ROYAL AIR FORCE YEARBOOK 1985

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ROYAL AIR FORCE YEARBOOK 1985

INTRODUCTION

by the Chief of the Air Staff, Air Chief Marshal Sir Keith Williamson, GCB, AFC

FOR THE ROYAL AIR FORCE, the year 1984 was marked by an increasing tempo in the rate of its re-equipment and expansion programme which has the Tornado as its lynchpin. The strike/attack Tornado GR Mk 1 has of course been in service now with the RAF for some three years, and the recent arrival of the Tornado F Mk 2 into our front line heralds a quantum leap in our air defence capabilities. Indeed, a most significant feature of the present re-equipment programme is the increasing importance that has been placed on strengthening our air defences right across the board. I am therefore very pleased to see that this has been reflected in the present issue of the Year Book, not only with articles on No 11 Group and No 74 Phantom Sqn, but also on the new five-nation European Fighter Aircraft which will have a formidable air-to-air capability in addition to its powerful ground attack functions.

But, of course, none of the many equipments now being provided for the front line will be of any value unless we have high quality personnel to operate, maintain, supply and support them. Our servicemen and servicewomen continue to be our most valuable asset, and we take great pride in their loyalty, dedication and professionalism.

Having read the articles in the Year Book, I very much hope that you will find it possible to visit one of the many RAF "At Home" days being held this year and so judge for yourself why we are so proud of the professionalism of our people and the quality of our equipment.

Keith Williamson

RAF YEARBOOK 1985

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A REFURBISHED UMBRELLA

The wide-ranging modernisation of Britain's air defences described by Paul Jackson

INEVITABLY, mention of the RAF's present rôle in defending Great Britain from air attack evokes thoughts of the battle 45 years ago in which the course of world history was changed by the determination and courage of those forever remembered as "The Few". The whirlwind pace of technical development has ensured that little except proud tradition links the Hurricane pilot of 1940 with the two-man team which would now take the Tornado F Mk 2 to war, although some further parallels will be found in a close examination of today's Air Force. Perhaps the clearest of these — equating to the 1936-40 build-up and introduction of invaluable radar to what was then known as Fighter Command — is the wide-ranging modernisation of air defences now reaching its climax. Though the present guardians of British skies might accurately be described as "The Even Fewer", their smaller numbers are more than offset by the sophistication of weaponry now entering service.

The rôle once performed by Fighter Command is now assigned to No 11 Group — one of the three Groups that comprise the RAF's home-based combat element, Strike Command. From headquarters at the historic Bentley Priory at Stanmore, North London, Air Vice-Marshal K W Hayr, CB, CBE, AFC, administers No 11 Group and its force of Phantom and Lightning fighters; Bloodhound and Rapier surface-to-air missiles (SAMs); radar and control units; airborne early warning (AEW) aircraft; and an embryo Tornado F Mk 2 component. The task — which seems deceptively simple when written on paper — is to defend against air attack the United Kingdom and maritime forces, operating up to several hundred miles from shore.

No 11 Group's "beat" is known as the UK Air Defence Region (UKADR): an area of sky which includes not only the landmass, but also the South-Western Approaches, most of the North Sea, and an extensive amount of the cold, deep waters between the UK and Iceland. Whilst this is not all a territorial area, it is one over which unidentified interlopers are routinely examined for the information (and peace of mind) of both Britain and her allies. Indeed, NATO interceptor forces are uniquely under permanent command of the Supreme Allied Commander Europe (SACEUR), even when there is no international tension, as the only method by which the West can ensure constant vigilance with its limited assets. This collective and ever-alert security force came into being during the 'fifties; hence the present round of modernisation to be seen going on throughout Europe.

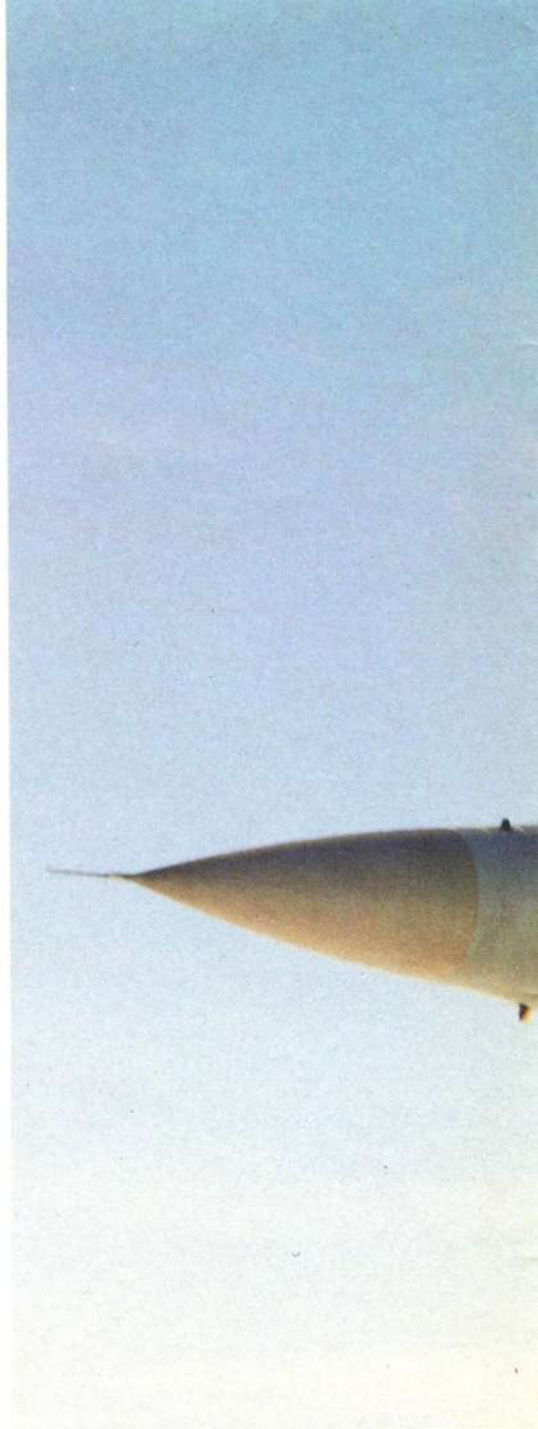
Of other changes under way in No 11 Group, one of the most important is in outlook. Indeed, it could well be an appropriate moment for the Group badge, depicting "Big Ben" encircled by an astral crown, to be changed for that of the Roman god, Janus — because No 11 is now looking both ways. As a legacy from earlier times, fighter airfields and most radar sites are on the East Coast, despite the present and ever-growing ability of Soviet low-level interdictors to enter UK airspace from the West, via the "back door", by flying from Arctic bases. Now, in a series of steps involving additional radar coverage and airfield facilities, that potential method of entry is being closed to the potential enemy.

Tornado: key to the future

Twin pillars of the present air defence modernisation programme which will be completed by the end of the decade are the Panavia Tornado F Mk 2 and BAe Nimrod AEW Mk 3. Already in service as a strike-interdictor, the Tornado has undergone rôle adaptation to British air defence requirements in its Mk 2 form, and will revolutionise air fighting when all seven planned squadrons are operational, flying the 162 aircraft (and three prototypes) on order. The Nimrod is known for its submarine-hunting prowess, but 11 of the type are being modified to the airborne early-warning Mk 3 standard as "flying radar stations" to detect approaching low-level intruders when still far from Britain's shores.

In concert with new policies, the Tornado has been designed to operate farther from its base than any of the short-legged British fighters that have preceded it. Typically, it will combat multiple low-level targets in all weather and in the face of heavy electronic jamming whilst operating over 400 miles (645 km) from home. A prototype has already demonstrated a combat air patrol (CAP) of 2 hrs 20 mins when 374 miles (602 km) out from base, without recourse to the aircraft's in-flight refuelling capability. Furthermore, the Tornado can take-off from a short, or battle-damaged, airfield, yet has excellent supersonic acceleration and is capable of low-level flight at speeds which are beyond the structural limits of most potential adversaries.

The aircraft's primary — though not explosive — weapon is its Marconi AI-24 Foxhunter track-while-scan pulse-Doppler radar, permitting it to detect and track targets at ranges well in excess of those achieved by systems currently in service. In conjunction with the four BAe Sky Flash medium-range, radar-guided air-to-air missiles (AAMs) mounted beneath the belly, this enables the Tornado to make a "look-down/shoot-down" attack against contour-hugging interdictors. Further weapons are the short-range, heat-seeking AIM-9L Sidewinder AAMs attached to the inside of the two wing pylons and a single, internal 27-mm Mauser cannon. Though a long-range, two-seat fighter, the Tornado should not be viewed as a sluggish heavyweight. Granted, it is not intended for close-in combat, but with wings at minimum sweep it can give a good account of itself against most of the types in current service.



The major event of 1984 for No 11 Group was the introduction of the Tornado F Mk 2, with the arrival of the first two aircraft at No 229 OCU on 5 November. Illustrated above is the third prototype F Mk 2, in operational finish and configuration with AAMs and drop tanks. (Inset) One of the Sidewinder-equipped Hawk T Mk 1As that now provide No 11 Group with reserve air defence force, for use in time of emergency. In peacetime, they serve as trainers at the Tactical Weapons Units.

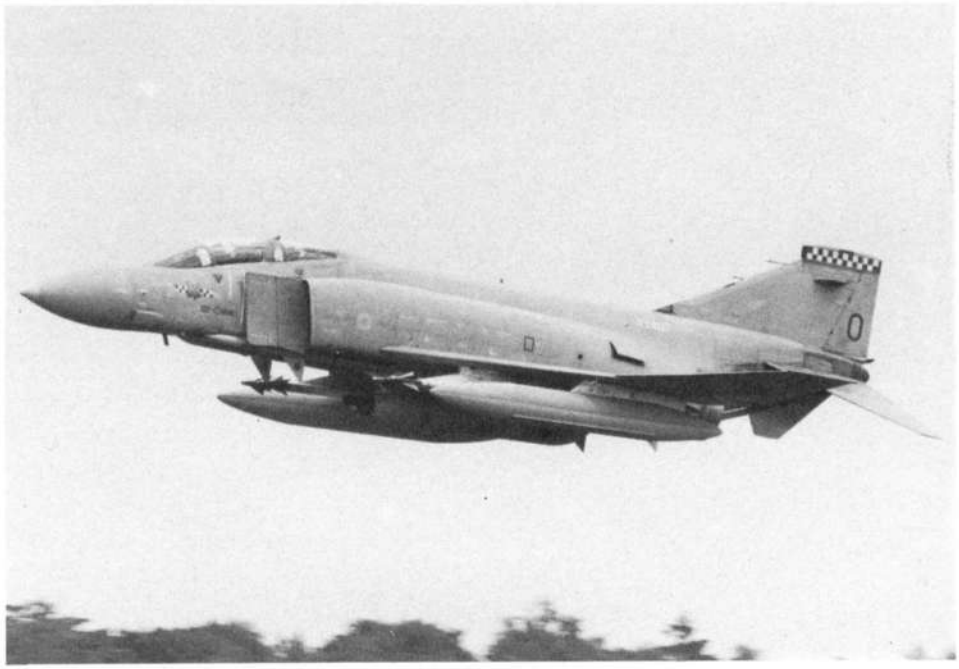
New combat concepts

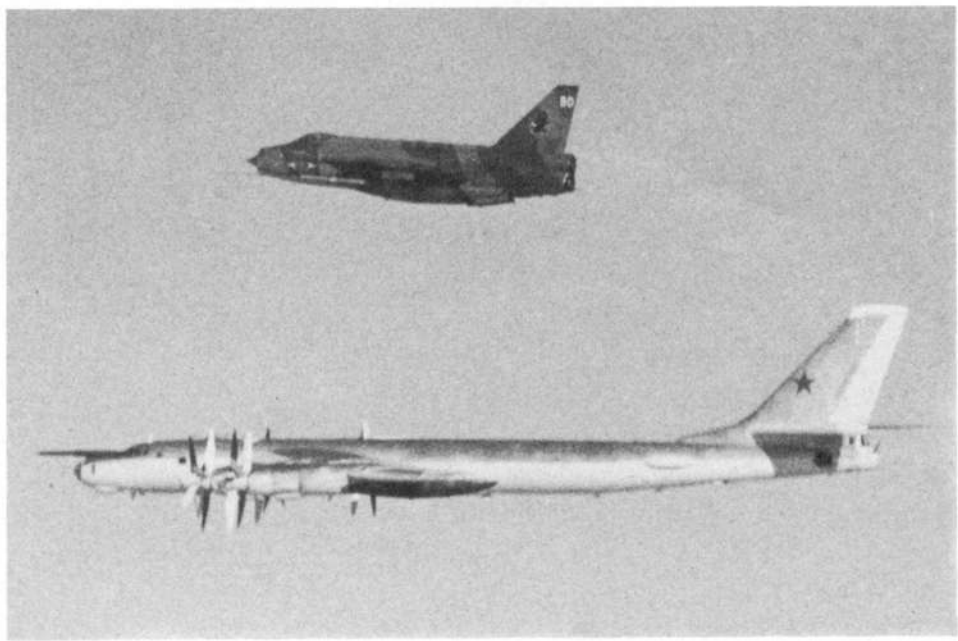
When the first Tornado squadron is declared operational, No 11 Group will take a significant stride forward; but the promised leap into the future will come when Link 16 comes on line at the end of this decade. Link 16 is part of the new Joint Tactical Information Distribution System (JTIDS) which will revolutionise air defence to a degree not seen since radio was first taken into the air. By the time this system is fully deployed, the Tornado will be able to join battle without a word being spoken, because the voice is inadequate for split-second relay of the mass of data required for effective operations.

Either of the two video screens in the rear cockpit can display relevant parts of the same computer-generated tactical picture as that circulated to every ground control station and airborne early-warning aircraft in the area. Instructions transmitted to the Tornado on the same link will indicate the optimum method of attacking enemy aircraft, whilst the aircraft will automatically relay back its weapon and fuel states to the control centre. Of course, the Tornado will be able to intercept targets that its crew alone can see, while at the same time relaying the enemy's location for incorporation into the tactical picture. In fact, the system will work like a giant pictorial "Ceefax" or "Oracle" system, with the difference that "subscribers" will provide, as well as extract, information.

Changes are also taking place on the ground at Tornado F Mk 2 bases. Gone are the lines of fighters waiting the day's flying, and in their place have come the hardened aircraft shelters (HAS), as already built at Tornado GR Mk 1 bases. Coningsby's installation has just been completed, and comprises (as well as the aircraft shelters), a Pilot Briefing Facility, a Hardened Personnel Shelter and a number of bowser or equipment shelters — each of them capable of withstanding a direct hit from a conventional HE bomb. Coningsby will be followed by Wattisham (for Phantoms), Leuchars and then Leeming (the last-mentioned station having transferred from Support Command to No 11 Group on 1 October 1984). Also available to the force will be facilities in the Hebrides for easier coverage of the "back door".

Much remains to be done before the Tornado is ready to take its place in the front line, and a lot of it is happening at Coningsby, Lincs, where the re-formed No 229 Operational Conversion Unit took delivery of its first two aircraft on 5 November 1984. Initial instructor training will be by BAe at Warton, where the Tornado is assembled, during the first part of this year. On their return to Coningsby, these instructors will conduct conversion courses for the rest of the OCU staff, before the aircrew destined for the first squadrons enter OCU training. Between 1985 and 1995 three Phantom squadrons and the two Lightning squadrons are scheduled to convert to the Tornado F Mk 2, and two additional new squadrons will be formed on the type to make up the planned seven-squadron force. Unlike the strike-Tornado course, training on the F Mk 2* will include conversion to both the aircraft and its weapon systems at one OCU.





(Top) The Phantom FGR Mk 2 provides the backbone of No 11 Group's air defence force until the full deployment of Tornado F Mk 2s. Illustrated is an aircraft of Coningsby-based No 29 Squadron. (Immediately above) A Binbrook-based Lightning of No 11 Squadron keeps company with a Tupolev "Bear", somewhere over the North Sea.

Second of No 11 Group's eagerly-awaited new assets is the Nimrod AEW Mk 3, whose bulbous nose and tail fairings conceal aerials for a Marconi multi-mode, pulse-Doppler radar capable of locating ships as well as aircraft. Unfortunately, development problems with this highly advanced radar make the phrase "eagerly awaited" more than apt, but it is agreed that when the aircraft does belatedly enter service (an event that is not now expected before 1986) it will have been worth waiting for. Complementing the 18 Boeing E-3A Sentry AWACS aircraft operated by NATO, and the USAF's fleet of E-3Bs and E-3Cs, the Nimrod AEW Mk 3s will replace the elderly Shackleton AEW Mk 2s of No 8 Squadron at Lossiemouth.

Originally a maritime patrol aircraft, the Shackleton was modified in 1972 to carry

**The first 18 production Tornado F Mk 2s for the RAF are from tri-national Batch 4, and as such are powered by RB.199-34R Mk 103 reheated turbofans and lack automatic adjustment of wing sweep. They will later be updated to Batch 5-6 standard with automatic sweep angle selection and Mk 104 engines, having extended afterburner nozzles for additional power.*

1940s-technology AN/APS-20 radar extracted from Royal Navy Fairey Gannets. Its assigned task was then defence of the Fleet, although the RAF soon found it a most useful system for assisting in air defence of the mainland. Six of the 12 AEW Shackletons were grounded as an economy measure in 1981, the survivors having an operational life remaining of some two years. Despite obvious radar limitations, their experienced and dedicated systems operators still manage to provide a useful service to No 11 Group interceptors by plotting low-level targets seeking to elude ground-based radars and directing fighters onto their quarry.

This and much more will be undertaken by the Nimrods that are to be based at Waddington, near Lincoln. In peacetime, they will be deployed as and when required to support NATO and national policing missions; in wartime, it has been reported that a dispersed pattern of four, operating at 25,000 ft (7 620 m) would be able to maintain a constant watch on the approaches to the British Isles. In doing so, they would augment the coverage provided by No 11 Group's ground radars — which are also undergoing modernisation.

Radar update

Lurking in the shadows of the air defence organisation — in more senses than one — are the men and women responsible for maintaining a constant watch over the radar screens of their darkened control rooms. Their tasks also include directing interceptors onto their targets and co-ordinating far larger operations which might include several squadrons meeting a mass attack by enemy aircraft. Therefore, and not without reason, has it been said that fighter control is one of the most interesting and satisfying specialist branches of the RAF today — calling for a degree of dexterity that makes a game of three-dimensional chess seem simple in comparison.

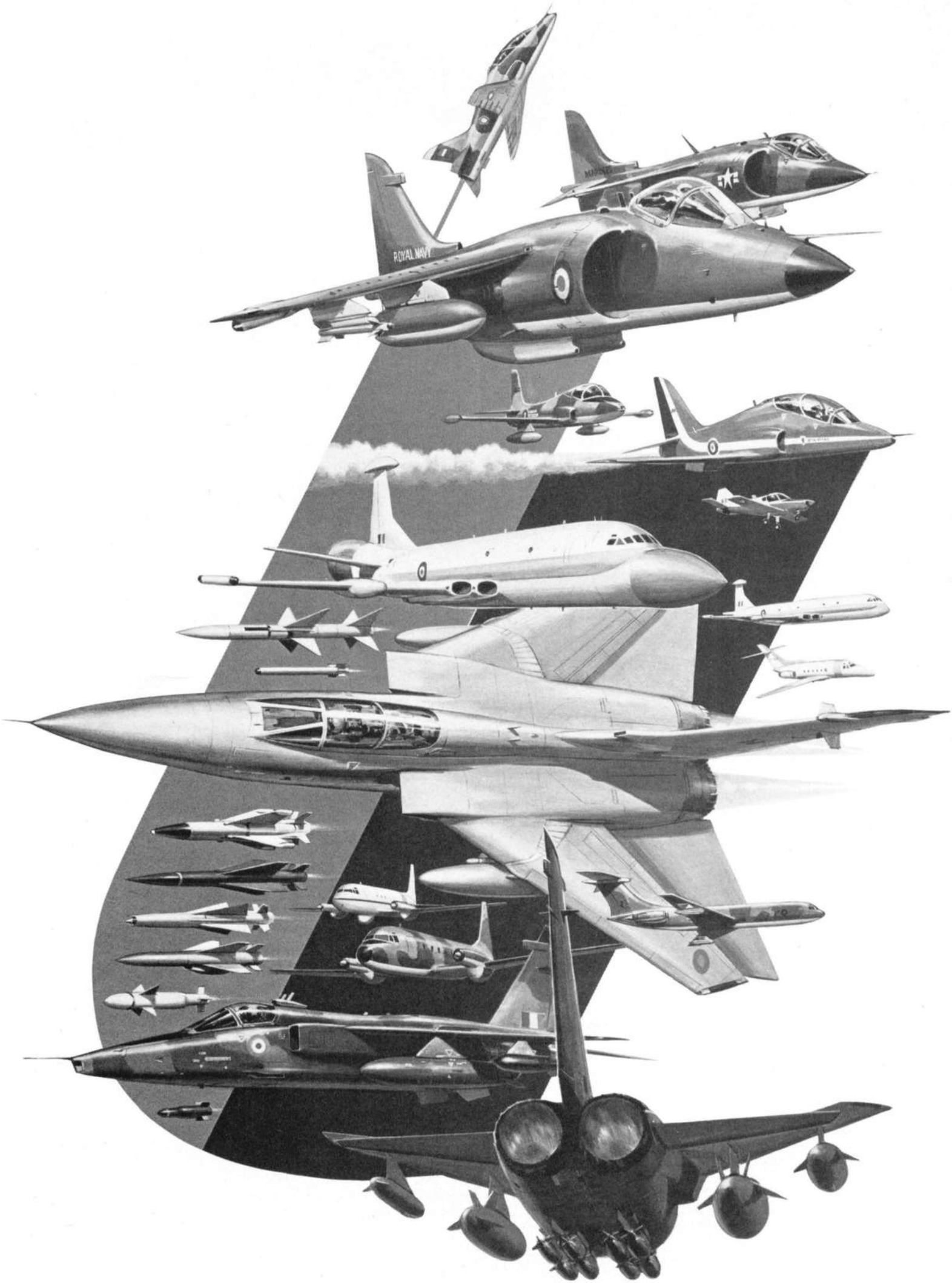
In ultimate control of the air battle is the AOC-in-C of Strike Command (CINCUKAIR) at High Wycombe, who normally delegates the task to the AOC of No 11 Group at Bentley Priory. It is from High Wycombe that wartime operations would be directed, although there is a reserve underground command post now under refurbishment at the Priory. Lower in the chain of command are the Sector Operations Centres (SOC) at Buchan, Grampian; Boulmer, Northumberland, and Neatishead, Norfolk. These three each have attached radar sites, but are additionally fed with information from Control and Reporting Posts at Portreath, Cornwall; Staxton Wold, North Yorkshire; Bishops Court, Northern Ireland; Benbecula, Outer Hebrides; Saxa Vord, Shetland, and — in a unique operational arrangement — a Danish radar on the Faroes. Each SOC has fighter squadrons, tankers and AEW aircraft assigned to it, being entirely responsible for their tactical control. Reallocation of units between SOCs, or to forward bases

(Top) Lightning F Mk 6 of No 5 Squadron, carrying Red Top AAMs; (above) Phantom FGR Mk 2 of No 29 Squadron, displaying its Sidewinders and Sparrows; (right) a Nimrod AEW Mk 3; (below right) a Bloodhound SAM.

at Stornoway and Brawdy, is the prerogative of the AOC No 11 Group or the CINCUKAIR.

Typically, a current reporting site might have a Type 84 and a Type 85 radar — the former performing well against "Window" or chaff-type interference and in poor weather, the latter claimed to be the most powerful in the world. Type 85s have their own power-generating stations, as they would otherwise overburden the National Grid. Here, though, is the weakness of the existing system, for radar stations have fixed positions and are easy targets for attack.

Transportable radar is the answer, with "clever" electronics taking the place of naked power to obviate the worst effects of enemy jamming. In the early stages of delivery are six Marconi Martellos (one type 713 and five type 723s), two General Electric GE 592s and six


ROYAL NAVY

Plessey AR 3205s for replacement of static radars at the eight existing units, plus the Faroes. Based "in the field", they will provide flexibility for the Control and Reporting system. Improvement of facilities and communications will enable any one of four underground Sector Operations Centres to take over the functions of another.

QRA force

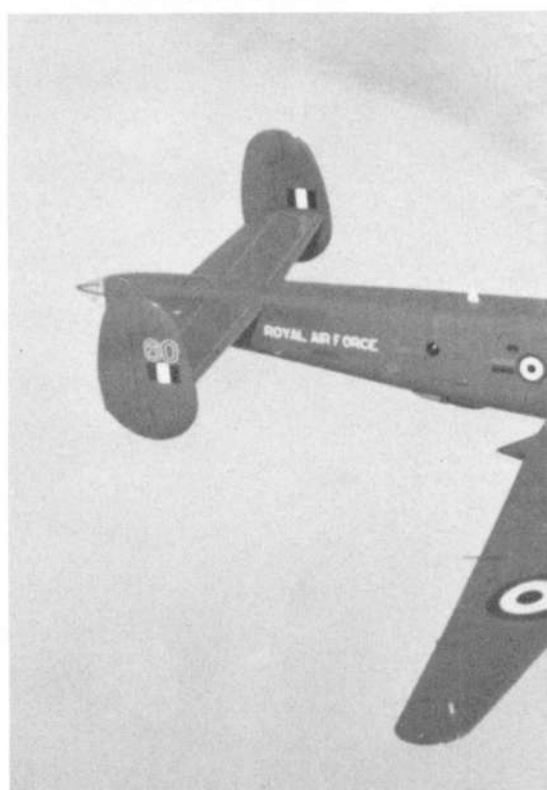
When the probing radar fingers locate an unidentified aircraft, it becomes the subject of a special watch. If later confirmed as Soviet military, the plot becomes an "X-Ray" and surveillance is further increased. Those aircraft passing through the UKADR are afforded a free escort service by the Phantoms and Lightnings of No 11 Group's Quick Reaction Alert (Interceptor) force — QRA(I), or "Q" for short.

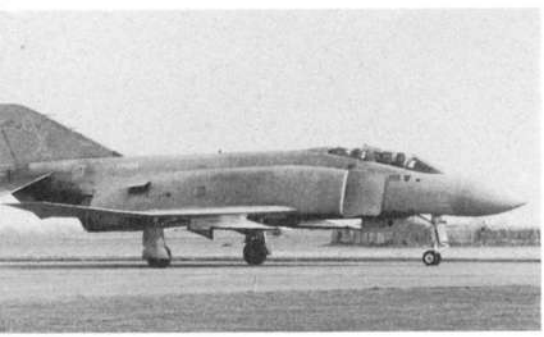
In a specially-constructed two-aircraft hangarette by the runway's end, the QRA aircraft stand constantly armed and fuelled, their crews maintaining a 24-hour watch in the same building, ready to take off within 10 minutes of the signal being given. Often, the aircraft they intercept is a maritime reconnaissance Tupolev *Bear* on its way to patrol the Atlantic, or perhaps a Tupolev *Badger* engaged in gathering electronic intelligence. Both activities are quite legal outside of the 3-mile (5-km) territorial limit, so the interception is relaxed and routine — on both sides.

Oldest of those aircraft assigned to interception is the Lightning, now based only at Binbrook, Lincs. Nos 5 and 11 Squadrons are the operational units, and the Lightning Training Flight provides conversion courses (typically of five months' duration and including 44 hours of flying).

Prime equipment of these squadrons is the Lightning F Mk 6, armed with two Firestreak or Red Top AAMs, plus a pair of 30-mm ADEN cannon in the forward portion of the belly tank. Both AAMs are heat seeking, and even though the Red Top is an improved weapon with a limited head-on attack capability, either may be carried on QRA. F Mk 6 aircraft have provision for over-wing fuel tanks ("overburgers" in Lightning pilots' slang), although these are not used on QRA. The older and lighter F Mk 3 variant of the Lightning — weighing 28,700 lb (13 018 kg), compared with the F Mk 6's 31,000 lb (14 061 kg) — lacks the cannon armament and is used in small numbers by the LTF for instruction and display flying. Each unit also has Lightning T Mk 5 side-by-side two-seat trainers ("Tubs"), which, like all other aircraft on the station, are equipped with in-flight refuelling probes. The Ferranti AI.23D Airpass pulsed radar is to the same modification standard on all marks of Lightning, though lacking the look-down capability of more modern fighters.

It is Binbrook's boast that it is home to the RAF's last true fighter pilots, in that the





Lightning is the sole single-seat interceptor remaining in service. Therefore, the high workload demands an above-average ability on the part of the pilot. This professionalism is matched by the ageing but still very capable Lightning. The ability of the 30-year-old fighter to "mix it" in close combat with the best of the new is attested by camera-gun pictures showing, perhaps, Northrop F-5 aggressor Tiger IIs, F-15 Eagles and even F-16 Fighting Falcons squarely in the sights. (However, it should not be supposed that these combats were by any means all in the Lightning's favour!) Also appreciated is the tendency of the aircraft to warn a pilot gently if he is demanding too much, whereas the Phantom has the tendency to "refuse a fence", with embarrassing consequences if the crew takes similar liberties.

Phantom and friend

To its distinct advantage, the Phantom has longer range; a multi-mode pulse-Doppler radar, and a weapons fit including radar-guided AAMs for medium-range interception in all weathers. With a 2,500 lb (1 134 kg) fuel tank under each wing and one of 4,000 lb (1 814 kg) on the centreline, it can remain aloft without tanker support for three hours — enough for an interception 400 miles (644 km) from base. The missile armament is four AIM-7E Sparrows, or their British-developed Sky Flash variants, beneath the fuselage, plus four heat-seeking Sidewinders (now the latest "all-aspect" AIM-9L model) under the wings. It is possible to fit an SUU-23A gun pod containing the rapid-firing — 6,600 rounds per minute — GAU-4 20-mm cannon beneath the fuselage, but this is sacrificed on QRA for the extra fuel tank.

Three variants of the aircraft are in service, including two squadrons (Nos 43 and 111) of ex-Royal Navy F-4K Phantom FG Mk 1s at Leuchars. Wattisham, Suffolk, has the newly-formed No 74 Squadron, with refurbished F-4J(UK) Phantoms bought from the US Navy to replace the unit now defending the Falklands, as described in more detail elsewhere in this book. The other Phantoms are F-4M Phantom FGR Mk 2s with No 56 Squadron at Wattisham and No 29 Squadron at Coningsby, the latter having been additionally dedicated to SACLANT since January 1980 for air defence of naval forces, and also assigned to overseas reinforcement. Training courses, lasting 19 weeks and including 60-70 hours of flying for *ab initio* student crews, are conducted at Coningsby by No 228 OCU. No Phantoms will be found wearing the OCU's insignia, however, for all its aircraft fly in the markings of the assigned "shadow", No 64 Squadron.

(Top) Fifth production Tornado F Mk 2 in No 229 OCU markings; (far left) a Rapier launch from a mobile fire unit; (centre) the mighty Type 85 air defence radar; (above left) a Phantom FGR Mk 2 of No 228 OCU; (left) Shackleton AEW Mk 2.

Several measures were announced during the early 1980s to further strengthen air defences, including retention of the two Wattisham-based Phantom squadrons after the Tornado has been fully deployed, and arming four squadrons of Hawk T Mk 1 advanced trainers with a pair of AIM-9L Sidewinder AAMs. No 11 Group's Hawks are those assigned to armament training and based at Brawdy with No 1 Tactical Weapons Unit (Nos 79 and 234 "shadow" Squadrons) and at Chivenor with No 2 TWU (Nos 63 and 151 Squadrons). Conversion of 88 of these to Hawk T Mk 1A standard is now well advanced, allowing a force of 72 to be declared to NATO in the defensive rôle — for which a new grey "air superiority" colour scheme has been adopted.

