

Royal Air Force



YEARBOOK 1986

UK £1.00 USA \$2.75 CANADA \$3.25
(GG70354)



HARVEY
© 86



Tucano

The smartest way to join the jet set.

Because of its high performance which provides the capabilities that used to be found only in jet aircraft, the Tucano takes the student pilot far beyond turboprop flying. This means that the number of student-hours in jet trainers is dramatically reduced as, indeed, are the operating costs. But, best of all, the Tucano can be adjusted to suit the skills-level of the individual student.

The heart of the Shorts Tucano is the 1100 shp Garrett single shaft constant speed engine. This provides all the performance required for operating up to and above the ceiling of 25,000 feet while enabling the plane to cope admirably with the rough and tumble and frequent power setting changes of its training role. And tandem seating affords the best visibility, for both instructor and student, to be found in any trainer.

The Tucano can also be fitted with 1,000 kilos of assorted ordnance for weapon training or for COIN operations.

The world's biggest selling, new-generation turboprop trainer simply bristles with all the features demanded by modern air forces.

No wonder the Shorts Tucano has been selected by the Royal Air Force to develop the skills and confidence of its pilots now and well into the next century.

HIGH TECHNOLOGY. HIGH PERFORMANCE.

LOW-COST.

That's what makes the Shorts Tucano the Trainer for the future.

Shorts Tucano

MORE VALUE FOR MONEY

SHORT BROTHERS PLC—PO Box 241, Airport Road, Belfast BT3 9DZ,
Northern Ireland. Telephone 0232 58444. Telex 74688.
SHORT BROTHERS PLC—Berkeley Square House, Berkeley Square,
London W1X 5LB. Tel: 01-629-9541. Telex 24934.

Royal Air Force

YEARBOOK 1986

INTRODUCTION

by the Chief of the Air Staff Air Chief Marshal Sir David Craig, GCB, OBE



The Royal Air Force's far-reaching re-equipment programme advanced apace throughout 1985, with many new aircraft and weapons entering service. The capability increase the RAF gets from these and other equipments now in the pipeline spans virtually the full extent of the Air Power spectrum. But getting the right aircraft and weapons into service is only part of the story. Of equal importance is the task of developing and exploiting their full operational potential, and that depends very much on the skill and professionalism of our people. We are, of course, an all volunteer force. We take great pride in our Service, its traditions and that strong sense of comradeship which we all share. There are a whole variety of interesting and worthwhile careers for young men and women in today's RAF; and our Reserve and Auxiliary Forces, which are also being strengthened, enable many more citizens to make a part time but vital contribution to our nation's defences.

I am very pleased to see that the current edition of the Year Book reflects many of these important themes. The article on the TriStar illustrates the sort of capability growth that the re-equipment programme is giving to us, while those on No 12 Sqn, No 100 Sqn and the Ethiopian Airlift show very clearly the operational expertise and personal dedication of which we in the RAF have always been justly proud.

I very much hope that, as well as reading and enjoying these and other articles in the Year Book, you will find it possible to visit one or more of the various "At Home" days being held at RAF stations this year. There you can see and judge for yourself the sterling spirit of our people and the fine quality of their aircraft and other equipments. I do hope that you will come and see us.

David Craig

RAF YEARBOOK 1986

Edited by WILLIAM GREEN and GORDON SWANBOROUGH.

Artwork by JOHN WEAL and AVIAGRAPHICA, copyright PILOT PRESS LTD.

Cover artwork by WILF HARDY.

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

Designed by GRAPHIC ASSIGNMENT LTD, The Old Post Office, Church Road, Halstead, Kent TN14 7HE.

Published by the ROYAL AIR FORCE BENEVOLENT FUND for the benefit of fund and the Royal Air Forces Association, between which all profits are shared.

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

ABC MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

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

The views expressed in RAF Yearbook 1986 are those of the authors alone and should not be taken as an expression of official policy.

CONTENTS

OPERATION BUSHELL AND THE RELIEF OF ETHIOPIA	3
An account by Rodney Steel of the largest-ever relief effort mounted by the Royal Air Force.	
THE RAF GOES WIDEBODY	11
The Lockheed TriStar is now taking on its intended dual transport/tanker rôle with the Royal Air Force, as described here by the editors.	
FIRST DELIVERIES	16
How Bomber Command went into operation in September 1939, dropping leaflets over Germany, recalled by Rupert Cooling.	
UNDER THE RED STAR	21
The editor of <i>Jane's All the World's Aircraft</i> , John W R Taylor, assesses the threat posed by the latest Soviet warplanes.	
FLYING THE BUCCANEER ON SHINEY TWELVE	29
Sqn Ldr C F Wrighton provides a view from the rear cockpit of a still-potent warplane.	
RAF HISTORY — IN THE AIR	35
Surviving examples of the Lancaster, Spitfire, Hurricane, Meteor and Vampire provide the RAF with a flying museum, described by Tim Laming.	
THE RAF'S YEAR — 1985	42
An illustrated chronology of significant events of 1985.	
LANCASTERS BY THE HUNDRED	49
Former Avro test pilot J H "Jimmy" Orrell recalls the wartime task of testing Britain's most famous bomber.	
CENTURY SQUADRON CANBERRAS	54
Paul Crickmore describes the work of No 100 Squadron flying the RAF's oldest operational jets.	
THE RAF IN GERMANY: 1946-1986	57
A pictorial presentation of the types of aircraft flown by the RAF in Germany since World War II ended, with notes by J D R Rawlings.	
THE ROYAL AIR FORCE — A BASE DIRECTORY	62
Home and overseas stations, their rôles and equipment, described by Paul Jackson.	

SMITHS INDUSTRIES HEAD-UP DISPLAYS AND WEAPON AIMING SYSTEMS - COMBAT PROVEN

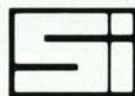


SMITHS INDUSTRIES — THE LOGICAL CHOICE

Smiths Industries head-up display - the heart of the Harrier avionics system - proved a major contribution to the success of Harrier operations in the South Atlantic conflict.

In every mode-flight, navigation, attack, weapon-aiming - Smiths Industries head-up display performed faultlessly, enhancing the Harriers' manoeuvrability and weapon system.

Smiths Industries head-up displays are chosen for Harriers, Sea Harriers, AV-8A, Harrier II, RAF Jaguar, Indian Air Force Jaguar, JA37 Viggen and the multi-national Tornado. Proof indeed of their combat proven effectiveness.



SMITHS INDUSTRIES
Aerospace & Defence Systems

OPERATION BUSHELL AND THE RELIEF OF ETHIOPIA

When the British government decided, in November 1984, to offer relief aid for Ethiopia, it fell to HQ No 1 Group, RAF, at Upavon and to the personnel of the Hercules squadrons at RAF Lyneham to respond at very short notice. A detachment of two Hercules and some 75 officers and men was established and in operation at Addis Ababa within days — initially for a three-month period. Eventually, the RAF stayed until the end of 1985, making *Operation Bushell* the longest sustained relief effort ever. Some of its achievements in the face of major difficulties are described by Rodney Steel.

Right across the African continent, along a belt south of the Sahara, the parched land is barren and exhausted. In 1984 the rains had failed yet again, and famine threatened whole populations. Nowhere were lives at greater risk than in Ethiopia, where nearly eight million inhabitants lacked adequate food.

The only practicable way to get large quantities of food to people starving in outlying wilderness areas was by air. That meant either making air drops or landing on short, dirt runways out in the bush to discharge the vitally needed stores. It looked like a job for the RAF's Lyneham-based Hercules squadrons, already experienced in similar African operations during the Rhodesian elections of 1980 and with two units (Nos 47 and 70 Squadrons) specially trained in low-level air-drop techniques.

Under the designation *Operation Bushell*, two Hercules were despatched at short notice to Addis Ababa on 31 October 1984 under the overall command of Wg Cdr Barry Nunn from Headquarters No 1 Group, accompanied by four aircrews and about 50 ground staff. A tented detachment headquarters was set up at Addis Ababa airport, where the RAF transports were joined in due course by military aircraft sent out to help in famine relief operations by the Soviet Union, West Germany, France, Italy and Libya.

The tropical heat and the altitude of the Ethiopian plateau posed operating problems similar to those which the RAF had experienced in Rhodesia four years previously. Aircraft performance was markedly degraded by high temperatures and thin air, Addis Ababa itself being 8,000 ft (2 440 m) above sea level, with mid-day temperatures there as high as 25 deg C, but falling to freezing at night, and dawn humidity being an enervating 80 per cent.

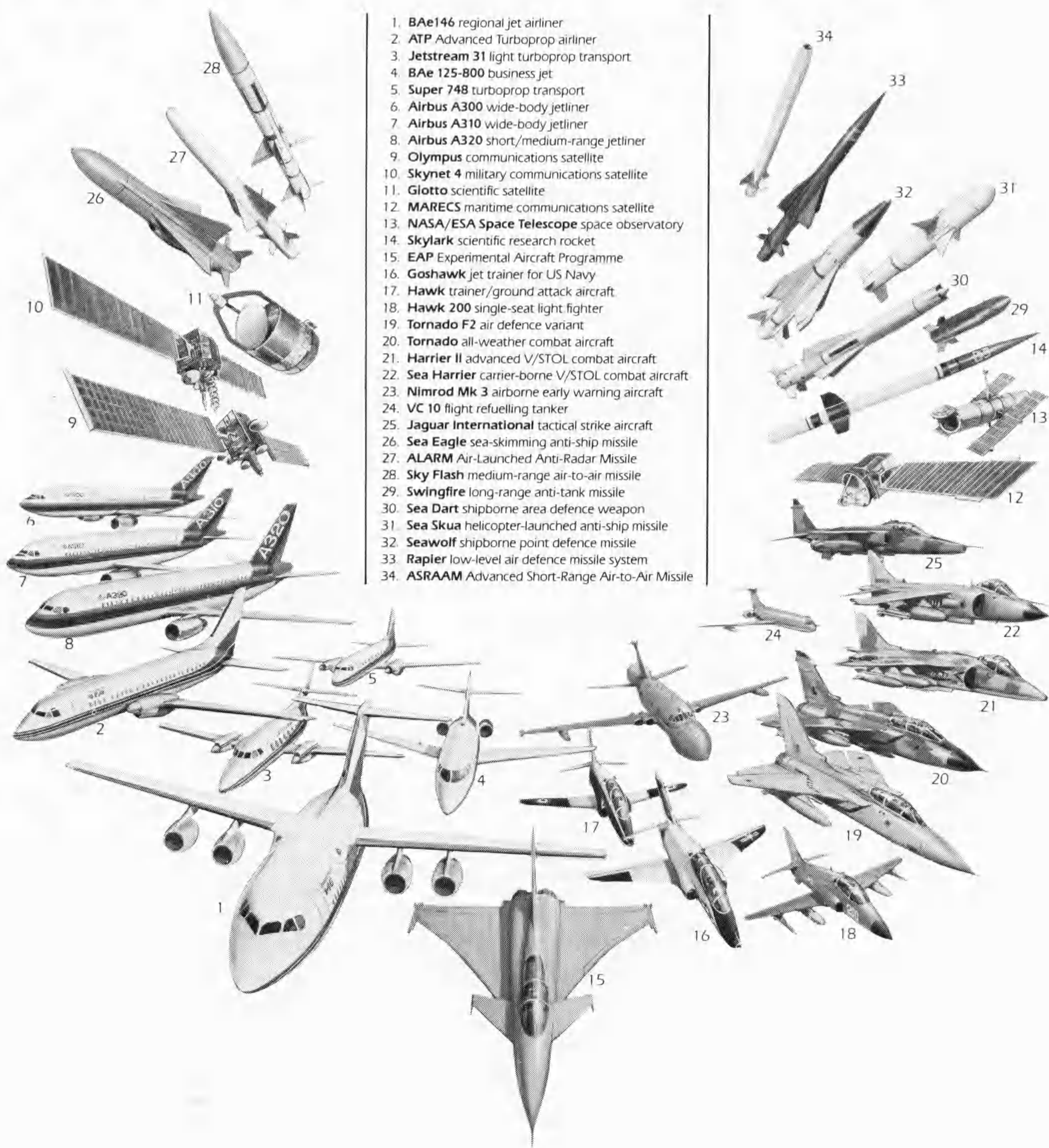


(Above) A rough-field arrival. (Below left) Loading at Addis Ababa.



(Above right) Unloading at an airstrip. (Below) Air drop demonstration.





No other company makes so varied and so vital a contribution to the strength of the Royal Air Force and the front-line defence of Great Britain.

No other company in the world designs and builds a wider range of military aircraft, missile defence systems and related equipment.

No other company can bring as great a depth of capability and experience to bear on future defence needs as British Aerospace.

BRITISH AEROSPACE

***...up where
we belong***



British Aerospace plc, 100 Pall Mall, London.

Rough desert air strips pound the Hercules

Initially it was anticipated that the Hercules would be used primarily for air drops of food supplies in remote areas which road transport could reach only with difficulty. From exploratory reconnaissance flights it soon became clear that using the desert air strips at Makelle and Axum as advanced landing grounds would be a better means of maximising the Hercules' load-carrying potential, relying on trucks to transport supplies to feeding centres deep in the bush run by the Red Cross, Oxfam and other agencies. Grain had first to be picked up from an airstrip at the Red Sea port of Assab, 332 mls (534 km) north-east of Addis Ababa, where 30 local labourers could load a Hercules in 30 minutes — compared to the four hours required for loading the Soviet Antonov An-12s, whose crews refused to permit Ethiopians on board.

The RAF's first famine relief sorties were flown on 4 November 1984, collecting all the available supply of grain at Assab and taking it to Axum (237 mls/381 km away) and Makelle (183 mls/295 km distant). It was immediately apparent that the Hercules were going to take a severe pounding from the rough desert air strips, and projecting airdrops were bound with foam to prevent damage from flying stones, while taxi lights had to be covered with sticky tape. On the last trip to Axum during that first day of operations, one of the Hercules burst a tyre and the return to Addis Ababa had to be made with the undercarriage in the down position and the defective wheel removed from its axle, an overnight stop at Axum to await a repair party being considered impossible for both operational and security reasons.

Resupply Hercules were soon regularly staging into Addis Ababa from Lyneham, and a team from UK MAMS (UK Mobile Air Movements Squadron) established a tent city ("Muppetsville") to accommodate personnel in the grounds of the British embassy when the International Livestock Centre for Africa (where they had initially been billeted) was taken over by delegates to the Organisation for African Unity's conference — who also filled all the hotels. A six-man team of RAF police guarded the Hercules aircraft at night, and an RAF medical officer (Sqn Ldr John Merritt, from Lossiemouth) looked after health problems and the inevitable minor injuries — digestive upsets and the effect of physical over-exertion in heat and rarefied air were common problems.



OPERATION BUSHELL AND THE RELIEF OF ETHIOPIA



(Above, left to right) An RAF policeman and Ethiopian guard exchange views at Addis Ababa. After an air drop, supplies are quickly recovered. The rough air strip exacted a heavy toll from Hercules tyres until tougher covers and specially-devised landing techniques helped to minimise the problem. (Photographs illustrating this article by John Upsall, Chris Yorke-Edwards and Geoff Whyham.)



The RAF was the first foreign military detachment to get its famine relief airlift in Ethiopia under way, and to maintain the initial momentum a system for rotating men back to the UK on regular resupply flights after 21 days was instituted. In addition to long, arduous days on duty, many of the RAF men gave up their precious time off to help load and unload the Hercules, joining Ethiopians in humping sacks of grain and bales of blankets.

In less than a week from the start of *Operation Bushell*, the RAF detachment could announce that over 500,000 lb (226 800 kg) of supplies had been airlifted by the two Hercules. A regular operational pattern was soon established, with the four resident aircrews working a 12-hour day, alternating one day on and one day off. Additional advance landing strips were found at Alamata, Asmara and Gondar, the average flight lasting an hour with 30 minutes for loading or unloading and, when necessary, refuelling. Some improvement in the surface of the dirt strips was effected by local labour, which ameliorated the damage being caused to the undersurfaces of the aircraft by flying stones, but the mechanics were still faced with a constant need to patch dents with filler and speed tape, while burst tyres continued to occur occasionally. Bird strikes were also a major hazard, and some of the larger elements in the local avifauna sometimes did considerable damage when failing to take adequate avoiding action in the face of an oncoming Hercules.

Repair facilities

Repair facilities were necessarily somewhat primitive — tents, and the wide open spaces of the airport pan — but running repairs and refuelling were always accomplished before the groundcrew left the airport at night. A five-hour local curfew meant that any particularly obstinate snags which took later than midnight to fix meant a night sleeping in the aircraft for the mechanics, although the RAF police detachment kept guard every night, somewhat incongruously attired in arctic parkas against the nocturnal chill.

Two operations officers shared day-to-day planning in consultation with the Ethiopian government's Relief and Rehabilitation Centre. Loads had to be constituted according to their destination, for at Alamata, for instance, it was only possible to land a 20,000-lb (9 070-kg) payload, whereas for Asmara, Assab and Makelle the figure was 42,000 lb (19 050 kg). The rainy season in Ethiopia extends from June to September, and even in the prevailing drought there were occasional downpours which would soak grain sacks and increase their weight by up to 50 per cent, posing real headaches for the loadmaster and the MAMS team that accompanied each flight.

By the beginning of 1985, the RAF was airlifting a million pounds of foodstuffs a week into famine areas, with the running total of food, medical supplies and blankets exceeding



8,000 tons. What was originally intended to be a three-month detachment became progressively extended, and at the end of January 1985 the first air drops of food were authorised.

Some famine areas were almost totally inaccessible by road and to help starving people there the UN Assistant Secretary General suggested air drops — which had in fact been part of the RAF's original plan. Two practice drops at Addis Ababa airport demonstrated that it was possible to attach up to twenty 110-lb (50-kg) grain sacks to a thick plywood sheet and push it out of an aircraft flying at 50 ft (15 m) and 140 mph (225 km/h).

On 26 January 1985, a No 47 Squadron crew captained by Flt Lt Jim Norfolk from Lyneham's Support Training Wing successfully dropped eight pallets at the small town of Rabel, 10,000 ft (3 050 m) up in the Ethiopian highlands. The cords attaching the sacks to the plywood sheets were designed to break on impact with the ground, and in the event 90 per cent of the bags landed intact in close proximity to the target. This technique had been perfected by the RAF in Nepal during famine relief operations in 1974 and was consequently known as the "Nepal drop".

After such a convincing demonstration, witnessed by Ethiopian officials, relief organisation representatives, and (from aboard the Hercules) the British ambassador to Ethiopia, Mr B L Barder, air drops quickly became a regular feature of the RAF's activities. Under the code names *Operation St Bernard* (used by the United Nations) and *Operation Hope* (coined by the Ethiopians), air drops were laid on to save the 175,000 or so people starving in mountainous areas. Polish Red Cross helicopters (Mil Mi-8s) took aircrew into the remote dropping zones to reconnoitre the sites, accompanied by ground parties to supervise the drop and provide a radio link with the aircraft.

Two or three drops a day, each of about 16 tons of supplies, now became routine. The *Luftwaffe* joined in these operations, adopting the RAF's proven "Nepal drop" technique from its Transall aircraft, and with the advent of the rainy season in June air drops became as important a part of the famine relief effort as air

landing sorties. On 20 September 1985, the combined efforts of the Lyneham Hercules detachment and their stalwart colleagues of No 47 Air Despatch Squadron, Royal Corps of Transport (which was responsible for launching air-dropped loads from the Hercules' freight ramp) had chalked up a total of 25,000 tons (25 400 tonnes) of grain airlifted to famine victims in 1,658 sorties: 15,000 tons (15 250 tonnes) air landed in 1,000 sorties, and 10,000 tons (10 160 tonnes) air dropped in 658 sorties.

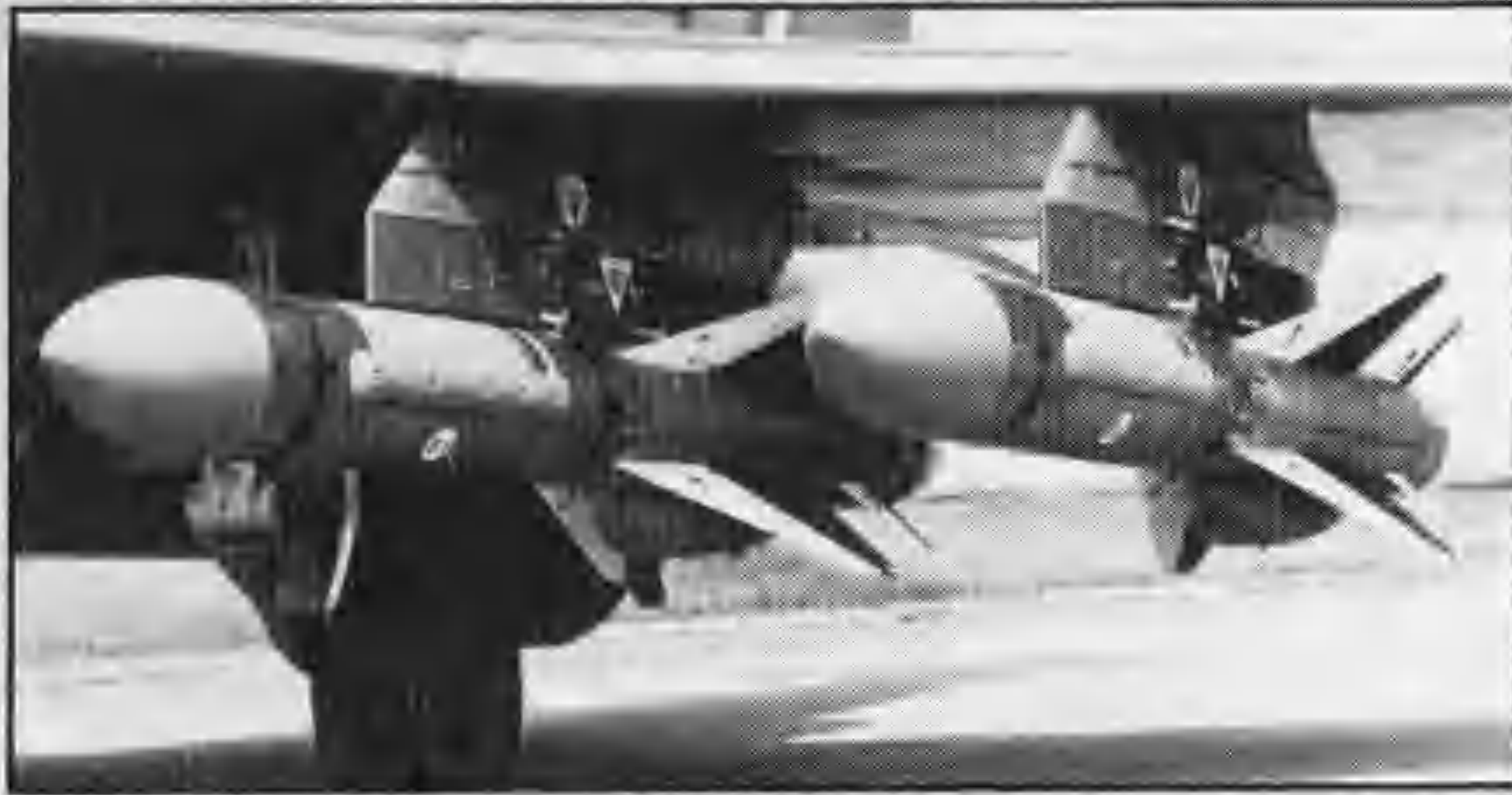
First anniversary

Through the autumn of 1985, operations continued on an unabated scale with each aircraft flying four or five sorties a day. Air landing sorties were normally flown by No 24 and 30 Squadron crews, while air drops remained the responsibility of the specially trained crews of Nos 47 and 70 Squadrons, who had delivered 13,000 tons (13 210 tonnes) of grain in this manner by *Operation Bushell*'s first anniversary on 4 November 1985, the grand total carried by the hard working Hercules having then mounted to 30,000 tons (30 480 tonnes).

Wear and tear on the aircraft meant returning them to the UK for maintenance every two or three weeks. Air and ground crews spent three weeks at a time in Ethiopia, while the air commander post rotated between wing commanders at No 1 Group and Lyneham every six weeks.

With a steady improvement in the overall famine relief situation towards the end of 1985, it was possible to withdraw the RAF detachment from Ethiopia shortly before Christmas. The last Hercules took-off from Addis Ababa for the return journey to Lyneham on 18 December, carrying among its passengers the detachment's last CO, Wg Cdr Roger Green (Lyneham's OC Ops).

A grand total of 2,152 famine relief sorties had been flown, carrying 32,158 tons of provisions, of which 17,778 tons were air landed in 1,198 sorties and 14,380 tons delivered by 954 air drops. Out of Lyneham's 30-strong fleet of standard-bodied Hercules transports, 14 at one time or another flew on *Operation Bushell*. □



ZEUS, HERMES, SKY SHADOW, SKYFLASH, SEA EAGLE, ALARM
Systems for today's aircraft

THE ABILITY TO DETECT THE POWER TO PROTECT

Marconi Electronic Warfare systems and Radar Missile Guidance
An integrated defence system

Building security for today and the future

Marconi
Defence Systems

Marconi Defence Systems Limited, The Grove, Stanmore, Middlesex HA7 4LY Telephone: 01-954 2311 Telex: 22616





THE WORLD'S FIRST NAME IN AERO ENGINES

ROLLS-ROYCE LIMITED, 65 BUCKINGHAM GATE, LONDON, SW1E 6AT.



THE RAF GOES WIDEBODY

A squadron with a proud history, Brize Norton-based No 216 now has the responsibility for operating the largest aircraft yet to enter service with the RAF — the Lockheed TriStar. Operating in the passenger transport rôle since mid-1983, the TriStars are now entering a new phase in their Service life after modification for the tanker/transport rôle. They substantially increase the RAF's tanking and transport capabilities, and give No 216 an opportunity to add to its already long list of achievements, which include that of being one of the first military jet transport units in the world when it introduced the de Havilland Comet in 1956.

RAF Brize Norton, in Oxfordshire, is well used to the coming and going of outsize aeroplanes. Opened modestly in 1937 as a training base, it was much used during World War II to train glider pilots, and to launch Horsa gliders for the D-Day and Arnhem landings. The arrival of Convair B-36 bombers of the USAF in June 1952 took Brize Norton into the big league, and it has stayed there ever since, operating Boeing B-50s, B-47s and B-52s until reverting to an RAF Transport Command base in 1965 to handle the Vickers VC-10 and the Short Belfast. In their day the largest types in RAF service, these were later joined by the Bristol Britannias. With the withdrawal of the Belfasts and Britannias in the mid-seventies, the VC-10 transports of No 10 Squadron kept alive the "Big Brize" image, and were joined in 1984 by the VC-10 tankers of reformed No 101 Squadron.

With its fleet of five VC-10 K Mk 2s and four K Mk 3s, No 101 is exclusively an air-to-air refuelling squadron, like the operators of the Victor tankers at RAF Marham, Nos 55 and 57 Squadrons. Basing No 101 at Brize Norton was logical, as it served to centralise the operation and servicing of all the RAF's VC-10s, including the C Mk 1s of No 10 Squadron. It added air-to-air refuelling to the rôles for which Brize was responsible, but this in turn helped to smooth the way for the introduction of the TriStars, which give the RAF, for the first time, a single aircraft serving in the dual rôles of tanking and passenger/cargo transportation. With 21 VC-10s of all types in service (and up to nine more tankers possibly to come) and nine TriStars in process of delivery, Brize Norton seems certain to remain the RAF's principal "big aeroplane" station into the next century, and it is already the subject of a major works programme to make it the largest operational RAF base in the UK.

Not only do the TriStars share Brize Norton with the VC-10s: they also have a common origin in the commercial airline business. Both the VC-10 and the TriStar were designed as civil air transports and have been adapted for the military rôle; moreover, the VC-10 tankers and the TriStars actually saw airline service



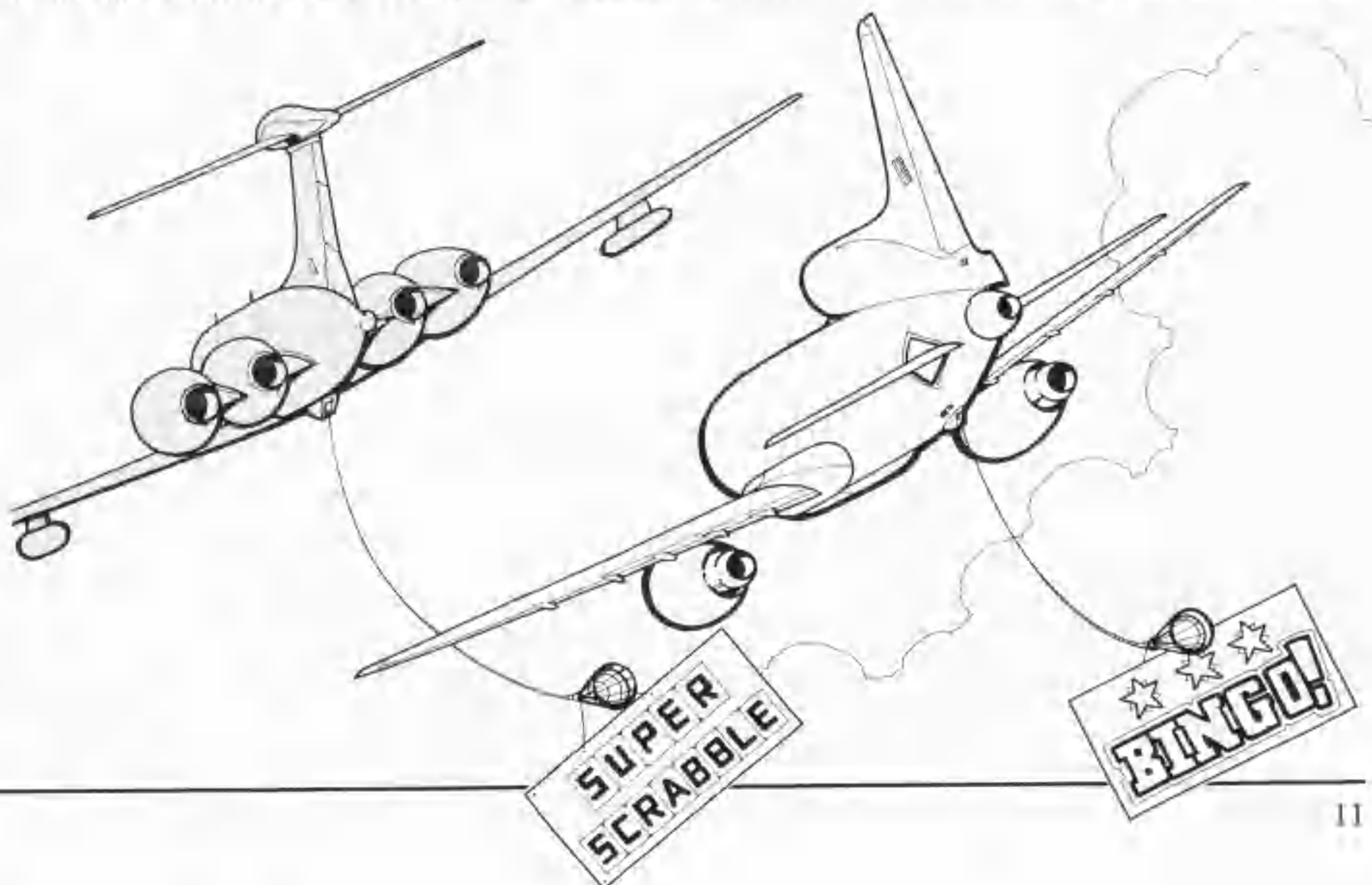
before being purchased by the MoD to boost RAF tanking and transport capacity. So far as the TriStars are concerned, the first six aircraft to be seen at Brize Norton were originally purchased and used by British Airways, with three more to join No 101 Squadron later that were used by Pan American World Airways. All were known as TriStar 500s in airline service, and their Rolls-Royce RB.211-524B4 turbofans, with a thrust of 50,000 lb st (22 680 kgp) each, are the most powerful engines ever operated by the RAF.

The need to add to the RAF's tanking and transport force emerged with some urgency during and immediately following the Falklands conflict during 1982. One consequence of the war itself was that the Victor tankers used up some of their remaining airframe hours much more quickly than previously estimated. The subsequent establishment of a large and permanent garrison on the Falklands has added a long-term requirement for transportation of men and supplies in each direction, making an unexpected additional demand on the transport force. The purchase of six TriStar 500s that were surplus to British Airways requirements was announced by the MoD on 14 December 1982, as a means of meeting these added

demands for tankers and transports up to the end of the present century. During 1984, three more TriStars were purchased from Pan American.

To provide the complete dual-rôle facility in the TriStar, considerable modification of the basic commercial aircraft is necessary, and in February 1983 Marshall of Cambridge (Engineering) Ltd received a contract to cover the design, fabrication and installation of the necessary airframe changes. This work is now structured in several phases and will lead eventually to the operation by No 216 of three distinct variants of the TriStar. Before any of these emerged from Marshall's Cambridge works, however, two unmodified TriStars (ZD948 and ZD952) were operated from Brize Norton in the transport rôle and the British Airways configuration. The first flight from Brize Norton was made, in fact, on 5 July 1983, to Edmonton, Alberta, with flight deck and cabin crews provided by British Airways.

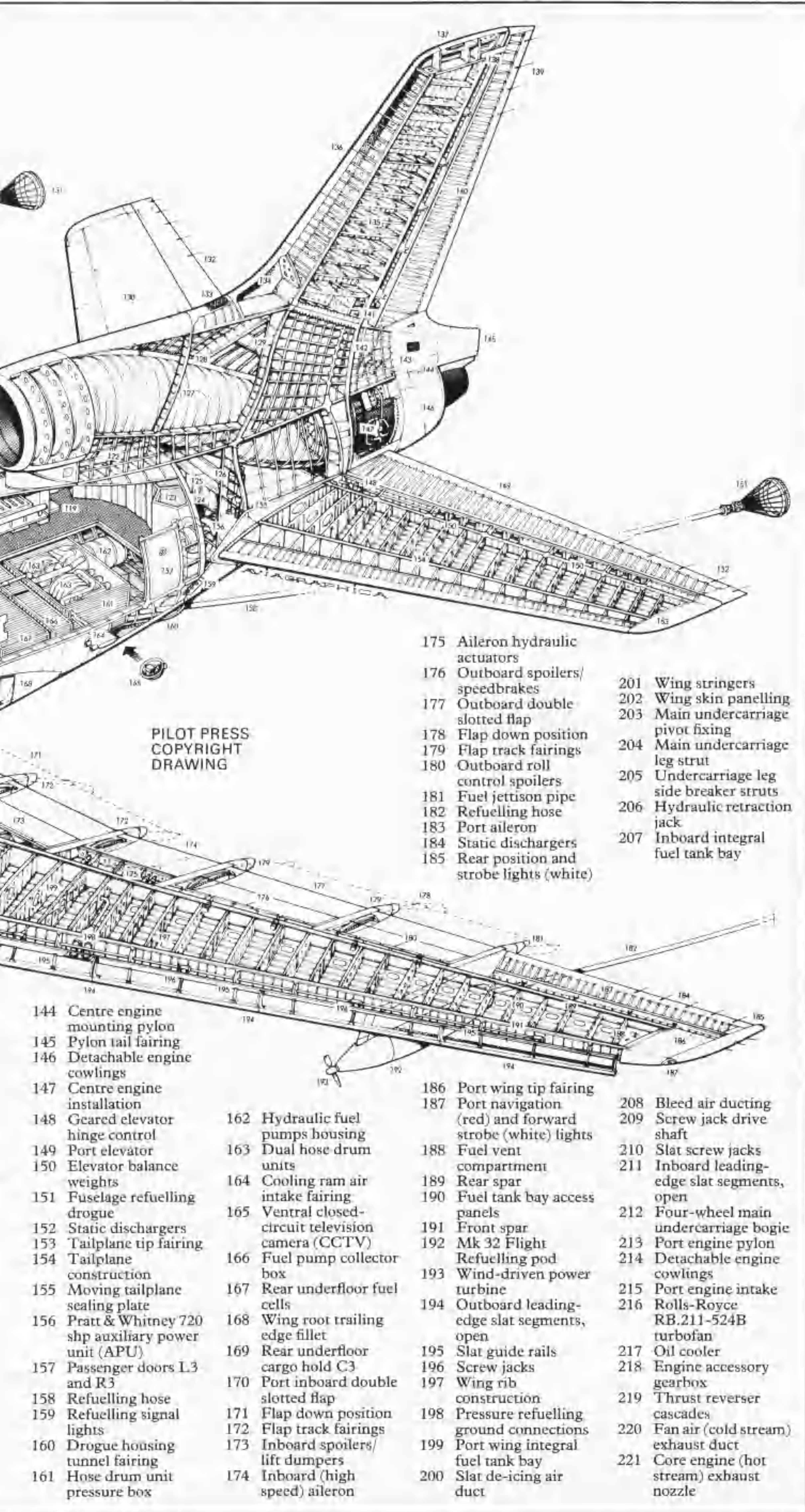
The training of RAF flight crews by BA training captains proceeded through 1983 and the first TriStar operation by an all-RAF flight crew was made to Akrotiri on 22 February 1984, although the first flight with a full RAF cabin crew also did not take place until March



