

ROYAL AIR FORCE YEARBOOK 1983

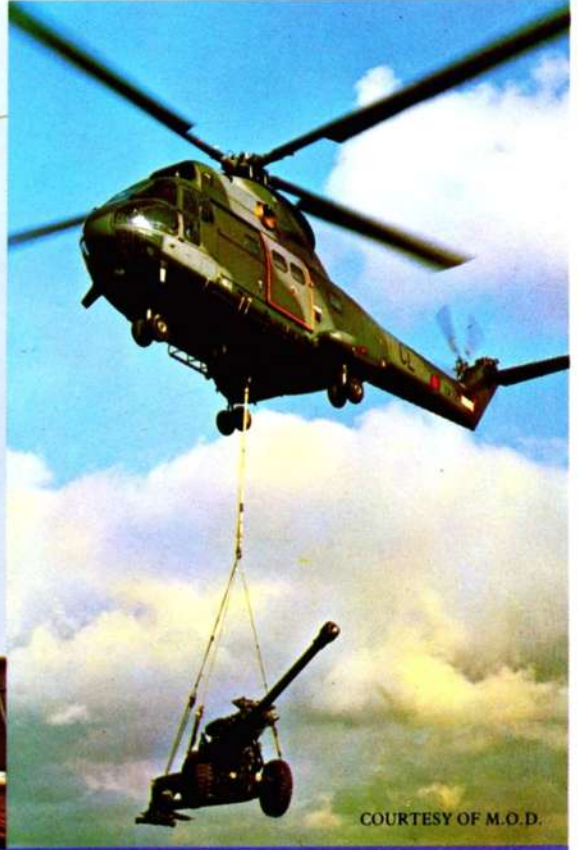
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ROYAL AIR FORCE YEARBOOK 1983

INTRODUCTION

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



Keith Williamson

RAF YEARBOOK 1983

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Cover by WILF HARDY/JACK PARKER.

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

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

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

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

THE YEAR 1982 was dominated by the Falklands Campaign in which the quality of the men and women in our Armed Forces proved to be the decisive factor. We can, I think, justifiably look back on the Campaign with satisfaction and pride, and I am particularly pleased that the RAF's contribution to it has been described in full in this Yearbook. But if we are entitled to take satisfaction from the events of 1982 I believe we, in the Royal Air Force, are also justified in looking forward to the rest of the decade with confidence and optimism. Our extensive re-equipment programme, with Tornado as its centrepiece, is now well underway and it will not be long before we will be able to claim that the high quality of our men and women is matched by the quality of our aircraft and weapon systems.

I very much hope that as you read the articles in this Yearbook you will share this optimism and confidence. I also hope that many of you will find it possible to go to at least one of the various "At Home" days that we will be holding throughout the year, for you will then be able to see for yourselves evidence of the professionalism of our people and the quality of our equipment.

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Mobility with Versatility

Paul Jackson describes the equipment and responsibilities of No 38 Group

TRADITIONALLY and logically, the Groups which form the second echelon of the RAF's command structure have been tasked with a single purpose and equipped with aircraft (excluding support types) of a broadly similar nature. Thus, within Strike Command, No 1 Group has operated all-weather strike aircraft, No 11 Group, interceptors, and No 18 Group, the maritime reconnaissance and helicopter rescue units; but when No 38 Group is considered, classification becomes more difficult. It may at first be hard to find a single theme linking Hercules and VC10 transports with Chinook and Puma helicopters, or even Harrier and Jaguar ground-attack fighters — yet a common denominator does exist, and in a word, it is "mobility".

Unique among RAF Groups, No 38 is equipped for rapid deployment in support of NATO or British interests outside Europe — as clearly illustrated by its large-scale and invaluable participation in the Falklands conflict. A self-contained mobility unit, usually working in close collaboration with ground forces, the Group is equipped to move the Army and its weapons to the scene of conflict in four-engined transport aircraft; ferry supplies from storage dumps to the front line and rapidly deploy men by helicopter, and provide offensive support for the battle with its fighter-bombers. Last December's White Paper on the lessons of the Falklands campaign noted that "flexibility of forces, equipments and tactics" played a key rôle in the British victory over the numerically superior Argentine armed services, and it may be claimed that nowhere in the RAF is this theme better practised than in the ranks of No 38 Group.

(Heading photo) A Jaguar GR Mk 1 of No 54 Squadron, flying from RAF Coltishall, at low level with four 1,000-lb (454-kg) bombs and two 264-imp gal (1 200-l) tanks. (Below) The Lockheed Hercules is the workhorse of No 38 Group: this is a C Mk 3, with stretched fuselage.

To achieve flexibility, the Group's fighter and helicopter squadrons are perpetually at readiness to take the field (sometimes literally) at a moment's notice, whether in freezing Norway or sunny Italy to bolster NATO flanks, or in the central region of West Germany. Movement entails the ferrying of not just aircraft, but the complete squadron and its support elements: servicing personnel and their tools and spares; tenting or other accommodation; communications equipment; protective clothing; maps; pencils — in fact, almost everything except the squadron silver.

With headquarters at the historic former RFC airfield at Upavon, Wiltshire, No 38 Group is the largest and most diverse of the RAF's Groups, comprising 300 aircraft of 11 types and some 16,000 personnel under the command of Air Vice-Marshal D P Hall, CB, CBE, AFC. Having assumed its present form in 1975, when the fighter support squadrons of the original No 38 were combined with the now defunct No 46 Group's transport arm, No 38 Group undertakes an astounding variety of tasks, interesting and mundane, from flying Her Majesty the Queen to hauling mixed freight, and from participating in defence of the Falkland Islands to checking airfield navigation aids.

Labours of Hercules (and VC10)

Whilst armies marched on their stomachs in Napoleon's day, gleaning their food and fodder from local resources, modern forces are heavily dependent on a vast and uninterrupted supply line stretching back to the main base and capable of delivering their





The Jaguar shares with the Harrier responsibility for providing No 38 Group with its attack capability. This example from Coltishall-based No 6 Squadron is carrying six 1,000-lb (454-kg) bombs on fuselage and wing strongpoints.

foreseen and unforeseen requirements on demand. Air transport is by far the most efficient way of supporting the overseas elements of all three Services, and it is therefore not surprising that four-engined transports, the Hercules and VC10, constitute a sizeable proportion of No 38 Group's fleet.

The ubiquitous Lockheed C-130 Hercules, first flown in 1954 and still coming off the Georgia production line after manufacture of 1,700 aircraft, is the workhorse of Britain's military air transport arm. Chosen, in its C-130K Hercules C Mk 1 form, as a replacement for the cancelled HS.681, the aircraft entered RAF service in 1967, 61 "Hercs" now forming the equipment of the Lyneham Transport Wing and flying over 10 million air miles in an average year's operations. In parallel with a programme of wing strengthening which will assure the continued serviceability of the flexible and popular Hercules well

into the 1990s, 30 aircraft are being stretched to C Mk 3 standard by the addition of two-fuselage plugs totalling 15 ft (4.57 m) of extra cargo hold length, this programme (by Marshall of Cambridge) now being two-thirds complete.

The exigencies of the Falklands conflict brought a fresh crop of Hercules variants, including AAR-capable freighters and tankers. The addition of probes and internal fuselage tanks extended the range to enable round-trip flights from Ascension to the Falklands and on one occasion produced a record flight time of 28 hours and 3 minutes. The tanker, with its ability to operate from short airfields, has a unique advantage over its Victor and Vulcan compatriots, and its speed range is of course ideally suited to refuelling other Hercules.

Lyneham's pool of aircraft is shared by four squadrons and a training unit, of which Nos 47 and 70 Squadrons are officially *The Harriers of No 1 Squadron, based at RAF Wittering, give No 38 Group a unique capability to operate close-support from minimal-size landing strips. Illustrated are some of the squadron's Harriers at Ascension Island during the Falklands campaign.*





(Above) The Chinook has given a useful boost to No 38 Group's Support Helicopter Force, as forcibly demonstrated during the Falklands campaign. The photo shows a No 18 Squadron Chinook at Ascension Island, where (left) the VC10 C Mk 1s of No 10 Squadron were also regular visitors during and since the conflict.

dedicated to transport support (including low-level dropping operations); Nos 24 and 30 Squadrons to route flying and aerial refuelling, and No 242 Operational Conversion Unit (OCU) to the instructional rôle. In practice, however, squadrons regularly understudy for each other, drawing the appropriate mark of aircraft from the pool to meet the requirements of the individual mission to be flown. Indeed, such is the Herc's versatility that it is impossible for each crew to be conversant with its many conceivable operational modes, and although almost half of the Hercules aircrew are now qualified to receive fuel from Vulcan, Victor or Hercules tankers, only a small number are current in specialist activities such as the airborne snatching of small packages from the ground; ultra low level air-drops (ULLA), and supporting Britain's Special Forces.

Hercules undertake regular services to Cyprus, Belize, Gibraltar, Ascension Island and the NATO armament practice camp at Decimomannu in Sardinia, and non-scheduled flights for British
The four squadrons of Lockheed Hercules based at RAF Lyneham provide No 38 Group with its tactical airlift capability. About half the inventory are being converted to C Mk 3s by 1985, while 16 of the C Mk 1s now have probes for air-to-air refuelling, as seen here.

units in Germany or to meet the demands of short-notice overseas detachments, such as the Zimbabwe transitional peace-keeping force, and the more recent, larger, expedition to the South Atlantic. Aircrew training includes such activities as landings on 2,500-ft (762-m) grass airstrips at Deptford Down and Upavon Gallops, whilst for combined forces' exercises, the Lyneham Wing typically assigns 25 per cent of its effort to supporting RAF deployments; 5 per cent to the Navy and no less than 70 per cent to the Army — in the last-mentioned instance carrying troops, Land-Rovers, trailers, Scorpion light tanks and the occasional field gun.

Conversion to the Hercules is managed for all crew members (pilots, navigator, air engineer and loadmaster) by No 242 OCU in a five-month course to "D" category standards. This allows crews to participate in limited military transport flying to gain experience. After six months exposure to the transport rôle and two weeks periodic refresher training it is normal for crews to progress to "C" category which permits world-wide flying with passengers, and thereafter the more experienced crews may progress through to "A" qualification as examiners for the Hercules fleet. High standards are demanded of all personnel in the transport force of No 38 Group, for when regularly operating autonomously far from home, each aircraft commander must be capable of using his own initiative. Similar professionalism is sought from the remainder of the team, as in these



situations mutual trust and confidence are essential.

Invaluable though the Hercules may be, its noisy, rough-and-ready interior contrasts starkly with the comfort of the 13 VC10 C Mk 1s of No 10 Squadron based at Brize Norton, Oxon, alongside their training unit, No 241 OCU. Tasked with long-range or strategic transport, the graceful "Tens" classified the Cyprus run as a short sortie when introduced to the RAF in 1966, but now their briefest overseas flights are to Northern Ireland. Gone, too, are the days when all aircraft captains were squadron leader rank, the policy now being to employ some experienced (third or fourth tour) flight lieutenants, plus a few second-tour co-pilots and first-tour navigators and flight engineers.

Some 20 per cent of VC10 flights are scheduled — weekly to Washington, Belize, Cyprus and Germany-Sardinia — plus three per week to Ascension Island. Other flights comprise a varied assortment of tasks within the aircraft limits of 146 passengers, 45,000 lb (20 400 kg) of freight (loaded on pallets through the large cargo door), or a combination of the two. VC10s are equipped with removable VIP furnishings when they regularly carry members of the Royal Family and senior Government officials, a slightly lower standard obtaining for other non-scheduled operations such as transporting the Army from Germany to the exercise area at Suffield, Canada, or rotating Gurkhas between Hong Kong and Brunei. Once regarded as "shirt-sleeve fliers", the VC10 crews have a full wartime rôle, involving amongst other things the wearing of NBC (nuclear, biological and chemical) protection suits and the new AR5 respirator. Flying in this cumbersome but essential kit is regularly practised — although for reasons better imagined than described, it is restricted to freight-only sorties!

All military formations naturally consider themselves an indispensable component of their Service — and indeed, it would be a sad reflection on morale were that not the case — yet No 38 Group's strategic and tactical units are entitled to claim that their rapid and efficient operations are of vital importance to all branches of the British armed forces. The lumbering Hercs and stylish Tens are the first to be called-out for any operation, in order that they may pre-position equipment and supplies for the men to follow. As one Hercules pilot put it, "Without us, no one goes anywhere." He was biased, of course; but perfectly right.

Front-line helicopters

After its arrival in the battle zone, the Army is still heavily reliant on air support, one of its main requirements being for swift delivery of supplies from forward distribution centres: ammunition, fuel, reinforcements, spare parts, to name only a few. Casualties must be speedily evacuated and troop transport provided for a dash forward to exploit an enemy weakness. The unique qualities of the helicopter endow it with the ability to provide all these vital services, and the *Pumas of No 33 Squadron at RAF Odiham supplement the Chinooks of No 7 Squadron, and — as illustrated here — are progressively being fitted with the so-called "polyvalent" air intake filters to facilitate operations in icing conditions.*



sign by the main gate at RAF Odiham, Hants, proclaiming it to be "The Home of the Battlefield Helicopter" leaves no doubt as to who is responsible for assisting the Army in this area.

Britain's Support Helicopter Force was immeasurably boosted from November 1980 when the first of 33 Boeing Vertol Chinook HC Mk 1 twin-rotor aircraft arrived at Odiham, initially for No 240 OCU in the crew conversion rôle. The two planned operational squadrons have now been formed at RAF Odiham, of which No 18 commissioned in 1981 and No 7 last year. No 18 Squadron is being transferred to RAF Germany this year, leaving No 7 (and its detachment at Port Stanley) as the sole Chinook squadron in No 38 Group. Three Chinooks were lost when their transport ship was sunk during the South Atlantic operations, but the deficiency will be more than rectified by the arrival of an additional eight new aircraft from June 1984 onwards.

The Chinook's potential was exploited to the full during the Falklands fighting, as evidenced by the fact that the single surviving aircraft employed during hostilities carried a greater weight of freight than an entire squadron of 14 Sea Kings, on one occasion transporting 81 fully-equipped troops — almost twice the normal complement of 44 — and this after the servicing detachment had lost all its tools and spares by enemy action! Loads of up to 11 300 kg (24,912 lb) can be carried internally or on external cargo hooks.

RAF enthusiasm for the Chinook is not restricted to its weight-lifting capabilities, for the aircraft employs a range of advanced technology not yet fully available to the US Army, the major operator of the type. A Cruise Guide Indicator allows all manner of loads to be transported with automatic selection of optimum flight-control settings, while retrofit programmes for the first aircraft to be delivered will shortly result in the entire fleet being equipped with long-life glass-fibre rotor blades and a pressure refuelling system for rapid top-ups in a combat environment. Recent installation of passive warning equipment and training with night vision aids has taken RAF Chinook experience beyond that of any other user, and the provision of three external cargo hooks has given the helicopter enhanced flexibility in rôles such as re-supply, where loads could be dropped-off to three separate ground units without landing. During the Falklands campaign, the Chinook carried up to six ball-shaped fuel delivery cells suspended in pairs on its hooks, the configuration having an unofficial name sounding not unlike the plural noun for "impotent male cattle"!

Arrival of the Chinook has by no means conferred redundancy on the other support helicopters, and Puma HC Mk 1s of No 33 Squadron continue to operate from Odiham on lighter tasks, transporting up to 5,500 lb (2 495 kg) of cargo or 16 fully-equipped troops. Developed by the French Aérospatiale concern in conjunction with Westland Helicopters, the Puma entered British service in 1971, and nine years later, a further seven were delivered to the RAF to supplement the 40 supplied initially. All Pumas in service are to be fitted with composite rotor blades and these were standard equipment on the follow-on batch; their unlimited fatigue life and the increased performance and diminished vibration they give the Puma make them a worthwhile investment.

Training the Puma's two-man crew is provided by the remaining Odiham resident, No 240 OCU, in the form of a 47-hour pilot conversion course prior to posting to an operational squadron. The more complex three-man Chinook demands 77 hours with the OCU, comprising 35½ for the captain, 31½ for his co-pilot, and six hours of mutual instruction, the crewman having four hours' specialist training included in this total. At present, all Chinook captains and half the crewmen are highly experienced airmen, but in order to provide a basis for evolution of the force, many co-pilots are fresh from flying training school, as are some Puma captains.

Pumas, including those deployed with RAF Germany, are being fitted with the distinctive "polyvalent" type of air-intake filter, following the solution of some early installation problems. At the penalty of a slightly diminished performance, these provide protection against both sand (unlikely) and ice ingestion, the latter being a more probable hazard during deployments to Norway for training in the NATO reinforcement rôle.

For NATO operations, the Pumas and Chinooks of the Group are assigned to SACEUR to complement the helicopters based in RAF Germany and to enhance the mobility of theatre land forces.

Mobile attack force

No 38 Group's commitment to the Army does not end with the provision of mobility, for although the ground forces have their own light helicopters for observation and anti-tank rôles, the modern

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battlefield demands the presence of high-performance jet strike aircraft. The first need is for reconnaissance, to discover the enemy's movements and intentions, and the second for an attack capability against all manner of targets: storage dumps, airfields and, especially, such bottlenecks as a river crossing or amphibious landing. Harriers and Jaguars are tasked for such close-support operations, the former contributing its own specialist brand of flexibility to the mobility theme.

Wittering, hard by the A1 trunk road in Cambridgeshire, became the home of the world's first operational military VTOL aircraft in 1969, and currently accommodates the Harrier GR Mk 3s of No 1 Squadron. Charged with supplying close air support, battlefield interdiction and day reconnaissance (with a single integral left-facing camera) anywhere in the NATO region, the Harrier can emulate the helicopter and operate from dispersed sites, although it prefers a level-ish strip a couple of hundred yards long in order to take-off with a full weapon load.

A typical armament load comprises the two podded under-fuselage 30-mm ADEN cannon and a BL 755 cluster-bomb (CBU) on each of the two outboard wing pylons (100-gal/455-l tanks occupying the inner position except for very short range sorties), but a range of other possibilities includes 1,000-lb (454-kg) bombs and SNEB rocket launchers, plus the options acquired for the Falklands war: AIM-9L Sidewinder air-to-air missiles and Royal Navy 2-in (5-cm) rockets. The Sidewinder fit is an interim measure, occupying valuable strike weapon positions, and a future modification will provide an extra attachment point for a permanent self-defence AIM-9 installation. Further protection is provided for some aircraft in the form of a chaff ("window") dispenser in the rear fuselage, while all aircraft have an RWR on the fin and (except for a few T Mk 4A two-seaters of co-located No 233 OCU) a laser ranger and marked target seeker (LRMTS) in the nose for accurate weapons delivery. In the final two days of the Falklands war, Harriers made their first successful attacks with "Pave Way" laser-guided 1,100-lb (500-kg) bombs and, according to one report, the phenomenal accuracy of these weapons when flying down a laser beam reflected from a target illuminated by an operator on the ground played a significant rôle in prompting the Argentine surrender at Port Stanley.

Needless to say, there is no shortage of pilots expressing a preference to fly the popular Harrier, and the lucky few spend six months with No 233 OCU at Wittering before posting to No 1 (F) Squadron, or one of the two units in Germany, or No 1417 Flight in Belize, Central America (Wittering providing the aircraft for the last-mentioned unit, while all squadrons contribute its personnel on a rotational basis). Conversion to the Harrier is a straightforward affair prefixed by VTOL orientation in a Gazelle helicopter, the course being slightly longer than conventional jet adaptation because of the aircraft's renowned versatility — as evidenced by the six basic types of landing which need to be practised.

Under present plans, Harrier GR Mk 3s will continue to operate from Wittering for the foreseeable future and a second UK-based squadron will be formed after Harrier GR Mk 5s are delivered to RAF Germany from 1986. Some small reinforcement for the home-based Jaguar GR Mk 1 squadrons of No 38 Group is possible before then, however, when RAFG Jaguars are displaced by Tornados in 1984-86, but for the moment the force comprises Nos 6, 41 and 54 Squadrons, all of which are stationed at Coltishall, Norfolk.

Produced by the Anglo-French SEPECAT consortium of British Aerospace and Dassault-Breguet, the hard-hitting yet comparatively small Jaguar operates in the same rôles as the Harrier, with No 41 Squadron providing the photographic reconnaissance expertise. Armed with two 30-mm ADEN cannon, it can carry two 264-lmp gal (1200-l) drop-tanks on the inboard pylons and four weapons strongpoints (BL 755 cluster-bombs or free-fall or retarded 1,000-lb/454-kg bombs), but for short-range work, eight bombs or CBUs may be carried — two under the fuselage, two on the tandem inboard pylons and one on each outer position; provision is also made for the carriage of the Pave Way laser-guided bomb. For self-defence against radar-guided missiles, the Jaguar's tailcone parachute housing has been replaced by a chaff dispenser, and in prospect are additional storage points for Sidewinder missiles, the ALQ-101 ECM (electronic countermeasures) pod and a Phimat chaff and flare dispenser.

These, in conjunction with the already-installed LRMTS and RWR, should suffice to make the Jaguar as elusive as it is potent, although a further avionics modification will become operational in Coltishall's aircraft from this year onwards in the shape of the Ferranti FIN 1064 inertial navigation system — a far more competent

navigation and weapon-aiming "black box" than that available when the Jaguar was conceived — to enhance accuracy in the single-pass attack *modus operandi* of close air support.

All three No 38 Group Jaguar units specialise in low-level operation (down to 100 ft/31 m on training exercises in the USA), using the terrain for concealment; No 41 Squadron has a dual rôle in that it is assigned on a 50:50 basis to attack with CBUs and tactical reconnaissance with a centreline pod containing five optical cameras and an infra-red linescan system for taking "heat pictures" through cloud or camouflage. This additional responsibility means that the squadron takes with it, on its practice deployments, a mobile Reconnaissance Intelligence Centre (RIC) of 65 personnel and their processing and interpretation cabins as well as the usual Jaguar complement of 13 aircraft (including a T Mk 2 two-seater), up to 100 groundcrew, 16 pilots and a ground liaison officer.

The reconnaissance pilot must be able to provide a commentary on what he has seen during the mission, thus augmenting the data obtained from his pictures, and personnel of No 41 Squadron posted to the unit after some 70 hours of conversion to the Jaguar at No 226 OCU, Lossiemouth, Morayshire, receive extra training in recognition of military vehicles, weapons and other subjects once they arrive at Coltishall. As with the transport force, aircraft operate autonomously on many recce sorties, demanding a high level of initiative be displayed by every pilot.

Communications and training

Behind each well-publicised military unit, there exists a lesser-known formation, and within No 38 Group this category is represented by the Andovers, Devons, HS.125s, Wessex and Gazelles employed on VIP transport and calibration duties; the men of the RAF Regiment, and the training schools.

Foremost among these formations is The Queen's Flight, a unit of elite aircrew and aircraft technicians based at Benson, Oxon, and responsible for providing air transportation for Her Majesty Queen Elizabeth II; members of the Royal Family, senior Government ministers and Chiefs of Staff undertaking their official duties, and visiting heads of state. Equipped with three distinctively-painted (red, white and blue) Andover CC Mk 2s and two Wessex HCC Mk 4 helicopters, the Flight operates almost autonomously within No 38



Future options for No 38 Group Jaguars are illustrated here as a trial installation. They are (above) the ALQ-101 ECM pod and (below) the Phimat chaff and flare dispenser.





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(Left) The Devons of No 207 Squadron, now well over 30 years old, soldier on in the communications rôle. Similarly tasked are (right) the Gazelle HCC Mk 4s of No 32 Squadron.

Group, providing its own airways and diplomatic (foreign overflight) clearances and undertaking all except the most extensive regular maintenance on its aircraft. Punctuality is the courtesy of royalty, and high standards of aircraft servicing ensure that a Queen's Flight aircraft is *never* delayed by technical problems. Last year, for example, an Andover undertook a six-week tour to the Far East and on return to Benson its only unserviceable item was the autopilot warning light.

Well utilised, particularly during the summer months when all five may be involved in a heavy programme of Royal engagements on most days of the week, aircraft of The Queen's Flight are supplemented by large jet transports of the Commonwealth air forces and civilian airlines when rapid, long-range flights are required, but the Andovers have nevertheless traversed the globe on many occasions, visiting such unlikely places for an RAF aircraft as Spain, Austria, Lebanon and even the USSR.

The remainder of No 38 Group's VIP fleet is stationed at Northolt, on the western outskirts of London, where No 32 Squadron is equipped with Andover CC Mk 2s and one (cranked-fuselage) C Mk 1, HS.125 CC Mk 1s and CC Mk 2s and Gazelle light helicopters. Co-located No 207 Squadron, with detachments at Wyton and Turnhouse, continues to fly the 35-year-old Devon C Mk 2.

Other Andovers are based at Benson, from where No 115 Squadron's aircraft (which moved from Brize Norton in January) regularly visit all RAF airfields to calibrate their navigation and

landing aids to ensure high safety standards. Carrying electronic monitoring and telemetry equipment, their specialist Andover E Mk 3s are easily recognised by bright red and white colours and the Milligan Lamp mounted in the nose to allow theodolite operators to observe the aircraft's progress down the glidepath in murky weather. Benson, already the home of the Wessex Aircraft Servicing Flight, now also accommodates the Andover ASF, whose responsibilities include the single Andover C Mk 1 based in Norway for use of the C-in-C AFNORTH, and the Andover Training Flight. The last-mentioned was detached from No 241 OCU in January with an Andover C Mk 1 to provide 11-week conversion courses, involving 38 hours' flying for future Andover captains.

Not to be forgotten in No 38 Group's complement are the men of the RAF Regiment — soldiers in blue — whose task it is to defend installations against infiltration or air attack. No Rapier SAMs are assigned to the Group, but the ground threat is met by four units equipped with light armoured vehicles, comprising Nos 2 and 15 Squadrons* at Hullavington, Glos; and Nos 51 (moving from Wittering in August) and 58 at Catterick, North Yorks. Also the Regiment Depot and gunnery training centre, Catterick incinerates retired RAF aircraft for the purpose of training airfield firemen, while Hullavington — known to millions as "RAF Kingswell" in the recent TV drama series "Squadron" — is the home of the Parachute Support Unit, which packs some 13,000 'chutes each year and maintains a fleet of 21 barrage balloons for jumping practice.

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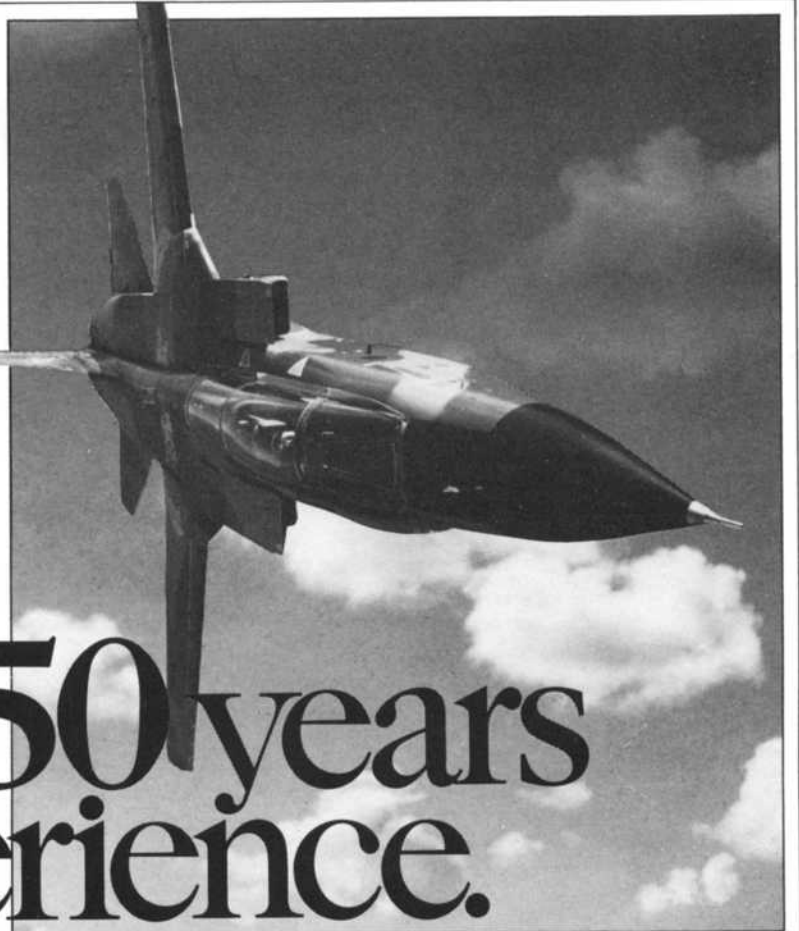
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Future re-organisation

Having examined the past and present of No 38 Group, it is appropriate to turn now to its future. In brief, however, there is none, for this year is the last in which No 38 Group will appear in the RAF Order of Battle. Strike Command is currently in the throes of a re-organisation in which the number of Groups will be reduced from four to three to achieve a more cost-effective command structure; as the junior Group, No 38 is due for "the chop". HQ No 1 Group, now at Bawtry, will move to Upavon by next Spring (1984) and take over No 38's current assets, but a slimming-down process now in hand will mean that it contributes only the UK-based Tornado units and the Victor K Mk 2 tanker aircraft to the present structure. Thus it would perhaps be more accurate to say that No 38 will live-on very much as before in spirit, if not in terms of the sign by Upavon's main gate.

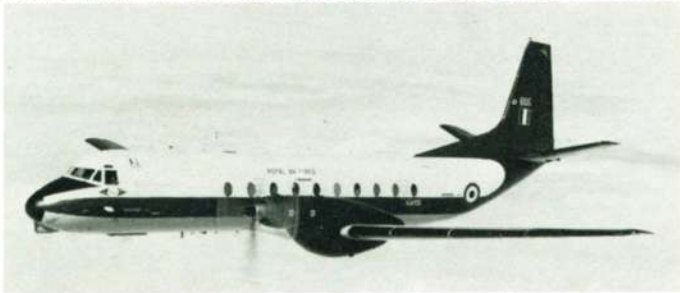
Whatever its title, the Group has much to look forward to in the next few months, and a challenging responsibility will be to usher into RAF service the two BAe 146 Series 100 airliners ordered in December for delivery this summer. These are to be flown from Brize Norton (probably by No 10 Squadron) on general transport duties for a two-year period, after which, if judged suitable for The Queen's



Until introduction of the BAe 146, expected by the end of 1985, The Queen's Flight flies on with (below) three Andover CC Mk 2s and (above) two Wessex HCC Mk 4s.



(Above) A still-camouflaged Andover C Mk 1 of No 115 Squadron and (below) one of the same unit's more colourful Andover E Mk 3s.



(Below) This HS.125 CC Mk 1 is one of four operated as VIP transports by No 32 Squadron from Northolt.



Flight, they will be exchanged for a pair of Series 200 models with appropriate interior fittings as long-needed Andover replacements. Brize is also soon to receive the first of nine additional VC10s bought from civil airlines and converted to tanker standard as the VC10 K Mk 2 (five aircraft) and Super VC10 K Mk 3 (four), and yet further tanker/transport capability will be available there from 1984 when the first of six ex-British Airways TriStar 500s are delivered after modifications authorised in December, four of these being earmarked for later installation of a large freight door and strengthened floor. Capable of carrying personnel and equipment as well as fuel, the TriStars and VC10 tankers will provide a vast improvement in the Group's ability to maintain units abroad.

New names and new equipment come to all RAF units, large and small, but the underlying dedication to maintaining a credible deterrent remains unchanged by these superficial moves. Last year, in an operation involving a tremendous contribution by No 38 Group, Britain's dedication to upholding democracy was put to the test in the South Atlantic, and in actions reflecting credit on all those involved, the country's military flexibility, daring and resourcefulness astounded Argentina, the world and (if the truth be known) itself. Until such time as Britain is no longer willing to defend its people and their friends from those who harbour designs against the Free World, there will be a continuing requirement for an RAF "Mobility Group", and although this is no longer to bear the present Group identity, the new formation can have no better ambition than to emulate the performance in peace and war of its predecessor, No 38 Group, which always delivered the goods — in more senses than one. □

*Regiment squadrons have their own numbering sequence and are unconnected with like-numbered flying units.

CHRIS WREN

Regular readers of the RAF Yearbook will be quick — and sad — to notice that this year's edition does not carry the usual humorous contribution from the widely-known aviation cartoonist, raconteur and wit, Chris Wren. He died suddenly on 9 December 1982, aged 74, whilst attending the annual ETPS dinner at Boscombe Down — one of the many Service establishments, at home and abroad, which he loved to visit and where he was an ever-welcome guest.

Ernest Alfred, as he was christened, or

Chris, as he was universally known, Wren, had a special affinity with the RAF, and was a generous supporter of the RAF Benevolent Fund, regularly providing drawings for Christmas cards and supporting it in other ways. He joined the AAF (No 604 Squadron) in 1932 and served full-time in the RAF from 1939 to 1946. Post-war appointments left him free to maintain his association with the Service, both personally and through his pen; the association is continued today through "young Chris", his son, Flt Lt Christopher Wren, in whose flying prowess Chris took so much delight.



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Corporate Success



Operation Corporate, the military action to repossess the Falkland Islands, was a considerable challenge to the Nation's resolve and the Armed Services' ability to operate effectively, speedily, at long range and without nearby land bases. Due credit has been widely paid — and rightly so — to the outstanding efforts of the Royal Navy, the Army and the Royal Marines, and throughout the operation the public at large were kept in daily touch with their activities by the media. The RAF, which also played an important rôle and attained a high degree of success, did not have its story so well publicised at the time. The mainly supportive, often routine and sometimes covert nature of many of the RAF tasks did not lend themselves to the nightly TV bulletins. Nevertheless, the air contribution was a significant factor in the overall success of the campaign, as testified by the stories now being told of round-the-clock activities, rapid modifications to aircraft and a multitude of record-breaking long-distance operational flights. This account of the RAF participation in Operation Corporate has been prepared by the Air Historical Branch in conjunction with the Directorate of Public Relations, RAF.

DIPLOMATIC RELATIONS between the Argentine Government and the United Kingdom reached crisis point on 1 April 1982, and on the following day the first Argentine forces invaded British territory. Notwithstanding the 8,000 miles of ocean between Great Britain and the Falklands, the decision was made to restore British sovereignty over the Islands, and a Task Force was hastily assembled. In the early hours of 2 April, a Hercules transport of No 24 Sqn left RAF Lyneham, beginning the airlift of men and supplies to the vitally important halfway staging point, Ascension Island. On 5 April, the vanguard of a Royal Navy Task Force, eventually to total over 100 ships, sailed from UK ports.

Ascension Island, situated approximately halfway between the UK and the Falklands, was the key link on the route south; it became a staging post for both ships and aircraft, a communications centre, storage depot, maintenance base and, of course, one of the busiest airfields in the world. When the transportation of the Task Force was at its height, airfield movements had risen from the pre-Corporate norm of just over one a day to 400 per day. By the end of Corporate, there had been 6,700 fixed and rotary wing aircraft arrivals and departures, some 6,000 passengers had been processed and over 17 million pounds of freight handled.

Ascension Island — a lone volcanic

outcrop in a vast ocean — has a 10,000-ft (3 050-m) runway which the Americans built on its lava surface under leasing arrangements to support a satellite tracking station. Apart from its excellent runway, good weather and Cable and Wireless communications facility, the island had little to offer the 800-plus RAF personnel based

there during Corporate. However, the lack of recreational facilities was scarcely a problem for the aircrew, groundcrew and supporting staffs, who worked virtually around the clock to fly and maintain the aircraft based upon or staging through the airfield, appropriately named "Wideawake".

Wideawake Airport — so named after a

(Heading photo) Wideawake Airport on Ascension Island became one of the world's busiest during Operation Corporate, with up to 400 movements a day. In this photo can be seen 15 Victor K Mk 2 tankers, one Vulcan, two Nimrod MR Mk 1s, a pair of Hercules C Mk 1s and a single Naval Sea King HC Mk 4. (Below) Aircrew briefing facilities at Wideawake were rudimentary.



(Below) A distinctively-painted I.A.58A Pucará of IV Escuadrón de Exploración y Ataque from the IX Brigada Aérea, FAA, which deployed to Port Stanley and detached aircraft to Goose Green and Pebble Island.

(Below left) An Aermacchi M. B. 339A of the 1ª Escuadrilla Aéronaval de Ataque, 4ª Escuadra Aéronaval, as used at Port Stanley.



(Right) One of the Douglas A-4P Skyhawks of the V Escuadrón de Caza y Bombardeo, V Brigada Aérea, which operated from Villa Reynolds.

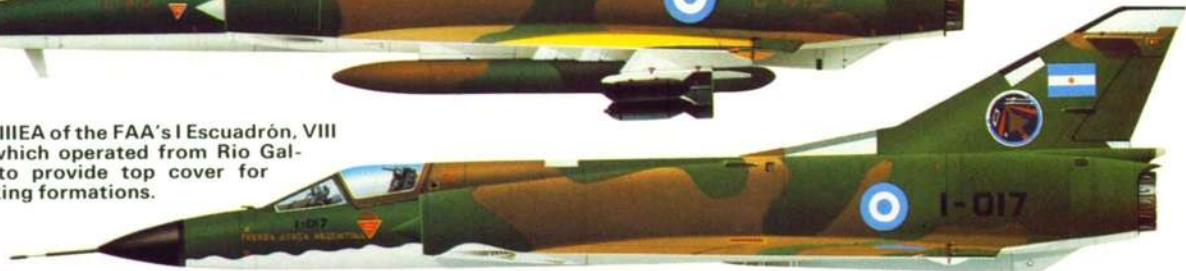


(Below) A Dassault-Breguet Super Etendard of 2ª Escuadrilla Aéronaval de Caza y Ataque, 3ª Escuadra Aéronaval, which operated from Rio Grande during the conflict.

(Below) One of the FAA's Daggers (Israeli-built) flown by the II Escuadrón de Caza, VI Brigada Aérea, from Rio Grande; their usual home base is Tandil, Buenos Aires.



(Right) A Mirage III EA of the FAA's I Escuadrón, VIII Brigada Aérea, which operated from Rio Gallegos primarily to provide top cover for attacking formations.



(Above) An Agusta A109 of Batallón de Combate Aviación 601, Comando de Aviación del Ejército (Argentine Army Aviation).

(Right) One of the Argentine Army's Boeing Vertol CH-47C Chinooks, flown in the Falklands by the Batallón de Combate Aviación 601.



NOT TO SCALE

local bird species — provided only the basic facilities for the planned range of aircraft movements. Not surprisingly, almost everything to support the high density of movement of the air element of the Task Force itself had to be brought in. A high level of support was needed for round-the-clock operations by transport, reconnaissance, tanker and fighter aircraft and helicopters. A crucial element was aviation fuel, supplies of which at times ran very low because of the

prodigiously high usage rate of the many aircraft based on the island or staging through. The arrival of the Victor tankers, in particular, caused anxious calculations to be made, but thanks to careful management operations were never at risk.

Another important part of the Ascension operation was to provide accommodation, food and water, both for the permanent force and for those in transit. One problem that could not be overcome was the relative

shortage of aircraft parking space; yet, at the end of May, the airfield proved able to accommodate no fewer than 16 Victors, three Nimrods, three Hercules, two Vulcans, eight Harriers, three Phantoms, one Chinook and one Sea King — a total of 37 aircraft. Even so, some with low priority had at times to be deployed back to Gibraltar or the UK.

Since Ascension Island was so obviously important and held very considerable air assets, there was a need to defend it against an "Entebbe-type" attack which the Argentinians might have been able to mount with C-130s. A continuous radar watch was maintained, an early warning radar having been lifted to the top of the island high point, 2,800-ft (853-m) Green Mountain by a Chinook. Fighter cover was provided initially by Harrier GR Mk 3s and later by a trio of the more suitable Phantom FGR Mk 2s of No 29 Sqn when the Harriers deployed to the Falklands. Ground defence against air attack was provided by the RAF Regiment, while RN ships and Nimrods were responsible for surveillance of the seas around Ascension Island.

Maritime air tasks

As the Task Force approached Ascension, UK-based Nimrods could no longer provide the maritime air cover for the units proceeding south; on 6 April, two Nimrod MR Mk 1s

(Below) One of the Harrier GR Mk 3s of No 1 (F) Squadron deployed to the South Atlantic for the Falklands operation, with underwing Sidewinder AAM.



(Below) No 202 Squadron Sea King HAR Mk 3s operated from Ascension, and later Port Stanley, for SAR, some repainted dark grey as shown.



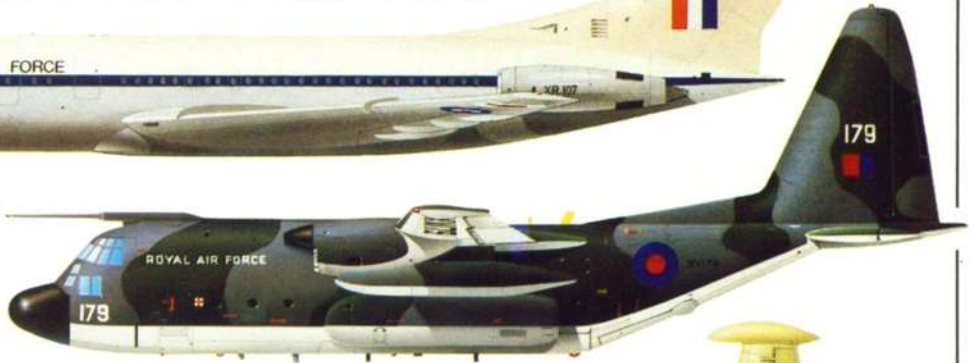
(Below) "Bravo November" was the sole survivor of four No 18 Squadron Chinook HC Mk 1s aboard the "Atlantic Conveyor", going on to give outstanding service in the Falklands.