With its turning performance of 7+ *g* permitting it to obtain quick kills against a subsonic incoming formation, the Hawk will have an impact similar to a fox in a chicken coop. The difference is that if the "chickens" attempt to use their superior speed to escape, they will become (to mix the metaphor) "sitting ducks" for the Phantoms with their different, Mach 2, performance envelope.

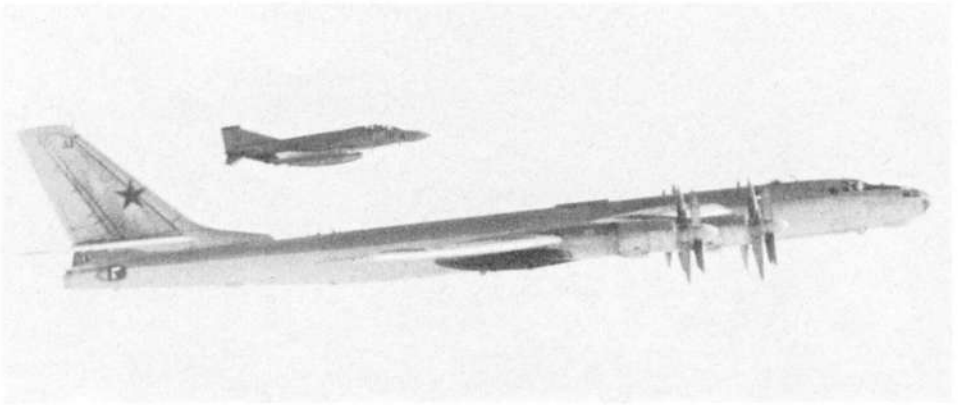
Missile modernisation

Intruders which manage to evade the manned defenders over the North Sea will then have to contend with the SAMs. In a belt from the Humber almost to the Thames are seven flights of Bloodhound 2s in the hands of Nos 85 and 25 Squadrons (the latter unit having been based in RAF Germany until 1982). Despite their age, the Bloodhounds are in the process of an extensive "mid-life" improvement programme to control surfaces, ramjets, radomes, and their launch control posts, which will see them well into the 1990s.

Airfield defence by short-range SAMs of the RAF Regiment (which has a separate squadron numbering system from the Bloodhound and aircraft units — eg, Nos 19, 20, 27, 48 and 66 Regiment Squadrons) involves the Rapier. Until recently, only the Scottish bases of Leuchars and Lossiemouth had mobile Rapier units which would deploy during wartime to concealed sites a mile or two away to catch attackers unawares. Last November, however, the first squadron of three in the newly-established No 6 Wing was commissioned and assigned to the CINCUKAIR via No 11 Group.

Uniquely, No 6 Wing operates Rapiers funded by the US taxpayer and assigned to defence of USAF bases in England, but manned by the RAF under an agreement of February 1981. At a certain alert state, these weapons would be "plugged in" to the UKADR command structure. In common with earlier Regiment equipment, the USAF Rapier fire units are trailer-mounted and towed by Land-Rover, accompanied by a similarly mobile DN181 Blindfire radar providing 24-hour capability in all weathers.

Indeed, "all day, every day" precisely sums-up the commitment by No 11 Group to Britain's security. New aircraft and weapons being delivered are substantially increasing the RAF's acknowledged potency in air combat, whilst modernised ground radar and communications provide the means for economic and effective control of any future air battle. But it would be far better that such a conflict never develops, and to this end, constant vigilance is maintained — and (perhaps more importantly) seen by potential adversaries to be maintained. At this very moment, whenever it may be, No 11 Group's eyes are watching radar screens and its QRA crews are waiting within feet of their armed aircraft. □



No 11 Group has an ongoing commitment to intercept unidentified aircraft passing through the UK Air Defence Region, using the Phantoms and Lightnings of the Quick Reaction Alert (Interceptor) force. (Above right) A Phantom escorts a Tupolev "Bear" out of UK airspace. (Right) The Tornado F Mk 2 will join the "Q" force when it reaches full operational status in the squadrons of No 11 Group.

Royal Air Force Tornados triumph in US bombing contests

Royal Air Force Tornado all-weather combat aircraft have triumphed in the prestigious US Air Force bombing competition, "Giant Voice". Taking part in the contest for the first time, they triumphed over both American and Australian entrants on the Americans' home ground. Tornados of No 617 Squadron, supported by RAF Victor tankers, were competing against B-52 and F-111 aircraft of the USAF Strategic and Tactical Air Commands and F-111s of the Royal Australian Air Force. The competition included strategic and tactical bombing contests at high level (15,000-20,000 ft) and low level (500 ft), all sorties involving flights of several hours and distances of between 1,500 and 2,000 miles. Tornado demonstrated the lethal accuracy of its bombing from all heights with the following comprehensive success:

1st and 2nd, LeMay Trophy

– for the crew with the most points from three high and low-level sorties.

1st and 3rd, John C Meyer Trophy

– for the team with the "best low-level damage expectancy" over six sorties.

2nd, Mathis Trophy

– for the best high-level and low-level team bombing scores (including time control) over six sorties.

Never before have crews and aircraft from outside the USA won either the LeMay or John C Meyer Trophies. The winning crew in the LeMay contest was Sqn Ldr Peter Dunlop and Flt Lt Richard Middleton. They also won the Tornado Trophy awarded by British Aerospace.

PANAVIA

AERITALIA BRITISH AEROSPACE MESSERSCHMITT-BOLKOW-BLOHM

A PRAIRIE VORTEX SWEEPS THROUGH SAC

by Michael J Gething, Managing Editor, "Defence"

"IT'S VULNERABLE, heavy and expensive. I just don't think it's a good 'plane." So said Richard DeLauer, Under-Secretary of Defense for Research and Engineering in the US Department of Defense, in an off-the-record chat with the editorial staff of the *Washington Times*, at the end of last October. He was speaking of the Tornado, cornerstone of the RAF's strike and defence forces for the remainder of the present century.

Mr DeLauer chose his moment well — the very moment when RAF Tornadoes, competing against the best USAF crews that could be fielded in the annual Strategic Air Command Bombing Competition, made an almost clean sweep. Eligible to compete in three categories, the Tornado crews took first place in two and second in the other — as well as a second, a third and a sixth place in the three events! The contest is widely regarded as one of the most realistic of exercises, and the success of the Tornadoes is the more remarkable considering that the RAF's Tornado GR Mk 1s are low-level interdictor strike aircraft while much of the SAC competition is flown at high level, and also that this was the Tornado's first appearance in "Giant Voice", as SAC codenames the event.

HQ Strike Command decided as long ago as July 1983 that No 617 Squadron — The Dambusters — would provide two teams of two crews each to participate in the SAC competition to be held in October 1984, with the support of the Victor K Mk 2 tankers of No 55 Squadron. Both No 617 and No 55 are based at RAF Marham. The competition was inaugurated in 1948, and over the years other air forces, notably the RAF, have been invited to participate. The RAF first entered "Giant Voice" in 1951, but in 30 years recorded success only in 1974, when one Vulcan crew won the Mathis Trophy and another won a navigation trophy. Although there was a phase in "Giant Voice" for the tanker support elements, the RAF declined to enter the Victors, as they were required actively to support the Tornadoes during their competition sorties. The opposition for 1984 comprised FB-111s and B-52 Stratofortresses of SAC, F-111Ds of TAC, F-111Fs from USAFE in Europe and F-111Cs of the Royal Australian Air Force.

Once the RAF decision to participate had been taken, plans were made to bring eight Tornadoes up to the required standard, in order to fly six to the United States. This would ensure that at least four aircraft were always available for the competition sorties. Among the modifications required were a data-dump facility for tone-release scoring; increased waypoint/fixpoint numbers in the Ferranti FIN 1010 Digital Inertial Navigation System; a stores-management modification to allow stores jettison on take-off; inclusion of an AFDS display on the HUD for use during low-level operations, and improvements to the RWR and ECM pod to cope with the EW element of the competition.

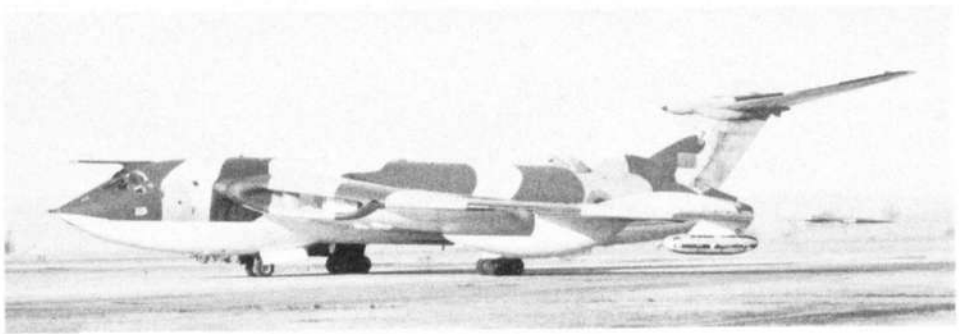
After each work-up sortie at Marham, every Tornado was carefully scrutinised to ensure maximum knowledge of systems and serviceability, with a full debrief conducted between aircrew and chief tradesmen. Each major system was scored out of ten for accuracy and effectiveness and the results fed into the squadron's computer. Thus, an instant record of individual aircraft performance was available at any stage.

The Victors, too, received their share of fine-tuning, with particular attention given to the avionics, and an IFF interrogator was installed to ensure an accurate rendezvous with the Tornadoes. As Sqn Ldr Pete Dunlop pointed out "The Victors couldn't win the competition for us, but they could have lost it for us". At least two air-to-air refuellings (AARs) were required for each competition sortie, and close co-operation between Victor and Tornado was essential. The co-location of both squadrons at Marham ensured face-to-face debriefs.

With aircraft modifications underway, selection of the aircrew began. All squadron aircrew were considered eligible: flying skill and "big match temperament" were required of the pilots, while the navigators were selected for their radar background and skill, plus competence in the full spectrum of the Tornado's equipment. The Victor crews were constituted for the duration of training and the competition.

By May, six crews had been selected in time for the first in-theatre detachment to Ellsworth AFB, South Dakota, the home of SAC's 28th Bomb Wing — winner of the 1983 competition — and venue for "Giant Voice" 1984. The six crews completed identical work-up routines, and the final selection was made, as required by SAC, on 1 September. They were:

	Pilots	**Navigators**
Team A:	Sqn Ldr Pete Dunlop	Flt Lt Dick Middleton
	Flt Lt Iain Hunter	Flt Lt Dermot Dolan
Team B:	Flt Lt Steve Legg	Sqn Ldr Vic Bussereau
	Flt Lt John McDonald	Sqn Ldr Alan Dyer-Perry



(Top) The six Tornado GR Mk 1s ready to depart RAF Waddington; (centre left) briefing the crews and (centre right) preparing spares to accompany the detachment; (above) one of the Victor K Mk 2 tankers that accompanied the Tornadoes.

FOR THE GROUNDCREW, a nucleus of trade chiefs, all acknowledged experts, was established to mastermind all aspects of aircraft preparation. Their postings were frozen for the duration of the competition. Tradesmen were drawn on merit and availability.

In all, some 250 personnel from both squadrons were involved. For No 617 Squadron, a project officer who understood all aspects of what was a relatively unknown area of Tornado capabilities was required. A suitable candidate, a Qualified Weapons Instructor from the Tornado Weapons Conversion Unit, was found, and in February 1984, Sqn Ldr Nigel Huckins was posted to the squadron to mastermind all aspects of the venture.

During late April/early May, three Tornadoes and two Victors detached to Ellsworth AFB, as *Prairie Vortex I* (the RAF code-name for its participation in the SAC contest), to gain in-theatre experience of USAF operations. Specifically, their job was to investigate operations over the United States, to fly representative sorties over routes and targets, and to collect first-hand intelligence and target data. The detachment was successful — all 15 planned sorties being flown — with the much-needed mapping and radar data collected. Operating out of a USAF base into an FAA-controlled sky presented its own problems, but plans to deal with this were formulated in the light of the experience.

The final three months of the UK work-up started to bring the elements of training together. June was devoted to "academic" radar offset bombing and tone-release techniques over Spadeadam range by day and night, with the limited number of modified aircraft available. Further aircraft were used for trials with the reprogrammed Marconi Sky Shadow ECM pod, and all aircrew became current in AAR techniques. Half-route simulations of 3-3½ hour duration were flown during July, including one AAR bracket. Practice bombs were dropped over West Freugh and results analysed. AAR techniques were refined and ECM pod trials continued. By August, full route simulations of 5-6 hours were being flown, using Spadeadam, West Freugh, Holbeach and Wainfleet ranges, by day and night.

Although configured with three 330-Imp gal (1 500-l) external fuel tanks, the Tornadoes required at least two AAR brackets per sortie. The technique devised, and which worked successfully in a total of 111 join-ups during the detachments, brought the Victor and Tornado together by day or night, in VMC or IMC, without ground radar assistance. At the rendezvous (RV) point, the Victor was required to be 2 nm (3,7 km) ahead of the Tornado. Using the Victor's ARI15956 IFF interrogator to ensure long range accuracy, the Tornado's ground-mapping radar, TACAN and stopwatch timing, the tanker and receiver approached one another at different heights (around 18,000 ft/5 500 m), timed to arrive at datum points 16 nm (29,6 km) apart. At its datum, the Victor began a 180 deg precision turn, while the Tornado delayed 2 nm (3,7 km) before turning through 25-30 deg (depending on altitude) towards the tanker. With their speed differential, the RV was completed some two minutes later, bringing the Tornado in position to close on the Victor and make contact. Fuel transfer began five minutes after RV datum time.

In mid-August, an advance party left for Ellsworth AFB to prepare for the main party of six Tornadoes and three Victors, which departed the UK on 29 August. This gave the detachment, code-named *Prairie Vortex II*, the whole of September to complete its in-theatre training. The work carried out by Sqn Ldr Huckins and the advance party, and the subsequent preparation of route and target combat mission folders tailored to each crew, was now to pay dividends.

The competition was split into two phases, with each crew flying one live-bomb drop sortie, and one radar-offset simulated tone-bomb release by day and night. To ensure launching a competition sortie within the 20 minute "window", two aircraft were always taxied to the end of the runway, while ground parties stood by to correct any last minute problems, in touch with the aircrew and squadron ops room by portable radio.

The first phase sorties, flown on 1 and 4 October, involved a high-level transit of two hours to the "Red Flag" ranges over Nellis AFB, with AAR support; a 30-min run across the ECM range with jamming and fighter harassment from Canadian CF-101 Voodoos directed by an E-3A Sentry (without success!) to drop two bombs within 10 nm (18,5 km) of each other on re-show targets using one offset; followed by climb-out, AAR and return to base. The Tornadoes were launched on time and performed successfully, although one problem occurred on a Sky Shadow ECM pod which, fortunately, did not result in a missile "kill" of the Tornado in question.

The next week began with what should have been the night sortie of phase two, but, because of the squadron's order in the take-off stream — 0600 hr — this became the day sortie. After a high-level sector with AAR and one tone-bomb release, the flight came down to low level (750 ft/230 m) where the terrain-following radar of Tornado was used to advantage. During this sector, four more tone-releases were made. The action was further complicated by the need to climb to 18,000 ft (5 500 m) for a second refuelling between the second and third bombs: the time from bomb release to this RV datum was a mere 3½ minutes! A high-level return to base completed the six-hour sortie. As Flt Lt Dick Middleton said "It was long periods of inactivity interspersed with short bursts of hyper-activity". Take-off timings were again met and successful sorties flown, although a computer malfunction caused a wild score for one member of Team A.

The second sorties, nominally the daylight one, became nocturnal for the Tornadoes after

an 1830 hr take-off. The route and requirements were identical to the previous sortie, but flown in reverse. The aircraft launched on time and in good order, but one member of Team B suffered radar failure in flight, while another ECM pod played-up.

The detachment returned to the UK on 23 October, while the results from all sorties were being analysed, but was back at Barksdale AFB a week later for the announcement of results, competition de-brief and (as it turned out) the prize-giving and subsequent celebrations. The exact results were as follow:

The Mathis Trophy: open to B-52s, all F-111s and Tornadoes, to determine the top bomber unit, based on total points compiled in high- and low-level bombing: RAF Team A — second out of 21, with 5,089 points; Team B — sixth with 4,973 points (the winners were 416th Bomb Wing, Griffiss AFB, with 5,160 points).

The John C Meyer Trophy: for F-111s and Tornadoes, to determine the unit able to produce the highest damage expectancy rating: RAF Team A — first of eight with 90·43 per cent; Team B — third of eight with 83·08 per cent (second place being taken by F-111Ds of 27th TFW, Cannon AFB, with 86·5 per cent).

The Curtis E LeMay Bombing Trophy: again for all three aircraft types, awarded to the crew with most points for high- and low-level bombing: Sqn Ldr Pete Dunlop and Flt Lt Dick Middleton (RAF Team A) with 2,616 points came first of 42 crews, with Flt Lts Iain Hunter and Dermot Dolan (RAF Team A) with 2,612 points coming second (third place going to a B-52 crew from the 416th Bomb Wing with 2,581 points).

Needless to say, the *British Aerospace Trophy* for the best Tornado aircrew went to Sqn Ldr Dunlop and Flt Lt Middleton!

With a considerable investment of taxpayers' money laid out in the RAF participation in this competition, it is natural to expect that some lessons came out of No 617 Squadron's success, in addition to the satisfaction of winning. The tactical tanking lessons were most important, and should be taken up operationally. The Sky Shadow ECM pod was given its best evaluation so far, although one or two weaknesses remain to be rectified. For operational flying, many of the avionics "tweaks", including increase in waypoint numbers, stores management modifications, AFDS display on the HUD and some terrain-following radar mods, will be taken up. The use of modularity kept serviceability high "providing you've got the spare LRUs (line replacement units)". The Tornado's excellent long-range capability has been proved — six-hour sorties, equating to almost 3,000 nm (5 550 km) were flown as a matter of course.

The final words can be left to No 617's CO, Wg Cdr Tony Harrison. "As far as the squadron is concerned, we found it enjoyable and it got the squadron together. We *are* the premier RAF Tornado bombing squadron . . . we've proved it conclusively!" *Prairie Vortex* proved something about the Tornado, too — Richard DeLauer please note! □

Acknowledgements: The editors and author wish to thank Wg Cdr Tony Harrison, Sqn Ldr Pete Dunlop and Flt Lt Dick Middleton, all of No 617 Squadron — The Dambusters — for their assistance in the preparation of this feature; plus all the other members of the Squadron, RAF Marham and HQ Strike Command who made the result and this feature possible.

FROM D.H.9 TO WESSEX . . . THE RAuxAF ANNIVERSARY

by Rodney Steel

WHEN THE FIRST Auxiliary Air Force units were formed, 60 or so years ago, one of them was such an elite organisation that it became known as "the millionaires' mob". Twenty years later, the 20 auxiliary squadrons that were by then in being were still elite units, but for a different reason: they included among their number some of the most famous operational squadrons in the RAF, having earned undying glory during the great air battles of the Second World War.

Today, the Royal Auxiliary Air Force remains an exclusive organisation: only the best will do for this newly re-emergent territorial force which is undergoing a substantial expansion to a prospective strength of 5,000 men and women, with plans for a new flying rôle in the near future.

The original Air Force Constitution Act of 1917 incorporated provisions for a reserve, but not until 1923 were specific steps taken to establish one. The British government finally accepted the recommendations of the Salisbury Committee (part of the Committee of Imperial Defence) that the Home Defence Air Force should include a territorial element, and envisaged 20 squadrons of "weekend flyers" to back up regular RAF units.

As an initial step, plans were formulated to inaugurate six auxiliary squadrons (numbered from 600 up, each with a part-time CO and only a small cadre of regular personnel) and seven special reserve squadrons (numbered from 500 up, with regular COs, and a substantial nucleus of regular officers and airmen).

In May 1925, No 502 (Ulster) Squadron became the first of the new territorial flying units to spring into being, followed quickly by No 602 (City of Glasgow) Squadron in September 1925, and Nos 600 (City of London), 601 (County of London) and 603 (City of Edinburgh) Squadrons in October 1925. Within five years a further seven units had been raised, and another was added in 1931. These 13 founder squadrons were nearly all light bomber units, mostly using D.H.9As, Fawns and Wapitis, although larger aircraft (Vimys, Hinaidis, Hyderabads and Virginias) equipped some heavy squadrons; for basic training, Avro 504s and Tutors were employed.

No 601 Squadron was the famous "millionaires' mob", established through the instigation of veteran World War I flyer Lord Edward Grosvenor and drawing its pilots largely from well-to-do young denizens of prestigious White's Club in London's West End. Titled officers were almost ten-a-penny in other reserve squadrons too, and, in any event, a tidy bank roll was required to finance Auxiliary Air Force activities: pilots were required to have a civil pilot's A licence as a condition of entry (instruction fees could be reclaimed from the Air Ministry on successfully qualifying), and service pay and allowances did not really cover expenses, even before off-duty socialising was taken into account. For the airmen in ground trades, the opportunity of working on aircraft was probably the chief attraction of auxiliary service, with frequent opportunities for flying as passengers and sometimes a little unofficial piloting instruction. Even among the junior non-commissioned ranks there were a substantial number of well-off young men, and it was not unknown for a chauffer-driven Rolls-Royce to collect an airman on a Sunday evening after the weekend's flying was finished.

More modern equipment was released in the mid-'thirties, with Harts and Hinds becoming more or less standard issue for those auxiliary units that retained the bomber rôle, but one or two had an army co-operation task and used the Audax, Hector or Lysander, while Nos 502 and 500 became general reconnaissance squadrons with Ansons. The special reserve squadrons were integrated into the Auxiliary Air Force during 1936-37, and eight new squadrons were formed between 1936 and 1939, with the tempo of training becoming very much more intensive as the political situation in Europe steadily deteriorated.

By the late 'thirties, 14 of the territorial units had become fighter squadrons, variously equipped with Demons, Gauntlets, Gladiators and even (by the spring of 1939) Hurricanes and Spitfires. On the outbreak of war, when the auxiliaries were absorbed into the RAF, three units had Hurricanes, four were flying Spitfires, and three operated Blenheim night fighters.

In Scotland, Nos 602 and 603 Squadrons destroyed the first two German aircraft to fall over British territory (in fact the sea) during World War II (on 16 October 1939) and 12 days later they shared in the destruction of the first hostile machine actually to crash on Britain itself — a Heinkel He 111 brought down near Haddington, East Lothian. Three auxiliary squadrons were in France in 1939-40, and 14 of them took part in the Battle of Britain — 12 as day fighter units with Spitfires or Hurricanes and two with Blenheim night fighters. Flt Lt J C Dundas, of No 609 Squadron, achieved outstanding fame on his last sortie, from which he failed to return, by shooting down the *Luftwaffe* ace Helmut Wick, credited with 56 victories: the British Spitfire and the German Messerschmitt both fell into the Channel and neither pilot was ever seen again.

Inevitably the heavy toll of casualties sustained by all the RAF squadrons involved in the Battle of Britain had made severe inroads into the pre-war cadres of weekend flyers, and from the autumn of 1940 onwards, the former auxiliary squadrons were increasingly manned by personnel with no territorial background. Even the surviving auxiliaries were gradually scattered by postings and promotions, although some ground crew members eventually managed to remain with their original units until the end of the war.

The auxiliary squadrons played a leading rôle in the RAF's switch to the offensive in 1941, taking part in fighter sweeps across occupied Europe and providing fighter escorts, flying Halifaxes with Coastal Command and the Middle East Air Force, hunting U-boats with Wellingtons, scouring the night skies in Beaufighters and Mosquitoes for *Luftwaffe* raiders (No 604 Squadron pioneered the use of airborne interception radar under the guidance of John Cunningham), and attacking enemy shipping with Hudsons. Auxiliary fighter squadrons flew from Malta and in the western desert, as well as over Burma. Medium bombers accompanied the advancing Allied armies through Italy, and Mosquitoes operated with the Pathfinder force in addition to being used by No 613 Squadron for a pinpoint attack on a Gestapo headquarters in The Hague. Towards the end of the war, No 609 Squadron operated rocket-firing Typhoons with distinction during the invasion of Europe, while No 610 (flying Spitfire XIVs) and No 501 (using Tempests) were assigned to the south coast to tackle the V-1 flying bomb menace, being joined in August 1944 by No 616 Squadron with Meteors — the first RAF unit to equip with jet aircraft.

While these stirring deeds were taking place in the air, auxiliary air force squadrons had been formed to man the balloon barrage which ringed London and other key sites. Eventually there were 47 of these units, deployed successfully not only against the day raiders of 1940 and the subsequent *Luftwaffe* night blitz but also to provide defence against the V-1 flying bombs in 1944.

Over a period of 60 years, the Royal Auxiliary Air Force has flown a variety of aircraft types, almost all of them at the same time that similar equipment was in front-line operational service with the Royal Air Force itself. Illustrated opposite — in each case in the hands of an Auxiliary squadron — are most of the types flown up to 1945. From left to right, top to bottom, they are: Avro 504N (J9420) of No 601 (County of London); D.H.9A (J8211) of No 603 (City of Edinburgh); Vickers Virginia X (J7438) of No 500 (County of Kent); Handley Page Hinaidi of No 503 (County of Lincoln); Handley Page Hyderabad (J8321) of No 503; Westland Wapiti (K2241) of No 604 (County of Middlesex); Hawker Harts (K3848, K3845, K3816) of No 500; Hawker Hart (K2435) of No 605 (County of Warwick); Hawker Hart (K3865) of No 602 (City of Glasgow); Hawker Demon (K4499) of No 604; Hawker Hector (K8127) of No 615 (County of Surrey); Gloster Gauntlet II of No 615; Hawker Hurricane IIC of No 601; Bristol Blenheim IF of No 601; Bristol Blenheim IF (L8715) of No 604; Avro Anson I (N5361) of No 608 (North Riding); Armstrong Whitworth Whitley VII (BO622) of No 612 (County of Aberdeen); Handley Page Halifax II Srs 1 (Special) (HR686) of No 502 (Ulster); Supermarine Spitfire Is of No 611 (West Lancashire); Spitfire I of No 602; Supermarine Spitfire VB (BM594) of No 611.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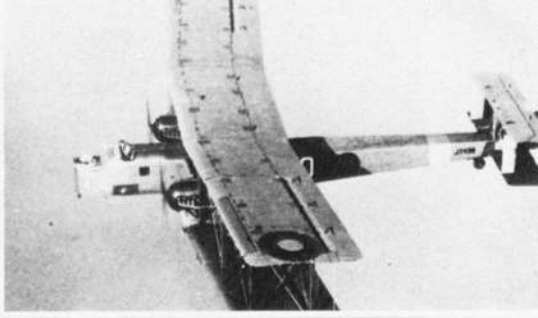

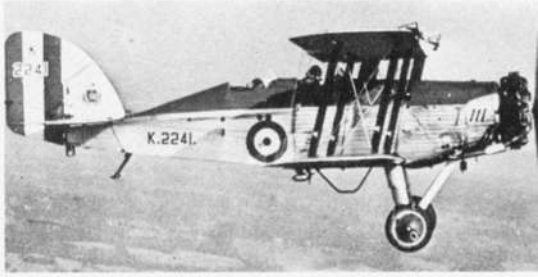
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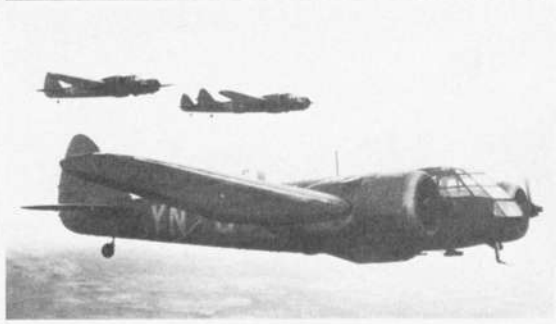
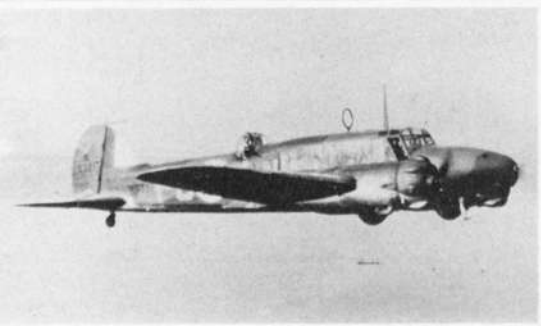
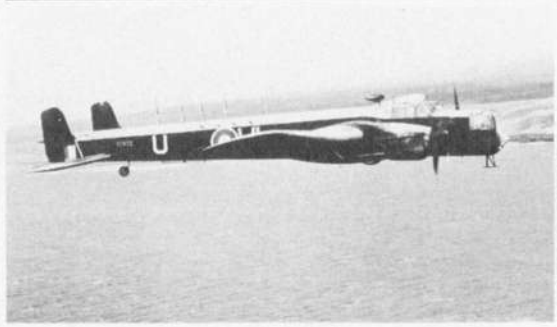






PEACE IN 1945 brought disbandment for the regular squadrons bearing auxiliary numbers, but a new generation of weekend flyers were soon attracted to re-activated part-time squadrons. There was no shortage of recruits, with many of the old hands even offering to take a reduction in rank so that they could re-enlist.

Officially re-formed on 2 June 1946, the new Auxiliary Air Force was intended to include 20 squadrons: 13 fighter, three night fighter and four light bomber. In the event, the light bomber rôle was quickly dropped in favour of night fighting with the Mosquito NF Mk 30, the interceptor units starting off with Spitfire XIVs, LF Mk XVIs and 21s, but later acquiring F Mk 22s.

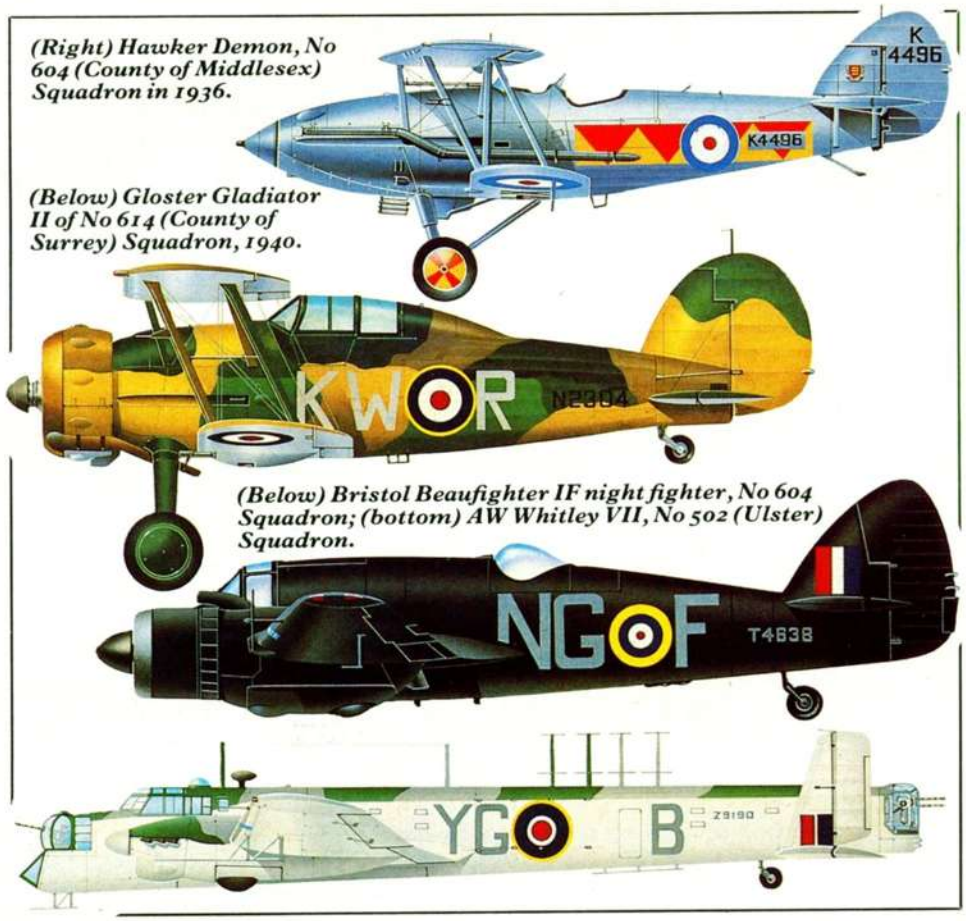
The night fighter units became day fighter squadrons in 1948, this change coinciding with the beginning of a switch to Vampire or Meteor jets throughout what had become, on 16 December 1947, the Royal Auxiliary Air Force. At the end of 1951 it was an all-jet force, but by 1954, the regular RAF squadrons were beginning to receive swept-wing fighters capable of supersonic speeds (in a dive, anyway). Swifts, Hunters and Sabres were regarded by some as too hot for weekenders to play with, notwithstanding the success of the Air National Guard in America with more advanced jet types.

