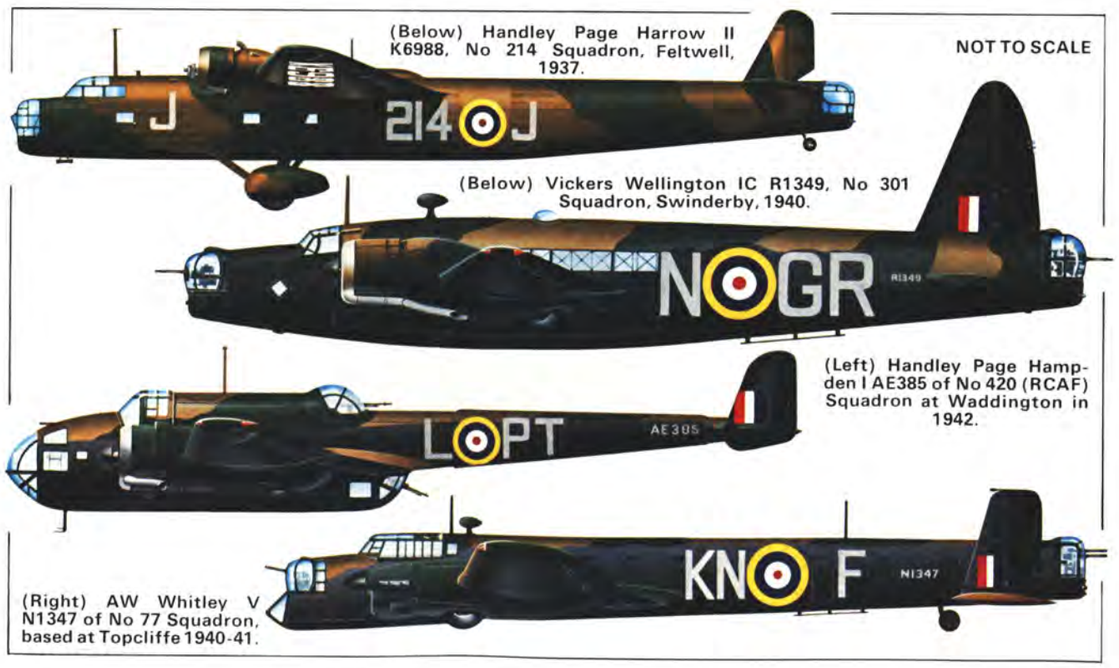
(Above right) Fairey Battle II K7639 of No 106 Squadron at Thornaby, 1938-39.

(Above) Bristol Blenheim I K7045 of No 114 Squadron, Wyton, 1937-39.

instruments, and the pilot can vary his line of view or position in the cockpit by means of an adjustable seat which can be raised or lowered in flight by the operation of a lever attached to the starboard side of the seat.

"On the port side of the front cockpit is mounted a Vickers fixed ·303-in (7,7-mm) gun operated by synchronising gear, the trigger being mounted in the spade grip on the control column. On the starboard side are mounted the bomb release levers.

"The rear cockpit is immediately behind and accommodates the wireless instruments, Lewis gun and magazines, chart boards, duplicate bomb release gear and course setting bomb sight. The air-gunner sits facing aft to operate the wireless gear, and when he rises to use the gun the seat folds up under the action of a spring, thus giving him increased freedom of movement. The gun is carried on a special type of rotating mounting and can be fired at almost any angle upwards and over the sides downwards. A camera mounting is fitted



(Below) Handley Page Harrow II K6988, No 214 Squadron, Feltwell, 1937.

NOT TO SCALE

(Below) Vickers Wellington IC R1349, No 301 Squadron, Swinderby, 1940.

(Left) Handley Page Hampden I AE385 of No 420 (RCAF) Squadron at Waddington in 1942.

(Right) AW Whitley V N1347 of No 77 Squadron, based at Topcliffe 1940-41.

behind the rear cockpit.

"For bombing duty the air-gunner can quickly take up a prone position underneath the pilot's seat where, through a large aperture, covered by a sliding door when not in use, he has a good field of view forwards and downwards. A current of warm air from the radiator keeps the bomb-aimer warm in this position.

"A complete wireless installation, including CW transmitter and receiver, is fitted into a tubular steel crate mounted on the port side of the rear cockpit. Communication between pilot and air-gunner is effected by speaking tubes."

Between-the-Wars "Heavies"

Not until World War II did the terms "tactical" and "strategic" become truly valid in common usage, and even then the division was often arbitrary — as, in earlier times, were "light", "medium" and "heavy". Until the mid-'thirties, "day" and "night" were the operative (and operational) classes; and all RAF day bombers were single-engined except one — the Boulton Paul Sidestrand (the Overstrand being really a late-mark Sidestrand). Although speed and manoeuvrability are the qualities most often stressed respecting this type (officially listed as "medium-range day bomber") even more important was armament-effectiveness, crew protection (most memorably instanced by the pioneer power-operated turret in the Overstrand's nose) being a dominant consideration that pointed directly to the heavily-turreted bombers of 1939-45.

As for the night bombers of the 'twenties and 'thirties, these were at first the wooden Handley Page Hyderabad (1925) and the metal Hinaidi (1929) — very close relations of Imperial Airways liners, undistinguished in performance but distinguishable visually because of the water-cooled Napier Lion engines in the first-named and the air-cooled Bristol Jupiters in the second — and (it is almost unnecessary to add) the Vickers Virginia (1924) in a bewildering succession of Marks. Thus follows the promised official description, relating to the last of these:

"The Virginia X is a long-distance bombing landplane fitted with two Lion Series V engines. The structure is of metal throughout [earlier Marks had been of wooden, or mixed, construction] ... the outer main planes may be folded back to facilitate housing.

"A crew of four is normally carried, including the tail gunner. The pilots' cockpit is fitted with a folding seat for a second pilot. The bow cockpit accommodates the bomber-gunner, whilst to the rear of the pilots' cockpit a closed cabin is provided for the navigator or W/T operator.

"The main military load consists of HE bombs, which are carried in three groups, located one group under the fuselage and a group under each bottom centre plane. The external bomb loads may each consist of two 550 lb [250 kg], four 250 lb [114 kg], or six 112 lb [51 kg] bombs, but the fittings for the fuselage or internal group provide only for nine 112 lb [51 kg] bombs. Three Lewis guns form the defensive armament, one at the bow cockpit, whilst two are carried by a twin gun attachment on the Scarff ring fitted at the tail gunner's cockpit. Provision is made for five 97-round magazines for each gun.

