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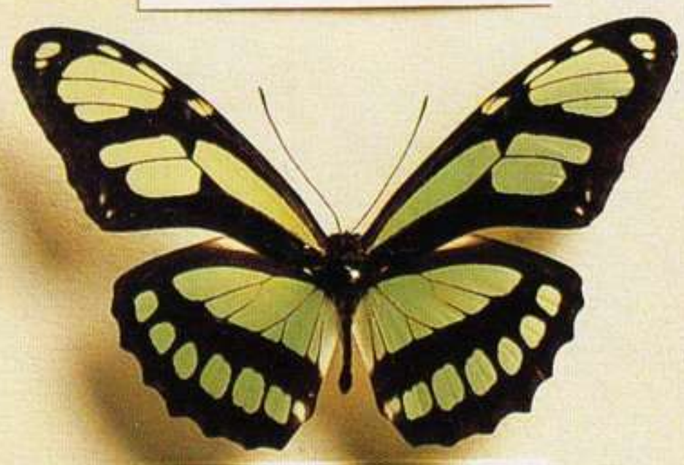
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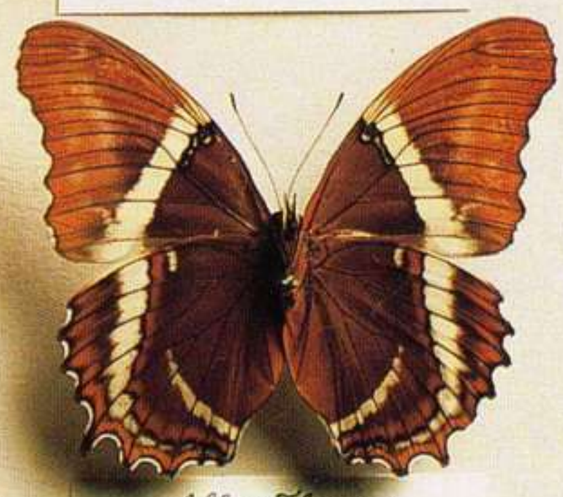
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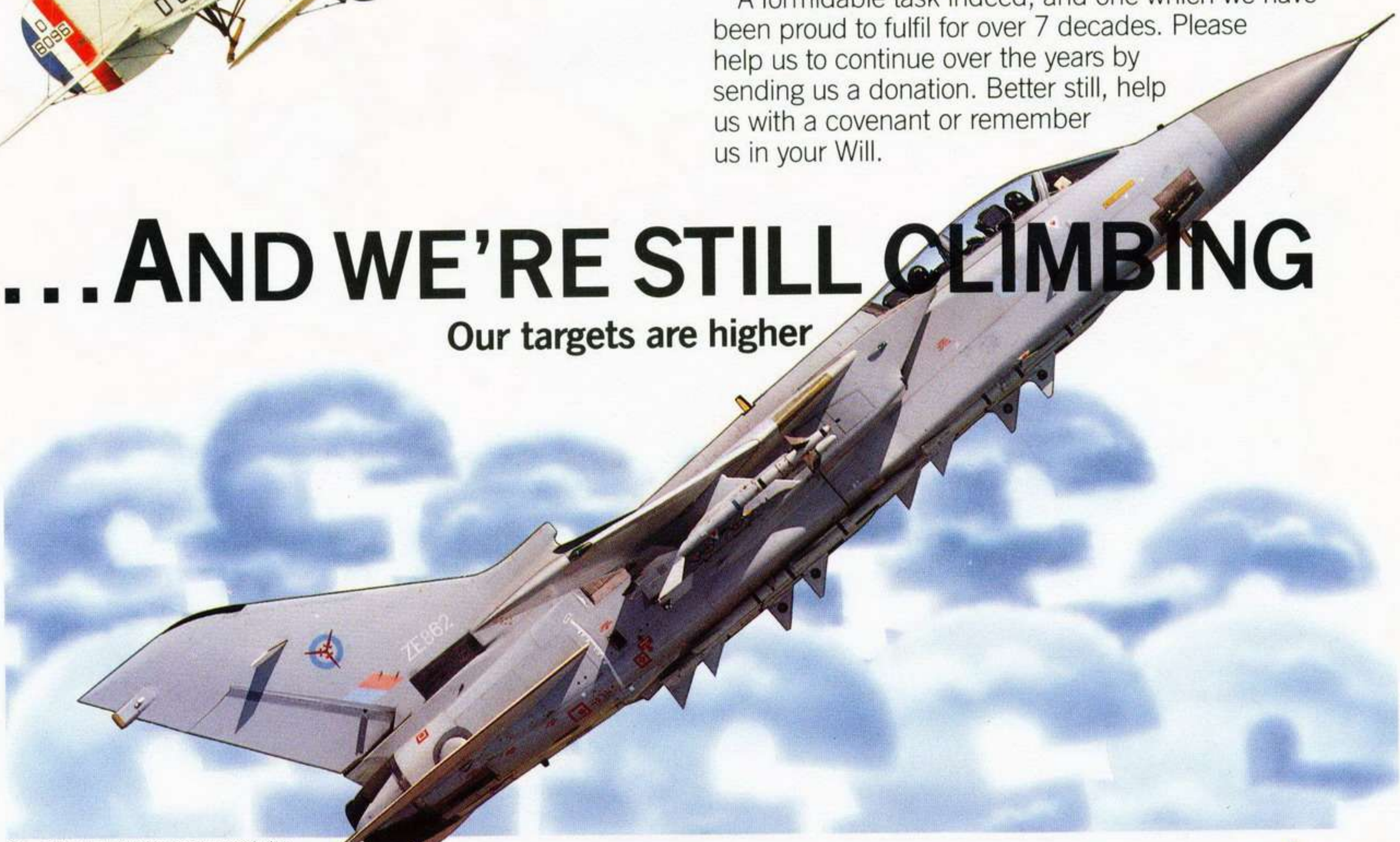
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Royal Air Force YEARBOOK 1994

INTRODUCTION 5
Air Chief Marshal Sir Michael Graydon GCB, CBE, ADC, FRAeS

ALL CHANGE FOR TEN Peter R March 7

BYE BYE BUCC Lindsay Peacock 10

DENY FLIGHT Bob Archer 17

RAF IN THE USA 1: EURO-NATO JOINT JET PILOT TRAINING 19
Peter R March

TRAINING FOR THE FUTURE Gp Cpt Bill Taylor OBE, RAF 22

THE GREEN ELEPHANT GOES ROTARY Patrick Allen 25

RAF IN THE USA 2: REDS 'FLY THE FLAG' Peter R March 30

D-DAY – THE BEGINNING OF THE END Lindsay Peacock 32

RAF IN THE USA 3: RED FLAG's BIG PACKAGE Peter R March 36

HARRIERS ABROAD Andy Evans & Sqn Ldr Andy Suddards 40

HAWK SCHOOL – LOW LEVEL NAVIGATOR Peter R Foster 43

WARTS AND ALL... Paul Jackson 51

SPITFIRE TO SUKHOI Tom Delaney 56

THE CORNISH CONNECTION Peter Cooper 59

THE RAF's HERCULES TANKERS Bob Archer 65

THE RAF BENEVOLENT FUND Edward Bishop 68

SOVEREIGNS IN THE SKY Peter Symes 72

THE RAF'S YEAR 1993 Brian Strickland 79

HOME AND AWAY Sue J Bushell 83

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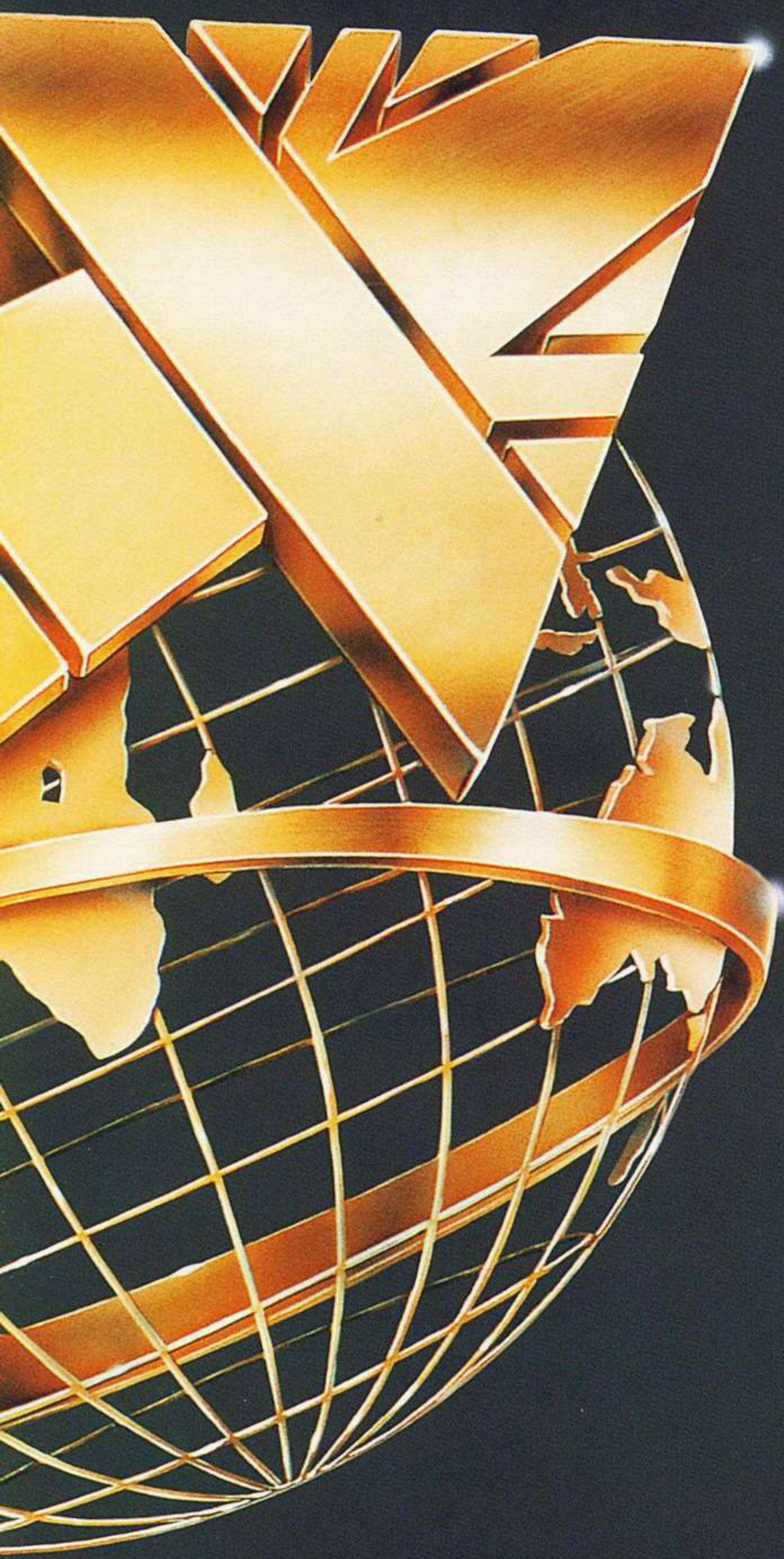
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INTRODUCTION



Air Chief Marshal Sir Michael Graydon
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Chief of the Air Staff

This year marks the culmination of much of the work set in hand to restructure the Royal Air Force in light of the changed strategic situation following the demise of the Warsaw Pact and Soviet Union. With the exception of the disbandment of our remaining Buccaneer squadron in March, the required reductions to our front line have been completed. In all some 14 squadrons have been disbanded involving the withdrawal of over 170 aircraft, the closure of 24 bases and the reduction in our manpower requirement from some 89,000 in 1990 to around 70,000 by the beginning of 1995.

The most significant change has been the reduction to our forces based in Germany where we have closed two of our four main operating bases and disbanded seven flying and two Royal Air Force Regiment squadrons. These reductions both in Germany and in the United Kingdom have been achieved quickly and effectively; however, in a world which remains a distinctly unstable place many of our remaining units have seen an increase in their operational commitments to a level significantly higher than that experienced during the Cold War era.

This trend seems set to continue with our forces deployed not only in support of our many long standing operational commitments such as in Hong Kong, the Falkland Islands and, closer to home, Northern Ireland, but also on operations such as we have seen over Iraq and the former Yugoslavia. The commitment of the Royal Air Force to both these operations is considerable. In the former Yugoslavia this includes Hercules aircraft to deliver much wanted aid to Sarajevo, E-3D Sentry and Nimrod maritime patrol aircraft to assist in the monitoring and enforcement of United Nations sanctions, Tornado F3 fighter aircraft to assist in the enforcement of the no fly zone and Jaguar aircraft on call to provide close air support to UNPROFOR forces engaged in humanitarian relief operations. This is just one example of the type and scale of operation in which the Royal Air Force is involved today. But we can only provide this level of support in Bosnia and elsewhere because we have retained a range of effective equipment operated and supported by well trained and well motivated men and women.

Equipment such as the Harrier GR7, the Royal Air Force's newest and most advanced combat aircraft which is currently deployed to Turkey on United Nations air policing duties over Northern Iraq. As well as performing this important task the aircraft has enhanced the Royal Air Force's capability to operate at night and in poor weather. In addition, our plans to update our Tornado GR1 aircraft are well advanced and once complete should sustain the aircraft's operational capability well into the next century.

We also have plans to update or replace our Hercules transport aircraft, to improve our support helicopter force and to purchase a range of new precision weapons which will further enhance the operational capability of our front line. Meanwhile, the development of Eurofighter 2000 continues and we look forward to the first flight of the development aircraft this year.

Behind the scenes, the commitment of our Servicemen and women to supporting our many overseas operations, amidst the turbulence caused by the drawdown and restructuring of the Service, is a mark of their loyalty and dedication which has been the hallmark of the Royal Air Force throughout its history. It is on the needs of our people that we will continue to focus to ensure that we are able to recruit and retain the high calibre men and women we require to man an increasingly technological force. However, the responsibility for our people is not confined to those serving in today's Royal Air Force; we have responsibilities to those who through bereavement, ill health or, quite simply, old age are in need of assistance. For these people the Royal Air Force Benevolent Fund has stood by in times of crisis and in this the Fund's 75th Anniversary Year I would like to pay tribute to the dedicated and generous support of the Fund which has long been and will remain a fundamental and valued part of the Royal Air Force family.

Michael Graydon

ALL CHANGE FOR TEN

Peter R March looks at the transformation of *Shiny Ten*, the RAF's 'airline' to TTT 'Tanker-Transport Ten', the Service's latest multi-role tanker and transport squadron.

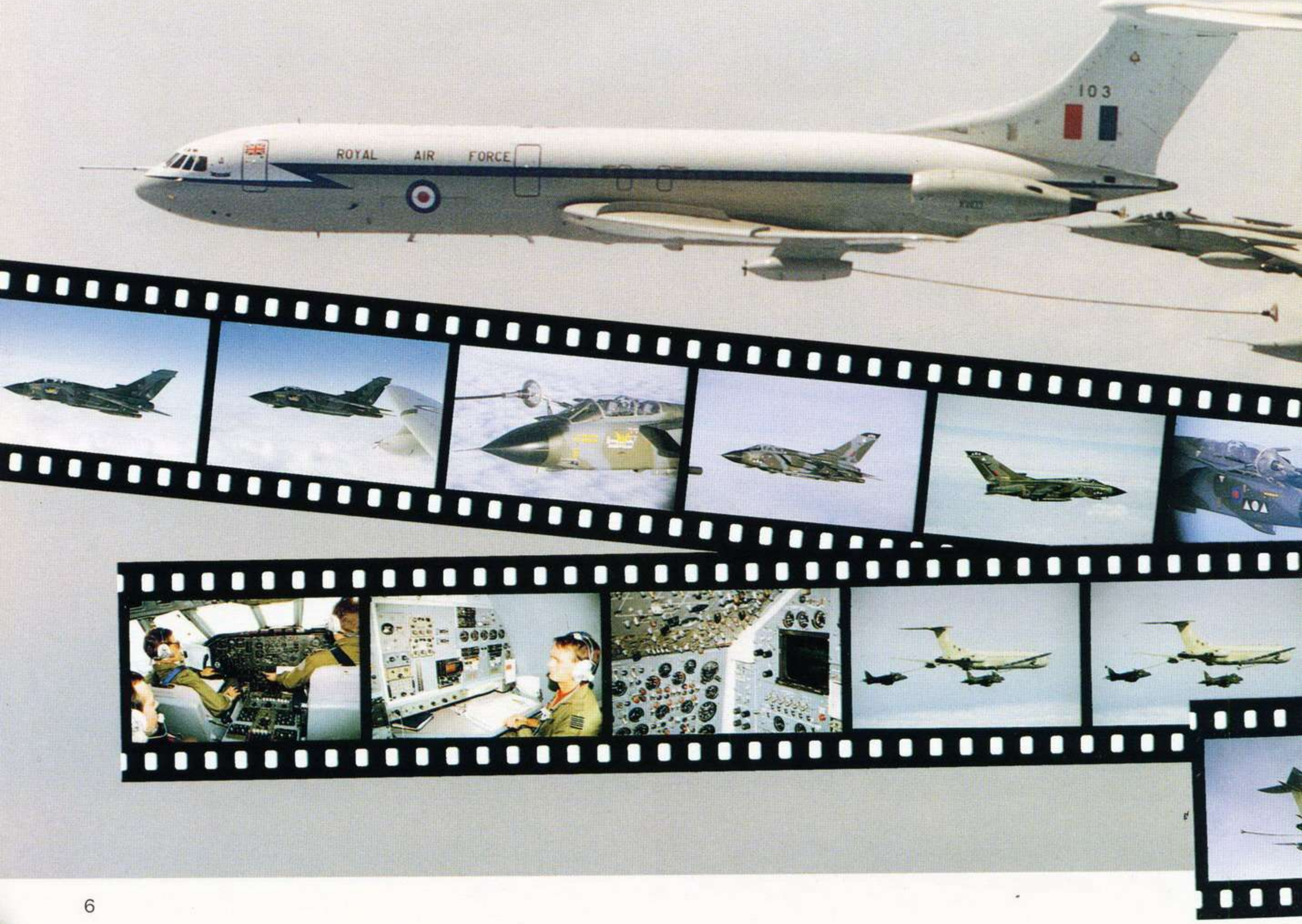


Ten years ago (or even less) to have suggested to the captain of an RAF VC10 of No 10 Squadron that he and his crew should wear standard olive green flying overalls for an operational flight to Akrotiri, Cyprus would have filled him with horror. This would not have been part of the image that the 'RAF's Airline' would have wanted to convey to the passengers heading for the Mediterranean Island. By the same token he would not have expected to be accompanied in close formation by a pair of Tornados on one side and trailing behind another VC10 that had two Harrier GR7s at its wing. Many things have changed in the past couple of years in the RAF, not least for No 10 Squadron based at RAF Brize Norton in Oxfordshire.

Since the Falklands War the need for more tanker aircraft has become self evident. As a 'force-multiplier' the Victor K2s, temporarily assisted by Vulcan K2s that were subsequently replaced by VC10 K2/3s, and TriStar K1s, showed their value in the build up to the Gulf War and through to its conclusion. The VC10s in particular, operating with No 101 Squadron proved an excellent air-to-air refuelling platform, performing an essential task in extending the range and weapon carrying capability of the Tornado GR1s. The ferrying of aircraft to and from the Gulf by Victors and Tristars was another important element. Since that time, without any respite, the RAF's 'hoses in the sky' have been fully stretched. While the Gulf War highlighted the flexibility that this gave to the RAF, the new areas of conflict in the former Jugoslavia (Operation *Grapple/Deny Flight*) along with continuing responsibilities over Iraq (Operations *Jural* and *Warden*) put great pressure on the three tanker squadrons (Nos 55, 101 and 216 Sqns) and the life-span of the Victor K2 was rapidly running out. Further VC10 tanker conversions (of ex-British Airways Super VC10s stored at Abingdon) were slowly being completed for No 101 Squadron, there was a real need for yet more 'hoses' to become available.

The VC10 had already proved itself an ideal tanker aircraft, with its high tail, and rear fuselage mounted engines, so it was an obvious solution to convert some, if not all, of the RAF's fleet of 13 VC10 C1s for this additional role. It involved the fitting of Flight Refuelling Ltd hose/drum units under each wing, additional instrumentation in the cockpit and a television camera and screen to monitor

VC10 C1K XV103 refuelling Jaguars on a training exercise for No 10 Sqn crews converting to the new AAR role. BAe





Above: *VC10 C1K XV103, the first tanker conversion for No 10 Sqn, refuelling Jaguar GR1As from RAF Coltishall in preparation for their deployment to Italy as part of Operation* Deny Flight. Pete Jenkins



Above: *In the cold early morning, VC10 C1 XR806 is prepared for its transatlantic flight.* Right: *Flt Lt Roy Wheatley (left) and navigator Dave Lockie are briefed on the weather for the flight to Washington.* PRM



the tanking operation. This work was to be effected, initially on five aircraft, by FR Aviation at Bournemouth. These C1Ks, as they were designated, retain the full passenger/cargo carrying facilities as no additional fuel tanks are carried in the fuselage, unlike the full 'K' variants. Once again flexibility of operations was the keynote in giving this multi-role capability to No 10 Squadron.

The RAF's VC10s were first introduced into service in 1967 when they transformed the service's airlift capacity. The step from the Britannia and Comet was a major one, giving a world-wide capability to Air Support Command for passenger, casualty evacuation, cargo and VIP transport. Built to the 1960 Specification C239 the RAF's 14 VC10s were manufactured by the British Aircraft Corporation at Weybridge with the dimensions of the standard VC10 but the more powerful Rolls-Royce Conway engines and extra fuel capacity of the Super VC10. They also featured a tail mounted auxiliary power unit, a large side-loading freight door and a strengthened cabin floor. The VC10 C1 combined the best features and learnt from the experience gained from the civilian VC10 variants in service with the airlines.

Airborne for its maiden flight on 26 November 1965, the first VC10 C1 (XR806) soon showed its excellent qualities of speed and capacity. Deliveries commenced to No 10 Squadron in July 1966, initially to RAF Fairford, while facilities for the new aircraft were completed at its designated base, RAF Brize Norton. In August 1966 the first overseas route trials commenced, as the new aircraft was to be operated by No 10 Squadron on a network of regular 'scheduled' services to the Middle and Far East (Bahrain, Gan, Singapore and Hong Kong) and North America (Washington-Dulles), as well as meeting the ad hoc and special needs of the three services for exercises, deployments etc. At the peak of its long-range scheduled operations No 10 Squadron was making 27 VC10 flights a month to the Far East. With its many additional 'charter' flights *Shiny Ten* was a very busy 'airline'.

There have been many changes (mostly reductions) over the past 27 years in Britain's overseas commitments, hence the regular and 'as required' destinations for Ten's VC10s have reflected them. Since the Gulf War the 'scheduled' commitments have been reduced to just Washington and Belize, Decimmomanu, Split and Northern Ireland, but still with a great number of 'charters' for exercises, deployments, VIPs and emergencies world-wide.

A typical October Wednesday schedule – RR2080 from Brize Norton to Belize, via Washington-Dulles, involves two of No 10's crews. The home-based captain, on this occasion Flt Lt Roy Wheatley, meets the remaining eight members of his crew (co-pilot, navigator, air engineer, air loadmaster, four stewards and a ground engineer) at 03.00 to brief for the departure two hours later. The all-important meteorological briefing confirms that the VC10 with its 109 passengers will be able to make the flight to Washington without a refuelling stop at Gander, according to the computer printed 'jet plan' that has been produced by Flight Operations at Brize Norton. The weather report for Washington is also good with no en-route complications. The calculations are then done, using the passenger and cargo weights for the flight, produced by the Movements staff, to determine how much fuel is required. On this occasion it was decided to put in 138,000lb which gave a maximum take-off weight of 323,000lb for departure, having used 2,000lb for start-up and taxi. A flight time of 7hr 45min was to be expected, the VC10 still being one of the fastest transports on the North Atlantic route.

Some 30 minutes before the scheduled departure at 05.00 the crew members are all in place on board XR806, making their final preparations. The terminal staff are cleared to embark the passengers and after a short delay while a problem with one of them is



Photo strips (left to right): *High over the Mediterranean the No 14 Sqn Tornado GR1 (1) drops back to position (2) to take on fuel from XV103's starboard hose (3). The No 2 Sqn Tornado GR1A (4), flown by Gp Cpt Niall Irving moves across to the port side (5) to top up its fuel tanks (6).*

Flt Lt Steve Smith (left) with co-pilot Flt Lt Neil Purves at the controls of XV103 (7). OC No 10 Sqn, Wg Cdr Al Stuart, navigator for the flight (8). The new tv monitor and instruments at the flight engineer's position on the C1K (9). The C1K was in formation with No 101 Sqn's VC10 K3 that refuelled two Harrier GR7s from No 20 (R) Sqn as far as RAF Akrotiri, Cyprus (10-12).

Once free of its 'chickens', the No 10 Sqn crew took the opportunity of doing some receiving themselves behind the centreline hose of the K3 (13-18). Photographs Peter R March

sorted out, the VC10 is ready to taxi out to runway 26. With a near maximum all-up weight for take-off the engines are run up to full power before releasing the brakes. The standard departure takes the VC10 north-west over Chedworth, Glos climbing rapidly to 29,000ft at Wallasey and on up to 33,000ft soon afterwards for the Atlantic crossing. The long over-water sector proves straightforward and rather monotonous for the experienced crew who have flown it many times before. They are able to predict the radio calls as the coast of Canada is approached and the flight continues southwards into the very busy Canadian and US airspace. With much of the fuel load used the lighter VC10 is cleared to complete its journey at 39,000ft to increase its fuel efficiency and speed (now Mach 0.84).

After a carefully routed descent, the VC10 touches down at Washington-Dulles Airport, the flight time of 7hr 20min being 25 minutes quicker than predicted. This was largely due to some favourable winds over the Atlantic and helpful US air traffic control, which permitted Roy Wheatley to cut some corners by more direct routing.

After the passengers have disembarked the aircraft is handed over to another No 10 Sqn crew who are to take the VC10 for its next two legs during the day, from Washington to Belize and return. In the meantime the pilots, Flt Lts Roy Wheatley and Gordon Parry and the remainder of the crew, rest for the 'statutory period' before taking the VC10 with another full load of passengers back to Brize Norton, where it arrives on the Thursday morning. A typical airline type of operation that No 10 has performed so well for the past 27 years.

However, the next flight that the crew are programmed for might well have been quite a different story. Since delivery of the first VC10 C1K (XV103) back to the squadron after modification at Bournemouth in December 1992, crews have been undergoing training for the new air-to-air refuelling (AAR) role. This six-week course with No 242 Operational Conversion Unit (renumbered No 55 (R) Sqn in October 1993) involves some 28 hours flying, where the skills of formation flying and leading, manual flying and receiver training are developed. The initial trainee captains and co-pilots have been selected on the basis of consistently high assessments over the previous year. By the end of 1993 five of the squadron's crews had been trained for the AAR task and a further trio of experienced crews had joined from No 101 Squadron. At the same time the squadron had received four of the C1Ks from the eight scheduled to be converted by the end of 1994.

Apart from routine training sorties over the North Sea, No 10 Squadron's first major contribution to the RAF's AAR task came early in June 1993 when the third C1K conversion (XV109) was deployed to RAF Kinloss to support Tornado F3s in a major multi-national sub-surface, surface and air exercise (JMC932). All of the squadron's qualified flight deck crew were involved and a total of 14 hours were flown and 37 aircraft were refuelled. Soon after this exercise the squadron's first overseas tanker trail was made when XV109 was involved (with aircraft from No 101 Sqn) in the rotation of Tornado GR1s to and from the Gulf, where they are based for Operation *Jural*.

The final phase of No 10 Squadron's entry into the AAR role came in November 1993 when VC10 C1K XV103 captained by Flt Lt Steve Smith took off from Brize Norton bound for Akrotiri and Bahrain. At Muharraq the squadron was to take over the duties of providing AAR support for Operation *Jural* from No 101 Sqn. Retirement of the last six Victors the previous month and increased commitments in the European trouble spots had stretched the RAF's AAR resources to the limit.

Making use of the C1K's versatility, the deployment to Bahrain involved a trail to the Middle East with two Tornado GR1s, along with a No 101 Sqn tanker and two Harrier GR7s. The converted transport had the added advantage that it could also carry the full squadron detachment of aircrew and supporting ground crew, together with personnel involved with the Tornados and Harriers, in its comfortable passenger cabin.

The two VC10s met up with their charges over the east coast at 25,000ft and the C1K gave the first of three top-ups of fuel to the Tornados in mid-Channel. As these two aircraft were heading for the Dubai Air Show they were without any external long-range tanks, which meant more refuelling than usual en route, thus providing good practice for the No 10 Sqn crew. This was further re-reinforced during the later part of the journey into Akrotiri, when Steve Smith and co-pilot Neil Purves took on the role of receiver and got some useful practice plugging into the centre hose of the K3.

All this was a far cry from the staid airline operations of *'Shiny Ten'*. The very experienced pilots who had been with the squadron for many years have now largely left, bringing an end to its 'Jurassic Park' image. Looking around the squadron crew room it is abundantly clear that the general age of captains and co-pilots is in 1994 very much lower than it was five years ago. The background of the new flight-deck crews are also more varied than before - with pilots coming from the Support Helicopter Force, Hercules, Nimrods and Andovers. They are bringing with them a varied and more flexible approach, both of which are essential for No 10 Sqn's multi-role tasking. Wg Cdr Al Stuart, the squadron's Commanding Officer, can be justifiably proud of the way that No 10 Sqn has made the transition to its new role.

As one of the RAF's senior squadrons, No 10 will reach its 80th anniversary on 1 January 1995, having first been formed at Farnborough as a Royal Flying Corps training squadron with various BE aircraft on New Year's Day 1915. With distinguished service in both World Wars as a bomber squadron, No 10 transferred to Transport Command on 7 May 1945. It played an important part in the Berlin Airlift but disbanded in February 1950. Returning to Bomber Command on 15 January 1953, No 10 Squadron operated Canberras, and included involvement in the Suez Crisis. It became a Victor squadron on 15 April 1958 and remained with these aircraft until 1 March 1964, when it disbanded. The squadron re-formed again, this time with Air Support Command and the new VC10 C1, on 1 July 1966.

At a time of stringent economies, the RAF has made the best possible use of its increasingly scarce resources, in converting its supporting international 'airline' into a front-line multi-role tanker-transport squadron. By fully utilising the potential of its proven VC10s and versatile aircrew, in the words of No 10 Squadron's motto, it has 'Hit the mark'.





Above: *No 14 Sqn Tornado GR1 drops back behind the C1K's starboard wing to take fuel.* Peter R March

Left: *Flt Lt Steve Smith* (left) *and co-pilot Flt Lt Neil Purves keep XV103 steady at 26,000ft while the Tornados manoeuvre into position.* Peter R March

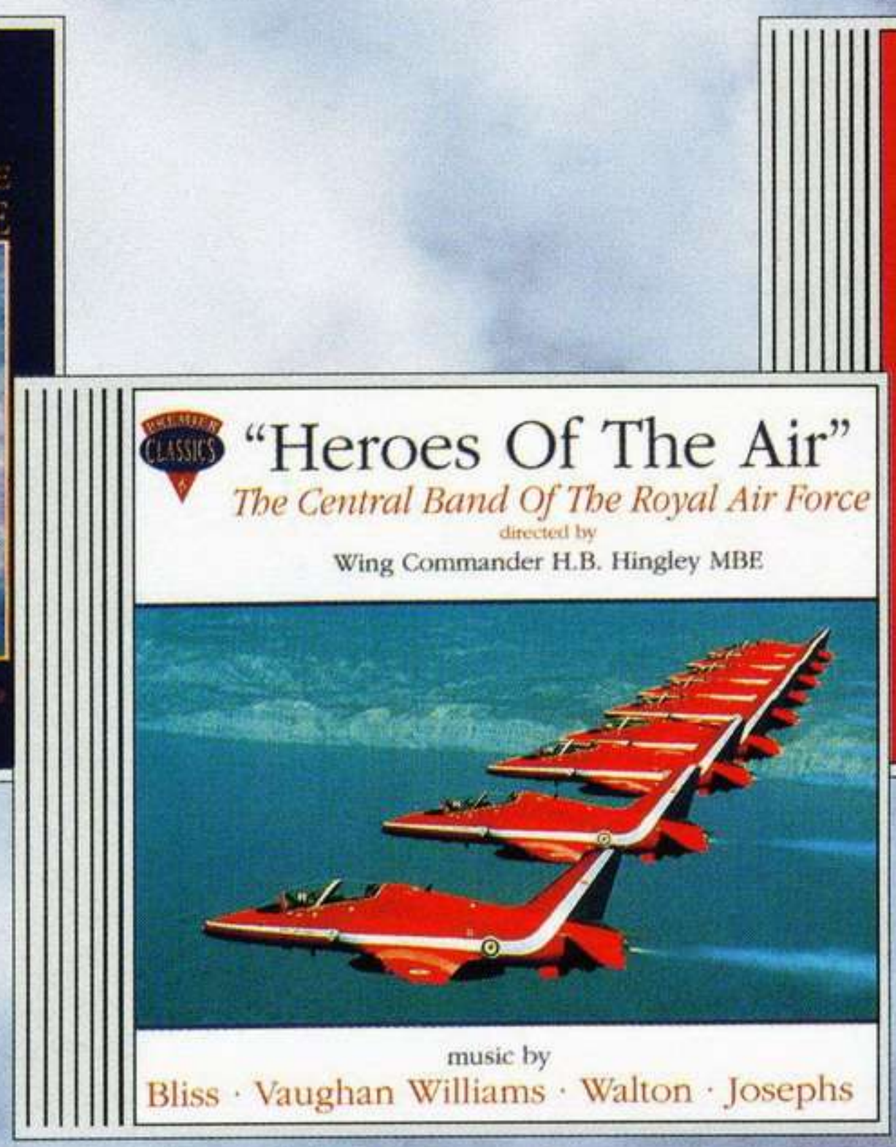
VC10 C1K XV103 getting airborne for another refuelling sortie. Peter R March



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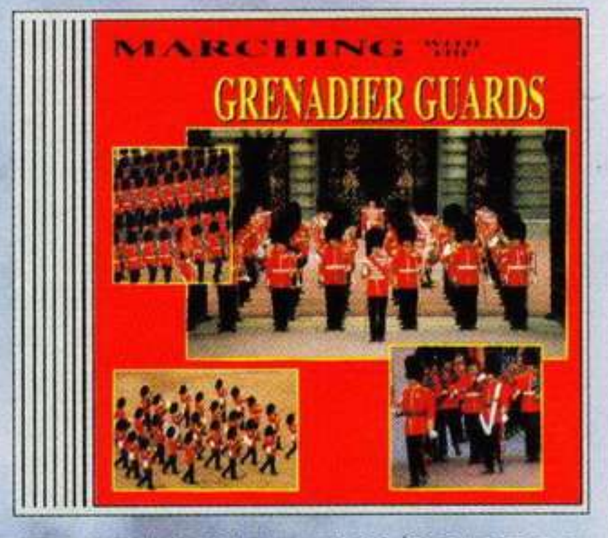
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Lindsay Peacock

It is one of the more interesting facts of military aviation history that few warplanes have made the transition from being a purely land-based machine to that of a carrier-borne one with anything more than a limited amount of success. The Spitfire managed it in WW2, enjoying a distinguished Naval career as the Seafire, but for the most part the different demands of sea-going aviation militate against this sort of transition.

In the reverse direction, the difficulties pose less of an obstacle, with the result that quite a few Naval aircraft have found acceptance with land-based air arms. Undoubtedly the most notable recent example of this is the F-4 Phantom, which was designed as a carrier aircraft and became an outstanding land-based fighter. On this side of the Atlantic, Blackburn's Buccaneer also managed a successful transfer from sea to shore, although it is probably fair to comment that in this instance the transition was driven more by political considerations than anything else.

Regardless of the motives, one would not be too wide of the mark to assert that the RAF was less than enthusiastic about being given the Buccaneer. It had originally been destined to get the TSR2, which was axed in 1965 primarily on grounds of cost. Then, in 1966, it was promised F-111Ks, but they too were cancelled barely two years later, with development problems being blamed, although cost was probably just as much a factor.

The only feasible alternative was the Buccaneer, which, nearly three decades later, has just come to the end of its RAF career. It is something of a paradox to report that its passing is viewed by many with regret. In essence, once established in RAF service, the 'ugly duckling' very quickly became a 'swan', winning many admirers by virtue of its rugged design and its almost unparalleled qualities as a strike aircraft.

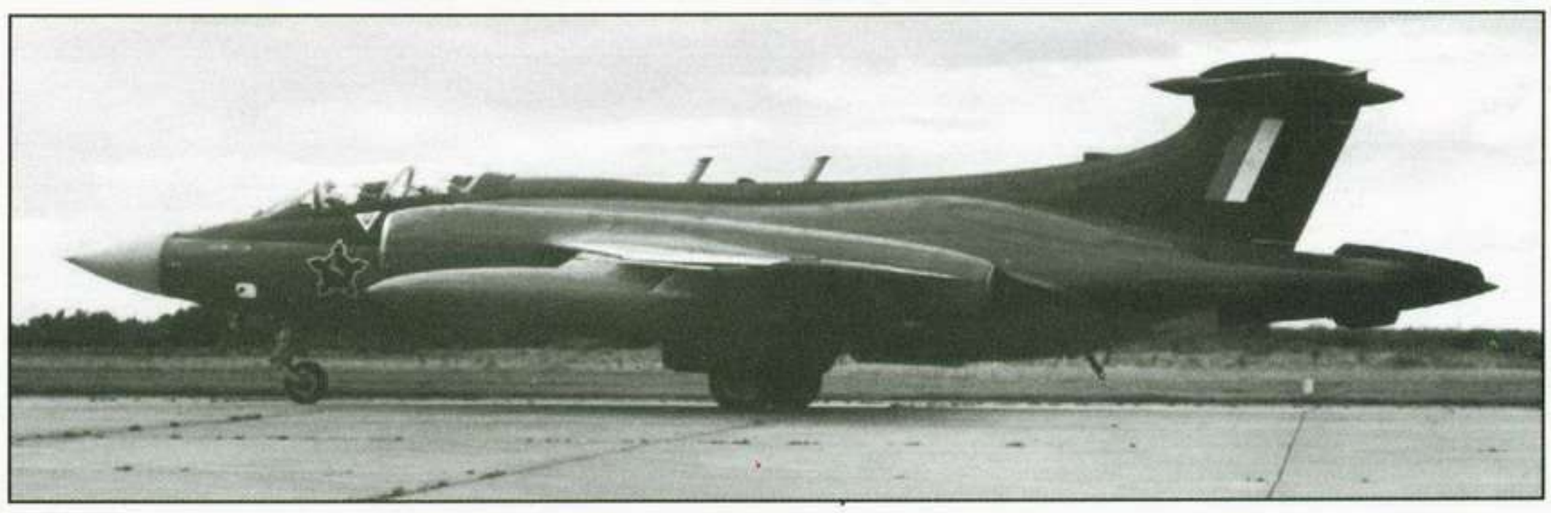
In recent years it has been employed primarily on maritime applications from Lossiemouth, operating mainly in the anti-ship attack role, in conjunction with the potent Sea Eagle air-to-surface missile. This was in fact a mission on which it did not actually ever have the chance to use its weapons in anger. Indeed, until Saddam Hussein's ill-fated attempt to subjugate Kuwait as Iraq's 19th province, Buccaneer combat experience was mainly the preserve of South Africa which had employed its aircraft in bombing raids against UNITA guerrilla forces in Angola. As far as the RAF was concerned, exposure to the perils of war was confined to half-a-dozen or so overflights of Beirut during Operation *Pulsator* late in 1983. On that occasion, no ordnance was expended and another eight years were to pass before it was again in action.

Then, having served as a 'designator' for laser-guided bombs deposited by accompanying Tornados, the Muharraq-based Buccaneers finally got the chance to deliver their own weapons, dropping just under 50 1,000-lb bombs during the final few days of the Gulf War, often with spectacular success. By almost any yardstick, it was an impressive accomplishment, as well as one that set the seal on the final period of RAF service.

That service career was launched in 1969, but the Buccaneer saga predates this event considerably, with development being launched in the early 1950s, in response to the Navy's NR/A.39 specification. This invited proposals for a two-seat, carrier-borne, all-weather attack

Below: *Third pre-production NA39 Buccaneer was XK488, seen here during early trials.* Bottom: *One of 16 Buccaneer S50s supplied to South Africa in the mid-1960s before a United Nations embargo curtailed further sales.*





Main picture: *A No 12 Squadron Buccaneer, based at Lossiemouth, in the familiar maritime role.* PRM

Inset left: *Buccaneers provided laser designation for accompanying Tornados over Iraq during the Gulf War in 1991.* Mike Rondot

aircraft with the ability to maintain high subsonic speed at low level, while carrying a respectable weapons load. Blackburn's B103 was ultimately selected as worthy of further development in 1955 and this announcement was followed in July by a contract for no fewer than 20 pre-production examples of the NA39 (XK486-491 and XK523-536) to undertake manufacturer and service trials.

Construction of these airframes was soon under way at the Brough factory and the first example made a successful maiden flight on 30 April 1958 from Bedford, whence it had been taken by road. This aircraft was intended to undergo aerodynamic test duties and therefore lacked the mission avionics systems and other features which were progressively incorporated in later airframes. These culminated in the last half-a-dozen which were essentially to full production standard and earmarked for service evaluation. Most of these were ultimately assigned to the Fleet Air Arm's (FAA) 700Z Squadron that functioned as an intensive flying trials unit so as to smooth the path of its introduction into front-line service. This formed at Lossiemouth in March 1961 and received its first Buccaneer in August.

By early 1961 a production contract had been placed with Blackburn Aircraft for a further 40 Buccaneers (XN922-935, XN948-973). Designated as S1s, these were eventually allocated to three front-line squadrons, starting with 801 Naval Air Squadron, that was formally commissioned at Lossiemouth in July 1962. It began its first period of sea duty aboard HMS *Ark Royal* in February 1963, paving the way for the formation of 800 and 809 Squadrons. As it turned out, the operational career of the S1 was relatively short and undistinguished, Blackburn (later absorbed into the Hawker-Siddeley group) and the Navy quickly recognising that re-engining would result in greatly enhancing the performance of the Buccaneer.

The Buccaneer S1 relied upon a pair of

Below: *Buccaneer S2 of 800 Naval Air Squadron being catapulted from the deck of HMS* Eagle. PRM







Top: *Buccaneer S2 of No 16 Squadron, with underwing SNEB rockets, taking off from Laarbruch.* PRM
Above: *Training was undertaken by Buccaneers of No 237 OCU, established at Honington in 1971.* PRM

Above: *Buccaneer under shelter at Muharraq being prepared for a sortie during the Gulf War.* Mike Rondot

Gyron Junior 101 turbojets, each of which possessed a maximum rating of 7,100 lb st. Whilst this was adequate for operation in temperate zones, this version was decidedly short of 'puff' in a hot climate and was unable to be launched from a carrier at maximum weight. As a consequence, normal operational procedure entailed leaving the parent carrier with only a partial fuel load and then refuelling from a Scimitar tanker to top up its tanks.

Switching to the considerably more powerful Rolls-Royce Spey turbofan would eliminate this shortcoming at a stroke. Other benefits also accrued, not least of which was the fact that the boost in thrust was accompanied by lower fuel consumption, offering the dual advantages of enhanced performance and greater range. Two pre-production airframes (XK526 and XK527) were fitted with a pair of 11,200lb st RB168-1 Speys to serve as prototype of the Buccaneer S2. These made their respective first flights on 17 May and 19 August 1963 and were duly followed by the first new-build example (XN974) on 5 June 1964, the decision to proceed with production having been made public some two-and-a-half years earlier, in January 1962.

Ultimately, 84 S2s were manufactured for the FAA (XN974-983, XT269-288, XV152-168, XV332-361 and XV863-869) with deliveries being accomplished between August 1964 and March 1969. Just over 60 of these went on to see further service with the RAF, while six were passed to MoD test organisations and establishments for various trials projects. As it turned out, the end of production for the Navy dovetailed quite neatly with the Buccaneer's adoption by the RAF. New-build Buccaneers continued to trickle from the assembly line at Brough for another eight years or so, finally ending on 6 October 1977 when the last example (XZ432) was handed over.

During the intervening period, some 46 Buccaneer S2Bs were completed specifically for the RAF (XW525-550, XX885-901, XZ430-432) along with three S2Bs for the Royal Aircraft Establishment (XW986-988). Finally, no survey of production would be complete without some reference to the 16 examples of the basically similar S50 (411-426) that were supplied to South Africa in the mid-1960s. Plans to purchase a follow-on batch were well advanced but failed to reach fruition when a United Nations arms embargo was implemented.

Thus, manufacture of the Buccaneer S2 and its derivatives eventually totalled 149, to which should be added 20 pre-production S1s and 40 production S1s, giving a grand total of 209 aircraft. As Paul Daniels might say, "not a lot" . . . and old age and attrition inevitably exacted a heavy toll over the years, reducing the fleet to a stage where barely two dozen examples remained active with Nos 12 and 208 Squadrons at Lossiemouth. Today, even that meagre number has dwindled as the Buccaneer era comes to and end (in April 1994), when No 208 Squadron stands down and the Tornado GR1 finally takes its place, by which time it will have clocked up close to a quarter-century of RAF service, with five front-line squadrons and an Operational Conversion Unit (OCU).

The process of equipping RAF squadrons got under way during 1969, with initial aircrew conversion being undertaken at Lossiemouth during the spring and summer of that year, courtesy of 736 Squadron that provided the Fleet Air Arm's training requirements. By 1 October 1969, sufficient aircrew had been trained for No 12 Squadron to form with Buccaneer S2s at RAF Honington.

Then, as for the next 24 years, this unit was principally involved with maritime duties and, indeed, its initial complement consisted of former FAA aircraft. In contrast, the remaining four squadrons were orientated more towards overland strike tasks and the first of these officially came into existence on 1 October 1970 when No 15 Squadron was re-formed at Honington with the first of the Buccaneers produced specifically for the RAF. On completion of training, it moved to Laarbruch as part of RAF Germany in January 1971, being joined in due course by No 16 Squadron, which began forming at Honington in the summer of 1972.

On 1 March 1971 No 237 OCU was established at Honington to train all Buccaneer

Formation of No 15 Squadron Buccaneer S2Bs, with one aircraft not carrying toned down markings.







Inset (top): *A variety of colourful nose art adorned Buccaneers deployed to the Gulf.* PRM

Inset (above): *The* Pave Spike *laser designator carried during Gulf missions.* Andrew March



Left: *A No 12 Squadron Buccaneer outside its HAS at Lossiemouth displays its weaponry, which includes* Sea Eagle *missiles.* PRM

aircrew for the RAF, a task which it was destined to fulfil for some two decades. Next to appear, in July 1974, was No 208 Squadron and the roster of RAF Buccaneer units was completed in December 1978 when No 216 Squadron was established at Honington, moving north to Lossiemouth in July 1980. As with No 12 Squadron it had a maritime role but No 216 had barely completed its work-up period when a catastrophic accident near Nellis AFB, Nevada forced a major reappraisal of the Buccaneer's future service with the RAF.