All but two of the Auxiliary squadrons flew Spitfires either during or after World War II. No 602 (County of London) took Spitfire VCs (above) to North Africa in 1942. No 611 (West Lancashire) was fortunate to receive Spitfire Is (right) at Digby before the war started.

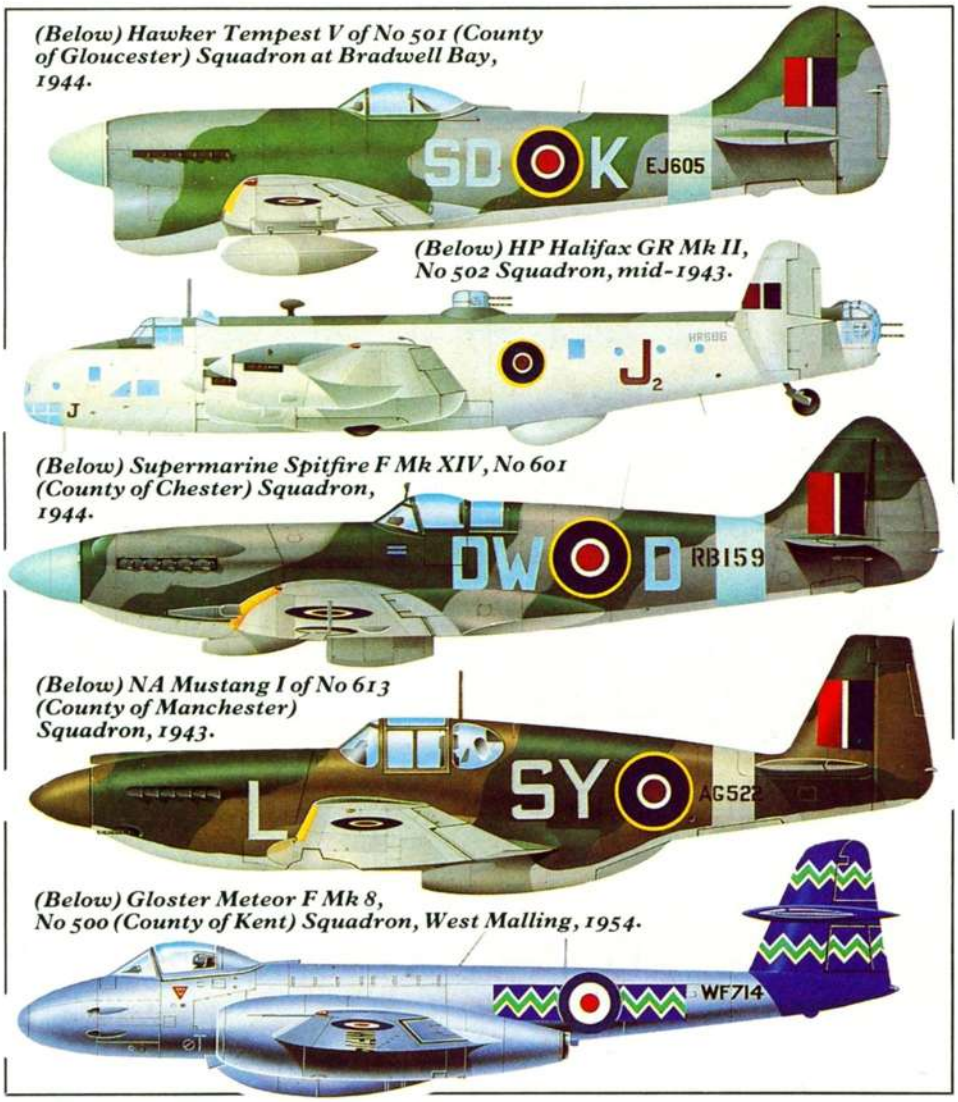
(Right) Hawker Demon, No 604 (County of Middlesex) Squadron in 1936.

(Below) Gloster Gladiator II of No 614 (County of Surrey) Squadron, 1940.

(Below) Bristol Beaufighter IF night fighter, No 604 Squadron; (bottom) AW Whitley VII, No 502 (Ulster) Squadron.



FROM D.H.9 TO WESSEX . . . THE RAuxAF ANNIVERSARY

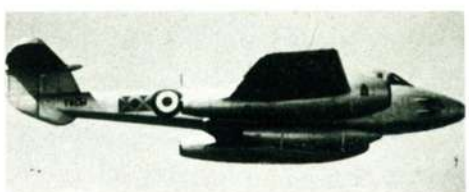


(Opposite page) Spitfire F Mk 22s of No 611 (West Lancashire) and a Mosquito NF Mk 30 of No 616 (South Yorkshire), typifying the equipment used by the RAuxAF squadrons in the early post-war years. (Below) De Havilland Vampire FB Mk 5s of No 614 (County of Glamorgan). (Below right) Meteor F Mk 4 of No 609 (West Riding of Yorkshire) and (centre right) Meteor F Mk 8 of No 611. The Vampire and Meteor were the only jet fighters flown by the auxiliaries, but it is noteworthy that No 616 (South Yorkshire) (photo bottom right) was the very first to equip on Meteor Is in 1944.

A PRESSING NEED for defence cuts sealed the fate of the territorial fighter squadrons. In 1957, the Royal Auxiliary Air Force's flying units were disbanded, as also, shortly afterwards, were the fighter control and radar reporting units that had come into being post-war, along with the air observation post squadrons and Regiment squadrons, leaving only three maritime headquarters units (at Northwood, Pitreavie and Mountbatten) to maintain the auxiliary traditions. Their work was (and still is) to monitor the movements of surface vessels and submarines, and to guide Royal Navy ships or RAF aircraft out on patrol.

Expansion in 1979

Then, in 1979, it was announced that there would be a re-expansion of Britain's territorial air force. Three Royal Auxiliary Air Force Regiment squadrons were formed (Nos 2503 County of Lincoln at Scampton, 2623 East Anglian at Honington and 2622 Highland at Lossiemouth) with the task of providing the ground defence of airfield perimeters. A substantial number of trained infantrymen — ex-RAF Regiment, ex-army, or former marines — applied for the 140 or so vacancies in each squadron, along with potential recruits from such diverse civil occupations as teaching, banking, automobile engineering, the telephone service and agriculture. In addition, women were recruited for communications duties, which although essentially non-combatant nonetheless require them to carry a personal weapon. Selection procedures were stiff, with searching initiative and fitness tests to be successfully accomplished before acceptance for enrolment.



SO SUCCESSFUL did the Royal Auxiliary Air Force Regiment scheme prove that three more squadrons were activated: at Marham (No 2620 County of Norfolk), Brize Norton (No 2624 County of Oxford), and St Mawgan (No 2625 County of Cornwall). Equipped with small arms, general purpose machine guns, light mortars and anti-tank weapons, these highly mobile units have Land-Rovers and 3-ton trucks to facilitate rapid deployment. Training takes place in evenings and at weekends, and the annual two-week camp is usually held at a military training area where live firing is possible in a battle environment, with involvement when the opportunity occurs in station or NATO exercises. At Lossiemouth, one flight has also been working with the Rapier ground-to-air missile to ascertain the feasibility of Royal Auxiliary Air Force personnel manning these batteries.

Also newly formed is a movements squadron at Brize Norton (No 4624 County of Oxford) which will eventually be nine flights strong with over 200 personnel. Its members are responsible for the documentation and loading of RAF transport aircraft based at Lyneham and Brize Norton, as well as passenger processing, and can expect to serve on overseas detachments in north-west Europe or on the Falklands air bridge at Ascension, as well as deploying on NATO exercises such as (in 1984) Exercise "Lionheart". Their availability greatly facilitated the release of regular RAF movements personnel to take part in the airlift of food to Ethiopia in the autumn of 1984.

At Wroughton there is No 4626 (County of Wiltshire) aeromedical evacuation squadron, currently recruiting a team of qualified doctors and nurses together with trained or trainee medical assistants to provide teams for airlifting casualties to hospital — this unit is already beginning to play its part in RAF activities, and had some of its members in Europe for Exercise "Lionheart".

Future developments include plans to expand the Royal Auxiliary Air Force Regiment squadrons to a total of 21, and possibly the establishment of an auxiliary Wessex support-helicopter squadron to provide airlift capacity for a Yorkshire-based territorial army brigade. Aircraft from Royal Navy sources have already been earmarked, and the scheme now depends on arranging the necessary finance and regular cadre for them.

In addition, a new Waddington-based Royal Auxiliary Air Force squadron will be equipped with reconditioned 35-mm Oerlikon anti-aircraft guns captured from Argentina during he Falklands war. Only about two-years-old at the time of the campaign, these mobile guns in twin-mountings required very little refurbishment and are complete with Skyguard radar guidance and fire control systems, which give them an all-weather short-range kill capability comparable to that of Rapier missiles.

Thus, the future for the Royal Auxiliary Air Force is bright, and with the fine traditions of this territorial force there can be no doubt that if plans for a Wessex squadron do bear fruit, it will be one of the keenest and most skilled helicopter units in the British armed forces. □

(Top left) Personnel of No 4624 (County of Oxford) Movements Unit loading a Hercules at RAF Lyneham (photo, Peter Benson); (above) Spitfire F Mk 21s flown by No 600 (City of London) Squadron in 1948; (below) men of a Movements Unit on a weekend training assignment (photo, Peter Benson).

THE SILENT V-FORCE

Paul Jackson reports on the Air Cadets' modernised glider fleet

SINCE ITS FORMATION by Royal Warrant in 1941, the Air Training Corps has placed great emphasis on providing flying experience for its cadets. One of the most enjoyable and cost-effective methods has proved to be personal tuition in the silent and unhurried world of the two-seat sailplane, but now that the wood and fabric Slingsby gliders are well past their prime, an infusion of new equipment is taking place. Before the end of this year, Britain's Air Cadets will undoubtedly have the world's biggest and best-equipped fleet of gliders at their disposal.

A nationwide organisation functioning within RAF Support Command, yet staffed largely by volunteers, the Air Training Corps (ATC) is open to young people — boys and girls — aged between 13 and 20. Conceived as a pre-Service training formation in the days of war and conscription, it has now immeasurably broadened its curriculum to include such activities as the Duke of Edinburgh's Award Scheme — though aviation remains very much its preoccupation. Almost 900 squadrons and 100 detached flights cater for the interests of air-minded youth willing to spare a few hours per week.

ATC flying takes place in regular RAF aircraft in addition to the dedicated fleet of 50 de Havilland Chipmunk T Mk 10 piston-engined trainers and 150 gliders operated respectively by 13 Air Experience Flights and 27 Volunteer Gliding Schools (VGS). Whilst the sailplanes wear RAF markings, they are inscribed "Air Cadets" so as not to exclude the 186 RAF Sections of the school-orientated Combined Cadet Force which have the same flying entitlement as the ATC. A further 50 Slingsby T.38 Grasshopper primary gliders are allocated to secondary school CCF units and infrequently make the short hops implied by their name from the playing fields of England.

Farewell to the "Woods"

The Yorkshire-based company founded by Fred Slingsby has provided the ATC with its gliders since the earliest days of Corps gliding. Now, however, it has turned entirely to the production of powered touring aircraft, forcing the Ministry of Defence to look abroad to replace a fleet which until recently included 60 T.21 Sedberghs, 70 T.31 Kirby Cadets and five T.45 Swallows.

Known as "Woods" because of their construction, these gliders have given air experience to countless cadets since the late-1940s, but are now outmoded in terms of building materials and performance. Having been kept in excellent condition by a group of 35 RAF glider specialists, many will be offered for sale on the civilian market. The RAF support teams may be disbanded, however, and civilian contractors engaged to repair the latest equipment.

Slingsby's name is not to disappear entirely from cadets' flying logbooks, for between 1977 and 1981, 40 T.61E Venture T Mk 2s were supplied from Kirkbymoorside to selected gliding schools. The Venture — which takes its name from the ATC motto, "Venture-Adventure" — is that aeronautical contradiction, a powered glider. Basically a licence-built SF-25C Falke from the West German firm of Scheibe, the Venture uses its 1600 cc Volkswagen engine for take-off and clearing the circuit. Thus it enables gliding to take place at airfields where winch-launching is not practicable. Thereafter, the simple act of switching-off transforms it into a true glider with performance similar to that of a Sedbergh — hardly competition class, but sufficient for training.

Schools not equipped with Ventures are reliant on the winch. Originally adapted from the equipment which raised and lowered barrage balloons in World War II, the older winches are being replaced, beginning in the middle of this year. Somewhat later, Schools will receive new (Land-Rover-towable) control caravans for the airfield management of the gliding operation. Of course, the most important modernisation is in the sailplanes themselves, and here the RAF has turned to the originator of sport gliding, Germany.

As the result of pressures on the defence budget, it was not until 1982 that first contracts could be placed with UK representatives for a small initial batch of modern gliders. "Modern" in the sailplane world means glassfibre construction for robustness and ease of repair; improved aerodynamics providing better performance; a 720-channel radio for communication with new ground stations at units; and a very welcome piece of transparent plastic shielding aviators from the rigours of the elements.

The chosen aircraft was the Schleicher ASK 21, a tandem-seat competition and training sailplane with a span of 55 ft 9½ in (17 m), which had made its first flight in 1979. At the same time, a "one-off" purchase was also made, exclusively for the Air Cadets Central Gliding School (ACCGS) at Syerston, of five single-seat Schleicher ASW 19Bs and a pair of two-place Schempp-Hirth Janus Cs. The two last-mentioned types replace the T.45 Swallows formerly operated by this instructor-training school, and give personnel the opportunity to take part in national and international competitions with equipment on a par with that used by the opposition.

Delivery of 10 ASK 21s and the other seven aircraft was made during the early months of 1983. Cadets were encouraged to suggest two appropriate names (leaving the Janus with its original title) and, perpetuating the "V" theme, the gliders were duly dubbed ASK 21 Vanguard and ASW 19B Valiant. When Mr Colin Humphreys, Deputy Under-Secretary of State (Air), named the two in a ceremony at Syerston during September 1983, the main batch of 100 two-seaters remained to be ordered, and the natural assumption was that more Vanguards would follow.

This proved to be in error. Three British representatives of German firms and the Grob-Werke GmbH of Mattsies, near Mindelheim,

(Left, top to bottom) Schleicher AWS 19 Valiant T Mk 1 — one of five such single-seat high performance sailplanes used by ACCGS for instructor flying; Grob G103 Viking T Mk 1, the type chosen as the standard replacement for the Sedbergh, Kirby Cadet and Swallow; Schleicher ASK 21 Vanguard T Mk 1 at the ACCGS. (Above, top to bottom) Slingsby Grasshopper T Mk 1 primary glider; "assembly line" at Syerston for Viking T Mk 1s arriving from Germany; Slingsby Venture T Mk 2 motor-glider of No 644 VGS at Syerston; one of the Schempp-Hirth Janus C sailplanes used by the ACCGS for competition flying.

also in West Germany, replied to an invitation to tender, and it was the last-mentioned whose price and delivery schedules for the G.103 Twin II Acro secured it the major order. The first two G.103s were handed-over last September and officially aero-towed to Syerston on 5 October. In the front seat of the first was ex-Air Cadet Lord Trefgarne, Under-Secretary of State for the Armed Forces, making this the first occasion on which a Minister of the Crown has flown an RAF aircraft into service! In the ceremony which followed, the G.103 joined the RAF's new "V-Force" under the name of Viking.

Essentially, there are few differences between Vanguard and Viking, both in performance and appearance (aficionados of aircraft recognition, take note). The Viking has a slightly larger span of 57 ft 5 in (17,50 m) and — for example — is reckoned to be better for demonstrating the stall. Otherwise, the two are equally suited to the task of taking the Air Cadet gliding organisation into the 21st century.

Training transformed

It is the Viking which will train over half of the 2,000 cadets per year, aged 16 or over, who gain their gliding proficiency badge to certify that they have flown solo. This will involve between 30 and 50 launches, as a parallel to the seven to nine hours of flying required in a Venture to reach the same standard. About 14,500 younger cadets each year receive familiarisation training of three winch launches or 20 minutes with the motor glider, meaning that the Air Cadet glider fleet generates some 90,000 launches and 10,000 Venture hours per year, excluding training and checking-out of instructors at Syerston.

These latter duties were performed on a borrowed ASK 21 early in 1983 before the first Vanguard (ZD643) made its initial flight at the ACCGS on 28 April that year. The first Janus C flew on 7 July, and five days later the Valiant received its release for service. No time was lost, and the Air Cadet organisation returned to the competition scene for the first time since 1967, thanks to its modernised equipment. The 1983 National Championships saw a Janus flying at Lasham and a Valiant at Husbands Bosworth, whilst the Inter-Services Championships at Henlow also included Air Cadet representatives. Similar representation was made in 1984.

Already, distinctions have been achieved. Flt Lt Michael Throssell and Cadet Paul Edwards were awarded the British Gliding Association's Seager Cup last year for a round trip of 182·5 miles (293,7 km) in Janus ZD675, and in May 1984 Flt Lts Robin Miller and Bruce Tapson, also with a Janus, broke the 200-km (124 miles) declared goal record for the UK.

Meanwhile, the Vanguard was entering the training rôle with the issue of four to No 618 VGS at West Malling on 18 June 1983 and three to No 645 VGS at Catterick the next month. At the former, Corporal Leslie Hazell gained the distinction (on 4 August) of being the first cadet to solo on the new equipment.

Now, attention is being devoted to introducing the Viking to Air Cadet service. Over 40 had been delivered by the close of 1984, with the balance of the 100 due before the end of this year, and of these the first five were retained by the ACCGS. No 631 VGS at Sealand was next to receive its allocation of seven, followed by five to No 645 VGS and three to No 622 at Upavon. No 645's short career with Vanguards is thus at an end, its aircraft having been transferred to the ACCGS and the only other Vanguard unit, No 618. Nine more schools are converting to Vikings this year, with more to follow in the early part of 1986.

In a programme costing a mere £2 million in its entirety (enough to buy a six-foot length of Tornado F Mk 2), the Air Cadet organisation has transformed its sailplane fleet and so ensured a higher standard of training in the future. The new, modern image will do much towards attracting fresh membership, and that will be of benefit to the RAF, 25 per cent of whose recruits (and 40 per cent of aircrew) are ex-cadets. The present CAS, Sir Keith Williamson, was introduced to military flying whilst a member of the ATC. This weekend or next, maybe a 14-year-old future leader of the RAF will be climbing into a Viking for his initial familiarisation flight. □

AIR CADET VOLUNTEER GLIDING SCHOOLS

Self-launching schools

611 VGS	Swanton Morley
612 VGS	Benson
613 VGS	Halton
624 VGS	Chivenor
632 VGS	Ternhill
633 VGS	Cosford
635 VGS	Samlesbury
637 VGS	Little Rissington
642 VGS	Linton-on-Ouse
644 VGS	Syerston

Normal complement is three Venture T Mk 2s each, with No 644 VGS using aircraft of the ACCGS.

Air Cadets Central Gliding School
Based at Syerston with all operational types, including seven Venture T Mk 2s, five Viking T Mk 1s, three Grasshopper T Mk 1s, five Valiant T Mk 1s and two Janus Cs, plus a diminishing complement of Sedbergh T Mk 1s and Kirby Cadet T Mk 3s. Ventures are pooled with No 644 VGS and all types with co-located Central Flying School Examining Wing Gliding Squadron.

Winch schools

614 VGS	Wethersfield
615 VGS	Kenley
616 VGS	Henlow
617 VGS	Manston
618 VGS	West Malling
621 VGS	Weston-super-Mare
622 VGS	Upavon
625 VGS	South Cerney
626 VGS	Predannack
631 VGS	Sealand
634 VGS	St. Athan
636 VGS	Swansea
643 VGS	Scampton
645 VGS	Catterick
661 VGS	Kirknewton
662 VGS	Arbroath
663 VGS	Kinloss

Original complement was one-three Sedbergh T Mk 1s and two-five Kirby Cadet T Mk 3s, although Nos 631 and 634 VGS were assigned five-nine of the former and no Kirby Cadets. No 618 VGS operates six Vanguard T Mk 1s. First three Viking T Mk 1 units are Nos 631, 645 and 622 VGS.


TO THE RAF : BORN IN BATTLE
RAF PER JOCUM A.D.
HAPPY GEBURTSTAG TOMMY!
I THOUGHT THEY WERE SUPPOSED TO HAVE NO SENSE OF HUMOUR ---
RR 1920
BADGAG OR BUST
SENT TO FAR-FLUNG OUTPOSTS OF THE EMPIRE ...
I DON'T CARE IF YOU DID JOIN UP TO FLY --- GET RID OF IT!
UNTIL A NEW FRACAS MEANT NEW TECHNOLOGY
WITH MANY BOMBER BOYS' FINDING THEIR AIRCRAFT GETTING SMALLER ...
MAYDAY
THAT'LL BE DOUGLAS' BIG WING!
AND THEIR BOMBS GETTING BIGGER
FOR SOME IT WAS BACK OVERSEAS ----- WHERE THE WEATHER WAS TO PROVE AN ADDITIONAL HAZARD
--- A WORD ABOUT YESTERDAY'S LIFEBELT DRILL, FLIGHT SARN'T
BLUE SECTION, JETTISON DROP TANKS --- GO
'IN JEST TO THE STARS' .... HONEST

ASTRA

THE JET AGE WAS NOT WELCOMED BY ALL...

WHAT DO YOU WANT, A WRITTEN GUARANTEE FROM SIR FRANK?

VE VAS ROBBED

...WHILE THE AUXILIARIES RETAINED A FLAIR OF THEIR OWN

CHIEFY'S NOT CROSS — CHIEFY JUST WANTS TO KNOW HOW SIR DID IT....

STILL NEWER DESIGNS TO CATER TO NEW DEMANDS

INTRODUCE THE MISSILE ERA — ADD NATIONAL SERVICEMEN .... AND STAND WELL BACK!

WE GAVE IT SWING WINGS TO MAKE IT EASIER TO GET INTO HENDON

WANTED SHORT STIRLING GOOD NICK

YOU REALISE WE'LL MISS NAAF! BREAK NOW

--THE RIGOURS OF PEACE!

IN A CONTINUING PROGRESSION TO MEET--

WRUBBISH!

HURRICANE | TYPHOON | WHIRLWIND | TEMPEST | TORNADO

I THOUGHT THEY WERE SUPPOSED TO HAVE NO SENSE OF HUMOUR...

UKAE PUFF

METEOROLOGICALLY SPEAKING, MARKETING FEELS IT DOESN'T HAVE THE SAME IMPACT

237 funny how you never forget your last three!

THE TIGERS ARE BACK

"I FEAR NO MAN" proclaims the motto of the RAF's original "Tiger" Squadron, No 74. Its soubriquet was earned in World War I and carried proudly through World War II. After a 14-year gap, No 74 is flying again in its traditional rôle of air defence, equipped with newly-delivered Phantom fighters. The return of the Tigers, and their earlier history, is recounted by John D R Rawlings.

THE SETTING SUN is just tipping the distant fields, murky through a purple-copper haze from the Suffolk stubble-burning, when the peace of an early autumn evening is broken as five Phantoms burst across Wattisham in a loose V-formation. Three aircraft are in a blue-grey finish whilst two are wearing the customary dull two-tone RAF grey, now sported by nearly all Phantoms. These two latter, Charlie and Quebec of No 56 Squadron, pull up into an impressive vertical climb, quickly gaining thousands of feet, whilst the other three swing round through north to east and settle down in echelon starboard for the run-in and break on Wattisham's runway. Over they come and pull round in a tight turn, clearly eager to get down into their new home — for these three aircraft are McDonnell Douglas F-4Js, ex-US Navy aircraft bought second-hand to bolster the RAF's fighter defence force.

As these first of 15 F-4Js come over the threshold on the evening of Thursday, 30 August 1984, familiar yellow and black tiger skin markings can be seen on their noses, and a tiger's head, on a white disc, on their fins. No 74 Tiger Squadron, RAF, is back in the flying business after 13 years almost to the day. All eyes were on ZE352, 354 and 359 as they taxied onto Wattisham's hard-standing outside the hangars, forerunners of the Squadron's complete quota of 15 aircraft; few among the group of watchers spared a glance across Wattisham's real estate to the north side, where two forlorn Lightning F Mk 1 decoys, XM139 and XM147, stood. Yet the latter aircraft had been the pride of No 74 Squadron 24 years previously, when in 1960 the Squadron had the honour of ushering in the Lightning to the operational ranks of Fighter Command, the first RAF squadron with a Mach 2 performance.

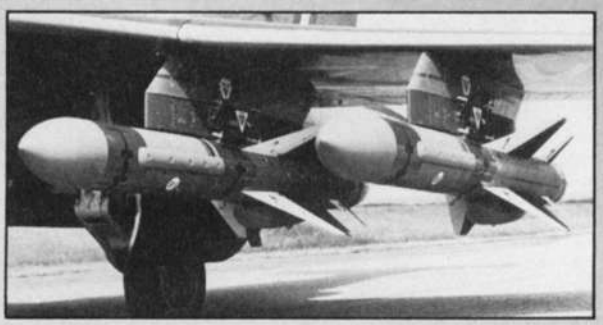
This happy rebirth of a famous fighting squadron is the direct result of the Falklands War and the subsequent need to station a squadron of Strike Command's No 11 Group Phantoms at Stanley for protection of the Islands. This meant that the fighter force in the UK, already minimal and eagerly awaiting the boost of the Tornado F Mk 2 was seriously reduced. To restore the balance as quickly as possible, and also to give British air defence additional muscle even when the Tornadoes start coming into service, the RAF sought a means of acquiring another squadron of Phantoms. Clearly, it would be impossible to match the RAF's own Spey-Phantoms, for these had been a special production batch built well over a decade earlier; the nearest compatible type readily available appeared to be the US Navy's F-4J, a substantial fleet of which was in store following the Phantom's replacement by the F-14 Tomcat on US Navy aircraft carriers. Fifteen suitable airframes were selected, none with more than 4,300 hours on the airframe, and these aircraft were flown from storage at Davis-Monthan to the US Navy facility at North Island in California to be given what the USN calls the Standard Depot Level Repair and Service Life Extension Program. This resulted in the airframes coming out in first-class condition and upgraded almost to F-4S standard, the only differences being the absence of pilot helmet gun sights and leading-edge slats.

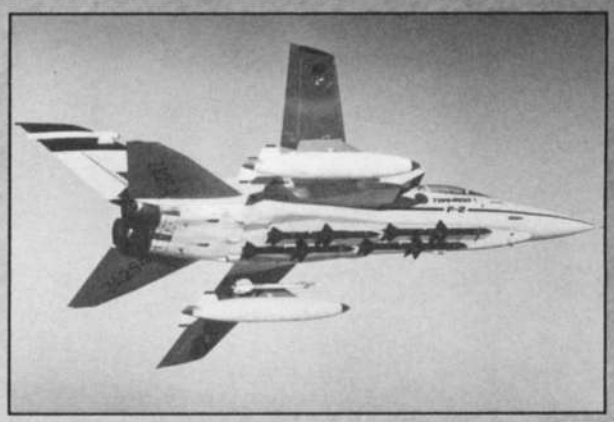
The nearest British equivalent to these aircraft is the F-4K Phantom FG Mk 1, (the version originally acquired for use by the Royal Navy) but there are still considerable differences, of which the most significant is the engine. The RAF's new Phantoms have General Electric J79-GE-10B engines, which each deliver 11,000 lb st (4 990 kgp) dry and 17,800 lb st (8 074 kgp) with afterburners, compared with 12,000 lb st (5 443 kgp) and 20,000 lb st (9 072 kgp) respectively on the Spey-engined F-4K and F-4M in RAF service. The J79, however, has a faster afterburner light-up and improved throttle response and this results in the F-4J having a marginally poorer low-level acceleration but a significantly better performance at high altitude, helped by the lower frontal area of the fuselage and its reduced form drag. Fuel consumption is also, apparently, slightly higher at low-level. The -10B engine is virtually smokeless, an advantage in more ways than one and most apparent when seeing the new Phantoms operating in and out of Wattisham.

The Westinghouse AWG-10 radar already fitted, combined with the digital computer, gives the F-4J an enhanced search and attack capability, with more information from the radar being fed into the slaved optical sight, to give a virtual head-up attack system. There is a much improved radio fit, with different TACAN and transponders, and the RWR (radar warning receiver) is not fitted to the fin top — as on the previous British aircraft — but is faired into the wing leading edges; there is, however, a much more advanced RWR on the way for the aircraft. The F-4Js reveal their naval ancestry by having internal wing-folding and Corner radar reflectors. These were fitted to enhance the response on the approach radars on US Navy carriers and can also perform the same useful function at Wattisham and other UK or European airfields where the Phantoms will land. They have integrated flare and chaff dispensers on both sides of the aircraft and the slatted tailplane as fitted on the RAF's Phantom FG Mk 1s. The leading-edge slats were not fitted on the wings partly to save time and also because the aircraft makes a better interceptor without them, and this has now become the primary mission, whereas ground attack and close support were also important when the Spey-Phantom was purchased.

At present, the aircraft are operational with Sparrow and AIM-9L Sidewinder missiles, but before the year is out they will also have been made compatible with the UK-developed Sky Flash and the SUU-23A gunpod under the fuselage, thus bringing them into line with the other fighter Phantoms in the RAF. In fact, the rôle is identical with that of No 11 Group squadrons elsewhere and, like the other Phantom units, the type will use both Victor and VC.10 tankers.

