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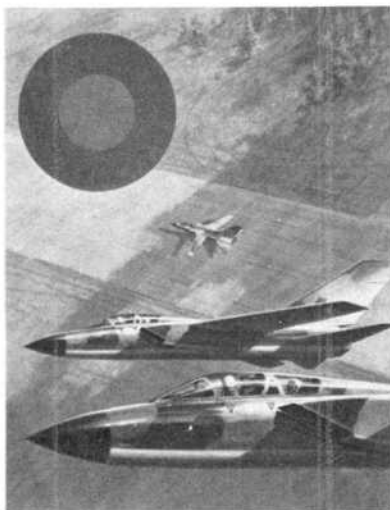
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Our cover featuring MRCA, specially painted for us by Derek Bunce, is reproduced by courtesy of Gibson, Gilbert, White. This joint-European combat aircraft is one of the most advanced in the world, destined to play a vital role in the future of the RAF, German and Italian Air Forces

Contents

THE MACHINERY OF COMMAND	7
<i>CAS outlines the policy behind the new Command structure</i>	
THE UNITED STATES AIR FORCE IN BRITAIN	9
<i>First of a new series on Allied Air Forces</i>	
FIFTY YEARS OF SERVICE	15
<i>The story of how NAAFI has served the RAF over half a century</i>	
MAINTENANCE COMMAND	19
<i>A rare account, by the C-in-C, of the supply and engineering organisation of the RAF</i>	
PLANNING RAF COMMUNICATIONS FOR THE 80s	23
<i>D of S takes a long look ahead at the reins of command and control</i>	
FLYING THE JAGUAR	27
<i>A Boscombe Down project test pilot, evaluating Jaguar, describes how she handles</i>	
THE JAGUARS ARE COMING – 16 PAGE COLOUR SUPPLEMENT	
<i>Gordon Swanborough describes the RAF's next combat aircraft in detail</i>	
THE RAF AND THE INDUSTRY	29
<i>John Taylor stresses the vital importance of maintaining this very successful team</i>	
IT'S A GREAT COMFORT to join the RAFA	34
TRAINING COMMAND	35
<i>The C-in-C describes the many functions of Service training in the Command's new guise</i>	
SAIL RAF	42
<i>The Vice-Cdre of RAFSA will surprise many readers with the skill and great number of RAF sailors</i>	
A REMARKABLE SCHOOL	45
<i>Sir Arthur Bryant visits Vanbrugh Castle</i>	
AIR PUBS	47
<i>Inns and Hosteries with RAF connotations</i>	
RAF MOUNTAIN RESCUE – started in wartime and still vital	52
THIS YEAR'S 'AT HOME' DAYS & OTHER COUPONS	54
<i>'Benfund Postal Bargains' and Free 'At Home' Day Coupons</i>	

by Dr-Ing John P Milford Reid,
BSc Eng(Hons), C Eng, AFRAeS, MSAE, MIAS,
Editor and Publisher
Royal Air Force Souvenir Book

THE ROYAL AIR FORCE, ever since its creation in 1918 – with rare exceptions – has relied mainly on British Industry to provide its aircraft and associated equipment; while for its part, the British Aircraft Industry has always regarded the RAF as its first and most essential customer, to be given absolute priority at all times. Thus the Service and the Industry grew up and developed together, became largely inter-dependent, and formed a strong community of interest which soon led to a close, efficient and generally cordial relationship. From every essential, national point of view – strategic, economic and technological – this was a sound, intelligent and wholly beneficial arrangement to both sides. But a few years ago this situation began to erode, to the mutual disadvantage of both the RAF and the British Aerospace Industry (as we now call it), and to the grave danger of the country as a whole. The reasons for this erosion need not concern us here, but pinpointing past mistakes is vital to formulating less mistaken policies for the future.

The White Paper of Feb 1971 defines our basic defence objectives:

- 1 To enable Britain to resume, within her resources, a proper share of responsibility for the preservation of peace and stability in the world
- 2 To improve the capabilities of the Armed Forces, to overcome their manpower difficulties, and to enhance their role in the community
- 3 To establish and maintain a sound financial basis on which to develop and carry out defence policy and plans in the years ahead

... and states that our basic security depends on the strength of NATO, the North Atlantic alliance to which much of Britain's forces is committed, but our interests and commitments elsewhere must not be disregarded, as they flourish only in stable conditions.

In order to continue to safeguard our interests (and those of our friends and allies) Britain simply cannot afford – from either an economic or strategic viewpoint – to let her capacity to develop and produce the bulk of her defence equipment from her own technical and economic resources decay, and this demands continual strength and stability within the industries producing such equipment. In

other words, we cannot fulfil our defence and economic objectives if the RAF were obliged to become dependent upon *wholly* foreign sources of supply for its weapon systems. Nonetheless, as our strategy and economy become progressively more orientated towards Europe, there must be a closer integration and standardisation of military aircraft and equipments with our European allies, and this points to the joint development and production of weapon systems with our European allies in order to spread today's huge development costs and generate larger and more efficient production runs: such collaborative projects have become much more feasible in recent years due to close compatibility between RAF operational requirements and those of other European Air Forces.

This is the *rationale* behind the two major European collaborative military aeroplanes destined to play a vital part in the RAF's future order of battle – the Anglo-French Jaguar and the Anglo-German-Italian multi-role combat aircraft (MRCA). Jaguar – the first internationally specified and developed aeroplane ever to enter UK service – will reach the RAF next year, and is thus described in some detail in this year's Souvenir Book: MRCA, specially painted by Derek Bunce for our front cover, will come later. (Derek Bunce, of Gibson, Gilbert, White, is also the painter of this year's centre spread picture.) Such projects as these should strengthen the close inter-dependence between the RAF and the Industry which is proud to support it: they should also remind all concerned – politicians, Air Marshals, Civil Servants and Industrial managers – that the fundamental basis of the prosperity and stability of any aerospace industry lies in its main aeroplane and weapon programmes, whether purely national, such as Harrier and Nimrod, or internationally collaborative like Jaguar and MRCA; and that if these programmes flourish, then the producers of all forms of associated equipment – including aero engines – will flourish also.

The financial tragedy which has recently overtaken the great Aero-engine company of Rolls-Royce threatens the destruction of one of Britain's greatest aviation assets, and a firm and lasting solution *must*

The Royal Air Force Souvenir Book is published annually to raise funds for the Royal Air Force Benevolent Fund and the Royal Air Forces Association

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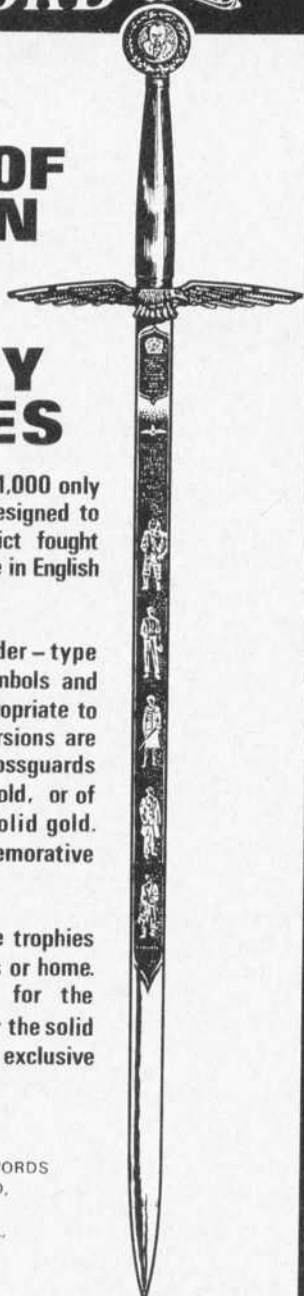
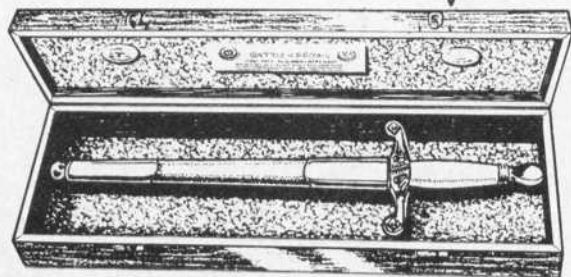
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FLT LT THE PRINCE OF WALES is the most distinguished new entrant to the RAF, and entered the RAF College at Cranwell in March for a five months' course, during which he will complete 80 hrs on Jet Provosts to acquire his Wings. He may also join No 1 Graduate Entry Scheme Course in some defence and management studies. He has already flown over 100 hrs on Chipmunks and Bassets, and the College is delighted to have him on its first Graduate Course. ▼

A LIMITED EDITION OF 1,000 beautifully made Battle of Britain Commemorative Swords by Wilkinson Sword Ltd are available for purchase. The first of these was recently presented to ACM Sir John Grandy, the retiring CAS, in the Defence Council's Suite in MoD, and is to become the Award in an Annual RAF Competition, the conditions of which will be announced shortly. Such an elegant prize is sure to be fiercely competed for.



Lord Portal happily surrounded by some boys of Vanbrugh School



MRAF VISCOUNT PORTAL OF HUNGERFORD retired last December after 23 years as Deputy Chairman of the RAF Benevolent Fund Council. His services as CAS for most of WWII earned him a permanent place in history, recognised by his Knighthood of the Garter in 1946. He is senior Marshal of the RAF and holds the coveted Order of Merit; his DSO and MC for gallantry were won in WWI and he was made Knight Grand Cross of the Order of the Bath in 1942 at the height of WWII. It has long been the Benevolent Fund's policy to appoint a distinguished banker or businessman as Council Chairman with a very senior RAF officer as Deputy, and Lord Portal has thus served with Lord Riverdale of Sheffield, Viscount Knollys and Mr Harald Peake. The picture shows him with Lady Portal as guests of honour at Speech Day at the Benevolent Fund's residential school at Vanbrugh Castle, Blackheath (see p 45). Lady Portal was a member of the School Committee for 24 years until 1969 and helped guide its development into a first class prep school. In

Editorial concluded on page 51



The Machinery of Command

by Air Chief Marshal
Sir Denis Spotswood,
GCB, CBE, DSO, DFC, AFC,
Chief of the Air Staff

IN HIS LAST TWO CONTRIBUTIONS TO THE SOUVENIR BOOK, my predecessor looked forward to the next 50 years for the RAF and surveyed the tasks and challenges likely to confront us during the 70s. He pointed to the re-equipment programmes now well under way, and drew attention to the even more advanced equipments being developed for service in the latter part of this decade, and this edition reports progress on the development of some of these. This year – my first as CAS – I have decided to write something of the *machinery of command*; that vital and delicate mechanism of men, women and equipment upon which we rely to develop and maintain the full operational capability of our weapons systems.

RAF organisation has always been a matter of evolution, to meet the demands of the time and the state of aviation art, and a major step was taken in 36, when four functional Commands were set up in UK – Bomber, Fighter, Coastal and Training – while Forces overseas remained under geographical command, their Units being trained functionally in UK. This basic functional organisation in UK admirably met the demands of WWII, although it was realised even then, as the war situation changed and the capabilities of aircraft and crews advanced, that air power should be exploited beyond strictly functional boundaries; *ie* aircraft developed as bombers, together with their crews, could be adapted to, say, reconnaissance and sea warfare, fighters to ground attack, bombers to air transports, *etc.* This is well known now – *eg* Battle of Britain fighter squadrons became those which took a major part in the offensive leading to the recapture of Europe, with roughly the same aircraft . . .

Before being appointed Chief of the Air Staff on April 1, Sir Denis Spotswood became C-in-C Strike Command in 1968 following appointments as C-in-C 2nd ATAF Germany in 66, AOC 3 Gp Bomber Cd (64-66) and Commandant RAF College, as well as senior planning staff posts in SE Asia during the Burma campaign and later with the Ministry, USAF, and SHAPE as ACoS Air Defence. In WWII the ACM commanded 500 (County of Kent) Sqn and later, Fighter Cd Stations at Horsham St Faith, Coltishall and Linton-on-Ouse, and won the DSO and DFC and two 'mentions'. In 64 he completed a study of the long-term requirements of the size and structure of the RAF, and was thus largely responsible for the creation of Strike Command. Sir Denis holds the US Legion of Merit, and became Air ADC to the Queen in 1970.



Phantoms of 43 Sqn, Leuchars, flying over Scotland – the Phantom is a typical, modern, multi-role aircraft, in service with Strike and Air Support Commands



The Buccaneer's versatility includes low level sorties, manual and automatic dive bombing, toss bombing and rocketing and tactical ops

Even earlier, the RAF grasped quickly the now accepted principle of command (or *management* if you prefer) – that there should be three levels of control: first, the policy-making level – the Air Council in the old Air Ministry; next, the top level management, the Commands; and finally the operating Units – the Stations, Wings or Squadrons, as the situation demanded. Admittedly, Group HQ were also introduced, originally to alleviate Command problems when the Service was very large and, latterly, to provide for role expertise.

Advances in our aviation have, of course, continued – made possible, I believe, by the imagination, ingenuity and skills of our personnel . . . our most successful aircraft have been those which have proved to be widely flexible, whose inherent capabilities have in fact matched those of the people who operate them. *Eg* in the last decade the necessary transition from high- to low-level operations exemplifies the trend; today in many cases we have learned to operate most effectively our expensive weapons systems in ways and for purposes which differ almost completely from anything the designers had in mind originally. Nor will that change: from the Phantoms and Harriers we have now to the MRCAs we shall get towards the end of the decade, our new aircraft are potentially even more flexible than the Mosquitoes, Canberras and Hunters proved to be. And so, with intermediate adaptations intervening, it was decided by the middle 60s that we had reached the point where the old functional UK Commands, which had served so famously, no longer met the needs of the time . . . needs themselves changing rapidly as a result of national and Allied policy and strategy.

Consequently, it was decided in 68 to merge progressively four Home Commands – Bomber, Fighter, Coastal and Signals – to form Strike Command, and to regularise the position of Transport Command, which became Air Support Command. This reorganisation was preceded by the merger of Flying and Technical Training Commands, while Maintenance Command, with its engineering and supply responsibilities, has also been given a new look in recent years and, in Whitehall jargon, has become far more *cost-effective* in the process, despite the increasing complexity of its functions and equipments. Although the creation of a single Training Command was also primarily for reasons of economy, those leading to the formation of the two new Operational Commands, whilst in themselves resulting in substantial economies in personnel and real estate, were brought about with operational considerations predominating.

Not only, in the 60s, had there been further significant reductions in the size of the Service but, more important in the context of this article, our aircraft were becoming progressively more capable of fulfilling more than one role; and modern technology had also begun to provide us with the means to control our resources effectively, unhindered by geographical spread, formerly significant even in an area as

restricted as the UK. Data handling has been one such provision. Moreover, it was becoming more than ever necessary to safeguard the two principal characteristics of air power – its operational flexibility and the speed with which it can be concentrated. I do not think I can do better than quote the late Marshal of the Royal Air Force Lord Tedder who, in his book *Air Power in War*, made these two statements:

'The flexibility of air force is indeed one of its dominant characteristics. . . . Given centralised control of air forces, this flexibility brings with it an immense power of concentration which is unequalled in any other form of warfare.'

'Air warfare cannot be separated into little packets; it knows no boundaries on land or sea other than those imposed by the radius of action of the aircraft; it is a unity and demands unity of Command.'

The essence of these two statements applies now as never before. With much smaller forces, yet with very wide-ranging responsibilities – indeed we are responsible now for even more roles than when Tedder wrote – it is essential to have a command organisation to exploit air power to the maximum. I am convinced that the decision to form Strike and Air Support Commands was a major step in this direction which is already paying great dividends; without it, it would have been more difficult for our people to develop a 'multi-role' concept and to practise it as they now are more than ever before, with great and growing effectiveness.

In itself, this has had a testing effect on the *Machinery of Command*. Previously, so much peacetime inter-role training had to be 'set-piece', and close co-ordination between separate Commands having different priorities was a pre-requisite. Now, with all types of operational aircraft in only two Home Commands, each with clearly defined responsibilities, yet with considerable interdependence, we can follow Tedder's dicta. More than ever Commanders and staffs, as well as air- and ground-crews, have to react immediately to different situations and commitments almost at no-notice. In all this they show themselves as complete masters and revel in it; we can indeed bring composite 'air force' to bear at great speed and with high effectiveness.

Here I come to the core of this article: the essential element of the Royal Air Force is a human one. Whatever the organisation, it will be effective only through the skill, experience and imagination of those serving in it. The aim of all Commanders at every level is to utilise and develop these characteristics in those serving under them. Our Command organisation plays a vital part in helping to achieve this aim and in meeting the challenges which lie ahead; like the RAF of which it is a part, a Command must be dynamic in character, alert and responsive to the needs of the moment, and sufficiently flexible to meet the wide spectrum of its operational tasks.

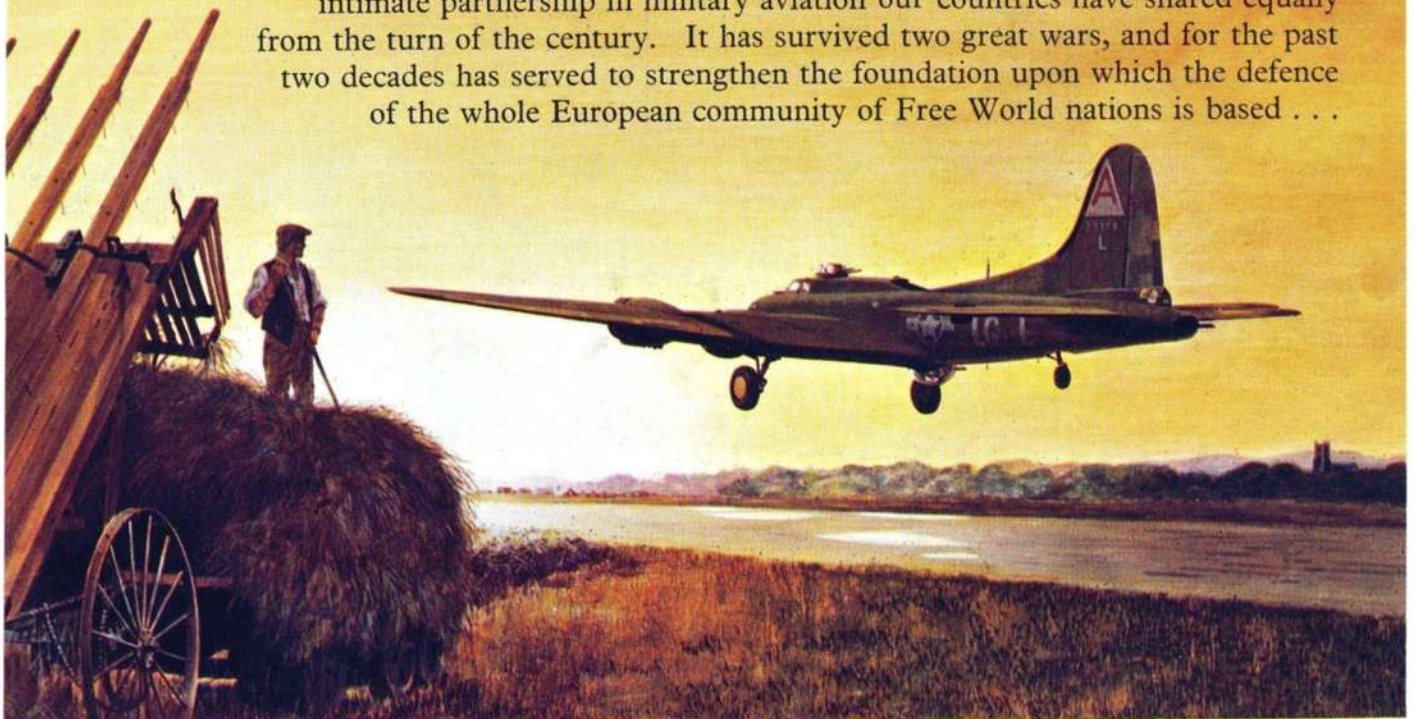
And clearly we do not lack diversity! The present division of responsibilities between the four Home Commands, and between them and those overseas, is now working very satisfactorily; but, while some period of consolidation is obviously desirable before we can decide on any further steps, the need for these must remain under continuous review, in the spirit of our belief that *command must match needs*. Whatever these steps may be, they will be made in the light of our understanding and experience of the use of air power – concentration and flexibility being paramount – and in our knowledge of the high qualities of those serving in the RAF. ☉



The USAF in Britain

by Major General John H Bell,
Commander,
Third Air Force,
United States Air Force

IT MAY SURPRISE YOU TO LEARN that USAF aircraft have been flying from airfields in Great Britain for over a quarter of a century. Our failure to realise this can partially be attributed to the common acceptance of the long-standing and intimate partnership in military aviation our countries have shared equally from the turn of the century. It has survived two great wars, and for the past two decades has served to strengthen the foundation upon which the defence of the whole European community of Free World nations is based . . .