That tragic event occurred on 7 February 1980, as a result of a wing failure and the Buccaneer fleet was immediately grounded for inspection. The flight restriction was not lifted for six months and a number of aircraft were deemed to be beyond economical repair. With insufficient Buccaneers now available, the RAF had no option but to disband No 216 Squadron shortly before the end of 1980, at more or less the same time as No 12 Squadron moved to Lossiemouth.

The situation thereafter remained relatively stable until the summer of 1983, when RAF Germany began converting its Buccaneer squadrons (Nos 15 & 16) to the Tornado GR1. The UK-based Strike Command squadrons (Nos 12 & 208) were switched to maritime roles rather than overland strike. The first RAFG unit to re-equip was No 15 Squadron (in July 1983) and No 16 duly followed suit at the end of February 1984. The two home-based squadrons were concentrated at Lossiemouth, with No 208 moving north to join No 12



Right: *No 208 Squadron Buccaneer – the last squadron to fly the type operationally.* Mike Rondot



Top: *Buccaneer line-up at Manston for the 16-aircraft flypast celebrating the Queen's birthday in June 1993.* Brian Strickland Inset: *Buccaneers continue to serve as test and trials aircraft with the A&AEE.* PRM

Squadron in July 1983, with No 237 OCU following in October 1984. By a circuitous chain of events the Buccaneer has concluded its British military career at Lossiemouth the same base at which it started, more than three decades ago.

The extended process of retirement actually began on 1 October 1991 with the disbandment of the Buccaneer OCU, whose services were no longer needed due to the diminished requirement for qualified aircrews. As for the two squadrons that remained, it was very much a matter of 'business as usual' until the end of March 1993. At that point, No 12 Squadron commenced its final six months of operation as a Buccaneer unit and ceased operations on 30 September 1993, when No 12 (Tornado) Squadron came into existence for the maritime role, receiving its aircraft from No 27 Squadron at Marham.

Thus, the distinction of being the last front-line RAF unit to fly the Buccaneer operationally fell to No 208 Squadron, which continues until 31 March 1994. In this instance, however, No 208 is less fortunate than No 12, as it ceases to exist at the end of the 'draw-down' period. At that time, No 617 (Dambusters) Squadron takes over responsibility for tasks formerly allocated to No 208, and moves to Lossiemouth from Marham with its Tornado GR1s. So the long Buccaneer era comes to an end, leaving just a trio of test and trials aircraft to remind us of the distinguished service of this Fleet Air Arm carrier bomber and subsequent RAF overland nuclear and maritime strike aircraft.

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OPERATION DENY FLIGHT

Bob Archer reports from southern Italy where RAF Tornados and Jaguars are playing a key role in assisting the United Nations humanitarian work in the former Republic of Yugoslavia

Royal Air Force combat aircraft were flown to the Italian AF base at Gioia del Colle in southern Italy during 1993 to participate in Operation *Deny Flight*. This was in response to UN Resolution 836 which imposed an air exclusion zone over Bosnia-Herzegovina and was to provide protective air power to assist the UN Protection Forces (UNPROFOR) in their humanitarian endeavours. Tornado F3s were deployed in April, under RAF code-name Operation *Grapple*, to perform Combat Air Patrol (CAP) duties. They were followed by 12 Jaguar GR1As from the Coltishall Wing on 16 July for Close Air Support (CAS) and Photo Reconnaissance (PR). RAF Leeming assumed the CAP role with Nos 11, 23 and 25 Squadrons all detaching air and ground personnel to Gioia before the commitment was passed to RAF Coningsby with Nos 5 and 29 Squadrons. The three Jaguar squadrons, which together form the Coltishall Wing, have rotated for two month periods.





Composed around a nucleus of air and ground personnel from No 6 Sqn, the Jaguars deployed to Italy on 16 July 1993, with Nos 41 and 54 Sqns subsequently assuming the commitment for two month periods. The detachment comprised eight aircraft dedicated to Close Air support (CAS) together with four reconnaissance capable examples.

Jaguar GR1As dedicated to the CAS role routinely fly with a pair of 1,000lb iron bombs attached to hardpoints on the underside of the fuselage. All of the Jaguars have a similar defensive suite to the Tornado, consisting of a pair of Vinten VICON 78 flare dispensers attached to the underside of the rear fuselage and a single Bofors Phimat chaff dispenser suspended beneath the starboard underwing hardpoint. Attached to the port side underwing station is the AN/ALQ-101 (V-10) jammer pod, while mounted above the wings are a pair of AIM-9 Sidewinder missiles for self defence.

Photographs RAF Coltishall & Bob Archer (above)



Tornado F3 immediately before launching from Gioia del Colle Air Base, Italy for a night sortie over Bosnia-Herzegovina. Although displaying No 23 Squadron markings, the aircraft was being flown by a No 5 Sqn aircrew. The mission on 6 February 1994, which was extended to over 6hr 30min duration, brought the total Tornado flying time to more than 3,000 hours since the aircraft deployed in April 1993. The Tornado is ideal for operations over Bosnia as the GEC Avionics Foxhunter pulse-Doppler radar is very effective at detecting targets at medium to low level. This often involves helicopter violations being tracked following the contours of the mountainous landscape. The F3s are flown fully armed with live weapons, consisting of four long-range BAe Dynamics Sky Flash missiles together with a pair of medium range AIM-9 Sidewinders mounted on underwing rails. The F3's sophisticated Marconi modular radar homing and warning receiver (RHWR) detects, analyses and classifies threats which are displayed visually in both cockpits as well as audibly in the earphones. The system enables the crew to prioritise multiple threats, although the most likely danger within Bosnia airspace would be from groundfire. Defensive equipment installed includes two Bofors Phimat chaff dispensers mounted outboard of the underwing launch rails, and a pair of Vinten VICON 78 flare dispensers attached to the underside of the rear fuselage. Photograph Bob Archer

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THE ROYAL BRITISH LEGION

RAF IN THE USA 1

It is a little known fact that since 1981 there has been a permanent RAF detachment in Texas where, to date, 58 student pilots have received their basic flying training. **Peter R March** reports from Sheppard AFB, Wichita Falls, Texas – home of



EURO-NATO JOINT JET PILOT TRAINING

Driving through the gates of Sheppard AFB on the outskirts of Wichita Falls in northern Texas, and on through the maze of buildings and aircraft hangars with their lines of B-52s, F-111s, F-15s, F-16s, C-130s, amounting to almost every type in the USAF's current inventory, you could believe that you were in some kind of super museum. In fact this is the USAF's main aircraft maintenance training centre – the 3700th Technical Training Wing. Clearly this vast ground training establishment is not providing the aircraft for the busy dual circuit of Cessna T-37 *Tweety Birds* and Northrop T-38 Talons that are continually buzzing overhead. They are coming from a lodger unit – the 80th Flying Training Wing, that occupies the western corner of the base. On the apron in front of the modern air-conditioned buildings are rows of white-painted T-38s and black/white T-37s. They all carry a distinctive NATO badge on their fins as well as standard USAF markings, signifying that they are operated for the Euro-NATO Joint Jet Pilot Training (ENJJPT) Program.

ENJJPT began in 1973 in response to a recognised need to improve the interoperability of the various air arms within NATO. In 1978 the NATO nations accepted a US proposal to locate a joint jet pilot training school at a US base. Seven years after the idea had been launched, Sheppard AFB, Texas was selected as the site for this training. The defence ministers approved the programme in December 1980 and it became a reality on 1 October 1981 when the first entry of students commenced their training.

This unique task was given to the 80th Flying Training Wing (FTW), a unit that had previously (as the 3630th FTW) provided the German Air Force pilot training programme and, from March 1973 at Sheppard, training for other overseas air arms. The Wing now has four elements – the 80th Operational Support Squadron (OSS) which provides administrative and air traffic control services; the 88th Flying Training Squadron (FTS), which looks after the academic and personal well-being of the students and trains the flying instructors on the T-37 and T-38; the 89th FTS that provides T-37 flying training and the 90th FTS which does the same on the T-38. The 80th FTW is a unit of the 19th Air Force of Air Education and Training Command, a new title adopted in the USAF's reorganisation on 1 July 1993.

Twelve nations participate in ENJJPT – Belgium, Denmark, Germany, Italy, Netherlands, Norway, Turkey, USA and the United Kingdom, all having instructors and students at Sheppard, with Canada, Greece and Portugal contributing instructors but having no students under training. It was set up as a 24-year programme with each participating country paying a proportional share of the operating costs. In the past year, as the programme reaches its mid-point, just over half of the students/instructors come from European air arms, as the following table reveals.

Country	No of students	No of instructors
Belgium	2	2
Canada	0	2
Denmark	9	8
Germany (24%)	45	51
Greece	0	6
Italy	20	21
Netherlands	18	19
Norway	9	14
Portugal	0	4
Turkey	4	8
UK (2%)	6	6
USA (46%)	137	134
Total	**250**	**275**

At its peak student training year (1990-91) a total of 320 students passed through ENJJPT, flying a total of 94,000 hours; it reduced in 1991-92 to 285 students (83,000 hours) and has since been further cut-back, as all of the air arms reduce the strength of their



Left: *A line-up of T-37s awaiting their crews for the afternoon's flying.* All photographs Peter R March

Top: *Wearing distinctive headgear, Fg Off Keven Gambold climbs the ladder for his first flight in the T-38A Talon.*





Above left: *Fg Off Sam Martin in the T-37 ground trainer, preparing for his next check flight.*

Above right: *Sqn Ldr Eric Constable* RAF, *seen preparing a student for a training flight, is the Senior National Representative from Britain at ENJJPT.*

air forces. As there are fewer students passing through the programme the number of instructors required is being cut appreciably in the current year; the major providers – Germany and the USA will reduce to 42 and 117 instructors respectively. By late 1993 a total of 2,727 students had been trained at ENJJPT of which 58 had come from the RAF – representing 2% of the total.

The Senior National Representative (SNR) from Britain for the past two years has been Sqn Ldr Eric Constable. A Qualified Flying Instructor (QFI) with considerable experience on the Tucano from its introduction at No 7 FTS, Eric arrived at Sheppard in February 1992 for a 3 1/4 year tour. For the first four months, while taking over from his predecessor, he was with the 88th FTS, as a student himself converting on to the T-37 and learning to instruct 'the American way'. Not surprisingly after Central Flying School (CFS) training and 23 years in the RAF this was not an easy transition. As he explained, in much the same way as all of the other RAF instructors – "I found it difficult to re-orientate; all flying here is done under strictly controlled Instrument Flight Rules (IFR), there is no flying by Visual Flight Rules (VFR). In the UK the RAF operates under VFR to the maximum and the training methods and overall programme reflects this. In the cockpit the actual student training procedure is also strictly laid down and must be followed rigidly – there is little flexibility."

Eric took over as the British SNR in July 1992, with responsibility for the six resident RAF instructors and their families and the recently arrived six students from the UK, who had just embarked on their 53 weeks at ENJJPT. The instructors and families are accommodated in the nearby small town of Wichita Falls, while the students live on the base with the international community in self-contained flatlets. Eric's initial flying training task was as an instructor pilot on the T-37 *Tweety Bird* with the 89th FTS, becoming a Section Commander on 1 January 1993 running four Flights with over 100 students and instructors. Nine months later he took over responsibility as Operations Officer with the 88th FTS for Academic Training (Ground School) and T-37/T-38 Pilot Instructor Training (ENJJPT's mini CFS).

Throughout the 80th FTW/ENJJPT the senior posts are allocated across the participating nations. Towards the end of 1993 the Wing was commanded by a USAF officer with a German as Director of Operations and a US



Above: *Instructor (Sqn Ldr Constable) and student (Fg Off Sian Hughes) walk out to their aircraft past the impressive lines of T-37s.*

Right: 'Tweety' *touching down at Sheppard – the T-37's wide track undercarriage and good handling qualities make it an excellent jet trainer.*



Deputy Commander. The three FTSs were respectively commanded by US, German and Italian officers, with RAF, Dutch and US deputies. This multi-national approach continues at all levels, underlining ENJJPT's mission that it is to 'produce top quality fighter pilots for the NATO alliance. These student pilots (and instructors) will be the leaders of tomorrow's air forces and in the final analysis, if we train together we can fight together'.

The RAF students at Sheppard arrive in the USA in April/May each year. They have all completed their Initial Officer Training at RAF Cranwell and have a background of Initial Flying Training on Bulldogs at a University Air Squadron. They are single, as it is an unaccompanied posting, and after studying the details of the course, have volunteered for selection. Fg Off James Heald, for example, studied Aeronautical Engineering at Loughborough University and completed his IOT at Cranwell early in 1993. Like all graduates from the RAF College he was expecting a long 'hold' before commencing Basic Flying Training (BFT) on the Tucano. Selection for ENJJPT meant that this was cut to just two months.

Not surprisingly, soon after arrival at the 80th FTW he was quickly immersed in the introductory aviation physiology and ground school phases. The first part of the flying training is 123 flying hours on the very noisy and aged Cessna T-37B *Tweety Bird*, the USAF's primary trainer since 1959. With side-by-side seating for the student and instructor (like the recently retired Jet Provost), the T-37B is powered by two Continental J69-T-25 turbojets of 1,025lb dry thrust each. It was designed as a low-cost, straightforward, no-frills jet trainer with manual controls and hydraulic systems typical of the period. This means that its handling qualities are very docile and the wide track tricycle undercarriage makes it relatively easy for landing. The main drawbacks are its slow acceleration/spool up of the twin turbojets (taking up to 20 seconds to go from idle to full power) and an old-fashioned cockpit layout and instruments. Perhaps the biggest problem for efficient operation is the T-37's lack of cockpit air conditioning to cope with summer temperatures that can reach as high as 130 deg F.

Having already experienced RAF flying instruction techniques with their UASs back home, the ENJJPT students find the new way of doing things somewhat more regimented – and 'very inflexible'. They have to be aware of



T-38 Talons (and T-37 'Tweeties') are constantly in the air over Sheppard AFB.

this from the outset. For example, whenever they depart for a training sortie in the T-37, they have to make a standard IFR departure to a predetermined area in which they must remain throughout. They are watched by radar and if they go out of the allocated 'box of sky' they are warned and if it is repeated, they are penalised. Once they get used to this and the quirks of the instructional technique, progress is very rapid. With their Bulldog experience behind them, something that the majority of other students do not have, the RAF students achieve high grades in their flying assessments. They also have to get used to everything being very public within their flight. Pre-flight and post-flight briefing is held within earshot of the other students, red marks for errors are posted up and any shortfall in performance becomes very well known.

Inevitably there is a good deal of friendly rivalry within and between the flights. While on the T-37 James Heald was on 'B' Flight with another RAF student, three Germans, five Italians and six USAF pilots. The latter group tended to make their mark on the Flight as they had to be very competitive as they knew that only the top three students would go on to fighter training.

Alongside the flying training the students continue with their 'academics' or ground subjects. The instructors for this are different from the ones that they fly with. Again the teaching is very precise and everything has to be learnt and is examined very closely. The written papers are marked and every relevant term used has not only to be provided in the answers, but spelt correctly. As with the flying there is a check/test at the end of every section and if passed the student progresses to the next. There is no turning back – once a section or exercise is finished that topic is not covered again or revised.



Below: *The fighter-like T-38 is a big step from the docile, slow reacting T-37.*



Flying operations at Sheppard AFB are also quite different. Once the pre-flight briefing has taken place the student gets his flying kit and with the instructor 'books out', receiving details of his training sector etc. Because of the high temperatures in summer, flying gets under way as soon as it becomes fully daylight. Crews are taken by minibus to and from their aircraft on the extensive flight line – to avoid walking too far across the hot apron. Special attention also has to be given to hearing protection as the *Tweety Bird*, far from singing sweetly, has a very high-pitch, shrill, scream that is particularly damaging to unprotected ears.

There are two separate runways for use by the 80th FTW (together with a third one for the limited civil airliner operations). Each of the trainers has its own runway, with circuits flown on opposite sides to avoid any conflict. The T-37s have an 8,000ft, and the T-38s a longer 10,000ft runway, both parallel to one another. Control is not from the impressive base air traffic control tower but from two Runway Service Units (RSUs) alongside each of the strips. Aircraft returning from a training sortie (for the T-37s 1hr 20min with a 30min transit) follow a standard arrival procedure, and call up the RSU for landing clearance. Some aircraft will make several 'go arounds' or 'touch-and-goes' if they have fuel remaining at the end of the sortie. Close attention is paid to the departing and arriving T-37s by the staff of the RSU, which includes a duty flying instructor. Poor airmanship, faulty procedures or any other errors are reported back to the respective flight for the debrief.

As the RAF students progress through their 123 hours flying on the T-37 they get increasingly anxious to progress onto the next phase of the course – 137 hours flying the supersonic Northrop T-38 Talon. In their words this is a 'real aeroplane', 'it's very much a two-seat fighter', and 'it's like going from a family saloon to a Ferrari racing car'. Dating from a first flight by the prototype on 10 April 1959, the T-38A was put into production as an advanced trainer for the USAF and by the mid-70s over 1,100 had been produced. It is powered by two General Electric J85-GE-5 turbojets developing 2,680lb (dry) and 3,850lb (with afterburning) thrust. This gives it a top speed of 858mph at 36,000ft, a major step up from the T-37's maximum of 425mph at 20,000ft. It has tandem seats for the pilots, and is pressurised and air-conditioned. The controls are assisted, including stability augmenters for its yaw and pitch channels and a fully-powered rudder. Reports from the succession of RAF students training on the Talon are that it is light and easy to handle and is capable of achieving all that is required of it.

This second phase of the ENJJPT course is longer than the standard USAF UPT (undergraduate pilot training) course. There is more instrument flying and tactical four-ship formation flying. Each student has 137 hours total time on the T-38, which includes over 34 hours IF and 52 hours of formation flying. Another reason for the increased hours (a total of 260 for ENJJPT compared with 190 for USAF UPT) is that the 80th TFW has no full T-37/T-38 simulators, only some very good link trainers. The RAF students, like their colleagues from other countries, are quite happy to have more actual flying hours. Unlike the UK, the high number of hours can readily be achieved in northern Texas, with very few days in the year being lost to bad weather.

The multi-national instructor force is an essential ingredient of ENJJPT. The RAF team is working with similar professionals from across the NATO air arms, all having to adjust and make allowances for the differences in their own schemes and the USAF pilot training programme that they are teaching. Flt Lt Andy Nightingale who arrived at ENJJPT in April 1993 said that he had found it very 'front-loaded', with a great deal of pressure in the three-months Pilot Instructor Training course. He felt that he was lucky that he was a CFS-trained QFI, as he could concentrate on the many new rules, the systems and the aircraft. He enjoyed working with the other nationalities and was sure that the cross flow of ideas was beneficial to all.

The days are long, with flying from first light until after sunset, so much so that the Wing flies as much in one month as many RAF Stations do in a whole year. But of course having nearly 200 aircraft on strength helps!

Although very much a minority player (2%), the RAF does make a significant impact on ENJJPT, with the SNR Sqn Ldr Eric Constable having a leading role as 88th FTS Operations Officer; the CFS trained and very experienced RAF instructors bring their individual contributions to the training effort and the six students with their flying at the UAS's behind them, produce very creditable results in the performance leagues of their flights. But it is certainly not all one way, as both instructors and students underlined. "We have all gained from a wealth of information from the other nations, from both the training points of view and living and working in the same environment". ENJJPT really is achieving its aim of training together now ..... "so that if the need arises, the future pilots in NATO's air arms will be able to fight together more effectively and ultimately win together".

TRAINING FOR THE FUTURE

Group Captain Bill Taylor OBE, RAF looks at Royal Air Force Cosford's key role in training the Service's next generation of aircraft technicians.



During 1993 the RAF witnessed many significant events, the foremost of which was its 75th Anniversary. The year also saw the end of the Apprentice Scheme, with the final graduation at Cosford in October. Conceived by Lord Trenchard, and instituted in 1920, apprentices were to exemplify high quality training and the Service ethos for more than 70 years. Since 1938, that task has been shared between RAF Cosford and RAF Halton, but following a far-reaching review, Cosford will soon become the centre for all aircraft engineering training; the title of Number 1 School of Technical Training (No 1 SofTT) and the Queen's Colour, will transfer there from Halton in early 1995. Technological advances and high equipment costs underline the importance of investment in training; and as new, more technologically advanced and integrated aircraft such as the Eurofighter 2000 are developed, for the first time since 1938 the training of all aircraft trades will be brought together.

In the years since World War 2, the RAF has maintained its aircraft with a mixture of semi-skilled and skilled men. The semi-skilled man – termed the mechanic – has entered the RAF and, after basic training and some years working at the front line, has been selected by competition for further training to skilled level. At the skilled level – termed the technician – there have been a variety of methods of entry. In addition to the former mechanic graduating from further training, direct entry to the skilled workforce was possible from either the Apprentice Scheme or the Direct Entry Technician Scheme.

Unlike the airlines, which have for many years operated with a largely multi-skilled workforce, the RAF has stuck to its single trades. Always seen as the flagships of the trade structure, the aircraft trades of Airframe, Propulsion, Weapon, Aircraft Electrical, Flight Systems, Air Radar and Air Communications have gained a deserved reputation for excellence founded on the training given at Halton and Cosford. However, in the mid-1980s, the RAF had great difficulty recruiting the number of apprentices it needed and so a wide-ranging study into the training, employment and methods of entry for aircraft

Top left: *Individual computer workstations are used more and more in all of the RAF's training schools.*

Middle: *Developing skill-of-hand is a vital element in all of Cosford's courses.*

Bottom: *Transport aircraft systems are demonstrated on the Andover, two examples of which arrived at Cosford in 1993.* All photographs RAF Cosford



tradesmen was undertaken. The study team reported in 1989, recommending a single method of entry and the formation of a single Avionic trade from the electronic specialisations, but retaining the single skills in the mechanical and aircraft electrical specialisations. As No 1 SofTT moves to Cosford, the transition to the new trade structure, methods of entry, training and employment will be completed.

It was the rapid expansion of the RAF in the mid-1930s that saw the construction of Cosford, to enable more apprentices to be trained in those dark years before World War 2. Number 2 School of Technical Training (No 2 SofTT) opened at Cosford on 4 August 1938, following the transfer of No 5 (Apprentice) Wing from Halton. As the war began, the need to train yet more people grew. Course lengths were reduced and eventually Cosford turned over to training the Boy Entrant. Apprentices did not return to Cosford until 1964, to be trained alongside Boy Entrants (and later Direct Entry Technicians) until the last entry graduated on 7 October 1993.

To enable the RAF to reduce in size to the post-*Options for Change* manning levels, recruiting has been curtailed. The resulting slow-down in basic training and further training throughput has given Cosford the opportunity to upgrade its facilities in preparation for the arrival of the elements from Halton. A major programme of works began in 1993 to refurbish the hangars and training facilities, and construct new barrack and mess accommodation. The long-term project to refurbish Fulton Block as training laboratories and classrooms has been completed, giving Cosford excellent technical and domestic facilities for its vital task.

Other key factors which pointed to the concentration of aircraft technician training at Cosford include its excellent road and rail communications – located adjacent to the M54 and having its own railway station. From the training perspective, Cosford's location close to the mountains of North Wales mean that the Resource and Initiative training which forms such a key role in the development of the RAF's young trainees is just a short distance away, enabling considerable use of this facility to be made on most basic training courses. Although not directly relevant to the engineering training task, Cosford also has its own airfield with a hard-surfaced runway, which provides for the needs of the University of Birmingham Air Squadron and No 633 Voluntary Gliding School. Also operating from the airfield at the weekends is the Wrekin Gliding Club, a regional club of the RAF Gliding and Soaring Association, which provides the opportunity for non-aircrew personnel of the RAF to participate in flying and associated activities in their spare time.



Main picture above: *Jaguars are the mainstay of the instructional aircraft fleet, on which the students receive their essential hands-on training.*

Top: *Modern avionic systems are demonstrated on the Jaguar.*

Middle: *Teaching electronic theory demands a great deal of comprehensive test equipment and system emulators.*

Above: *Laboratory equipment is used to demonstrate the principles of radar and stealth technology.*

With the introduction of its new methods of entry and training to the aircraft engineering trades, the RAF now has just three principal stages of technical training. From 1995, all these stages of training will be undertaken at Cosford and divided into Basic Training (BT), Further Training (FT) and Advanced Further Training (AFT). Clearly, as there is so much complex equipment in RAF service, additional specialist training will always be needed, and this will continue to be carried out at the aircraft Ground Maintenance Schools, such as that for the Tornado at Cottesmore, and that for the Harrier GR7 at Wittering. Additionally, trade-based management training will still be given to newly promoted Corporals and Sergeants at the Trade Management Training School at Scampton.

Turning then to the courses to be offered at Cosford, it is appropriate to start with BT. This is the first specialist trade course to confront the new trainee on graduation from the RAF School of Recruit Training – ironically now relocated at Halton after many years at Swinderby. The aim of the BT course is to prepare the trainee for his or her first productive posting in the RAF as a mechanic. It is most likely that the first two years or so will be spent on an operational squadron, so the course is designed to meet that need, comprising elements of academic tuition and specific instruction in aircraft engineering and RAF maintenance procedures.

BT is, however, the foundation on which the individual's future career is built, and as a result the course includes a significant element of subjects not dealt with in so much detail in later courses. Foremost of these is skill-of-hand, for without this competence it would be easy for a mechanic to cause considerable damage to an aircraft or equipment through the misuse of simple handtools. Another element of training fundamental to BT is a week spent on a Resource and Initiative camp at Fairbourne, designed to build upon the trainee's initial recruit training and further develop leadership skills, a hallmark of the Apprentice Scheme. The length of the BT course varies depending upon the trade concerned, ranging from 25 weeks for the Propulsion course to 33 weeks for the Airframe course. In general each course numbers about sixteen students.

It is during the airfield phase of training that the various threads of the course are drawn together making use of the extensive range of ground instructional aircraft at Cosford. No amount of classroom work can replace the hands-on experience of working on a live aircraft, of which the Jet Provost has perhaps become the workhorse of the training fleet. The Jet Provost is an ideal airframe on which to allow trainees to practice fitting and removing structural components, and for basic instruction on aircraft systems, whilst system equipment removal and testing, including engine running, are practised on the Jaguar.

The most modern training aircraft at Cosford





Above: *Seen here at Halton before moving to Cosford in September 1993, propulsion training now uses the Adour engines from the instructional aircraft fleet.*

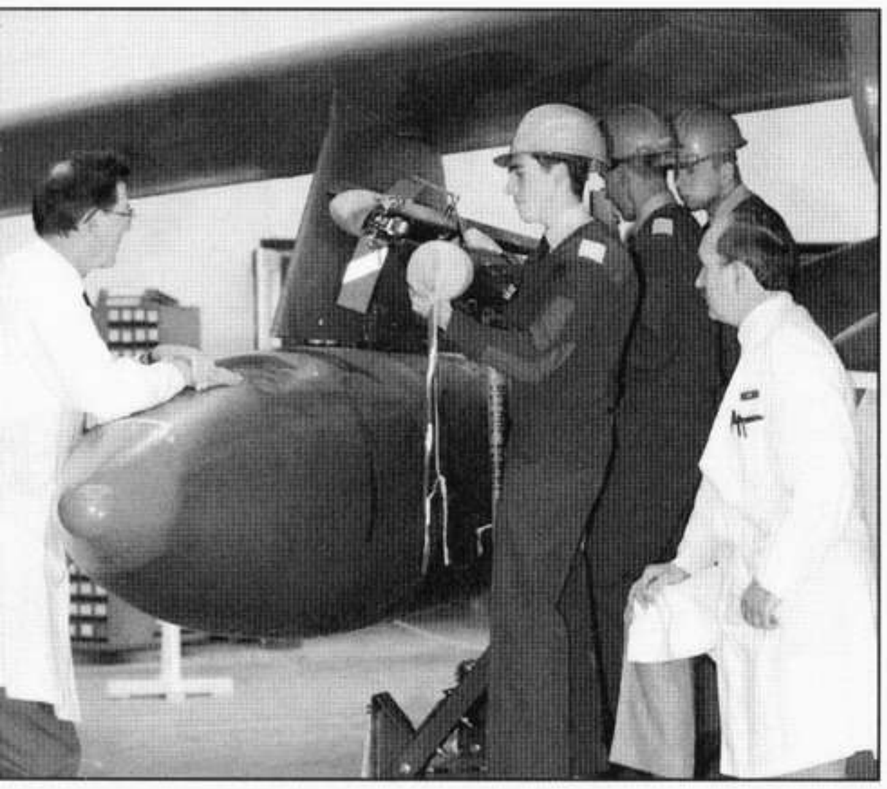
Right top: *The propulsion systems training rig, modelled on the Jaguar and its systems, has also been transferred to Cosford.*

Right: *Now replaced by the Mk T5A variant, the venerable Jet Provost provides mechanics with their first experience of aircraft marshalling.*

is Tornado PO.6 (XX948/8879M), which is used by the weapon trainees for weapon loading training. Avionic trade needs are met by the widespread use of computer-based training aids, which are especially relevant due to the greater use of software-controlled aircraft systems, whilst modern avionic requirements are illustrated by the Jaguar and its systems. The avionic trade instructors look forward to the day when they, too, can get their hands on a Tornado and its integrated avionic systems!

Having looked in some detail at the specific training requirements for each trade, all mechanics must be taught the same flight line procedures and safety precautions, as well as how to carry out aircraft servicing before and after every flight. This is achieved in a separate hangar where a fleet of Jet Provosts is operated just like a front-line squadron. Until 1993, the Jet Provost fleet comprised T3 and T4 variants, but with the withdrawal of the T5A from flying training, the opportunity was taken to upgrade the entire fleet. Complete realism is the order of the day, and the aircraft are taxied into and out of the flight line on simulated sorties by specially trained SNCO instructors. This final practical phase of the course lasts some three weeks, after which the trainee departs for his first tour on an operational unit.

Below: *A development-batch Tornado is utilised for weapon loading practice.*



The tradesman or woman next comes into contact with Cosford about two years or so after completing BT when, if they have performed well enough in the squadron environment, they return for FT. The FT course marks the transition from semi-skilled to skilled employment, and Junior Technician rank is awarded on successful completion of the course. Apart from the FT course for the Avionic trade that lasts for 60 weeks, the majority of the FT courses are in the region of 40 to 45 weeks in duration. On these courses the students are given a greater depth of instruction on aircraft and system technology, especially in the areas of fault diagnosis, repair and testing.

Typical of the instructional tasks included in FT is the stripping and reassembly of an Adour engine on the Propulsion course, whilst the Weapon students remove and service ejection seats and their components. Much of the propulsion systems training is done on a specially made rig based on the Jaguar that was moved to Cosford from Halton. Within FT more use is made of computer-based training aids and system maintenance trainers, which are often configured around the Tornado's systems. Much use is made of the Jaguar and, for the future, it is probable that Cosford will eventually see the arrival of a small number of Tornados. The demonstration of integrated avionics systems will become especially important as the RAF begins its preparations for the Eurofighter 2000 at the turn of the century.

With the next generation of aircraft in mind, we come to AFT, an essential building block if the RAF is to cope with the new, high-technology aircraft and systems on the horizon. It is essential that the RAF develops its best technicians, channelling them though a demanding, academically orientated course designed to enhance their analytical and diagnostic skills. This requirement is achieved by AFT, which is given to selected Corporals at or near the point of promotion to Sergeant. As a largely academic course, AFT includes little aircraft-based training, although the whole of the course is related to aircraft and their systems. Such is the standard of the course that it has now been accredited by the Business and Technical Education Council for the award of its Higher Certificate.

Graduates of the AFT course would expect to go to specially identified duties where their newly found skills can be put to good use. Typical of such appointments are posts on the project teams for the introduction to service of new aircraft and weapon types, some of which are located overseas, and on the software maintenance teams that support the integrated avionics systems of modern military aircraft. The pool of AFT graduates is seen as the RAF's core of technological skill and expertise, in much the same way as the former ex-Apprentice, which is also likely to provide a number of skilled officers for the Engineer Branch.

Now that the transfer of all aircraft engineering training to Cosford is nearly complete, the station's key role in sustaining the RAF's operational capability is clear. With ever-more complex technology and aircraft systems on the horizon, the RAF's need for capable tradesmen and tradeswomen has never been greater. Cosford is undergoing substantial change to allow it to meet the challenge, and carry the mantle of No 1 School of Technical Training into the next century.



The Green Elephant goes rotary

Towards the end of 1993, No 240 Operational Conversion Unit – the RAF's Puma and Chinook training unit – received both a new title and a new version of the Chinook helicopter. **Patrick Allen** reports from RAF Odiham.



In line with the policy to allocate squadron numbers to the RAF's advanced flying training and operational conversion units, No 240 OCU took over the title of No 27 (Reserve) Squadron on 1 October 1993. Up to this date No 27 Squadron had its famous 'Green Elephant' badge on the fins of Tornado GR1s operating from RAF Marham, Norfolk. With the retirement of Buccaneer S2s from No 12 Squadron at RAF Lossiemouth the Tornados were transferred to this squadron and adopted its identity. This left No 27 Squadron's number-plate available for re-allocation to RAF Odiham's long established helicopter training unit. First formed on 5 November 1915 (RFC) at Hounslow Heath, No 27 Squadron flew the Martinsyde G100 Elephant for almost two years, the aircraft name being adopted as the centre-piece of the Squadron's badge. Today this 'Green Elephant' logo has replaced the familiar No 240 OCU 'Hummingbird' painted on the Squadron's Pumas and Chinooks.

First delivered to the US Army in 1961 (CH-47A), the RAF has been operating the Boeing-Vertol Chinook HC1 medium lift helicopter since 1981. During the intervening period Boeing Helicopters has developed a Chinook modernisation and improvement programme for the US Army, who operate over 420 Chinooks in three different variants. In April 1985 Boeing received one of the largest multi-year contracts in the US Army Aviation history to remanufacture and modernize the Army's entire Chinook fleet to the latest advanced CH-47D standard. This up-date programme includes improvements to the helicopter's systems that enhance its capabilities and reliability (by about 30%) whilst reducing support and operating costs and provides the US Army with many additional benefits of a new medium-lift helicopter.

With the US Army no longer operating a similar version of the Chinook to the RAF's CH-47C/CH-114, it was predicted that the cost to the RAF of supporting an ageing Chinook fleet would become unacceptably high beyond 1996.

It prompted the RAF to take a close look at the US Army's Chinook modernisation programme, which resulted in the Ministry of Defence and Boeing Helicopters signing a $224 million contract in 1990 to update the RAF's fleet of 32 Chinook HC1s to the new HC2 standard. The mid-life up-date is similar to the US Army's

Top: *Second RAF Chinook to undergo conversion to HC2 standard was ZA681.* Above: *Helicopter support for the Army as a Chinook HC2 prepares to lift a 105mm Howitzer.* All photographs Patrick Allen

advanced CH-47D configuration. The first RAF Chinook HC1 (ZA718) was returned to the Boeing factory at Philadelphia for conversion in 1992. Remaining aircraft in the fleet have followed at a rate that has allowed the RAF to maintain an adequate Chinook operational capability with its three squadrons.

Although externally similar to the HC1, the RAF's Chinook HC2 is effectively a brand new helicopter, with many new and improved systems and components. Having been completely dismantled they are then rebuilt and returned as zero-timed airframes, without regard to their prior history or flight hours. Major improvements include a new, uprated, 7,500shp transmission and drive system. This has helped to increase the aircraft's emergency single-engine performance and includes several additional safety features. A simplified and improved modular hydraulic system reduces the risk of leaks and also improves reliability, while a new maintenance panel located in the aft cabin, provides 26 separate monitoring and inspection functions. This monitors the helicopter's hydraulics, transmission and engines, helping to ease maintenance and thereby improving the diagnostic process in the event of a malfunction. Other features include a redundant and improved electrical system, additional generator and an uprated auxiliary power unit (APU) which provides hydraulic and electrical power for ground operations. The Automatic Flight Control System (AFCS) and an improved cockpit layout helps to reduce the pilot's workload.

One major change to the 'new' Chinook involves the powerplant. The original Lycoming T55-L-712Es are removed and sent to the RN Aircraft Yard at Fleetlands, Hants for rebuilding to the new enhanced T55-L-712F standard. This involves replacing the 'hot' end of the engine to allow higher temperatures and increased engine performance. Also a new Full Authority Digital Electronic Control (FADEC) system is fitted, replacing the old hydro-mechanical fuel system by an advanced digital engine control system. The UK designed dual-channel FADEC has significantly improved engine response times that enhances power management throughout the engine operating range and increases the helicopter's response and handling characteristics. FADEC has replaced the need for the pilot to operate 'beep' switches on the collective to help control engine torque and rotor (NR) speeds. FADEC automatically matches engine torques or engine temperature and provides complete engine power management, together with precision rotor speed control throughout the operational flight envelope. This provides automatic emergency single engine performance should one engine fail. The system has improved engine power control that helps to save fuel while reducing life-cycle costs. Recent figures suggest that FADEC will give the new Chinook a 600% increase in engine reliability over the older CH-47C power control system, whilst engine related life cycle cost will be reduced by 40-50%.

The first Chinook HC2 conversion (ZA718) returned to the UK on 20 May 1993 and was delivered to A&AEE Boscombe Down, for the necessary Controller of Aircraft (CA) release trials with the Rotary Wing Test Squadron. The second Chinook HC2 (ZA681) arrived at RAF Odiham on the 10 September 1993, to be followed at monthly intervals by the remainder of the fleet. In January 1994 the last RAF Chinook HC1 returned to RAF Odiham from the Falklands for its MLU preparation and







Above: *The 'Green Elephant' badge now appears on No 27(R) Squadron's mixed helicopter fleet of Pumas (left) and Chinooks (right).*

scheduled departure to the USA in May 1994. This aircraft will return to the UK in the Spring of 1995, thus completing the RAF's Chinook MLU programme.

As the first Chinook HC1s began to return to Boeing Helicopters the 242 OCU's Chinook Flight disbanded at RAF Odiham in June 1992. During the MLU programme the decision had been taken to discontinue training new RAF Chinook crews. However, a number of ad-hoc Chinook conversion courses were run by former OCU Instructors posted to No 7 Squadron, also based at Odiham. In all, approximately 12 pilots and eight Crewmen were trained on No 7 Squadron between June 1992 and August 1993. These included Chinook conversion courses for the new Commanding Officers of Nos 7, 18 and 78 Squadrons.

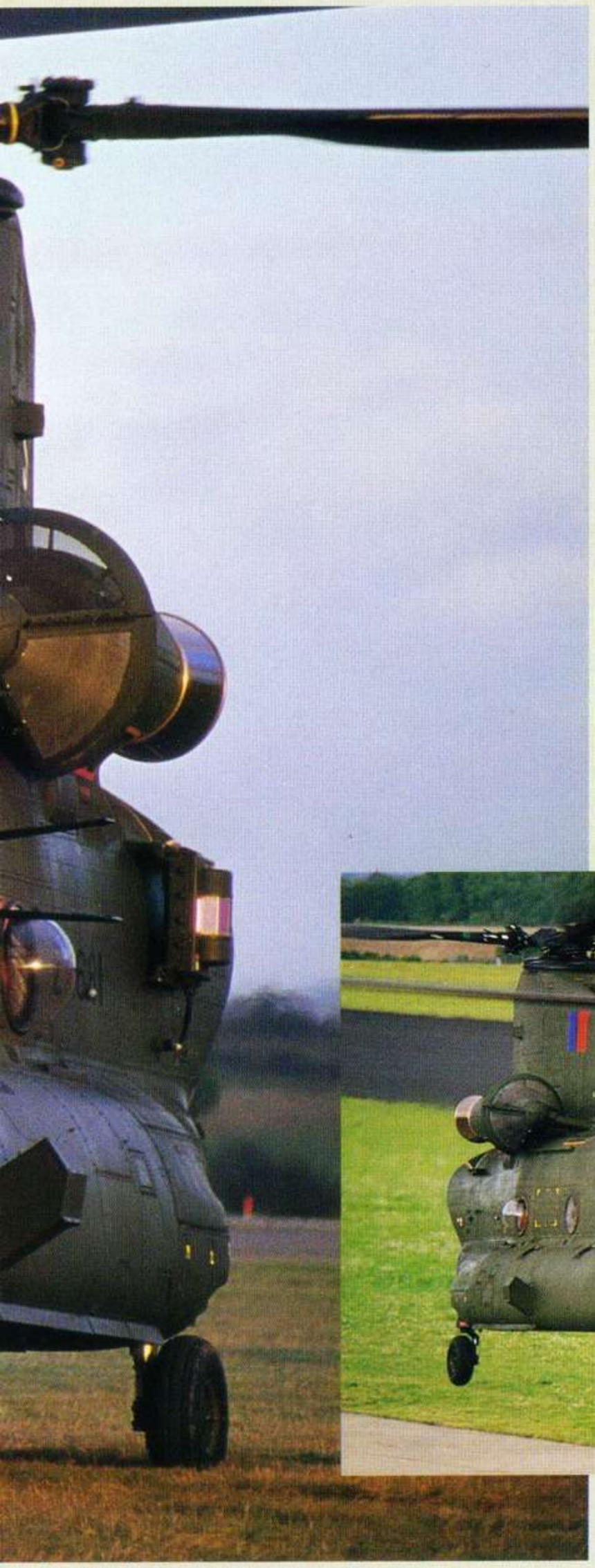
During the stand down period the Commanding Officer of the OCU Chinook Flight, Squadron Leader David Morgan along with Flight Lieutenant Chris Taylor and a small team from the OCU, began designing the new Chinook Transition and Conversion courses. This included a new Chinook navigator syllabus and Ground School training programmes. The Chinook Maintenance School, responsible for the training of RAF Chinook engineers and technicians, was also busy re-writing its syllabus around the new helicopter and its uprated powerplant. As part of the MLU programme over 300 Chinook manuals, which are needed to support and maintain the aircraft, were re-written and improved.

Sqn Ldr David Morgan and his team visited Boeing Helicopters at Philadelphia on several occasions to check through the new flight reference manuals, accept new aircraft and provide the main contact between the customer and contractor. During August 1993 they also undertook Boeing's ten-hour Chinook conversion course, under the instruction of Boeing's Senior Test Pilot, Ron Mecklin. Prior to this Ron had visited Boscombe Down to convert the A&AEE test pilots on the newly delivered ZA718.

No 240 OCU became No 27(R) Squadron on 1 October 1993 and in January 1994 the new Chinook Flight reformed at RAF Odiham with a compliment of seven pilot, three navigator and six crewman instructors. Until May 1994, the Odiham Chinook HC2 fleet will be pooled and shared between Nos 7 and No 27(R) Squadrons. The first Chinook HC2 transition training began in late November 1993 as No 27(R) Squadron began to convert the existing RAF Chinook HC1 crews. Not classified as a true conversion course, the transition syllabus involves four hours 'hands-on' flying per pilot. Crews are trained together (ie two pilots and two crewmen) with each pilot spending eight hours in the cockpit learning the aircraft's new systems and procedures. Crewmen training includes instruction on the aircraft's new maintenance panel with its comprehensive selection of captions, filter lights and pressure gauges. As he now monitors many of the aircraft's systems, the crewman's role is more important in operating the Mk2.

Chinook pilots and crewmen also undertake a comprehensive training package on the British International Helicopters' Chinook simulator based at nearby Farnborough. This simulator has been updated to the Chinook HC2 standard to include both the FADEC and the maintenance panel. Ab initio Chinook training resumes at RAF Odiham in July 1994, with the final Chinook HC2 returning to the UK in the spring of 1995. In September 1993 the MoD ordered a further three new-build Chinook HC2s and in November the possibility of further Chinooks being ordered (alongside some EH101s) was announced.

The versatility and excellent lifting capability of the RAF's Chinooks has become increasingly important to the Army as it moves towards more mobile and flexible force operations. The 'new' version of the helicopter, together with the high quality training provided by No 27(Reserve) Squadron, means that the RAF is well placed to provide the Army with the very best in helicopter support well into the 21st century.