"The electrical installation provides the usual lighting and heating services; brackets are fitted to accommodate four landing flares for night flying. The W/T equipment provides for continuous wave two-way working."

From this first-hand inspection (as it were) of the majestic Virginia, it may seem somewhat odd to glance back at the comparable "officially-conducted tour" of the trim two-seater Hart — yet this is quite deliberately done, for though the Hind (1935) is often passed off as just another Hart variant its true significance is that its introduction gave about thirty quickly-formed or re-equipped bomber squadrons experience with supercharged engines (Kestrel Series V). This was an important preparation for bombers to come, though "blown" Kestrels, as we shall see, had already been introduced in the twin-engined Heyford.

After the Hind, the RAF's only single-engined bombers of British origin were the Vickers Wellesley and Fairey Battle, both of which entered service in the spring of 1937 — by which time the Home defence force had been reconstituted, with Bomber Command ranged alongside Fighter, Coastal and Training Commands.

The Wellesley's record-breaking propensities have already been mentioned; yet there is something significant to add. This geodetic monoplane marked the end of the traditional "general-purpose" line; and though built to a GP specification — which also called for a torpedo-dropping capability, in succession to the Vickers Vildebeest (1933) that had taken over the Horsley's TB role, earlier mentioned — the Wellesley, as adopted, stressed long-range bombing capability, and it is most fittingly considered as the Wellington's forerunner.

As for the Battle, here was a well-designed aeroplane of which too much was asked — and too late — so that even one of the new Merlin engines was inadequate. The eventual loss of forty Battles out of a striking force of 71 at Sedan in May 1940 serves as a wreath of honour as well as one of sadness. The Fox's lineal descendant had been trapped by tactical circumstances, equally with technical deficiencies.

Three types of twin-engined bomber remain to be named as links with the principal British bombers of the 1939 war. These "link" types were the Handley Page Heyford (1933) — notable for its supercharged Kestrel engines, internal bomb load stowed in a specially thickened lower wing, and retractable manually-worked "dustbin" turret; the Fairey Hendon (1936) — Bomber Command's first low-wing monoplane, and Kestrel-powered like the Heyford; and the Handley Page Harrow (1937) — a high-wing design, distinguished by its three gun turrets, two of which were power-operated.

Quite apart from the Harrow's technical significance, it had a tactical one also, being closely related to an experimental type in the class called (by reason of its dual rôle) "bomber-transport". The main types in this class were Vickers Vernon (1922), Victoria (1926) and Valentia (1934), and Bristol Bombay (1939); and though many stirring tales are told of exploits entailing (for instance) the throwing of bombs out of Bombays' doors, we have room here only to record that in the early '20s a Sqn Ldr Harris showed the way to better bombing (literally so — with spotlights and Michelin flares) using as his chosen, or perhaps enforced, instrument a portly Vernon. Which brings us conveniently to the Bomber Command offensive against Germany, so largely directed by the officer just mentioned, though he is known today as Marshal of the RAF Sir Arthur T Harris, AOC-in-C, Bomber Command, 1942-45.

The WWII Types

Within space-limits it is needful only to get the multi-engined bombers of 1939-45 in *perspective*, for they have been exhibited clearly enough in *focus* (disclosing microscopic and esoteric details of the gestation) in the aeronautical publications with which we in Britain are abundantly blessed. Thus, we will scan them (the war having become increasingly an electronic one) — and alphabetically rather than by arbitrary classification, except to remark that "in the beginning" were the Blenheim, Whitley, Hampden and Wellington.

ARMSTRONG WHITWORTH WHITLEY (1937). Two Tiger or Merlin engines; introduced four-gun powered turret after one-gun manual type; withdrawn from first-line service spring 1942 after gallant "firsts" with leaflets and bombs.

AVRO MANCHESTER (1940). With its two under-developed Rolls-Royce Vulture X-form engines, the most powerful of the "twins"; potent also in armament, and more advanced, thus setting the "two nose, two dorsal, four tail" defensive gun pattern. In itself, disappointing; in its development — the Lancaster — triumphant.

AVRO LANCASTER (1942). Best of Britain's big bombers, with four Merlin engines more than atoning for Vulture failings and failures. Described by the aforementioned Harris as the greatest single factor in winning the war — perhaps a difficult assessment to substantiate, though backed with over 600,000 tons (609600 tonnes) of bombs in nearly 160,000 sorties; also by crew-enthusiasm; public esteem and symbolism; and adaptability for (eg) the Wallis 22,000-lb (9988-kg) bomb and "spinning-drum" dam-busting weapon.

BRISTOL BLENHEIM (1937). The date may surprise; but so, at the time, did this type's high performance on two Mercury engines, as fitted in the contemporary Gladiator biplane fighter. Performance, however, was eroded by afterthoughts, armouring and armament. Superb in its pre-war heyday; compromised by time and circumstance.

DE HAVILLAND MOSQUITO (1941). No compromise in this unique twin-Merlin bomber; no armament; no great demands on "strategic" materials — and yet astonishing adaptability. With a single (4,000-lb/1 816-kg) bomb, for instance, it approached the recurrent inter-war concept of "one man, one bomb", though side-by-side seating was a weighty factor in tactical effectiveness — and still permitted level speeds around 400 mph (647 km/h). Envied and feared by the technically progressive Germans, the "Mossie" caused acute irritation by its swiftness, stealth and sting, and set the style for Britain's first jet bomber.

Harrier by Hawker Siddeley...



Total systems capability by Dowty.

LANDING GEAR · RAM AIR TURBINES · POWERED FLYING CONTROLS · FUEL CONTROL SYSTEMS · SEALS · PROPELLERS · V.P. FANS · GEARBOXES · SYNCHRONISERS · HYDRAULICS · ELECTRIC SWITCHES AND INDICATORS · HIGH INTEGRITY CASTINGS

DOWTY

Dowty Group, Cheltenham

HANDLEY PAGE HAMPDEN (1938). A counterpart in several ways of Germany's Do 17, but even narrower. Constricted in accommodation and restricted in defence (having no powered gun-mountings or turrets), the type came about half way — technically and chronologically — between the Blenheim and the Wellington, but was Pegasus-powered like the latter. Gallant bombing service extended until late 1942, though the Hereford development (Napier Dagger engines) was used almost entirely for training.

HANDLEY PAGE HALIFAX (1940). A turbulent history of design, development and operation must not obscure the fact that this companion type to the Lancaster was in service well before the latter; but neither can it disguise a general inferiority in bombing capability. A mighty bomber, even so — in the H.P. tradition, and sustaining the company's claim that "throughout the war, Halifaxes were in the forefront of the British aerial offensive".