Return from Mission – Donald Hedin, courtesy of USAF art collection



B-47 STRATOJET, main heavy bomber of SAC for many years, served in UK 1953-1965

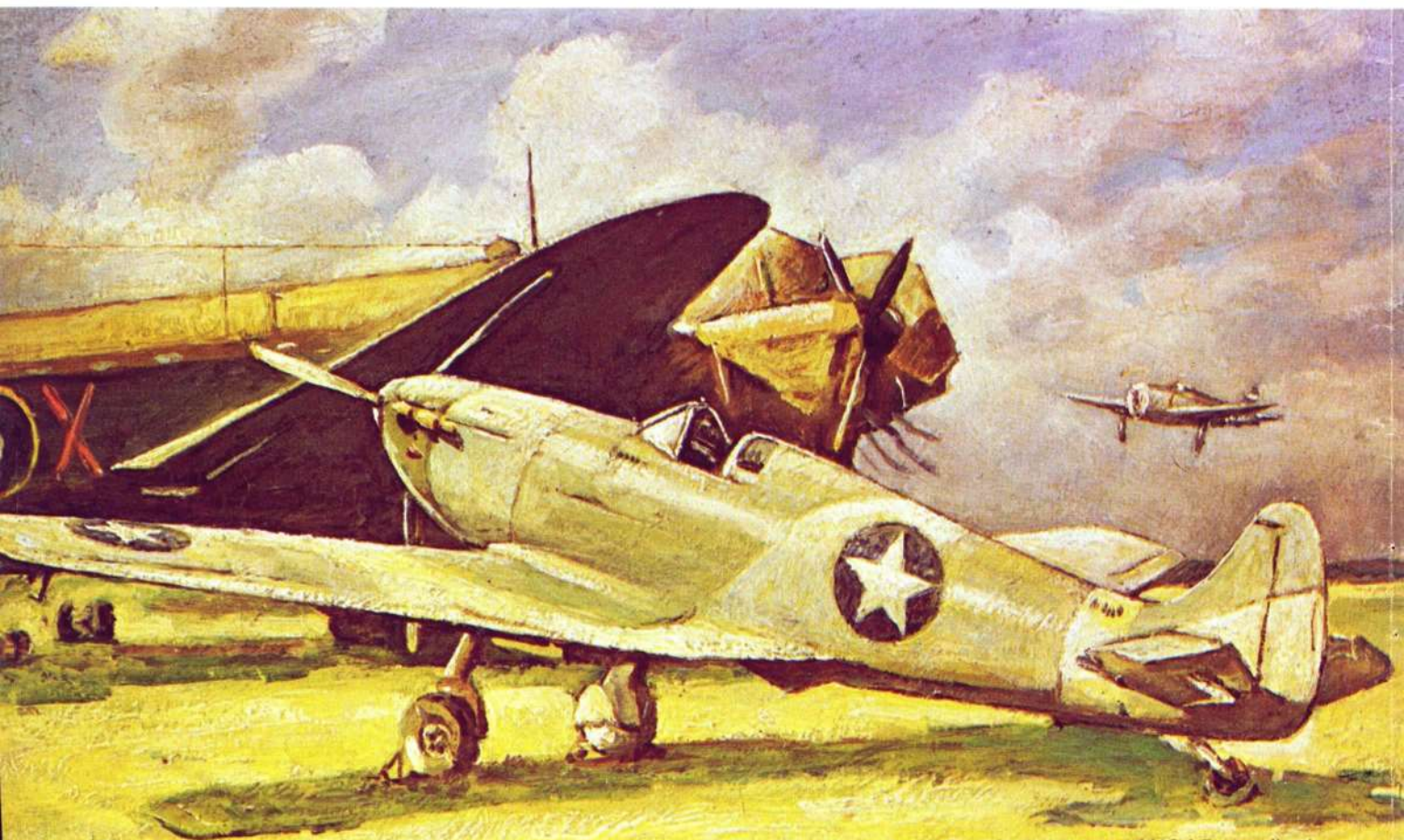
John Bell, Cdr US 3rd Air Force and senior USAF officer in UK, born Lewiston, Penn, began his career as aviation cadet at Kelly Field, Texas. In WWII, he was assigned to the China-India-Burma Theatre. Later assignments won him great experience in ops, engineering, logistics, supply, plans, policies and personnel. With 5,000 flying hours on fighters, Gen Bell, qualified Phantom pilot, flies regularly with 81 Tactical Fighter Wg at RAF Bentwaters, Suffolk. Previous commands include 328 Fighter Gp at Richards-Gebaur Air Base, Missouri, and 51 Fighter Interceptor Wg at Naha, Okinawa. Graduate of Air War College and Command and Staff School, he qualified in advanced business at Harvard. Awards and decorations include the Distinguished Service Medal, Legion of Merit, Air Medal, AF Commendation Medal with two oak leaf clusters and the Army Commendation Medal with one oak leaf cluster

AS THE 24th AND PRESENT COMMANDER of the organisation that has evolved into the US Third Air Force in Britain, I see daily that this partnership our air forces share is a splendid example of what can be achieved between peoples of two nations through tolerance, understanding, and close co-operation. With all due respect for a strong Anglo-American alliance, it is doubtful that – under normal peacetime circumstances – more than 22,000 servicemen and five major Operational Wings of assorted tactical aircraft, which we now have in Britain, could easily avoid becoming a source of irritation without British tolerance of our presence, an understanding of why it is mutually necessary for us to be here, and the excellent co-operation we receive from the civilian communities as well as the British defence establishment. Moreover, our countries have shared a mutual interest in aviation technology since the first powered flight made by the Wright Brothers at Kitty Hawk, North

Carolina on 17 December 1903. In fact, the British Government was so interested that it sent a representative to the United States seeking to buy the plane.

world war one

But the cornerstone of this partnership was laid in 1915 – almost two years before America entered World War I – when American volunteers were being trained by the British. After America entered the war on 6 April 1917, Britain officially accepted and trained 500 US pilots and observers, along with numerous aircraft mechanics and other ground personnel at airfields and factories all over the country. During the seven months the US took part in WWI aerial combat, its Air Service crews – using British Sopwith Camels and de Havilland 4s and French Salmsons, Spads, and Breguet A-2 aircraft – flew 35,000 combat hours for a total of 13,000 pursuit





F-86 SABRE, tactical jet fighter, flew from Manston, Kent with 406 Interceptor Wing, 1954-8



MAINTENANCE CREWS check F-100 Super Sabre, USAF tactical workhorse in UK since 1957, and first USAF aircraft to fly supersonic in level flight

flights, 6,600 observer flights, and 1,100 bombing missions, during which they dropped a total of 225,000 pounds of explosives on the enemy.

the second world war

The next chapter in the history of our Anglo-American air forces partnership began some 20 years later as war clouds again collected on the horizons of Europe, and this second major conflict of the 20th century imminently became the most severe test for the mortar that held it together. It also brought American pilots back to British airfields where, with their RAF contemporaries, they helped to prove for all times the intrinsic value of aerial warfare, or more accurately, of *Airpower*. The crucial test for Britain and its Royal Air Force came all too soon, but the foresight of the British aircraft industry had prepared it better to begin wartime aircraft production than its American counterpart. Britain's aviation industry had expanded in 1938 from the production of 150 to 700 planes per month by the time the country declared war on Germany, 3 September 1939. American military aircraft production was also substantially increased from 100 a month in 1938 to 402 a month by April 1940, and it was rapidly preparing to double that rate. Although Britain and France had ordered 2,500 aircraft from the US by March 1940, delivery had scarcely begun when the RAF had to face its most critical challenge in a desperate battle to save the nation and ultimately to change the whole course of World War II history . . . and what a magnificent display of dedicated, professional airmanship was shown by RAF pilots in the Battle of Britain! They courageously waged and won the air war over Britain against the overwhelming odds of the German Luftwaffe between August and September 1940.

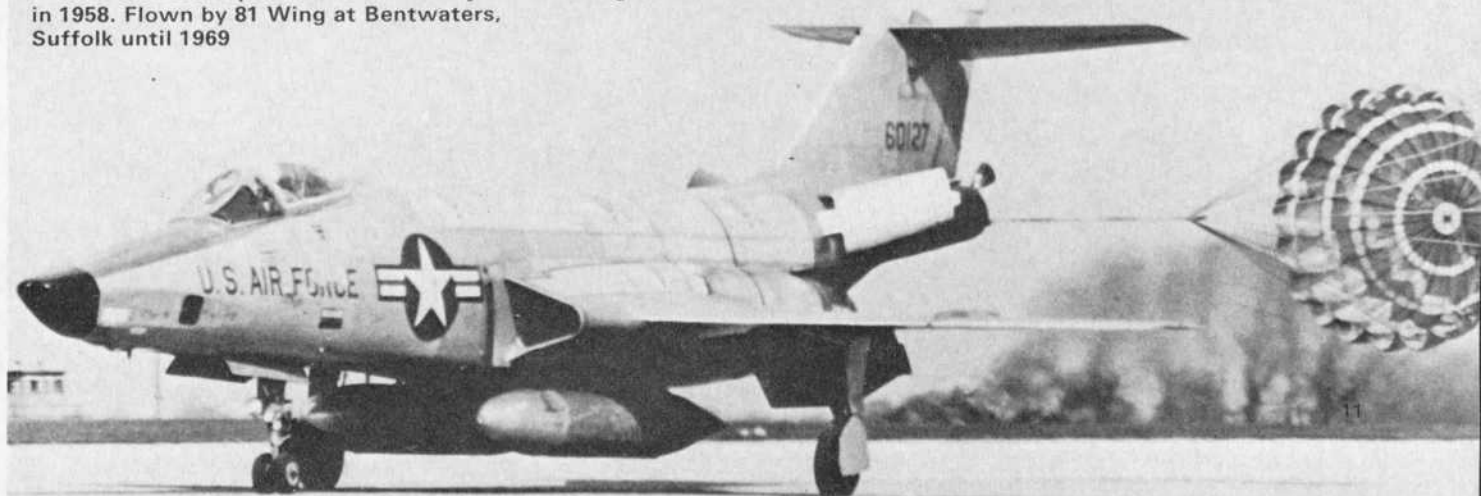
From April 1940 to December 1941, when the Japanese attack on Pearl Harbour forced the US to declare war on

Japan and the Axis powers, America delivered 6,756 aircraft to Britain. When the US entered the war, the Army Air Force – as it had been named in mid-41 – had expanded to 16,000 cadets, 23,000 officers, and 275,000 enlisted men with an aircraft inventory of 12,000 planes. The first few months of American participation in the war saw the USAAF acting in a defensive role, but by December 1942, 882 aircraft – mostly B-17 Flying Fortress heavy bombers and C-47 Dakota transport aircraft – had been deployed to Britain. They were assigned to the US Eighth Air Force, organised in the UK under the command of Maj Gen Carl Spaatz. These aircraft were based on RAF airfields in East Anglia where most of the US Third Air Force operational units are still located. At that time, Third Air Force was located in the South-eastern US, where it was busy training and equipping Eighth Air Force for the big battle ahead.

daylight bombing raids

The first wartime mission flown by the AAF from British soil came on 4 July 1942 – American Independence Day – when six crews of the 15th Bombardment Sqn who had been training in Britain joined the RAF to strike at German airfields in Holland using RAF Douglas Boston bombers. This was followed on August 17 by a dozen B-17 Flying Fortress heavy bombers, commanded by Colonel Frank A Armstrong Jr, and escorted by RAF Spitfires, as they raided marshalling yards at Rouen-Notteville, France. This was the first all-AAF bombing mission, and the initial trial for daylight precision bombing techniques in which the AAF was to place so much faith. Eighth Air Force bombers continued to fly several small missions during the successive weeks as a prelude to the strategic bombing offensive that was used by the RAF and AAF to destroy the German industrial capability.

F-101 VOOODOO replaced F-84 Thunderjet tactical fighter in 1958. Flown by 81 Wing at Bentwaters, Suffolk until 1969



B-66 DESTROYER tactical bomber replaced B-45 Tornado in UK in 1958. Continued on reconnaissance here until replaced by RF-4C Phantom II in 1965



However, Eighth Air Force was unable to accomplish a great deal until the spring of 1943, since much of its strength was being sapped to build up the US Twelfth Air Force under Brigadier Jimmy Doolittle for its role in Operation Torch, the invasion of N Africa. Meanwhile, some two-thirds of Eighth Air Force's aircraft were employed on concentrated strikes against German submarine bases and yards in an attempt to reduce high Allied shipping losses resulting from German U-boat attacks on the Atlantic shipping lanes. Flying Forts continued to pound targets in France and the Low Countries until the summer of 43 when Eighth Air Force and the RAF launched their massive strikes aimed at Germany's industrial belt. American planners of the aerial offensive against Germany had decided to use the concept of strategic daylight bombing, while the RAF chose similar tactics for night strikes.

losses and escorts

Thus, in one of the early attempts to prove the merits of its strategic daylight bombing concept, Eighth Air Force launched from bases in Britain on August 17, 146 heavy bombers on a mission against the Messerschmitt factory that produced about half of the single engined fighters for the Luftwaffe at Regensburg, some 300 miles inside Germany. The success of the mission was encouraging, but it resulted in the loss of 24 Flying Forts. A few hours later, 230 B-17s flew a similar strike against the vital ball bearing plant at Schweinfurt, again requiring deep penetration into Germany. The raid sustained a heavier loss of 36 Flying Forts, and such losses ultimately led to the development and introduction of long-range fighter escorts to furnish cover for the bombers against the heavy German air defences. With this protective cover provided by P-38 Lightnings, P-47 Thunderbolts, and P-51 Mustangs, Eighth Air Force bombers – mostly B-17 Flying Forts and B-24 Liberators – were able to hammer relentlessly at Germany's production capacity in 1944, and together with the efforts of RAF Bomber Command, the industrial life of the Ruhr was effectively destroyed. Nothing in the German heartland that could contribute to the war effort was safe from attack. Raids involving more than 1,000 bombers were not uncommon. British-based Eighth Air Force planes flew as many as 3,300 sorties in late February alone, and simultaneously, the RAF continued with its massive night attacks, leaving the Germans little time to rest. To press home to the Germans the gravity of their situation, 1,000 heavy bombers conducted the first of many successive raids on Berlin on March 6-8, by which time, long-range P-51 Mustang fighters – switching from a defensive to an offensive role – were able to precede the bombers, seek out Luftwaffe fighters and destroy them, often before they left the ground. The back of the German Air Force was gradually being broken.

Meanwhile, Brigadier Elwood R Quesada brought the nucleus of the US Ninth Air Force from the Mediterranean to England. Composed of medium bombers, fighter-bombers, and troop carriers, it was expanded into one of the largest

tactical air forces in history. The combined strength of the Eighth and Ninth Air Forces and the British Second Tactical Air Force was then directed to support Overlord, the Allied invasion of Europe. Using rail centres and bridges as prime targets, the airpower of these Units was successful in minimising the number of reserve troops the Germans were able to muster against the Allied invasion when it began on 6 June 1944. Once the beachheads were established and the Allied armies moved forward, Ninth Air Force moved across the English Channel to Normandy to resume its invasion support efforts.

In addition to supporting the ground campaign, heavy bombers of Eighth Air Force and the RAF Bomber Command pressed on with the bombing of strategic targets within Germany. In spite of heavy losses, they were able to rob Germany of its vital production of fuel and lubricants as the Allied Armies raced across France and into Germany. While not to detract from the vital roles played by ground armies and naval operations, post-war studies proved that Allied Airpower was a decisive factor in the war. The result was a major strategic victory. When the Germans surrendered to the Allies on 7 May 1945, the US Army Air Force had flown 750,000 bombing sorties and a million fighter sorties and had dropped 1.5 million tons of bombs on the Axis powers.

the cold peace

Weary of war and jubilant with the prospects of world peace at last, both Britain and America proceeded in 1945-46 with the dismantling and complete withdrawal of US air operations in the UK and demobilisation. Apprehensions brought on by a gradual chilling of post-war relations between the Russian-dominated countries of Eastern Europe and the West gave some Allied military leaders cause for concern. Among them was British Air Marshal Sir Arthur Tedder, and wartime Eighth Air Force Commander General Carl Spaatz, who were making farewell visits about that time to US bases in Britain. It was they who decided informally to prepare four East Anglian RAF bases to accommodate, if necessary, US B-29 heavy bombers, and the necessity for doing so was not long in coming. While world attention focussed in 1948 on the massive Anglo-American air forces' airlift to relieve the blockaded city of Berlin, RAF Scampton, Marham, Waddington and Lakenheath began to receive the first US Air Force B-29s. (On 18 September 1947, the AAF became the US Air Force, independent of the Army and a separate Service.) The USAF 59th Air Depot Wing also was established at RAF Burtonwood, Lancs, to perform maintenance on transport aircraft involved in the Berlin Airlift.