Tiger Squadron had to meet a very tight schedule to achieve its operational readiness date, soon after delivery of the last three aircraft. This challenge means that the whole unit has had to buckle to and work under pressure from the beginning, and it has resulted in a very high state of morale. A walk into the crew room shows many of the Squadron's historical relics are already installed, with a tiger skin in pride of place. The tiger skin marking first appeared on No 74's aircraft (then Gloster Gauntlets) in 1937 at Hornchurch; but long before that No 74 had been nicknamed the "Tigers". This occurred during





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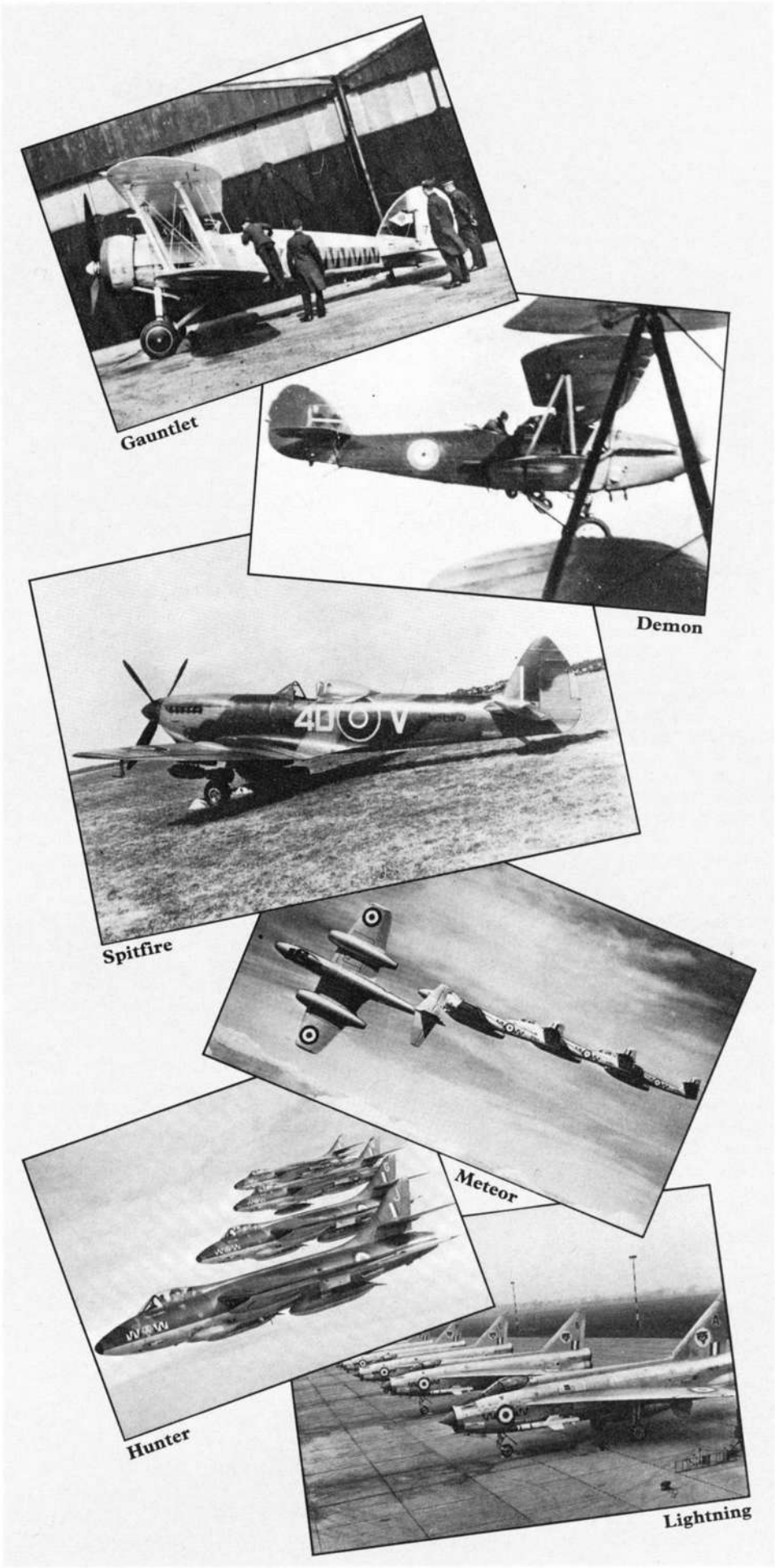
World War I, when the Squadron had served as a scouting unit with some distinction. It originated, as was then the pattern, as a Training and Depot Squadron at Northolt on 1 July 1917, having the somewhat prosaic task of training pilots and observers and providing a reserve of crews and aircraft. However, after eight months of such activity and with the prospect of a huge German Spring offensive on the Western Front, the Squadron was split "down the middle" and an operational unit, also numbered No 74 Squadron, was formed from it. After an air firing course, the Squadron prepared for operations under its new CO, Major K L Caldwell, a New Zealander. Equipped with 19 S.E.5as, No 74 went to France on 30 March 1918 just as the German offensive was running out of steam. By mid-April it was operational and, with Captain E C Mannock as "A" Flight Commander, soon began to achieve a reputation. From April onwards the Allies began to wrest the initiative from the Germans on the Western Front and slowly but surely take up a winning situation. The summer of 1918 was the period of the big air battles, with RAF squadron formations tangling with the German circuses high over the trenches. In these battles, No 74 acquitted itself magnificently, as it did also in the ground strafing duties which were an integral part of the final offensive in the War. Although operational only for eight months, No 74 Squadron claimed 225 enemy aircraft and 15 balloons destroyed. Nineteen of its pilots were killed or missing. With the Armistice, however, the Squadron was soon reduced to a cadre, and it returned to England on 10 February 1919, disbanding at Lopcombe Corner on 3 July that year.

The squadron re-forms

Few Royal Air Force squadrons have been re-formed on board ship but this is what happened to No 74. War was looming in the Mediterranean as a result of Mussolini's invasion of Abyssinia and the RAF was busy, in 1935, reinforcing its Egyptian and Mediterranean bases. A new formation was drafted aboard HM Trooper *Neuralia* at Southampton Docks, known as the "Demon Flights" and commanded by Squadron Leader H G Crowe, MC. It contained detachments from 11 RAF units and its task was to proceed to Malta with Hawker Demons and provide local defence against Italian air attacks. On 14 November 1935 this odd formation was welded into a re-formed No 74 Squadron, remaining in Malta until July 1936, when it returned to the UK in the *Somersetshire*.

On its return it was posted to Hornchurch, a fighter station on the north bank of the Thames near Dagenham in Essex, with Squadron Leader D S Brookes in command and a new batch of brand-new pilots on the Squadron, among them one A G Malan. The Squadron flew Demons until March 1937, when the gunners were posted away and in came Gloster Gauntlet single-seat fighters. With the fashion to carry colourful markings on the silver-doped biplane fighters of



THE TIGERS ARE BACK

the 'thirties, No 74 evolved a black and yellow marking resembling a tiger skin — the marking still to be seen today on the Phantoms.

For the war that was on the horizon by the end of 1938, the Squadron was re-equipped with the Spitfire, early production Mk Is beginning to replace the Gauntlets in February 1939. The Squadron quickly adjusted to the tremendous increase in performance, to retractable undercarriages and flaps and to a general upgrade in operational complexity; soon, too, the aircraft were fitted with two-pitch propellers which gave a valuable boost to the Spitfire's performance. By the time World War II broke out, No 74 was in all respects operational except that it had not attended an armament practice camp, and its pilots therefore had not yet fired the Spitfires' Browning guns.

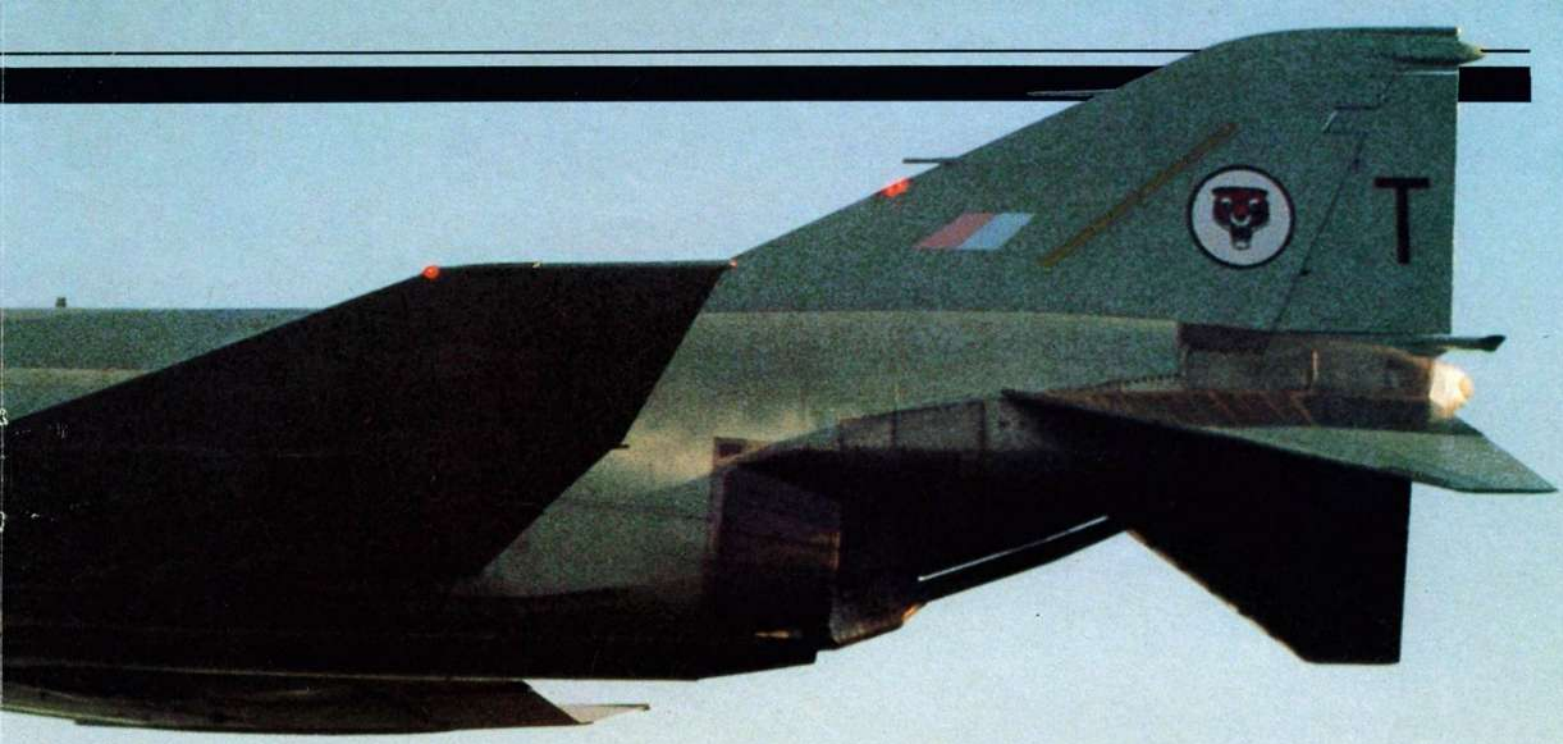
Within 24 hours of war being declared, No 74 was off on a night scramble, alerted to attack what turned out to be returning British bombers. Two days later, the Squadron was scrambled again, for the "Battle of Barking Creek", when large numbers of fighters were sent up to intercept an "enemy force" in the Thames Estuary which did not in fact exist; the Squadron shot down its first two aircraft in World War II — tragically, two Hurricanes of No 56 Squadron from nearby North Weald. But on 20 November the Squadron *did* score its first enemy aircraft, sending an He 111 into the sea off Southend.

May 1940 brought real action for the Squadron. With the BEF hard-pressed in France and falling back in disarray, the Squadron patrolled time and again over the battle area, attacking any German aircraft to be found; for a week the Squadron was in action through all the daylight hours and in that time engaged in 26 combats, claiming 19 aircraft destroyed and losing four pilots (one killed and three as POWs).

The finest hours

Returning from a spell in Yorkshire to the Hornchurch Sector in time for the Battle of Britain, the Squadron began its finest hours fairly quietly, for most of the action was with the Channel squadrons, but single victories were achieved here and there. Particularly significant was the night patrol by "Sailor" Malan on 18 June when he shot down two He 111s, for the Spitfire was not the best of aircraft for night flying. July brought fierce fighting, with the Squadron tackling *Luftwaffe* formations of 100-plus aircraft coming up the Thames Estuary or across Thanet. The pressure mounted throughout the month, culminating in a tremendous dogfight between the Tigers and Messerschmitt Bf 109s of JG51 on 28 July, with the Squadron claiming nine destroyed. Such actions became the pattern for August, with heavy fighting and up to five intense combats each day. By 14 August the Squadron was in urgent need of another rest, which began at Wittering and continued at Kirton-in-Lindsey, where the unit at last received its Spitfire Mark IIs. Moving to Coltishall, the Squadron resumed flying in the Battle of Britain on 9 September, now flying in the "Big Wing" formations which Leigh-Mallory advocated for No 12 Group squadrons. Now under the command of Malan, the Squadron was back to heavy fighting once more, albeit at not quite the same pitch as before for it was slightly removed from the London area. Then, with the battle almost over, the Tigers moved to Biggin Hill in October, in which sector it was to fly for the next nine months, joining No 92 Squadron, in the period which brought up Biggin Hill's claim of 600 enemy aircraft destroyed. With the coming of 1941, the Squadron went over to the offensive with Channel Sweeps, bomber escorts and, later, "Rhubarbs"*. During this period, No 74's morale was at its peak, with a fine leader and flying on the offensive instead of defensive sorties. Cannon-armed Spitfires came in May 1941, enabling the Tigers to accomplish ever greater destruction. Malan handed over to Mungo Park — another of the Squadron's old hands — who continued the good work, but within three months he was posted missing and, a few weeks later, No 74

**Small-scale attacks on ground targets of opportunity.*



No 74 Squadron was responsible for introducing the English Electric Lightning into RAF service, starting in 1960 with F Mk 1s, progressing to F Mk 3s (above) and finally flying F Mk 6s in Singapore before being disbanded in August 1971. At RAF Wattisham, the squadron is now flying the ex-US Navy F-4J Phantoms (top, and page 33) delivered in 1984.

left the south-east of England for what would prove to be the next three years.

Limited to air defence duties in the quieter parts of the UK, the Squadron now entered upon a quiet period, followed by an even drearier one, when, in April 1941, it went overseas without aircraft. After a tour right round Africa, it ended up in Egypt with the mundane task of servicing US Army Air Force Liberators. It then moved across land to Persia and on 10 December received its first aircraft for eight months — three very second-hand Hurricanes, with which it worked up before moving to the Gulf for oilfield protection duties. In May 1942 the Squadron moved back to Egypt, where it returned to operations, flying recces over Alamein and convoy patrols. Eventually, by September, it was returning to Spitfires once more, taking these to Cyprus for operations over the Dodecanese. The Squadron returned to the Canal Zone in October 1942, where it remained on unspectacular defence duties until April 1944.

Back to the UK

Then returning to England, No 74 received Spitfire IXs as part of 2nd Tactical Air Force and on 19 May was at readiness at Lympne, beginning operations again with a Wing escort over Lille. It now became very much involved with the Invasion of France, flying bomber

escorts and "Ramrods"*. On D-Day it flew patrols over the beachhead, but its main tasks were bomber escorts and ground attack in the battle area. This was interrupted in July when it was called upon to deal with V-1 flying bombs as they came in over Kent. This proved to be for only a short spell, then it was back to the Continental fighting in earnest, moving across to France itself on 19 August. Closer now to the fighting, the Squadron was able to fight intensively day after day, principally flying ground attacks against motor transports. Its Spitfires were now equipped to carry two 500-lb (227-kg) bombs and this work continued — but at a slower pace — during the winter of 1944-45, the Squadron moving forward to keep up with the advance. The spring brought an increase in activity once more and the Squadron fought on right up to the end of the War in Europe, an event that brought a new task for No 74. Returning to the UK in May, and ending up at Colerne, the Squadron again came into the forefront of Fighter Command. Spitfires were out, in their place coming Gloster Meteor F Mk 3s as the Squadron became part of the first jet fighter Wing in the RAF. It had to convert its pilots to this new type of flying and to evolve the best way of using the Meteor in interceptor and defence duties. For the next year or two, the Squadron was very busy, losing not a few pilots as they grappled with the problems of the early Meteors. In August 1946 the Squadron moved to what was to be its permanent base of Horsham St Faith (now Norwich Airport), where it stayed for 13 years. During this period it became an integral part of Britain's defence force, going through the various Meteor marks and proudly reinstating the tiger markings in 1951. The Meteor continued with the Squadron until 1957, when No 74 re-equipped with Hunters, enabling the Squadron to experience the delights of transonic flying and to hone their high-speed interceptor skills even further.

With Hunters, No 74 moved to Coltishall in preparation for its most important task yet. On 14 July 1960 it received the first Lightning to enter squadron service with the RAF, the Tigers having been tasked with bringing this Mach 2 fighter into the RAF's front line. This was obviously a busy period for the Squadron, under its CO, Squadron Leader J F G Howe, as it coped with the inevitable problems attendant upon the introduction of such an advanced new type. Appearances at the Farnborough Show two years running put No 74 on the map again and also encouraged its personnel to paint the spines and fins of their Lightnings in an attractive black scheme, with large tigers' heads on the fins. Becoming operational, the Squadron was now in the forefront of Britain's air defences and, to be more effective in meeting the Russian reconnaissance bombers well out over the North Sea, it moved up to Leuchars in Scotland in 1964. There, it flew improved F Mk 3 Lightnings, transferring to the F Mk 6 in 1967. These it immediately took out to Singapore in June, to become the resident fighter squadron where it provided tough "teeth" for the Far East Air Force until withdrawal from the area brought about the Squadron's disbandment at Tengah on 31 August 1971. From the 'thirties to the end of the 'sixties, then, No 74 (Tiger) Squadron built its tradition as a premier air defence unit — a tradition that is now to be continued with the Phantoms at Wattisham. □

**Fighter escorts for short-range daylight bombing attacks.*

THE SEARCH FOR A NEW EUROPEAN FIGHTER

by Roy Braybrook

IF ALL GOES WELL, the next RAF combat aircraft after the Tornado F Mk 2 will be the EFA (European Fighter Aircraft), a single-seat, twin-engined, highly agile STOL fighter that will enter service in 1995, and will outclass even the then-current model of the F/A-18 Hornet.

The background history to the EFA programme goes back many years, and has not been without its trials and tribulations. In planning a replacement for the RAF Jaguar ground attack aircraft, the original idea was to combine this with a Harrier replacement, as the two types were performing similar rôles and had entered service within two years of each other. The resulting Air Staff Target (AST.396) was for a STOL ground attack aircraft combining the warload-radius performance of the Jaguar with the STO-VL performance of the Harrier, and introduced special sensors to allow dusk/dawn operations. However, this concept threatened to become expensive, and the 1975 demonstrations by the F-16 proved that with modern technology an outstanding dog-fight aircraft could also provide the ground attack performance that the RAF was looking for. As a result, AST.396 was superseded by AST.403, which slightly relaxed the airfield performance requirement but demanded an air combat performance comparable to that of the F/A-18.

Discussions were held with Germany and France on a possible joint development, the ECA (European Combat Aircraft), but neither country was interested in using jet lift for STO-VL. Rather than abandon collaboration, the RAF split its requirement into AST.409, a STO-VL Harrier replacement that will eventuate as the GR Mk 5, and a revised AST.403 as purely a Jaguar STOL replacement. Further talks were then held with the two potential partners with a view to combining AST.403 with the TKF-90 *(Taktisches Kampfflugzeug)* F-4F/RF-4E replacement and the ACT-92 *(Avion de Combat Tactique)* Jaguar replacement. It is interesting to note that France was then planning to replace the Jaguar with an air combat fighter, a plan that was soon to change. In any event, there were serious differences between the UK and France on the choice of engines (RB.199 or SNECMA M88), and the ECA programme soon foundered, mainly due to the lack of available funds on Germany's part.

British Aerospace (BAe) pressed ahead with its own studies (P.110) based on AST.403 and using two RB.199 engines. The company hoped that, although MoD had no funds for such a project in the short term, HMG would make a clear statement expressing an intention to buy something like the P.110 at a later stage, and that this would make it possible for BAe to get financial support from Saudi Arabia or Oman for full-scale development. In the absence of such a statement, BAe undertook initial development as a joint venture with Rolls-Royce, Dowty, Ferranti, Lucas, Marconi and Smiths. Eventually, on 3 September 1982, MoD announced a jointly-funded Experimental Aircraft Programme (EAP), in which industry would bear half the costs, and a fighter-like research aircraft would fly "in about three years time". The EAP contract was signed on 26 May 1983, at which stage it was hoped that Germany and Italy would join in the programme, taking shares of 40 and 15 per cent respectively, with Germany building a second demonstrator.

In the event, May 1983 also marked the unveiling at the Paris Air Show of the mock-up of the Dassault-Breguet ACX *(Avion de Combat Experimental)*, a few yards from the mock-up of the BAe ACA (Agile Combat Aircraft), the projected production version of the EAP demonstrator. Although the ACA and ACX differed in (for example) the design of the vertical tail and air intakes, they were similarly-sized twin-engined single-seat aircraft with cranked-delta wings and foreplanes. Whatever the philosophical differences between the two companies, there was a clear political case for investigating the possibility of a collaborative programme.

When the defence ministers of Britain, Germany and France met in September 1983, it was agreed that there should be an attempt to formulate a joint requirement. It surprised many observers that the resultant Outline European Staff Target (OEST) was signed by the five chiefs of staff (Italy and Spain having joined the team in the meanwhile) on 16 December 1983, but, in fact, the groundwork had been laid by a tripartite meeting at "colonels level" in Paris early in the year, before the Paris Air Show. At the December meeting in Cologne, it was agreed that emphasis was to be given to the air-air rôle and to affordability, and that the five-nation domestic market would represent around 800 aircraft.

During the next three months the airframe and engine industries of the five nations carried out a pre-feasibility study, on the basis of which the five defence ministers, meeting in Madrid on 9 July 1984, agreed that a new engine was needed, and to proceed with six-month feasibility studies, to be considered at a meeting of the ministers in March 1985. At the same time, the implications of using the new EFA engine in the Tornado ADV were to be studied. What did not come out in the press releases was that there was no agreement on whether there should be an interim engine to power development batch and initial production aircraft.

During September 1984, a statement of work was formulated by the national armament directors (in the case of the UK, the Chief of Defence Procurement), and the feasibility study was begun by industry. On 11 October 1984, the five chiefs of staff signed the EST in Rome. At this stage the prospective domestic market had grown to 1,000 aircraft, with the Netherlands possibly adding a further 250, if that nation is to be added to the group. It is anticipated at the time of writing that the March 1985 meeting of ministers will sanction project definition, leading to a go-ahead for full-scale development a year later, a first flight around 1990, and entry into service in 1995. Some sources indicate that an in-service date with the proposed new engine is more likely to be 1996-98.

The EST outlines a design that gives priority to the air-air rôle, and also produces a good air-ground performance, but not so as to prejudice the air-air side. The RAF input takes the form

Scheduled to fly in mid-1986, the sole technology demonstrator in the Experimental Aircraft Programme (EAP) is now under construction at BAe Warton Division, Lancs. The appearance of the EAP prototype is shown (opposite page) and the front fuselage section and cockpit are seen (left) under construction. The various technologies to be tested and integrated into this demonstrator will be available for use in future fighters such as those under study for the five-nation European Fighter Aircraft (EFA) project. Among the design studies that may lead to an EFA are those (above) by British Aerospace, (below left) Dassault-Breguet and (bottom left) Messerschmitt-Bölkow-Blohm.

of AST.414, a replacement for the Jaguar and Phantom, with few details released. The *Luftwaffe*'s input is far more open, with requirements for operation from 1,640 ft (500 m) stretches of runway, and a maximum speed of Mach 1·8 at 36,000 ft (11 000 m) and Mach 1·10 at sea level. The JF-90 *(Jagdflugzeug)* is to be capable of an instantaneous 4 *g* at Mach 1·50 at 19,700 ft (6 000 m). At 9,850 ft (3 000 m) it is to be able to generate a 24-28 deg/sec turn rate, and to sustain 13-15 deg/sec. At low speed it should be able to turn with a radius of 1,475 ft (450 m), and to hold a turn of around 1,800 ft (550 m) radius. Its radar is to detect at 43 naut miles (80 km), track at 27 naut miles (50 km), be able to track eight targets simultaneously, to track-while-scan, and provide non-co-operative target identification (NCID). In combat air patrol sorties, it is required to have one hour on station at 270 naut miles (500 km) radius. An escort radius of 540 naut miles (1 000 km) is required. The Italian requirement is more concerned with overwater air defence and Tornado escort missions, and emphasises radar performance, infilling the gaps in the ground-based early warning network. Ironically, France's basic need is now for a ground attack aircraft.

In bringing together the needs of five air forces, there has inevitably been considerable compromise. This is evidenced by the empty weight of the aircraft, which has been agreed as 9·5 tonnes (20,950 lb), whereas France reportedly wanted 8·5 tonnes (18,750 lb) and Britain and Germany 10·5 tonnes (23,150 lb). For comparison, the F/A-18 currently has an empty weight of 23,925 lb (10·85 tonnes) which could be slightly reduced by "denavalising". The new engine will probably be rated at around 20,000 lb (9 070 kg), but EFA may begin life with the 16,540 lb (7 500 kg) RB.199-104 or the 18,000 lb (8 165 kg) General Electric F404.

There seems to be little doubt that EFA will be a canard aircraft of cranked-delta wing planform. The cranked-delta combines the excellent fuel volume and low wave drag of a delta with the better sustained turn performance of a conventional swept wing. The use of a foreplane gives a favourable interference with the wing under high lift conditions, hence it improves airfield performance (especially in the context of a jet-flap) and turn rates. The canard may also make possible new manoeuvring modes, co-ordinating wing flap and foreplane deflections for direct lift control, and rudder and differential foreplane movements for "sidestep" motions. The option of a national (AST.414) programme remains, but the EFA programme appears to offer the RAF the most advanced Jaguar/Phantom replacement feasible by the mid-1990s timescale. □

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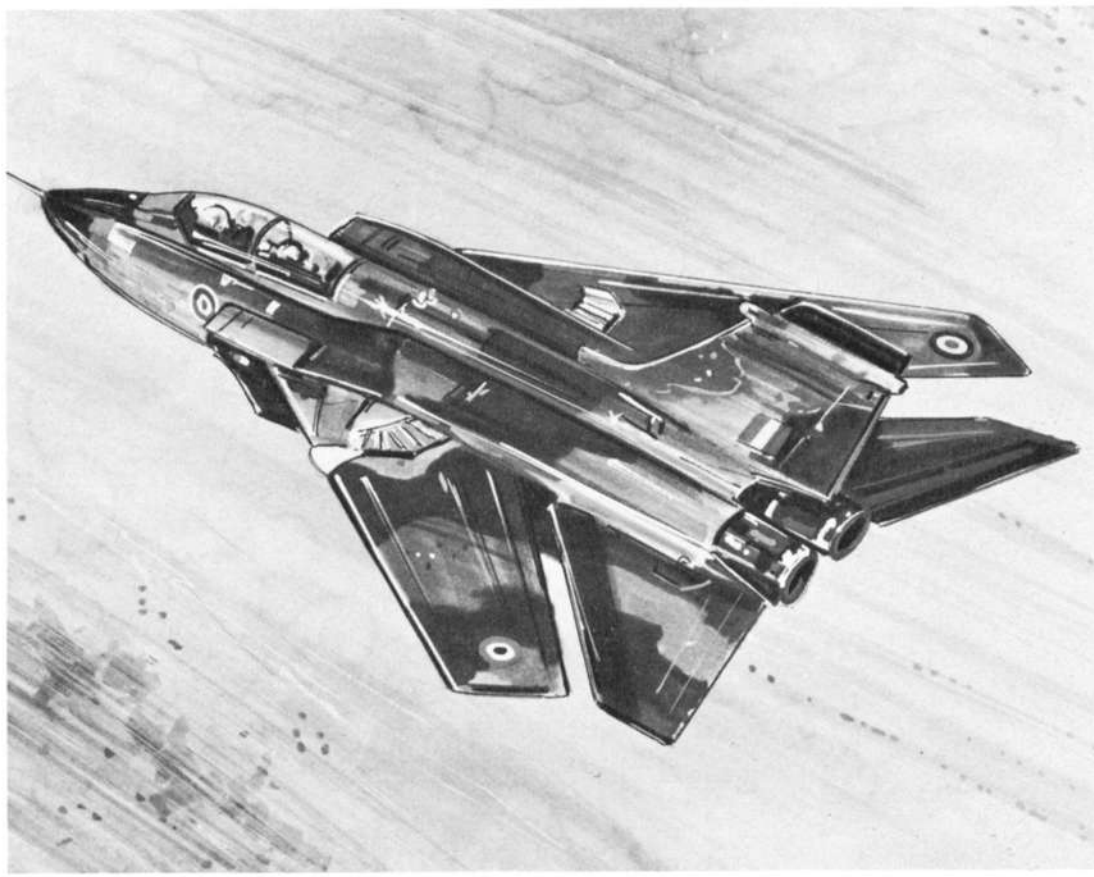

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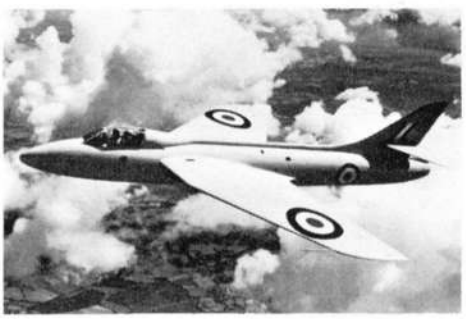
HAWKER'S HUNTER . . . THEN AND NOW

by Neville Duke, DSO, OBE, DFC, AFC

The Hawker Hunter, which entered service with the RAF in mid-1954, is now nearing the end of a career that has spanned more than 30 years and has seen this elegant jet fighter operate in a number of rôles at home and overseas. The last major RAF use for the Hunter was at No 1 Tactical Weapons Unit, RAF Brawdy, where single and two-seaters served in a training rôle. Whilst Hunters are still to be found in service with a few foreign air forces, the last to operate with the RAF are the Integrated Flight Instrumentation System T Mk 7s used as surrogate Buccaneer trainers at RAF Honington. Marking the "first and last days" of the Hunter, Hawker's former chief test pilot here recalls some of the problems encountered in getting the aircraft "right".



On 20 July 1951, Neville Duke, in his capacity of chief test pilot for Hawker Aircraft Ltd, flew the prototype of the Hunter for the first time. Then known simply as the P1067, this aircraft had the serial number WB188 and is shown in its pale green finish in the two illustrations above. It later acquired an overall red finish, an Avon R.A.7R engine with afterburner and side-mounted airbrakes, and in this guise (top and above right) it was used by Duke to set a world speed record of 727·63 mph (1 170,97 km/h). The second prototype, WB195, was also finished in pale green and in the illustration (right) reveals the perforated landing flaps-cum-airbrakes that did not prove successful.

THE HAWKER P.1067 seemed to be a pilot's aeroplane, all the way from the drawing board to roll-out of the prototype — it looked right on paper and in form. It felt right, too, in the cockpit, which was just snug enough to make the pilot feel entirely a part of the aeroplane. The cockpit was slightly narrow at the shoulders, which gave the snug effect common to British fighters, and the seating position gave the pilot a commanding view of the outside world and a feeling that the aeroplane was an extension of oneself.

Those were the days of the "super priority" production programme, which was a mixed blessing in that whilst the development programme was expedited, the timescale for incorporation of any improvements and modifications found desirable in the course of flight testing was curtailed by the need to "freeze" the production drawings. The Hunter was unique in its day in being ordered in large quantity from the drawing board. The flight test programme generally proceeded without undue snag or delay, however, and the aircraft was being demonstrated to more than 700 mph

(1 127 km/h) within a month of its first flight.