SHORT STIRLING (1940). Often regarded (somewhat unkindly) as the carthorse among the warhorses, the Stirling was nevertheless historic as being the RAF's first four-engined (sleeve-valve Bristol Hercules) monoplane. Relatively small wing span — restricted by Air Ministry hangar size — itself restricted operating height, whereas the vast height of the undercarriage was dictated by a shoulder-wing layout. This might have been expected to afford uninhibited bomb stowage, but the reverse was true because of compartmental design (4,000-lb/1816-kg was largest bomb taken). With the Manchester, however, the Stirling pioneered lavish turret armament and — perhaps even more significant — a precursor of the OBOE blind-bombing system that, in later types, vastly increased the RAF's lethality. Thus it served as a pathfinder for the Pathfinders.

VICKERS WELLINGTON (1938). Geodetic construction (mentioned respecting the Wellesley) gave this most famous RAF "twin" (Pegasus, Hercules, or Merlin engines were general) great capacity for lifting and stowage, and for taking battle-damage. Familiar in the Mediterranean as well as nearer home (mostly over Germany) the "Wimpey" was uncommonly adaptable for operations and experiments. Important among these last were the first 4,000-lb (1816-kg) bomb installation and quite extensive work on pressure cabins — the latter an Air Staff request in 1938. Technically and operationally a "great" — even if pioneer activities included the learning of hard lessons (eg, turrets are no substitute for darkness).

The first of the trio of V-bombers that, collectively, have formed the backbone of the RAF's bombing force for the last two decades, was the Vickers Valiant. The type saw brief operational service during the Suez campaign in 1957.



The Post-war Changes

In our early post-Armistice review we had to consider aircraft "inherited" by the new RAF; yet, now having reached the more momentous juncture, or disjunction, of May 1945 we find a different obligation — so swift were the basic changes that ensued (with jet bombers in service by 1951) and so clamant were the questions "What were the lessons of the war?" and "What now?". Yet still some filling-in of the bomber scene remains.

First, it must be stressed that no account has been taken of bomber-class aeroplanes serving with Coastal and other Commands; nor of the fighter-bomber class which, though clearly reflected in today's strike aircraft, had its origins well before the RAF was formed; nor even of America's contribution to British bomber strength best exemplified, perhaps, by the North American Mitchell. To the USA we acknowledge instead a post-war debt; for when the Avro Lincoln (1945) — a developed Lancaster, and the RAF's last big piston-engined bomber — was palpably outclassed by the Boeing B-29, with its pressurising and remotely-controlled low-drag barbettes, the Washington (RAF name) came as an augmentation, relief and lesson.

The supersession of speed figures by Mach numbers calls for comment on the general absence of data in this survey. The reason is emphatic: "typical" figures for variants are generally unhelpful and, when the reader is blinded by qualifying factors, unassimilable. So let rule-of-thumb prevail: better to err in simplicity than blurr in complexity. Thus, to summarise:

Bomber	Range miles (km)	Speed mph (km/h)	Bomb load lb (kg)
O/400	700 (1 126)	85 (137)	1,750 (795)
D.H.9A	450 (724)	100 (161)	450 (204)
Hart	450 (724)	150 (241)	500 (227)
Battle	1,000 (1 610)	220 (354)	1,000 (454)
Blenheim	1,000 (1 610)	240 (386)	1,000 (454)
Wellington	1,200 (1 930)	180 (290)	4,500 (2 043)
Lancaster	1,600 (2 575)	200 (322)	14,000 (6 356)
Mosquito	1,400 (2 253)	400 (644)	4,000 (1 816)

Should it be reckoned that this closing part of the RAF bomber story is simply one of "switching to jets" in peaceful times (in the Queen's Coronation Review twenty-five years ago, 440 of the 640 miscellaneous aircraft were jet-powered), we must recall the Suez incident of 1957, when Canberras and Valiants dropped bombs in anger, though not of the "A" sort (Valiant, 1956) nor the "H" (Valiant, 1957). The shock of the TSR-2 cancellation followed in 1965; but respecting the situation in early 1958 we may quote an official Air Ministry document:

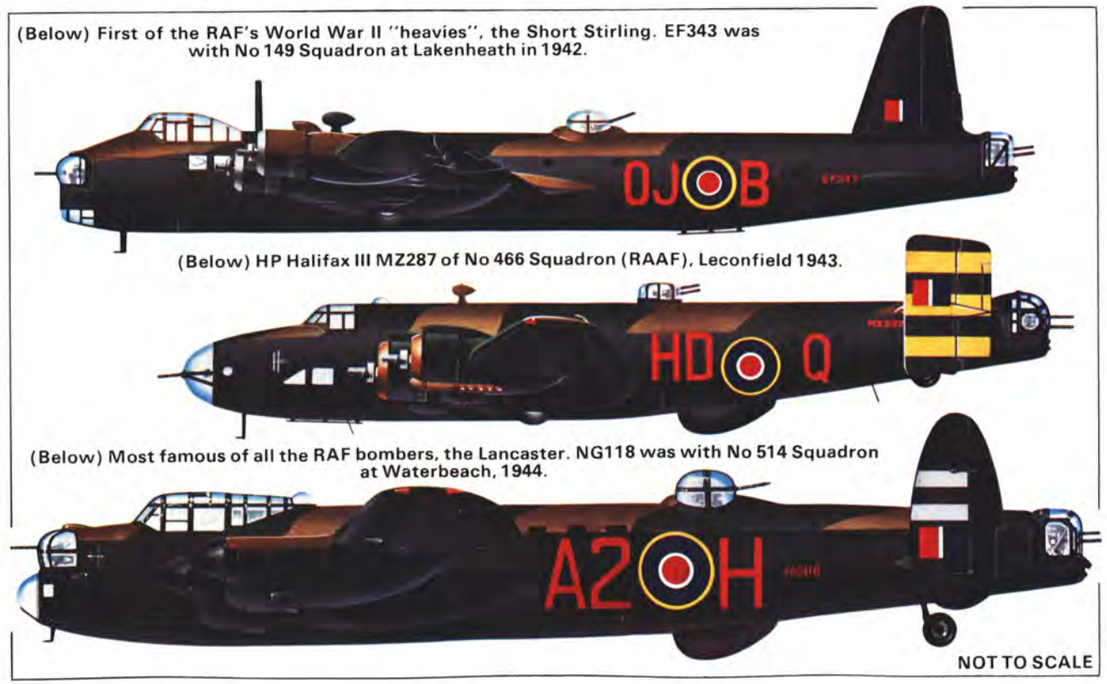
"The Canberras have proved invaluable in training for the 'V' aircraft now coming into service in quantity. These aircraft (Valiants, Vulcans, and Victors) are formidable machines, capable of very long range carrying the most powerful nuclear weapons, and equipped with a self-contained radar navigation and bombing device of the H2S type. This device, although complicated and costly, enables weapons to be delivered with great accuracy in any weather. In general, these aircraft can navigate to the limit of their radius of action and bomb individually. They are independent of ground-based radar or radio except for landing in bad weather. They fly at speeds comparable with those of fighter aircraft, and at altitudes great enough to pose certain problems to even SAGW [guided-weapon] defence. Bombing is done mainly by radar, and pathfinder techniques as we knew them in the War are not required. Radio and radar countermeasures play a vital part in tactics, and many of the principles learned in the last war, particularly those associated with the deception and swamping of fighter control systems, will be used. The significant fact which emerges from the development of the 'V' Force and Strategic Air Command [USA] is that, for the first time in history, there will be in existence a force capable of penetrating to the heart of enemy territory and delivering a mortal blow in a single attack."