Lockheed TriStar K Mk 1

Cutaway Drawing Key

- | | |
|---|---|
| 1 Fixed Mk 8 flight refuelling probe | 43 Fuel venting system air intake |
| 2 Radome | 44 Cabin window panel |
| 3 Dual VOR localiser aeri-als | 45 Floor beam construction |
| 4 Radar scanner dish | 46 Baggage containers |
| 5 Dual ILS glideslope aeri-als | 47 Cabin wall trim panelling |
| 6 Front pressure bulkhead | 48 Dual IFF aeri-als |
| 7 Curved windscreen panels | 49 Fuel venting air duct |
| 8 Windscreen wipers | 50 Cabin floor baggage handling system |
| 9 Instrument panel shroud | 51 Forward underfloor fuel cells: additional fuel load 100,000 lb (45 360 kg) |
| 10 Rudder pedals | 52 Forward underfloor cargo hold C2 |
| 11 Cockpit floor level | 53 Lower lobe frame and stringer construction |
| 12 Ventral access door | 54 Fuel pump/collector box |
| 13 Avionics equipment bay | 55 Wing root fillet |
| 14 Pitot heads | 56 Taxiing and runway turn-off lamps |
| 15 Observer's seat | 57 Bleed air system ducting |
| 16 Captain's seat | 58 Escape chute and life raft stowage |
| 17 Centre control pedestal | 59 Passenger door L2 |
| 18 Second pilot's seat | 60 Galley unit |
| 19 Pilots' overhead panel and circuit breaker panel | 61 Ball mats |
| 20 Flight engineer's station | 62 Passenger door R2 |
| 21 Closed circuit television and refuelling control panel | 63 UHF aerial |
| 22 Cockpit roof escape hatch | 64 Dual anti-collision lights |
| 23 Refuelling probe floodlights | |
| 24 Cockpit air conditioning ducting | |
| 25 Crew toilet | |
| | 26 Flight deck doorway |
| | 27 Galley unit |
| | 28 Nose undercarriage wheel bay |
| | 29 Forward entry door |
| | 30 Crew rest compartment, 12 seats |
| | 31 Starboard service door |
| | 32 Refuelling pipe pressure sealing box |
| | 33 UHF/VHF aerial |
| | 34 Curtained cabin divider |
| | 35 Interphone |
| | 36 Wardrobe |
| | 37 Air system heat exchanger |
| | 38 Nose undercarriage leg strut |
| | 39 Twin nosewheels |
| | 40 Hydraulic steering jacks |
| | 41 Nosewheel doors |
| | 42 Air conditioning plant, port and starboard |
| 26 Flight deck doorway | 65 Fuselage/front spar attachment main frame |
| 27 Galley unit | 66 Dry bay |
| 28 Nose undercarriage wheel bay | 67 Centre section fuel tanks |
| 29 Forward entry door | 68 Floor beam construction |
| 30 Crew rest compartment, 12 seats | 69 Centre fuselage frame and stringer construction |
| 31 Starboard service door | 70 TACAN aerial |
| 32 Refuelling pipe pressure sealing box | 71 Starboard wing inboard fuel tank bay |
| 33 UHF/VHF aerial | 72 Thrust reverser cascades, open |
| 34 Curtained cabin divider | 73 Starboard engine nacelle |
| 35 Interphone | 74 Nacelle pylon |
| 36 Wardrobe | 75 Fixed portion of leading edge |
| 37 Air system heat exchanger | 76 Fuel surge box and boost pump reservoir |
| 38 Nose undercarriage leg strut | 77 Fuel system piping |
| 39 Twin nosewheels | 78 Outboard fuel tank bay |
| 40 Hydraulic steering jacks | 79 Pressure refuelling ground connections |
| 41 Nosewheel doors | 80 Screw jack drive shaft |
| 42 Air conditioning plant, port and starboard | 81 Slat screw jacks |
| | 82 Leading-edge slat segments, open |
| | 83 Mk 32 Flight Refuelling pod |
| | 84 Wind driven power turbine |
| | 85 Refuelling pod pylon adaptor |
| | 86 Outboard slat segments |
| | 87 Fuel vent compartment |
| | 88 Wing tip fairing |
| | 89 Starboard navigation (green) and forward strobe (white) lights |
| | 90 Rear position and strobe lights (white) |
| | 91 Static dischargers |
| | 92 Starboard "active control" aileron actuators |
| | 93 Aileron hydraulic actuators |
| | 94 Fuel jettison pipe |
| | 95 Refuelling hose |
| | 96 Outboard roll control spoilers |
| | 97 Outboard spoilers/speedbrakes |
| | 98 Flap screw jacks |
| | 99 Flap track fairings |
| | 100 Outboard double slotted flap, down position |
| | 101 Inboard (high speed) aileron |
| | 102 Inboard double slotted flap, down position |
| | 103 Flap vane |
| | 104 Inboard spoilers/lift dumpers |
| | 105 Pressure floor above wheel bay |
| | 106 Fuselage/rear spar attachment main frame |
| | 107 Hydraulic reservoirs |
| | 108 Centre section service bay |
| | 109 Main undercarriage retracted position |
| | 110 Hydraulic flap drive motors |
| | 111 Rear cabin passenger seating, 204-seat layout |
| | 112 Overhead stowage bins |
| | 113 Overhead air conditioning ducting |
| | 114 Fuel venting piping |
| | 115 Port stowage bin racks |
| | 116 Cabin ceiling panelling |
| | 117 Rear fuselage frame and stringer construction |
| | 118 Cabin ceiling lighting panels |
| | 119 Cabin attendant's folding seat |
| | 120 Noise attenuating intake fairing |
| | 121 Centre engine intake |
| | 122 Intake support structure |
| | 123 Passenger toilet compartments (five) |
| | 124 Rear pressure dome |
| | 125 Tailplane centre-section carry-through |
| | 126 Variable incidence tailplane tandem hydraulic actuators |
| | 127 Intake S-duct |
| | 128 Intake de-icing air duct |
| | 129 Sloping fin spar bulkhead |
| | 130 Starboard tailplane |
| | 131 Wing refuelling drogue |
| | 132 Starboard elevator |
| | 133 HF aerial |
| | 134 Intake/fin root fairing |
| | 135 Tailfin construction |
| | 136 Fin leading edge |
| | 137 Dual VOR aeri-als |
| | 138 Rudder mass balance |
| | 139 Static dischargers |
| | 140 Rudder rib construction |
| | 141 Rudder hydraulic actuators |
| | 142 Engine bleed air system ducting |
| | 143 Bleed air spill duct |



PILOT PRESS
COPYRIGHT
DRAWING

- 175 Aileron hydraulic actuators
- 176 Outboard spoilers/speedbrakes
- 177 Outboard double-slotted flap
- 178 Flap down position
- 179 Flap track fairings
- 180 Outboard roll control spoilers
- 181 Fuel jettison pipe
- 182 Refuelling hose
- 183 Port aileron
- 184 Static dischargers
- 185 Rear position and strobe lights (white)
- 201 Wing stringers
- 202 Wing skin panelling
- 203 Main undercarriage pivot fixing
- 204 Main undercarriage leg strut
- 205 Undercarriage leg side breaker struts
- 206 Hydraulic retraction jack
- 207 Inboard integral fuel tank bay

- 144 Centre engine mounting pylon
- 145 Pylon tail fairing
- 146 Detachable engine cowlings
- 147 Centre engine installation
- 148 Geared elevator hinge control
- 149 Port elevator
- 150 Elevator balance weights
- 151 Fuselage refuelling drogue
- 152 Static dischargers
- 153 Tailplane tip fairing
- 154 Tailplane construction
- 155 Moving tailplane sealing plate
- 156 Pratt & Whitney 720 shp auxiliary power unit (APU)
- 157 Passenger doors L3 and R3
- 158 Refuelling hose
- 159 Refuelling signal lights
- 160 Drogue housing tunnel fairing
- 161 Hose drum unit pressure box
- 162 Hydraulic fuel pumps housing
- 163 Dual hose drum units
- 164 Cooling ram air intake fairing
- 165 Ventral closed-circuit television camera (CCTV)
- 166 Fuel pump collector box
- 167 Rear underfloor fuel cells
- 168 Wing root trailing edge fillet
- 169 Rear underfloor cargo hold C3
- 170 Port inboard double-slotted flap
- 171 Flap down position
- 172 Flap track fairings
- 173 Inboard spoilers/lift dumpers
- 174 Inboard (high speed) aileron
- 186 Port wing tip fairing
- 187 Port navigation (red) and forward strobe (white) lights
- 188 Fuel vent compartment
- 189 Rear spar
- 190 Fuel tank bay access panels
- 191 Front spar
- 192 Mk 32 Flight Refuelling pod
- 193 Wind-driven power turbine
- 194 Outboard leading-edge slat segments, open
- 195 Slat guide rails
- 196 Screw jacks
- 197 Wing rib construction
- 198 Pressure refuelling ground connections
- 199 Port wing integral fuel tank bay
- 200 Slat de-icing air duct
- 208 Bleed air ducting
- 209 Screw jack drive shaft
- 210 Slat screw jacks
- 211 Inboard leading-edge slat segments, open
- 212 Four-wheel main undercarriage bogie
- 213 Port engine pylon
- 214 Detachable engine cowlings
- 215 Port engine intake
- 216 Rolls-Royce RB.211-524B turbofan
- 217 Oil cooler
- 218 Engine accessory gearbox
- 219 Thrust reverser cascades
- 220 Fan air (cold stream) exhaust duct
- 221 Core engine (hot stream) exhaust nozzle

1985. A further highlight occurred on 12 May last year when a TriStar flew into RAF Mount Pleasant on the Falklands for the first time, setting records on the outward and return flight via Ascension.

Marshall's flew the first converted TriStar tanker/transport (ZD950) at Cambridge on 9 July 1985, and this aircraft later went to the A&AEE at Boscombe Down to obtain CA release. Thus it fell to the second conversion (ZD953) to be the first delivered to No 216 Squadron, in March 1986. These two aircraft, and the two that follow (ZD951 and ZD949), are officially designated K Mk 1s upon delivery to the RAF, being equipped to carry passengers and to fulfil the AAR rôle. The fifth and sixth conversions (ZD948 and ZD952) will emerge from Marshall's as KC Mk 1s, a designation indicating that they can operate as tanker/cargo carriers. A further phase in the conversion will then see the first two K Mk 1s returned to Cambridge to receive the cargo handling modification, whereupon they become KC Mk 1s also. Finally, the three ex-Pan American aircraft will become TriStar K Mk 2s as tanker/passenger transports; lacking the cargo handling provisions, they have some small but important airframe differences that result in a difference in fuel capacity and hence performance and servicing requirements.

Configuration changes

The conversion of the TriStar to serve as a tanker has been designed to have the minimum effect upon its ability to carry passengers and/or cargo in the main cabin. The key features are additional fuel tanks in the pressurised front and rear underfloor cargo bays, providing an extra 100,060 lb (45 397 kg) of fuel; a twin Mk 17T hose-drogue unit (HDU) installation in an unpressurised compartment at the aft end of the rear cargo compartment, with associated tunnels and ejection systems; a modification of the aircraft fuel system to integrate the extra tankage into a single system so that all fuel on board can be used by the aircraft itself or can be transferred to receiving aircraft, and provision for an in-flight refuelling probe, offset to starboard above the flight deck, so that the TriStar can itself take on fuel from another tanker.

Eventually, the TriStars will also be fitted with Flight Refuelling Ltd Mk 32 pods under each wing, to become three-point tankers (as are the Victors and VC-10s). The twin HDU installation in the fuselage is to provide redundancy, so that a mission need not be aborted in the event of a failure in one of these units; they cannot be used simultaneously, and provision is made on the refuelling control panel at the flight engineer's station to prevent inadvertent deployment of both fuselage drogues. The extra controls and equipment for the AAR rôle require the FE station to be enlarged, which has led to a relocation of the aft cockpit bulkhead. A separate toilet compart-

IN-FLIGHT REFUELLING SYSTEMS
FUEL SYSTEM COMPONENTS
REMOTELY PILOTED VEHICLES
TOWED TARGET VEHICLES
CRYOGENIC SYSTEMS
PURE AIR GENERATORS
FILTRATION SYSTEMS
FLUID AIR COOLING
PRECISION GENERATION SYSTEMS
PRECISION HANDLING EQUIPMENT
COMPOSITE ENGINEERING
PLASTIC MANUFACTURING
CONTAINER MANUFACTURING
THREAT MATERIALS
GAMMA Moulding
ELECTRONIC SIMULATIONS
RESEARCH ENGINEERING
ELECTRONIC COUPLINGS
DEVELOPMENT

FR **GROUP**

A GROWING FORCE IN WORLD DEFENCE

FR Group plc, involved internationally in the development and production of a wide range of aerospace, military and industrial equipment.

**FLIGHT REFUELLING LTD • HYMATIC ENGINEERING COMPANY LTD
ALAN COBHAM ENGINEERING LTD • FR AVIATION LTD
STANLEY AVIATION CORPORATION • FR HITCO LTD • W.E.S. LTD**
Wimborne · Dorset · England BH21 2BJ · Tel: (0202) 882121 · Telex: 41247 · Fax: (Group 2 & 3) (0202) 880096

ment is also provided for the three-man crew, and a 12-seat crew rest area-cum-club class compartment for special category passengers is provided immediately aft the flight deck.

In the passenger rôle, the TriStar carries 204 in a 10-abreast (3 + 4 + 3) arrangement, forward facing in standard airline-type economy-class seating, breaking with the RAF's tradition of using aft-facing seats in its transport aircraft. Galleys and toilets grouped at the rear of the cabin are also the standard airline installation. Because the extra tankage occupies the under-floor baggage holds, special provision has had to be made for passenger baggage — which, on long-range trooping flights, can be of considerable bulk. Part of the Marshall kit for the TriStar conversion therefore comprises sets of containers, 33 per aircraft, each measuring some 5 ft 6 in by 2 ft 6 in by 5 ft (1,68 by 0,76 by 1,52 m) and weighing 115 lb (52 kg) unladen. With a capacity of 760 lb (345 kg) each, the 33 containers in a single aircraft can carry 25,080 lb (11 376 kg) of baggage.

The later conversion of the TriStar to the KC Mk 1 configuration introduces a cargo door in the upper left side of the forward fuselage, a reinforced floor in the central cabin area and a cargo handling system that includes castor mats and rollers, and winches at each end of the cabin. Up to 20 standard cargo pallets can be carried but passenger/baggage loads are also possible, with standard VC-10 type seats mounted in a nine-abreast (2-5-2) layout on the cargo pallets. Typical combination loads will be 194 seats with three baggage pallets, 182 seats with four pallets, 170 seats with five pallets or 157 seats with six pallets.

Compared with the 504,000 lb (228 615 kg) of the TriStar 500 in airline service, the RAF TriStar is cleared to operate at 540,000 lb (244 950 kg), albeit with the in-flight loading reduced from 2.5g to 2.0g. The increased take-off weight is necessary for max-fuel, max-payload operations, but in most situations the aircraft will operate without passengers for the tanker rôle and without underfloor fuel when carrying passengers or cargo. In the latter case, with wing fuel only, some 95,000 lb (43 100 kg) can be carried a distance of 4,200 naut mls (7 750 km).

In practice, it now seems possible that No 216 Squadron will be flying its TriStars primarily as transport aircraft, and primarily on the long route to the Falklands, a distance of some 7,400 naut mls (11 900 km) with a stop at Wideawake on Ascension Island. In an earlier incarnation, No 216 was also a dual rôle squadron, being designated as a bomber-transport unit in April 1931. In those days, too, it was operating the RAF's largest land-based aircraft then in service — Vickers Victorias and Valentias — and was operating in support of Britain's overseas garrisons, then in the Middle East. For the squadron — motto, "CCXVI donna ferens" (216 bearing gifts) — the wheel has come nearly full circle: but for the RAF, the TriStar is setting completely new standards. □



(Top of page) The first of the RAF's TriStars converted to KC Mk 1 tanker/transport standard, on an early flight test. Despite the tanking rôle, these aircraft have the white fuselages with blue trim of RAF transport aircraft. Prior to conversion, though, some were operated by No 216 Squadron with the original British Airways blue and white finish, as seen (below) on ZD948 at Mount Pleasant Airport in the Falklands. Contact between the TriStar and a Hercules is shown above and right.



FIRST DELIVERIES

MORE than 45 years have now passed since the commencement of World War II, and the start of RAF operations against Germany. For many of the crews of Bomber Command serving in 1939, operations began not with a bang but with a flutter, as they carried propaganda leaflets instead of bombs to rain down upon the homeland of the Third Reich. Rupert Cooling describes the experiences of one such crew, and their unexpected arrival in France.

Tigers were known to be temperamental, even unreliable. There were few pilots flying the RAF's only heavy night bomber who had not experienced trouble at some time. Many returned to base with holes punched through the long chord cowlings as the Tiger VIII radial engines of their Armstrong Whitworth Whitleys blew off cylinder heads, even complete cylinders. Now, in pitch darkness, Flight Lieutenant Tony O'Neill faced a familiar problem. At 16,000 ft (4 880 m), the port engine was failing. His Whitley III, K8969, G-George began to lose height slowly. The weight against his right foot demanded increasing rudder bias to counter the effect of asymmetric thrust. This time, however, there was a difference. It was not the lit-up landscape of a peaceful Britain, nor yet the ruffled waters of the North Sea which lay below. It was Germany, the valley of the Ruhr; a hostile Germany, plunged in blackness beneath a creased coverlet of cloud. It was the night of 3-4 September 1939, and World War II was not yet one day old.

The operation had started three days before. Based at Linton-on-Ouse, No 58 Squadron, along with No 51, flew Whitley night bombers. Re-equipment had commenced early in 1938, first with the Mark II and then the Mark III. Both aircraft were powered by Armstrong Whitworth's 845 hp 14-cylinder Tiger VIII engines, but the Mark III carried a power-operated nose turret in place of the manually-operated installation of the Mk II, mounting only a single Vickers gun. It still retained the manually operated rear turret, but added a retractable ventral "dustbin" aft of the wing trailing edge, rotatable through 360 degrees and fitted with twin Brownings. Bomb stowage was also improved; heavier weapons could be fitted to the racks. But that was academic; it would not be bombs that these Whitleys would carry when first they went to war.

Runway laying was in progress at Linton; the base was non-operational. On 1 September, 10 aircraft — three from No 51 Squadron, seven from No 58 — were detached to Leconfield. Their "bomb load" was to be paper, 13 tonnes of it; six million leaflets, later to become known, from the code word allocated to them, as nickels. Nickels, in a variety of languages, were dropped throughout the war. Nickels in obscure oriental languages showered over Japan-

ese occupied territories; nickels fluttered down over North Africa and the Western Desert, inviting Axis troops to surrender. In 1942, it became the practice for new bomber crews to be "blooded" with a nickel sortie over France or the Low Countries prior to leaving Operational Training Units for front-line squadrons. Such airborne propaganda had a long history, antedating the flying machine itself. In conflicts a century before, balloons had carried leaflets aloft, to be released by the burning of a slow match. Now, they were to form the opening salvo of the offensive against the Third Reich. General mobilisation had been ordered on 1 September. On that night and the one following, the crews stood by. On 3 September, they went.

But for Tony O'Neill, it had all begun four years earlier when he gained a short-service commission. The Avro Tutor was a delightful aircraft on which to learn to fly and No 5 Flying Training School at Sealand, near Liverpool, had much to commend it. Then followed conversion to those elegant aeroplanes, designed by Sidney Camm, built by Hawkers: the Hart and the Fury. Awarded his flying badge, his wings, it was to Mildenhall and No 99 Squadron that he was posted to fly the Handley Page Heyford.

In 1937, the first Whitleys entered service, initially with No 10 Squadron and under the direction of No 4 Group whose headquarters were at Linton-on-Ouse. Progressively, Nos 58, 51 and 78 Squadrons were similarly equipped until No 4 Group as a whole became a Yorkshire-based, exclusively Whitley night bomber force. Grounded for four months by a rugby match, a car crash and a broken wrist, Tony O'Neill recovered to join No 58 Squadron, at first on Ansons and then the Whitley.

In January 1938, the Whitley Mark II replaced the Mark I, providing an extra 50 hp per engine for take-off and also the first military use of two-speed blowers which significantly improved performance. Flying Officer O'Neill was frequently finding his way to the Armstrong Whitworth factory at Baginton, collecting another aircraft and ferrying it up to Yorkshire. By the end of August 1939, 196 Whitleys were on charge to the RAF, ranging from 32 of the original Mark Is to five of the latest Merlin-engined Mk Vs. By 13 July 1943,



ANI!

...la non vi è stata questione che dovesse
...ra. Ma per istigazione dei vostri alleati,
...l'Italia e l'Inghilterra, che non è stata mai
...nta. Adesso i bombardieri
...toriamer
...to la gue
...l'Inghilt
...esponsa
...er e su
...il vor
...ia, di

Warnung

Großbritannien an das Deutsche Volk.

Deutsche,
Mit läßt erwogenem Voratz hat die Reichs-
regierung Großbritannien Krieg aufzuzwingen.
Doch wußte sie, daß die Folgen ihrer Handlung die
Welt in ein größeres Unheil stürzen, als
1914 es tat. Im April gab der Reichstangler euch
und der Welt die Versicherung seiner friedlichen
Absichten; sie erwies sich als ebenso wertlos
wie keine im September des Vorjahres im Sport-
loft verkündeten Worte: „Wir haben keine
weiteren territorialen Forderungen in Europa zu
stellen.“

Niemals hat eine Regierung ihre Untertanen
unter geringerem Vorwand in den Tod geschickt.
Dieser Krieg ist gänzlich unnötig. Von seiner
Seite wären deutsches Land und deutsches Recht
bedroht. Niemand verübte die Wiederbesetzung
des Rheinlandes, den Verlust des Anschlusses und
die unruhig durchgeführte Einküperung der
Subeten in das Reich. Weder wir, noch irgendein
anderes Land, versuchte je dem Ausbau des deutschen
Reiches Schranken zu setzen—solange dieses nicht
die Unabhängigkeit nicht-deutscher Völker verletzte.
Offen Bestrebungen Deutschlands—solange
sie ändern gerecht blieben—hätte man in fried-
licher Beratung Rechnung getragen.

279



The Armstrong Whitworth Whitley, in its Tiger-engined Mk II and Mk III variants, was one of the RAF's principal types of night bomber when war broke out. The upper illustration shows a Mk II, the lower photographs show aircraft and crews of No 58 Squadron in 1938/39.

1,814 Whitleys of all Marks had been built. Little more than a year later, all but the Mark V were declared obsolete; that too suffered the same fate in 1945. One aircraft, retained by the makers, did appear at the first post-war SBAC Show held at Radlett — but only as a tug, towing Armstrong Whitworth's tailless glider, the A.W.52G.

His predicament over the Ruhr notwithstanding, Tony O'Neill liked the Whitley. It was easy to fly and easy to land. Indeed, it had a mind of its own when landing, for, with its huge "barn door" wings and high angle of incidence it would settle firmly on its wheels from the most unpromising of approaches. Equally, it resisted the demands of its pilot for a three-point landing, preferring instead to lower its tail in its own good time. It was robust, even rugged, and offered its crew at least some basic comfort on their long and arduous journeys through the night. If vice it had, then it was confined to the Merlin-engined Mk IV, IVA, V and VII, with their tendency to swing to port on take-off. Unless this was dealt with firmly by the differential advance of throttle and judicious use of rudder, curved take-off runs and crab wise climbs were common consequences. When cruising, the Whitley had a most distinctive "sit" in the air, moving steadily ahead with its nose dipped, much in the way of a dog following a strong scent or trail. This resulted from the wing, designed before the introduction of flaps as a landing aid, having an 8½-deg angle of attack which limited flapless landing runs. This became irrelevant when flaps were later incorporated into the design,

but it affected the thrust line of the engines: hence the nose-down attitude of the fuselage.

With a dying engine, G-George's nose was even further down than normal. It had been a long haul since take-off from Leconfield in the dusk of the first night of War. The crews assembled for briefing; the route was revealed; it ran from Leconfield to Borkum, off the estuary of the Ems, south along the Dutch frontier to Essen then along the Ruhr valley, scattering bundles of leaflets through the flare chute. It was a long way round, but Belgium and Holland were neutral; that neutrality had to be respected. The weather forecast, not yet affected by secrecy, stemmed from observations less than 12 hours old. Intelligence was a different matter. Searchlights, guns, balloons were a matter of conjecture and deduction. Radar (or Radio Direction Finding, RDF) was still so secret that even its existence was unknown to the crews. Navigation would rely on the standard Dead Reckoning aided by such radio bearings as could be coaxed from the atmosphere. In the gathering dark, the Whitleys crossed the coast and headed out over the North Sea, for the first time bound for Germany.

The island of Borkum lay below, a black shadow fringed with a grey lace of surf. Cloud

covered the German coast itself and spread across the hinterland. Distantly, an unpractised searchlight groped through a break in the stratus sheet. Flt Lt O'Neill sat, watching the instruments glowing greenly in the dark, glancing at the port engine and the abraded disc of night which marked the spinning airscrew. Gradually, G-George climbed to the selected height of 16,000 ft (4 880 m); oxygen masks enclosed each crew member's mouth and nose, uncomfortable, but at least bearable. Four hours out, the Whitley was over the Ruhr. A few heavy shells burst in tiny red sparks, ineffectively distant. Inside the gloom of the long metal fuselage the crew began posting bundles of leaflets through the flare chute. There was no oxygen point in its vicinity; there were no portable bottles. In less than 10 minutes, the two men involved were exhausted. Two others took their place; those relieved went forward to plug in to the main supply and refresh themselves against a further spell. It was then that the engine showed the first signs of failure.

The decision was self-evident. Two hours to the south-west lay France and friendly territory. There was no point in risking aircraft and crew in a flight through hostile airspace, steadily losing height, then to face the North Sea on a single engine. O'Neill headed towards Rheims, discharging the last few bundles of leaflets as he went. That the route would take G-George across neutral Belgium was unfortunate, but an aircraft in trouble could expect more consideration than one deliberately violating the frontiers of a non-combatant nation.

In any case, with total cloud cover beneath and German reaction to the invasion of their airspace so negative, it was likely that the Belgian response would be even less energetic. Again, there was little choice. Slowly descending, the Whitley droned on, across the Belgian frontier, past Liege, into France. The port engine failed completely; its propeller windmilled in the slipstream, for the day of the feathering airscrew was still in the future. The starboard engine began showing signs of strain; a landing could not long be delayed, but it was still dark. The cloud layer stretched above them now; ground detail was all but invisible. Tony O'Neill launched a flare. In the tenuous light, he identified one field large enough for a wheels up landing. It was nip and tuck to line up and creep in over the hedge; a railway embankment caused a moment of concern but he was committed. With a thump and a tearing, rending resonating rasp of buckling metal, G-George slid over the vegetable patch. Group Captain O'Neill, DFC, now retired, recalls cabbages bouncing about the cockpit like short pitched cricket balls as the broken bomb aimer's window sheared them off like the harvester's knife. The crew emerged, a little shaken but unharmed. They had been in the air for seven-and-three-quarter hours.

The silence was profound, almost oppressive. A few hesitant trills as the dawn chorus responded to the faint glimmer of first light, an erratic ticking from contracting metal within the cooling engine, the subdued murmur of their own voices, were the only sounds, the sole evidence of life. As light increased, individuals emerged from the deeper darkness which obscured the field, stumbling over the growing crop of cabbage. Caution, suspicion bordering on hostility was evident in their individual mien.

G-George lay inert upon the earth. The Whitley's tailplane was festooned with leaflets in German gothic script where the slipstream had trapped them. It was some time before this group of French farm workers could be persuaded that it was the Royal Air Force which had dropped in on them. From then on, the warmth of the welcome became overwhelming. Slowly, tension relaxed; tiredness supervened. They had landed close to the village of Dormans, near Epernay in the heart of the Champagne country. As news spread, the village was *en fête*. Eventually, transport was found to ferry the fatigued crew to Rheims, where a telephone call to Linton notified the squadron of their situation and safety; finally, the bliss of bed and the peaceful tranquillity of sleep. On 5 September, a D.H.89 Rapide flew Flt Lt O'Neill and his crew to Harwell; by Wednesday all were back at Linton. Only G-George did not return; there was no way in which the Whitley could be repaired and flown out of that vegetable field; simpler to salvage what might be used as spares and declare the remainder scrap.

Next year, in 1940, there would be another air delivery, another new belligerent, another



The cockpit of a Whitley Mk V used as a glider tug is shown in this photo. The crawlway to the bomb-aiming position in the nose has been partially blanked-off, as it was no longer needed in this aircraft.

first flight with paper propaganda. After four months, based at Boscombe Down, flying coastal patrols over the Western Approaches, No 58 Squadron withdrew from front-line service for conversion to the Merlin-engined Whitley Mark V. In April, Tony O'Neill got in three sorties to Norway; on 10 May the balloon went up in France. It was a return to the Ruhr, this time with bombs, then frustrating forays over Flanders, searching for signs of the German Army as it surged across France to Paris and the Channel ports. On 10 June, Italy entered the war; on 11 June, 36 Whitleys were briefed to bomb Turin and Genoa. From Linton and from Dishforth, the big bombers converged upon the island of Guernsey. With a full fuel load and bombs aboard, take-off was not to be contemplated wholly with confidence, but all got away, despite the restricted runway length. Weather grew steadily worse; at 15,000 ft (4 570 m) ice began to form. Fragments flew off the propeller blades, to thud and rattle against the metal fuselage as the Whitleys bucked and heaved within the unstable mass of high and heavy cumulus. In an electric storm, the wireless failed. In common with all aircraft, the Whitley carried no de-icing equipment; the standard panacea was Kilfrost, smeared before take-off over the leading edges of wings, tailplane, rudder and fins. This muddy coloured paste was not a sovereign remedy. Somewhere in the stygian murk close to track and still above

them stood the rocky pinnacle of Mont Blanc. The chance of a safe crossing of the Alps seemed slim; indeed, at one time O'Neill seriously contemplated the prospect of having to bale out. At least the wind would carry the leaflets to Italy and the Swiss could read Italian, even if the message was not intended for them.

Bombs were jettisoned and the Whitley headed home for Yorkshire along with 22 others similarly defeated by conditions. Nine that got through to Turin found the city fully illuminated and lights were not turned off until most of the bombs had been released. For the two who bombed Genoa, the lights remained on throughout. Two Whitleys crashed in France on the way home.

At the end of June 1940, Flt Lt O'Neill was screened; his first operational tour was over. Whitleys (and Wellingtons) would continue attacks on Italy, but not until September 1941 was the number of aircraft on that first sortie exceeded. It was October 1942 before the Lancasters arrived in force. In the meantime, Tony O'Neill found himself at Ringway, the old (and indeed the present) Civil Airport for Manchester. It was at Ringway that the tiny nucleus of the Airborne Forces was created. It was to grow into a brigade which fell upon Sicily; a division which seized inland the vital points in Normandy, a corps which held Arnhem against all odds and finally made sure of the crossing of the Rhine. It would not be bombs or leaflets that Tony O'Neill dropped for the next few months; it would be men, the first paratroops who floated down over the landscape from his Armstrong Whitworth Whitley. □



Mission accomplished

A Nimrod MR Mk2 touches down on the runway of RAF St. Mawgan, its maritime reconnaissance sortie successfully completed. Within minutes, the consoles of the THORN EMI Electronics Mission Support System (MSS) are displaying surveillance data extracted at 8 times recorded speed from the Nimrod's mission tapes. Thus aircrews on patrol, or about to take off, can be briefed in a fraction of the time previously required.

Inside the Nimrod, a THORN EMI Electronics Searchwater radar is a vital element in the aircraft's complement of electronic sensors maintaining a round-the-clock surveillance over the approaches to our island's shores. MSS and Searchwater are just two examples of advanced technology from THORN EMI Electronics serving the defence needs of the United Kingdom and NATO.

Leadership in Defence Electronics



THORN EMI Electronics

THORN EMI Electronics Limited 120 Blyth Road Hayes
Middlesex UB3 1DL England telephone 01-573 3888 telex 22417.

A THORN EMI Company



Tornado

repeats successes in US bombing contests

For the second year running, RAF Tornado all-weather combat aircraft triumphed in the USAF Strategic Bombing Competition in the United States. Represented this year by Tornados of 27 Squadron, supported by Victor tankers of 57 Squadron, and competing against USAF B52 and F-111 crews, the RAF took 1st and 2nd places in both the John C. Meyer and Le May Trophies, and competing against John C. Meyer and Le May Trophies and 2nd place in the Mathis Trophy – even better than the 1984 results.

The competition is a demanding test, in a hostile electronic environment, of the precision of both bombing and timekeeping in high and low level sorties. Each of the 34 crews flew two daylight sorties and one night-sortie, each mission lasting over 6 hours and covering more than 2,400nm.

1st & 2nd John C Meyer Trophy
for best Tornado or F-111 team (2 crews), for highest damage expectancy achieved over 6 low-level sorties.

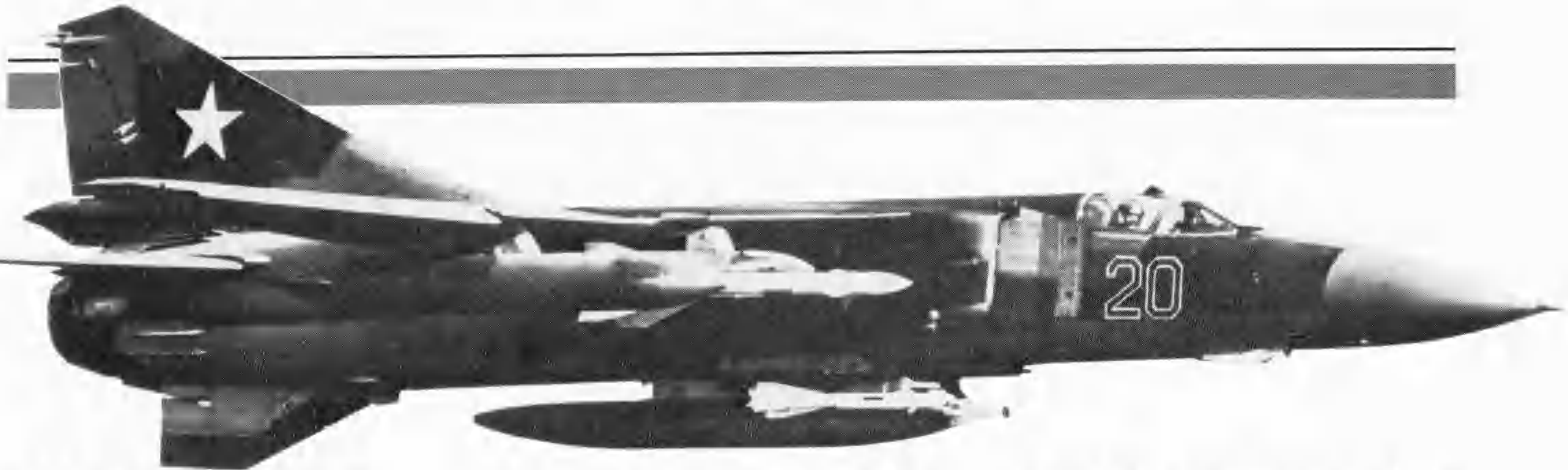
1st & 2nd Le May Trophy
for Tornado, B52 or F-111 crew scoring most points over 3 high and low level sorties.

2nd Mathis Trophy
for Tornado, B52 or F-111 team (2 crews) scoring most points over 6 high and low level sorties.



PANAVIA
Panavia Aircraft GmbH, München, Arabellastrasse 16, Germany

AERITALIA BRITISH AEROSPACE MESSERSCHMITT-BOLKOW-BLOHM



UNDER THE RED STAR

John W R Taylor, editor of "Jane's All the World's Aircraft", reviews the new generation of aircraft now becoming available to the air forces of the Soviet Union and her allies, offering altogether new levels of technical competence that the Royal Air Force must learn how to counter.



(Head of page) Some 400 MiG-23 interceptors are currently operated by the Voyska-PVO and about 40 interceptor regiments distributed between the 17 tactical air forces fly MiG-23s, one of the most recent production versions, Flogger-G, being illustrated. The world's largest aeroplane, the An-124 or Condor (below right), is expected to be deployed by the VTA military transport aviation force this year and may be joined by a derivative of the An-72 or Coaler STOL utility transport (immediately above).

According to the US Department of Defense, the number of Warsaw Pact combat aircraft in operational units confronting NATO in Europe is 7,430. This total is made up of 2,250 fighter-bomber/ground attack aircraft, 4,195 interceptors, 585 reconnaissance aircraft and 400 bombers. It does not include four-engined strategic bombers or the 540 combat aircraft in central Russia available as reinforcements. By comparison, NATO deploys in Europe a total of 2,990 combat aircraft, made up of 1,960 fighter-bomber/ground attack, 795 interceptor and 235 reconnaissance aircraft.

The Warsaw Pact's five-to-two numerical superiority has often in the past been dismissed as irrelevant in view of the West's assumed leadership in high technology and training. Nobody ever doubted that the Soviet Union was closing the technology gap; what is overlooked is that this has been happening for so long that the gap is no longer wide enough to offset the numerical disparity.

By far the clearest warning was given in 1985 by Donald C Latham, US Assistant Secretary of Defense for Command Control Communications and Intelligence (C³I). Addressing a military electronics symposium of the Air Force Association, he said that the Soviets "are ahead in the application of digital technology (and) in applying IR (infra-red) systems to their fighters". At least three of the latest Soviet fighter aircraft have IR sensors, against none in the USAF, although the American F-106 pioneered the use of search and track IR many years ago.