Initially, it was intended that the 60 B-29 bombers brought to Britain as a result of tensions over Berlin would remain only for a 30-60 day period of temporary duty. To control and support these Units operationally, a Provisional HQ for Third Air Division was created at RAF Marham, but when it became obvious that the presence of the B-29s

F-100 SUPER SABRES moved to Lakenheath from France with 48 Tactical Fighter Wing in 1960



was to be more than temporary, the 'provisional' title was dropped from Third Air Division's official designation, and it transferred on 8 September 1948 to Bushy Park near London. It did not move to the location now occupied by Third Air Force HQ at South Ruislip Air Station until 15 April 1949. Throughout 1948 the B-29 Operational Units – part of USAF's Strategic Air Command (SAC) – continued to conduct exercises with the RAF to test the bombers for their wartime roles. As East-West tensions continued to mount, planners added RAF Sculthorpe in Norfolk to the four original B-29 bases, and plans were developed to use four more, with the US and Britain sharing the reconstruction costs. Thus, RAF Fairford, Greenham Common, Brize Norton and Upper Heyford were added to the growing list of US bomber bases. An 'Ambassadors Agreement' was signed in April 1950 by the then US Ambassador Lewis Douglas and UK Under Secretary for Air Aidan Crawley to cover the reconstruction programme for these bases. Tensions relaxed somewhat after the East Germans and the Soviets ended the Berlin Blockade in September 1949, by which time, RAF and USAF planes had flown more than 2.3 million tons of food and supplies into the troubled city.

far eastern conflict

Eruption of the Korean conflict in June 1950 caused a further strengthening of Western defences in Europe, and with this came the signing of an agreement between the US and Britain for a special airfield construction programme. It was designed to provide a total of 30 UK bases from which both strategic and tactical USAF air operations would be conducted. To control these increased activities, Third Air Division was disbanded and replaced by Third Air Force at South Ruislip on 1 May 1951, under the control of United States Air Forces in Europe (USAFE) with its HQ at Wiesbaden, Germany, under whose control it remains in peacetime. Third Air Force has been commanded by many distinguished Air Force officers, among them the then Maj Gen John P McConnell, who later became US Air Force Chief of Staff. Major changes in the concept of USAF air operations in Britain followed; up to this point, emphasis had been placed exclusively on a strategic operation. A tactical mission was now added. SAC had already taken steps toward this end with the organisation of Seventh Air Division HQ at South Ruislip to attend to the strategic bomber force on rotational duty in the UK from various SAC units in the US.

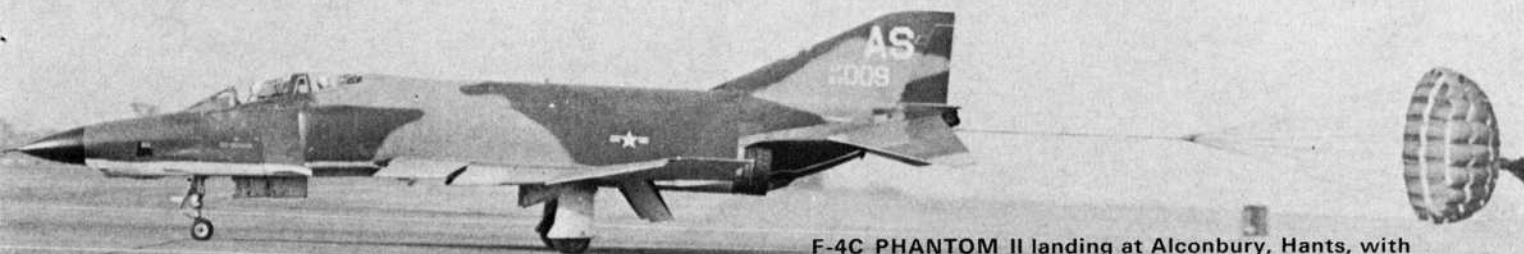
Third Air Force, on the other hand, was to receive Tactical Fighter Units to support the newly acquired tactical mission, as well as assuming responsibility for logistical support for the USAF and other US Forces elements in UK. The Joint Transfer Agreement delineating responsibilities of the two Commands was signed on 16 May 1951.

Third Air Force strength – in both aircraft and people – grew rapidly until by June 1952, it had acquired Operational control over an Air Division, a Light Tactical Bomb Wing, and three Tactical Fighter Wings that had been moved to the UK. These included the 49th Air Division and its 47th Bombardment Wing and 20th Fighter-Bomber Wing, the 81st Fighter Interceptor Wing and the 123rd Fighter-Bomber Wing. The 20th and 81st Wings are still part of Third Air Force today, under slightly modified titles. The Fighter Wings were equipped with the F-84 Thunderjet aircraft and the Bombardment Wing employed the B-45 Tornado tactical bomber, and the total US military strength including Air Force and Army personnel in UK rose to more than 45,000.

common defence arrangement

With such a considerable increase in the size of the US commitment in Britain, it was apparent that a comparable expansion in facilities would be necessary. To sustain the expense, a joint US-UK cost sharing agreement, signed in September 53, consolidated all previous agreements and established the cost to each nation. Britain agreed to provide 63 million dollars, and the US would pay the remainder, estimated at the time at 300 million dollars. The programme included preparation of facilities to accommodate US personnel at 43 major Stations and airfields, which allowed for a major wartime overseas deployment of SAC bombers. The construction programme agreement followed an earlier meeting between Britain's Prime Minister Sir Winston Churchill and President Harry S Truman, when they agreed upon 'arrangements to be made for the common defence' of both the US and Britain.

Consequently, the period 1954-58 caused a major change in military strategy and considerable reductions were made in the number of US personnel in Britain where strengths had reached an all-time high of more than 55,000. Ten bases were returned to Air Ministry control, among them the large supply depot at RAF Burtonwood (by now employing 10,000 people) as a result of a streamlined supply system enabling support to be given direct from depots in the US. The switch from



F-4C PHANTOM II landing at Alconbury, Hants, with brake chute. Used for tactical fighting/recce in UK by USAF since 1965

C-130 HERCULES transports have operated from Mildenhall since 1966, when 513 Tactical Airlift Wing transferred from France



90-day rotational tours of its Wings of B-47 bombers to a much shorter post-strike operation allowed Seventh Air Division to reduce its strength by almost half in 1955, and SAC eventually terminated all of its bomber operations in the UK. US Army anti-aircraft and smoke generating Units which had been deployed to Britain for the protection of US bases left in 1956, and the number of US bases in Britain was cut to 26. Despite this reduction in the combat force, the USAF and RAF stood alerts in the face of several international crises during that time. These included Indo-China in 1954, Hungary in 1956 and Lebanon in 1958. An up-to-date force was maintained by exchanging F-84s and F-86s for F-100 Super Sabre and F-101 Voodoo tactical jet fighters, and ageing B-45 Tornados for B and RB-66 Destroyer reconnaissance and tactical bombers.

As a stop-gap measure pending the development and testing of an inter-continental ballistic missile (ICBM) force, the US placed at the disposal of the RAF 60 Thor intermediate range ballistic missiles (IRBM) to bolster the West's deterrent posture in the late 1950s. Third Air Force, acting under a joint government agreement signed in February 1958, assisted in the construction of the Thor sites and helped deliver the missiles to the RAF who maintained and controlled them. This interim programme was discontinued in 1963 when the US had developed and installed an Atlas and Titan ICBM force capable of countering the Soviet threat. Third Air Force also assisted in the construction of a site at RAF Fylingdales Moor in Yorkshire that completed the network

of a Ballistic Missile Early Warning System (BMEWS). Construction began in 1960, and the Station was completed and opened by the RAF on 17 September 1964, as the third in a link of three such installations to provide early warning against a ballistic missile attack on either the UK or N America, the other two sites being in Greenland and Alaska.

Another major test of the solidarity of the Anglo-American air forces partnership came in 1959 when France and America faced a dispute over the control of US tactical forces based in France. As a result, the US withdrew two USAF Tactical Wings – the 10th Tactical Reconnaissance Wing of RB-66 aircraft and the 48th Tactical Fighter Wing of F-100 Super Sabres – and moved them to RAF Alconbury and Lakenheath respectively. However, this was only a beginning of the complete US departure from France. In March 66 France withdrew all military participation in the North Atlantic Treaty Organisation (NATO), and subsequently, two more USAF Wings moved to Britain. By mid-66, the 513th Troop Carrier Wing was moved to RAF Mildenhall and the 66th Tactical Reconnaissance Wing of RF-101 aircraft to Upper Heyford, with one of the 66th Wing's three Squadrons transferring to Alconbury. Another Unit, the Military Airlift Command's (MAC) 322nd Air Division went to High Wycombe Air Station, but was later re-located at Rhein/Main Air Base in Frankfurt, Germany.

Since its arrival back in Britain in 1948, the USAF has thus sustained many changes in its organisational structure, but working in close co-operation with the RAF, it has continued through the years to be a formidable muscle in the Tactical Air Arm of NATO. The principal mission of Third Air Force and the USAF in Britain is to prepare for and conduct tactical air operations to include ground attack, interdiction, reconnaissance, close air support and tactical airlift in the fulfilment of the US NATO commitment. To accomplish its tactical combat mission, Third Air Force employs three tactical fighter Wings, a tactical reconnaissance Wing, and a tactical airlift Wing. These include the 10th Tactical Reconnaissance Wing (RF-4C Phantom IIs) at Alconbury; the 20th Tactical Fighter Wing (now converting from the F-100 Super Sabre to the swing-wing F-111 at Upper Heyford); the 48th Tactical Fighter Wing of F-100 Super Sabres at Lakenheath; the 81st Tactical Fighter Wing of F-4C Phantom IIs at RAF Bentwaters/Woodbridge; and the 513th Tactical Airlift Wing composed of two rotational C-130 Hercules transport Squadrons at Mildenhall.

I would place strong emphasis on that portion of our mission responsibilities that requires us *to prepare*. Under our present deterrent posture, it is the preparation – or practice – that keeps our force fit and fully occupied. Practice is essential if we are to carry out our wartime role of tactical

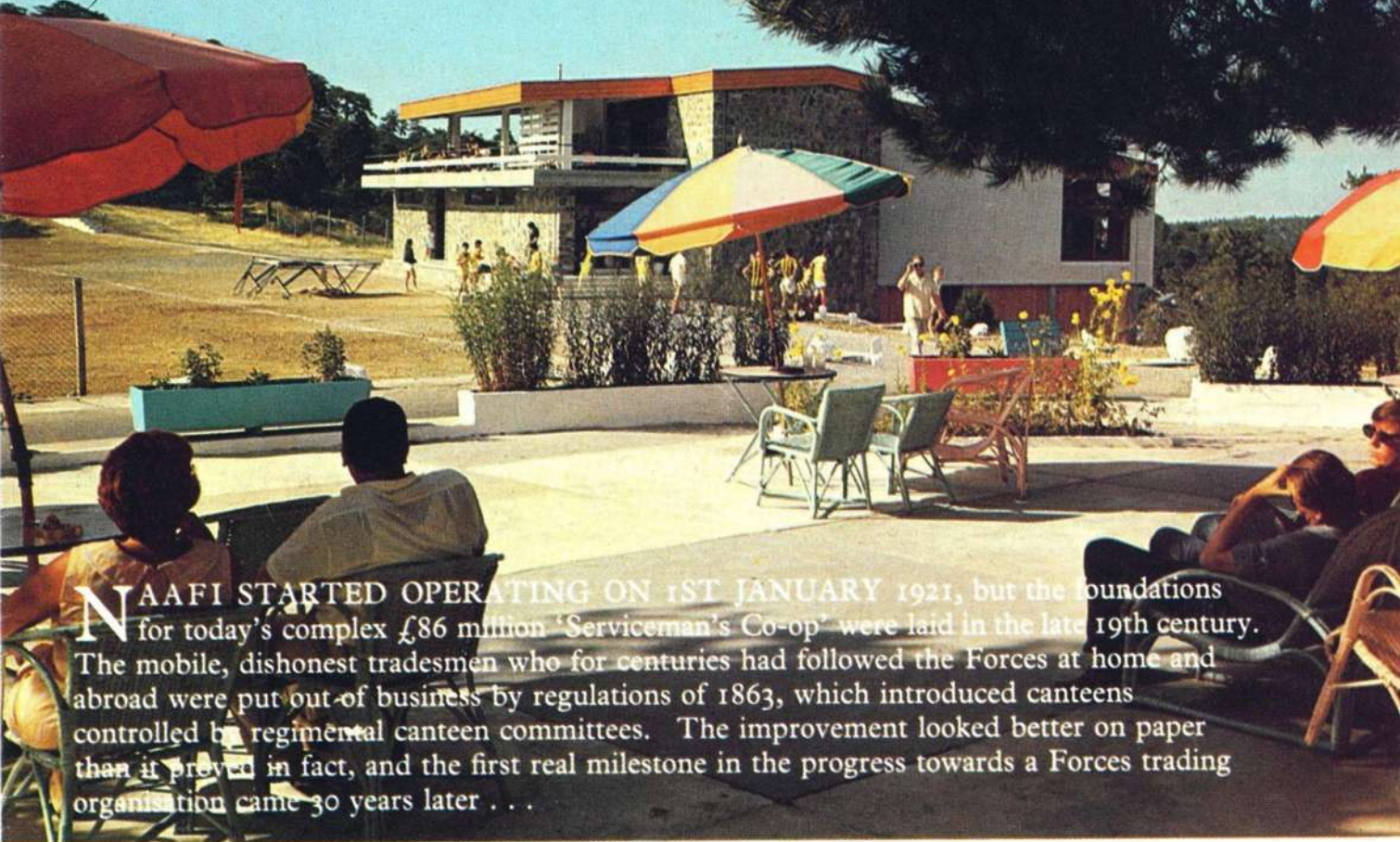
F-111 SWING WING tactical fighter at Upper Heyford, Herts. Latest replacement for F-100 Super Sabres in 20 Tactical Fighter Wing arrived UK late 1970



**Article concluded
on page 46**

Fifty Years of Service

by Michael Walker



NAAFI STARTED OPERATING ON 1ST JANUARY 1921, but the foundations for today's complex £86 million 'Serviceman's Co-op' were laid in the late 19th century. The mobile, dishonest tradesmen who for centuries had followed the Forces at home and abroad were put out of business by regulations of 1863, which introduced canteens controlled by regimental canteen committees. The improvement looked better on paper than it proved in fact, and the first real milestone in the progress towards a Forces trading organisation came 30 years later . . .

INCREASING CONCERN FOR THE WELL BEING of Servicemen united Capt Lionel Fortescue (who had already pioneered an efficient canteen service in his own 17th Lancers), Maj Harry James Craufurd, Grenadier Guards, and Surgeon Capt Herbert Murray, Scots Guards; who with friends, raised £400 to found the Canteen and Mess Co-operative Society in 1894, ruling that interest on the investment was not to exceed 5%, and that further profits be rebated to regimental canteens. WWI linked the Canteen and Mess Society with a leading firm of canteen contractors, Richard Dickeson & Co, to form the Expeditionary Forces Canteens, but other contractors found loopholes to continue exploiting Servicemen, and in 1915 a board of control drew up an approved list of contractors, prices and rates of rebate, and an inspectorate of canteens was formed. Unsatisfactory contractors still

remained, and two years later all contractors supplying the army at home and in permanent overseas Stations were absorbed into the Army Canteen Committee, registered as a *company trading not for profit*. The EFC continued to supply forces in the field, and the central organisation was renamed the Navy and Army Canteen Board when naval contractors were absorbed: the RAF, formed in April 1918, used the NACB facilities from the start.

In March 1920, Winston Churchill, then Secretary of State for War, appointed an inter-departmental committee to consider a permanent Forces canteen service, and by December the Navy, Army and Air Force Institutes was incorporated. In its first year, NAAFI's resources reached across the British Empire, which then comprised a quarter of the world. The two years after the Great War, were difficult times; large establishments were maintained in occupied Germany and Egypt, and then in Turkey as well, and NAAFI accompanied the Forces on policing missions in trouble spots such as the Saar, Palestine, and China: troops faced an Arab revolt in Mesopotamia and rebellion in Ireland.

At home, prices had risen by 50% in a year, and unemployment rose to 2,500,000 in 1921. RAF recruiting slogans offered 'easily the most alluring career open to the adventurous-minded young Briton'. At such a time, free food, lodging and uniform were useful inducements, but the guaranteed minimum pay, although better than that offered by the other Services, was only 3s a day. NAAFI's first year, when it catered for



NAAFI Mobile on a WWII bomber base, 'somewhere in England'

Modern NAAFI Mobile serving groundcrew at a Lightning Sqn dispersal at Akrotiri in Cyprus



NAAFI provides poolside service for swimmers at the Island Club, Limassol, Cyprus

448,000 Servicemen and their families, produced a turnover of over £8 million: a surplus trading profit of £500,000 was returned to the Forces. It had inherited the bare wooden boards, uncomfortable seats and lack of decoration of previous contractors. One model canteen was set up in each Command, and after a trial period the improved pattern was extended to cover the UK, involving, amongst other costly items, 30 acres of floor covering and over 59 miles of curtaining. In Germany, the corporation ran two Rhine steamers to provide outings for troops, while in Palestine NAAFI supplies had to be collected by mule train and stored in a cave. A base supplying the RAF in Amman was linked to desert outposts by camel train, while in Britain NAAFI reorganised catering in the Royal Households and provided a midnight breakfast for the Press who went to see Amy Johnson and other famous flyers set off at dawn to race to Australia.

The readiness and ability of NAAFI to adapt to any given situation proved invaluable during WWII. In 1939 there were 482,000 Servicemen, and NAAFI staff numbered about 8,000. By the following year, the corporation was catering for well over 2 million and turnover jumped to nearly £34 million. By the end of the war, Service strength stood at over 4½ million, served by 120,000 NAAFI staff, half of them women, and turnover reached an all time high of almost £182 million, and this rapid expansion was achieved in spite of the fact that NAAFI was originally denied the necessary quantity and quality of manpower. The fortunes of war, which NAAFI shared with its customers, proved costly . . . the collapse of Norway and France alone put NAAFI £1½ million in the red; 500 NAAFI men and women were killed, and many more wounded or captured. Over 100 were decorated for gallantry. But NAAFI remained solvent, and at the end of the war was able to repay £10½ million lent by the Treasury to finance the wartime service.

The end of the WWII brought no prolonged peace: NAAFI men went back into uniform to serve in Korea, Suez, and today in Anguilla, while civilian staff have seen active service in Malaysia, Cyprus, Kenya, and Aden. But peace, such as it was, brought further problems. From 1945-48 NAAFI customers were reduced by four-fifths – a swingeing cut-back still reflected in the steady run-down in Service strength over the past 20 years. NAAFI's geographical sphere has also shrunk . . . as one country after another became independent, more and more of NAAFI's operations have been confined to the relatively less profitable home territory. To remain viable, the corporation had to invest in improving the scope and standard of its services and in streamlining its own internal organisation. An early sign of NAAFI's pioneering competitive spirit came in 1953, when a shop in

Egypt was turned over to self-service; another landmark was the introduction of NAAFI's own N-Symbol goods. Although by no means the first retail organisation to develop own-label products, the corporation has been consistently successful in this field, with many of the N-symbol lines regularly outselling the previous brand leader – sometimes by as much as six to one!

Intensive study of the market and rationalisation of shop routines has resulted in a pricing policy which often beats the multiple stores even before the deduction of discount or dividend. To the normal supermarket trade, NAAFI has, during the past decade, added many features which the grocery chains have not been able to emulate – deliveries, instalment credit, deposit accounts and mail order. The entitled customer can buy a car and insure it through NAAFI, purchase a life assurance policy, invest in unit trusts, send flowers by Interflora, build up a wardrobe of off-the-peg or bespoke suits, or send a gift parcel to a distant friend. NAAFI also sells petrol, car accessories, books, records and even, in certain places, postage stamps. NAAFI's recognition of the status of the Serviceman today has led to improvements in Servicemen's clubs which make them a far cry from the spartan pre-war canteens. Progress is now being made in the development of the concept of the social club – particularly in the RAF



Contract catering by NAAFI in one of the Messes at RAF Swindon



Above Wartime aircrew call at the NAAFI before an 'op'



Right Typical wartime scene in NAAFI Canteen

Top right Vending machines in modern NAAFI Club at RAF Benson



where the conversion programme is almost complete.