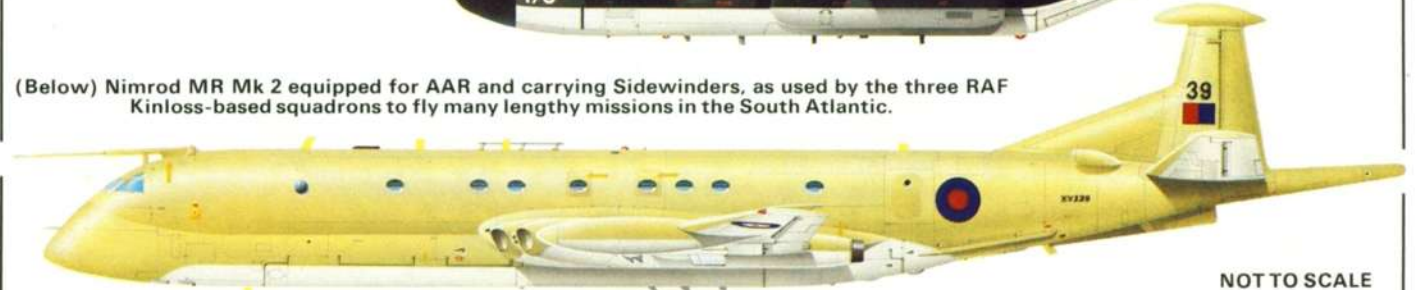
(Above) Victor K Mk 2 tankers, and their crews, were drawn from Nos 55 and 57 Squadrons (the latter illustrated) and No 232 OCU to support operations in the South Atlantic. (Below) Vulcan B Mk 2 XM607, which flew three of the "Black Buck" missions.



(Above) One of No 10 Squadron's VC10s, used to fly casualties back to the UK from Ascension Island. (Right) A Hercules C Mk 1, as operated by the Lyneham Transport Wing, with AAR probe added.



(Below) Nimrod MR Mk 2 equipped for AAR and carrying Sidewinders, as used by the three RAF Kinloss-based squadrons to fly many lengthy missions in the South Atlantic.



NOT TO SCALE

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Nimrod MR Mk 2Ps, with provision for AAR, operated in a number of rôles during the campaign, and made flights of up to 19 hrs endurance out of Wideawake.

from No 42 Sqn began to operate from the island. These were subsequently replaced by the more capable MR Mk 2 version equipped with Searchwater radar. Thus, the Nimrods became the eyes and ears of the Royal Navy in carrying out regular surface surveillance sorties in the vicinity of the Task Force and in distant waters, to identify and monitor the movement of surface shipping which could have been hostile.

The Nimrod was given added punch in order to enhance its armed reconnaissance activities. It was cleared to carry 1,000-lb (454-kg) and cluster bombs, Stingray torpedoes and AGM-84A-1 Harpoon air-to-surface missiles. For self-defence, Sidewinder air-to-air missiles were fitted under the wings, and a further very important modification was the introduction of air-to-air refuelling capability, making possible operational sorties that lasted almost 20 hours.

Nearly 150 sorties were flown by Nimrods in the nine weeks of the operation. Their primary purpose was maritime surveillance, but they also contributed to its success in a number of other ways: they acted as airborne communications relay stations; they were used for dropping mail to the ships of the Task Force; when the other aircraft were undertaking their long-range flights the Nimrods provided a search and rescue monitoring facility, and when required they acted as rendezvous marshals when tanker and receiver aircraft had narrow margins for error in the link-up and fuel transfer schedule.

Victors — workhorses of the South Atlantic

The underpinning of very long-range operations, such as were necessary for Corporate, is the tanker aircraft. The Victors which were to provide the tanker support to so many spectacular sorties by other aircraft opened their account by mounting their own maritime reconnaissance missions. The first four Victors reached Ascension on 18 April, a further five arrived on the following day, and the first surveillance mission was mounted on 20 April.

At the time, the vital task of monitoring surface shipping and plotting the position of icebergs or pack ice in the region of South Georgia was far beyond the range of the Nimrod. Before they left the UK, some of the Victors were quickly modified with inertial navigation equipment, radar and photographic reconnaissance systems. The Victor crews, although specially trained for the task, were supplemented by Vulcan radar navigators who had been with the recently-disbanded No 27 (Maritime Reconnaissance) Sqn.

The first reconnaissance sortie by a Victor

of No 55 Sqn was supported by five more Victors operating in the air refuelling mode. The flight time was 14 hours 40 minutes. Soon afterwards, two more such sorties were flown over the waters surrounding South Georgia, each of more than 14 hours. Their task was to watch for Argentine Fleet movements until the surrender of the ground forces at Grytviken on 25 April.

Victor tanking operations, involving No 57 as well as No 55 Sqn, had begun with these Victor-Victor sorties but were soon to include transfers to Nimrods, Vulcans, Hercules, Harriers and Phantoms. Altogether, some 500 sorties were flown involving more than 600 fuel transfers; only six involved major problems and none resulted in the loss of an aircraft.

Vulcan swansong

Five attacks against Argentine targets were made by Vulcan bombers between 1 May and 12 June. These attacks, code-named "Black Buck", represented the first time that Vulcans in 25 years' service had ever dropped bombs or fired missiles in anger. They also came very late in the operational life of the aircraft, for the remaining Vulcan B Mk 2 squadrons, Nos 44, 50 and 101 had been scheduled for disbandment on 30 June when Corporate began.

Planning and preparation for the sorties, each of which involved a return distance of approximately 8,000 miles (the equivalent of London to Karachi and back), began at Waddington and Marham on 9 April. The aircraft's in-flight refuelling system, which had not been used for many years had to be tried and tested. The conventional bombing capability — again not practised for many years — had to be restored. A self-defence electronic countermeasures pod (the AN/ALQ-101B, as carried by RAF Buccaneers) was fitted under the starboard wing of the Vulcans, making use of long-disused Skybolt strongpoints. Crew training involved night astro-navigation exercises, conventional bombing practice at Garvey Island and

vital air-to-air refuelling training, as none of the crews had ever undertaken in-flight refuelling in Vulcans before.

On 29 April, two Vulcan B Mk 2s deployed to Ascension Island; a third, the back-up aircraft, was not required and was able to return to Waddington. The first Black Buck mission took place on 30 April/1 May. Two Vulcans took-off at 22.53 hours for the attack on the runway at Port Stanley but the primary aircraft (XM598) suffered an in-flight unserviceability and had to return to Ascension Island. Thus, the reserve aircraft, (XM607) captained by Flt Lt Martin Withers, took over the attack mission.

The Vulcan did not travel unescorted. Initially, 10 Victors, a first wave of four and a second wave of six, set course for the first rendezvous, where the Vulcan was refuelled and those Victors scheduled for later transfers were refuelled by other Victors which, having discharged their precious cargo, then returned to Ascension. This "cascade" refuelling plan was to be repeated a number of times until only one Victor remained with the bomber.

The Vulcan refuelled six times en route to the Falklands, so that at all times it had sufficient fuel to return safely to Ascension Island should the need arise, diversion airfields in South America clearly being out of the question. Most of the flight was made at altitudes between 27,000 ft and 32,000 ft (8,230 m-9,145 m) but, in order to avoid radar detection, when within 300 miles (480 km) of the target the operating height was reduced to 250 ft (76 m) above the sea.



(Below) Two of the Vulcan B Mk 2s deployed at Wideawake for the Black Buck missions, and (above right) 1,000-lb (454-kg) HE bombs being loaded into the Vulcan's weapons bay.





(Above) Victor K Mk 2s on the flight line at Wideawake. Some 70 per cent of the total Victor force was deployed to Ascension for Operation Corporate, with up to 10 aircraft needed to support a single Vulcan mission.



(Above) Operating to the limit of their endurance, Hercules transports air-dropped supplies and personnel to the Task Force at sea. This drop was photographed from a ship 2,000 mls (3 220 km) south of Ascension. (Below) The Vulcan XM607 — which flew three of the five Black Buck missions against Port Stanley airfield — lands at Wideawake.

The radar bombing attack was made at 10,000 ft (3 050 m) and at 350 knots (648 km/h). At 0724 Greenwich Mean Time (04.24 local), 21 bombs, of 1,000 lb (454 kg) each, were released over the airfield: the first overt military action against the Argentine occupation of the Falkland Islands. After the release of the bombs the Vulcan made a full-power climbing turn away from the target; looking back the crew saw flashes as the bombs exploded beneath a thin layer of low cloud. As the aircraft reached its return cruising altitude of 41,000 ft (12 500 m), the South Atlantic dawn was breaking.

The recovery flight was far from uneventful. Less fuel than planned had been transferred on the final inbound rendezvous, so an early link-up with a Victor tanker (four



had to be launched for the recovery phase) became crucial to the Vulcan's safe recovery. In the event, with a Nimrod monitoring the rendezvous well south of the planned point, contact was made in good time, but the problems were not over. Fuel from the Victor's drogue flooded back over the Vulcan's windscreen, making the link-up an extremely difficult manoeuvre. Furthermore, the Nimrod and the Victor tanker themselves were now left with only just enough fuel to return to base. When it touched down at Ascension, the Vulcan had flown 15 hours 45 minutes.

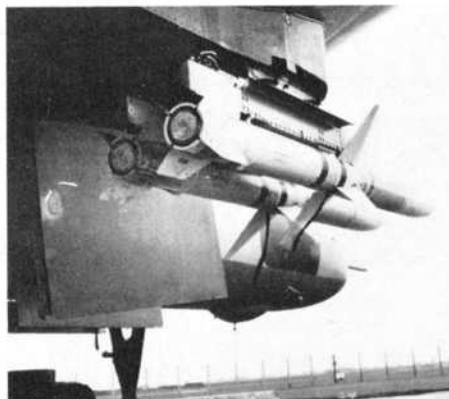
The bombs from this first mission cratered the centre of the runway, thus denying the airfield to the high performance jet fighters and jet transport aircraft for the remainder of the conflict. At the time it was believed that all operations had ceased, but subsequently it was revealed that limited operations by the Argentine Hercules transports were still possible. Nevertheless, this mission had a profound effect on Argentine air force operations and deployments.

Black Buck 2 was able to benefit significantly from the experiences of the first operation. There were modifications made to the very complex refuelling plan and additional transfers were scheduled. On 3/4 May, XM607, this time captained by Sqn Ldr Reeve, set course from Ascension Island to Port Stanley airfield. Although there were initial refuelling difficulties, the flight was relatively uneventful and took 15 hours and 46 minutes. Unfortunately, the run-in to the target was less steady than on Black Buck 1 and the consequent release less accurate. Nevertheless, considerable damage was caused to the airfield surroundings.

The next two Black Buck sorties were targeted not against the airfield but against the Type 43 radars at Port Stanley. For this purpose, the Vulcans were armed with AGM-45A Shrike anti-radar missiles. On the first of these sorties, both captained by Sqn Ldr McDougall, the attack on the radars coincided with Harrier low-level attacks on the airfield. On the second sortie, the crew assessed that the radars were being switched off as they approached but being turned on again as they departed. In order to combat this manoeuvre, the crew initiated a feint departure and then released two of their four missiles. Flashes from the ground were seen from the fog-shrouded area of the radar site.

Refuelling on the return journey proved to be a major problem in that the Vulcan's probe broke, and this necessitated an emergency diversion into Rio de Janeiro. During the descent, attempts were made to jettison the two remaining missiles but one failed to leave the aircraft, causing the crew additional complications with the Brazilian authorities after landing; the aircraft and crew were allowed to return to Ascension after a seven-day stay.

The final Vulcan operation on 12 June was again captained by Flt Lt Withers flying XM607. En route to Port Stanley an engine flamed out, but was restarted in time for the sixth and seventh inbound refuelling transfers. Although there were further problems on the run-in to the target, the bombs, fused to air-burst for attacks not against the runway but the "soft" targets — vehicles and light aircraft — in the general area, were released overhead and flashes from the



For two anti-radar strikes, the Vulcan XM597 carried pairs of AGM-45A Shrike missiles under each wing, on hastily-developed pylons.

airfield were observed. The return flight was uneventful; there were no problems with the Vulcan, the 14 Victors involved in the 18 refuelling sorties or with the Nimrod providing search and rescue cover. So ended a series of five of the most complex and longest range bombing missions in the history of military aviation.

Harriers — from sea and land

Although Sea Harriers were embarked on HMS *Hermes* and *Invincible* when the Task Force departed in early April, the RAF's Harrier GR Mk 3s did not depart the UK for Ascension until early May. The interval was well used: the Harriers were provided with an air defence capability by the fitting of the AIM-9 Sidewinder, and their pilots undertook ski-jump take-off and deck-landing training, and additional air combat practice.

The first wave of Harriers deployed to the South Atlantic flew a non-stop 9 hour 15 minute transit flight from St Mawgan, Cornwall, to Ascension on 3 May. This record distance of 4,600 miles (7,400 km) compared with the previous longest non-stop distance for a single engine V/STOL aircraft of 3,500 miles (5,632 km) from London to New York in the May 1969 "Daily Mail" Transatlantic Air Race.

By 5 May, another seven GR Mk 3s had flown to the island, or were on their way; because of refuelling problems, three had had to make diversions en route. Three aircraft were now retained at Ascension to provide air defence cover, one had to be returned to the UK, and on 6 May six GR Mk 3s were embarked upon SS *Atlantic Conveyor*, where they were carried as deck cargo, "bagged" in specially designed heavy-duty rubber bags to protect them from salt water ingress.

On 17 May, *Atlantic Conveyor* having arrived in the operational area, the Harriers were readied for action, and on 18-20 May they were flown to HMS *Hermes*, where the pilots of No 1 Sqn made their first deck landings on an aircraft carrier at sea.

Work-up training was limited to one day, during which two pilots (the CO of No 1 Sqn, Wing Commander Squire, and Flt Lt Glover) were tasked, when in the air on their training sortie, to intercept an Argentine military Boeing 707 on a reconnaissance mission some 200 miles (320 km) north-east of the Task Force. Although no interception was made, this was the opening round of the squadron's operational involvement in the

campaign and the first RAF land-based aircraft operation from an aircraft carrier since World War II.

From 20 May — the eve of the British landings in the Falkland Islands — until 15 June, when the Argentine forces surrendered at Port Stanley, RAF Harriers operating alongside the Sea Harriers from HMS *Hermes* and *Invincible*, flew 126 operational sorties (not including transit flights from HMS *Hermes* to the Forward Operating Base that was eventually set up at San Carlos on 5 June, nor those sorties that had to be abandoned because of bad weather or aircraft unserviceability).

In supporting the landings at San Carlos, the GR Mk 3s were armed with BL755 cluster bombs, 2-in (5-cm) rockets, free fall and retarded 1,000-lb (454-kg) bombs, and 30-mm cannon. This day's action saw the loss of an RAF Harrier, when Flt Lt Glover's aircraft was shot down; although he ejected, he was injured and taken prisoner, being later transferred to Argentina and held there until the end of hostilities as the only British PoW of the entire campaign.

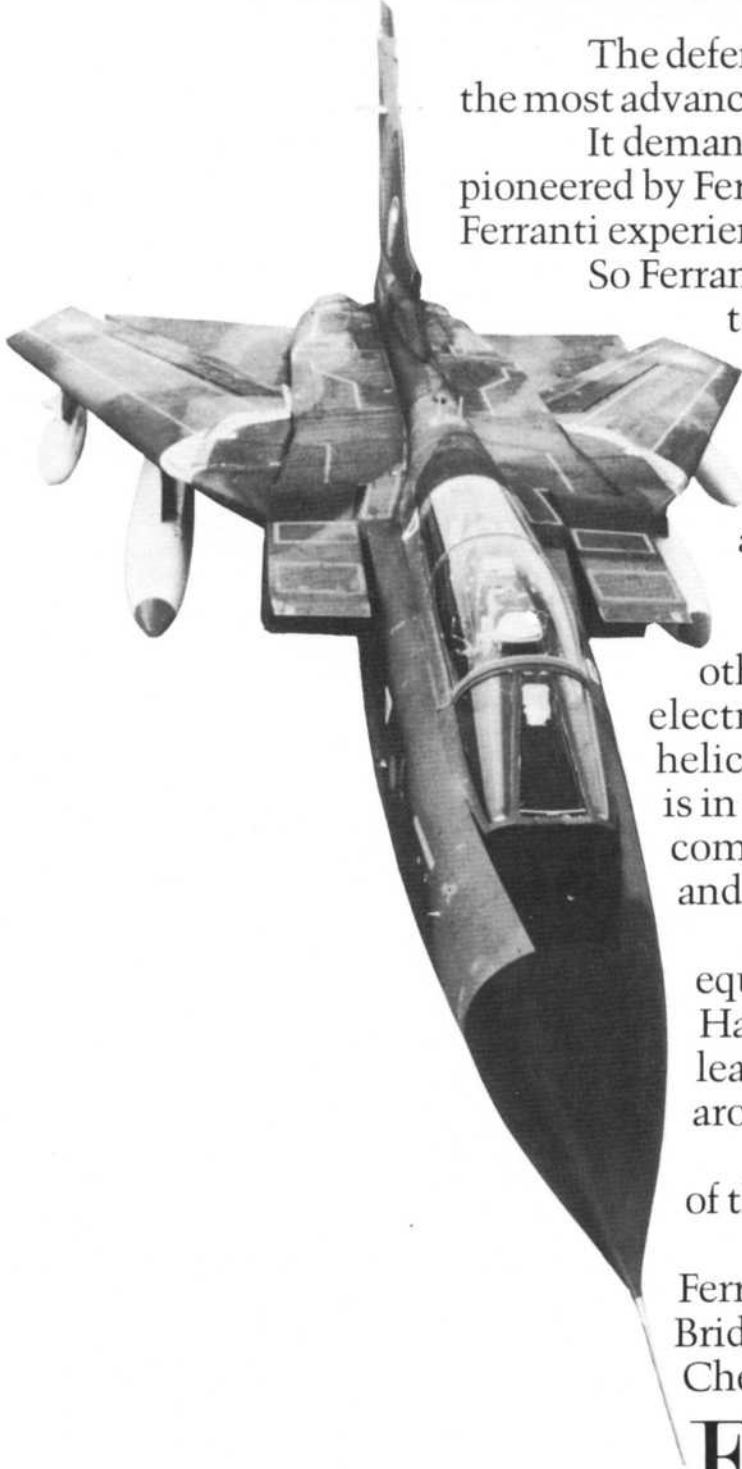
Three days after the first landings, No 1 Sqn was tasked — with the Sea Harriers — to make a co-ordinated bombing attack on Port Stanley airfield. These low-level attacks and subsequent toss bombing attacks did not severely damage the airfield but had a devastating effect on the aircraft and buildings located in the area.

The subsequent assault by No 2 Para on Darwin and Goose Green was supported by the Harriers and, although there were some problems with the forward air control system, one raid of GR Mk 3s making a cluster bomb attack on dug-in Argentinian positions was reported by the Paras as having "a significant effect" on the outcome of the battle. During the attacks on Goose Green, the RAF lost its second Harrier; this aircraft was shot down but the pilot, Sqn Ldr Iveson, successfully ejected, and thereafter evaded capture for more than 48 hours before being picked up by an Army Gazelle helicopter.

When Goose Green had been recaptured, No 1 Sqn was given the task of attacking *Three RAF Harrier GR Mk 3s (left foreground) share deck space on HMS Hermes with Sea Harriers and a Sea King. Paveway LGBs are seen on the outboard pylons of the front aircraft.*



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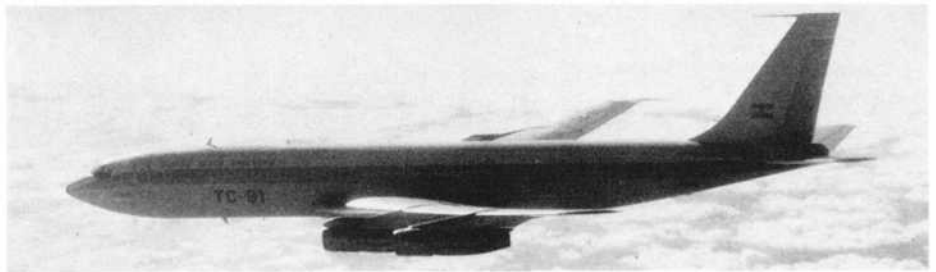
Selling technology

FG/14/010a 

well-camouflaged targets to the west of Port Stanley. The tightening of the perimeter around the town meant that the threat to the Harrier from concentrated small arms and anti-aircraft fire greatly increased, and aircraft frequently returned with battle damage. On one of these missions Sqn Ldr Pook's aircraft began to lose fuel as a result of fire from the ground. In spite of his nursing the aircraft back towards *Hermes* it ran out of fuel just 30 miles (48 km) from safety. The pilot ejected from the crippled aircraft but was quickly picked up from the sea by a Royal Navy helicopter.

At the end of May, two GR Mk 3s again attacked Port Stanley airfield and although the aircraft returned, both suffered cracked windscreens, punctured fuel tanks and debris damage. It was a relief for the Squadron, especially the servicing personnel, when two replacement aircraft arrived on 1 June and two more on 8 June, having made remarkable 8½-hour flights from Ascension direct into the battle zone. Although these aircraft were well supported en route by Victor tankers, Nimrods and Hercules search and rescue aircraft, no diversion airfields were available in the event of malfunction or missed fuel transfers; furthermore, at the end of these epic flights, the pilots had to make their first-ever deck landings.

The construction of the forward operating base at San Carlos was delayed because some of the matting needed for the landing area was lost with the sinking of the SS *Atlantic Conveyor*. Nevertheless, by 5 June a site large enough for four aircraft was available. This was of considerable assistance when operating the Harriers in support of the final assault. It is significant that during this phase the Harrier acquired a new weapon, the Paveway laser-guided bomb. This was used with great success in pinpoint attacks on two targets on 13 June and was



This Boeing 707 was used by the Argentine Air Force for reconnaissance sorties around the Task Force. The photograph was taken when it was intercepted 200 mls (323 km) NE of the Task Force, by two RAF Harriers on a training sortie from HMS Hermes on 19 May.

about to be used again as the surrender was signed.

No account of the Harrier operations in the South Atlantic is complete without mention of the considerable success rate of the Royal Navy's Sea Harriers. They were credited with 20 aircraft kills confirmed and three probable. Much praise is due to the pilots, seven of whom were RAF officers serving with the Royal Navy. Of these, Flt Lt Barton is credited with shooting down the first Argentinian aircraft in the conflict and Flt Lt Morgan had the highest number of kills.

The Falklands airlift

The air transport task fell naturally into two parts. First, during the build-up of Ascension, Hercules and VC10s were required to move personnel and equipment to the island. Second, there was a need to establish a regular reinforcing and resupply service from the United Kingdom to the Task Force. Bulk supplies generally were sent by ship, but resupply of essential spares, equipment and the transmission of mail was an air transport task.

By the time of the ceasefire, well over 500 sorties had been flown by VC10s (No 10 Sqn) and Hercules (Nos 24, 30, 47 and 70 Sqn), together with a small number by

commercially-operated ex-RAF Belfast freighters and chartered civil Boeing 707s. This scale of RAF transport effort over a relatively short period is second only to the Berlin Airlift in post-war air supply operations. More than 7,000 tons were airlifted including 6,000 passengers, about 100 vehicles and more than 20 helicopters. Additionally, the VC10s operating in a casualty evacuation rôle from Uruguay carried 570 aeromedical patients. Once some of the Hercules had been fitted with an air-to-air refuelling system they were used for long-range resupply missions, many of which involved 25-hour flights; the longest was an air-drop mission to East Falkland on 18 June, when Flt Lt Locke and his crew were airborne for 28 hours and 3 minutes.

The RAF contribution to the airlift within the Falklands operational theatre itself was to have been undertaken by four Chinook helicopters of No 18 Sqn. Unfortunately, three of these were lost when *Atlantic Conveyor* was attacked by an Exocet missile, but the sole survivor flew more than 150 hours over the next two months, carrying 1,500 troops, 600 tons of equipment and 650 prisoners of war. On one particular mission the aircraft was tested to the limit: normally cleared to carry only 30 armed

The Air Commander for air operations in the South Atlantic Air Marshal Sir John Curtiss, KCB, received the KBE for his services. The Assistant Chief of the Air Staff (Operations), Air Vice-Marshal Kenneth Hayr, CBE AFC and Air Vice-Marshal George Chesworth, OBE DFC, Chief of Staff to the Air Commander and the officer who mounted the first Vulcan raid against Port Stanley airfield, were both made Companions of the Bath; the senior RAF officer at Ascension Island from 15 April-16 July 1982 was Group Captain Jeremy Price, ADC, who received a CBE.

In all, 2,004 RAF personnel received the South Atlantic Campaign medal, and the following 74 honours for the South Atlantic Operation were bestowed on members of the RAF, including 50 "in theatre" meritorious and gallantry awards; the latter are denoted by an asterisk*.

CBE

Gp Capt C Evans; Gp Capt A Hunter; Gp Capt P King.

OBE

Wg Cdr D Baugh*; Wg Cdr A Bagnall; Wg Cdr P Fry, MBE; Wg Cdr J Sim, AFC; Wg Cdr A Slinger; Wg Cdr C Sturt; Wg Cdr B Weaver; Sqn Ldr B Morris*.

MBE

Sqn Ldr W Lloyd*; Sqn Ldr T Sitch*; Sqn

RAF SOUTH ATLANTIC AWARDS

Ldr C Jefford; Sqn Ldr D Niven; Sqn Ldr J Stokes; Flt Lt J Dungate*; Flt Lt B Mason*; Flt Lt A Neale*; Flt Lt E Clinton, WRAF; Flt Lt P Room; WO D Barker; Master Air Loadmaster A Smith*.

DSC

Flt Lt D Morgan*.

DFC

Wg Cdr P Squire*; Sqn Ldr R Langworthy*; Sqn Ldr C McDougall*; Sqn Ldr J Pook*; Flt Lt W Withers*.

Immediately after the first Vulcan mission, its captain Flt Lt Withers (left) talks to Gp Capt Price and AvM Chesworth. Flt Lt Withers was awarded a DFC for this mission.



AFC

Wg Cdr D Emmerson*; Sqn Ldr R Tuxford; Flt Lt H Burgoyne*; Sqn Ldr A Roberts*.

QUEEN'S GALLANTRY MEDAL

Flt Lt A Swan*; Flt Sergeant B Jopling*.

BEM (Mil)

Flt Sergeant K Kenny*; Chief Technician T Kinsella*; Sergeant J Coleman*; Cpl D Vivian*; Flight Sergeant J Bell; Chief Technician R Vernon; Sergeant P Tuxford; Sergeant J Vickers.

QUEEN'S COMMENDATION FOR BRAVE CONDUCT

Junior Technician A Thorne*; Snr Aircraftsman K Soppett-Moss*.

QUEEN'S COMMENDATION FOR VALUABLE SERVICE IN THE AIR

Wg Cdr M Todd*; Sqn Ldr T Allen; Sqn Ldr A Banfield; Sqn Ldr G Berrell; Flt Lt P Bayer; Sqn Ldr M Beer*; Sqn Ldr J Brown; Sqn Ldr E Wallis*; Flt Lt J Cunningham*; Flt Lt J Keable*; Flt Lt M MacLeod*; Flt Lt G Rees*; Flt Lt R Rowley*; Flt Lt P Standing*; Flt Sergeant S Sloan*.

MENTION IN DESPATCHES

Sqn Ldr J Elliott*; Sqn Ldr R Iveson*; Flt Lt E Ball*; Flt Lt M Hare*; Flt Lt G Graham*; Flt Lt A Jones*; Flt Lt I Mortimer*; Flt Lt H Prior*; Flt Lt R Russell*; Flt Lt R Wright*; Flying Officer P Taylor*; Flying Officer C Miller*; Flt Sergeant D Knights*; Cpl A Tomlinson*.

The Falklands...

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troops, it carried, in response to an urgent operational situation, 81 in a single lift. The Chinook's overall effort was remarkable in that it was roughly equivalent to the lifting capacity of a whole squadron of Sea King helicopters; it was even more remarkable for the lack of technical support, for spares, tools, and ground support equipment had all been lost with *Atlantic Conveyor*, yet the ground crew, with a few borrowed tools and under constant threat of air attack, kept the helicopter in a flyable condition from 27 May until 23 June.

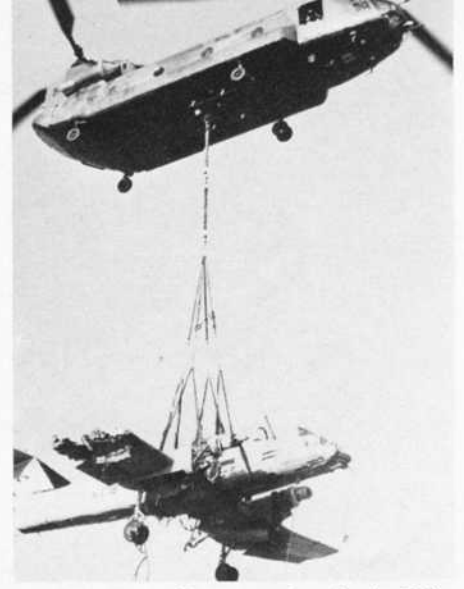
Well founded, timely support of the major units was another essential ingredient to overall success. To achieve this, certain RAF support formations were deployed with the Task Force: the Tactical Supply Wing, the Mobile Catering Support Unit, and the Tactical Communications Wing which provided every facet of military signals from air head facilities on Ascension to ship-to-ship communications on a range of chartered merchant vessels. Search and rescue cover on Ascension Island was provided by a Sea King helicopter from No 202 Sqn. The RAF Regiment was deployed both on Ascension and in the Falklands, where a Rapier missile squadron that had travelled south with the Task Force was disembarked at San Carlos to help defend the bridgehead. Thereafter, they moved to the airfield at Stanley. The RAF's Explosive Ordnance Disposal Unit, also disembarked at Port San Carlos, was soon brought into action in clearing bombs, napalm tanks, anti-personnel mines and ammunition from the Goose Green area.

Support in the United Kingdom took forms

too numerous to list but is typified by two examples. First, the vital supply line extending over 8,000 miles (12 875 km) began and was managed from home. Second, industry and service establishments were fully stretched in undertaking urgent and substantial modifications to aircraft in a fraction of the time normally assigned to such tasks; some of this effort is more fully described in another article in this Yearbook, and has provided many of the RAF's aircraft with permanently enhanced capabilities.

Immediately after the surrender, work began on re-opening the airfield. This involved very considerable and dangerous ordnance clearance tasks, still continuing in 1983, and a runway repair programme. It was 24 June before the first Hercules was able to land at the RAF's newest station — RAF Stanley. Thereafter, teams from the Royal Engineers constructed a matting-covered extended runway which enabled air defence Phantoms to relieve the Harriers of their temporary air defence rôle. The RAF Rapier units that had at first been deployed around RAF Stanley were soon sited in more permanent locations, and air defence radars were set up.

The RAF air defence force of aircraft radars and missiles is an important element of the garrison force and likely to remain so for the foreseeable future, while both the garrison and the population of the Island depend entirely on the RAF Hercules for rapid transport. The airbridge flights system set up soon after the ceasefire is still a feature of daily life, and a significant proportion of passengers and freight destined for the



In the post-conflict operations in the Falkland Islands, additional Chinooks from No 18 Squadron joined "Bravo November", the sole survivor from the Atlantic Conveyor. One of these helicopters is seen here removing a damaged Pucara.

Falkland Islands is sent by air through Ascension Island. Thus, the support force at Wideawake will remain *in situ* for some time to come, and support of the Falkland Islands will remain an RAF task well into the future.

Operation Corporate is now complete. The problems, achievements, losses and successes are matters for the record. But the work continues: "Britain will defend the Falklands for a long, long time": Prime Minister Margaret Thatcher, January 1983. □



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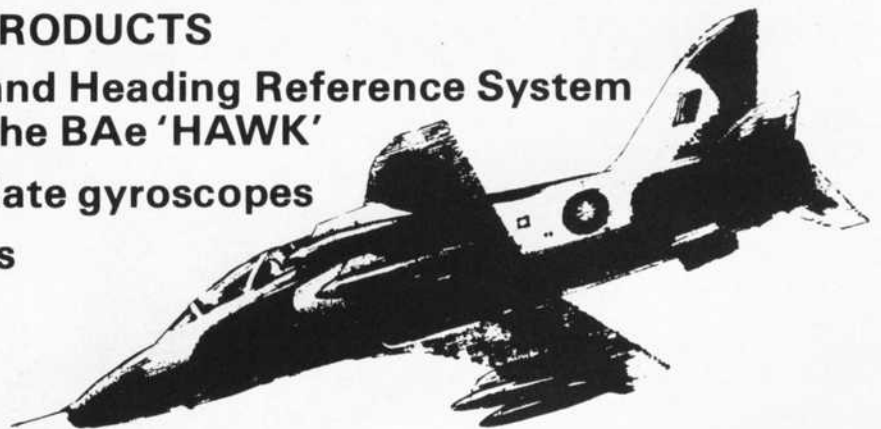
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The Falklands Fall-out

Action taken during the conflict in the South Atlantic, and subsequently to support the British military presence on the Falkland Islands, has resulted in an enhancement of the RAF's resources. New variants of well-known aircraft have been developed, new types have been ordered, inventories of some types are to be increased and weapons capabilities have been improved, as described in this account.

THE BIGGEST single factor to be taken into account in respect of military operations in and around the Falkland Islands is their distance from the nearest base freely available for the use of aircraft of the Royal Air Force. Whilst the Argentine mainland is little more than 460 miles (740 km) from RAF Stanley, and various other landfalls on the coast of the South American sub-continent can be made at distances up to 1,725 miles (2 775 km) or more, regular use of airfields on the mainland by British military aircraft was, and is, politically unacceptable.

From the United Kingdom, the Falklands are 7,813 miles (12 570 km) distant — obviously too far even for air-refuelled non-stop flights to be made with any degree of regularity. The nearest point on the West African coast, Freetown, is 4,788 miles (7 700 km) away; Ascension Island, some 3,915 miles (6 300 km) from Stanley, and 4,260 (6 855 km) miles from the UK, thus holds the key to providing air support. Throughout the period of the conflict itself, and ever since, Wideawake Airfield has been the single most important point on the route between the UK and the Falklands; all RAF aircraft destined for operation in the Falklands, or flying support and supply missions, have staged through Wideawake. Even so, there is a daunting amount of the South Atlantic to be overflown between Wideawake and Stanley, even now that rest and replenishment are available in the Falklands before the return leg is flown; for the Vulcans flying the "Black Buck" missions (described elsewhere in this issue) and for the Hercules that air-dropped men and supplies to the Task Force and, later, over Port Stanley itself, non-stop flights of 7,830 miles (12 600 km) or so were the longest operational sorties the RAF has ever been called upon to undertake, with Vulcans airborne for up to 16 hours at a time, and Hercules for 24-26 hours. Some of the Victor tankers that made these epic missions possible themselves flew only slightly shorter sorties than the Vulcans, as did Nimrods on maritime reconnaissance and other missions.

From all this preamble, it is obvious that air-to-air refuelling took on a new importance for the RAF in the course of *Operation Corporate*; and with the need to support a sizeable Falklands garrison for the foreseeable future, the AAR requirement has in no way declined with an ending of armed conflict. At the time of the Argentine invasion of the Falklands, the RAF's tanker force comprised 22 Victor K Mk 2s, operated by Nos 55 and 57 Squadrons at RAF Marham, Norfolk, where the Victor OCU, No 232, is also based. Plans have been made to supplement this force with nine ex-commercial VC10s converted to three-point tankers, but the first of these made its maiden flight only on 22 June 1982 (a week after the ceasefire in the Falklands) and it will be 1984 before the VC10 tankers make a useful contribution to the task. Consequently, the development of stop-gap tankers became one of the top priorities,

and has resulted in the appearance of the Vulcan K Mk 2 and the Hercules C Mk 1 (K) as described later in this account, followed by the decision to acquire and modify ex-commercial Lockheed TriStars for the same rôle as a longer-term solution. None of these tanker conversions was available, however, during the conflict itself, and with up to 70 per cent of the Victor force deployed on Ascension Island, and much of the remainder employed on high-priority training tasks in the UK, the RAF received short-term relief from some of its NATO tasks that were taken over by KC-135As of the USAF.

The provision of sufficient tankers was only one side of the support coin: the obverse was concerned with the ability of various aircraft to receive fuel from the tankers. All RAF fighters and strike aircraft (that is to say, Harriers, Jaguars, Phantoms, Buccaneers and Tornados) are "probed" and AAR is regularly practised by their crews. Consequently, the movement of Harrier GR Mk 3s of No 1 Squadron south from the UK to Wideawake and, in some cases, on to HMS *Hermes*, and of the detachment of Phantoms of No 29 Squadron that provided air defence for Wideawake, posed no special problems, although the distances were remarkable. Among the transports, the VC10s of No 10 Squadron have in the past been given AAR capability but did not require to use it during *Corporate*; the Victor tankers also were already "probed" to receive, as well as dispense, fuel — a vital facility for the South Atlantic operation, in which the

(Heading photo) One of the six Vulcan K Mk 2 tankers now operated by No 50 Squadron, having been developed at short notice when the Falklands campaign highlighted the need for extra tanker capacity. In this photo, a Tornado has just broken contact with the drogue, producing the familiar plume of spilled fuel. (Below) Pilot's eye view — from a Hercules — of a Vulcan tanker.





In the course of the Falklands conflict, both the Nimrod MR Mk 2 (above) and Hercules C Mk 1 (below) were given AAR capability. Sixteen of each type are now in service with probes.



tankers frequently themselves had to refuel in order to be able to reach the more distant RVs and still have enough fuel to return to Wideawake after refuelling the receiver aircraft. One of the first requirements, nevertheless, was to bring all Victor crews up to pitch in receiving fuel by night — not previously a standard training requirement although all were proficient to fly as tankers by night.

The "probing" programme

Of the remaining aircraft needed to operate in the South Atlantic, the Vulcans were already "probed" but their AAR systems had not been used for some 15 years and crews were not current in the refuelling technique; no provision for AAR had been made on the Nimrod maritime reconnaissance aircraft or the Hercules transports. Fitting probes on these types of aircraft thus became a requirement of utmost priority as soon as the decision had been taken to send a task force to the South Atlantic. Standard Flight Refuelling Ltd probes, with Mk 8 nozzles, were used; as new probes could not be made in the time available, they were drawn from RAF stocks, including those destined for the VC10 tankers and — the majority — taken from those Vulcans that were already out of service or were not earmarked for the "Black Buck" missions (five aircraft) or for conversion to tankers (six aircraft). British Aerospace Manchester Division became responsible for "probing" the Nimrods and Marshall of Cambridge (Engineering) for the Hercules, and the result of these programmes is that both these types now permanently have AAR capability.

Marshall of Cambridge became involved with the Hercules (for which type the company was already the designated technical support centre) on 15 April 1982; with a Hercules C Mk 1 already on hand at Cambridge completing a major service inspection, the design and installation of the first probe was completed within 10 days, and the first flight of a probed Hercules was made on 28 April. After making a first "wet" coupling with a Victor tanker during trials at the A&EE Boscombe Down on 2 May, this aircraft was delivered to the RAF at Lyneham on 5 May; it reached Wideawake on 12 May and the first refuelling mission by a Hercules into the TEZ (total exclusion zone) was made on 16 May.

The probe, with a Mk 8 nozzle, is mounted on the upper forward fuselage, offset to starboard; from it, the in-flight refuelling pipe (of



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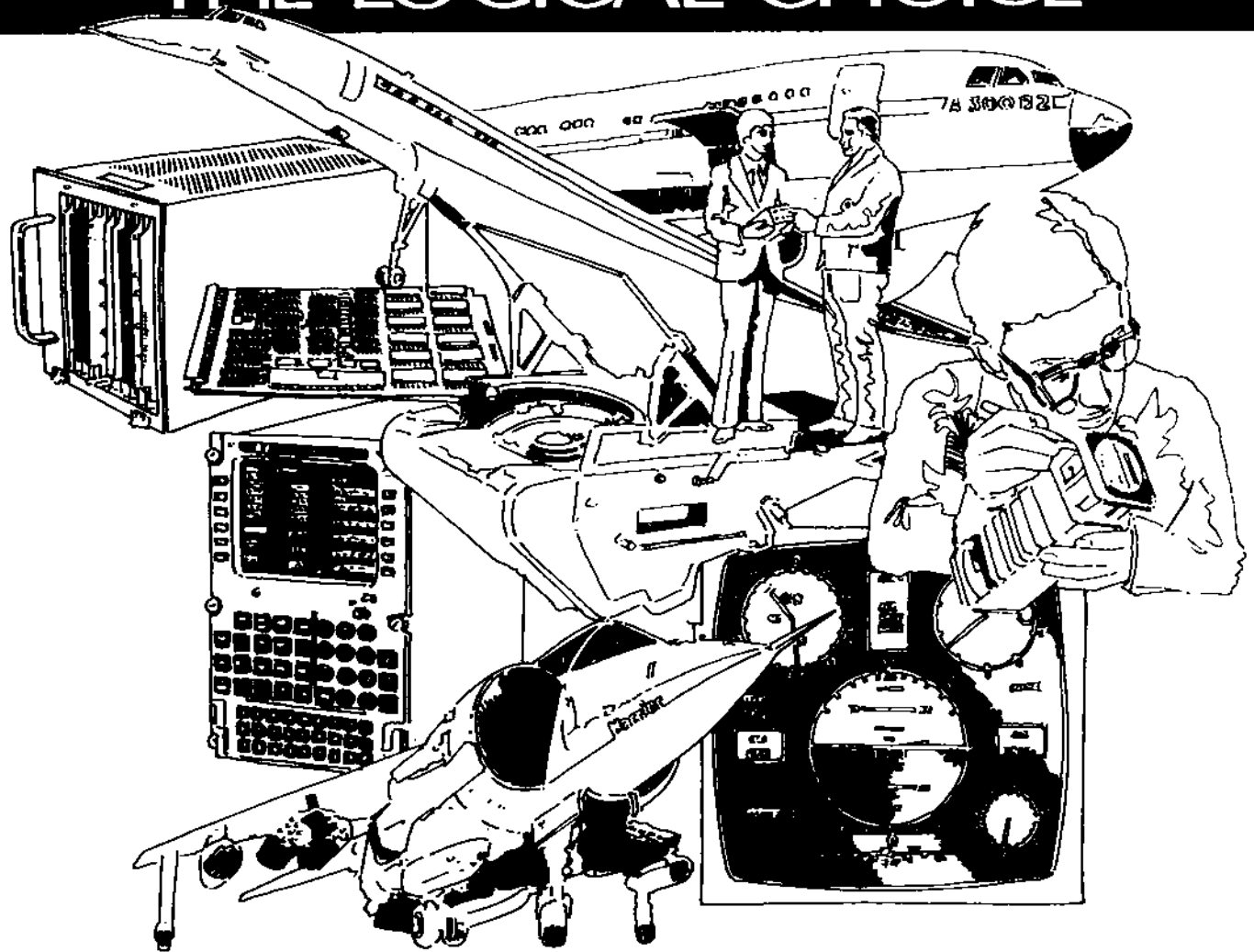
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3-in/7,6-cm diameter) is routed aft along the upper surface of the fuselage, to enter the wing trailing edge-to-fuselage fairing on the starboard side, and thence connect with the vertical ground refuelling pipe. The latter has been modified to have a "Y"-branch, adjacent to which is a non-return valve to isolate the in-flight refuelling system when the aircraft is refuelled on the ground; another such valve just aft of the probe serves to contain fuel in the event of nozzle failure at the weak link, which can result from excessive side loads applied in the rare case of a badly-aligned contact between probe and drogue. Two floodlights were fitted to the side of the co-pilot's instrument panel and positioned to illuminate the probe from the right-hand windows, and the refuelling control panel was located above the navigator's station on the flight deck.