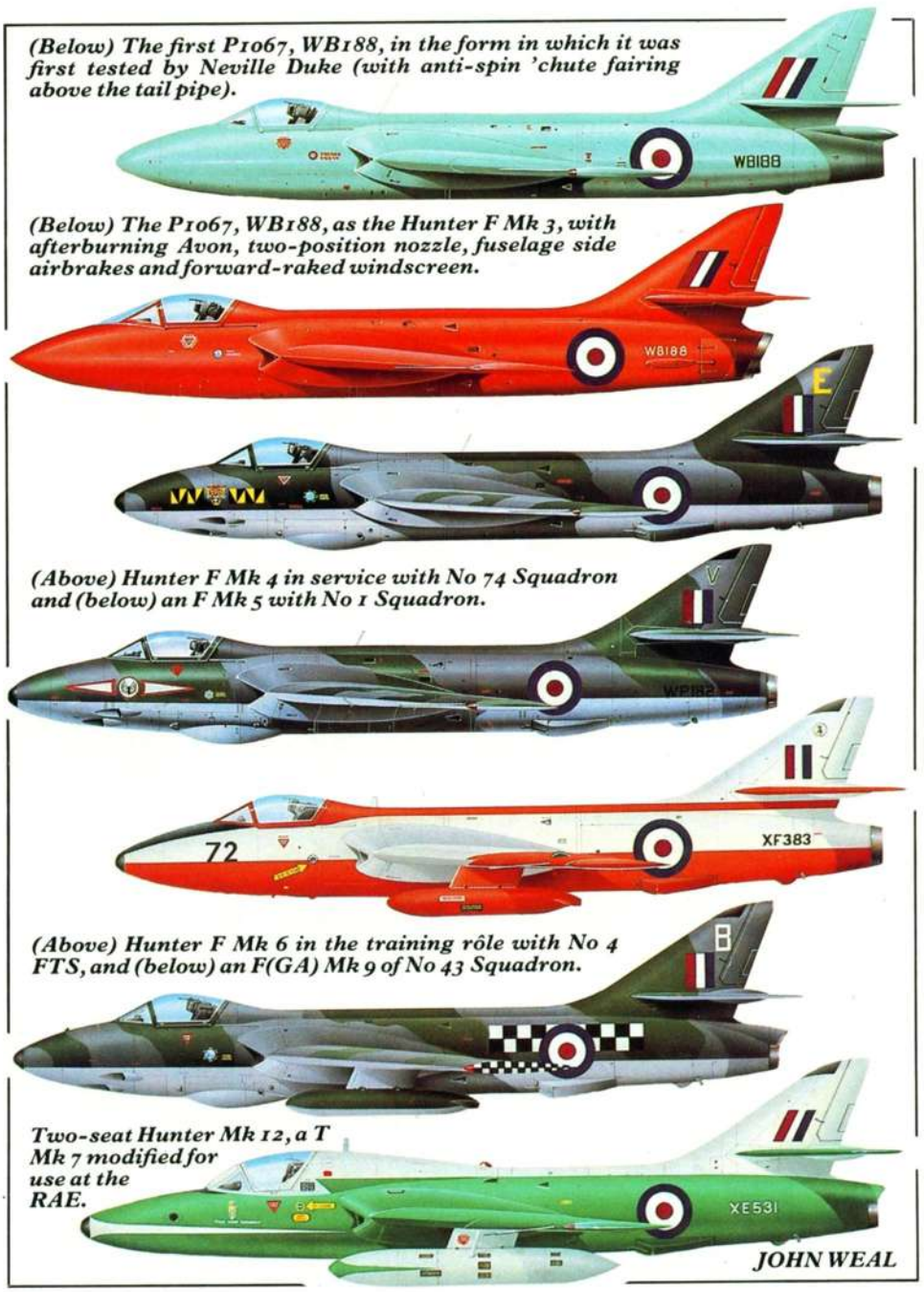
The main lines of development soon centred on improvement in longitudinal control in the high subsonic Mach Number range, progression to trans- and supersonic speeds, air brake development and gun firing. A serious "undamped elevator vibration" occurred on the second prototype of the P.1067 (WB195) during a demonstration at West Raynham, when a very violent vertical vibration suddenly set in during a pull-up manoeuvre at some 590 knots (1 093 km/h). The phenomenon ceased only after speed had decayed through the resonance range to some 540 knots (1 000 km/h). This event, of course, gave rise to much intensive in-flight resonance testing over a prolonged period. In those days, such tests involved vibrograph recordings at small increments of speed, eventually going up to 600-620 knots (1 110-1 148 km/h) at sea level, the necessary vertical resonance being induced by a sharp clout by the fist on the control column and records taken of the subsequent vibration, hopefully unexcited. The control column had to be left free during the recording.

We thought the problem eventually cured after much investigation and experimentation with mass balancing, until a recurrence at Boscombe Down, when the pilot nearly ejected. Subsequently a complete cure was found but this particular aircraft was, I believe, the only one to exhibit this particular phenomenon.

It soon transpired that the air brake system was unsatisfactory. The original proposal had been to use the landing flaps, coupled with small "dive recovery" flaps at about the quarter chord position under the wing roots. These dive recovery flaps originated in the early jet days and were fitted to the first Hawker P.1040, when the effects of Mach Number on longitudinal control were relatively unknown, and they were intended to provide a nose-up effect in the event of loss of elevator control. This combined arrangement had been tested and proved on the P.1052 and P.1081 development aircraft and provided a very powerful air brake system.

The landing flaps on the P.1067 were stressed for operation to limiting speed of 620 knots (1 148 km/h) — relief valves being used in the system. However, the dive recovery flaps failed to provide the necessary effect and the resulting nose down change in trim was unacceptably strong above a moderate speed.

Testing was carried out with reduced span flaps, slotted flaps and endless other fixes until eventually a most powerful arrangement using one third span inboard flap area was evolved. This all but solved the problem at any combination of airspeed (ASI) and MN except for a very small régime around 550 knots (1 019 km/h) IAS and 0·95 indicated Mach Number (MNI), where a change in trim occurred. Speeds up to 600 knots (1 110 km/h) IAS below 0·95 MNI were satisfactory, and MNI of any description up to supersonic were acceptable provided the precise combination of ASI/MNI was avoided. A disadvantage of this system, however, was a change in attitude, obviously a serious problem from the gunnery aspect, and the brake system designed into the Hunter therefore had to be abandoned.



(Below) The first P1067, WB188, in the form in which it was first tested by Neville Duke (with anti-spin 'chute fairing above the tail pipe).

(Below) The P1067, WB188, as the Hunter F Mk 3, with afterburning Avon, two-position nozzle, fuselage side airbrakes and forward-raked windscreen.

(Above) Hunter F Mk 4 in service with No 74 Squadron and (below) an F Mk 5 with No 1 Squadron.

(Above) Hunter F Mk 6 in the training rôle with No 4 FTS, and (below) an F(GA) Mk 9 of No 43 Squadron.

Two-seat Hunter Mk 12, a T Mk 7 modified for use at the RAE.

JOHN WEAL

Petal type airbrakes were designed and fitted to the prototype Hunter, but the most satisfactory arrangement all round, and attractive to the production engineers, was the underfuselage arrangement that is a well-known feature of the Hunter. Unhappily the solution came too late to be designed into the production line, which was well under way by this time, and the lovely lines of the original P.1067 had to be compromised by fitting the device externally. A beneficial by-product of the strong landing flap system was that they could be used as combat flaps, providing increased manoeuvrability in the dog-fight situation.

The original flying controls on the P.1067 were hydraulically boosted ailerons and elevators with 14:1 and 5:1 ratios respectively. In Britain in 1951, powered flying controls were something of a novelty, and sufficient suspicion and concern existed for us to contrive the first flight with the ailerons in power but the elevators manual. Anybody who has flown with Hunter controls in manual will appreciate the

The first of the Hunters, WB188, flown by Neville Duke and photographed by the late Cyril Peckham.

handicap — manual reversion is a simple and entirely safe and effective emergency system to be used in the event of loss of hydraulic control, but it does give rise to very heavy controls. The tailplane was electrically actuated for trimming purposes and could be used to "back up" longitudinal manoeuvrability in manual — but on the first flight it was found that the trimmer range was inadequate and the subsequent landing required some physical effort. It was found early in the flight test programme that the aileron boost system would stall at high rates of application at high speed, and a full powered system was devised, together with a simple spring to give feel to the controls.

Longitudinal control was more of a problem at high Mach Number, where a decline in elevator effectiveness above about 0·95 MNI resulted in much reduced manoeuvrability. Unfortunately, production again overtook development and the early Hunter went into service with this system, giving rise to unfavourable comparison with the F-86 Sabre and its flying tail arrangement. Development finally produced a fully powered elevator with a spring to give feel proportional to elevator deflection plus, later, an electrical interconnection with the tailplane which followed up automatically, when brought into circuit, to give good control at high Mach Number.

Beyond Mach One

Prior to these control developments, much flight testing was naturally centred on the transonic régime — a comparatively little known region of flight at that time. We were stuck for a considerable time in the high subsonic area up to 0·97-0·98 MNI, where heavy aerodynamic buffet and rudder vibration occurred. Various fixes were tried and eventually the reverse bullet arrangement at the fin and tailplane junction smoothed things out and we went supersonic. This was the biggest psychological and practical event of the whole test programme and the bogey of the sound barrier was partly laid to rest, although this phase was not without its interesting moments.

A feature of going supersonic in the P.1067 was a deliberate and unrestrainable forward movement of the control column and, at this point, the elevator became absolutely solid and immovable. Recourse to the trimming tailplane was required to alter the angle of dive. These tests were, typically, made from a full throttle level at 45,000 ft (13 716 m) into a dive of increasing angles over the test period — ultimately at angles up to about 45 deg, although about 30 deg was sufficient to achieve supersonic speed if the entry was correct. Recovery was effected by throttling back and letting the Mach Number fall as lower altitudes were attained, or easing out of the dive using the tailplane trim carefully, normal control being regained at subsonic speed.

With development of the control systems — first the fully powered elevator and later the flying tail system — I think few pilots would deny the adequate and classical handling and control qualities that were achieved with the Hunter.

We were not entirely sure of actually achieving supersonic flight — Mach Number indicator readings were unreliable and grossly in error in that régime at that time. However, the supersonic "bang" provided confirmation and heralded the era of the phenomenon at public displays, like the annual gathering at Farnborough, until people became fed up with the noise.

Needless to say, amongst the recipients of our early "bangs" were old friends and rivals Supermarine and de Havilland at South Marston and Hatfield — no time being wasted in letting them know of our progress by a couple of sharp detonations. They were then struggling with the Swift and the D.H.110, but had not yet gone supersonic.

My log book at the period of the first flight in the P.1067, which was made at Boscombe Down on 20 July 1951, shows flights in quite a variety of aircraft, which indicates the interesting nature of those days. A Canberra was flown at Boscombe Down to gain experience with the Avon engine, an experimental Firefly 4 with powered controls using the same type of units as those fitted in the P.1067 and a Sea Fury at Langley with a powered elevator system. There were many flights to and from Boscombe and Langley in the company's D.H.89A Rapide and Whitney Straight, displays were given at Hatfield and Hendon with the Hawker Hart and the Hawker Tomtit (which I owned at the time) and normal test work on the prototype Seahawk (the N.7/46) and production Sea Furies continued from Farnborough and Langley. A total of nine types in the space of a single month.

After five flights from Boscombe, the P.1067 was flown to Farnborough on 10 August 1951, where company testing was centred until we moved our test facility from Langley to Dunsfold on 7 September that year.

The last big formation of RAF Hunters, led by Wg Cdr Brian Hoskins, before their departure from Brawdy in July 1984; photographed by Geoff Lee (BAe, Kingston).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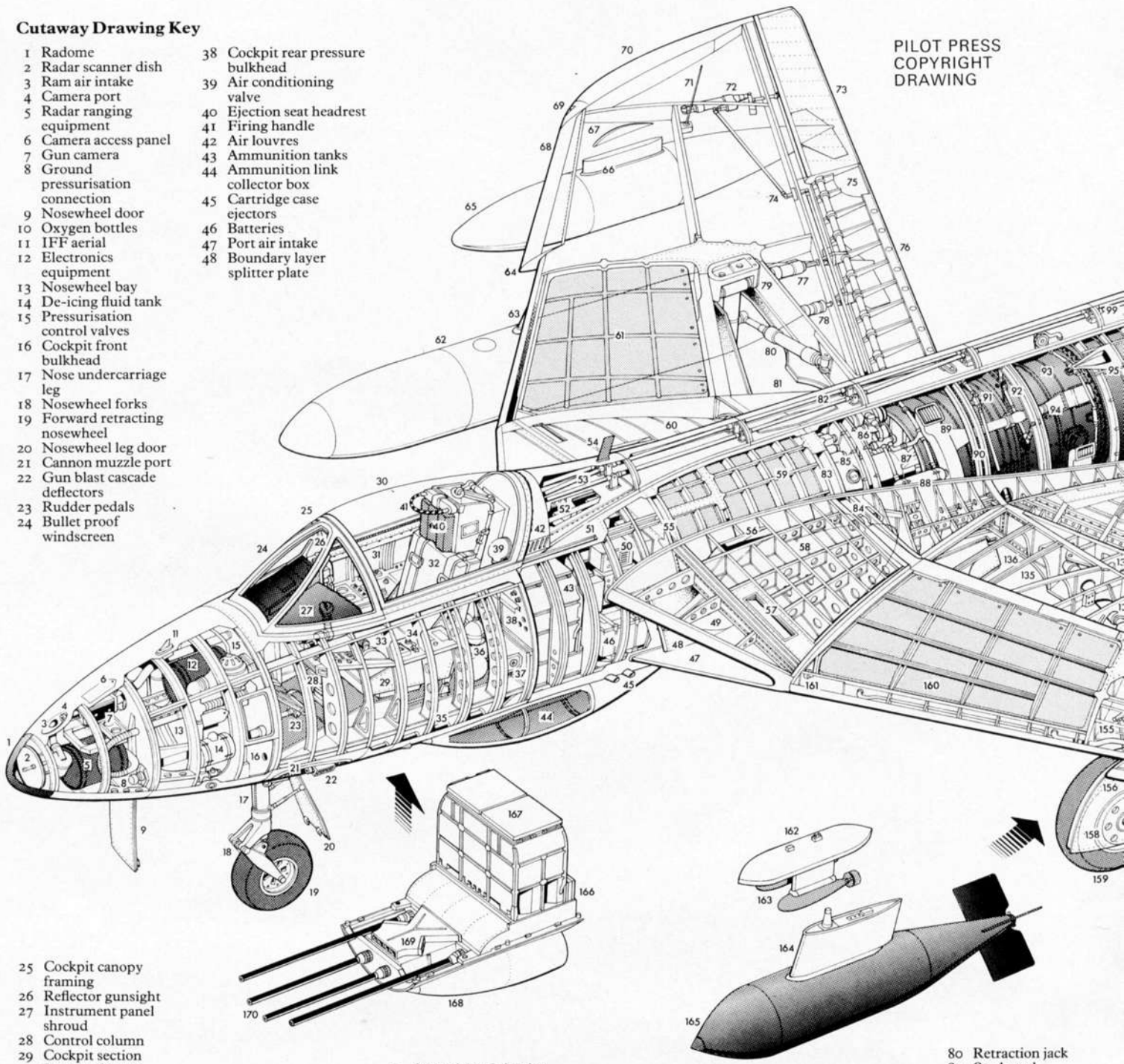
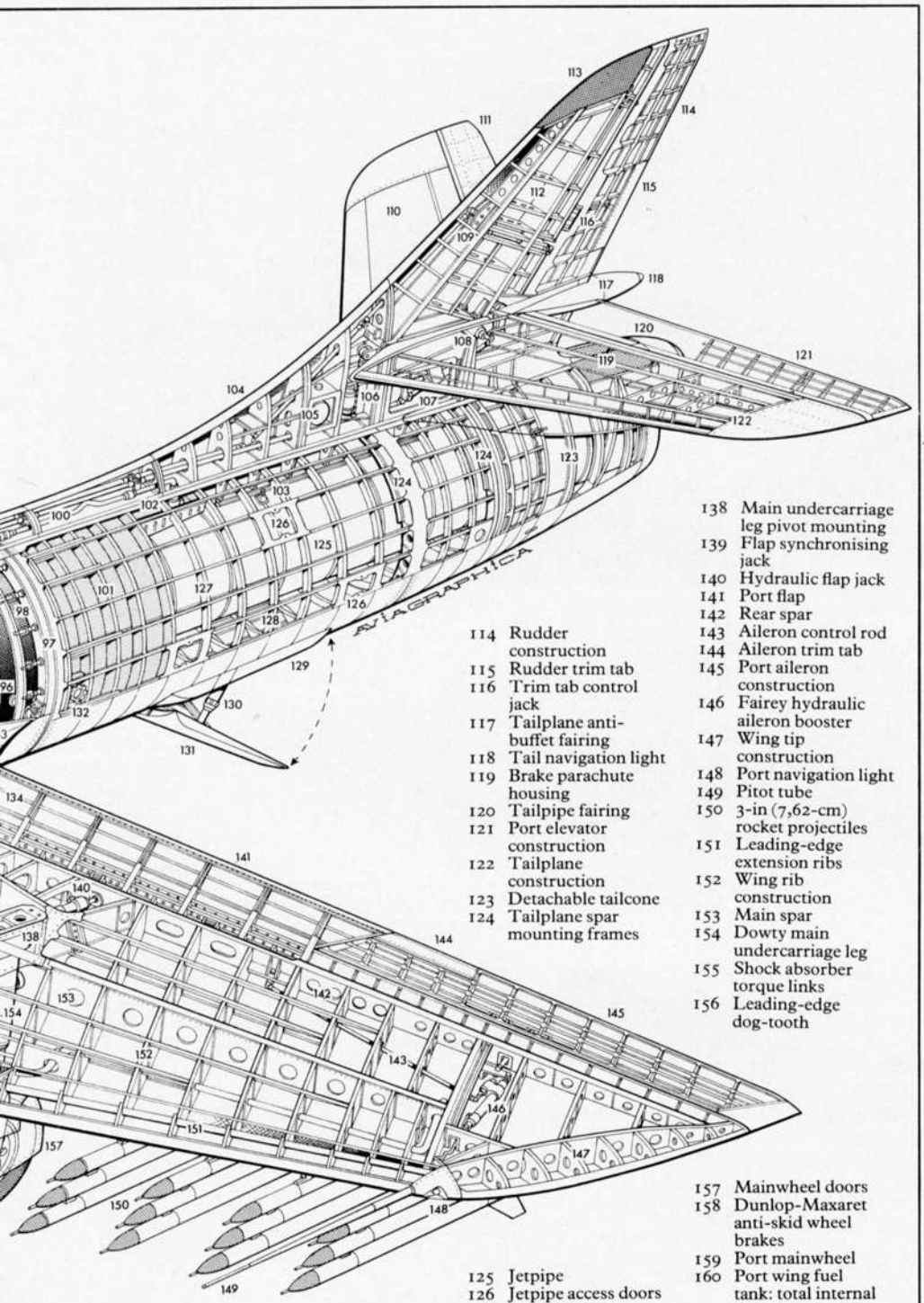
Hawker Hunter F(GA) Mk 9



Cutaway Drawing Key

1 Radome
2 Radar scanner dish
3 Ram air intake
4 Camera port
5 Radar ranging equipment
6 Camera access panel
7 Gun camera
8 Ground pressurisation connection
9 Nosewheel door
10 Oxygen bottles
11 IFF aerial
12 Electronics equipment
13 Nosewheel bay
14 De-icing fluid tank
15 Pressurisation control valves
16 Cockpit front bulkhead
17 Nose undercarriage leg
18 Nosewheel forks
19 Forward retracting nosewheel
20 Nosewheel leg door
21 Cannon muzzle port
22 Gun blast cascade deflectors
23 Rudder pedals
24 Bullet proof windscreen
25 Cockpit canopy framing
26 Reflector gunsight
27 Instrument panel shroud
28 Control column
29 Cockpit section fuselage frames
30 Rearward sliding cockpit canopy cover
31 Pilot's starboard side console
32 Martin-Baker Mk 3H ejection seat
33 Throttle control
34 Pilot's port side console
35 Cannon barrel tubes
36 Pneumatic system air bottles
37 Cockpit canopy emergency release
38 Cockpit rear pressure bulkhead
39 Air conditioning valve
40 Ejection seat headrest
41 Firing handle
42 Air louvres
43 Ammunition tanks
44 Ammunition link collector box
45 Cartridge case ejectors
46 Batteries
47 Port air intake
48 Boundary layer splitter plate
49 Intake lip construction
50 Radio and electronics equipment bay
51 Sliding canopy rail
52 Air conditioning supply pipes
53 Control rod linkages
54 Communications aerial
55 Fuselage double frame bulkhead
56 Boundary layer air outlet
57 Secondary air intake door, spring loaded
58 Intake duct construction
59 Forward fuselage fuel tank
60 Starboard intake duct
61 Starboard wing fuel tank
62 230 Imp gal (1 046 l) drop tank
63 Inboard pylon mounting
64 Leading-edge dog-tooth
65 100 Imp gal (455 l) drop tank
66 Outboard pylon mounting
67 Wing fence
68 Leading-edge extension
69 Starboard navigation light
70 Starboard wing tip
71 Whip aerial
72 Fairey hydraulic aileron booster jack
73 Starboard aileron
74 Aileron control rod linkage
75 Flap cut-out section for drop tank clearance
76 Starboard flap construction
77 Flap hydraulic jack
78 Flap synchronising jack
79 Starboard main undercarriage mounting
80 Retraction jack
81 Starboard undercarriage bay
82 Dorsal spine fairing
83 Main wing attachment frames
84 Main spar attachment joint
85 Engine starter fuel tank
86 Air conditioning system
87 Engine intake compressor face
88 Air conditioning pre-cooler



89 Cooling air outlet louvres
90 Rear spar attachment frames
91 Aileron control rods
92 Front engine mountings
93 Rolls-Royce Avon 207 engine
94 Bleed air duct
95 Engine bay cooling flush air intake
96 Rear engine mounting
97 Rear fuselage joint ring
98 Joint ring attachment bolts
99 Tailplane control rods
100 Fuel piping from rear tank
101 Rear fuselage fuel tank
102 Fuel collector tank
103 Jetpipe mounting rail
104 Fin root fairing
105 Hydraulic accumulator
106 Tailplane trim jack
107 Fairey hydraulic elevator booster
108 Tailplane mounting pivot
109 Rudder hinge control rods
110 Starboard tailplane
111 Starboard elevator
112 Tailfin construction
113 Fin tip aerial fairing
114 Rudder construction
115 Rudder trim tab
116 Trim tab control jack
117 Tailplane anti-buffet fairing
118 Tail navigation light
119 Brake parachute housing
120 Tailpipe fairing
121 Port elevator construction
122 Tailplane construction
123 Detachable tailcone
124 Tailplane spar mounting frames
125 Jetpipe
126 Jetpipe access doors
127 Rear fuselage frame and stringer construction
128 Airbrake jack housing
129 Airbrake retracted position
130 Airbrake operating jack
131 Airbrake open position
132 Engine bearing cooling air outlet
133 Wing root trailing-edge fillet
134 Flap housing construction
135 Port main undercarriage bay
136 Mainwheel door
137 Port main undercarriage retraction jack
138 Main undercarriage leg pivot mounting
139 Flap synchronising jack
140 Hydraulic flap jack
141 Port flap
142 Rear spar
143 Aileron control rod
144 Aileron trim tab
145 Port aileron construction
146 Fairey hydraulic aileron booster
147 Wing tip construction
148 Port navigation light
149 Pitot tube
150 3-in (7,62-cm) rocket projectiles
151 Leading-edge extension ribs
152 Wing rib construction
153 Main spar
154 Dowty main undercarriage leg
155 Shock absorber torque links
156 Leading-edge dog-tooth
157 Mainwheel doors
158 Dunlop-Maxaret anti-skid wheel brakes
159 Port mainwheel
160 Port wing fuel tank: total internal fuel capacity 392 Imp gal (1 782 l)
161 Leading-edge pin joint
162 ML twin stores carrier
163 20-lb (9-kg) practice bombs
164 Inboard wing pylon
165 1,000-lb (454-kg) bomb
166 Four 30-mm Aden gun pack
167 Ammunition boxes, 100 rounds per gun
168 Link collector box
169 Gun gas purging air duct
170 Cannon barrels remaining in aircraft when gun pack is withdrawn

After only 11 hours of testing time, the aircraft was being demonstrated at the SBAC display at Farnborough at speeds up to 700 mph (1 127 km/h), so development had progressed at a fairly satisfactory pace in a short time. The following week I flew the Tomtit at about 100 mph (161 km/h) to come last in the *Daily Express* south coast air race.

After the Farnborough Show, there followed a long period of routine performance testing leading to handling work in the New Year of 1952. These trials were mainly concerned with high Mach Number investigation and within a month figures of 1·0 MNI and 600 knots (1 110 km/h) were recorded, pushing up to 1·03 MNI in April. However, these readings were subject to unknown position error and no instrumented confirmation that we were supersonic could be obtained. Meanwhile, further advances were precluded by the degree of tail end buffet and vibration experienced up to these speeds.

In an endeavour to cure our troubles, various and varied fixes were tried, such as spoilers on the fin, fin and tail turbulators, a short-span rudder, additional dorsal fin, and modified rear-end shapes around the jet pipe area, until the magic happened on 6 June and we were rewarded with a vibration free flight for the first time, after fitting the reverse bullet fairing at the fin and tailplane junction. The first confirmed supersonic flight was then made on 24 June, but may well have occurred on any of the flights after 6 June when we were getting readings of up to 1·06 MNI.

After a 25-minute flight from Dunsfold to Brussels, the first public supersonic demonstration of the P.1067 was given on 10 July 1952 at the International Air Display, Melsbroek, and the following SBAC Farnborough was all "bangs" with the Hunter and the D.H.110 — ending with the tragic accident with the de Havilland prototype when John Derry and many others were killed and injured after the aircraft broke up in a high speed rolling pull out at low level at the end of a supersonic dive.

Gun-firing problems

By the end of 1952, we had three prototype Hunters flying, the second (WB195) having flown on 5 May and the third, the Sapphire-powered prototype Hunter Mk 2 (WB202), on 30 November. After handling and performance testing, the third aircraft was earmarked for gun firing trials — ironically, as it turned out.

A majority of testing at this time and in the early part of 1953 concerned flutter investigation on WB188 and WB195. Meanwhile, gun firing on the Sapphire Hunter went extremely well, and things looked good when the first production Hunter Mk 1 WT555 was flown on 16 May 1953. The modified first prototype WB188 made its first flight as the Hunter Mk 3 with reheat on 7 July and all seemed well, until the bomb-shell dropped with the results of gun firing at Boscombe Down using an early production Avon-powered Hunter Mk 1.

HAWKER'S HUNTER . . . THEN AND NOW

The Hunter's sole remaining rôle in the RAF is as a surrogate Buccaneer trainer. At RAF Honington, suitably-equipped T Mk 7 two-seaters provide an Integrated Flight Instrumentation System (IFIS) as a link between the Hawk advanced trainer and the operational Buccaneers.

Engine surging occurred — at first only at altitude but later, and with practice in getting the right combination of flight factors, it could be obtained under many conditions.

During all the gun firing with the Sapphire Hunter, the phenomenon had not been present, the difference being attributable to the variable swirl vane system on the Avon engine. Fuel dipping — a brief reduction in fuel flow at the moment of gun firing — basically cured the trouble in due course but it was a long and trying process and the problem occurred at a politically awkward time just when the Hunter was going into service with No 43 Squadron. Gun firing thus became a concentrated issue and when the time came to clear the more powerful Hunter Mk 6, 16 gun firing sorties were made on two consecutive days in March 1956 and a total of 51 sorties in five days. The turn round times of only a few minutes not only illustrated the effectiveness of the gun pack arrangement designed by the Hawker company, incorporating all four gun bodies and empty magazines which could be replaced by a loaded pack, but also the skill and stamina of our armourers and ground crews who kept up this pace for so long. In all, some 40,000 rounds were fired during these trials to prove the final arrangements for collecting links, and all at full throttle up to over 600 knots (1 110 km/h) at near sea level to prove blast deflectors, engine handling and structural integrity.

The prototype Hunter WB188, which was modified to take the Avon RA7R engine with reheat thrust of 9,600 lb (4 355 kg), was a result of the current Air Staff thinking at the time in favour of reheat development of existing engines for improvement in rate of climb and acceleration. However, with the existing subsonic-designed Hunter, very little improvement in level flight speed could be obtained and Sir Sydney Camm reasoned that the weight, unnecessary complication, cost and parasitic nature of the equipment when not in use made a "dry" engine of increased power a better proposition. Hence the introduction of the RA14 of 10,000 lb st (4 536 kgp) in the ultimate Hunter development, the F Mk 6.

Further performance improvements could have been obtained from the basic Hunter design if the so-called "thin wing" Hunter with a 6 per cent thickness/chord ratio and 50 degrees of wing sweep-back had been developed. This would have been powered by a reheated RA14R engine and would have been supersonic in level flight. Construction of this development, known as the P.1083, was well underway but was cancelled by the Government on 13 July 1953. The design had been proposed as far back as 1950 and would have given a Hunter follow-on with a capability of Mach 1·20 in level flight.

A further, little-known, proposal was the delta wing P.1091 project, based on the Hunter and also using the RA14R. A more startling project design was the P.1128 executive jet of 1957, with a six-seat cabin incorporated into the basic Hunter design but powered by two Bristol Orpheus turbojets in the rear fuselage.

Of these and other developments, it is the P.1083 I regret the most, closely followed by the *tandem* Hunter two-seat trainer version, proposed but abandoned in favour of the side-by-side seating arrangement preferred in those days. Today it would have been the tandem version, and very nice it looked too — and perhaps the P.1083 would still be in production. There seems to be undiminished affection for the Hunter today and amongst the 200 or so aircraft types I have flown I have the fondest feelings for this old friend. □

Designed from the start for the RAF, the Hunter achieved considerable export success, and has also served at home with the Royal Navy. All three markets are represented in this line-up.

THE RAF's YEAR 1984

JANUARY

23: A Nimrod of No 206 Squadron from RAF Kinloss, carrying the Secretary of State for Defence, Michael Heseltine, made a record-breaking non-stop flight from Stanley in the Falklands to Brize Norton. The 8,000-mile (12 875-km) journey took just 17 hr 15 min, refuelling three times from Victor and Hercules tankers *en route*.

FEBRUARY

22: The first all-RAF crewed Lockheed Tri-Star 500 introduced on the UK-Cyprus route, with 257 passengers.

29: No 16 Squadron phases out the Buccaneer in favour of the Tornado at Laarbruch. The Buccaneer was the spearhead of RAF Germany from 1971 onwards.

Sqn Ldr David Gale awarded The Queen's Commendation for Valuable Service in the Air as a result of an incident when he was serving on exchange with the United States Air Force. He was aircraft commander on a C-141 Star Lifter transport carrying 80 passengers when an engine exploded on take-off. Despite considerable damage to the aircraft he managed to bring it safely back to Ramstein with no casualties.

Chinooks from Nos 7 and 18 Squadrons evacuate British civilians and members of the peace-keeping force from Beirut to Cyprus. This BritForLeb operation continues to the end of March.

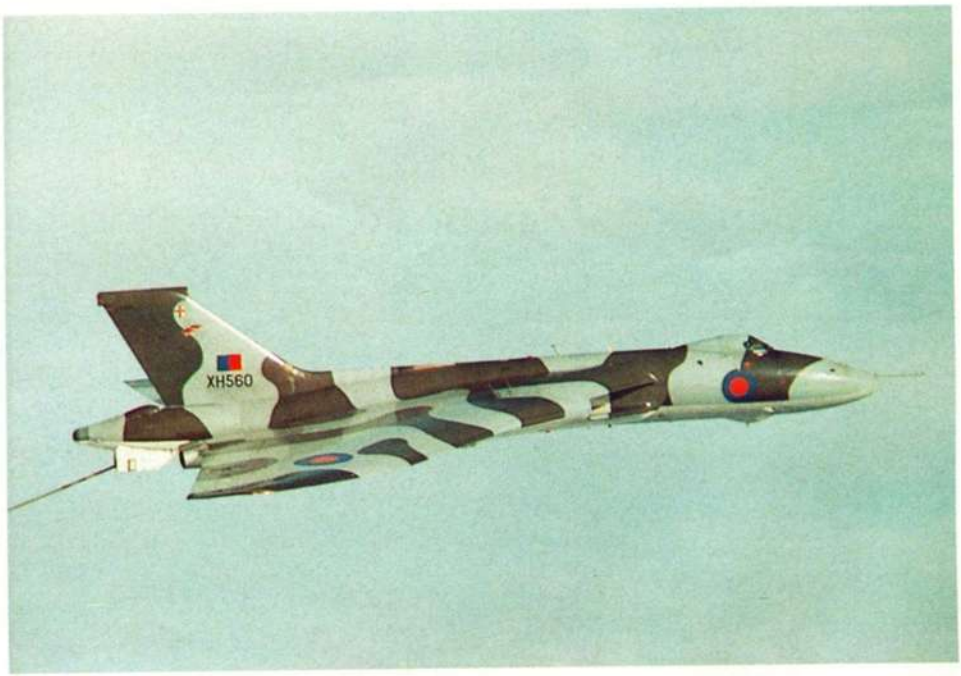
MARCH

5: First flight of production model Tornado F Mk 2 at Warton.