Above: *Chinook HC2 ZA681 touches down at RAF Odiham at the end of its delivery flight on 10th September 1993.*



Above: *No27(R) Squadron's Chinook HC2 transition syllabus, which began in November 1993, involves four hours 'hands-on' flying by each pilot.*

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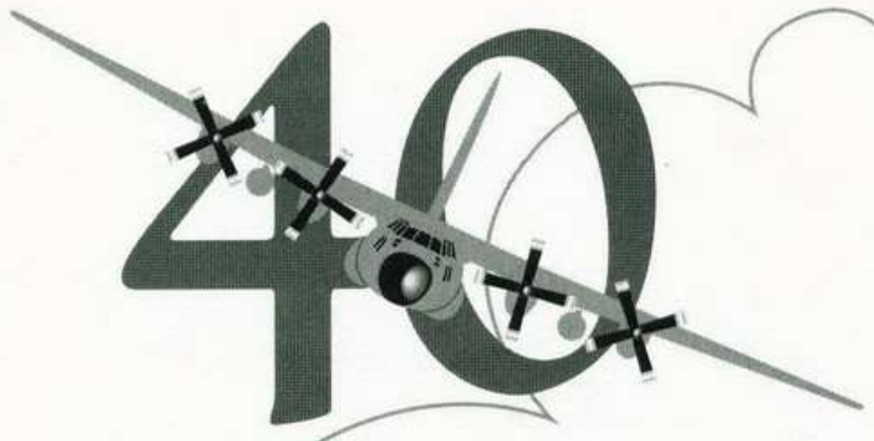
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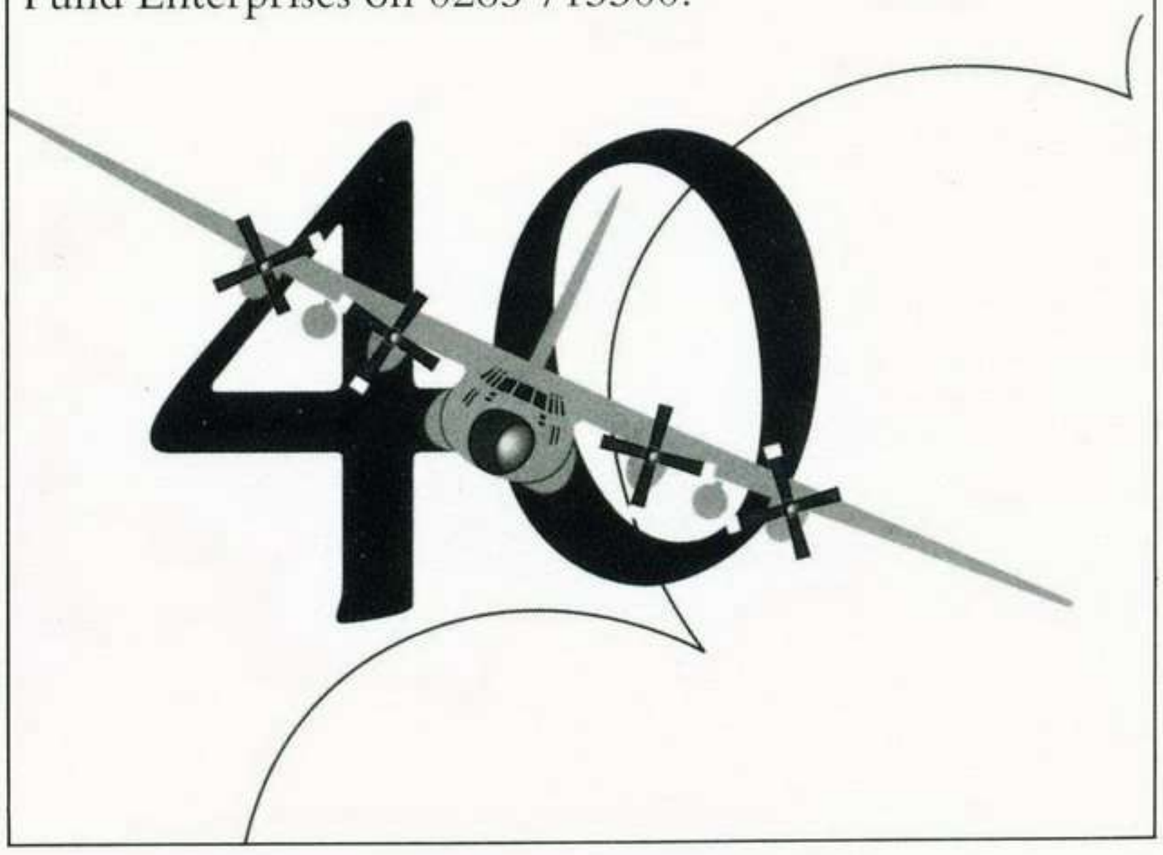
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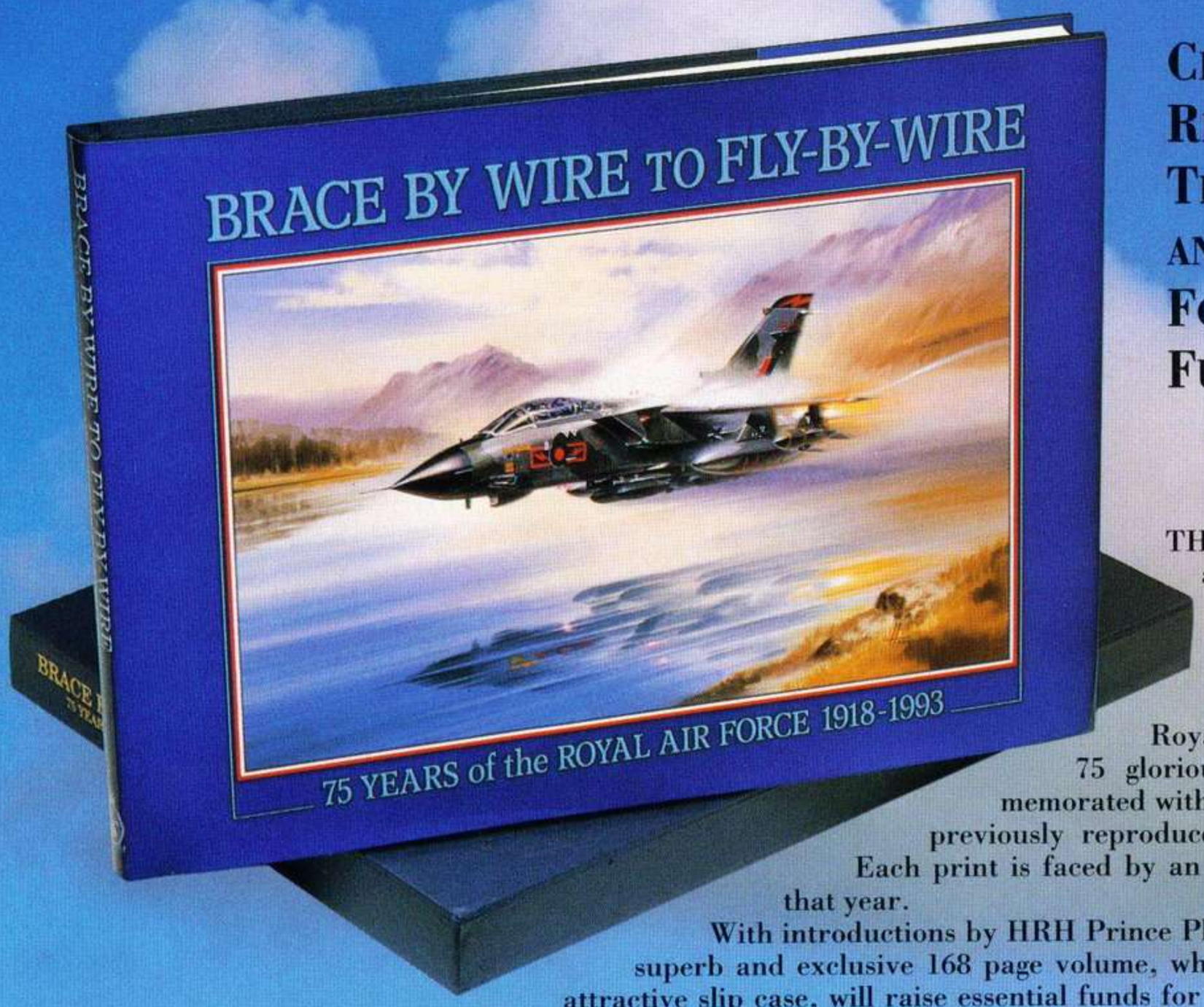
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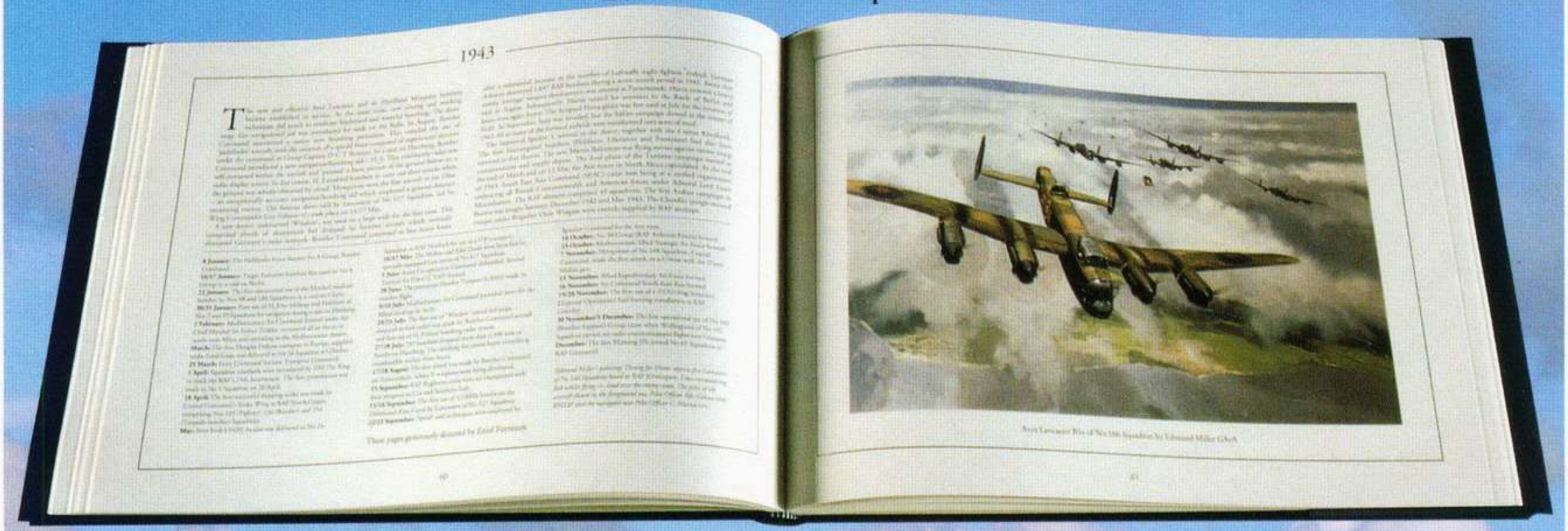


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REDS 'FLY THE FLAG'

Last September the RAF Aerobatic Team *The Red Arrows* departed from Scampton for their longest display tour for many years – a five week visit to the USA. Taking 11 Hawks with them and supported by a Hercules C3 from Lyneham crewed by Nos 24 and 30 Squadrons, the team commenced their public displays at the opening event for the new Denver International Airport, in Colorado. A huge crowd of over 300,000 people attended the weekend air show that also featured the USAF's *Thunderbirds* team flying F-16 Fighting Falcons and the Canadian *Snowbirds* flying CL-41 Tutors. The *Arrows'* majestic display was greeted enthusiastically by the crowd who inevitably made very favourable comparisons with their own national team.

And that was the pattern throughout the tour, with 'rave notices' in the press and solid appreciation from many thousands of spectators.

After Denver it was south to Nellis AFB near Las Vegas and the searing heat of the Nevada Desert, followed by a much chillier venue at Salinas, California. Here, in the misty conditions, the *Arrows* found themselves thrust to the top of the bill as the *Thunderbirds* team was grounded following injury to the leader when he fell from a ladder.

This star billing was to be repeated twice more as the *Red Arrows* took Texas by storm. But first there was a brief stop and display at Alliance Airport just outside of Forth Worth. This newly constructed cargo airport, one of Ross Perot's enterprises, has extensive concrete aprons on which the RAF team and accompanying Hercules could be lined up to be viewed by the crowd. The fact did not escape the media that the *Red Arrows* were not only replacing the *Thunderbirds* but also another star item – a Russian Antonov An-124 transport











Top: *The Red Arrows depart from Ellington for New Orleans as the troops move out for the WW2 set-piece.* All photographs Peter R March

Above left: *The* Reds *salute to the Dambusters – the Lancaster Bend 'with one engine on fire', appropriately over the Canadian Lancaster.*

Above: *Generations apart – Red Arrows in Concorde formation over the vintage warbird park with two B-17 Flying Fortresses at Wings over Houston.*

Inset: *The Arrows complete their performance at the Alliance show with the familiar bomb-burst.*

Left: *Time to relax and watch the rest of the show at the big Alliance airshow.*

ROYAL AIR FORCE

RAF IN THE USA 2

Peter R March



Above: *Like all the pilots and groundcrew, Red Arrows team leader Sqn Ldr Adrian Thurley was beseiged by autograph hunters after the display at Fort Worth.* PRM

that had not shown up. The *Arrows* made headline news for the three days prior to the Forth Worth International Air Show and as a result, according to the organisers, attracted "the biggest crowds on the two days that we have ever seen".

Next it was across the Gulf of Mexico to the historic town of New Orleans for another two-day show. This event was at the Naval Air Station and somewhat lower key than the big events in Texas. However, they were the focus of a TV crew who were making a documentary about the team.

One of the USA's major air shows, the Wings over Houston Air Show at NASA's Ellington Field, was suffering the same problem as other Texas events – the loss of the *Thunderbirds*. A request to the British Air Attaché in Washington and the happy chance that the AOC Support Command was in the USA at the time, produced the answer that the Wings show wanted – that the *Red Arrows* could appear. This in itself was to create a newsworthy item – the US teams are only permitted to do one display a day and are not permitted to transit on a show day. The *Red Arrows* were quite happy to position to Houston after their performance at New Orleans; display on the Sunday in Texas and return to New Orleans to close their show. As the local newspaper put it in Thursday's edition – '*Thunderbirds* pull out of airshow', to be followed on Friday by 'RAF *Red Arrows* to the rescue'. After an excellent build up on local TV and radio the crowds turned out in their tens of thousands for what was now billed as the *Red Arrows Airshow* on Sunday.

The display director – Ralph Royce from the nearby Lone Star Museum in Galveston and a regular visitor to UK air shows – hit upon the novel idea of opening the Sunday with an hour long 75th anniversary salute to the RAF. As well as the *Reds* there was a visiting Nimrod MR2P from Kinloss-based No 120 Squadron making a return visit after a very popular debut in 1992. The 'Battle of Britain Flight' had an even more novel twist. As in the UK the flight was led by a Lancaster – the Canadian Warplane Heritage example all the way from Hamilton, Ontario, and at its wing-tips were Bill Greenwood's much travelled Spitfire T9 (one of the participants in the 1968 Battle of Britain movie) and a worthy Hawker stand-in for a Hurricane, Howard Pardue's ex-Iraqi Fury FB10.

Needless to say this was very popular with the crowd who continued to applaud the *Red Arrows* long after they had landed. After the Wings over Houston event the appreciative organisers set to work seeking sponsorship for the team's future return visit to the USA. "We want the best at Houston - we want the *Red Arrows* again", was the comment from Lou Lewis, the show's media co-ordinator.

The final display at New Orleans was the last of the public appearances on the tour. Squadron Leader Adrian Thurley, the pilots, manager, commentator, engineers and support staff now faced the long journey back to England. But first there was a private show to perform at Andrews AFB, Washington for British Embassy, White House and Pentagon invited guests. This was the *Red Arrows'* 2804th display since their first performance in 1964 and the last of the 1993 season. It was also Adrian Thurley's final appearance leading the team having completed his three-year tour of duty. He summed up the *Red Arrows'* impressions of their five weeks away from Britain for RAF News in these words: "Our displays were something most Americans had never seen before and the reaction of the public was fantastic. We have signed thousands of autographs and shaken hands with countless well-wishers. I think the Americans will remember the *Red Arrows* for a long time."

RED ARROWS DISPLAYS 1994

A new year, a new team leader and three new pilots – the *Red Arrows* will be as busy as ever in 1994, their 30th display season. Squadron Leader John Rands, previously a member of the team in 1987-89, is joined by Flight Lieutenants Spike Jepson, Kelvin Truss and Mark Zanker making their debuts. A provisional list of *Red Arrows* displays for 1994 follows. Please note that this list is liable to alteration.

22 May	Barton
28 May	Bangor
28-29 May	RAF Mildenhall
29 May	Portsmouth
30 May	Truro
3 June	RAF Odiham
4 June	Plymouth Hoe
4-5 June	Southend
5 June	Southsea Common
7/9 June	Isle of Man
11 June	Rutland Water
11 June	Wroughton
12 June	Vaerlose, Denmark
12 June	Gardermoen, Norway
13 June	Aberdeen
18 June	RAF Locking
18-19 June	Biggin Hill
19 June	RAF Cosford
25 June	Woodford
25 June	RAF St Athan
26 June	Ovar, Portugal
2 July	Humberside
3 July	Koksijde, Belgium
5 July	Dover
6 July	Shepway
7 July	Portsmouth
9 July	RAF Chicksands
10 July	Silverstone
15 July	Llandudno
16 July	Abingdon
16 July	RNAS Yeovilton
17 July	Bruntingthorpe
17 July	RAF Church Fenton
17 July	Pontefract
21 July	Ayr
22 July	Porthcawl
23 July	Luxembourg
24 July	Flanders, Belgium
24 July	RAF Manston
26 July	Lyme Regis
27 July	RNAS Culdrose
27 July	Peterhead
30 July	RAF Leeming
30-31 July	RAF Fairford
31 July	Sanicole, Belgium
1 August	Warsaw, Poland
3 August	Land's End
3 August	RAF St Mawgan
4 August	Bournemouth
5 August	Bristol
17 August	Cromer
17 August	Weymouth
18 August	Plymouth
18 August	Fowey
19 August	Torbay
20 August	Eastbourne
21 August	Halmstad, Sweden
25 August	Clacton
26 August	Dartmouth
27 August	Buochs, Switzerland
28 August	Carlisle
28 August	Leicester
29 August	Elvington
29 August	Hoylake
2 September	Cleethorpes
3 September	RAF Benson
4 September	Southport
4 September	Antwerp, Belgium
6 September	Newquay
10-11 September	Farnborough
11 September	Duxford
15 September	Guernsey
15 September	St Helier
17 September	RAF Finningley
17 September	RAF Leuchars
18 September	Cranfield

D-DAY





Above: *A Mustang from No 430 Sqn, RCAF, on a battlefield tactical reconnaissance sortie.*
James D Oughton Collection

Lindsay Peacock looks back 50 years to D-Day and the planning involved.

By June 1944, the tide of battle in World War 2 had shifted as the combined might of the Allies began to tilt the balance ever more steadily and inexorably against Germany. In the east, the *Wehrmacht* was taking a fearful hammering from the Red Army – in the west, massed formations of bombers struck deep into the German homeland by day and night, while fighters and fighter-bombers ranged freely over occupied territory.

Even though it could weaken the resolve to continue with the fight and simultaneously decimate a nation's ability to arm itself, it was evident that air power alone was not sufficient to inflict final defeat. Something more was needed – and that something began in the dawn light of 'D-Day' on 6 June 1944 when Allied troops stormed their way ashore in Normandy to open the long awaited second front. Within a year of those landings taking place, Adolf Hitler had died by his own hand and the much vaunted 'Thousand-Year Reich' had been vanquished.

While it ultimately took less than a year to defeat Germany, the first real steps on the path to eventual success were actually taken in April 1942, just over three years before the final battle was won and victory was assured. It was in that month that the first tentative US-conceived proposals for invasion were considered in London and there were many setbacks to be endured by the Allies during the long gestation period that culminated in the successful execution of Operation *Overlord*. In the spring of 1942, however, there just were not sufficient resources available to guarantee success, it being recognised that any landing would require the use of an overwhelming force.

Almost exactly a year later, the military situation was much more favourable to the Allies and it was in April 1943 that detailed planning got under way for an enterprise that was at first referred to as *Round-Up*. In the event, this was just one of several code-names used during the planning phase, others being *Super-Round-Up*, *Round-Hammer* and *Rudge*. Ultimately, it became Operation *Overlord* and General Dwight D. Eisenhower was appointed as the Supreme Commander Allied Expeditionary Force or 'SHAEF', with Air Chief Marshal Sir Arthur Tedder of the RAF as deputy.

Inevitably, such an ambitious undertaking required meticulous preparation and the preliminary planning identified four main phases as pre-requisites for success. In broad terms, these were: the strategic bombing of Germany; the attacking of targets such as railways, coastal defences, harbours and air bases in and adjacent to the designated landing area during the lead-up to invasion; the assault phase itself and, finally, a continuation of the first two as the ground forces consolidated their foothold and broke out of the bridgehead.

It should come as no surprise to learn that air power was essential throughout this enterprise, but one of the first significant actions involved the expenditure of nothing more offensive in nature than film, since it was necessary to survey potential landing areas and determine which sites offered the greatest hope of success. As a result, a considerable amount of effort was expended in a detailed study of the French coastline and suitably configured aircraft – including RAF photo-reconnaissance Spitfires and Mosquitos – most definitely played a key role in the early stages. In addition to covering likely landing zones, they also gathered valuable intelligence on German defences, which were also a factor to be considered in planning for the return to the European mainland.

The reconnaissance task seldom receives any of the recognition it so richly deserves, but there can be no doubt that it was a hazardous mission, nor that it made an immeasurable contribution to ultimate success. Eventually, as is well known, the planning staff opted for Normandy as being best suited for a landing in force and once that decision had been taken, it was only a matter of time before the emphasis of air operations shifted to those of a much more offensive nature.

As far as preparing the immediate area in which the invasion would take place, the first sorties were launched in early March 1944, although the softening-up process did not really begin in earnest until April. British and American heavy bombers were very much in the forefront, especially in the offensive that was waged against the railway network throughout April and May, when they repeatedly struck at major centres, yards, depots and repair facilities. Even though this began fairly slowly, by D-Day, a combined total of just over 66,000 tons of bombs had been dropped on some 80 targets in France and Belgium. This weight of ordnance achieved the desired objective of causing huge disruption and, in conjunction with forays by fighters and fighter-bombers against locomotives, rolling stock, bridges and the like, it effectively isolated Normandy from the rest of France by the time that the invasion armada set sail.

Fighter interdiction was by no means limited to the railway, for there were plenty of other targets to be dealt with – radar sites, signals intelligence facilities, communications centres and so on – and these too were hard-hit in the two months leading up to D-Day. Indeed, on 6 June, less than 20% of the enemy's radar in north-west France was capable of use and even that modest figure was further degraded during the early hours of the invasion, to a point where only 5% was operable. As a consequence, the

The beginning of the end





defending forces had been more or less rendered electronically 'blind' and were thus unable to receive any advance warning of the impending assault on 'Festung Europa'.

Strenuous efforts were also made to try and blunt the capability of the Luftwaffe, with virtually every airfield within a 150-mile radius of Caen being attacked. Initially, this work concentrated on denying use of maintenance and repair facilities, before shifting to runways, hangars and parked aircraft. Since this involved raids on about 100 airfields, it should be obvious that the effort was significant and made a considerable contribution to the 200,000 sorties flown by Allied aircraft in the two-month period directly preceding *Overlord*.

A further idea of the magnitude of these operations can be gained from the knowledge that roughly 200,000 tons of bombs were expended, although it should be noted that many targets outside the invasion area were also struck. This was done specifically to avoid betraying the fact that Normandy had been selected as the landing site for the upcoming invasion. By way of illustration, when attacking coastal gun defence sites, Allied aircraft made a point of hitting two targets outside the Normandy region for every one that lay inside it. Thus, the German defenders were unable to determine any general pattern to the aerial assault and, more importantly, any specific area of interest.

At the beginning of June, the Allies were ready and raring to go and it must have been hugely frustrating for everyone who was privy to the planned date when the fine and settled weather of May gave way to a succession of depressions sweeping in from the Atlantic Ocean. In the event, it deteriorated to the point where it became necessary to postpone

Left: *Attacks by German warships on the Allied landing and support vessels were countered by Coastal Command strike aircraft, such as this Beaufighter of No 455 Sqn, RCAF.* James D Oughton Collection



Paratroops of the 22nd Independent Parachute Company boarding a No 295 Sqn Albemarle at Harwell in the early hours of D-Day, June 6, 1944. James D Oughton Collection

the landing by 24 hours. At that time, the forecast indicated that it might slip still further, by another day – or even two, whereupon a two-week delay might ensue before conditions would again be favourable.

On the afternoon of 4 June, however, the situation showed signs of improvement, with the forecasters predicting a break in the unwelcome conditions that prevailed. This indicated that a 'window of opportunity' might present itself for a period of about 24 hours starting early on 6 June. Barely 12 hours later, in a conference of senior officers which began at 0415 on 5 June, Eisenhower took the fateful decision to execute *Overlord* – the invasion was 'on' . . .

For the Allied Expeditionary Air Force (AEAF), there were just two main objectives on D-Day. One was to deliver parachutists and glider-borne forces to secure the flanks of the invasion area; the other was to provide air cover for the Normandy landings. As far as the RAF was concerned, the first of these was quite an ambitious undertaking and responsibility for transporting the 6th Airborne Division to its operating area (near Benouville on the left flank) was shared by Nos 38 and 46 Groups.

The first aircraft away were half-a-dozen Albemarles, which departed from Harwell just after 2300 hr on 5 June with No 22 Independent Parachute Company. They were intended to function as pathfinders and were

Left: *US Ninth Air Force Douglas A-20 Havocs bombed targets ahead of the advancing Allied armies.* James D Oughton Collection

Below: *American troops deplaning from a British Airspeed Horsa Mk I glider during the Normandy landings.* James D Oughton Collection







Left: *Dakotas* (top) *and Mitchells were among the many varied types of aircraft that took part in D-Day operations.* Photographs Peter R March

bound for three main drop zones near the River Orne, where the paratroops would position lights and beacons as markers for the main force that was to follow. As it turned out, problems in identifying the drop zones resulted in some elements being deposited in the wrong area, which gave rise to some confusion when the main body of the 3rd Parachute Brigade arrived soon after aboard 108 Dakotas. The night's other large paradrop involving British soldiers passed off much more smoothly, with the bulk of the 5th Parachute Brigade being delivered to the correct zone by a fleet of 129 aircraft.

On the whole, then, the operation was carried through with reasonable success, allowing the airborne forces to accomplish most of their missions. For the personnel of Nos 38 and 46 Groups, the period at the start of D-Day was indeed hectic, since between them they despatched no fewer than 264 aircraft (Albemarles, Dakotas, Halifaxes and Stirlings) and 98 glider combinations. In total, they dropped 4,310 paratroops and delivered another 500 soldiers by glider along with 17 artillery pieces, 44 jeeps and 55 motorcycles. Inevitably, there were casualties, with seven aircraft and 22 gliders lost to various causes.

As the airborne forces were being flown into action, the main landing force was approaching the Normandy coast. In the meantime, well to the North at the narrowest part of the Channel, Lancasters of Nos 218 and 617 Squadrons were playing a full and active part in Operation *Taxable*. This was a 'spoof' operation involving sea and air elements that was designed to mislead the German defenders into believing this section of coastline was the focal point for an Allied invasion. It required aircrew to fly a precise steadily advancing orbit for several hours while ejecting bundles of 'window' or chaff at regular intervals, with a view to producing a radar image of a fleet of ships approaching the coast along a 14-mile front. In consequence, several key enemy radar installations in the area had deliberately been left undamaged specifically to 'detect' this fallacious fleet.

Elsewhere, near Yvetot, Halifaxes and Stirlings from three more squadrons were busily dropping dummy paratroops and an assortment of pyrotechnic devices to convey the impression of an airborne assault in force, an objective that was evidently met. Equally significant was a much larger contribution made by Bomber Command, which despatched over 1,000 aircraft to deposit more than 5,000 tons of bombs on ten coastal batteries covering the vital beaches, causing most of them to remain silent during the first critical moments of the landing when Allied troops began fighting their way ashore as dawn broke.

On some beaches, the incoming forces met little opposition and were able to move inland relatively swiftly as they sought to consolidate their foothold and secure their positions. On others, they were met with fierce and determined resistance and nowhere was this more apparent than on 'Omaha', where US troops were pinned down for several hours and sustained heavy casualties.

While the forces on 'Omaha' struggled to overcome staunch opposition, in the skies above Normandy, Allied fighters and fighter-bombers roamed freely in search of targets and responded to the surprisingly limited number of requests for air support. The RAF contribution alone numbered some 171 squadrons, drawn mainly from the Second Tactical Air Force (2nd TAF) and Air Defence of Great Britain (ADGB) commands. Examples of the Mustang, Spitfire and Typhoon were predominant during the day and the primary task was to prevent the Luftwaffe from interfering with the landings.

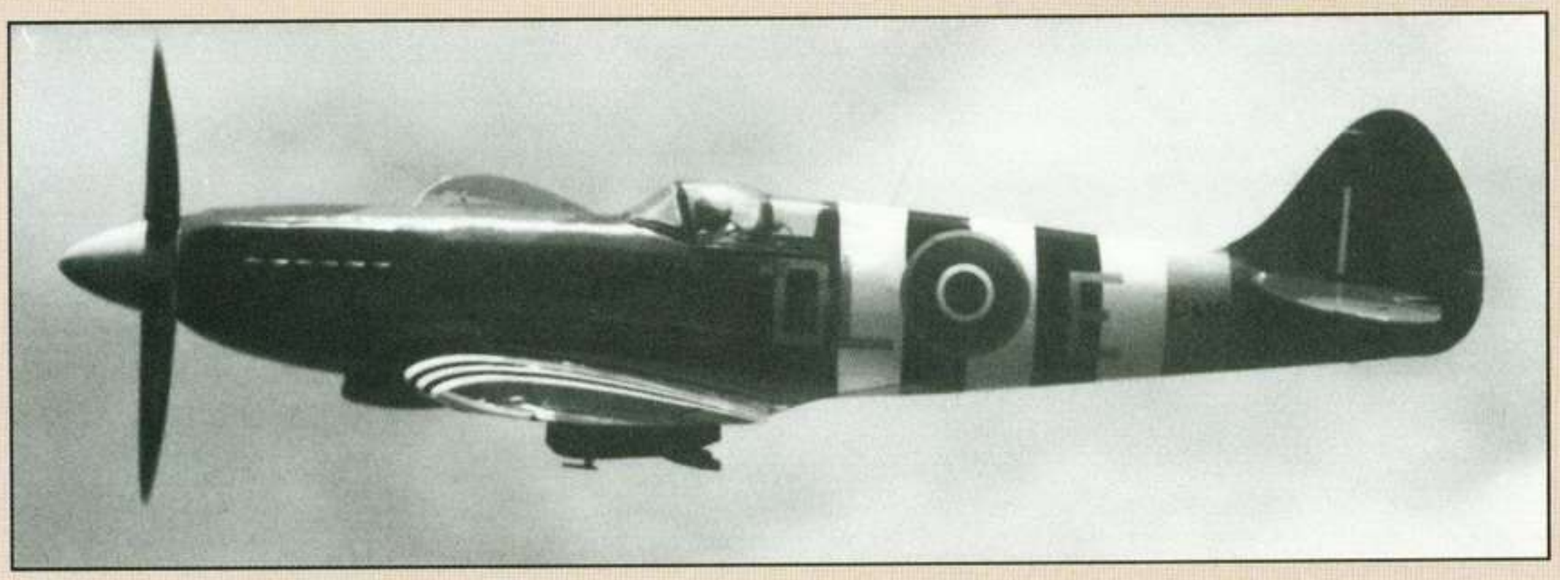
Luftwaffe air bases continued to come under heavy attack, with 2nd TAF fighter-bombers using guns, bombs and rockets to good effect in raids on these installations. In addition, ADGB elements organised standing patrols in the invasion area so as to head-off any attempt the Luftwaffe might make to bomb landing craft and other shipping bound for the beaches as the invading forces poured ashore. At night, similar work was undertaken by radar-equipped fighters, with Beaufighters and Mosquitos from ADGB squadrons being at the forefront of the RAF's nocturnal force.

These operations can only be described as spectacularly successful and the Luftwaffe was probably most notable by its almost complete absence. Indeed, the aerial response was so muted that no less a personage than Air Chief Marshal Sir Trafford Leigh-Mallory (Air Commander-in-Chief, AEAF) repeatedly asked where the Luftwaffe was throughout that tense day.

Whatever the reason for the apparent lack of interest in Allied operations on the Normandy beaches, it should be noted that the Luftwaffe was not completely idle, but the few sorties that were staged achieved little beyond mere nuisance value. Perhaps the best indicator of German inactivity is the fact that only five aircraft had been brought down by the afternoon – four Junkers Ju 88s and a solitary Focke-Wulf Fw 190. That is an extraordinarily small figure when you consider that almost 15,000 sorties (including 5,656 by the RAF) were recorded by Allied aircraft in the 24-hour period ending at midnight on 6 June. Attrition during the same interval was surprisingly and gratifyingly light, with anti-aircraft artillery being responsible for all the 113 aircraft that were lost on D-Day itself.

Apart from fighter forces which continued patrolling in and around the beachhead throughout the night, for the RAF, the day ended pretty much as it had begun, with Nos 38 and 46 Groups again combining forces to perform a major airlift tasking. This was known as Operation *Mallard* and entailed the movement during the evening of some 256 gliders carrying vitally-required reinforcements and supplies for the men of the British 6th Airborne Brigade. Two main landing zones were used – one to the north of Renville and the other between Ouistreham and Benouville – and all but ten of the Horsas and Hamilcars were towed safely to their destinations, courtesy of close escort furnished by a total of 15 fighter squadrons drawn from ADGB's No 11 Group.

By midnight, the great military adventure was making good progress and the Allies had successfully taken the first tentative steps on a long and dangerous journey that would culminate in Germany's unconditional surrender in May 1945. At the time, though, that lay far off in a still uncertain future – and for the planners who conceived *Overlord*, there was still no assurance or guarantee of success. Meanwhile, the war went on . . .



Left: *A Spitfire PR XIX wearing the conspicuous black and white D-Day invasion stripes.* Peter R March

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RAF IN THE USA 3



A pair of Tornado GR1As taking off from Nellis against the impressive desert background. Peter R March

Peter R March visits Nellis AFB, Nevada to look at the RAF's involvement in

RED FLAG's big package

The unpopulated Nevada Desert north of Las Vegas has been the setting for many secret activities – nuclear experiments, testing stealth aircraft and frequent intense air battles to name just a few. The latter originate from Nellis Air Force Base – the home of *Red Flag*, *Air Warrior*, *Gunsmoke* and other dramatic competitions and exercises that have trained US forces and air arms from 20 countries over the past two decades. Early this year the RAF was invited to take part in *Red Flag* 94/2, with the French Armée de l'Air, the US Navy and the USAF.

At the beginning of January 1994 eight Tornados, comprising aircraft from Nos 2, 14 and 31 Squadrons, were flown out to Nellis AFB, escorted by VC10 tankers of No 101 Sqn. *Red Flag* is divided into three, two-week modules, each providing a similar training course. Flying the RAF Tornados were crews from No 13 Sqn during the first two weeks, No 31 for the middle session and No 14 for the third two weeks. Throughout the period there was also a pair of Hercules from No 47 Squadron playing their own inimitable part in the complex exercises over the Nevada Desert Ranges.

Red Flag, part of a series of USAF inspired training exercises that also includes *Green Flag* with intensive electronic warfare for US forces only and *Maple Flag* held annually at Canadian Forces Base Cold Lake, started 18 years ago. Its objective is to train aircrew to fly effectively as part of a composite force and in the words of Col Jim Henderson, the Deputy Commander of the 414th Training Squadron *(Red Flag)*, it is to "maximise combat capability and survivability by realistic training in a combined air and ground environment". It is also a forum for the free exchange of ideas and tactics.

The location of *Red Flag* at Nellis AFB is significant. This sprawling 11,000 acre airfield is situated approximately eight miles north-east of Las Vegas, Nevada on the southern edge of the Nevada Desert, which is virtually unpopulated for 25,000 sq miles. In this desert the USAF has established range facilities and monitoring that is the vital essence of *Red Flag*. The total land area occupied by Nellis and its restricted ranges is more than 4,742 sq miles. An additional 7,700 sq miles of airspace north and east of these ranges is also available for military flying. The air base has two long, parallel runways, extensive parking aprons and plenty of land for hangars and buildings.

On the Nellis Range complex there are more than 1,400 targets, from individual vehicles to large industrial complexes, airfields (with over 100 obsolete aircraft), gun and missile sites and very extensive electronic simulation facilities. Over most of the ranges aircraft can fly down to 100ft at supersonic speeds and launch live missiles and bombs on the designated targets.

In this typical day/night *Red Flag* exercise, flown in the afternoon and evening, friendly Blue Forces engaged hostile Red Forces. The Blues for RF94/2 comprised an interdictor force of eight RAF Tornados (from RAF Brüggen), four FAF Mirage 2000Ns (from Luxeil and Nancy), eight USAF F-16Cs (347 Fighter Wing, Moody AFB), three B-52Hs (5 Bomb



Wing, Minot AFB) and six US Navy A-6E Intruders (VA-165, Whidbey Is NAS). They had fighter escort provided by eight F-15C Eagles (1 Fighter Wing, Langley AFB) and a trio of FAF Mirage 2000Cs plus a two-seat 2000B (from Cambrai and Orange). Suppression of enemy air defence capabilities came from a mix of *Wild Weasel* F-4G Phantoms and F-16 Fighting Falcons of the recently established 561st Fighter Squadron (57 Wing, Nellis AFB).

The Red Forces were made up of home based F-16Cs from the Adversary Tactics Division

(57 Wing), a very experienced pack of 'defending aircraft' – Fighting Falcons configured and flown like *Flankers* and *Fulcrums*. They were supported on this occasion by ten USN F-14A Tomcats from VF-24/211 at Miramar NAS. These aircraft, together with the surface threats provided by simulated SAMs, radar controlled guns and electronic jamming of radars and communications, provided a very hostile operating environment for the attacking aircraft.

Both forces had the services of airborne command and control aircraft – two E-3B AWACS (552 ACW, Tinker AFB) and two E-2C Hawkeyes (VAW-112, Lemoore NAS). Also taking part were four C-130s (two each from No 47 Sqn, RAF Lyneham and 939 RQW, Portland MAP), working with four HH-60G Pave Hawks from the latter USAF unit; two French AF C-160 Transalls (from Toulouse) and a trio of KC-135 Stratotankers (Beale AFB) providing tanker support.

A key part of *Red Flag* is the RFMDS – the Red Flag Measurement and Debriefing System, a computer network which gives real-time monitoring, and post-mission reconstruction of the exercise. Ground sensors all around the ranges interrogate special pods carried by the aircraft, allowing up to 36 combatants to be tracked and recorded simultaneously (altitude, speed, type and amount of ordnance carried and dropped). Less detailed information can be included for a further 100 aircraft. The great value of this is that the full exercise can be played back to the crews in the de-brief with pauses on individual scenarios and even hard-copy print-outs

Below: *Safety reflections as the aircraft are prepared at dusk for the second (night) sortie.* Peter R March

Right: *Bombing up. Heavy work for the No 14 Sqn groundcrew on the* Red Flag *flight-line at Nellis.* Michael Montford

Below right: *As night approaches, a No 14 Sqn Tornado takes-off for an attack mission at low level over the Nevada range.* Michael Montford



produced. Nothing is missed by the RFMDS – it can even reproduce the pilot's view from inside the cockpit and accurately predict whether a claimed kill was achieved or the target actually hit. Each mission's overall effectiveness can be objectively assessed and the lessons learned by everyone involved.

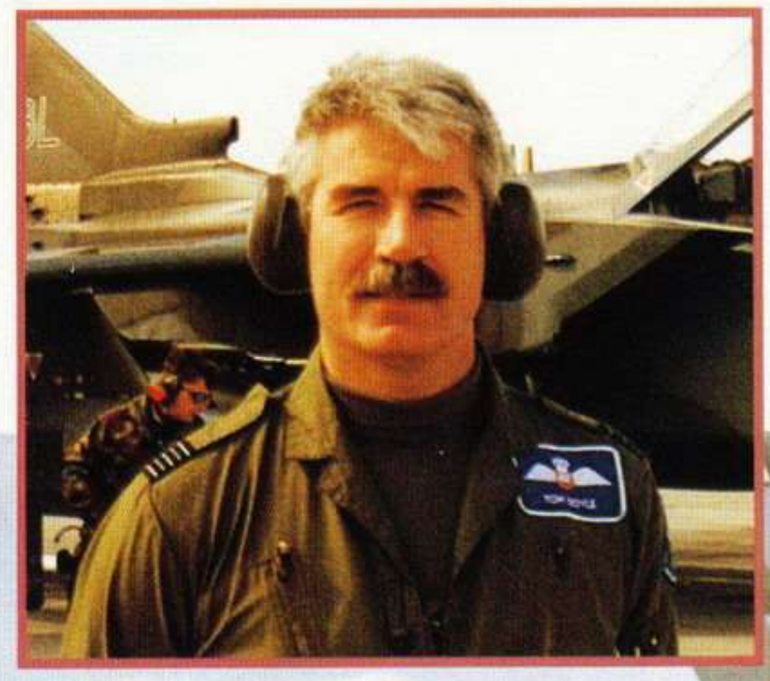
The ten working days (and nights) for the participants, in each of the modules of *Red Flag* 94/2, were very carefully structured to get the most out of the flying. It commenced with a familiarisation flight around the ranges for all of the crews to get them used to the desert scenery and the complex departure and arrival procedures at Nellis. Infringement of the flying rules, particularly where airspace boundaries are concerned, are viewed very seriously and can lead to a crew being sent home.

A series of exercises then follow for the next six days covering anti-terrorist operations, political/power situations, chemical and biological warfare, airfield attack, hostage rescue and nuclear war, at flying levels commencing with 500ft minimum and working down to 100ft or less. The end of the second week concludes with a three-day air campaign – 'all-out big package warfare', where no holds are barred on either side. If a crew is knocked out – they are 'killed' from the exercise. The threats are all stepped up with more and wider electronic jamming and very active enemy defences to overcome.

After the initial familiarisation flight by the individual air arms, the twice daily missions progressively involved the other 'friendly' air arms. The RAF's Tornados were soon planning and carrying out interdiction missions with French Air Force Mirage 2000Ns and USAF F-16 Fighting Falcons and B-52H Stratofortresses. They had air defence cover provided by French Mirage 2000Cs, and USAF F-15C Eagles. The composite force eventually included F-4G Phantom and F-16C *Wild Weasels*, reconnaissance aircraft and a command and control E-3B AWACS.

Wing Commander Tom Boyle the OC of No 14 Squadron had 14 crews, mostly from his own squadron, taking part. They were supported by 95 ground crew from Brüggen and a further 40 from the Permanent Support Party at Goose Bay. To meet the *Red Flag* eligibility rules all of the pilots had 500hr or more fast jet experience; and the crews had to reach a high level of preparation to enable maximum benefit to be gained from the two

Right: *Wg Cdr Tom Boyle, OC of No 14 Sqn, firmly believes in the value of* Red Flag *to his crews – there being no better training aid.* Peter R March













Above: *One of two Hercules C1s from NO 47 Sqn at Lyneham taking off for its part in the day's* Red Flag *activities.* Peter R March

Above right: *A pair of F-15C Eagles from the 1st FW gets airborne to provide fighter escort for the RAF Tornados.* Peter R March

Right: *The French Air Force played a co-operative part in* Red Flag *92/4, flying Mirage 2000s.* Peter R March

weeks at Nellis. What then, in Wg Cdr Boyle's view, were the benefits of the RAF taking part? "For the relatively new, first tour pilot and navigator the learning curve is immensely steep. They are working down to the lowest limits at high speed, in a strange environment, with extensive electronic warfare, serious ground threats, against targets onto which they can drop live ordnance. They are learning to fly as part of a big attack package and when this concludes they have to cope with the complex recovery procedure to land back at Nellis. All the while their performance is being closely monitored from the ground. There is no doubt that they are better experienced aircrew when they return home. On many counts two weeks at *Red Flag* is worth a year's routine training back home".

Wg Cdr Boyle was just as certain about its value for the more experienced crew members. "They benefit from learning about the other nation's approaches to the many issues that emerge at *Red Flag*. Some of our crews showed themselves very capable of planning and leading packages. They have been able to tactfully work with and around the rather inflexible attitudes that some of the air arms display. And there is no doubt that the de-briefing sessions are immensely valuable in drawing out the tactics and strategies and feeding back into our future operational planning".

The overall value of *Red Flag* involvement by the RAF is well summed up by the Detachment Commander Group Captain Vaughan Morris, Station Commander, RAF Honington and former OC of No 14 Squadron, who said that "*Red Flag* represents training in the real world – you only have to look at the Gulf and its continuing commitment, with Operations *Jural/Warden*, and the on-going Operation *Grapple/Deny Flight* situation in Bosnia-Herzogovina. Command Air Operation training with large multi-national packages is the established requirement and *Red Flag* is an ideal way to provide it".

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HARRIERS ABROAD

Andy Evans and **Squadron Leader Andy Suddards** report on the overseas deployments of the Harrier GR7 during 1993.

The RAF's force of Harrier GR7s with 2 Group Strike Command, newly based at RAF Laarbruch, Germany, was again very busy in 1993, with two major overseas deployments. During the course of the year elements of Nos 3 and 4 Squadrons were deployed to Turkey to replace the RAF Jaguar GR1A detachment and a brief return to a familiar Harrier GR3 stamping ground in Belize.

It was in December 1992 that the announcement was made by the Ministry of Defence that a detachment of Harrier GR7s was to move to the Gulf region. They were to continue the armed reconnaissance missions in support of the United Nations protection of the Kurds in Iraq, and to relieve the Jaguars after their lengthy time on station. Eight Harrier GR7s, drawn equally from Nos 3 and 4 Squadrons, were deployed to Incirlik AFB in Turkey, under the aegis of Operation *Warden*, during the first two weeks of April. They were supported by VC10 tankers from No 101 Squadron at Brize Norton. For the initial detachment the crews were provided by No 4 Squadron and it was planned that each of the operational Harrier units would provide crews on a rotational basis. The aircraft all underwent a high degree of maintenance to equip them for the hostile operating environment. The initial







Main picture: *Harrier GR7s deployed to Turkey are painted in 'air defence grey' to counter the ground-to-air threat.* Phil Boyden, BAe Top: *Sqn Ldr Andy Suddards in readiness for another sortie from Incirlik.* Above: *A fully armed Harrier GR7 on patrol over Iraq.* Photographs Sqn Ldr Andy Suddards

eight aircraft have subsequently been rotated back for maintenance.

For the Harriers' deployment to Turkey, perhaps the most significant challenge was the re-introduction of the photo-reconnaissance role, a task routinely undertaken by the GR3, but not quoted as part of the new GR5 or GR7's operations. This addition to the Harrier's already wide role involved some significant modifications in order to fit the now retired Harrier GR3's reconnaissance pod, to the centreline station of the GR7. The pilots also had to acquaint themselves with the recce role, although for some, being former GR3 pilots, it was a matter of brushing up of their skills using the new aircraft, while for others it involved an intense period of work-up. In addition all crews were required to gain their 'qualifications' on night-tanking and close formation flying.

The aircraft all received an overwash of 'air defence grey', as the Jaguars had before them, replacing the more familiar desert sand scheme of the Gulf war, as it was perceived that the major threat was from ground to air, and it was felt that a lighter coloured aircraft would not stand out so much against predominantly blue sky.

Each sortie mounted over Iraq is treated as a combat mission, and the aircraft fly fully armed, with two live Sidewinder missiles, two cluster bombs or CRV-7 rocket pods, twin ADEN cannons, a Phimat pod, a full complement of internal flares and two drop tanks containing 11,800lb of fuel. Crews fly 'fully sanitised' without personal effects or unit insignia. Typically, sorties are of 2.5 hours duration, the aircraft flying in pairs, with six of the eight Harriers active each day. Pilots fly around six sorties each week with a down day declared once in every seven.

Combined operations are also mounted and the Harriers routinely fly with elements of the United States and French Air Forces, receiving support from Mirage 2000 fighters, F-16 Fighting Falcons and F-15 Eagles, together with F-4G Phantom *Wild Weasels.* Crews have reported no real problems operating the Harrier in the desert environment, and it continues to mature as a very flexible and effective tool for the RAF.

The task of making a brief return to Belize fell to No 4 Squadron, who despatched four Harrier GR7s to the Central American country on 6 September 1993. This was the first deployment of the GR7 to the region since the withdrawal of No 1417 Flight's GR3s just two months previously. The aircraft flew out to Belize, supported by No 101 Squadron's VC10 tankers, via Goose Bay in Canada and Key

West in Florida, with the journey time being some 14 flying hours.

The deployment of the four aircraft had a twofold purpose. First, it was to show that Belize could be quickly reinforced should the need arise, thus demonstrating the UK's continuing commitment to the security of the country, despite the 'drawdown' of permanent forces based there. Secondly it was to take part in two ceremonials commemorating important events in the Belizean calendar. The first of these was St George's Caye Day on 10 September (which marked the repelling of Spanish forces by the local population when they were supported by a British warship) and secondly to celebrate Belize's twelfth year of independence, on 21 September. On both occasions the Harriers staged a flypast. Both were very well received, underlining the fondness that the people have for the RAF and its v/stol aircraft.

Belize is similar in size to Wales, with a population of 180,000. Its terrain ranges from dense, mountainous jungle, through mangrove swamp, to colourful barrier reef.While in Belize the Harrier GR7 pilots took full advantage of the excellent training facilities and, with fewer restrictions, conducted low flying, air-combat and weapon delivery sorties. They also helped with the turnover of bomb stocks, despatching 1000lb bombs from both high and low levels, and firing SNEB rockets over the Seven Hills and New River Lagoon ranges. The targets of scrap painted up vehicles (when not stolen by the locals) took a severe pounding. The hot and humid climate in Belize causes long-term storage problems for munitions, and No 4 Squadron was more than happy to oblige with their disposal!