The corporation has also led the way in automated cafeterias, which can offer the Serviceman snacks, beverages, sweets, and cigarettes, 24 hours a day. Automation in other departments has helped to transform NAAFI from a Services' canteen organisation into a large and varied business: the first computer was installed in Germany in 1956, and successive generations of computers are now at work in London, Germany, and Nottingham. Here again, NAAFI led the retail field, and streamlined working methods have introduced increased efficiency in almost every sphere, from distribution of stores to the mundane task of filling shelves in shops. NAAFI's deputy chairman, Sir Charles Hardie, who is on the boards of over a dozen companies, stated quite simply in a newspaper interview: 'NAAFI is the best run business I am connected with, without question.'

The development of NAAFI over its first 50 years has benefited the Serviceman in two ways; not only is he offered a range of goods and services unparalleled in the history of the armed forces, but his use of those services has enabled NAAFI to distribute a total trading surplus of £170 million – an average of over £9,000 per day – over the full fifty year period. In addition to a share in the normal rebate and

NAAFI provides catering services at beach and yacht clubs such as the snack bar at Akrotiri water-ski club



discount allowed on purchases in NAAFI, which amounted to well over £133 million between 1921 and 1970, the RAF also benefits from the extra rebate which NAAFI returns to the Services from profits at the end of each trading year. Since 1967, the RAF Central Fund has received £642,512 from NAAFI extra rebate – amounting to about one-third of the Fund's income.

NAAFI can look back over its first fifty years with a sense of achievement, but this is no time for resting on laurels. 'I see no easy road ahead for NAAFI,' states Sir Humphrey Prideaux, the chairman, in the 50th annual report. 'At home we are caught up in the wage cost explosion which threatens the whole country's economy. The extent of our overseas operations is diminishing. On the other hand, our performance in efficient and imaginative merchandising and in cost control continues steadily to improve; and we are concentrating all our efforts on these essentials. The NAAFI of today owes much to the achievements of earlier generations and the traditions of service which they established; but the modern generation can be proud too of the way in which it has adapted itself to the many changes of the recent past, and I have no doubt that it will acquit itself well in whatever the future may bring.'

©



Wartime NAAFI Mobile in the Western Desert



NAAFI ATS EFI girls on the march during WWII



Spring fashion parade at NAAFI Queensway Club, RAF Rheindahlen, Germany



Hercules C.MK.1
is the RAF's latest military strategic
transport aircraft. It is capable of carrying a
crew of five and 92 troops, 62 paratroops, or
74 casualty stretchers plus two medical
attendants. The Lockheed-Georgia Company
is proud to have manufactured these aircraft
for service with Air Support Command,
and the RAF overseas

LOCKHEED

Lockheed-Georgia Company, Marietta, Georgia, U.S.A.
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Maintenance Command

by Air Marshal J S Rowlands,
GC, OBE, BSc, CEng, FRAeS, AInstP,
Air Officer Commanding-in-Chief,
Maintenance Command

OPERATIONAL UNITS OF THE RAF would quickly come to a standstill without powerful backing in the fields of engineering, supply and administration. Maintenance Command provides much of this support, which must be rapid, dependable and flexible to meet the ever-changing needs of the Operational Commands. This support task is complex because the RAF is a very large organisation, operating a wide range of advanced aircraft and equipment all over the world. To meet it, Maintenance Command keeps in the forefront of advances in technology and logistics management and exploits these techniques to the full . . .



Priority spares leaving a Supply Depot at night on the *Early Bird* delivery service



VULCANS being serviced at an Aircraft Engineering Unit

THE TASK OF MAINTENANCE COMMAND is logistic support and, viewed from any angle, it is big business. For example, each year we service or repair about 800 fixed and rotary wing aircraft and some 15,000 items of electronic equipment. Our aircraft and component servicing capability is the largest of its kind, Service or civilian, in the United Kingdom. The ever-expanding catalogue of equipment supplied by Maintenance Command now lists over 1,000,000 different items, and easily outstrips the combined inventories of all the UK motor manufacturers. The equipment held in our Supply Depots is valued at several hundreds of millions of pounds and occupies more storage space than that of the biggest chain stores group in the country. Administratively, we are responsible for over 70 units, about 10,000 Servicemen and 16,000 civilians at nearly 200 locations in UK alone.

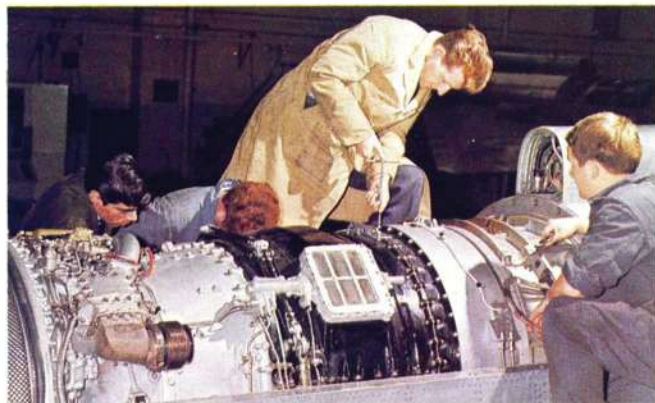
diversified engineering

So much for scale: now a closer look at the Command's engineering activities. The range is great and includes the servicing, repair, reconditioning, modification and salvage of aircraft, components and other equipments, large and small, used by the Royal Air Force. The main engineering commit-

ment naturally concerns aircraft. We carry out all this work on types ranging from large bombers such as the Victor and Vulcan, through transports like the Argosy and Andover, fighters and ground attack aircraft such as the Lightning and Phantom to light machines like the Chipmunk and Beaver. We also work on helicopters, many from the Army and Royal Navy, and even gliders are occasionally dealt with. After servicing, aircraft are flight checked by our test pilots, who are all RAF officers.

The re-painting of RAF aircraft is almost exclusively done in Maintenance Command by experts in modern paints and finishes and their work must be done in a properly heated, dust-free environment. Another important function of the Command is to store and maintain, at various states of readiness, aircraft held in reserve for the flying Units. A further task is the salvage of crashed or damaged aircraft, and their repair as necessary. The Servicemen employed on this duty possess great expertise and they are required to travel widely both at home and overseas.

On the avionic side we service and repair the whole range of airborne electrical instrument and radio components for the Royal Air Force on a direct exchange basis – *ie* we collect unserviceable items and replace them with serviceable ones, rather like the part-exchange schemes operated by the motor



Servicing an engine in a **LIGHTNING**

About the author . . .

Air Marshal J S Rowlands became AOC-in-C Maintenance Command in April 1970. He joined the RAF in 1939 and was awarded the George Cross in 1943. He has filled senior appointments at the Armament Design Establishment (1944), the Royal Aircraft Establishment (1946), the Atomic Weapons Research Establishment (1948 and 1958) and at Stations in Bomber Command. In 1961 he became an Attaché at the British Embassy in Washington as the Representative of the Chief Scientific Advisor, Ministry of Defence. In 1964 he attended the Imperial Defence College, he was the first Assistant Commandant (Engineering) at the RAF College Cranwell (1965), and was the first Director General of Training for the RAF in MoD (1968) before moving to Maintenance Command

PHANTOM engines being tested after installation using a noise attenuator
 manufacturers for car components. Some of the items are of great complexity, and in order to diagnose their faults and repair and test them, we have extensive electronic facilities staffed by large numbers of expert technical personnel. Some items are so delicate and sensitive that they are repaired in 'clean room' conditions by technicians in white coats and hats looking just like surgeons, and indeed the environment has to be controlled every bit as closely as an operating theatre.

There are many other engineering aspects of the work of Maintenance Command that do not normally attract attention — eg we have extremely good manufacturing facilities including a wide range of advanced machine tools, heat treatment plant, and gold, silver and other plating facilities to meet the urgent needs of the Operational Commands. We also manufacture compressed gases in considerable quantities: of especial interest is breathing oxygen, which we produce at an extremely high degree of purity because aircraft of the three Services depend on it. Bomb disposal is a continuing commitment of Maintenance Command entailing the clearance of ranges and explosives areas, and the disposal of dangerous or unserviceable explosives. Some of these items are in a sensitive state and need specialist treatment and the work is often hazardous.

worldwide supply

In the Supply field our task is to receive, store and issue to Units throughout the world equipment ranging from aircraft, weapons, and components to knives and forks. Our Supply Depots handle about 3,000,000 transactions annually, whilst the road transport fleet moves about 150,000 tons each year, covering about 12,000,000 route miles in the process. In addition to our own transport, we make very extensive use of rail, air, sea and civilian road transport services and we also have an overall responsibility for RAF surface movements in this country. The Depots have large and specialist packaging sections which keep abreast of modern techniques, and package equipment of varying sizes, weights and fragility to meet the needs of the different methods of storage and transportation.

Royal Air Force equipment — aircraft, missiles and electronic equipment — is very costly and it is vital that we obtain the maximum value and use from it. If it becomes unserviceable, spares must be supplied quickly in whatever part of the world they are needed. To do this we have a priority system for handling the thousands of demands which pour into the Depots each day, segregating the more urgently required items for delivery by *Early Bird*, a twice daily road delivery service to Units in the United Kingdom or to an airfield for overseas issues. An alert and efficient supply organisation is essential to maintain this high speed response.

Over recent years we have progressively reorganised the equipment storage methods in our Depots. We have regrouped items according to size, weight and frequency of issue so that the small items which generate most of the workload are concentrated in high density storage. This regrouping is a mammoth undertaking involving the physical movement of many millions of individual items, large and small. All this has become practicable only because we now use powerful digital computers, but more of this later; the result is increased efficiency, a saving in the number of men and women needed to run the Depots, and a reduction in the warehouse space required.

No summary of the Supply tasks of the Command would be complete without mentioning two specialised supply responsibilities: Ammunition Supply Depots hold our explosive stocks, including many items in everyday use such as engine starter cartridges, and we also have a large number of Petroleum Supply Depots holding considerable reserves of aviation fuel.



Radio repair workshop at avionic component repair unit ▼



RED ARROWS' GNATS being painted for 1971 season ▲





Fork lift truck operators at a supply depot

Issuing stores from high density storage

Below left
WRAF Electronic Mechanic soldering aircraft electrical connectors

Below right
Training and diagnostic model of Skynet satellite made in Maintenance Command



Maintenance Command has considerable responsibilities in the field of administration; this term embraces the management of personnel, pay, recruiting, discipline, welfare, accounting, infra-structure planning and maintenance, medical and dental services, chaplaincy, catering, education, statistics, physical fitness, pastimes and sports. As well as managing its own engineering and supply Depots which are, incidentally, all commanded by RAF officers, the Command has administrative responsibilities for many other Units including the RAF elements of the Royal Aircraft Establishment at Farnborough and the Aeroplane and Armament Experimental Establishment at Boscombe Down, the RAF Record and Pay Office, the Transient Families Unit, most of the RAF Bands, the Medical Rehabilitation Units, a Unit in Norway and a host of others, not forgetting all the RAF personnel at United States Air Force bases in UK and those serving at the Ministry of Defence and elsewhere in London, Air Attaches and Special Duties List personnel all over the world.

large civilian element

Unlike the Operational Commands, Maintenance Command has a very large civilian element in addition to Servicemen. This civilian force involves administration different from that normally encountered on Service Units. For example, negotiations with Trade Unions and Staff Associations on matters such as work measurement, productivity agreements and working conditions are common features of our day-to-day work.

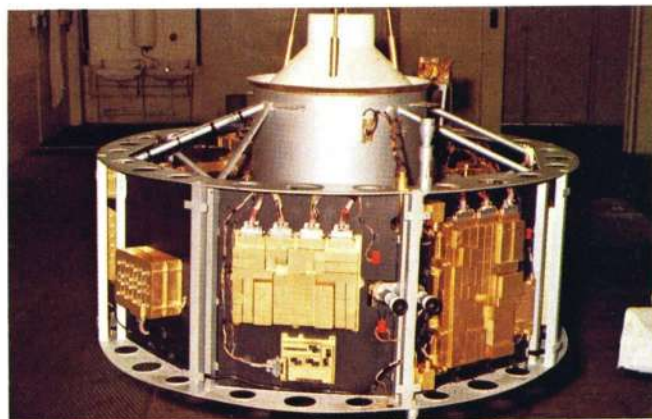
With increasing stringency on the Defence Budget,

money spent on logistic support has a direct effect on the size of the front line. Thus we strive constantly to increase our cost-effectiveness, an over-worked word but truly apposite in this context. Eg we mechanise and automate wherever possible to ensure that our workforce – many of whom are in the higher age bracket – benefit from having the most efficient aids available. In our Supply Depots we use many types of fork-lift trucks, telescopic order pickers, electric trolleys, automatic banding machines, vacuum packers, shrink-wrapping machines and so on, while a wide range of special electrical and mechanical aids is used in our Engineering Units. Before purchasing such appliances we ensure that their cost will be recovered quickly by improved productivity, and to assist us in achieving greater efficiency we employ the services of outside consultants in the Materials Handling field to advise on new methods and techniques.

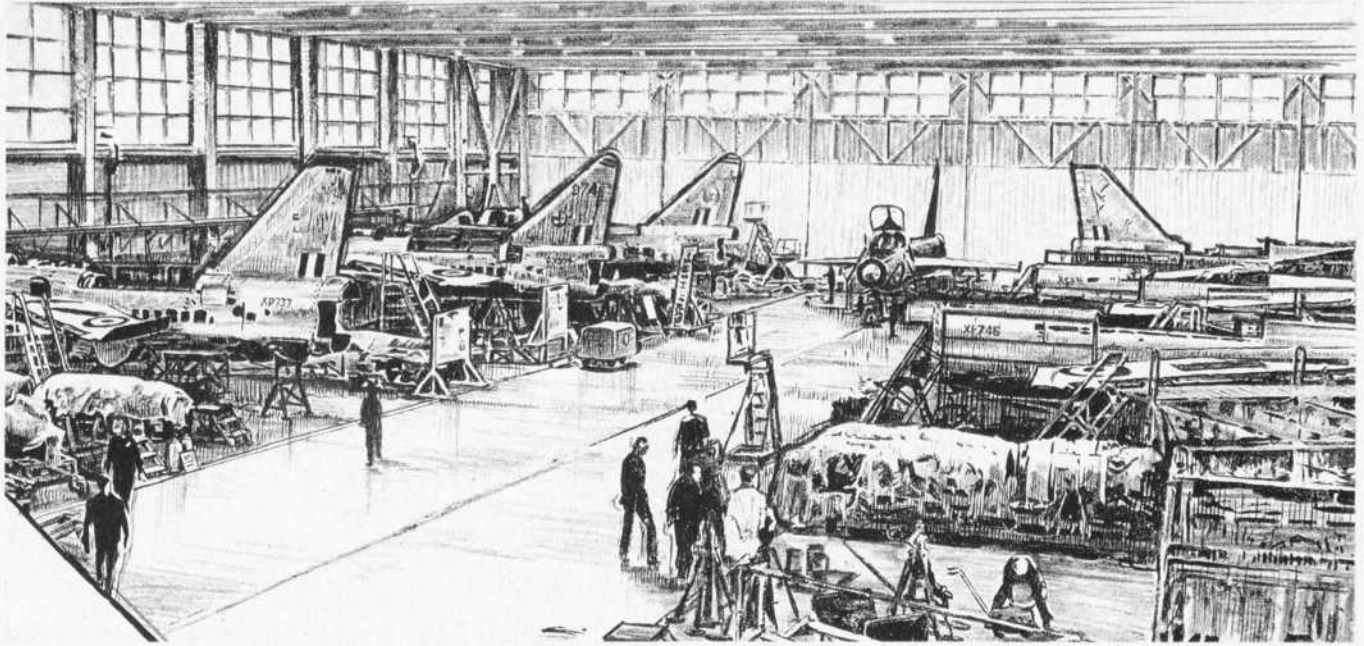
computers

Maintenance Command already has considerable knowledge and experience in the use of computers, and we are rapidly extending their applications. The first major application was in the Supply Depots, in each of which is a large digital computer, and the major regrouping of stocks, mentioned earlier, was made possible only by their use. They have also resulted in easier and more purposeful work in the Depots, a considerable rise in efficiency and a significant fall in manpower.

Computers are also being exploited in the Engineering field. Currently they are used on a bureau basis at three Units



Competition Entry Drawings by W Jackson



as an aid to the planning, progression and control of aircraft servicing and we shall extend this procedure to all appropriate Units. We are also planning the extensive application of computers in the management of the general engineering and manufacturing tasks of the Command, and to the avionic component repair and distribution task. Operational research must of course precede any new application so, in parallel with the extension of the use of Automatic Data Processing (ADP) we are also taking steps to strengthen our operational research capacity. The use of these complementary techniques is rapidly increasing our effectiveness, leading to large financial savings, and also sharpening our management which is already abreast of the best practices in Industry.

efficient management

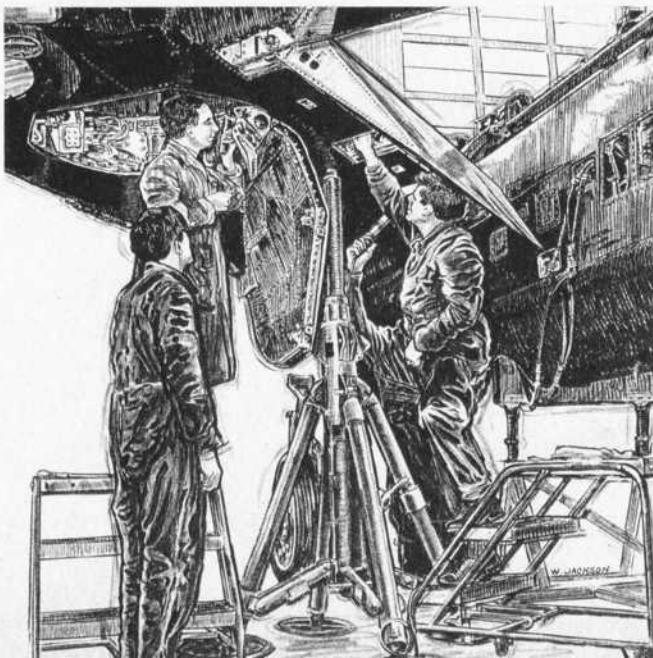
Our aims are constantly to improve methods, reduce costs, and raise productivity, and the use of computers, operational research and mechanisation are means to this end. Another is a productivity scheme for civilian industrial employees which we have agreed with the Trade Unions and which we shall develop over the next year or so. At the same time we are rapidly improving the Management Information Systems within the Command and, where appropriate, these will be linked with computers. A further important contribution to

efficient management is training, which we provide extensively for both Service and civilian managers within the Command at our Management School. We also run four Civilian Schools for Technical apprentices and we make wide use of outside training facilities. Both Service and civilian personnel are employed over the very wide range of trades and skills in the Command and while Servicemen are posted after 2½-6 years, depending on the job, most civilian employees have long and rewarding careers with us, a considerable number having spent more than 25 years in the Command.

a dynamic command

To summarise, Maintenance Command provides the logistic support vital to the operational capability of the Royal Air Force. As a very large business, our aim is to improve efficiency and effectiveness at minimum cost. This strengthens the RAF in two ways, first by improving the quality and responsiveness of the Engineering and Supply support given to the Operational Commands and secondly by releasing funds to help meet the ever-increasing costs of a strong front line. Despite the very considerable advances we have already achieved in the engineering, supply and managerial fields we are not complacent, but are constantly seeking to improve our performance by keeping up-to-date with advances in all these fields and apply them if they promise improvements. Hence the Command is constantly evolving and the pace is quickening as new managerial and other techniques bite.