In a separate but simultaneous programme, the Engineering Wing at Lyneham — home of the four squadrons (Nos 24, 30, 47 and 70) operating the Hercules in its C Mk 1 and C Mk 3 versions — had devised and fitted an auxiliary tank installation in the forward cabin, to extend the Hercules' unrefuelled range. This modification, developed in a five-day period starting 16 April, comprised fitting two 825-lmp gal (3 750-l) auxiliary tanks, originally procured for use in the RAF's Andover C Mk 1s and subsequently held in store. Adding some 13,200 lb (5 990 kg) of fuel to the Hercules' standard 63,000 lb (28 580 kg), these two tanks extended the maximum endurance by some four hours, and they are a standard feature of the 16 Hercules C Mk 1s that Marshall fitted with probes, the last of these being delivered on 25 October 1982. In addition, Marshall designed and fitted the Omega long-range navaid to all these aircraft, with the aerial located in the upper rear fuselage (to port of the fin).

The probed Hercules — only C Mk 1s have been so modified — are identified, for convenience, as PLR2s, indicating "probe, two long-

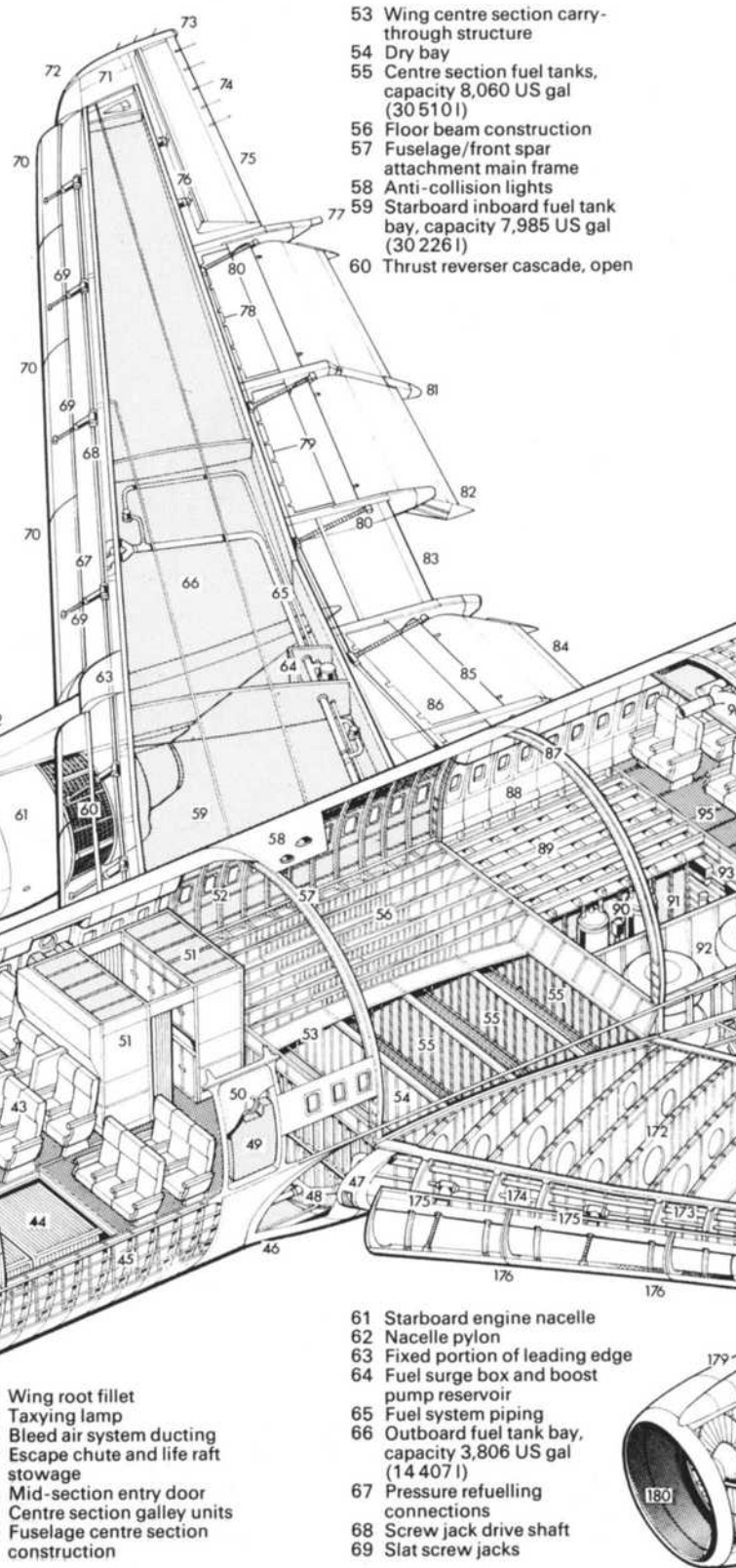
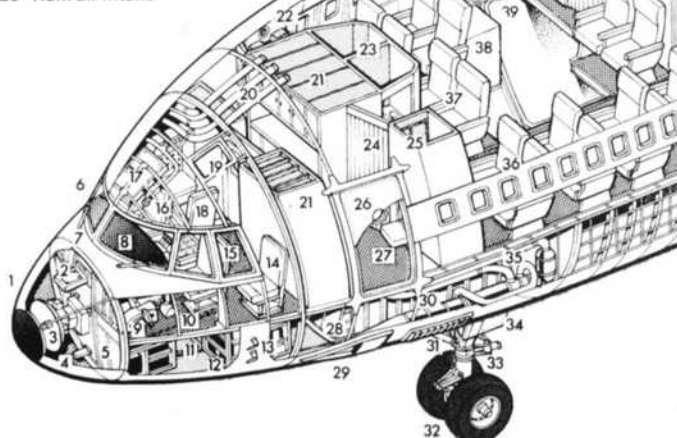
range tanks". Lyneham also developed a four-tank modification (LR4), but this was a very short-term stop-gap pending availability of probed aircraft, since payload was drastically reduced by the weight of the extra fuel (there being no increase in maximum take-off weight). The LR4 configuration did, however, provide the basis for the Hercules tanker conversion, described later.

Work to "probe" Nimrods began at Woodford on 14 April and the Manchester Division took just two weeks to fit and fly the first installation, on 27 April. As on the Hercules, the probe is located above the flight deck, with the fuel line taken into the fuselage immediately at the end of the probe, and thence into the aircraft fuel system. The probed Nimrod, which also has a small ventral fin added to improve stability during AAR operations, made the first "wet" contact with a Victor tanker on 30 April, and two days later the

Lockheed TriStar 500 Cutaway Drawing Key

This cutaway drawing depicts the TriStar 500 in typical airline configuration, representative of the British Airways version. For the RAF tanking rôle, HDUs will be added underfloor in the rear fuselage.

- | | |
|---|--|
| 1 Radome | 30 Heat exchanger |
| 2 VOR localiser aerial | 31 Nose undercarriage leg strut |
| 3 Radar scanner dish | 32 Twin nosewheels |
| 4 ILS glideslope aerial | 33 Steering jacks |
| 5 Front pressure bulkhead | 34 Nosewheel doors |
| 6 Curved windscreen panels | 35 Air conditioning plant, port and starboard |
| 7 Windscreen wipers | 36 Cabin window panel |
| 8 Instrument panel shroud | 37 Six-abreast first-class seating, 24 seats |
| 9 Rudder pedals | 38 Forward underfloor freight hold |
| 10 Cockpit floor level | 39 Forward freight door |
| 11 Ventral access door | 40 VHF aerial |
| 12 Forward underfloor radio and electronics bay | 41 Curtained cabin divider |
| 13 Pitot tubes | 42 Overhead stowage bins |
| 14 Observer's seat | 43 Nine-abreast tourist class seating, 222 seats |
| 15 Captain's seat | 44 Baggage/freight containers, twelve LD3 containers forward |
| 16 First officer's seat | 45 Fuselage frame and stringer construction |
| 17 Overhead panel | |
| 18 Flight engineer's station | |
| 19 Cockpit roof escape hatch | |
| 20 Air conditioning ducting | |
| 21 Forward galley units | |
| 22 Starboard service door | |
| 23 Forward toilet compartments | |
| 24 Curtained cabin divider | |
| 25 Wardrobe | |
| 26 Forward passenger door | |
| 27 Cabin attendant's folding seat | |
| 28 Nose undercarriage wheel bay | |
| 29 Ram air intake | |



- | |
|--|
| 53 Wing centre section carry-through structure |
| 54 Dry bay |
| 55 Centre section fuel tanks, capacity 8,060 US gal (30 510 l) |
| 56 Floor beam construction |
| 57 Fuselage/front spar attachment main frame |
| 58 Anti-collision lights |
| 59 Starboard inboard fuel tank bay, capacity 7,985 US gal (30 226 l) |
| 60 Thrust reverser cascade, open |

- | |
|---|
| 46 Wing root fillet |
| 47 Taxying lamp |
| 48 Bleed air system ducting |
| 49 Escape chute and life raft stowage |
| 50 Mid-section entry door |
| 51 Centre section galley units |
| 52 Fuselage centre section construction |

- | |
|---|
| 61 Starboard engine nacelle |
| 62 Nacelle pylon |
| 63 Fixed portion of leading edge |
| 64 Fuel surge box and boost pump reservoir |
| 65 Fuel system piping |
| 66 Outboard fuel tank bay, capacity 3,806 US gal (14 407 l) |
| 67 Pressure refuelling connections |
| 68 Screw jack drive shaft |
| 69 Slat screw jacks |

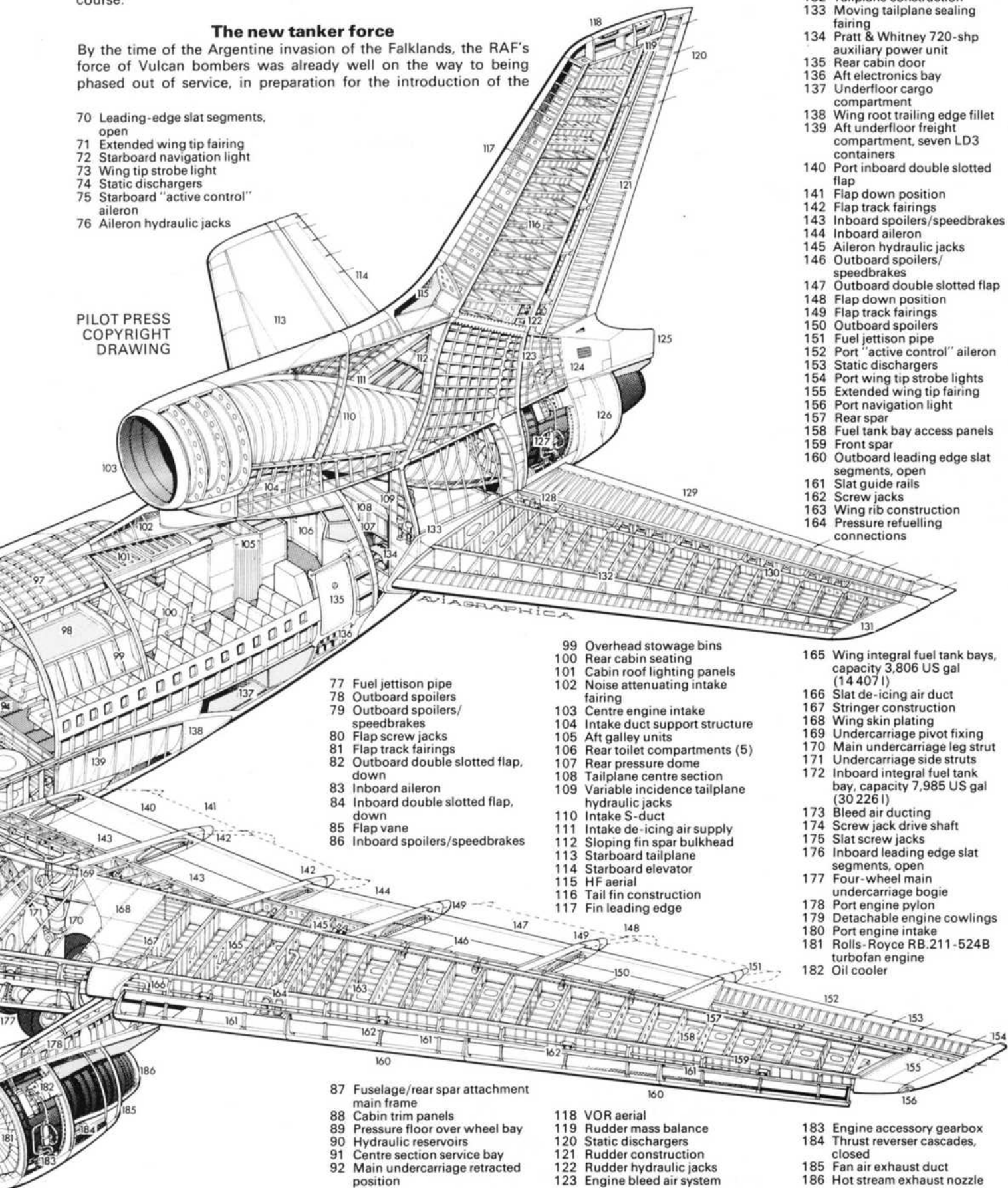
second aircraft, with fully productionised systems, was rolled-out, service clearance being obtained on 5 May. A total of 16 Nimrods was fitted with probes, all but three of these before the conflict ended; already converted from MR Mk 1s to MR Mk 2s, they are now conveniently referred to as Mk 2Ps. Thanks to the work undertaken on these aircraft, the Nimrod AEW Mk 3s that are to enter service with No 8 Squadron in 1984 could also be given an AAR capability in due course.

The new tanker force

By the time of the Argentine invasion of the Falklands, the RAF's force of Vulcan bombers was already well on the way to being phased out of service, in preparation for the introduction of the

- 70 Leading-edge slat segments, open
- 71 Extended wing tip fairing
- 72 Starboard navigation light
- 73 Wing tip strobe light
- 74 Static dischargers
- 75 Starboard "active control" aileron
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- 98 Cabin ceiling panelling

- 124 Centre engine pylon mounting
- 125 Tail fairing
- 126 Detachable engine cowlings
- 127 Centre engine installation
- 128 Geared elevator hinge control
- 129 Port elevator
- 130 Elevator balance weights
- 131 Tailplane tip fairing
- 132 Tailplane construction
- 133 Moving tailplane sealing fairing
- 134 Pratt & Whitney 720-shp auxiliary power unit
- 135 Rear cabin door
- 136 Aft electronics bay
- 137 Underfloor cargo compartment
- 138 Wing root trailing edge fillet
- 139 Aft underfloor freight compartment, seven LD3 containers
- 140 Port inboard double slotted flap
- 141 Flap down position
- 142 Flap track fairings
- 143 Inboard spoilers/speedbrakes
- 144 Inboard aileron
- 145 Aileron hydraulic jacks
- 146 Outboard spoilers/speedbrakes
- 147 Outboard double slotted flap
- 148 Flap down position
- 149 Flap track fairings
- 150 Outboard spoilers
- 151 Fuel jettison pipe
- 152 Port "active control" aileron
- 153 Static dischargers
- 154 Port wing tip strobe lights
- 155 Extended wing tip fairing
- 156 Port navigation light
- 157 Rear spar
- 158 Fuel tank bay access panels
- 159 Front spar
- 160 Outboard leading edge slat segments, open
- 161 Slat guide rails
- 162 Screw jacks
- 163 Wing rib construction
- 164 Pressure refuelling connections

- 77 Fuel jettison pipe
- 78 Outboard spoilers
- 79 Outboard spoilers/speedbrakes
- 80 Flap screw jacks
- 81 Flap track fairings
- 82 Outboard double slotted flap, down
- 83 Inboard aileron
- 84 Inboard double slotted flap, down
- 85 Flap vane
- 86 Inboard spoilers/speedbrakes

- 99 Overhead storage bins
- 100 Rear cabin seating
- 101 Cabin roof lighting panels
- 102 Noise attenuating intake fairing
- 103 Centre engine intake
- 104 Intake duct support structure
- 105 Aft galley units
- 106 Rear toilet compartments (5)
- 107 Rear pressure dome
- 108 Tailplane centre section
- 109 Variable incidence tailplane hydraulic jacks
- 110 Intake S-duct
- 111 Intake de-icing air supply
- 112 Sloping fin spar bulkhead
- 113 Starboard tailplane
- 114 Starboard elevator
- 115 HF aerial
- 116 Tail fin construction
- 117 Fin leading edge

- 165 Wing integral fuel tank bays, capacity 3,806 US gal (14 407 l)
- 166 Slat de-icing air duct
- 167 Stringer construction
- 168 Wing skin plating
- 169 Undercarriage pivot fixing
- 170 Main undercarriage leg strut
- 171 Undercarriage side struts
- 172 Inboard integral fuel tank bay, capacity 7,985 US gal (30 226 l)
- 173 Bleed air ducting
- 174 Screw jack drive shaft
- 175 Slat screw jacks
- 176 Inboard leading edge slat segments, open
- 177 Four-wheel main undercarriage bogie
- 178 Port engine pylon
- 179 Detachable engine cowlings
- 180 Port engine intake
- 181 Rolls-Royce RB.211-524B turbofan engine
- 182 Oil cooler

- 87 Fuselage/rear spar attachment main frame
- 88 Cabin trim panels
- 89 Pressure floor over wheel bay
- 90 Hydraulic reservoirs
- 91 Centre section service bay
- 92 Main undercarriage retracted position

- 118 VOR aerial
- 119 Rudder mass balance
- 120 Static dischargers
- 121 Rudder construction
- 122 Rudder hydraulic jacks
- 123 Engine bleed air system

- 183 Engine accessory gearbox
- 184 Thrust reverser cascades, closed
- 185 Fan air exhaust duct
- 186 Hot stream exhaust nozzle



(Above) A Hercules C Mk 1, modified to have a refuelling probe, takes on fuel from a Hercules C Mk 1(K) tanker. Both conversions were made by Marshall of Cambridge (Engineering) at short notice during the Falklands campaign. (Below) Another view of a Hercules tanker.



Tornado (as separately described elsewhere in this issue); four squadrons (Nos 9, 27, 35 and 617) had already disbanded and, but for *Operation Corporate*, Nos 44, 50 and 101 would have gone in June 1982. For Nos 44 and 101, the conflict brought only a temporary reprieve and these two units stood down on 21 December and 4 August 1982 respectively, bringing an end to operation of the Vulcan as a bomber. However, No 50 Squadron remains in being to operate the six Vulcan K Mk 2 tankers that were produced to supplement the Victor force until the arrival of the VC10s.

To produce the tanker, BAe's Manchester Division was able to take advantage of earlier work that provided three auxiliary tanks, each with a capacity of 8,000 lb (3 628 kg), in the bomb-bay for ferry flights. This installation increased total fuel capacity to about 96,000 lb (43 545 kg), and it was a relatively easy task to fit a standard Flight Refuelling Ltd Mk 17 hose drum unit (HDU or "hudu") in a somewhat unattractive box-like fairing under the rear fuselage (the ECM equipment being removed from the tail cone immediately above). BAe was notified of the requirement for a Vulcan tanker on 30 April, and the first flight was made on 18 June from Woodford. C of A release was obtained on 23 June, on which day delivery was made to Waddington.

The reduced ground clearance resulting from the HDU installation calls for revised take-off and landing techniques, and a new colour scheme has been adopted for the underside of the aircraft, as on the Victors, with wing flaps, ailerons and much of the fuselage painted white, and a longitudinal red-and-black bar to help alignment by the approaching receiver. As in the Victor K Mk 2, the nav-radar is responsible for fuel management during refuelling, but the rear-view periscope in the Vulcan had to be located to the right of the aft-facing crew compartment, and is used by the AEO. Crew complement remains unchanged at six. No 50 Squadron has an establishment of 10 crews for its six tankers and is engaged primarily in support of the UK air defence fighter force, freeing Victors for the South Atlantic.

At the same time that British Aerospace was asked to develop the

Vulcan tanker, Marshall of Cambridge received word from the Ministry of Defence (on 30 April) that it should prepare a TI (Trial Installation) for a Hercules tanker, again using the standard HDU Mk 17B. For this purpose, a Hercules C Mk 1 with the four long range tanks in the fuselage arrived at Cambridge on 1 May, and this aircraft, converted to tanker configuration, flew for the first time on 8 June; the standard probe was also fitted, to allow the tanker itself to refuel in flight, and Omega was installed.

The tanker modification was achieved by locating the HDU on the cargo ramp, with the drogue deployment box and auxiliary serving carriage on the cargo door. This allowed the Hercules to remain pressurised when the drogue was not deployed; to achieve a system that would permit pressure to be retained during the drogue deployment would have been more difficult and time-consuming. Fuel supply was taken from the main aircraft tanks (not the auxiliary tanks in the fuselage) by tapping the standard dump pumps, and pressure to the fuel supply through the HDU to the receiver was provided by a bleed-air turbine-driven fuel pump. To cool the bleed air and components in the HDU, two ram air intakes and two exhaust ports were incorporated through the pressure hull. Standard external lighting for tanker aircraft was provided, and the control panel was located above the navigator's station, adjacent to the in-flight refuelling panel.

The drogue was successfully deployed on the first two flights from Cambridge, on 8 and 10 June, and the Hercules tanker was then delivered to the A&AEE on 11 June. Dry couplings were made with a Harrier, but some problems were encountered, including a slight buffeting around the rear fuselage that was caused by the HDU pack projecting from the cargo ramp, and overheating of the HDU oil cooler. The aircraft was returned to Cambridge and small strakes were fitted on the cargo ramp; with these and a third ram air intake for cooling fitted, the Hercules tanker flew again on 20 June and next day made a successful "wet" transfer of 5,900 lb (2 676 kg) of fuel to a Buccaneer, at 1,000 lb/min (454 kg/min), before returning to the A&AEE on 22 June.

There followed a further period of development flying, including "prods" by Sea Harrier, Phantom, Nimrod and Hercules, at varying aircraft weights and altitudes, and the first tanker was delivered to RAF Lyneham on 5 July, but a problem with the heat exchangers persisted and it was eventually decided to introduce alternative heat exchangers. With this final modification, all four tankers had been delivered to the RAF by 26 July 1982, taking the designation C Mk 1(K). Operational use of the Hercules tankers from Wideawake began in the first week of August and by the end of 1982 two were based on Ascension Island and two at Stanley. Typically, on transits between these two points, the transport Hercules refuel twice from a Hercules tanker, but the latter usually needs to refuel from a Victor during the mission, an operation that calls for the "toboggan" technique with both aircraft in a shallow dive while fuel is transferred, to achieve compatible airspeeds.

Although the Hercules tankers — two more of which were under conversion in the early months of 1983 to make six in all — can refuel a variety of aircraft, they were developed primarily to support the probed Hercules C Mk 1s in South Atlantic operations. With the



The Vulcan K Mk 2 is now the only variant of the Vulcan to remain in service, the last of the bombers having been retired at the end of 1982. The last-minute decision to convert six Vulcans as AAR tankers meant that all three of the RAF V-bombers have now served in that rôle.

Victors and Vulcans inevitably reaching the end of their fatigue lives quite soon — at which point expensive refurbishment would be required if they were to be retained in service — the future tanker force depended largely upon the nine VC10s (five K Mk 2s and four K Mk 3s). However, the enlarged numbers of aircraft capable of AAR and the enlarged area of RAF operations meant there was a definable shortfall in the tanker capacity in the longer term, and to overcome this the RAF is to acquire six Lockheed TriStars.

These aircraft, which will be the first examples of the TriStar in military service, are the six TriStar 500s that were acquired by British Airways in 1979. The first Dash 500s built by Lockheed, they have been in service since 7 May 1979 but as airline traffic has not increased as rapidly as forecast since that time they represent excess capacity that BA is glad to be able to sell. Compared with the original TriStar (in its Dash 1, 100 and 200 versions) the Dash 500 has a shortened fuselage and increased fuel capacity; with 50,000 lb st (22 680 kgp) Rolls-Royce RB.211-524B4 engines, these aircraft have a range of some 4,310 miles (6 940 km) with the maximum commercial payload and 4,950 miles (7 965 km) with 300 passengers. As well as being the largest and heaviest aircraft in RAF service, at 496,000 lb (224 982 kg), the TriStar will be among the most advanced, with active controls and a modern technology Flight Management System.

For the tanker rôle, the TriStars will be modified, during 1983/84, by Marshall of Cambridge, the principal work being to fit twin (side-by-side) HDUs in the rear fuselage and to adapt the fuel systems, perhaps with extra tankage in the underfloor holds. The TriStars will be single-point tankers, the pair of HDUs providing redundancy in case of an equipment failure; in the longer term, it would no doubt be possible to fit HDUs in underwing pods, as on the Victor and VC10.

Above deck, the TriStars will be fitted to carry passengers in the conventional RAF aft-facing manner, with or without freight. A more extensive freight-carrying capability will be given to four of the six. Before the Falklands campaign came to an end, Nimrod MR Mk 2s had been deployed carrying pairs of Sidewinders on wing strongpoints, and this capability is now retained permanently. An aircraft of No 120 Squadron is illustrated. (Right) A Nimrod refuels from a Victor K Mk 2.

aircraft in a second phase of modification, with cabin flooring stressed for greater weight concentrations, a mechanised freight handling system and a large loading door in the forward port side of the fuselage.

Enhanced armament

The immediate requirements of the conflict in the Falklands led to the introduction of several new weapons on aircraft not previously cleared to carry them, and in most cases these now remain part of the regular RAF armoury. One exception, of course, was the work undertaken at RAF Waddington, to adapt the Vulcan to carry (on wing strongpoints) an ECM pod and Martel or Shrike anti-radar



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The armament of the Harrier GR Mk 3 was enhanced, before aircraft of No 1 Squadron were despatched to the South Atlantic, by adapting the outboard wing pylons to carry Sidewinder AAMs as an alternative to bombs or rocket pods. All GR Mk 3s have subsequently been modified to permit Sidewinder carriage.

missiles; the latter were used on two of the "Black Buck" missions but with the retirement of the Vulcan this work has no further application.

Taking advantage of early work (more than 10 years ago) to allow the Nimrod to carry Martels under each wing — an option that was not eventually taken up by the RAF — British Aerospace at Manchester was quickly able to adapt probed Nimrod 2Ps to carry pairs of Sidewinder AAMs on each of two wing pylons. This installation to provide Nimrods with a self-defence capability was first flown on 26 May and was in service by 31 May. Sidewinders are now among the Nimrod's permanent armament options, as are the Stingray torpedo and the AGM-84A-1 Harpoon anti-shiping missile, for which the aircraft's bomb-bay has been suitably adapted. The Harpoon installation was first flown on 10 June 1983 and was in service by 19 June.

The Sidewinder, in AIM-9G, -9H and the latest -9L versions, was the most important of the air-to-air weapons used by British forces in the Falklands, and the Harrier GR Mk 3s of No 1 Squadron were among the aircraft rapidly adapted to fit and fire them. Previously, Sidewinder installations had been cleared for the AV-8As of the US Marine Corps and the Navy's Sea Harriers, but not for use on RAF Harriers — which had a dedicated strike rôle and were not expected to engage in air-to-air combat. Very rapidly, the GR Mk 3s were modified to allow Sidewinders to be carried on the outboard pylons, clearance being obtained on 3 May after firing trials at Aberporth starting on 29 April. The final modification for *Corporate* allowed pairs of AIM-9s to be carried on each outboard pylon, but this was not flown (on a Sea Harrier) until mid-June. For the RAF Harriers, the post-*Corporate* standard is a single missile each side. Tanks of 190 Imp gal (864 l) capacity can now be carried, having been developed for use during *Corporate* as an alternative to the usual 100-imp gal (455-l) tanks and the 330-imp gal (1 500-l) ferry tanks.

In the very last days of the conflict RAF Harriers flew sorties

carrying, on the outboard pylons, 1,000-lb (454-kg) Paveway laser-guided bombs. These bombs, which the RAF had hitherto applied only to the Buccaneer and Tornado, were used most effectively in the final air attacks on Stanley. Like the Sidewinder, the Paveway is now available as a permanent option on RAF Harriers, which also benefited from several temporary equipment modifications, such as the fitting of FINRAE (Ferranti inertial rapid alignment equipment) and a radar transponder to improve navigating accuracy from and back to aircraft carriers. Provision was made for chaff to be carried — temporarily, in bundles tucked under the airbrake, but a more definitive internal modification has now been introduced. A Harrier was also test-flown at the A&AEE Boscombe Down just before the end of the conflict carrying an ECM pod on the fuselage centreline.

This is a convenient point at which to mention another important new weapon in the RAF armoury, a production order for which was confirmed late in 1982. This is the JP233 airfield denial weapon, which was already included in forward planning prior to the Falklands, but the need for which was clearly underlined when the RAF found it impossible, with existing conventional bombs, completely to close the runway at Port Stanley airfield. Despite the success of the Vulcan "Black Buck" missions, especially the first, in hitting the runway with 1,000-lb (454-kg) bombs at the end of the longest operational bombing raids ever attempted, the damage caused by such a bomb is relatively easily repaired and sustained bombing would have been necessary to keep the airfield out of use. To be produced in quantity by a group of companies headed by Hunting Engineering, the 11,000-lb (5 000-kg) JP233 will be carried under the fuselage of the Tornado, in side-by-side pairs, and is expected to be used by other combat types also. Two types of submunition are carried in JP233: the SG357 bomb (36 in each JP233) to penetrate runway surfaces and cause the maximum heave and fracture damage, and the HB876 (225 in each JP233) area denial weapon to cause damage to vehicles and aircraft on the surface and

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One of the important additions to the RAF's armoury, recently ordered into production, is the JP233 airfield denial weapon, seen here under test on a Tornado GR Mk 1.

— through the use of time delays — to disrupt and delay repair activities. Flight testing of the JP233 began on a Tornado on 23 February 1982.

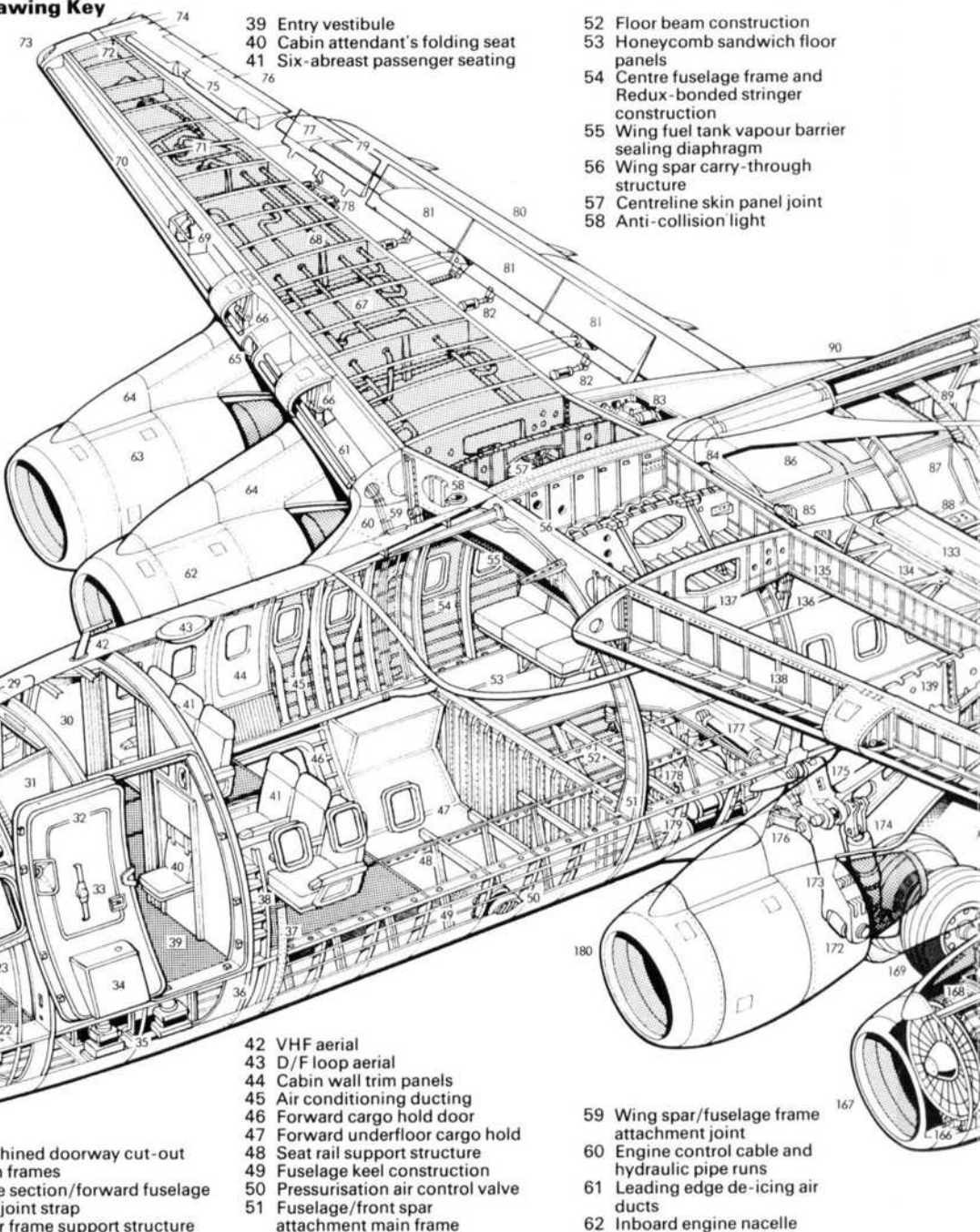
New aircraft

Orders have been, or are to be, placed by the Ministry of Defence to replace all combat losses during *Operation Corporate*. So far as the RAF was concerned, losses were restricted to three Harrier GR Mk 3s (one each on 21, 27 and 30 May) and one more in an accident on 8 June, and three Chinook HC Mk 1 helicopters in the sinking of the *Atlantic Conveyor* on 25 May. In addition to the replacement orders for these losses, however, five more Chinooks are to be acquired, increasing the total acquisition to 38, for operation by Nos 18 and 7 Squadrons.

The other important new purchase arising as a "Falklands Fall-out" is that of "at least 12 Phantom F-4J aircraft", as announced by the Minister of Defence on 14 December last. These are ex-US Navy stocks, and will differ from the Phantoms already in RAF service in a number of respects — not least in having General Electric J79 engines rather than the Rolls-Royce Speys that are unique to the British Phantom FG Mk 1 and FGR Mk 2. These F-4Js will, according to the MoD, form a squadron for the air defence of the UK, to replace the FGR Mk 2s now committed to the South Atlantic and based at RAF Stanley.

British Aerospace 146-100 Cutaway Drawing Key

- 1 Radome
- 2 Weather radar scanner
- 3 Radar mounting
- 4 ILS aerial
- 5 Oxygen bottle, capacity 400 Imp gal (1 812 l)
- 6 Sloping front pressure bulkhead
- 7 VOR flush aerial
- 8 Nose undercarriage wheel bay
- 9 Nosewheel leg strut
- 10 Twin nosewheels
- 11 Pitot tube
- 12 Rudder pedals
- 13 Instrument panel
- 14 Windscreen wipers
- 15 Instrument panel shroud
- 16 Windscreen panels
- 17 Overhead switch panel
- 18 First officer's seat
- 19 Centre control pedestal
- 20 Control column handwheel
- 21 Side console panel (area navigation system)
- 22 Cockpit floor level
- 23 Captain's seat
- 24 Direct vision window/flight deck emergency exit
- 25 Folding observer's seat
- 26 Flight deck bulkhead
- 27 Air conditioning ducting
- 28 Starboard galley unit
- 29 Forward service door
- 30 Main cabin divider
- 31 Port side forward toilet compartment
- 32 Forward entry door
- 33 Door latching handle
- 34 Escape chute stowage
- 35 Underfloor radio and electronics equipment bay



- 39 Entry vestibule
- 40 Cabin attendant's folding seat
- 41 Six-abreast passenger seating
- 52 Floor beam construction
- 53 Honeycomb sandwich floor panels
- 54 Centre fuselage frame and Redux-bonded stringer construction
- 55 Wing fuel tank vapour barrier sealing diaphragm
- 56 Wing spar carry-through structure
- 57 Centreline skin panel joint
- 58 Anti-collision light

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DRAWING

- 36 Machined doorway cut-out main frames
- 37 Nose section/forward fuselage skin joint strap
- 38 Door frame support structure

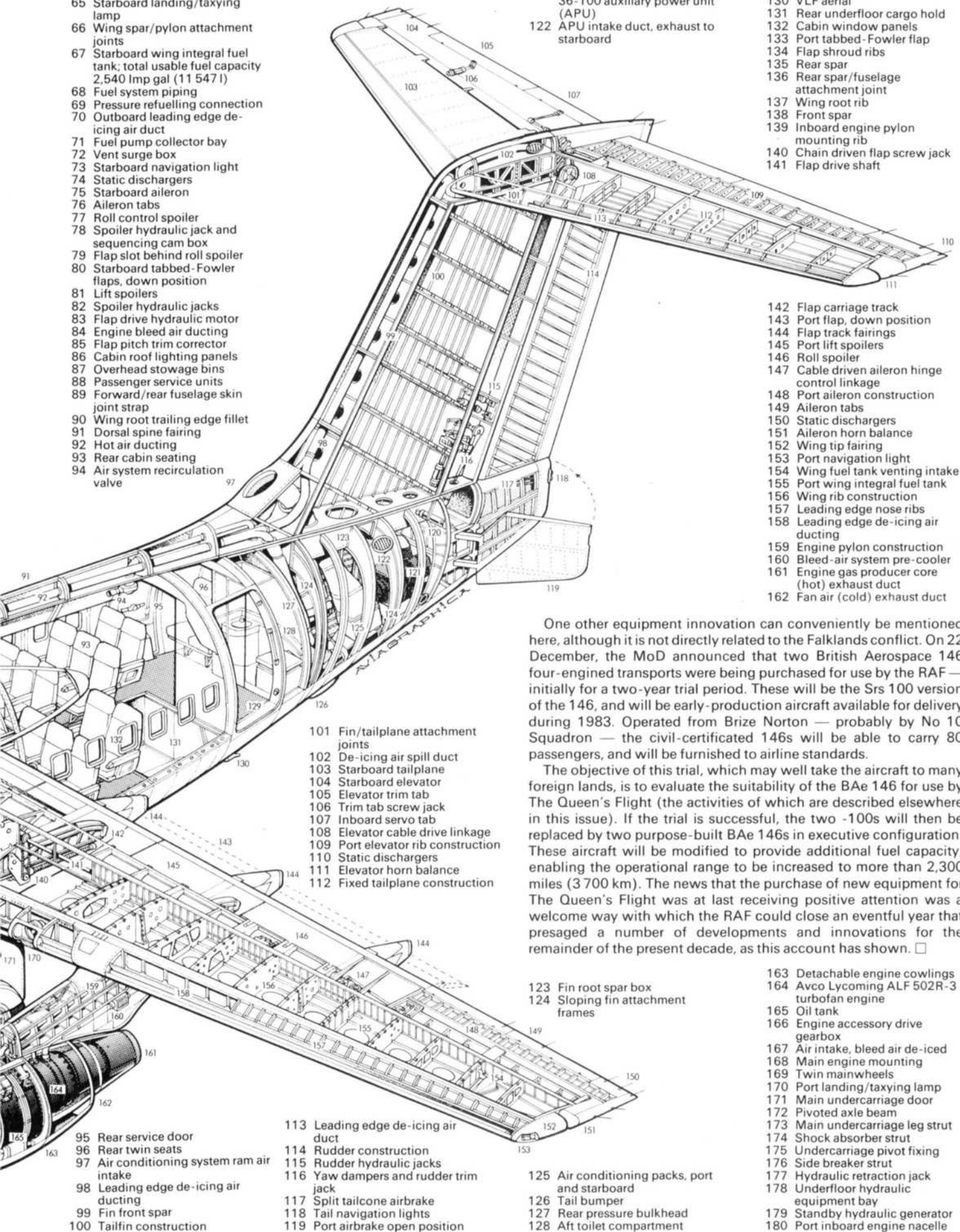
- 42 VHF aerial
- 43 D/F loop aerial
- 44 Cabin wall trim panels
- 45 Air conditioning ducting
- 46 Forward cargo hold door
- 47 Forward underfloor cargo hold
- 48 Seat rail support structure
- 49 Fuselage keel construction
- 50 Pressurisation air control valve
- 51 Fuselage/front spar attachment main frame

- 59 Wing spar/fuselage frame attachment joint
- 60 Engine control cable and hydraulic pipe runs
- 61 Leading edge de-icing air ducts
- 62 Inboard engine nacelle

- 63 Outboard engine nacelle
- 64 Nacelle pylons
- 65 Starboard landing/taxying lamp
- 66 Wing spar/pylon attachment joints
- 67 Starboard wing integral fuel tank; total usable fuel capacity 2,540 Imp gal (11 547 l)
- 68 Fuel system piping
- 69 Pressure refuelling connection
- 70 Outboard leading edge de-icing air duct
- 71 Fuel pump collector bay
- 72 Vent surge box
- 73 Starboard navigation light
- 74 Static dischargers
- 75 Starboard aileron
- 76 Aileron tabs
- 77 Roll control spoiler
- 78 Spoiler hydraulic jack and sequencing cam box
- 79 Flap slot behind roll spoiler
- 80 Starboard tabbed-Fowler flaps, down position
- 81 Lift spoilers
- 82 Spoiler hydraulic jacks
- 83 Flap drive hydraulic motor
- 84 Engine bleed air ducting
- 85 Flap pitch trim corrector
- 86 Cabin roof lighting panels
- 87 Overhead stowage bins
- 88 Passenger service units
- 89 Forward/rear fuselage skin joint strap
- 90 Wing root trailing edge fillet
- 91 Dorsal spine fairing
- 92 Hot air ducting
- 93 Rear cabin seating
- 94 Air system recirculation valve

- 120 Airbrake hydraulic jack
- 121 Garrett-AiResearch GTCP 36-100 auxiliary power unit (APU)
- 122 APU intake duct, exhaust to starboard

- 129 Rear entry doorway, aft hinging plug type door
- 130 VLF aerial
- 131 Rear underfloor cargo hold
- 132 Cabin window panels
- 133 Port tabbed-Fowler flap
- 134 Flap shroud ribs
- 135 Rear spar
- 136 Rear spar/fuselage attachment joint
- 137 Wing root rib
- 138 Front spar
- 139 Inboard engine pylon mounting rib
- 140 Chain driven flap screw jack
- 141 Flap drive shaft



- 142 Flap carriage track
- 143 Port flap, down position
- 144 Flap track fairings
- 145 Port lift spoilers
- 146 Roll spoiler
- 147 Cable driven aileron hinge control linkage
- 148 Port aileron construction
- 149 Aileron tabs
- 150 Static dischargers
- 151 Aileron horn balance
- 152 Wing tip fairing
- 153 Port navigation light
- 154 Wing fuel tank venting intake
- 155 Port wing integral fuel tank
- 156 Wing rib construction
- 157 Leading edge nose ribs
- 158 Leading edge de-icing air ducting
- 159 Engine pylon construction
- 160 Bleed-air system pre-cooler
- 161 Engine gas producer core (hot) exhaust duct
- 162 Fan air (cold) exhaust duct

- 101 Fin/tailplane attachment joints
- 102 De-icing air spill duct
- 103 Starboard tailplane
- 104 Starboard elevator
- 105 Elevator trim tab
- 106 Trim tab screw jack
- 107 Inboard servo tab
- 108 Elevator cable drive linkage
- 109 Port elevator rib construction
- 110 Static dischargers
- 111 Elevator horn balance
- 112 Fixed tailplane construction

- 123 Fin root spar box
- 124 Sloping fin attachment frames

- 163 Detachable engine cowlings
- 164 Avco Lycoming ALF 502R-3 turbofan engine
- 165 Oil tank
- 166 Engine accessory drive gearbox
- 167 Air intake, bleed air de-iced
- 168 Main engine mounting
- 169 Twin mainwheels
- 170 Port landing/taxying lamp
- 171 Main undercarriage door
- 172 Pivoted axle beam
- 173 Main undercarriage leg strut
- 174 Shock absorber strut
- 175 Undercarriage pivot fixing
- 176 Side breaker strut
- 177 Hydraulic retraction jack
- 178 Underfloor hydraulic equipment bay
- 179 Standby hydraulic generator
- 180 Port inboard engine nacelle

- 113 Leading edge de-icing air duct
- 114 Rudder construction
- 115 Rudder hydraulic jacks
- 116 Yaw dampers and rudder trim jack
- 117 Split tailcone airbrake
- 118 Tail navigation lights
- 119 Port airbrake open position

- 125 Air conditioning packs, port and starboard
- 126 Tail bumper
- 127 Rear pressure bulkhead
- 128 Aft toilet compartment

One other equipment innovation can conveniently be mentioned here, although it is not directly related to the Falklands conflict. On 22 December, the MoD announced that two British Aerospace 146 four-engined transports were being purchased for use by the RAF — initially for a two-year trial period. These will be the Srs 100 version of the 146, and will be early-production aircraft available for delivery during 1983. Operated from Brize Norton — probably by No 10 Squadron — the civil-certificated 146s will be able to carry 80 passengers, and will be furnished to airline standards.