So much for tactics; now for the aeroplanes:

ENGLISH ELECTRIC CANBERRA (1951). This jet-propelled operational counterpart of the Mosquito (two Rolls-Royce Avon turbojets) broadly followed the geometry of the Gloster Meteor fighter, and was thus conservative in layout, with unswept wing. This wing, however, was so generous in area that the Canberra excelled not so much in speed as in climb, ceiling, manoeuvrability and operational flexibility. Such a fine all-rounder did it prove that it was built by Martin in the USA as the B-57. In its "intruder", or "interdictor" form, with a four 20-mm gun pack under the fuselage and underwing bombs (the normal bomber load of 6,000 lb/2 724 kg was internal) the Canberra marked a transitional phase from high-level bomber to low-level strike aircraft.

VICKERS VALIANT (1955). Though having no defensive armament (in common with Britain's other jet bombers) the four-Avon Valiant carried over three times the Canberra's load of conventional bombs at roughly the same speed (nearer 550 than 600 mph/885-965 km/h). Aerodynamically it was interesting in having its power plant buried in the very lightly swept wing, whereas the Americans were going nap on sharp sweep and "podded" engines. Very extensive use was made of electrical mechanisms — for instance, to operate the bomb doors when these were opened (upwards, to avoid drag) and at the same time exclude airflow from the fuselage. Generally, however, our first 'V' bomber was one without frills. It served as an air-refuelling tanker before all aircraft of the type were scrapped, over 10 years ago, following discovery of metal fatigue.

AVRO VULCAN (1957). Although variants of types can barely be touched upon in this brief review, it is important to distinguish between the two Marks of Vulcan, because, though both were delta-winged, the Mk 2 wing was larger and much modified. Four Bristol Siddeley Olympus turbojets gave outstanding performance at height (over 600 mph/965 km/h at 40,000 ft/12 200 m and up) and a notable armament development was the introduction, in 1962, of the Avro Blue Steel inertially navigated stand-off bomb. This could run in



(Below) First of the RAF's World War II "heavies", the Short Stirling. EF343 was with No 149 Squadron at Lakenheath in 1942.

(Below) HP Halifax III MZ287 of No 466 Squadron (RAAF), Leconfield 1943.

(Below) Most famous of all the RAF bombers, the Lancaster. NG118 was with No 514 Squadron at Waterbeach, 1944.

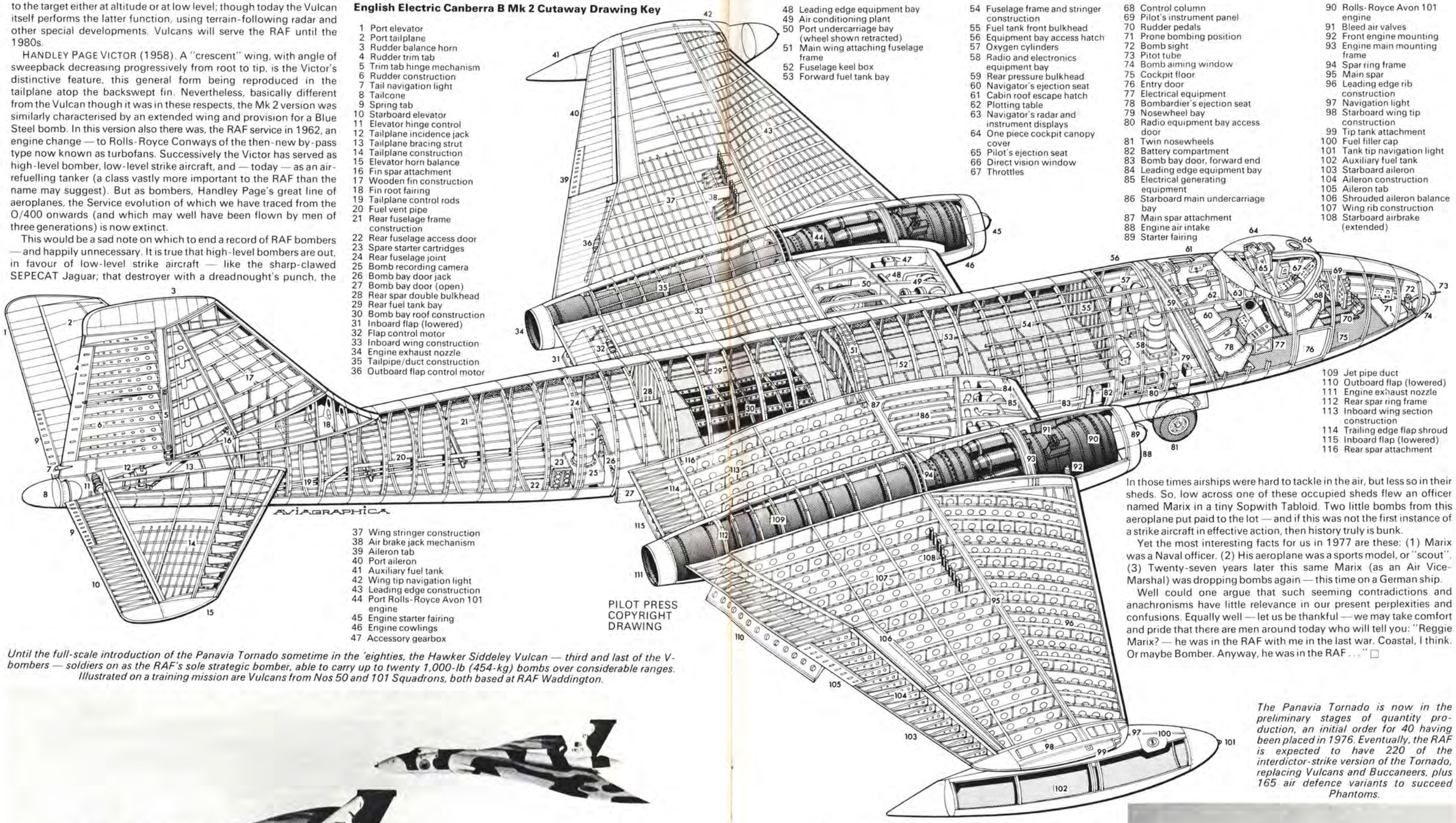
to the target either at altitude or at low level; though today the Vulcan itself performs the latter function, using terrain-following radar and other special developments. Vulcans will serve the RAF until the 1980s.