The motto of the Command is *Service* and that is what we aim to give the Royal Air Force. ©





Skynet spacecraft control station



Planning RAF Communications for the 1980's

by Air Cdre S M Davidson,
CBE, CEng, FIERE,
Director of Signals (Air),
Ministry of Defence



Skynet master communications terminal

YOUR FIRST REACTION to my title may well be:

What? Planning for the 1980s now – in 1971? You must be joking!

No joke! Modern communications equipment is extremely expensive and must be planned for 10-15 years of service life. Furthermore, system planning, equipment development and production, and finally installation and proving can take five years or more. So current planning will determine the systems to which the RAF will be committed for most of the 1980s. . . .

Accepting these arguments, you might then ask:

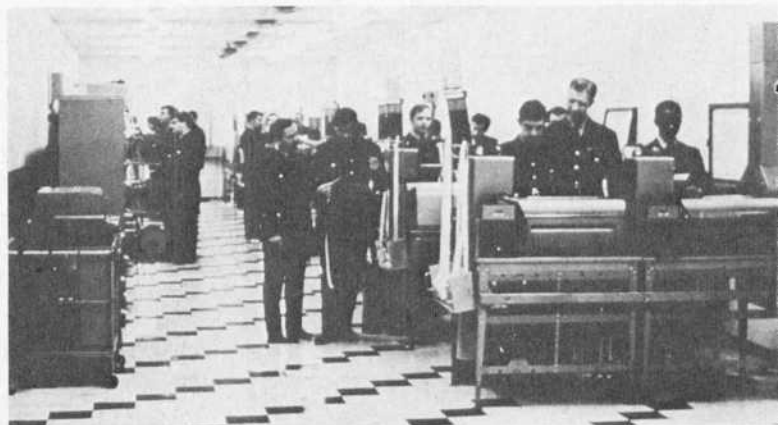
What is so very special about Communications in the RAF?

Vital! They are the **Reins of Command and Control**. Moreover, they involve the exploitation of an extremely interesting area of electronic technology, in which the pressure of new ideas and better methods is a constant challenge to the planner . . .

About the author . . .

Air Cdre Davidson trained initially at No 1 Electrical and Wireless School at Cranwell in 39 and flew throughout the war in Coastal Cd flying boat Sqns. He then served in air staff and aircrew instructor posts as a Signals/Radar leader until 1949. Transferred to Tech (Sigs) branch in 1950 after further engineering training at RAF Technical College, he has since held a wide range of signals and electrical engineer staff appointments at Home and in the Middle East, on the Directing Staff of RAF Staff College Bracknell and at No 1 Radio School Locking as Assist Commandant. Chairman of the Joint Signal Board (ME), Aden (66), and Command Electrical Engineer NEAF (67/68), the Air Cdre is a graduate of RAF Staff, Joint Services Staff, and Imperial Defence Colleges

Main traffic hall at relay station



PERHAPS AT THE OUTSET I SHOULD EXPLAIN THE term *reins of command and control*. In the past, communications problems made it virtually essential for most operational commanders to be left to get on with the job in accordance with broad directives from higher authority. But today's world power line-up and weapons are such that the detailed conduct of war—limited or otherwise—is so much more a matter of politics that closer Governmental control is inevitable. Communications technology can now, at a price, provide the means of exercising this central control. What is true of strategic communications—*ie* links between MoD and overseas theatre HQ—is also largely true of communications from theatre HQ to front line operational units. Some modern weapons are not things to be used lightly by those up front and mobility demands good control communications; it is also essential that nuclear strike aircraft can be recalled or redirected if need be. Thus communications—always important in national defence—are now vital and these reins of command and control must be of higher quality and reliability than ever before.

strategic communications

The three Services' long range strategic communications systems were amalgamated into one world-wide network of relays and linking circuits for economy in 1966, known as the Defence Communications Network (DCN), mostly manned and managed by the RAF. At present, multi-channel HF radio circuits carry the bulk of the traffic by slow-speed telegraphic means between UK and the main relay centres overseas. Three of these use first-generation automatic switching devices but the rest are manually operated, and there are some special RAF voice channels on the radio links. The system is fast enough for most current needs, extremely reliable and being mainly manual in operation, provides the flexibility that no fully automatic system could do at reasonable cost today. And it is a large, busy network, with some 220 primary channels which in 1969 handled rather more than 35,500,000 messages. Of these only 647 were lost or mishandled—an error rate of only 1 in 54,711 or 0.0018%.

To this HF radio network we have recently added the UK defence satellite communications facility, Skynet 1, the first operational military satellite communications system in the world, now undergoing final trials and work-up. The RAF is responsible for its overall management, including command and control of the satellites and the operation and maintenance of all the fixed earth stations. The RN operate the shipborne satellite terminals and the Army the mobile earth stations provided for contingencies. The RAF fixed Skynet earth stations in UK, Cyprus, Gan, Bahrain and Singapore will be systematically integrated with the HF radio traffic system during 1971 to provide improved speech trunks and medium speed data channels as well as improved flexibility in clearing telegraph messages. The advent of shipborne and mobile satellite terminals will provide the means of high quality direct communications between distant contingency operation areas and MoD in London.

The cornerstone of our development plans in strategic communications for the 1980s is to exploit the merits of the composite HF radio plus satellite systems to best advantage. Thus we aim to phase out all our outdated HF transmitters and receivers which demand so much manual attention, by introducing modern self-tuning high stability replacements. Similarly on the satellite side, we intend to replace the Skynet 1 satellites as their useful life expires, with Skynet 2 uprated versions, and have longer term plans in hand for the subsequent replacement of these. Skynet earth stations will be modernised to ensure their continuing compatibility with the successive space segments and be redeployed to serve Hong Kong and Malta also.

But apart from this evolutionary development, the relay stations of the network will see major changes for the 1980s. These relays are now mostly manually operated but skilled manpower is costly and hard to find. Hence we plan to employ computer directed message switching systems to the maximum extent possible without loss of the operational flexibility essential to any military communication system and, most important, without demanding an excessive share of very limited future defence budgets. We also plan to raise signalling speeds to cope with the steadily increasing demand for data transmission to serve various computers. And finally, we have completed plans to meet the full need for high grade direct speech communication between UK and all overseas bases and staging posts.

WRAF teleprinter operators preparing messages for transmission

Even if they don't improve on that 0.0018% loss rate, the RAF communicators working in DCN in the 1980s will ease the burden of those responsible for long range command and control of the three Services by moving their orders, instructions and management data faster and in keeping with the demands of computers which will then be one of the basic tools of higher management.

ground/air communications

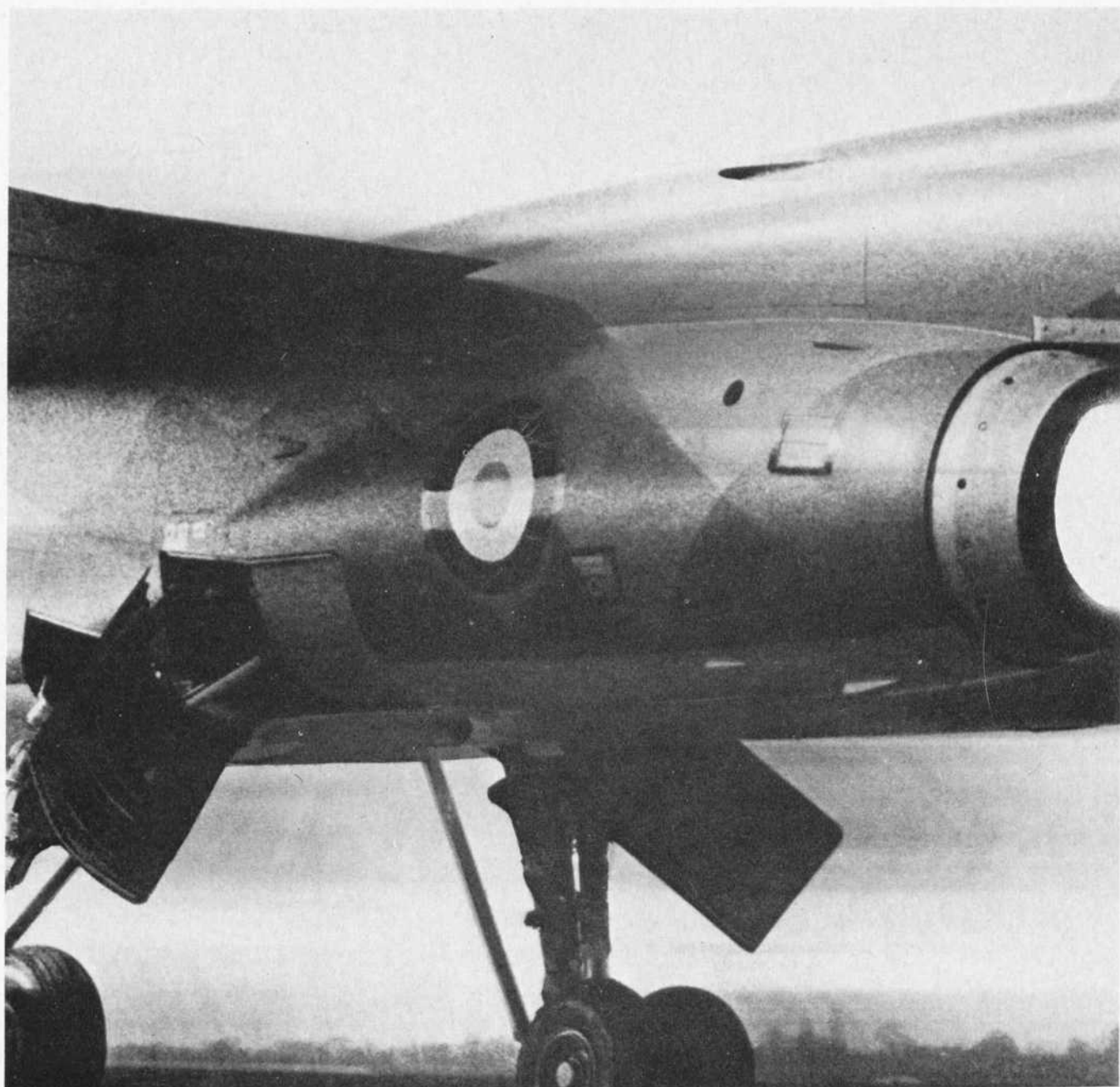
Communications between ground control and RAF aircraft should show little fundamental change in the short-range air traffic control sector, but much new thinking has been necessary to adjust communications to the long range aircraft control needs of the 1980s, and we do not at present see satellites as the answer to this problem. Whilst a satellite system would clearly be technically feasible by the 1980s for control of some aircraft, the complexity and cost of a world-wide all-RAF-aircraft multiple access system is at present considered unacceptable. So our forward planning in this area is once again mainly in the HF radio band. Already the traditional hand-speed morse code system has faded well into the background, and single sideband voice is now used for all transports and most other large, modern operational aircraft. Voice communication will continue as the primary mode for long range aircraft control but will be supplanted or supported in some cases by the radio teletype method of working.

But the major change in ground/air communications thinking concerns the organisational arrangements for the future. In UK in the past, the RAF has been functionally organised into (*eg*) Bomber, Fighter and Coastal Commands, each with its own ground/air system. Now that multi-role Operational Commands are the vogue and, later in the 1970s, the RAF is to assume greater responsibility for Naval support, we have been forced to rethink our long range ground/air communications philosophy. The common, wide area over which RAF aircraft of all roles must now operate, the need to ensure that ships can signal the RAF for air support and then talk to the aircraft concerned, all at a price we can afford to pay, are the three main factors we have had to consider in this context.

Thus we plan for the future an integrated UK ground/air HF radio system for all Operational Commands, based on two widely separated transmitter sites and two similarly separated receiver sites all equipped with a generous scale of the most modern autotuned HF equipment. The four sites will be connected to a central control point where all channels can be monitored and the necessary services plugged through in telephone exchange style to the ops room control points needed for the operations in hand. Since all ops centres committed to control air operations or exercises will be tied into the central communications control point, any one or more will have access to and use whatever range of ground/air channels is appropriate to their role at any time. The new single-point management arrangement will ensure efficient technical control of the resources and provide all ops rooms with a much wider scale of air/ground HF radio cover than could possibly be offered by separate penny-packet provisioning. And the wide separation of transmit and receive stations will provide all users with the space

Article concluded on page 28





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flying the jaguar

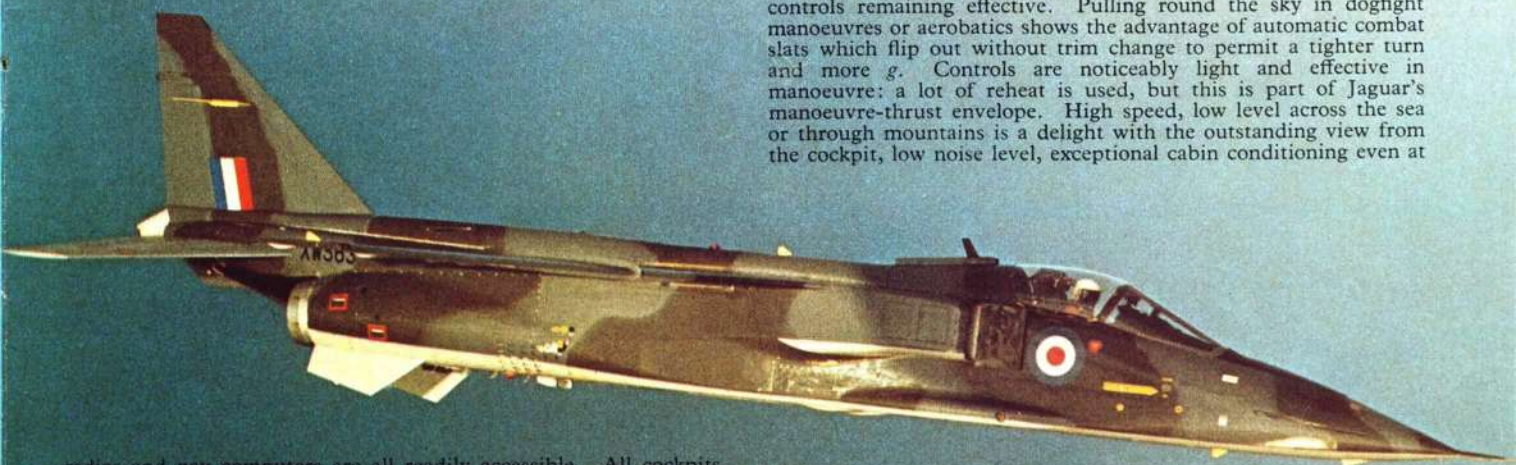
Competition Entry by Flt Lt J J Lee

Jeremy Lee, first RAF test pilot to evaluate the British Jaguar for MAS is seen here in the cockpit at Warton



JAGUAR'S DRAMATIC AND ARTISTIC SHAPE arouses a pilot's curiosity, a closer look revealing high quality flush-riveting, panel engineering and beautifully arranged hydraulic plumbing, fuel lines and control rods. High speed thin wings, full span trailing edge flaps and leading edge slats mark it as a supersonic STOL machine; high wings and large hinging access panels are designed for quick servicing and arming-up; engines, ammo trays,

temptation to do so before radar clearance must be held in check!) with no sensation at all as the Machmeter kicks through Mach 1. Pitch and roll control remain light and sweet in supersonic manoeuvre and plenty of *g* pulled even while returning subsonic. Low speed handling shows how a STOL-capable, thin-winged aircraft behaves . . . reduce speed to the stall, cross-checking incidence on the strip indicator alongside the head-up display, aircraft clean or wheels and flaps down, when speed will be under 120 kts, before wing-rocking precedes the stall itself, with all flying controls remaining effective. Pulling round the sky in dogfight manoeuvres or aerobatics shows the advantage of automatic combat slats which flip out without trim change to permit a tighter turn and more *g*. Controls are noticeably light and effective in manoeuvre: a lot of reheat is used, but this is part of Jaguar's manoeuvre-thrust envelope. High speed, low level across the sea or through mountains is a delight with the outstanding view from the cockpit, low noise level, exceptional cabin conditioning even at



radios and nav computers are all readily accessible. All cockpits are similar, but this one has more room than any modern European fighter. The pre-start checks done, one can start-up the third turbo-jet known as the 'air generator' (*micro-turbo* in French), which must reach steady RPM before initiating starting cycles on the two RR/Turbomeca Adours. Once these are running, the air generator is switched off, and after routine control checks, she is ready to taxi, made particularly easy by nose-wheel steering selected electrically on the stick; the ride over even roughcast surfaces is extremely smooth and reminds one that Jaguar is designed for STOL from semi-prepared strips. The view through the large canopy and low-silled windscreen is exceptional; carefully positioned rear view mirrors on the canopy arches supplement rearward view, so that there is little excuse for a bogie creeping into one's six o'clock!

Line-up on the runway, check the engine to full thrust on the brakes, then release and push the throttles up to max re-heat . . . acceleration is impressive, the nose-wheel lifted off at 120 kts, and one is airborne at 155 and cleaning up undercarriage and flaps quickly as the aircraft rapidly reaches climbing speed. A very few mins later one is level at 35,000 ft, just about to go supersonic (the

high sustained speeds and very low fuel consumption, ideal for long, low level missions. When the full nav/attack system is fitted and the head-up display complete, Jaguar will really come into its own in the strike and close support role.

Return to the circuit for a short landing; running in for the break at 350-400 kts, turning down-wind selecting airbrakes out, lowering wheels, retracting airbrakes and then dropping full flap reduces speed gradually to 160 kts in the finals turn. Set up datum incidence on finals, adjust power for the desired rate of descent, and Jaguar floats down like a mallard to its flight pond: the round-out is gentle as she cushions herself in ground effect before touchdown. Throttles to idle, stream the tail parachute, apply the brakes, and be glad that your straps are tight, for in 600 yds she will be stationary. The circuit pattern is very easy to set up at datum approach speed without detracting from the manoeuvrability requirements of a combat fighter, and this could certainly be the easiest STOL aircraft in the world to handle round the circuit. ©

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- 1 OAKHANGER—United Kingdom
- 2 CYPRUS—Middle East
- 3 BAHREIN—Gulf
- 4 SINGAPORE—Far East
- 5 GAN—Indian Ocean
- 6 MOBILE STATION—Germany
- 7 MOBILE STATION—N Africa



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diversity essential to achieve full cover of the very extensive operational areas both over land and sea likely to be involved in future diverse-role air operations from fixed bases.