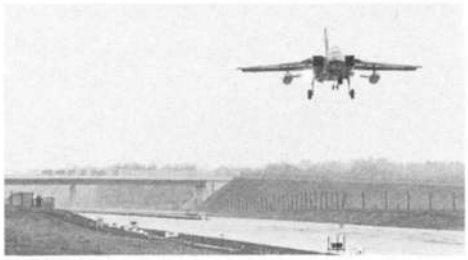
28: The first Tornado F Mk 2 long-range interceptors rolled out at Warton in the presence of Secretary of State for Defence Michael Heseltine. These production machines were destined for Boscombe Down development flying.

30: Disbandment parade for No 50 Squadron, marking the end of the Vulcan with the RAF. The extension of the service of this former V-Bomber was directly due to the Falklands conflict and the need to expand the air tanker fleet pending the availability of VC-10 and TriStar conversions.

Test pilot Sqn Ldr Nigel Wood selected to be the RAF candidate to become the first Briton in space aboard the US shuttle for the launching of Skynet 4 satellites in 1985/86. He started his training in company with the other three UK candidates.



(Top right) Production models of the Tornado F Mk 2 entered flight test in March and deliveries to No 229 OCU at RAF Coningsby began in November; the first two OCU aircraft are illustrated. (Centre right) The RAF bade farewell to the Vulcan at the end of March, with a final demonstration of the K Mk 2 tankers of No 50 Squadron. (Bottom left) No 74 (Tiger) Squadron re-formed at RAF Waddington in October on Phantom F-4J (UK) fighters. (Bottom right) The Devon was retired by No 207 Squadron in June.



Tornado GR Mk 1 of No XV Squadron lands on German autobahn.

APRIL

5: Tornado GR Mk 1s of No XV Squadron and Jaguar GR Mk 1s of No 2 Squadron in RAF Germany are among 80 aircraft from six air forces that demonstrate the Emergency Landing Strip procedure on a portion of autobahn between Munster and Wilhelmshaven.

A Boeing B-17 Flying Fortress bomber was handed over to the RAF Bomber Command Museum by General William P Acker, Commander of the US 3rd Air Force.

Decision announced to axe the RAF Marine Branch in 1986, and to close RAF Mount Batten, Plymouth.

Intention to order new fleet of grp gliders for the Air Training Corps announced.

At the end of the month, three Tornado GR Mk 1s from No 617 Squadron and two Victor K Mk 2s from No 55 Squadron begin to deploy to Ellsworth AFB, South Dakota, in Exercise *Prairie Vortex I*, the preparatory phase for RAF participation in the annual SAC bombing competition.

MAY

1: No 101 Squadron re-formed at Brize Norton equipped with four VC-10 K Mk 2 air-to-air tankers. Five more aircraft (K Mk 3s) are being added to the squadron strength over the next year.

JUNE

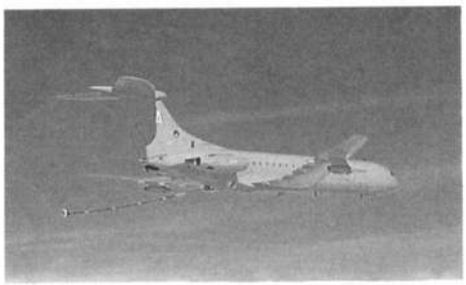
6: Lancaster, Spitfire and Hurricane of the BoB Memorial Flight overfly Arromanches on the 40th Anniversary of the Normandy landings by Allied forces.

13: The first Tornado for RAF Brüggen was handed over at St Athan prior to its delivery flight to Germany by Brüggen Station Commander, Gp Capt Joe Sim, piloting the aircraft.

30: The Devon said farewell after 37 years of service with the Royal Air Force. The last aircraft were based at RAF Northolt with No 207 Squadron, which disbanded on this day, and were used for short-range communications and VIP transport duties.

30: No 20 Squadron at Brüggen changed from being a Jaguar operator to the Tornado. Previous types flown by this famous squadron include the Harrier, Hunter, Sabre, Vampire, Beaufighter, Tempest, Spitfire, Hurricane, Lysander, Blenheim, Wapiti, Hart, Bristol Fighter and FE2.

The Queen's Commendation for Valuable Service in the Air was awarded to Flt Lt William Akister for safely landing a fully loaded Hercules after it flew into a violent



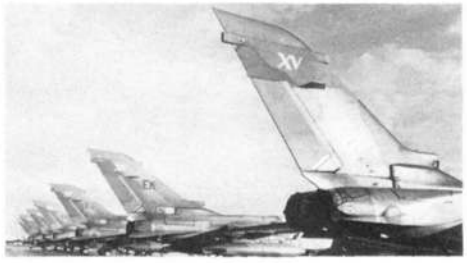
(Top) No 7 Squadron Chinook HC Mk 1 ends BritForLeb operations at Larnaca. (Above) VC10 K Mk 2 of No 101 Squadron.

tropical storm on the final approach to Ascension ending a 3,000-mile (4 828-km) journey from the Falkland Islands.

JULY

3: First of five VC-10 K Mk 3 tankers destined for No 10 Squadron makes its maiden flight at Filton.

25: Departure of the Hawker Hunter from No 1 TWU, Brawdy, marked with a nine-ship formation display including F Mk 6A, T Mk 7



and F(GA) Mk 9 versions. Disposal of the TWU Hunter fleet began next day with delivery of seven aircraft to St Athan for storage. Hunters remain in RAF service only as trainers for the Buccaneer units, No 237 OCU and Nos 12 and 208 Squadrons.

AUGUST

29: Six Tornado GR Mk 1s and three Victor K Mk 2s, from Nos 617 and 55 Squadrons respectively, depart for Ellsworth AFB, SD, in Exercise *Prairie Vortex II*, to take part in the SAC bombing competition during October.

Order announced for two British Aerospace 146-100 jet transports for The Queen's Flight, to replace the Andovers which have been in use since the 1960s. Two 100-series 146s in service since June 1983, during an intensive evaluation programme, are returned to the manufacturers. The new machines will be fitted with special communications equipment and VIP interior.

Sqn Ldr Josephine Kingston, WRAF, a member of the RAF Medical Branch, began a 30-hour flying course at Swinderby, on Chipmunks, prior to taking up her post as Senior Medical Officer at Odiham. An RAF Flight Medical Officer holds a diploma in aviation medicine awarded by the Royal College of Physicians and has to complete an RAF course in advanced aviation medicine. This gives the FMO a specialist knowledge of the psychological and physical stresses and strains affecting aircrew. The flying course gives selected FMOs practical experience to complement all the theory.

The Ministry of Defence placed a contract with Ferranti Computer Systems Ltd to supply an Air Defence Ground Environment System for use by the RAF in the Falklands.

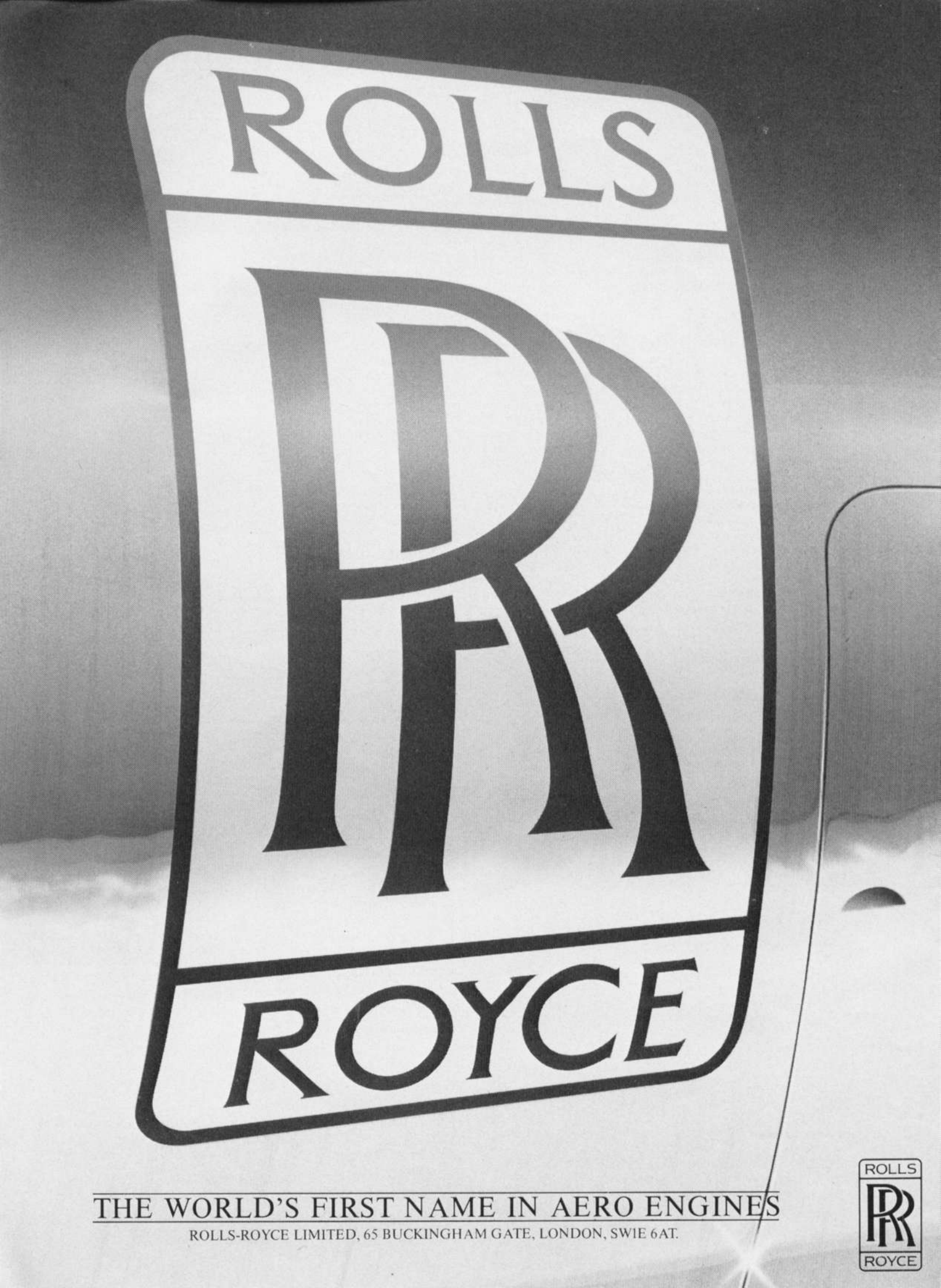
SEPTEMBER

1: No 31 Squadron inaugurated with Tornado GR Mk 1 aircraft at Brüggen, commanded by Wg Cdr Dick Bogg. The squadron had been flying Jaguars since 1976 and flew its first Tornado on 14 August, 10th anniversary of the first flight by the Tornado.

19: Central Flying School moved from Leeming to Scampton.

Exercise *Lionheart* took place in Germany.

(Clockwise from top left) BAe 146-100 leaves No 241 OCU; Tornado GR Mk 1 joins No 31 Squadron; Tornadoes of No XV Squadron visit Decimomannu; Harrier GR Mk 3, Phantom FGR Mk 2 and Jaguar GR Mk 1 of RAF Germany in Exercise Lionheart.



THE WORLD'S FIRST NAME IN AERO ENGINES

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During the lead-up to the reinforcement exercise 30,000 troops were airlifted by the airbridge, comprising both RAF and chartered civil airliners. The RAF used Hercules, VC-10 and TriStar transports, and all these types, plus civil Boeing 747s, operated to Gütersloh. The Chinooks and Pumas lifted more than 10,300 troops and 2,330,000 kg of freight.

OCTOBER

2: RAF Police in Germany presented with the Wilkinson Sword of Peace.

18: MoD announces commitment to buy two TriStar 500s from Pan American, to be delivered before end-1984, with an option on a third for April 1985. They are for conversion to air refuelling tanker rôle with secondary passenger/cargo transport capability and will join five other TriStars in No 266 Squadron.

19: After an absence of 13 years, No 74 Squadron, "The Tigers" re-formed as a frontline fighter unit, based at Wattisham, and equipped with F-4J(UK) Phantoms, purchased from the US Navy.

21: Cpl Steve Jones, an airframes technician from St Athan, became the fastest marathon runner in history when he won the big race in Chicago, USA.

The RAF won the Fincastle Trophy, awarded annually for expertise in airborne anti-submarine warfare in a competition between teams from the UK, Australia, Canada and New Zealand. The team from No 42 Squadron, based at St Mawgan, Cornwall, achieved victory in 1984 with the competition held at the RAAF base at Edinburgh, near Adelaide, South Australia.

The Royal Auxiliary Air Force celebrated its 60th Anniversary. In recent years the auxiliaries have grown to include six Regiment field squadrons for ground defence of air bases, with more to follow, a movements squadron and an air evacuation squadron. The Maritime Headquarters Units also continue with auxiliary support.

NOVEMBER

1: No 216 Squadron re-formed at Brize Norton, equipped with Lockheed TriStars. Initially operating in the passenger/cargo transport rôle, the TriStars will eventually become multi-rôle aircraft with tanking capability.

5: The first two Tornado F Mk 2 interceptors delivered to No 229 Operational Conversion Unit, RAF Coningsby, at the start of the build-up of the RAF's training programme.

5: At a ceremony at Lakenheath, No 66 Squadron, RAF Regiment, became the first Rapier squadron dedicated to the protection of major US bases in the UK.

RAF flies out detachment of Hercules to assist in distribution of famine-relief supplies in Ethiopia. Operation *Bushell* involved aircraft from all the Lyneham-based Hercules squadrons, with crews rotating regularly. Within hours of arriving at Addis Ababa the RAF detachment was in business heading up-country, flying grain into some of the roughest and most inhospitable airstrips in the world. Other air forces soon followed. Also, No 216 Squadron TriStar 500 made two round trips from Brize Norton to Addis Ababa to ferry 30 tons of food and medical supplies. By year-end, the Hercules have ferried more than 3,500 tons of supplies, with the effort continuing unabated.

Returned from an outstandingly successful participation in USAF's annual bombing competitions, Sqn Ldr Pete Dunlop (left) and Flt Lt Dick Middleton display at Honington the John C Meyer and Curtis E LeMay Bombing Trophies and the British Aerospace Trophy. Full details of the RAF's participation, code-named Prairie Vortex, appear on pages 15-17.

Delivery at Syerston of first Viking TX Mk 1 tandem two-seat training sailplanes for use at ATC Gliding Schools. Earlier, MoD had ordered 100 of these Grob G.103 grp trainers from Germany to replace the elderly Sedberghs and other types and complete modernisation of the Cadet gliding inventory, begun in 1983.

RAF achieves major successes in SAC bombing competition through its Exercise *Prairie Vortex II*. Tornado GR Mk 1s, supported by Victor K Mk 2s, take first and third place in the John C Meyer Trophy, first and second in the Curtis LeMay Bombing Trophy and second and sixth place in the Mathis Trophy.

DECEMBER

18: Ministry of Defence announces that final selection of a new trainer for the RAF (to meet Air Staff Requirement 412) will be made between Shorts-built Embraer Tucano designed in Brazil and British Aerospace-built Pilatus PC-9 designed in Switzerland. Subsequently, MoD agreed to give further consideration to the all-British Hunting Firecracker and the Westland-built A20 designed in Australia.

Nimrod MR Mk 2 of Kinloss-based No 201 Squadron claims a record for a flight to the Falklands and back, as part of its participation in Exercise *Southern Rein*. Under command of Squadron OC Wg Cdr Terry Earl, the Nimrod was officially timed by the Royal Aero Club, with a flying time of 38½ hrs for the round trip.

Year-end statistics show that RAF search and rescue helicopters (Sea King and Wessex) were called out 949 times in 1984. Of 893 persons rescued, all but 50 were civilians. RAF mountain rescue teams were called out 50 times and rescued 40 persons.

SIX FOOT EIGHT - BOOTED AND S WAS I THE RAF's TALLEST PILOT?

by John Crampton, DFC, AFC and Bar

To become a pilot in the Royal Air Force has always required dedication, determination, skill and fitness — qualities that the Service is fortunate to have found in large measure among its recruits over six decades. For some, though, simply to meet the rigorous standards set by the recruiting boards has not been sufficient to ensure their selection; they have had to overcome other difficulties before pinning the coveted wings on their tunics. John Crampton's problem was that he was too tall . . . but, where there's a will, there's a way, as this light-hearted account shows. After leaving the RAF, incidentally, the author later joined the sales team of Hawker Aircraft in 1959, becoming technical sales manager at Kingston in 1961 and playing a major part in the successful export of the Hawk and the marketing of the Harrier.

"SIX-AND-A-HALF FEET!" The much be-ribboned Group Captain sounded as if he was pronouncing the direst of sentences at a court martial. Flanked by two officers of only slightly lower rank and no less grimness of expression, he sat at a trestle table in a sparsely furnished room, dispensing decisions that could change the destinies of we lesser mortals, who, one by one, took our lonely seat on the other side of that table.

The tone in which the Group Captain pronounced my height did not suggest that he found it impressive. His next remark left me in no doubt. "The cockpits of our aircraft cater quite satisfactorily for gentlemen of, er, somewhat more *average* stature. You, I fear, would find them decidedly cramped, Mr, ahem, Cramp . . . ton!" If the pun was intentional, neither he, his colleagues, nor I, laughed.

To have one's burning passion denied was indeed no laughing matter — and I *was* being denied the opportunity to become a pilot in the Royal Air Force. Continuing in his rôle as deputy for the Almighty, the Group Captain made quite sure I was under no illusion as to my unfitness to join that elite band to which I aspired. "You also weigh too much. Furthermore, you appear to have a slight problem with your right eye."

Thus was enacted one of the most dramatic, if least known, moments in the history of World War II — an event at RAF Uxbridge in the autumn of 1940. I had reached that hallowed place by way of a recruiting office close to Euston Station (many epic stories have modest beginnings!), having, at the age of 18, left a job with the General Electric Company, run away from home and ignored specific instructions from my father, in order to make good my ambition to fly with the RAF. I simply *had* to fly.

We were a happy band of self-styled fledgelings on the train from Euston to Uxbridge; my fellow recruits soon dubbed me Lofty and their exuberance bolstered my sagging confidence.

The usual aptitude tests and medical examinations that followed our arrival at RAF Uxbridge posed no great problem, yet I felt miserably inadequate and thoroughly underconfident as the day progressed, a state of mind that made worse the stammer from which I then suffered and which sometimes rendered me speechless. Yet that intense little flame burned on within me, inextinguishable. I was consumed with a passion for aeroplanes; I dreamed of the day I would become a pilot . . .

My heart stopped. It *must* have stopped. The Group Captain's words reached me from a great distance. "We might be able to accept you as a navigator, Mr Crampton. Aeroplanes with navigators as well as pilots are a little larger."

Navigator? *Navigator*! Never. My heart, which apparently hadn't stopped but had only descended to my boots — a journey of more than average length, as the Group Captain would have been quick to point out — returned approximately to its normal position and behaviour. I spoke clearly and without a stammer. "Sir, it is my wish to join the RAF as a pilot. If I cannot be a pilot, I will not join."

Flying-boats?

Perhaps it was the decisiveness of my answer, my bearing, my obvious qualities as a future pilot . . . or perhaps it was just because this was the autumn of 1940 and the RAF really *did* need every pilot it could lay its hands on: but whatever the reason, the Uxbridge Trio showed a willingness to reconsider their decision. They thought. They raised their eyebrows at one another. Finally, one spoke, in muted tones: "What about flying-boats?" Said another, "We will ring old Ted".

Ted (or was it Fred — it is, after all, many, many years ago) was rung. Ted (or Fred) seemingly acquiesced. The Group Captain spoke again. "Well, Mr Crampton, provided that you agree to fly flying-boats, and, um, ahem, provided that you get your weight down and provided that you, ah, overcome the problem with your eye, we will accept you as aircrew, pilot u/t (under training). Is that acceptable?"

Distantly, through the closed window of that uncomfortable room at Uxbridge, I heard the unmistakable sound of a Merlin receding into the distance. Spitfire? Hurricane? They were not to be for me. But I was *in*. The relief flooded over me. "Flying-boats, sir. Yes, sir!"

The RAF Eye Clinic was at Cambridge. There, I was to encounter my second hurdle, for my stereoscopic vision was suspect. I don't know why the Commanding Officer of the Unit was away for a week when I arrived, but I quickly learned that I could not be turned down without his authority. In his absence, the pretty staff nurse at the Clinic took me in hand — I can only assume that tall men turned her on — and taught me all there was to know about the sort of "goofoscope" I was to look through when Sir tested me. I learned by heart the sequence in which various objects were to appear: the square closer than the circle, the circle closer than the oblong, and so forth — although, in truth, they all looked to be on the same plane to me. Memory did not fail me, and when the CO returned and tested me, I was passed fit for flying duties. My conscience never troubled me — but I did still seem to get a twitch in my right eye from time to time when pretty nurses were around . . .

And so to my Receiving Wing, near Torquay: then, in the fullness of time, to Initial Training Wing at Cambridge and finally, at long last, to No 15 Elementary Flying School at Carlisle. On 1 April 1941, I made my first flight; my instructor, brave soul, was one P/O Robinson, and the aircraft was Miles Magister R1848. The Group Captain had not been wrong: Crampton was indeed cramped! That aeroplane clearly was designed to accommodate

PURRED . . .

midgets — but I had no real problems flying the Maggy — it's amazing how well you can cope if you really want to. I soloed in two weeks after 9 hrs 5 min of dual, and completed the course on 9 May with 50 hrs 40 min in my log-book.

Canadian Prairies

Next posting: Canada. That seemed reasonable enough, I thought, since I was bound for flying-boats and Canada had a lot of water. Something didn't seem quite right when I found myself at Moose Jaw, newly-established on the Prairies — which my dictionary very accurately defined as "a large treeless tract of level grassland". However, Moose Jaw meant Harvards, and Harvards had big, roomy cockpits and were a joy to fly; I didn't complain. Wings Parade on 26 August 1941, and I found myself posted to Canada's Central Flying School at Trenton, Ontario, with the rank of Pilot Officer, to learn how to become a flying instructor. At Trenton, we flew Ansons, Harvards, Fleet Finch biplanes and Cessna Cranes, none of which gave the RAF's tallest pilot(?) any problems. Back at Moose Jaw, I spent the whole of 1942 instructing. Sent back to Blighty early in 1943, I was given the same task, now on Masters and Oxfords.

Ted (or was it Fred?) must have been a very patient man — or perhaps he just was wiser than I in the ways of the RAF. At any rate, he never did get me on his flying-boats. Early 1944 brought a posting to Bomber Command, and in April, at Abingdon, I added the Whitley to my log-book. Now *that* was a damned difficult aeroplane for me to get into — and even when I finally stowed the various parts of my anatomy in the cockpit, I found the thing would only fly nose down, in a pig-like attitude. The Whitley never endeared itself to me, and not without relief I was soon transferred to a man-sized bomber, the Halifax, which I first flew from Rufforth, near York, and then, as "B" Flight Commander on No 76 Squadron at Holme on Spalding Moor. That kept me busy, now a Squadron Leader, from August 1944 till the war in Europe ended. Don't let anyone tell you different: No 76 won that war.

With the onset of peace, I was posted to No 16 Ferry Unit at Dunkeswell in Devon, and the list of types in my log-book grew apace: Proctor, Dominie, Dakota, Lancaster — and, from the sublime to the ridiculous, a Kirby primary glider. I was now an old hand at folding my elongated frame into standard cockpits, yet some of these called for the development of still more unorthodox techniques. Exciting as this may have been, it paled to insignificance against the daily sight of the new, mysterious, magical jet-engined Gloster Meteors of Exeter-based No 222 Squadron as they whizzed effortlessly around the locality. Cramped or not, there was one type I *had* to fly.

A visit to the airfield and a chat with the boss (Squadron Leader C C F Cooper) solved all problems. He kindly agreed to my transfer to the squadron, stipulating only that I remove my acting Squadron Leader's scraper ring, as he felt it would be bad form to have two squadron leaders on one squadron. That was certainly OK by me, and three weeks later (14 August 1946) I flew my first Meteor III.

With the advent of autumn came an attachment to the Day Fighter Leader's School at West Raynham, flying Spitfire 14s. Now that was an aeroplane for midget midgets! I decided unorthodox methods were called for in the interest of safety, and to land the Spitfire I used to open the canopy, put the seat fully up, pull my goggles down, and look *over* the windscreen. It was almost as good as those few heavenly hours I had spent in 1943 flying an elderly Avro Tutor at South Cerney.

By 1947, No 222 Squadron was at Tangmere, and there I rejoined them, to fly Meteors again. Summer Practice Camp with the squadron took me to Lubeck, North Germany, and a chance to fly gliders at weekends — gaining a "C" certificate in the process. Then, in June 1948, I was posted to No 72 Squadron at Odiham to fly sports cars — the beautiful little Vampires, which gave me just enough room, in a sitting crouch, to close the canopy.

The end of 1948 brought a splendid Christmas present — a posting as Personal Assistant to Air Chief Marshal Sir James Robb, who was then Vice Chief of the Air Staff but was to become the (first) Commander-in-Chief of the Air Forces of Western Europe. Sir James had been allocated his own Dove (VP981) which we collected from Hatfield on 3 January 1949 and set about teaching ourselves to fly it. I found it quite a struggle to get behind the controls of the Dove — but we flew many happy hours in VP981 all around Europe and NW Africa, until the end of 1950.

Back to bombers

Promotion meant a squadron command and in April 1951 I took over No 97 Squadron at Hemswell, flying Lincolns. Another very awkward climb to get into that scaled-up Lancaster, but, once enthroned, there was bags of room — almost like a flying-boat (I think!).

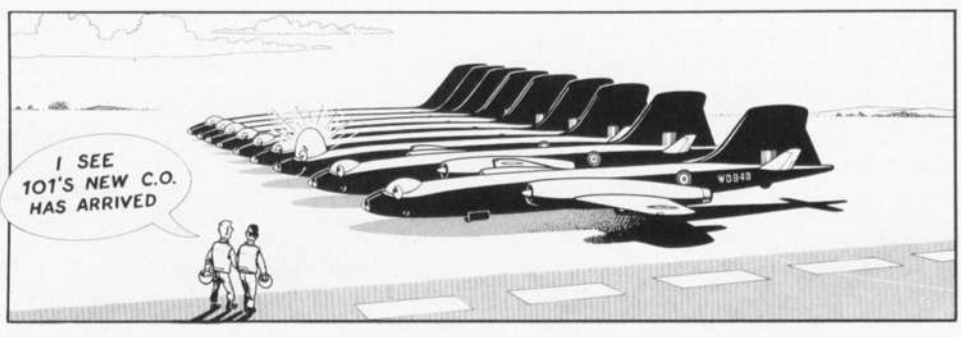
I can hardly claim to have planned it that way, but in 1951 I was one of very few Bomber Command pilots with jet experience. So when a call came, in the summer of that year, for just such pilots, I took two smart steps forward and found myself *en route* to the USA to fly North American RB-45C Tornado four-jet reconnaissance bombers, then in service with USAF's Strategic Air Command. I had learned to like North American aeroplanes in the days of flying the Harvard, and I was not disappointed on re-acquaintance with this new product from the same factory.

Back home in 1952, I found myself Binbrook-bound for what proved to be my final flying assignment in the RAF, and one of my happiest. This was in command of the RAF's first Canberra-equipped squadron, No 101, where I succeeded "Hopalong" Cassidy. Once again, my height posed a few problems, thanks, in this case, to Jimmy Martin's development of ejection seats. The question now was not so much whether I could get *into* the cockpit, but whether I could get *out*, without taking part of the instrument panel with me, with little benefit to my femurs, knee caps and tibias. Before my posting to No 101 was confirmed, therefore, I was asked to get my thigh length measured to make sure it was within the limits defined by the path of the ejector seat. What, I asked the medics, *is* the maximum thigh length? "Ah," they said, "we don't know."

It seemed to me that the cart was being put before the horse: the Canberra before Crampton. So I pulled rank and insisted that the medics found out *before* they measured me — and lo and behold, my thigh measurement came out within the limits, by the tiniest fraction! And flying the Canberra was perfect bliss.

When squadron flying gave way to staff jobs, I was able to keep my hand in on the Chipmunk — with again no serious problems — until I decided to retire from the Service in 1957.

All my schoolboy dreams had come true, despite that moment at RAF Uxbridge when all seemed lost — and I never once sat behind the controls of a flying-boat. From time to time, I hear stories of desperately keen fellows who have been turned down as pilot trainees because of their height and they sadden me. I have met one or two of them who have looked up at me accusingly, as if to say "How did *you* wangle it?" Well, if the Almighty was over-generous with my stature and sparing in confidence, he compensated with perhaps the greatest of all gifts . . . good luck! □



THE RAF's FIRST FIGHTERS

by J M Bruce

WHEN THE ROYAL AIR FORCE came into being on 1 April 1918 its constituent halves — the Royal Flying Corps (Military Wing) and the Royal Naval Air Service — had been at war for 44 months. Of the RAF's 76 squadrons then in France, 34 were fighter or fighter-reconnaissance squadrons, plus two similar squadrons of the Australian Flying Corps. Additionally, there were three squadrons in Italy, one (plus No 1 Squadron, Australian Flying Corps) in Palestine, one in Macedonia, and one in Mesopotamia; while in the Mediterranean Area eight squadrons included fighter aircraft in their equipment. For Home Defence against airships, Gothas and Giants there were 16 squadrons.

In the Field, the four fighter-reconnaissance squadrons in France (Nos 11, 22, 48 and 62), "Z" Flight of No 34 Squadron in Italy, part of No 1 Squadron, AFC, in Palestine, and Home Defence Squadrons Nos 33, 36, 39, 76 and 141 had, or were soon to have, the peerless Bristol F.2B, the greatest and best two-seat fighter of its time. Every other operational British fighter unit had single-seaters, apart from the odd Armstrong Whitworth F.K.8 or elderly F.E.2b or 2d compelled to pretend to be fighters in some Home Defence units.

Of the 29 single-seat fighter squadrons, 15 had Sopwith F.1 Camels, 10 had S.E.5as, two had Sopwith Dolphins, No 23 Squadron still had Spad 13s, and in No 29 Squadron long-obsolete Nieuports (mostly Nieuport 27s) lingered on. The RAF's first monoplane fighter, the Bristol M.1C, existed in small numbers in No 72 Squadron in the heat of Mesopotamia and with Squadrons Nos 17 and 47 in Macedonia. In the Home Defence squadrons Camels, Bristol Fighters and S.E.5as were on strength, but some venerable F.E.2bs and 2ds clung heroically to operational fighting status, B.E.12s and 12bs formed at least part of the equipment of several squadrons, and single-seat conversions of the Avro 504K were coming into service.

The basic designs of these F.E.s and B.E.s went back, respectively, to those of the F.E.2a and B.E.2c of 1914. The F.E.2b served the RAF until the Armistice, admittedly in diminishing numbers in the Home Defence rôle, but doggedly and effectively as a night bomber: indeed, the type was in production until May 1919. The initial batch of F.E.2as and the earliest F.E.2bs had seen service as fighter-reconnaissance aircraft in 1915-16 and had proved to be reasonably effective against the Fokker monoplane fighters, primarily because their pusher configuration gave their observers an excellent field of fire forwards, upwards and abeam. It also made the F.E.s vulnerable to attack from astern, and once their undistinguished performance was outstripped by the speedy Albatros and Halberstadt fighters in the autumn of 1916 the F.E.2bs could no longer live in the skies of France by day.

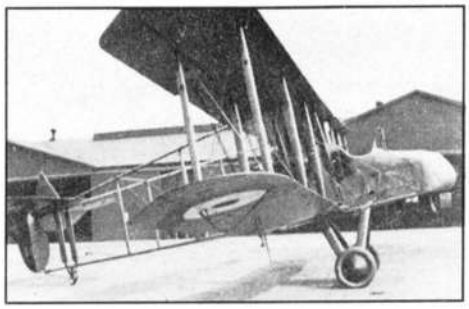
Power for the F.E.2b was provided first by the 120 hp Beardmore, which was simply the Austro-Daimler engine manufactured in Glasgow by The Beardmore Aero Engine Ltd and in Coventry (with piquant appropriateness) by The Daimler Co, Ltd. Later F.E.2bs had the 160 hp Beardmore, developed from the earlier 120 hp engine by Frank Halford at the beginning of his brilliant career.