The detachment was felt to have been very worthwhile. With the improvement in relations with neighbouring Guatemala (whose original claim to Belize led to the original deployment of Harrier GR3s) seen as a welcome advance, the full withdrawal of permanently based British Army and RAF units can be finally effected later in 1994. Further occasional Harrier deployments to this location can be anticipated in the coming years.

The busy overseas Harrier schedule continued apace through to the end of 1993. After the Belize interlude, No 4 Squadron resumed its part in Operation *Warden*, returning to Turkey in October to take over from its partner back at Laarbruch, No 3 Squadron. Two pilots from the latter took part in yet another GR7 deployment in November, when two aircraft, borrowed from No 20(R) Squadron, were flown out to the Gulf to take part in the big Dubai Air Show. The Harriers, which did not carry long-range ferry tanks, were refuelled by a VC10 K3 for part of the journey and a newly operational VC10 C1K of No 10 Squadron for the final leg from Cyprus.

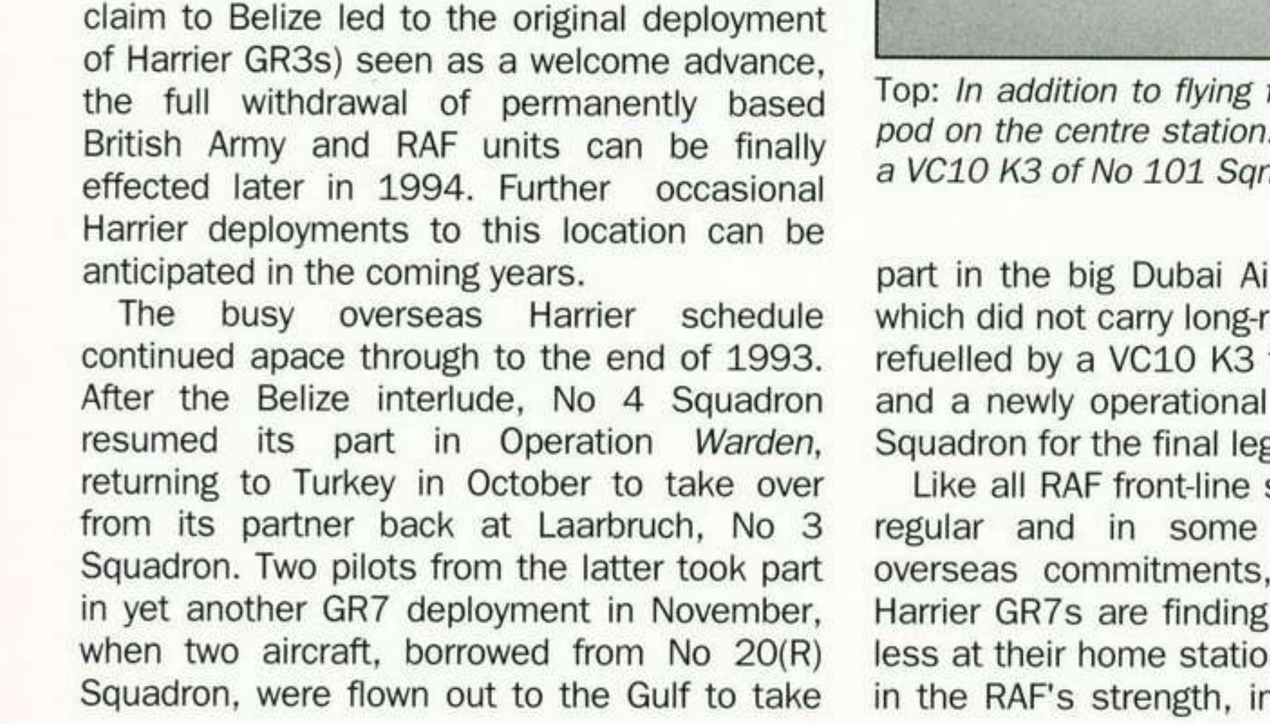
Like all RAF front-line squadrons engaged in regular and in some cases longstanding overseas commitments, the Germany-based Harrier GR7s are finding themselves less and less at their home stations. Drastic reductions in the RAF's strength, in both manpower and aircraft, at the same time as dramatically increased commitments, are inevitably putting a greater strain on the resources actually available. But as it has always done the RAF is rising to the occasion, not least with its unique Harrier force.

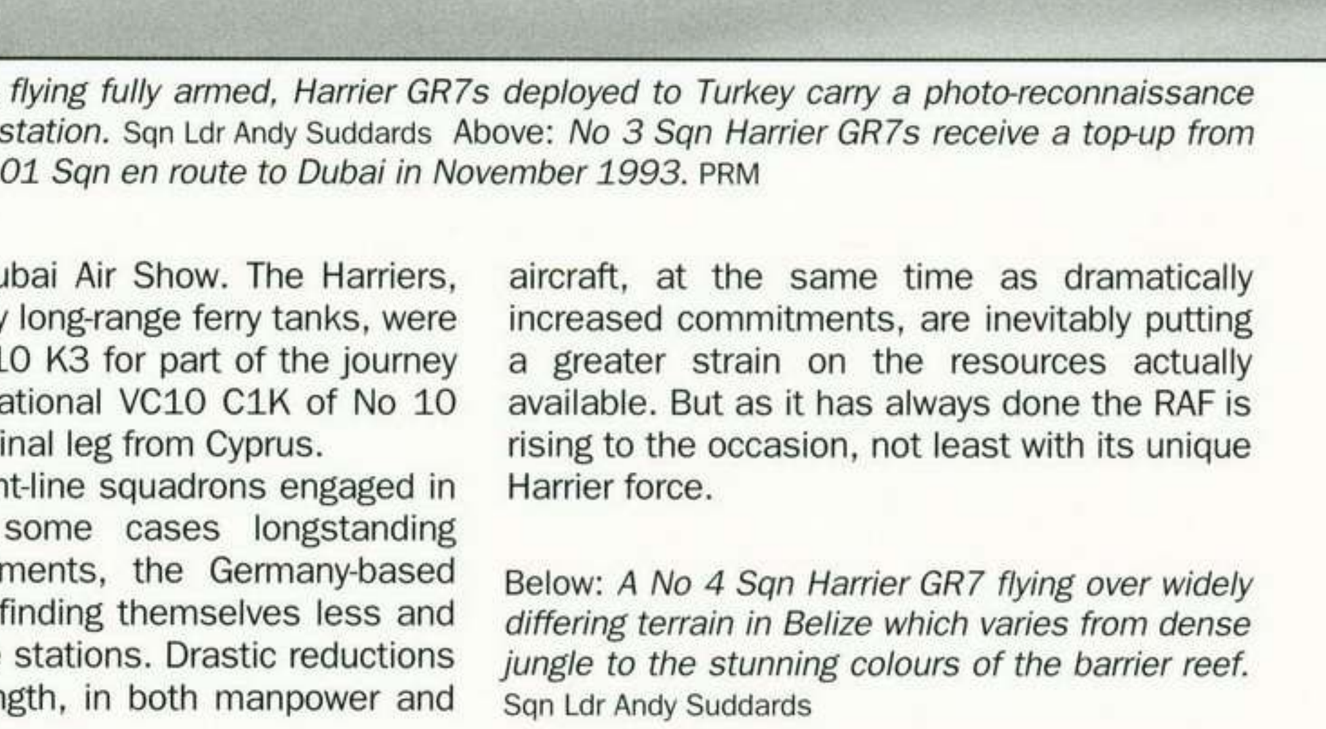




Top: *In addition to flying fully armed, Harrier GR7s deployed to Turkey carry a photo-reconnaissance pod on the centre station.* Sqn Ldr Andy Suddards Above: *No 3 Sqn Harrier GR7s receive a top-up from a VC10 K3 of No 101 Sqn en route to Dubai in November 1993.* PRM

Below: *A No 4 Sqn Harrier GR7 flying over widely differing terrain in Belize which varies from dense jungle to the stunning colours of the barrier reef.* Sqn Ldr Andy Suddards









LOW LEVEL NAVIGATOR

Top: *Entry into the low-level through cloud cover tests the navigator's ability to steer the aircraft to the correct point.* Peter Foster

Left: *Looking for the IP – the view from the nav's seat in the Hawk T1A* . PRM

HAWK SCHOOL

Peter R Foster

"Good morning gentlemen. Today's sortie is a pairs hi-lo-hi co-ordinated laydown/dive attack on two targets. The aims of the sortie are to introduce and practice pairs low-level techniques with pairs co-ordinated dive and laydown targeting. A simulated generator failure and practice diversion will be introduced after leaving the second target unless we are forced to knock if off earlier. Before we continue with the route and mission brief we will go through the domestics...."

So begins the patter of a student navigator who has been streamed to fly fast jets and is currently working his way through the latter part of the Hawk Strike Attack (HSA) syllabus at RAF Finningley. Home to No 6 Flying Training School (6 FTS), the unit's main task is to teach *ab initio* student navigators the rudimentaries of air navigation before they pass on to front line units.

Until mid-1992 the navigation course had been structured in much the same way as it had been since the 'V-bomber' era, with students undertaking much of their navigation training flying backwards in a Dominie T1 without so much as an opportunity to see where they were going. Even the 'fast jet', advanced stage was conducted on the Jet Provost T5, with its operating speed of around 300kt, it was hardly representative of what the newly qualified navigator was going to find on his or her first posting. Although not at the forefront in respect of equipment, the dedication and quality of training at Finningley did produce excellent results.

With the 'Options for Change' policy making huge reductions in the RAF, including the disbanding of a number of front line squadrons and early withdrawal of several types of aircraft, there has been a growing surplus of more modern aircraft available for other roles. The 'Eustace' report, which recommended a new approach to navigator training, was adopted and the opportunity was taken to utilise some of these aircraft now becoming available and introduce them into the navigator training syllabus.

In 1992 RAF Finningley gained three new types of aircraft – the Bulldog and Tucano to supplement the ageing Dominie in the Basic Air Navigation Training School and the Hawk to replace the Jet Provost for the advanced, low-level, fast jet, phase. Although the Hawks first arrived in mid-1992 it took several months for the new programme to be fully integrated into the course structure. This allowed time for the staff crews to put together and refine the correct training package. Much of this task analysis was based on inputs from the operational conversion units who, as the recipients of the newly qualified navigators

were well placed to identify where any shortcomings were being found.

Ab initio navigators arrive at Finningley from many different backgrounds. They include former student pilots who, for a variety of reasons, have failed to meet the exacting standards of pilot training. There are ex-University Air Squadron members who have several years of flying experience behind them and others who are crossing over from one branch to another, as well as those who have come from Initial Officer Training at RAF Cranwell.

The basic navigation course is split up into a number of distinct modules. Streaming takes place at the end of the third module, after some 28 weeks of training, which includes around 61 hours of flying. Those destined for fast jets then undertake a further period of instruction on the Dominie, in which they specialise in low-level navigation system management and radar training, before graduating to the two-seat Hawk. The equipment in the Dominie T1, although old, provides a very important phase in the training and allows the student to undertake a number of exercises where management of the system is related to the basic navigation skills. There is an up-date programme for 11 of the 20 aircraft that were originally procured in 1965 for use by No 1 Air Navigation School at RAF Stradishall, with new avionics to bring the system more in line with that fitted to current front-line aircraft.

Most people have, at some time been in a position where they have needed to use a road map to find their way from A to B. It is quite straightforward when you have roads to follow, but take away the actual roads on the map and you will have to use inspired guesswork – a form of dead reckoning. This becomes even more difficult if landmarks are not easy to see or visibility is poor. Take this situation into the air and push the speed up to 450kt, throw in some turns, add fuel management and a pilot who wants to know lots of detail about what is ahead, and you



Above: *BFTS students with instructor Flt Lt Pete Foster in the planning room at Finningley.* Peter Foster

Right: *A low-level navigation exercise for a No 6FTS Hawk 'pairs' sortie.* PRM



Below left: *Recovery to Finningley in poor weather requires extra demands on the crew.* Peter Foster

Below right: *The runway and approach lights appear out of the gloom as the Hawk prepares to land.* Peter Foster





LOW LEVEL NAVIGATOR



Left: *Airbrake extended, a No 6FTS Hawk begins the let down to low altitude. Transit flights to low flying areas such as Wales or Scotland are carried out at between 17,000 and 35,000ft.* Peter Foster

have the learning task for the navigator. The training syllabus is structured in measured steps, pushing a little harder after each exercise, which in turn builds confidence, until a map reading exercise at nearly 500mph becomes straightforward. Then all of the other parameters are introduced step by step, so the learning curve, whilst appearing quite steep, does remain constant.

By the time our student navigator is giving his briefing – for the pairs low-level navigation exercise with two co-ordinated targets – he should have flown some 110 hours and be able to meet a number of demanding criteria.

"...Runway 02 is in use, the colour state is green, we have visibility of 4km. The cloud is scattered at 1,500ft, with eight eighths at 2,000ft and the tops at 4,500ft..."

The first part of the briefing covers the departure information from Finningley for the two Hawks that are to head out on a low-level navigation exercise to find a number of targets.

"Transit at flight level 190 and begin the descent to enter the low level area abeam the Amble Light, on a heading of 320deg which will ensure that we keep well to the west of Boulmer – but watch for helicopter traffic. Maintain 250ft minimum separation distance. Two minutes out start looking for the 'IP' (initial point) for the run in to the first target. This should be identifiable as a 'V' shaped wood ahead of you and providing you keep to the east of the high ground this should not cause too many problems. From the 'IP', head 335deg with nine miles to run. Another good point of reference at 42 seconds is a distinctive wood an your starboard side and if you cross just on its western edge you should be on track. At one minute another sizeable wood should be evident and then begin looking for the road running down its western edge. Have your eyes follow this to a major junction then look slightly left and acquire the smaller road which leads to a group of three buildings. Your target is the left hand one of these."

The brief given by the young navigator is, of necessity, complex but he has to be in a position to structure this so that it can be accomplished in a maximum 30-minute period. This gets him used to planning and briefing a

Below: *The Dominie (left) is used for basic navigation training, with students progressing onto the Hawk (right) for advanced fast-jet experience.* Andrew March

Bottom: *Newly arrived Tucanos supplement the older Dominies for navigator training.* Peter Foster





LOW LEVEL NAVIGATOR

sortie in rapid time, as will be necessary should he be planning an operational mission for real. In assembling the sortie details, the student has to take into account many factors including the all important aircraft endurance. In the case of the Hawk it has an internal fuel capacity in practical terms of 1360kg and at low level, flying at 420kt, it will as a rule of thumb use around 17.5kg each minute. Navigators have to allow 60kg of fuel for start-up and taxiing and a normal minimum fuel state on landing back at Finningley of 200kg. This leaves 1200kg of fuel for the actual sortie which will give an overall sortie time of just over an hour at low level. It can be increased by flying at high level for the transit before entering the low level route, which will give a better fuel consumption. Therefore most navigation exercises are of 60 minutes, and with most of the low level flying taking place in Scotland, Cumbria or Wales, this generally requires transit flying at heights between 17,000 and 35,000ft.

In a two aircraft (pairs) sortie the planning is divided between the two crews concerned. From receipt of the task the navigator who is leading the pair will plan the target runs, decide on IPs/Rejoins and mark them on the low flying charts (LFC). He then decides on the general route to be flown, brief the No 2 navigator on the High Level (HL) route and the Low Level Entry Point (LLEP), prepares the route on the LFC, completes the LL/HL maps and confirms the timings and fuel etc. He also prepares the briefing slides and the information that is to be copied onto kneepads.

The navigator of the second aircraft will assist in the planning as required, drawing up the target maps and obtaining photographs if they are available. He checks on any special procedures detailed in the Low Flying Handbook (LFHB), completes and submits the low-level booking forms and so on. The briefing has to take all aspects of the flight into account and make sure that all eventualities are catered for.

Before actually arriving at their assigned aircraft the crew check in at the operations desk where the Ops/Authorising Officer points out any changes that have recently occurred, such as weather problems. He also ensures that the crews are aware of any items of importance shown on NOTAMS. These might include details of Royal Flights, new hazards in a particular area or other operations or exercises.

The period on the Hawk squadron for the student is around 20 weeks, with a syllabus split occurring about half way through. Those destined to go on to strike/attack aircraft follow an appropriate final stage of their basic training while those going to the air defence Tornado F3 have different requirements. During this concluding part of the course the students are encouraged to interpret their experience and think more independently rather than rigidly follow the approaches laid down by their instructors up to now.

The instructors at No 6 FTS come from a variety of backgrounds, although on the Hawk squadron there is a general requirement for the pilots to be from a fast-jet, two-man, environment. It is very important that the instructor pilot is very experienced as he has to let himself be led by a relatively inexperienced navigator who might put him in a dangerous position. He needs to be able to anticipate this before it gets out of hand or at least indicate to the student, who is probably working under a great deal of pressure, that he should try an alternative course of action.

At the end of 122.5 hours flying in just over one year the successful fast jet navigator will have achieved a high standard in a difficult syllabus and he (or she) will receive the coveted navigator's brevet. One thing is certain the structure of the 'new course' has met with a positive response from those who have been completed the training. In particular the introduction of the two man cockpit environment at a much earlier stage utilising both Bulldog and Tucano has made the move into the fast jet world that much easier. The only minus to be highlighted by today's young navigators is the long periods on holding postings before they move on to the operational conversion units. This makes those next stages just that little bit more difficult as they attempt to bring themselves back up to speed whilst being faced with a whole new world of system management.

So begins a navigation training sortie that has seen several hours of planning but is effectively the end result of several years actual training in the Royal Air Force and approximately a year's tuition at the hands of No 6 Flying Training School at RAF Finningley.







Right top: *No 6FTS equipment includes a number of Bulldog T1s.* Peter Foster

Right: *The Dominie T1 has been in service since 1965 as the RAF's navigator trainer.* Daniel March

Below: *Turboprop Tucano trainers have added a new dimension to navigator training by early introduction of the crew concept.* Peter Foster

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Roman road at Timgad, Algeria

snow, dirt roads were churned into quagmires, and movement stopped altogether.

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In the late 20th century this lesson of strategic and tactical mobility is still apt. For every country with global commitments, Roman roads are their airlift fleets.

Presently that logistical potential is adequate to respond to small scale crises around the world. But in the event of a major outbreak overseas, and given the strength of current airlift fleets, there is a concern in many countries about their ability to protect world-wide interests.

Flexibility is critical to an efficient defense. Julius Caesar understood it. All Romans understood it. It was the primary reason for their paved roads. Without them, the Roman Empire would not have lasted as long as it did, for the mere knowledge that legions could be on the scene within weeks was usually sufficient to keep the peace.

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THE CANBERRA T17 BOWS OUT

Paul Jackson

In the darkened interior of his frigate, the Tactical Controller (Tacco) was having a bad day. The exercise was in full spate and all assigned communication channels appeared to have been jammed, robbing him of the vital incoming data required to conduct his piece of the 'war'. It was therefore with a massive sigh of relief that the Tacco discovered a clear radio channel on which a friendly E-3 Sentry was assisting a Nimrod MR2 and a helicopter to shadow 'enemy' vessels and keep a wary eye open for attacking aircraft.

Eagerly, the naval officer noted the positions of hostile units reported by the three aircraft, feeding the data into his computerized battle-management equipment and relaying it to the remainder of his task force. At length, interrupting the three-way conversation, the Tacco suggested that the E-3 might takeover controlling the pair of fighters assigned to him for air defence, as it seemed to have a better idea than he of what was going on. The E-3 was forced to decline – apparently because of degraded sensors – but thereafter, the aircraft helpfully continued to pass as much data as possible to the frigate before fuel shortage forced it to turn for home.

"E-3 is off task this time. Changing call-sign from *Magic 99* to *Sierra Papa Oscar Oscar Foxtrot.*" *S-p-o-o-f* – those dreaded letters are etched upon the memory of the Tacco for ever more. Thanks to them, if he is ever in a real war, he will never again imperil his vessel through being lured by siren voices on a miraculously unjammed channel. The E-3, Nimrod and helicopter were no more than the pilot, navigator and Electronic Warfare Officer (EWO) of a Canberra T17 – a 40-year-old converted light bomber that had effectively 'sunk' an entire task force for the hour or more needed for it to cross-check and dump the spurious information unhesitatingly copied into its shared tactical database.

A classic spoof, similar to that described above, was the highlight of a recent exercise in which No 360 Squadron's Canberra T17s played the part of a less than chivalrous enemy: the type of opponent for which it is always prudent to practice. Packed tightly with many different types of 'black box', this warty-nosed aircraft can play equally devious tricks on the radars with which fighters and surface-to-air (SAM) missile batteries find their prey. Here, clever manipulation of 'wiggly amps' takes the place of telling 'porkies', but the degradation of the opponent's awareness is no less profound.

It would be wrong to assume that No 360 Squadron only leaves its base at Wyton during exercises. Every working day, there is constant movement at the Cambridgeshire station as hemp-coloured T17s take off to test the UK's defences – or sometimes, those as distant as Turkey or northern Norway. As the result of realistic training provided by the ageing Canberra, radar and communications operators on land, sea and in the air have learned methods of keeping operational in the face of the inevitable electronic interference that will accompany hostilities. Provision of these vital training services is now passing to civilian hands and No 360 will disband later this year.

This unique unit has an unusual constitution and history. It began at RAF Watton on 1 April 1966 with the formation of the Joint Trials and Training Squadron to assume the electronic warfare (EW) training roles of No 97 Squadron and the Royal Navy's No 831 Naval Air Squadron. Accordingly, the unit receives 25% of its manpower – air and ground – from the RN and assigns about a quarter of its annual 3,700 flying hours to testing the skills of warships and Sea Harriers. Reflecting this

Right: *Four-ship formation of No 360 Squadron Canberras, led by T17A WJ633 'EF'.* Peter Foster



unprecedented background, it was decided to assign a previously unused squadron number to the JTTS, which became No 360 on 23 September 1966.

Equipped since its inception with Canberra T17s converted from redundant B2s, No 360 moved to Cottesmore on 21 April 1969 and to its present base at Wyton on 5 August 1975. Its final CO was appointed on 15 April 1993 when Cdr Phil Shaw, RN, took up his post, perpetuating the tradition that each fourth leader is from the Senior Service. After abandoning plans to form a No 361 Squadron in the Far East, No 360 became the sole operator of T17s, having 16 on strength and eight more in storage. By the beginning of 1994, this had dwindled to just eight, including all six modified in the mid-1980s to T17A configuration. Now working harder than ever before, due to the demise of their compatriots, these eight will remain until disbandment.

In 1993, No 360's lightning flash fuselage markings and moth-and-trident tail badge were also applied to two Canberra PR7s that had previously been used by the disbanded No 231 OCU. Their task is to calibrate targets for ground radars, but they can also be used to enhance the jamming force by laying chaff from specially modified tip-tanks, each carrying a former V-Force dispenser, armed with 432 bundles of D, E, F and I-band needles. (The pods also contain a pair of No 4 Mk 1 2.5-inch chaff cartridge dispensers that are not used.) Passing the chaff task to the Mk 7 allows T17s to increase their fuel load to 14,920lb (including liquid-filled tip-tanks), giving an endurance of 3hr 20min. With 22,000lb of internal fuel, the PR7 variant needs no external supplement when flying in company with Mk 17s. Also newly on strength are two ex-OCU Canberra T4 trainers which, together with the PR7s will go to No 39 (1 PRU) Squadron at Marham in October 1994 to complement its PR9s and single T4, as the RAF's last Canberra squadron.

Like their Canberras, which were built by four manufacturers (English Electric, Avro, Handley Page and Short), No 360's aircrew hail from diverse backgrounds. RAF pilots include some highly experienced on Canberras, the V-Force and other large jets as well as others at the start of their operational flying career. The latter may have narrowly failed their fast-jet training and been considered worth a second try after building up experience and confidence. In this, Canberra operations are ideal, for while the role is not too demanding, the aircraft insists upon competent handling.

Few naval pilots come to No 360 via Sea Harriers. Obviously, most have a helicopter background and have moved to fixed wing flying via No 231 OCU. This route was closed for both services when the OCU disbanded on 23 April 1993, but two special conversion courses on No 360's T4s have been run subsequently for the station commanders of Wyton and Marham.

Sitting side-by-side in the T17's claustrophobic and poorly-lit compartment behind the pilot are the navigator (left) and EWO (pronounced 'ee-woe'). Those with an RAF origin come from two separate streams, the latter being Air Electronics Officers (or commissioned ex-AEOps). Their conversion onto the Canberra T17 takes six weeks. By contrast, RN Observers spend the first half of their three-year posting as an EWO then move to navigating for the remainder. It is therefore possible that random selection will result in some sorties being flown by three naval crew. However, some simpler missions can be managed with one experienced man in the back operating both sets of equipment. The PR7s are also flown with two aboard for their task of laying broad chaff corridors or barriers, this joint operation with jamming T17s being a comparatively new departure.

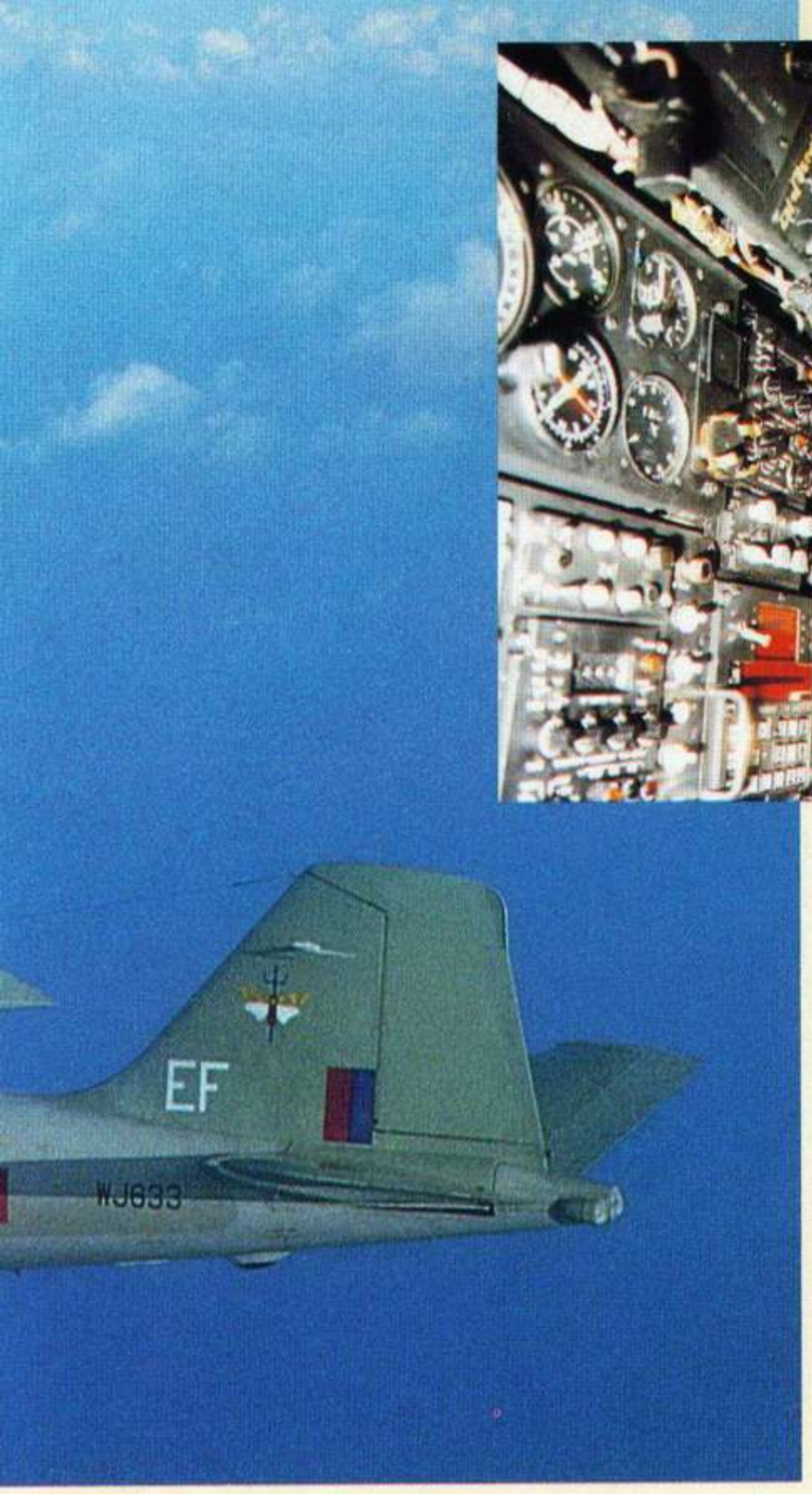
As expected, No 11 Group of Strike Command – the air defence force – is No 360 Squadron's prime 'customer'. Naval requirements are for practice sorties to be flown against Sea Harriers and ships working-up for a cruise, as well as the multi-vessel Joint Maritime Course exercises when Canberras accompany the attacking bomber forces. Smaller commitments include the exercising of Army Rapier SAMs; participation in other NATO countries' exercises in a 'mercenary' capacity; special trials; and testing new equipment for the MoD.

No 11 Group's Tornado F3s are frequently pitted against the skilful jammers. Liaison with the appropriate squadron Training Officer ensures that the degree of jamming is proportional to the fighter crew's level of experience. Older hands may be subjected to a complex package involving bombers, jammers and escorting fighters. Under such circumstances, interceptors would make first for the jammers, but if the bombers are close to releasing their weapons, the fighter controller (on land or in an E-3D Sentry AEW1) may wish to change tactics. Needless to say, No 360 will be doing all in its power to complicate that decision.

The Canberra T17 has no equipment for detecting the direction from which a fighter's radar signals are coming and is accordingly classified as a training aircraft within the terms of the CFE Treaty. That said, in a set exercise it can make a Tornado F3's crew work very hard. 'Brute force' techniques like radiating noise on the fighter radar frequency are augmented by more subtle ruses such as tricking the electronics into changing between

Below: *Modifications required to accommodate specialised electronic equipment have given the Canberra T17 its 'warty' appearance.* Andrew March









Above left: *Central to jamming operations by the T17A is the Tektronix 492 spectrum analyser, here being operated by Flt Lt Jem Waring from the EWO's position.* Above right: *Aerial array in the T17A's nose. Two rectangular horns have been removed from the lower mounting plate.* Photographs Paul Jackson

radar modes instead of locking-on to a target, or re-broadcasting signals with a slight time delay to give the impression of multiple targets.

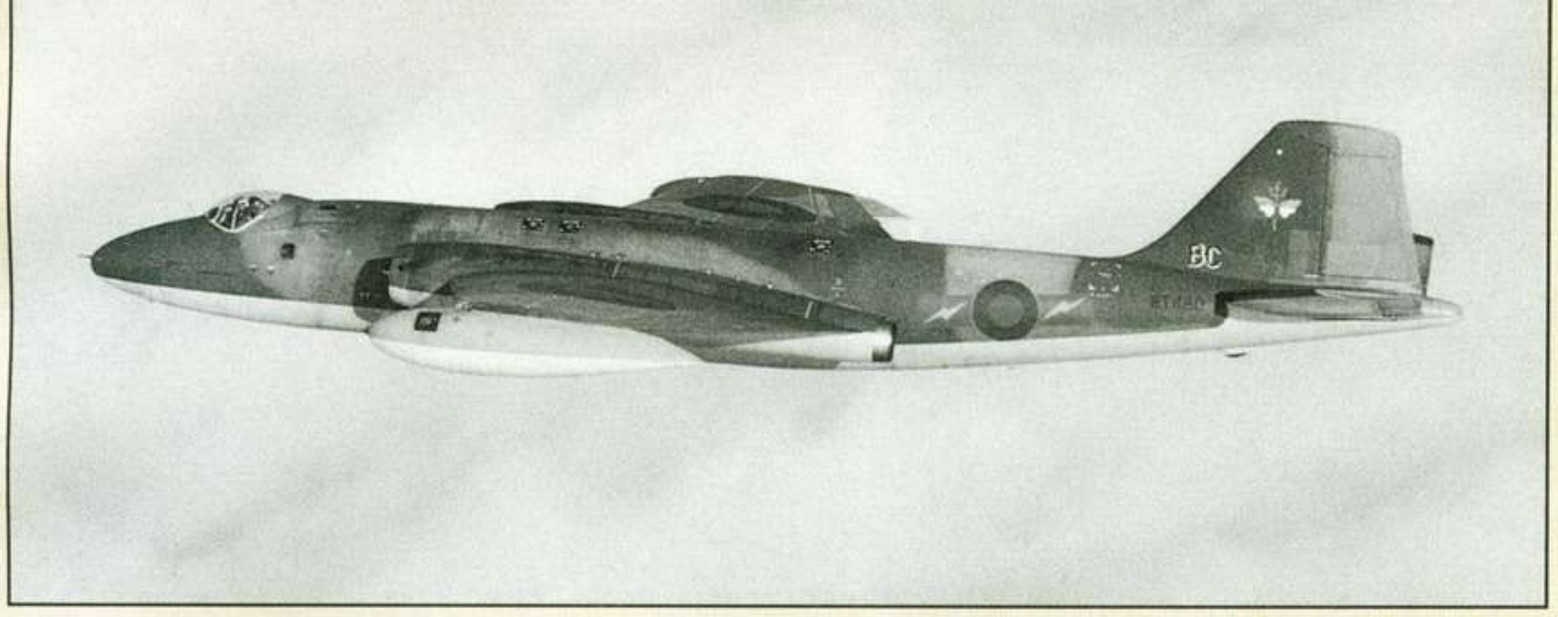
In the lead-up to their withdrawal in October 1992, Phantoms requested maximum agility from their targets because crews were highly experienced in handling radar and weapon systems in the face of hostile jamming. Tornados have been a little less demanding, as the accent has been on training with the continuing series of radar software upgrades.

Able to touch 450kt IAS without tanks at low-to-medium level, the T17 is more usually restricted to 355kt with external fuel, the corresponding turning limits being 4g and 3g. Mach limits without tanks are 0.75 below 15,000ft; 0.79 to 25,000ft; and 0.80 above that. Heights up to 45,000ft may be requested by fighters. A typical sortie would be flown at 250kt IAS (about 300kt TAS) to simulate a Russian *Badger* or *Bear* bomber. If that makes the Canberra look less than realistic when pretending to be more modern aircraft, it should be remembered that it is the fastest EW trainer in NATO. For more realistic practices against fast jets, those few air

Drawings by Mike Keep ©

CANBERRA T17A ANTENNA POSITIONS

1 I/J-band, transmit, vertical polarization
2 I/J-band, receive, circular polarization
3 E/F-band, Narde horn, transmit, horizontal or vertical polarization
4 I/J-band, receive, vertical polarization
5 D-band, transmit, horizontal or vertical polarization
6 I/J-band, transmit, circular polarization
7 D-band, Tamar aerial, transmit, horizontal or vertical polarization
8 I/J-band, transmit, vertical polarization
9 I/J-band, transmit, circular polarization
10 I/J-band, receive, circular polarization
11 I/J-band, receive, vertical polarization
12 ILS glidepath
13 VHF communications
14 ADF/radio compass loop
15 HF wire
16 UHF communications, upper
17 ADF/radio compass sense
18 IFF upper
19 ILS localizer
20 A/B-band, transmit. Not on baseline T17
21 '*Green Satin*' Doppler (removed from T17A, but dielectric plate remains)
22 Tektronix 492 receive
23 IFF lower
24 Omega navigation receive
25 Turbo generator for electrical power (both wings)
26 A/B-band, receive. Not on baseline T17
27 ILS marker/ident
28 UHF communications, lower
29 TACAN
30 Cooling air scoops



Above: *During 1993, No 360 Squadron inherited three Canberra T4 trainers from the former No 231 OCU.* Geoff Lee, BAe

forces that have them must use aircraft like the EF-111A Raven escort jammer from a front-line squadron.

Fighter squadrons book Canberra time in advance, but often do not know precisely the type of training they need until shortly before take-off. Telephone contact is then required to finalize jamming intensity and check safety details. This can pose difficulties, as Canberra crews brief an hour before departure and can have long transit times to the assigned training area, which may be over the North Sea; the fighter world revolves around a shorter cycle and faster positioning. Not infrequently, an urgent early-morning call requesting the day's jammer settings from a fighter squadron is taken by an operations clerk who announces that he is the only one in the building.

Ground radars of the older (80-series) type would show distinctive features when being jammed, but arrival of the Types 91, 92 and 93 in No 11 Group has opened further possibilities. Computers process their radar pictures to eliminate the usual background interference, so a cunning jammer can give a false sense of security to an unwary operator. This is done by gradually introducing jamming to cause the automatic interference cut-off level to rise imperceptibly to its maximum, so masking a real target during the early stages of its approach. When No 360 is flying, a blank screen does not necessarily mean that nobody is about.

Fighter controllers who observe the specified security measures will not be caught as spectacularly as the hapless Tacco in the frigate. However, those not susceptible to deception may be partial to a little distraction in the form of music or a few jokes broadcast by the Canberra's tape-player. An operator awaiting the punch-line is not giving full attention to more important matters.

The Canberra T17 had been designed to give a hard time to Lightnings and Bloodhound SAMs as well as the few remaining ships with the old A-band radar. To keep up with technology, the T17A was devised for improved and more powerful jamming of fighter radars. Six aircraft, of 12 then on strength, were selected for the corresponding modification. Conversion of the 'prototype' was completed by BAe in July 1986. The work involved installing significant additional instrumentation for the EWO and a spade aerial under each wing – presenting the main external recognition feature. This first T17A serialled WD955 was, and still is, the RAF's oldest jet aircraft having been first accepted into service (as a B2) on 12 December 1951. It is expected to fly its 8,000th hour early in 1994 and would have exhausted its fatigue life in 1996, had not retirement intervened.

Key elements of the T17A upgrade are a Tektronix spectrum analyser and computer controller mounted ahead of the EWO; a Sylvania/GTE *Dragonfly* A/B-band communications jammer (under-wing aerials); and an Ericson/Whittaker AN/ALQ-167 *Druce Moth* radar jammer. Left in place are the original T17 fit of the D-band and E/F-band noise jammers. Most jamming equipment is stored in the sealed bomb-bay where it is cooled by under-fuselage air scoops and receives electrical power from a turbo-generator in each outboard wing.

By way of a brief explanation of the above, the electromagnetic spectrum is divided into bands in alphabetical order, of which A-Band is better known as the VHF of household radio. Moving to higher frequencies, D/E/F-Bands are generally used for surface-based surveillance radars (and microwave ovens) and I/J-band covers both airborne radars and some short-range surface-to-air missile systems.

Except for underwing spade aerials, the T17A's new equipment uses existing antennae fitted to the baseline T17. The large nose radome covers four horn aerials: E/F-Band the top pair, with two D-Band below. Evenly spaced around the nose are four dielectric fairings for I/J band: a pair of circularly-polarized (CP) receiver horns above; a CP transmitter below; a vertically-polarized (VP) receiver to port; and a VP transmitter, starboard. Additionally, the lower fairing mounts a small, external D-Band blade aerial. The aircraft's tail cone is sliced-off and fitted with two rear-facing, CP aerials, partnered by a further pair of horns in fairings added each side. The port pair are transmitters and the starboard pair, receivers. In addition, Omega VLF navigation was installed in place of the original *Green Satin* Doppler and Ground Position Indicator.

Built in the days before accessibility of components was written into aircraft specifications, the Canberra is a labour-intensive aircraft in terms of maintenance. Engineering tasks beyond squadron resources are delegated to the station or the aircraft industry, yet some long-term contracts with the latter have now been allowed to lapse. Rolls-Royce is to refurbish no more 6,500lb st Avon Mk 102 engines (normally undertaken every 1,700 hours), while the last 2,000-hour major overhaul of a T17 (WJ981) was completed by FR Aviation at Bournemouth/Hurn at the end of 1993. Aircraft falling due for a 'major' in 1994 are receiving a one-off servicing ('enhanced minor star') to see them safely up to retirement.

Many serviceability snags are age-related – either in terms of items wearing out or as a result of different constructional techniques and tolerances. Aircraft Form 700s (logbooks) invariably include notification of non-critical cracks that are to be inspected regularly, and even when spare parts are 'robbed' from Wyton's growing boneyard, they sometimes will not fit because they have been built by another sub-contractor. Few would guess that Canberra fins are constructed of wood, meaning that Wyton must retain personnel with carpentry skills, fabric-laying and doping.

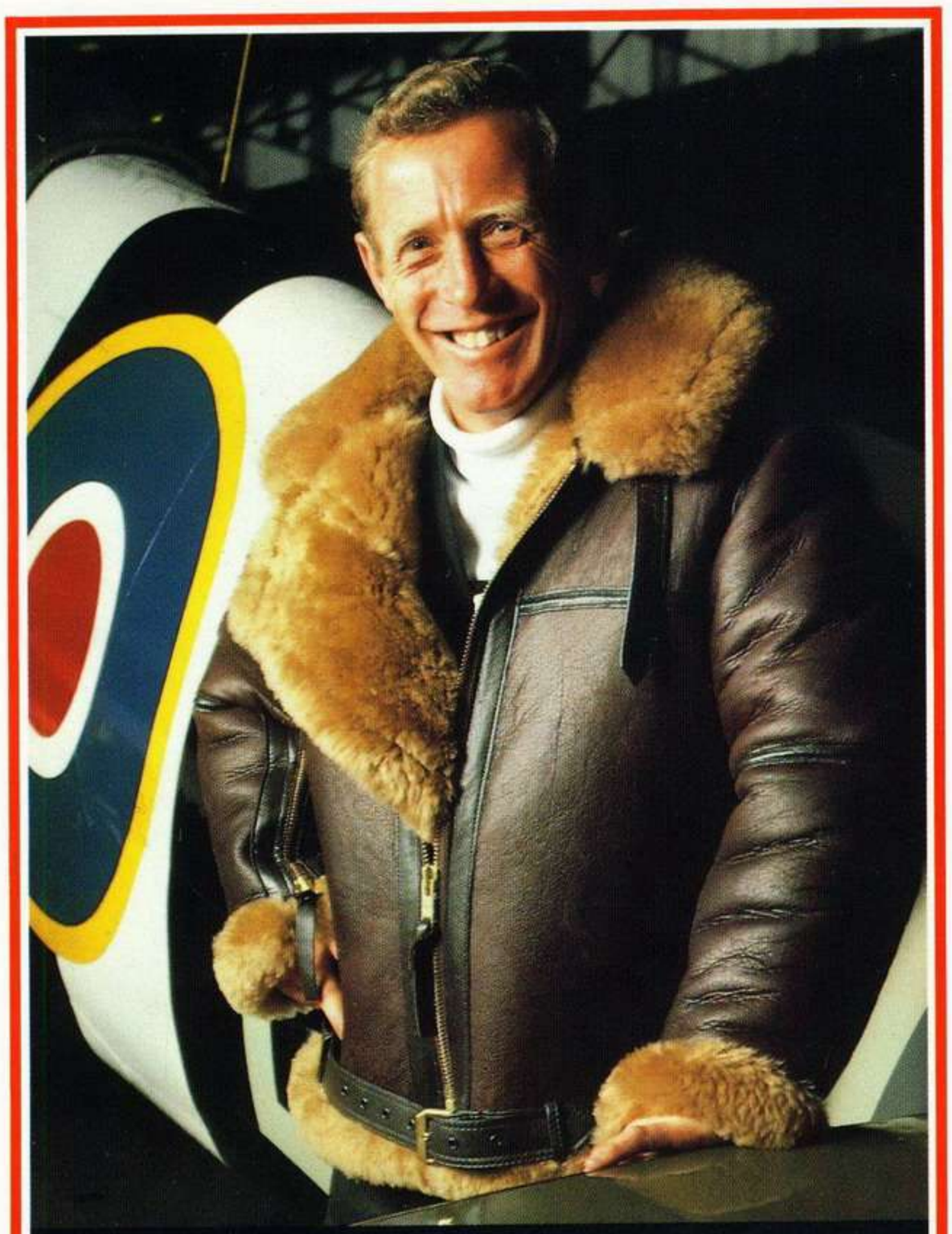
As a case in point, a few years ago the station 'chippy' caused consternation to the squadron's senior engineering officer by declaring his aircraft unserviceable with fungus of the fin. Rectification of the fleet went smoothly except in the case of WJ607 which refused to fly straight with its new fin. Searching investigation by BAe established that, when built in 1953, the aircraft's individual mainplanes were at opposite extremes of permitted length tolerances. Consequently, the fin had been fitted at an angle to offset the effects of having one wing longer than the other. They don't build them like *that* any more!

Nevertheless, despite having daily maintenance performed outside in all weathers, the T17s turn-in a creditable 80% serviceability when maximum effort is required for exercises. Hangar servicing occurs every 125 flying hours – usually between two and three times per year. The T17s used to fly around 300hr annually, but diminishing numbers have pushed individual utilization up towards the 400hr mark.

At one time it had been planned to re-spar the T17/A fleet to extend their service until 2002, alongside the Canberra PR9s of No 39 (1 PRU) Squadron. Now the RAF's youngest squadron and its oldest jet aircraft will disappear this October and pass the exacting EW training role to eight pod-equipped Dassault Falcon 20s belonging to FR Aviation, six of which are to be based at Tees-side Airport and two at Bournemouth/Hurn from July 1995 onwards. To the 'bean counters' in today's cost-conscious armed services, sub-contracted civil aircraft are irresistibly attractive; to many others, the most attractive and irresistible sight in the sky is that grand old lady, the Canberra T17 – (ECM) warts and all.



Right: *Also added to No 360 in 1993 were a pair of Canberra PR7s, which look unusual wearing the fin and fuselage markings so long associated only with T17/As.* Paul Jackson



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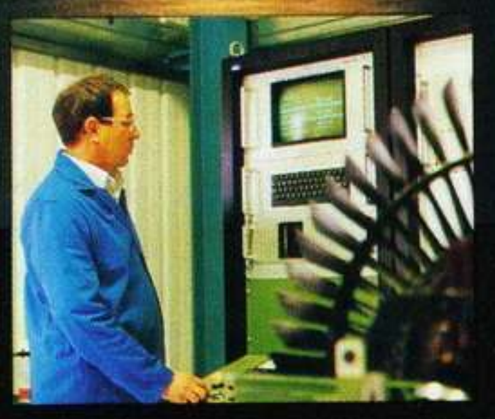
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Above: *Tom Delaney and Spitfire at the end of WW2, and, nearly fifty years later, strapped into more modern hardware in the form of a Sukhoi Su-28* Frogfoot. Right: *Spitfire Mk IX.*

Spitfire t

Tom Delaney looks back at his first acquaintance with the Spitfire nearly 50 years ago, and encounters a modern day Russian Sukhoi.

No less than 48 years have elapsed – or so my log book tells me, since my first solo in a wartime Spitfire Vb on 2 March 1945. My recollection of this is that we were warned beforehand that things happened rather quickly, and despite cockpit drill in a static mock-up and complete education as to which lever operated each control, the warning was well given and heeded. Gentle throttle opening, the response of the Merlin as the throttle went forward, swing, keeping straight, lift off, undercarriage etc took up to 500ft before I was able to start to understand what was happening! This was dramatic power compared with the Harvard that had been encountered during training, and its climbing ability was sensational.