The objective of this trial, which may well take the aircraft to many foreign lands, is to evaluate the suitability of the BAe 146 for use by The Queen's Flight (the activities of which are described elsewhere in this issue). If the trial is successful, the two -100s will then be replaced by two purpose-built BAe 146s in executive configuration. These aircraft will be modified to provide additional fuel capacity, enabling the operational range to be increased to more than 2,300 miles (3 700 km). The news that the purchase of new equipment for The Queen's Flight was at last receiving positive attention was a welcome way with which the RAF could close an eventful year that presaged a number of developments and innovations for the remainder of the present decade, as this account has shown. □



TORNADO HERITAGE



THIS YEAR sees the greatest change in the RAF's Strike Force for a quarter of a decade. Following upon the departure into history of the RAF's V-bomber Force with the retirement in December 1982 of the last Vulcan to operate in the bombing rôle, 1983 sees the achievement of operational status by the first two of the RAF's Tornado IDS squadrons — No 9 at Honington and No 617 "Dambusters" at Marham. These are the precursors of an all-Tornado strike force as significantly advanced in its own way as was the V-Bomber Force when it came into being in the late 'fifties. Previous Yearbooks have given full details of the Tornado itself and of its use by the first specialised training units in the RAF; here, we look at the two squadrons themselves, and the traditions that Nos 9 and 617 Squadrons of 1983 will inherit. Just 40 years ago, No 617 Squadron, specially formed and trained for the purpose, struck at the Ruhr dams in a unique bombing raid; thereafter, it specialised in the use of those other remarkable weapons, the Tallboy and the Grand Slam, in which specialisation it was joined by No 9. Since that time, the two squadrons have had almost parallel histories but have maintained a friendly rivalry that has helped to keep both among the RAF's premier bombing squadrons.

It seems almost unbelievable today to recall that, in 1942, the RAF had been using bombs as large as 1,000 lb (454 kg) for only a short while, for such bombs had first been ordered six months after the outbreak of World War II and none of the bomber aircraft then in use had been designed to carry any bigger weapons — although some were physically capable of so doing. Most of the RAF's bombers were then only just able to carry a conventional bomb load on a typical bombing trip over Germany; even the new breed of four-engined bombers was having its troubles, the Stirling with performance limitations and the Halifax with control problems. The one exception was the Avro Lancaster, just into service in 1942 and the one aircraft with enough excess capacity and performance to enable the next big step forward in the use of advanced weapons and techniques of bombing.

The Lancaster, therefore, became the means whereby one man's ideas, which had been formulating since the summer of 1939, could be realised. The man was, of course, Barnes Wallis, whose fertile brain had long since realised that conventional bombing would be very wasteful in terms of destroying German industry and that special weapons would be needed against special targets. Since the beginning of the War he had been researching into the chemistry, anatomy and aerodynamics of bombs, and all this research was now to be brought to fruition and coupled with that all-time great amongst the bombers, the Avro Lancaster.

Wallis had long concluded that, rather than try to bomb all the widely-dispersed war factories in Germany, it would be more economic and effective to attempt to destroy something of common need to all of them, such as raw material or power. He hit upon water as being the most effective of such targets, for water was not only used in great quantities in many of the manufacturing processes of industry, but also produced hydro-electric power for large areas of German industry, especially the vast, sprawling, industrial complex of the Ruhr. So was born the concept of breaching the dams which provided that power.

Initially, Wallis thought in terms of an "earthquake" bomb, dropped from an aircraft at 40,000 ft (12 200 m) in order to penetrate to such a depth as to cause sufficient earth movement to collapse the dam walls. But the weight of the bomb itself and the diversion of effort required to design a specialised aircraft to carry it to that altitude was clearly impracticable at that stage of the War. So he turned his mind to the water-skimming bomb that was finally employed by the Dambusters. The tale of the development of this revolutionary weapon has been well-told more than once; eventually it turned out that the suitable weapon, weighing no more than 5 tons (5 080 kg) was a device that the Lancaster, suitably modified, could easily deliver to the Ruhr Dams.

The technique evolved by Wallis for the attack on such dams meant that the bomb itself had to be cylindrical in shape, 4 ft 2 in (1,27 m) in diameter and 5 ft (1,52 m) long. It also had to be spinning (backwards) as it left the aircraft, so the Lancaster itself needed modification. The bomb-bay was cut away, with doors removed and the rear end faired. Two V-shaped brackets were fixed to the aircraft outboard of the bomb-bay to hold the weapon on the centre of gravity of the aircraft and belts were attached to the bomb so that an auxiliary motor inside the aircraft could rotate it up to the required speed before launch.

On 8 March 1943, the first instruction was issued to Avro's works in Manchester to start the conversion of 23 Lancaster Mk 1 aircraft. The first three of these were despatched to Farnborough and Boscombe Down for performance and handling trials with the minimum delay as the first operation was planned to take place in May. On 21 March a special squadron was formed, to take this particular weapon into action; based at Scampton it was given the

(Heading, left) A Tornado on the approach as dusk falls. (Below) One of the specially-modified Lancasters used by No 617 Squadron for the dams raid 40 years ago.





(Above) ED817 was one of 23 Lancasters modified to carry the "Upkeep" weapon used to break the Ruhr dams, but did not participate in the raid itself. This photograph clearly shows the struts between which the bomb was carried, to be spun up before dropping. (Below right) This rare shot of the Mohne dam, photographed shortly after the raid, was taken from a German serviceman in Normandy in 1944 and offered for publication here nearly 40 years later!

number 617, under the command of Wg Cdr Guy Gibson. It worked up quickly on standard Lancasters, flying low-level sorties by day and night over water and land until 18 April, when the first of the specially-modified Lancasters arrived at Scampton. These aircraft had the mid-upper turrets removed and two lights placed under the nose and in the belly, synchronised so that their beams coincided exactly 60 ft (18,3 m) beneath the aircraft, this being the exact height at which the Lancasters needed to fly to drop the weapon (code-named *Upkeep*) successfully. The last of the 19 aircraft required for the operation arrived at Scampton on 13 May, the first day of the moon period in which the attack was to take place. In the event, the mission, code-named Operation *Chastise*, took place three days later, on 16 May 1943.

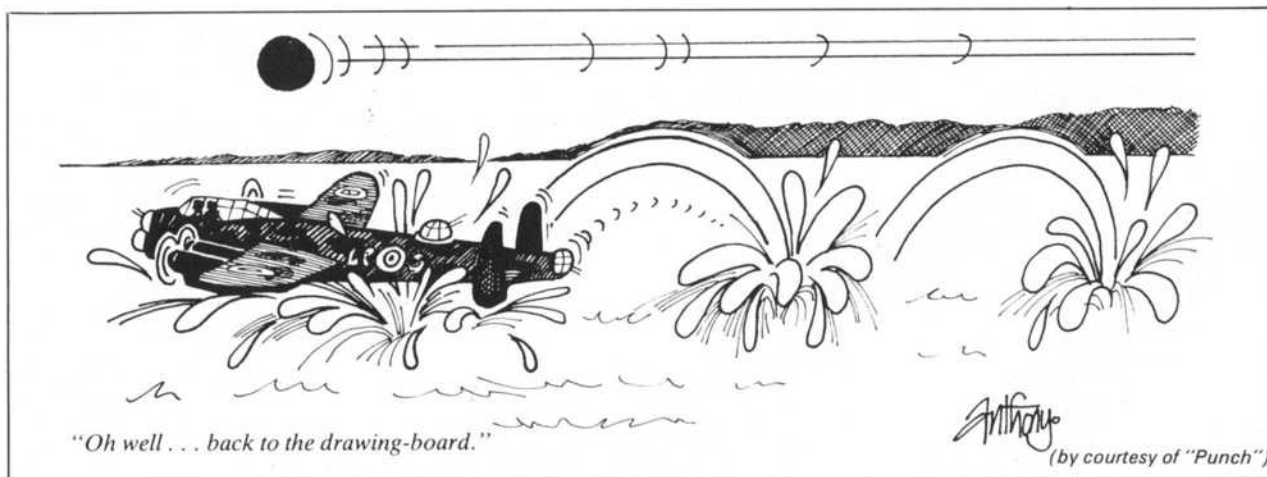
The dams are breached

The 19 aircraft of No 617 Squadron were divided into three waves, Gibson leading the first wave of nine aircraft first to the Mohne Dam. There, Flt Lt Hoggood made the second attack after Gibson himself had led in but failed to breach the dam with a successful attack. Hoggood's aircraft was hit and crashed in flames, his weapon having hit the parapet and exploded. Flt Lt Micky Martin followed, but his bomb fell short; Sqn Ldr Young also failed to score, but Flt Lt Maltby, flying Lancaster ED906/G "AJ:J", dropped the bomb which settled properly and breached the Dam. With water pouring on to the river and villages below, Gibson took the remaining three aircraft of his wave (Sqn Ldr Maudsley, Plt Off Knight and Flt Lt Shannon) on to the Eder Dam. Maudsley went in first but flew so low that his Lancaster hit the parapet and blew up; Shannon scored a direct hit but the Dam withstood the impact, and Knight, in aircraft ED912/G



"AJ:N", breached the Eder. Flt Lt Astel and crew had been shot down *en route* to the target and Sqn Ldr Young was lost on the way home.

The second wave, which had actually taken off earlier than the first, went to the Sorpe Dam, the aircraft attacking individually. Only one of the five Lancasters in the wave reached the target, two being shot down, one flying so low that its bomb hit the Zuyder Zee and was pulled off, and one having to return with radio trouble. Flt Lt McCarthy alone reached the Sorpe, hit the parapet with his weapon but failed to breach the Dam. A third wave of five aircraft was airborne as a reserve force. Flt Sgt Townesend in this group went to the Ennepe Dam, where he made a successful drop but without a breach. Plt Off Ottley went to the Lister Dam but was shot down *en route*. The other three were sent to the Sorpe as back-up to



McCarthy; Plt Off Burpee was shot down on the way, Flt Sgt Brown dropped but the Dam did not breach and Flt Sgt Anderson found the target obscured by mist and could not bomb.

The effect of the raid was much as had been hoped, with factories as far as 40 miles (64 km) away flooded and a serious shortage of water providing a significant blow to German industry. Thus took place the mission that earned the name of "Dambusters" for No 617 Squadron and captured the imagination of the British nation at the time. It is a title that the Squadron proudly carries today, but the aftermath brought anti-climax for No 617. Its aircraft were taken away and converted back to normal configuration — the raid had been a one-off and as the Squadron had been specially formed for that purpose there appeared to be nothing more for it to do. High- and low-level training continued but whilst decorations were handed out and receptions arranged for the Squadron, it became known within their Group (No 5), as the "one-op squadron".

By 15 July, however, the Squadron was back at war once more, attacking a power station in Italy. No 5 Group had become something of an elite organisation within Bomber Command and more often than not was selected when small or difficult targets were to be attacked. By this time the Pathfinder technique of marking targets was in regular use, but their methods were found to be too imprecise for some small targets and No 5 Group began to look to better methods of marking. With this idea coming forward, and with No 617's reputation for accurate flying and bombing, it was decided

force, flying in to mark the targets with great precision and in the process developing No 5 Group's new Pathfinding methods. The Squadron was also involved in pioneering into service the Stabilised Automatic Bomb Sight (SABS) which put the Squadron back at high-level once more. For the next six months No 617 continued to operate in this vein, using the 12,000-lb (5 445-kg) bombs on suitable targets, equipped with Lancasters with bomb-bays bulged to accommodate this type of bomb.

"Tallboy" operations

The next stage of bombing development came with a bomb that would work on the "earthquake" principle conceived by Wallis years earlier. There was an increasing number of targets where these would be the most — indeed, the only — effective weapon, amongst them some of the new V-weapon sites. Tunnels, viaducts and heavily concreted installations were all prime targets for an "earthquake" bomb, which was named the Tallboy. After spending the night of D-Day flying a boring "spoofing" sortie to and fro over the English Channel to give the German radars the impression of an invading sea force miles from the true landings, No 617 Squadron was quickly into "Tallboy" business.

First call was to prevent a German *panzer* division moving up from Bordeaux to reach the battle area. No 617 took the bombs to Saumur to block the tunnel there — true tactical bombing as a change from its more traditional rôle! Cheshire went in first with his Mosquito,

(Below) ED812/G was one of the specially-modified Lancaster IIIs used by No 617 Squadron to attack the Ruhr dams.



(Right) By 1945, No 617 Squadron was using the code letters YZ on its Lancaster B Mk I (Specials).

(Above) Lancaster B Mk VII of No 9 Squadron in India, 1946.

to retain the Squadron for pinpoint attacks on difficult targets, whilst also using it for routine missions as and when available.

Meanwhile, Wallis's original ideas of larger bombs were coming to fruition; first the 4,000-lb (1 815-kg), then the 8,000-lb (3 630-kg) bomb and then, about to come into use in the summer of 1943, was the 12,000-lb (5 445-kg) bomb — not an earthquake bomb but a blast weapon with a light casing. No 617 was well-placed to pioneer this bomb and, on 15 September 1943, it put up eight crews for the first raid using a weapon of this size. By now, Gibson had left and SqN Ldr Holden was in command; the Squadron had moved, too, from Scampton to Coningsby. Holden led seven other crews to the Dortmund-Ems Canal near Ladbergen, the idea being to attack from low level to breach the Canal. It was a disastrous raid; Holden was shot down, taking most of Gibson's original crew with him, mist came up to obscure the Canal and only three crews returned.

With Holden gone it was only a few days before the most famous RAF bomber pilot of World War II, Wg Cdr Leonard Cheshire, arrived to command No 617 Squadron; characteristically, he dropped a rank to take on the job. Under his command, new techniques came into play in the Squadron. He acquired some Mosquitoes to add to the strength and with these he formed the Squadron's own Pathfinder

dropping markers in the tunnel's mouth; "Tallboys" followed and the tunnel was not just blocked, but the hill "exploded" and fell in on the tunnel — the *panzers* never made it to the bridgehead. Next call was to protect the Allied shipping in the Channel from German submarines and E-boats. These were domiciled at Le Havre and Boulogne respectively in concrete pens which on 14 and 15 June received No 617's attention; in two raids, 133 boats were destroyed. Then, suddenly, the V1 "buzz" bombs began falling on London from sites all over Northern France and Belgium, and the Squadron was deployed dropping "Tallboys" to remove as many sites as possible, concentrating on the thick concrete buildings that other bomber squadrons could not destroy.

From January 1944, the Squadron had been at Woodhall Spa, a satellite of Coningsby where it was sole user and thus could develop new techniques and equipment more secretly. Whilst the V1 sites were being attacked, Cheshire had the idea that an even smaller and nimbler aircraft than the Mosquito could be a good marker aircraft and in due course a North American Mustang III (HB837) arrived at Woodhall for his use. In July, the Squadron took on a new look as the CO (Cheshire) and his three Flight Commanders were all posted as tour-expired and Wg Cdr Willie Tait took over with three new Flight



(Above) Lincoln B Mk II RF513 (note Wing Commander's pennant on nose) with No 617 Squadron in 1947, bearing the post-war code letters KC.
 (Below) Lincoln B Mk II RE305 as flown by No 9 Squadron in October 1948.

Commanders. Operations continued as before with Tait marking targets in the Mustang with as much verve as his predecessor; on one occasion at Wizernes, as the markers could not be seen, he instructed the aircraft to aim on him as he flew tightly round the target at 1,000 ft (305 m), but this ploy was also ineffectual. August 1944 was a busy month for the Squadron with 13 "Tallboy" raids, mostly on the submarine pens around the French and Dutch coasts. But something different was again in the offing.

No 9 joins in

At this stage No 9 Squadron also came into the picture. Unlike No 617, which had been in existence only just over a year, No 9 was one of the RAF's longest-standing squadrons, having formed originally on 8 December 1914 as part of the Royal Flying Corps. This was only a short existence, the Squadron disbanding three months later, but on 1 April 1915 it re-formed and thence served throughout World War I on Corps Reconnaissance duties on the Western Front. This "life" ended on the last day of 1919, and a new No 9 formed at Upavon on 1 April 1924 as a heavy bomber squadron equipped with Vickers Vimys, having thereafter served continuously in this rôle. It became the first squadron to fly the Vickers Wellington bomber in January 1939, and was involved in the first Wellington raid of World War II, on 4 September 1939, when Brunsbuttel was attacked.

No 9 Squadron went on to fly consistently in Bomber Command's night offensive from early 1940 onwards, re-equipping with Lancasters at the end of 1942, by which time it had transferred into No 5 Group. The Squadron came to the fore in 1944 by virtue of its high record of accurate bombing, having dropped more practice bombs with greater accuracy than any other squadron in the Group.

The AOC of No 5 Group, Air Vice-Marshal the Hon Ralph Cochrane, had decided that the next enterprise for his special squadrons should be to attack the *Tirpitz*. This formidable threat to Allied shipping was berthed in Alten Fjord near the northern tip of Norway and an unnecessary share of Britain's resources was earmarked just to keep guard against her breaking out. Alten Fjord was, however, too far for the Lancasters to go when carrying "Tallboys", and it was decided that No 617 and No 9 Squadrons should fly to a base in Russia, Yagodnik near Archangel. From there, an attack on the *Tirpitz* would be only a 1,200 mile (1 930 km) round trip, well within the Lancaster's capabilities. The flight out, by both squadrons, was an epic in itself for it was a 12-hour mission, well

within the Arctic Circle where compasses were most unreliable. Bigger problems came when, after 11 hours of flying, none of the aircraft could raise the Yagodnik radio beacon, for it was the wrong type of beacon for the receivers in the aircraft. In these circumstances it is incredible that so many of the aircraft actually reached Yagodnik — although many found other airfields and some had to force-land, six of the Lancasters ending up irretrievably in marshland. On 15 September, 28 Lancasters, many with bulged bomb-bays containing "Tallboys", set out from Yagodnik for Alten Fjord. Those that did not



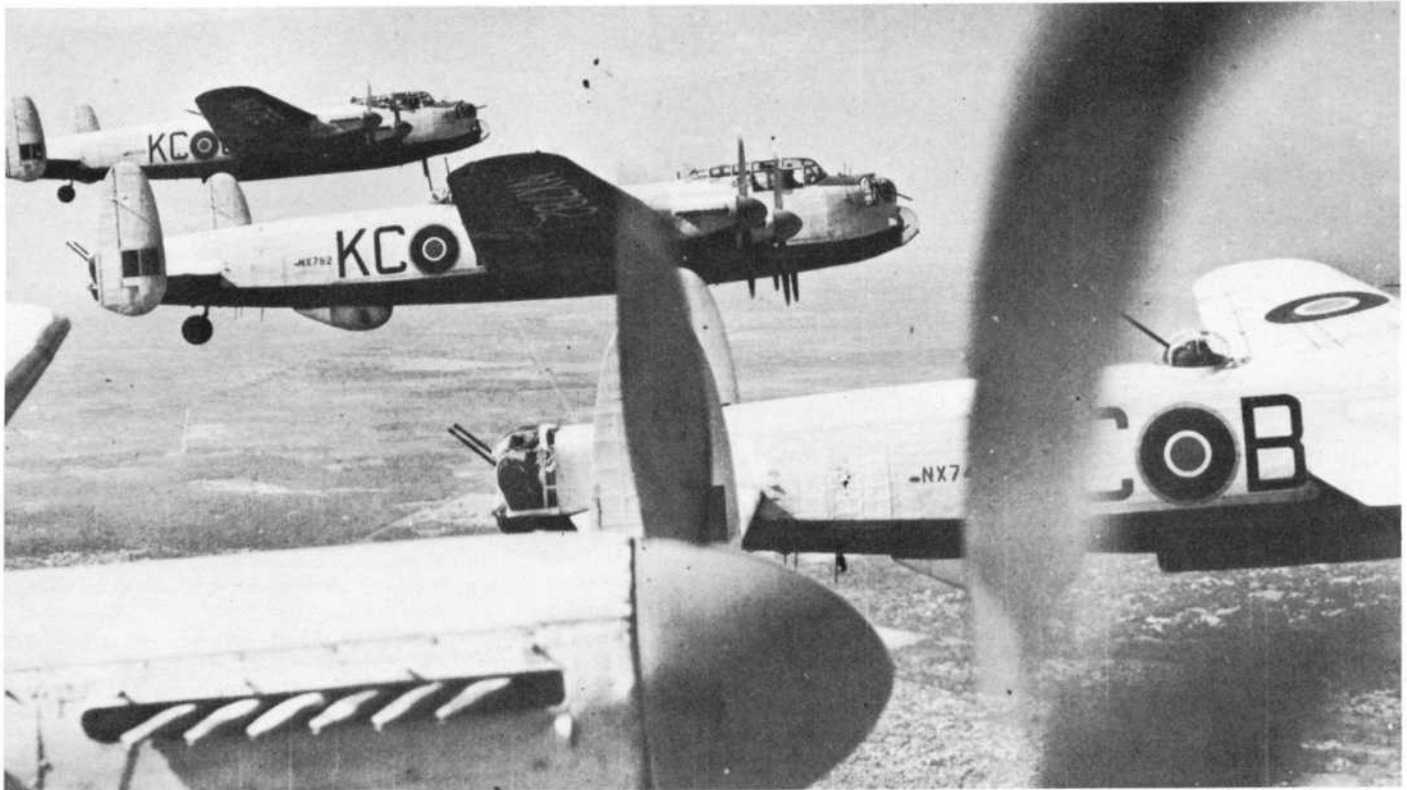
(Above) A Lancaster B Mk III serving with No 617 Squadron (after code letters had been changed from "AJ" to "KC"), with deepened bomb-bay to accommodate the 12,000-lb (5 443-kg) Tallboy bomb.
 (Below) The first Lancaster modified to carry the 22,000-lb (9 980-kg) Grand Slam, at Boscombe Down for trials.



(Below) A Canberra B Mk 2 in the early 'fifties finish, as flown by No 617 Squadron from Binbrook.



(Right) Canberra B Mk 6 flown by No 9 Squadron in the late 'fifties. The red nose flash indicates the Binbrook Wing.



(Above) In the white (top) and black (undersides) finish adopted for aircraft of Tiger Force, Lancaster B Mk VII's of No 617 Squadron operating from Benares, India, in early 1946 and (below) a similarly-finished B Mk VII of No 9 Squadron at Salbani.



carry "Tallboys" had special mines designed to attach themselves alongside the ship's hull and eventually explode against the underside. All went according to plan until the final run-in to the *Tirpitz*, but the approaching force had been detected and the Germans had lit their multitude of smoke-pots, so that the bombers lost sight of the ship beneath a white veil. Six aircraft, at least, dropped their "Tallboys" but no results could be seen and the aircraft returned to Yagodnik. One aircraft wandered off course and was never heard of again.

Another effort from Yagodnik was out of the question, for the weather now settled a winter's drizzle over all, and the remnants of the Lancaster force sadly left for Lincolnshire — much to the Russians' chagrin. The Germans, however, now co-operated by moving *Tirpitz*, which had in fact been damaged in the attack, to Tromsø — just within range of a Lancaster flying from northern Scotland. A quick modification programme took place at Woodhall Spa and at Bardney (No 9's base). Mid-upper turrets were removed and Merlin 24s replaced the Packard Merlins on No 9's Lancaster Mk IIIs (the Mk 24 gave more take-off power), and long-range tanks (adapted from Wellingtons and Mosquitoes) were installed in the fuselages. Before another attack on the *Tirpitz* could take place, No 617 Squadron added to its dam-busting fame by opening up the Kembs Dam on the Rhine with "Tallboys" so that it would be drained in time for the Rhine crossing by the American troops on the ground. Then, on 28 October, Nos 9 and 617 again set out for *Tirpitz*. This mission was Alten Fjord all over again, with the ship disappearing beneath its thick white cloud a mere 30 seconds before the first Lancasters reached the aiming point. Several aircraft made up to four runs over the target, and several bombs were dropped, but no one was very happy about the result and by the time the crews landed back at Lossiemouth (their forward base for these raids) reconnaissance had already confirmed that *Tirpitz* was still intact. Another chance came on 12 November, and the two squadrons taxied their Lancasters out at Lossiemouth, overweight and with rime ice forming

on their wings, to reach the Norwegian mountains as dawn was breaking. Although there was fog in the valley, *Tirpitz* was in the clear, and this time 20 "Tallboys" fell on and around the ship, sealing her fate. The crews themselves saw her begin to list and by next morning she was upside down and finished. Which squadron actually sank her will never be known and this event, more than any other, accounts for the rivalry that has been maintained between the two squadrons to the present day.

"Grand Slam"

Both No 9 and No 617 continued to use their "Tallboys" to good effect (no other squadron used this weapon), principally on shipping installations and in particular the German U-boat pens in Holland and Norway. More dams were attacked, the Sorpe by No 9 Squadron and the Urft by both units, but neither of these attacks produced the devastating effects of No 617's initial raid in May 1943. Barnes Wallis, meanwhile, had realised his ambition of producing a real "earthquake" bomb, a weapon that would cause a localised earthquake and shake the target to pieces. This 22,000-lb (9 980-kg) "Grand Slam" bomb was produced at the time Nos 9 and 617 were pre-occupied with the *Tirpitz*.

The Lancaster was the only aircraft with the capability of lifting such a concentrated and massive bomb and two Mk Is with high-boost Merlin 38 engines were modified by removing the mid-upper turret and H2S radar, deleting the bomb doors and providing fairings at each end of the bomb-bay. These two aircraft went to Boscombe Down for handling trials beginning in October 1944, where it was found that no serious problems arose below 230 mph (370 km/h), but that above that speed vibration began and the controls, especially the ailerons, became very heavy. A 260 mph (418 km/h) limit was therefore imposed on loaded aircraft. Many trials were conducted on these two aircraft, culminating in a live drop over the New Forest only a day before the bomb was used operationally for the first time on 14 March 1945.

No 617 Squadron had meanwhile been receiving some of these Lancaster B Mk 1 (Special) aircraft (32 were modified, but not all entered service). "Grand Slam" bombs had been arriving at Woodhall Spa during the first few days of March, and on the 13th the Squadron awaited the result of the New Forest before bombing up for an operational drop. On 14 March, Sqn Ldr Calder took-off carrying a "Grand Slam", accompanied by other Lancasters with "Tallboys". The target was the Bielefeld Viaduct near Bremen, the chief artery for supplies between the north-west German cities and the Ruhr, where the land fighting was now taking place. Already

3,000 tons of bombs had been dropped on the Viaduct, but with no permanent effect; the single "Grand Slam" worked as Wallis had predicted and seven spans of the viaduct disappeared.

The second "Grand Slam" attack was mounted against the Arnsberg Bridge, hard by the Mohne Dam of abiding memory to No 617. Five of the mighty bombs were dropped, and a similarly devastating effect was produced. By the end of the month, all the main railway bridges serving the Ruhr had received "Grand Slam" attention and the weapon was then tried on the U-boat pens at Bremen, which had just been completed. The pens were never used, two of No 617's bombs reducing them to piles of smashed concrete. By this time, 41 "Grand Slams" had been dropped with devastating effects; there seemed to be no more targets worthy of their use.

The conflict ends

Both squadrons continued to use "Tallboys" on other suitable targets. On 16 April, No 617 sank the *Lutzow* at Swinemünde, and on the 25th both squadrons flew together on their last wartime raid, to take out Hitler's enclave at Berchtesgaden. With the war in Europe at an end, the two squadrons, which had been brought together by the use of the "Tallboy" bomb, were destined to soldier on together in remarkable proximity. No 617 moved to Waddington in June 1945, to be followed by No 9 in July, and both squadrons re-equipped with Mk VII Lancasters to become part of "Tiger Force", the new bomber force being built up to go out to the Far East for the final assault on Japan. Training began, but operations were pre-empted by the use of atomic bombs at Hiroshima and Nagasaki, and the sudden end of the Far East War.

All the RAF's bomber squadrons in India had, by 1945, been equipped with Lend-Lease Liberator bombers and as these had to be returned to the USA, Nos 9 and 617 Squadrons were sent to India to replace them. They established base at Salbani in January 1946, and worked together on an acclimatisation programme, being put on standby for bombing when the Indian Navy threatened to mutiny. The Squadrons remained in India until April 1946, when the changing political climate made a return to the UK timely.

Peacetime routine

The two squadrons moved back to England in May 1946 and began their peacetime routine at their permanent peacetime base, Binbrook, high on the Lincolnshire wolds; there, Nos 9 and 617 were joined by Nos 12 and 101 Squadrons, making up the Binbrook Wing. That same summer, all four squadrons converted to Avro Lincolns.

In July 1947, No 617 Squadron was tasked to fly a goodwill tour of the United States named "Operation Goodwill", drawing aircraft and crews from the other Binbrook squadrons, including No 9, to achieve the required strength. The Squadron was away from 23 July to 9 September on a highly successful tour that included the first direct crossing of the Atlantic by a complete RAF squadron. For the next five years, both squadrons maintained a normal peacetime routine with their Lincolns, including the annual Exercise "Sunray", when flights would go to the Middle East on detachment for a couple of months, the various bombing trophy competitions, defence exercises and participation in the slowly growing number of air displays.

Binbrook was selected as the base at which Bomber Command would begin to transition to a jet bomber force. The English Electric

Canberra was the type involved and the first aircraft began to arrive in June 1951, but Nos 9 and 617 soldiered on with Lincolns whilst No 101 became the RAF's first jet bomber squadron; No 617 followed in January 1952, then No 12 and finally No 9 in May 1952. In September 1952, a No 9 Squadron crew flew one of the new jet aircraft out to Australia where, painted with anti-flash white undersides, it was used for experiments on the Woomera range. Both squadrons took part in the formation fly-past at Odiham on 15 July 1953 to mark the Coronation of HM Queen Elizabeth II, and in 1954 No 9 Squadron took its Canberras to Sweden on a goodwill visit. Both Squadrons received the more powerful B Mk 6 version of the Canberra in 1955.

No 617 Squadron had scarcely become acquainted with the Mk 6 when it was sent to Malaya, the first four aircraft arriving at Butterworth on 17 June 1955 (Operation "Mileage") to be joined by the remainder of the squadron later. This was no goodwill tour but an operation in deadly earnest, for Malaya was being wracked by terrorist activity. The Squadron flew its first operation on 23 June when two aircraft flew a datum-run strike on a terrorist transit camp; other strikes followed daily, either by bombing on a timed run from a datum point or what were known as "Austermark" strikes where an Army Air Corps Auster would drop markers on the target area and the Canberras would bomb on these. The last sorties were flown on 23 August, by which time No 617 had flown 39 strikes against the Communists. The Squadron stayed at Butterworth until November, when it flew back to Binbrook, to be disbanded on 31 December 1955.

It was now No 9's turn for a period of hectic activity. On 25 January 1956, the Squadron set out for Lagos in Nigeria at the beginning of a month's tour of West Africa, flying displays to coincide with HM The Queen's visit. It returned to the UK on 25 February and three weeks later set out for Butterworth to follow in No 617's footsteps. First strikes were flown on 7 April and after three weeks of operations, No 9 went farther east on a goodwill tour to the Philippines, then returning to Butterworth for further operations until, relieved by No 101 Squadron, it returned to Binbrook on 23 June. It returned to normal peacetime operations, but on 30 October was despatched to Malta for the Suez operations. Based on the Fleet Air Arm base at Hal Far, the Squadron was ready for operations six hours after its arrival and the following evening eight of its Canberras bombed Abu Sueir airfield in Egypt. More raids were flown on 1, 2 and 3 November. Following the ceasefire, the Squadron remained in Malta until 17 December, when it returned to Binbrook.

No 9 Squadron returned to a more normal peaceful routine in



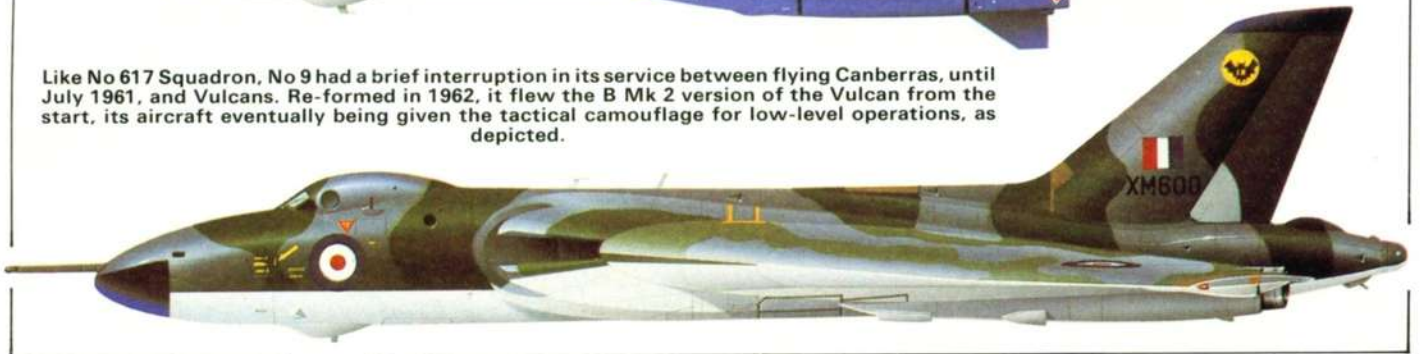
(Below) No 617 Squadron took its Lincolns to the USA in July 1947 on "Operation Goodwill", a tour lasting some seven weeks that included the first direct Atlantic crossing by a full RAF squadron. (Above right) Lincoln B Mk 2 of No 9 Squadron, 1950.



(Below) After disbanding on Canberras in December 1955, No 617 Squadron re-formed on Vulcan B Mk 1s at RAF Scampton, where the unit had originally been formed in 1943. In 1962, the squadron became the first to become operational on the Vulcan B Mk 2 with Blue Steel stand-off bomb, as depicted in this illustration.



Like No 617 Squadron, No 9 had a brief interruption in its service between flying Canberras, until July 1961, and Vulcans. Re-formed in 1962, it flew the B Mk 2 version of the Vulcan from the start, its aircraft eventually being given the tactical camouflage for low-level operations, as depicted.



1957, the biggest step forward being the introduction of the Low Altitude Bombing System, whereby Canberras would fly to their targets below radar height and deliver their bombs during a roll-off-the-top manoeuvre. This required modifications to the Mk 6 Canberras, to allow them to carry tactical atomic bombs and to have a new form of bombsight for this type of manoeuvre; it also required much training by the crews. No 9 pioneered the technique, being the first RAF squadron to drop bombs in this way. The year 1959 saw the end of the long-standing association with Binbrook and its Wing, No 9 moving to Coningsby in June.

No 617 re-appears

By this time, No 617 had taken the stage once more. For some time, the Canberra Force in Bomber Command had been playing second fiddle to the new V-Force. First the Valiant had entered service, then the futuristic delta-winged Avro Vulcan and scimitar-winged Handley Page Victor had joined to take over the deterrent rôle within the RAF. On 1 May 1958, No 617 Squadron was re-formed once more and received its first Avro Vulcan B Mk 1 four days later at Scampton, where the distinguished squadron had originally formed 15 years before. In 1959, the Squadron received its Standard from the Queen Mother and also won all three Bomber Command Bombing and Navigation Trophies, following this by sending four of its Vulcans on a goodwill round-the-world tour in 1960.

As No 617 was getting into its stride once more, the sun was temporarily setting on No 9, for the days of the Canberra as a front-line bomber were drawing to a close and, on 27 June 1961, the Squadron disbanded at Coningsby. That same month, a Vulcan of No 617 Squadron set up a new world record by flying 11,500 miles (18500 km) in 20 hr 3 min non-stop, from England to Australia,

using air-to-air refuelling. Three months later, the Squadron re-equipped with the more advanced Vulcan B Mk 2 and No 617 was poised to take the next big step in Bomber Command's offensive capability (reminiscent of its pioneering with "Tallboy" and "Grand Slam"), for Scampton had been chosen as the first base to operate the new Blue Steel stand-off bomb. With nuclear capability, this weapon had the range to fly 100 miles (160 km) to its target after launch. No 617 flew the service trials with Blue Steel early in 1962, and after a thorough work-out was declared operational early in 1963. Once again, the Dambusters Squadron was the spearhead of Bomber Command.

Skybolt comes . . . and goes

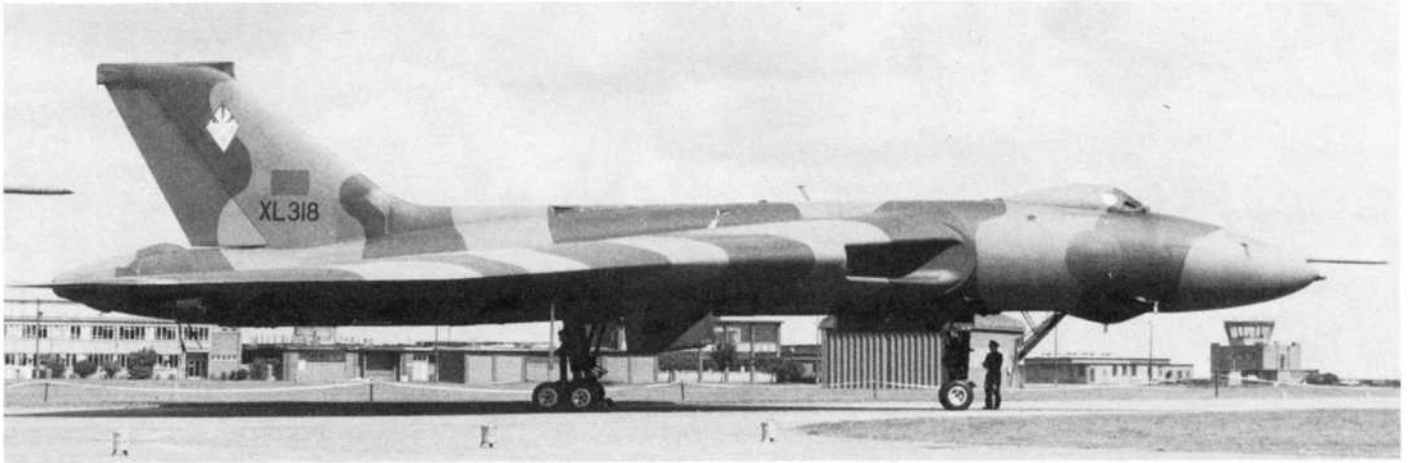
A more advanced stand-off weapon was already being planned for use by Bomber Command, the American Skybolt. Modified Vulcan B Mk 2s would carry a Skybolt beneath each wing and another Wing of Vulcans was to be formed for this purpose, at Coningsby. Not surprisingly, the first squadron of this new Wing was the re-formed No 9. Throughout the 'sixties, the two squadrons soldiered on with Vulcans, but the promised Skybolts never appeared and the Coningsby Wing moved to Cottesmore in 1966 to leave Coningsby clear for the next new RAF bomber, the F-111 swing-wing — which was also cancelled. At about the same time, it was realised that Soviet defences had reached such an advanced capability that Vulcans would stand little chance of high-level penetration of Soviet airspace, and both No 9 and No 617 Squadrons — with the whole Vulcan Force — changed their tactics completely for the low-level rôle, with their big all-white aircraft soon being camouflaged in green and grey.