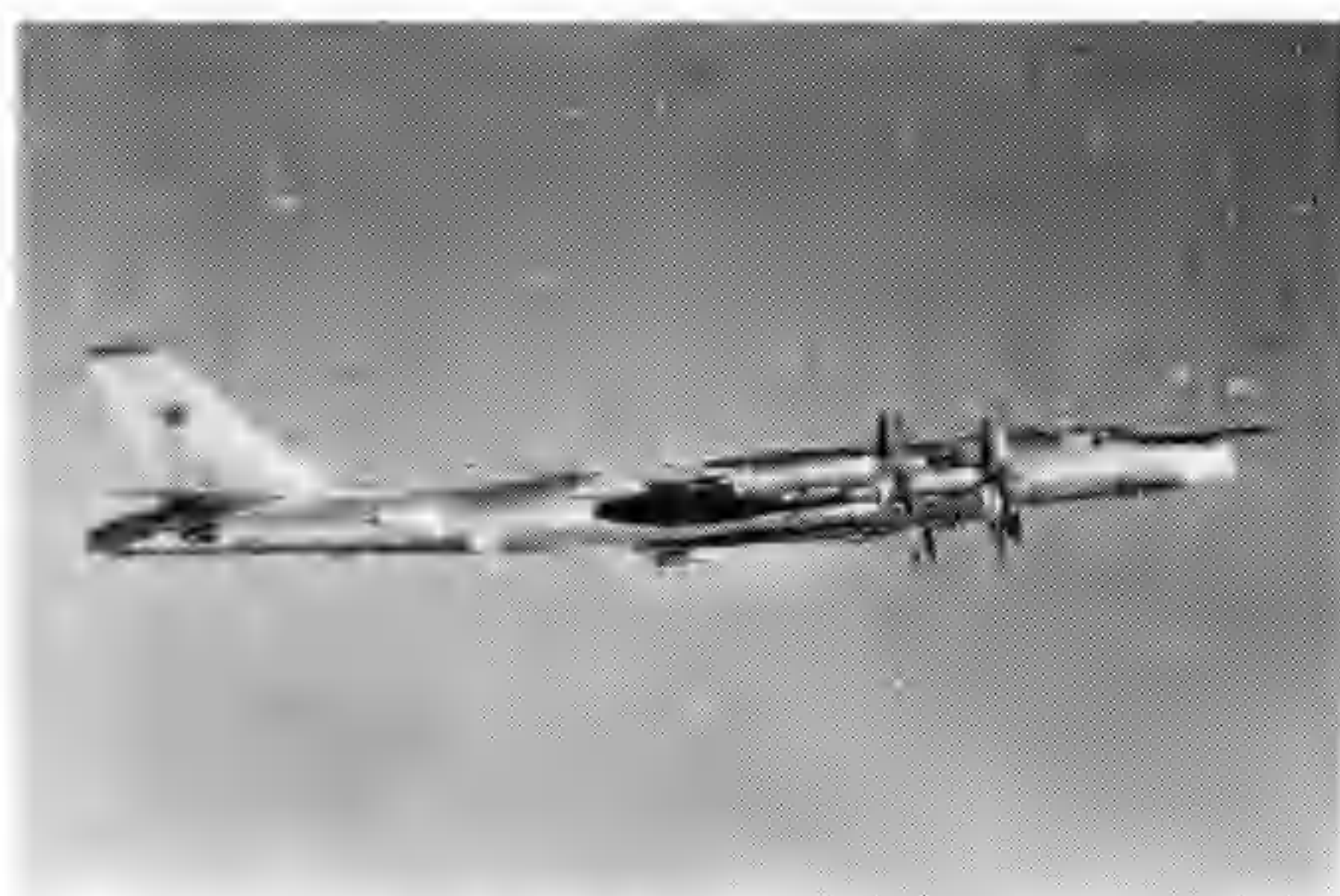
Turning to new generation armament, he said: "We are trying to field AMRAAM [the Hughes AIM-120A advanced medium-range air-to-air missile] at an incredible cost, while they already have a missile on some of their aircraft that is even better than AMRAAM." Summing up, he stated that the MiG-31 (NATO *Foxhound*), with a maximum take-off weight exceeding that of a B-17 Fortress strategic bomber of World War II, is superior to any existing US aircraft. In

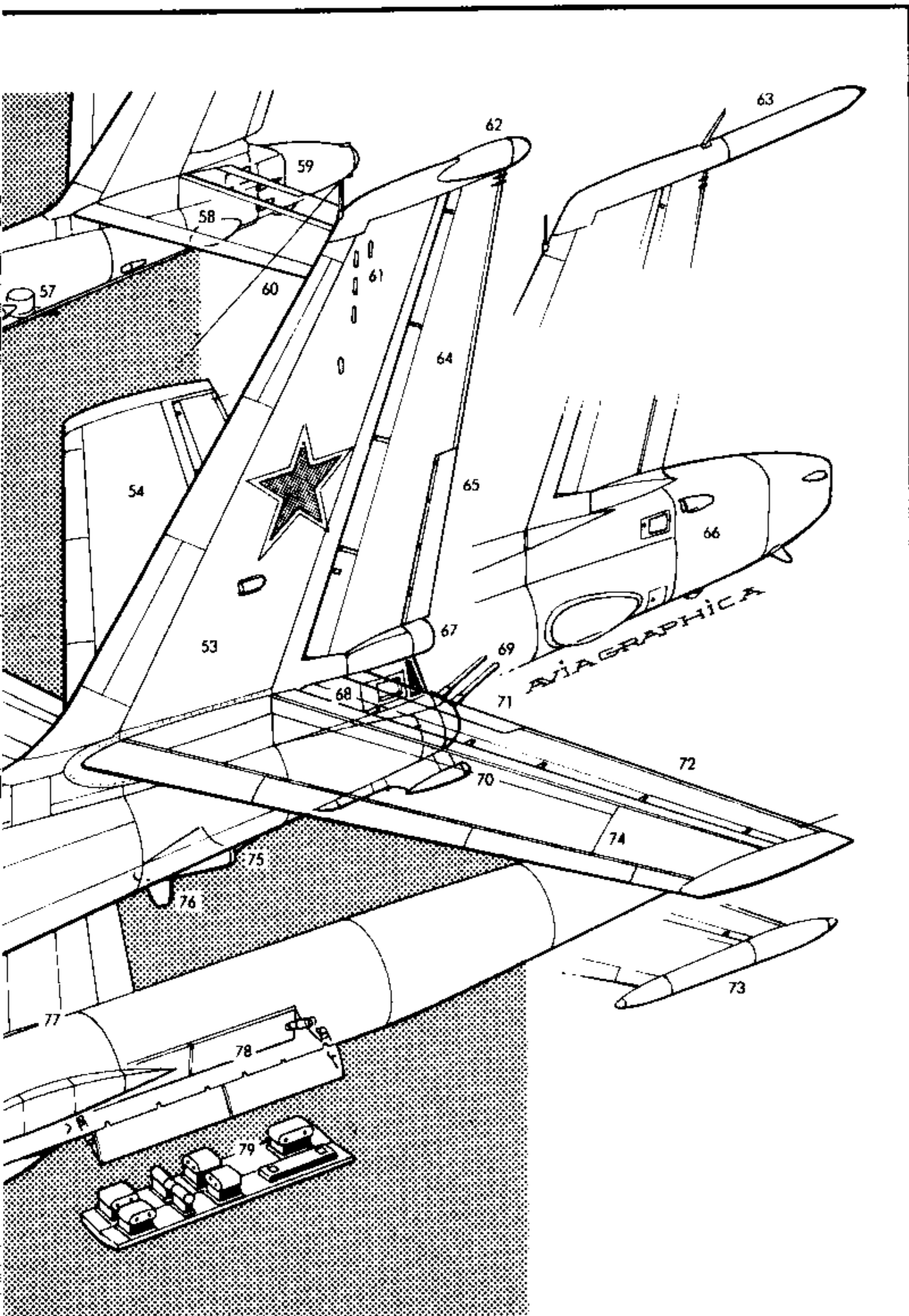


Tupolev Bear (late model aircraft)

Schematic Drawing Key

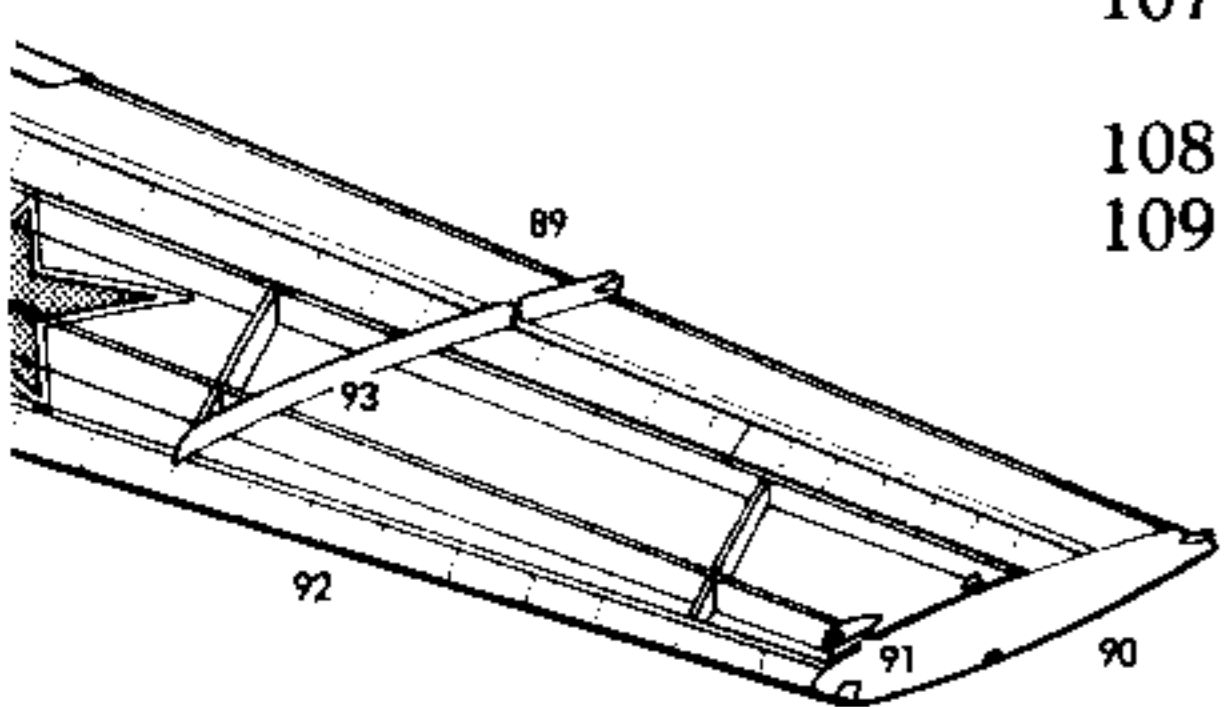
-
- 1 Fixed in-flight refuelling probe
 - 2 Radome (small fixed forward radar)
 - 3 Nose radome ("Short-Horn" navigation and bombing radar)
 - 4 Avionics equipment bay (port and starboard)
 - 5 Instrumentation antennae
 - 6 Retractable landing/taxying lamp (port and starboard)
 - 7 Nose undercarriage leg struts
 - 8 Nosewheel steering jacks
 - 9 Aft retracting twin nosewheels
 - 10 Nosewheel doors
 - 11 External cable duct
 - 12 Hydraulic retraction jack
 - 13 Nose undercarriage pivot fixing
 - 14 "Odd-rods" IFF antennae
 - 15 Windscreen panels
 - 16 Raised cockpit section glazing (Bear-E, -F and -H)
 - 17 Blade antenna
 - 18 Cockpit roof escape hatch
 - 19 Forward fuselage crew compartment
 - 20 Bulged nosewheel bay doors (strengthened higher gross weight undercarriage)
 - 21 Cooling air scoop
 - 22 Wing root attachment joint
 - 23 ADF sense aerial
 - 24 Inboard wing panel
 - 25 Starboard wing integral fuel tanks
 - 26 Starboard engine nacelles
 - 27 AV-60N eight-bladed contra-rotating propellers
 - 28 Propeller spinners
 - 29 Wing fences
 - 30 Outboard wing panel
 - 31 Wing tip lighting
 - 32 Starboard aileron
 - 33 Aileron tab
 - 34 Outboard single-slotted Fowler-type flap (lowered)
 - 35 Flap guide rails
 - 36 Nacelle tail fairing
 - 37 Mainwheel doors
 - 38 Inboard single-slotted Fowler-type flap
 - 39 ADF sense aerial
 - 40 Observation blister
 - 41 AS-4 Kitchen air-to-surface missile (Bear-G)
 - 42 Bear-G missile-carrying aircraft
 - 43 Modified "Crown Drum" navigation and attack radar
 - 44 Fixed forward radar antenna
 - 45 Standard cockpit glazing
 - 46 Ventral antennae (port and starboard)
 - 47 Satellite navigation antennae
 - 48 ADF sense aerial
 - 49 Underwing missile pylon (port and starboard)
 - 50 Outboard wing pylon
 - 51 Chaff/flare dispenser pod
 - 52 Fin root fillet
 - 53 Tailfin
 - 54 Starboard tailplane
 - 55 Bear-G radar-directing antennae
 - 56 Lateral radome
 - 57 Ventral cannon barbette (2 x 23-mm remotely-controlled cannon)
 - 58 Rear crew compartment observation blister
 - 59 Sensor tailcone
 - 60 HF aerial cable
 - 61 Short-wave ground control communications antennae
 - 62 Fin tip aerial fairing
 - 63 Magnetic Anomaly Detection (MAD) boom (Bear-F)
 - 64 Rudder
 - 65 Rudder tab
 - 66 Sensor equipment tail fairing (some Bear-D aircraft)
 - 67 I-band tail warning radar antenna compartment
 - 68 Tail gunner's compartment
 - 69 2 x 23-mm tail cannon
 - 70 Fixed aft facing radar antennae (port and starboard)
 - 71 Elevator trim tab
 - 72 Port elevator
 - 73 Tailplane tip sensor fairing (Bear-D)
 - 74 Port tailplane
 - 75 Ventral radome
 - 76 Communications aerial
 - 77 Fuselage profile Bear-E and -F
 - 78 Two-section weapons bay doors (Bear-F)
 - 79 Weapons bay camera and reconnaissance pallet (Bear-E)
 - 80 Ventral search radar
 - 81 Raised cockpit section glazing
 - 82 Nose observation compartment
 - 83 External cable duct
 - 84 Port inboard single-slotted flap
 - 85 Nacelle tail fairing
 - 86 Main undercarriage (stowed position)
 - 87 Outboard flap
 - 88 Aileron tab
 - 89 Port aileron
 - 90 Wing tip fairing
 - 91 Port wing tip lighting
 - 92 Leading edge thermal de-icing
 - 93 Wing fences
 - 94 Outboard wing panel three-spar construction
 - 95 Outer wing panel joint rib





PILOT PRESS
COPYRIGHT
DRAWING

- 104 Underwing missile pylon (port and starboard)
- 105 Twin missile carrier
- 106 AS-15 cruise missile (two per wing) folded position
- 107 Engine fire extinguisher bottle
- 108 Bifurcated jet pipe
- 109 Engine bearer struts



- 96 Wing integral fuel tanks (total fuel capacity 72 980 l/ 16,054 Imp gal)
- 97 Port outboard engine nacelle
- 98 Ventral oil cooler
- 99 Engine cowling panels
- 100 Four-wheel aft retracting main undercarriage bogie
- 101 Main undercarriage leg strut
- 102 Hydraulic retraction jack
- 103 Inboard wing panel four-spar construction
- 110 Main engine mounting ring frame/firewall
- 111 Kuznetsov NK-12MV turboprop engine
- 112 Engine accessory equipment
- 113 Engine air intake
- 114 Propeller reduction gearbox
- 115 Engine cowling annular air intake
- 116 Propeller hub pitch-change mechanism
- 117 Port contra-rotating propellers
- 118 AS-15 cruise missile (deployed configuration)

(Far left) *Bear-G* is a reconfigured version of the 30-year-old *Tu-95* which carries a pair of supersonic *AS-4 Kitchen* missiles. From the same stable, *Blackjack* (centre left) is a supersonic strategic bomber expected to enter service in 1987-88. (Immediately left) Nearly 300 of the early 'fifties vintage *Tu-16* remain in service with the strategic bombing force and more than 350 (in attack, *recce* and tanker versions) with Naval Aviation, the example illustrated being a *Badger-C* with a *Kingfish* missile on the portside wing pylon.

particular, Asst Sec Latham asserted, it "has better avionics, a better C³ system to work into, a better air-to-air missile, is faster, has greater combat range, and (the Soviets) are producing it like gangbusters".

Such words must come as a shock to anyone familiar with the openly published performance figures for aircraft like the F-15 Eagle. It is easy to forget that a maximum speed usually applies to a clean aircraft, without external weapons, and that the number of aircraft types able to cruise at supersonic speed for a prolonged period of time can be counted on the fingers of one hand. Success in modern air combat results from a combination of many factors, including quality of avionics and weapons, inherently high turning rate, system reliability, aircrew proficiency and morale and, of proven importance, the availability of efficient airborne early warning and control (AEW&C) aircraft.

The fact that, during air fighting over the Bekaa Valley in Lebanon, only the Israelis had AEW&C support is often overlooked. An air force that knows precisely where its enemies are, and in what strength, so that it can ambush them and not be lured into traps itself, can achieve the most outstanding combat results, as did the Israelis. In the past, Soviet interceptor pilots were restricted by the lack of an AEW&C aircraft better than the *Tu-126 Moss*, and by their enforced operation under ground control. They can now expect much improved support from *Mainstay* AEW&C aircraft, based on the *Il-76* transport, and are being encouraged to take individual control of a mission once the target has been acquired through the medium of GCI (ground controlled interception) techniques.

This represents one of the major advances in Soviet air power doctrine in the 1980s, and is becoming fully effective with the introduction into service of three new-generation fighters.

First of this trio was the *MiG-31 Foxhound*, to which Donald Latham referred. It is easy, but quite wrong, to regard this as simply an uprated *MiG-25 Foxbat* because the two aircraft are similar in configuration. *Foxhound* is very different in most operational respects. The capability of its new AA-9 long-range radar homing missiles, of which it carries eight, is such that it has been able to trade some of *Foxbat's* speed for increased combat radius. It carries a crew of two, whose capability is enhanced by the fact that *Foxhound* is the first Soviet fighter to offer true lookdown/shutdown and multiple target engagement capability. More than 70 *Foxhounds* were operational by the spring of 1985, leading to the DoD comment in its *Soviet Military Power* document that Soviet air defences are becoming much more efficient at intercepting low-flying penetrators in addition to their long-established excellence in dealing with aircraft flying at medium and high altitudes.

Since that document was published, the all-new *MiG-29 Fulcrum* and Sukhoi *Su-27 Flan-*

ker have joined *Foxhound* in squadron service. Numbers are still comparatively small; but although the greater complexity of these aircraft has brought a 33 per cent reduction in the estimated production rate of Soviet fighters, to 900 a year, this still compares with only 525 a year for NATO nations (excluding France and Spain) and is adequate to permit early export of *MiG-29s* to India.

In terms of size, the *Su-27* is a little larger than the F-15 Eagle, while the *MiG-29* is in the class of an F-16 Fighting Falcon. Comparative dimensions, weights and performance figures are given in an accompanying table. Inevitably, the Soviet pair will be described as copies of their US counterparts, but similarities in configuration are always to be expected in aircraft designed to do the same jobs, and it should be remembered that the Mikoyan bureau pioneered the modern trend towards twin fins on fighters.

The *MiG-29* and *Su-27* each carry six AA-10 medium-range radar homing missiles with similar capabilities to those of the longer-range AA-9. Of equal significance is that their look-down/shutdown pulse Doppler radars embody key elements of technology found in the advanced Hughes AN/APG-65 digital radar fitted to the US Navy's F/A-18 Hornets, acquired without the niceties of an export licence. The same covert methods are said to have assisted the Soviets to make the AA-9 and AA-10 more effective, and to develop airborne radar countermeasures for use against the American F-14 and F/A-18.

Such knowledge should not be allowed to diminish one's respect for Soviet aircraft designers, who continue to display the personal ingenuity that is discarded too readily in the West in favour of the robot thinking of computers.

Fulcrum and *Flanker* are said by the DoD to be highly manoeuvrable. They are primarily counter-air fighters, with a secondary attack capability, although even *Flanker's* reputed 13,225 lb (6 000 kg) external stores load is not impressive when compared with the F-15E's 23,500 lb (10 660 kg). A two-seat combat-capable version of the *MiG* is also in production, and it is known that both fighters have been observed at Saki naval airfield on the Black Sea, where the Soviet Navy has a 297-m (975-ft) dummy flight deck, complete with arrestor gear and barriers, plus two experimental ski-jump ramps, as part of its development programme for the 65,000-ton nuclear-powered aircraft carrier that is under construction at Nikolayev and is expected to be named *Kremlin*.

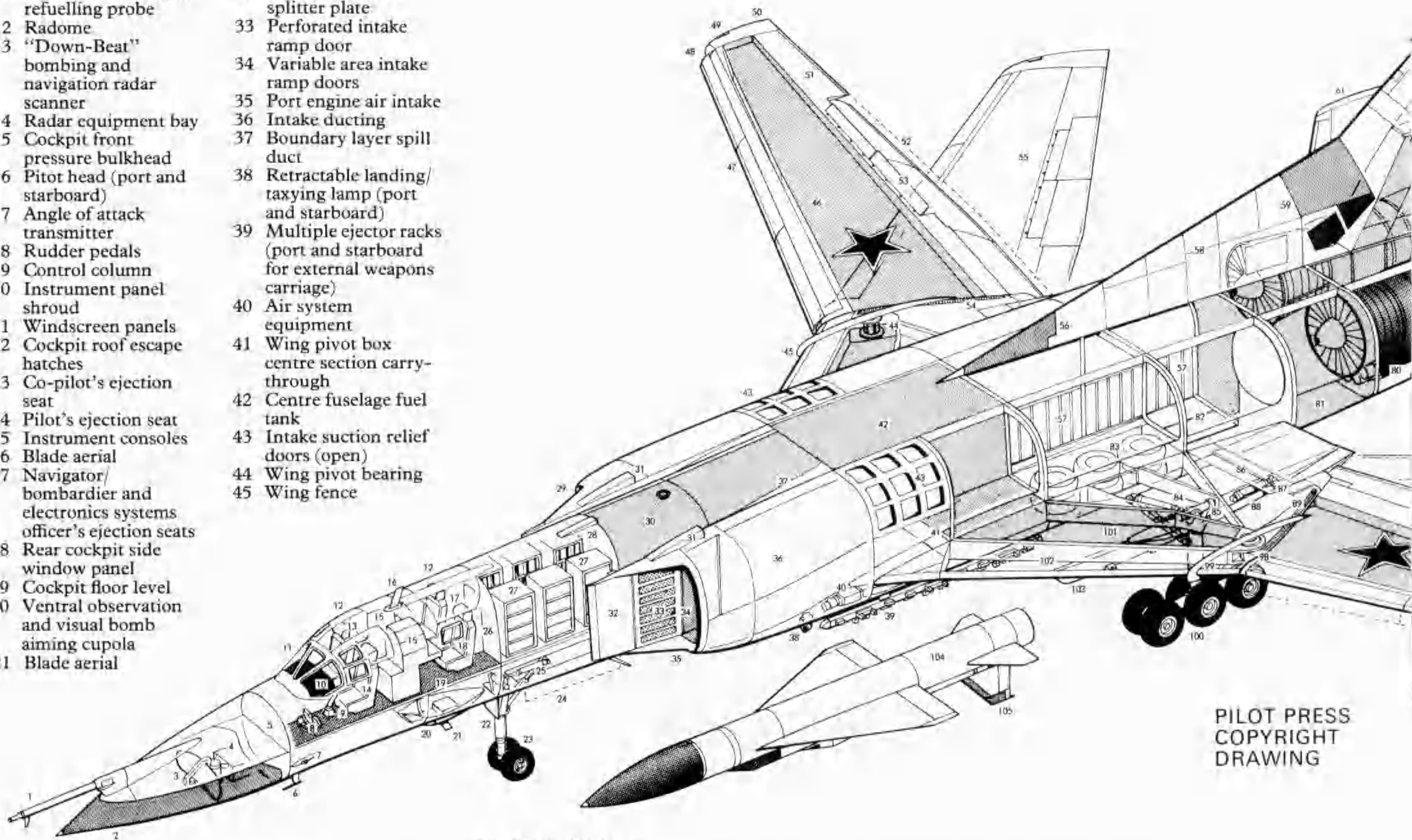
It cannot be assumed from all this activity that navalised versions of either the *MiG-29* or *Su-27* are scheduled to become components of the ship's carrier air group. Other types sighted at Saki include the Sukhoi *Su-25 Frogfoot*, which is a most unlikely candidate for ship-board operation. Despite its NATO reporting name in the "F for fighter" category, *Frogfoot* is an attack aircraft comparable with the

Tupolev Tu-22M/26 Backfire-B

Schematic Drawing Key

- 1 Detachable in-flight refuelling probe
- 2 Radome
- 3 "Down-Beat" bombing and navigation radar scanner
- 4 Radar equipment bay
- 5 Cockpit front pressure bulkhead
- 6 Pitot head (port and starboard)
- 7 Angle of attack transmitter
- 8 Rudder pedals
- 9 Control column
- 10 Instrument panel shroud
- 11 Windscreen panels
- 12 Cockpit roof escape hatches
- 13 Co-pilot's ejection seat
- 14 Pilot's ejection seat
- 15 Instrument consoles
- 16 Blade aerial
- 17 Navigator/bombardier and electronics systems officer's ejection seats
- 18 Rear cockpit side window panel
- 19 Cockpit floor level
- 20 Ventral observation and visual bomb aiming cupola
- 21 Blade aerial

- 32 Boundary layer splitter plate
- 33 Perforated intake ramp door
- 34 Variable area intake ramp doors
- 35 Port engine air intake
- 36 Intake ducting
- 37 Boundary layer spill duct
- 38 Retractable landing/taxying lamp (port and starboard)
- 39 Multiple ejector racks (port and starboard for external weapons carriage)
- 40 Air system equipment
- 41 Wing pivot box centre section carry-through
- 42 Centre fuselage fuel tank
- 43 Intake suction relief doors (open)
- 44 Wing pivot bearing
- 45 Wing fence



PILOT PRESS
COPYRIGHT
DRAWING

- 22 Nose undercarriage leg strut
- 23 Twin nosewheels
- 24 Pre-closing nosewheel doors
- 25 Nose undercarriage retraction mechanism
- 26 Cockpit rear pressure bulkhead
- 27 Avionics equipment racks
- 28 Equipment cooling air spill duct
- 29 Starboard engine air intake
- 30 Forward fuselage fuel tank
- 31 Boundary layer bleed air spill duct

- 46 Starboard wing integral fuel tank
- 47 Leading edge slat segments (open)
- 48 Starboard wing fully forward (20-deg sweep) position
- 49 Starboard navigation lights
- 50 Wing tip fairing
- 51 Fixed portion of trailing edge
- 52 Starboard slotted flap (down position)
- 53 Two-segment spoilers/lift dumpers (open)
- 54 Wing glove sealing plate
- 55 Starboard wing fully aft (65-deg sweep) position
- 56 Flush aerial fairing

- 57 Centre fuselage weapons bay
- 58 Extended fin root fillet
- 59 Flush aerial
- 60 Fin root fuel tank
- 61 Starboard all-moving tailplane (taileron)
- 62 Tailfin
- 63 Short wave ground control communications aerials
- 64 Fin tip aerial fairing
- 65 Sirena 3 tail warning radar
- 66 Tail navigation light
- 67 Rudder
- 68 ECM aerial fairing
- 69 "Bee-Hind" tail gun control radar
- 70 Twin 23-mm cannon
- 71 Remotely-controlled gun barbette

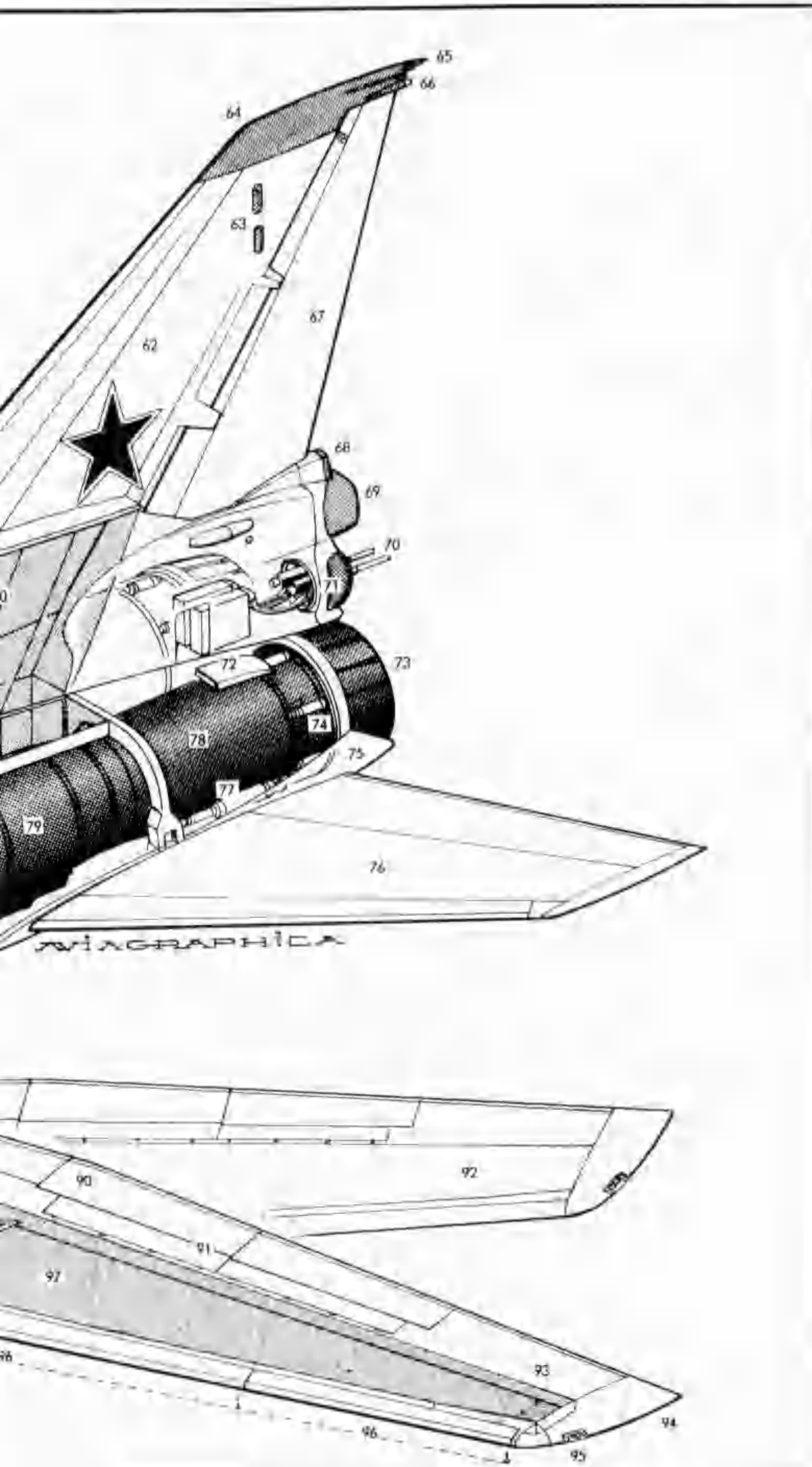
- 72 Afterburner duct cooling air scoop
- 73 Variable-area afterburner nozzle
- 74 Afterburner nozzle control jacks
- 75 Tailpipe fairing
- 76 Port all-moving tailplane (taileron)
- 77 Tailplane hydraulic actuator
- 78 Afterburner duct
- 79 Kuznetsov afterburning turbofan engine
- 80 Engine accessory equipment gearbox
- 81 Rear fuselage integral fuel tank
- 82 Ventral weapons bay doors
- 83 Main undercarriage wheel bay

- 84 Hydraulic retraction mechanism
- 85 Mainwheel leg pivot fixing
- 86 Wing glove section split trailing edge flap
- 87 Flap actuator
- 88 Ventral undercarriage leg pivot fairing
- 89 Wing glove sealing plate
- 90 Port three-segment slotted flap
- 91 Two-segment spoilers
- 92 Port wing fully swept position
- 93 Fixed portion of trailing edge
- 94 Port wing fully forward position

- 95 Port navigation light
- 96 Leading edge slat segments
- 97 Port wing integral fuel tank
- 98 Wing pivot bearing
- 99 Wing fence
- 100 Six-wheel main undercarriage bogie
- 101 Wing pivot box integral fuel tank
- 102 Fixed wing glove section leading edge
- 103 Glove section additional stores pylon
- 104 AS-4 "Kitchen" air-to-surface missile
- 105 Folding ventral fin



The programme to update about 300 MiG-25 Foxbat-A interceptors to Foxbat-E standard (as illustrated far left) with a limited lookdown/shootdown radar and an IR sensor has now reached an advanced stage. A two-seat derivative of the MiG-25, the MiG-31 Foxhound (immediately left) was the first Soviet fighter to offer true lookdown/shootdown and multiple target engagement capability.



USAF's A-10A Thunderbolt II. In the tradition of the Soviet Il-2 *Shturmovik* of World War II, it is a big-winged bomb truck able to carry 9,920 lb (4 500 kg) of external stores on 10 underwing pylons. These can include the full range of Soviet air-to-surface weapons, such as AS-7 *Kerry* missiles and chemical bombs, and are supplemented by a new twin-barrel 30-mm gun under the port side of the aircraft's nose.

Other features include a heavily armoured single-seat cockpit, nose mounted laser range-finder and marked target seeker, split wingtip airbrakes reminiscent of those of the US Navy's A-6 Intruder and a flare dispenser in the tailcone.

Two non-afterburning versions of the MiG-21's Tumansky R-13-300 turbojet give the Su-25 a higher performance than the A-10A, and it appears to have performed satisfactorily, against limited surface-to-air opposition, during its baptism of fire in Afghanistan, where it has been used in action against the mujahideen in mountainous regions, in partnership with Mi-24 *Hind* attack helicopters. After a slow start, production has built up to a rate that has permitted exports to begin to the Soviet Union's Warsaw Pact partners. First recipient of Su-25s was the Czechoslovak Air Force,

which had a single squadron in 1985, reputedly as replacements for vintage MiG-15s.

The Soviet air forces have undergone considerable organisational changes in recent years. The Voyska-PVO home air defence force retains nearly 10,000 surface-to-air missile launchers at 1,200 sites for strategic defence, together with more than 4,000 launch vehicles for tactical SAMs; but its piloted interceptor strength has been halved, to 1,200 all-weather aircraft. One-third of these are MiG-23 *Flogger-B/Gs*. About 300 MiG-25 *Foxbat-As* are being updated progressively to *Foxbat-E* standard, with a nose similar to that of the *Flogger* variants, housing a limited lookdown/shoot-down radar and carrying an IR sensor. The rest are MiG-31s and older types such as the Su-15/21 *Flagon*, Tu-28P *Fiddler* and Yak-28P *Firebar*.

In an emergency, this interceptor force could be supplemented by its former fighters that were transferred to the 17 tactical air forces. Of nearly 140 regiments and squadrons in these air forces, assigned to military districts and groups of forces, around 40 interceptor regiments are equipped with MiG-23 *Flogger-B/Gs*. Ten others have late-model MiG-21 *Fishbeds*, and there are smaller numbers of *Foxbats*, *Firebars*,

SOVIET AND US COMBAT AIRCRAFT (Comparative data)

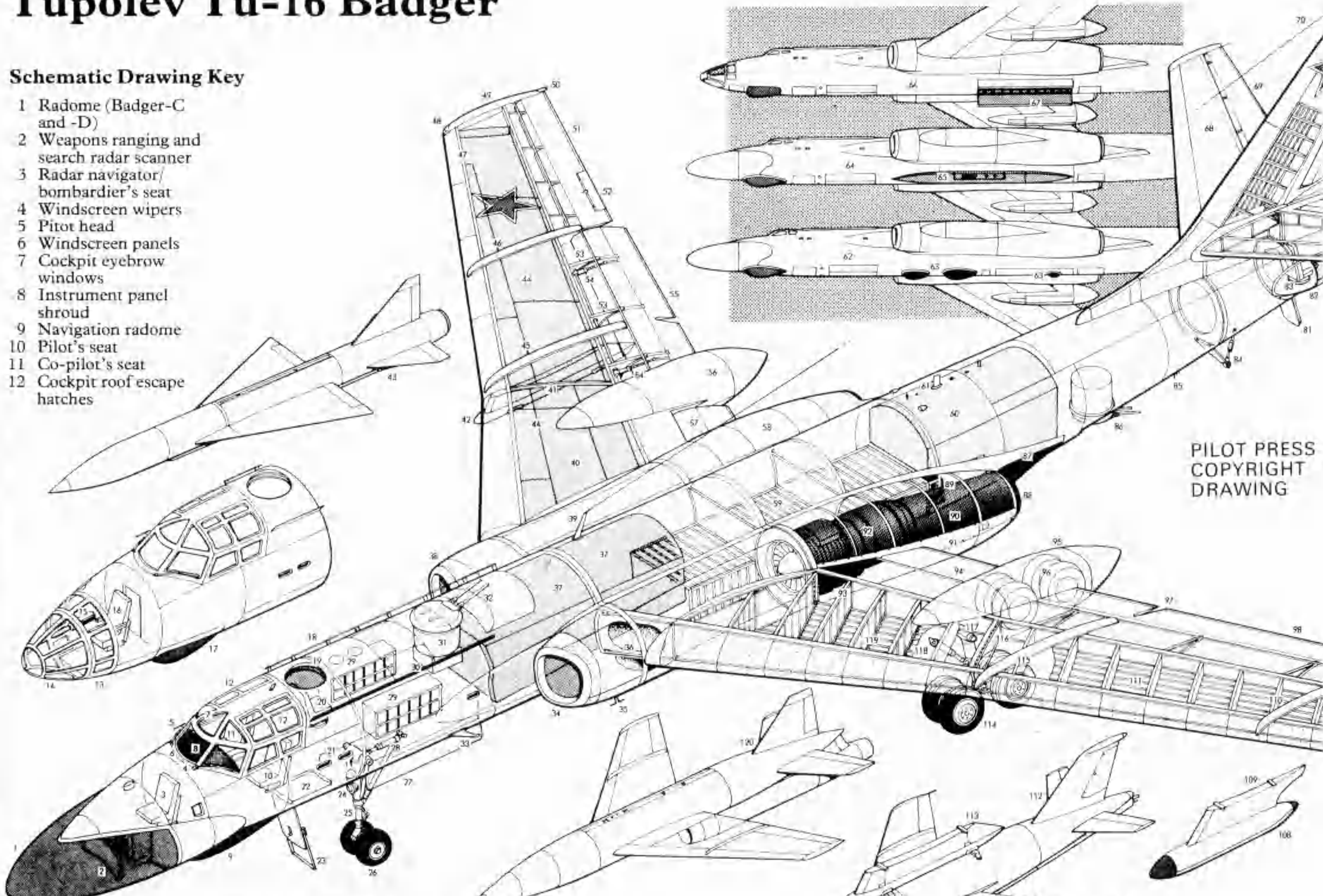
Type	Engine(s) each kN (lb st)	Span m (ft in)	Length m (ft in)	Max take-off weight kg (lb)	Nominal weapons/ payload kg (lb)	Max level speed at height Mach, or km/h (mph)	Combat radius km (mils)
MiG-29 <i>Fulcrum-A</i>	2 × Tumansky R-33D 81,4 (18,300)	10,25 (33 7½)	15,50 (50 10)	16 500 (36,375)	NA	2.2	1 150 (715)
F-16C Fighting Falcon	1 × Pratt & Whitney F100-PW-200 111,2 (25,000)	10,01 (32 10)	15,01 (49 3)	17 010 (37,500)	5 443 (12,000)	over 2.0	630 (391)
MiG-31 <i>Foxhound</i>	2 × Tumansky R-31 137,3 (30,865)	14,00 (45 11¼)	23,50 (77 1¼)	41 150 (90,725)	NA	2.4	2 100 (1,305)
F-14A Tomcat	2 × Pratt & Whitney TF30-P-414A 93,0 (20,900)	19,54 (64 1½) spread	19,10 (62 8)	33 724 (74,349)	6 577 (14,500)	2.34	1 610 (1,000)
Sukhoi Su-27 <i>Flanker</i>	2 × Tumansky 133,5 (30,000)	14,50 (47 7)	21,00 (69 0)	28 500 (63,000)	6 000 (13,225)	2.35	1 500 (930)
F-15C Eagle	2 × Pratt & Whitney F-100-PW-100 106,0 (23,830)	13,05 (42 9¾)	19,43 (63 9)	30 845 (68,000)	10 705 (23,600)	over 2.5	1 000 (621)
Sukhoi Su-25 <i>Frogfoot</i>	2 × Tumansky R-13-300 50,0 (11,240)	15,50 (50 10)	14,50 (47 6)	19 200 (42,330)	4 500 (9,920)	880 (546)	550 (341)
A-10A Thunderbolt II	2 × General Electric TF34-GE-100 40,3 (9,065)	17,53 (57 6)	16,26 (53 4)	22 680 (50,000)	7 258 (16,000)	706 (439)	650 (404)
Antonov An-124 <i>Condor</i>	4 × Lotarev D-18T 229,75 (51,650)	73,30 (240 5¾)	69,50 (228 0¼)	405 000 (892,872)	150 000 (330,693)	865 (537)†	4 500 (2,795)*
C-5B Galaxy	4 × General Electric TF39-GE-1C 191,2 (43,000)	67,88 (222 8½)	75,54 (247 10)	379 657 (837,000)	118 388 (261,000)	919 (571)	5 526 (3,434)*

Soviet data (except An-124) estimated. †max cruising speed *with max payload NA not available.