However, things came into perspective after that. Various other Spitfire Mark Vs at the Operational Training Unit (OTU) and Mark IXs were flown at refresher courses and on the squadron, meant concentrating not on how prettily one could roll or loop, but on how efficiently interception and ground attack could be performed. Memories now recall as to how delightful the Spitfires were to fly, having well balanced controls which required little effort to move around the sky and where G could be pulled to one's own physical limit. Steep turns could be taken to the stall without being bitten (though flick manoeuvres were prohibited) with loops at around 300mph, rolls at 240 which tended to barrel (or was it me?). This gave freedom to look all around without hinderance to see if danger was behind. The most beautiful elliptical shape of the Spitfire wing allowed formation to be flown in tight station, together with the thrill of watching the flight peel off from echelon for landing. A veritable love affair was established by which a flight of Spitfires in formation could flirt with the ground at 200+mph and down to 100ft.

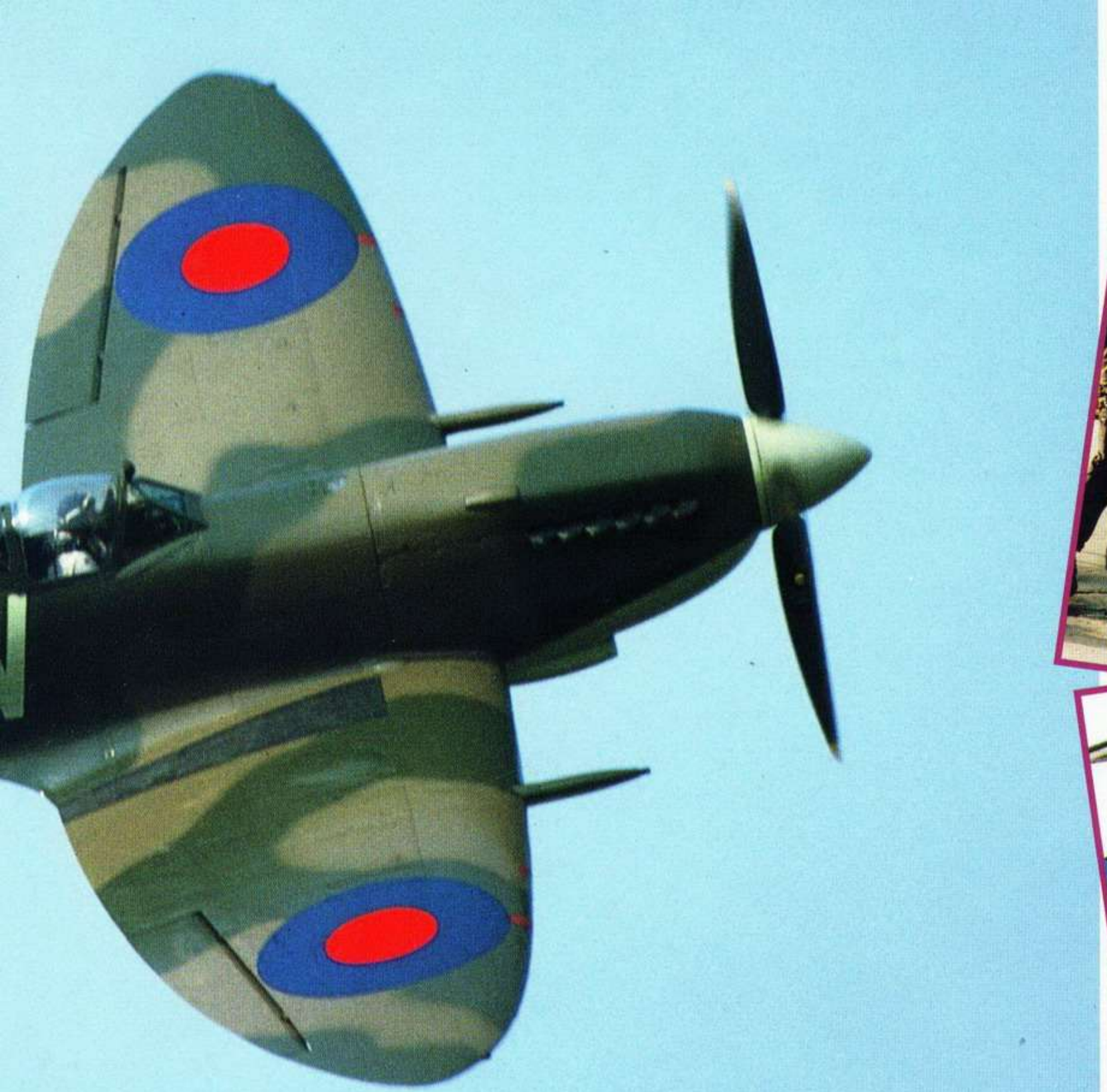
Conversion later to the Spitfire Mark 21 with a Rolls-Royce Griffon 61 and a five bladed propeller, led me to believe that the limit of the airframe/engine combination had been reached. Unfortunately it did not fly as precisely as the Mark IX, because of its massive torque which was particularly apparent on take-off.

Such was the background to my introduction to the twin jet Sukhoi Su-28 Frogfoot (the export version of the Su-25) a ground attack aircraft of a much later generation, carrying a load of ordnance that could seriously damage one's garden. It is a comparatively large aircraft which requires a steeplejack approach to the cockpit via a ladder on the port side, then a step onto the port engine cowling and, for me, into the rear cockpit. This, of course, was preceded by the fitting of G suit, flying suit, helmet and harness by the very helpful Sukhoi ground crew. A brief 'tour' of the instrument panel was given with a warning not to pull the red painted handles conveniently situated between my legs. Seat adjustment, by the right thigh, was by electric pusher and not by lever. The harness lock by the left thigh featured a simple pivoted lever. Whilst there exists a measure of standardisation in instrument layout among most Russian aircraft, the 'standard' RAF panel certainly did not feature. Different instruments are installed, such as an angle of attack indicator, an aerobatic artificial horizon, a small altimeter in metres with each graduation about one quarter inch apart being 100m, a radio altimeter and a mach meter red lined at around 0.85. This needed more concentration than I was able to give on my first acquaintance.

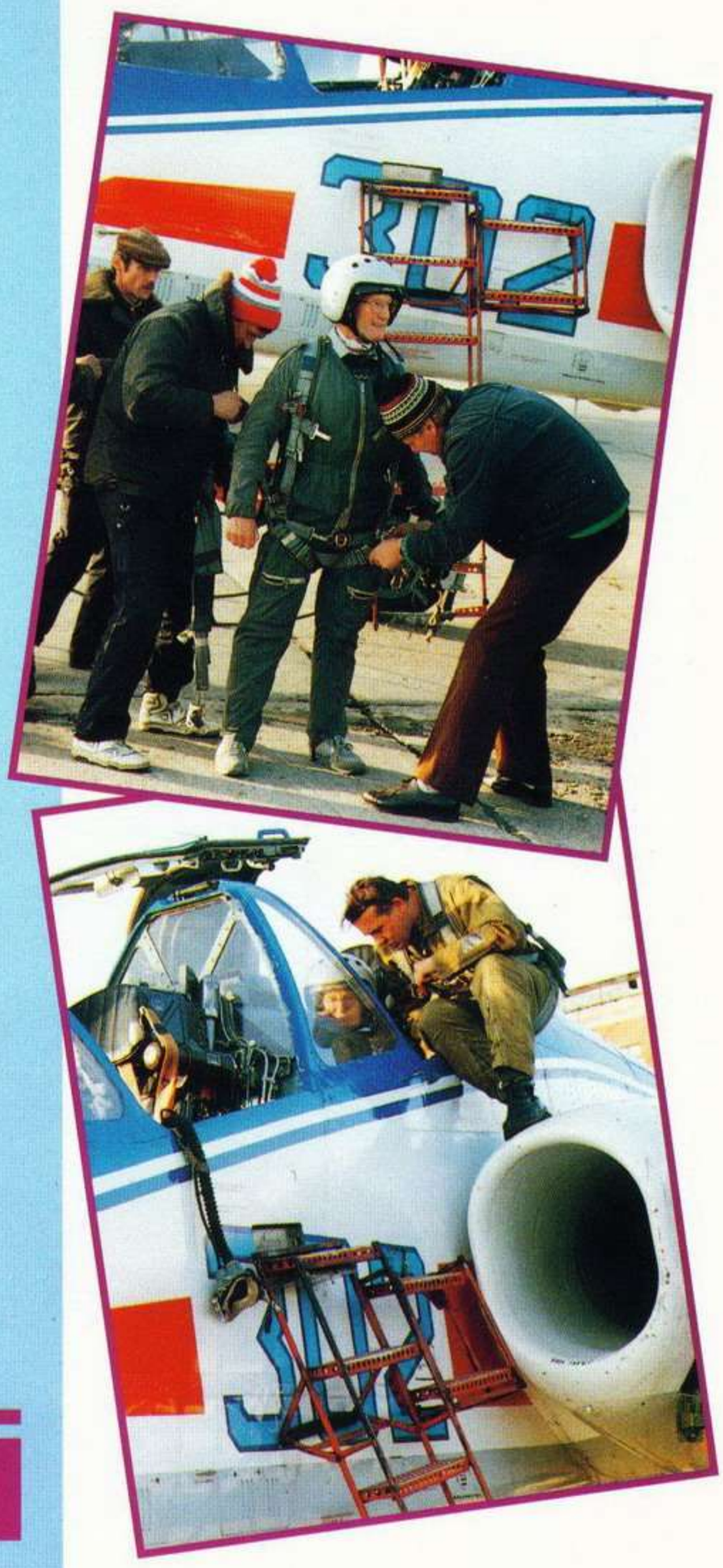
But where were the wings? They were swept

Spitfire V AB910 is maintained by the Battle of Britain Memorial Flight.





o Sukhoi



Top: *Ground crew attach the various straps on the harnesses.* Above: *Sukhoi test pilot Igor Votintsev briefs Tom Delaney on the cockpit layout.*

back out of sight, so that with one's head resting on the cushion, they were out of view. Forward visibility was a great improvement over the Spitfire with the view from the Sukhoi cockpits making taxying relatively easy, apart from a tendency for the aircraft to deviate towards the side to which the brake was applied. The rear view was helped by two internal oblong mirrors, unlike the external round one above the screen on the Spitfire.

One quickly got some idea of the available power by the smoothness with which it was readily available. This was more than vindicated when, after all checks, the throttle was opened and the aircraft quickly accelerated with a typical jet roar for wheels up and climb. Flying without a store of arms, we quickly reached 1,000ft and headed to the low flying area.

Once again today's technology made its presence felt. Down to some 150ft, following a river whose course was somewhat irregular, at a speed between 500/600km this height did not seem sufficient with very steep turns being undertaken so close to the deck. The G suit spontaneously inflated, deflated and inflated as G went on to reflect the winding course we were flying. Ailerons were so responsive, with the aircraft 'flipping' from side to side, while the pilot was held firmly in place. No Spitfire that I flew responded in such a way, but I think that the Spitfire gave more satisfaction, if not thrill.

So on up to around 3000m, where easing the throttle back produced an instantaneous braking effect and pushing it forward gave incredible acceleration, which made one realise even more how much power was available. We touched Mach 0.82 in level flight. There are three wing configurations: normal high speed, aerobatic, and landing – each of which is selected by a small electric switch. In steep turns, pulling on the stick in

The pre-flight briefing at Zhukovsky: Tom Delaney (left), Richard Goode (centre) and pilot Igor Votintsev.



The unusual lines of the Su-28 (export Frogfoot*) show clearly as it taxies out for take-off from the flight test centre at Zhukovsky.*





normal flight mode did cause buffet. Prudence, my ever present co-pilot, stopped me from going further. However, with the wing in aerobatic mode one could tighten up the turns, but turning the head to look around in the turn, as one did in the Spitfire, was made difficult by the G force and the presence of the flying helmet, as well as the head rest built into the seat. To look to the side one had to turn the head further because of the restricted line of sight from the helmet. Rolls to both left and right seemed not too difficult, but required a little more rudder than I expected.

But I got lost in the loops. I could not see the wings to line them up with the horizon and was very conscious of the high sustained G forces while travelling over acres of sky. The clouds which started off below us took an awful long while to reappear. No wonder pilots use the artificial horizon, which in earlier days would have been securely caged. A loop with a half roll on the downward line destroyed our altitude while, it seemed, blowing the G suit to Bibbendum proportions.

There then followed a long approach back to Zhukovsky airfield during which the forward visibility seemed quite bad as though light and dust was diffusing over the screens. The approach, with power, led to a soft touch down with the aircraft being allowed to roll rather than use its parachute. This does mean that a water hose is needed to cool down the brakes, but is possibly easier.

The flight was made with the front seat occupied by Igor Votintsev, a most accomplished Russian pilot. He was the pilot who flew from Moscow to Vladivostok and return, non-stop, making four refuelling transfusions on the journey. It took some 16 hours and he was equipped with a receptacle for personal needs but his navigator was not so fortunate! I certainly did not need this facility during my all-too-brief flight in the Sukhoi.

As we taxied in along the test establishment's huge expanse of concrete taxiways I hardly had time to look at the lines of Bears, Flankers, Fulcrums, Blackjacks and examples of almost every conceivable type of contemporary Russian aircraft. I waved to the young Australian who was about to depart for his first supersonic jet flight in the back seat of a MiG-29. I had to pinch myself to realising how incredible it was that I had just completed a flight in one of Russia's latest military aircraft, at the country's previously secret flight test centre, with a top test pilot showing me the Sukhoi's impressive attributes. The world has changed so dramatically across the five decades since I had last found myself at the controls of an operational fighter, not least

Below: *Taxying in past lines of experimental Russian aircraft.* Left: *The traditional handshake with the pilot from a still excited Tom Delaney.*



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THE CORNISH CONNECTION

Peter Cooper looks at the work involved in maintaining the RAF's Search and Rescue fleet.

The two bedraggled lifejacketed figures were desperately hanging on for life to the up-turned hull of their sailing dingy, which was being lashed and heaved by a frenzied sea, wondering whether help would arrive in time.

However, the alarm had already been raised and the Coast Guard Service had jumped into action by alerting the local Search and Rescue Flight (SAR), held at 15 minutes readiness, to proceed to the location some two miles off the rocky coastline. The SAR Flight helicopter was airborne within minutes and was soon nearing the position of co-ordinates that had been given by the Coast Guard.

For the two sailors in the water the sight and sound of the approaching yellow Sea King helicopter was indeed most welcome. With the automatic flight control system engaged, the Sea King positioned in a steady hover, being instructed by the winch operator, and within two minutes it was all over. The yachtsmen had been winched aboard and were being attended to by crew members, enroute to a nearby hospital for checks and any necessary treatment.

This is a typical routine sortie for an SAR Flight, all part of a days work. The aircraft, either a Westland Wessex HC2 or a Sea King HAR3, are held in a fully serviceable state of readiness for any eventual emergency whether at sea, or over land and equipment is carried for either situation. Indeed, 1993 saw the UK Search and Rescue units involved in 2150 incidents and assisted 1473 people, the busiest Flight being D Flight 202 Squadron, Lossiemouth, in Scotland with 234 scrambles which involved 214 people. More rescues have been carried out at night by RAF crews thanks to the increasing use of the latest and extremely effective Night Vision Goggles. Most RAF SAR helicopters now carry sufficient sets of NVG to allow all members of the crew to look for missing or injured people on the darkest of nights without the need for extra illumination on the aircraft.

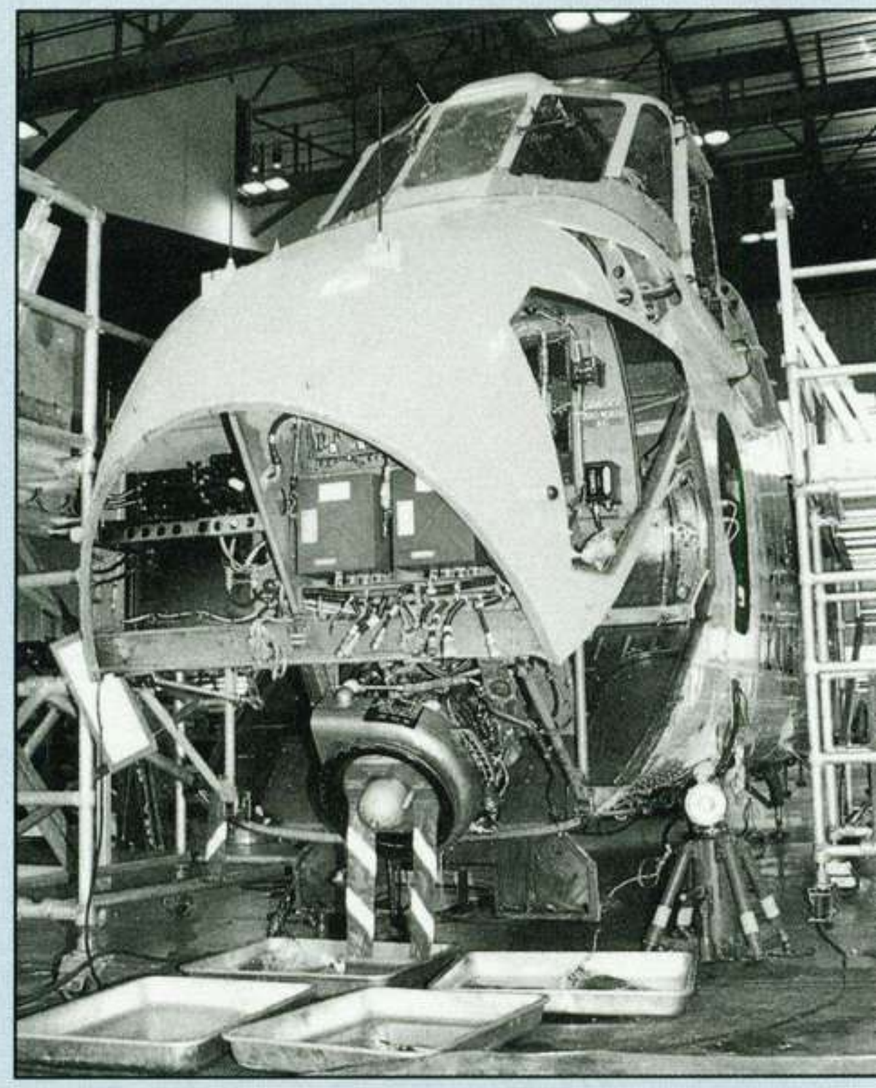
Another major contribution to the saving of life by SAR units over the past year has been the introduction of more specialised medical training for the rear crewmen and for selected members of the RAF Mountain Rescue teams. They are now qualified to carry out the most up-to-date life-saving techniques should a casualty require more than just basic first aid while on the way to hospital.

There are currently 16 Wessex HC2s and 19 Sea King HAR3s on RAF SAR strength and these are dispersed as follows: Wessex HC2s of No 22 Squadron allocated to A Flight at RAF Chivenor, North Devon; C Flight at RAF Valley, Angelsey; and E Flight at RAF Coltishall, Norfolk, each operating two aircraft together with the SAR Training Unit (SARTU) at RAF Valley which has five. Three Wessex are normally scheduled into planned programmed maintenance. At the time of writing, one was detached to Westlands for trials work and one was on loan to the Support Helicopter (SH) force. The 19 Sea King HAR3s equip Nos 202 and 78 Squadrons, the former comprising A Flight at RAF Boulmer, Northumberland; B Flight at RAF Brawdy, Dyfed; C Flight at RAF Manston, Kent; D Flight at RAF Lossiemouth, Moray; and E Flight at RAF Leconfield, Yorkshire and the Sea King Training Unit (SKTU) at RAF St Mawgan each with two helicopters. Two Sea Kings are operated by No 78 Squadron at RAF Mount Pleasant in the

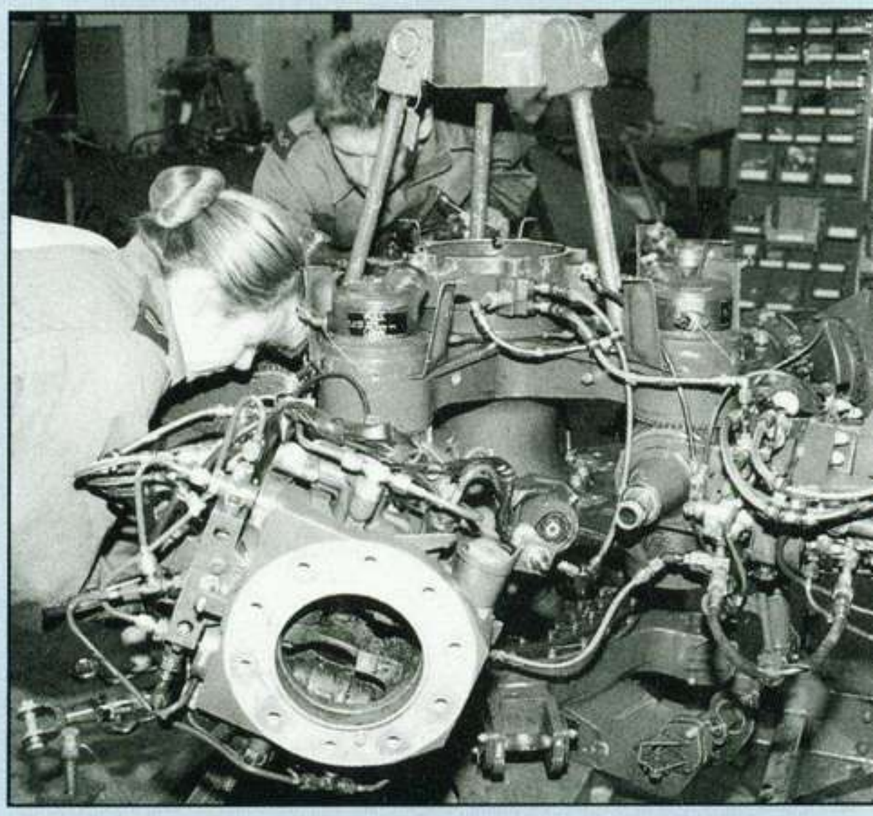


Main picture: *Rescue sorties around the coast often put extra demands on crews as demonstrated by this Sea King hovering close to a sea cliff.* Right: *SAR helicopters can be called upon to assist ships in difficulty or to pick up urgent medical cases for transfer to hospital.*









Above: *An elevated view of the Wessex HC2 servicing bays with the HMF at St Mawgan showing XR588, the first production HC2, in the foreground undergoing a Minor servicing, whilst XV730 seen beyond awaits its turn.* Above right: *Nose view of Wessex XS675 with the second engine still to be re-fitted.* Right: *The Structure's Bay have repaired and partially re-skinned a rear fuselage in preparation for fitment to Wessex HC2 XS675, the original being returned for re-work.* All photographs Peter Cooper

Falkland Islands and three are normally undergoing programmed maintenance. Currently, one is on long term repair and re-build at RNAY Fleetlands, and one is engaged on non-flying trials work at Westlands.

The SAR Flights with their yellow Sea King or Wessex helicopters, are very much in the public eye. What is not so evident, but of paramount importance, are the activities of the teams who maintain the helicopter fleet, to provide each RAF SAR Flight around the country with two serviceable helicopters – one for immediate call out, and the second on standby readiness.

For many years the Headquarters SAR Wing was based at RAF Finningley, Yorkshire; co-located with the HQs of Nos 22 and 202 Squadrons and the SAR engineering organisation. Both Wessex and Sea King engineering personnel were associated with one of the Squadrons and would work only on the type operated by their respective squadron. However, with various operational and logistical changes currently being implemented within the RAF it was decided to move the entire SAR engineering support organisation to RAF St Mawgan, the Nimrods of this Cornish station having departed to a new Scottish home at RAF Kinloss, thus creating considerable space at this large airfield on the Western Cornish coast.

The move to the South West corner of the UK commenced in September 1992 with the first helicopter work commencing in mid-October with RAF St Mawgan being fully operational in its new role by December. This was no mean achievement, as the personnel complement was made up both of those who transferred from Finningley and others who had remained at St Mawgan having changed roles from Nimrod to rotary types. Indeed, for a short period helicopter maintenance was being undertaken at both places, with the added logistical and spares support requirement for both centres.

At St Mawgan a significant change in the engineering organisation occurred. The second line maintenance activity lost its direct Squadron association and the Aircraft Engineering Squadron, with its two flights – Helicopter Maintenance Flight (HMF) and Components Maintenance Flight (CMF) – came into existence. The HMF is now tasked to conduct on-aircraft maintenance for both the Wessex and Sea King; whilst the CMF was established for maintenance or repair of the large number of different helicopter components. The HMF is based in the large hangar which was built for Nimrod second line maintenance and CMF in the facilities provided for similar work on Nimrod components. Considerable alterations were required in the latter to accommodate the very different elements of helicopter support work.

At SAR Flight level the first line maintenance and rectification of minor defects is carried out by engineering tradesmen belonging to the SAR squadrons – the maintenance requirement being determined by flying or operating hours, or a calendar period. The extent of work required is dependant on component and rotatable items hours which may be strictly life or overhaul limited. The depth of work is restricted, with routine maintenance organised into group or periodic elements which can be achieved in a short timescale, thus enabling swift recovery. Status reports and exchange of information and requirements is maintained at the SAR central engineering records section at St Mawgan.

The St Mawgan Engineering Records and Plans Section maintains a check on individual aircraft flying hours and notifies which helicopter is due for service. Some six weeks prior to despatch of the aircraft to St Mawgan a pre-Minor or Major survey will be undertaken at Flight level and a comprehensive list of work to be done prepared. At this point an out-of-phase component list is also compiled and all this information is evaluated to enable a comprehensive engineering plan to be devised, well in advance of actual receipt of the helicopter. This enables a smooth passage once in the hangar with the minimum amount of delay to the respective maintenance. Ideally spares are ordered to arrive at St Mawgan at the appropriate stage of the maintenance, but this is not always achievable. In some cases, where parts may not be available, these can be 'robbed' from another helicopter in the hangar undergoing work, although as far as possible this is avoided.

Above: *A Sea King HAR3 main rotor head receives attention for a minor defect.*

The engineering organisation at St Mawgan is supported by the supply sections of Supply and Mechanical Transport Squadron. Supply support is a vital part of all activity and it requires continual monitoring of aircraft states for spares requirements, with the Priority Cell taking action regarding availability, supply and demand for spares.

The HMF is commanded by a flight lieutenant who is responsible for six engineering teams, three for the Wessex and three for the Sea King. These teams basically consist of nine or 15 personnel for the Wessex

and Sea King respectively, although the numbers can vary dependant upon the specific task. A typical team will be lead by a chief technician together with a sergeant, four or five corporals and a mixture of junior technicians and senior aircraftsmen, from both airframe and engine disciplines making up the balance. Tradesmen of the electrical and avionics disciplines, who work on the aircraft in the hangar, are drawn from the specialists in CMF.

It is normal for there to be three Wessex and three Sea King helicopters in the large St Mawgan hangar at any one time, although engineering and maintenance programme requirements can sometimes affect this number. The programmes are split into Minor, Minor Star or Major maintenance and the type of maintenance is determined by flying hours. In the case of the Wessex, maintenance is at 400 hour intervals; a Minor after 400 hours and 800 hours; a Minor Star at 1200 hours; another Minor at 1600 and 2000 hours; followed by a Major at 2400 hours.

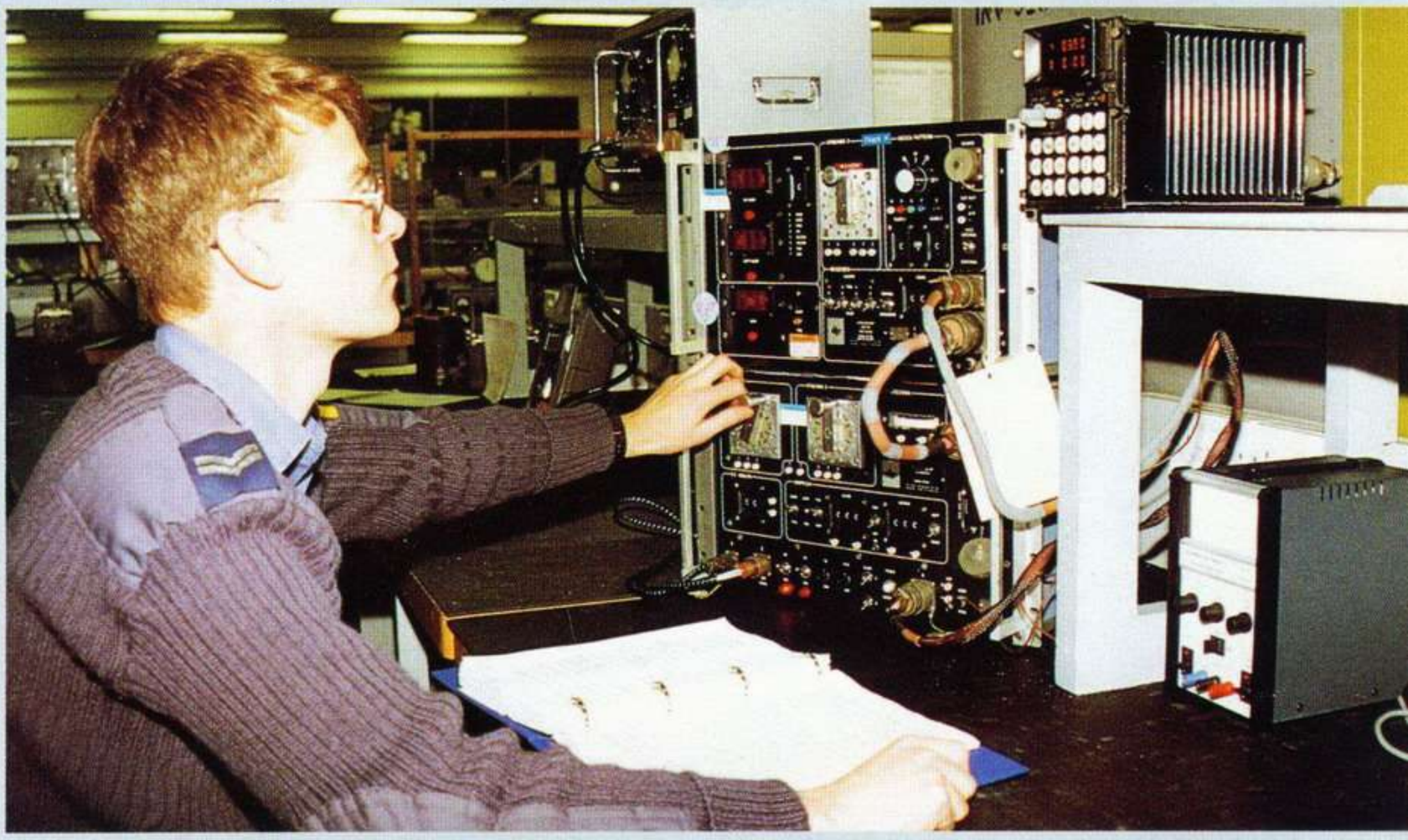
The Sea King has a slightly different schedule, due mainly to its airframe and systems being more tolerant and having an increase in component life. The basic servicing interval is 600 hours with a Minor maintenance carried out at 600 hours; a Minor Star at 1200 hours; another Minor at 1800 hours; with the Major at 2400 hours completing the cycle.

Should any in-depth repair or modification work be required then the Mobile Aircraft Support Unit (MASU), will be called in to assist. MASU, a Royal Navy Unit based at RNAS Lee-on-Solent, undertakes tri-service maintenance and support for all of the MoD helicopter fleet and has the experience and manpower to undertake some of the intricate and in-depth repairs required. This provides expertise which it would be difficult for the personnel at Flight or HMF level to accumulate.

When a helicopter arrives at St Mawgan its hours are checked against the pre-survey report and, at this point, all engineering documentation will be available in the hangar. The helicopter will then have its rotor blades removed, then be jacked and stripping will commence – the depth of strip being dependent upon its Minor, Minor Star or Major schedule. Components are then dispatched to their relevant maintenance bays.

The first stage of the maintenance is a detailed airframe inspection to look for defects (ie corrosion) and these will be rectified accordingly and paint work will be removed as required. The difference between Minor and Major Maintenance is largely in the extent of airframe inspection and re-work requirements. All defects are noted on inspection cards and a specific job card or maintenance work order will be raised. During Minor maintenance it may not be necessary to remove all the components but this is largely dependant upon noted defects or consumed life of

Below: *The Avionic and Electrical Bay has a wide range of specialised equipment for various component tests. Here a Sea King Tactical Air Navigation System is under test to check its accuracy.*



Below: *The Blade Bay undertakes minor repairs to main and tail rotor blades.*

Right: *Final adjustments are made to the tail rotor of a Sea King HAR3.*

Bottom: *With major components re-fitted, Sea King HAR3 XZ595 undergoes fuel flow tests prior to systems functional tests, re-fitment of the main rotor blades, engine runs, and test flight.*









Above: *Three Sea Kings are usually undergoing work with the HMF at any one time. As soon as a bay is vacated it is quickly filled by an incoming aircraft, pre-planned some weeks in advance.*



Above: *Final adjustments are made to the Sea King's starboard engine, prior to undergoing fuel system checks.*

components. A typical time for inspection and rectification of defects for a Wessex undergoing a Minor is 20 days.

A Major maintenance for a Wessex may encounter considerable areas of airframe corrosion arising from operations in a salt laden environment and could result in extensive rectification work. Treatment of skins, or in some cases replacement of complete skin panels, can take a considerable time. A tail cone may need to be removed for repair in the Structures Bay. The greater depth of work required during a Major is why a longer period of time is allocated. The Wessex fleet leader in respect of flying hours has now accrued almost 11500 hours, with fleet average around the 9000 hour mark, having originally entered RAF service in 1964.

The Sea King HAR3 is a younger airframe, having entered service in 1978, but already the lead example is nearing 8000 hours. It is a more sophisticated helicopter compared with the Wessex, and has an airframe with improved corrosion resistance. Notwithstanding this there are still areas that require detailed inspection, for example Non Destructive Testing (NDT) on the main gearbox mount frames, checks on the sponson attachments, and checks of the Automatic Flight Control System (AFCS). The Sea King has more avionic systems and instruments than the Wessex and during maintenance many items are removed for checks.

After the inspection and rectification phases are complete, the rebuild commences. Components returned from the bays which include engines and main transmission, gear boxes, shafts, heads and rotor blades are re-fitted ready for an initial ground run. This is then followed by any systems adjustments or rectification, compass swings and test flights. Test flights for both helicopters are flown by the aircrew of the Flight Test Centre.

Engines are removed to the Engine Bay for any local strip and rectification work, whilst overhauls will be conducted by Rolls-Royce at Filton or the Royal Navy at Fleetlands. A limited capability uninstalled engine run test rig is also available at St Mawgan. The Rolls-Royce Gnôme turboshaft is common to both the Wessex and the Sea King, two 1550shp Mark 110/111's in the former and two Mark 122/123's of 1660shp in the latter. These reliable engines have a time between overhaul (TBO) of 2500 hours and, with slight changes, can be installed in either the port or starboard position in their respective helicopters.

An important feature associated with engine and gearboxes is health monitoring and the Early Failure Detection Centre (EFDC) carries out this work for the whole of the SAR force. Engine and gearbox health is assessed by monitoring debris on magnetic plugs, removed from engine and gearbox oil systems, and samples of oil are sent for Spectrometric Oil Analysis Programme (SOAP) tests. The SAR Flights send in magnetic plugs and samples at routine intervals for monitoring with the records for each sample being kept and analysed against each subsequent sample. These records are checked every 75 flying hours and if any increase in debris trend is noted then a decision to increase the frequency of sampling, or remove an engine or gearbox may be made.

The Hydraulic (oleos, reservoirs, controls etc), Wheel and Tyre Bays each deal with their respective equipment maintenance whilst the Structures Bay undertakes repairs to any airframe component as required (eg Wessex rear fuselage sections, Sea King pylons, doors and steps). The Avionic and Electrical Bays have all the relevant test equipment on hand for the different avionic, electrical and instrumentation carried on both helicopter types: this includes radar, radio, instruments, navigation equipment, flight and engine control systems and electrical components.

A Blade Bay has been established which is capable of handling minor repairs to main or tail rotor blades but repairs of a greater depth are undertaken by the manufacturer. Wessex main rotor blades suffer from blade pocket cracking and these can be repaired on site. Neoprene leading edge erosion strips may also require routine replacement. Blending of any blade minor damage (ie nicks and dents), is also tasked to this bay. Sea King blades are of a composite type material and very damage tolerant. The Wessex main rotor blades are an 'on condition' item (ie no specific overhaul life), but the Sea King main blades are currently lifed at 10,000 flying hours.

All RAF helicopter winches, plus those from the Belgian Air Force Sea Kings, are maintained in the St Mawgan Winch Bay. Wessex winches are serviced after 15 months/1000 lifts, and Sea King winches after 12 months/600 lifts. The Wessex winch, capable of a 600lb static load, on a 300 foot length of cable, is checked to a load of 1800lb – the cable being replaced at each overhaul. The Sea King cable is capable of the same load but is an 'on condition' item with a four year life. Floatation gear, seats, harnesses and the internal 'wet' floor fit are all checked by the Role Bay.

Changes in the RAF SAR force to meet the needs of the future will be seen in 1994. In July 1994, B Flight of No 202 Squadron at RAF Brawdy will transfer its Sea King helicopters to RAF Chivenor to become A Flight of No 22 Sqn. The SAR Flight at RAF Manston, C Flight of No 202 Squadron, will transfer to Wattisham in July 1994, and become B Flight of No 22 Sqn. The Wessex aircraft from Chivenor and those of E Flight of No 22 Squadron at RAF Coltishall, which will disband, will be released from SAR use. In mid-1996, the last UK SAR Wessex Flight, C Flight of No 22 Squadron RAF Valley, will convert to the Sea King and the procurement of six new Sea King helicopters will make the transition to an all Sea King SAR force possible.

The Headquarters of No 22 Squadron will remain at RAF St Mawgan and that of No 202 Squadron at RAF Boulmer. The RAF Sea King Training Unit (SKTU), which moved from RNAS Culdrose to St Mawgan during April 1993, will expand to become the Sea King Operational Conversion Unit. The Wessex HU5C helicopters of No 84 Squadron at RAF Akrotiri, Cyprus, will be replaced by ex-SAR Wessex HC2 aircraft. The year 1996 will see the withdrawal of the Wessex from UK SAR service, but its use as an RAF support helicopter will continue.

RAF St Mawgan will remain the primary support base for the RAF SAR force and a centre of excellence for SAR helicopter maintenance support. The personnel of Engineering and Supply Wing based at this former RAF maritime airfield can be justifiably proud of the part they play in keeping the 'yellow' helicopters of the RAF Search and Rescue force flying.

Below: *Wessex HC2 XR501 of A Flight, No 22 Squadron landing at RAF Chivenor after a routine sortie. Chivenor maintains three of these helicopters on strength.*



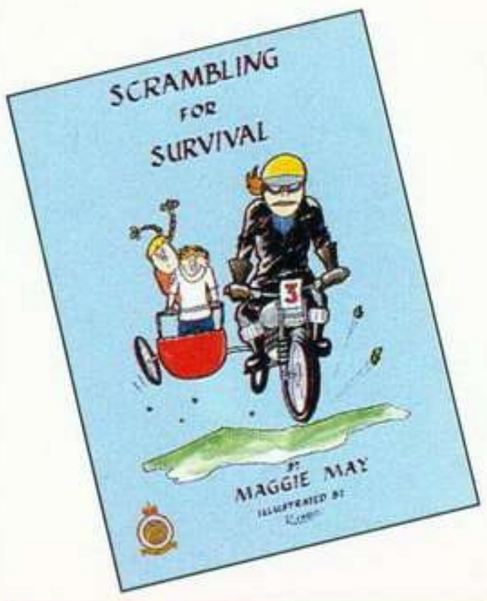
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- And right now I wish that you'd gone!

I'm up to my eyes in the housework
But I'll stop what I'm doing (what's new?)
To wait on you hand, foot and finger, my love,
The way you're expecting me to,

Yes, I'll sew on the button that's missing
And sort all your socks into pairs
Then I'll iron those two shirts, find your old pair of shorts
And pick up these things on the stairs:

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(And if I have mine with a valium or two

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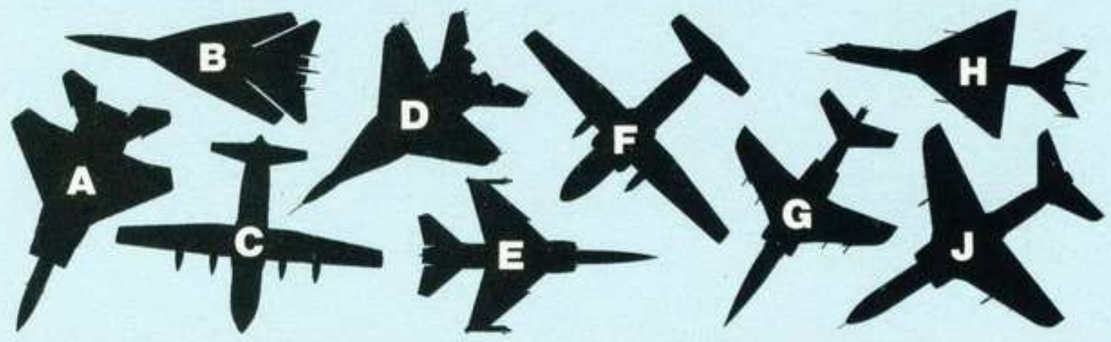
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3. No responsibility can be accepted for loss of entries or damage to them however caused.
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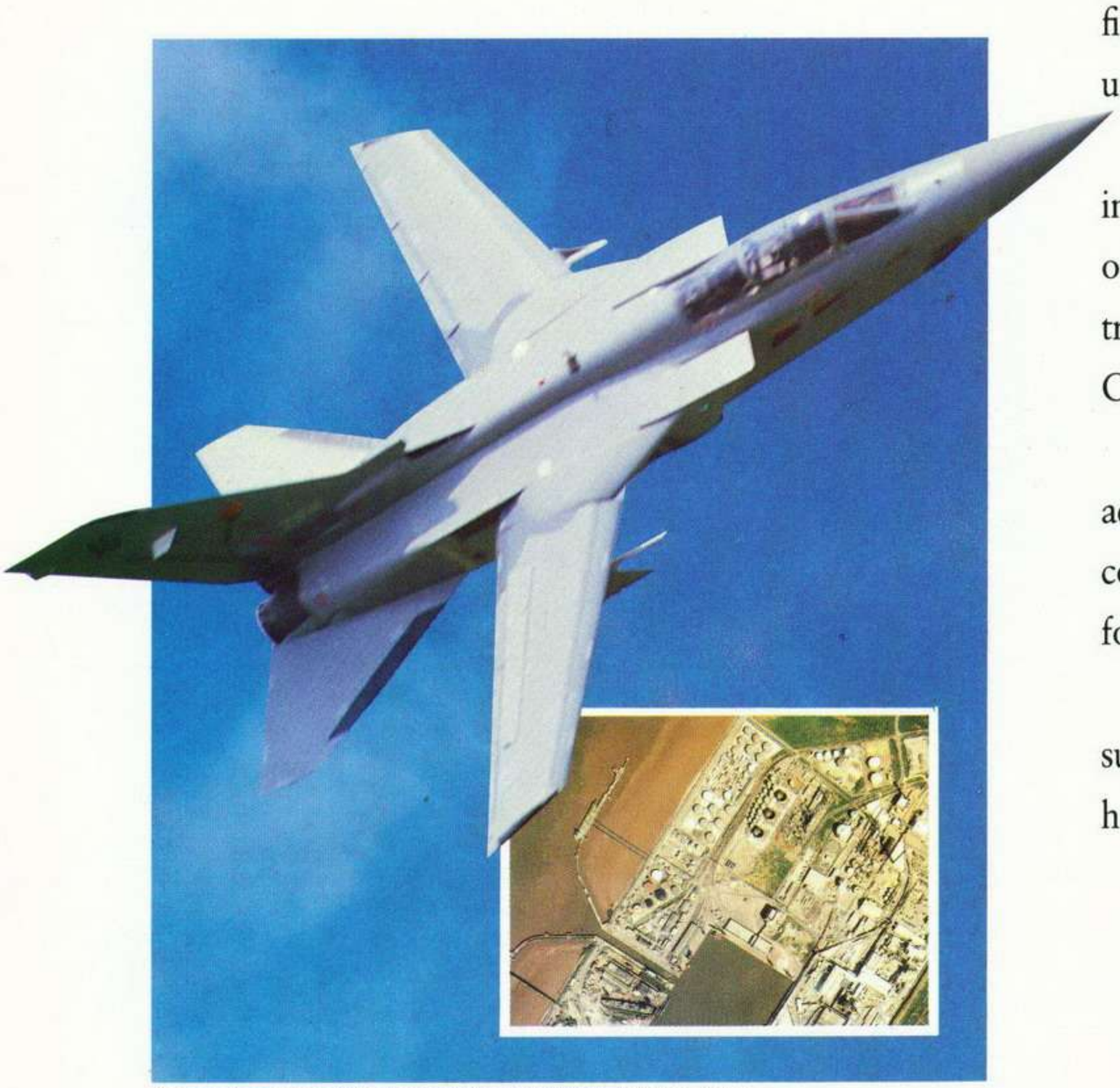
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Main picture: *The Falklands crisis resulted in the conversion of a number of Hercules to air-refuelling capability. Here a Nimrod takes on fuel during early refuelling trials.*

Right: *A No 43 Sqn Tornado F3 takes up position behind the Hercules before making contact with the drogue.* Bob Archer

Bob Archer looks at the invaluable contribution that the Hercules C1K has made to RAF air-to-air refuelling since the Falklands War.

The RAF's HERCULES tankers

During its 27 years of service the Royal Air Force fleet of Hercules has performed a variety of roles, many in response to crisis such as humanitarian relief as well as wartime resupply. The Argentinean invasion of the Falkland Islands in April 1982 was one such crisis which involved the Hercules being extensively flown to pre-position all manner of cargoes to Wideawake Airfield in the Ascension Islands, and later to the Falkland Islands themselves once the Argentineans were routed. The distance between the United Kingdom and Ascension Islands of 4,260 miles was an unmanageable non-stop range for the Hercules necessitating a refuelling in West Africa at either Banjul in the Gambia or Dakar in Senegal. The next stage between Ascension and the Falklands was 3,915 miles of Ocean which required the Hercules to route via South America to refuel at Montevideo, Uruguay. However, some were direct flights involving the Hercules departing Ascension at their maximum take-off weight of 175,000lbs. The runway at Wideawake has a raised section in the middle which did nothing to help the heavily laden Hercules to break ground. The distance to the Falklands was within range for a Hercules, although the unpredictable weather at Stanley frequently created landing difficulties at a time when diversion airfields were several hours distant and fuel reserves at a premium. The solution was to air refuel the Hercules through the new probe system which had been hastily developed and installed by Marshall Aerospace of Cambridge. The runway at Stanley Airport was only 4,100ft long and was therefore far too small to accommodate aircraft the size of the Victor tanker. Marshall was requested by the Ministry of Defence to determine the suitability of the Hercules being modified as a tanker aircraft.