At the end of the 'sixties, the nuclear deterrent rôle was transferred

(Below) No 617 Squadron now flies the Panavia Tornado GR Mk 1 from RAF Marham. The "lightning flash" marking, first carried on the Vulcans, is perpetuated in both tail and front fuselage markings, as shown here. No 617 is destined to remain based in the UK as one of the Vulcan-replacement squadrons.



(Right) A Tornado GR Mk 1 of No 2 Squadron, first operational squadron in the RAF to fly this new warplane, and destined for service in Germany in place of Buccaneers.



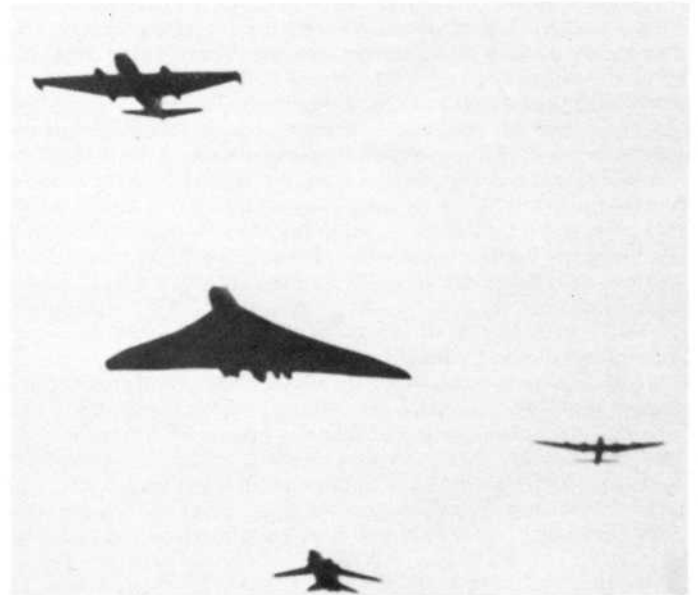
At the time of its disbandment at the end of 1981, No 617 Squadron was flying Vulcan B Mk 2s from RAF Scampton, in the two-colour wrap-around camouflage scheme as depicted here.

from the RAF's V-Force to the Royal Navy's Polaris submarines and the Vulcans were now committed to a more conventional bombing rôle, although still carrying tactical nuclear weapons. No 617 Squadron retained its task as a Blue Steel operator, flying the last Blue Steel sortie on 2 December 1970. By then, the Cottesmore Wing had broken up, No 12 Squadron having disbanded and Nos 9 and 35 Squadrons starting a new phase of operation altogether, based at Akrotiri in Cyprus as part of the CENTO Pact forces, committed to support the other nations in this Middle East alliance, as well as being well disposed to strike at any Communist aggression in the south. No 9 Squadron remained on alert in this task until 1975, when yet another Defence retrenchment all but closed Akrotiri base and resulted in the unit's return to the UK.

There were now set up two main Vulcan bases: Waddington with Nos 9, 44, 50 and 101 Squadrons and Scampton housing Nos 27, 35 and 617 Squadrons, plus the Operational Conversion Unit. So the two squadrons, which, since 1944, had been in the forefront of Bomber Command's progressively developed striking force, were still there, in the diminutive bomber element of the 'seventies, performing the same rôle now that Blue Steel had gone. By the end of the decade, however, more changes were in sight, with retirement for the Vulcan and introduction of the new Tornado. As the Vulcan Force began to run down, No 617 Squadron was disbanded at Scampton on 22 December 1981 and No 9 Squadron at Waddington on 29 April 1982.

This, then, is the shared heritage of the RAF's two premier strike squadrons of today, a heritage of which they are justly proud and which gives some insight into the traditions on which the No 9 and No 617 Squadrons of today will build. Any visitor to Honington (No 9) or Marham (No 617) today will be struck by the similarities with the past. Both airfields were Bomber Command bases during World War II (in fact, No 9 was based at Honington from July 1939 to August 1942) and in those days the bombers were dispersed all around the perimeter of the airfield. Dispersal is again the order of the

day for the Tornado squadrons, except that these very advanced strike aircraft are now housed in impregnable shelters. The old crews waited for ops in Nissen huts out at dispersal; today's crews are in hardened shelters whence they can go to fight in a hostile environment and return safely. But the crews themselves are little changed. Arguably they are more professional, at least technically, but the spirit and comradeship which took Nos 9 and 617 Squadrons again and again into danger for their country 40 years ago is no different, and the flying and ground personnel alike are proud to carry on the tradition of these two famous squadrons. □



When No 9 Squadron disbanded on Vulcans at RAF Waddington in April 1982, a unique four-aircraft fly-past was planned, comprising a Lancaster, Canberra, Vulcan and Tornado. Poor weather prevented the fly-past, but the formation is shown (above right) during rehearsal (photo courtesy of Lincolnshire Echo). (Below) One of No 9 Squadron's first Tornados, at RAF Waddington on 29 April 1982.



The RAF's Long-distance Flights



By H A Taylor

A RECORD FLIGHT by the RAF half-a-century ago may well have been brought to mind last year when, on 1 May, a Vulcan B Mk 2 made the first long-range attack on the airport at Port Stanley. This involved the longest non-stop distance ever flown during a real-life bombing sortie — some 6,800 nm (7,830 miles or 12 602 km), assuming a Great Circle track, from Ascension Island and return. The Vulcan on this mission, and four others that followed during the Falklands campaign, was flight-refuelled by Victor K Mk 2s and the 16-hour operation was rather less arduous for the crew than for the two RAF pilots of the Fairey Long Range Monoplane (LRM) which broke the world's distance record during 6-8 February 1933. They were airborne for 57½ hours while covering the 5,309 miles (8 544 km) between RAF Cranwell, Lincolnshire, and Walvis Bay, South-west Africa.

This flight briefly gave Britain all three of the absolute world records recognised by the *Federation Aéronautique Internationale (FAI)*. These were, respectively, for speed, altitude and distance in a straight line. The first had been captured on 29 September 1931, when, 12 days after Britain had won the Schneider Trophy outright (as described in "RAF Yearbook 1982") Flt Lt G H Stainforth averaged 407.5 mph (655 km/h) during four runs over a 3-km (1.9-mile) course along Southampton Water in one of the Supermarine S.6B floatplanes prepared for the race. The altitude record had been

obtained on 16 September 1932 by C F Uwins, flying a Bristol Pegasus-engined Vickers Vespa general-purpose biplane, with a height of 43,976 ft (13 404 m). Sadly, all three records were to be lost before the end of 1933.

The Fairey LRM used to break the record in 1933 was the second of two nearly identical aircraft designed and built for long-range flights and, if not officially at first, for attempts on the distance record. The story of these two aircraft had begun six years before the record flight was actually made, but they were not, even then, the first to be sponsored by the Air Ministry and flown by an RAF crew on long-distance attempts. At the time when possible designs for the special long-range aircraft were being initially discussed, and before the issue of a specification, the Ministry had made plans for a record attempt with special versions of a standard RAF aircraft. Two Hawker Horsley II two-seat day and torpedo bomber biplanes were modified for the purpose. At that time, the record was held by France, at 3,353 miles (5 396 km), flown in October 1926 by Costes and Rignot in a Breguet XIX. The Horsleys (J8607-8), each powered by a 665 hp Rolls-Royce Condor IIIA, were modified with extra fuselage and wing tanks to increase the fuel capacity from 230 to 1,100 Imp gal (1 045 to 5 000 l) and with strengthened undercarriages to deal with a take-off weight of some 14,000 lb (6 350 kg) by comparison with a maximum of 9,000 lb (4 082 kg) for the standard aircraft.

Flown by Flt Lt C R (later Air Marshal Sir Roderick) Carr, accompanied by Flt Lt L E M Gillman, the first Horsley took-off from RAF Cranwell on 20 May 1927 with India as the target. After it had covered some 3,420 miles (5 504 km), however, fuel starvation led to a ditching in the Persian Gulf near Bandar Abbas. Even if this was allowed as a record — the distance covered may not have reached the 100-km (62-mile) margin required — on that very same day Charles Lindbergh's Ryan monoplane had reached Paris after covering 3,610 miles (5 809 km) from New York. A second attempt, on 18 June, by Carr, flying the second Horsley, ended with a serious oil leak and a grossly overloaded emergency landing at RAF Martlesham Heath. A third attempt, on 2 August, ended near Linz, Austria, with a ditching in the Danube.

Meanwhile, discussions between the Ministry and two or more British aircraft manufacturers had continued, to culminate in the issue by the Directorate of Technical Development of the draft Specification 33/27, which was accepted in December 1927 by Major T M Barlow, chief engineer of the Fairey company. Three prospective layouts — two biplanes and a monoplane — had been offered by Fairey and models tested at the National Physical Laboratory (NPL). The high-wing monoplane was selected because of its higher lift-drag ratio and the advantages offered of better fuel-storage space in the wing and of basic gravity feed. The chosen engine was the reliable Napier Lion.

As eventually evolved, the Fairey LRM had a clean, cantilever,



(Above and below) The first of the Fairey LRMs, J9479, arriving at Shaibah on its return flight from Karachi in 1929, having failed in its first attempt on the long-range record. (Heading photo) The three specially-equipped Vickers Wellesleys of the Long-Range Development Unit.



two-spar wing with a system of pyramid bracing to give torsional stiffness and a total fuel capacity for 1,157 Imp gal (5 260 l) in eight wing tanks feeding into a collector box in the fuselage. By the time the aircraft — then known as the "Postal Aircraft" so as to disarm and pacify possible government critics of the expense involved — was nearing completion, the distance record was standing at 4,466 miles (7 188 km) after a flight by an Italian Savoia S-64 (a derivative of the single-engined S-55 flying-boat) from Rome to Touros, Brazil, in July 1928. This distance was well within the theoretical capabilities of the LRM, which, assuming a mean speed of 85 mph (137 km/h) and an average consumption of 18 gal/hr, should have been able to cover more than 5,400 miles (8 690 km) to tanks-empty.

By comparison with the Horsley — and even with the Vickers Wellesleys which were to regain the record for Britain in 1938 — the conditions for the two-man crew were not too uncomfortable for a 50-hour-plus session. The single-seat cockpit ahead of the leading-edge was enclosed and roomy enough to permit the pilots to move to and from the aft cabin. Such changes were, in fact, made during the first, and disastrous second, attempts on the record, but not, so far as is known, during the successful attempt with the second LRM, which, as later described, had at least a primitive automatic pilot. Instrumentation was somewhat limited, but included a rate-of-turn indicator — so essential for blind flying.

The first Fairey

There were several changes in the selected crew for the attempt, but Flt Lt A G Jones-Williams MC was soon to be chosen as pilot-in-charge and he made the initial test flight with the first LRM, J9479, accompanied by Flt Lt L V Major, a specialist navigator, who was to be the second crew member. Contractor's trials by Capt Norman Macmillan, Fairey's chief test pilot, were completed by 7 December 1928 and the aircraft was handed over to the RAF and flown to Cranwell, which, with its suitably long take-off runways, was, as before, to be the British starting point for the record attempt.

This had earlier been planned for December, with southern Africa, possibly Cape Town, as the target, but technical difficulties — including irregular and excessive fuel consumptions caused by the accidental reversal of the advance/retard ignition control during an engine-change — further delayed the start. A 24-hour consumption test and shake-down flight was not completed until 22-23 March 1929. This, on which Jones-Williams and Major were accompanied by D L Hollis-Williams, who had led the Fairey design team on the project, was reasonably successful, though a dangerous exhaust leak, and burnt valves which caused a drop of 200 rpm, might well, had this been a record attempt, have ruined the chances. More than 1,920 miles (3 090 km) were covered for a consumption of 430 gal (1 955 l), demonstrating a possible full-tank range of up to 5,500 miles (8 850 km). Following this flight, Major was replaced by Flt Lt N H Jenkins, one of the original crew members proposed, and he was to join Jones-Williams in the record attempts.

Other difficulties had included those involved in establishing a maximum safe weight for the take-off distances available in different conditions. Tests made during the winter, with the turf frozen hard, had produced optimistic results but a later test in more normal conditions had shown that take-off speed could not be reached at a

similar weight and in comparable wind conditions. Tests eventually showed that a maximum weight of 16,000 lb (7 257 kg), as originally proposed, would be possible on a slightly downhill run of 4,500 ft (1 372 m) towards the west into a 10-mph (16 km/h) wind. The weather and other conditions were by then unsuitable for a flight to southern Africa and by 10 April a route to India, with a target of Bangalore, Mysore, was being proposed — a Great Circle distance of about 5,000 miles (8 050 km) and an actual practical track distance of 5,300 miles (8 530 km).

A departure date of 23 April was agreed and, after a 24-hour delay because of unfavourable winds and weather over Europe, the LRM took-off at 09.27 hrs GMT on 24 April 1929 with a fuel load of 1,043 Imp gal (4 740 l) after a run of 3,705 ft (1 130 m) into a 30 mph (48 km/h) wind, reaching 1,000 ft (305 m) and throttling back after five minutes. All went well over Europe and the Near East with good ground speeds, though the aircraft was flying mostly in or above cloud at about 8,000 ft (2 438 m). The situation deteriorated after over-flying Baghdad, with headwinds reducing ground speeds to 65 mph (105 km/h) or less. Soon after reaching Karachi at 10.50 GMT, 27 April, it became obvious that the record could not be broken by the necessary margin even if the LRM were to be flown on to tanks-empty with a crash landing in the dark. The attempt was abandoned, and a return made to Karachi, after being airborne for 50 hrs 48 min.

Various changes were made to J9479, as a result of experience on this flight, in preparation for another attempt later in the year, to southern Africa — including rudder/fin modifications to improve directional stability, increased radiator area, an improved rate-of-turn indicator and inclusion of a radio transmitter for position reporting. In September the record distance had been increased, with a flight by Costes and Bellonte in their Breguet XIX *Point d'Interrogation* from Paris to Manchuria, and now stood at 4,912 miles (7 905 km).

Unhappily, this second attempt, with the Fairey LRM, with the same crew, ended in disaster 12 hours after departing Cranwell at 08.00 GMT on 16 December, when the aircraft struck high ground south of Tunis and both pilots were killed. The most likely cause was a failure of the panel altimeter. A log entry made an hour before the crash noted that the LRM was "in very thick cloud at 5,000 ft", yet the recovered barograph record showed a gradual descent from 5,000 ft (1 524 m) over Sardinia to 2,600 ft (790 m) near the point of impact at 2,400 ft (750 m) on the leeward side of the highest point of a ridge.

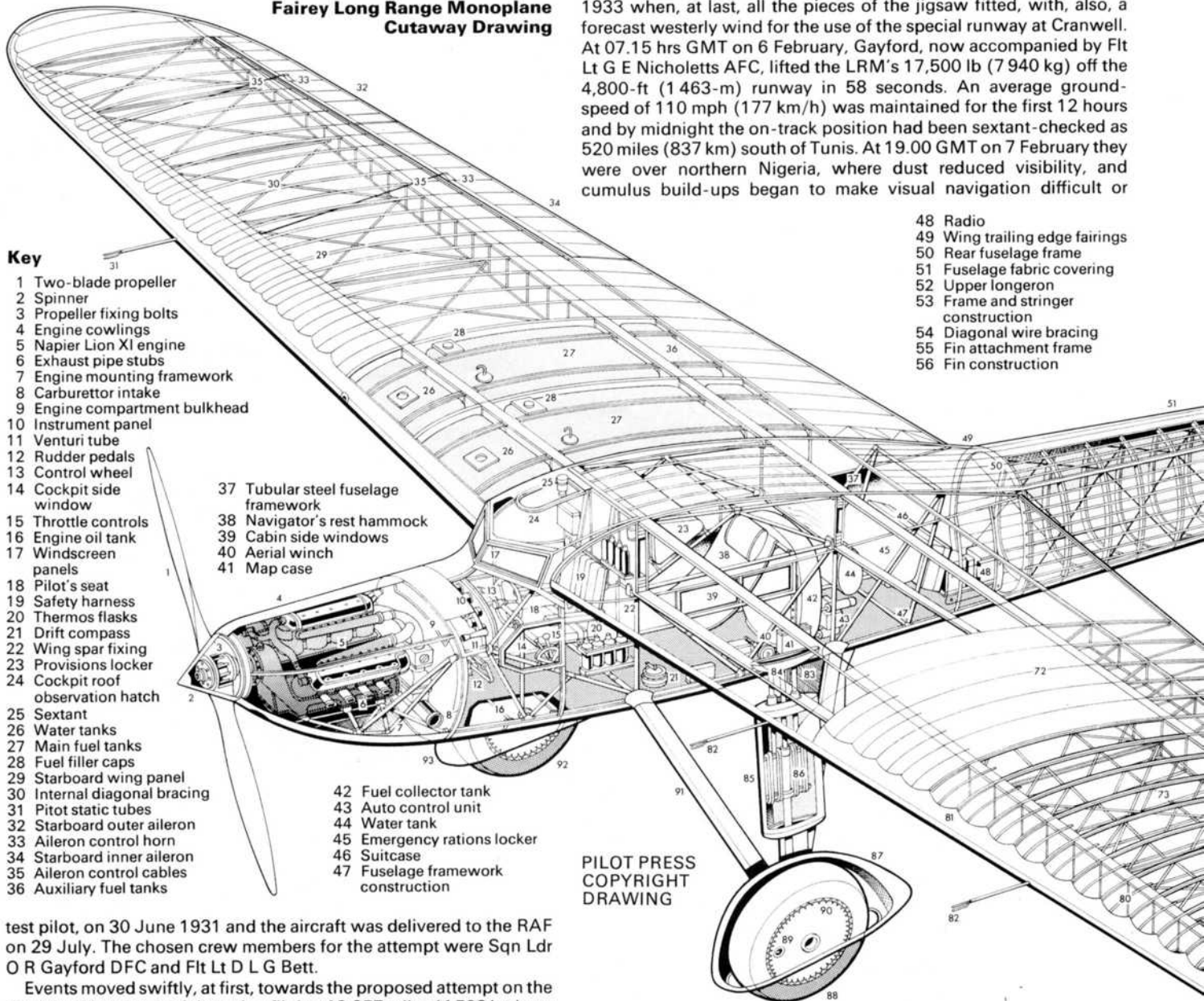
Another Fairey flies

Six months later, in July 1930, the Air Ministry decided that a second, similar, LRM should be built. An entirely new aircraft would have involved a delay of at least two years; the record stood as before; and refinements could, it was thought, improve the performance adequately to meet any likely increase. The new version of the LRM, K1991, had wheel spats, improved fairings, the previously revised fin/rudder design and a modified fuel system to reduce losses through evaporation and surging. Better flight instrumentation, with more duplication, was provided, with means, also, for taking sextant and drift sights; a two-axis automatic pilot, for directional and lateral control, was to be provided by the Royal Aircraft Establishment (RAE). The initial flight was made by C S Staniland, Fairey's chief

The Fairey LRM is seen here being manhandled by Fairey workmen on one of its first outings — perhaps on the occasion of its first flight — late in 1928.



Fairey Long Range Monoplane Cutaway Drawing



Key

- 1 Two-blade propeller
- 2 Spinner
- 3 Propeller fixing bolts
- 4 Engine cowlings
- 5 Napier Lion XI engine
- 6 Exhaust pipe stubs
- 7 Engine mounting framework
- 8 Carburettor intake
- 9 Engine compartment bulkhead
- 10 Instrument panel
- 11 Venturi tube
- 12 Rudder pedals
- 13 Control wheel
- 14 Cockpit side window
- 15 Throttle controls
- 16 Engine oil tank
- 17 Windscreens panels
- 18 Pilot's seat
- 19 Safety harness
- 20 Thermos flasks
- 21 Drift compass
- 22 Wing spar fixing
- 23 Provisions locker
- 24 Cockpit roof observation hatch
- 25 Sextant
- 26 Water tanks
- 27 Main fuel tanks
- 28 Fuel filler caps
- 29 Starboard wing panel
- 30 Internal diagonal bracing
- 31 Pitot static tubes
- 32 Starboard outer aileron
- 33 Aileron control horn
- 34 Starboard inner aileron
- 35 Aileron control cables
- 36 Auxiliary fuel tanks

- 37 Tubular steel fuselage framework
- 38 Navigator's rest hammock
- 39 Cabin side windows
- 40 Aerial winch
- 41 Map case

- 42 Fuel collector tank
- 43 Auto control unit
- 44 Water tank
- 45 Emergency rations locker
- 46 Suitcase
- 47 Fuselage framework construction

- 48 Radio
- 49 Wing trailing edge fairings
- 50 Rear fuselage frame
- 51 Fuselage fabric covering
- 52 Upper longeron
- 53 Frame and stringer construction
- 54 Diagonal wire bracing
- 55 Fin attachment frame
- 56 Fin construction

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DRAWING

test pilot, on 30 June 1931 and the aircraft was delivered to the RAF on 29 July. The chosen crew members for the attempt were Sqn Ldr O R Gayford DFC and Flt Lt D L G Bett.

Events moved swiftly, at first, towards the proposed attempt on the record, with a successful proving flight of 2,857 miles (4 598 km), on 27-28 October, from Cranwell to Abu Sueir, Egypt, via Tunis, and afterwards to Khartoum. On the return flight, however, fog necessitated a forced landing near Saffron Walden, Essex, and K1991 was not again airworthy until February 1932. Further trials and the installation and test of the autopilot meant that the best period for the planned flight to southern Africa had long passed and preparations were made for an attempt in November.

The need for suitable wind, weather and moonlight conditions over the African route delayed the start until the first week in February

1933 when, at last, all the pieces of the jigsaw fitted, with, also, a forecast westerly wind for the use of the special runway at Cranwell. At 07.15 hrs GMT on 6 February, Gayford, now accompanied by Flt Lt G E Nicholls AFC, lifted the LRM's 17,500 lb (7 940 kg) off the 4,800-ft (1 463-m) runway in 58 seconds. An average ground-speed of 110 mph (177 km/h) was maintained for the first 12 hours and by midnight the on-track position had been sextant-checked as 520 miles (837 km) south of Tunis. At 19.00 GMT on 7 February they were over northern Nigeria, where dust reduced visibility, and cumulus build-ups began to make visual navigation difficult or

impossible. The autopilot, which had been giving trouble in the bumpy conditions, finally gave up during the night.

The next day adverse winds reduced the ground speed to an unexpected extent when south of the Bight of Biafra, so that, for instance, an east-west railway line in northern Angola was mistaken for one further south. The result was that, when the crew reported their position by radio at 12.00 GMT as 30 miles (48 km) north of Walvis Bay, they were probably more than 300 miles (482 km) north of this point. When the LRM finally landed there, at 16.00 hrs GMT on 8 February, there were fewer than 10 gal (45 l) of fuel remaining. But all was well; they had flown a Great Circle distance of 5,309 miles (8 544 km) in 57 hrs 25 min. The actual track distance was probably at least 5,410 miles (8 707 km), so the average ground speed was about 94 mph (151 km/h).

Geodetics for extra range

In August 1933 this record was broken yet again with a flight from New York to Rayak in Syria, of 5,657 miles (9 104 km) by Codos and Rossi in the Bleriot 110 *Joseph Le Brix*. During the summer of 1934 consideration was given to the idea of re-engining the LRM with Junkers Jumo IV or Bristol Phoenix compression-ignition engines with variable-pitch propellers and making other changes — including even the fitting of a retractable undercarriage. Not unexpectedly, the RAE produced a far from encouraging report on these proposals for an aircraft which, in any case, did not have the structural strength factors now needed to meet the extreme gust case. Nobody was then to know that a prospective British record-breaker would be flying in less than a year's time.

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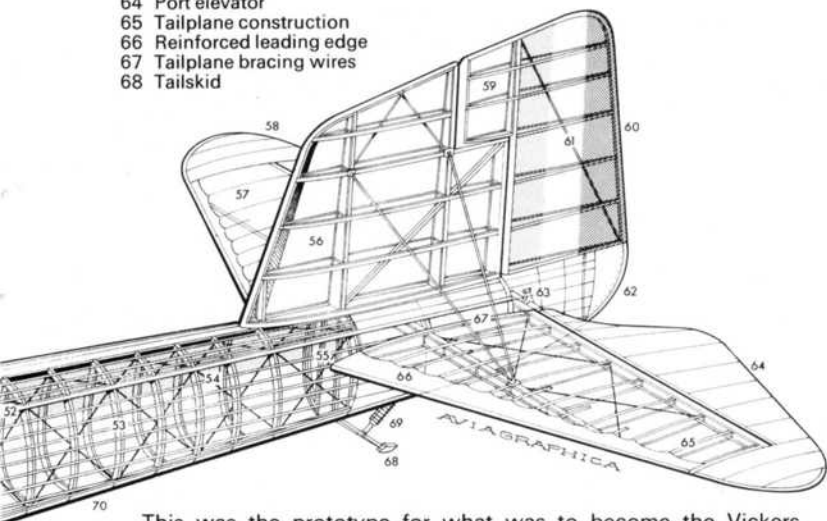
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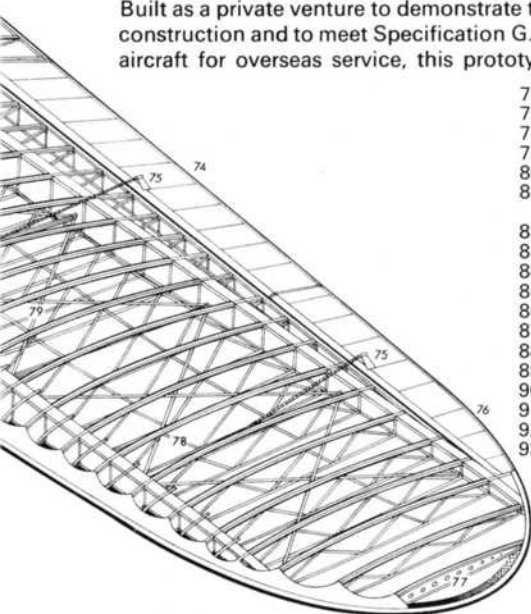
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- 57 Starboard tailplane
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- 62 Tailcone
- 63 Elevator hinge control
- 64 Port elevator
- 65 Tailplane construction
- 66 Reinforced leading edge
- 67 Tailplane bracing wires
- 68 Tailskid
- 69 Tailskid shock absorber
- 70 Bottom longeron
- 71 Trailing edge construction
- 72 Wing fabric covering
- 73 Wing rib construction
- 74 Port inner aileron
- 75 Aileron control horn



This was the prototype for what was to become the Vickers Wellesley, the first of the geodetic bombers. With its low structure weight, high-aspect-ratio cantilever wing with a relatively unobstructed interior, retractable undercarriage and clean lines, the single-engined Wellesley was something of a "natural" for the very unnatural requirements of an absolute record for distance flown. Built as a private venture to demonstrate the advantages of geodetic construction and to meet Specification G.4/31 for a general purpose aircraft for overseas service, this prototype (originally the Vickers



- 76 Port outer aileron
- 77 Wing tip construction
- 78 Lattice ribs
- 79 Wing internal bracing
- 80 Leading edge stiffeners
- 81 Plywood leading edge reinforcement
- 82 Pitot static tubes
- 83 Radiator
- 84 Undercarriage leg fixing
- 85 Shock absorber fairing
- 86 Elastic cord shock absorber
- 87 Wheel spat fairing
- 88 Port mainwheel
- 89 Tyre valve
- 90 Tyre lacing
- 91 Undercarriage leg strut
- 92 Starboard mainwheel
- 93 Starboard wheel spat

Type 246 and later the Type 281) was the first to use fully the geodetic form of construction devised by B N (later Sir Barnes) Wallis, the then chief designer (structures) of Vickers Aviation.

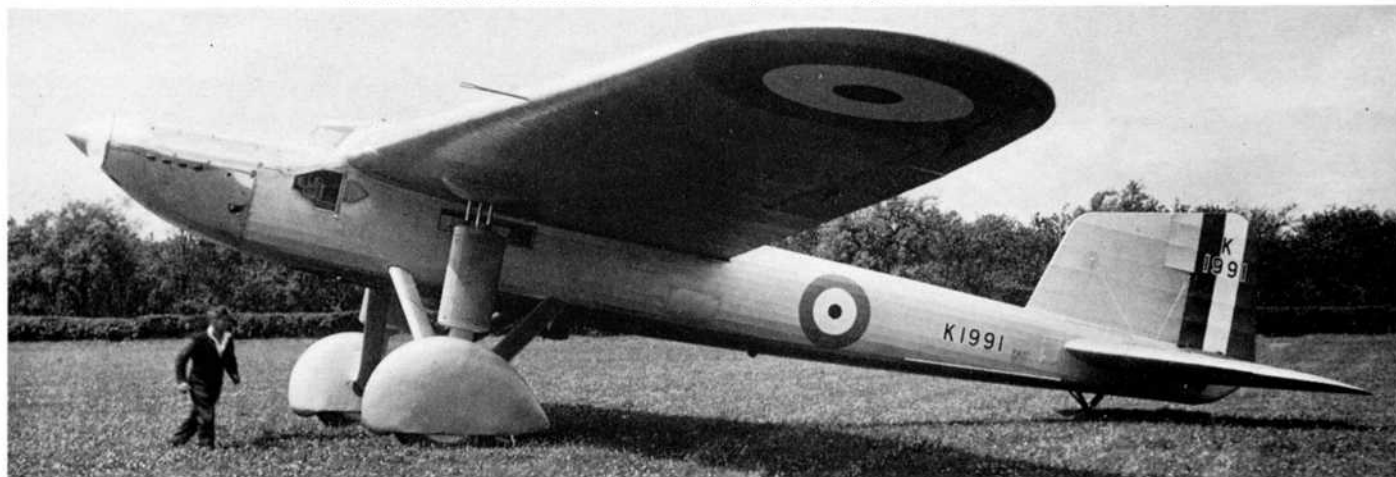
The system involved a principle in which, as Wallis noted at the time, "all parts of the structure are formed as geodesics in the streamline shape of the fuselage and also in the curved profile of the wings". A geodetic line is the shortest distance between two points on a spherical surface; so, in simplified terms, if the lines are structural members and are arranged as opposing spirals on a tubular, or flattened tubular, surface, and the points of intersection are rigid joints, then the shear and torsional loads are balanced out in the "opposing geodesics" and a very strong structure is obtained, with little or no need for internal bracing.

Vickers also offered a more conventional biplane (with geodetic fuselage) to meet the specification and this, paradoxically, was selected by the Air Ministry as one of three prototypes for competitive evaluation and was later chosen for production, an order for 150 units being drawn up. The alternative Type 246 monoplane did not fly until 19 June 1935 — ten months after the biplane, which by then had been evaluated by the A&AEE at Martlesham Heath. Although it was to be something of a blessing in disguise, progress with the monoplane was further delayed by an accident on 23 July after an undercarriage failure — but by then the results of flight tests, and hard selling by the Vickers management, had convinced the Ministry that it was a potential winner. The order for the biplane was cancelled and another placed for 96 units of the monoplane to Specification 22/35, in which many of the general-purpose provisions of the G.4/31 specification were dropped. The Wellesley-to-be had become simply a day and night bomber.

Meanwhile, the rebuilding of the prototype, now serialised K7556, had included several improvements, including sliding cockpit covers, increased chord for the rudder, powered hydraulic, instead of manual, operation for the undercarriage and smaller versions of what were to be 1,000-lb (459-kg) bomb panniers fitted under the wings. The engine was a Bristol Pegasus X with a fixed-pitch propeller, but production Type 287 and 294 aircraft were powered by Pegasus XXs driving DH Hamilton Standard two-pitch propellers. Production — with the tests and new techniques being developed for the structure — was slow to start, but all 96, plus 80 ordered later, had been delivered by March 1938.

Earlier, in January of that year, the RAF's Long Range Development Unit (LRDU), commanded by Wg Cdr O R Gayford, DFC AFC, who had captained the LRM record flight, had been formed at Upper Heyford. Whether this was initially intended specifically for the purpose of regaining the long-distance record is uncertain, but it was very much concerned with developments likely to lead to such an attempt. In this development work the Wellesley was an obvious choice for experiments, including that of jettisoning fuel in case trouble developed in the early stages of a long flight with an overloaded aircraft. The fifth production Wellesley, K7717 — one of a non-standard batch of eight Type 287s — was used for the initial jettisoning experiments and served as a flying test-bed for other necessary developments, including the special high-compression Pegasus XXII which was adapted to run on 100-octane lead-free fuel; this was installed in an NACA-type cowling — in place of the Townend ring on standard Wellesleys — which was faired into the

The second Fairey LRM, K1991, flew in June 1931 and is depicted in the cutaway drawing as well as the photograph below. Differences from the first aircraft included the wheel fairings and enlarged fin and rudder.



forward monocoque fuselage. All this work was completed and test-flown by Bristol at Filton.

Five Wellesleys from the third production batch, L2637-9 and L2680-1, were allocated to the LRDU. These, identified as Type 292s, were fitted with Pegasus XXIIIs in the long-chord cowlings with adjustable cooling gills. They had automatic mixture and boost controls and drove Rotol constant-speed propellers in place of the standard two-pitch propellers. A smaller supercharger was used in the XXII so as to provide the best results at the operational height of 10,000 ft (3 048 m) chosen for the record attempt. Fuel capacity was increased from the normal maximum, with auxiliary tanks, of 430 Imp gal (1 955 l) to 1,290 Imp gal (5 864 l), and oil capacity to 60 gal (273 l). The undercarriage was strengthened and fitted with heavy-duty tyres for weights up to 19,000 lb (8 618 kg). Most importantly, since dual control could not be fitted and it was impossible for the pilots to change places in flight, an RAE Mk IV three-axis autopilot was fitted. Powerplant changes, in addition to those mentioned, included accessory drives for a second hydraulic pump and a vacuum pump for the gyro instruments. None-too-roomy interior arrangements were made for a third crew member between the two cockpits, and there was radio equipment consisting of WT for transmitting position reports and short-range HF R/T for inter-aircraft communication.

The record during 1938 stood at 6,306 miles (10 148 km), gained by the Soviet Union with a flight over the North Pole from Moscow to San Jacinto, California, by Gromov, Yumashchev and Danilin with a single-engined ANT-25-1 monoplane designed for the purpose. The record flight on 12-14 July 1937 followed a similar one, a month earlier, which reached Vancouver after the first trans-polar flight in history, but failed to break the existing record. On 7-8 July a flight of four of the special Wellesleys, L2638-9 and L2680-1, led by Sqn Ldr R Kellett, completed a non-stop "tour" of 4,300 miles (6 920 km) from Cranwell to the Persian Gulf and back to Ismailia, Egypt. The distance was covered in 32 hours, an average of 134 mph (216 km/h) and the results made it reasonably certain that the Soviet record could be beaten by a more-than-adequate margin.

The Wellesley attempt

Final plans for the attempt involved a take-off from Ismailia — where a 3,600-ft (1 097-m) SE-NW runway was prepared, with a sloping concrete platform, 450 ft (137 m) in length, at the SE end to aid initial



(Above left) The Wellesley L2639 (Flt Lt H A V Hogan) being prepared at Ismailia for the attempt on the record. (Below) All three Wellesleys of the LRDU at Perth whilst touring Australia after the successful record flight in 1938.



acceleration. Darwin, Northern Territory, Australia, was the target. The route was chosen because of the likely better weather and take-off conditions at Ismailia; because a Great Circle track would avoid very high ground and be mostly over British or friendly territory; and because the calculated range should involve a "landfall" in Australia, with one or more alternative earlier record-breaking landing points in what were then the Dutch East Indies.

On 5 November at 03.55 hrs GMT three aircraft took-off from Ismailia on the attempt, each then at a weight of about 18,400 lb (8 346 kg), and reached the planned operating altitude of 10,000 ft (3 050 m) in 45 minutes. Sqn Ldr Kellett, with Flt Lt R T Gething and P/O M L Gaine as crew members, led the little formation in L2638; the two other aircraft and crew members were L2639, flown by Flt Lt H A V Hogan, with Flt Lt R G Musson and Sgt T D Dixon, and L2680, flown by Flt Lt A N Combe, with Flt Lt B K Burnett and Sgt H B Gray. The expected favourable winds became adverse after 12 hours and weather conditions deteriorated over the Bay of Bengal (much more of an ocean than a "bay") and became even worse over the South China Sea and Borneo. The existing record was exceeded after passing Macassar, on Celebes Island, but L2639 was then running short of fuel for the crossing of the last stretch of ocean beyond Timor. Naval vessels were stationed on the three long sea crossings — the Arabian Sea, the Bay of Bengal and the Timor Sea — but, with distances of up to 1,000 miles or more involved, these will not have been much of a comfort when fuel reserves were dwindling. By agreement over the R/T with the other two pilots, Flt Lt Hogan landed at Koepang, Timor Island, for refuelling.

Sqn Ldr Kellett and Flt Lt Combe and crews pressed on and completed the flight to Darwin's Ross Smith aerodrome, landing at 04.00 hrs GMT on 7 November. Neither Wellesley had much in the way of fuel remaining. The leader's aircraft had 44 gal (200 l) in its tanks, but L2680 had no more than 17 gal (77 l). The two crews had been airborne for 48 hrs 5 min, averaging some 150 mph (241 km/h), and a world distance record of 7,158 miles (11 520 km) was duly homologated later by the FAI. Flt Lt Hogan and crew, who arrived at Darwin later, had also broken the record by a useful margin after covering 6,658 miles (10 715 km) to Koepang.

With six years of war intervening, this record was not broken until 1946 when, between 29 September and 1 October, Cdr T D Davies, of the US Navy, with three crew members, flew a twin-engined Lockheed P2V-1 Neptune maritime patrol bomber, named *Truculent Turtle*, from Perth, Western Australia, to Columbus, Ohio, a distance of 11,236 miles (18 082 km). This record is still unbeaten by any piston-engined aircraft and is likely to remain so. Successful attempts on the world's speed record were resumed post-war, with official and RAF support in 1945 and with the re-formation of an RAF High Speed Flight in July 1946. No further attempts by the RAF were made on the record for absolute distance in a straight line. Symbolic, perhaps, of practical progress since the 1930s is the fact that Pan American World Airways introduced, in 1982, a regularly-scheduled non-stop passenger service with Boeing 747s between Los Angeles and Sydney, Australia, a distance of 7,487 miles (12 049 km) — or 329 miles (529 km) farther than that flown so arduously by the crews of the Wellesleys 44 years earlier. □

Search and Rescue in the RAF

BY MALCOLM ENGLISH

IT IS A little known fact that the Royal Air Force has, since 1 April 1918, been operating a seaborne force. The vessels were initially inherited from the Royal Naval Air Service at the time of its merger with the Royal Flying Corps. Early Marine Craft Sections were formed, with a fleet of motor boats, whose tasks were to support the many floatplanes in service at that time. Typically, they were used for ferrying aircrew to and from their aircraft and servicing and refuelling the floatplanes (both flying boats and seaplanes) on the water.

In the 1920s, the early floatplanes were followed into service by larger seaplanes needing much longer take-off runs and having considerably higher take-off speeds. To provide assistance in the event of a mishap during take-off of these waterborne aircraft, the Royal Air Force borrowed three fast Royal Navy coastal motor boats. These three craft also provided a partial solution to another growing problem. It was becoming increasingly frequent practice for land-based aircraft to fly over the sea, thus raising a requirement for safety cover in areas away from the waterborne aircraft bases. Surface craft were, therefore, detached to operate from ports close to the areas of flying operations.

A longer term solution to these problems came with the introduction of the 200-Class seaplane tenders, the first of which was delivered to the Royal Air Force in 1932. With a top speed of 27 knots (50 km/h), this was claimed to be the fastest craft in the world on the basis of its length to horsepower ratio. Instrumental in the concept of these craft was Aircraftsman Shaw who had been stationed at RAF Mount Batten from 1929 to 1933; Shaw was, of course, the adopted name of Colonel T E Lawrence of "Lawrence of Arabia" fame.

With Bomber Command working up to a war footing in 1938, there was concern at the lack of adequate sea rescue facilities to support its exercises over the North Sea, and as a result of Bomber Command



"lobbying", more high speed launches were ordered. Further, all high speed launches in home waters were placed under the administrative and operational control of Coastal Command. In 1939 responsibility for the co-ordination of both rescue aircraft and marine craft was delegated to the Commanders of the Coastal Reconnaissance Groups.