Tupolev Tu-16 Badger

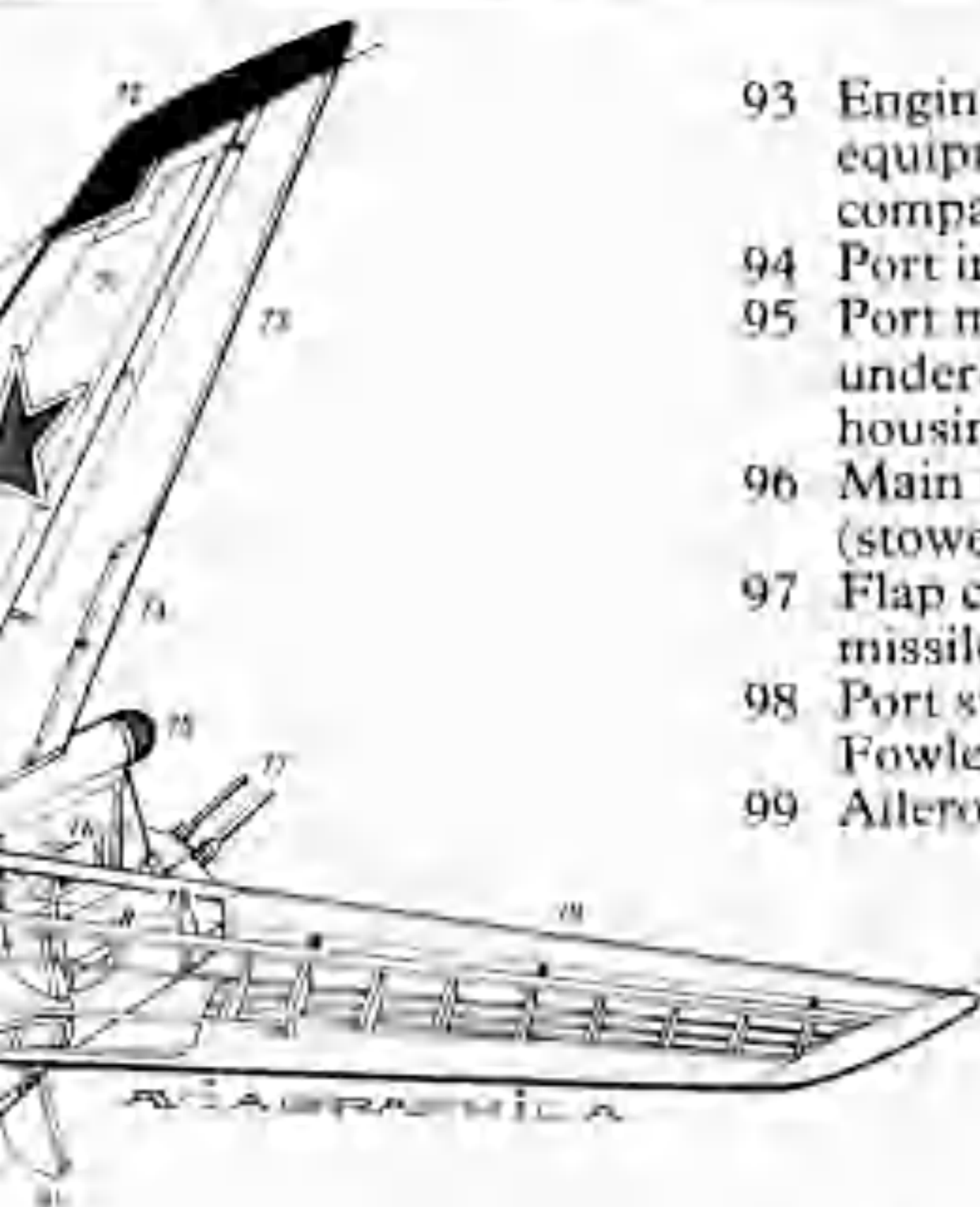
Schematic Drawing Key

- 1 Radome (Badger-C and -D)
- 2 Weapons ranging and search radar scanner
- 3 Radar navigator/bombardier's seat
- 4 Windscreen wipers
- 5 Pitot head
- 6 Windscreen panels
- 7 Cockpit eyebrow windows
- 8 Instrument panel shroud
- 9 Navigation radome
- 10 Pilot's seat
- 11 Co-pilot's seat
- 12 Cockpit roof escape hatches

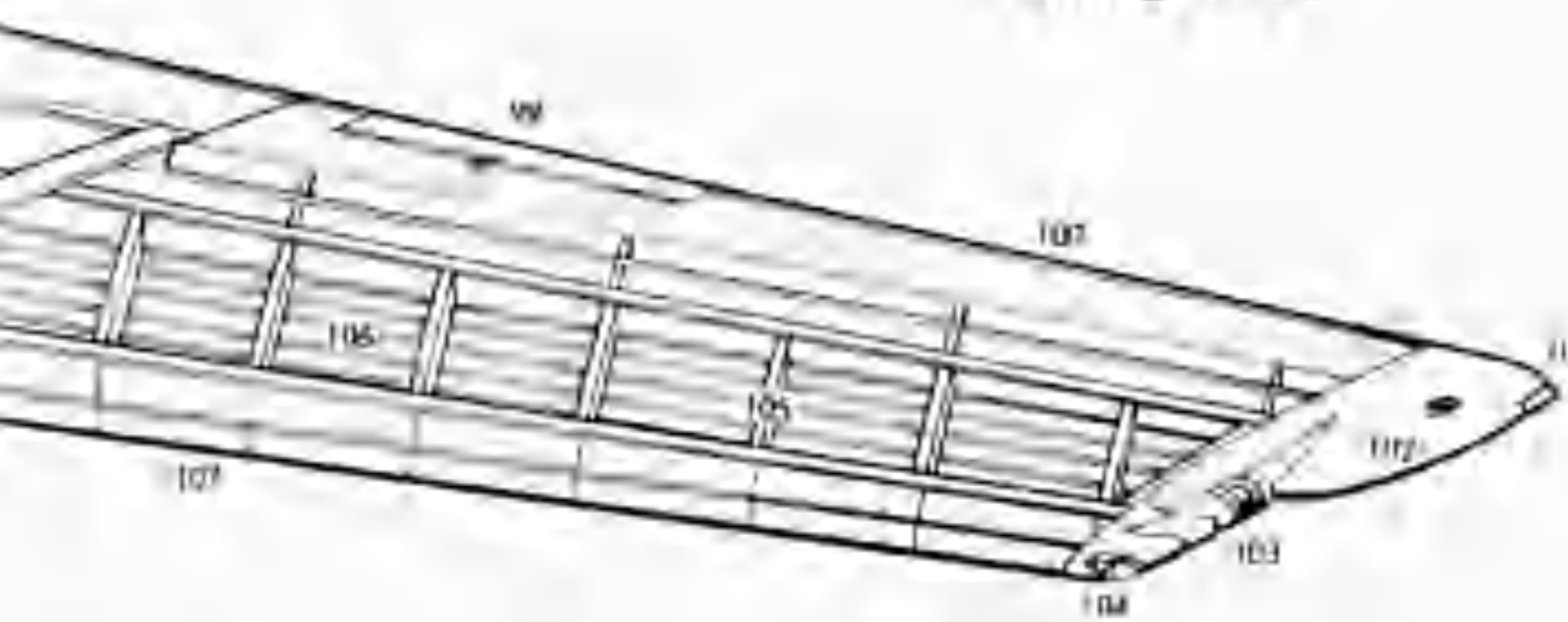


- | | | | | | |
|---|---|---|---|--|---|
| <ol style="list-style-type: none"> 13 Glazed nose section (all variants except -C and -D) 14 Optically flat sighting window 15 Fixed forward firing NR-23 23-mm cannon (on starboard side only) 16 Navigator/bombardier's seat 17 Navigation radome 18 "Towel-rail" aerial 19 Astrodome observation hatch 20 Forward gunner's swivelling seat 21 Cabin side window panels 22 Ventral entry/exit hatch 23 Extending boarding ladder | <ol style="list-style-type: none"> 24 Retractable landing/taxying lamps (port and starboard) 25 Nose undercarriage leg strut 26 Twin nosewheels (aft retracting) 27 Nosewheel doors 28 Nose undercarriage hydraulic jack 29 Electronics equipment racks (port and starboard) 30 HF blade antenna 31 Remotely controlled dorsal gun turret 32 Twin NR-23 23-mm cannon 33 Communications acrials (port and starboard) 34 Port engine air intake 35 Radar altimeter aerial | <ol style="list-style-type: none"> 36 Intake duct divided around front spar 37 Forward fuselage fuel cells (maximum internal capacity approx 10,000 Imp gal/45 500 l) 38 Starboard engine air intake 39 Aerial mast 40 Starboard inboard wing panel 41 Outer wing panel joint 42 Starboard missile pylon 43 AS-6 "Kingfish" air-to-surface missile (Badger-G "modified") 44 Starboard wing integral fuel tanks | <ol style="list-style-type: none"> 45 Inboard wing fence 46 Outboard wing fence 47 Outer wing panel 48 Starboard navigation light 49 Wing tip fairing 50 Fuel jettison pipe 51 Starboard aileron 52 Aileron tab 53 Flap guide rails 54 Starboard screw jacks 55 Starboard single-slotted Fowler-type flap (down position) 56 Starboard main undercarriage fairing 57 Inboard flap segment 58 Starboard engine bay | <ol style="list-style-type: none"> 59 Centre section internal weapons bay (capacity 19,800 lb/9 000 kg) 60 Rear fuselage fuel cells 61 Blade antenna 62 Badger-D electronic reconnaissance variant (ventral view) 63 Ventral radomes 64 Badger-C maritime-strike variant 65 Semi-recessed missile housing (AS-2 "Kipper" air-to-surface missile) 66 Badger-A bomber (ventral view) | <ol style="list-style-type: none"> 67 Weapons bay doors (open) 68 Starboard trimming tailplane 69 Starboard elevator 70 HF aerial cable 71 Tailfin 72 Fin tip aerial fairing 73 Rudder 74 Rudder tab 75 Gun ranging radar antenna 76 Rear gunner's station 77 Twin NR-23 23-mm cannon 78 Elevator tab 79 Port elevator 80 Port tailplane construction |
|---|---|---|---|--|---|





- 93 Engine accessory equipment compartment
- 94 Port inboard flap
- 95 Port main undercarriage housing
- 96 Main undercarriage (stowed position)
- 97 Flap cut-out for missile tail fin
- 98 Port single-slotted Fowler-type flap
- 99 Aileron tab



- 100 Port aileron
- 101 Fuel jettison pipe
- 102 Port wing tip fairing
- 103 In-flight refuelling receptacle (wing tip-to-wing tip refuelling)
- 104 Port navigation light
- 105 Outer wing panel rib construction
- 106 Wing skin/stringer panel
- 107 Thermally de-iced leading edge
- 108 Electronic intelligence gathering pod (Badger-F)

- 81 Rear pressurised compartment ventral entry/exit hatches
- 82 Observation blister (port and starboard)
- 83 Radio operator/observer's station
- 84 Retractable tail bumper
- 85 "Odd-rods" IFF aerials
- 86 Ventral remotely controlled gun barbette (2 x NR-23 23-mm cannon)
- 87 Exhaust fairing
- 88 Engine exhaust nozzle
- 89 Ventral strike camera
- 90 Outboard canted jet pipe
- 91 Engine bay access doors (above and below)
- 92 Mikulin RD-3M (AM-3M) single-shaft turbojet engine

- 109 Electronic pod pylon
- 110 Outboard wing fence
- 111 Port wing integral fuel tanks
- 112 AS-5 "Kelt" air-to-surface missile (Badger-G)
- 113 Port wing missile pylon
- 114 Four-wheel main undercarriage bogie (aft retracting)
- 115 Inboard wing fence
- 116 Outer wing panel bolted joint rib
- 117 Main undercarriage pivot fixing
- 118 Hydraulic retraction jack
- 119 Inner wing panel integral fuel tank
- 120 AS-2 "Kipper" air-to-surface missile (Badger-C)

One of the latest additions to the immense Soviet helicopter fleet is the Mi-28 *Havoc* (illustrated by an artist's impression far left), a dedicated attack helicopter with a two-man crew. The Ka-27 *Helix* (centre left) is widely used by the Soviet Navy in the ASW rôle, and the Mi-24 (immediately left) attack helicopter is usually mixed with Mi-8 *Hip* transport helicopters in the helicopter-equipped attack regiments of the Soviet ground forces. The *Hind-D* version of the Mi-24 illustrated (serving with the Syzran Air Force Academy) lacks the usual undernose turreted Gatling gun.

Fiddlers and new *Foxhounds* and *Fulcrums*. The *Floggers* are likely to remain in widespread use throughout the 1980s; but the older types will be replaced with *Foxhounds*, *Fulcrums* and *Flankers*.

Su-24 *Fencers*, in the class of USAF's F-111s and the RAF's Tornado GR Mk 1s, form the spearhead of the ground attack regiments, but are far outnumbered by smaller Su-17 *Fitters* and MiG-27 *Floggers*. Other units operate MiG-23 *Floggers*, Su-25s and MiG-21s. Tactical reconnaissance aircraft are primarily MiG-25s, Su-17s and MiG-21s, with a few Yak-28 *Brewers* still awaiting replacement, some in an ECM jamming rôle.

This reminds us that the Soviets never like to throw away aircraft which have become obsolete in their original rôle. The ECM/electronic intelligence/communications intelligence force, in particular, has a variety of one-time bombers and transports, including An-12 *Cubs* intended to jam the target seeking radars of NATO Hawk surface-to-air missile sites in time of crisis.

About 225 other *Cubs* supplement the 275 Il-76 *Candid*s that are taking over progressively as the backbone of the VTA military transport aviation force. Its regular fleet includes the 55 remaining four-turboprop An-22 *Cocks* built in the early 1970s as tank carriers, but these are overdue for replacement by Antonov's impressive new An-124 *Condor*, first flown in December 1982.

The *Soviet Military Power* document emphasises that Soviet air operations are always planned as part of a well-co-ordinated combined arms operation. Thus, the Soviet ground forces are responsible for maintaining not only the world's largest airborne force, comprising seven full divisions and elements of an eighth in Afghanistan, but a wholly unique inventory of combat and support helicopters. These are deployed as squadrons at division level. At army level there are 20 attack regiments, each with up to 60 Mi-8 *Hip* transport helicopters and Mi-24 *Hind* attack helicopters. The term "transport" should not be taken too literally, as *Hip* can also carry four anti-tank missiles and 192 rockets. Similar weapons under the stub wings of *Hind* can be replaced with up to 3,307 lb (1 500 kg) of chemical or conventional bombs, and it has either a four-barrel Gatling gun under its nose or a twin-barrel 23-mm cannon on the side of its forward fuselage.

Hind was designed originally to carry a squad of assault troops in its armoured cabin, with weapons primarily to fight its way through to a drop zone. Mil's new Mi-28 *Havoc* was intended from the start as an attack helicopter, with a traditional two-man crew in tandem and less bulky airframe, making it more comparable with the US Army's AH-64 Apache. No less formidable is *Hokum*, the Kamov design bureau's new co-axial twin-rotor helicopter in the 12,000-lb (5 450-kg) class, with duties that include anti-helicopter combat.

The threat already posed by hundreds of

Hinds, plus the potential of *Havoc*, persuaded the US Army to cancel further production of its Sgt York divisional air defence (Divad) tracked self-propelled gun system in August 1985. There seemed little point in spending billions of dollars on it, when the Soviet helicopters could hover beyond the weapon's range and pick it off with a missile. Four months later, a member of the House of Representatives Armed Services Committee suggested that the Army might also take another look at its proposed LHX light multi-purpose helicopter programme, as *Hokum* flies nearly 50 mph (80 km/h) faster than the proposed maximum speed of the LHX, which was not even off the drawing board at that time.

There is, currently, no western counterpart to *Hokum*. Nor is there a western helicopter in the class of the Mi-26 *Halo*, which can carry two airborne infantry combat vehicles or about 90 combat equipped troops. Russian designers have always had a predilection for "building big" since Igor Sikorsky flew the world's first four-engined aeroplane at St Petersburg (now Leningrad) in 1913. Visitors to the 1985 Paris Air Show were able to see the Mi-26, the world's biggest production helicopter, parked near the An-124 *Condor*, the world's largest aeroplane of the present time. *Condor's* size is no gimmick. On 26 July 1985 it set 21 records by lifting a payload of more than 171 metric tonnes (some 377,000 lb) to a height of 35,269 ft (10 750 m). This exceeded by a staggering 53 per cent the previous record set only seven months earlier by its US look-alike, the C-5A *Galaxy*.

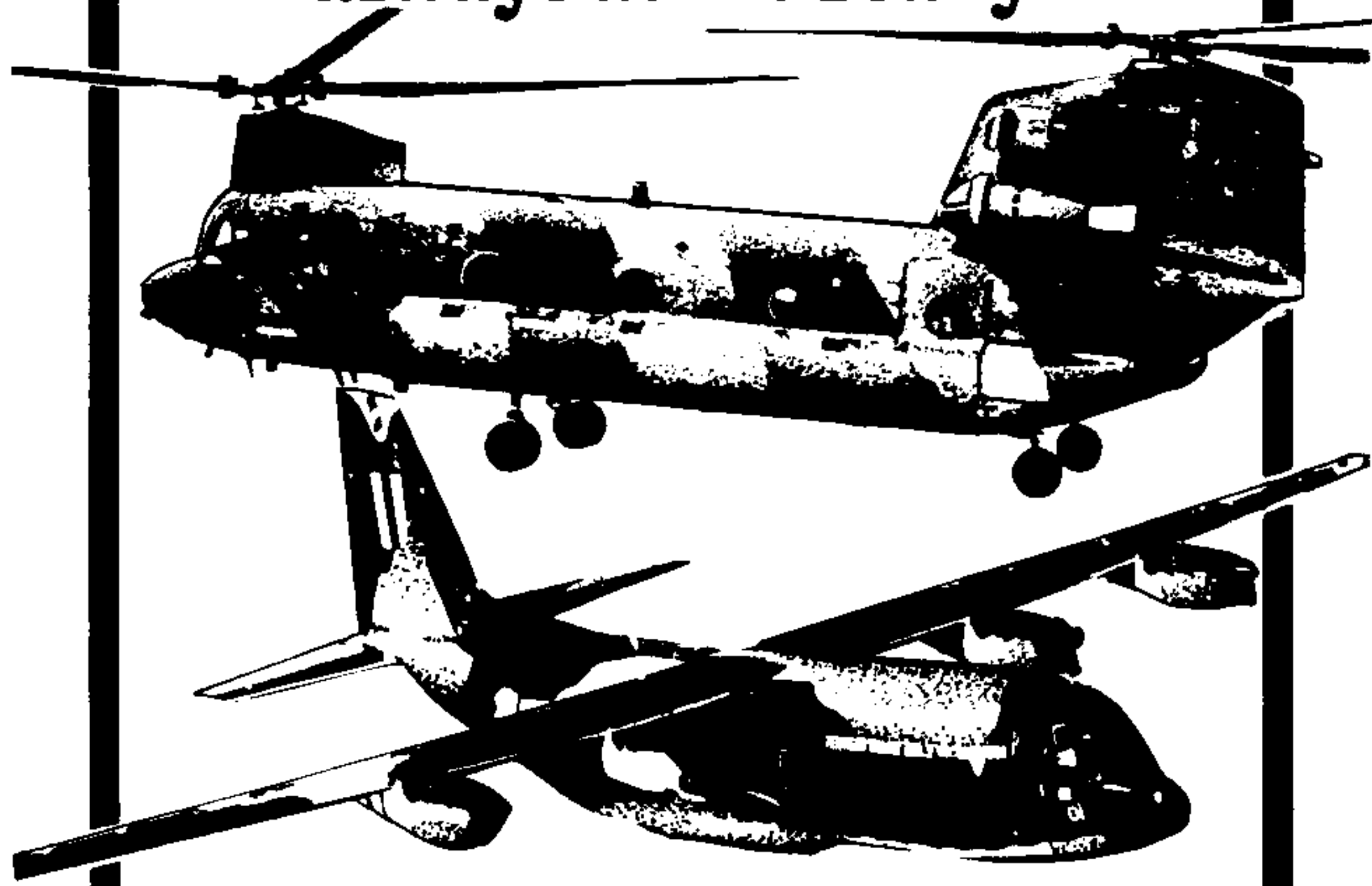
Condor was designed to carry the Soviet Army's largest main battle tanks, and can also ferry SS-20 mobile nuclear weapon systems rapidly from one area of storage or deployment to another. But do the qualities of one aircraft compared with another still matter in an age of nuclear missiles?

Former US Secretary of Defense Robert S MacNamara has expressed the opinion that "I do not believe we can avoid serious and unacceptable risk of nuclear war until we recognise — and until we base all our military plans, defence budgets, weapon deployments and arms negotiations on the recognition — that nuclear weapons serve no military purpose whatsoever. They are totally useless — except only to deter one's opponent from using them".

This probably explains why the Soviet air forces intend to add the huge new Tupolev *Blackjack* strategic bomber to the 300 smaller supersonic *Backfires* that they already have. Until *Blackjack* is ready for service, in 1987-88, an entirely new model of the 30-year-old Tu-95, known as *Bear-H*, is operational as a counterpart to the USAF's B-52 cruise missile carrier. Somebody, somewhere, clearly understands that only piloted aircraft offer the flexibility to fight small wars and to prevent any conflict escalating to the stage where nuclear weapons would be brought into use. □

MILITARY AIRCRAFT MAINTENANCE

always at the ready



Fields

Field Aviation Ltd Huntavia House
420 Bath Road West Drayton
Middlesex UB7 0LL England
Tel: 01-897 6446 Telex: 8952145

A member of Hunting Associated Industries p.l.c.

College of Aeronautics

Cranfield Institute of Technology
for post-graduate aeronautical
education



Research, Development,
Aircraft Design, Aircraft
Modification and Role Change

**Cranfield Aeronautical
Services Ltd.,
Cranfield, Bedfordshire
MK43 0AL**



Complete your DC10 and B737 training requirements at the British Caledonian Flight Training Centre.

Full ground and simulator training facilities available with or without company instruction. CAA and FAA (Phase I/Phase II) approved simulators backed up by extensive AVT, system and cockpit procedures trainers.

All instructional staff are type rated experienced airline personnel.

Training also arranged for B707, B747, A310, BAC 1-11.

Courses available include: Full transition to type recurrent training (including loft); Check pilot/instructor training; Micro-burst simulation; Pre Jet introductory training.

For further information contact: Rodney C. Dean,
Manager Marketing, BCAL Flight Training Ltd.,
Fleming Way, Crawley RH10 2UH UK.
Tel: 0293 543541. SIGNAL LGWOGBR.

**British
Caledonian**  **Flight Training**

FLYING THE BUCCANEER ON SHINEY TWELVE

The Buccaneer occupies a special place in the RAF's armoury — not least for the fact that it was designed and first put into production for the Royal Navy. If its adoption by the RAF was something of an afterthought, there is now no lack of enthusiasm for its capabilities as a fast-flying, long-ranging, rugged strike aircraft, and a major update programme now under way will keep the Buccaneer in service well into the 1990s, with the Ferranti FIN 1063 inertial navigation platform, BAe Sea Eagle anti-ship missile and other improvements. Squadron Leader C F Wrighton gives a navigator's eye view of the Buccaneer.



Despite the overcast skies and slight drizzle, I am uncomfortably warm as I leave the hangar and walk to the aeroplane. The several layers of insulation and the heavy waterproof immersion suit I am wearing may well save my life if I eject into the icy North Atlantic waters, but on the ground they impede my motion and slow me down. With oxygen and anti-g pipes hanging loose, a heavy life-jacket crammed with the impedimenta of survival, I feel more like a "Michelin Man" than the suave young fighter ace found in fiction. Nevertheless, looking back to the hangar I can see the No 12 Squadron crest proudly displayed and I know I am following in the tracks of a long line of distinguished aviators.

No 12 Squadron's motto "*Leads the Field*" aptly sums up the unit's achievements over the years. The first and only operators of the Fairey Fox, No 12's pilots were able, 60 years ago, to

show a clean pair of heels to any pursuing fighters, and the Fox's head was appropriately adopted as the squadron crest. Re-equipping with the Hawker Hart, the squadron started a long maritime tradition by developing all-weather bombing tactics against Capital ships. In 1940, the first Victoria Crosses of World War II were posthumously awarded to Fg Off Garland and Sgt Gray for their gallantry, flying Fairey Battles, in destroying the Vedwezelt Bridge at Maastricht. After the War, the squadron was amongst the first to re-equip with the Canberra, pioneering the introduction of jet bombers into RAF service and employing them operationally in the Malayan Crisis. Converting to the Vulcan B Mk 2, the squadron became part of Britain's Deterrent Force and over the period converted from high-level to low-level penetration and bombing. In 1969, No 12 Squadron re-formed as the first to operate the Buccaneer S Mk 2B in the specialist

Maritime Strike/Attack rôle. Once again, No 12 was "Leading the Field".

Ahead of me, six Buccaneers sit heavily on the ground, as if to deny that 26 tons of metal can fly in the air like a bird. The bulges at the cockpit and round the hips demonstrate the theory that a smooth change of area from nose to tail will decrease the high speed subsonic drag. In fact, the first design drawings of the Buccaneer showed a more conventional shape with a parallel-sided fuselage; then Dr Richard Whitcomb advanced his "area rule law" and the Buccaneer was redesigned by adding the bulges. That the theory works is borne out by the words of a squadron song:

"Faster-lower; lower-longer
"Who will beat the Buccaneer."

Even today, 20-plus years after the Buccaneer's introduction, there are few other aircraft that can fly as fast; or as low; or as far. None at all can do all three.



Closer to the aeroplane, the large petal airbrakes at the rear of the fuselage are quickly noticed. The Buccaneer blows air over the wings to lower the landing speeds, and the increased engine power required to produce this "blow" is balanced against the airbrake. One side effect is that selection of full airbrake above 500 kts (926 km/h) is like running into a brick wall, and height can be reduced very rapidly indeed. In fact, the airbrakes have a more mundane use as well; fully extended, in conjunction with the folding nose and wings, they allow the Buccaneer to be parked in a very small area.

Dark stains on the underside of the aircraft betray the very high hydraulic pressure used to guarantee undercarriage lowering; a hydraulic system working at 4,000 psi (281 kg/cm²) inevitably leads to seal leaks and a fluid-darkened bomb door. The bomb door itself rotates, to minimise trim change when opened, and enables the aircraft to carry four 1,000-lb (454-kg) High Explosive bombs without any drag penalty. It is also a useful place to put baggage on "landaways", which may explain why Buccaneer aircrew are always well dressed on detachment, although minor fuel leakages sometimes lead to a rather exclusive "Eau d'Bucc"!

Creature comforts

Final external check of the aircraft completed, it is time to climb the ladder and carefully ease into the rear cockpit, sliding legs between the radar on the left, the Martel missile television screen in the middle, and the navigation equipment on the right. Once seated, the Buccaneer cockpit is quite comfortable (for the first half hour, that is — then the hard seat pack begins to make its presence felt) provided that you don't need a lot of space.

The pilot's cockpit is slightly roomier, but only just, and the heavy winter clothing makes it smaller still. Both Buccaneer cockpits are a fascinating display of antique-looking instruments and switches. The basic display was invented long before "ergonomics" was a keyword and any semblance of design in the original concept has been submerged under many "add-on" controls and instruments.

Nevertheless, although sometimes described as an "ergonomic slum", the Buccaneer's cockpit is not difficult to operate, and to trained aircrew everything falls to hand with practised ease. Once engines have been started, systems and controls are checked and we are ready to taxi: today we are Number Four of a six-aircraft formation, leading our element and ready to take over if the formation leader has an unserviceability. Taxying out, we see that a visiting aircraft has parked a bit close so we fold the wings before moving forward. Once clear, the wings are lowered again and checked locked. Nobody has yet taken off in a Buccaneer with the wings folded and I don't want to be the first to try.



A walk around Buccaneers of No 12 Squadron reveals salient features of this potent strike aircraft. Notice the Martel anti-ship missile carried by the aircraft below. Folding wings — a novelty for the RAF — recall the aircraft's Naval origins and the badge recalls the fact that No 12 was the first and only RAF unit to fly the Fairey Fox. Air-to-air refuelling probes are permanently extended and the Buccaneers practise AAR regularly to meet their maritime strike mission requirements.



Approaching the active runway we call Air Traffic Control for clearance to take-off. The first two aircraft position on the runway and check their engine thrust and wing blow pressures. As the first aircraft rolls, number three moves in to take his place and so on until all six are airborne. This way, the maximum length of runway is available — a useful bonus today as we are operating from the short runway with heavy aircraft. Acceleration with a blown take-off is not impressive by fast jet standards, but the take-off roll is suitably shortened as we climb away. I always find the first few airborne moments of a blown take-off a bit tense as we are in that "dead" zone between wheels-off and single engine safety speed. Lose an engine now and the only way to land is by courtesy of Martin Baker; my hand is never far from the ejection seat handle until we accelerate to a more acceptable rate of progress. Aircraft climb away alternately High-Low-High, to avoid their predecessors slipstream, and a careful eye is kept on all the flap surfaces and wheels indicators to ensure everything is up and clean before we accelerate away to the first event.

Switches are checked as we approach the range and the bombs selected as we enter the

Danger Area. The practice bombs are only small, weighing 28 lb (13 kg) each, but a small charge gives a smoke and flash to aid spotting and they are classified as live ordnance. The pilot pushes the throttles forward to achieve 550 kts (1 020 km/h) and we settle at 200 ft (60 m) altitude on the run into the target for our first "Toss" bomb. I am working the radar controls to place a set of markers over the target radar response; when I am satisfied I call "steer by sight" and the pilot follows his slaved weapon sight. At a predetermined distance the display elevates and the pilot pulls the aircraft up at 4g to follow until the automatic systems release the bomb. After bomb release, we roll over inverted and pull down to low level to escape the target's "air defences". The manoeuvre is a bit like a fairground roller coaster, except that the penalties for doing it wrong are rather severe. Time for two more bombing passes, and then we join up together and leave the range to rendezvous with the tanker.

Looking ahead I can see the tanker to the right and slightly high. It is another Buccaneer from our squadron, fitted with a refuelling pod on the starboard wing. As we close up, the tanker trails his hose and we manoeuvre to join

up in an orderly queue to take fuel. Airborne refuelling is done in total R/T silence, using hand signals, and the first three aircraft "plug" in turn and move clear. Our turn next, and I feel slightly superfluous as we move behind the hose; the navigator can help by "conning" the pilot into the "basket", but I know from experience that my "man" needs no such aid.

Moving my seat fully up, I check that all the refuelling switches are set correctly and sit back to watch. The refuelling probe is mounted on the nose of the Buccaneer, offset slightly to the right and, although it is firmly bolted in position, it doesn't interfere with vision. Indeed, it has been known for a Buccaneer pilot first to discover that no refuelling probe has been fitted only at the moment of rolling out behind the tanker. Such embarrassments are spared us today as my pilot lines up the probe with the "basket" on the refueller's hose and advances smoothly into contact. Sitting "plugged in" as we take on fuel, I feel improbably close to the tanker while I monitor the fuel flow and stopwatch, counting the seconds to "transfer complete" and the chance to move away. At last the fuel tanks indicate full and we slip back and out to join the other refuelled Buccaneers.

Combat Aircraft



FLIGHT CONTROL EXPERIENCE

The proven course to successful control
 Successful aircraft feature Fairey control systems.
 With a record in aviation that few can equal,
 Fairey's experience in flight control
 technology brings simplicity
 and reliability to the most
 advanced requirements.

Fairey Systems

Fairey Hydraulics Limited
 Cranford Lane Heston Middlesex TW5 9NQ
 England Telephone: 01 759 2666
 Telex: 22230 FAIRHY G

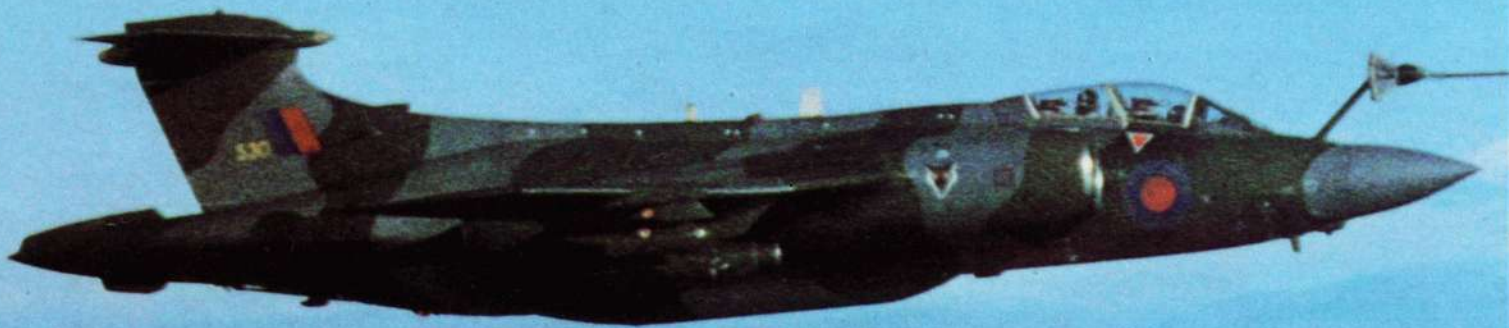
Low-level formation — the Buccaneer in its element

As we climb away from the tanker, heavy now with fuel, we widen the formation into two sections of three. Although we are at high level in friendly airspace, the fighter threat is always present, and flying wide gives us the best visual cross-cover to clear the skies. Ears as well as eyes are busy searching as we listen for the tell-tale sounds of enemy radars on our warning receivers. High level may be easier to fly academically, but the Buccaneer becomes increasingly vulnerable with height, and we must remain ever alert. At last we reach the "top of descent" point and plunge to the relative safety and security of low level. It is a beautiful day with little cloud and the large airbrakes play their part as the altimeters unwind at an alarming rate. Rate of descent slows down though, as we reach the last few thousand feet and level out at a comfortable 100 ft (30 m)

above sea level. The Buccaneer is back in its environment, and the aircrew feel more at ease as they slip back once again into low-level formation.

Back at low level, the Buccaneer reveals why it earned the nickname of "Easy Rider". Despite gusting winds revealed by the choppy sea below, the ride is commendably comfortable. A high wing loading and good aerodynamics make the Buccaneer very stable and yet instantly responsive to control inputs. The aircraft *can* be flown at 50 ft (15 m) above sea-level hands off (but it doesn't do a lot for my blood pressure in the back seat). The ability to fly at high speed at ultra low level is really the strength of the Buccaneer, and enables us to exploit the bottom 100 ft (30 m) of the atmosphere to penetrate to the target below the radar horizon and the defensive threat.

The master instrument at low level is the radar altimeter, a large dial mounted in the front cockpit where it can be seen by both the pilot and the navigator. The old style pressure altimeter suffers from pressure error and mis-reads as speed changes. It can be very disconcerting to accelerate and then look at the altimeter and see *minus* 200 ft (60 m). Consequently, the pressure altimeter is adjusted to agree with the radar altimeter reading at every new speed. This precaution is necessary because the radar altimeter gives reliable indications only in close to straight and level flight; in a 60-degree banked turn, for example, the "unreliable" pressure altimeter is suddenly the master reference. No problem if we have a good horizon, but correct settings are vital if we are on instruments and want to avoid hitting the sea or climbing into missile cover.





420 — 480 — 540 kts

The speed increases in stages as we close to the target — 420 — 480 — 540 kts (778 — 889 — 1 000 km/h). Apart from the slight increase in noise level, nothing gives away the velocity increase but the relentlessly increasing figures on the millibar scale as I adjust the pressure altimeter to agree with the radar altimeter height. Switches are set, anti-ship missiles warmed up and necks strained as we comb the horizon for enemy fighters. To my left I see the leader climb as he rises above the radar horizon for a quick update on the target position. Almost before he levels off he is on his way back down again as the formation presses in, hidden from the target by the curvature of the earth. Now we are at missile launch and for real we would turn away from the target and stay outside the range of the enemy's defences. Today we simulate the TV missile Martel itself and close to the ship.

On the TV screen I can see a smudge on the horizon and moving the Martel controller I centralise the markers on the target. As the blob grows in the screen I identify it as the expected Royal Navy frigate and our wings rock in greeting as we pass overhead. We would like to stay and practise against the Navy, but today we have other work to do and, re-forming past the frigate, we decrease speed and head off for our next task.

Recheck fuel, switches safe and all systems checked, it's a regular litany that goes on in all stages of flight, missed once and something is bound to go wrong! The Buccaneer is full of back up systems and the relative simplicity of its equipment makes it very reliable; as long as the stopwatch works the Buccaneer can deliver its weapons on time. Still, better safe than sorry — it's more than embarrassing to run out of fuel 300 naut mls (555 km/h) north of Base, and it's a long way from land to be floating around in a dinghy. The sky is clouding over now and the six Buccaneers move closer together as the visibility decreases. Although flying on a beautiful blue day is a very pleasant pastime, it makes life simple for any marauding fighter pilot and we much prefer a more concealing "murk" to creep through to the target. A ripple of whitecaps on the water shows that the wind has increased and veered — we are obviously close to the frontal system mentioned in the pre-flight briefing. I hope it doesn't get quite as bad as the forecast.

We do not accelerate as we approach the next contact, in fact we adopt a completely non-aggressive posture, for the ship is a "Bolshoy Protivolodochny Korabl" of the Soviet Navy en-route from the Russian shipyards to the Mediterranean. Slipping into trail, we fly round the vessel — known to NATO as a *Kresta 2* — making a note of the time and her position as she cuts through the water. Viewed up close, she presents a formidable sight, bristling with armament catering for all aspects of Naval warfare. Twin multi-barrel rocket

launchers, torpedo tubes and the large quadruple SS-N-14 missiles mounted either side of the bridge in inclined boxes all deal with the submarine threat; more pertinent to our eyes are the four anti-aircraft guns and the SA-N-3 surface-to-air missiles that could be aimed in our direction. The top of the ship is covered with radars, and our ears tell us that electronic as well as human eyes are pointing towards us, assessing us as we assess them. Our eyes carefully cover the surface of the ship, looking for any modifications that might have been incorporated, searching for all non-standard fitments or new equipments. Nothing out of the ordinary today, and sea and air power eye each other respectfully as we circle past.

A radio call of "Bingo Two" from number six tells the leader he has reached the fuel minima required to transit home. We make a quick check of our fuel gauges to make sure we haven't missed going through the same figures, but we are 500 lb (227 kg) up, and all the cockpit and engine gauges are indicating good. We reform into two sections of three aircraft as we leave the ship and head home. Looking above I can see cloud and expect a long instrument climb out. We start to drop back from the lead element until we are two sections in trail, and I can see my two wingmen move in close anticipating the weather ahead. The lead element has almost disappeared now, but we have achieved the desired separation and I can see them climb into the cloudbase. As we penetrate the cloud the tendrils of white reach out between the aircraft and on my left I can see the tail and then the fuselage of the adjacent Buccaneer almost disappear. Just as I think we are going to lose him the cloud thins and we breathe again as we continue to climb. I select short scale on the radar and look ahead to pick up the lead element to check the separation. There they are, flying so close they appear as one big blob on the radar screen, range looking good and smack on the nose.