HANDLEY PAGE VICTOR (1958). A "crescent" wing, with angle of sweepback decreasing progressively from root to tip, is the Victor's distinctive feature, this general form being reproduced in the tailplane atop the backswept fin. Nevertheless, basically different from the Vulcan though it was in these respects, the Mk 2 version was similarly characterised by an extended wing and provision for a Blue Steel bomb. In this version also there was, the RAF service in 1962, an engine change — to Rolls-Royce Conways of the then-new by-pass type now known as turbofans. Successively the Victor has served as high-level bomber, low-level strike aircraft, and — today — as an air-refuelling tanker (a class vastly more important to the RAF than the name may suggest). But as bombers, Handley Page's great line of aeroplanes, the Service evolution of which we have traced from the O/400 onwards (and which may well have been flown by men of three generations) is now extinct.

This would be a sad note on which to end a record of RAF bombers — and happily unnecessary. It is true that high-level bombers are out, in favour of low-level strike aircraft — like the sharp-clawed SEPECAT Jaguar; that destroyer with a dreadnought's punch, the

English Electric Canberra B Mk 2 Cutaway Drawing Key

1 Port elevator
2 Port tailplane
3 Rudder balance horn
4 Rudder trim tab
5 Trim tab hinge mechanism
6 Rudder construction
7 Tail navigation light
8 Tailcone
9 Spring tab
10 Starboard elevator
11 Elevator hinge control
12 Tailplane incidence jack
13 Tailplane bracing strut
14 Tailplane construction
15 Elevator horn balance
16 Fin spar attachment
17 Wooden fin construction
18 Fin root fairing
19 Tailplane control rods
20 Fuel vent pipe
21 Rear fuselage frame construction
22 Rear fuselage access door
23 Spare starter cartridges
24 Rear fuselage joint
25 Bomb recording camera
26 Bomb bay door jack
27 Bomb bay door (open)
28 Rear spar double bulkhead
29 Rear fuel tank bay
30 Bomb bay roof construction
31 Inboard flap (lowered)
32 Flap control motor
33 Inboard wing construction
34 Engine exhaust nozzle
35 Tailpipe/duct construction
36 Outboard flap control motor
37 Wing stringer construction
38 Air brake jack mechanism
39 Aileron tab
40 Port aileron
41 Auxiliary fuel tank
42 Wing tip navigation light
43 Leading edge construction
44 Port Rolls-Royce Avon 101 engine
45 Engine starter fairing
46 Engine cowlings
47 Accessory gearbox
48 Leading edge equipment bay
49 Air conditioning plant
50 Port undercarriage bay (wheel shown retracted)
51 Main wing attaching fuselage frame
52 Fuselage keel box
53 Forward fuel tank bay
54 Fuselage frame and stringer construction
55 Fuel tank front bulkhead
56 Equipment bay access hatch
57 Oxygen cylinders
58 Radio and electronics equipment bay
59 Rear pressure bulkhead
60 Navigator's ejection seat
61 Cabin roof escape hatch
62 Plotting table
63 Navigator's radar and instrument displays
64 One piece cockpit canopy cover
65 Pilot's ejection seat
66 Direct vision window
67 Throttles
68 Control column
69 Pilot's instrument panel
70 Rudder pedals
71 Prone bombing position
72 Bomb sight
73 Pitot tube
74 Bomb aiming window
75 Cockpit floor
76 Entry door
77 Electrical equipment
78 Bombardier's ejection seat
79 Nosewheel bay
80 Radio equipment bay access door
81 Twin nosewheels
82 Battery compartment
83 Bomb bay door, forward end
84 Leading edge equipment bay
85 Electrical generating equipment
86 Starboard main undercarriage bay
87 Main spar attachment
88 Engine air intake
89 Starter fairing
90 Rolls-Royce Avon 101 engine
91 Bleed air valves
92 Front engine mounting
93 Engine main mounting frame
94 Spar ring frame
95 Main spar
96 Leading edge rib construction
97 Navigation light
98 Starboard wing tip construction
99 Tip tank attachment
100 Fuel filler cap
101 Tank tip navigation light
102 Auxiliary fuel tank
103 Starboard aileron
104 Aileron construction
105 Aileron tab
106 Shrouded aileron balance
107 Wing rib construction
108 Starboard airbrake (extended)
109 Jet pipe duct
110 Outboard flap (lowered)
111 Engine exhaust nozzle
112 Rear spar ring frame
113 Inboard wing section construction
114 Trailing edge flap shroud
115 Inboard flap (lowered)
116 Rear spar attachment



PILOT PRESS COPYRIGHT DRAWING

Until the full-scale introduction of the Panavia Tornado sometime in the 'eighties, the Hawker Siddeley Vulcan — third and last of the V-bombers — soldiers on as the RAF's sole strategic bomber, able to carry up to twenty 1,000-lb (454-kg) bombs over considerable ranges. Illustrated on a training mission are Vulcans from Nos 50 and 101 Squadrons, both based at RAF Waddington.

In those times airships were hard to tackle in the air, but less so in their sheds. So, low across one of these occupied sheds flew an officer named Marix in a tiny Sopwith Tabloid. Two little bombs from this aeroplane put paid to the lot — and if this was not the first instance of a strike aircraft in effective action, then history truly is bunk.

Yet the most interesting facts for us in 1977 are these: (1) Marix was a Naval officer. (2) His aeroplane was a sports model, or "scout". (3) Twenty-seven years later this same Marix (as an Air Vice-Marshal) was dropping bombs again — this time on a German ship.