Hercules C1 XV296 was flown from Lyneham to Cambridge Airport on 1 May 1982 as the prototype conversion with the fitment of a Flight Refuelling Ltd Mark 17B Hose Drum Unit (HDU). The unit was mounted on the inside of the rear cargo door with the hose and drogue extended through an opening in the centre of the loading ramp. The drogue was faired-in to the exterior of the door, with air refuelling signal lights mounted either side. A small rectangular fairing was added to the exterior of the cargo door which permitted the drogue to fit snugly, when not in use, thus enabling the aircraft to remain pressurised during transit flights. The rear cargo door was fixed in the closed position to prevent

damaging the HDU if opened accidentally. Additional tankage was not initially added as the fuel was drawn from the Hercules' own main tanks, although four large containers were subsequently installed in the fuselage which were capable of holding an extra 28,000lb of fuel.

The installation was completed within five weeks, with the first test flight taking place on 8 June when the drogue was successfully deployed. A second sortie took place two days later before the aircraft, now allocated the designation C1K, was flown to the Aeroplane and Armament Experimental Establishment (A&AEE) at Boscombe Down on 11 June for evaluation. During a test flight flown later in the day involving a 'dry' contact with a Harrier, the hose and drogue experienced buffeting which was considered to be unsafe for routine operations.

The Hercules returned to Cambridge on 15 June for modification to alleviate the problem. In the meantime Hercules C3 XV199 was loaned to Marshall and flown to Cambridge where numerous small woollen tufts were attached to the rear fuselage to evaluate air flow over the rear cargo door. Designers at Marshall added strakes to the underside of the loading ramp door to guide the airstream directly aft, and in parallel to, the hose and drogue when extended. With the additional modification in place, XV296 flew several test flights during mid-June before making its first successful 'wet' contact on 21 June with a Buccaneer. The Hercules was flown to Boscombe Down next day for acceptance trials before being declared suitable for operational service. With these complete the aircraft returned to Marshall on 29 June in preparation for delivery to RAF Lyneham on 5 July.

A further three C1s were initially earmarked for conversion to the tanker role, consisting of XV192, XV201 and XV204 which were delivered to Marshall on 21 June, 28 April and 12 June, returning to Lyneham on 26 July, 15 July and 21 July respectively. A further two were converted by Marshall during early 1983, with XV203 and XV213 being returned to Lyneham on 4 March and 10 March. Although conversion to the tanker role was not completed until after the Argentine surrender on 14 June, the aircraft were quickly impressed into service almost exclusively on the South Atlantic run. Their primary duty was to provide air-to-air refuelling (AAR) for Hercules flying cargo and personnel on the 'air bridge' between Wideawake Airfield, Ascension Islands and Stanley Airport.

With the Falkland Islands liberated, the next stage was for a credible land-based air defence to be established together with AAR support. The existing runway at Stanley Airport was too short to accommodate Phantoms with their look down/shoot down capability, so 2,000ft of AM2 matting was added enabling No 29 Squadron to commence operations from mid-October 1982. Once in theatre the Phantoms, and latterly Tornado F3s, were routinely air refuelled by Hercules tankers, particularly when patrolling the area to the west of the Falkland Islands. The continued presence of the mixed RAF contingent at Stanley resulted in the formation of numbered Flights to operate on a more permanent basis. No 1312 Flight was established on 20 August 1983 as the operator of the Hercules C1K with a nominal strength of two aircraft and three crews. The necessity to resupply the Garrison lead to the construction of Mount Pleasant Airport, which is known simply as MPA, to the south-west of Port Stanley. The facility was officially opened in May 1985 replacing the makeshift facilities at Stanley Airport.

No 1312 Flight operates with one aircraft and crew on a rota basis to maintain a round-the-clock Quick Reaction Alert (QRA). The QRA crew are on duty for a duration of 48 hours with a second on standby as replacement in the event of a scramble. As stated earlier, the primary role is to provide air-to-air refuelling support for the Tornados, although there are numerous secondary, but nevertheless important, duties for the crews of No 1312 Flight. The Hercules are frequently employed to act as a low level target for the interceptors which is a role totally removed from that normally associated with a cargo aircraft. The role is known as 'fighter affiliation' and is conducted with the Tornado Flight split between those defending the Hercules and those acting as aggressors. To be effective the Hercules employs evasive tactics more akin to the Tornados! Hercules crews also monitor shipping around the Falklands using either the *Orange Blossom* electronic support measures (ESM) housed in wingtip pods or the standard Ekco E290 nose radar. Whereas responsibility for the waters immediately around the Islands themselves is vested with the local Government, the Falkland Islands Outer Zone is patrolled exclusively by the RAF. Initially all shipping was visually sighted and identified, although more recently the task has been relaxed to include only those which are considered unusual. The Hercules is also employed in the search and rescue role as it is the only long range military aircraft based at MPA. Finally the Hercules is tasked to resupply the outpost at South Georgia with limited air drops of mail and provisions; the volume of cargo being restricted by the space available between the fuel tanks inside the aircraft.

The aircraft and crews of No 1312 Flight are

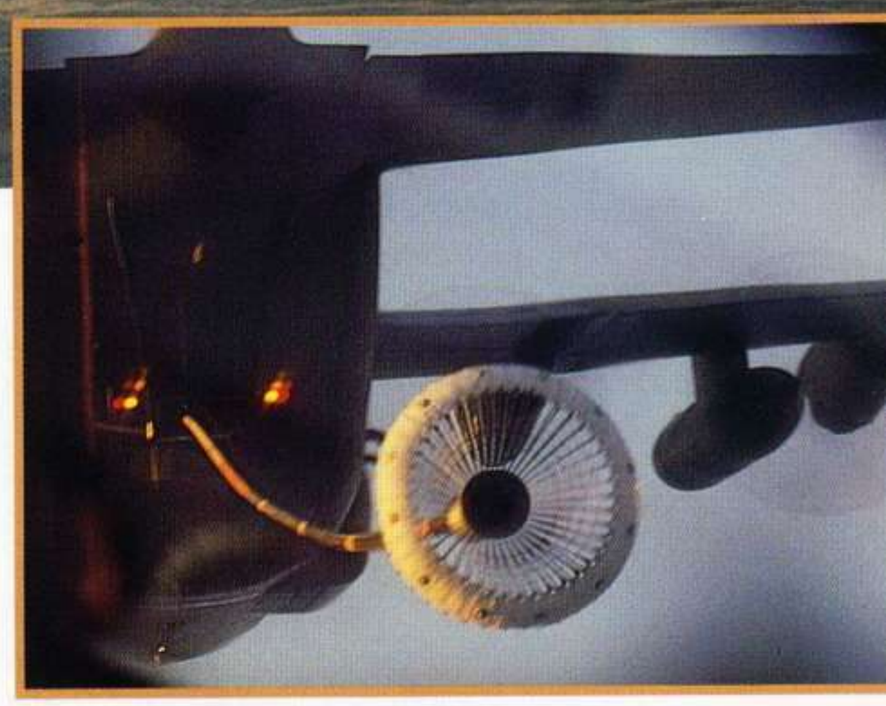


Left: *The refuelling drogue seen in the stowed position, flanked by a set of traffic lights. Note the strakes and yellow refuelling guidance stripe for the benefit of approaching 'customers'.* Bob Archer

Below: *Hercules C1K XV203 on the apron at RAF Lyneham. Of the six tanker conversions, five remain operational with two on station with 1312 Flight at Mount Pleasant on the Falkland Islands.* Bob Archer









Above: *A Hercules C1K tanker silhouetted against the sunset during a sortie over the North Sea with No 74 Sqn Phantom FGR2s in November 1991.* Right: *The receiver's eye view of the drogue being extended from the Hercules and* (below right) *the Phantom's refuelling probe making contact.* Photographs Bob Archer

drawn from RAF Lyneham, which is the home of the Hercules. The station has Nos 24, 30, 47 and 70 Sqns as its four operational squadrons in residents together with No 57 (Reserve) Squadron, whose role is to perform all manner of training associated with the Hercules. The latter unit, which was formerly No 242 Operational Conversion Unit (OCU), is the largest squadron at Lyneham and is divided into separate components each with specific tasks to perform. One of these components is the Support Training Squadron which is the parent organization for the Tanker Training Flight (TTF). Composed of two full crews who are air-to-air refuelling instructors backed up by a small administrative team, the Flight organises five courses each year of seven weeks duration to train ten complete student crews. The term 'student' is a little misleading as those destined to receive AAR training are fully qualified and experienced Hercules aircrew. Additional courses are organised for crews proficient in AAR who are required to attend the TTF for an annual refresher to be re-qualified.

Crews destined to fly the C1K are drawn from Nos 24 and 30 Squadrons with between one-third and one-half of the personnel of the two units are qualified in the AAR role. The TTF trains students in the specialised roles which they will routinely perform during the four month tours of duty in the southern hemisphere. The course commences with the provision of training to be the receiver during Hercules to Hercules AAR sorties. This involves flying in close formation with the receiver making contact from the extended drogue, and quite naturally requires total concentration on the part of both crews. The next stage is to dispense fuel to a variety of receivers including Hercules aircraft from the other Lyneham squadrons, as well as fast jet types. The students begin with AAR sorties conducted during daylight, but progress to night refuellings, some of which are accomplished in radio silence. Training sorties are performed within the specified air refuelling areas (ARA) located off the coast of the UK. As the majority of receivers are stationed on the eastern side of the country, the lion's share of the ARAs are over the North Sea.

To ensure students derive the maximum benefit from their training, the instructors arrange AAR sorties with a variety of aircraft types including Fleet Air Arm Sea Harriers as well as RAF Tornados, Harriers and Jaguars. Hercules AAR tracks are primarily located at low level as the C1K operates more effectively at these altitudes. Refuelling of fast jets invariably requires the tanker to be on station earlier than planned, as the AAR portion forms only a small part of the receiver's sortie. Refuellings are frequently planned for 8,000ft although poor weather conditions over the North Sea can result in contact being made well below this level. The sortie on which the Tornado photograph was taken took place off the coast of North Eastern England during late January when the weather dictated a change. Planned for 8,000ft, some rain storms in the area forced the sortie down to 4,000 ft and for a brief period to 2,000ft in the search for clearer weather. However, at the lower level there was some turbulence which taxed the flying skills of the No 43 Squadron Tornado pilot, as well as the crew of the Hercules tanker. Undeterred, the Hercules pilot held the tanker as steady as possible while the Tornado crew attempt to 'prod' the drogue.

The Hercules does not have a rearward facing camera system to enable the refuelling operation to be monitored from the cockpit, so the Loadmaster maintains a visual watch of the extended hose and the receiver through the small aperture in the cargo door. The quantity of fuel supplied on each 'prod' is supervised by the Navigator who must ensure that sufficient remains for the tanker to reach its eventual destination, with a realistic reserve. Fuel for the receivers is pumped from the tanks in the wing of the Hercules and not from the containers in the cargo area. However, fuel from these additional tanks can be pumped up into the wing between 'prods' to maintain stability of the Hercules. Fuel is frequently carried in the forward pair of tanks in the cargo hold, but rarely in the aft pair apart from long distance flights such as those to the Falkland Islands.

In the time honoured tradition the fast jet receivers formate with the tanker on the starboard side before one repositions directly behind the Hercules. With the aid of a yellow line painted on the underside of the Hercules, the receiver moves gently forward until contact is made with the drogue. Once the refuelling probe has successfully coupled with the drogue fuel is transferred at a rapid rate. Fighter aircraft often take turns to 'prod' more than once as this affords practice at the art and hones professional pride for the pilots. With refuelling complete the fighter aircraft invariably depart the area with the customary display of manoeuvrability and a little afterburner.

As can be seen, the keynote is flexibility with crews being required to adapt to circumstances. Unlike their cargo hauling duties, where they fly from one location to another in accordance with the flightplan, the AAR role necessitates the crew learning to accommodate the needs of the receivers. Although the primary operating area for the Hercules tanker is the south Atlantic, those stationed in the UK are regularly tasked with refuelling sorties. The increase in the number of overseas commitments by VC10 and TriStar tankers, coupled with the recent retirement of the Victor fleet, has seen a growing number of requests for the services of the Hercules C1K. Of the six aircraft originally modified, five remain as tankers, with XV192 having converted back to the airlift role.

During December 1993 the Ministry of Defence issued a requirement for a tender to replace part of the RAF Hercules fleet by the end of the decade. Amongst the types to be considered are the C-130H Hercules and the new C-130J Hercules II. In addition Marshall is undertaking a feasibility study for the refurbishment of the existing Hercules fleet as an alternative to purchasing new equipment. Personnel at RAF Lyneham who have studied the design and capabilities of the C-130J suggest it would be ideal for the AAR as well as routine cargo operations.

Edward Bishop, author of 'The Debt We Owe', takes a look back over 75 years of

The Royal Air Force Benevolent Fund



Above: *Stephen Pritchard outside his new home near Wrexham.*

If a second Royal Air Force 75th anniversary seems confusing then it is because the RAF Benevolent Fund was founded a year after the merging in 1918 of the Royal Flying Corps and Royal Naval Air Service into the Royal Air Force. Strictly speaking the Benevolent Fund began as the RAF Memorial Fund which was launched in 1919 by Air Marshal Sir Hugh Trenchard – later Marshal of The Royal Air Force Lord Trenchard – to raise a memorial to airmen who had died in the 1914-18 War.

In the summer of 1923 the memorial, a simple monument in Portland stone surmounted by a gilded eagle and facing symbolically across the Thames to France, was unveiled on the Embankment near Westminster by the Prince of Wales. However, the Fund had not waited for the memorial's completion before beginning its 75 year task of helping airmen and airwomen.

In war the magnificent men in their flying machines – the Cavalry of the Air as prime minister Lloyd George lyricised – were among the 'multitude of heroes'. But peace had brought the Cavalry of the Air very much down to earth in the front line of civilian life. Seventy-five years on, when the Fund spends some £7 to £8 million a year on welfare, its modest shilling for a night's lodging to seek work and provisions of tools of a trade and repair of boots appear modest in the extreme. Yet in 1919 and the early 1920s such benefits met the criterion of alleviating distress and were in tune with what the Fund could afford as appeals brought in such sums as £5 donated by King Alfonso of Spain and handed to the Secretary at an inaugural fund raising ball at the Ritz Hotel.

So many examples could be cited to demonstrate the difference 75 years has made, but perhaps the cases of two current beneficiaries quoted here say it all.

Senior Aircraftman Stephen Pritchard was a Movements Operator with Air Movement Squadron at RAF Brüggen when he suffered multiple injuries in a motorcycle accident. He can expect to be in a wheelchair for the rest of his life. Stephen needed a home and the Fund stepped in. Through its Housing Trust it provided a new bungalow where Stephen wanted to live in Wales. It also helped with furniture, a costly medical bed, a deposit on an Astra, cash for the car's modifications, a powered wheel chair and a personal computer to facilitate work from home for a market research company.

Flight Lieutenant Tim Ellison, who survived a Harrier GR3 crash at RAF Wittering is also wheelchair-bound. But he is mobile again thanks to a modified Toyota Landcruiser purchased with a grant from the Fund. Help towards alterations to the family bungalow, multi-gym equipment and a lightweight wheelchair has also been provided.

Stephen and Tim's welfare cases are but two of some 18,000 assisted in any year. None would have been possible but for the Father of the RAF Lord Trenchard's foresight and 75 years of judicious fundraising, good housekeeping and advantageous investment.

Over the years, other than conventional donations and legacies and, vitally, the serving RAF's half a day's pay a year scheme, the



Left: *Pupils at the Fund's Duke of Kent School.*

Below: *The well attended International Air Tattoo, held at RAF Fairford, provides important funding.*
Peter R March





Left: *Flt Lt Tim Ellison plans his first trip in his specially modified vehicle.* Peterborough Evening Telegraph

Fund has attracted money from some unexpected sources. There was Alfonso's fiver of course and an early £31.11s from Wei-hai-wei in China and £406 from Swaziland. There were also unexpected windfalls from Lawrence of Arabia, Emperor Haile Selassie of Ethiopia and Sir Barnes Wallis of Dambusters renown.

When, following the 1914-18 War, Colonel T E Lawrence submerged himself as an LAC in the RAF, he would tip the Fund off about the problems of barrackroom fellows and seek assistance for them. Flushed with royalties from books abut his desert exploits in WWI he also established the Anonymous Education Fund – since retitled the Lawrence of Arabia Fund.

Haile Selassie's gift arrived on the then Secretary's desk during WWII. Opening the brown paper parcel the Secretary found 100 ounces of gold. The gift was accompanied by a note apologising that the emperor had no cash but was 'particularly grateful to the RAF for its part in restoring him to the throne'.

If Sir Barnes Wallis's generosity was more prosaic by comparison it was to become one of the Fund's most cherished beneficences. His gift of a £10,000 Inventors' Award for designing, among other weapons, the bouncing bombs which breached the Mohne and Eder dams in 1943 part-funded a Trust at his old school, Christ's Hospital. Foundationers from the Duke of Kent, the Fund's own school at Ewhurst in Surrey are regular beneficiaries.

The RAF Benevolent Fund by no means relies upon such individual generosity, welcome though it is. In a tradition going back to inter-war aerial pageants and displays its air shows have become international events.

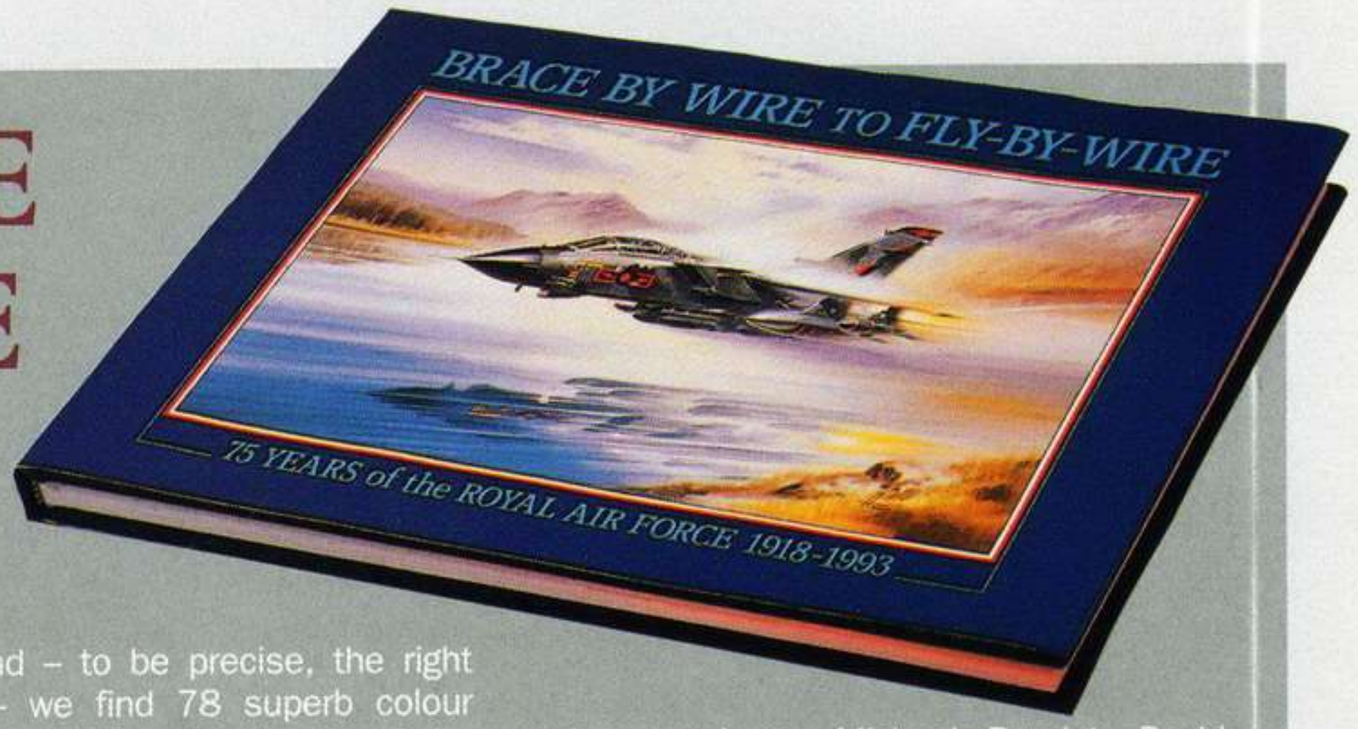
If the RAF organisers of a 1920 pageant were so non-plussed by £6,700 gate money that six wives 'banked' it under their pillows that night, today's International Air Tattoos – bringing in some £3-400,000 – are a highly sophisticated business operated from RAF Fairford by its commercial arm, RAF Benevolent Fund Enterprises.

Social conditions may have changed radically since resort to the pillow bank, but veterans, dependants and the serving air force will be reassured that the Fund continues to raise and spend money on their behalf.

The Fund still assists 1914-18 War veterans and their dependants and there are many 1939-45 War survivors for whom convalescent or long term, possibly permanent care is needed. Waiting lists for the Fund's homes, Princess Marina House at Rustington in West Sussex and Alastrean House near Tarland in Aberdeenshire confirm this.

Thus, the Royal Air Force Benevolent Fund as Winston Churchill, Britain's wartime prime minister put it so characteristically in a BBC Radio appeal, will continue for many years to repay 'The Debt We Owe'. For, as a former Chairman said: 'It would be unthinkable not to help'.

BRACE BY WIRE TO FLY-BY-WIRE



Edited by Peter R March
RAF Benevolent Fund Enterprises,
168pp, colour, £30.00 hardback and boxed

Producing a book which appeals to two, usually separate groups of readers is a creditable achievement which can generate a third, even wider market – especially if HRH Prince Philip and the Prime Minister can be persuaded to jot a few words of approval on the opening pages. Such has been achievement of this landscape-format volume, which traces the RAF from the stick-and-string/seat-of-pants days of 1918 through 75 years to today's electronically-flown aircraft.

On one hand – to be precise, the right hand pages – we find 78 superb colour paintings, 9in x 5.75in size, by 29 of the UK's leading aviation artists. Subjects are arranged in chronological order and each has been chosen for its authenticity and attention to detail - no avant garde artistry here. Contributors include Wilf Hardy, whose work regularly decorates the covers of RAF Benevolent Fund Enterprises publications, and others more associated with the gallery, such as Michael Rondot, David Shepherd, Michael Turner, Keith Woodcock and Frank Wootton.

On the other hand, every illustration is faced by a page devoted to events concerning the RAF in each year of its existence. Approximately half the page is in narrative form; the remainder a chronology. Together, the words paint a remarkably comprehensive picture of the RAF's history which will be both of value to researchers and of interest to the browser.

Taken together, the 75 paintings and 75 yearly entries form a unique record of the RAF's campaigns and achievements. Even the most determined of nit-picking reviewers can find little ground for complaint in either the illustrations or the accuracy of the text and quality of its presentation. Full marks are unreservedly in order.

Paul Jackson



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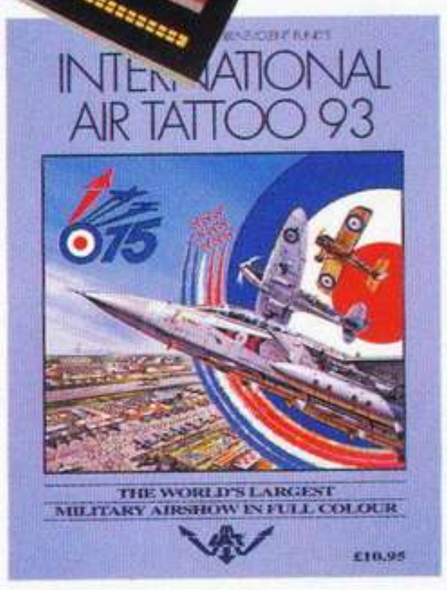
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THE Shuttleworth COLLECTION

SOVEREI



Peter Symes recounts the tragic background of the RAF pilot, Richard Ormonde Shuttleworth, in whose memory the finest relics of the pioneering pre-war days of aviation in Britain have been preserved in flying condition, at a tiny grass airfield in Bedfordshire.

On the A1, where it bypasses Biggleswade some 45 miles north of London, there are signs that read 'Aeroplane and Vehicle Collection'. Follow them just two miles westwards into the heart of rural Bedfordshire and you will catch a glimpse of the imperious outline of a Victorian Gothic Mansion. Then, lush green in contrast with taller grass, you will light upon the cruciform of two grass runways of an aerodrome and, in front of a backdrop of majestic trees, a row of hangars. Turn through the gates of what the hoarding proclaims as *The Shuttleworth Collection* and you will be transported back to yesteryear and the life and times of one Richard Ormonde Shuttleworth, the last Squire of Old Warden.



In 1938 Richard Shuttleworth was 29 years old and come the Munich Crisis he tried, for the second time, to join the Royal Air Force Volunteer Reserve (RAFVR) but was turned down yet again because of impairment to his hearing, caused by a motor racing accident. Acting on advice to 'tip the Medical Orderly 10 shillings (50p) and get him to put his thumb on the side of your face instead of your good ear', he was thus referred to the Chief Medical Officer, who had already turned him down twice. This time Richard was able to persuade him, largely because of his already significant civilian flying experience, and he was accepted.

Having been allowed to get in the especially important harvest that year on his estate, Pilot Officer Shuttleworth, RAFVR was sent to the Central Flying School at RAF Upavon at 48 hours notice in November 1939, before progressing to No 10 Flying Training School at Ternhill to fly Airspeed Oxfords and North American Harvards. Then in the summer of 1940, when the demand for operational pilots became critical, he was posted to No 12 Operational Training Unit at RAF Benson to consolidate his 109 hours on military types on top of the 1000 hours private flying experience, by flying the lumbering Fairey Battle, alongside some 30 young Polish pilots.

A characteristic of the Battle's take off was

Left: *Pilot Officer Shuttleworth RAFVR outside his home at Old Warden.* Below left: *The first Comper Swift is delivered in 1932, with the original hanger in the background.* Below right: *Richard Shuttleworth in the Bleriot XI at the London Aero Club Garden Party in September 1936.*





GNS in the sky

that a change of propeller pitch reduced the recorded RPM and gave the indication of an engine failure. Consequently an inexperienced pilot could be induced to take his hand off the throttle to pull up the flaps and if he forgot to tighten the friction knob, the throttle would creep back and the aircraft lose vital power. Consequently, the training accident rate was very high. The inventory at RAF Benson included somewhat weary Battles that had actually been in action in the débâcle in France and the Low Countries in May 1940.

On the night of 1-2 August Richard signed for one of these Fairey Battles (L4971), for night cross-country flying, but was recalled in view of a forecast deterioration in the weather. According to an NCO concerned "Pilot Officer Shuttleworth was still sitting in his machine, rather vexed at being recalled. He pointed to the still star-studded sky and asked why there was a recall, which I explained. After a while he announced that he was taking off again for some local flying. He thereupon started his engine, taxied to the flare path and took off. A very short while afterwards I saw a huge red glow appear on the horizon..." Thus the motto *Isto Velecior Vita* (Swiftly Thither Life) that appears on the escutcheon of the Shuttleworth family became tragically apposite.

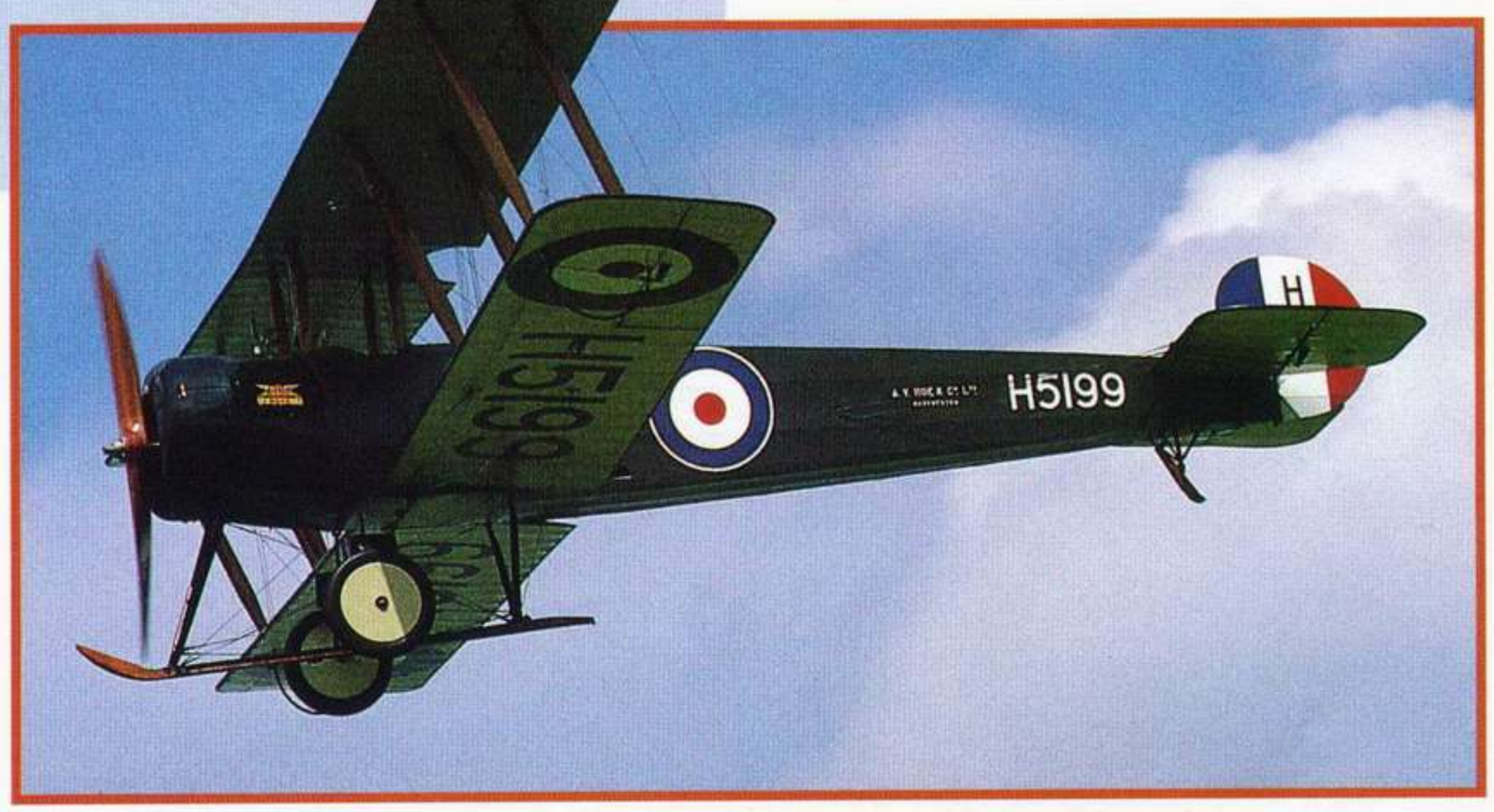
The Shuttleworth story begins in the 1850s when a Joseph Shuttleworth went into partnership with a Nathaniel Clayton in Lincoln. They had identified a market for steam-powered farm machinery and risked their whole capital in the race to build a winning product. They succeeded and the following 40 years saw a once humble works at Stamp End in Lincoln expand to cover 20 acres and to employ a work force of 2,000. In his transition from tradesman to gentry, Joseph Shuttleworth's wealth became great and he was soon established as a notable figure and benefactor both in Lincoln and latterly in Bedfordshire, where he had purchased Old Warden Park in 1872. After his death in 1883, this fine estate was left to his younger brother, Frank, a Major in the 7th Hussars. Frank Shuttleworth ran this estate where he was Joint Master of the Cambridge Hounds, organised famous shoots, raised the Bedfordshire Imperial Yeomanry and was made High Sheriff of the County. Into this archetypal Edwardian story came his only son Richard Ormonde Shuttleworth on 16 July 1909. Significantly his birth was nine days before Louis Bleriot became the first to fly an aeroplane across the English Channel.

In 1913 Colonel Frank Shuttleworth died,

Left: *Bristol Fighter D8096 joined the collection in 1949.* Peter R March

Below: *Shuttleworth's Avro 504K is the trainer version of the type, built in 1918.* Peter R March

Bottom: *A further WW1 type – the Royal Aircraft Factory SE5A F904, which flew as a 'skywriting' aircraft in the 1920s.* Peter R March











Above: *Avro Tutor K3215 served with the RAF College Cranwell for several years.* Graham Finch

Right: *Early aviation is represented by a replica Bristol Boxkite, originally made for the film* Those Magnificent Men in their Flying Machines. PRM

leaving Richard to be brought up in the manner befitting the young 'Squire of Old Warden'. At 13 he scraped into the hallowed cloisters of Eton College, though he already showed signs that academics were not going to be his strong point. Eton's then radical and popular School of Mechanics no doubt triggered a genetic throwback to his grandfather and Richard's mechanical bent burgeoned. The penalty was, however, frequent caning for being covered in oil and grease and arriving late at lessons. He rebelled at the regimentation and, having failed his exams after two years, he was euphemistically 'superannuated' from Eton. To get into the cavalry, like his father before him, he was sent on a crammer course at Lathbury Park, near Newport Pagnell (but not without keeping a motorbike secretly in a barn nearby). In 1930 he passed out of Sandhurst as a 2nd Lieutenant in the 16th/5th Lancers.





Having tuned a 1923 349cc Sparkbrook motorcycle to travel from Tidworth for weekends at home, he got wind of an 1897 Panhard Levassor gathering dust in a garage in Leighton Buzzard. It had been owned by Lord Rothschild, who had gained fourth place in the Paris-Amsterdam race in 1898 at an average speed of 24mph, but in the early 1920s he ordered his chauffeur to get rid of 'the old crock'. Richard purchased it for 25 shillings (£1.25), and with a 1903 de Dietrich 24hp Racer that languished in the mansion garage, he effectively began the Shuttleworth Collection.

In 1932 a significant turning point came in the life of Richard Shuttleworth. This was when he inherited the fortune of his childless uncle who had witnessed the winding up of the Clayton & Shuttleworth enterprise in Lincoln. After producing a number of Handley Page 0/400s, Sopwith Triplanes and Camels, including the aircraft (B7270) that Captain Roy Brown was flying when he was credited with shooting down Baron von Richtofen, the company had fallen victim to the post-war slump. Then valued at £2 million his inheritance made him one of the richest men in England. Any lesser character might have been inclined to leave our shores for an easier life abroad, but not Richard Shuttleworth. For the next eight

Left top: *The 1912 Blackburn Monoplane at rest in the exhibition hangar at Old Warden.* Peter R March

Left: *This Sopwith Pup was obtained in 1936, when it was a civil registered Sopwith Dove, and was subsequently converted back to original Pup standard.* Peter R March





Left: *The Collection's Hawker Hind, retrieved from Afghanistan in the 1970s, and Gloster Gladiator are the only examples of their type flying today.* Peter R March

Above: *The Hawker Tomtit is the sole survivor of 25 examples built.* Peter R March

years, he became a veritable whirlwind of enterprise and high-spirited adventure.

In 1927 a New Zealand-born RAF officer, George Stead, had given Richard his first flight and recalled "from then on it was the air for him". In fact, Richard had resigned his commission in the Army partly because of aspirations to join the RAF. Unfortunately they decided that they had no need for his services – at least for the time being.

The first aircraft he acquired was a 1928 DH60 Hermes Moth, 'a snip at £300', in which he learnt to fly, with a combination of some professional, and not a little, self tuition. Then, with 8,725 shares in Flight Lieutenant Nicholas Comper's company (Comper Aircraft), he obtained a couple of Comper Swifts that he and George Stead flew via Italy, North Africa, Arabia, along the coast of Baluchistan to Karachi and thence to Delhi, to take part in the Viceroy of India Challenge Trophy. This was followed by a Spartan Arrow, an ex-military 450hp Napier Lion engined Blackburn Velos that he later cannibalised to use the materials to restore other aeroplanes in the collection, and a de Havilland DH84 Dragon that was purchased for £2,500 after being declared surplus from HRH Edward, Prince of Wales' Royal Flight. Following the liquidation of National Flying Services he obtained several of their Desoutter Monoplanes for hiring out.

Richard's acquisition of his first truly historic aeroplane, appropriately a 1909 Bleriot XI, was quickly followed by a 1910 Deperdussin from a local man, Mr A E Grimmer. From mid-1936 he regularly showed these frail craft at RAF Displays at Hendon, Empire Air Days at Cranfield and the Royal Aeronautical Society Garden Parties. While on holiday in Belgium he bought and flew home a Hanriot HD1 (HD-75) WW1 fighter that had once served on the Belgium Air Force's 'Thistle Squadron'. This Hanriot is now displayed at the RAF Museum Hendon. He acquired a 1915 Avro 504K to use for public joy rides and a Sopwith Dove that he converted back to its 1916 single seat Pup fighter configuration. Pilots for these aircraft in addition to himself included Jimmy Edmunds and Flt Lt Allen Wheeler, whom he had befriended when the former was stationed at RAF Henlow. In 1938 Richard heard about a Blackburn Monoplane dating from 1912 stored at a farm near Wittering. When he found the owner indifferent to removing the hayrick over it, Richard bought that too – not leaving it behind, as the farmer probably bargained upon, but retrieving it to Old Warden for use on his farm.

After joining the RAFVR, May 1939 saw Richard, Jimmy Edmunds and Allen Wheeler flying respectively the Bleriot, Deperdussin and the Pup at the RAeS Garden Party at Fairey's Great West Aerodrome. Although war was looming, it was not the last time that the Shuttleworth machines were to take to the air.

Nine months later Richard Shuttleworth was dead. His funeral was a crowded, tear-stained affair at St Leonard's Church on the hill overlooking Old Warden, to where his coffin of oak hewn from the Estate was drawn on a farm wagon. The effect of his death upon his mother was obviously devastating but she dedicated herself to running a Red Cross Convalescent Home and Auxiliary Hospital in the mansion throughout the war. Richard had bequeathed everything to her, and she decided to use his legacy to provide a centre for agricultural training and for the promotion of education and training in the science, practice and history of aviation and automotive transport. For such purposes she established the Richard Ormonde Shuttleworth Remembrance Trust in 1944.

Half a century later you can see at Old Warden Aerodrome many of the aeroplanes and vehicles which Richard originally acquired and have been on show since The Shuttleworth Collection opened to the public in 1963. A De Havilland Moth and Bleriot XI, together with the original Panhard Levassor and a Railton Sports car, herald the visitor to the continuing presence at Old Warden of seven of the aeroplanes and a dozen or so vehicles that Richard Shuttleworth had the foresight to collect in just a decade of his brief lifetime.

The number of aeroplanes at Old Warden has expanded well beyond that original seven to almost 40 today, about half being the sole surviving examples of their marque and by far the majority still maintained in flying condition. This collection is arguably unique in having the largest number of airworthy original military and civil aeroplanes. While the RAF Museum at Hendon has a comprehensive display of RFC and RAF aircraft spanning the 85-year history of manned flight in Britain, you have to travel up the A1 a little way to Old Warden to see working examples of the military machines from the Royal Flying Corps and birth of the RAF in 1918, through to WW2.

Bleriot XIs served with the Royal Flying Corps until the British aircraft industry gathered momentum. The Shuttleworth aircraft was built in 1909 and used for training at Hendon until it crashed in 1912. In 1911 the War Office ordered four examples of the Bristol Boxkite, when many senior offers were opposed to the introduction of the aeroplane that, they insisted, could never replace the horse! There are no surviving examples of this early military aircraft but the Collection does boast the only flying replica of the Boxkite made for the film *Those Magnificent Men in their Flying Machines*. Four Avro 504s made military history in November 1914 by carrying out the first pre-planned bombing attack, on the Zeppelin sheds at Friedricshafen. The Collection's Avro 504K is the trainer version. It was built in 1918 and was used by the RAF as late as 1940 when it was impressed back into service for gliding towing experiments.

The Sopwith Pup is notable, not least for being the first aeroplane to be landed on a ship underway, when in August 1917 Sqn Cdr E.H. Dunning of the Royal Naval Air Service (RNAS) performed this remarkable feat. Richard Shuttleworth's acquisition is painted in the markings of N6181 *Happy* of 3 Squadron RNAS. On the day of his 100th birthday it was flown past Sir Tom Sopwith who had earlier classified as a 'late production' aircraft, an example of his Triplane that the volunteers of the Northern Aeroplane Workshops completed for the Collection. It flies as N6290 *Dixie II* of Naval Eight Squadron, and has recently been joined, by the type that replaced it on the Western Front, a Sopwith Camel (B6291) kindly lent by Tony Ditheridge. This is a genuine machine that served on 10 Squadron RNAS – albeit for only two days before being extensively damaged.

Air supremacy from 1917 onwards is illustrated by the Bristol F2b 'Brisfit' that earned the reputation of being the most effective fighting aeroplane of WW1. The Collection's D8096, built in 1918, served with No 208 Squadron RAF in Turkey in 1923 for the Chanak crises. Registered G-AEPH in 1936 the Bristol Fighter was stored through WW2, passing into the care of the Shuttleworth Collection in 1949. It was rebuilt to flying condition by the Bristol Aeroplane Co at Filton and was airborne again on 14 February 1951. Until 1992 it was flying with the earliest Rolls-Royce aero engine in operation (a 275hp R-R

Falcon III V-12). This powerplant has since been replaced by a spare Falcon III while the original is being overhauled.

Service history of the Collection's Royal Aircraft Factory SE5A (F904)is obscure. When it was discovered in the roof of the Armstrong Whitworth flight shed near Coventry in 1955 it was found to have been G-EBIA flown by the 'skywriter' Major Savage in 1924. Rebuilt at Farnborough by the Royal Aircraft Establishment it was flown again on 4 August 1959 by Richard Shuttleworth's close friend Air Commodore Allen Wheeler. The SE5A was the mount of aces like McCudden and Mannock who encountered opponents flying such types as the Luft-Verkehrs-Gesellschaft (LVG) CVI, the Collection's example being the only genuine German two-seater from WW1 in flying condition.

The period between the wars is well represented at Old Warden by RAF training types like the Hawker Tomtit (K1786), the sole survivor and the last one of only 25 built around 1928. There is the ubiquitous DH82 Tiger Moth (T6818) and of course several examples of the DH60 Moth from which it derived. The Tiger Moth has a practical application today for the conversion of new Shuttleworth's pilots who are, in the main, graduates of the Empire Test Pilots' School. There is also the Avro Tutor (K3215) that proudly carries on its fin the badge of the RAF College Cranwell where it served from 1933 to 1936; and the Miles M14A Magister (P6382), a survivor of 1242 built, that served with no fewer than 16 Elementary Flying Training Schools.

The last of the RAF's front line biplanes are also well represented. There is a Hawker Hind (K5414) painted in the markings of No XV Squadron. This light bomber was retrieved 6000 miles overland from Afghanistan in the 1970s and flew again at Old Warden on 17 August 1981. It is the only Hind flying in the world, and is the last airworthy original representative of Hawker's military biplane line that served the RAF so well in the 1930s. Likewise the Gloster Gladiator (L8032), the RAF's last biplane fighter to see front-line service, is the only example flying today. This machine, a hybrid of two machines (the remainder being the Sea Gladiator in the Fleet Air Museum, Yeovilton) is painted with the markings of No 247 Squadron that flew them from Roborough, Plymouth throughout the Battle of Britain.

The Collection's Spitfire (AR501) is a Mark Vc clipped wing version that flew with No 310 (Czech) Squadron in 1942. Post-war it was used as an instructional airframe until restored to flying condition for the film *The Battle of Britain*. It is probably the most authentic looking Spitfire and definitely the only one with the correct propeller currently flying in the UK. Joining the Spitfire in 1994 will be Hurricane 1B (Z7015), that has been rebuilt to flying condition over many years – initially at Staverton and more recently at Duxford, in a collaborative effort lead by the Imperial War Museum. Built in Canada for the RAF in 1939 it was converted as a Sea Hurricane by General Aircraft. Like the Spitfire, this historic fighter was used as a ground instructional airframe at Loughborough before being acquired by the Shuttleworth Trust.

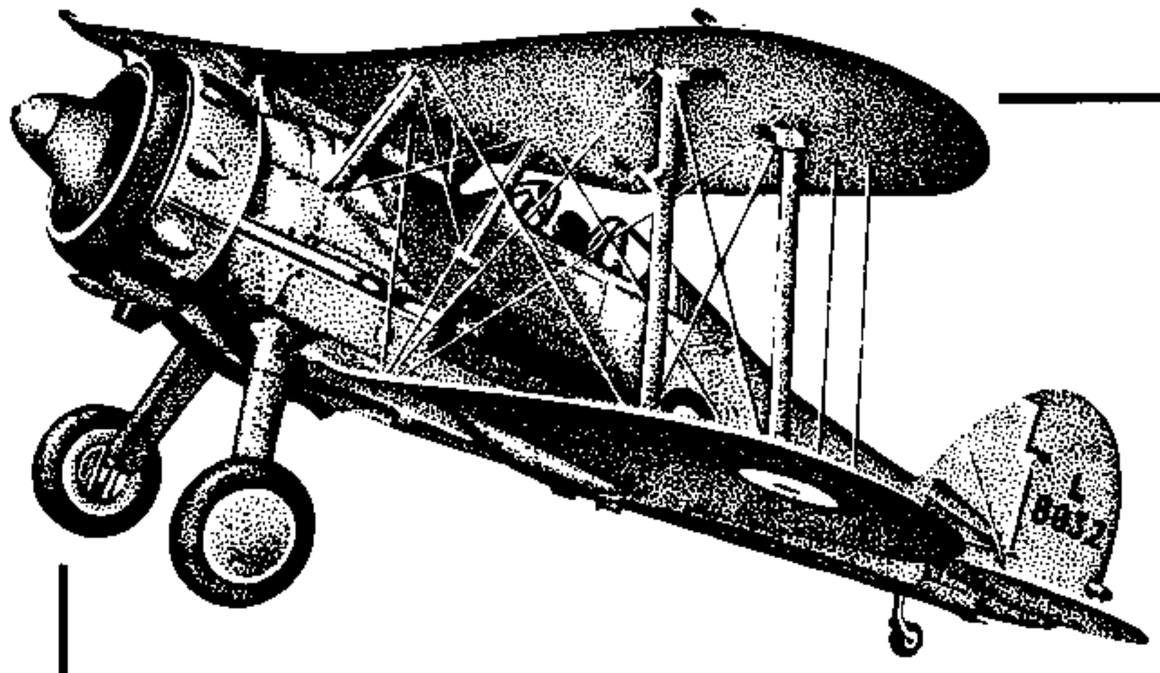
These historic aircraft are on view throughout the year at Old Warden Aerodrome and a number of them are flown, along with notable types from other collections and more modern aircraft, on the first Sunday of the month from May to October. On three Saturday evenings in the summer some of the oldest and most delicate aircraft are displayed, if the calmer evening weather conditions permit.

Thanks to the energy and enthusiasm of Richard Ormonde Shuttleworth and the desire of his mother to preserve his memory, there is at Old Warden a priceless collection of airworthy historic aeroplanes representing the progress of aviation in each of the three decades from the 1909 Bleriot Type XI to the Spitfire three decades later.