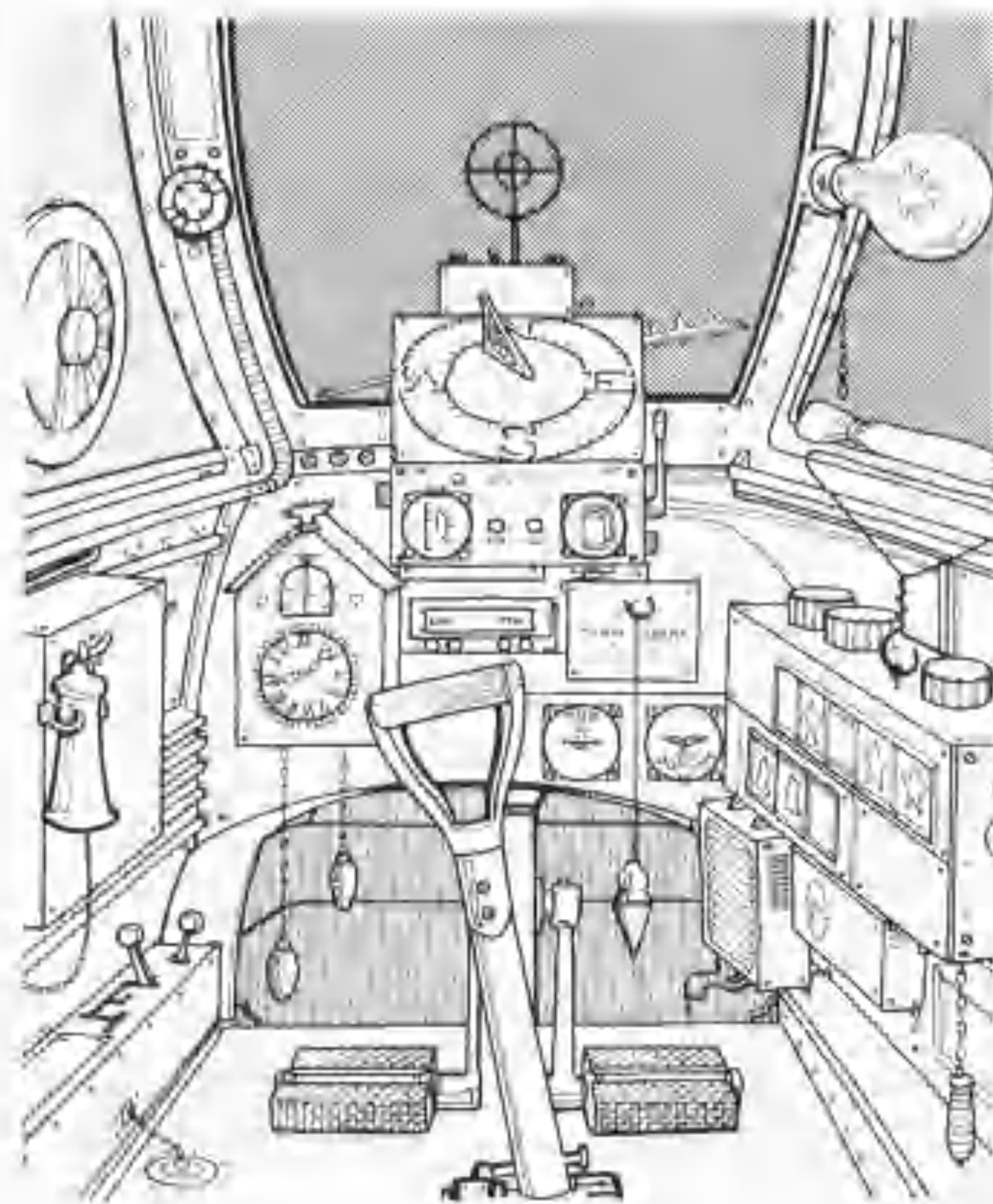
Suddenly the cockpit lights up with sunlight as we burst through the cloud tops, allowing the wingmen to relax and move out to a more comfortable position. Looking ahead I can see the lead element and I am tempted to catch up, but my pilot reminds me of the weather deterioration forecast and we decide to ease the recovery by staying in trail. As if to confirm his choice the airfield weather reports are coming through on the HF radio, and sure enough base weather is decidedly poor and getting worse. The high level return is uneventful and it's difficult to stay alert and remember we are still vulnerable to fighter threat until we are back in the coffee bar. Better stay sharp though — there is 20,000 ft (6 100 m) of cloud to penetrate before we land and the bottom might be very close to the ground.

The leader calls us all over to Base frequency for the recovery and Air Traffic Control inform us that the weather is deteriorating fast. Just as we are contemplating the descent our right hand man informs us that he has lost his main

instruments and will be coming down on our wing. I look across to see him coming in fast, determined not to be left alone on top of the cloud. A quick blip of the airbrake and he is in position ready for descent. The way down is as cloudy as was the way up, but this time life is complicated by turns and the final approach.

Our wingman tucks in tight and remains glued to the right hand side as the altimeters unwind. At 2,000 ft (610 m) the speed bleeds back as we approach the runway's extended centre line, my wingman looks across waiting for the hand signal to indicate undercarriage lowering and on cue all six wheels come down together. A decrease in power and we start to descend on the final approach. I try to keep one eye on the speed, one on the wingman and one looking ahead willing the airfield lights into view! At 100 ft (30 m) to break-off height we are still in cloud; 50 ft (15 m) to go and I convince myself I can see land below; 20 ft (6 m) to go and the airfield breaks out ahead. A slight correction to the line, and we are down.

We settle thankfully onto the runway; after 2 hr 30 min airborne, it is always good to open the canopy and breathe fresh air again. The sortie will soon be over for the aircraft but not for the aircrew, who have yet to report any intelligence information and debrief amongst themselves. Debriefs are an important part of a sortie and all aspects of the flight are discussed and dissected to see if we can find a better way to do it tomorrow; indeed, it has been known for the debrief to last longer than the flight. The Buccaneers will not get much rest either; one-and-a-half hours to refuel and they will be airborne again on the next sortie, with other crews — the last all-British bomber taking to the skies again to show that "British is Best". □



"... Buccaneer cockpits are a fascinating display of antique-looking instruments and switches."

RAF HISTORY – IN THE AIR

Aviation history is a wide-ranging subject, rife with images of dark museums and fusty text books. The Royal Air Force, however, makes a great effort to keep its history very much alive, and visible in its natural element, where it can best be appreciated by the general public. Tim Laming describes the “flying museum pieces” that every year are a popular feature of air shows throughout the country.

The origins of the RAF’s “heritage collection” of airworthy aircraft can be traced back to 1957, when the decision was taken to form a “Battle of Britain Flight” at RAF Biggin Hill, with a complement of five aircraft; two Spitfire Mk 16s, two Spitfire Mk 19s (PM631, PS853) and a lone Hurricane (LF363). In 1958, the Flight was relocated to North Weald and subsequently it moved to Martlesham Heath, during which time the two Spitfire 16s were lost in flying accidents. In 1960 the Flight moved to Horsham St Faith, and then to Coltishall in 1964, where the unit acquired a Spitfire Mk II (P7350, which had been used in the “Battle of Britain” film) and a Spitfire Mk VB (AB910), which was presented to the RAF by British Aircraft Corp. A second Hurricane (PZ865) was donated by Hawker Siddeley, increasing the number of aircraft on strength to six.

In 1976 yet another move took place, this time to RAF Coningsby, which is now the home of the Flight and looks likely to remain so for the foreseeable future. The Battle of Britain

Flight was created to provide a flying memorial to the RAF’s major operations (chiefly the Battle of Britain) and the men who fought throughout World War II within the RAF, and also to remind the general public of the important, if not decisive, part played by the RAF in the defence of the UK. In keeping with this objective, another famous aircraft joined the BBMF in 1973 in the shape of Lancaster PA474, which had been rescued from possible destruction at RAF Henlow in 1965. The Lancaster was partially restored and flown to RAF Waddington, from where the aircraft made a limited number of test flights, whilst being completely restored to full flying condition. In 1968 permission was granted for the Lancaster to perform at the 50th anniversary review of the RAF at Abingdon and, following this event, the aircraft made regular display flights (still operating from Waddington) until joining the renamed Battle of Britain Memorial Flight. Since then the famous bomber has flown at a vast number of air displays, usually in company with a Spitfire and Hurricane drawn from the Flight’s collection.

Thanks to a great deal of goodwill and understanding on the part of all the personnel at Coningsby, the BBMF manages to fit in quite well with the routine operations of a front-line fighter station, and the World War II Spitfires can often be seen sharing the airfield facilities with the equivalent fighter of the ‘eighties, the Tornado F Mk 2. The rather interesting comparison between these two fighters inspired Air Vice-Marshal Ken Hayt, CB CBE AFC, to suggest to the BBMF that

they might consider flying a Spitfire and Tornado as a synchro display pair during the 1985 display season. Although the Flight’s reaction was initially rather sceptical, the idea was eventually put into practice and resulted in a very popular addition to many air shows during 1985. Hopefully the routine is to be repeated in 1986.

Although the BBMF is a fully established and tasked RAF unit, the number of personnel attached to the Flight is surprisingly small, consisting at the time of writing of just 13 groundcrew and the Flight Commander, Sqn Ldr Tony Banfield, who is responsible for the administration and management of the unit, together with all display flying of the Lancaster. The remaining Spitfire and Hurricane pilots come to BBMF purely as a secondary task, in addition to normal flying duties within the Coningsby Phantom fleet. Sqn Ldr Banfield is, in fact, the only full time officer assigned to BBMF, and whilst many of the unit personnel often disappear during the winter months, the Flight Commander remains very much in business at Coningsby, making arrangements for the forthcoming display season, and writing up reports on the previous year’s activities.

During the winter the aircraft are grounded and subjected to a thorough inspection and servicing. Unlike more modern aircraft there are no finite fatigue limits on any of the BBMF aircraft, which means that there is no limiting number of airframe hours to which the aircraft can be flown. The unit pursues an “on-condition” maintenance policy, involving a continual inspection process that allows the servicing

The RAF's Vintage Pair — Vampire T Mk 11 (XH304) and Meteor T Mk 7 (WF791) — fly over Eastner Castle, near Ledbury, Herefordshire.





*Hawker Hurricane PZ865 with Spitfire IIA P7350 between Manston and Coningsby.
(Photo, Richard Winslade.)*

In Defence of Tomorrow

Novel Solutions to Operational Requirements

Take an Operational Requirement, assess the battle scenario, apply breadth of vision and develop a weapon system that solves the problem cost-effectively... this is the approach that has produced Hunting's novel range of modern weapon systems.

In today's complex battle environment, new equipments require innovative professionals, advanced technical resources and methods of production, often involving the application of new materials to achieve the optimum solution.

The Company has a proven track record as a Prime Contractor on a successful range of weapon systems, including the air-delivered JP233 airfield attack system and the IMPROVED BL755 anti-armour cluster bomb, and work on advanced concepts of next generation versions of these air systems is in progress.

In ground-based anti-armour weapon systems, Hunting is coordinating the UK contribution to European production of MLRS and is a partner in

Europaeische Produktion GmbH (MLRS EPG), an international company based in West Germany formed to produce MLRS under licence in Europe. Hunting is also preparing for production of LAW 80 Light Anti-tank Weapon, which is of great interest to Infantry forces World-wide.

Hunting's work for MOD (Naval Systems) includes the NATO SEA GNAT missile decoy system. The Company is also active in underwater weapon systems including mines and torpedoes.

Hunting offers expert professional engineering and subcontract facilities in Composite Material Technologies such as filament wound and plastic components; precision High Technology Metallic Components; and, in Warhead Technology, a complete study, design, development and production capability.

As a Prime Contractor or Subcontractor or in joint ventures, national or international, Hunting offers a dedicated capability in Marketing, Advanced System Studies, R & D, Project Management, Production, Sales and Field Support.



HUNTING
ENGINEERING LIMITED

REDDINGS WOOD AMPHILL BEDFORD MK45 2HD
TELEPHONE: AMPHILL (0525) 403431
A subsidiary of Hunting Associated Industries plc



team to keep each airframe airworthy until a fault is found that is too expensive to rectify. In view of the remarkable abilities and enthusiasm of the ground crew, the individual aircraft are likely to remain airworthy until at least the end of the century. Over 360 requests for BBMF displays are received each year, and all are considered in turn, gradually being either accepted or rejected until a figure of around 150 is achieved. The large number of requests dictates that some have to be turned down, not least because there is a limit to the number of hours each aircraft can operate each season. For the Spitfires, a limit of 35 hours is placed on each aircraft, with 50 hours for each Hurricane, and 75 hours for the Lancaster — a figure that is roughly equivalent to the original expected service life of a wartime Lancaster! These annual figures have to cover not only the actual display flying, but also the transit times to and from shows, engine test flights, and any practice displays that might be necessary. Flying hours are not the only limits that have to be observed by the unit; in order to keep the aircraft in good condition for as long as possible, restrictions are placed on each aircraft's display flying envelope. The Lancaster, although quite capable of speeds up to 300 kt (556 km/h), is limited to 200 kt (370 km/h), and flying manoeuvres are kept within a 1.5g limit. The Spitfires and Hurricanes are restricted to 275 kt (509 km/h) and 4g, with an overall weather minima, for all the aircraft, of just over 3 miles (5 km) visibility, and a cloudbase of 1,500 ft (460 m). Every attempt is made to avoid flying in cloud, as all the aircraft still rely on wartime navigation techniques, and rain causes damage to the propellers.

Gentle approach

In order to comply with all of these restrictions, the BBMF flying routines are, perhaps, somewhat less spirited than is strictly necessary, but the unit's gentle approach will probably ensure that the Flight's aircraft are still airworthy when many other privately-owned "warbirds" have been grounded — and a carefully-flown display is certainly better than no display at all. Although all the aircraft are 40 or more years old, the greater part of each airframe is retained in original condition, although from time to time some components have to be remanufactured by the Flight's engineers in order to keep the aircraft in the air. Parts that are beyond the BBMF's manufacturing capability are provided by other RAF engineering units, and occasionally some items are contracted-out to civilian industry. The BBMF offers no pretence that the aircraft are anything other than representative of their period, and that some concessions to authenticity have to be made at times. For instance, the overall polyurethane paint finish, which gives each aircraft (apart from the fabric-covered Hurricanes) a high-gloss finish, is far from authentic, but does keep the aircraft in a far better condition for a long

period of time than the wartime matt paints.

The BBMF is a self-contained RAF unit which travels the country from show to show, with its own servicing team. Everyone working within the Flight is a volunteer from normal RAF duties, who has simply applied to join the unit. There is no specialised servicing training for the unit's rather unique aircraft, and engineers arrive at Coningsby with only standard RAF trade capabilities. Learning to cater for the needs of historic aircraft is very much a home-grown business. During the display season the servicing team can expect to work at least three out of every four weekends, in support of the Flight's aircraft, and its members quickly learn to "live out of suitcases". The work is hard, and the recognition for their dedication is little. As Sqn Ldr Banfield explains "if you're looking for a medal, or any kind of appreciation, you're in the wrong job".

Whilst all the BBMF aircraft have a fairly long term airworthiness to their credit, the future of the unit is rarely very secure, as the finances needed to support the team are reviewed regularly, and there is never any guarantee that sufficient funds will allow the team to continue for more than a year or so at a time. The BBMF also has a two-seat Sea Fury T Mk 20 (VZ345) to give its pilots tailwheel, piston engine, flying experience. This aircraft is based at Boscombe Down, and serviced by the A&AEE, giving some relief to the very limited resources available at Coningsby. The Fury is not flown very frequently (and at the time of writing is being repaired following a flying accident), and most tailwheel continuation training is flown on Chipmunk WK518 which is operated from Coningsby quite regularly, although the similarities between it and the Spitfire and Hurricane are obviously rather nominal!

A little-publicised addition to the BBMF for the 1985 season was Devon VP981, which is maintained for occasional flights in support of the Spitfire and Hurricane. The Devon provides a useful communications "shepherd" for the two fighters when the Lancaster is not scheduled to participate, and can also carry the supporting ground crew. The Devon is now a valuable historic aircraft in its own right, too, following the withdrawal of the last operational RAF Devons in 1985. Pilot training for the Lancaster is something of a problem, as there are few aircraft still airworthy that even vaguely match the flying qualities of the Lancaster. Until 1976, the BBMF could rely on the remaining RAF Hastings transports for multi-engine tailwheel piston experience, but there is now left just a handful of Shackletons, time on which can be "borrowed" for training as required. The remaining Shackleton AEW Mk 2s will be withdrawn in the next 2-3 years, and there will then be no suitable aircraft readily available to the RAF on which to train for the Lancaster. Whilst at least one aviation group is actively attempting to persuade the MOD to keep a Shackleton in flying condition, the

possibility of this second Avro "heavy" joining the BBMF would seem to be remote. A much more likely addition, however, is that of a Mosquito, which will hopefully replace one of the Spitfire 19s at some time in the future.

The Vintage Pair

In 1971, a second historic aircraft display team was formed within the RAF, this time devoted to just two aircraft of a more recent era, but nonetheless a significant part of the RAF's history. At this time, the last examples of the Meteor and Vampire jet trainers were being withdrawn from active service, one of the last operators being the Central Flying School, then based at Little Rissington. Through the determination of CFS air and ground crew, Meteor T Mk 7 WA669 and Vampire T Mk 11 XH304 were saved from almost certain destruction, and flown for a trial period during 1972. The displays proved to be a great success, and the "Vintage Pair" was given full RAF recognition. Since this time, the team has flown the Vampire and Meteor each year, as a tribute to the RAF's first jet aircraft.

If the BBMF team of personnel is small, the Vintage Pair team is even smaller, with no full-time members, all the air and ground crew working as a secondary duty to their normal tasks within the CFS. The four aircrew are all CFS Qualified Flying Instructors (QFIs), whose primary task is to train pilots to become flying instructors on the Jet Provost. Sqn Ldr Bruce McDonald, the team's manager until 1986, was a founder member of the Vintage Pair, and wryly explains "the Vampire and Meteor are gentlemen's aeroplanes, flown by gentlemen". Certainly, the two aircraft are flown in a very "gentlemanly" manner because, as for the BBMF, keeping airframe stress to a minimum is a constant priority. Airframe limits are a maximum of +2.5g and -0.5g, with a total of about 50 displays each year, together with aircrew training and any necessary test flying and display rehearsals. In order to save valuable fatigue life, some of the display rehearsal flying is done with two Jet Provosts, but the JP bears little resemblance to the two Vintage aircraft, so can be substituted only for practising display sequences and positioning. Meteor WA669 went back to active duty with No 1 TWU at Brawdy in 1975, but returned to the team after its "second retirement" in 1982. In the meantime, a second Meteor T Mk 7 (WF791) had joined the team, and took part in each display season until 1985, by which time the team had moved from RAF Leeming to its present base at RAF Scampton, where it now constitutes part of the CFS Examining Wing, in company with the rest of the CFS, and a rather more famous CFS squadron, the "Red Arrows". All three Vintage aircraft had reached the end of their original projected fatigue lives by 1984, but thorough inspection of each airframe has revealed that the Vampire and both Meteors are capable of flying for

Lucas Aerospace and The Royal Air Force.

Partners from Vickers Vimy to Panavia Tornado.



European co-operation on a grand scale has made Tornado a reality. During the '80s, we can look forward to 800 aircraft in service, forming the backbone of the NATO airborne front-line defence.

Lucas Aerospace involvement in the international aviation industry can be traced back to the earliest pioneering days. And

in the last sixty seven years, our role in assisting the advance of technology has become larger, more comprehensive, more vitally important.

Innovating, testing and proving new product technology for engine and airframe systems and equipments.

Lucas equipment on Tornado includes electrical generating

systems, engine management systems, nozzle and thrust reverser actuation, secondary, flying control equipment, windscreens and quarter-lights and various other electro-mechanical equipments.

Lucas Aerospace. A partner in today's international aviation industry, meeting the challenge of tomorrow.

Lucas Aerospace Limited, Brueton House,
New Road, Solihull, West Midlands. B91 3TX.
Tel: 021-704 5171. Telex: 335 334 LUCAROG

Lucas Aerospace

A Lucas Industries Company

Technology you can trust



(Above) Spitfire PR Mk 19 PM631 and Tornado F Mk 2. (Below right) Spitfire P7350.



(Above left) Vulcan B Mk 2 XH558. (Below) The BBMF Lancaster PA474.



many more years to come, providing sufficient funds are forthcoming to finance each display season. Spares are also rather easier to obtain than for the older BBMF aircraft, and a large collection of components is held in reserve at Scampton, coming from various sources including complete aircraft like Meteor NF Mk 11 WD790, which was given to the team by the RAE when it was retired from service.

The display Vulcan

Perhaps the most impressive (certainly the biggest and noisiest!) addition to the RAF's collection of airworthy historic aircraft is Vulcan XL426, which began display flying in 1984 following the retirement of the Vulcan from active service earlier in that year. The Vulcan was initially operated for a trial period until the end of 1984, when it was decided that funds would be made available to fly the aircraft for another year, as a tribute to this famous Avro bomber — originally part of Britain's nuclear deterrent, and later to play a vital part in the 1982 Falklands operations. The 1985 season was an outstanding success for the Vulcan, proving to be a very popular attraction at many air displays throughout the country. However, XL426 was officially withdrawn from display flying duties at the end of the year, and the future of the "Vulcan Historical Flight" is uncertain, chiefly because of the high cost of flying the huge delta winged bomber. Two Vulcans (XH558 and XH560) were held in reserve after their withdrawal from active service, and stored at RAF Waddington, from where XL426 had operated in 1984 and 1985. Both aircraft had last operated as B Mk 2K air-to-air refuelling tankers, before which they were both B Mk 2MRR maritime reconnaissance aircraft. One of the pair (XH558) was restored to airworthy condition, having the tanker's hose and drogue unit removed from the tail, and ballast installed to compensate for the weight of the ECM equipment which was previously fitted in this area. It was then flown to RAF Kinloss, in September 1985, where the Nimrod Servicing Unit gave the Vulcan a thorough servicing, and repainted it in a full gloss finish, in order to preserve the airframe exterior in good condition for as long as possible. XH560 was designated as a suitable spares back-up aircraft, and both aircraft were returned to storage, pending a decision on the future of the Vulcan Display Flight. Whilst it is to be hoped that XH558 will appear at air displays during 1986, its future is by no means certain, and beyond this year, the prospects would appear to be even more bleak.

Many countries are aware of their aviation history, and most air forces retain at least some of their more significant aircraft as museum exhibits. The Royal Air Force, however, is the only major air arm to maintain any historical aircraft in flying condition, and to fly them regularly. The RAF's flying heritage truly is "living history". □

THE RAF'S YEAR 1985

17 January: AOC-in-C Strike Command announces further serious delays in the introduction into service of Nimrod AEW Mk 3 and a continuation in service of the Shackleton AEW Mk 2s of No 8 Squadron at RAF Lossiemouth.

26 January: A Hercules C Mk 1 of No 47 Squadron on detachment from RAF Lyneham makes the first air-drop of supplies during *Operation Bushell*, over the small town of Rabel at an altitude of about 10,000 ft (3 050 m) amsl.

1 February: Delivery of first VC10 K Mk 3 (ZA150) to No 101 Squadron at Brize Norton, where it entered service on 20 February, joining five K Mk 2s already in service.

11 February: RAF Germany Band suffers the loss of 19 of its 42 members, killed in a road crash. Band is brought back to strength and resumes engagements on 16 April.

13 February: British Aerospace ALARM defence suppression missile flown for the first time, on Tornado GR Mk 1 ZA354.

21 February: RAF Mountain Rescue Service receives the RAF Escaping Trophy in recognition of over 40 years of voluntary service rescuing civilians and military personnel.

22 February: No 216 Squadron flies first service of a TriStar with an all-RAF flight deck crew, from Brize Norton to Akrotiri.

25 February: Wessex HC Mk 2 XT674 of No 22 Squadron "C" Flight, flies the 3,000th search and rescue operation mounted from RAF Valley since 1955. More than 2,000 people recovered in 30 years, with 1,000 operations in the first 14 years, the second 1,000 in nine years and the third 1,000 in seven years.

21 March: Secretary of State for Defence Michael Heseltine announces selection of Shorts Tucano as the RAF's next basic trainer, for service-entry in 1987.

March: A specially-equipped VC10 C Mk 1 of No 10 Squadron, RAF Brize Norton, with a medical team, flies a Lassa fever victim home from Freetown, Sierra Leone, to Filton, near Bristol.

1 April: No 2729 (City of London) Squadron, RAuxAF Regiment, formed at RAF Waddington. Tasked with airfield defence, it is equipped with anti-aircraft guns captured during the Falklands conflict, with associated Skyguard fire control radars.

8 April: Master Air Loadmaster Carl Pollock of No 22 Squadron, RAF Manston, is awarded the Air Force Cross for gallantry in the rescue of two youths from a water-filled cave near Ramsgate.

26 April: Flt Lt Max David Procopides wins Queen's Commendation for Valuable Service in the Air for the rescue of a soldier in extremely hazardous conditions in Belize, flying a Puma HC Mk 1 of No 1563 Flight.

30 April: First flight of Harrier GR Mk 5 ZD318 (Development Batch 1) at Dunsfold, by Mike Snelling.

April: No 17 (F) Squadron equipped with Jaguars is disbanded at RAF Brüggen, and is immediately succeeded by No 17 (Des) Squadron to fly Tornados from the same base.

30 April-2 May: NATO aircraft operating from bases throughout northern Europe mount more than 570 sorties against RAF airfields, missile sites, radar stations and naval vessels in and around the UK in *Exercise Priory 85/1*.

1 May: No 229 Operational Conversion Unit formally inaugurated at RAF Coningsby to train crews on the interim Tornado F Mk 2 and definitive F Mk 3.

2 May: Sqn Ldr Nigel Wood, RAF, selected to become the first British astronaut to fly aboard the Space Shuttle *Columbia* in June 1986.

3 May: RAF Mount Batten completes the final Master Coxswain's course, pending the closure of the RAF Marine Branch on 1 April 1986. Task to be continued by civilian contractor, using the present fleet of RAF craft.

11 May: Lockheed TriStar from No 216 Squadron makes first flight to Mount Pleasant Airport, Falklands, setting records of 8 hr 22 min for the Brize Norton-Ascension leg, 8 hr 19 min for Ascension to Mount Pleasant and 18 hr 28 min elapsed time for the whole flight.

12 May: Mount Pleasant Airport in the Falkland Islands opened by HRH Prince Andrew. British Airways opens regular scheduled troop flights by Boeing 747, to replace the Hercules Airbridge to RAF Stanley, pending introduction of TriStar service by No 216 Squadron in 1986.

May: Five Harrier GR Mk 3s from No 1 (F) Squadron, RAF Wittering, with a 70-strong detachment, operate from HMS *Invincible* in the second regular exercise to practise offensive air support of forces ashore from RN aircraft carriers.

2 June: Four new stained glass windows dedicated at St George's Chapel of Remembrance at RAF Biggin Hill, commemorating the service of groundcrew in the Battle of Britain.

10 June: Following the opening of Mount Pleasant Airport (see 12 May), the last Victor K Mk 2 AAR tanker returns to RAF Marham from Ascension Island, where aircraft detached from Nos 55 and 57 Squadrons had been on duty continuously since the Falklands conflict.

11-19 June: Commander-in-Chief of the Chinese People's Liberation Army Air Force Zhang Tingfa makes a nine-day fact-finding tour of the RAF, including visits to RAF College, HQ Strike Command, RAF Neatishead (air defence radar stations), and RAF Marham.



(Above) Tornados and Jaguars, No 17 (F) Squadron,



(Above) BAe/MDC Harrier GR Mk 5. (Below) 3,000th





RAF Brüggen.



SAR operation, RAF Valley.



(Above) ALARM missiles on Tornado.



(Above) Shorts Tucano.



(Above) Panavia Tornado F Mk 2, No 229 OCU.



(Above) Sqn Ldr Nigel Wood.



(Above) Boeing Chinook, No 1310 Flight, RAF Stanley.

14 June: HM The Queen unveils the South Atlantic Campaign Memorial in the Crypt of St Paul's Cathedral. The memorial bears the names of 225 members of the Task Force who lost their lives in the conflict.

15 June: HRH The Duke of Kent, President of the RAF Benevolent Fund, appointed Honorary Air Vice-Marshal in the RAF.

29 June: Diamond Jubilee of the RAuxAF, and 40 years of Movements Training, marked by a parade of No 4624 (County of Oxford) Movements Squadron at RAF Brize Norton.

June: No 1453 Flight stands down at RAF Stanley, and its Harrier GR Mk 3s are returned (in Hercules transports) to the UK and RAF Germany.

June: HRH The Princess of Wales accepts appointment as Honorary Air Commodore, RAF Wittering.

1 July: Air Marshal Sir David Parry-Evans, KCB CBE, appointed C-in-C RAF Germany and Commander Second Allied Tactical Air Force, succeeding Sir Patrick Hine, who becomes (on 30 July) Vice-Chief of the Defence Staff in the rank of Air Chief Marshal.

9 July: First flight of TriStar K Mk 1 ZD950 at Cambridge after conversion to dual-rôle tanker/transport by Marshall of Cambridge (Engineering) Ltd.

July: No 19 Squadron, RAF Regiment, reformed at RAF Brize Norton as the third of the Regiment's Short Range Air Defence Squadrons. Equipped with Rapier SAMs and Blind-fire radar, it is tasked with the defence of RAF Upper Heyford and RAF Fairford.

July: A crew from No 206 Squadron, RAF Kinloss, wins the Plessey Marine Anti-Submarine Warfare Efficiency Award for the development of tactics and operational use of sonobuoys by Nimrod crews.

14 August: RAF to provide training expertise for the Sultanate of Oman Air Force in support of an order for eight Tornado air defence fighters which are to be diverted from the RAF production line, for subsequent replacement from later production.

27 August: Exercise *Prairie Vortex* begins with deployment of four Tornado GR Mk 1s from No 27 Squadron, RAF Marham, to Ellsworth AFB, ND, for USAF Bombing and Navigation Competition (see entry for 13 November).

29 August: Nimrod MR Mk 2 XV229 of No 42 Squadron, RAF St Mawgan, locates wreck of *Virgin Atlantic Challenger* in the Eastern Atlantic and assists in rescue of the crew, with subsequent participation by a Sea King of No 202 Squadron, RAF Brawdy.

29 August: Air Chief Marshal Sir Peter Harding succeeds Air Chief Marshal Sir David Craig as Air Officer Commanding-in-Chief Strike Command.

SITS. VAC: NO PREVIOUS EXPERIENCE REQUIRED.

Ever dreamed of flying in a fast jet like the Tornado GR1? We could make your dream come true. Because the RAF have vacancies right now for Pilots and Navigators.

It takes two to fly a Tornado. The Pilot concentrates on getting where you're going, fast. The Navigator concentrates on what you're doing, choosing the weapons systems and the Electronic Counter Measures you'll need. Together, you make the Tornado one of the most effective weapons in NATO's vital front-line defence.

If you already know something about flying, that's great. If you don't, we'll teach you everything you need to know for your part in the Tornado's double-act.

For instance, we'll take a Pilot from flying a Chipmunk on to a Jet Provost. Then to a Hawk and on to a Tornado GR1 travelling at 550 mph at 100 feet.

Both Pilot and Navigator earn at least £8,082* a year during training. And you'll enjoy one of the most exciting careers in Britain.

WHAT NOW?

To join the RAF as a Pilot or Navigator, you must be between 17½ and 23½ years old. You need at least five acceptable GCE 'O' levels or equivalent. If you are studying 'A' levels or planning to go to university, ask us about RAF Sponsorships.

To find out more, call in at any RAF Careers Information Office (in the phone book under Royal Air Force) or write to Group Captain Paul Terrett, OBE, at (AB) Officer Careers, (RAFYB), Stanmore HA7 4PZ, giving your date of birth and your present and/or intended qualifications.

*1985/86 pay scales.

STEP BY STEP TRAINING.

TORNADO GR1.
The front-line.



HAWK. Fast-jet
experience.



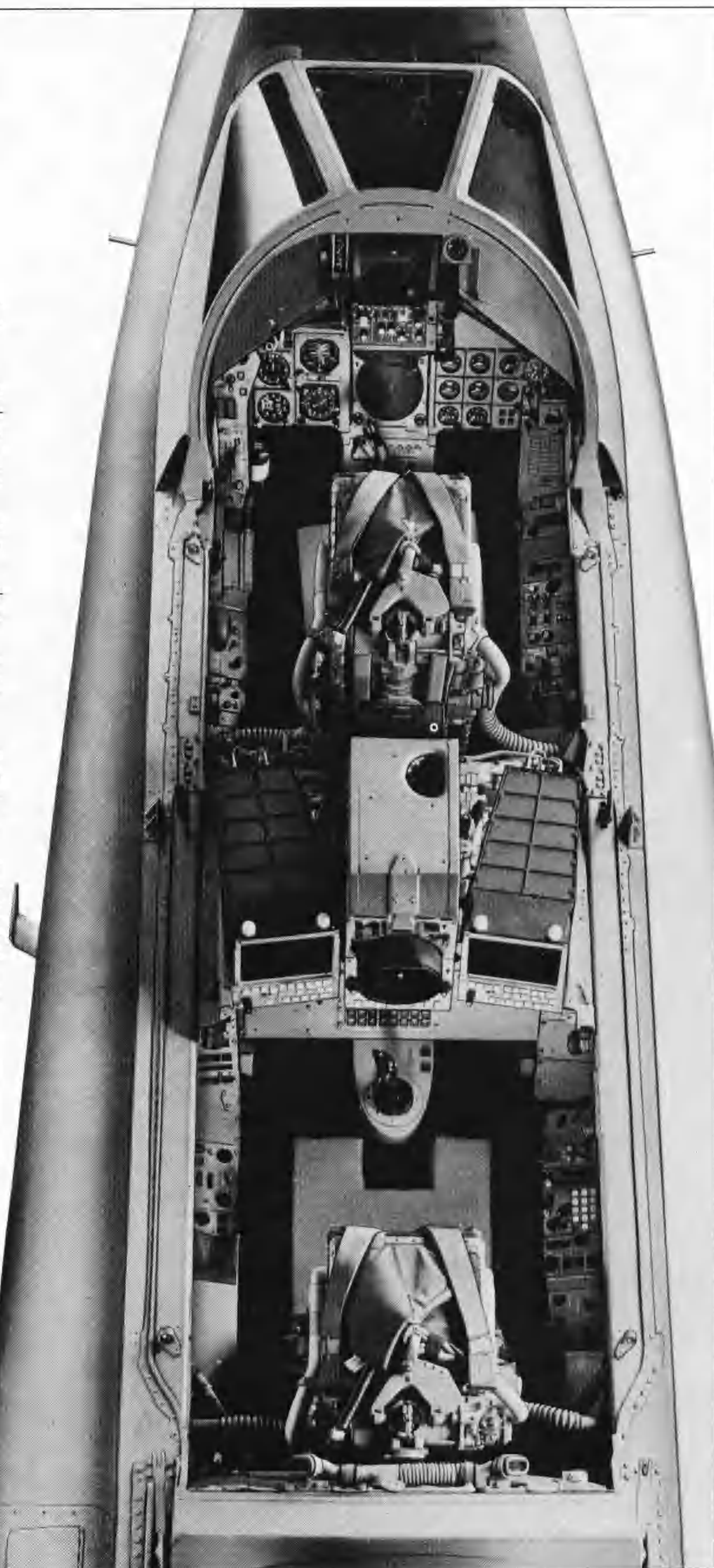
JET PROVOST
Your first jet.



CHIPMUNK.
Your first trainer.



RAFOFFICER
PILOT & NAVIGATOR



August: Secretary of State for Defence Michael Heseltine announces that Britain, Federal Germany and Italy have agreed to proceed with the next stage of programme definition for a European Fighter Aircraft (EFA). The aircraft is to be optimised for the air-to-air rôle, have BVR capability, good supersonic performance and be highly agile in the subsonic régime. Engines to be developed from Rolls-Royce XG40 turbofan. Subsequently, Spain agreed to participate, with work on EFA to be shared between BAe, MBB, Aeritalia and CASA.

August: Operation Tapestry flights by Nimrod MR Mk 2s of Nos 120, 201, 206 and 42 Squadrons for surveillance of oil rigs brought to an end. Tapestry flights for fishing protection continue pending ministerial review.

August: RAF becomes responsible for the Falkland Islands garrison with the appointment of Air Vice-Marshal Richard Kembal as Commander British Falkland Islands.

6-13 September: Exercise Brave Defender tests ability of all three Services to defend key points against attack by enemy special purpose

forces and conventional air attack, with participation by units of the RAF and RAuxAF.

18 September: Harrier GR Mk 3s from Nos 3 and 4 Squadrons at RAF Gütersloh participating in Exercise Cold Fire operate for the first time ever from a German autobahn, demonstrating their ability to use a 2-km length of one lane as a landing strip, with an operation centre in a lay-by.

22 September: Two Puma HC Mk 1s from No 1563 Flight in Belize detached to Mexico City for five days to assist rescue and relief operations following two earthquakes. Supplies flown in by Hercules C Mk 3 of No 242 OCU.

24 September: Last of nine VC10 AAR tankers, a K Mk 3 (ZA147), handed over by British Aerospace for service with No 101 Squadron at Brize Norton.

(Right, top to bottom) Westland Puma of No 1563 Flight, deployed from Belize to Mexico City in September; BAe Harrier of No 4 Squadron operating on German autobahn; Harrier GR Mk 3s of No 1 Squadron aboard HMS Invincible.



UNIVERSAL MOBILE TOOL CONTROL CABINETS

The Elite Tool Security System is designed for use both as a mobile tool storage and an access unit. It is particularly suitable for service work on aircraft, vehicles and large items of plant. Cabinets are fitted with fully retractable sliding shutter doors and can be fully secured. The unit is completely mobile and may be fitted with various internal components to accept tools, spares and equipment to choice.

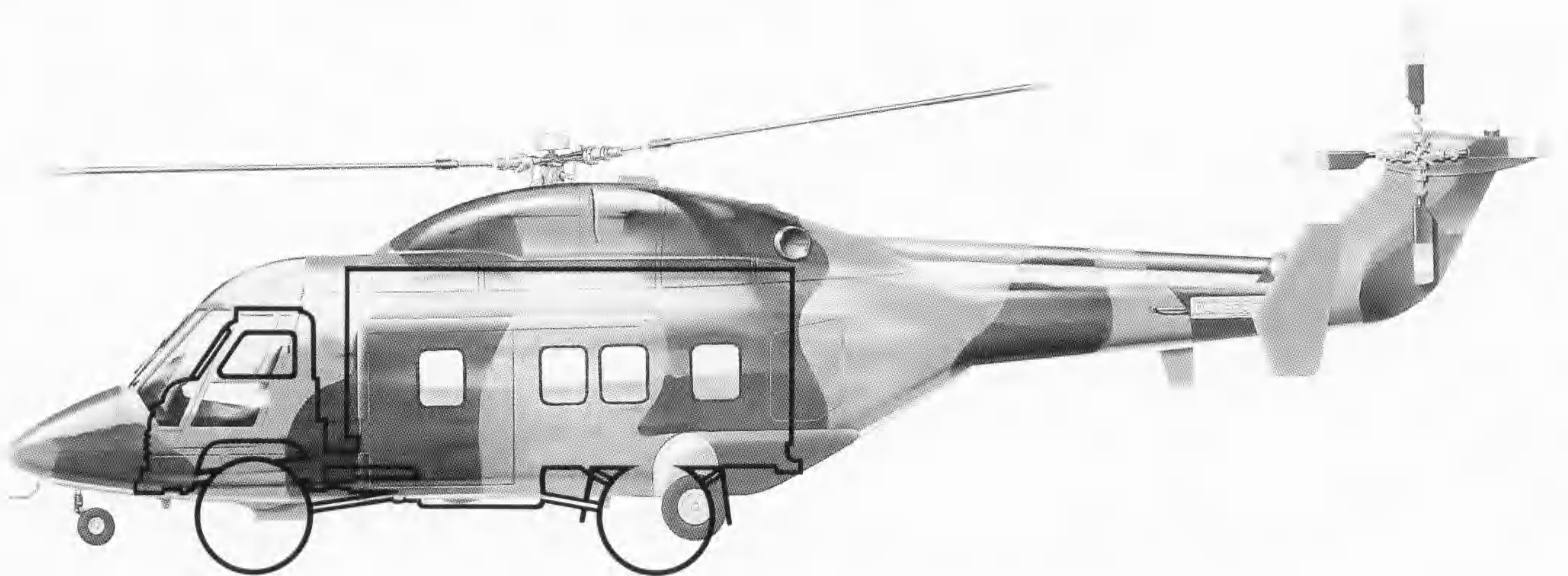
ELITE

Elite Manufacturing Co. Ltd., Elite Works, Station Road, Manningtree, Essex CO11 1DZ. Tel: Colchester (0206) 392171. Telex 987675 Elite G.



Westland TT30

the flying truck



Moving troops from A to B, complete with their equipment and deploying them in seconds, has been one basic requirement of the battlefield commander that has never changed. The Westland TT30 does just that, fast, economically and without frills. Troop movement needs easily usable space and plenty of it, Westland TT30 has that, better than any other helicopter in its class. The large cabin (13 cubic metres) accommodates fourteen fully equipped troops with their weapons, high roof height and low sills to large side doors facilitate easy exit of all troops and equipment – 6.2 seconds under service trial conditions. With the agility and response of an attack soldier's helicopter the Westland TT30 is the pilot's helicopter, and defence economist's helicopter – all in one. Westland TT30 – The Flying truck.

Westland TT30

Westland Helicopters Limited, Yeovil, England.