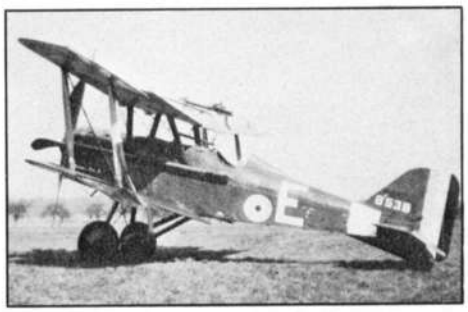
Curiously, the F.E.2d had been introduced in June 1916 as a stop-gap pending deliveries of the 160 hp F.E.2bs. It was created by replacing the Beardmore engine by the excellent 250 hp Rolls-Royce V-12 that was later named Eagle; various Marks of this engine and the later 275 hp developments were fitted to F.E. airframes as engines became available, and the F.E.2d gave excellent service when introduced in France, stolidly battling on until the autumn of 1917 and sustaining the fighter-reconnaissance rôle long after the 160 hp F.E.2bs had had to be taken off daylight operations.

Engine availability and development were always critical, but never more so than in 1917-18, by which time airframe design, development and production had advanced and expanded markedly, and at a pace that engine development and production could not match. That B.E.12s and 12bs were in service with Home Defence squadrons in 1918 was primarily attributable to their inherent stability, a quality that gravely limited the daylight combat effectiveness of B.E.2cs, 2ds, 2es, 12s and 12as in every theatre of war, yet was a substantial advantage when these sedate and undistinguished aircraft had to fly at night as defenders of the realm against noctivagant German airships. The potential effectiveness of the B.E.12 and 12a against enemy aeroplanes was impaired by their R.A.F.4a engine, a mediocre air-cooled V-12 of 140 hp with twin upright exhaust stacks and a large air scoop that obscured much of the pilot's forward view.

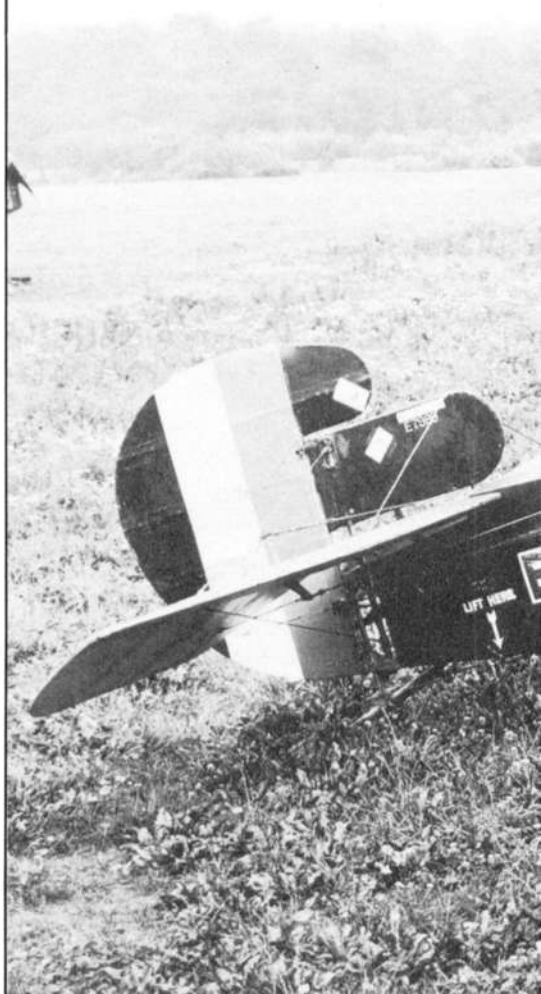
One of the most remarkable production orders of the war was the official Contract No A.S.11453/1 of 18 August 1917, which called for 200 B.E.12s (C3081-C3280) to be built by the Daimler Co, Ltd, of Coventry. These were intended primarily for Home Defence duties, and doubtless an awareness of the B.E.12's inadequate performance prompted efforts to fit the 200 hp Hispano-Suiza engine in the B.E.12 airframe. This was accomplished in September 1917 by the Southern Aircraft Repair Depot at Farnborough, and it was intended that 150 of the 200 new B.E.12s would have the Hispano-Suiza, the installation and necessary modifications to be undertaken by the Northern Aircraft Repair Depot at Coal Aston, near Sheffield. The Hispano-powered aircraft were designated B.E.12b, and the type did not enter operational service until late 1917.

The engine installation on the B.E.12b was generally similar to that of the similarly powered S.E.5a. The choice of the 200 hp Hispano-Suiza and the timing of the B.E.12b's introduction into Home Defence squadrons were remarkable, for late in 1917 that engine





(Top) F.E.2b B419, shown with front cockpit faired over, with No 38 Sqn, RFC, in October 1917; (above) S.E.5a B536 "Bubbly Kid II" was with No 56 Sqn in March 1918; (centre above) B.E.12 No 6616 was flown at some time by No 36 (Home Defence) Squadron; (top right) this B.E.12b C3114, is believed to have been based at Gosport in 1918; (far right) F.E.2d B1882 was flown by pilots of Nos 33, 39 and 78 Sqns, RFC, during 1917; (below) one of the first 15 Sopwith Snipes issued to No 43 Sqn RAF, in 1918.

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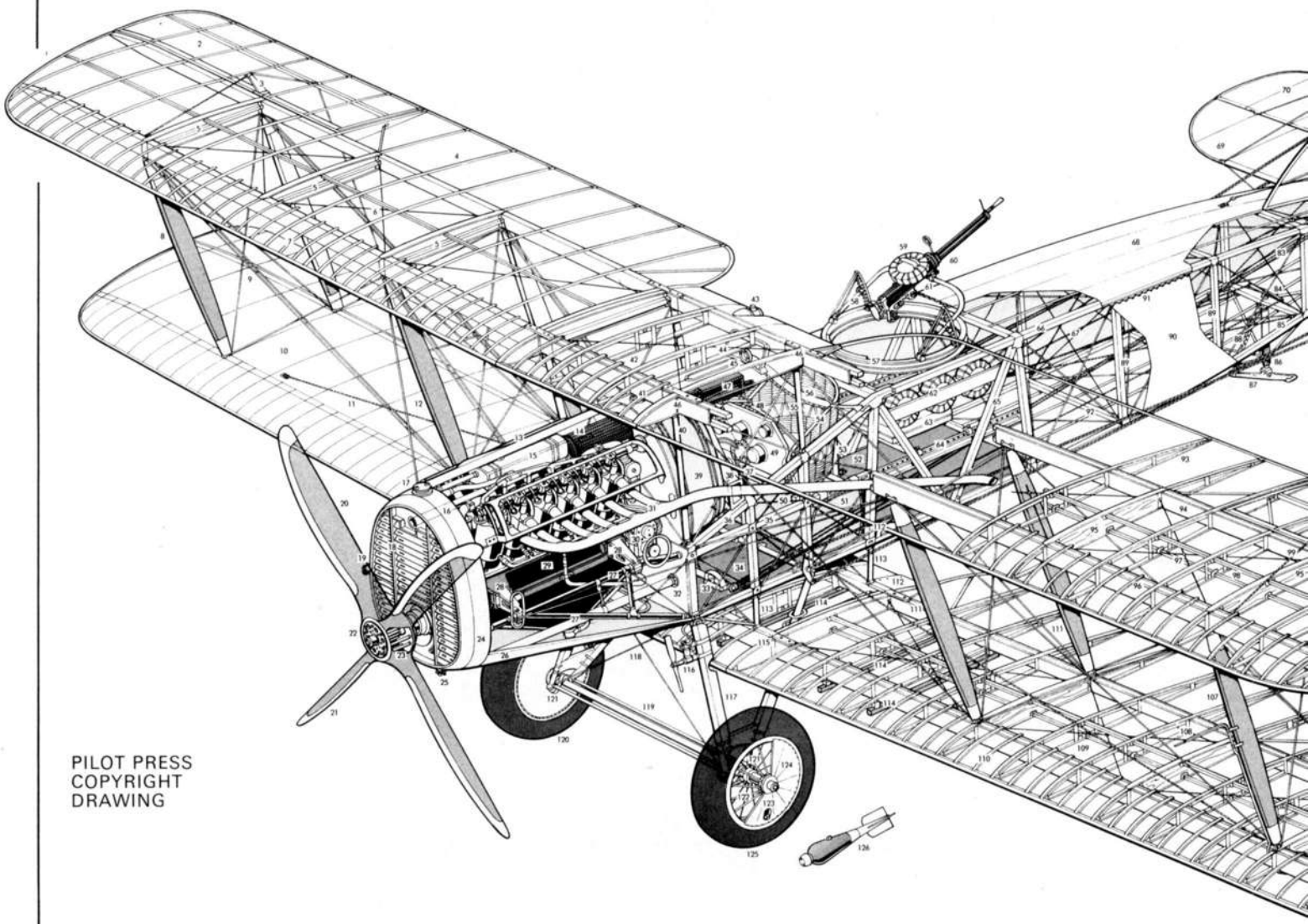
Bristol F2B Fighter



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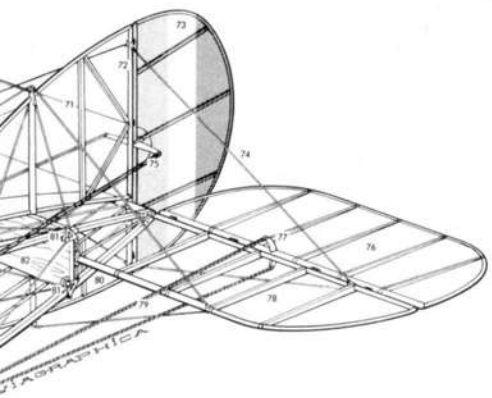
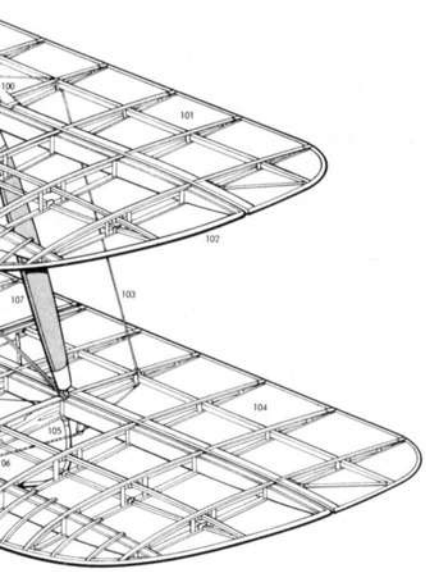
DRAWING

Cutaway Drawing Key

1 Wing-tip edge member
2 Starboard upper aileron
3 Aileron control horn
4 Fixed trailing-edge ribs
5 Compression ribs
6 Wing panel internal wire bracing
7 Leading-edge stiffeners
8 Outboard interplane struts
9 Diagonal wire bracing
10 Lower wing panel fabric covering
11 Aileron operating cable
12 Inboard interplane struts
13 Upper engine cowling panels
14 Machine gun barrel
15 Cooling system expansion tank
16 Machine gun muzzle blast tube
17 Radiator filler cap
18 Radiator shutters
19 Shutter control lever
20 Four-bladed laminated wooden propeller, two-bladed propeller alternative fit
21 Anti-erosion metal-bound propeller leading edge
22 Propeller hub
23 Propeller hub fixing bolts
24 Radiator
25 Radiator drain cock
26 Lower engine cowling panels
27 Engine bearer struts
28 Main engine mountings
29 Rolls-Royce Falcon III liquid-cooled 12-cylinder Vee engine
30 Engine magneto
31 Exhaust pipe
32 Engine bay rear bulkhead
33 Rudder pedals
34 Cockpit floor panelling
35 Seat mounting longeron
36 Sloping upper longeron
37 Control column
38 Cartridge case ejector chute
39 Upper (main) fuel tank; total fuel capacity 44 Imp gal (200 l)
40 Centre section front strut
41 Fuel filler cap
42 Upper wing panel centre section
43 Compass
44 Windscreen panel
45 Gunsight
46 Wing spar/centre section attachment joint
47 0·303-in (7,7-mm) Vickers machine gun
48 Machine gun mounting struts
49 Instrument panel
50 Engine throttle and mixture control levers
51 Lower fuel tank
52 Observer's cockpit floor panelling
53 Observer's emergency control column
54 Pilot's seat
55 Centre section rear strut
56 Cockpit coaming
57 Scarff-ring machine gun mounting
58 Gun elevating mechanism
59 Ammunition drum
60 0·303-in (7,7-mm) Lewis machine gun
61 Swivelling gun mounting
62 Spare ammunition drums
63 Observer's sliding seat
64 Seat mounting rail
65 Diagonal fuselage braces
66 Upper longeron
67 Fuselage internal wire bracing
68 Fabric top decking
69 Starboard tailplane
70 Starboard elevator
71 Fin construction
72 Sternpost
73 Rudder construction
74 Tailplane bracing cables
75 Rudder control horn
76 Port elevator construction
77 Elevator control horn
78 Tailplane construction
79 Elevator control cables
80 Ventral fin segment
81 Trimming tailplane incidence control linkage
82 Rear fuselage bulkhead
83 Rudder control cables
84 Tailskid steering linkage
85 Fuselage lower longeron
86 Tailskid mounting struts
87 Steerable tailskid
88 Elastic cord shock absorber
89 Vertical spacers
90 Fuselage fabric covering
91 Fabric lacing
92 Horizontal spacers
93 Wing trailing-edge ribs
94 Rear spar
95 Compression ribs
96 Front spar





97 Wing panel internal wire bracing
98 Rib support stringers
99 Aileron balance cable
100 Aileron control horn
101 Port upper aileron
102 Wing-tip edge member
103 Aileron interconnecting cable
104 Port lower aileron
105 Ventral wing-tip skid
106 Aileron operating cable
107 Outboard interplane struts
108 Pitot tube
109 Lower wing panel rib construction
110 Leading-edge stiffeners
111 Inboard interplane struts
112 Boarding steps
113 Lower wing panel centre section attachment struts
114 Ventral bomb racks (six)
115 Wing spar/centre section attachment joint
116 Wind driven fuel pump
117 Main undercarriage V-struts
118 Diagonal wire bracing
119 Axle beam
120 Starboard mainwheel
121 Elastic cord shock absorbers
122 Wheel spokes
123 Tyre inflation valve
124 Wheel disc fabric cover
125 Port mainwheel
126 20-lb (9-kg) Cooper bomb (12)

was greatly in demand, scarce at best, and depressingly unreliable even when available. It was principally and urgently needed for S.E.5as and Dolphins, a need reflected in the War Office decision of 19 December 1917 to abandon the idea of fitting the 200 hp Hispano-Suiza to the corps-reconnaissance version of the Bristol F.2B, replacing it with the 200 hp Sunbeam Arab.

It had been hoped to use the Arab as an alternative engine for the S.E.5a, but development difficulties so retarded deliveries of the Sunbeam engine that in January 1918 there were about 400 S.E.5a airframes lying in store engineless. Up to the end of 1917 only 81 Arab engines had been delivered by the parent Sunbeam company: production from the Austin, Lanchester and Napier firms was still months in the future, and when Arabs were forthcoming in quantities they were wanted for Bristol F.2Bs.

More engines might have been available had not the Wolseley company misinterpreted a contract for 400 direct-drive Hispano-Suiza engines and devoted design and production effort to evolving, not without delay and difficulty, the engine that was eventually produced as the Wolseley Viper. By the time of the Armistice all but two of the RAF's 15 S.E.5a squadrons in France had Viper engines.

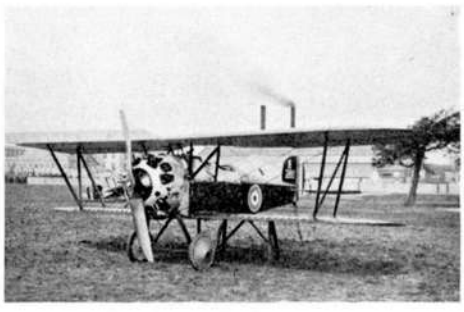
The S.E.5a had made a somewhat uncertain start to its operational career with No 56 Squadron, RFC, which flew its new S.E.5s to France on 7 April 1917; but once its initial problems were overcome it proved to be a sound fighter. Its combination of a single fixed Vickers gun and an overwing Foster-mounted Lewis gun was not ideal, especially at high altitudes where the physical effort needed to change magazines on the Lewis gun proved all but impossible for pilots on the fringe of anoxia: oxygen equipment came to be specified for the 1918 generation of new fighter types, but the generality of S.E.5a and Camel pilots knew it not.

For its pilot the S.E.5a provided a stable gun platform, good manoeuvrability, structural strength and a good general view from the cockpit, and to the end it could hold its own against the German fighters then in use. It is not without significance that most of the highest-scoring British fighter pilots flew S.E.5as.

Its rotary-powered contemporary, the Sopwith F.1 Camel, was regarded in its day as a very different aircraft: waspish and wilful where the S.E.5a was steady and tractable; yet, in understanding hands, enthusiastically responsive and agile. The Camel came to operational flying in France a few weeks later than the S.E.5, and was used by both RFC and RNAS squadrons. Although it acquired a considerable reputation once it was understood and soundly engined, its early career, notably in the RFC, was a source of frustration. This was especially so with Clerget-powered Camels, the performance of which, never brilliant at best, deteriorated rapidly as the engine aged; those with the 110 hp Le Rhône and 150 hp B.R.1 had significantly better and more consistent performances.

The Camel's worst feature was the poor view that it gave its pilot. As he sat almost directly under the upper wing he had little upward view

(Below, clockwise) Bristol F.2B C4630 was serving with No 62 Sqn when the RAF was founded in 1918; Bristol M.1C C4907 was on the strength of No 17 Sqn in Macedonia in April 1918; the third Bristol Scout F, B3991, at Farnborough in September 1918; the second Scout F, B3990, at Martlesham Heath in February 1918.



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and was blind to the inside of a banked turn. Some improvement was provided, from July 1918, by greatly enlarging the central cut-out in the centre section. Partly for the same reason, but also to facilitate upward firing of the two overwing Lewis guns, the Home Defence variant of the Camel had the cockpit moved aft. Nevertheless, the F.1's outstanding if somewhat idiosyncratic manoeuvrability made it a redoubtable dog-fighter, and its short nose made it a more effective ground-attack aircraft than the S.E.5a, though the losses sustained on such tasks were horrifying and led, via the T.F.1 armoured Camel, to the Sopwith Salamander of 1918.

At sea, the Sopwith 2F.1 Camel was quite widely used from small aircraft carriers, from the tiniest of flying-off platforms fitted to battleships and cruisers, and from lighters towed by destroyers. In this last category, N6812 had a moment of spectacular glory on 10 August 1918 when, after taking off from a lighter towed by HMS *Redoubt*, Lt S D Culley shot down the Zeppelin L.53. Seven 2F.1s also registered a conspicuous "first" on 19 July 1918 by delivering the first carrier-borne air strike in history. Flown from HMS *Furious* they bombed the Zeppelin base at Tondern with devastating effect.

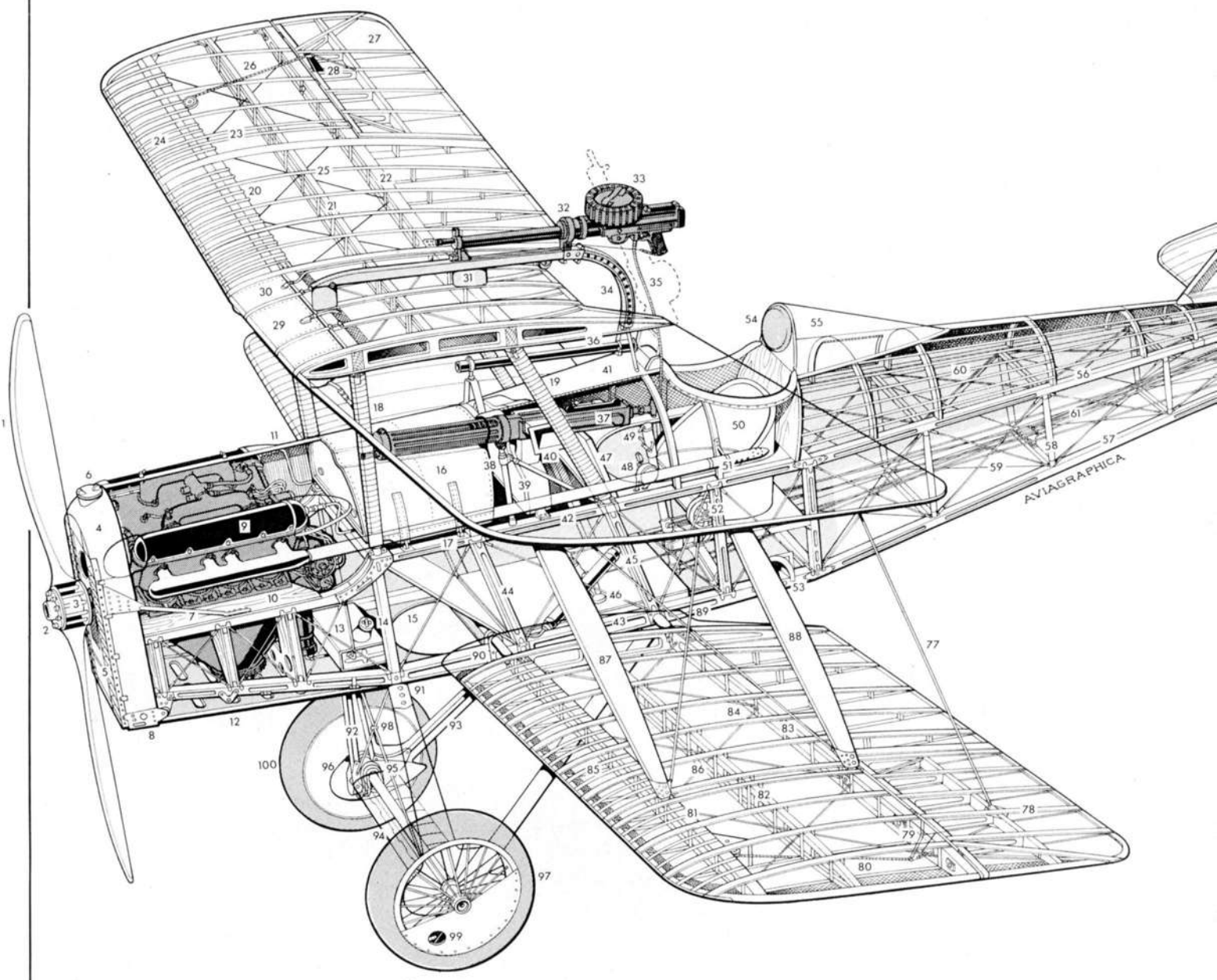
The 2F.1 Camel, derived from the Sopwith FS.1 seaplane fighter design, continued and developed the fundamental deck-flying work so ably pioneered and sustained by the Sopwith Pup. Naval variants of the Pup, including its unprepossessing folding derivative the Beardmore S.B.3D, were still in service on 1 April 1918 and remained so until the Armistice. It was a Pup, flown from HMS *Yarmouth*'s minuscule flying-off platform, that shot down the Zeppelin L.23 on 21 August 1917; the pilot was Flight Sub-Lieutenant B A Smart.

A later Sopwith fighter, the 5F.1 Dolphin, was something significantly different: it was also seriously underrated, after the war at least. In its geometry, paramount consideration was given to the pilot's view from the cockpit — perhaps understandably in view of the alarmingly limited outlook from the Camel. Because the pilot was so located that his head protruded through an open rectangle where, in a more conventional biplane, the centre-section would have been, the mainplanes had negative stagger. Advantage of the structure of the wing-support frame was taken to mount two upward-firing Lewis guns to supplement the twin fixed Vickers, but in operational use only the starboard Lewis was carried. Nevertheless the Dolphin was the first true multi-gun fighter of British design.

The Dolphin's two-bay wings were of relatively high aspect ratio, and the aircraft's high-altitude performance was better than that of its contemporaries. Its handling qualities were excellent and drew appreciative comment from those who flew it operationally. The standard engine was the 200 hp Hispano-Suiza which, as in the S.E.5a, brought problems. The Dolphin was put into production in France with the 300 hp Hispano-Suiza, possibly for French, certainly for American, use in 1919: American expectations counted on the delivery of 2,194 French-built 300 hp Dolphins by the middle of 1919.

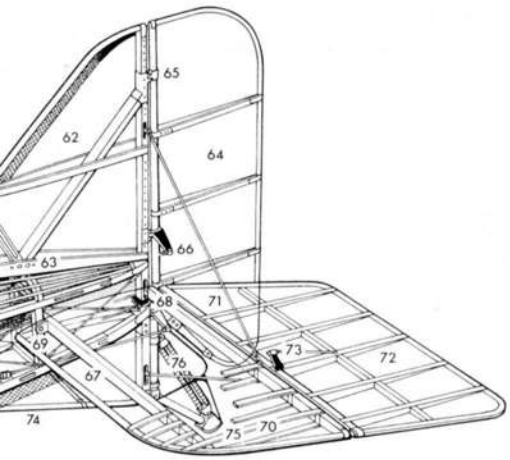
At the end of the war, only four RAF squadrons (Nos 19, 23, 79 and 87) were operational with Dolphins, but at least five more (Nos 81, 90, 91, 93 and one other) were planned for up to January 1919. If all had happened as projected, replacement of Dolphins by Buzzards, Dragons and/or Nighthawks would have begun in April 1919.

Royal Aircraft Factory S.E.5a



Cutaway Drawing Key

1 Laminated wooden propeller
2 Propeller attaching plate
3 Attaching bolts
4 Radiator
5 Radiator shutter plates
6 Filler cap
7 Radiator mounting strut
8 Bottom fitting
9 200 hp Wolseley Viper engine
10 Engine mounting structure
11 Top cowling
12 Hinged bottom cowling
13 Oil tank
14 Oil filler cap
15 Engine cooling air duct
16 Main fuel tank
17 Fuel tank fixing
18 Centre-section forward strut
19 Centre-section aft strut
20 Front spar
21 Built-up centre spar
22 Rear spar
23 Wing ribs
24 Leading-edge stiffeners
25 Diagonal wire bracing
26 Aileron connecting cable
27 Starboard upper aileron
28 Aileron horn
29 Auxiliary fuel tank
30 Radiator header tank
31 Lewis gun mounting
32 0·303-in (7,7-mm) calibre Lewis gun
33 Ammunition drum
34 Gun elevating track
35 Firing cable
36 Fixed gun sight
37 Vickers 0·303-in (7,7-mm) machine gun
38 Machine gun mounting
39 Ammunition tank
40 Cartridge ejector chute
41 Plywood fuselage top decking
42 Forward fuselage upper longeron
43 Forward fuselage lower longeron
44 Vertical frame member
45 Priming pump
46 Rudder pedal bar
47 Instrument panel
48 Throttle control
49 Control column
50 Pilot's seat
51 Exhaust pipe
52 Tailplane incidence control
53 Access step
54 Headrest
55 Headrest fairing
56 Aft fuselage top longeron
57 Aft fuselage bottom longeron
58 Vertical spacers
59 Diagonal wire bracing
60 Dorsal structure
61 Rudder and elevator cables
62 Fin structure
63 Fin attachment
64 Rudder structure
65 Rudder hinge
66 Operating horn
67 Variable incidence tailplane
68 Tailplane actuator
69 Hinge point
70 Tailplane structure
71 Tailplane bracing wire
72 Elevator structure
73 Elevator horn
74 Ventral fin
75 Steerable tail-skid



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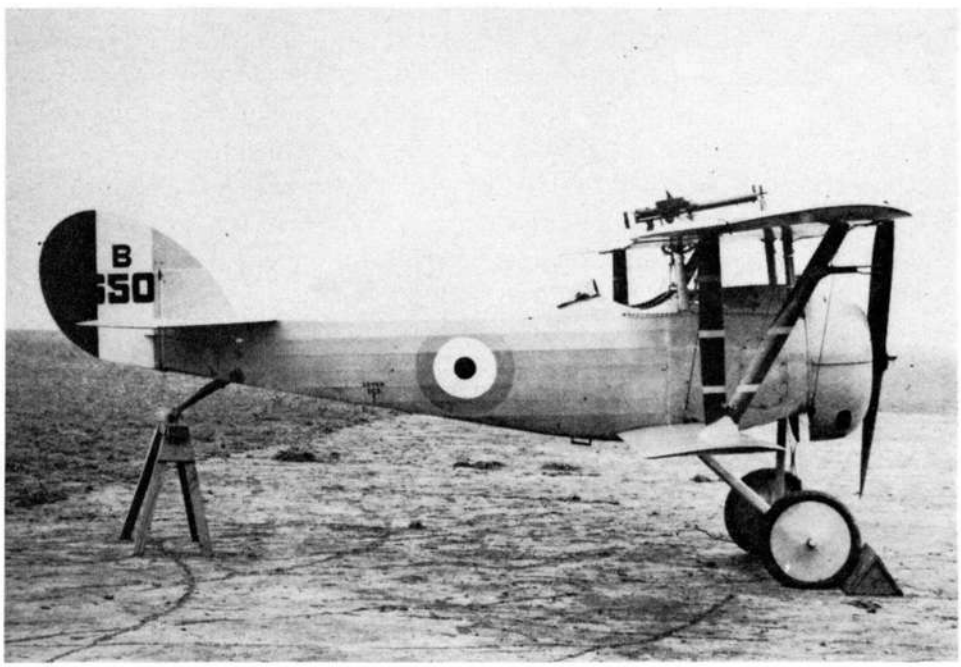
76 Tail-skid shock absorber
77 Aileron interconnecting wire
78 Starboard lower aileron
79 Aileron horn
80 Operating cable
81 Front spar
82 Built-up centre spar
83 Rear spar
84 Diagonal bracing wires
85 Leading-edge stiffeners
86 Wing ribs
87 Forward interplane strut
88 Aft interplane strut
89 Strut bracing wires
90 Spar root fitting
91 Undercarriage attachment
92 Steel tube undercarriage legs
93 Leg fairings
94 Hinged axle box
95 Elastic cord shock absorber
96 Axle fairing
97 Port mainwheel
98 Undercarriage bracing wires
99 Tyre inflation valve
100 Starboard mainwheel

Another fighter that gave its pilot a superlative field of view of the entire upper hemisphere was the Bristol M.1C, which was the Royal Air Force's first operational monoplane. The production aircraft were late to appear, having been preceded by the single M.1A prototype (A5138) and four M.1Bs (A5139-A5142), which were built in 1916. A5139 went to France for evaluation in January 1917 and spent six weeks there, visiting several RFC squadrons. Its excellent performance and good handling characteristics made a considerable impression on RFC pilots, inspiring eager hopes of re-equipment with the Bristol monoplane, but these were never realised. Trenchard, perhaps unduly influenced by his dislike of the generally similar Morane-Saulnier Types N, I and V that had been unpopular in their time, declared on 23 January 1917 that he wanted no more Bristol monoplanes sent to France.

Three of the M.1Bs went, in September 1917, to No 111 Squadron in Palestine, and in that month production of 125 slightly modified aircraft designated M.1C began. These went, in ineffectively small numbers, to the Middle East, and served without distinction in Macedonia and Mesopotamia. One or two remained on an operational footing with No 63 Squadron in Persia well into 1919.