In this context, the UK base is the most difficult communications problem, since HF radio propagation conditions over the northern sea areas have always been difficult to harness to reliable military use. This new ground/air approach is also planned for use at all overseas base areas where multi-role air operations or exercises are anticipated, and our mobile equipment inventory will include similar cover for the varied needs of contingency operations.

tactical communications

Next we must look at the tactical point-to-point communications problem of the home base—*ie* the problem of providing communications between principle operations centres, role operations rooms and operational Stations. The main factors here are the recent changes in organisational structure mentioned earlier *re* ground/air, and the pressing need to provide operational commanders and controllers with the data they need continuously in a more manageable form and at lower cost. Searching analytical enquiry has recently proved that all RAF ops centres and role ops rooms in UK need very similar data, and many of them need the same data from many sources and concerning many places. *Eg* airfield state reports and Met information on many specific primary and diversion airfields can be needed by several different role ops rooms; and aircraft serviceability data and generation rate information can be needed by both the main ops centre and the role ops room. Transmission of this multi-customer data in an unco-ordinated manner is costly in communications equipment, and manual handling is far too slow for modern operational needs; also, the continuous assimilation and manual display of such data on tote boards and the like, demands too large a share of space and manpower resources which will be even more scarce and costly in the 1980s than now.

Thus our thoughts are now occupied with ways and means of continuously gathering in all this basic operational data, routing each bit of it automatically to those ops centres and role ops rooms that need it, and processing it there to suit local needs or for automatic display in a manner acceptable to the specialist users at each location. The planners' crystal ball here is still somewhat cloudy. System feasibility studies have shown promising possibilities and more detailed follow-up engineering studies are now in hand. Once again the ubiquitous computer or computer-directed switch can be seen as the key to the solution, but linking communications by line, radio relay or even tropospheric scatter methods, all operating to a much higher performance standard than of late, will clearly be required. No firm decisions on these tactical communication system specifications can be taken until the detailed control arrangements to match recent Command decisions for the forces involved are settled, but clearly there is fascinating work to be done during 1971 by our communications planners and system designers. Tactical communications for the RAF in overseas theatres are much less complex than in UK; roles are often less complex and force levels are lower. But the same problems remain and the UK base solution is certain to influence overseas tactical communications provisioning.

communications manpower

All these changes in RAF communications will call for changes in the balance and skills of our signals tradesmen. Fewer men should be needed overall but their level of skills must be higher; fewer mechanics and perhaps more fitters on the maintenance side; fewer routine operating jobs but greater scope for more supervisory work and problem-solving by traffic specialists who will have to deal with the messages that defeat the computer switches in the strategic network and who will set up, switch and monitor in a quality control sense the calls and traffic on the new integrated ground/air system. In short, RAF communications systems for the 1980s will demand of the men involved—operators and engineers—a wider and deeper involvement in the system as a whole; and this can only mean even greater job satisfaction for all concerned. ©

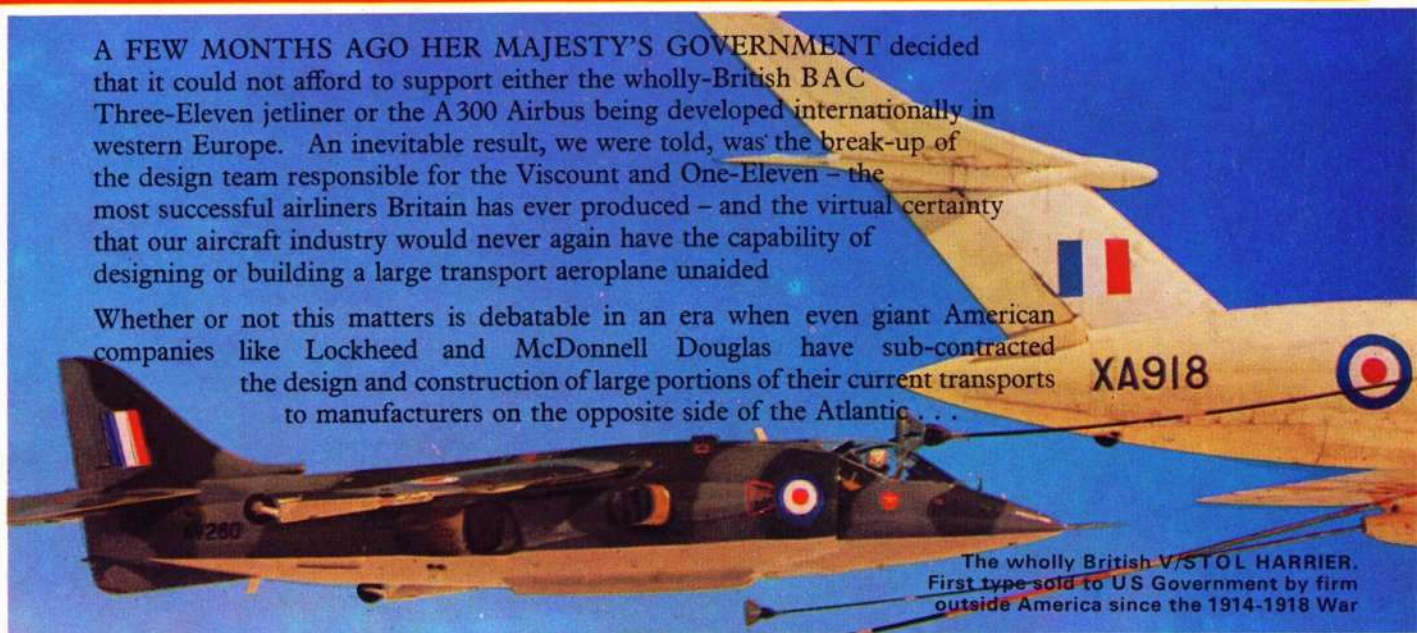


The RAF and the Industry

by John W R Taylor,
Leading Aviation Journalist,
and Editor of Jane's

A FEW MONTHS AGO HER MAJESTY'S GOVERNMENT decided that it could not afford to support either the wholly-British BAC Three-Eleven jetliner or the A300 Airbus being developed internationally in western Europe. An inevitable result, we were told, was the break-up of the design team responsible for the Viscount and One-Eleven – the most successful airliners Britain has ever produced – and the virtual certainty that our aircraft industry would never again have the capability of designing or building a large transport aeroplane unaided

Whether or not this matters is debatable in an era when even giant American companies like Lockheed and McDonnell Douglas have sub-contracted the design and construction of large portions of their current transports to manufacturers on the opposite side of the Atlantic...



The wholly British V/STOL HARRIER. First type sold to US Government by firm outside America since the 1914-1918 War

About the author...

John Taylor is a regular contributor to the Souvenir Book, renowned for his outspoken and independent views. Here, however, he writes in praise of our Aircraft Industry and the Royal Air Force as partners and pleads for realistic and continuing Government support for our universally acknowledged military aircraft design teams and constructors, on both sound defence and economic grounds. One of our most prolific and distinguished aviation writers, with nearly 150 published books, John Taylor also edits *Jane's All the World's Aircraft* and the periodical *Air BP*. In 1959 he won the Robertson Trophy for his *History of the Central Flying School*. Before going freelance, he was a member of Sydney Camm's design team at Hawker and for eight years technical publicity officer for Fairey Aviation

STRIKEMASTER – successful derivative of Jet Provost Trainer, sells extensively abroad for Strike, Ground Attack, weapons and jet flying training on sheer merit. Variety of stores illustrates CAS's point about multi-role capabilities of modern aircraft (pp 7/8)



FAR MORE SERIOUS is the persistent refusal of support and contracts for Britain's military aircraft builders in the past decade. Even a cursory glance at history and export statistics will show that these are the people who have always been primarily responsible for the solvency and prestige of our aircraft industry. The Hawker company,

squadrons have had to equip with Phantom fighters – a type first flown in 1958 and costing hundreds of millions of precious dollars – and can look forward only to Jaguars and MRCA's (Multi-Role Combat Aircraft) evolved in partnership with France, Germany and Italy and, inevitably, a compromise rather than *precisely* what the RAF would have specified if the requirements of other nations need not be considered. This does not imply criticism of Jaguar and MRCA, which promise to be highly efficient and valuable aircraft. It is the policy of

NIMROD maritime reconnaissance aircraft is only other wholly British aircraft in current RAF operational service – and like the Harrier, unrivalled in its class –
John Young painting



for example, supplied combat types to air forces all over the world in the 20s and 30s. In 1971, this same manufacturer became the first outside America to sell an operational combat aircraft to the US Government since the 14-18 War.

The aircraft is, of course, the V/STOL Harrier, which has been adopted by the US Marine Corps. At the hand-over ceremony of the first AV-8A Harrier, General Homer Hill, USMC, described it as 'a marvellous aeroplane, a very big milestone in aviation, which in the years ahead will have a very wide application in your country and mine. . . . It is, he added 'the answer to a US Marine Corps dream, representing a new dimension in air and sea power.' In contrast, how often have modern commercial aeroplanes been the answer to anyone's dream? More often they are nightmares to airlines that have to buy and fill them, airports that have to handle them, and air traffic control systems that have to cope with ever-higher performance and ever-more-thirsty engines that cannot be kept waiting in the crowded approaches to major terminals.

Confronted with the facts, HM Government might be expected to encourage our military design teams to the limit. Instead, taking the Harrier as an example, only 77 single-

equipping the RAF in this way, rather than the merits of individual 'pieces of ironmongery' that must be examined closely.

Before WWI it was considered by the British Government that the aircraft needed by the newly-formed RFC should be designed, developed and, so far as possible, built in the state-run Royal Aircraft Factory at Farnborough. Even if we overlook the fact that this led to the RFC's being equipped with the unfortunate BE2 'Fokker fodder' of 1915-16, it never worked as a policy. To meet wartime demands 'Factory'-designed aircraft had to be manufactured by private companies. To fill the gaps and give RFC pilots something to fly while home production was getting organised, we had to shop overseas. France was the only nation with a well-established aircraft industry, manufacturing good aeroplanes. Consequently, when the RFC and RNAS flew to the Continent in August 1914, on the outbreak of war, 22 of their 73 aircraft were wholly French and every one had an engine of French manufacture. Not until April 1918 did the British air services cease to fly aeroplanes built in France!

The lesson was not forgotten. During the years between the wars, the Royal Air Force (born by a merger of the RFC and RNAS in April 1918) was supplied with the 'custom-built' products of Britain's privately-owned industry, while 'Farnborough' became a world-renowned research centre, supporting and inspiring the companies which built the aeroplanes, aero-engines and equipment. When times were



CONCORDE would provide RAF transport crews with Mach 2 experience on large aircraft and also recoup some of the outlay

seaters have been ordered for the RAF. Work on a more advanced, supersonic version designated P1154 was cancelled by Mr Wilson's Government as an economy measure in 1964, simultaneously with the HS 681 STOL transport and a few months before the TSR2 tactical strike/reconnaissance aircraft. The swing-wing strike aircraft that British companies were to produce in partnership with French concerns survived on paper for a few years. The more elaborate swing-wing F-111K that was to be purchased from the USA was cancelled as a further economy measure. So, apart from the Harrier and the Nimrod maritime reconnaissance aircraft, each designed in the UK and unrivalled in its class, the RAF's combat

hard financially, these companies kept alive by selling their products overseas and manufacturing everything from motor-cycles to milk churns. So, when the need for urgent expansion of our armed forces arose in the mid-30s, to combat the threat of the reborn *Luftwaffe*, the industry had the finest combat aircraft in the world ready for mass-production. It was fortunate indeed that the Government of the time did not pronounce – in the manner of its counterparts of the 50s and 60s – that the RAF could not have Spitfires, Hurricanes and Wellingtons unless these types were ordered also by Australia, or Italy, or Germany, to spread the cost. The production orders had, however, come almost too late.

Knowing that British companies would not be able to deliver all the new combat machines needed for the inevitable war against Hitler, HM Government had to go shopping overseas once again. There was no point in trying to buy from France, where nationalisation of the industry in 36 had reduced the production of thoroughly-modern combat aircraft to a trickle. So, large orders were placed in the USA. Some of the types purchased, like the Harvard trainer and maritime reconnaissance Hudson, were to give superb service. Others, such as the Mustang, were to evolve into great aircraft after initial disappointment. But the shortage of British fighters and bombers led to frustration and disaster when pilots flying American-built Buffalos had to engage Japanese Zeros, and when the home-based RAF tried to operate Airacobras and the first Fortresses over enemy-occupied Europe. Many fine combat types of American design did serve with the British air forces during and after WWII, but experience has shown repeatedly that our own designers are second to none in the world for capability, imagination and flair for producing the right types at the right time, and in a form that can be manufactured economically.

That is the first and most important reason why the RAF should always be equipped with combat aircraft of British design. There is not the slightest reason why training and transport types should not be bought overseas if it would save money; although the success of the BAC Jet Provost/Strike-master family in the export market emphasises that the effort and cost involved in developing aircraft of this kind can be offset by what they earn by their quality. That quality has stood the test of time. Once the decision had been taken to buy the products of private manufacturers in WWI, it was only a matter of months before the RFC and RNAS began receiving machines such as the Sopwith Pup and Triplane, the DH2 fighter and DH4 bomber, followed by the Sopwith Camel (the most successful fighter of the war) and the big Handley Page O/100 and O/400 which pioneered the whole concept of strategic night bombing.

Between the wars, British industry built and RAF pilots flew the Supermarine seaplanes which gained the coveted Schneider Trophy for Britain and raised the world speed record above 400 mph for the first time. The same Industry/Service team set height records and long-distance records; helped to establish the first Empire air routes for Imperial Airways to follow across the deserts of the Middle East; and, by the use of air control techniques, brought peace to areas that had been traditional trouble-spots throughout history, at little cost in lives or money. The Hawker Hurricane, in 1940, became the first fighter to exceed the Camel's record of 1,294 enemy aircraft destroyed in air combat. The Lancaster bomber was the only aircraft that carried and dropped 10-ton bombs, the Meteor the only Allied jet aircraft used in action in the second World War. Afterwards, another RAF Meteor put the world speed record above 600 mph for the first time, underlining a British leadership in jet-age technology that has given us the Harrier today.

A second reason for buying British is a function of political and military common-sense. With Hitler in control of France in the Summer of 1940, it would have been embarrassing if all Spitfire wings and Hurricane tail units had had to come from



The brilliant low-level TSR-2 - cancelled

PIONEERING BETWEEN THE WARS



VIMY landing at Heliopolis on the Cairo-Baghdad pioneer airmail run a Service/Industry lead to the world-wide Imperial Airways network of civil routes



S6 Schneider Trophy Winner



SOPWITH CAMEL, designed by private industry, was the most successful fighter of WWI

the Continent under a joint production programme. Nowadays, the withholding of essential components does not even depend on direct military action. Much of Indonesia's Soviet-supplied air power has been grounded in recent years through the non-supply of spares, as the result of a suspected change of political bias in the Republic. Israel has been denied 50 Mirage fighters ordered in France, although the aircraft's cost has been paid in full. For political reasons, too, S Africa was refused a replacement for one of the 16 Buccaneers it bought from Britain when the aircraft was lost on its delivery flight. At the time of the Suez campaign of 1956, the USA made clear its opposition to the British and French policy of defending what these nations considered to be their own property. Can any great nation (and the writer opposes strongly any suggestion that Britain is no longer great) accept a situation in which its first line of defence might be rendered ineffective overnight because the country from which it purchased arms did not approve of a decision made by its responsible leaders?

Britain's role in this century has been primarily as a

HARRIER: supersonic derivative P1154 was cancelled in 1964, together with HS681 STOL transport, which reduces effectiveness of operational V/STOL types
- John Young drawing





HURRICANE WWII production line



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HURRICANE, first fighter to beat Camel's record of 1,294 kills



METEOR, only Allied WWII jet, & 1st aircraft to exceed 600 mph

BETWEEN THE WARS, British Industry built and RAF pilots flew machines which provided fine wartime combat aircraft

restorer of peace and champion of liberty – high-sounding words, perhaps even a little archaic and fashionably rejected in an age of student enlightenment and protest – but nonetheless true. No nation is perfect, but some are a lot better than others, and it is worthwhile maintaining the capability of doing what one considers to be morally right, whatever the cost. Aerospace power is the means by which nations exercise that capability in an imperfect world. Nobody is expected to like intercontinental ballistic missiles, Polaris submarines or missile-carrying combat aircraft; but the alternative to the deterrent 'peace through fear' is even less attractive. The big, almost insurmountable, problem is how to provide an effective defence without bankrupting ourselves.

As a start, painful though it is, Britain must face up to the fact that it has always made money from military aircraft rather than airliners, and should continue to do so. This does not mean that our aircraft industry cannot meet the needs of other, limited markets, like that for feeder-liners in the class of the Britten-Norman Islander, or even do quite well with larger types like the HS 748 and BAC One-Eleven. But it is hardly practicable any longer to try to compete with large American civil transports such as the Boeing 747, McDonnell Douglas DC-10 and Lockheed TriStar. The resources of our aircraft industry are far better devoted to those sectors of design and manufacture where ingenuity and skill earn bigger rewards than sheer size.

For better or worse the somewhat-smaller Concorde is a fact, and a very expensive one. We must hope that it will be accepted internationally for commercial service, despite the environmental problems. In any case, as the aircraft has been

TODAY AND TOMORROW, aircraft like Harrier, Jaguar and MRCA should prove a match for Soviet types, given suitable equipments

DOUGLASS 1967 prototype 'jump-jet' but revealing Soviet interest



HARRIER production line



MULTI-ROLE COMBAT AIRCRAFT

HARRIER in USMC livery



brought to a practical stage, at such cost, it would seem sensible to recoup some of the outlay by adapting it for military use. There are tasks for which a small number of Air Support Command Concorde transports would be valuable, even in the light of Britain's diminishing international commitments. They would provide RAF aircrews with experience of flying large aircraft for long distances at twice the speed of sound, and so act as a stepping stone between the aircraft of today and the really high-speed machines that will perform future transport roles and, probably, restore the deterrent from its present, rather stupid place under the sea to its rightful location in the skies. For tactical combat the RAF is to have the MRCA and Jaguar, which promise to be at least as good as their counterparts in the US and Soviet air forces. Here, the problem does not lie in superior aircraft, but in evolving new equipment or devices to enhance the aircrafts' capability.

In brief, there is currently no aircraft in the world that could be certain of hitting enemy land forces at night or in bad weather if they were in contact with friendly forces. This is a crucial chink in the armour of all military powers. The Russians have already demonstrated their ability to deploy large and superbly equipped land forces quickly and efficiently at night, when they invaded Czechoslovakia in 1968. Had this led to a head-on clash with NATO troops, under cover of darkness, the western air forces would have been powerless in the immediate combat area. Jaguar and MRCA will be able to utilise the latest equipment to offset this deficiency. One device is a laser weapon-sight which enables a strike aircraft to home on signals 'bounced' off a target their pilots cannot see, by a forward air controller on the ground. Other sophisticated electronic, optical and infra-red target detectors are under evaluation, from aircraft as diverse as the USAF's B-52 bomber and the US Army's AH-1G HueyCobra attack helicopter. When the problem is solved eventually, MRCA and Jaguar should both offer satisfactory tactical strike capability for the 70s and early 80s – provided MRCA succeeds in becoming the first entirely satisfactory swing-wing design, apart from the Soviet Air Force's MiG known to NATO as 'Flogger'.