26 September: Saudi Arabia contracts to buy 48 Tornado IDS and 24 Tornado ADV for its air force; deliveries to start March 1986 by arrangement with RAF, which will defer acceptance of some of its own Tornados to make this possible. Training of RSAF crews on RAF Tornados at the TTTE, RAF Cottesmore, begins before end of 1985.

28-29 September: Maritime reconnaissance aircraft from the RAF (No 120 Squadron, Nimrod MR Mk 2 XV238), RAAF (P-3C), RNZAF (P-3B) and CAF (CP-140) participate in Fincastle Trophy Competition at RAF Kinloss.

1 October: British Aerospace announces receipt of £40m contract to update 42 Buccaneer S Mk 2s under ASR1012, to provide for the carriage of Sea Eagle ASM, with relevant modification to *Blue Parrot* radar, installation of improved EW equipment and chaff/flare dispensers and an improved Louis Newmark automatic flight control system.

9 October: Tornado GR Mk 1 ZA361 at the TTTE, RAF Cottesmore, completes its 1,000th flying hour — the first Tornado anywhere to reach this total.

15 October: Air Chief Marshal Sir David Craig succeeds ACM Sir Keith Williamson as Chief of the Air Staff, and becomes Air ADC to HM The Queen.

1 November: No 14 Squadron with Jaguars disbanded at RAF Brüggen and immediately re-formed on the Tornado, marking the passing of the Jaguar Wing in RAF Germany and formation of the last RAF Germany Tornado squadron, which began as No 14 (Des) in May.

5 November: Two Sea King HAR Mk 3 helicopters from No 202 Squadron "D" Flight, RAF Lossiemouth, participate in rescue of 51 crewmen from the oil rig support vessel *Tharos* in the North Sea.

7 November: The 1984 Wilkinson Sword of Peace is awarded to RAF Lyneham for its contribution to the international relief operation in Ethiopia, and for its efforts in maintaining the South Atlantic Airbridge.

(Right, top to bottom) Last of nine VC10 tankers for No 101 Squadron; Tornado GR Mk 1 of TTTE reaches 1,000 hours; Sepecat Jaguar GR Mk 1 of No 14 Squadron, last of the Jaguar Wing squadrons at RAF Brüggen.



DOWTY. DEFENDING THE FUTURE

50 years at the forefront of aerospace and defence worldwide has provided the launch pad for Dowty's deep involvement in next-century defence developments. For sea, land and air.

From initial design through to final manufacture. Including hydraulic, electronic and electric systems engineering. Applications ranging from new-generation fighter aircraft to the latest land force bridging equipment to the most potent naval defence developments.

The highest levels of innovation backed by global product support service.

DOWTY

Innovation by design

Dowty Group Plc,
Aerospace & Defence Division,
Arle Court, Cheltenham,
Gloucestershire, England
Telephone: Cheltenham (0242) 521411
Telex: 43176 Fax: (0242) 570721



13 November: Tornados of No 27 Squadron, RAF Marham, supported by Victors from No 57 Squadron, achieve major successes in annual USAF bombing and navigation competition at Ellsworth AFB, ND. The team takes first and second places for precision low-level bombing and wins John C Meyer Trophy; Tornado crews take first and second places for precision high- and low-level bombing and win the Curtiss Le May Trophy, and the squadron takes second and eighth places in the Mathis Trophy event for high- and low-level bombing sorties.

16 November: RAF begins relief effort following Nevado Del Ruiz volcano disaster in Columbia, with despatch of one Hercules from Belize to Palanquero carrying supplies; two Puma HC Mk 1s also from Belize (No 1563 Flight) arrive in Columbia on 18 November and begin distributing food and medical supplies. Detachment stayed on task until 24 November and returned to Belize on 26 November.

20 November: First flight at Warton of initial production model Tornado F Mk 3, the definitive air defence fighter variant for No 11

Group which introduces RB.199 Mk 104 engines, provision for automatic wing sweep and other new features.

25 November: Delivery of last Hercules C Mk 3 conversion (KV299) by Marshall of Cambridge Engineering, bringing RAF fleet of the stretched version to 30.

20 December: Return to RAF Lyneham from Ethiopia of the final Hercules C Mk 1 engaged in *Operation Bushell*, with members of the RAF and Army detachment. In nearly 14 months, two Hercules (on rotation) flew every day, without a single exception, to deliver more than 32,000 tonnes of relief supplies, by landings and by air drops.

(Right, top to bottom) A Tornado of No 27 Squadron (Sqn Ldr Steve Johnson and Sqn Ldr Derek Chamberlain) prepares to leave RAF Marham for USAF Bombing and Navigation Competition; victorious crews of No 27 Squadron, and No 57 Squadron (Victor tankers) in USAF Bombing and Navigation Competition.



"I hear this year's defence budget cuts are really beginning to bite."

The Royal Air Force Benevolent Fund repays the debt we owe



The sole purpose of the Royal Air Force Benevolent Fund is to help past and present members of the Royal Air Force, including the Women's Services, their widows, children and dependants. The entitlement lasts for life and tragedies occur in peace time as well as in time of war. The Fund provides help for those disabled, flying or otherwise on duty, for the dependants of those killed and for those who need help at any time by reason of bereavement, disability, sickness, infirmity, poverty, accident or other misfortune.

The Fund seeks to enable dependants to maintain some semblance of the life to which they have become

accustomed and to help children into careers their fathers might have expected them to follow. Each person's needs are considered in the light of their personal circumstances with the object of providing whatever assistance may be required.

In 1985 some £7m was needed for the relief of distress and the greater part of this went to help widows, children and the disabled. We need your help; every donation we receive means there is more to give. Advice on legacies, bequests and covenants is gladly given. If you know of anyone who may qualify for help from the Fund, please let us know.

Royal Air Force Benevolent Fund

67 Portland Place, London W1N 4AR Telephone: 01-580 8343

Also at

20 Queen Street, Edinburgh EH2 1JX. Telephone: 031-225 6421

Registered under the War Charities Act 1940 and the Charities Act 1960 Registration No. 207327

LANCASTERS BY THE HUNDRED — A TEST PILOT'S VIEW



Parked on the Avro airfield at Woodford, the first Canadian-built Lancaster (KB300) was flown extensively by the author, to compare its performance and handling with that of the British aircraft.

BETWEEN 1941 and 1945, more than 3,600 Lancasters were built by A V Roe and Co Ltd at their Manchester factories (and nearly 3,000 more by other companies). The major components of most of the Avro-built Lancasters came together for final assembly at Woodford, where they were given production test flights before being delivered to the RAF. Responsible for testing no fewer than 900 of these Lancasters in a three-year period was J H "Jimmy" Orrell, later to become Avro's chief test pilot. Now living in retirement but still taking a lively interest in the affairs of "the old firm" down the road at Woodford, Jimmy Orrell, OBE, has contributed this memoir of testing the Lancasters and Lincoln, 40-odd years ago.

Much had changed at A V Roe when I rejoined the company in April 1942, after an eight-year stint with Imperial Airways flying on the European and Empire routes. The country was now at war, the "Battle of Britain" over and production of bomber aircraft a top priority. In my absence, the Manchester bomber with its ill-fated Rolls-Royce Vulture engines had been conceived, developed, tested, put into production, entered service and was now on the point of being withdrawn from Bomber Command — a failure.

Yet out of the Manchester had been born the Lancaster — in essence, the same aeroplane but with a lengthened wing on which were mounted four Rolls-Royce Merlin engines instead of the two unreliable Vultures. The first "four-engined Manchester" (it was known as the Manchester Mk III before being renamed Lancaster) had flown early in 1941 and production Lancasters were coming off the line by October that year. My task for the next few years, primarily, was to take newly-built Lancasters on their aerial baptisms, ensuring that they were up to standard for delivery to Bomber Command, in the hands of whose crews they were to wreak such havoc on the Third Reich.

Aircraft production — fighters as well as

bombers — was vital to Britain's survival in 1942, and all the aircraft and engine factories were working seven days a week, day and night. Under no less pressure were the associated companies producing undercarriages, tyres, gun turrets, hydraulic systems, bomb gear, radio equipment, instruments and the hundred-and-one other items that went to make up an operational aeroplane.

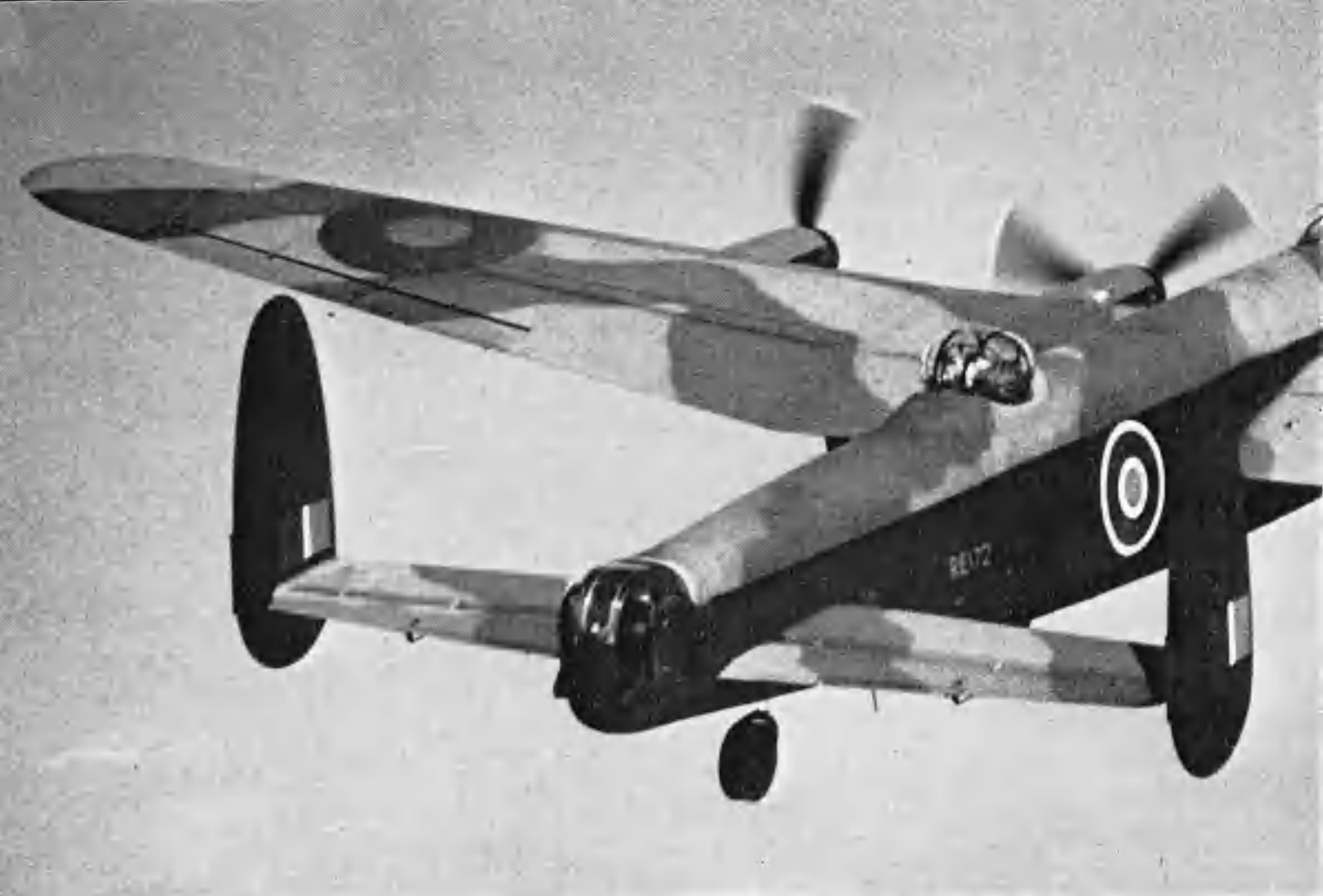
The main Avro factory was at Chadderton, in north Manchester and some 16 miles (26 km) from the aerodrome at Woodford, where most of the Lancasters were assembled and flight-tested. Fuselages and wings were built in the form of large sub-assemblies, each being completed with fittings, controls and instruments, etc, before being moved by road to Woodford. This method of manufacture — enforced on Avro as there was no airfield at Chadderton and the Lancaster was too large to allow complete fuselages or wings to be moved by road — had its advantages during the test flight programme and proved to be a boon in the repair and rebuilding of aircraft damaged in service or, as sometimes occurred, in air raids on the factory.

Because of the possibility of air raids and the exigencies of the "black-out" regulation, test-flying at Woodford was restricted to daylight hours. This meant working long hours from

dawn to dusk in the summer and often scrambling to land before darkness descended in the winter months. Development of the Lancaster, I quickly learned, had been relatively quick and trouble-free, thanks in fact to experience gained with the Manchester but also because of the excellence of the basic design by Roy Chadwick and his team. The result was a bomber of quality and performance, developed in record time and produced, through the efforts of the factory workforce, in record numbers.

The initial test flight of each Lancaster off the assembly line dealt with those things relative to, and effective in, flight — ie, aircraft state of build, flying controls, engine and propeller operation, undercarriage and flaps, bomb doors, hydraulics, fuel system, electrical services and instrument installation. Presuming there were no serious snags, the initial flight would then be continued to check performance and handling through the speed range.

An initial flight of this kind could be completed in 30 to 40 minutes, with the help of a flight-engineer to record figures and check functioning of the services. The main aim was to produce an aircraft with zero trim on ailerons, elevator and rudder, checked over the speed range, thus giving the pilot a maximum



trim adjustment in the event of engine failure or damage to the aircraft by enemy action.

After pre-flight checks, the take-off and climb quickly gave a fair indication of the state of the aircraft. The engineer would go aft and check that the landing flaps were fully retracted. The next business, which was to trim the aircraft in level flight cruise conditions, noting the amount of trim required laterally, directionally and fore and aft, gave little trouble, usually requiring small adjustments to trimmer tab and control settings. No lateral trim indicated a good wing combination. This happy situation was not always the case, however, and there was a spate of aircraft needing aileron trims for level flight. In these cases, the amount of trim required was noted, and the engineer would go aft and observe the position of the ailerons relative to the wing trailing edge. This gave evidence of the amount of wing incidence required to correct the fault. Back on the ground, the adjustment was made by loosening the bolts of the rear section of the wing, attached to the rear spar. It was then possible to insert slotted washers on the top or bottom bolts, this having the effect of increasing or decreasing the wing incidence. This little trick was known locally as a "wing-pack", and was done by a team of fitters in about eight hours. It was one instance where the sectional manufacture of the aircraft was an advantage.

This spate of wing trouble was eventually traced back to the jigs for the main wings. I believe the jig anchorage and structure was strengthened up to prevent small discrepancies during manufacture, and this was followed by regular checks on alignment.

The second and subsequent production test flights would repeat the test schedule in general, checking that any faults on the previous flight had been cleared. Performance and handling would be covered in all respects and, only then, would the aircraft be cleared for delivery. It is worth recording that a large proportion of production aircraft were cleared for delivery after two flights.

Out of the thousands of Lancasters built at Woodford, there was but one fatal accident. It was said to be caused by the fuel-jettison pipes coming out of the wing while the aircraft was in a steep dive, probably when "g" was applied to pull out. The jettison pipes were torn off, hitting the tailplane and stripping the elevator skin. The aircraft (PB579) dived into the ground about three miles south of Woodford, killing Avro test pilot S H Gleave.

In my case, I had no serious trouble, but odd snags did occur which stopped one becoming too complacent about flying a marvellous aircraft. For example, flying in the better weather off the west coast of England on one occasion, whilst in a steep turn, both outboard engines cut out. With fingers crossed, I decided to return to Woodford on the inboard engines. The fault was found to be rainwater in the terminal blocks on the engine bulkhead, which shorted the ignition leads in the steep turn. Fortunately the inboard blocks were not so bad. The cure — provide drain holes in terminal blocks. The fault was caused by the aircraft having been left standing out on dispersal in a wet period. It was better that this happened at Woodford and not on a bomber station.

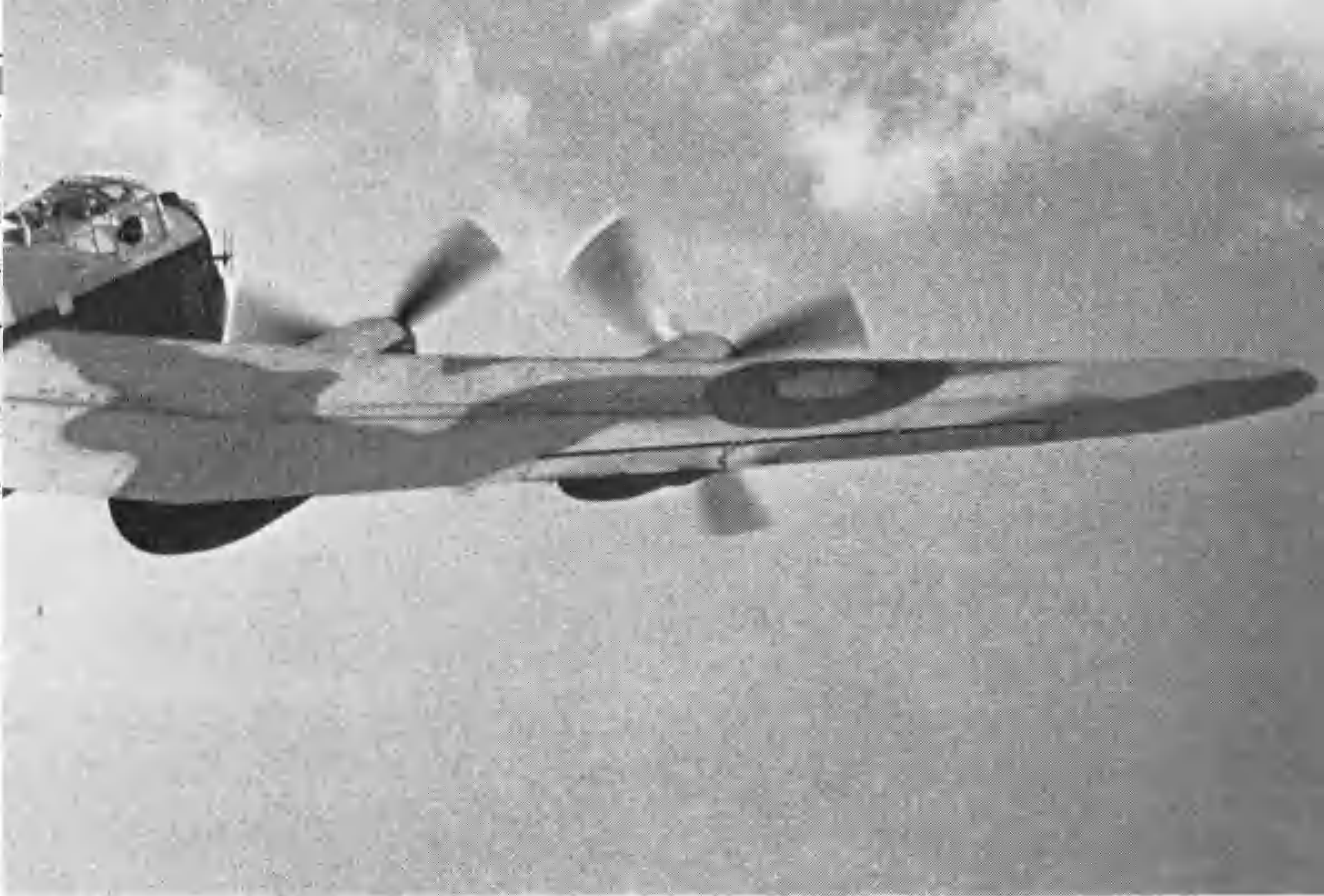
On the odd occasions, one or two throttles

(Above) A late-production Avro Lancaster B Mk III, from the Yeadon assembly line. (Right, top to bottom) A typical wartime scene at Woodford; the modified Lancaster "Aries II", among the types tested by the author; Lancaster front fuselages at Chadderton, with centre fuselages beyond, from where they were moved to Woodford for final assembly. (Far right) Jimmy Orrell in 1949.

jammed when closing down power. It was better then to leave the throttles in that position and cut the ignition. The engineers could find the cause, remedy the fault and take action to obviate a repetition of the problem.

One aircraft proved to be "a problem child" and, of course, it had to be one subsequently selected for a special raid. In the routine way, I duly went through the usual drill but when it came to testing cruise conditions, I found it was at least five knots down. In the air, everything was clean. On the ground, the aircraft was checked, the engines checked, the propellers checked, airspeed indicator calibrated, but the second flight was no better. On the third flight, I formatted with another Lancaster in cruise condition. To keep station I had to increase power; the aircraft was definitely slow, but in every other respect a good aircraft. The facts were duly noted on the test schedule and the aircraft was cleared for delivery.

It transpired that this aircraft, with six other Lancasters, was detailed for an important mission — to attack a Gestapo Headquarters holding some important French Resistance workers who had to be freed some time before "D" Day. The aircraft were despatched, each carrying a heavy bomb load with a minimum of



fuel for a fast raid. At some stage, the pilot of the "rogue" aircraft realised he could not complete the mission and decided to return to base. Fortunately the raid was successful, but then came a rocket from "Bomber" Harris, chief of Bomber Command, to Roy (later Sir Roy) Dobson (then Works Manager). This was passed on to Woodford, with a few more well-chosen words regarding this aircraft. We could only refer to the test schedule; with a war on your hands, what else could you do?

Various changes were made on Lancasters to suit Bomber Command requirements and all such changes had to be flight tested. For instance, the aircraft for No 617 Squadron's "dam busting" raid were found not to be affected by the removal of the bomb doors, leaving a big cavity for the revolving bomb that Barnes Wallis had developed. On the other hand, a change of rear gun turret to an FN type upset the tailplane airflow on Lancaster NN801 (Austin-built) at Elmdon in April 1945. After take-off, the pilot found the aircraft difficult to handle, feeling that he was losing control fore and aft. He ordered the engineer and AID inspector to bale out, but the latter unfortunately opened his chute too soon, banged his head in the escape hatch and was killed. The pilot then decided to make an attempt to land the aircraft at Elmdon, which he did successfully.

As the parent firm, Avro received a report on the whole incident and I was sent to Elmdon to investigate the trouble, with a few words of caution from Roy Chadwick, the chief designer. After much discussion, and noting the changes with the new turret, I decided to fly

solo, knowing the aircraft was manageable but not pleasant.

True enough, the elevator was extremely light in trim, any movement causing oscillations fore and aft. It was obvious that the elevator was in a dead air layer until disturbed. I could appreciate the pilot's feelings after flying numerous Lancasters with excellent controls. After a long telephone conversation with Roy Chadwick, it was decided to thicken up the elevator trailing edge with "Flettner", a strip of material fitted to the top and bottom surfaces of the trailing edge of the elevator. This certainly cured the trouble and three check flights determined the exact amount of "Flettner" required.

A similar fault occurred on the Lancastrian. This was the Lancaster modified to operate the BOAC Kangaroo route to Australia via South Africa. Armament was removed and the cabin equipped for seven passengers and freight. The nose and rear of the fuselage were rounded off to streamline the body. On the first flight, the elevator was found to be in the same state as experienced on Lancaster NN801. It was anticipated that similar action on elevator trailing edge would do the trick, and true enough,

putting "Flettner" on the elevator cured the trouble. On the other hand, when the H2S blister was fitted under the fuselage, it had no effect on the aircraft; nor did a fuel tank mounted on the top of the fuselage for long flights prove to be a problem.

Considering the number of Lancasters built at Woodford, great credit must be given to the design team, the factory workers, the engineers and the inspectors for producing a fine aircraft. It made the test pilots' task that much easier to finish the job to the desired standard.

Factory tours by Sqn Ldr Nettleton, VC, and crew, and also by Wg Cdr Guy Gibson, VC, and his crew were a great boost to the workers. I found favour with a Russian delegation, too, whilst taking them for a flight because my name, to them, sounded the same as the Russian town Orel, much in the news at that time!

By 1943, the first Lincoln was being developed, to operate in the Far East against the Japanese. At first, the two versions of this bomber, powered respectively with British or American-built Merlin engines, were known as the Lancaster IV and Lancaster V, showing that the design was related to the Lancaster.

Both fuselage and wing were enlarged, however, and although the overall configuration and general appearance were the same, it was decided to rename the new bomber Lincoln. Capt H A "Sam" Brown made the initial flights, starting on 9 June 1944, with Bill Thorn and I joining in the test programme whenever possible in the working day. I can recall doing high altitude performance and maximum design speed handling. Eventually, I took the Lincoln to the A & AEE at Boscombe Down for acceptance trials.

About 100 Lincolns were delivered to the RAF before the Japanese surrender, but none saw active service in the Far East. The orders which had by then been placed totalled 800, to be built by Avro and Armstrong Whitworth, but the contracts were then slashed. About 530 Lincolns were finally built for the RAF, however, additional contracts being placed post-war, and some saw active service in Malaya and Kenya.

My log book confirms exactly 900 Lancasters, a fair number of Lincolns and some Yorks tested and cleared for acceptance by the RAF. I have to thank factory workers, engineers and inspectors for their good work. I'm happy to be still around to say so. □

FARNBOROUGH INTERNATIONAL 86



PUBLIC OPEN DAYS

Friday, Saturday, Sunday
5-6-7 September 1986

— the Aerospace Exhibition and Flying Display of the Year

ADMISSION CHARGES

Adults	£8.00
Children (under 14)	£2.00
Cars (excluding occupants)	£4.00
Coaches (excluding occupants)	£20.00

Please note: animals are not admitted

ADVANCE BOOKINGS — DISCOUNT

Keith Prowse & Co. Ltd. are official ticket agents for the Public Days

Advance Box Office:
Banda House, Cambridge Grove, Hammersmith, London W6 0LE. Telephone: 01-741 8999

A discount of 10% is offered on advance bookings for parties of 25 and over visiting the Show on the Public Days



The volunteer members of the
ROYAL OBSERVER CORPS

help safeguard Britain's future
by training to perform a vital role
in the event of war.

**ARE YOU THE SPECIAL TYPE OF PERSON
WE ARE LOOKING FOR?**

We have a few vacancies
for men and women between the ages of 16 and 55
to serve in their spare time
at locations throughout the United Kingdom.

A uniform is provided
and allowances are paid for attendance on duty.

For full details write to:
*The Commandant,
Headquarters Royal Observer Corps,
Bentley Priory, Stanmore,
Middlesex HA7 3HH
or Telephone 01-950 4000 ext 457*

Osprey Aerospace Books

More than 100 titles to choose from
offering in-depth studies of
military aircraft, superb
air-to-air colour photographs
and much more!

New series starts
in June.

For a free catalogue
showing all Osprey
Aerospace titles,
please fill in
the coupon
below.

FREE AEROSPACE LEAFLET

Please fill in your name and address below
and post today to: Marketing Department,
Osprey Publishing, 27a Floral Street, London WC2E 9DP.

Name _____

Address _____

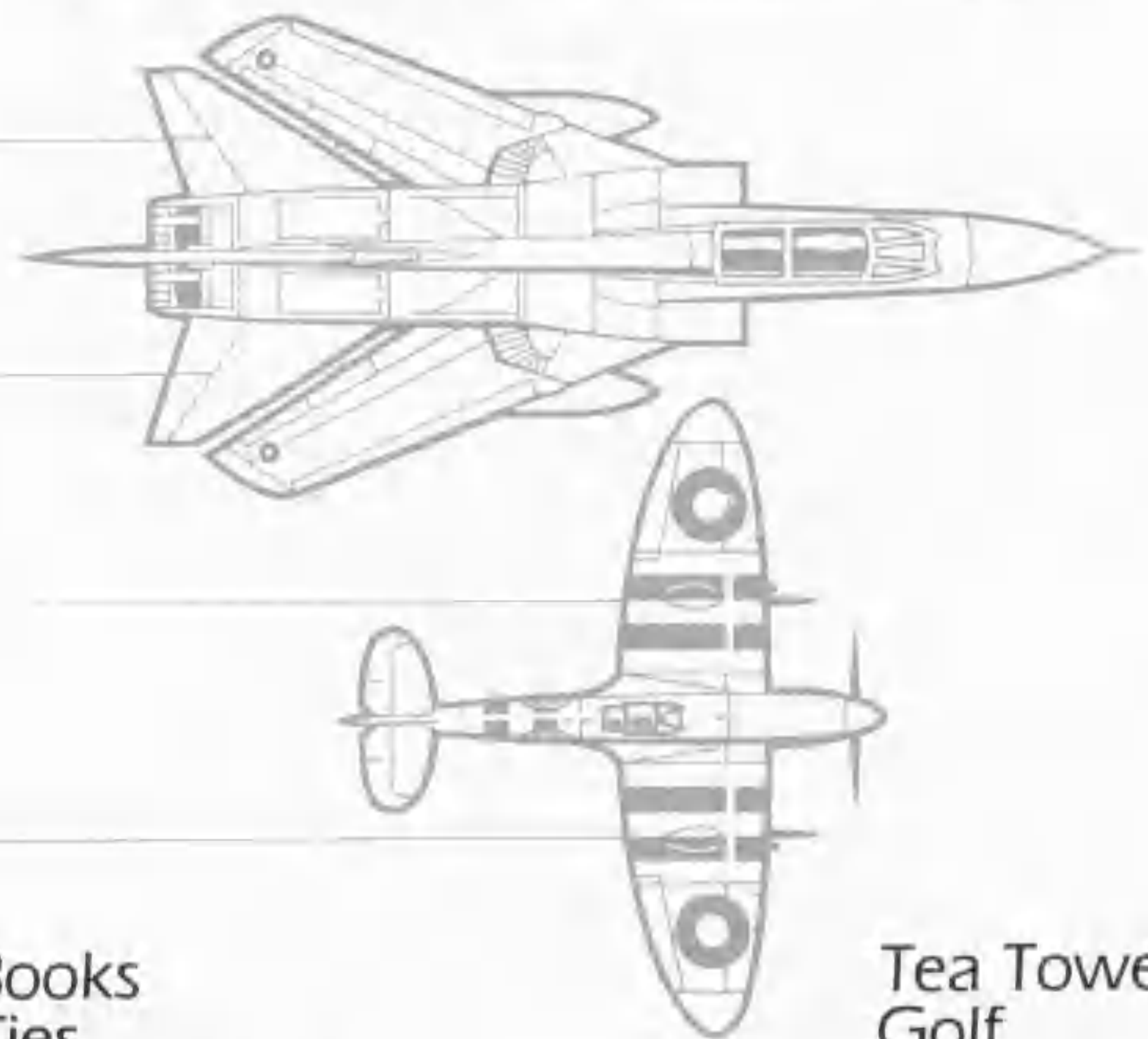
RAFYB/86

OSPREY PUBLISHING



LOOK OUT FOR THE SKYHIGH MOBILE SHOP

and our new product logo



Books
Ties
Headquarters
Mugs
Badges
Stickers
Teaspoons
Erasers

Tea Towels
Golf
Umbrellas
Pens
Pencils
Notebooks
Posters
Films

and many, many more items

AT MAJOR AIRSHOWS AND EVENTS
THROUGHOUT THE COUNTRY INCLUDING

TVS AIR SHOW
SOUTH
Bournemouth-Hurn Airport
Dorset
31 May-1 June

INTERNATIONAL
AIR SHOW '86
Middle Wallop Airfield
Hampshire
12-13 July

Both events organised by International Air Tattoo
on behalf of the RAF Benevolent Fund

Further details from
INTERNATIONAL AIR TATTOO
Building 1108, RAF Fairford,
Cirencester, Gloucestershire GL7 4DL
Tel: 0285 713300

For your diary - IAT '87, 18/19 July 1987 - RAF Fairford

All Proceeds from Skyhigh to
RAF BENEVOLENT FUND
67 Portland Place, London W1N 4AR
Tel: 01-580 8343

Charity Registration Number 207327

CENTURY SQUADRON CANBERRAS

First flown on 13 May 1949, the English Electric Canberra continues to serve the Royal Air Force in several significant rôles, though it has long been usurped as a front-line bomber. Most of the RAF's Canberras are today concentrated in No 100 Squadron at RAF Wyton, where examples of the B Mk 2, PR Mk 7, E Mk 15 and TT Mk 18 are still to be seen. This squadron's primary purpose is to provide target facilities for all three armed services — a rôle that goes far beyond the most obvious one of towing airborne targets for ground-to-air gunnery and missile practice. Paul Crickmore has flown with No 100 Squadron to provide this account of a sortie for the benefit of students at the RAF's School of Fighter Control

Tower KQC36 and 22, with the Alconbury traffic in sight you will be cleared take-off.

36 Take-off, K36, 22.

Intercom 36 Pilot Wait for the thumbs up. Got that? Just wait for a sec so we don't conflict with the Alconbury, we'll let him get well out of the way. Right, should be all right now.

36 K36 rolling.

Intercom 36 Pilot Brakes off, accelerating. Clear to full power. (RPM) 77 50, 77 50; 510 520 (JPT).

Intercom 36 Nav 60 knots . . . 100 knots.

Intercom 36 Pilot That checks. 520 and 550 (JPT) stable, rotating.

Intercom 36 Nav 135 knots.

Intercom 36 Pilot Airborne now. Brakes. Gear is travelling and holding flat.

Intercom 36 Nav 155 knots.

Intercom 36 Pilot Rog. Back to 7600 and climbing gently. Alconbury's well out of the way now. And gear lights out. Just wait for his airborne call. Okay, turning starboard now.

22 K22's airborne.

36 K22, stud 5, stud 5, go.

36 K22, check.

22 K22.

36 K22, loud and clear. Wyton departures K36 and 22 airborne.

Wyton Radar K36 and 22, roger. Continue the SID, step climb FL 115 initially.

36 FL 115 initially, K36.

Wyton Radar You are identified on departure.

Canberra variants operated by No 100 Squadron include the TT Mk 18 (top and bottom), the E Mk 15 (centre left) and the PR Mk 7 (centre right).





Louis Newmark



Aircraft Division
World Authority for ASW HELICOPTER
AUTOMATIC FLIGHT CONTROL SYSTEMS

- Attitude/Director Indicators
- Linear and Rotary Actuators

GYROSCOPIC PRODUCTS

- 6000 series Attitude and Heading Reference System
Standard equipment on the BAe 'HAWK'
- Vertical, Azimuth and Rate gyroscopes
- Gyromagnetic Compass Systems.



LOUIS NEWMARK PLC
Aircraft Division

80 Gloucester Road, Croydon, Surrey CR9 2LD. Telephone: 01-684 3696 Telex 264004

And so we are airborne from RAF Wyton's runway 27 in Canberra TT Mk 18, WK118, with Flt Lt Martin Durham at the controls and Flt Lt Phil Wenham navigating, turning onto a heading to track the 020 deg radial from Alconbury *en-route* to our exercise area, some 150 miles (241 km) east of Flamborough Head. Thirty seconds flying time behind us are Sqd Ldr Vince Robertson and his navigator Sqd Ldr Alex Wedderburn in Canberra E Mk 15 WJ756. Both crews and aircraft are part of No 100 Squadron, whose task it is to provide target facilities for all three armed services. On this particular sortie the two aircraft were to act alternately as fighter and target, for the benefit of student fighter controllers attending the School of Fighter Control (SOFC), located at RAF West Drayton, in Middlesex.

Having been handed off from Wyton Radar to Eastern Radar, climbing at a steady 4,000 ft/min (1 220 m) at 250 knots (463 km/h) indicated airspeed and 7,600 rpm, we levelled off at flight level (FL) 250 and cruised at Mach = 0.72. Sqd Ldr Robertson then took over the formation and lead for the crossing of air route Upper Blue One, near Dogger. Shortly after clearing, Eastern handed us off to "Firefly", the RT call-sign for the SOFC. We were being "worked" by "controller 70", a young WRAF Pilot Officer. The system of numbering controllers not only reduces RT time, but also provides an element of security. She ensured that both aircraft had good two-way radio contact with her, could maintain visual met conditions (VMC) and informed us that the fighter was to fly at FL 230 and Mach = 0.75, whilst the target was to be at FL 250 and Mach = 0.65.

First exercise

Arriving at the exercise area, we descend, as the fighter aircraft for this first practice intercept, to FL 230, whilst "22" maintains FL 250. Since all intercepts of this type are made in the horizontal plane, this manoeuvre ensures a 2,000 ft (610 m) height separation between the two "combatants". Levelling at 230, Firefly 70 states that this will be an "Op Ex" — that is, an Operational Exercise where unknown headings are used, together with target crossing angles (TCAs) of between 90 and 180 deg. Earlier in a fighter controller's training, known target headings are used and the workload on the trainee is then increased progressively.



Yellow undersides with black stripes distinguish the target-towing Canberras.

Each Canberra is now put on a divergent heading and the work begins. We are told to report our state, to which Phil our navigator replies, "K36, Bravo 220, Tiger Slow plus 90". This code includes K36 as our aircraft call-sign; Bravo, the letter identifying the type of aircraft; 22 to show it is equipped with winches and tip tanks (reported since, on the TT Mk 18, these are heavy and produce drag); 0 indicating no weapons onboard. Tiger Slow says we are subsonic, with "plus 90" to indicate 90 minutes remaining on task. We were briefed to "Identify and Report" — speculation on the flight deck was "that it was probably a Canberra"!

Breaking port now to head 200 deg, the target "22" broke to starboard and headed 320 deg. Rolling out and reporting steady on 200 deg, the TCA would be 120 deg. From now on speed and height, bearing and distance and directional crossing information — in this case left to right — of the target are fed to us almost constantly, until — there, just a speck at first, "22" grew in our vision. Sure enough, all the information controller 70 had given us was spot on. At the appropriate range we were turned quite hard right and brought onto 320 deg — the same heading as the target. The turn, having been timed perfectly, put us in the target's 6 o'clock position at about 3 miles (4.8 km) and so allowed Martin to make his ident report "Twin jet, medium bomber (retired)". The tables were now to be reversed, "22" becoming the hunter and we the hunted, with the trainee controller 70 again achieving another good, although this time less tight, intercept.

Having spent 90 minutes on task with the SOFC and completed about 12 intercepts, a

check on our fuel state indicates that it is time to leave the area. Arriving overhead Wyton at 1,000 ft (305 m) in arrow port, with "22" lead, the classic run in and break is executed precisely 3 seconds after lead, to give a 1,000 yard (915 m) separation down-wind and 1,500 yards (1 371 m) on the runway.

Landing at 1215 gave time for a hurried RAF-issue flight-line lunch, before attending the pre-flight brief for the next sortie. This was to be a "banner" towed on a 1,000 ft (305 m) line by Canberra B Mk 2 WP515, to enable seven Lightnings, with the aid of their gun cameras, to evaluate their air-to-air firing techniques. This sortie was flown by Flt Lt Rick Pearson, with Flt Lt John Lawlor navigating. The flight went very well, lasting 2 hr 45 min, and clearly demonstrated the diverse tasks carried out by No 100 Squadron. To meet these requirements, the squadron has a mix of Canberra B Mk 2s, E Mk 15s, PR Mk 7s and TT Mk 18s. The last-mentioned Mark has one Flight Refuelling "Rushton" winch pack located under each wing, to enable it to tow Rushton intercept targets on cables up to 50,000 ft (15 240 m) long. These are used as targets for Rapier missile firing. "Sleeve" targets are towed for Royal Naval gunnery practice. The squadron also provides targets for the RAF's Air Defence forces, carries out some Radar Flight Checking and provides facilities for major NATO exercises. □

The author gratefully acknowledges the assistance of Wg Cdrs Colin Adams and Mike Purdie, Sqd Ldrs Vince Robertson and Alex Wedderburn and Flt Lts Martin Durham, Phil Wenham, Rick Pearson and Steve Longley.