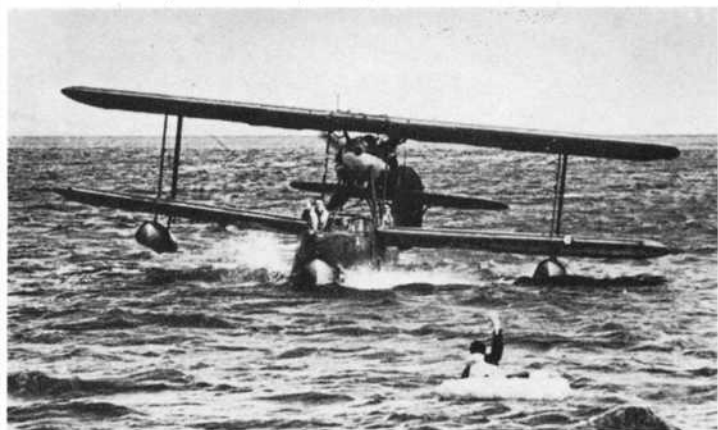
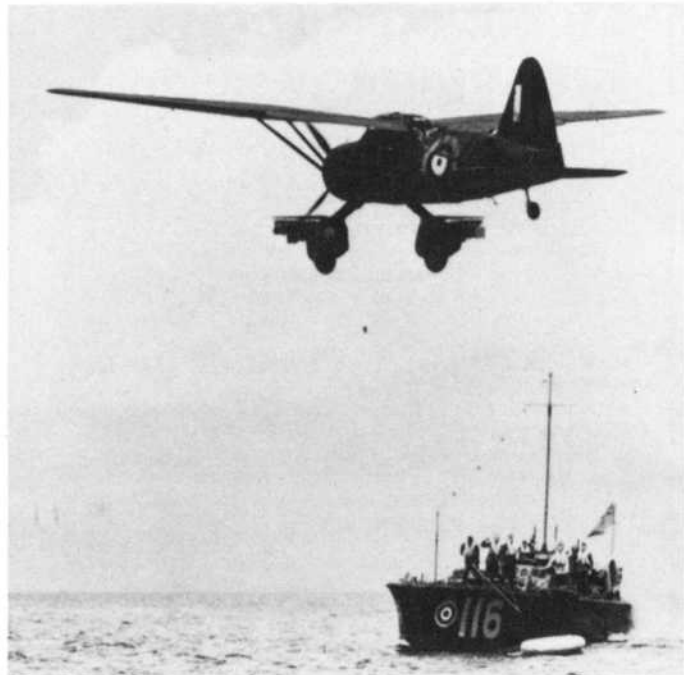
The birth of ASR

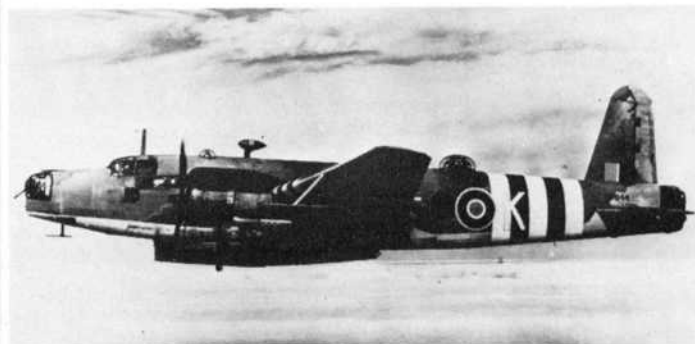
The Air Sea Rescue (ASR) Service was formed in February 1941. Its title was chosen to differentiate it from the contemporary Naval Sea Rescue Service. It also emphasised its primary task of rescuing airmen from the sea — a priority which continues to this day.

During World War II, the ASR service rescued 13,626 personnel, including 5,721 RAF and USAF aircrew in home waters and 3,300 aircrew overseas. Unfortunately, in spite of these apparently impressive statistics, the recovery rate of trained aircrew was, in late 1941, only 37 per cent. In an attempt to improve the efficiency of the service, the organisations responsible for the safety of aircraft and aircrew were then brought under the control of Marshal of the Royal Air Force, Sir John Salmond. These organisations dealt with rescue



(Top of page) A No 202 Squadron Sea King HAR Mk 3 practises rescue procedures with the Gt Yarmouth and Gorleston Lifeboat. (Left) A Lysander IIIA, with survival packs on the sponsons, overflies an ASR launch. (Above) Loading rescue packs into a Spitfire IIC of No 276 Squadron and (below) a Walrus of the same ASR unit.





The development of an airborne lifeboat, to be dropped to survivors in the water, gave a significant boost to ASR during World War II. The lifeboat is seen here carried for trials by a Hudson III (left) and operationally by a Warwick III of No 275 Squadron (right).

policy, aircraft and marine craft, and their ancillary equipment, and liaison with Coastal Command.

Until early in 1940, when 12 Westland Lysanders were loaned to Fighter Command specifically for ASR duties, aircraft had been used in this rôle only on an *ad hoc* basis. Aircraft involved were usually from the same squadron as the missing aeroplane and there was little or no co-ordination with other participants or rescue agencies. During 1941, the initial Lysander force was augmented by another six aircraft, nine Walrus amphibians and two squadrons of Hudsons. The latter came under the control of Coastal Command and were specifically tasked with ASR duties.

By February 1942, 85 aircraft from seven squadrons were dedicated to the ASR rôle. These included two Coastal Command squadrons, one of Ansons and the other of Hudsons. Later that year, a squadron of Defiants was superseded by 40 specially-equipped Spitfires which assumed responsibility for escort and protection of marine craft and aircraft engaged in rescue duties.

The peak of aircraft involvement occurred in mid-1944 with a total of 169 operating within the ASR service. By this time the fleet of Walruses and Hudsons had been supplemented by 60 Warwicks. In spite of its unconventional design, the pusher-engined biplane

Walrus was a most versatile aircraft, and with its ability to alight on the water, it was able to perform both the search and rescue functions that today are indicated by the initials SAR that have superseded the war-time ASR.

Survival equipment

Aircraft in the Service's inventory other than those dedicated to ASR were provided with survival equipment that could be dropped to survivors. In 1940, the Thornaby Bag and the Bircham Barrel were in use. Basically, these items consisted of buoyant containers filled with tins of food, drink and first aid equipment. Their function was, of course, to provide succour, enabling the aircrews to survive until rescued.

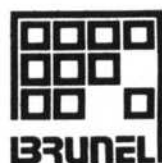
This equipment was followed in 1941 by a device known as Lindholme gear after its inventor, the then Station Commander at RAF Lindholme. It consisted of three cannisters, a centre one containing a 10-seat dinghy and two outer ones, attached by approximately 600 yds (550 m) of buoyant ropes, containing survival equipment. Carried in the bomb-bay of the delivery aircraft, it was dropped across the line of drift of the survivors so that they floated down to it. Lindholme gear was so successful that it is still in

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No 22 Squadron — one of the RAF's two squadrons specialising in SAR — is currently providing a Sea King detachment at RAF Stanley and also served at Wideawake Airport on Ascension Island during the Falklands conflict (right). Replacing the detached Sea Kings at RAF Leconfield are Wessex HAR Mk 2s (left).

service, almost unchanged after 42 years, carried today by RAF Nimrod, Shackleton and Hercules aircraft.

The final significant innovation, chronologically speaking, to enter service during the war was an airborne lifeboat. Introduced in 1943, these 30-ft (9-m) craft were carried and dropped by Hudsons and by Warwick ASR Mk IIIs.

Search and Rescue requirements

In 1947, the United Kingdom signed the Chicago Convention charter from which was born the International Civil Air Organisation (ICAO). Because of the vast increase in post-war commercial flying, much of which included long stretches over water, the charter contained a requirement for all maritime nations to provide an SAR service. As a result, the then Board of Trade, which lacked the ability to satisfy this obligation, asked the Royal Air Force to fulfil it. Fortunately, the Royal Air Force was still well-equipped after its wartime commitments, with approximately 150 ASR aircraft and 106 ASR marine craft units (MCUs).

The ICAO charter defined regions for each country to look after. The large size of the UK region, covering approximately 380,000 square miles and extending west to a latitude of 30 deg, south to 45 deg, north to 61 deg and across the North Sea to the east, reflected the country's power at the time the charter was signed. For ease of management, the UK area has been divided into two, the northern sector having its rescue co-ordination centre (RCC) at Pitreavie, Edinburgh and the southern sector RCC being located at Plymouth.

During this period, King George VI granted Royal approval for Royal Air Force marine craft of 68-ft (21-m) and over to wear the Union Flag, an honour previously reserved to HM ships of the Royal Navy. Simultaneously, in December 1947, the Royal Air Force element of the combined Air Sea Rescue Service became the RAF Marine Branch as a separate arm of the Service in its own right.

The post-war years saw the run-down of the RAF Marine Branch, overseas tours having a temporary boost during the period of the

Korean War. In the UK, the advent of helicopters for SAR duties in 1953 tended to speed up the demise of the home-based marine craft units.

Today, four UK marine craft bases remain: No 1100 MCU is at Alness and No 1113 MCU at Holyhead and RAF Mount Batten in Plymouth, with a detachment at Tenby. Their primary rôle is to provide a training service for aircrews, but the sole overseas unit at Gibraltar still maintains a permanent SAR standby service.

The helicopters arrive

The first Royal Air Force helicopter squadron dedicated to SAR, No 275 Sqn, was formed at RAF Linton-on-Ouse in April 1953. SAR was no new rôle for this squadron, however: at RAF Valley, in 1941 it was equipped with Lysanders for SAR duties. Being located on a fighter station it automatically became part of Fighter Command, but all of the current SAR squadrons are organisationally part of the successor to Coastal Command, No 18 Group. No 275 Sqn was initially equipped with Bristol Sycamores and tasked with providing SAR cover over the North Sea.

Almost concurrently, in 1952, the Air Sea Warfare Development Unit was evaluating the Sycamore at RAF St Mawgan. Subsequently, No 22 Sqn was reformed in 1955 at St Mawgan and Thorney Island, equipped with the Westland Whirlwind HAR Mk 2. Compared with the Sycamore, it had a slightly increased range and lifting capability. Then, in August 1962, Whirlwind HAR Mk 10s were introduced into service, replacing the HAR Mk 2s, the most significant difference between these types being the change from Alvis Leonides piston engine to the Gnome 101 turboshaft.

After giving 14 years of sterling service the Whirlwinds were superseded by the Wessex HAR Mk 2. Although the improvement in performance was not astounding, the Wessex's twin engines were, at least, a great psychological comfort — especially when operating far out to sea, as was so often the case by the nature of their task.

On 1 September 1959, No 275 Sqn, which was then based at RAF

(Left) The launch No 122, typical of the ASR craft used by the RAF during World War II, contrasted with (right) HMAFV Wellington, serving for rescue and target-towing duties at Gibraltar.



All air-to-air refuelling equipment used by HM Forces during the Falklands operations was supplied by Flight Refuelling Limited.



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Leconfield, was renumbered No 228, continuing to operate with Sycamores until 1961, when they were replaced by Whirlwind HAR Mk 2s and HAR Mk 4s. The following year, the Squadron was re-equipped with Whirlwind HAR Mk 10s and on 1 September 1964 it was renumbered No 202 Sqn, still retaining its SAR rôle. In August 1978, the SAR service was given a quantum leap in capability with the introduction of the Sea King HAR Mk 3 with No 202 Sqn.

Powered by two uprated Gnome 1400 series turboshaft engines, the HAR Mk 3 variant of the Sea King is equipped with sophisticated navigation and radar equipment giving it the ability to operate in poor weather and at night. An increased fuel capacity gives it an unrefuelled radius of action of some 300 miles (483 km). By staging on oil rigs this enables the Sea King HAR Mk 3 to reach as far as Iceland.

Overseas deployment

In addition to the UK units, No 28 Sqn, equipped with the Wessex HAR 2, is deployed to Hong Kong. Its primary rôle is that of support but it has secondary SAR duties, a task shared with the Royal Hong Kong Auxiliary Air Force. Wessex HAR Mk 2s are also flown by No 72 Support Helicopter Squadron in Northern Ireland, where they, too, have a secondary SAR rôle.

During the latter half of 1982, the Sea King HAR Mk 3 Flight from

The Westland Whirlwind was one of the first helicopters used for SAR by the RAF, equipping No 22 Squadron when it reformed in 1955.



RAF Coltishall was deployed to the Falkland Islands, primarily to support the fighter operations from Stanley Airfield. They spent a short while on Ascension Island during the period of combat operations from that base, but their rôle there has now been taken over by the Royal Navy. In order to fill the gap at RAF Coltishall left by the requisitioned Sea King HAR Mk 3s, RAF Leconfield and RAF Manston each donated a Wessex HAR Mk 2.

At the time of writing, little has been heard of this detachment's activities, apart from a sudden increase in support duties during a temporary grounding of the RAF's Chinook HC Mk 1 fleet. Because the Sea King HAR Mk 3s were operating on a war footing, at least one has been camouflaged in low visibility dark grey, replacing the familiar peace-time SAR finish, a distinctive gloss yellow overall.

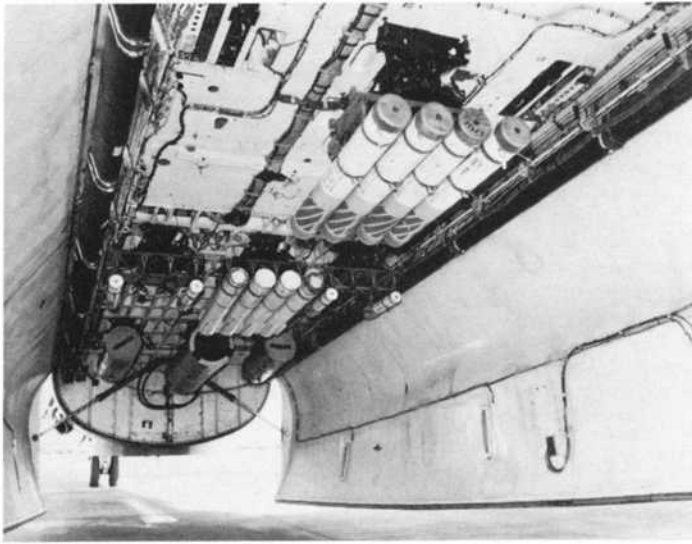
The unremitting task

The two UK RCCs are manned 24 hours a day, 52 weeks a year, and have a comprehensive signals network — both civil and military. There is direct communication between the RCCs and the Coastguard which is responsible for civil maritime SAR. Having few resources, the Coastguard relies heavily on the RAF, RN and the RNLI lifeboats for SAR support.

RAF Search and Rescue Resources, United Kingdom

Location	A/C Type	Flt/Sqn
Lossiemouth	Sea King HAR Mk 3	D/202
Leuchars	Wessex HAR Mk 2	B/22
Boulmer	Sea King HAR Mk 3	A/202
Leconfield	Wessex HAR Mk 2	D/22
Coltishall	Wessex HAR Mk 2*	C/202
Manston	Wessex HAR Mk 2	E/22
Culdrose	Sea King HAR Mk 3	SKTU
Chivenor	Wessex HAR Mk 2	A/22
Brawdy	Sea King HAR Mk 3	B/202
Valley	Wessex HAR Mk 2	C/22

*Normally equipped with Sea King HAR Mk 3 which are at present deployed to the Falkland Islands.



(Left) Rescue stores in the bomb-bay of a Shackleton AEW Mk 2 of No 8 Squadron — smoke canisters and flares forward and Lindholme packs to the rear. (Right) A Sea King HAR Mk 3 of No 202 Squadron participating in an international search-and-rescue helicopter event during 1980.

SAR Helicopter Squadron (Nos 22 and 202) and Wing Headquarters are both sited at RAF Finningley, as is the major engineering facility. This South Yorkshire base was chosen for its geographical location which is central to the satellite SAR airfields.

All RAF helicopter pilots are trained for SAR operations. Initial tuition is given at RAF Valley in conjunction with RAF marine craft. After some 20 hours of basic training there, the student pilots are separated: those destined to fly Sea King HAR Mk 3s go to the Sea King Training Unit (SKTU) based at RNAS Culdrose, whilst the Wessex HAR Mk 2 crews complete their course at RAF Valley. Until recently, first tour pilots were not allowed to fly SAR helicopters; this restriction has now been waived, with the introduction into service of the Sea King HAR Mk 3 with its two-pilot crew.

To widen the SAR crew's experience there are exchange tours between RAF and *Luftwaffe* helicopter crews, and it is hoped in the near future to arrange a similar exchange with the US Coast Guard for Sea King crews. Helicopters are on a 15-min standby during daytime. At night Sea King HAR Mk 3s and Wessex HAR Mk 2s are on 45-min and one-hour readiness respectively.

Fixed-wing support

In addition to the SAR helicopter units, air support may be provided by the two Nimrod bases, one at RAF Kinloss in the north and the other at RAF St Mawgan in the south. These take it in turn to provide an aircraft on a one-hour readiness for SAR duties.

The Shackleton AEW 2s of No 8 Sqn, based at RAF Lossiemouth and soon to be phased out of service, normally carry air sea rescue apparatus in their spacious bomb-bays. This consists of Lindholme gear and a mixture of flares and markers, as carried by the Nimrods and the Lyneham Transport Wing Hercules — which are also capable of providing a back-up SAR service if required.

Further support for the RAF SAR helicopters is available from the Royal Navy helicopter bases at RNAS Culdrose, Portland, Prestwick and Lee-on-Solent. Last, but by no means least, is the 67th Air Rescue and Recovery Squadron of the USAF based at RAF Woodbridge. Equipped with HH-53C Super Jolly helicopters and HC-130 Hercules, it is able to provide a valuable long-range capability when required.

For rescues on land, the Royal Air Force has six mountain rescue teams. Formed during the Second World War, there are now teams based at RAF Kinloss, Leeming, St Athan, Stafford and Valley. The teams are 30 to 36 strong, and, with the exception of a cadre of about five per team, all are volunteers. They work very closely with the many civil volunteer teams and are under the direct control of the Home Office.

To further improve its standard of excellence, the SAR force is constantly updating its equipment. A potential weak link (no pun intended) is the Sea King HAR Mk 3's single hoist. Failure of a hoist to operate on a short-range mission may not matter too much but at the helicopter's extreme range it could have fatal consequences. Hence, a modification to introduce a secondary hoist, powered by a different system (one hydraulic, the other electric) for maximum reliability, is currently being flight tested. For operations at night and in poor weather, an infra-red optical system is also being considered.

Improved homing systems are also under investigation, including a satellite-aided tracking system (SARSAT). This is a NASA system using satellites placed in a low polar orbit to obtain positional fixes to within 3 mls (5 km).

Obviously, equipment is modified in the light of experience. Typical of this is a quick splice device and improved cutting knife that have been introduced as a result of an unsuccessful attempt in 1981 to rescue a USAF A-10 pilot from the North Sea. This attempt went tragically wrong, resulting in the death of a winchman in an unselfish and courageous act which perhaps epitomises more than any other the dedication of today's RAF SAR force. □



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THE RAF'S YEAR - 1982

January

1: RAF New Year Honours: Knighthoods conferred on two senior officers of the Royal Air Force — Air Marshal John Rogers, Air Member for Supply and Organisation; and Air Marshal Arnold Morris, Chief Engineer, RAF. CBE awarded to Air Commodore Dan Honley, RAF Director of Public Relations.

6: Opening of Tornado Weapons Conversion Unit (TWCU) at RAF Honington, designed to give pilots 32 hours in-combat training each after initial course at the Tri-National Tornado Training Establishment at RAF Cottesmore.

20: Twenty-two awards made to the RAF at the International Hotel and Catering Exhibition at Olympia.

26: HM The Queen visited RAF Marham, of which she is Honorary Air Commodore, and formally opened the Sandringham Centre social complex.

RAF St Athan Mountain Rescue Team logged over 2,000 man hours in rescue missions this month, during ferocious blizzards that brought South Wales to a standstill. The whole team later received the Commander-in-Chief Strike Command's Commendation — an unprecedented accolade.

February

1: Battle of Britain fighter pilot Air Commodore Sir Archie Winskill retired after 14 years as Captain of The Queen's Flight.

12: Eight Nimrods from Kinloss and St Mawgan involved in rescue operation when the Greek tanker *Victory* broke in two 800 miles (1 290 km) west of Lands End. The aircraft provided some 40 hours of continuous "top cover".

14: First flight of ASAT, the Advanced Subsonic Aerial Target made by Flight Refuelling Ltd. This target drone is expected to come into operational service in 1984.

25: No 18 Squadron (Chinooks) reformed at RAF Odiham, Hants.

Expansion of the RAF's tanker force was one of the features of 1982, with two new types in service (Hercules and Vulcan), TriStars ordered for the long term, and the first flight, on 22 June, of the first of the VC10 tankers (below). British Aerospace at Filton is converting five Standard VC10s and four Super VC10s to K Mk 2 and K Mk 3 three-point tankers, respectively.



March

1: RAF Germany receives its first woman Engagement Controller — 22-year-old Pilot Officer Lesley-Ann Tidy at RAF Bruggen.

3: Expansion of Royal Auxiliary Air Force Regiment by three squadrons announced in the House of Commons by Mr John Nott, Secretary of State for Defence.

13: RAF's 10,000th dog, "Jason", appears on BBC 1's "Multi-Coloured Swap Shop" children's programme. The first dog, also a German Shepherd, signed on in 1941 and served for seven years.

25: Diamond Jubilee Sword of the Royal Air Force presented to RAF St Mawgan by Princess Margaret.

April

3: The Falklands War. Major air transport task begins as eight Hercules transports depart for Ascension Island. A VC10 leaves Brize Norton for Montevideo to collect Falklands Governor Rex Hunt and party captured during the Argentine invasion and subsequently released.

7: 60th anniversary of No 2 Squadron RAF Regiment at RAF Hullavington. No 2 Squadron's history pre-dates that of the RAF Regiment itself by 20 years, having been formed as No 2 Armoured Car Company RAF at Heliopolis in Egypt in 1922 and remaining in the troubled Middle East throughout the inter-war years.

13: Display of aircraft ancient and modern at RAF Wyton on the 70th anniversary of military aviation in the UK. Attended by veteran airmen of both world wars. To mark the 90th birthday of Marshal of the Royal Air Force Sir Arthur Harris, wartime leader of Bomber Command, a Lancaster bomber of the Battle of Britain Flight flies over his home at Goring-on-Thames, Oxfordshire.

15: RAF men captured at Port Stanley at the time of the Argentine invasion returned to Britain. Chief Technicians Noel Robson and Keith Stuart reveal they were allowed the

same freedom of movement as the civilian population and are given an extensive debriefing at the Ministry of Defence.

21: First airdrop by Hercules from Ascension Island to ships of the Task Force in the South Atlantic.

May

1: First Vulcan attack on Port Stanley Airfield — bomb hits middle of runway. The mission lasts 16 hours and is made possible by in-flight refuelling from Victor tankers.

2: Flight Lieutenant Paul Barton shoots down first Argentine aircraft of the campaign — a Mirage III.

9: First air-to-air refuelled Nimrod sortie from Ascension Island.

13: 70th anniversary of one of the RAF's oldest aeroplane squadrons, No 2, formed at Farnborough in 1912 and the first squadron in France in World War I. Now based at RAF Laarbruch, flying Jaguars.

20: First Harrier GR Mk 3 attack on Port Stanley airfield.

27: *Atlantic Conveyor* lost with three RAF Chinook helicopters on board. Sole surviving Chinook later to achieve fame as the Falklands "Flying Angel".

28: RAF's last PR Canberra Squadron, No 39, disbands at RAF Wyton.

31: Pope John Paul II on "walkabout" at RAF Leeming, while changing aircraft between York and Edinburgh.

June

1: No 63 Squadron (Rapier) RAF Regiment lands at San Carlos.

No 9 Squadron reforms at RAF Honington as RAF's first Tornado GR Mk 1 Squadron.

3: Vulcan diverts to Brazil after in-flight refuelling incident involving loss of its probe, on return leg of anti-radar strike on the Falklands.

14: First laser guided bomb attack in the Falklands from a Harrier GR Mk 3 scores a direct hit on Argentine AAA. Argentines surrender.

Hong Kong businessman Stanley Ho presents £300,000 to the RAF Museum in appreciation of the RAF's rôle in liberating the island from the Japanese during World War II.

16: Opening of Guild of Aviation Artists annual exhibition at the Qantas Gallery, Piccadilly and Old Bond Street, London.

21: HM The Queen marks 40th anniversary of the RAF Regiment with a review at RAF Wittering.

23: Secretary of State for Defence John Nott opens the new £1m Sea Eagle Development Building at Hatfield, purpose-built for the new generation sea-skimming anti-ship missile.

July

15: "Rescue Nine Zero", a fictionalised re-enactment of a real-life incident involving a Sea King of No 202 Squadron portrayed by a crew from the squadron's flight at RAF Brawdy, wins a Gold Award from the British Industrial and Scientific Film Association. The film tells the story of 22 survivors from the blazing Swedish freighter *Finneagle*,

winch to safety in the teeth of 70-ft (21,3-m) waves and high winds. One George Medal, one Air Force Cross, one Air Force Medal and two Queen's Commendations awarded as a result of this action.

18: Sixty years after its first tour of duty on a Royal Navy ship, No 4 Squadron RAF is back with the Senior Service again — to see Britain's latest carrier HMS *Illustrious* on her way to her first commission. The first occasion was back in 1922, when No 4 deployed on the Royal Navy's first purpose-built carrier, HMS *Argus* and formed part of the Army of Occupation in Constantinople. This time a training detachment of six RAF GR Mk 3 Harriers from RAF Gütersloh helps *Illustrious* with her work-up trials while RN Sea Harriers are committed to operations in the South Atlantic.

31: First airman to swim the English Channel is Glaswegian SAC Ron MacDonald, an Officers' Mess steward at RAF Finningley.

August

2: No 4624 (County of Oxford) RAF Movements Squadron formed at Brize Norton as a unique unit to provide reinforcements to any movements organisation in the UK or overseas in time of emergency.

6: World's only airworthy Sunderland flying boat *Excalibur VIII* arrives in the Thames to help boost the South Atlantic Fund. Built in 1944, the aircraft served with No 201 Squadron. It is greeted overhead by a Nimrod maritime reconnaissance aircraft of the same squadron, crewed by men recently returned from the Falklands.

11: New operational commander of the UK air defence force is Air Vice-Marshal Kenneth Hayr. The new AOC No 11 Group is the first New Zealander in the post since Air Vice-Marshal Keith Park during the Battle of Britain.

26: Officers at RAF Stanley hold their first inaugural dining-in night under canvas — in combat dress and wellington boots with the addition of black sticky tape bow-ties to add a touch of sartorial elegance.

September

1: RAF forms its second Chinook squadron, No 7, at RAF Odiham.

4: No 63 Squadron RAF Regiment returns to RAF Gütersloh after three months' service in the Falklands. The presence of the squadron's Rapier missiles was a strong deterrent to Argentine aircraft threatening the Goose Green airstrip.

Group Captain Sir Douglas Bader, who died following an Aircrew Association function in London, described by Air Chief Marshal Sir Michael Beetham, Chief of the Air Staff, as "truly a national hero in every sense".

By the end of 1982, Tornados were in the hands of two famous RAF bomber squadrons — No 9 (left) and No 617 (right) — and were working up to full operational status.

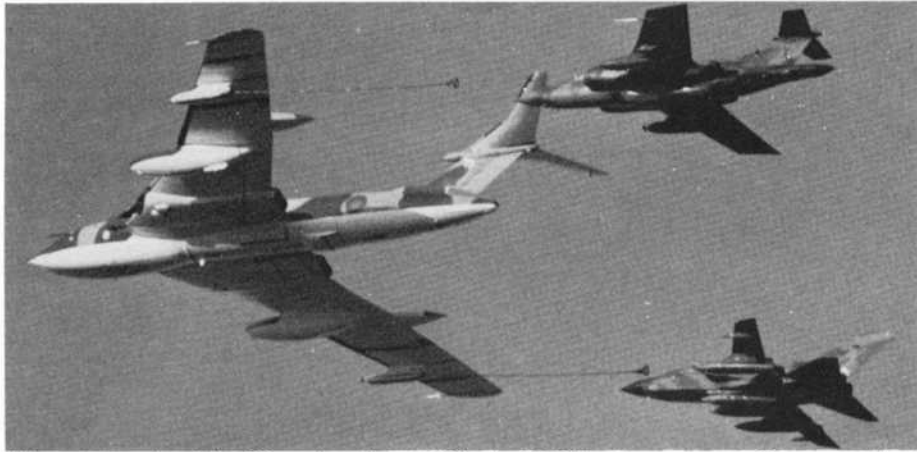


(Above) A Vulcan B Mk 2 of No 44 Squadron makes a farewell fly-past over its home base, RAF Waddington. During the year, five Vulcan bomber squadrons disbanded: No 35 in February, No 27 in March, No 9 in April, No 101 in August and No 44 in December.



(Above) Eight Harriers from Nos 3 and 4 Squadrons at RAF Gütersloh participated in the 1982 "Maple Flag" exercise in Canada during July. (Below) During Strike Command's "Exercise Mallet Blow", Buccaneers of No 15 Squadron at RAF Laarbruch joined with F-111Es of the USAF's 79th Tactical Fighter Squadron at RAF Upper Heyford to form an attacking force.





When a Tornado of No 9 Squadron flew 4,600 mls (7 400 km) non-stop to Cyprus and back in November, it refuelled from a Victor tanker and — during a low-level tactical phase of some 600 mls (965 km) — by a Buccaneer in the combat refuelling mode.

7: Air Defence of the United Kingdom and Denmark to be strengthened through the purchase of four Marconi Martel 3D radars at a cost of over £20m.

12: Memorial Service to mark centenary of Lord Dowding, Commander-in-Chief of Fighter Command during the Battle of Britain, held at his home town of Moffat, Dumfriesshire.

19: First interdenominational Battle of Britain Service at Stanley Cathedral attended by Senior RAF Officer and Station Commander RAF Stanley, Group Captain Bill Wratten.

October

12: Vulcans, Victors, Nimrods, Harrier GR Mk 3s, Hercules and a VC10 among aircraft

taking part in spectacular fly-past during the City of London's Salute to the Task Force.

13: Twelve "in theatre" gallantry awards made to members of the RAF in the Honours for the South Atlantic Campaign, including a DSC for Flight Lieutenant David Spencer, who flew 50 operational sorties as a Sea Harrier pilot with No 899 Naval Squadron.

15: Retirement of Air Chief Marshal Sir Michael Beetham, longest serving Chief of the Air Staff since Lord Trenchard. Succeeded by Air Chief Marshal Sir Keith Williamson and appointed Marshal of the Royal Air Force.

November

10: RAF Tornado of No 9 Squadron RAF

Honington flies non-stop to Cyprus and back — a 4,300-mile (6 920-km) flight with the aid of in-flight refuelling by Victor and Buccaneer tanker aircraft.

14: Group Captain Joan Hopkins appointed the RAF's first woman commander of an operational station — at RAF Neatishead, near Norwich.

30: HRH The Duke of Edinburgh visits RAF Bruggen.

December

1: Formation of CHIRP, the Confidential Human Factor Incident Reporting Procedure for commercial airline pilots, introduced by the RAF Institute of Aviation Medicine.

9: Gliding's top award, the Lilienthal Medal, presented by HRH Prince Andrew to three-times-running world champion Squadron Leader George Lee.

14: Decision to purchase six ex-British Airways TriStar 500 long-range airliners for conversion into strategic tankers announced as part of the post-Falklands £1,000m spending package. These will provide a massive increase in air-to-air refuelling capacity. Other Government orders included five more Chinook helicopters (apart from replacement of Falklands losses), a squadron of ex-US Navy F-4J Phantoms, and 24 more Rapier fire units for the RAF and Army.

16: Christmas party for 60 local children given by the Catering Squadron at RAF Stanley.

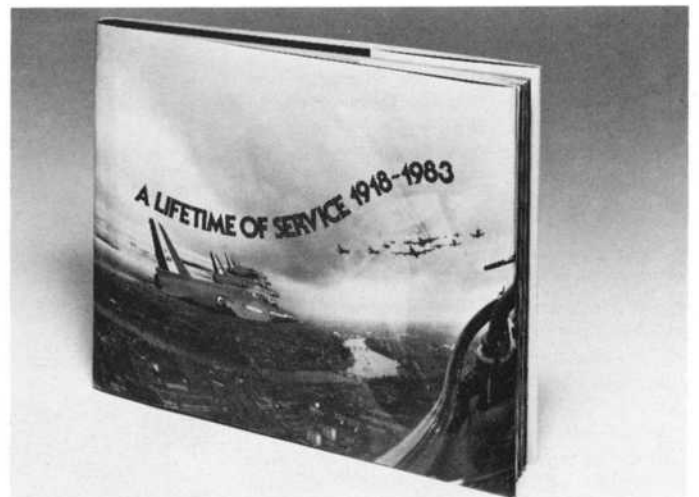
22: RAF orders two of Britain's latest airliner, the BAe 146, to evaluate their suitability as replacements for the ageing Andovers of The Queen's Flight.

"A Lifetime of Service 1918-1983"

ON 1 April 1983 — coincident with the publication of this edition of the Yearbook — the Royal Air Force is 65 years old. Thus, the youngest of Britain's three Services has completed "a lifetime of service", and the anniversary is marked by publication of a handsome volume of the same title.

This lavishly illustrated book, which includes more than 125 colour plates, sets out to create a pictorial record of the Royal Air Force from its foundation on 1 April 1918 to the day of its 65th birthday. These illustrations include photographs as well as paintings, selected from a wide range of available material to meet the criteria of covering the most interesting, nostalgic, important and dramatic of the endeavours — and achievements — of the Service. The majority of the illustrations, as one would expect, depict aircraft; others illustrate different aspects of life in the Royal Air Force, as it was or as it now is. Thus, the book embraces a wide range of activities and many of the achievements of the Service from the First World War to the Falklands Operation in 1982.

Each photograph or painting, carefully reproduced by the best of contemporary processes, is supported by an extensive caption,



The dust jacket of "A Lifetime of Service 1918-1983" (above) reproduces a unique photograph by Arthur Gibson showing the RAF formation crossing London to mark the Silver Jubilee of HM Queen Elizabeth II. By way of contrast, the first illustration in the book (left) shows a Bristol F2B Fighter and pilots of No 22 Squadron photographed at Vert Galand, in France, on the day the RAF was formed, 1 April 1918.

responsibility for the accuracy of which rests with Eric Munday of the RAF Air Historical Branch, while that organisation's head, Air Commodore Henry Probert, has written the historical introduction.

The foreword to "A Lifetime of Service 1918-1983" has been written by Marshal of the Royal Air Force the Rt Hon Lord Elworthy, KG, GCB, CBE, DSO, MVO, DFC, AFC, MA. Published by Seagull SA of Guernsey, CI, it is the copyright of the RAF Benevolent Fund, which will benefit from the proceeds on the sale of each copy. The volume is available through booksellers, price £15.00 or direct from the RAF Benevolent Fund, 67 Portland Place, London W1N 4AR for £12.50 including postage and packing.

VICTORY in the DESERT



The 13th of May 1943 marks the fortieth anniversary of the Axis surrender in Tunisia. For both sides, Allied and Axis, the campaign in North Africa had been fraught with difficulty wrought by operating conditions and over-extended lines of supply. Reputations of generals had been broken in the to-and-fro of three years of fighting, wherein air power played a substantial part in victory. W J A "Tony" Wood here provides an account of the air fighting that culminated in the Allied victory in 1943.

LIFE was not wholly unpleasant for the pilots and ground crews of the units assigned to Air Marshal Sir William Mitchell's RAF Middle East Command in the early months of 1940, when World War II was not yet one year old. With its headquarters located in Cairo, the boundaries of this extensive command stretched south to Kenya and east to the borders of the Indian subcontinent to encompass Iraq, Palestine, Trans-Jordan, Aden and the deserts of the Sudan. The heat, the flies, the vagaries of Middle Eastern cuisine, warm beer and the ever-present sand that was the bane of every Warrant Officer and Flight Sergeant on the line, could be tolerated — and perhaps even the boredom, in this last sprawling backwater of the old Empire. But, in May 1940, the pace of war accelerated with the launching of the German *blitzkrieg* in France and the headlong advance of the *panzers* to the Channel coast. Then, on 10 June, came Mussolini's belated declaration of war against Britain and France.

Italian garrisons in Libya alone amounted to 215,000 men, and these now faced some 36,000 troops of General Sir Archibald Wavell's command in Egypt. The staff of RAF Middle East Command, now led by Air Marshal Sir Arthur Longmore, had been unable to glean information as to the *Regia Aeronautica's* order of battle through reconnaissance, because of the British government's insistence that Italy should not be antagonised. However, it was estimated that more than 200 Italian bombers and 250 fighters were based on airfields in Libya and Cyrenaica. To apply pressure on these forces, therefore, the commander of No 202 Group, Air Commodore Raymond Collishaw, took the initiative with characteristic gusto.

Eight Blenheim Mk I light bombers of No 45 Squadron swept at 50 ft (15 m) from out of the dawn haze on 10 June, to attack the Italian base at El Adem with total surprise: the bombers made a number of passes, strafing lines of immaculately parked Fiat CR.42 fighters and dropping 250-lb (110-kg) HE and 50-lb (24-kg) bombs on the various dispersals. No fighter reaction was experienced, thanks, no doubt, to the fact that the *Duce* had neglected to inform the Italian *Comando Supremo* in North Africa of the state of war. Flak opened up, however, and one Blenheim crashed into the sea off Tobruk; a second was written off in a crash near Sidi Barrani. While the raid was in progress, No 211 Squadron made a reconnaissance of the front line, and No 33 Squadron's Gladiator Mk Is were up on an uneventful patrol at 06.00 in the Mersa Matruh-El Daba area. The Lysanders of

No 208 (AC) Squadron were also active at dawn in the Fort Maddalena-Sollum sector to the front of the 7th Armoured Division's positions.

Limited resources

At this time there was a desperate need for modern equipment within RAF Middle East Command. Available in Egypt, with some assistance from RAF Palestine and Trans-Jordan, were 63 Gloster Gladiators, one Hawker Hurricane Mk I, 73 Bristol Blenheims, 24 Bristol Bombays and Vickers Valentias, 24 Westland Lysanders and 10 Sunderland Mk I flying boats. The Gladiator Mk I fighters, armed with four 0.303-in (7.7-mm) Browning machine guns and capable of 255 mph (410 km/h), equipped Nos 33, 112 and 80 Squadrons; Nos 113, 45, 211, 55, 11 and No 30 Squadron in reserve were equipped with Blenheim Mk Is that were considered to be slower than the Italian Savoia-Marchetti SM.79 bombers. But over the following weeks a steady supply of newer types, including Hurricane Mk IAs, Blenheim Mk IVs and Vickers Wellington ICs, arrived. Despite the numerical superiority of the *Regia Aeronautica*, the balance of power was maintained by this influx, and by the good operational standards of pilots and crews. Over the battle line, the Gladiator proved a match for the Fiat CR.42 and the Macchi MC.200 which arrived on Italian squadrons in the course of September.

The long awaited Italian offensive broke on 13 September 1940, with Marshal Graziani's forces advancing into Egypt to take Sollum and Sidi Barrani. By this time, No 274 Squadron had been formed, and Nos 33 and 208 Squadrons had been re-equipped with Hurricane Mk IAs: the Australian No 3 (RAAF) Squadron was given Gladiator Mk II fighters. The fighter's duties included the defence of the Nile Delta and the naval base at Alexandria, offensive sweeps over the Italian lines, and escorts of army co-operation Lysanders and light bombers; the Blenheims flew frequent sorties against enemy airfields, troop concentrations and against road traffic on the all-important highway (the only one!) that ran from Tripoli to Alexandria; the Wellingtons operated mainly by night against the ports of Tobruk and Benghazi. Thus was the pattern of operations set for the next three years, with the opposing air forces supporting their respective ground forces during the lulls, and during the frequent offensives and counter-offensives. Above all, the war in North Africa



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was to be a war of the supply lines, with first one side and then the other pressing forward until it came to the limit of its lines of communication and supply and then halting.

Wavell's first offensive

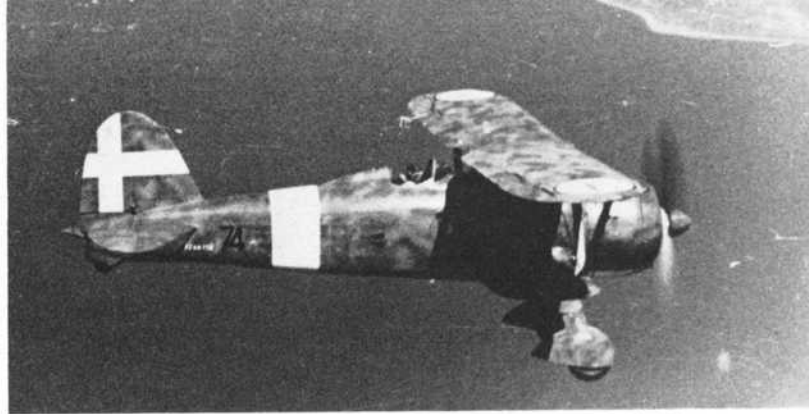
Ten squadrons of light bombers and fighters, and two of army co-operation aircraft were at Collishaw's disposal for the support of the first British offensive, which started on the morning of 9 December 1940. As a prelude to this Operation *Compass*, medium-level fighter sweeps were flown by Nos 33, 112 and 274 Squadrons on the 8th, primarily to secure air supremacy over the Fiat CR.42s of 2° and 4° *Stormi CT* in the El Adem-Tobruk sector: during the night Blenheims and Wellington ICs, assisted by No 216 Squadron's Bombay Is, bombed tactical objectives at Bardia, Buq Buq, Tobruk and Maktila. The offensive, led by General Richard O'Connor's 7th Armoured Division, exceeded all expectations: opposition by low-key Italian forces was broken, and Graziani's units broke and fled: 30,000 Italian prisoners and the bulk of their equipment were taken at Tobruk on 22 January 1941, with British and Commonwealth forces in a headlong advance. Of the *Regia Aeronautica* little was seen. By 7 February, Msus, Beda Fomm and the key seaport of Benghazi had been taken, and two days later the 7th Armoured's leading echelons reached El Agheila, on the border of Tripolitania, a distance of over 500 miles (805 km) from the starting off point. It was a massive Italian defeat, achieved with a force of small proportions: over 130,000 POWs, 400 tanks and 850 artillery pieces fell into British hands, whilst on the airfields at El Adem, El Gubbi, Acroma, Tmimi, Martuba, Derna, Barce and many others the wrecks of one thousand Italian aircraft were found abandoned. It was to be a blow from which the *Regia Aeronautica* never recovered. The triumph of "Wavell's Thirty Thousand" in Libya in that dark winter of 1940-41 was a great morale fillip for the people at home, but in this extraordinary war in North Africa nothing remained static for long.