Nonetheless, the economic advantages of further Anglo-French and Anglo-German collaborative ventures must be weighed carefully against the potential political hazards before the Jaguar and MRCA patterns are repeated. The Harrier has shown that Britain can still 'go it alone' on a revolutionary new concept and, in doing so, earn rich rewards, financially as well as militarily. America has not begun to rival British pioneering in this field, and although we can expect to see Soviet attempts to evolve an operational tactical 'jump-jet' soon – for the simple reason that such an aircraft offers immense advantages in dispersal and hit-and-run strike operations over a small area – the RAF is already building up a wealth of operational experience in partnership with our aircraft industry. We shall see a lot more of the 'jump-jet' in the years ahead. General Homer Hill called it 'a new dimension in air and sea power', and the Royal Navy must be thinking seriously of the future potential of operating Harrier-type anti-submarine and strike aircraft from a wide variety of conventional and hydrofoil ships. The weapon-carrying capability and range of the Harrier grows in step with every increase in output from the remarkable Pegasus vectored-thrust engine which powers the aircraft. 8,000 lb of bombs and rockets has already been carried by the AV-8A version and all kinds of exciting possibilities lie ahead.

Thus, for more than half a century, the RAF and the British aircraft industry have proved that, working together, they can match and often beat the best that anyone else can put into the sky. More than once this has been good enough to save Britain from defeat only because political tardiness and economic restrictions have been offset by luck or by the grace of God, depending on one's beliefs. Luck does not make a reliable third partner in this particular game.

If you like working in a team, you'll like the RAF, because that's how *we* work. There are vacancies *now*—for men, women and apprentices—and there's a first class trade training for everyone.

As an Apprentice you could take a two-year full time course in aircraft or electronic engineering. You'd qualify as a Fitter, with a fine future

ahead. Or there are one-year courses in administration and supply. It's a big opportunity to start life with a good trade. Age limits 15½—17½.

As an adult you could join any time from 17 onwards. Communications is among the trades available: you could learn to operate a teleprinter or radio—sending and receiving messages over the RAF's world-

wide communications network.

Call at your nearest RAF Careers Office (address in phone book) and find out more. Ask about the new pay scales (after 12 months at least £21.35 a week for men, £18.55 for women). Then take home two free books to read. Or get them by posting the coupon.

Join the keep-'em-flying team.



There's a place for you

To: **RAF Careers, (98Z HV1), Government Buildings, London Road, Stanmore, Middlesex HA7 4PZ**, I like the idea of training for a trade and working in a team.

Please send me my free books:

"Into the 70's with the RAF" plus "The New Men" ☐ or "Smart Girl" ☐
or "RAF Apprentice" ☐ (please tick whichever applies to you).

Name (Mr. Mrs. or Miss).....

Address.....

..... Date of birth.....

Royal Air Force



a delightful garden setting. Sussexdown, near Storrington is the Royal Air Forces Association's home for the permanently disabled. It also has limited accommodation for convalescents



It's a great comfort



Above The Tamar lounge and television room at Sussexdown
Below The main lounge for convalescents at Sussexdown



FEW OF OUR READERS will not have heard of the Royal Air Forces Association... which is no cause for wonder since it is the largest Service and ex-Service Association of its kind in the Commonwealth. Even so, many people have but a hazy idea of the kind of work it is quietly doing in the interests of serving and ex-Service people, or the enormous scope of its activities.

It maintains with ample justification that no one who has served with the Royal Air Forces will come to the Association, when in need of help, without everything possible being done to ensure that his (or her) difficulties, whatever they may be, are resolved. These services are designed to deal with every type of problem which is likely to be encountered in everyday life and are available to all who have served with the Royal Air Forces and their dependents: it does not matter whether or not they are members of the Association.

To those in the Service, and more particularly perhaps to those who are leaving the regular Service for the very different conditions of civilian life, the availability of a very comprehensive 'bureau', coupled with practical help where it is required, is of the utmost value. Legal matters and the '1,001' other problems of so diverse a nature that it is impossible to list them... but which beset people in the rat-race of ordinary life, are all part and parcel of the matters dealt with by the Association's welfare service.

The problems of unemployment are another facet, as is the very informed advice and help which is available to those wishing to emigrate or, in reverse, to come into Great Britain. Many pensions - particularly war and disability pensions - are dealt with every year, some quite simple but some of considerable complexity requiring the most expert advice and attention.

The Association fulfils two very important roles, and although through constant use (and often mis-use) the words have become almost trite, they

still express very far-reaching and very necessary ideals: first and foremost the preservation of that inexplicable but very real thing called 'comradeship' which is so valuable a part of Service life (often unrealised whilst you are in it and so much missed when you leave it); and secondly the expression of the feeling of what has been described as 'togetherness' by helping in every way possible 'the other chap'... and the omnibus word for this is 'welfare'.

A membership of over 100,000 is spread throughout the world and it can fairly be said that wherever Royal Air Force people are to be found - and that means practically everywhere - there too you will find members of the Association, and in all probability a flourishing and active branch. Of 703 branches no less than 68 are overseas, not only in the Commonwealth but in the Americas and Europe. Many have first-class club facilities which provide a meeting-place for members, their families and friends, in all parts of the world, whether it be Delhi or Derby, New York or Newquay or Cape Town or Colwyn Bay. Everywhere you will find a friendly welcome and a meeting point with people of similar interests in all walks of life.

This widespread network of branches is also the mainspring of one of the finest and most comprehensive welfare services ever to be set up, for at every branch there is an honorary welfare officer whose major job is to make sure that no one in need of advice or help will ask in vain. To make this ideal a reality, each welfare officer is backed by the full resources of specialist staff based at nine area headquarters and at central headquarters in London.

The Association also maintains two of the finest Homes in the country, Sussexdown, at Storrington in Sussex, specially equipped and staffed for the care of the permanently disabled, and a convalescent home at St. Anne's on Sea in Lancashire. Both have earned the highest praise for their comfort, homeliness and amenities from guests and

to join the RAFA

official bodies alike.

In all this the Association works hand-in-hand with the Royal Air Force Benevolent Fund, the purpose of which is complementary to that of the Association. Branch welfare officers act in a general way as the Fund's representatives 'in the field'. But welfare in its broadest sense is not the only thing which the Association offers by a long way. Through its branches all over the world its importance in social life is significant. Branches everywhere play a great part in the life of the community. Comradeship and friendship are no longer just words; social events of great variety, and in many cases ingenuity, bring everyone together in the truly old RAF way.

Naturally, such a comprehensive and world-wide welfare service costs a great deal of money to maintain, quite beyond the capacity of the members themselves despite their very considerable and constant efforts. The Association is consequently most grateful to share the proceeds of this Souvenir Book with the Benevolent Fund and wishes to thank all purchasers for their generous support.

Richard Peck House, the Royal Air Forces Association's convalescent home at St. Anne's on Sea, Lancashire



CENTRAL HEADQUARTERS,
43 GROVE PARK ROAD, LONDON W4
Telephone 01-994 8504

Please give generously

SOME 10,000 HIGHLY TRAINED OFFICERS AND MEN leave the RAF each year at the end of their service – an inescapable fact of life which has to be made good by new men trained to fill the gaps all the way up, so that the Service has a continuing training commitment covering the whole field of professional skills from the humblest trade assistant to the most advanced jet pilot: this basic training of officers and airmen is the primary function of Training Command.

To conserve manpower, the RAF has always sought to extend a man's professional skills in breadth and depth progressively throughout his career. Furthermore, much of the RAF operates near the frontiers of technology, which advance continuously; and these two factors mean that further training, both to widen existing skills and to learn new ones, has to be undertaken at intervals throughout a man's service. This post-graduate training, as it might be called, is the Command's other great responsibility . . .

Jet Provosts of the Red Pelicans Aerobatic Team
from the Central Flying School of Training Command
—Arthur Gibson photograph



Training Command

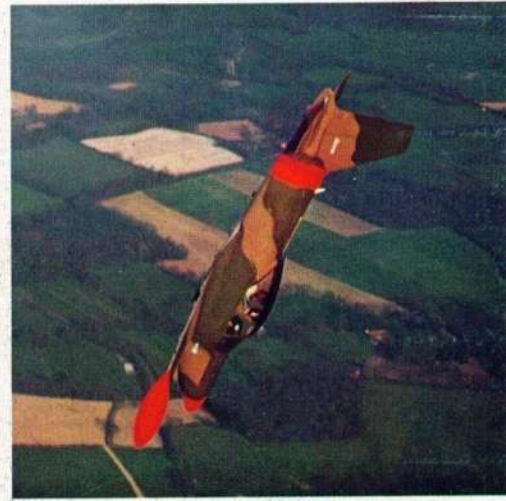


by Air Marshal Sir Leslie Mavor,
KCB, AFC,
Air Officer Commanding-in-Chief,
Training Command



The basis of an advanced airforce

SIAI Marchetti SF 260M





JET PROVOST
basic trainers over the
'Orange' at RAF College, Cranwell

ALTHOUGH THE FIGHTING EFFECTIVENESS OF THE RAF is greatly dependent on the training given by Training Command, training is itself no more than a support function, so there must be no question of wasteful expenditure of resources. Otherwise, in these days of tight control of defence spending, the RAF's cutting edge – its front line fighting strength – would inevitably suffer. Thus the pervasive theme in Training Command is 'cost-consciousness', and the pre-occupation at all levels is with the efficient use of men and material to achieve our objectives.

As to the training courses themselves, these vary from simple informative courses lasting for a day or two only, to those lasting more than three years and lead to an engineering degree or a pilot's brevet; the latter, though not the longest, being perhaps the most costly training course given in any profession. Although it is an over-simplification, it is convenient to imagine the Command's task as embracing three distinct areas: officer training, professional training (both ground and flying), and trade training.

officer training

Nearly all RAF aircrew are commissioned, but aircrew form only a part of the Service's total body of officers. There are many officers serving in the ground branches and the five 'professional' branches of the service. Nearly all of them – there are a few exceptions such as Chaplains – are selected and trained as officers by my Command. Selection is a most important part of the process, for by its skillful exercise we can ensure that we do not waste time, effort and money in trying to train unsuitable candidates. All officer selection takes place at Biggin Hill, the famous wartime Fighter Station, and the process lasts three days, during which time the candidate is medically examined and given a chance to show, under controlled test conditions, the sort of stuff he is made of.

The standards required are high and only about one in five pass for the GD (Flying) branch and one in four for the ground branches. Successful candidates are given probationary commissions and, if they have the necessary academic qualifications and are accepted by a university, go to that university under RAF sponsorship to gain a degree. This Graduate Entrant Scheme has replaced the Flight Cadet system of entry which has existed for the last fifty years. (There is, of course, no bar to a young man seeking to join the Service either during, or after his time at university should he so wish.) Those who are not qualified for university, go straight to the officer training course under the Direct Entry Scheme. The purpose of this early officer training course is to make the individual aware of the sort of personal standards that the Service expects of him, and to lay the essential foundation on which all his subsequent professional training, and indeed his productive service, is based.

About the author...

The author entered the RAF College as a Flt Cdt in 1935, followed by flying duties at the School of Army Co-op. He won the AFC in 31 Sqn for wartime army co-op and transport ops in India, Middle East and Burma. In 44 he became Flt Cdr and Ch Instructor at 109 OTU before taking the Staff College course at Bracknell, followed by air staff training at HQ 38 Gp, then several staff and flying appointments in Home Cd, 3 Air Nav School, Air Min and the Staff College. After commanding RAF Lindholme (59-61), he became Director of Air Staff Briefing at Air Min. The Imperial Defence College course (64) led to AOC 38 Gp and ACAS (Policy) at MoD in 66. Air Marshal Mavor became C-in-C Training Command in April 1969.

The newly fledged officer is then given his 'professional' training in Training Command, designed to bring him to the professional standards required of the junior officer in his branch. To this end, the Command runs a number of training courses which vary from relatively short familiarisation courses to, at present, a full degree standard engineering course, (which will disappear as the Graduate Entrant Scheme reaches full fruition). Additionally, officers of the ground branches return to the Command from time to time during their careers, either to further their professional knowledge or to undertake specialist courses in particular areas of their branch's operations.

The professional training of aircrew covers the training of all aircrew categories currently employed in the Royal Air Force. This training is broken down into a number of different phases or levels designed to develop skill progressively and to identify, sooner rather than later, those whose flying aptitude or personal qualities fail to come up to expectations.

Pre-entry training is carried out in University Air Squadrons as part of the Graduate Entrant Scheme, and in the 13 Air Experience Flights established to give air experience to members of the ATC and the Combined Cadet Force.

Post-entry pilot training is carried out in three stages, primary, basic and advanced. The primary stage is a short course, given on the Chipmunk, which is designed to introduce the pupil pilot to the elementary arts of flying. The second, or basic, stage of flying training is carried out on the Jet Provost at one of three flying training schools. On successful completion of this phase, pilots are awarded their wings. Thereafter, pilots join one of three streams for their advanced flying training. The 'fast-jet' stream (using the Gnat and Hunter) is for those who are judged more suitable for flying the high performance, single-pilot aircraft (such as the Phantom and Buccaneer) in Operational Service; the 'multi-engine' stream (Varsity) absorbs those who are best suited to the larger, heavier, two-pilot types such as maritime, transport and medium bomber aircraft, and the helicopter stream (Sioux and Whirlwind), those who are destined for the rotary wing roles. Successful graduates form the advanced training schools then



RED ARROWS famous 1,200 mph 'Roulette'
– Arthur Gibson photograph



RED ARROWS
in perfect line
abreast formation

Drawings of other
trainers, old and
new, on pages
40-41

leave Training Command to enter operational training. It is worth noting that the responsibility of Training Command in pilot training is restricted to the *teaching of the skills of pure flying*, and that, for all aircrew categories, instruction in the use of the aircraft as a military weapon is given exclusively in the appropriate operational command.

The training of aircrew other than pilots is at present carried out on the Varsity at two flying training schools. Navigators are trained at the new navigation training school at Finningley, and air electronic officers and air engineers at Topcliffe. In pursuit of economy and greater efficiency we plan to combine these two schools at Finningley, which will then be the centre for the *ab-initio* training of all aircrew other than pilots. The award of the brevet is in all cases made at the end of the basic course, after which the newly fledged navigator, AEO or Air Engineer goes on to operational training, where he teams up with the rest of his crew.

trade training

Although the Command's most expensive task by far is the training of aircrew – it absorbs in value about two thirds of the Command's resources – the biggest task in terms of numbers is the training of airmen and apprentices for the 200-odd trades in the RAF. Basically, there are two forms of entry to airman service – apprentice entry and adult entry: the latter term covers all those who enter the Service over 17½, other than as apprentices. These adult entrants are given a short general Service training course at the recruit's school and then go to a technical training school for a longer course of trade training before entering productive service. Apprentices, on the other hand, undertake a much wider course with a higher academic content at one of our apprentice training establishments, where the courses vary from one to three years depending on the trade.

Apprentice training in the RAF has come to be prized very highly outside the Service as well as within. The RAF's apprentice schools – the biggest and best known is at Halton – have a world-wide reputation and have trained apprentices from many foreign and Commonwealth air forces. No less than 20% of Halton apprentices have gone on to win commissions, and some 45 have subsequently reached Air Rank. But this achievement by a few exceptionally gifted ex-apprentices should not be allowed to obscure the purpose of Halton, which is to provide the RAF with senior NCOs of the very highest qualifications and calibre.

There are four different grades of apprentice ranging from the 'single skill' administrative apprentice who is trained for one year for such trades as cook and clerk, to the technician apprentice, whose training lasts for three years and fits him to fill the most highly skilled posts in the engineering trades. The technician apprentice normally graduates as a corporal and the aim of the technician apprentice scheme is to provide a flow of highly qualified airmen capable of advancing rapidly to the senior non-commissioned ranks. Primary emphasis is placed during their training on the 'systems approach' and on developing diagnostic skills.

The other type of apprentice schemes do not demand the same high academic standard on entry and are intended to give a thorough grounding in a single skill within a trade group.

Craft List I covers some of the engineering and electronics trades where the apprentice's training lasts for two years and successful graduates pass out as junior technicians. Craft List II and administrative apprentices are trained for one year and pass out as senior aircraftmen or leading aircraftmen for such trades as telegraphist, clerk, cook or supplier.

post-graduate training

As I have said, in addition to its primary task of undertaking training *ab-initio* for nearly all men and women entering the RAF, Training Command has a very big post-graduate training commitment for officers and airmen. The post-graduate and refresher training of aircrew is concerned mainly with the re-injection into operational staff or flying appointments of those who have done a spell on the ground, or with the training of flying instructors at CFS. The Command is also administratively responsible for the RAF Staff College and for the Junior Command and Staff School at Tern Hill, which undertakes the training of junior officers in the elementary arts of good management and Service administration.

On the other hand, the scope of post-graduate training for airmen in Training Command is very nearly as wide as that of the initial trade training task. It encompasses a comprehensive system of refresher and post-graduate courses aimed at keeping every skilled tradesman fully abreast of developments within his trade; and at ensuring that he has the opportunity to learn the skills of a new trade should his old trade become obsolescent. Apart from this learning of new skills, there is a continuing need in most trades for short courses to bring tradesmen up-to-date on new equipment and techniques. Some of these courses are conducted within the Command and some by manufacturers; the sponsorship of servicemen on manufacturer's courses, however, remains the responsibility of Training Command.

a look to the future

The major challenge facing the Command today is to devise ways of reducing the cost of the training task while improving the quality of our output to meet the higher demands of the front line; in other words, our major concern now and for the future is to improve our efficiency as trainers. Aircrew training, as I have said, is likely to remain the most expensive of our operations. We aim to achieve a major gain in efficiency by concentrating the training of all aircrew other than pilots on one Station; but by far the largest part of our aircrew training bill is incurred in the training of pilots.

The well tried progression of basic and advanced training (with or without a primary 'grading' stage) has been standard treatment for all pilots for many years, with only minor evolutionary changes. However, it is apparent that the cost of giving this 'standard treatment' to all trainee pilots is becoming economically insupportable, as well as being out of tune with developments in the front line, where specialisation on one operational role throughout the pilot's active flying career is becoming the rule.

Against this background, the accident that the current generation of training aircraft are all approaching the end of their useful lives together has given us a once-in-a-lifetime chance to carry out a fundamental reappraisal of the whole process of pilot training. The results of this study have shown that over the next ten years we can bring about a major reduction in pilot training costs by replacing our present training aircraft fleets with fewer, more versatile types and by advancing the point at which trainee pilots are selectively streamed into one of the three broad categories I mentioned earlier. *Eg*, we should be able to reduce the number of aircraft used to train an aspiring fighter pilot from five to two, without detriment to his ultimate operational capability. The need to get a good economic return from our existing assets means that we cannot go all the way in one bound, but the

Article concluded on page 46

Leaving school? Changing your job?



A place for you with the flying team.

How do you start on your way towards it?

Pilot Richard Walker, B.Sc., 26, Flight Lieutenant, started with a Degree. Says "I became interested in flying in the University Air Squadron—first by the thrill of it, then by the very high professional standards."

Navigator Darryl Rodgers, 22, Flying Officer; started with O-levels. Always wanted to fly, never thought of any other career, says "A lot of people think RAF life is very stiff and formal; it isn't."

Air Traffic Controller Neil Cargill, 32, Flight Lieutenant, started twice, but left the RAF only once. After 18 months in industry, he was back. "You miss the comradeship," he says, "not to mention the opportunities to travel."

Accountant Roderick Bryden, 28, Flying Officer; started with A-levels. As a civilian, worked 5 years in Sales Administration, couldn't stand the monotony. Says RAF gives you a worthwhile job, and a much broader outlook on life.