"... 'sleeve' targets are towed for Royal Navy gunnery practice."

THE RAF IN GERMANY: 1946-1986

The war in Europe ended with Royal Air Force units operating in Germany as part of the 2nd Tactical Air Force, renamed the British Air Force of Occupation (BAFO) in July 1945. The name reverted to 2nd TAF in September 1951 and the title RAF Germany was adopted in January 1959, but the rôle has remained unchanged throughout: to provide, within the context of NATO's 2nd Allied Tactical Air Force, a front-line deterrent force and attack capability designed to preserve the status quo in Europe. For 40 years, therefore, the Germany-based squadrons have been very much at the "sharp end" of the Royal Air Force. The aircraft they have flown since the end of World War II are here described by John Rawlings and depicted in a series of colour profile drawings.

Auster AOP Mk 6

This type equipped No 652 Squadron, the only AOP unit in RAF Germany, from 1947 onwards, being stationed at first at Celle with detached Flights. It was taken over by the Army Air Corps on 1 September 1957.

BAC Lightning F Mk 2/F Mk 2A

In September 1965, No 19 Squadron took its Lightning F Mk 2s to Gütersloh to become the first fully-supersonic defenders in RAF Germany. In December, the similarly-equipped No 92 joined them, based at Geilkenkirchen, giving the Command the mightiest punch its defence force had enjoyed up to that time. No 92 joined No 19 at Gütersloh in January 1968 and from then on both squadrons' aircraft were progressively modified up to F Mk 2A standard, approximately matching Fighter Command's F Mk 6. These two squadrons continued to use Lightnings for fighter defence duties until replaced by Phantoms in December 1976 and March 1977 respectively.

Boeing Vertol Chinook HC Mk 1

The first RAF squadron to equip with this medium-lift helicopter was No 18 Squadron at Odiham on 4 August 1981. After nearly two years of work-up, the squadron moved out to Gütersloh on 3 May 1983 to provide an entirely new airborne element in RAF Germany. It has remained there in this airborne lifting rôle to date.

De Havilland Chipmunk T Mk 10

The only quasi-operational Chipmunks in the RAF are those which have served, and still serve, with the Station Flight at RAF Gatow in Berlin, where they fly within the Berlin area to exercise the British rights to fly over the city. They have also served, at various times since the 'fifties, in some of the other Station Flights at RAF bases.

De Havilland Devon C Mk 1/C Mk 2

From 1948 to 1985, one or more Devons have served with the Communications Squadron at Wildenrath under its various names of 2nd TAF Comms Squadron, RAF Germany Comms Squadron and No 60 Squadron.

De Havilland Heron C Mk 3

One of these aircraft (XM296) served with No 60 Squadron from March 1971 for a number of years.

De Havilland Mosquito FB Mk 6

RAF Germany inherited the fighter-bomber squadrons that had made up No 2 Group, 2nd TAF, equipped with Mosquito FB Mk 6s. These were Nos 21, 107, 305, 418, 464, 487, 605 and 613 Squadrons. During the early post-war years there was much reorganisation and renumbering of these squadrons, the situation being quite chaotic for a while. When regularised,

there remained in RAFG a Wing of Mosquitoes at Wahn comprising Nos 4 and 107 Squadrons, the latter being renumbered No 11 Squadron in October 1948. This Wing moved to Celle in 1949 and to Wunstorf in 1950, where it re-equipped with Vampires.

De Havilland Mosquito B Mk 16/B Mk 35

To form a Strike Force in RAF Germany, a Wing was formed at Wahn from the miscellany of light bomber squadrons left over at the end of the conflict. This Wing was equipped with Mosquito B Mk 16s and comprised No 128 Squadron (which was renumbered No 14 on 1 April 1946), No 98 Squadron and No 180 Squadron (renumbered No 69 Squadron on 31 March 1946). In September 1949 the Wing moved to Celle, having been reduced to a two-squadron formation at the end of 1947 when it lost No 69 Squadron; Nos 14 and 98 re-equipped on the Mosquito B Mk 35 in 1947/48. In November 1950 it moved to Fassberg, re-equipping with Vampires the following year.



Helicopters have played an important rôle in RAF Germany since 1963. No 18 Squadron now flies Boeing Chinook HC Mk 1s (left), having previously used the Westland Wessex HC Mk 2 (below).



De Havilland Vampire F Mk 1

The Vampire became the universal equipment of RAF Germany in the early 'fifties, and the first jet fighter to serve there. To start this process, No 3 Squadron received Vampire F Mk 1s in place of its Tempests at Wunstorf in April 1948. The squadron was tasked with obtaining operational experience with the type in service in Germany and its experience paved the way for the later re-equipment of the other fighter squadrons with Vampire F Mk 5s. In June 1948 it moved to Gütersloh and there began re-equipping with the FB Mk 5 in May 1949.

De Havilland Vampire FB Mk 5

In the early 'fifties, this version of the Vampire became the standard weapon in RAF Germany, being used in the dual rôle of interceptor fighter and ground attack interdictor. The original Wing was built up at Gütersloh in 1949 with Nos 3, 16 and 26 Squadrons, but from then on there was a rapid expansion to other bases. No 16 Squadron moved to Celle in November 1950 and was there joined by newly-re-formed Nos 93 and 94 Squadrons before the year was out. No 26 went to Wunstorf in January 1950 where it was joined by No 4 Squadron in July, No 11 in August and No 5 in March 1952, whereupon No 4 went to Jever. In the meantime, the Gütersloh Wing had been maintained by re-forming No 67 Squadron in September 1950 and No 71 in October. No 4 Squadron was joined at the newly-built airfield at Jever by No 20 in July. Fassberg had been built in 1951 and three squadrons were re-formed to provide a Wing there: Nos 112 and 118 in May and No 266 in July 1951, No 98 following in October. The final Vampire base was Oldenburg, Nos 20 and 26 Squadrons moving there in July and August 1952, and being joined by the re-formed No 234 Squadron. In the meantime, No 145 Squadron had been added to the Celle Wing in March 1952. Sixteen squadrons of Vampire FB Mk 5s thus provided a large numerical force in Germany, but by April 1954 the entire Vampire force had been replaced.

De Havilland Venom FB Mk 1/ FB Mk 4

The Venom in its FB Mk 1 version was rushed into service with RAF Germany in 1952 to take advantage of its performance improvement over that of the Vampire. First aircraft went to No 11 Squadron at Wunstorf in August 1952; Nos 5 and 266 re-equipped before the year ended, to make up No 123 Wing. No 121 Wing at Fassberg changed up to Venoms when No 14 Squadron re-equipped in May 1953, No 98 in August and No 118 in October. Celle's No 139 was the third Wing to re-equip, with No 16 Squadron in February 1954, No 145 in May and No 94 in June. Venom FB Mk 1s were replaced by FB Mk 4s in the Wunstorf Wing in 1956, the Fassberg Wing having re-equipped with Hunters in 1955; the Celle Wing



Tempest V, No 3 Squadron



Tempest II, No 33 Squadron



Mosquito FB Mk 6, No 4 Squadron



Spitfire PR Mk 19, No 2 Squadron



Vampire FB Mk 5, No 112 Squadron



Meteor PR Mk 10, No 541 Squadron



Venom FB Mk 4, No 266 Squadron



Meteor NF Mk 11, No 68 Squadron



(Above) Sabre F Mk 4, No 234 Squadron



(Below) Canberra PR Mk 7, No 80 Squadron



Hunter F Mk 6, No 130 Squadron



Canberra B(I) Mk 8, No 16 Squadron



Swift PR Mk 5, No 2 Squadron



Javelin FAW Mk 9, No 5 Squadron



Lightning F Mk 2A, No 92 Squadron



Phantom FGR Mk 2, No 2 Squadron



Buccaneer S Mk 2, No 16 Squadron

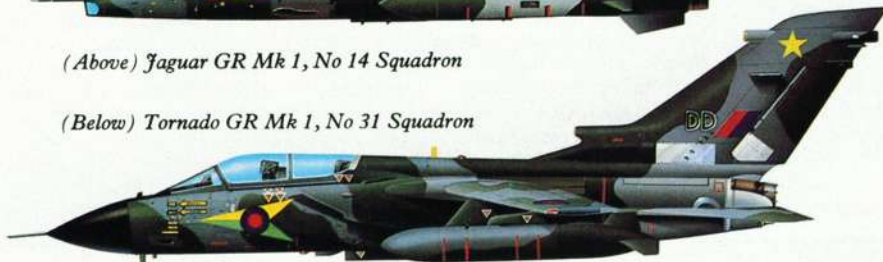


Harrier GR Mk 3, No 20 Squadron



(Above) Jaguar GR Mk 1, No 14 Squadron

(Below) Tornado GR Mk 1, No 31 Squadron



squadrons disbanded between September and October 1957.

English Electric Canberra B Mk 2

The advent of the Canberra in the RAF offered the potential of a much more powerful strike capability, and RAF Germany was quick to take advantage of it. A Strike Wing, No 125, was formed at Gütersloh with Canberra B Mk 2s when No 149 Squadron moved out from Cottesmore in September 1954, whereupon three other squadrons were formed to join it, Nos 102 in October, 103 in November and 104 in March 1955. The Wing disbanded in 1956.

English Electric Canberra B(I) Mk 6/B(I) Mk 8

The more powerful Canberra B Mk 6, serving with Bomber Command in the UK, was modified in two stages for the low-level nuclear and interdiction rôle required in Germany, first as the B(I) Mk 6, an interim version with an interchangeable belly gun pack and underwing pylons, and then the B(I) Mk 8 which had a completely redesigned forward fuselage, better suited to the rôle. The B(I) Mk 6 went into service with No 213 Squadron at Ahlhorn in March 1956, moving to Brüggen in August 1957 where it served for 12 years, disbanding on 5 December 1969. The B(I) Mk 8 equipped all the other RAF Germany squadrons, starting with No 88 which re-formed at Wildenrath in January 1956 and served there until December 1962, when it was renumbered as No 14 and continued through to June 1970. It was followed by No 59 Squadron in February 1957 at Geilenkirchen, this squadron becoming No 3 on 4 February 1961 and serving with B(I) Mk 8s until January 1972. No 16 Squadron was the third and final Canberra B(I) Mk 8 unit, forming at Laarbruch in March 1958 and serving there until June 1972.

English Electric Canberra PR Mk 3/PR Mk 7

The Canberra took over the photo-recce rôle from the Meteor in May 1954 when No 69 Squadron formed with PR Mk 3s at Laarbruch. It proved the rôle and maintained the task until further PR squadrons had been formed, then moving (on 1 July 1958) to Luqa, Malta, to be renumbered No 39 Squadron. By then three other PR Canberra squadrons had been formed in Germany, all with the later PR Mk 7. First was No 31 Squadron at Laarbruch in March 1955, followed in June 1955 by No 80, also at Laarbruch, but moving to Brüggen two years later. The third squadron was No 17, which reformed at Wahn in June 1956 and moved to Wildenrath in April 1957. No 80 Squadron served until September 1969 when it was disbanded; No 17 served until December 1969, leaving No 31 Squadron to maintain the rôle with Canberras until March 1971.

**Gloster Meteor FR Mk 9/
PR Mk 10**

The Meteor first served in Germany in the reconnaissance rôle, from December 1950 when No 2 Squadron at Buckeburg relinquished its Spitfire PR Mk 19s. Gloster Meteor FR Mk 9s served with this squadron until May 1956, having moved to Gütersloh in May 1952, Wahn in July 1953 and Geilenkirchen in October 1955. Also in December 1950, No 541 Squadron at Benson received Gloster Meteor PR Mk 10s and took these out to Buckeburg in June 1951. It continued in the high altitude PR rôle until disbanded at Wunstorf on 6 September 1957. Several Meteor PR Mk 10s had also served with No 2 Squadron for a few months in 1951. A second Meteor FR Mk 9 Squadron, No 79, re-formed at Gütersloh on 15 November 1951, moving to Buckeburg in July 1954; it kept the type until re-equipped with Swifts in August 1956.

Gloster Meteor NF Mk 11

A night-fighter element was introduced into RAF Germany for the first time in 1952. The first Wing of Gloster Meteor NF Mk 11s was formed at Wahn, comprising Nos 68 and 87 Squadrons, re-formed in January and equipped by March. A second Wing was formed at Ahlhorn later in the year, No 96 re-forming on 1 October and No 256 on 17 November. These four squadrons maintained a night and all-weather defence capability until 1959, when changes were made to accommodate the Gloster Javelin as a replacement. On 20 January 1959, No 68 Squadron (which had moved to Laarbruch in July 1957) was renumbered as No 5, continuing to fly Meteors until August 1960. No 87 had already moved to Brüggen in July 1957 and re-equipped with Javelins that September, while No 96 had moved to Geilenkirchen in 1958 and was renumbered No 3 Squadron on 21 January 1959, immediately re-equipping with Javelin FAW Mk 4s. No 256 had also moved to Geilenkirchen in February 1958 and was renumbered as No 11 on 21 Jan 1959, keeping Meteors until March 1960.

**Gloster Javelin FAW Mk 1/
FAW Mk 4/FAW Mk 5**

No 87 Squadron was completely re-equipped with Gloster Javelin FAW Mk 1s by November 1957 at Brüggen. It was the only squadron to fly this version, and these were supplemented in small numbers by FAW Mk 5s in September 1958 and FAW Mk 4s in December 1959. No 5 Squadron received Javelin FAW Mk 5s at Laarbruch in January 1960 and kept them until moving to Geilenkirchen in November 1962. No 3 Squadron re-formed at Geilenkirchen on 21 January 1959 and re-equipped with Javelin FAW Mk 4s, serving for two years until disbanding there on 31 December 1960. No 11 Squadron was already at Geilenkirchen with Meteor NF Mk 11s and re-equipped with

Javelin FAW Mk 4s in October 1959, retaining some Meteors until March 1960. Javelin FAW Mk 5s augmented the FAW Mk 4s from January 1962 onwards.

Gloster Javelin FAW Mk 9

From two Wings of Javelin FAW Mk 4/5s, RAF Germany's all-weather force was reduced to one Wing, at Geilenkirchen, in the 'sixties. No 3 Squadron disbanded in December 1960, just after No 87 Squadron, leaving Nos 5 and 11 at Geilenkirchen. In December 1962 both these squadrons re-equipped with the missile-armed Javelin FAW Mk 9 and provided the main defence for RAFG until the mid-'sixties and the advent of the Lightning. No 5 Squadron disbanded on 7 October 1965 and No 11 on 12 January 1966.

Hawker Tempest V

Of the Tempest Wings in 2nd TAF which moved into Germany at the end of the War, four squadrons remained as part of BAFO and thence RAF Germany. Two of these, Nos 3 and 80, were at Wunstorf, and two at Fassberg, Nos 16 and 56. They maintained a punchy fighter force until post-war types could replace them. No 56 at Fassberg was soon disbanded, in March 1946; No 16 at Fassberg went over to Tempest IIs in April 1947, No 80 to Spitfire F Mk 24s in January 1948 and No 3 to Vampire F Mk 1s in April 1948.

Hawker Tempest II

The Tempest II was too late for operations in World War Two but a Wing was built up in RAF Germany shortly after the end of the War. This was based at Fassberg, where No 33 Squadron replaced its Spitfire LF Mk 16Es in October 1946. It was joined by No 26 Squadron in January 1947 and No 16 Squadron in April 1947. The Wing moved to Gütersloh in November 1947, where it remained for two years. At the end of 1948 it was decided that Gütersloh should become a Vampire base, and No 16 began re-equipping in November 1948, followed by No 26 in April 1949. No 33 Squadron continued to fly its Tempests there until July 1949, when it took them to the Far East Air Force.

Hawker Hunter F Mk 4

The Hunter F Mk 4 became the standard fighter for RAF Germany in the mid-'fifties, eventually replacing all the Vampires and Sabres. Jever became the first Hunter station, with No 98 Squadron and No 118 Squadron in March 1955, followed by No 4 in July and No 93 in January 1956. The second Wing formed at Oldenburg, with No 14 Squadron in May, No 26 in June and No 20 in November 1955. The third Wing was at Brüggen, comprising Nos 67 and 71 Squadrons in January and April 1956, followed by Nos 112 and 130 almost immediately afterwards. The final two squadrons were at Geilenkirchen, Nos 3 and

234 re-equipping on Hunters in May 1956. This large force of Hunters seemed set to serve RAF Germany for many years to come, but the notorious 1957 White Paper on Defence brought about an immediate reduction in force levels in RAF Germany. As a result, No 3 Squadron disbanded in June 1957, No 26 in September, Nos 67 and 71 in April, Nos 98 and 118 in July and Nos 112 and 130 in May. This left only five Hunter squadrons in Germany, which were then re-equipped with the Hunter F Mk 6.

Hawker Hunter F Mk 6

The emaciated RAF Germany of 1957 contained five Hunter squadrons, equipped with the F Mk 6. Of these, Nos 4 and 93 Squadrons were at Jever, No 14 was at Ahlhorn (moving to Gütersloh in September 1958), No 20 was at Oldenburg (also moving to Gütersloh in 1958) and No 26, which in September 1958 re-formed at Gütersloh on the F Mk 6 after disbanding with F Mk 4s in September 1957. These two Wings remained operational at Jever and Gütersloh until the end of 1960, when all five squadrons were disbanded.

Hawker Hunter FR Mk 10

This version of the Hunter was introduced into RAF Germany to replace the Swift FR Mk 5. No 4 Squadron was re-formed at Gütersloh a day after its disbandment at Jever and given the first FR Mk 10s, being joined in Germany by No 2 Squadron at Gütersloh in March 1961. These two squadrons maintained the fighter-*recce* rôle until the end of the decade, when No 4 went to the UK to re-equip with Harriers whilst No 2 remained dedicated to the fighter-*recce* task, re-equipping with Phantoms between December 1970 and March 1971.

**Hawker Siddeley Andover CC
Mk 2**

At least one of these aircraft served with No 60 Squadron in the 'seventies at Wildenrath.

**Hawker Siddeley (BAe)
Harrier GR Mk 1/GR Mk 3**

This revolutionary fighter/ground-attack aircraft was tailor-made for the RAF Germany rôle. No 4 Squadron brought its Harrier GR Mk 1s to Wildenrath in June 1970 to work up the rôle, after re-equipping at Wittering. For nearly a year the squadron comprised the only Harrier force in RAFG, the second squadron, No 20, being formed on 1 December 1970 at Wildenrath. The two-squadron Wing soon became fully operational, converting to the GR Mk 1A, and then the GR Mk 3, in the next 18 months. On 1 January 1972 the Wing was completed by the re-forming of No 3 Squadron at Wildenrath. On 28 February 1977, after five years as a three-squadron Wing, No 20 Squadron was split into two and added, one half each, to Nos 3 and 4 Squadrons. These two augmented squadrons have continued in the front

line ever since, moving to Gütersloh in March 1977, where they now await the arrival of Harrier GR Mk 5s in the not-too-distant future.

Hawker Siddeley (BAe) Buccaneer S Mk 2B

The Buccaneer, originally a naval strike fighter, was adapted for and adopted by the RAF at the end of the 'sixties, the S Mk 2B version being intended to replace the strike Canberras in RAF Germany. A two-squadron Wing was formed at Laarbruch, starting with No XV Squadron which re-formed at Honington on 2 October 1970 and moved to Laarbruch on 11 January 1971. It was joined there by a re-formed No 16 Squadron on 6 June 1972. The Wing provided the heavy attack component of RAF Germany until the advent of the Tornado, No XV Squadron re-forming with the latter in July 1983 and No 16 in February 1984.

Hunting Percival Pembroke C Mk 1

Coming into service in the 'fifties, the Pembroke soon formed the main component of the 2nd TAF Communications Squadron, which was later renamed RAF Germany Comms Squadron and then, on 3 February 1969, No 60 Squadron. It has always been stationed at Wildenrath, and continues to operate Pembrokes in the internal communications rôle.

McDonnell Douglas F-4M Phantom FGR Mk 2

This version of the Phantom has a long association with RAF Germany in three different rôles. It first entered the Command in the ground-attack rôle in 1970, forming a Wing of three squadrons at Brüggen. No 14 replaced its Canberras with Buccaneers in June, No 17 re-formed in August 1970 and No 31 re-formed in October 1971. In the meantime the Phantom had taken up its second rôle in the Command by replacing the Hawker Hunter FR Mk 10 in the fighter-recce task with No 2 Squadron at Laarbruch in April 1971. The Phantom served in these two rôles for the next five years, until the advent of the Sepecat Jaguar, which began replacing the Brüggen Wing from April 1975, when No 14 re-equipped, followed by Nos 17 and 31 in December. At Laarbruch, No 2 Squadron soldiered on with the Phantom until September 1976. However, the aircraft's task in RAF Germany was not yet over, for it was now reintroduced in the air defence rôle. Nos 19 and 92 Squadrons relinquished their Lightnings to re-equip on Phantoms at Wildenrath in July 1976 and January 1977 respectively. These two squadrons have maintained the air defence task in RAFG ever since, and are likely to continue to do so into the 'nineties.

North American (Canadair) Sabre F Mk 1/ F Mk 2/ F Mk 4

Because of the advent of the MiG-15 in

European skies and the delays in getting British-built transonic fighters into service, Canadian-built Sabres were purchased by the RAF to plug the gap. The first Sabre Wing was based at Wildenrath and comprised Nos 3 and 67 Squadrons, in May 1953, and No 71 in October. In November, No 3 moved to Geilenkirchen. Meanwhile, No 4 at Jever re-equipped with Sabres in October 1953 and at the same time the Wing at Oldenburg became a large Sabre formation comprising No 20 Squadron (October 1953), No 26 (November 1953), No 234 (November 1953) and No 93 (April 1954). The final Wing was at Brüggen, where No 130 Squadron had re-equipped as early as August 1953 and was joined by No 112 in January 1954. The Sabres began to leave RAF Germany as Hunters arrived, the Jever and Oldenburg squadrons standing down in 1955 and the others in 1956.

Panavia Tornado GR Mk 1

This tri-national warplane has come into RAF Germany's service comparatively recently and is still in the process of re-equipping the Buccaneer and Jaguar squadrons. It first replaced the Buccaneer at Laarbruch, No XV Squadron re-equipping in September 1983 and No 16 in May 1984. To this Wing was added No 20 Squadron from Brüggen, which re-equipped from Jaguars in June 1984. The Jaguar Wing at Brüggen then itself began to re-equip, No 31 Squadron in June 1984, No 17 in August 1984 and No 14 in August 1985. The Tornado GR Mk 1 will eventually replace the Jaguars of No 2 Squadron, operating in the low-level recce rôle, but this is not expected until 1987, after the Tornado recce equipment has been proved for service and a UK-based squadron has first re-equipped with the Tornado in this rôle.

Sepecat Jaguar GR Mk 1

This Anglo-French aircraft entered RAF Germany in April 1975 to replace the Phantom in the ground-attack rôle, equipping an attack Wing at Brüggen and a fighter-recce squadron at Laarbruch. The first Jaguars went to No 14 Squadron, followed by Nos 17 and 31 in December. In March 1977 the Wing was strengthened by the addition of No 20 Squadron, which re-formed there after its disbandment as a Harrier unit. Meantime, No 2 Squadron at Laarbruch had replaced its Phantoms with Jaguars in the fighter-recce rôle in March 1976. The Jaguar has now been replaced by the Tornado in all but No 2 Squadron, which will remain as the final Jaguar unit in Germany for at least another year.

Supermarine Spitfire PR Mk 19/ F Mk 24

Although the Spitfire served in large numbers in 2nd TAF, eventually in Germany, only two squadrons survived into the peacetime RAF Germany. The first of these was No 2 Squad-

ron, which flew Spitfire PR Mk 19s in the recce rôle from Buckeburg up to the end of 1950, when it was progressively re-equipped with the Gloster Meteor FR Mk 9. It also flew a few Spitfire FR Mk 14Es on low-level recce duties. The other Spitfire squadron was No 80, which re-equipped from Tempests at Wunstorf with the ultimate Spitfire variant, the F Mk 24, in January 1948. This squadron flew the Spitfire on air defence duties from various bases in Germany until leaving for the Far East in 1949.

Supermarine Swift FR Mk 5

Although the Swift proved unsuccessful in its primary rôle as an interceptor fighter, the FR Mk 5 version held promise as a low-level fighter-recce aircraft, and was introduced into RAF Germany to replace the Meteor FR Mk 9. Thus, it served with two squadrons, Nos 2 and 79, entering service with the former in March 1956 and the latter in June 1956, respectively at Geilenkirchen and Gütersloh. No 2 Squadron took its Swifts to Jever in October 1957 and both squadrons served until the end of the decade, when No 79 Squadron disbanded (coincidentally with the re-forming of No 4, some of its Swifts briefly flying with the latter squadron). No 2 retained its Swifts until the advent of the Hunter FR Mk 10 in March 1961.

Vickers Valetta C Mk 2

At various times in the 'fifties and early 'sixties, the RAF Germany Communications Squadron operated at least one of these medium-range transports on its routes and for VIP duties. It finally left the Command in June 1969.

Westland Whirlwind HAR Mk 10

For two years, RAF Germany had the services of No 230 Squadron at Gütersloh in the tactical support rôle, this being the first helicopter squadron to fly in such a rôle as part of the Command. It moved in on 14 January 1963 and left again on 1 January 1965, being then replaced by No 18 Squadron.

Westland Wessex HC Mk 2

No 18 was the first UK-based RAF squadron to use the Wessex, in the tactical support rôle. As soon as a second UK squadron (No 72) had become operational, No 18 left Odiham to replace No 230 Squadron's Whirlwinds at Gütersloh on 1 January 1965. It served there for three years, returning to the UK in 1968. Just over two years later, the squadron returned to Gütersloh, on 31 August 1970, and served continuously in support of BAOR for 10 years. It disbanded at Gütersloh on 1 December 1980.

Westland/Aérospatiale Puma HC Mk 1

At the end of 1980, No 230 Squadron left Odiham at Gütersloh with Pumas to take on the tactical support rôle, and has remained there ever since as RAF Germany's permanent operational helicopter support unit.

THE ROYAL AIR FORCE – A BASE DIRECTORY

by Paul Jackson

Travellers on Britain's highways and byways cannot fail to notice red and white road signs directing traffic to a Ministry of Defence Establishment. Some will be prefixed with the title "RAF", for despite its progressive contraction from the World War II peak, the Royal Air Force continues to maintain stations throughout the country. As a guide to the traveller — and perhaps to those living nearby or visiting an "Open Day" — the following pages list, and explain briefly the function of many of these stations.

The information thereby presented also serves to provide a directory of the aircraft types in service at these bases, and the squadrons that fly them. The more important (and perhaps the busiest) bases are covered first, followed by notes on smaller units. Finally, overseas bases are mentioned. Space considerations prevent inclusion of details of ground stations such as headquarters, hospitals, radar centres, RAF Regiment squadrons and some maintenance bases, although certain important or interesting non-flying units are included when sited on an operational airfield. Also omitted are those RAF stations assigned to the United States Air Force, the principal of which are Alconbury, Bentwaters, Fairford, Greenham Common, Kemble, Lakenheath, Mildenhall, Molesworth, Sculthorpe, Upper Heyford and Woodbridge.

Abingdon, Oxfordshire

Opened in 1932 as a bomber base, Abingdon is perhaps better remembered as a station of the former Transport Command, having operated Yorks, Hastings, Beverleys and Andovers. Its regular flying units at present comprise the London and Oxford University Air Squadrons, both with Bulldog T Mk 1s, and No 6 Air Experience Flight with Chipmunk T Mk 10s. However, Abingdon's main function is as the

Aircraft Maintenance Unit for all RAF Jaguars and — to a lesser extent — Hawks and Hunters. Other residents are the travelling RAF Exhibition Flight, with its large collection of airframes, nose sections and even full-size plastic replicas; the Aircraft Salvage and Repair Unit; and the Battle Damage Repair Flight. The airfield is dominated by 11 stored Super VC10s bought from British Airways for possible future tanker conversion.

Benson, Oxfordshire

Originally a bomber base, following its opening in 1939, Benson achieved fame as the wartime home of the Photographic Reconnaissance Unit. Its most distinguished resident is now, of course, The Queen's Flight, operating two recently-delivered BAe 146s (which partly replaced three Andover CC Mk 2s) and two Wessex HCC Mk 4 helicopters. Andover E Mk 3/3A navigation aids calibration aircraft are flown by No 115 Squadron here, supported by the Andover Training Flight (which borrows aircraft as required), whilst Venture T Mk 2 powered gliders serve No 612 Volunteer Gliding School.

Binbrook, Lincolnshire

A fighter base since 1962, Binbrook was associated with Bomber Command when opened in 1940, gaining the distinction in 1951 of housing the RAF's first Canberra-equipped jet bomber squadron. Lightning interceptors arrived in 1965 and it is now the last base for that type, operated by Nos 5 and 11 Squadrons as part of the UK air defence network, principally with F Mk 6 versions. In addition, personnel are converted to the aircraft by the Lightning Training Flight — also operating F Mk 3s and two-seat T Mk 5s — whilst the Lightning Augmentation Flight maintains an emergency reserve which could don the mantle of an operational squadron in wartime.

Brawdy, Dyfed

After two years in RAF service, Brawdy was transferred to the Royal Navy in 1946 and did not revert to its former owners until 1974, when Hunters of No 229 OCU arrived. Redesignated No 1 Tactical Weapons Unit, this unit converted to Hawk T Mk 1s from 1977 onwards, its prime rôle being training in the use of gun, bomb and rocket armament for pilots progress-

ing from No 4 Flying Training School at Valley to their first squadron. The Hawks now wear the colourful markings of Nos 79 and 234 Squadrons, their emergency "shadow" units. Also in residence is "B" Flight of No 202 Squadron with Sea King HAR Mk 3s for search and rescue.

Brize Norton, Oxfordshire

Brize began life as a training and maintenance unit in 1937 and specialised in airborne forces and their parachute and glider equipment during World War II. Between 1950 and 1965 it was an outpost of the USAF's strategic bomber force, remaining in the large aircraft business on reversion to the RAF for transport operations. VC10 C Mk 1s of No 10 Squadron began arriving in 1966, followed by the hemp-camouflaged VC10 K Mk 2 and Super VC10 K Mk 3 aerial tankers of No 101 Squadron from 1983. No 216 Squadron formed in 1984 to fly TriStar tanker-transports, the first of which entered service early this year. No 241 Operational Conversion Unit trains crews on aircraft "borrowed" from the appropriate resident squadrons.



Sepecat Jaguar, No 54 Squadron, Coltishall.



BAe 125 CC Mk 3, No 32 Squadron, Northolt.



Lockheed Hercules C Mk 1 (K), No 1312 Flight, Stanley.



BAC Canberra PR Mk 9, No 1 PRU, Winton.

Chivenor, Devon

A civilian aerodrome converted to RAF use in 1940, Chivenor was first a Coastal Command base before post-war transfer to anti-aircraft co-operation, and then advanced flying training duties. Chivenor trained the RAF's Hunter pilots until 1974. After six years of inactivity, it re-opened in 1980 for the Hawk T Mk 1s of No 2 Tactical Weapons Unit (Nos 63 and 151 "shadow" Squadrons). In addition to providing training in the use of armament, the Hawks have a wartime air defence rôle with Sidewinder missiles. Wessex HC Mk 2s of "A" Flight, No 22 Squadron, provide search and rescue cover for this popular holiday area.

Church Fenton, Yorkshire

Between 1937 and 1959, Church Fenton provided fighter protection for the West Yorkshire industrial area and the cities of Leeds and Bradford, turning then to the training rôle until temporary closure in 1975. Venue of an annual and well-attended SSAFA display, Church Fenton re-opened in 1979 as the base of No 7 Flying Training School. After aspiring pilots have been graded by 14 hours of Chipmunk flying at Swinderby, Fenton's resident Jet Provost T Mk 3As take them through their first 97 hours of jet training, and those selected to fly

combat aircraft receive a further 58 hours on Jet Provost T Mk 5As before transfer to Valley.

Coltishall, Norfolk

Coltishall opened as a fighter station in 1940 and was the home of the RAF's first operational Lightning squadron just 20 years later. Lightning operations, including pilot training, dominated the scene until Coltishall became a Jaguar GR Mk 1 base in 1974. Resident Jaguar squadrons are Nos 6 and 54 in the strike/attack rôle and No 41, which has a dual tactical reconnaissance and attack task. Bloodhound Mk 2 SAMs defending the base are operated by "D" Flight of No 85 Squadron; and "C" Flight of No 202 Squadron is present with SAR Sea King HAR Mk 3s.

Coningsby, Lincolnshire

A bomber station from 1940 until 1964, Coningsby saw aircraft as diverse as the Hampden, Lancaster, Mosquito, Washington, Canberra and Vulcan, and was intended to house the first squadrons of TSR.2s. Its present association with the Phantom FGR Mk 2 began in 1968, current units being No 29 Squadron in the air defence rôle and No 228 OCU ("shadow" No 64 Squadron) as the training unit for pilots and navigators. The RAF's first Tornado F Mk 2 interceptors arrived in November 1984 for the newly-formed No 229 OCU, which will be responsible for all crew training. No 228 will move to Leuchars this year, and Coningsby will eventually house three operational Tornado F Mk 3 squadrons — plus, of course, the Battle of Britain Memorial Flight's fleet of Hurricanes, Spitfires and a single Lancaster.

Cottesmore, Leicestershire

Opened as a bomber base in 1938, the aerodrome forged its first overseas connections

in 1943 with arrival of USAAF transport units. Reverting to Bomber Command for the V-Bomber force, it later saw target facilities and training Canberras before temporary closure for works in 1976. Cottesmore is now the Trinational Tornado Training Establishment (TTTE), operating some 50 Tornado IDS (RAF GR Mk 1) wearing British, West German or Italian insignia, the first of which arrived in 1980. Pilots and navigators from the RAF, *Luftwaffe*, German Navy and Italian Air Force convert to the Tornado in around 30 hours of flying each before attending weapons schools in their own countries and then joining an operational squadron.

Cranwell, Lincolnshire

Now famous as the home of the RAF College, Cranwell was opened in 1915 for the Royal Naval Air Service as an airship station. The College was established in 1920 and is currently responsible for training officers entering the RAF after a university education. A fleet of Jet Provost T Mk 5s provides a 77-hour training course for students who have flown 70 hours on Bulldogs with their former University Air Squadrons.

Farnborough, Hampshire

One of the most famous of British aerodromes, Farnborough was the birthplace of UK military aviation and is known today as the home of the biennial SBAC air displays. Despite the pioneering work undertaken for the Services by the resident Royal Aircraft Establishment and its diverse aircraft fleet, direct RAF involvement is minimal. Activities of the RAF Institute of Aviation Medicine include operation of a single Hunter T Mk 7 and a Jaguar T Mk 2.

Finningley, Yorkshire

Finningley opened in 1936 as one of the first "expansion" bases, since which time it has been mainly associated with training — a preserved Vulcan marking a long association with the type's OCU. Currently resident, No 6 Flying Training School instructs navigators, air electronics officers and air engineers on its fleet of Dominie T Mk 1s and Jet Provost T Mk 5As, and also provides pilots' twin-conversion on Jetstream T Mk 1s. Finningley is also the centre of RAF helicopter Search and Rescue,



Grob Viking T Mk 1, Air Cadets.



HS Shackleton AEW Mk 2, No 8 Squadron, Lossiemouth.



Westland Sea King HC Mk 3, No 202 Squadron, Coltishall.

and houses the HQs of No 22 Squadron (Wessex HC Mk 2) and No 202 Squadron (Sea King HAR Mk 3), plus supporting maintenance facilities. Yorkshire Universities Air Squadron flies Bulldog T Mk 1s from here, and No 9 AEF has Chipmunk T Mk 10s.

Honington, Suffolk

An RAF bomber station and USAAF fighter base since opening in 1937, Honington was used post-war by Transport, Maintenance and Bomber Commands in succession. An association with the Buccaneer lasted from 1969 until 1984, and the station is now equipped with Tornado GR Mk 1s, the first arriving in 1981. Resident No 9 Squadron formed in the following year, whilst combat training for crews is provided in courses lasting some 34 hours by the Tornado Weapons Conversion Unit ("shadow" No 45 Squadron).

Kinloss, Morayshire

Strong maritime connections have been held by this aerodrome since its opening in 1939, post-war equipment including the Lancaster, Neptune and Shackleton. Since 1971, Nos 120, 201 and 206 Squadrons here have operated the Nimrod maritime patrol aircraft, all of which are now to MR Mk 2 standard, with new radar and other improved sensors. Kinloss is the main Nimrod base, its functions including SAR and rescue co-ordination as well as the regular task of locating Soviet submarines and surface vessels. No 663 VGS here operates Air Cadet Sedbergh and Cadet gliders, and is to re-equip with Viking T Mk 1, summer 1986.

Leeming, Yorkshire

Bomber, Fighter and Flying Training Commands have occupied Leeming since 1940, but from 1984 only the Bulldog T Mk 1s of the Northumbrian Universities Air Squadron and Chipmunk T Mk 10s of No 11 AEF have been in residence. Leeming is being rebuilt, with new facilities including hardened shelters, to house three Tornado F Mk 2 interceptor squadrons from 1988-89 onwards.

Leuchars, Fife

Established as a balloon station in 1911, this oldest of Scotland's military airfields had maritime connections until re-assigned to Fighter Command in 1950. Leuchars' prime rôle is now the interception of unidentified aircraft penetrating the northern part of the UK Air Defence Region, for which it has two units — Nos 43 and 111 Squadrons — of Phantom FG Mk 1s (the model originally ordered for the Royal Navy). Phantom crew training will be undertaken from later this year when the FGR Mk 2s of No 228 OCU move in from Coningsby, but eventually Nos 43 and 111 will be re-equipped with Tornado F Mk 3s. Wessex HC Mk 2 SAR helicopters are flown by "B" Flight of No 22 Squadron, whilst Aberdeen University Air Squadron operates Bulldog T Mk 1s.

Linton-on-Ouse, Yorkshire

A bomber base since 1937, and having Canadian ties during World War II, Linton was later a station of Fighter Command until the present unit, No 1 Flying Training School, arrived in 1957. Equipped with Jet Provost T Mk 3As and T Mk 5As, the unit performs a similar rôle to that of No 7 FTS at nearby Church Fenton, but also incorporates the Refresher Flying Squadron formerly at Leeming. The RFS provides re-orientation courses for officers returning to flying after a "desk tour" or transferring from large to small jets. No 1 FTS parents the RNEFTS Bulldogs which operate from Topcliffe to give RAF-administered primary flying training to prospective Royal Navy pilots. No 642 VGS is here with Venture T Mk 2 powered gliders.

Lossiemouth, Morayshire

The RAF occupied "Lossie", mainly for training, between 1939 and the end of World War II, following which it became a Royal Naval Air Station until 1972. Now one of the RAF's busiest stations, its residents include the maritime strike/attack Buccaneer S Mk 2Bs of Nos 12 and 208 Squadrons, plus their newly-arrived training unit, No 237 OCU. Lossiemouth has been the home of the Jaguar since its 1973 début in the RAF, and all training is undertaken by No 226 OCU on GR Mk 1 and two-seat T Mk 2 versions. No 8 Squadron's Shackleton AEW Mk 2s continue to provide airborne early warning of low-level intrusions within the UK Air Defence Region, but will be replaced by Waddington-based Nimrod AEW Mk 3s in 1987-88. SAR Sea King HAR Mk 3s here belong to "D" Flight of No 202 Squadron.