A possible reason for the very limited production of the Bristol monoplane was the heavy commitment of the British & Colonial Aeroplane Co to the production of the superb Bristol F.2B. This classic two-seat fighter first appeared as the F.2A in September 1916; the earliest production F.2As were taken to France on 8 March 1917 by No 48 Squadron. These had the 190 hp Rolls-Royce Falcon I engine; the 275 hp Falcon III did not become available until the autumn of 1917, but with this magnificent engine the Bristol F.2B was in a class by itself and, despite the F.2A's inauspicious operational début, the F.2B rapidly acquired a superlative reputation and earned the undisguised respect of its adversaries. In terms of speed it could hold its own with most contemporary single-seaters, and its strength and controllability made it a redoubtable fighting aircraft. The back-to-back positions of pilot and observer inspired and facilitated ready co-ordination in the deadly business of aerial combat, and the Bristol was deservedly popular with its crews. It was to serve the RAF for more than a decade after the war ended, but on tasks dismally different from those that it discharged with such panache above the war-ravaged fields of France when, like Lancelot in his glory, whom it smote it overthrew.

Three classic French types were still to be found in the RAF's fighter inventory on 1 April 1918. Basically the oldest in design were the Nieuports 24, 24bis and 27, of which the last-named survived in No 29 Squadron in France until 20 April 1918; the Nieuport 24 and 24bis existed in small numbers in Squadrons Nos 111 and 113 in Palestine. All could trace their descent from the Nieuport 10 of 1914, most directly from the Nieuport 17 of 1916; the whole line of Nieuport single-seaters — Types 11, 16, 17, 17bis, 21, 23, 24, 24bis and 27 — had found places in varying numbers with RFC and RNAS units in various theatres of war and had, in their time, given excellent service despite inadequate and inconvenient armament; but by April 1918 the design was undeniably obsolete.



Nieuport 27 B3650 was on the strength of No 29 Sqn on the day the RAF was formed in April 1918.

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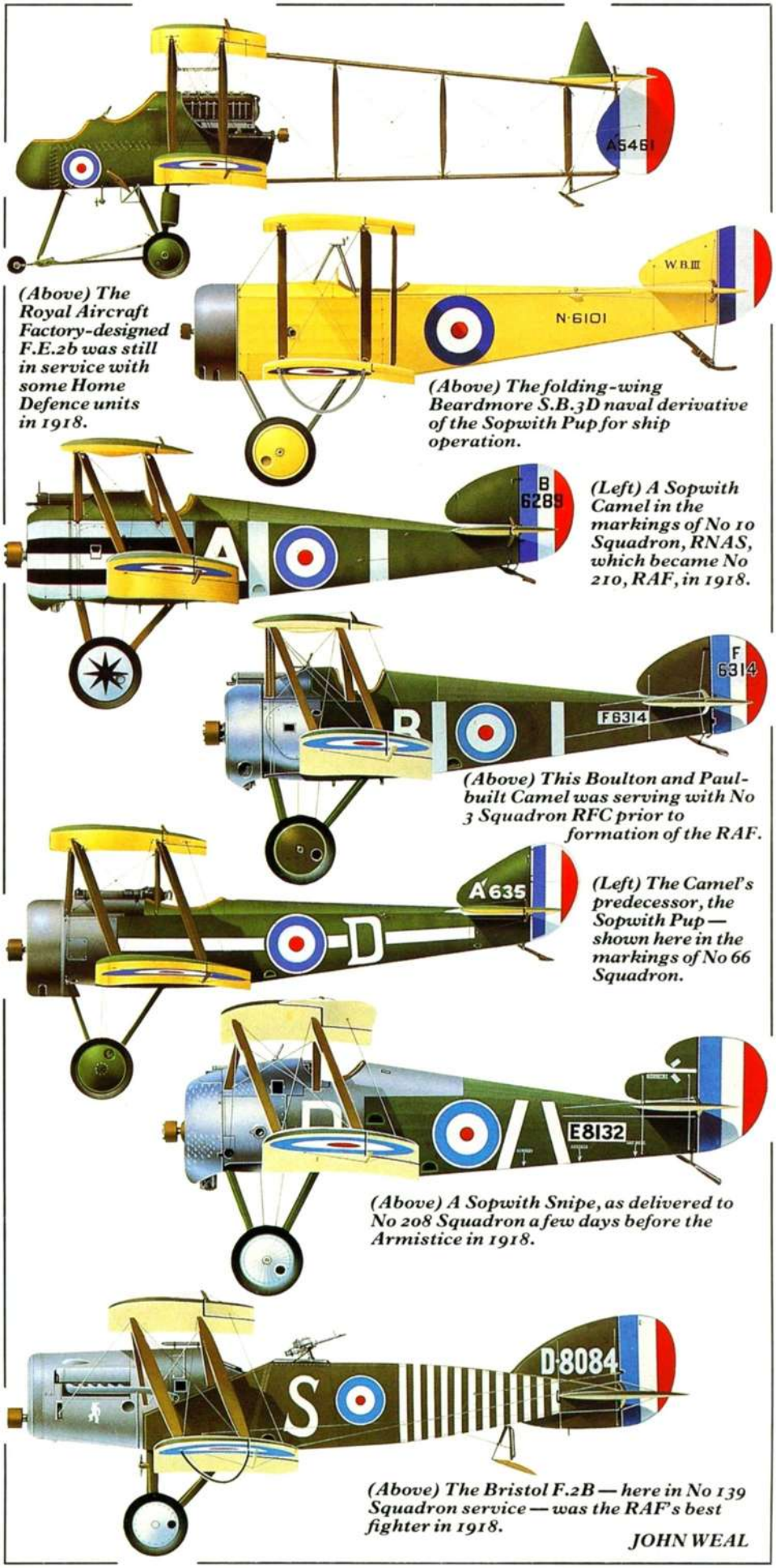
The Spad 7 and Spad 13 were to hold their own in French, Belgian, British, Italian and American service until the war ended; although the RAF finally discarded the Spad 13 on 4 May 1918 when No 23 Squadron (the only British squadron to be wholly equipped with the type) completed its re-equipment with Dolphins. The Spad 13 was never quite the success it should have been, for it was plagued by the unreliability of its 200 hp Hispano-Suiza engine, and it never distinguished itself with No 23 Squadron.

In the RAF it was outlived by its predecessor the Spad 7, albeit in small numbers and faraway places: a few soldiered on in Mesopotamia with Squadrons Nos 30 and 63, and in Palestine with No 72 Squadron. RFC pilots in general had found that the Spad 7 did not wholly suit their style of fighting. One who knew it, Squadron Leader G B A Baker, MC, was later to write:

> "While the Spad served the RFC well enough, it was essentially a diving aeroplane, at its best in the hands of the individualist, and was not so well adapted to formation flying, dog-fights or patrols, at medium heights as aeroplanes of British design, such as the Sopwith and the S.E.5."

As indicated in preceding paragraphs, some rather improbable types were with Home Defence squadrons at the time of the formation of the RAF. In terms of design history the oldest of these was the Avro 504K, a type that could trace its origins back to the autumn of 1913. During the war it established itself as an excellent training aircraft, and its agreeable handling qualities may have been a significant factor in the decision, taken early in 1918, to equip some Home Defence squadrons with a single-seat version, armed with a single Lewis gun on a Foster mounting on the centre section. Although this variant of the 504K had an undistinguished performance it could, given time, climb to a considerable altitude. By the time of the Armistice five squadrons had these 504K fighters, some with V-strut undercarriages in place of the characteristic Avro landing gear, but none ever engaged an enemy aircraft.

Another ageing type that survived in small numbers in the Middle East was the venerable Martinsyde Elephant. Its prototype had appeared in August 1915, and it is probable that it was intended as a long-range reconnaissance aircraft capable of defending itself. Perhaps because it was a single-seater it came to be regarded as a potential fighter, but it was relatively large and lacked the responsive manoeuvrability that was essential in a true fighter. Most of its operational service was as a bomber, its load-carrying capability being enhanced when the 120 hp Beardmore engine of the basic Martinsyde G.100 was replaced by the 160 hp engine of the same make; with the new power unit the aircraft was designated Martinsyde G.102. After the formation of the RAF, a few of these handsome Martinsydes flew on with No



(Above) The Royal Aircraft Factory-designed F.E.2b was still in service with some Home Defence units in 1918.

(Above) The folding-wing Beardmore S.B.3D naval derivative of the Sopwith Pup for ship operation.

(Left) A Sopwith Camel in the markings of No 10 Squadron, RNAS, which became No 210, RAF, in 1918.

(Above) This Boulton and Paul-built Camel was serving with No 3 Squadron RFC prior to formation of the RAF.

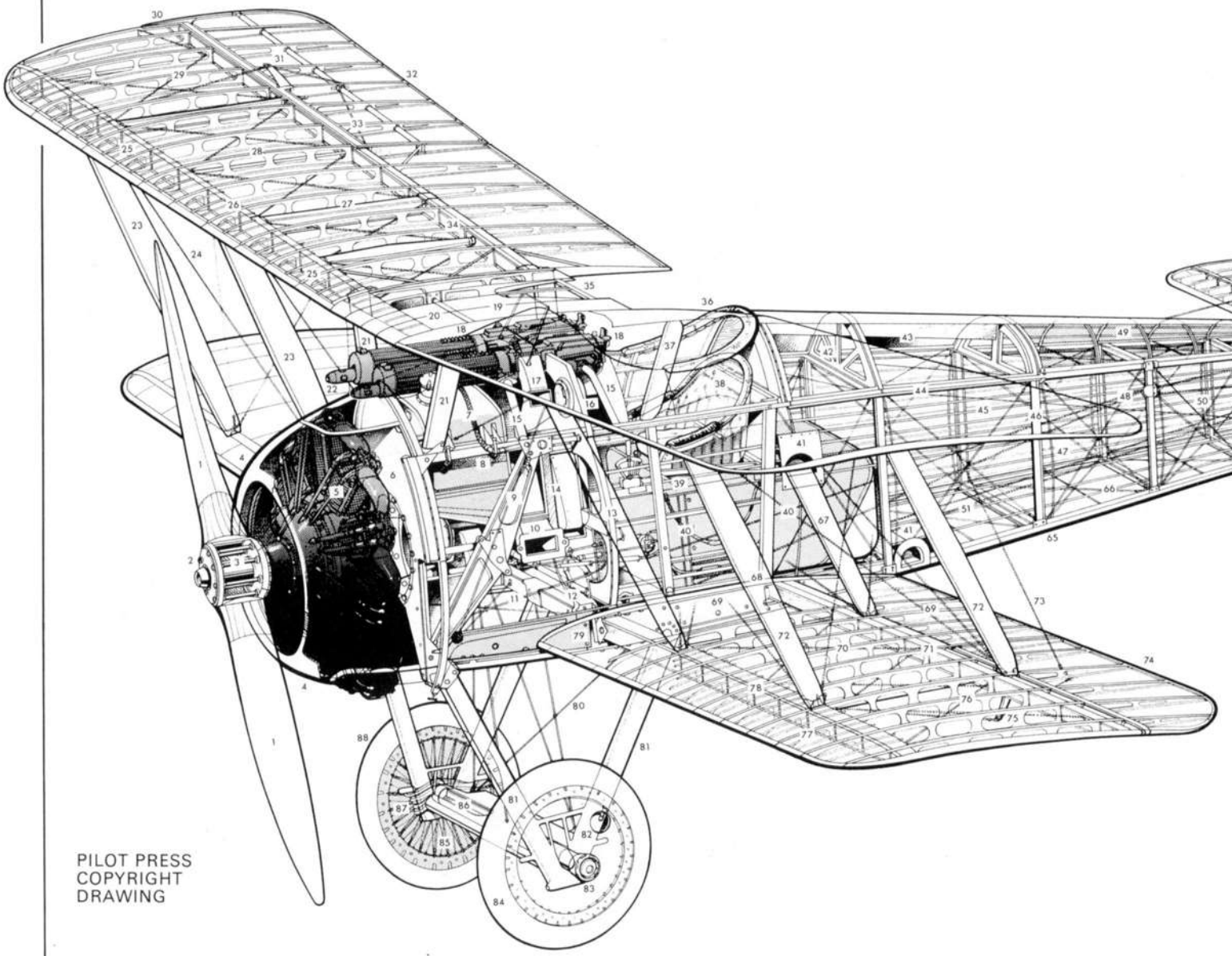
(Left) The Camel's predecessor, the Sopwith Pup — shown here in the markings of No 66 Squadron.

(Above) A Sopwith Snipe, as delivered to No 208 Squadron a few days before the Armistice in 1918.

(Above) The Bristol F.2B — here in No 139 Squadron service — was the RAF's best fighter in 1918.

JOHN WEAL

Sopwith 7F.1 Snipe



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DRAWING

Cutaway Drawing Key

1 Lang two-blade wooden propeller
2 Propeller attachment plate
3 Attachment bolts
4 Engine cowling
5 230 hp Bentley B.R.2 engine
6 Engine bulkhead/bearer
7 Combined gravity/oil tank
8 Tank/longeron attachment
9 Forward fuselage member
10 Cartridge ejector chute
11 Fuselage cross-member
12 Rudder pedal bar
13 Fuselage frame
14 Ammunition magazine
15 Gun mounting bars
16 Instrument panel (left-hand section)
17 Link ejector chute
18 Two fixed synchronised 0·303-in (7,7-mm) Vickers machine guns
19 One-piece screen
20 Horizontal wing centre-section
21 Centre-section front struts
22 Gun muzzles
23 Interplane struts
24 Diagonal bracing
25 Leading-edge stiffeners
26 Front spar
27 Spar connecting frame
28 Wing ribs
29 Diagonal cross-bracing
30 Aileron horn balance
31 Aileron hinge
32 Starboard upper aileron
33 Aileron cable (interplane)
34 Rear spar
35 Centre-section cut-out
36 Padded cockpit coaming
37 Centre-section rear strut
38 Pilot's wicker-work seat
39 Wooden seat mounting frame
40 Fuel tank
41 Entry steps
42 Dorsal frame
43 Dorsal centre-board
44 Upper longeron
45 Fuselage stringers
46 Vertical frames (spacers)
47 Fuselage side fairing profile
48 Port elevator control cables (starboard cables deleted for clarity)
49 Dorsal decking
50 Diagonal cross-bracing
51 Rudder control cables
52 Starboard tailplane
53 Tailfin structure
54 Starboard tailplane stay (upper)
55 Rudder horn balance
56 Rudder structure
57 Rudder post
58 Elevator control hinges
59 Port tailplane stay (upper)
60 Port elevator
61 Rudder hinge fairing
62 Variable incidence tailplane actuating pivot and sleeve

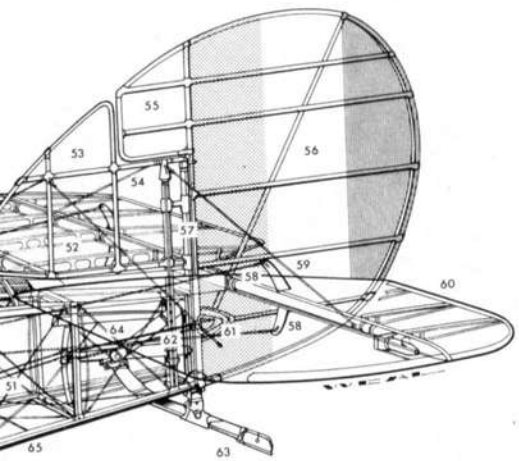
142 Squadron in Palestine and with Nos 30, 63 and 72 in Mesopotamia. Indeed, a few were still on the strength of No 63 Squadron at Kazvin in August 1919.

Had the war lasted a few weeks longer, a truly outstanding descendant of the Elephant would have gone into operational service in France. This was the Martinsyde F.4 Buzzard, the production form of the F.3, which had won rapturous reports from the Martlesham Heath test pilots who evaluated it, for they found that it outflew every other type matched against it in mock combat. Unfortunately the F.3 was powered by the Rolls-Royce Falcon III, the entire output of which was inadequate to equip the Bristol Fighters then on order. The F.3 was modified to have the 300 hp Hispano-Suiza, a direct-drive engine that promised to be less troublesome than its 200 hp geared predecessor, and, with cockpit moved a short distance aft, was given the new Martinsyde type number F.4. Deliveries of the 300 hp engine were so slow that it was impossible to form a squadron before the war ended, but forward planning projected 13 Buzzard squadrons in France by 1 June 1919.

In March 1918, a prototype Sopwith 7F.1 Snipe, B9965, was sent to France for assessment, and was moderately well received; on 20 March contracts for 1,700 Snipes were given to seven contractors. This type had started life with a 150 hp B.R.1 engine as an unambitious single-bay biplane that, as originally conceived, held out no hope of being an improvement on the Camel but did, significantly, give its pilot a much better view without recourse to radical structural or aerodynamic innovation. The installation of the 230 hp Bentley B.R.2 engine and provision of a fully faired fuselage and greater wing area increased the Snipe's effectiveness, but it was still far from perfect when first supplied to squadrons, and enlarged and improved vertical tail surfaces and balanced upper ailerons were only partially effective. By the Armistice only three squadrons had Snipes, but forward planning envisaged the addition or re-equipment of no fewer than 11 squadrons in France plus one with the Independent Force, two in Italy, eight on Home Defence, $4\frac{2}{3}$ with anti-submarine units, and three with the 5th Group, between October 1918 and 1 June 1919.

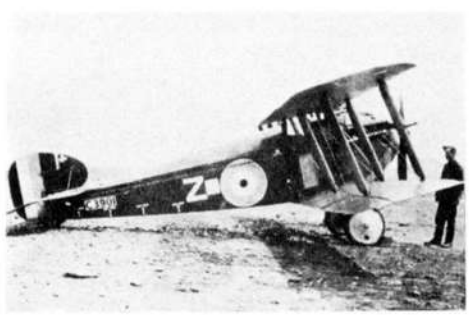
A version of the Snipe was fitted with the 320 hp A.B.C. Dragonfly radial engine and put into production as the Sopwith Dragon: a total of 330 Dragons were ordered from the Sopwith company, and it appears that 118 were built up to 9 August 1919. Another Dragonfly-powered fighter, the excellent British Nieuport Nighthawk (designed by H P Folland, who had earlier done so much exemplary design work on the S.E.5), was also ordered in much larger numbers from no fewer than six contractors: these contracts initially totalled 1,675 aircraft. All of the Nighthawk orders were conversions of contracts originally placed for Snipes, but most were cancelled before any deliveries were made.

In ignorance of the Dragonfly's disastrous and incurable faults, the RAF's planning staff



63 Tailskid
64 Tailskid damper/shock absorber
65 Lower longeron
66 Flat undersides
67 Interplane strut (inner)
68 Rear spar/fuselage attachment
69 Interplane cross-bracing
70 Wing ribs
71 Rear spar
72 Interplane struts (outer)
73 Aileron control cable
74 Port lower aileron
75 Aileron control hinge
76 Diagonal bracing
77 Leading-edge stiffeners
78 Front spar
79 Front spar/fuselage attachment
80 Undercarriage "X"-brace
81 Undercarriage legs
82 Valve access
83 Axle support
84 Port mainwheel
85 Wheel spokes
86 Axle fairing
87 Elastic cord shock-absorber
88 Starboard mainwheel

(Below, clockwise) The Sopwith Dolphin C3901 joined No 79 Squadron, RFC, in March 1918; Sopwith-built F.1 Camel B6345 went to Italy with No 28 Sqn, RFC, in November 1917 and was shot down on 23 April 1918, its pilot Capt C J Thompson being taken prisoner; the Sopwith Dragon was intended to succeed the Snipe in 1919, but its ABC Dragonfly engine was not successful; Martinsyde Elephant A3953 was on the strength of No 23 Reserve Sqn at Heliopolis as a training aircraft in April 1918.



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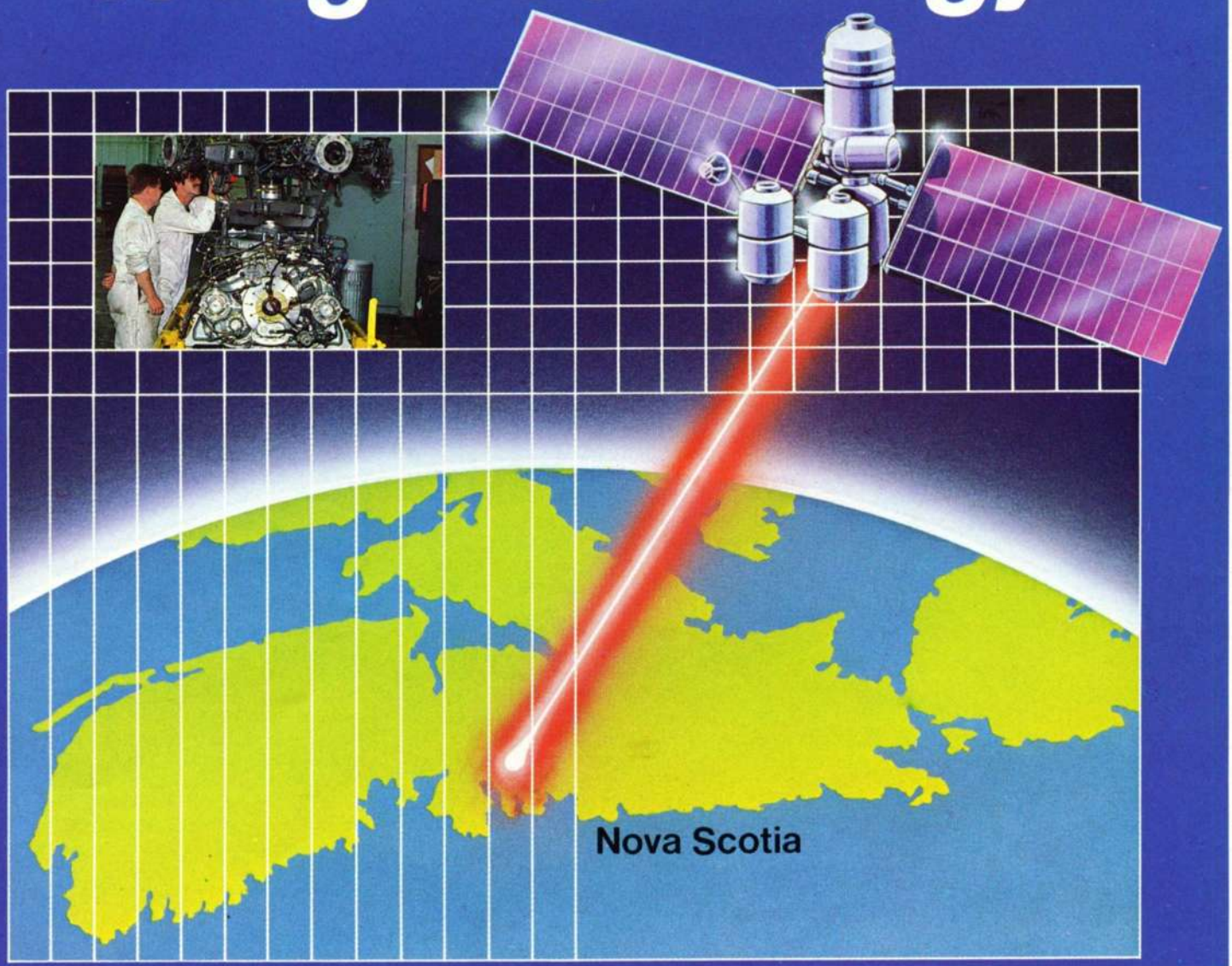

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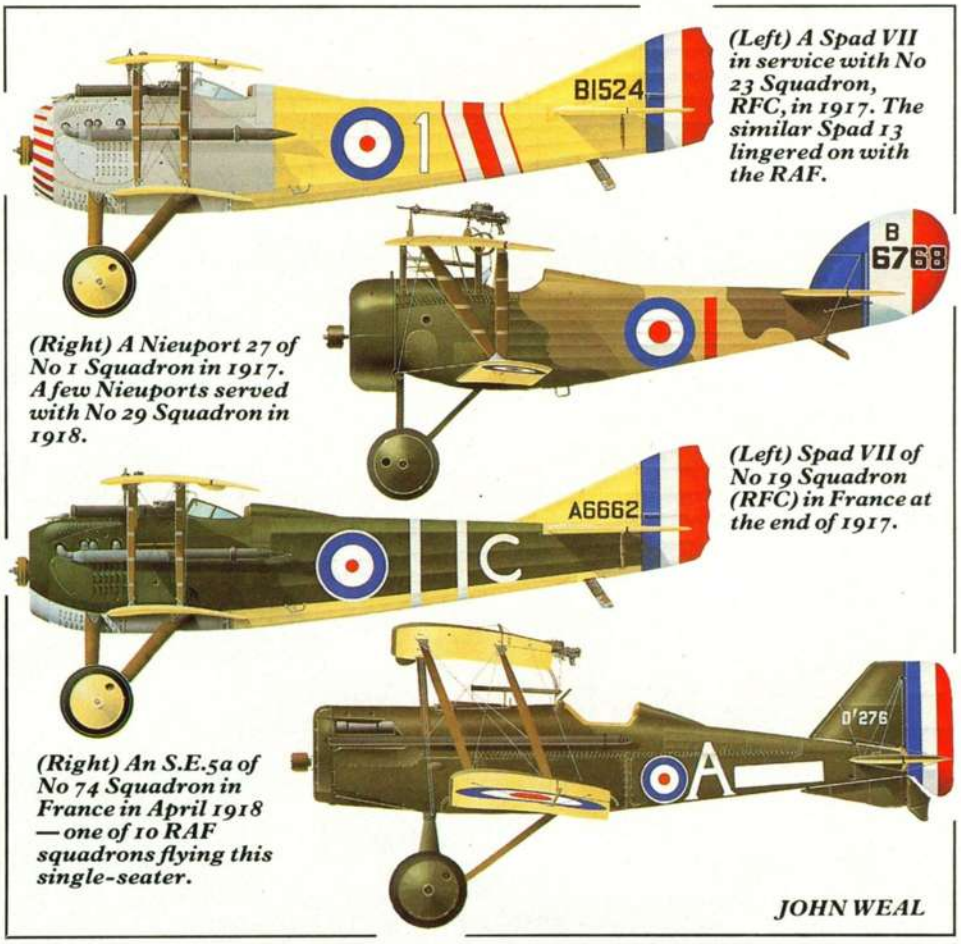
expected to be able to equip 21 squadrons with Dragonfly-powered fighters between December 1918 and 1 June 1919. Mercifully, the Armistice supervened to spare the RAF's fighter squadrons the major catastrophe that the Dragonfly would have visited upon them.

For ground-attack work it was intended to have 13 squadrons of Sopwith T.F.2 Salamanders by 1 June 1919, eight with B.R.2 engines, five with the 200 hp Clerget 11E; and allocations of production Salamanders had been made to Squadrons Nos 96 and 157 before the war ended. The Salamander owed its general form to the Snipe, but its forward fuselage was a box constructed of armour plate, and virtually all of the rest of its structure was built to higher strength factors than those of the Snipe. Structural problems retarded actual use of the aircraft, but no fewer than 526 were built before production ceased in August 1919.

Other prototypes were under construction just before the Armistice, but so many of them depended on the fatally flawed Dragonfly engine that there could have been no hope for their early introduction to front-line units. The one glimmer of hope could have lain in a fighter that seemed to be on the sidelines, yet was considered by some pilots to be the best and most manoeuvrable of all — better even, in this respect, than the Martinsyde F.4. This was the Bristol Scout F, a non-starter because of its Sunbeam Arab engine, which was fitted to the first two prototypes. But the third Scout F airframe was used to test the prototype 347 hp Cosmos Mercury 14-cylinder radial engine, one of the earliest products of Roy Fedden's genius, and a progenitor of the great line of Bristol radials. This might have been a potent combination of engine and airframe — but did no-one think of putting a 300 hp Hispano-Suiza into a Scout F? □



(Left) A Spad VII in service with No 23 Squadron, RFC, in 1917. The similar Spad 13 lingered on with the RAF.

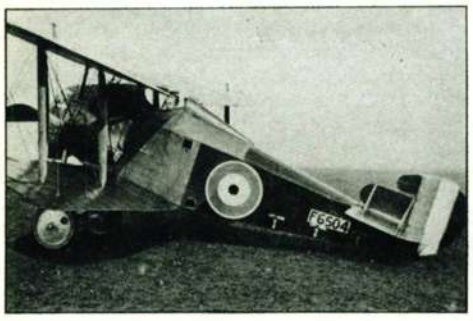
(Right) A Nieuport 27 of No 1 Squadron in 1917. A few Nieuports served with No 29 Squadron in 1918.

(Left) Spad VII of No 19 Squadron (RFC) in France at the end of 1917.

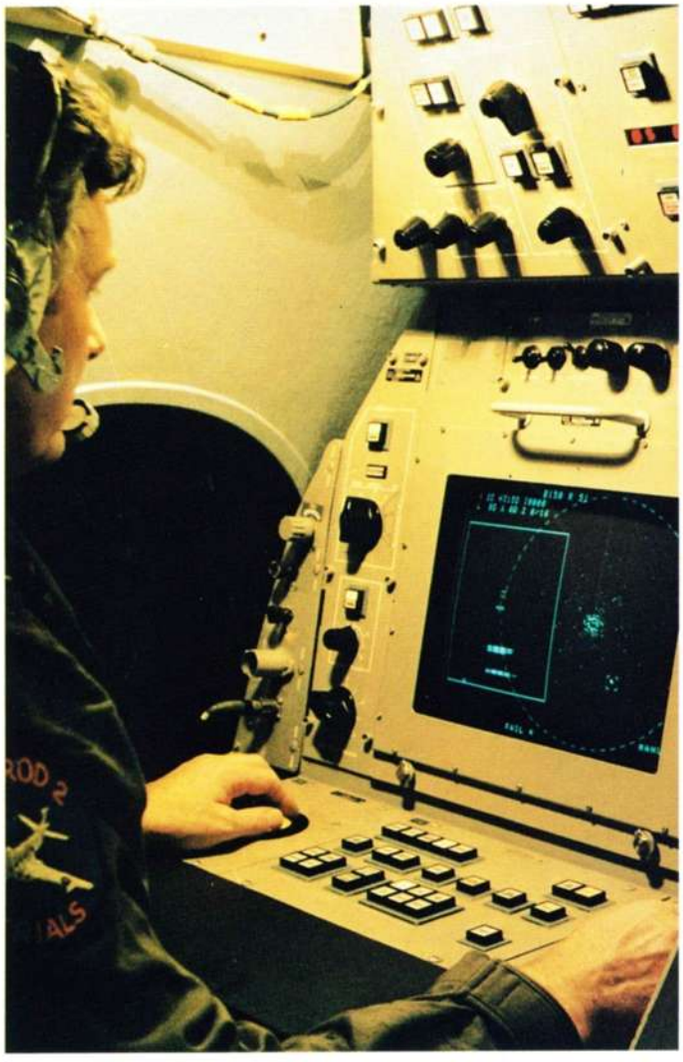
(Right) An S.E.5a of No 74 Squadron in France in April 1918 — one of 10 RAF squadrons flying this single-seater.

JOHN WEAL

(Right, and bottom right) Two views of the S.E.5a F904, which was built in 1918 by Wolseley Motors Ltd in Birmingham, and was used from 1924 to 1928 by the Savage Skywriting Co Ltd (as G-EBIA). It survived World War II in storage at Coventry and was then restored at the RAE Farnborough. (Bottom centre) This lovingly restored Sopwith Snipe E6938 is among the treasured exhibits of the USAF Museum at Dayton, Ohio; (below) Sopwith Salamander F6504 was among 24 of these biplanes allotted to No 157 Sqn during 1918.



(Left to right, top to bottom) Nieuport 24bis B3592 "Demoiselle" of No 111 Sqn in the spring of 1918; a Nieuport Nighthawk at Hendon in 1919; Martinsyde F.4 D4353 in service with the RAF Communication Wings in 1919; a Spad 13 of No 23 Sqn in 1919; a single-seat Home Defence version of the Avro 504K; Spad 7 A8812 with No 63 Sqn at Faluja in Mesopotamia; Sopwith 9901 Pup N6443 aboard HMS **Tiger**; *Sopwith 2F-1 Ships Camel taking off from HMS* **Pegasus.**



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