Well could one argue that such seeming contradictions and anachronisms have little relevance in our present perplexities and confusions. Equally well — let us be thankful — we may take comfort and pride that there are men around today who will tell you: "Reggie Marix? — he was in the RAF with me in the last war. Coastal, I think. Or maybe Bomber. Anyway, he was in the RAF . . ." □

The Panavia Tornado is now in the preliminary stages of quantity production, an initial order for 40 having been placed in 1976. Eventually, the RAF is expected to have 220 of the interdictor-strike version of the Tornado, replacing Vulcans and Buccaneers, plus 165 air defence variants to succeed Phantoms.

Hawker Siddeley Buccaneer; the incomparable get-up-and-go Harrier by the same firm; that husky hell-raiser the McDonnell Douglas Phantom and the planned king-pin of future RAF interdictor-strike missions the Panavia Tornado — all represented elsewhere in this volume. True also that the air is full enough of propaganda of one kind or another to fill a leaflet-dropping Whitley crew with envy; and no less true that changes in terminology confuse the picture further. Yet, we must not lose heart, for there is a little story still to tell.

This story goes back to 1914 — long before we even *had* an RAF.







PRUNE IS ALIVE AND WELL...

PILOT OFFICER PERCY PRUNE was the fool, the mug, the poop, the clot, the mutt, the affable dim-wit of the RAF. Fatuously exuberant yet permanently bone-headed, he always made a muck of everything he set out to do — and yet survived to make another.

According to his biography*, this gallant but bird-brained officer was born on 1 April 1922 at Ineyne Manor, Sussex, and went to school at St Finga's, Herts. Later — much later than most of his contemporaries — he went to university. He was elected to St Cleweless College, Cambridge, where he read The Decameron and Lady Chatterley's Lover but after just one term he became embroiled in a drunken fracas outside the "Hat & Feathers", at a time when he *was* actually wearing an absurd hat — with feathers. He was dismissed from the university — thus, he had no sooner 'gone up' than he was 'sent down'; and then, almost immediately, he was 'called up'.

He underwent initial training and then, thanks to a clerical error involving himself, as Aircraftsman 2nd Class Prune, P, 977950 and one Aircraftsman 2nd Class Prynne, P, 977949, the latter was posted for training as "Clerk, GD", while Prune went on to Initial Flying Training. He eventually passed out (although not in quite the same way as had at least three of his flying instructors) — this at a time when Britain's need for pilots was vital (though "Not *that* vital", as one of those instructors said at the time).

Prune was posted to his first operational squadron. Within a matter of hours he was posted to his second operational squadron and from that time forward he was passed like an Air Ministry buck from squadron to squadron and even from Command to Command. For the rest of hostilities he became a greater hazard to those who flew within his orbit than even the Enemy, yet he survived to hear the last All Clear, take a blind stroll down Civvy Street and eventually retire.

That's how it was according to his cartoon creator, Bill Hooper; but in real life, as a caricature figure serving to sugar-coat the pill of wartime air crew training, "PO Prune" was "born" during the last weeks of 1940 in a fetid atmosphere of 100 octane petrol, glycol and the dust and bomb blast of "panics", both "duff" and "pukka", in No 54 Squadron's "A" Flight dispersal hut at Hornchurch.

Although he was not then named "Prune", a pilot with the same egg-shaped head and mushroom nose was used to illustrate a series of hints and tips in a restricted publication called 'Forget Me Nots for Fighters', written by Bill Hooper's CO, Sqdn Ldr James ("Prof") Leathart, DFC†, from hard lessons learned during the hectic weeks of the Battle of Britain. Very soon afterwards, the Air Ministry, in the person of Sqdn Ldr Anthony Armstrong Willis, OBE, MC, applied for the adoption of Bill's cartoon pilot and, for the rest of the war, as "PO Prune", he permeated the pages of the RAF's official training memorandum, 'Tee Emm', serving as an awful warning of what *not* to do in the air (or on the ground for that matter), if one wished to survive.

With cosmic ineptitude, Prune was seen in 'Tee Emm' to drop every clanger in the "Airworks" and to cut a devastating swathe of

*'The Passing of Pilot Officer Prune' by Bill Hooper, Midas Books, Kent.

†Later Air Commodore, CB, DSO.



...and living in Sussex

destruction throughout every theatre of air warfare, as an object lesson for others. Many of Prune's undying sayings have been taken up by others since but he it was who first said "A good landing is one you can walk away from" and he proved this with depressing regularity with violent ploughing-in — down wind, wheels up, in flashes of fire and clouds of dust and smoke which brought "blood wagon" and fire tender haring out on to the airfield. If he ever selected wheels down he'd then stand on his brakes to finish up with what *he* called a "perfect three-point landing — two wheels and me prop' boss". When flying an aircraft with a fixed undercarriage, he'd been known to stooge around until he ran out of fuel and landed in a potato field a mile from base because he couldn't locate the "whoosit" with which to get the wheels down! After assiduously bombing Ponders End instead of Pfullendorf he said "I think my compass must've been out".

Prune tried but never learned, he was willing — but wet, dutiful but dumb and if he mastered anything aeronautical at all it was the flyers' "line shoot"; "Flak was so thick over target — just for a lark I selected wheels down and made a temporary landin' on it". Asked why he preferred one fighter-bomber aircraft to another he explained that one had a prop' blade four inches shorter than the other and this enabled him on a fighter sweep to fly lower when he was ground-strafing enemy installations. Animal cunning helped in his survival — when reprimanded for ropey navigation on an exercise which resulted in his successful bombing of a German dummy 'drome, he countered cleverly with "Ah, yes sir, but no waste — what! Only used dummy bombs". No respecter of high rank, he was once heard to say of a much be-medalled and ageing air marshal, "I bet he's been in the 'Airworks' since Pontius was a pilot".

There were some people who almost believed that there must be a real Pilot Officer Prune somewhere; after all, his promoters, Willis and Hooper, did succeed in bluffing a humourless civil servant sufficiently to get Prune into the official and restricted Air Ministry telephone directory — Prune's name, rank and telephone number immediately following "Provost Marshal" and preceding a certain "Flying Officer J E Pryce" — while his nameplate, alongside that of the Editor's, was on 'Tee Emm's' door. On one occasion "The Chief", Sir Arthur (later Lord) Tedder, Marshal of the RAF, who loved Prune, rang the number, tongue in cheek, only to be told by Tony Armstrong Willis that Percy was "out to lunch, sir, yesterday's lunch". "Caged birds" in German POW camps delighted in dropping Prune a line on the enemy's official post cards, addressed to "P/O P Prune, Princes House, Kingsway, London, WC2".