Lynham, Wiltshire

Apart from two years with Maintenance Command, beginning in 1940, Lynham has been a transport base, its units including the world's first jet transport squadron, equipped with Comets in 1956. Like Brize Norton, the station is equipped with full passenger and freight transit facilities, including a terminal with Customs, and sees many foreign aircraft visiting the UK. Lynham now houses the RAF's Hercules fleet of C Mk 1s and stretched-fuselage C Mk 3s, flown by Nos 24, 30, 47 and 70 Squadrons, plus No 242 Operational Conversion Unit. Scheduled and non-scheduled services are flown to all parts of the globe containing a British military presence.

Marham, Norfolk

Marham was an early base for the remarkable Mosquito, following its opening within Bomber Command in 1937, and later became a V-Bomber station. Arguably, it still retains that rôle, although the Victors operated by Nos 55 and 57 Squadrons are K Mk 2 versions, assigned not to bombing but to aerial tanker support of the RAF's interceptor fighters and any other of its aircraft requiring aerial refuelling services. No 232 OCU trains Victor crews,

The first Tornado GR Mk 1 was delivered to Marham in April 1982, and the type now equips Nos 27 and 617 Squadrons — the latter being the famous "Dam Busters" — which occupy the hardened shelters on the airfield.

Northolt, Middlesex

London's military airport, Northolt receives a broad variety of visiting transport aircraft from NATO countries and farther afield. Built in 1915, it had strong fighter affiliations until the end of World War II, when it became a light transport and communications base — and a civilian airport until Heathrow was completed. Recent retirement of the Devon light twin has seen Northolt reduced to just one resident unit: No 32 Squadron. Equipped with Andovers, BAe 125s and Gazelles, No 32 is responsible for short- and medium-range transport of VIPs, including government ministers and diplomats.

Odiham, Hampshire

Operational since 1937, Odiham was a fighter station from 1943 until 1960 when, in a dramatic change of rôle, it became a helicopter base. Its task is now the provision of mobility to the Army with Puma HC Mk 1s and twin-rotor Chinook HC Mk 1s — which arrived in 1971 and 1980, respectively. No 240 Operational Conversion Unit trains crew for both types, whilst No 33 Squadron operates Pumas and No 7 has the Chinooks. Both squadrons are equipped with mobile accommodation and support to allow them to live in the field with the army at home or overseas.

St Athan, South Glamorgan

St Athan has been a maintenance unit since it opened in 1939 and is liberally endowed with hangars and storage areas. The Battle of Britain display and large aircraft museum draw many visitors, but most aircraft arriving here are destined for attention by the Aircraft Engineering Wing. Responsible for almost all the RAF's front-line equipment, this specialises in complete overhauls of the Tornado, Phantom, Harrier, Buccaneer and Victor and also repaints aircraft. Other sections on the base service engines and components. The University of Wales Air Squadron operates Bulldog T Mk 1s and No 634 Volunteer Gliding School which has Sedbergh gliders is to be re-equipped with Viking T Mk 1 sailplanes in the summer of 1986.

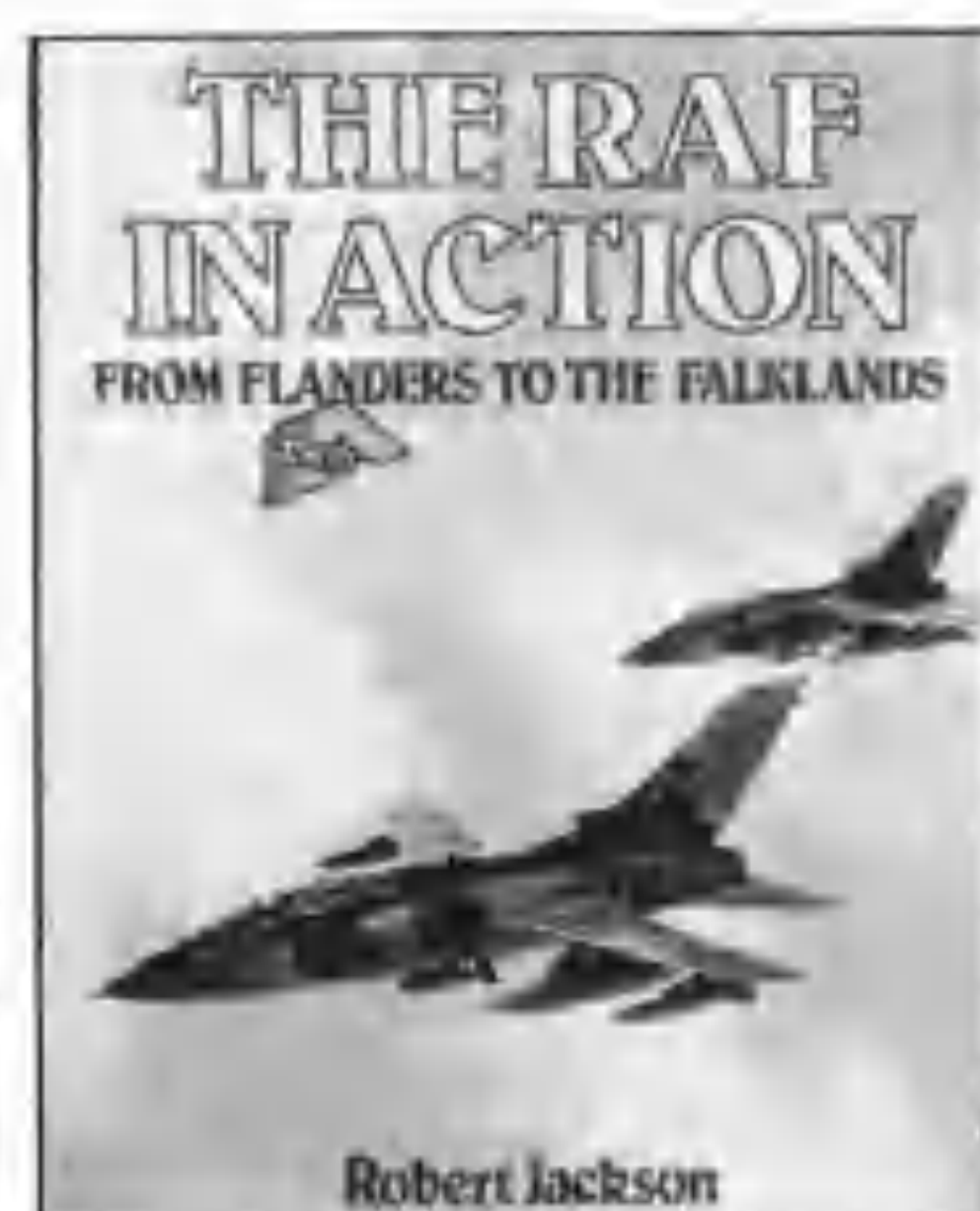
St Mawgan, Cornwall

A Nimrod MR Mk 2 maritime patrol base, St Mawgan is the southern complement to Kinloss, although it houses only No 42 Squadron, plus the type conversion unit, No 236 OCU ("shadow" No 38 Squadron). Proximity to Newquay and a popular holiday area has brought St Mawgan an annual air display and a civilian air terminal. Opened in 1943, the aerodrome has been extensively rebuilt and modified, resulting in a layout of buildings far removed from the familiar late-1930s pattern.

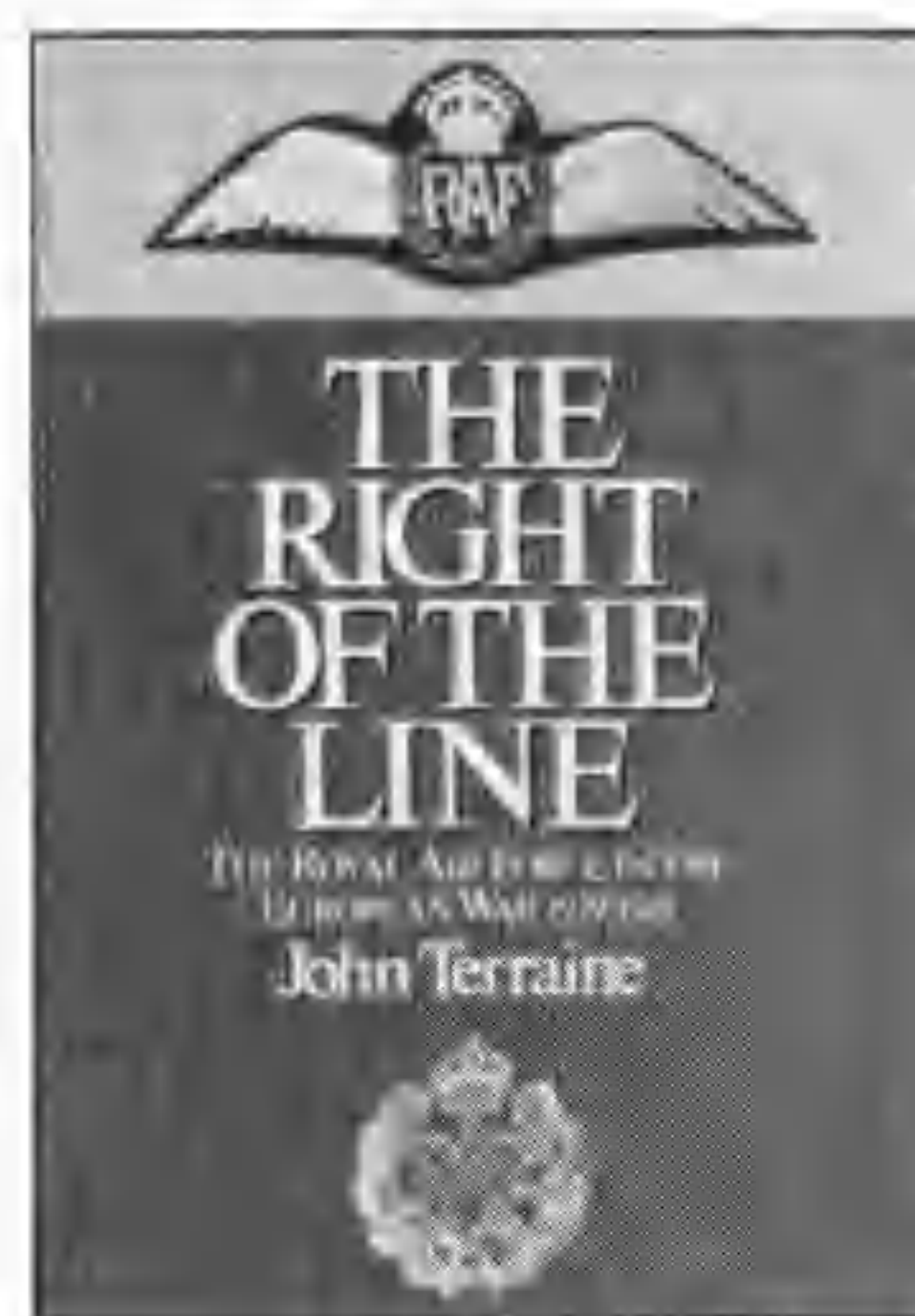
THIS READERS SERVICE BRINGS YOU THE VERY BEST IN AVIATION PUBLISHING



THE SQUADRONS OF THE RAF
James J. Halley
Presenting each squadron's history and detailed movements and equipment. 350 photos plus a similar number of squadron badges
£16.50



THE RAF IN ACTION: From Flanders to the Falklands
Robert Jackson
The RAF's operational history across the world. Showing the action in all the Royal Air Force's campaigns since its formation to the present day. 200 photos. £9.95



THE RIGHT OF THE LINE — The Royal Air Force in the European War, 1939-45
John Terraine
For the first time the story of the RAF's achievements in the war against Hitler's Germany is told in one volume. £16.95



FAST JETS — A pilot's eye view
Chris Allan
Flight Lieutenant Chris Allan is a serving RAF pilot and he used hand-held SLR cameras in the cockpit of his Lightning fighter to shoot the stunning air-to-air photographs featured in this book. 122 col. photos. £6.95



HUNTER SQUADRONS
Richard L. Ward
A NEW, photo-packed volume tracing the British service history of one of the world's outstanding post-war military aircraft. Illustrated with colour and B & W photos. £5.95

TAKE YOUR PICK OF THESE HIGH FLYING BOOKS



VOUGHT A-7 CORSAIR II
Robert F. Dorr
This is the first book to be published about the A-7 Corsair, one of the world's most formidable attack jets. 160 B & W and 14 colour photos. £8.95

GRUMMAN F-14 TOMCAT
Doug Richardson
The author describes its critical role as the airborne shield of the US Navy's carrier battle groups and why the Tomcat is so awesomely effective. 160 B & W and 14 colour photos. £8.95.

AVIATION FACT FILE SERIES
Illustrated with a wealth of photographs, some published for the first time, detailed cutaways and spectacular colour artwork, this series is set to become a classic in aviation literature. £5.95 each

F-111
F/A-18
A-10
F-4 Phantom
HARRIER
F-14
F-15
F-16
MIGS
TORNADO



SPITFIRE! SPITFIRE!
M. G. Burns
From the early years to the Battle of Britain Memorial Flight. The theme of this book throughout is the Spitfire, and the men who flew, fought in and built them. Illustrated with nearly 70 photos and line drawings. £3.95.

SPITFIRE ODYSSEY — My Life At Supermarine 1936-57
C. R. Russell
Over 100 photographs illustrate the story of this famous aeroplane by a man who not only witnessed the birth but also worked on the production line. 120 B & W photos. £9.95.

US SKY SPIES
Michael O'Leary
This book takes a look at this long gestation of specialised aircraft with many rare photographs, many of which have never been published before plus pictures of the men and recording equipment. 240 B & W photos. £9.95.

WARPLANES OF THE FUTURE
Bill Gunston
With outstanding full colour illustrations this book reveals tomorrow's fighters, bombers, transports, helicopters and electronic warfare aircraft. £9.95



LIFETIME OF SERVICE
A handsome book, lavishly illustrated with over 125 colour plates chosen to portray, as vividly and dramatically as possible, the development and achievements of The Royal Air Force as recorded by war artist and cameraman. £12.00

HOW TO ORDER

Write to RAF YEARBOOK READERS BOOK SERVICE, De Worde House, 283 Lonsdale Road, London SW13 9QW, giving your name and address together with the titles that you require. Enclose your cheque or P.O. made payable to Ducimus Books Ltd. U.K. customers should add 10% to the cost of the books required to cover postage and packing. Customers from outside the U.K. should pay by International Money Order or a Sterling Cheque drawn on a U.K. bank and 20% should be added to the value of the books required to cover overseas postage and packing.

WE HAVE OVER 1000 AVIATION TITLES IN STOCK PLEASE WRITE FOR COMPLETE LIST

From Spitfire to Tornado Ferranti has flown with the Royal Air Force.

Ferranti came to Scotland more than 40 years ago to manufacture a new gyroscopic gunsight that would help the RAF to play its part in the winning of World War II.

It was the beginning of a friendship that is as strong as ever today and moving confidently into the future.

The growing range of Ferranti products and systems includes flight mission planners, navigation equipment and cockpit displays, radars, lasers and sighting systems.

And all the time we are developing new systems for the next generation of aircraft. It's the way a friendship like ours grows and matures.

And makes an outstanding contribution to Britain's security.



Ferranti Defence Systems Limited,
Ferry Road, Edinburgh EH5 2XS

FERRANTI
Defence Systems

SC01/43/105



Westland Gazelle HT Mk 3, No 2 FTS, Shawbury.



HP Victor K Mk 2, No 57 Squadron, Marham.



Scottish Aviation Jetstream T Mk 1, No 6 FTS, Finningley.



Scottish Aviation Bulldog T Mk 1, London UAS, Abingdon.



Boeing Chinook HC Mk 1, No 18 Squadron, Gütersloh.



Slingsby Venture T Mk 3, No 616 VGS, Henlow.



De Havilland Chipmunk T Mk 10, Berlin Station Flight.



Hawker Siddeley Andover E Mk 3, No 115 Squadron, Benson.



BAe VC10 K Mk 2, No 101 Squadron, Brize Norton.

Scampton, Lincolnshire

Launching point for the 1943 raid on Ruhr dams, this airfield opened in 1936 and remained a bomber station until the last Vulcans were withdrawn in 1982. British Aerospace uses the airfield for Buccaneer and Phantom test flying, but it was not until 1984 that the RAF returned in force with arrival of the Central Flying School HQ, which is responsible for producing flying instructors. CFS elements in residence are the internationally-renowned Red Arrows team of Hawk T Mk 1As (since 1983); the Bulldog T Mk 1 squadron, and a Jet Provost squadron (T Mk 3As and T Mk 5As) — other components being at Valley, Shawbury and Syerston. The "Vintage Pair" air display duo is also maintained by the CFS here. Air Cadet Viking T Mk 1 sailplane flying is by No 643 VGS.

Shawbury, Shropshire

Shawbury opened for training and maintenance duties in 1938 and remains in the same "business" today. Support activities are restricted to light aircraft overhauls, but various types have been stored here since closure of Kemble in 1983. Flying residents include No 2 FTS with its fleet of Gazelle HT Mk 3s and Wessex HC Mk 2s, providing 125-hour courses (75 and 50 respectively) to the RAF's future helicopter pilots after their Jet Provost T Mk 3 stage. The CFS Helicopter Wing is detached here from Scampton and shares Gazelles with the FTS. Jet Provost T Mk 4s are flown by contract civilian personnel to give realistic training in aircraft direction to ground-based students of the Central Air Traffic Control School. No 8 AEF uses Chipmunk T Mk 10s.

Valley, Gwynedd

A wartime fighter and ferrying station, opened in 1941, Valley changed to the training rôle in

1951 and remains thus today. Units making use of virtually unrestricted airspace in the area include No 4 Flying Training School, equipped with Hawk T Mk 1s and providing an 85-hour advanced flying course for students finishing Jet Provost training at Church Fenton, Cranwell and Linton-on-Ouse, the next stage being Brawdy or Chivenor. Aircraft are shared with the Hawk squadron of the CFS, detached from Scampton. Wessex HC Mk 2s are operated from here by both "C" Flight of No 22 Squadron and the SAR Training Flight. Many of the visiting fighters to be seen at Valley are attending the Strike Command Air-to-Air Missile Establishment for annual training.

Waddington, Lincolnshire

Dating from 1916, but rebuilt in 1937, Waddington has always been a bomber station, and it was here that the first Vulcans were delivered in 1956. That era ended in 1984 when the last of



BAe Hawk T Mk 1, No 2 TWU, Chivenor.

the type were withdrawn. Delays in the Nimrod AEW Mk 3 programme have resulted in a hiatus at Waddington, and although the first of these aircraft was delivered in December 1984, it was assigned to development, not an operational squadron. Regular deployments by NATO E-3B Sentries have taken place in the interim. Nimrods are now expected to be fully operational by 1987, replacing Lossiemouth's Shackletons in providing a much-needed improvement in airborne early-warning cover.

Wattisham, Suffolk

Wattisham has been in use since 1939, as a bomber and USAAF fighter base in World War II, and for fighters subsequently. Meteors, Hunters, Javelins and Lightnings have now given way to Phantoms assigned to the air defence of southern England, Wattisham being earmarked as the base which will retain these aircraft into the next decade. Serving here are No 56 Squadron with Phantom FGR Mk 2s and No 74 with the unique F-4J(UK) model, delivered from US Navy surplus stocks in 1984 to replace aircraft now defending the Falkland Islands.

Wittering, Cambridgeshire

Training and fighter rôles occupied this station from its opening in 1916 until the mid-war years, when it became an experimental and development base for fighters. Bomber Command took-over in 1953, operating Canberras, Valiants and Victors until 1968. During the following year, Wittering became the initial Harrier station (and thus the world's first VTOL combat aircraft base), retaining this rôle today. It is home to No 1 Squadron, which participated in the Falklands War, and training unit, No 233 OCU, flying Harrier GR Mk 3s and two-seat Harrier T Mk 4/4A trainers.

Wyton, Cambridgeshire

Strong connections with reconnaissance have been maintained down the years by Wyton, although bombers were early residents following the station's opening in 1936. It was a Wyton Blenheim that flew the first RAF sortie of World War II. Canberras, Valiants and Victors were among post-war residents, and Wyton is now the last Canberra station. Its present residents include No 100 Squadron with Canberra B Mk 2s, PR Mk 7s, E Mk 15s and TT Mk 18s towing targets for aircraft or ground gunnery and SAM training; No 360 Squadron, a joint RAF/RN unit, flying Canberra T Mk 17 electronic jamming aircraft to exercise air and surface radar operators; No 1 Photographic Reconnaissance Unit with Canberra PR Mk 9s; and No 231 OCU flying Canberra B Mk 2s and T Mk 4s for training. Reconnaissance is also undertaken by the Nimrod R Mk 1s of No 51 Squadron, which additionally flies a single Andover C Mk 1 test-bed on behalf of the local Electronic Warfare and Avionic Unit. "B" Flight of No 25 Squadron mans the Bloodhound Mk 2 SAMs here.

Other UK bases

RAF units will also be found at the airfields listed below, although they cannot be regarded as major flying stations. Some, it will be noted, are civilian — particularly those housing Bulldogs of the University Air Squadrons (UAS) and Chipmunks of Air Experience Flights (AEF). The latter are part of the Air Cadet flying organisation, as are the Volunteer Gliding Schools (VGS) equipped with Venture T Mk 2 powered gliders or winch-launched Viking T Mk 1 sailplanes, except where otherwise stated. Some airfields function as Relief Landing Grounds (RLG) for nearby bases.

Aldergrove, Ulster: No 72 Squadron, Wessex HC Mk 2 transport helicopter.

Arbroath, Tayside: No 662 VGS, Viking T Mk 1.

Barkston Heath, Lincolnshire: "A" Flight, No 25 Squadron, Bloodhound Mk 2 SAM; Cranwell satellite airfield.

Bawdsey, Suffolk: "C" Flight, No 85 Squadron, Bloodhound Mk 2 SAM.

Boscombe Down, Wiltshire: Tornado Operational Evaluation Unit, Tornado GR Mk 1.

Boulmer, Northumberland: "A" Flight, No 202 Squadron, Sea King HAR Mk 3 search and rescue.

Catterick, Yorkshire: No 645 VGS, Viking T Mk 1; Fire-Fighting and Safety School.

Chetwynd, Shropshire: RLG for No 2 FTS, Shawbury.

Cosford, Shropshire: Birmingham UAS, Bulldog T Mk 1; No 633 VGS, Venture T Mk 2 glider; No 2 School of Technical Training; Aerospace Museum.

RNAS Cudrose, Cornwall: RAF Sea King Training Flight, Sea King HAR Mk 3 administered by the Royal Navy.

Dishforth, Yorkshire: RLG for Linton-on-Ouse and Topcliffe.

Elvington, Yorkshire: RLG for Linton-on-Ouse.

Exeter Airport, Devon: No 4 AEF, Chipmunk T Mk 10.

Fairwood Common Airport, West Glamorgan: No 636 VGS, Sedbergh and Cadet gliders. Converting to Viking T Mk 1, summer 1986.

Filton Aerodrome, Avon: Bristol UAS, Bulldog T Mk 1; No 3 AEF, Chipmunk T Mk 10.

Fulbeck, Lincolnshire: RLG for Cranwell.

Glasgow Airport, Strathclyde: Glasgow UAS, Bulldog T Mk 1.

Halton, Buckinghamshire: No 613 VGS, Venture T Mk 2; No 1 School of Technical Training.

Henlow, Beds: No 616 VGS, Venture T Mk 1; RAF Museum storage site (restoration workshops at Cardington).

PRINCIPAL UK STATIONS

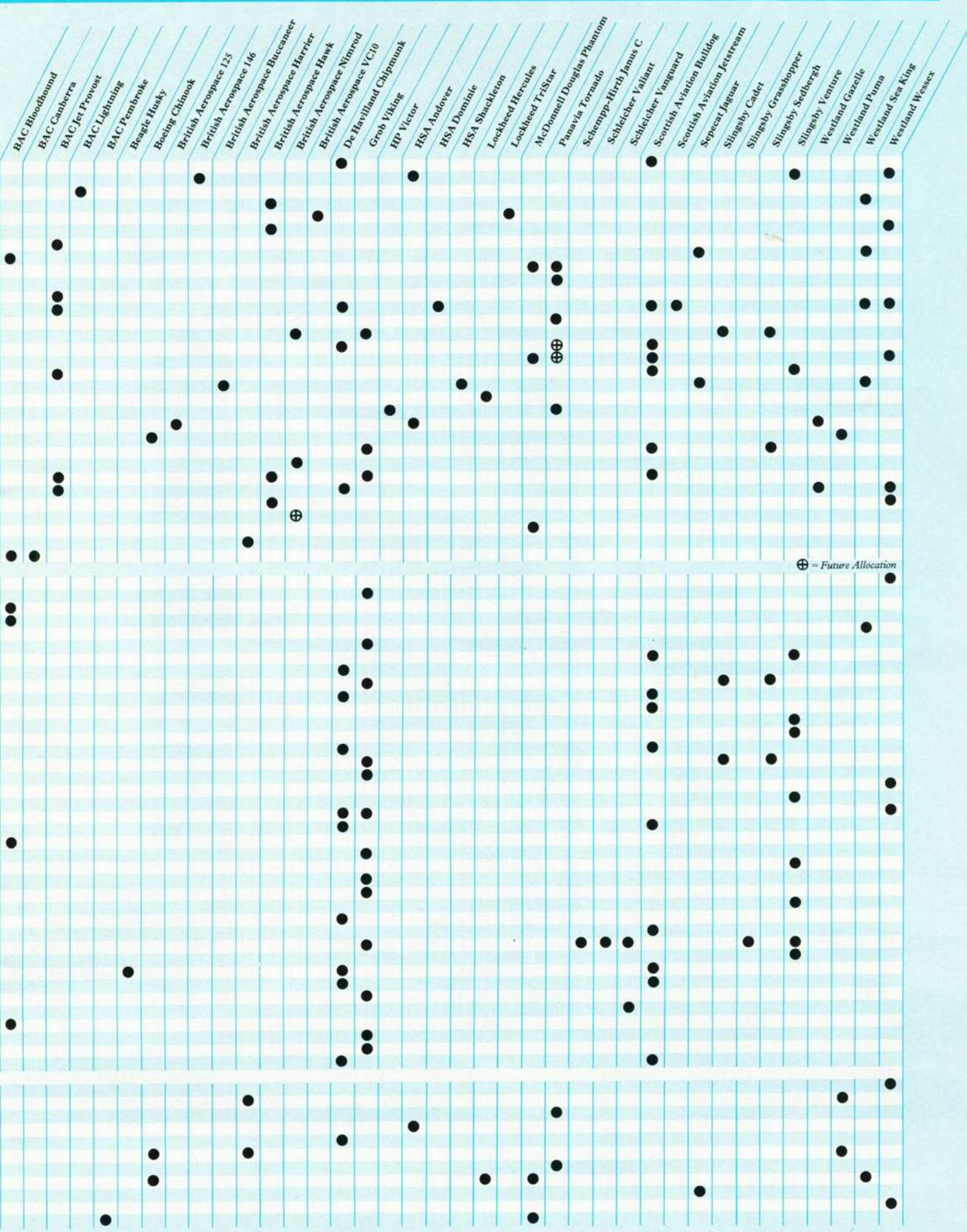
- Abingdon
- Benson
- Binbrook
- Brawdy
- Brize Norton
- Chivenor
- Church Fenton
- Coltishall
- Coningsby
- Cottesmore
- Cranwell
- Finningley
- Honington
- Kinloss
- Leeming
- Leuchars
- Linton-on-Ouse
- Lossiemouth
- Lyneham
- Marham
- Northolt
- Odiham
- St Athan
- St Mawgan
- Scampton
- Shawbury
- Valley
- Waddington
- Wattisham
- Wittering
- Wyton

OTHER UK FLYING BASES

- Aldergrove
- Arbroath
- Barkston Heath
- Bawdsey
- Boulmer
- Catterick
- Cosford
- Exeter Airport
- Fairwood Common Airport
- Filton Aerodrome
- Glasgow Airport
- Halton
- Henlow
- Hurn Airport
- Kenley
- Kirknewton
- Leconfield
- Little Rissington
- Manston
- Newton
- North Coates
- Predennack
- Samlesbury
- Sealand
- South Cerney
- Swanton Morley
- Swinderby
- Sydenham Airport
- Syerston
- Ternhill
- Teversham Airport
- Turnhouse Airport
- Upavon
- West Malling Aerodrome
- West Raynham
- Weston-super-Mare Aerodrome
- Wethersfield
- Woodvale

OVERSEAS FLYING BASES

- Akrotiri
- Belize City Airport
- Brüggen
- Fornebu Airport
- Gatow
- Gütersloh
- Laarbruch
- Mount Pleasant
- North Front
- Sek Kong
- Wildenrath



⊕ = Future Allocation

There are kings.
And there are
Superkings.



SKA33

LOW TO MIDDLE TAR Manufacturer's estimate.

DANGER: Government Health WARNING:

CIGARETTES CAN SERIOUSLY DAMAGE YOUR HEALTH



Westland Wessex HC Mk 2, No 28 Squadron, Sek Kong.



BAe Jet Provost T Mk 5A, No 1 FTS, Linton-on-Ouse.



BAC Lightning F Mk 6, No 5 Squadron, Binbrook.



Lockheed TriStar K Mk 1, No 216 Squadron, Brize Norton.



BAe Nimrod MR Mk 2, MR Wing, RAF Kinloss.



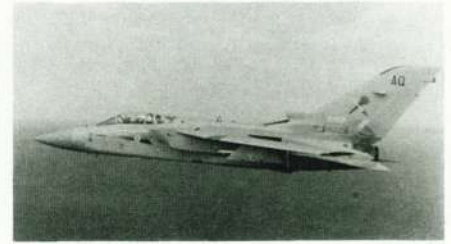
Westland Puma HC Mk 1, No 230 Squadron, Gütersloh.



BAe 146 CC Mk 1, Royal Flight, Benson.



Hawker Siddeley Dominie T Mk 1, No 6 FTS, Finningley.



Panavia Tornado F Mk 2, No 229 OCU, Coningsby.

Hurn Airport, Dorset: Southampton UAS, Bulldog T Mk 1; No 2 AEF, Chipmunk T Mk 10.

Kenley, Surrey: No 615 VGS, Sedbergh and Cadet gliders. Converting to Viking T Mk 1, summer 1986.

Kirknewton, Lothian: No 661 VGS, Viking T Mk 1.

Leconfield, Humberside: "D" Flight, No 22 Squadron, Wessex HC Mk 2 search and rescue.

Little Rissington, Gloucestershire: No 637 VGS, Venture T Mk 2.

Macrihanish, Strathclyde: NATO emergency advanced maritime patrol base.

Manston, Kent: "E" Flight, No 22 Squadron, Wessex HC Mk 2 search and rescue; No 1 AEF, Chipmunk T Mk 10; No 617 VGS, Viking T Mk 1.

Mona, Gwynedd: RLG for Valley.

Newton, Nottinghamshire: East Midlands Universities Air Squadron, Bulldog T Mk 1; No 7 AEF, Chipmunk T Mk 10.

North Coates, Humberside: "B" Flight, No 85 Squadron, Bloodhound Mk 2 SAM.

Predennack, Cornwall: No 626 VGS, Viking T Mk 1.

St Davids, Dyfed: RLG for Brawdy.

Samblesbury Aerodrome, Lancashire: No 635 VGS, Venture T Mk 2.

Sealand, Cheshire: No 631 VGS, Viking T Mk 1.

South Cerney, Gloucestershire: No 625 VGS, Viking T Mk 1.

Stornoway, Hebrides: Advanced emergency base for air defence fighters.

BAe Harrier GR Mk 3, No 233 OCU, Wittering.



Sturgate, Lincolnshire: RLG for Scampton.

Swanton Morley, Norfolk: No 611 VGS, Venture T Mk 2; Central Servicing Development Establishment.

Swinderby, Lincolnshire: Flying Selection Squadron, Chipmunk T Mk 10.

Sydenham Airport, Ulster: Queens UAS, Bulldog T Mk 1; No 13 AEF, Bulldog T Mk 1.

Syerston, Nottinghamshire: Air Cadet Central Gliding School, Venture T Mk 2, Viking T Mk 1, Vanguard T Mk 1, Valiant T Mk 1, Janus C and Grasshopper TX Mk 1; CFS Examining Wing Gliding Squadron, types ditto; No 644 VGS, Venture T Mk 2.

Ternhill, Shropshire: No 632 VGS, Venture T Mk 2; RLG for Shawbury.

Teversham Airport, Cambridgeshire: Cambridge UAS, Bulldog T Mk 1; No 5 AEF, Chipmunk T Mk 10, Husky.

Topcliffe, Yorkshire: Royal Navy Elementary Flying Training School, Bulldog T Mk 1 (RAF administered through No 1 FTS, Linton-on-Ouse).

Turnhouse Airport, Lothian: East Lowlands University Air Squadron, Bulldog T Mk 1; No 12 AEF, Chipmunk T Mk 10.

Upavon, Wiltshire: No 622 VGS, Viking T Mk 1.

West Malling Aerodrome, Kent: No 618 VGS, Vanguard T Mk 1 sailplane.

West Raynham, Norfolk: "A" Flight, No 85 Squadron, Bloodhound Mk 2 SAM.

Weston-super-Mare Aerodrome, Avon: No 621 VGS, Viking T Mk 1.

Wethersfield, Essex: No 614 VGS, Viking T Mk 1.

Woodvale, Merseyside: Liverpool UAS, Bulldog T Mk 1; Manchester UAS, Bulldog T Mk 1; No 10 AEF, Chipmunk T Mk 10.

Overseas RAF bases

Akrotiri, Cyprus: British Sovereign Base. Wessex HU Mk 5Cs of No 84 Squadron provide SAR cover for the co-located RAF armament practice camp and support units of the UN peacekeeping forces (UNFICYP).

Belize City Airport, Belize: Included in the UK forces defending Belize against Guatemalan territorial claims is No 1417 Flight with Harrier GR Mk 3s and No 1563 Flight, operating Puma HC Mk 1s.

Brüggen, West Germany: Built for the RAF close to the Dutch border and opened in 1953, Brüggen is one of the two Tornado GR Mk 1 strike/attack bases in RAF Germany. The three resident squadrons, Nos 14, 17 and 31, exchanged their Jaguars for Tornados in 1984-85, and will be joined by No 9 Squadron from Honington this year. Also here is No 431 Maintenance Unit, responsible for support facilities as diverse as aircraft repair and furniture supply.

Fornebu Airport, Norway: A single Andover C Mk 1 is based here for the use of the British officer holding the NATO position of C-in-C Air Forces Northern Europe, at nearby Kolsaas.

Gatow, West Berlin: Gatow is famous for the part it played as the British Sector airhead during the 1948-49 Berlin Airlift, and infamous as the only RAF station the opening ceremony of which was performed by Adolf Hitler (in 1935, under its previous management). Part of its perimeter is the border between West Berlin and East Germany, and it is overlooked by Eastern bloc watch-towers. The station remains a transport terminal for regular supply of the Berlin Garrison and possible emergency reinforcement. Its sole permanent aircraft allocation is two Chipmunk T Mk 10s of the Gatow Station Flight which are tasked with observation and exercising the right to fly within the Berlin Control Zone.

Gütersloh, West Germany: Gütersloh was built for the *Luftwaffe* in 1935 and became an RAF station in 1945. The camp retains many of the original buildings to this day, despite considerable modernisation of other facilities. A busy air transport terminal, it is also the only RAF combat base east of the Rhine. Residents include the Harrier GR Mk 3s of Nos 3 and 4 Squadrons, providing close fire support for the Army as well as — in No 4's case — tactical reconnaissance facilities. Helicopters are flown by Nos 18 (Chinook HC Mk 1) and 230 (Puma HC Mk 1) Squadrons on transport missions for the Army. All four squadrons are equipped to leave Gütersloh and operate in the field during wartime.

Laarbruch, West Germany: As the last RAF airfield built in Germany with war reparation moneys, Laarbruch opened in 1954. The resident squadrons include Nos 15, 16 and 20, all of which re-equipped with strike/attack Tornado GR Mk 1s in 1983-84, having previously flown Jaguars (No 20) and Buccaneers in the same rôle. The remaining unit is No 2 Squadron, tasked with tactical reconnaissance and attack using conventional weapons, which will not receive Tornados until the end of 1987.

Mount Pleasant, Falkland Islands: The RAF's newest base, Mount Pleasant was built from scratch, beginning in 1983, and attained an initial operational capability, with one of the planned two runways open, in 1985. No 23 Squadron's Phantom FGR Mk 2s provide air defence of the Islands from here, supported by the Hercules C Mk 1K tankers of No 1312 Flight. Nominally resident, but detached elsewhere, are No 1310 Flight's army support Chinook HC Mk 1s at Kelly's Garden; and No 1564 Flight's SAR Sea King HAR Mk 3s at Navy Point.

North Front, Gibraltar: A detachment of Jaguar GR Mk 1s is maintained here.

Sek Kong, Hong Kong: Wessex HC Mk 2s of No 28 Squadron are based here for general support duties within the Crown Colony.

Wideawake, Ascension Island: Scene of intense activity during the Falklands War in 1982, Wideawake (named after a local species of bird) still performs an important rôle as a half-way staging point for aircraft transiting to and from the South Atlantic.

Wildenrath, West Germany: Another RAF base in the far west of Germany, Wildenrath opened in 1952. Its present operational squadrons are Nos 19 and 92, both equipped with Phantom FGR Mk 2s assigned to policing of the Air Defence Identification Zone which runs parallel to the border with East Germany. No 60 Squadron here flies the RAF's last Pembroke C Mk 1s on communications and light transport duties, its personnel also being responsible for turn-round servicing of the large number of RAF and civilian charter transports passing through this important air-head.

McDonnell Douglas Phantom FGR Mk 2, No 23 Squadron, Stanley.



When the Royal Air Force, government establishments, and the best of British industry get their act together, they're a world-beating team.

Thermal Imaging Common Modules (TICM II) was a brilliant tri-Service programme conceived by the Royal Signals and Radar Establishment and implemented by British industry led by GEC Avionics.

Supported by the Royal Aircraft Establishment's 'Nightbird' programme, GEC Avionics soon demonstrated a complete night vision capability, installing thermal imaging, processing, head-up and head-down display systems and night vision goggles in a ground attack trials aircraft. The

HOW THE RAF GOT NIGHT EYES

resulting system enables a pilot literally to see in the dark.

It's a major 'force multiplier', increasing aircraft utilisation by a factor of three to one.

Now the GEC Avionics night imaging system is going into RAF Tornado GR. Mk 1, Harrier GR. Mk 5 and T. Mk 4 trainer, and is selected for the US Marine Corps AV-8B. The export prospects are immense.

Another great British achievement. And again led by the avionics company which has won export orders worth well over £¼ billion in just nine months - in the most technically demanding markets in the world.



GEC AVIONICS

GEC Avionics Limited, Airport Works, Rochester, Kent ME1 2XX, England.
Tel: (0634) 44400 Telex: 96333 Fax: 0634 827332.





NOTHING ELSE EVEN COMES CLOSE.

The RAF's HC Mk. 1 Chinook. Its external triple hook system can carry 25,000 pounds in a single lift. Internally, it can carry 80 armed troops at one time. It is capable of evacuating 24 stretcher cases or carrying 20,000 pounds inside.

The Chinook provided enhanced capability and flexibility on the 150-mile-long Cyprus/Beirut supply line with no problems. Chinooks are now providing enhanced capability for the NATO support operations role in the Central German sector.

Thanks to its exceptional capabilities, the Chinook is now deployed worldwide as a support vehicle for the RAF. No wonder. Nothing else even comes close. *Boeing Helicopters, P.O. Box 16858, Philadelphia, PA 19142, USA. Telephone 215-522-3751 or Telex 845-205.*

BOEING