The Luftwaffe arrives

Italian reverses in Greece and North Africa forced Hitler to intervene: in December 1940 *Generalleutnant* Hans-Ferdinand Geisler's X *Fliegerkorps*, an anti-shipping command drawn from Norway with Junkers Ju 87B-2 Stukas and Ju 88A-5 bombers, established itself in Sicily to bring pressure upon Malta's limited fighter defences, and to close the Sicilian Narrows to British shipping. On 14 February, General Erwin Rommel arrived in Tripoli at the head of the nucleus of the *Afrika Korps*: the air forces at his disposal initially comprised a force of Messerschmitt Bf 110D-3s (*III/ZG 26*) and the Stukas of *I/StG 1*, with a small reconnaissance detachment. The aim of the *Luftwaffe* was two-fold: first to attack British convoys and second to break up the concentrations of tanks and troops in western Cyrenaica.

Over North Africa, the *Luftwaffe* was in evidence as early as 10 February, when airfields in Cyrenaica came under attack by Ju 87s and Bf 110s, while Ju 88A-5s from Sicily raided Benghazi. Tobruk now became the main supply port for Wavell's over-stretched forces. No 3 (RAAF) Squadron moved to Benghazi from Benina, whilst the defence of Tobruk fell to AA and "A" Flight No 73 Squadron, assisted by the wireless and radar of Nos 216 and 235 MRUs, at El

(Above right) No 112 Squadron, well-known for its exploits with Tomahawks and Kittyhawks during the Desert War, also had Gladiators on its strength in Egypt in 1941. (Below) No 3 Squadron, R Australian AF, also flying Gladiators in Egypt in 1940, took these ex-RAF Gauntlets on strength, achieving at least one air-to-air victory with them over a Caproni Ca.133.



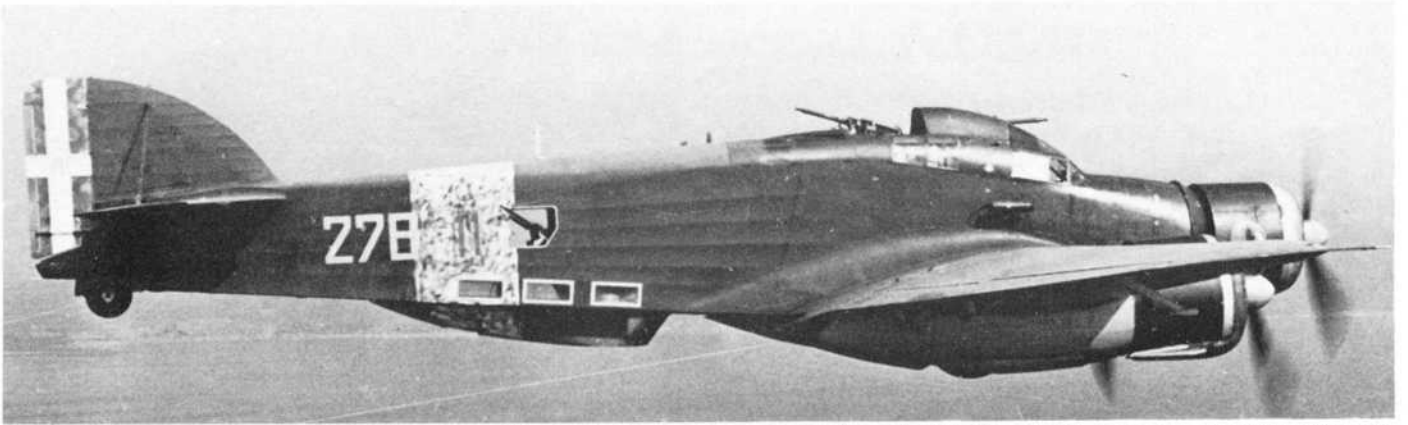
(Above) Fiat CR.42s, serving with the Italian Air Force in 1940-41, confronted the RAF's even more elderly Gladiators. Illustrated is a CR.42 of the 74° Squadriglia (18° Gruppo) on convoy escort duty off Sicily. (Heading photo, page 59) A Kittyhawk of No 112 Squadron RAF, with the well-known Shark's Mouth marking.

Adem. Conditions at Benghazi were soon chaotic and the port's facilities were unable to be used.

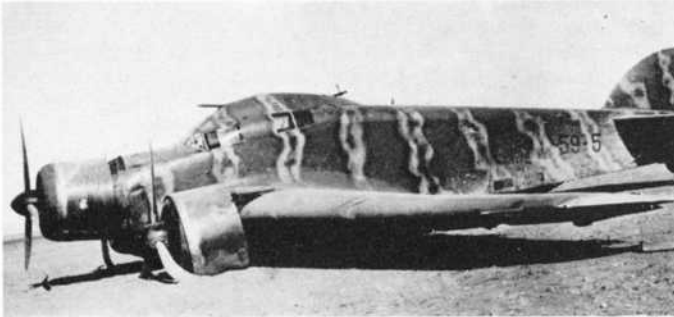
After three weeks of probing, the *Afrika Korps* commenced its forward drive from El Agheila on 31 March: at 06.00 the 2nd Armoured Division sighted German reconnaissance forces on the El Agheila road heading east, and RAF aircraft brought back news of over 200 PzKw IIs, armoured cars and MT debouching to the east of Brega Mersa. At 08.45 Blenheims of No 55 Squadron attacked convoys at El Malah, and bombed Misurata airfield to engage enemy fighters: the Gladiators of No 3 (RAAF) Squadron patrolled the front lines but made no contact. Six Ju 87s of *I/StG 1* dive-bombed the HQ 3rd Armoured Brigade at 13.30 on the following day, without interference from RAF fighters, with No 55 Squadron again in action against the Ras Lanuf landing grounds. But the Axis advance continued unchecked, and the weakness of RAF forces was now exposed, despite the movement of Nos 45 and 274 Squadrons from Egypt into bases in Cyrenaica.

By 5 April, Rommel had advanced to Mechili: three days later the 9th Australian Division pulled back from Gazala to Acroma, near Tobruk. By this stage all air units were placed under No 204 Group (HQ Maaten Bagush: advanced HQ at Tobruk), which controlled No 3 (RAAF) Squadron at LG.79, south of Buq Buq, No 6 Squadron at Tobruk West, the Blenheims of Nos 45 and 55 Squadrons at Qasaba and Maaten Bagush, and No 73 Squadron's Hurricanes at El Gubbi. The Germans now concentrated on encircling Major General L J





(Above) The Savoia-Marchetti SM.79 bombers of the Regia Aeronautica were much used in the Desert War, against land and naval targets. (Below left) This SM.79 of the 59^a Squadriglia lost its undercarriage when it swung on take-off at a Libyan airfield in November 1940.



Morshead's 9th (Aus) Division within the Tobruk perimeter. On 11 April the *Deutsches Afrika Korps* cut the Acroma-El Adem road and launched its first assault on the Tobruk defences at 18.00 hours: in the air, No 73 Squadron fought Bf 110s, with Nos 45 and 55 Squadrons bombing and strafing MT and troops on the Tobruk-Acroma highway. The *Luftwaffe* made its first determined attack on Tobruk on the 14th, when 70+ Ju 87s escorted by Fiat G.50s and Bf 110s dive-bombed troops, defensive positions and command posts: the eight serviceable Hurricane Mk IAs of No 73 Squadron flew 34 sorties during the day to lose four of their number. The defences of Tobruk remained intact, and the Australian garrison repulsed numerous attacks, settling down into a state of siege that was to endure for the next seven months. Hindered by difficulties in supply and communications, Wavell's Western Desert Force was pushed backwards: by 25 April, with the loss of Halfaya Pass, the British retired to the defensive positions at Mersa Matruh, on the Egyptian border.

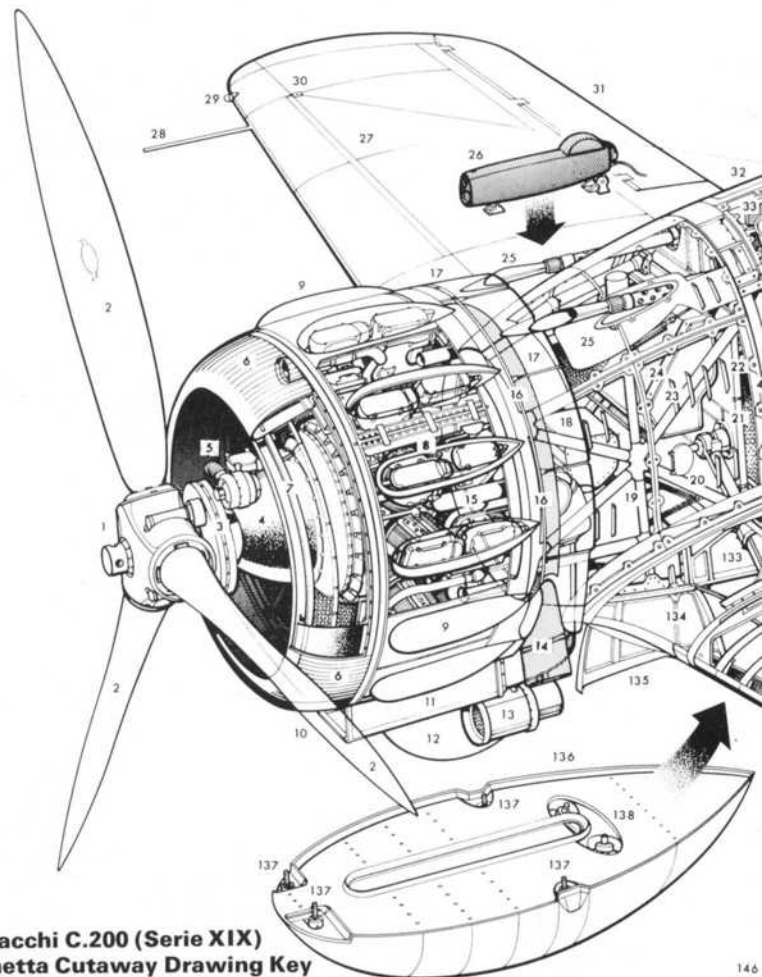
Failure of Brevity and Battleaxe

During April 1941, the Germans invaded Yugoslavia and Greece: in the campaign *Luftflotte 4* was assisted by Geisler's *X Fliegerkorps*. Pressure upon Malta was therefore eased, to permit air and naval strike forces to hammer at the Axis convoy routes to North Africa. It was now Rommel's turn to feel the strictures placed upon him by the lack of reinforcements and supplies. Tobruk remained under siege, and the *Afrika Korps* went over to the defensive: the small German air component was now led by *Generalmajor* Stefan Fröhlich as the *Fliegerführer Afrika* (Commander Air Africa). At his request the *I/JG 27*, equipped with Messerschmitt Bf 109E-7/Trop fighters, arrived at Ain-el-Gazala during the month. These, armed with two 20-mm MG-FF/M cannon and two 7.9-mm MG 17 machine guns, and capable of 357 mph (574 km/h) at 22,000 ft (6 700 m), outclassed the Hurricane Mk IA on every count save for the maximum-rate turn. Hurricanes, although sturdy, were capable of no more than about 325 mph (522 km/h) at rated altitude, because of the bulky Vokes tropical filter.

In the tactical desert war the importance of fighter cover was paramount, for without it the enemy was permitted to use his own dive-bombers and bombers to maximum effect, and give valuable support to his own ground forces. The priority accorded to RAF Middle East still remained low, even in 1941, and as a result the supply of fighters was restricted to those which were considered obsolescent in northern Europe. Added to this, Hurricanes and Curtiss P-40 (Tomahawk Mk Is) arrived in crates, or were later ferried via the difficult Lagos-Khartoum route, and were therefore not in pristine condition. German reinforcements on the other hand were

usually flown down via Bari or Lecce, in Italy, to Sicily and thence to North Africa. So by May-June 1941 at least *Fliegerführer Afrika* could count on a ready supply of Bf 109E-7s for *I/JG 27* and *7./JG 26*, amounting to a force of about 45 fighters. The *Luftwaffe* was at pains to maintain technical superiority, and in September the first Messerschmitt Bf 109F-2/Trops arrived which were capable of 373 mph (600 km/h) at 19,685 ft (6 000 m). These came with *II/JG 27*, fresh from the Russian Front, to bolster fighter strength in the desert to about 60. The doleful influence of the Bf 109F was to be felt by the pilots of RAF Middle East Command over the western desert for the next year.

The arrival of the important "Tiger" convoy on 12 May 1941, loaded with tanks and aircraft, enabled the British to go over to the



Macchi C.200 (Serie XIX) Saetta Cutaway Drawing Key

- | | |
|---|---|
| 1 Propeller hub | 8 Fiat A.74 R.C.38 14-cylinder radial air-cooled engine |
| 2 Variable-pitch Piaggio P.1001 propeller | 9 Cowling rocker arm fairings |
| 3 Hub plate | 10 Carburettor intake |
| 4 Casing | 11 Intake housing |
| 5 Pitch control mechanism | 12 Starboard mainwheel |
| 6 Oil radiator | 13 Intake filter |
| 7 Cowling ring | 14 Exhaust outlet |



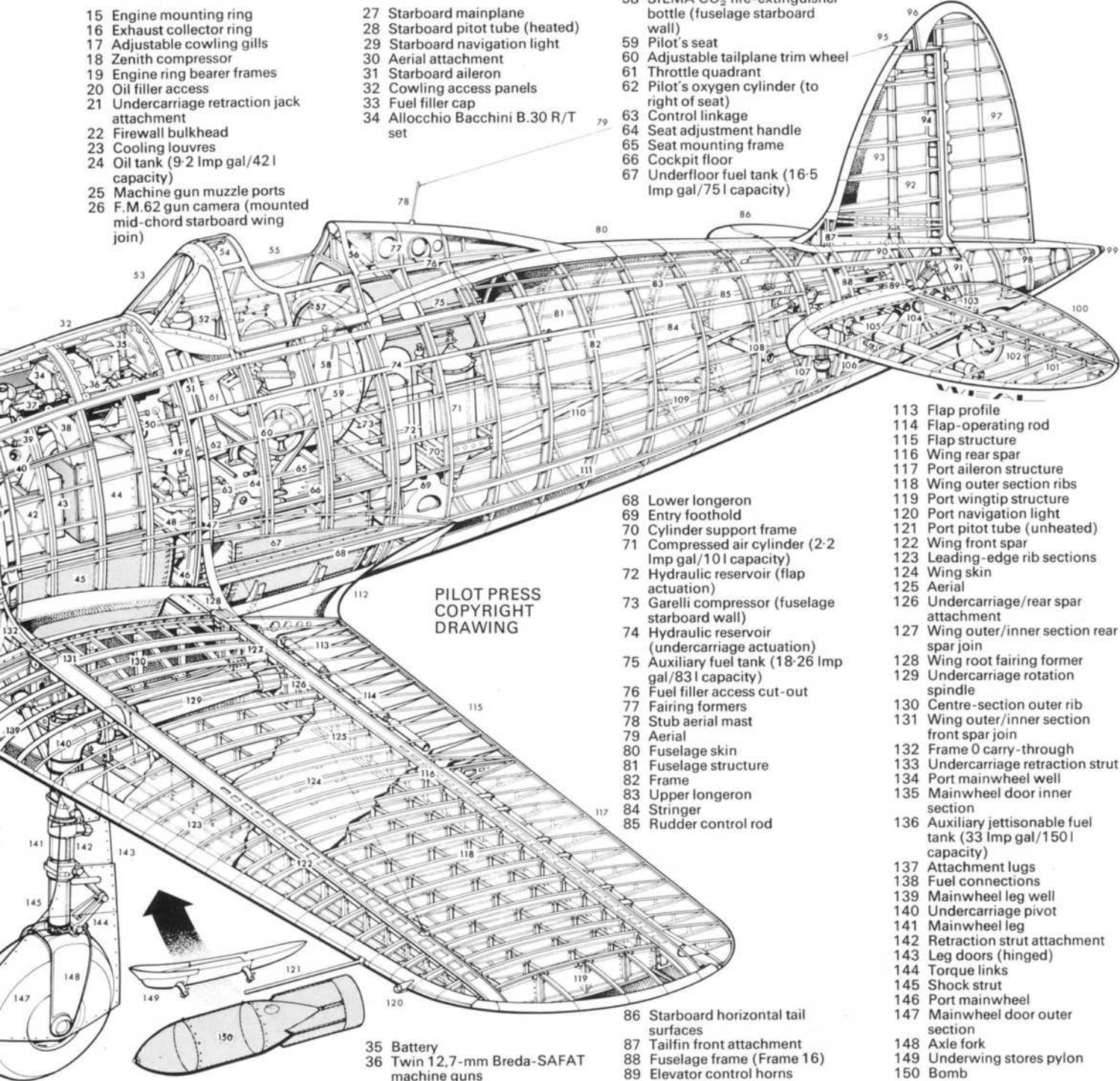
The Macchi MC.200 — also the subject of the cutaway drawing below — was in action early in the North African campaign; its wide undercarriage track, well illustrated in the photograph above, proved valuable during operations from rough airfields in Libya.

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- 23 Cooling louvres
- 24 Oil tank (9.2 Imp gal/42 l capacity)
- 25 Machine gun muzzle ports
- 26 F.M.62 gun camera (mounted mid-chord starboard wing join)

- 27 Starboard mainplane
- 28 Starboard pitot tube (heated)
- 29 Starboard navigation light
- 30 Aerial attachment
- 31 Starboard aileron
- 32 Cowling access panels
- 33 Fuel filler cap
- 34 Allocchio Bacchini B.30 R/T set

- 37 Gun synchronisation mechanism
- 38 Link and case ejector chute
- 39 Gun mounting arm
- 40 Ammunition feed chute
- 41 Fuselage forward frame (Frame 0)
- 42 Supplementary magazine
- 43 Ammunition magazine
- 44 Link/spent case collector
- 45 Main fuel tank (52.3 Imp gal/238 l capacity)
- 46 Centre-section rear spar carry-through
- 47 Fuselage frame (Frame 4)
- 48 Rudder pedal/heel rest assembly
- 49 Control column
- 50 Aerial attachment
- 51 Instrument panel
- 52 San Giorgio reflector gunsight
- 53 Windscreen
- 54 Canopy side-panel lock/release
- 55 Cutaway canopy side-panels
- 56 Turnover pylon structure
- 57 Side vision blisters
- 58 SILMA CO₂ fire-extinguisher bottle (fuselage starboard wall)
- 59 Pilot's seat
- 60 Adjustable tailplane trim wheel
- 61 Throttle quadrant
- 62 Pilot's oxygen cylinder (to right of seat)
- 63 Control linkage
- 64 Seat adjustment handle
- 65 Seat mounting frame
- 66 Cockpit floor
- 67 Underfloor fuel tank (16.5 Imp gal/75 l capacity)

- 90 Tailplane attachment (Frame 17)
- 91 Fuselage aft frame (Frame 18)
- 92 Tailfin structure
- 93 Support tube
- 94 Rudder post
- 95 Aerial attachment
- 96 Rudder balance
- 97 Rudder frame
- 98 Tail cone
- 99 Tail navigation light
- 100 Port elevator
- 101 Port tailplane structure
- 102 Non-retractable tailwheel
- 103 Tailwheel shock strut
- 104 Tailplane incidence torque tube (+1° 45' to -5° 30')
- 105 Tailplane support tube
- 106 Tailwheel strut attachment
- 107 Tailplane incidence screw
- 108 Lifting tube
- 109 Tailplane incidence control cables
- 110 Elevator control rod
- 111 Lower longeron
- 112 Wing root fillet



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- 68 Lower longeron
- 69 Entry foothold
- 70 Cylinder support frame
- 71 Compressed air cylinder (2.2 Imp gal/10 l capacity)
- 72 Hydraulic reservoir (flap actuation)
- 73 Garelli compressor (fuselage starboard wall)
- 74 Hydraulic reservoir (undercarriage actuation)
- 75 Auxiliary fuel tank (18.26 Imp gal/83 l capacity)
- 76 Fuel filler access cut-out
- 77 Fairing formers
- 78 Stub aerial mast
- 79 Aerial
- 80 Fuselage skin
- 81 Fuselage structure
- 82 Frame
- 83 Upper longeron
- 84 Stringer
- 85 Rudder control rod

- 113 Flap profile
- 114 Flap-operating rod
- 115 Flap structure
- 116 Wing rear spar
- 117 Port aileron structure
- 118 Wing outer section ribs
- 119 Port wingtip structure
- 120 Port navigation light
- 121 Port pitot tube (unheated)
- 122 Wing front spar
- 123 Leading-edge rib sections
- 124 Wing skin
- 125 Aerial
- 126 Undercarriage/rear spar attachment
- 127 Wing outer/inner section rear spar join
- 128 Wing root fairing former
- 129 Undercarriage rotation spindle
- 130 Centre-section outer rib
- 131 Wing outer/inner section front spar join
- 132 Frame 0 carry-through
- 133 Undercarriage retraction strut
- 134 Port mainwheel well
- 135 Mainwheel door inner section
- 136 Auxiliary jettisonable fuel tank (33 Imp gal/150 l capacity)
- 137 Attachment lugs
- 138 Fuel connections
- 139 Mainwheel leg well
- 140 Undercarriage pivot
- 141 Mainwheel leg
- 142 Retraction strut attachment
- 143 Leg doors (hinged)
- 144 Torque links
- 145 Shock strut
- 146 Port mainwheel
- 147 Mainwheel door outer section
- 148 Axle fork
- 149 Underwing stores pylon
- 150 Bomb

- 35 Battery
- 36 Twin 12.7-mm Breda-SAFAT machine guns

- 86 Starboard horizontal tail surfaces
- 87 Tailfin front attachment
- 88 Fuselage frame (Frame 16)
- 89 Elevator control horns



The RAF's transport component in North Africa depended heavily, in 1940-41, upon the Bristol Bombay (left) which had been built to a bomber-transport specification and did make a few bombing missions, as well as fulfilling a transport task. No 216 Squadron, which flew the Bombays, also operated the venerable Vickers Valentia biplanes; that shown (right) came to grief during the campaign.

offensive in May and June. The first action, termed Operation *Brevity*, took place on 15 May with the aim of recapturing the Halfaya Pass, but it was repulsed. For Operation *Battleaxe*, Wavell mustered all available forces for the relief of Tobruk. Air Marshal A W Tedder, who assumed command of RAF Middle East in May, fielded four Hurricane squadrons, one Tomahawk Mk Ib squadron, two Blenheim and one Maryland squadrons, and three squadrons and one flight of Vickers Wellington Mk IC bombers for the offensive, in addition to some Tac/R units. This force, amounting to 244 aircraft, gave support for the offensive that started on 15 June: but this assault also foundered, largely because of the efficiency of German anti-tank defences that included 88-mm Flak 36 and 37-mm PaK 35/36 guns. The front line remained static, and both sides consolidated during the ensuing months.

Crusader and Riposte

From Malta, the 10th Flotilla's submarines and Swordfish torpedo-bombers of the Fleet Air Arm, joined by Blenheim IVs and Wellingtons, carried out unremitting attacks on the Axis convoy routes from Italy to North Africa during the summer months: in September 1941, 11 Axis ships totalling 64,954 tons were sunk. An irate Rommel berated OKW over the loss of supplies and poured scorn on the Italian Navy: he threatened that no further offensives in the desert would take place unless the Malta problem was eradicated. In October *Generalfeldmarschall* Albert Kesselring's *Luftflotte 2*, then based on the central Russian Front, was ordered to prepare to move to Sicily: the transfer of units, under Loerzer's *II. Fliegerkorps*, took place during November and December. The *Stab/II. Fliegerkorps* took station in Messina with a strong force of Junkers Ju 88A-4 bombers and Bf 109F-4 fighters, while X.

Fliegerkorps was transferred to Crete and Greece. By January, the situation in Malta was almost untenable, the Allied strike forces moved out, and the Axis supply convoys to North Africa once again came through unscathed.

In the meantime, Wavell had been replaced by General Claude Auchinleck, and Tedder's Command had been re-organised and strengthened in preparation for a winter offensive. By October, RAF Middle East, excluding AHQ Malta, had 52 squadrons on strength, with 549 aircraft of which 380 were combat ready. The type of equipment still gave cause for concern: the Hurricane Mk I, IIA and IIB were consistently outfought by the Bf 109F, the Tomahawk IIb had proved to be disappointing, and was already scheduled for replacement by the Kittyhawk Mk I (P-40D and E), the production of the Maryland had ceased, causing a hiatus before the arrival of the more potent Martin Baltimore, the valuable Beaufighter Mk ICs were in very short supply, and to cap it all the desert conditions caused innumerable problems with the Wellingtons. Despite the difficulties, the pilots, crews and groundcrews continued to operate, while tactical co-operation with the Army was improved in efficiency. A specialist tactical air command was formed on 9 October 1941, when AHQ Western Desert (Desert Air Force) was established at Maaten Bagush under Air Vice-Marshal Arthur ("Mary") Coningham.

Aimed at raising the Tobruk siege and pushing the Axis back into Cyrenaica, Auchinleck's Operation *Crusader*, with the British 8th Army in the van, started on 18 December. The air forces under the Desert Air Force consisted of the following combat units: under AHQ Western Desert, Nos 60 (SAAF) and 1437 Flights (Maryland), No 39 Squadron (Beaufort I), No 203 Squadron (Blenheim IV) at Fuka; No 33 (LR Hurricane Mk I) and No 113 Squadron (Blenheim IVF) at Jarabub; and No 272 Squadron (Beaufighter Mk IC) at Gerwala. Under No 253 Wing (Tac/R), Nos 208 and 451 (RAAF) Squadrons with Hurricanes at Sidi Barrani, and No 237 (Rhodesian) Squadron with Hurricanes at Gerwala. The primary strike forces, equipped with Hurricanes, Tomahawks and Blenheim IVs, were located at Bir Khamsa and Sidi Haneish under Nos 258, 262 and 269 Wings with 18 squadrons, and one Royal Navy flight with Grumman Martlet Is. Six squadrons of Blenheim IVs, including the Free French Lorraine unit, were based at Fuka, Maaten Bagush and Abu Sueir under No 270 Wing. These forces gave very good support to the push, which, on this occasion, broke through weak Axis positions to raise the Tobruk siege (10 December), and to follow the usual route to the border of Tripolitania at El Agheila. So swift was the advance that both the Army and the RAF outran their lines of communication and supply. The losses to both sides were heavy: the RAF (including Malta's units) put up more than 12,000 sorties over the period 18 November 1941-20 January 1942, to lose about 300 aircraft. Cat E destroyed: the *Luftwaffe* lost 232 from all causes, with about 100 being lost by General Amione-Cat's *V. Squadra*, the Italian component in Libya.

But these losses, for the Axis at least, were quickly made good while flooded airfields and unserviceable aircraft badly reduced the Desert Air Force's potency. At 08.00 hrs on 21 January 1942, the Axis struck back. Rommel's *Panzerarmee Afrika* consisted of the 15th and 21st *Panzer Divisionen* and the 90th (Light) Division, backed by the Italian formations including the Brescia, Bologna, Ariete and Pavia divisions: in all about 12,500 German and 25,000 Italian troops. The counter-offensive was characterised by little activity by the opposing air forces due to the rain, which alternated with haze and blinding dust storms. The gains of *Crusader* were ceded, and a

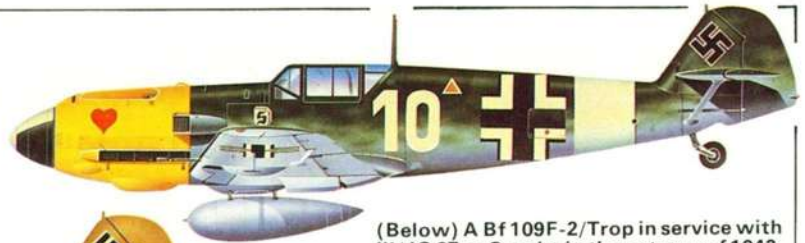


(Above) A Vickers Wellington IC of No 37 Squadron, operating in North Africa in 1941. (Below) Savoia-Marchetti SM.82 transports of the Regia Aeronautica.



(Right) A Messerschmitt Bf 109E-7 of III/JG 26 "Schlageter" operating from Gela, Sicily, in the spring of 1941.

(Below) Messerschmitt Bf 109F-4/Trop flown by II/JG 27 at Sanyet in September 1942.



(Below) A Bf 109F-2/Trop in service with III/JG 27 at Qasaba in the autumn of 1942.



(Left) A Junkers Ju 87B-2/Trop of 1./StG3 operating in North Africa in support of the Afrika Korps early in 1942 and (below) a Ju 87B-1/Trop in non-standard finish operating in Libya in mid-1942.



(Below) A Ju 88A-10 of 11 Gruppe, Lehrgeschwader 1 (II/LG 1), used in North Africa and later for anti-shiping operations in the Mediterranean from Crete.



(Above left) The Junkers Ju 52/3m was the transport workhorse in North Africa. This is a Ju 52/3m g6e of 2./KGzBV 102 operating under the command of KGzBV "N" (Naples).

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400-mile (640-km) retreat was made by the 8th Army all the way back to the Gazala-Bir Hacheim line, which was reached on 20 February.

Retreat to El Alamein

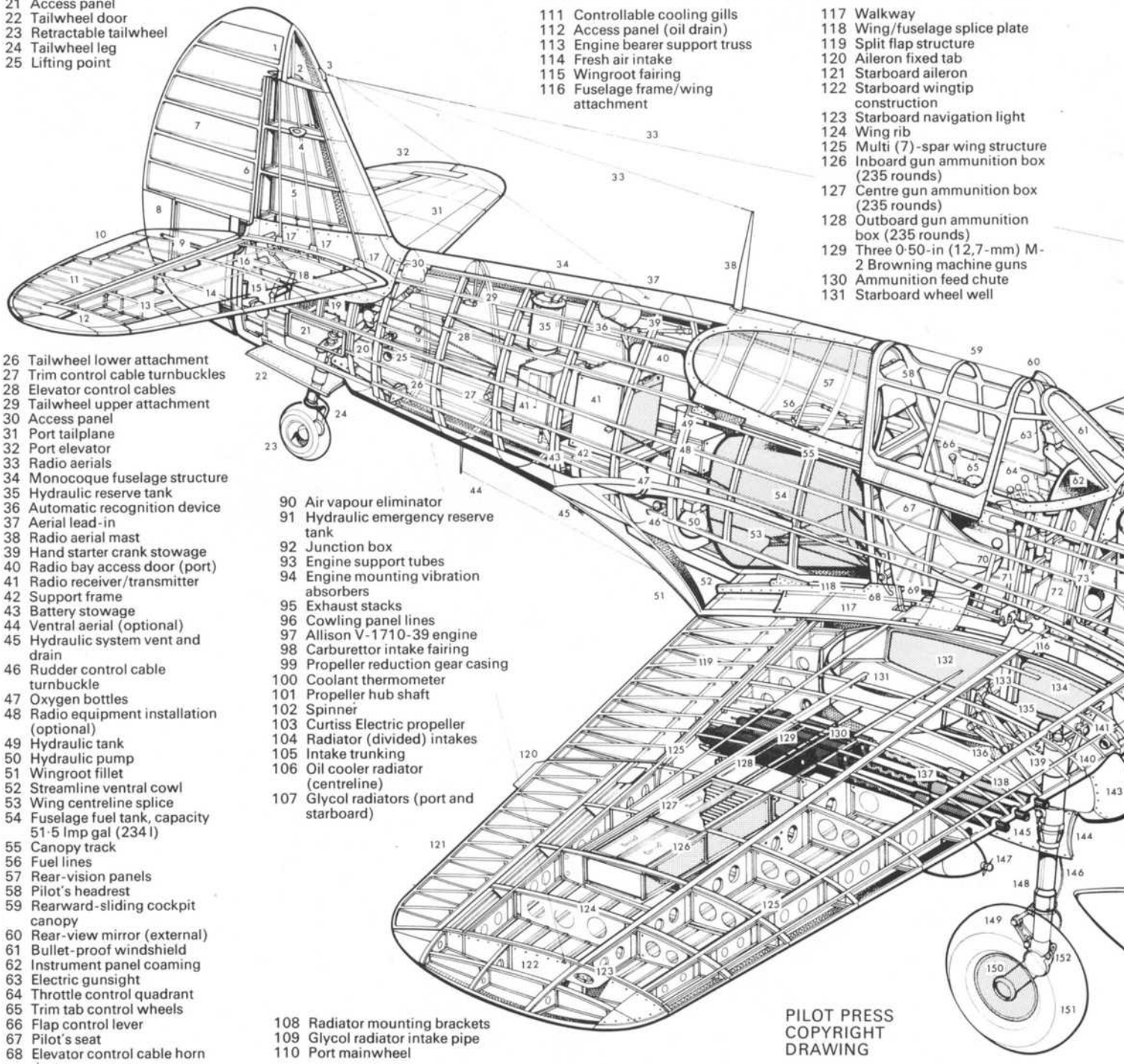
During the lull which lasted from late-February until May 1942, the strength of the Desert Air Force was weaker than it had been before the *Crusader* offensive. The heavy losses were made good only slowly, for what weak priorities had applied to the Force in particular and to RAF Middle East Command as a whole were further reduced by the demands of Malta and the Far East. Malta was in imminent danger of invasion and was being battered into a dangerous state of submission: therefore, the frugal supplies of Spitfire Mk VC fighters went to this beleaguered island. The crisis in the Pacific and the Far East had first call in the allocation of American equipment, upon which the Desert Air Force so much depended.

But Coningham's command did its best to make the maximum use of its limited forces and outmoded equipment. The fighter organisation was improved by the formation of No 211 Group (Gp Capt K B B Cross), which now controlled Nos 233, 239 and 243

(Fighter) Wings each with four or five squadrons. New measures included extra gunnery training, use of finger-four tactics to counter the dangerous Messerschmitt Bf 109F-4/Trops, better FAC (Forward Air Control), improved fighter-direction COL radars, and a high accent on ground attack and fighter-bomber techniques. With its headquarters at Maaten Bagush, in late-May 1942 the Western Desert air components consisted of No 15 (SAAF) Squadron at Amiriya and Kufra with Tac/R Blenheim IVs, Nos 40 (SAAF) and 208 Tac/R Squadrons with Hurricane Mk Is and Tomahawks at El Adem, the reconnaissance Nos 60 (SAAF) and 1437 Flights with Marylands at Sidi Barrani and Maktala, the Boston IIIs of Nos 12 and 24 (SAAF) Squadrons at Baheira, with No 233 Squadron's Baltimore Mk Is (Martin A-30A). Group Captain Cross' HQ No 211 Group was at El Adem, under which was No 233 (Fighter) Wing with Nos 2, 4 and 5 (SAAF) Squadrons and No 260 Squadron at Gambut with Tomahawks and Kittyhawks. Dusty Gambut hosted No 239 (Fighter) Wing with Nos 3 and 450 (RAAF) and Nos 112 and 250 (RAF) Squadrons equipped with Kittyhawk Mk Is. The Hurricane Mk IIAs and IIBs of Nos 33 and 274 Squadrons were also at Gambut under No 243 Wing, as was No 80 Squadron which was now

Curtiss P-40E Kittyhawk I Cutaway Drawing Key

- | | |
|--|---|
| 1 Rudder aerodynamic balance | 69 Seat support (wing surface) |
| 2 Rudder upper hinge (port external) | 70 Hydraulic pump handle |
| 3 Radio aerial bracket/insulator | 71 Control column |
| 4 Rear navigation light (port and starboard) | 72 Rudder pedal/brake cylinder assembly |
| 5 Tailfin structure | 73 Bulkhead |
| 6 Rudder post/support tube | 74 Oil tank, capacity 10.8 Imp gal (49l) |
| 7 Rudder structure | 75 Ring sight |
| 8 Rudder trim tab | 76 Flap control push-rod rollers |
| 9 Rudder trim tab push-rod (starboard external) | 77 Aileron control cables |
| 10 Elevator tab | 78 Aileron cable drum |
| 11 Elevator structure | 79 Aileron trim tab drive motor |
| 12 Elevator aerodynamic balance | 80 Aileron trim tab |
| 13 Tailplane structure | 81 Port aileron |
| 14 Rudder lower hinge | 82 Port navigation light |
| 15 Rudder control horn | 83 Pitot head |
| 16 Tab actuator flexible drive shafts | 84 Wing skinning |
| 17 Tailplane attachment lugs | 85 Ammunition loading panels |
| 18 Elevator control horn | 86 Bead sight |
| 19 Tab control rear sprocket housing/chain drive | 87 Coolant expansion tank, capacity 2.9 Imp gal (13l) |
| 20 Tailwheel retraction mechanism | 88 Carburettor intake |
| 21 Access panel | 89 Engine bearer support attachment |
| 22 Tailwheel door | |
| 23 Retractable tailwheel | |
| 24 Tailwheel leg | |
| 25 Lifting point | |



- | | |
|---|---|
| 26 Tailwheel lower attachment | 90 Air vapour eliminator |
| 27 Trim control cable turnbuckles | 91 Hydraulic emergency reserve tank |
| 28 Elevator control cables | 92 Junction box |
| 29 Tailwheel upper attachment | 93 Engine support tubes |
| 30 Access panel | 94 Engine mounting vibration absorbers |
| 31 Port tailplane | 95 Exhaust stacks |
| 32 Port elevator | 96 Cowling panel lines |
| 33 Radio aerials | 97 Allison V-1710-39 engine |
| 34 Monocoque fuselage structure | 98 Carburettor intake fairing |
| 35 Hydraulic reserve tank | 99 Propeller reduction gear casing |
| 36 Automatic recognition device | 100 Coolant thermometer |
| 37 Aerial lead-in | 101 Propeller hub shaft |
| 38 Radio aerial mast | 102 Spinner |
| 39 Hand starter crank stowage | 103 Curtiss Electric propeller |
| 40 Radio bay access door (port) | 104 Radiator (divided) intakes |
| 41 Radio receiver/transmitter | 105 Intake trunking |
| 42 Support frame | 106 Oil cooler radiator (centreline) |
| 43 Battery stowage | 107 Glycol radiators (port and starboard) |
| 44 Ventral aerial (optional) | |
| 45 Hydraulic system vent and drain | |
| 46 Rudder control cable turnbuckle | |
| 47 Oxygen bottles | |
| 48 Radio equipment installation (optional) | |
| 49 Hydraulic tank | |
| 50 Hydraulic pump | |
| 51 Wingroot fillet | |
| 52 Streamline ventral cowl | |
| 53 Wing centreline splice | |
| 54 Fuselage fuel tank, capacity 51.5 Imp gal (234l) | |
| 55 Canopy track | |
| 56 Fuel lines | |
| 57 Rear-vision panels | |
| 58 Pilot's headrest | |
| 59 Rearward-sliding cockpit canopy | |
| 60 Rear-view mirror (external) | |
| 61 Bullet-proof windshield | |
| 62 Instrument panel coaming | |
| 63 Electric gunsight | |
| 64 Throttle control quadrant | |
| 65 Trim tab control wheels | |
| 66 Flap control lever | |
| 67 Pilot's seat | |
| 68 Elevator control cable horn | |

- | |
|---------------------------------|
| 108 Radiator mounting brackets |
| 109 Glycol radiator intake pipe |
| 110 Port mainwheel |

mounted on the Hurricane IIC armed with four 20-mm cannon; No 73's Hurricanes operated from El Adem. Whilst not under its control, the Wellingtons of No 205 Group were at the call of the Desert Air Force: this Group also controlled Nos 252 and 272 Squadrons with Beaufighter ICs at Qasaba.

In the weeks of relative inactivity on the ground, these units flew regularly. The Wellingtons made nightly attacks on Benghazi where the *Flak* was heavy: the presence of I/NJG 2's Junkers Ju 88C-6 night fighters based at Derna and Barce was an added threat. By day Boston IIIs attacked the fields at Martuba, Tmimi, and Derna: bombing height was usually in the 8,000-10,000 ft (2 440-3 050 m) band to keep beyond the range of the 20-mm and the 37-mm *Flak* 18s, and an escort of Kittyhawks was the norm. Fighters flew offensive sweeps over the enemy lines, and often engaged I-III/JG 27 and III/JG 53 in combat. Beaufighters and LR Kittyhawks plied the Crete-Derna air bridge route, and found rich pickings amongst the low-flying Junkers Ju 52/3m transports.