If the Prune was not actually real, many people maintained that there was *a* Prune on every squadron and when in 1942 the Editor and cartoonist instituted the Most Highly Derogatory Order of the Irremovable Finger they not only gave the RAF a new phrase with which to enjoin instant action in an emergency: "FINGER!", but they were able to award this "order" each month in 'Tee Emm' to airmen of all ranks for "pruneries" they had committed. Since their names weren't mentioned, they were not personally pilloried but if they read of the award, as Prune once said — "If the cap fits it won't fall over deaf ears".

The war-time RAF appeared to take to heart Percy Prune *and* the lessons which his own clottishness was designed to teach, so for almost six years until after the war his finger continued to go unerringly to the wrong "tit" and until his demob' was reported in a second leader of *The Times**. He had become famous throughout the Allied air forces and (plagiarised) cartoons of him were even seen on the walls of Russian pilots' messes — ("Comrade Pruneski"? "Prunikoff"?) and then, from Berlin, Bill Hooper received an imposing document from "Captured Documents Dept", with that ominous eagle and swastika heading. It was a citation for a decoration — a rare wit on the *Luftwaffe* Air Staff had actually put PO Prune up for the Iron Cross — "for", ran the citation, "having destroyed so many Allied aircraft" — signed, Hermann Goering, *Der Reichsminister der Luftfahrt und Oberbefehlshaber der Luftwaffe.*

Prune's cartoon creator assures the Editors of the RAF Yearbook that Percy, as Squire Prune of Ineyne Manor, Prune Parva (where his family has held manurial rights for centuries), is still very much alive and ineptly farming the family acres in Sussex, faithfully dogged by his drunken, ageing bull-terrier "Groupy" — especially toward the "Mug and Finger Inn" at opening times. Percy is the president of the smallest and most inefficiently run branch of the RAF Association for which, to date, he has collected all of £5·51½p ("less £9·33p drinking expenses"), which, he airily suggested, that welfare organisation should "split with the old Ben' Fund — what!"

**And very few pilot officers achieved that!*

High Speed, High Power, High Performance.



Today's aircraft are a far cry from the machines that put the Royal Air Force name in the history books. With increasing complexity has come total dependence on system fluids and large numbers of critical components. It's just as well we now have APME Products to provide the reliability that comes with super-clean fuel, lubricants, hydraulic fluids and intake air.

APME PALL

Aircraft Porous Media Europe Ltd, Walton Road, Portsmouth, PO6 1TD
High Performance filters, air eliminators, oil purifiers, inertial separators and other products for aircraft and ground equipment.

ROYAL AIR FORCE YEAR BOOK

Readers of the **Royal Air Force Yearbook** may wish to know...

Binders are available to keep your copies of the **RAF Yearbook** in mint condition. Each specially-made luxury binder (in handsome blue with 'gold' lettering on the spine) holds six issues and costs £2·00 ($4·50) including postage and packing.

RAF Yearbook 1975 and **1976** editions may still be obtained. Price per copy 65p ($2·00) postage and packing inclusive. Additional copies of the current 1977 edition are available by post at the above inclusive cost per copy.

RAF Yearbook 1978 edition may be reserved by sending 70p ($2·00), including postage, **NOW!** Your order will be recorded and your copy sent to you on publication June 1978.

Place your orders, with payment, in writing to ***Ducimus Books Ltd*** *at the address below.* ***When ordering,*** *readers please note.* ***Payment*** *may be made by cheque, UK Postal Order, International Postal/Money Order.* ***Overseas readers (excluding USA/Canada)*** *making payments by personal cheques drawn on local banks should include an extra 50p to cover bank charges.* ***We regret*** *that orders cannot be acknowledged unless accompanied by return postage in the form of stamps (UK) or International Reply Coupons (Overseas/USA/Canada).*

DUCIMUS BOOKS LIMITED, 283 LONSDALE RD, LONDON SW13 9QW



When the RAF flies so does Muirhead

The Muirhead Vactric range of Servo Components is designed into:— Aircraft Control Systems, Attitude Indicators, Air Data Computers, Inertial Navigation Platforms, Head-up Displays, Weather Radar and Doppler Navigation.

MUIRHEAD VACTRIC

A custom designed range of components is used in the fuel control systems of supersonic aircraft. Our engine health monitoring and gearcase accessories are fitted to provide added safety and reliability.

Muirhead Vactric Components Limited

Garth Road Morden Surrey SM4 4LL England Tel. 01-337 6644 Telex 27796 Cables Vactrol Morden

DIEPPE* ——— *continued from page 44

hits in the fuselage. The Spitfires were then drawn off by German fighters, the 3Z+DH made off at 1,500 ft (460 m), landing at Creil just before 12.00 hours.

The crews of I/KG 77 and their comrades flew hard until dusk, pursuing and attacking targets of opportunity with results which, viewed in the light of the minimal damage to shipping, were remarkable for their ineffectuality.

At 10.30 hrs, Abbeville-Drucat airfield was bombed. Twenty-two of the 24 B-17E Fortresses of the 97th Bomb Group released their loads from 16,000 ft (4900 m) with commendable accuracy. This mission, termed Circus 205, achieved dividends, and it is difficult to understand why more attacks were not made against enemy airfields. German eye-witnesses at Abbeville stated that only three minutes elapsed between the first intimation of the attack and the arrival of the bombs. Dispersals and petrol dumps were hit, and there was considerable confusion. Some claimed that as many as 15 fighters were caught in the open and went up in flames, while others that only two Bf 109G-1s were destroyed as they re-fuelled. The British R/T listening watch noted that the important airfield remained out of action for over two hours with aircraft being diverted to other, more distant aerodromes, and that when the Abbeville Fighter Control came back on wavelength in the evening "a new and unfamiliar voice was heard on the air".

By 13.10 hrs, the last troop landing ship was reported some 3 mls (4,8 km) off Dieppe heading back towards England. From the air, little could be seen of the agony on the ground save for the fires, the dense smoke, the wallowing hulks and the charred tanks stranded on the shingle. In the air, however, the battle continued with unparalleled intensity and ferocity throughout the afternoon and evening. Every effort by the Ju 88s, Do 217s and Heinkels of the *Kampfgruppen* to attack or interfere with the homeward-bound convoys was parried and thwarted by the nimble Spitfires. Leigh-Mallory's fighters continued to give cover until the fall of night, with Beaufighters joining in the battle; and as these bulky, black, radar-equipped nightfighters nosed after their prey, the exhausted pilots of the Spitfires, Focke-Wulfs and Messerschmitts still jousted among the cloud banks in the gathering dusk over the Channel.