THE SHUTTLEWORTH TRUST GOLDEN ANNIVERSARY YEAR

PROGRAMME OF EVENTS AT OLD WARDEN AERODROME

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Sunday 5 June	**D-Day Display** including the 10th Great British Picnic
Saturday 18 June	**Sunset Flying Display II** (6.30pm)
Sunday 3 July	**Military Flying Training Day** including the Arnold Scheme & BFTSs Reunion and Steaman Rally
Saturday 16 July	**Sunset Flying Display III** (6.30pm)
Sunday 7 August	**Summer Air Fête** including No 1 British Flying Training School Reunion Garden Party
Sunday 4 September	**Air Racing and Records Display**
Sunday 2 October	**Autumn Air Day**



Time *always* flies at Old Warden

Air Displays: Sunday 1 May, Saturday 14 May, Sunday 5 June, Saturday 18 June, Sunday 3 July, Saturday 16 July, Sunday 7 August, Sunday 21 August, Sunday 4 September, Sunday 2 October.

There's plenty to see and do all year round at The Shuttleworth Collection. Five decades of transport history fill seven floodlit hangars displaying unique aeroplanes: from a 1909 Bleriot through types from WW1 and the heydays of flying in the 1920/30s to the ever evocative Spitfire of the 1940s, complemented by a magnificent collection of road vehicles such as an 1898 Panhard Levassor and a 1937 Railton sports car. From April to October there are flying displays, motoring and other outdoor events. In winter too there is always plenty to experience, such as overhauls and restorations. *Whatever the weather time will fly!*



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1. You may send as many entries as you like, but each entry must be made on an official coupon.
2. Photocopies of the coupon and handwritten entries will NOT be accepted.
3. No responsibility can be accepted for loss of entries or damage to them however caused.
4. The judges' decisions will be final. No correspondence will be entered into.
5. Closing date for receipt of entries is 30 September 1994. The prize winner will be notified by post.
6. The prize winner's name together with the solution will be available from the Promoter's Office at the address below on receipt of an SAE. PROMOTER, RAF BENEVOLENT FUND ENTERPRISES, BUILDING 15, RAF FAIRFORD, GLOS GL7 4DL.

Clues Across

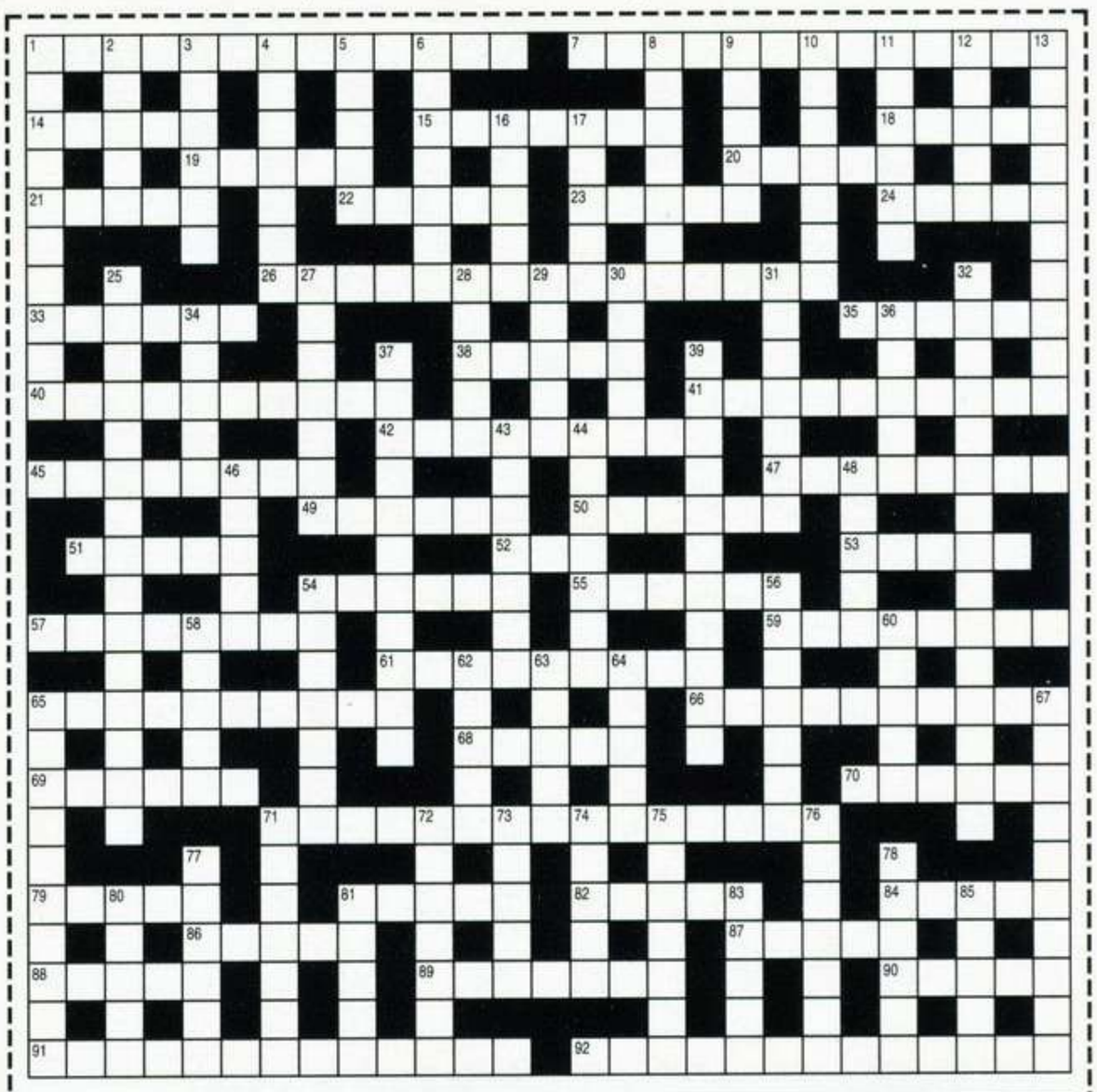
1 and 42 This IAT does not equal Indicated Air Temperature! (13, 3, 6)
7 Boeing B-29 or B-50 (13)
14 Way everybody could lose control in flight (5)
15 Vickers' aircraft found in Malta, we hear (7)
18 Lockheed P-3 (5)
19 Love soundly the Jaguar's engine (5)
20 Eg, DH-2, DH-4 or DH-6 (5)
21 and 47 A method of how to join the circuit (3-2-3-5)
22 A couple on the aircraft parking area (5)
23 Guardian of an Avro (5)
24 Aircraft tube aircrew member changed centrally from 12 to 20 (5)
26 Scale Effects' physicist's flow pattern constants (8, 7)
33 Supreme dominion class of flying boats (6)
35 Starry part of RAF motto with learner attached (6)
38 Sweeps along 'Russian' tactical missiles (5)
40 Aircraft snag fixer (10)
41 Launched Thor rises around the East and plays the orator (10)
42 See 1 across
45 Used to help carrier aircraft get airborne (8)
47 See 21 across
49 The S in AWACS, LABS or LAMPS (6)
50 Amounts of ammunition or stores (6)
51 Oar I'd use for moving RX/TX set (5)
52 Precautionary emergency call from aircrew (3)
53 Early Mexican Piper! (5)
54 Parachute used, for example, during 71 across (6)
55 A300-600R (6)
57 Buffalo maker (8)
59 Crystals ATS see in Court of Session? (4-4)
61 Heel over revolving aerofoil . . . . (4, 5)
65 and 81 down. . . . used for pitch control of helicopter (10, 5)
66 Type of target it should be easy to hit (4-6)
68 WWI German bomber obtained heavy artillery (5)
69 SAAB J32 (6)
70 General Dynamics' SAM is a colourful looker (6)
71 Ejections (8, 7)
79 Pedestrian wind speed indicators! (5)
81 C-130 Hercules air drop system near the ground (5)
82 Previous aircraft used by the Red Arrows (5)
84 Topless Czech trainer, L-29, became mischievous (5)
86 and 71 down The Curtiss H-12 (5, 7)
87 Whitney's partner (5)
88 IAI light STOL transport made of radium and vanadium in 'old' argon (5)
89 Train/re-train at an OCU (7)
90 Having a debt of zero aircraft structure (5)
91 Aerodynamic relationship to elevate over trail (4/4, 5)
92 Day the RAF was officially formed (5, 3, 5)

Clues Down

1 For example, an altimeter (10)
2 Prepare for Service (5)
3 Aerospatiale/MBB vehicle-mounted SAM (6)
4 Member of Avro stable chased a little eland over the plains (7)
5 This Czech trainer could be a risk (5)
6 Aircraft low-frequency, long-range radio navigation system (7)
8 Spey driven (recently retired) apparition (7)
9 Object finder looking either way (5)
10 Bell-Boeing V-22s (7)
11 A good fellow turned and took in no Service personnel (6)
12 Electronic Intelligence (5)
13 'Roll Out The Barrel' and 'We'll Meet Again', for instance (4, 6)
16 Fibbed about Northern ASP prepared for correctly spaced aircraft (5)
17 Saturn's greatest satellite missile . . . (5)
25 . . . moving thus before re-entry (5-10)
27 Listens frantically, then joins the Forces (7)
28 The L in LRMTS (5)
29 Junkers Ju 87 divebomber (5)
30 Distress the high-fliers! (5)
31 Oily rags are somehow found in the stratosphere (4, 3)
32 Penetrate hostile force's defences (5, 5, 5)
34 Start ones engines and hoist the flag (3, 2)
36 Cancel the flying programme (5)
37 Crazy NATO PRO? She's quick on the trigger (11)
39 Explosion of nuclear weapon at surface level (5, 5)
43 Hawker's trial encompassing European politician causes commotion (7)
44 Panavia's storm (7)
46 German submarine around about (1-4)
48 Outline military selection (5)
54 D.31 Turbulents (7)
56 Dickensian IRBM, SS-16 (7)
58 Nationalist of where the Viggen is made (5)
60 Gradient of approach to land (5)
62 If force omitted sortie becomes unimportant (5)
63 How aero-engine output is sometimes quoted (5)
64 One common feature of TAA and TWA (5)
65 Norfolk home of the Jaguar (10)
67 Formal occasion when friends are invited to dine in the Mess (5, 5)
71 See 86 across
72 Short time oriental feline became involved with another feline (7)
73 Bomber Command target at start of Battle of the Ruhr (5)
74 F-15 of the Falconidae family (5)
75 Hired plane, not the car repositioned on the right (7)
77 With water all around, the Britten-Norman aircraft dropped off the Queen (6)
78 Depart by modern aeroplane (3, 3)
80 Window comprising strips of metallic foil! (5)
81 See 65 across
83 RB-199 is a triple . . . . . engine (5)
85 Airman (5)

HOW TO ENTER

Fill in the answers to each of the clues in the crossword in ink or biro (not pencil). Complete your name and address on the entry form and send it to: **Aviation Crossword of the Year,** Building 15, RAF Fairford, Glos GL7 4DL by 30 September 1994. The first 3 all correct entries opened on 1 October 1994 will win a copy of BRACE BY WIRE TO FLY-BY-WIRE (value £30).



AVIATION CROSSWORD OF THE YEAR OFFICIAL ENTRY COUPON 1994

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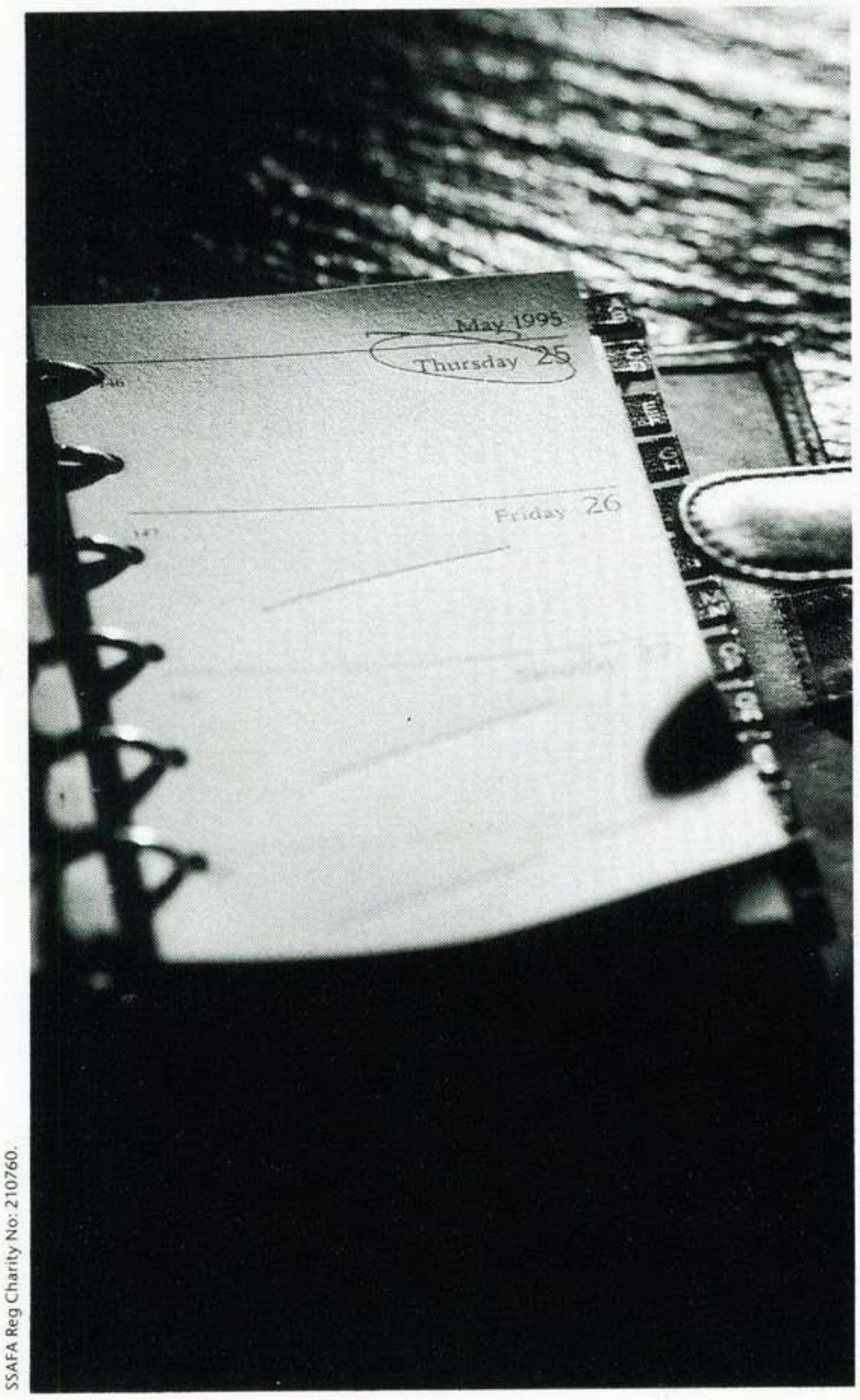
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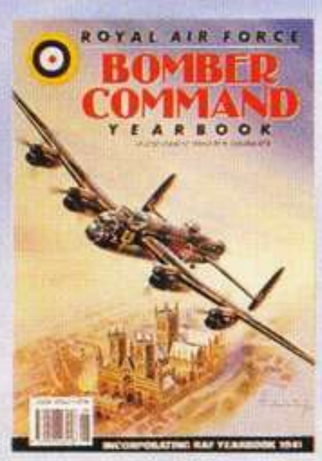
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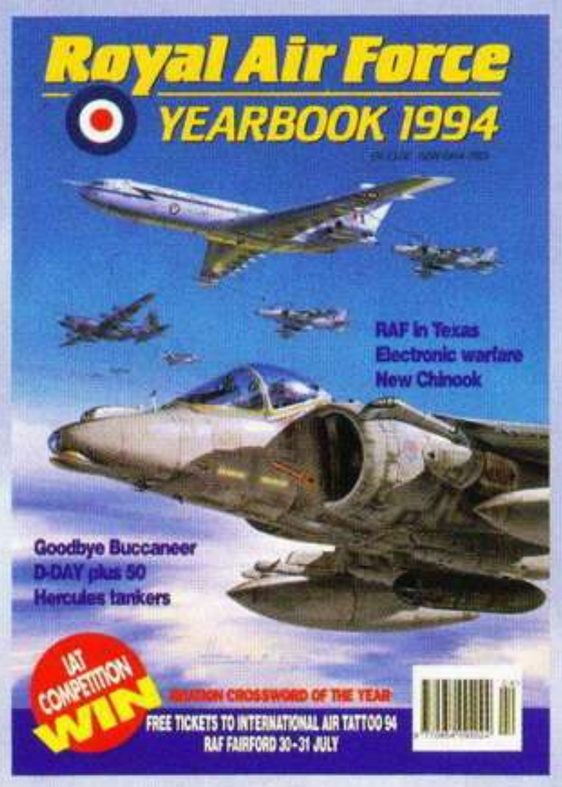


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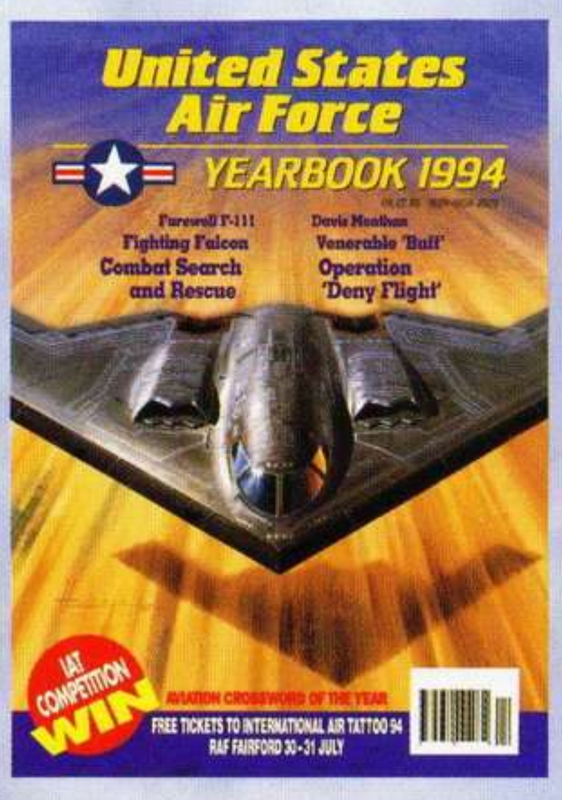
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Canberra PR9s of No 39 (1 PRU) Squadron at RAF Wyton commenced transfer on 30 November to RAF Marham. Three PR9s (XH134/AA; XH131/AF and T4 WT480/BC made a farewell flypast at Wyton. The remaining two PR9s transferred in early December. Geoff Lee BAe

THE RAF's YEAR 1993

Brian Strickland reviews some of the highlights of 1993

JANUARY

The final **Tucano** was handed over to the RAF at RAF Cranwell, signifying completion of the 130-aircraft production contract with Shorts plc.

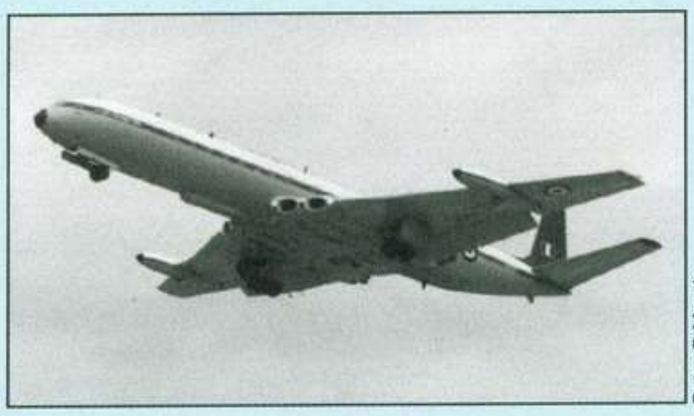
On 19 January a **Sentry AEW1** of No 8 Sqn visited the Hungarian capital of Budapest, together with a NATO AEW Force aircraft based at Geilenkirchen. The visit was to express NATO's appreciation of the Hungarian authorities for their support in allowing NAEWF aircraft to operate in Hungarian airspace to monitor compliance with the declaration of a No Fly Zone over Bosnia Herzegovina.

The first up-dated **Chinook HC2** for the RAF (ZA718) was rolled out on 19 January at the Boeing Defense and Space Group Helicopter Division, Philadelphia. This was the first of 33 Chinook HC1 conversions to a common standard with the US Army's CH-47D together with additional enhancements.

FEBRUARY

Sqn Ldr Chris Tingay became the first British serviceman to be decorated for gallantry in Bosnia. A Hercules pilot from RAF Lyneham, he was awarded the Air Force Cross for flying humanitarian relief flights into Sarajevo.

DRA Farnborough's Comet 4 (Mod) XV814 was withdrawn from service after 27,000hr and relegated to a spares source at Boscombe Down to keep XS235 flying. XS235 first flew on 26 September 1963 and is the world's last airworthy Comet.



Peter R March

MARCH

Announced that **RAF Greenham Common**, the former USAF base, was to close.

Six **Tornado F3s** were deployed to Italy from **RAF Leeming** to help UN forces monitor the No Fly Zone over Bosnia.



Peter R March

RAF Hullavington was formally handed over to the Army on 31 March. Bristol University Air Squadron and No 3 Air Experience Flight had already moved to Colerne.

After 48 years as an RAF airfield, **Gütersloh**, Germany saw the departure of its last RAF aircraft. The station had been the home of RAFG's Harriers, Chinooks and Pumas from 1977 until their move to RAF Laarbruch.

Marshall Aerospace at Cambridge had its RAF Hercules overhaul contract renewed for a further three years, during which 31 aircraft will receive attention.

APRIL

At the beginning of April Harrier GR7s replaced Jaguars at Incirlik AB, Turkey, for **Operation Warden**, reconnaissance flying over Northern Iraq. The first detachment was undertaken by eight Harrier GR7s from Nos 3 and 4 Squadrons at Laarbruch, with the initial crews from the latter. Wittering based No 1 Squadron was involved for the first time in July.

The Air Transport Flight at DRA Farnborough disbanded on 1 April. **Douglas Dakota ZA947** transferred to the Battle of Britain Memorial Flight at RAF Coningsby.

Phantom FGR2 XV408, one of the last Phantoms in RAF service (and painted in the distinctive blue colour scheme to mark the 74th anniversary of No 92 Sqn) was installed as Gate Guardian at the new Directorate of Recruiting and Selection at **RAF Cranwell**.



Her Majesty The Queen presented a new Colour to the Royal Air Force on 1 April to mark the 75th Anniversary of the founding of the Service, the fourth such colour received from Her Majesty. The ceremony took place at **RAF Marham** before an audience of other members of the Royal Family and invited guests. The planned flypast had to be cancelled because of rain and low cloud.

HQ RAF Germany disbanded on 1 April after 34 years of being in the fore-front of the NATO front line in Germany. Formed in October 1954 as 2TAF, it became RAF Germany in October 1959. The role of the RAF in Germany continues, albeit downgraded and reduced in size, as No 2 Group within Strike Command and is still a major contribution to NATO's Reaction Forces (Air).

MAY

A four-ship formation of **Tornado F3s** from **No 617 Sqn**, together with the Battle of Britain Memorial Flight's **Lancaster**, flew over London to commemorate the 50th anniversary of the **Dambusters' raid**.

No 216 Sqn at RAF Brize Norton took delivery of the squadron's final Lockheed TriStar ZE706 – bringing the squadron's strength to nine aircraft. This completed an eight year programme to modify the civil airliner for military service.

A ceremonial flypast of 14 aircraft took place on 20 May at **RAF Linton-on-Ouse** to bid farewell to the **Jet Provost** in the 'through-jet' training role, after having served more than three decades in the training role. Jet Provost T3A XN589, which chalked up 8,878.75 flying hours since its service entry in June 1961, was unveiled as the 'new' gate guardian.

From 24 to 28 May aircraft and crews from nine NATO air forces participated in **Exercise Ample Train**, a major ground crew training exercise, at RAF St Mawgan. This was the first time that the UK had hosted the exercise, which has been running for ten years.

The initial flight of **Tornado GR4** XZ631 took place on 29 May at Warton. It is the first development aircraft for the Tornado mid-life update programme which introduces new avionics into existing GR1 airframes. It was revealed that modification of Tornado GR1s to maritime GR1Bs was to be a two-phase programme. Nos 12 and 617 Sqns will be the first to receive the modified aircraft at RAF Lossiemouth.



BAe Defence

On 29 May the RAF participated in the **Battle of the Atlantic** commemoration at Liverpool. An hour long flypast over the River Mersey included Nimrods, Buccaneers, BBMF Hurricane and Spitfire and a Sea King of the RAF.

JUNE

It was announced that **Harrier GR3s** were to be withdrawn from **Belize** following the decision that the British military presence in the Central American republic was to be reduced to a training operation.

Eighteen RAF **Tornado F3s** were grounded at RAF St Athan after being severely damaged during servicing by a private company which had won the £7m contract under the Government's competitive tendering policy.

On 1 June the Air Defence System protecting the UK inaugurated the new Integrated Command and Control System – the major component of the **IUKADGE** programme.

Eight new pilots (including one RN) received their wings on 3 June at **No 4 FTS, RAF Valley**. They were the first group of RAF students to complete the new 100 hour 'Mirror Image' advanced flying training and weapons course.

The **Armed Forces Minister** announced on 10 June that fewer personnel would be needed in future in the RAF. It was expected that there would be up to 2,200 redundancies by April 1995.

On 19 June a **VC10 C1K** and crew from **No 10 Sqn** at Brize Norton were involved in the first air to air refuelling 'trail', following the conversion of the squadron's first VC10 transport for the additional tanking role.

After 72 years of apprentice training **RAF Halton** marked, on 24 June, the end of an era with the graduation of the 155th and final apprentice entry.

The **Empire Test Pilot's School** (ETPS) at A&AEE Boscombe Down celebrated its 50th anniversary on 25 June.

Gütersloh, Germany closed as an RAF station on 30 June and was transferred to the Army as the Princess Royal Barracks. A single Harrier flew over in salute.

JULY

Twelve **Jaguar GR1As** of No 6 Sqn at RAF Coltishall flew to Italy to participate in NATO operations to enforce a No-Fly Zone over Bosnia, as part of **Operation Deny Flight**.

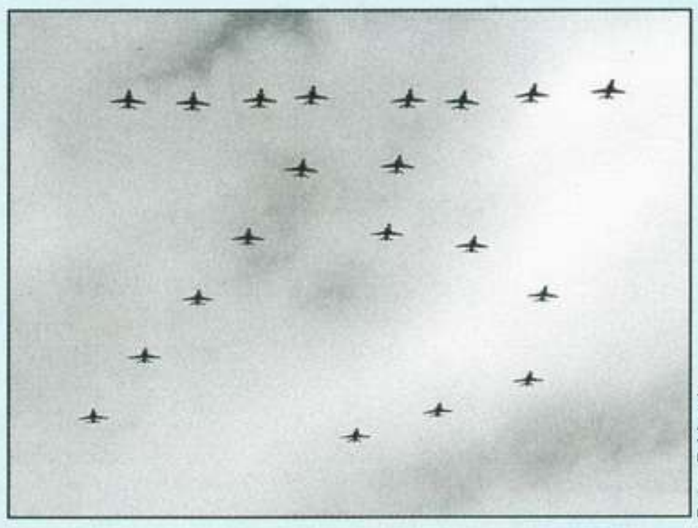
Rapier 2000, the new low-level air defence system, shortly to enter service with the RAF Regiment, scored 100% success in its first test firings using production equipment.

On 6 July **RAF Jurby Head** closed after being based in the Isle of Man for over 50 years. The base which employed only eight servicemen and two civilians was the smallest RAF base in the British Isles.

A memorial to those who flew in the **Battle of Britain** was unveiled on 9 July by HM Queen Elizabeth The Queen Mother. The stone figure of a long pilot forms the centrepiece of the memorial which is located on the White Cliffs at Capel-le-Ferne, near Dover. The figure sits on a stone base on which are carried the 66 crests of the squadrons that participated in the Battle.

The last flight of a **Canberra B2** (WJ731) took place on 7 July at **RAF Wyton**. The B2 was the most numerous version of the Canberra produced with more than 400 entering RAF service. WJ731 joined the RAF in November 1953 and had flown 7,392 hours and made 6,333 landings.

RAF Fairford, Glos was the location for the RAF Benevolent Fund's **International Air Tattoo 93**, the official public flying display to mark the 75th anniversary of the RAF. It included a flypast of 20 Hawks in a figure 75 formation.



Peter R March

The last three **Harrier GR3s** in service left Belize on 6 July, 16 years to the day after the first deployment arrived in Belize.

The first **VC10 K4** tanker (ZD242), converted by British Aerospace from a former British Airways Super VC10 airliner, made its maiden flight at Filton on 30 July.



Peter R March

AUGUST

On 1 August the Army took over **Upavon** after 75 years of Air Force stewardship, following the move of HQ No 1 Group to RAF Benson. The historic airfield will continue to be used by the Air Cadets VGS and Hercules from Lyneham OCU. Upavon was renamed Trenchard Lines by the Army, in remembrance of the 'Father of the RAF'.

A Hercules of **No 47 Sqn** flew from RAF Lyneham, on 12 August, with a 13 strong Aeromedical Evacuation Team (based at RAF Wroughton) to begin **Operation Irma**, the airlift of severely injured civilians out of Sarajevo for treatment in the UK.

The **Low Level Air Defence Training Squadron** (LLADTS) at RAF Finningley bade a final farewell to the **Jet Provost** for navigation training on 14 August. A 'dying swan' formation signalled the end of 22 years navigation training by the JP.



Peter R March

On 31 August **No 100 Sqn Hawks** took off from RAF Wyton for the last time following their transfer to RAF Finningley.

SEPTEMBER

RAF Wattisham was formally handed over to the Army Air Corps. The first helicopter unit (No 653 Squadron) moved in from Germany with its Lynx and Gazelles. An RAF presence – a SAR Sea King HAR3 flight of No 202 Squadron. remains at Wattisham.

Harriers from No 4 Sqn at RAF Laarbruch flew out to Belize to undertake the first training deployment of **Harrier GR7s** since the withdrawal of the permanently based flight of GR3s.

On 8 September a detachment of four Hawk T1As, from No 74 Sqn at RAF Valley, attended the **1993 Tiger Meet** at Kleine Brogel in Belgium. The squadron was awarded the Silver Tiger Award, presented each year to the NATO Tiger Squadron which maintains the highest standards of professionalism and demonstrates the 'Spirit of the Tiger'. This was the first time for seven years that a British squadron had won the trophy.

The second of 32 RAF **Chinook HC2s** (ZA681) arrived at RAF Odiham on 10 September, after being modified to CH-47D standard in the USA. It was announced that an additional three new-build Chinook HC2s were to be ordered, for delivery in 1995.

At the invitation of airshow organisers in the USA, the **Red Arrows** departed on 19 September for a five week tour of the USA. The successful visit included displays at Denver, Salinas, Fort Worth, New Orleans and Houston.

The **Falkland Islands Rescue Co-ordination Centre** scrambled two Hercules on 17 September on a double mission to search for survivors when a Russian cargo ship foundered with 40 crew in the South Atlantic. The second flight involved being airborne for 18 hours, a record for a SAR flight.

Bentwaters was formally handed back to the RAF by the USAF on 28 September.

OCTOBER

No 12 Sqn disbanded when Tornado GR1s of No 27 Sqn moved from RAF Marham to **RAF Lossiemouth**, to replace the Buccaneer which had served there in the maritime/strike role for 24 years.

On 1 October the 'numberplate' of **No 27 Sqn** was transferred from RAF Marham to **RAF Odiham**, taking over from No 240 OCU in the Puma and Chinook training role.

The official disbandment of **No 55 Sqn** at RAF Marham occurred on 15 October. The last seven airworthy Victor tankers, originally built as nuclear bombers, were put up for disposal. The squadron holds the record for flying a single aircraft type, having operated the Victor from the B1 in September 1960 to the K2 in October 1993. The '55' numberplate was passed to the OCU at Brize Norton.

On 19 October the responsibility for providing the aircrews and engineering support for the flight checking of all military landing and radar aids was transferred from No 115 Sqn at RAF Benson to a civilian contractor. **Hunting Aviation Services**, at East Midlands Airport, will continue to operate four **Andover E3s** in military markings. In its 75th year No 115 Sqn was disbanded on 1 October, for the third time in history, and the squadron Standard laid up.

NOVEMBER

RAF Lyneham was awarded the **1992 Wilkinson Sword of Peace** for its work in the field of humanitarian relief work in Bosnia, Somalia and Northern Iraq.



Peter R March



Ian Forshaw, RAF Shawbury

Victor K2 XH672 *Maid Marian* completed the RAF's final V-Bomber flight landing at RAF Shawbury on 30 November. The aircraft was dismantled and transported to the **Cosford Aerospace Museum** for re-assembly as a static exhibit. The crew for the flight were (from left) Sqn Ldr Steve Jenkins (captain), Flt Lt Tony Inglebrecht (co-pilot), Sqn Ldr Pete Lambert (AEO) and Sqn Ldr Bill Scragg (navigator). On the far right is Johnny Allan, one of the original Handley Page test pilots on the Victor.

The **Stainforth Trophy** was presented to RAF Kinloss. The trophy is awarded annually to the operational station which has provided the best overall performance throughout the year.

No 32 Sqn, based at RAF Northolt on VIP transport duties commenced the withdrawal of its Andovers. All seven were to be withdrawn over the following six months.

On 10 November **Tornado GR1As** of No 13 Sqn deployed to Bahrain to participate in **Exercise Desert Forger**. The exercise is part of a continuing series initiated after the Gulf War.

On 30 November the former DRA **Canberra B6** (Mod) XH568 flew into Bruntingthorpe after retirement to join the growing collection of preserved military aircraft there.

DECEMBER

RAF, RN and HM Coastguard rescue helicopters and mountain rescue teams assisted 1473 people in distress in Britain during 1993. The busiest SAR Unit was again 'D' Flight, **No 202 Sqn** at RAF Leuchars. Overall the 14 SAR Units around the UK were called out by the RAF Rescue Co-ordination Centres at Edinburgh and Plymouth to 2150 incidents, slightly more than in 1992. More rescues were carried out at nught by RAF crews in 1993 because of the increasing use of the latest night vision goggles.

Regular RAF Tristar schedules to the **Falklands** resumed, staging through Ascension Island after a three-month break while extensive runway repairs were carried out. It was necessary to ensure that 5,000ft of runway was always available to allow a Hercules to link up with the TriStar flights in Recife in Brazil where the TriStars were refuelling.

It was announced on 15 December that the MUs at **Carlisle** and **Quedgeley** were to be closed, with all stores to be based at Stafford. **RAF North Luffenham** was also to be closed in October 1996 and the engineering and maintenance tasks transferred to RAF Sealand.

On 7 December it was announced that **RAF Chivenor** was to phase down during 1994 and close for fixed wing flying in 1995. The Search and Rescue Flight of Sea King HAR3s would still move in from RAF Brawdy to replace the Wessex of No 22 Sqn.

RAF Swinderby closed on 17 December, the airfield latterly housing the 14 Chipmunk T10s of the Elementary Flying Training Squadron. The ab initio flying training task is now operated by civilian Slingsby Fireflies at Topcliffe.

On 29 December a Hercules of **No 47 Squadron** flew the 1,000th humanitarian relief mission into **Sarajevo**, bringing the total load carried to nearly 15,000 tonnes (more than carried during the Berlin airlift of the early 50s). An RAF Hercules flew an average of three sorties a day from Ancona in Italy, each lift conveying 15 tonnes.

Wessex HC2 XT605 [E], built by Westland in 1966 and stationed on No 28 Sqn **RAF Sek Kong** since 1972 achieved the milestone of reaching 10,000 flying hours – the equivalent to over a year in the air.



Peter R March

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HOME AND AWAY

Sue J Bushell reviews the principal airfields and operational flying units of the Royal Air Force in 1994



Right: *Jaguar T4/GR1As of Nos 6, 54 and 41 Sqns at RAF Coltishall.* Andrew March

There have been many changes in the Royal Air Force since the last survey of its airfields in the 1990 edition of the RAF Yearbook. As indicated by Air Chief Marshal Sir Michael Graydon in his introduction, by the end of next year some 24 RAF stations and installations will have closed as part of the ongoing *'Options for Change'* programme – some have been closed permanently, while others have been placed on a care and maintenance footing and still more have been handed over to the Army.

AKROTIRI, Cyprus (RAF)

Akrotiri, on the divided Mediterranean island of Cyprus, houses the Wessex HC5Cs of No 84 Sqn that provide search and rescue cover for the eastern Mediterranean area, as well as support for the UN peacekeeping forces based there. RAF Akrotiri is used throughout the year by Strike Command fighter and bomber squadrons for Armament Practice Camps and also by the *Red Arrows* for the team's pre-season work-up.

ALDERGROVE, Ulster (Civil)

First opened in 1918 for just one year, Aldergrove is the oldest airfield in the Province. It was eventually fully re-opened in 1925 and was an important Coastal Command base during WW2. Today, as well as being the largest and most important airfield in Northern Ireland, it is home to the Wessex HC2s of No 72 Sqn and Puma HC1s of No 230 Sqn together with a detachment of Chinooks from No 7 Sqn. Two further residents are Queens University Air Sqn (UAS) flying Bulldog T1s and 13 Air Experience Flight (AEF).

ARBROATH, Tayside (RN)

When it was opened on 19 June 1940, Arbroath was an observer training school for the Fleet Air Arm and remained with the Navy until 1970, when it was handed over to the Royal Marines. It is home to 662 Volunteer Gliding School (VGS), which provides flying experience for cadets with its fleet of Grob Viking TX1s.

BARKSTON HEATH, Lincolnshire (RAF)

When it originally opened in April 1941, Barkston Heath was a Relief Landing Ground for nearby Cranwell, as it is today. Later it was used by Douglas C-47s of the 9th Air Force, USAAF, which dropped more than 1,100 paratroopers on D-Day, a performance repeated over Arnhem in September 1944. At the close of WW2 Barkston Heath was returned to the RAF and was placed on care and maintenance before returning to its original role as an RLG for Cranwell in 1954, currently being used by the Tucano T1s of 3 Flying Training School and the Bulldogs of the RAF College Air Sqn.

BELIZE CITY, Belize (Civil)

Formerly British Honduras (Central America), Belize is policed by the Royal Air Force. Belize International Airport is home to the Puma HC1s of No 1563 Flight – the resident Harrier GR3s of No 1417 Flight were returned to the UK in 1993.

BENSON, Oxfordshire (RAF)

Part of the massive pre-war Expansion programme, work on Benson began in 1937 and became operational in early 1939. During the war it was home to the Spitfires and Mosquitos of No 1 Photographic Reconnaissance Unit. On 1 May 1946 it became the permanent home of the King's (now Queen's) Flight, which now operates two Wessex HCC4s and three BAe 146s on Royal duties. In addition Helicopter Support Force Wessex HC2s are operated by No 60 Sqn from Benson.. Also resident are the Bulldog T1s of the London and Oxford UASs and Chipmunk T10s of 6 AEF.

BOSCOMBE DOWN, Wiltshire (MoD PE)

First opened in 1917 (but closed between 1920 and 1927) Boscombe Down today houses the Aircraft and Armament Experimental Establishment (which arrived in September 1939), the Empire Test Pilots' School (from January 1968) and the RAF's Strike/Attack Operational Evaluation Unit which flies Tornado GR1s, Harriers and Jaguars. The A&AEE tests all new aircraft for the three services. Plans to relocate all of the Defence Research Agency's aircraft from Bedford and Farnboroughare currently being implemented.

BOULMER, Northumberland (RAF)

Situated on the coast near Alnwick, RAF Boulmer was opened in March 1943 as a satellite of Eshott, home of 57 Operational Training Unit (OTU). During the 1960s it was used as a relief landing ground by aircraft from Acklington. Today the Headquarters of No 202 Sqn is based at the airfield, plus the squadron's 'A' Flight, using Sea King HAR3s for Search and Rescue (SAR) duties.

BRAWDY, Dyfed (RAF)

Brawdy's only residents are the Sea King HAR3s of 'B' Flight, No 202 Sqn. These are due to transfer to 'A' Flight of No 22 Sqn at Chivenor by mid-1994, bringing flying operations at Brawdy to an end.

BRIZE NORTON, Oxfordshire (RAF)

The largest RAF airfield in the United Kingdom, Brize Norton was originally opened in 1937 as part of the pre-war expansion. During WW2 it was used for airborne forces training and also housed No 6 Maintenance Unit. Passed to the United States Air Force in 1950, it successively housed Strategic Air Command B-29s, B-36s, B-47s and B-52s on rotation, before it was handed back to the RAF in 1965. Today it is the RAF's only tanker and long-range transport base with two squadrons of VC10 aircraft: No 10 Sqn with C1/C1K tanker/transports and No 101 Sqn, which operates VC10 K2/3s and newly delivered K4s for air-to-air refuelling. Brize Norton is also base for the nine tanker/transport Tristars of No 216 Sqn. No 55 (Reserve) Sqn conducts Tristar and VC10 training using aircraft from the other resident units.

BRÜGGEN, West Germany (RAF)

RAF Brüggen opened in 1953 and in the intervening years has seen operations by Vampires, Sabres, Hunters, Canberras, Javelins, Phantoms, and Jaguars before its squadrons re-equipped with Tornado GR1s in the 1980s. Currently resident at Bruggen are four Tornado GR1 squadrons – Nos 9, 14, 17 and 31 Sqns.

CATTERICK, Yorkshire (RAF)

Familiar with military manoeuvres for the past 2,000 years, Catterick's military airfield was opened in 1914 for home defence duties of the area, later being used for squadron work-ups prior to despatch to the Western Front. Retained as an RAF airfield between the wars, Catterick became home to fighter squadrons during WW2 and the Headquarters of the RAF Regiment in 1945. Today there is only one unit based at Catterick – No 645 VGS, which operates Grob Viking TX1 gliders.

Tornado GR1, TTTE based at RAF Cottesmore. Andrew March



BAe 146 of the Queens Flight, RAF Benson. Peter R March







Top:*Fresh from winter overhaul at St Athan, the BBMF's Lancaster PA474 wears the markings of No 9 Sqn's WS-J (W4964)* Johnny Walker *'Still Going Strong'*. Above: *First Hawk T1 in the new all-black scheme for No 4FTS at RAF Valley.* Photographs Robby Robinson

CHIVENOR, Devon (RAF)

Chivenor started as a civilian airfield but was taken over by the RAF from May 1940 by the RAF for use by Coastal Command. It later passed to Fighter Command and was responsible for Hunter training until it closed in September 1974. Chivenor was completely rebuilt during 1979-80 to reopen as the home of No 2 TWU, which became 7 Flying Training School (FTS) in April 1992. The FTS and its constituent No 19 (Reserve) and 92 (Reserve) Sqns, both operating Hawk T1As, is scheduled to cease flying by 1 October 1994. Chivenor also houses the Wessex HC2s of 'A' Flight, No 22 Sqn. The Flight is upgrading to Sea King HAR3s and will receive the helicopters of 'B' Flight No 202 Sqn from RAF Brawdy by the end of June 1994. A further resident is 624 VGS, flying Vigilant T1 powered gliders. The base will be put into care and maintenance in 1995 – for the second time in 20 years.

CHURCH FENTON, Yorkshire (RAF)

Built as a fighter aerodrome, Church Fenton opened in June 1937 as home to Nos 72 and 213 Sqns. During WW2 its role was that of fighter protection for the industrial northern area of North Yorkshire. Post-war, it was one of the first RAF Fighter Command airfields to use Meteors in an operational role. It was transferred to Flying Training Command in July 1959 and became a basic flying training school (7 FTS). This lasted until 1992 when 7 FTS was closed under the *Options for Change* cuts. Church Fenton is now a relief landing ground for the Tucanos of 1 FTS from Linton-on-Ouse.

COLERNE, Wiltshire (Army)

Still under construction at the beginning of WW2, Colerne was used to train fighter squadrons before becoming involved in night fighter operations. Colerne was the first permanent Meteor base but at the end of September 1946 operational flying ceased. Night fighters returned in June 1952 and remained until 1957, when Colerne was passed to Transport Command. It became home to the Hastings and subsequently the main engineering base for the Hercules. Colerne closed on 31 March 1976 and was taken over by the Army. Flying resumed on 6 October 1993 when the Bulldog T1s of Bristol UAS and the Chipmunk T10s of 3 AEF moved in from Hullavington.

COLTISHALL, Norfolk (RAF)

Originally opened in May 1940, Coltishall has always been a major fighter base, operating Spitfires, Mosquitos, Vampires, Venoms, Javelins and Lightnings. Jaguars replaced the Lightnings in 1974 and today three squadrons (Nos 6, 41 and 54 Sqns) operate the type. Also currently present (but due to disband during summer 1994) are the Wessex HC2s of 'E' Flight, No 22 Sqn.

CONINGSBY, Lincolnshire (RAF)

Coningsby spent the period from its opening in November 1940 until 1965 as a bomber station. Initial residents were Manchesters, followed in succession by Lancasters, Lincolns, Washingtons and Canberras before the arrival of the first Vulcans. In November 1964 the Vulcans moved to Cottesmore and Coningsby was closed, for work to be carried out for the ill-fated TSR2. Cancellation of that programme saw Coningsby chosen to house the RAF's first Phantom units. Later, Coningsby was the first base to operate the air defence variant of the Tornado and today it accommodates No 56 (Reserve) Sqn, the Tornado F3 Operational Conversion Unit. Also based at Coningsby are two front-line F3 units, Nos 5 and 29 Sqns, as well as the F3 Operational Evaluation Unit. The Battle of Britain Memorial Flight is based here with its Spitfires, Hurricane and Lancaster together with its Devon, Dakota and Chipmunk for communications, transport and tailwheel training.

COSFORD, Shropshire (RAF)

Cosford opened in August 1938 as home to No 2 School of Technical Training and since that time has been continuously engaged in the training of ground tradesmen. With the closure of Halton it is taking over the 'numberplate' of No 1 SoTT. Flying units operating from Cosford include Birmingham UAS with Bulldog T1s and 633 VGS, which flies Vigilant T1 powered gliders. Cosford also houses the Aerospace Museum with its historic aircraft from the RAF Museum collection.

COTTESMORE, Leicestershire (RAF)

Opened in August 1938 Cottesmore was used by Bomber Command until handed over to the USAAF in 1943, becoming home to Douglas C-47s and Waco gliders. Handed back to the RAF at the end of WW2 it was used for training before being transferred to Bomber Command in 1954. Canberras arrived soon afterwards but in February 1955 the airfield was closed in preparation for the arrival of Victors in April 1958. At the end of 1964 Vulcan squadrons moved in to replace the Victors. Subsequently Cottesmore became home to Canberras and Argosies in the calibration role and No 360 Sqn, engaged in electronic warfare. From 1976 until 1978 the base was upgraded for the arrival of the Tri-National Tornado Training Establishment (TTTE), which moved in on 1 July 1980. The unit is engaged in training West German, Italian and British aircrew for the ground attack/fighter-bomber version of the Tornado.