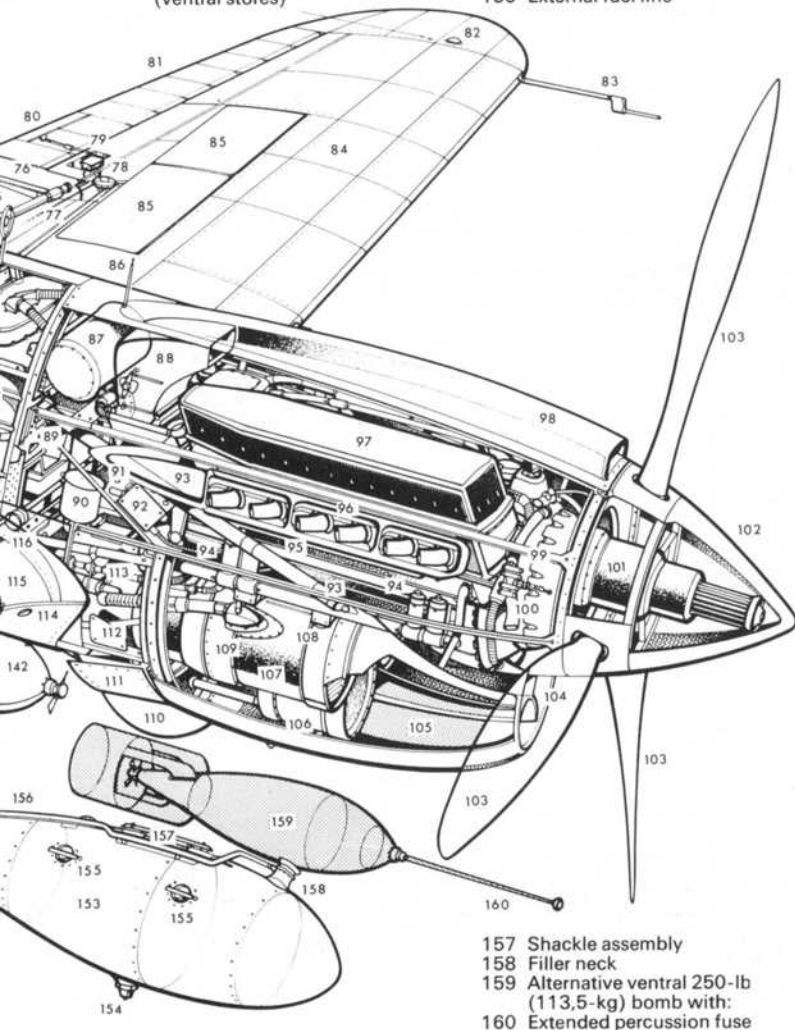
On 1 May 1942, at Berchtesgarden, Rommel was ordered to conduct an all-out offensive to take Tobruk: preparations were to be completed by the end of the month. A series of offensive actions started on 26 May 1942 in the Battle of Gazala to culminate four weeks later in the fall of Tobruk, a disastrous setback for the Allied

- | | |
|------------------------------------|---|
| 111 Controllable cooling gills | 117 Walkway |
| 112 Access panel (oil drain) | 118 Wing/fuselage splice plate |
| 113 Engine bearer support truss | 119 Split flap structure |
| 114 Fresh air intake | 120 Aileron fixed tab |
| 115 Wingroot fairing | 121 Starboard aileron |
| 116 Fuselage frame/wing attachment | 122 Starboard wingtip construction |
| | 123 Starboard navigation light |
| | 124 Wing rib |
| | 125 Multi (7)-spar wing structure |
| | 126 Inboard gun ammunition box (235 rounds) |
| | 127 Centre gun ammunition box (235 rounds) |
| | 128 Outboard gun ammunition box (235 rounds) |
| | 129 Three 0.50-in (12.7-mm) M-2 Browning machine guns |
| | 130 Ammunition feed chute |
| | 131 Starboard wheel well |

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cause that saw the relief of General Sir Claude Auchinleck, and his eventual replacement by General B L Montgomery. From the start, the Desert Air Force was outnumbered: 320 DAF aircraft (190 serviceable) faced 312 of *Fliegerführer Afrika* and 392 of *V. Squadra*. Having replaced Fröhlich in March, *Generalmajor* Hoffmann von Waldau's forces included I-III/JG 27 with *Jabostaffel*/JG 27 with 90 Bf 109F-4s at Martuba, the III/JG 53 with 35 Messerschmitts, 12./LG 1 with 10 Ju 88A-4/Trops at Derna with a force of over 90 Junkers Ju 87D-1 Stukas of StG 3. These units were backed by a strong force of Ju 88A-4s based on Crete under *X Fliegerkorps*: and this added its effort to what was to be the last of the *Luftwaffe's* great blitzkriegs in the western desert. A daily average of 300-350 sorties were put up by *Fliegerführer Afrika* during the Gazala battles, the Cauldron fire-fight, the assault on Bir Hacheim and the final onslaught on the Tobruk perimeters. In the air, the nature of the fighting was severe, with losses to both sides. Kittyhawks bore the brunt against the Messerschmitts, but a welcome arrival to the DAF was that of No 145 Squadron with Spitfire Mk VC: this at least could stand up to the Bf 109F-4/Trop in dogfights. But nothing attempted by Coningham's forces could alter the situation on the ground. Calling upon II and *X Fliegerkorps*, the *Luftwaffe* pounded Tobruk throughout 20 June from 05.00 hrs without respite, to achieve a peak of 580 bomber sorties, added to which were 177 of the Italian *V.*

- | | |
|--|--|
| 132 Wing centre-section main fuel tank, capacity 42.1 Imp gal (191 l) | 143 Undercarriage oleo leg fairing |
| 133 Undercarriage attachment | 144 Undercarriage fairing door |
| 134 Wing centre-section reserve fuel tank, capacity 29.2 Imp gal (133 l) | 145 Machine gun ports |
| 135 Retraction cylinder | 146 Hydraulic brake line |
| 136 Retraction arm/links | 147 One (or two) underwing 40-lb (18-kg) bomb(s) |
| 137 Machine gun barrel forward support collars | 148 Oleo leg |
| 138 Blast tubes | 149 Torque links |
| 139 Bevel gear | 150 Axle |
| 140 Undercarriage side support strut | 151 30-in (76.2-mm) diameter smooth-contour mainwheel tyre |
| 141 Gun warm air | 152 Tow ring/jack point |
| 142 500-lb (227-kg) bomb (ventral stores) | 153 Ventral auxiliary tank, capacity 43.3 Imp gal (197 l) |
| | 154 Vent line |
| | 155 Sway brace pads |
| | 156 External fuel line |



(Above) The Bristol Beaufighter IC — this one of No 252 Squadron at Heliopolis in 1941 — was a welcome step towards modernisation of the RAF forces in North Africa. (Below) A Tomahawk IIB of No 112 Squadron in 1941.



Squadra: by 18.00 the leading *panzer* thrusts were in the town. The end came early on the morning of the 21st, when Major General H B Klopper surrendered. Huge quantities of fuel, equipment and arms fell into Axis hands, with about 32,220 British and Commonwealth troops being captured.

With the loss of this strategically vital port, Lt Gen Ritchie's 8th Army fell back to El Alamein, a fly-blown village on the railway and road a mere 60 miles (96 km) west of Alexandria. For Rommel, the way lay open to Cairo, the Suez canal, and possibly onwards to the oil fields of the Middle East. And in July 1942, at the zenith of German fortunes, he could be forgiven the thought that nothing stood in his way.

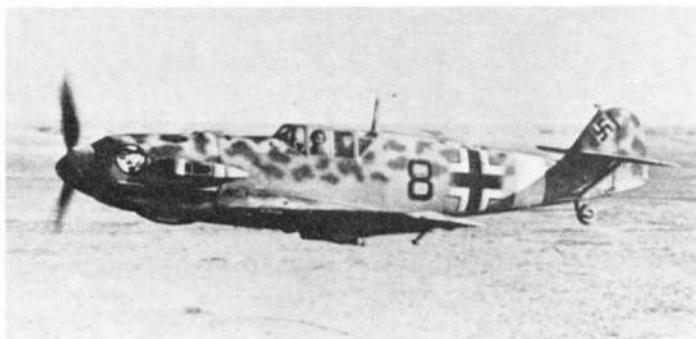
Alam Halfa to El Alamein

As so often had happened in the past in this extraordinary campaign, Rommel's *Panzerarmee*, already weakened by the recent fighting, had outstripped its vital lines of supply. The shortage of fuel, oil and lubricants was felt in particular by *Fliegerführer Afrika*, whose efforts declined towards the end of June 1942 due to this factor. And over the next three months the Axis supply situation, exacerbated by the extended lines of communications in North Africa, was to worsen: Malta was permitted to survive, and during July-September her air and naval strike forces sapped the supply of fuel, ammunition, tanks and guns to the ports of Benghazi and Tripoli. On the Allied side, the loss of Tobruk and the arrival of the Axis at the gateway to the Nile



The North African campaign took a heavy toll of aircraft on both sides, Allied and Axis. (Above) A Blenheim IV of No 113 Squadron burns at El Adem after being attacked by Bf 110s in 1941. (Below) A Hurricane of No 73 Squadron, also at El Adem in 1941.





(Above left) Junkers Ju 87R-2s serving in Sicily in May 1941; these dive bombers posed a constant threat to forces on the ground. (Above right) Messerschmitt Bf 109E-4/N Trop of I/JG 27, flying over the Libyan desert in 1941. (Below left) Junkers Ju 52/3m transports of the Luftwaffe paid a heavy price when caught by Allied fighters, either in the air or, as here, on the ground.

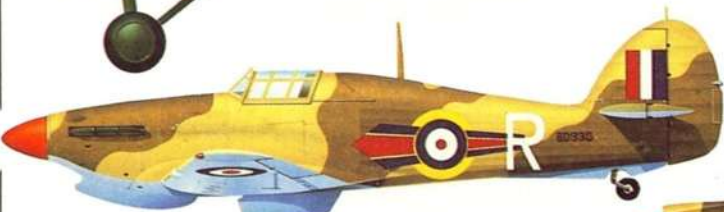


Delta had an astounding effect on a resolve, albeit tinged with panic, to defeat Rommel as No 1 priority. The bitter wrangle over the so-called "second front" for 1942 was resolved in July with the decision of the Chiefs of Staff to mount an invasion of French North-West Africa, termed Operation *Torch* and scheduled for November. In the more parochial field, RAF Middle East was now afforded a ready supply of reinforcements over the summer months, to which were added those of the American allies.

By the diversion of Hurricane Mk IIs and Spitfire Mk VCs to North Africa from the pipelines to the Far East, the strength of the DAF reached 463 in June, backed by another 420 aircraft in RAF Middle



(Top left) This Gauntlet was one of several, ex-RAF, flown by No 3 Squadron, RAAF, at Helwan, Egypt, in 1940. (Above) One of the three Sea Gladiators flown in the defence of Malta in August 1940, and later to become known as "Faith", "Hope" and "Charity".



(Above) Hurricane IIB of No 73 Squadron in the Western Desert, 1942, with modified unofficial use of pre-war markings and (below) a Hurricane IID "tank-buster" of No 6 Squadron at LG 91 in July 1942.



(Above) One of four "borrowed" USAAF F-6A Mustangs used for recon flights by No 225 Squadron in Tunisia in April 1943.



(Right) The South African Air Force's No 24 Squadron was flying this Boston IIIA from Souk-el-Khemis, Tunisia, in April 1943.



(Left) Contributing to Allied air power in Tunisia in April 1943 were the B-25C Mitchells of the 488th Bomb Squadron, 340th BG at Sfax.



(Above) The distinctive Sharks' Teeth marking was carried by Tomahawk IIBs of No 112 Squadron, at Sidi Haneish in the autumn of 1941. The same squadron later used Kittyhawk Is (left), this being the individual aircraft of Flg Off Neville Duke in 1942.



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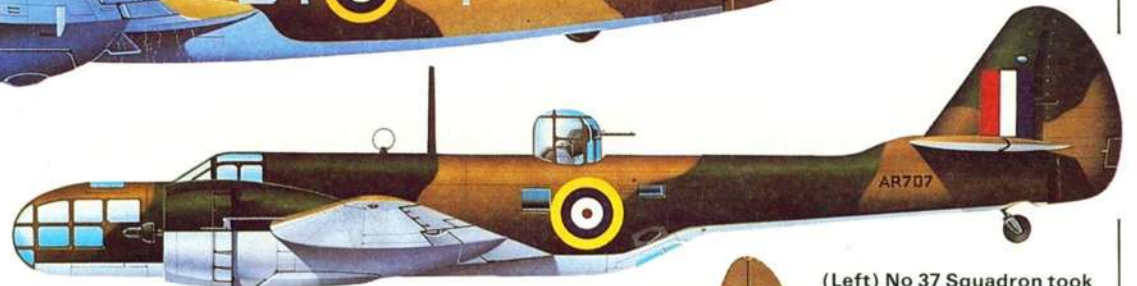
(Left) One of No 55 Squadron's Blenheim IVs operational from Fuka, Egypt, in early 1942, in a distinctive blue-toned Mediterranean finish.

(Right) The Blenheim V, distinguished from the Mk IV by its changed nose contours, was flown in the Tunisian campaign by Nos 18 and 114 Squadrons.



(Left) Serving with Coastal Command, No 252 Squadron was operating Beaufighter Mk ICs against shipping from Edcu in Egypt in mid-1942.

(Right) A Martin Maryland of No 431 Flight; the first to become operational on this type, it flew reconnaissance missions widely in the Mediterranean area from late 1940 onwards.



(Left) No 37 Squadron took its Wellington IAs from the UK to operate in North Africa in 1940 and was in Egypt in 1941 after taking part in operations during the rising in Iraq.



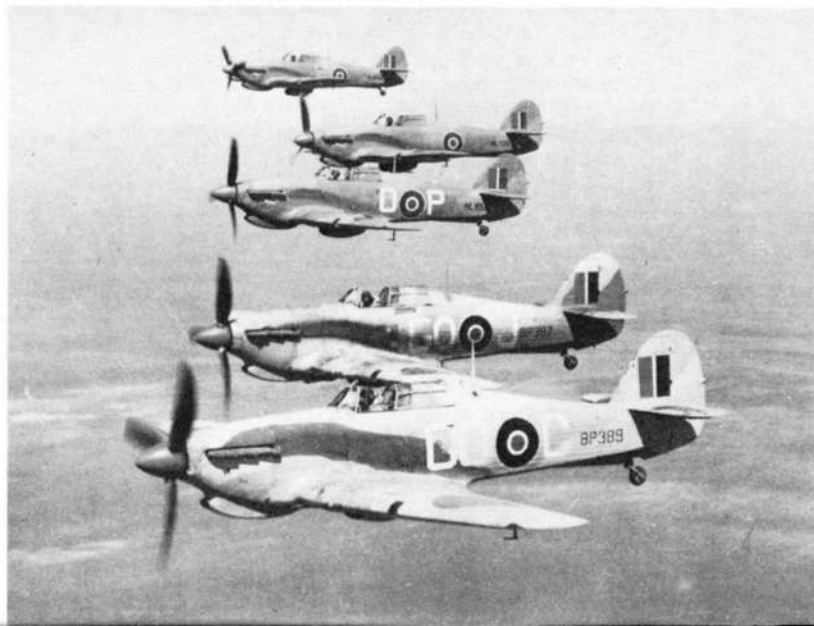
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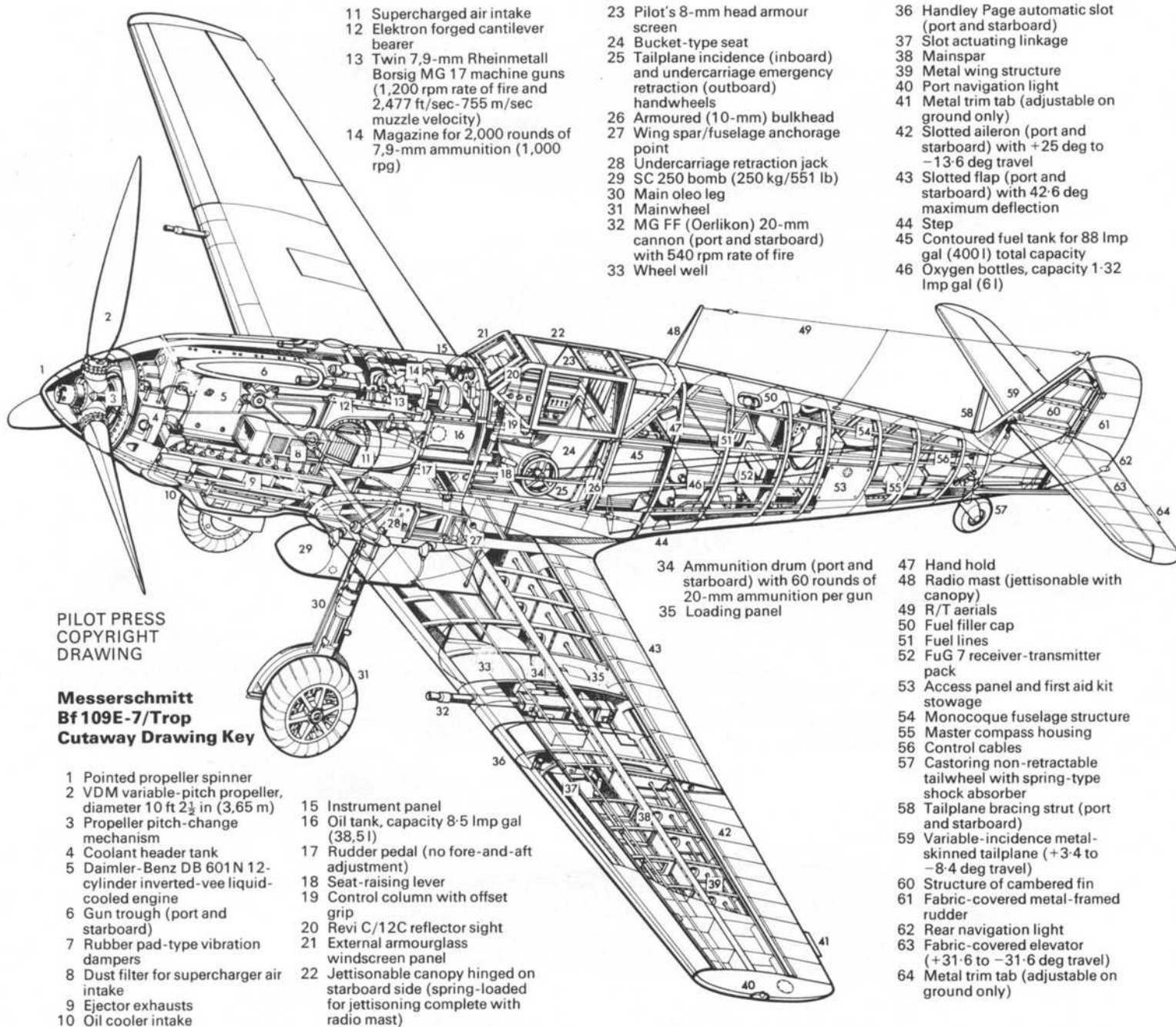
East. This strength was directed against Axis lines of communication in Libya, with the Bostons and Baltimores attacking by day, and Wellingtons and a few Liberators by night. On the ground, Rommel's attempt to break through the El Alamein defences was stopped in the battles of 1-5 July: repeated British ripostes came to a halt on 26 July, with both sides in a state of exhaustion. What was to be Rommel's final attempt to break his way into the Nile Delta took place at 23.00 hrs on 30 August 1942, when the leading elements of *Panzerarmee Afrika* breached the Allied lines between Bab el Quattra and El Taqa: the fighting was exceptionally savage, and was to result in Rommel's defeat during the Battle of Alam Halfa (First Alamein), considered by many historians to be the turning point in the desert war. The DAF's 565 aircraft (400 combat ready) were pitted against 720 aircraft of *Generalmajor* Hans Seidemann (*Fl.Fü. Afrika*) and the *V. Squadra*: but shortage of spares and fuel rendered the Axis force to about 450 in total effective strength.

A major air battle was fought on 1 September: 111 light bomber sorties dropped 80 tons of bombs, while 372 sorties by Kittyhawks, Spitfires and Hurricanes were sent against relays of Ju 87D-1 Stukas, and the latest 388 mph (625 km/h) Messerschmitt Bf 109G-1 fighters of *Jagdgeschwader* 27. During the night, Albacores and Wellingtons operated, with Halifax IIs and USAAF Liberators pounding Tobruk and airfields in Crete. In a week of air fighting that ended with Rommel's withdrawal on 7 September, 68 Allied aircraft had been lost in return for 36 German and five Italian aircraft.

After this rebuff, Rommel concentrated on holding his positions and gathering his forces in the face of growing strangulation and

interference with his supply lines. Strictly limited by fuel, Seidemann could maintain only a relatively small force near the front line. On 20 October 1942, *Fliegerführer Afrika*'s order of battle included the *Tac/R 4.(H)/12*, the *III/JG 27* and the ground-attack *I/Schl.G 2* at Bir el Abd; the *Stab* and *II/JG 27* at Turbiya and Quotaifiya, along *Hurricane* IICs — some with two of the four wing-cannon removed — serving with No 94 Squadron, operating from El Gamil in the Western Desert in late 1942.





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DRAWING

**Messerschmitt
Bf 109E-7/Trop
Cutaway Drawing Key**

- | | |
|--|--|
| 1 Pointed propeller spinner | 15 Instrument panel |
| 2 VDM variable-pitch propeller, diameter 10 ft 2 3/4 in (3,65 m) | 16 Oil tank, capacity 8.5 Imp gal (38,5 l) |
| 3 Propeller pitch-change mechanism | 17 Rudder pedal (no fore-and-aft adjustment) |
| 4 Coolant header tank | 18 Seat-raising lever |
| 5 Daimler-Benz DB 601N 12-cylinder inverted-vee liquid-cooled engine | 19 Control column with offset grip |
| 6 Gun trough (port and starboard) | 20 Revi C/12C reflector sight |
| 7 Rubber pad-type vibration dampers | 21 External armoured glass windscreen panel |
| 8 Dust filter for supercharger air intake | 22 Jettisonable canopy hinged on starboard side (spring-loaded for jettisoning complete with radio mast) |
| 9 Ejector exhausts | |
| 10 Oil cooler intake | |

- | | | |
|--|---|--|
| 11 Supercharged air intake | 23 Pilot's 8-mm head armour screen | 36 Handley Page automatic slot (port and starboard) |
| 12 Elektron forged cantilever bearer | 24 Bucket-type seat | 37 Slot actuating linkage |
| 13 Twin 7.9-mm Rheinmetall Borsig MG 17 machine guns (1,200 rpm rate of fire and 2,477 ft/sec-755 m/sec muzzle velocity) | 25 Tailplane incidence (inboard) and undercarriage emergency retraction (outboard) handwheels | 38 Mainspar |
| 14 Magazine for 2,000 rounds of 7.9-mm ammunition (1,000 rpg) | 26 Armoured (10-mm) bulkhead | 39 Metal wing structure |
| | 27 Wing spar/fuselage anchorage point | 40 Port navigation light |
| | 28 Undercarriage retraction jack | 41 Metal trim tab (adjustable on ground only) |
| | 29 SC 250 bomb (250 kg/551 lb) | 42 Slotted aileron (port and starboard) with +25 deg to -13.6 deg travel |
| | 30 Main oleo leg | 43 Slotted flap (port and starboard) with 42.6 deg maximum deflection |
| | 31 Mainwheel | 44 Step |
| | 32 MG FF (Oerlikon) 20-mm cannon (port and starboard) with 540 rpm rate of fire | 45 Contoured fuel tank for 88 Imp gal (400 l) total capacity |
| | 33 Wheel well | 46 Oxygen bottles, capacity 1.32 Imp gal (6 l) |

- | | |
|--|---|
| 34 Ammunition drum (port and starboard) with 60 rounds of 20-mm ammunition per gun | 47 Hand hold |
| 35 Loading panel | 48 Radio mast (jettisonable with canopy) |
| | 49 R/T aerials |
| | 50 Fuel filler cap |
| | 51 Fuel lines |
| | 52 FuG 7 receiver-transmitter pack |
| | 53 Access panel and first aid kit stowage |
| | 54 Monocoque fuselage structure |
| | 55 Master compass housing |
| | 56 Control cables |
| | 57 Castoring non-retractable tailwheel with spring-type shock absorber |
| | 58 Tailplane bracing strut (port and starboard) |
| | 59 Variable-incidence metal-skinned tailplane (+3.4 to -8.4 deg travel) |
| | 60 Structure of cambered fin |
| | 61 Fabric-covered metal-framed rudder |
| | 62 Rear navigation light |
| | 63 Fabric-covered elevator (+31.6 to -31.6 deg travel) |
| | 64 Metal trim tab (adjustable on ground only) |

with the Bf 109G-2/Trops of III/JG 53, and about 60 Junkers Ju 87D-1 Stukas (with a low combat state) at Qasaba under *Stab. I* and III/*Stukageschwader* 3. This small force, averaging about 110 serviceable aircraft, was given no quarter by the Desert Air Force, which hammered its airfields, dumps and installations at every opportunity during the preparatory phases of the great allied offensive.

In the line-up for General Montgomery's offensive at El Alamein, which commenced with overwhelming superiority in numbers on 24 October, the Western Desert Air Force mustered Nos 3 (SAAF), 232 and 285 Wings under its direct control with 216 aircraft, mostly Boston Mk IIIs, Baltimore Mk IIAs and Hurricanes: on loan from US IX Bomber Command, the B-25C Mitchells of the 12th Bombardment Group were also attached. In addition to the Spitfire Mk Vb and VC that now equipped a number of squadrons, the new Kittyhawk Mk III (P-40N) was a welcome arrival: powered by a 1,600 hp Allison V-1710-81, the Mk III was armed with six 0.5-in (12.7-mm) M2 Colt machine guns, and could carry a single 500-lb (225-kg) GP Mk IV bomb. Its manoeuvrability, and a maximum speed of 350 mph (563 km/h) at 5,000 ft (1 500 m), made it ideal for ground attack and fighter-bomber work that now formed a large part of the DAF's rôle. Sixteen squadrons, including Kittyhawks, served under No 211 (Fighter) Group to which the US 57th Fighter Group was attached. Eight squadrons of Hurricanes came under No 212 (Fighter) Group. No 6 Squadron and "A" Flight No 7 (SAAF) Squadron were equipped with the anti-tank Hurricane Mk IID,

which was armed with two 40-mm cannon: but the weight of this armament was too much even for the Hurricane, and the Mk IID was not a great success. The tactical forces of the DAF were backed by the powerful strike and anti-shipping units of No 201 Group, the Wellingtons of No 205 Group. The USA Middle East Air Force (USAMEAF), which was renamed the US Ninth Air Force on 12 November, contributed 35 B-24D Liberators of the 98th BG, and 16 B-24s and Boeing B-17F Fortresses of the 9th Bomb Sqn and the Halverson detachment.

The Battle of El Alamein started with a massive artillery barrage at 23.00 hrs on the night of 23 October 1942, and by dawn the 13th and 30th Corps were making fair progress through the minefields and the dug-in 88-mm guns and PzKw IIIs and IVs of the 15th and 21st Panzer Divisions. American units contributed 147 sorties to over 1,000 flown by Coningham's DAF, and of the *Luftwaffe* little was seen. The airfields at El Daba and Qasaba were littered with wrecks and burning aircraft, and the few Bf 109G-1s and Stukas that took to the air were harried constantly. During the entirety of the epic El Alamein battles, the contribution of *Fliegerführer Afrika* was minimal. Air superiority was almost totally in the hands of the DAF. On 3 November, Rommel ordered a withdrawal to the Halfaya Pass, and under rearguard actions units started to pull out. But on this occasion there was to be no orderly withdrawal to prepared defensive positions for, on 8 November, news was received of the Allied landings at Oran, Algiers and around Casablanca. Allied recon-

naissance aircraft sighted the roads jammed with an endless stream of traffic heading slowly westwards. Rommel had shot his bolt. Over the period 26 October to the dawn of 4 November 1942, the RAF (excluding Malta and No 201 Group) flew 10,405 sorties for the loss of 77 aircraft Cat E; 20 aircraft of the Ninth Air Force were lost in 1,181 sorties: records show that 64 aircraft of *Fliegerführer Afrika* were lost in the course of a meagre 1,550 "warflights", with V. *Squadra's* fighters, mostly Macchi C.202 Folgores, putting up 1,570 sorties for an estimated loss of 20.

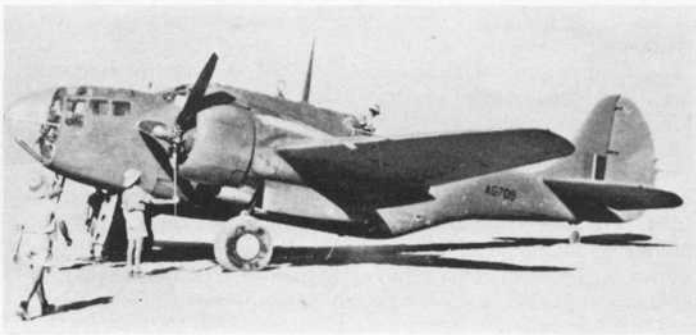
Tunisia and the end

El Alamein and Operation *Torch* ended the constant to-and-fro battles that had characterised the desert fighting of the previous two years. The final issue was never to be in doubt, but the Allies underestimated the resilience of the Axis in retreat and the difficulties of operations from the poor airfields of western Algeria. From now onwards it was to be a war on two fronts, with the Anglo-American commands facing increasingly difficult problems with supply against a resolute enemy. Montgomery's 8th British Army, supported by the DAF and US Ninth Air Force advanced from Libya, while the 1st British Army (Lt Gen Kenneth Anderson), with American forces temporarily under its command, made its way towards the Tunisian border from Algeria: the air forces allocated in this theatre consisted of the Western Air Command (US Twelfth Air Force under Brig Gen J H Doolittle) and the RAF Eastern Air Command under Air Marshal Sir William Welsh. The latter had Nos 322, 323, 324, 325, 326 and 328 Wings under his control, with strong forces of Spitfire VBs and Hurricane IICs, and the Blenheim Mk Vs of Nos 18, 114, 13 and 614 Squadrons under No 326 Wing at Blida.

On hearing of the landings in the west, the Germans acted with speed and efficiency: a *Hauptmann* Schürmeyer of *Stab/Luftflotte 2* flew into Tunis-Aouina airfield on the morning of the invasion to supervise the landing of combat and transport units. On 15 November, *Oberst* Martin Harlinghausen was installed as *Fliegerführer Tunis*, subordinated to II. *Fliegerkorps*, for the control of air operations: to his command were despatched some 200 fighter and ground-attack aircraft. These included III/JG 51, with the *Stab*, I and II/JG 53 with Messerschmitt Bf 109G-4s, the II/JG 2 with Focke-Wulf Fw 190A-4s, the 5./Schl.G 2 and III/SKG 10 with Fw 190 fighter-bombers, and the Ju 87D-3s of II/Stukageschwader 3. Initially the task of the fighters was to cover the relays of transport aircraft that formed the air bridge from Sicily: the units involved in transport operations included I-IV/KGzbV 1, and KGzbVs 102, 105, 200, 400, 600 and 800 with Junkers Ju 52/3m aircraft, and the KGzbV 323 that was equipped with the huge six-engined Messerschmitt Me 323D-1 freighter. Gliders and Italian SM.82s were also employed. The Axis build-up in Tunisia was swiftly accomplished and a crisis averted.

Montgomery's 8th Army made steady progress through Cyrenaica from the east: Benghazi was reached on 20 November, with Rommel pulling out of Agedabia three days later. After initial advances in the west, which saw airborne landings at Bone, Souk-el-Arba and Youkles-Bains, Anderson's 1st Army encountered stiff resistance and by late-November a static front line had been established from west of Mateur, through Sidi Nsir, Bou Arada and Medjez, and down to Fondouk. The rolling country, interspersed with valleys and wadis, favoured the defences. Frontal weather, with cloud bases down to 300 ft (100 m), rain and mist, often precluded Allied air effort, whilst the units of *Fliegerführer Tunis* could fly from all-weather fields in the Tunis-Bizerta area. Wing tactics were no use here, and Allied fighters operated in squadron or flight strength against marauding Fw 190A-4 fighter-bombers, and fought combats with well-flown enemy

The Martin Maryland — this example (left) in service with the South African Air Force — and the *Martin Baltimore* (right) provided valuable strength for RAF bomber squadrons in the North African campaigns.



A Messerschmitt Me 323 six-engined transport close to destruction. Large numbers of these transports, and the smaller Ju 52/3ms, tried with little success to run the gauntlet of Allied fighters patrolling off the North African coast.

fighters. Most of the *Jagdgruppen* in Tunisia were manned by pilots with experience gained in Russia and Northern France, and they were consistently good. The presence of *Hptm* Adolf Dickfeld's II/JG 2 *Richthofen*, that operated its Fw 190A-4 fighters from Kairouan and Tindja, was the cause of aggrieved requests for Spitfire Mk IXs. These came with No 243 Squadron, and were later issued to Nos 81, 92 and 72 Squadrons, and a Polish Fighter Flight led by the ace Sqdn Ldr S F Skalski, DFC. Blanket air cover was a thing of the past in the difficult conditions prevailing in Tunisia, and the land campaign was to endure for another five months.

With the changing conditions in the theatre as a whole, a decision was made at the Casablanca conference of January 1943 to reorganise the command structure of the Allied air forces. The changes were involved, but were necessary, and took place in the course of the following month. On 17 February 1943, Air Chief Marshal Sir Arthur Tedder became the air supremo responsible for all air operations to General Dwight D Eisenhower: on this day also he became AOC-in-C of the new Mediterranean Air Command (MAC). Subordinated to MAC was the Middle East Air Command (Air Chief Marshal W S Douglas) and the North-West African Air Forces (NAAF) led by General Carl A Spaatz.

Sholto Douglas's command encompassed the area of the old RAF Middle East Command, and was responsible for air defences and anti-shipping forces, but held control of the bombers of US IX Bomber Command and No 205 Group. The air forces directly engaged in battle against the Axis in Tripolitania and Tunisia came under Spaatz' NAAF which commanded the North-West African Tactical Air Force (Coningham), the North-West African Strategic Air Force (Doolittle), and the North-West African Coastal and Troop Carrier Air Forces. The fighters, and light and heavy bombers, were concentrated under the commands of Coningham and Doolittle. The former's NATAF controlled the Tactical Bomber Force, Air Vice-Marshal H Broadhurst's Western Desert Air Force (with No 211 Group), the US XII Air Support Command, and No 242 (Fighter) Group. Doolittle's NASAF controlled No 142 Squadron (Wellington III), the 5th Bombardment Wing with the 97th, 99th and 301st BGs (B-17F) and the 1st Fighter Group (P-38F), and the 47th (Medium) Bombardment Wing with a force of B-25 Mitchells and B-26 Marauders, plus the P-40Ns and Spitfire Mk VBs of the 82nd and 325th Fighter Groups.

By April 1943, the establishment of Tedder's Mediterranean Air Command was to exceed some 3,500 aircraft, of which about 2,200 were concentrated within the NAAF. But over the months the Germans had also placed priority in the Mediterranean theatre despite the hideous situation at Stalingrad: by January 1943 Kesselring's *Luftflotte 2* had 1,220 combat aircraft on strength, with about 850 stationed in Sicily, Sardinia and Tunisia. The status of *Fliegerführer Tunis* was raised to that of *Fliegerkorps* in February,



(Left) Still in three-tone camouflage used a year earlier in Belgium, this Fiat CR.42 was flown in Libya early in 1941 by the Cmdr of 83^a squadriglia, 18^o Gruppo, 3^o Stormo.



(Right) Macchi C.200 of the 373^a squadriglia, 153^o Gruppo in 1941, this being the aircraft flown by F Raffaelli, Commander of Forces, Eastern Sector.



(Left) A Savoia-Marchetti SM.79 of the 193^a squadriglia, 87^o Gruppo, 30^o Stormo, flying from Sicily in 1941. The "electric man" on the fuselage was the squadron emblem.



(Right) The 1^a squadriglia, 43^o Gruppo, 13^o Stormo was at Bir Dufan, Libya, in February 1942 with its Fiat BR.20Ms.



(Above) The Savoia-Marchetti S.81 three-engine bomber was widely used in North Africa; this example is in the markings of the 600^a squadriglia in the spring of 1943.

NOT TO SCALE

under *Gen Lt* Hans Seidemann, with *Fliegerführer 2* (*Oberst* Benno Kosch) and *Fliegerführer 3* (*Oberst* Walter Hagen) subordinated. Units under Seidemann's command included the Bf 109G-4s of I and II/JG 53, and I-III/JG 77 under the ace Müncheberg; Focke-Wulf Fw 190s equipped II/JG 2, the III/SKG 10 and I/Schl.G 2, while a new anti-tank type, the Henschel Hs 129B-1, made its appearance with 8./Schl.G 2 at Tunis-El Aouina. Although the units of *Fliegerkorps Tunis* fought well, they were unable to alter the situation on the ground to any marked extent: good support was given to the thrusts at Fériana, Sbeitla and Kasserine during 14-19 February, but as the weather improved and Allied heavies pounded the bases at Tunis, Bizerta-Sidi Ahmed, La Fauconnerie and elsewhere, conditions rapidly deteriorated for the *Luftwaffe*. The 8th British Army broke through the Mareth Line in March, to link up with the 1st Army: both now drove hard for Tunis in the face of stern resistance.

The contribution of Broadhurst's WDAF during the Battle of Mareth was considerable, and he was aided by the Wellingtons of No 205 Group by night while his Bostons, Baltimores, Kittyhawks, Hurricanes and Spitfires flew from dawn to dusk: 412 sorties were flown on 26 March for the loss of 11 pilots and one crew. But apart from the duties of ground support, his fighters were ranging farther afield. Planned in February, Operation *Flax* was a massive interdiction campaign against the *Luftwaffe's* air bridge from Sicily to Tunisia: but because of the demands of the Army, *Flax* was held back until early in April. The Americans were first off the mark when, on 5 April, a group of P-38F Lightnings downed 13 Ju 52/3ms off Cap

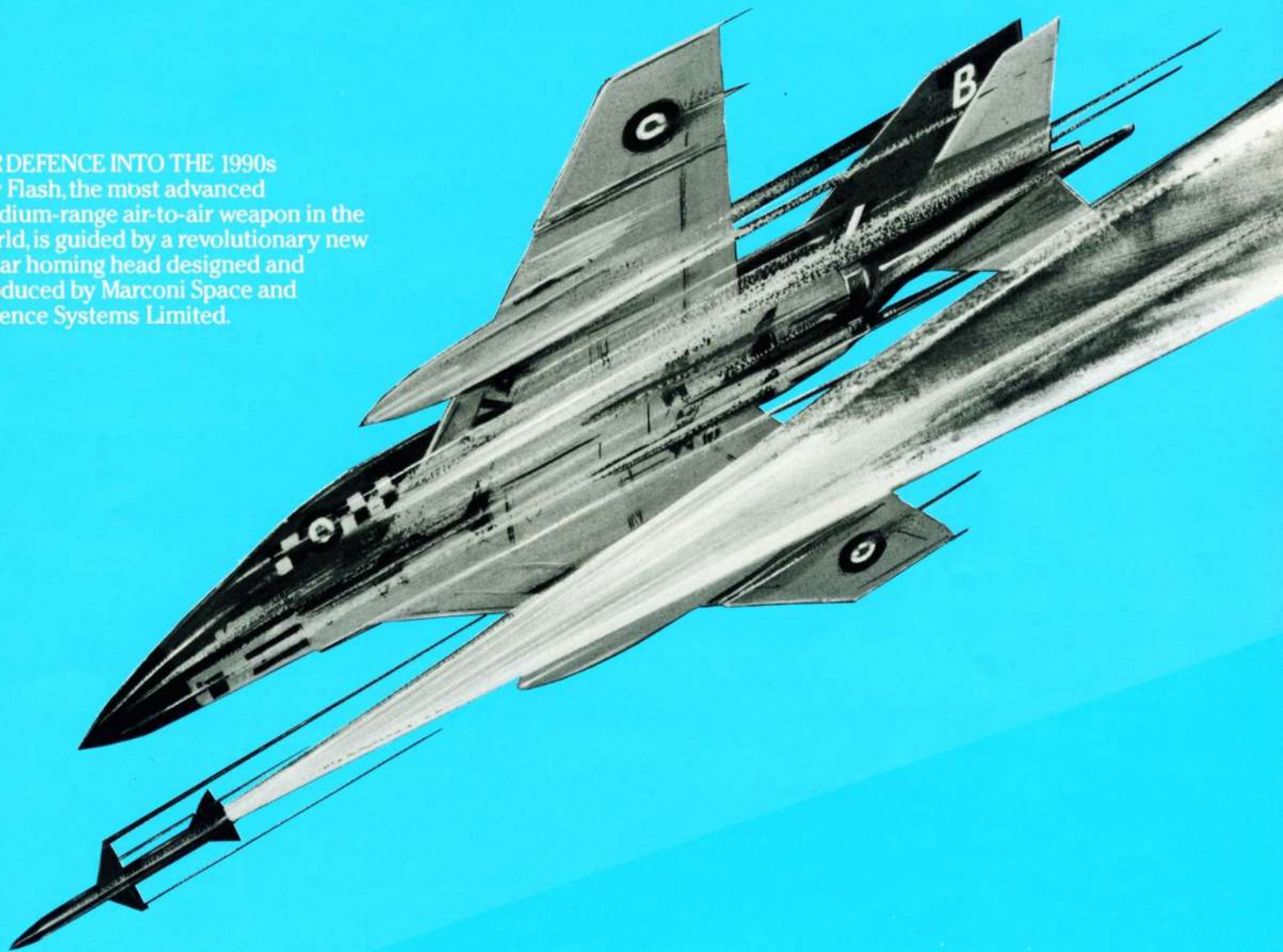
Bon, B-25s adding to the destruction with attacks on Trapani-Milo and Bocca di Falco airfields in Sicily: another force of B-25s, escorted by P-38s, also joined in the melée to shoot down another 15 transports and two Bf 109Gs. The transport termini at El Aouina and Bizerta received the attention of high-flying B-17s which straddled both with thousands of 30-lb (14-kg) fragmentation bombs. The slaughter continued in this vein for the next three weeks. In a climactic battle on 22 April 1943, a formation of Me 323D-1s of I/TG 5, flying just above the waves, was assaulted by the Kittyhawks of Nos 2, 4 and 5 (SAAF) Squadrons, the Spitfires of No 1 (SAAF) Squadron and the Polish Flight, and the P-40Ns of the US 79th Group, which collectively claimed 21 destroyed, plus a number of Messerschmitt fighters, Macchi C.202s and Reggiane R.2001s: four Kittyhawks were lost. With the decimation of his transport forces — for some 400 had been shot down since the start of *Flax* — Kesselring was forced to use nocturnal flights with all the difficulties that these involved. The fighters of AHQ Malta were also active during *Flax*, and destroyed an estimated total of 64 transports in the air and on the ground.

The *Luftwaffe* was absent during the final phase of the Tunisian campaign, with its last fighters and Stukas withdrawing to Sicily in the first week of May. On the 6th, the 4th Indian Division cleared the defences at Medjel el Bab to permit 5th Corps to proceed towards Tunis. On the following day both Tunis and Bizerta were reached, and on 13 May 1943, Field Marshal Giovanni Messe, the Axis supremo in Tunisia, surrendered. The campaign in North Africa was over. □



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