The tragic overall failure and the massive casualties of the ill-starred Dieppe raid of 19 August 1942 have been largely responsible for overshadowing the remarkable efforts displayed by all air- and groundcrews who took part in OPERATION JUBILEE. The savage casualties among the men of the Air-Sea Rescue service and the attrition of the vulnerable smoke-laying aircraft are dwarfed when compared to the more momentous happenings on land, but they were no less in terms of blood and sacrifice. The results of the great air battle of 19 August would appear to be a clear and creditable victory for the *Luftwaffe*, and in particular for the German fighter pilots. The latter could prove that the cost to the Royal Air Force of establishing local air supremacy over a limited area for a limited time, was prohibitive at that stage of the war because of inadequate equipment and insufficient numbers.

It is just as indisputable that, despite the casualties, RAF Fighter Command carried out all the tasks with which it had been entrusted within its limited resources. The *Luftwaffe*, if not held at bay, had been checked and the failure of the *Kampfgruppen* to seize such a golden opportunity to wreak havoc was a measure of both its failure and the fighting qualities of Allied fighter pilots. In the air, as on the ground, the lessons learned in this "reconnaissance in force" were many, and were later to prove invaluable. For the neutralisation of enemy ground positions, the Close Support units were proved to be woefully few in numbers and to have inadequate hitting-power. If the hegemony of the Fw 190 was to be surmounted, then the Spitfire VB had to be replaced with improved versions with greater power and longer range. Lastly, the bombing and destruction of the *Luftwaffe's* ground installations in the forward areas had to be achieved prior to an invasion, to force it to fight at a tactical disadvantage. In mid-1942, these aims and parameters were set far in the future; two years would pass before all these and other lessons were incorporated in the master plan for OVERLORD, when very different results would be achieved both on the ground and in the air. □

HOW TO PLACE YOUR ORDER

SO AS TO AVOID ERRORS AND DELAYS

1. Fill in the Order Form in capitals or typescript.
2. If overprinting is required give details in the space indicated.
3. Fill in the label with details (including Postal Code, if any, for sending of your order).
4. Send complete Order Form with total remittance to:—

J. ARTHUR DIXON, FOREST SIDE, NEWPORT, ISLE OF WIGHT. PO30 5QW

Reg. Office : 1 Redcliffe Street, Bristol
Company Registration No. 295275 (England)
VAT ,, ,, 137 8894 16

Initial any corrections or cheques will have to be returned necessitating delay.

5. Orders cannot be acknowledged unless this is specifically requested and a stamped addressed envelope or post card is enclosed.

In case of any difficulty with your order, contact

J. ARTHUR DIXON, FOREST SIDE, NEWPORT, ISLE OF WIGHT.

Telephones: NEWPORT 3381 & 4661 Dept. RAF BF

CHRISTMAS CARD OVERPRINTING INSTRUCTIONS IF REQUIRED

Please give details of wording for overprinting on your cards putting exactly the words required :— e.g. — **John and Jane or Mr. and Mrs. Brown etc.** Also insert address, if this is required as well as the name(s). (BLOCK CAPITALS)

This wording will be followed precisely

Tick here if the word " from " is not required below the greeting. ☐

Name(s).....

Address.....

.....

.....

CHRISTMAS CARD OVERPRINTING

Name and/or Address can be overprinted on cards at the following extra charges which are quoted as for ONE design only with a minimum quantity of 2 dozen cards.

2 dozen.....£1.41
3 dozen.....£1.76
4 dozen.....£2.10
5 dozen.....£2.45

Each additional dozen 35p.

HOW TO ORDER

Where several designs are chosen the rates must be reckoned for each one separately.

EXAMPLE :—

2 dozen cards of **RAF BF 1** = £1.41
plus
3 dozen cards of **RAF BF 2** = £1.76
Totalling £3.17

NOT £2.45 for 5 dozen.

DELIVERIES

Every effort will be made to ensure prompt delivery of orders. However, deliveries of cards cannot be guaranteed in time for Christmas in the U.K. on orders received after 1st December, 1977.

PLEASE SUPPLY TO :—

.....

.....

.....

.....

FOR OFFICE USE ONLY

Order No.	Date Received	Date Sent	Cheque P.O./Cash

PACK OF 6 CARDS WITH 6 ENVELOPES *

Card No.	Cost per Pack U.K. inc. Tax	Cost per Pack Overseas	Quantity Packs Ordered	Tick if to be Overprinted	£ . p
RAF BF 1	70p	65p			.
RAF BF 2	59p	55p			.
RAF BF 3	59p	55p			.
RAF BF 4	59p	55p			.
RAF BF 5	43p	40p			.
RAF BF 6	43p	40p			.
RAF BF 7	43p	40p			.
RAF BF 8	43p	40p			.
RAF BF 9	36p	33p			.
RAF BF 10	29p	27p			.
RAF BF 11	29p	27p			.
OVERPRINTING. If required charge for Overprinting.....cards					.
POSTAGE and HANDLING (U.K. Only) 1 - 5 Packs 35p Over 5 Packs 45p					.
POSTAGE and HANDLING Overseas 70p					.
DONATION					.
Please complete				TOTAL	.

To.....
.....
.....
.....
.....

From
J. ARTHUR DIXON
FOREST SIDE, NEWPORT, ISLE OF WIGHT



RAFBF1 **Down Channel**
70p — 7⅜" x 5⅞"



RAFBF2 **Winter of '43, Somewhere in England**
59p — 4⅛" x 7⅞"



RAFBF5 **Christmas Roses**
43p — 6" x 4⅛"

Royal Air Force Benevolent Fund Christmas Cards 1977



RAFBF3 **The Commonwealth Air Forces Memorial, Runnymede** 59p — 4⅝" x 7"



RAFBF4 **Winter Morning**
59p — 4⅝" x 7"



RAFBF6 **A Child is Born**
43p — 6" x 4⅛"



RAFBF7 **Found, Fixed and Friendly**
43p — 4⅛" x 6"

Each Cellopack contains 6 Cards and 6 Envelopes Pressure Wrapped and Heat Sealed

All Prices include Envelopes and Tax where applicable see opposite for order form & instructions

All cards bear the following greeting:

"With Best Wishes for Christmas and the New Year"



RAFBF8 **Robin**
43p — 6" x 4⅛"



RAFBF9 **Shepherd Boy**
36p — 6½" x 3⅜"



RAFBF10 **Silent Mice**
29p — 5 5/16" x 3⅜"



RAFBF11 **Snowman**
29p — 5 5/16" x 3⅜"