CRANWELL, Lincolnshire (RAF)

Cranwell has been an airfield since 1915 and was chosen to house the Royal Air Force College in 1920. Flying training has continued there ever since. Frank Whittle's Gloster E28/39, Britain's first turbojet, made its maiden flight from Cranwell in May 1941. Today Cranwell is the home of a fleet of Tucano T1s operated by 3 Flying Training School for the RAF College, and Bulldog T1s of the RAF College Air Sqn.

FARNBOROUGH, Hampshire (MoD PE)

The original birthplace of British aviation, Farnborough has remained at the forefront for eight decades. Its military role is coming to an end with the transfer of Defence Research Agency aircraft to Boscombe Down.

FINNINGLEY, Yorkshire (RAF)

Doncaster, Finningley was built as part of the RAF pre-war expansion programme and opened in 1936 as a bomber base. Post-war operations centred on flying training for a decade until 1954. Chosen as a V-bomber base, Finningley underwent extensive alterations and re-opened with Vulcans in 1957. They remained until the end of 1969, when Finningley transferred to its current role of aircrew training. Today it houses No 45 (Reserve) Sqn operating the Jetstream for pilot twin-engine conversion; while 6 Flying Training School uses the Tucano T1, Hawk T1 and Dominie T1 to train navigators, air engineers and air electronics officers. Finningley is also the new base for the Hawk target aircraft of No 100 Sqn, which moved from Wyton in September 1993. Further residents are the Bulldogs of Yorkshire UAS and 9 AEF's Chipmunk T10s.

GATOW, West Germany

The RAF has maintained a presence in Berlin since the end of WW2, principally at Gatow, which was used during the Berlin Airlift of 1948-49. The Station Flight operates a pair of Chipmunk T10s for communications purposes but these will return to the UK this summer when the airfield is formally returned to Germany.

HALTON, Buckinghamshire (RAF)

Halton was built on land donated by the Rothschild family and opened as the Halton School of Technical Training on 10 September 1917. This role continued until 1993, when the School of Technical Training commenced transfer to Cosford. There are two flying units – Nos 612 and 613 Volunteer Gliding Schools, both equipped with Vigilant T1s active at Halton.

HENLOW, Bedfordshire (RAF)

Henlow was opened in 1917 as a repair depot and continued as such throughout WW1. Post-war it was retained as a repair depot, and also took on many other important roles including the training of MT drivers and repair of parachutes. Post-war Henlow continued as a ground training base specialising in electrical engineering, radio and electronics. Today, there is just one flying unit – No 616 VGS with Venture T2s.

HULLAVINGTON, Wiltshire (Army)

Opened in June 1937 as a flying training station, Hullavington continued in this role throughout WW2 and up until 1965. More recently Bristol UAS and 3 AEF were temporarily resident, before moving to Colerne. In 1992 part of the airfield was handed over to the Army. Today Nos 621 and 625 VGSs, each equipped with Viking TX1s operate from Hullavington.

KINLOSS, Grampian (RAF)

Built in 1938-39, Kinloss was used throughout the war for flying training, but was also chosen in 1942 as an advanced base for operations against the Germans in Norway. Post-war, it passed to Coastal Command when 6 Operational Training Unit commenced flying courses with Beaufighters and Mosquitos. Later, as 236 OCU, it trained crews on Lancasters, Neptunes and Shackletons. Kinloss entered the Nimrod age in February 1971 and is now home to the RAF's entire Nimrod fleet – Nos 120, 201 and 206 Sqns, plus No 42 (Reserve) Sqn, the conversion unit for the type. A further resident is No 663 VGS with Vigilant T1 powered gliders.

LAARBRUCH, West Germany (RAF)

This West German air base was built by the RAF in 1954. Its present residents are the Harrier GR7s of Nos 3 and 4 Sqns, and the mixed Puma and Chinook fleet of No 18 Sqn – all of which moved from Gütersloh when RAF flying operations ceased there in 1993. They replaced Tornado GR1 squadrons withdrawn in the aftermath of the fall of the Berlin Wall and the collapse of the Warsaw Pact.

LECONFIELD, Humberside (Army)

Opened in December 1936 as a bomber station Leconfield was used by Fighter Command during the period 1939-1942 and as a heavy bomber station for the remainder of the war. It subsequently became a fighter station again until 1965, when it transferred to use by 60 Maintenance Unit. Handed over to the Army in January 1977, Leconfield remains the base for the Sea King HAR3s of 'E' Flight, No 202 Sqn.

LEEMING, Yorkshire (RAF)

Opened in 1940 as a bomber station, Leeming was switched to night-fighter training duties in 1947. Later Javelins flew from Leeming and in 1961 3 FTS was formed there. Leeming commenced a major refurbishment programme in 1986 and currently houses two squadrons of Tornado F3s – Nos 11 and 25 Sqns, together with the Bulldog T1s of Northumbrian UAS and the Chipmunk T10s of 11 AEF.

LEUCHARS, Fife (RAF)

Leuchars is the oldest Scottish military airfield with balloon activity being recorded as far back as 1911. Post-WW1 it became a major Fleet Air Arm base. Leuchars passed to RAF Coastal Command control in August 1938 and settled down to operate anti-shipping and mine-laying missions. After WW2 Leuchars became a fighter base and has successively seen Meteors, Vampires, Hunters, Javelins, Lightnings and Phantoms equip its squadrons. Today it is Tornado F3s that are operated by Nos 43 and 111 Sqns. Also resident at Leuchars are the Bulldog T1s of Aberdeen, Dundee & St Andrews UAS.

LINTON-ON-OUSE, Yorkshire (RAF)

Linton-on-Ouse was first opened in 1937 as a bomber airfield, but transferred to Fighter Command in July 1946. Home to Hornets, Meteors, Sabres and Hunters, it remained a fighter base until 1959, when 1 FTS moved in with Jet Provosts. Today, 1 FTS remains, now flying the Tucano T1. No 642 VGS, equipped with Venture T2 powered gliders, is also present.

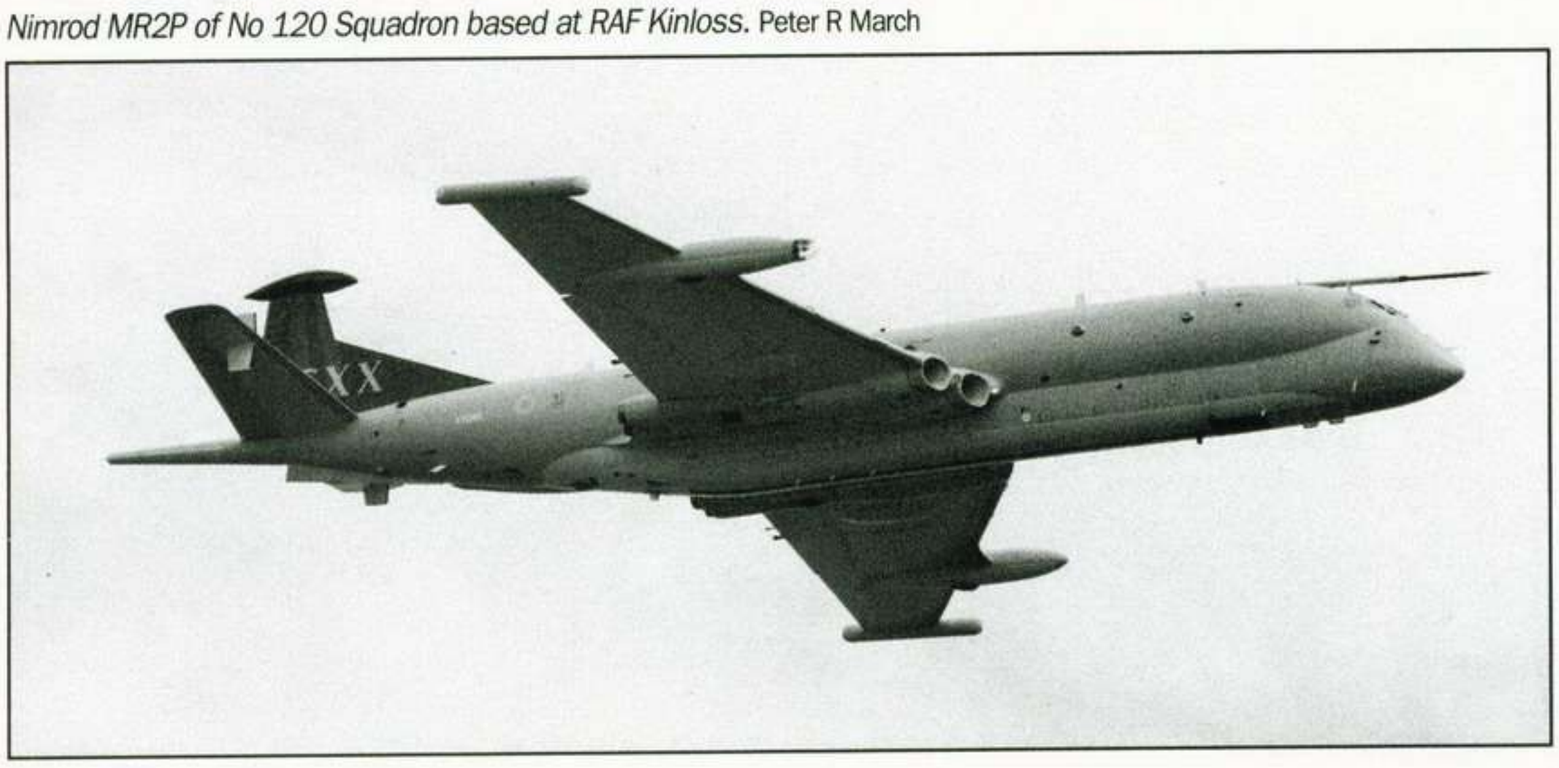
LOSSIEMOUTH, Grampian (RAF)

Although it was built for the RAF in 1939 and used for maintenance, flying training and air-sea rescue duties, after WW2 Lossiemouth was transferred to the Fleet Air Arm, remaining as such until 29 September 1972 when it returned to the RAF for Jaguar operations. Currently the base is home to No 16 (Reserve) Sqn, the Jaguar OCU; Tornado GR1s of Nos 12 and 617 Sqns and No 15 (Reserve) Sqn, formerly known as the Tornado Weapons Conversion Unit. This busy airfield also maintains a search and rescue element with the Sea Kings of 'D' Flight, No 202 Sqn.

LYNEHAM, Wiltshire (RAF)

First opened in May 1940 as a flying training base, Lyneham has been engaged in the transport role, first as part of Ferry Command and later with Transport Command. During WW2 it saw operations by Dakotas, Yorks and Liberators, and these were followed by Hastings, Comets and Britannias. Today Lyneham is the RAF's major tactical transport base, home to the Hercules fleet operated by Nos 24, 30, 47 and 70 Sqns. In addition No 57 (R) Sqn conducts Hercules conversion training using based aircraft.

Nimrod MR2P of No 120 Squadron based at RAF Kinloss. Peter R March



MANSTON, Kent (RAF)

Manston opened in 1916 as a landing ground and became a training base for the rest of WWI. Between the wars it was used by Army co-operation squadrons and played host to Fleet Air Arm units. Following its use as a Battle of Britain airfield, Manston was a base used for the Swordfish attack on the German battle cruisers *Scharnhorst* and *Gneisenau* in which Lt Cdr Eugene Esmonde won the Victoria Cross. Further fighter use continued throughout the War; Transport Command took over in 1946, followed by the USAF. Today it houses 1 AEF that flies Chipmunks and No 617 VGS operating Viking TX1 gliders. Search and rescue duties are currently carried out by the Sea King HAR3s of 'C' Flight of No 202 Sqn, but will be transferring to Wattisham as 'B' Flight of No 22 Sqn by mid-1994.

MARHAM, Norfolk (RAF)

Used by the RNAS and RFC during WWI as Narborough, Marham re-opened on 1 April 1937 as a bomber station. From the outbreak of WW2 it had Wellingtons and later received Stirlings. In 1943 the station was transferred to Fighter Command and operated Mosquitos. Post-war came the B-29 Washington, Canberra and Valiant. Today Marham is the RAF's major air-reconnaissance base, home to Nos 2 and 13 Sqns, both flying the Tornado GR1A. Also resident is No 39 (1 PRU) Sqn, which operates the Canberra PR9.

MOUNT PLEASANT, Falkland Islands (RAF)

Mount Pleasant is the RAF's newest base and was purpose-built during 1983-85. The airfield supports a variety of aircraft, including the four Tornado F3s of No 1435 Flight, No 1312 Flight which operates Hercules drawn from the Lyneham Transport Wing and No 78 Sqn with Chinook HC1s for army support and Sea King HAR3s for search and rescue duties.

NEWTON, Nottinghamshire (RAF)

Home of the Air Cadets Headquarters and the RAF Police School, Newton was originally opened in 1936. It became operational with Fairey Battles in July 1940 as part of No 1 Group, although it spent most of WW2 as a training airfield, a role continued after the War. Today there are two flying units resident at Newton – the East Midlands UAS, equipped with Bulldog T1s, and 7 AEF, flying Chipmunk T10s.

NORTHOLT, Middlesex (RAF)

Opened in 1915 and used as a fighter station for the next 30 years, Northolt played a key role during and after the Battle of Britain. Post-war it spent eight years as London's civil airport while construction work at Heathrow was put in hand. As the nearest military airfield to Central London, it receives many NATO visitors throughout the year. It is also the base of No 32 Sqn, which provides transport for VIPs throughout the UK and Europe with BAe 125s and Gazelles.

ODIHAM, Hampshire (RAF)

In use as a Summer Camp Landing Ground from the mid-1920s, Odiham was opened in 1937 for army co-operation duties and later housed ground-attack squadrons flying low-level missions over occupied Europe. Odiham remained in use as a fighter station



Aerial view of RAF Lyneham. Peter R March

until 1959. It was taken over by Transport Command as the main UK base for RAF transport helicopters, the first of which arrived in May 1960. Today two squadrons fly from the base – No 7 Sqn, equipped with the Chinook HC1/2 and No 33 Sqn, which flies the Puma HC1. No 27 (R) Sqn is also resident providing conversion training for the Chinook HC2 and Puma.

ST ATHAN, South Glamorgan (RAF)

Opened in February 1939, St Athan has since been continuously engaged in aircraft maintenance and technical training. Today it is responsible for all major work on the Harrier, VC10, Hawk, Jaguar and Tornado. It also trains ground personnel within 4 School of Technical Training. As well as the Station Flight operating a Hawk T1, there are currently two flying units at St Athan, these being the University of Wales Air Sqn flying Bulldogs, and No 634 VGS with Viking TX1 gliders.

ST MAWGAN, Cornwall (RAF)

St Mawgan near Newquay was opened in 1943 and used by Ferry Command as well as the USAAF's meteorological Flights. It was closed from 1 July 1947 until April 1951, when Lancaster GR3s of the School of Maritime Reconnaissance moved in. They were followed by No 22 Sqn's Whirlwinds in June 1954. The Lancasters were replaced by Shackletons two years later, remaining until Nimrods were introduced in early 1970. The MR role remained until September 1992, when the last Nimrods moved to Kinloss. Current flying units at St Mawgan are the Headquarters of No 22 (SAR) Sqn and the Sea King Training Unit; it is also the RAF's Sea King and Wessex SAR maintenance base.

SCAMPTON, Lincolnshire (RAF)

The famous 'Dambusters' raid on the Ruhr Dams by Lancasters of No 617 Sqn was launched from RAF Scampton in May 1943. After the war Scampton was home to Lancasters, Lincolns and Canberras before its first V-bombers arrived in 1958. A long association with bombers came to an end in 1982 when the Vulcan fleet was withdrawn. The airfield now accommodates the Central Flying School with its Jet Provosts, Bulldogs and Tucano T1s as well as the RAF *Red Arrows* Aerobatic Team with Hawk T1As.

SEALAND, Cheshire (RAF)

Originally dating from WWI, Sealand was an important packing depot between the wars and during WW2. Flying training was also carried out from the airfield. Today, No 631 VGS operates Viking TX1s from the south airfield while the RAF continues to carry out radar and radio maintenance from the station.

SEK KONG, Hong Kong (RAF/Army)

The small airfield at Sek Kong is currently home to the Wessex HC2s of No 28 Sqn, which provide support to the military forces within Hong Kong. The airfield is also used by the Royal Hong Kong Auxiliary Air Force for its H-60 Blackhawks in particular.

THE RAF'S FLYING SQUADRONS AND UNITS 1994

[as at 31 March 1994]

Squadron	Type & nominal strength	Base
1 Sqn	Harrier GR7 (13)/T4 (1)	Wittering
2 Sqn	Tornado GR1A (13)	Marham
3 Sqn	Harrier GR7 (13)	Laarbruch
4 Sqn	Harrier GR7 (13)	Laarbruch
5 Sqn	Tornado F3 (13)	Coningsby
6 Sqn	Jaguar GR1A (14)/T2A (3)	Coltishall
7 Sqn	Chinook HC1/2 (18)/Gazelle HT3 (1)	Odiham
8 Sqn	Sentry AEW1 (7)	Waddington
9 Sqn	Tornado GR1 (13)	Brüggen
10 Sqn	VC10 C1 (7)/C1K (6)	Brize Norton
11 Sqn	Tornado F3 (13)	Leeming
12 Sqn	Tornado GR1/1B (13)	Lossiemouth
13 Sqn	Tornado GR1A (13)	Marham
14 Sqn	Tornado GR1 (13)	Brüggen
15 (R) Sqn	Tornado GR1 (25)	Lossiemouth
16 (R) Sqn	Jaguar GR1A (7)/T2A (6)	Lossiemouth
17 Sqn	Tornado GR1 (13)	Brüggen
18 Sqn	Puma HC1 (5)/Chinook HC1 (5)	
	Gazelle HT3 (1)	Laarbruch
19 (R) Sqn	Hawk T1/T1A (24)	Chivenor
20 (R) Sqn	Harrier GR5/GR7/T4 (16)	Wittering
22 Sqn HQ	Wessex HC2 (total 15)	St Mawgan
A Flt	Wessex HC2	Chivenor
C Flt	Wessex HC2	Valley
E Flt	Wessex HC2	Coltishall
24 Sqn	Hercules C1/C1K/C3 (13)	Lyneham
25 Sqn	Tornado F3 (13)	Leeming
27 (R) Sqn	Puma HC1 (5)/Chinook HC1/2 (4)	Odiham
28 Sqn	Wessex HC2 (7)	Sek Kong
29 Sqn	Tornado F3 (13)	Coningsby
30 Sqn	Hercules C1/C1K//C3 (13)	Lyneham
31 Sqn	Tornado GR1 (13)	Brüggen
32 Sqn	HS125 CC1/2 (6)	
	BAe125 CC3 (6)	
	Gazelle HCC4 (4)	Northolt
33 Sqn	Puma HC1 (12)	Odiham
39 (1PRU) Sqn	Canberra PR9 (6)/T4 (1)	Marham
41 Sqn	Jaguar GR1A (14)/T2A (2)	Coltishall
42 (R) Sqn	Nimrod MR2	Kinloss
43 Sqn	Tornado F3 (16)	Leuchars
45 (R) Sqn	Jetstream T1 (11)	Finningley
47 Sqn	Hercules C1/C3 (11)	Lyneham
51 Sqn	Nimrod R1P (3)	Wyton
54 Sqn	Jaguar GR1A (14)/T2A (2)	Coltishall
55 (R) Sqn	VC10 C1/C1K/K2/K3	Brize Norton
56 (R) Sqn	Tornado F3 (24)	Coningsby
57 (R) Sqn	Hercules C1/C1K/C3 (5)	Lyneham
60 Sqn	Wessex HC2 (10)	Benson
70 Sqn	Hercules C1/C3 (12)	Lyneham
72 Sqn	Wessex HC2 (15)	Aldergrove
74 (R) Sqn	Hawk T1/T1A (22)	Valley
78 Sqn	Chinook HC1 (2)/	
	Sea King HAR3 (2)	Mount Pleasant
84 Sqn	Wessex HC5C (5)	Akrotiri
92 (R) Sqn	Hawk T1/T1A (24)	Chivenor
100 Sqn	Hawk T1/T1A (16)	Finningley
101 Sqn	VC10 K2/K3 (8)/K4 (1)	Brize Norton
111 Sqn	Tornado F3 (16)	Leuchars
120 Sqn	Nimrod MR2 (9)	Kinloss
201 Sqn	Nimrod MR2 (9)	Kinloss
202 Sqn HQ	Sea King HAR3	Boulmer
A Flt	Sea King HAR3	Boulmer
B Flt	Sea King HAR3	Brawdy
C Flt	Sea King HAR3	Manston
D Flt	Sea King HAR3	Lossiemouth
E Flt	Sea King HAR3	Leconfield
206 Sqn	Nimrod MR2 (9)	Kinloss
216 Sqn	Tristar K1/KC1/C2/C2A (9)	Brize Norton
230 Sqn	Puma HC1 (15)	Aldergrove
234 (R) Sqn*	Hawk T1/T1A (22)	Valley
360 Sqn	Canberra T17 (3)	
	Canberra T17A (4)/T4 (2)/PR7 (2)	Wyton
617 Sqn	Tornado GR1/1B (13)	Marham

*To be re-numbered 208 (R) Sqn

Overseas based Flights		
1312 Flt	Hercules C1K (2)	Mount Pleasant
1435 Flt	Tornado F3 (4)	Mount Pleasant
1563 Flt	Puma HC1 (4)	Belize
Operation Grapple		
	Jaguar GR1A (12)/Tornado F3	Gioia del Colle
Operation Warden		
	Harrier GR7 (8)/VC10 K2/3	Incirlik
Operation Jural	Tornado GR1	Dhahran
	VC10 C1K	Muharraq
Other flying units		
Central Flying School (CFS) HQ		
	Bulldog T1 (10)/Tucano T1 (22)	Scampton
CFS (Helicopter)	Gazelle HT3	Shawbury
1 FTS	Tucano T1 (36)	Linton-on-Ouse
2 FTS	Gazelle HT3 (22)/Wessex HC2 (8)	Shawbury
3 FTS	Tucano T1 (56)	Cranwell
4 FTS	Hawk T1/1A (44)	Valley
	[74/234 (R) Sqns]	
6 FTS	Bulldog T1 (5)/Dominie T1 (16)	
	Hawk T1 (10)/Tucano T1 (10)	
	Jetstream T1 (11)	Finningley
	[45 (R) Sqn]	
7 FTS	Hawk T1/1A (48)	Chivenor
	[19/92 (R) Sqns]	
Search and Rescue Training Unit		
	Wessex HC2 (7)	Valley
Sea King Training Unit		
	Sea King HAR3 (2)	St Mawgan
Strike/Attack OEU		
	HarrierT4/GR7/Jaguar T2A/	
	Tornado GR1/1A	Boscombe Down
F3 OEU	Tornado F3 (4)	Coningsby
TTTE	Tornado GR1 (18)	Cottesmore
Berlin Stn Flt	Chipmunk T10 (2)	Gatow
Northolt Stn Flt	Islander CC2/2A (2)	Northolt
St Athan Stn Flt	Hawk T1 (2)	St Athan
Queen's Flt	BAe 146 (3)/Wessex HCC4 (2)	Benson
Red Arrows	Hawk T1/T1A (11)	Scampton
Battle of Britain Memorial Flight		
	Spitfire/Hurricane/Lancaster/	
	Chipmunk/Devon/Dakota	Coningsby

Air Experience Flights		
1 AEF	Chipmunk T10 (4)	Manston
2 AEF	Chipmunk T10 (4)	Bournemouth/Hurn
3 AEF	Chipmunk T10 (8)	Colerne
4 AEF	Chipmunk T10 (4)	Exeter
5 AEF	Chipmunk T10 (8)	Cambridge/Teversham
6 AEF	Chipmunk T10 (8)	Benson
7 AEF	Chipmunk T10 (4)	Newton
8 AEF	Chipmunk T10 (4)	Shawbury
9 AEF	Chipmunk T10 (4)	Finningley
10 AEF	Chipmunk T10 (4)	Woodvale
11 AEF	Chipmunk T10 (4)	Leeming
12 AEF	Chipmunk T10 (4)	Edinburgh/Turnhouse
13 AEF	Bulldog T1	Belfast/Aldergrove

University Air Squadrons		
Aberdeen, Dundee & St Andrews UAS		
	Bulldog T1 (4)	Leuchars
Birmingham UAS	Bulldog T1 (6)	Cosford
Bristol UAS	Bulldog T1 (5)	Colerne
Cambridge UAS	Bulldog T1 (4)	Cambridge
East Lowlands UAS	Bulldog T1 (4)	Turnhouse
East Midlands UAS	Bulldog T1 (6)	Newton
Glasgow &Strathclyde UAS	Bulldog T1 (5)	Glasgow
Liverpool UAS	Bulldog T1 (4)	Woodvale
London UAS	Bulldog T1 (5)	Benson
Manchester UAS	Bulldog T1 (6)	Woodvale
Northumbrian UAS	Bulldog T1 (6)	Leeming
Oxford UAS	Bulldog T1 (4)	Benson
Queens UAS	Bulldog T1 (4)	Aldergrove
Southampton UAS	Bulldog T1 (7)	Boscombe Down
Wales UAS	Bulldog T1 (7)	St Athan
Yorkshire UAS	Bulldog T1 (8)	Finningley
RAF College Air Squadron	Bulldog T1 (6)	Cranwell

Volunteer Gliding Schools		
611 VGS	Viking TX1 (6)	Swanton Morley
612 VGS	Vigilant T1 (2)	Halton
613 VGS	Vigilant T1 (4)	Halton
614 VGS	Viking TX1 (4)	Wethersfield
615 VGS	Viking TX1 (8)	Kenley
616 VGS	Vigilant T1 (4)	Henlow
617 VGS	Viking TX1 (3)	Manston
618 VGS	Viking TX1 (7)/Valiant TX1 (1)	West Malling
621 VGS	Viking TX1 (4)	Hullavington
622 VGS	Viking TX1 (6)/Valiant TX1 (1)	Upavon
624 VGS	Vigilant T1 (3)	Chivenor
625 VGS	Viking TX1 (5)	Hullavington
626 VGS	Viking TX1 (3)	Predannack
631 VGS	Viking TX1 (8)	Sealand
632 VGS	Vigilant T1 (5)	Ternhill
633 VGS	Vigilant T1 (5)	Cosford
634 VGS	Viking TX1 (4)	St Athan
635 VGS	Vigilant T1 (4)	Samlesbury
636 VGS	Viking TX1 (3)	Swansea
637 VGS	Vigilant T1 (4)	Little Rissington
642 VGS	Vigilant T1 (5)	Linton-on-Ouse
645 VGS	Viking TX1 (5)	Catterick
661 VGS	Viking TX1 (4)	Kirknewton
662 VGS	Viking TX1 (5)/Valiant TX1 (1)	Arbroath
663 VGS	Vigilant T1 (3)	Kinloss
Air Cadet CGS	Kestrel TX1 (2)/Valiant TX1 (1)	
	Vigilant T1 (14)/Viking TX1 (12)	Syerston

SHAWBURY, Shropshire (RAF)

Although there was a small airfield at Shawbury during WWI, it was not until 1938 that the new, improved Shawbury opened as a training airfield and maintenance unit. These two functions have continued through to the present. Shawbury is now home to No 2 (H) Flying Training School which operates Gazelle HT3s for the basic training stage and Wessex HC2s for advanced helicopter pilot training. The Gazelles are also used by the helicopter element of the Central Flying School. No 8 AEF is another resident at Shawbury, flying Chipmunk T10s. A large number of aircraft are held in long-term store at Shawbury and maintenance of the RAF's lighter aircraft types and the Helicopter Support Force Wessex is carried out here.

SWANTON MORLEY, Norfolk (RAF)

Swanton Morley was opened in September 1940 as a bomber station and during WW2 Blenheims, Bostons, Mitchells and Mosquitos operated from here. Post-war it became the home of 4 School of Signalling from 1949 until 1957 and today houses the Viking TX1 gliders of No 611 VGS and the Central Servicing Development Establishment. The airfield is scheduled for closure in 1995.

SYERSTON, Nottinghamshire (RAF)

Opened in December 1940 as a bomber station, Syerston was used by Hampdens and Lancasters during WW2 before being passed to Transport Command in October 1945 for training purposes. No 22 FTS took up residence in January 1948 and was replaced by 1 FTS in May 1955, itself supplanted by 2 FTS in November 1957. Today Syerston is the Air Force's main glider base, housing the Air Cadet Central Gliding School with a variety of types including Kestrel, Valiant and Viking gliders and Vigilant powered gliders.

TERNHILL, Shropshire (RAF)

The first aerial activity at Ternhill was an emergency balloon landing in 1906 and during WWI it was a training depot station. In the late 1930s the site was chosen for flying training. Ternhill's last resident fixed-wing training unit was 6 FTS which left in August 1961. It then became home to the helicopter element of the Central Flying School until September 1976, when the helicopters departed to nearby Shawbury. Ternhill was reduced to a relief landing ground for the latter and currently accommodates the Vigilant T1s of No 632 VGS.

TURNHOUSE, Lothian (Civil)

Built in 1916 and continuously open since, Turnhouse was a fighter station during WW2 and is credited with the first enemy aircraft brought down. It remained a fighter base until March 1957. Today Turnhouse serves the Scottish capital as its international airport. It is also the base for two RAF flying units – the East Lowlands UAS, which operates Bulldog T1s and the Chipmunk T10s of 12 AEF.

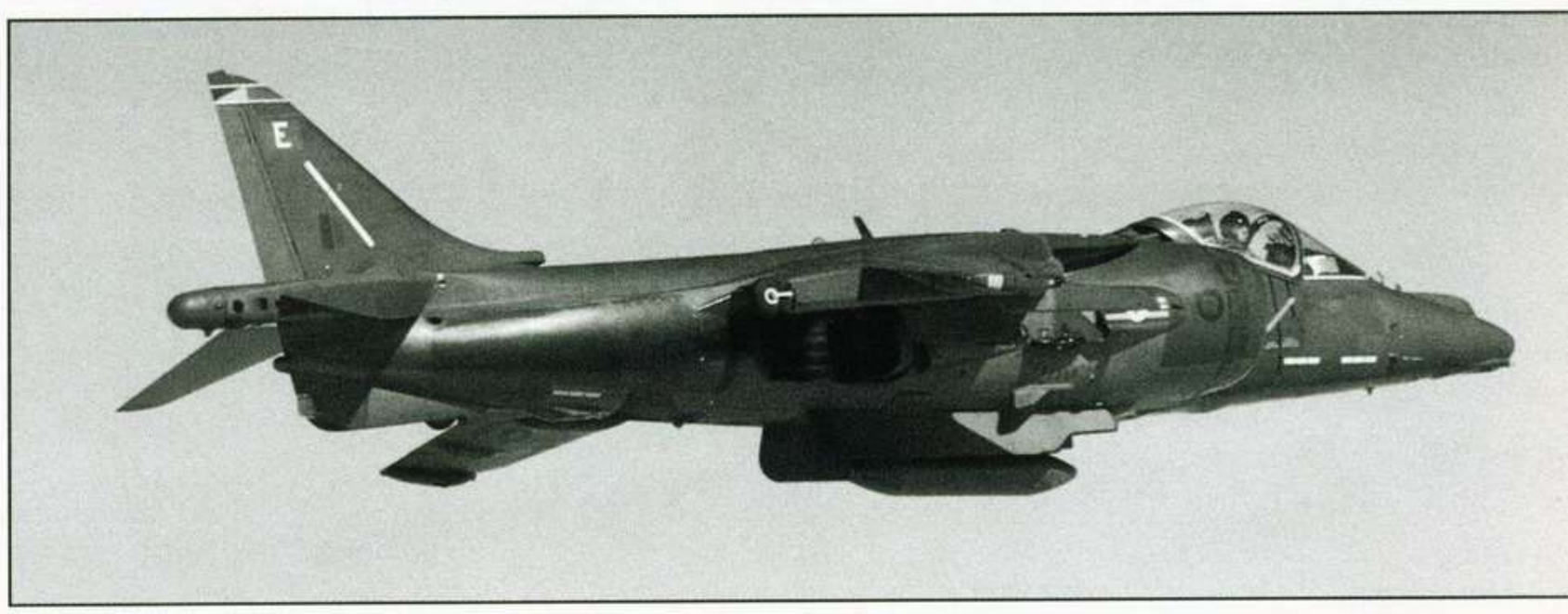
UPAVON, Wiltshire (Army)

Built in 1912 to house the Central Flying School of the Royal Flying Corps, Upavon has a long and distinguished history. The CFS remained (off and on) until 1 April 1942, and Upavon continued to house other training units until April 1946. Post-war it was taken over by 38 Group, Transport Command and later became the Headquarters of 1 Group, Strike Command until passed to the Army on 1 August 1993. Upavon is now renamed 'Trenchard Lines' but continues to accommodate No 622 VGS with its Viking TX1 gliders.

VALLEY, Gwynedd (RAF)

Situated on the Isle of Anglesey, Valley opened as a fighter base in 1941 with the responsibility of guarding the Liverpool area from enemy attack, as well as night fighter patrols. Presently it is home to 4 FTS (the advanced and weapons training unit) – comprising Nos 74 and 234 (Reserve) Sqns – which, together with the Central Flying School operate Hawk T1/1As. Search and rescue training on Wessex HC2s is conducted by the SAR Training Unit and 'C' Flight of No 22 Sqn is also present, again with Wessex HC2s.





Top: *Sentry AEW1, No 8 Sqn, RAF Waddington.* Andrew March Above: *Harrier GR7 of No 20 Sqn, RAF Wittering.* PRM

WADDINGTON, Lincolnshire (RAF)

Dating from WW1, Waddington was an important Bomber Command station during WW2 with Blenheims, Battles, Hampdens, Wellingtons, Lancasters and Lincolns all operating from the airfield before the airfield was put onto care and maintenance in preparation for the arrival of the first Vulcans. These continued in service until the end of 1984. Plans to base the RAF's airborne early warning aircraft at Waddington came to fruition in 1991 when No 8 Sqn moved in from Lossiemouth to begin operations with the Sentry AEW1.

WEST FREUGH, Dumfries & Galloway (MoD PE)

West Freugh was opened in August 1936 as a training base. It began experimental work in 1942 with the arrival of the Bomber Command Experimental Unit, which later became the Bombing Trials Unit and eventually was absorbed into the Royal Aerospace Establishment, which is today the Defence Research Agency (DRA). Aircraft operated include the Buccaneer S2B.

WITTERING, Cambridgeshire (RAF)

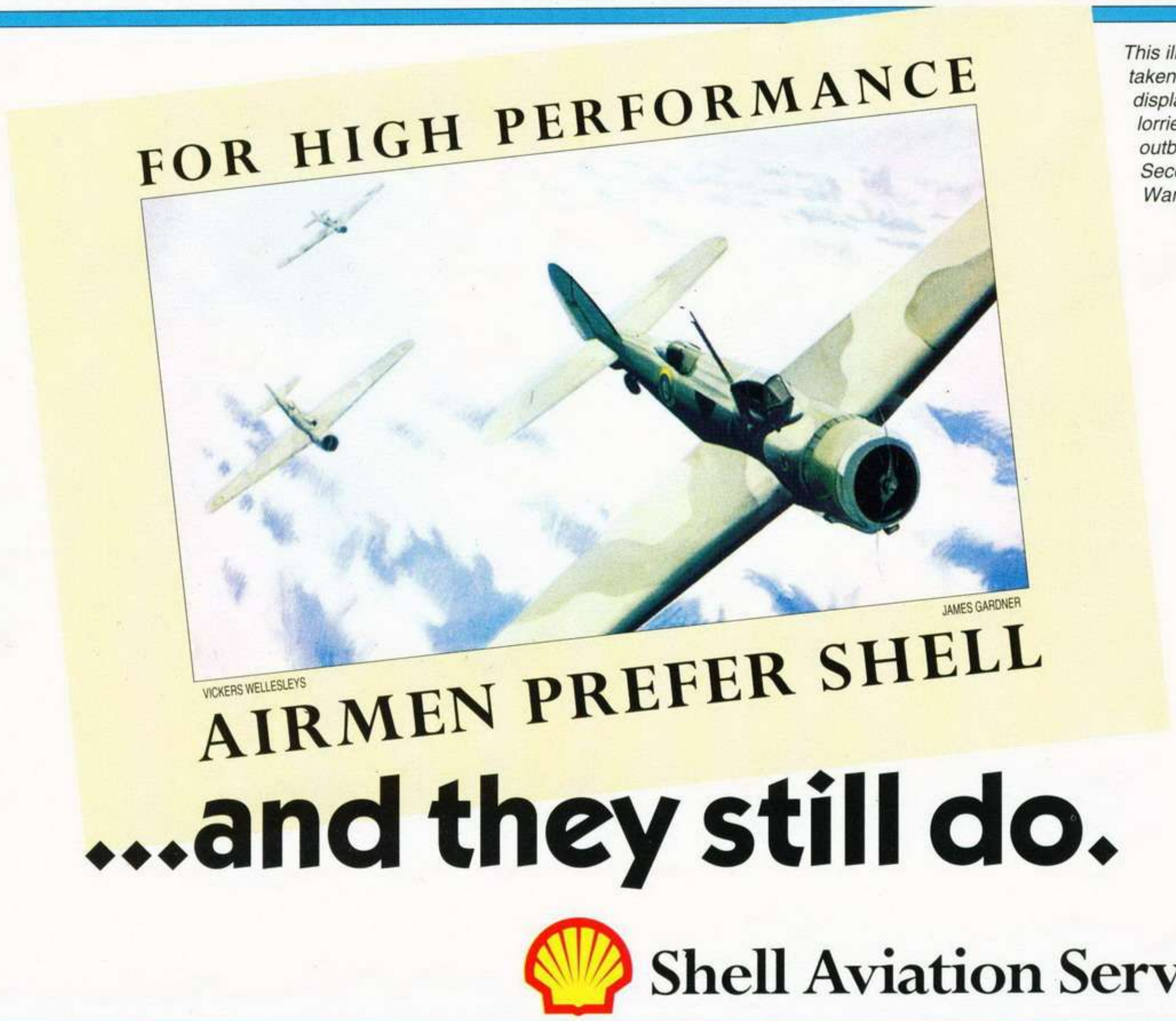
Another airfield dating from WW1, Wittering (originally known as Stamford) was retained between the wars and housed the CFS from October 1926 until 1935, when it was replaced by 11 FTS. At the outbreak of WW2 Hurricanes and Blenheims were on duty and these were later joined by Spitfires, and Beaufighters. Post-war residents have included night-fighter Mosquitos and Lincolns, Canberras and Valiants from Bomber Command, before Wittering became the UK Harrier base in 1969. Today No 20 (Reserve) Sqn – the Harrier Operational Conversion Unit and No 1 Sqn both fly the improved Harrier GR7. The Harrier OCU also operates some examples of the GR5.

WOODVALE, Merseyside (RAF)

Opened in October 1941, Woodvale's first resident unit was a Polish fighter squadron. Spitfires were eventually joined by Typhoons and there were also flying training and target towing flights resident. Post-war Woodvale became home to the famous THUM Flight, the last to operate Spitfires in the UK. Woodvale houses both the Liverpool and Manchester UASs, which fly Bulldog T1s, and the Chipmunk T10s of 10 AEF.

WYTON, Cambridgeshire (RAF)

To Wyton, opened in 1916 and rebuilt completely in 1935-36, falls the distinction of being the first RAF station to fly a sortie against the Germans in WW2. A bomber station throughout, it has seen operations by Stirlings, Lancasters, Mosquitos, Canberras, Valiants and Victors over the years. Today, it houses just two flying units: No 360 Sqn, which specialises in ECM training and operates the Canberra T17/17A (scheduled to disband in October 1994) and No 51 Sqn with Nimrod R1Ps for special reconnaissance duties (which will move to Waddington in January 1995).



This illustration is taken from a poster displayed on Shell lorries before the outbreak of the Second World War, in 1939

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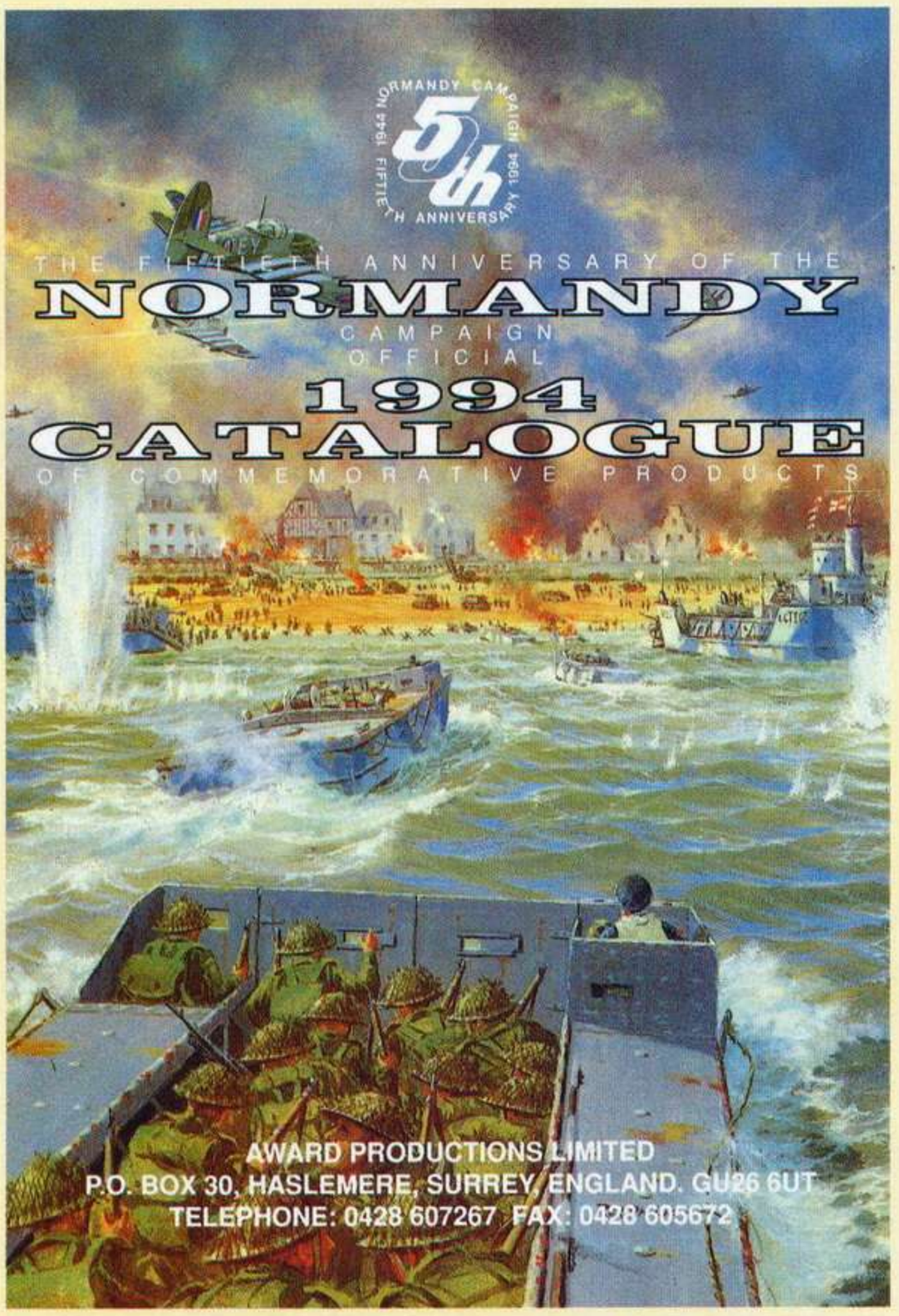
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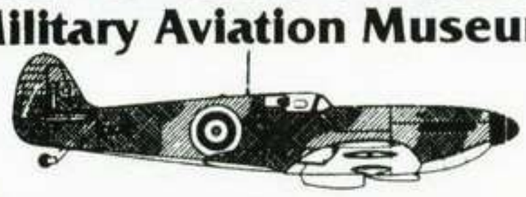
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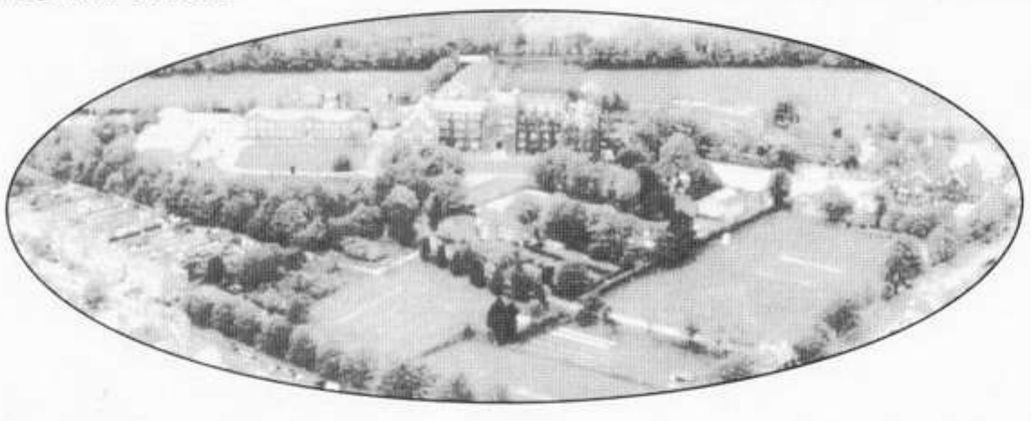
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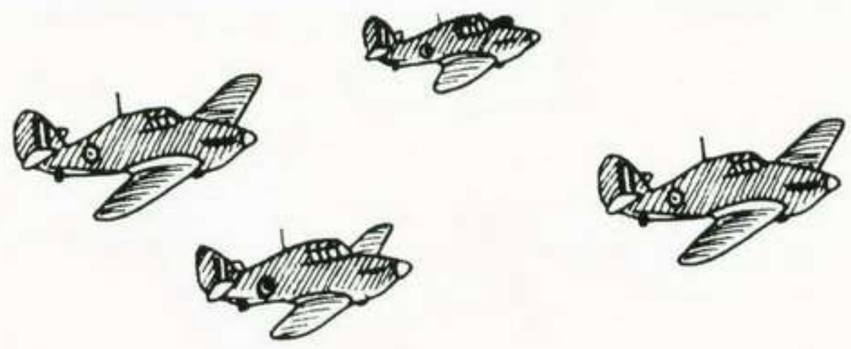
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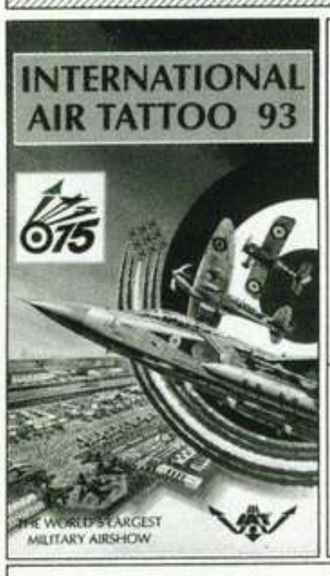
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