Engineer Terence McKenna, B.Sc., 35, Flight Lieutenant, started at 28 with a Degree and 'reckonable experience', was promoted in less than a year. Worked 6 years in industry, but finds that the RAF provides a more varied working and social life.

£2,272 at 22 Very attractive rates of pay, for flying and for ground management officers. For example: a pilot or navigator, on reaching the rank of Flying Officer, can now earn £2,272 a year.

It's your potential that counts. These officers have different educational backgrounds. They also have something else: a responsible job, and the capacity to hold it down. Have you? The RAF, a pioneer in personnel selection, can test you, discover your potential, advise you on all kinds of RAF careers. Fill in the coupon and find out more.

Royal Air Force



Into the 70's with the RAF is by an independent civilian writer. It gives you an unbiased picture of what it's like to live, work and travel as an officer in the RAF.

Visit your nearest RAF Careers Information Office—address in 'phone book—or send this coupon to **Group Captain E. Batchelar, RAF, Adastral House (982SL1), London, WC1X 8RU.** Please send me "Into the 70's..." and details of officer careers in flying/ground management/engineering. (Delete whichever does not apply.)

Name

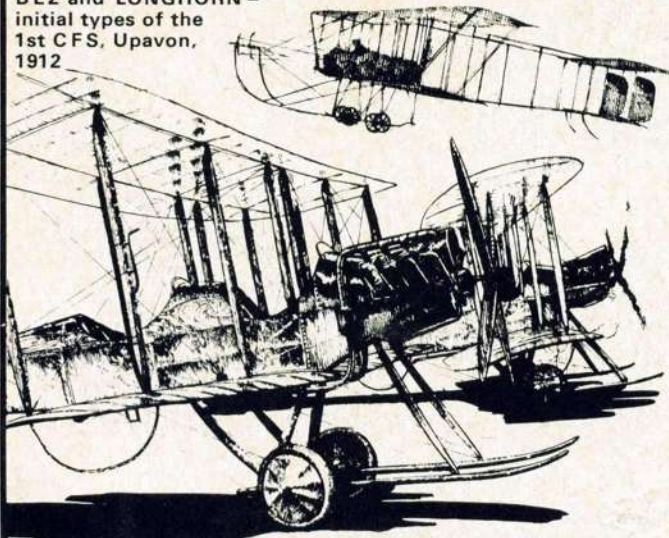
Address

Date of birth (You should be over 17)

Please enclose a separate note giving present or expected qualifications. Minimum requirement—5 acceptable O-levels, or equivalent, including English Language and Maths. For engineering appropriate A-levels or professional qualifications are necessary.

In the RAF there is always plenty of company of your own age.

BE2 and LONGHORN –
initial types of the
1st CFS, Upavon,
1912



THE STANDARD TRAINERS OF TRAINING COMMAND'S CENTRAL FLYING SCHOOL

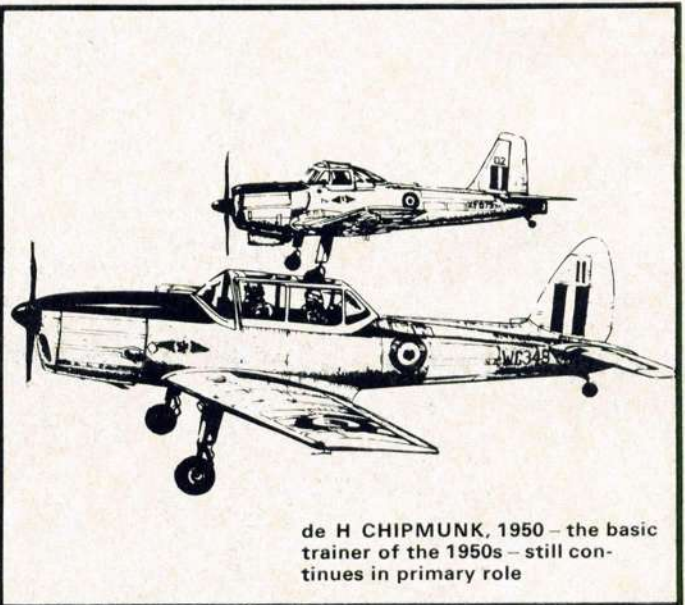
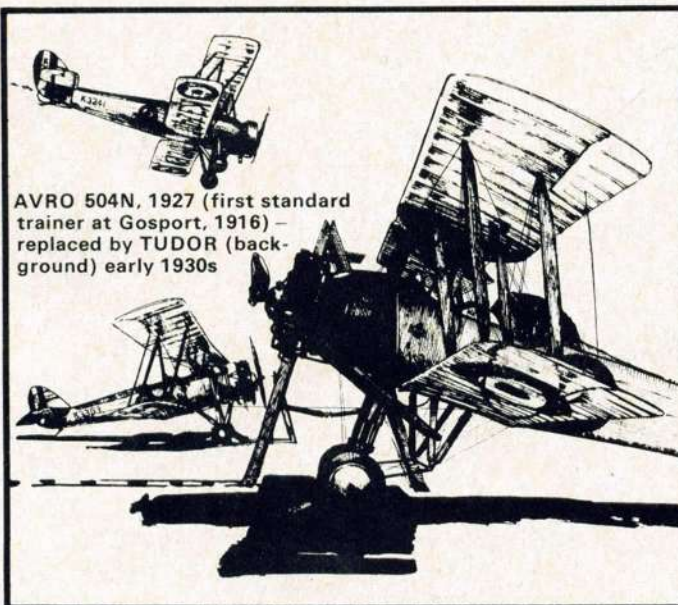
The world's oldest military flying establishment and finest instructors' school, is the flying hub of Training Command. Formed by Winston Churchill in 1912 to turn Army and Navy pilots into professional air fighters, Maj Hugh Trenchard was an early graduate. By WWI, CFS was the accepted centre of instruction in scout flying and air fighting. Lt Smith-Barry introduced dual controls and standard QFI pattern on 504s in 1916, when it became the School for Instructors in Flying. Examining Wing, refresher courses and foreign QFI training followed, and a formation aerobatic team first performed at Hendon Air Display in 1927. Blind flying was



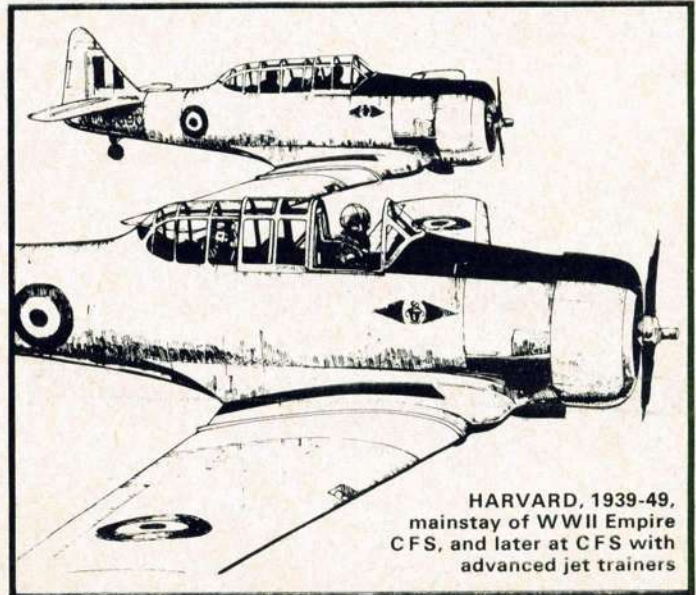
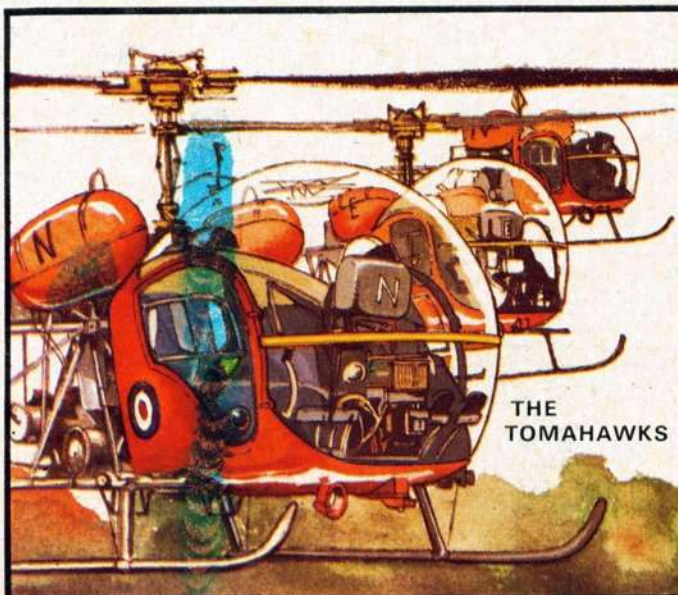
introduced in 1930. By 1958, training was 'all jet', and Helicopter instruction began in 1956. Today's Red Arrows Gnat jet trainer and Tomahawks Sioux helicopter aerobatic teams are shown in colour.

Competition Entry by James Robins

AVRO 504N, 1927 (first standard
trainer at Gosport, 1916) –
replaced by TUDOR (back-
ground) early 1930s

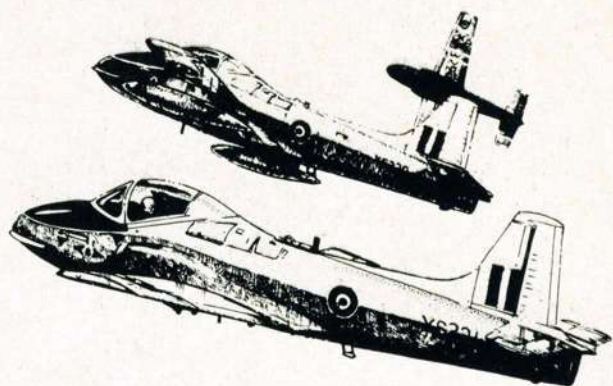
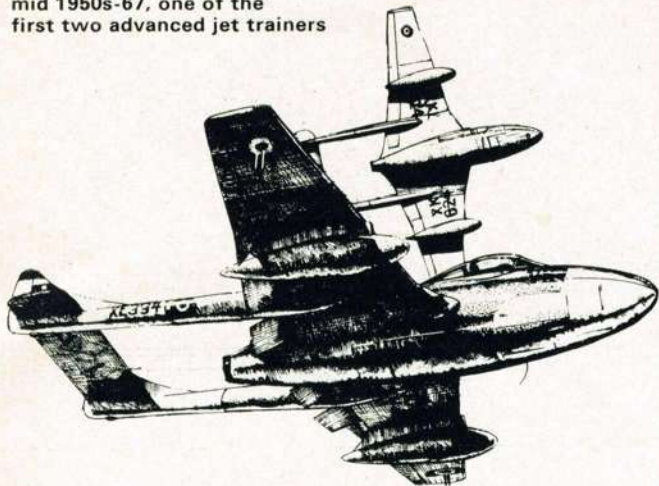


de H CHIPMUNK, 1950 – the basic
trainer of the 1950s – still con-
tinues in primary role



HARVARD, 1939-49,
mainstay of WWII Empire
CFS, and later at CFS with
advanced jet trainers

de H VAMPIRE,
mid 1950s-67, one of the
first two advanced jet trainers



BAC JET PROVOST,
first basic jet trainer, late 1950s –
T5 version introduced 1970

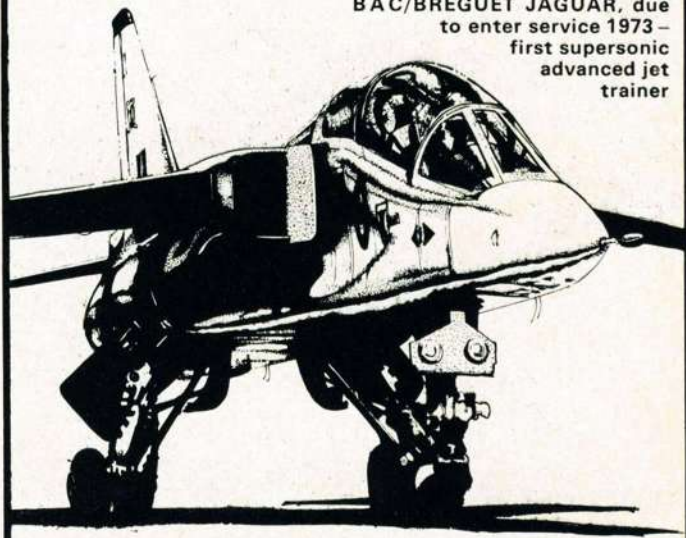


THE RED ARROWS

HAWKER SIDDELEY GNAT,
advanced jet trainer, 1961 –
still used by famous
Red Arrows aerobatic
display team



BAC/BREGUET JAGUAR, due
to enter service 1973 –
first supersonic
advanced jet
trainer





SLIPSTREAM OF COWLEY - Eileen Remyay



SLIPSTREAM OF COWLEY DURING COWES WEEK

The RAF's S&S34 ocean racing yacht purchased in 1969, with her crew of serving officers and airmen, has achieved conspicuous success against international competition in two seasons' racing

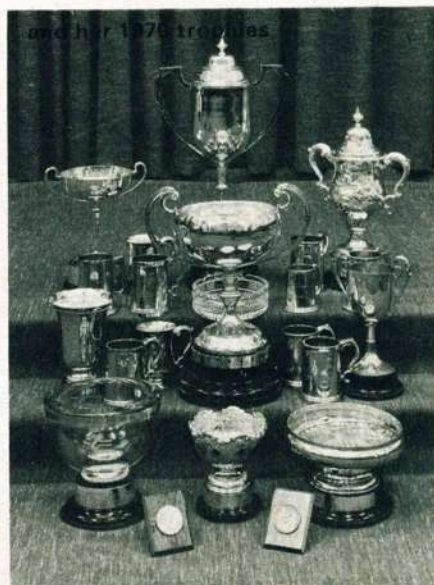
Overall winner RORC Points Championship 1970 and Allan Paul Trophy for most consistently successful OR Yacht. Five firsts in class in major races, fourth overall in Malta Middle Sea Race, Haylock's Trophy for best Service Yacht 1970

Data: 34 ft long, 10 ft beam, 6 ft draught
Reg tons: 8.2; Displ: 4.5 tons
Sails: Genoa 400, Mainsail 200 sq ft
Spinnaker more than doubles this area



Competition Entry by Gp Capt N T Harvey Vice Commodore of the R A F S A

IN 1948 THE OLYMPIC GAMES WERE HELD IN BRITAIN. In the yachting events at Torquay, Air Cdre A W B McDonald AFC, (later A M Sir Arthur McDonald KCB, AFC) was British helmsman in the single-handed class, sailing his Firefly dinghy. At that time, he formed the RAF Sailing Association to provide sailing facilities for members of the RAF and WRAF in the UK, to foster RAF interest in the art of sailing and boat management abroad, and to encourage competitive sailing through individual sailing championships, inter-Station, inter-Command and inter-Service yacht racing and other means. His great success is amply demonstrated by a paid-up UK membership of over 1,200 for much of the time, a National Champion in three major dinghy classes (Firefly, Finn and Fireball), a second British Olympic helmsman in 1968, and an ocean-going yacht and crew which finished the 1970 season as the leading boat in the Royal Ocean Racing Club's Offshore Programme . . .



and her 1970 trophies

**FIREBALL beating to windward -
RAF Championships, Plymouth**



**ALBACORE running
before the wind**



HOW, YOU MAY ASK, CAN THE RAF find the time and money to take part in this highly competitive rich man's sport and beat the millionaire at his own game? I hope to show how any member of the RAF or WRAF can learn to sail and in no time at all take part in RAF and National championships . . . it is possible for those sufficiently dedicated to become Olympic trialists or members of a top ocean-racing crew within four or five sailing seasons.

dinghy sailing

Since WWII many RAF yachtsmen have learnt to sail in the sunny climes of the Mediterranean and the Far East through novice coaching programmes run all the year round by their Station sailing clubs, so that by the end of their tours they have reached a very high standard of helmsmanship and racing skill. At home, clubs exist from Mount Batten to Saxa Vord and Ballykelly to Bawdsey; major centres such as Somerford Keynes near Lyneham, Grafham Water near Brampton, the Midland Centre on the Trent near Newark, and the Welsh Harp near Hendon provide facilities for groups of Stations. Starting with the six National 12 ft dinghies in 1948, the Association now owns over 200 modern racing dinghies, provided mainly through the generosity of the Nuffield Trust and allocated to Stations and Centres by the RAFSA Committee, although a few Units have bought boats with Station Institute funds.

So there is no need for personal capital resources to go sailing, and clubs have only to raise money for maintenance, insurance, renewal of sails and perhaps water or site rent, which is found from small annual subscriptions which vary by rank (£2-£6) and contributions (25p-£1) to RAFSA for general administration and organising major events. The RAF Sports Board makes annual grants from the Central Fund for boat and equipment purchases and to support centres with heavy overheads (as with other RAF sports associations). Members must help keep the boats in good sailing trim, and in return are first taught to sail as crew members and later as helmsmen; even in one season, a novice can reach the 'B' Certificate allowing him to take part in club racing and qualify to enter for Command and RAF Championships. 'A' Certificates call for much more skill and experience from helmsmen required to instruct and act as examiners. Weekly club racing is usual, with Wednesday afternoons reserved for inter-Station team racing, but for the lucky ones within easy reach of the water (5 mins from hangar to boat park at Thorney Island!) sailing is popular during summer evenings and is thus an all-week activity. Boats are usually put in the charge of qualified, preferably 'A' Class helmsmen as leaders, with 4-8 other members in each 'syndicate', those qualified being responsible for training the others, and everyone working to keep their boat in first class trim . . . team work is vital - the more you put in, the more you sail and the quicker you obtain that coveted 'B' Certificate. But the sport is not all work; boats are normally overhauled once a year, requiring only general upkeep and

minor repairs for most of the season, provided of course one does not have too many collisions!

Club regattas are held two or three times a year and Command and RAF Championships annually, Command events at some convenient centre and the Championships usually at RAF Mount Batten on Plymouth Sound, or as this year, at Grafham Water; the ideal is to alternate between inland and tidal waters. For major events, boats are towed to the centres by individual competitors and racing is spread over 2-3 days for Command events and 5 days for the Championship, affectionately known as the *Brady* after the donor of the trophy for the RAF Champion Helmsman. Up to 1969 the Brady was sailed in Fireflies which have been RAFSA's main class of boat for 20 years (in 1967 we owned 107). However, the 1970 Championship was run in four classes - Fireball, Albacore, Enterprise and Firefly - with the best helmsman from each qualifying for the final races in the latest fibreglass Fireflies. An entry of over 70 competitors left no doubt that this was the most successful Brady ever held and set a pattern for the future.

Following Sir Arthur McDonald's example in 1948, RAF dinghy helmsmen have taken part in many National and International competitions: in 1961 RAFSA purchased a few International Finn dinghies with its sights firmly on the 1964 Olympics, but neither of our leading helmsmen reached Tokyo, having finished 4th and 5th in the final selection trials. More experience brought greater rewards in 1968 when Sqn Ldr John Maynard went to Acapulco with the British team as Finn Class representative, but bad luck and sickness deprived him of a medal in this toughest and most demanding of the six Olympic classes. Members of the RAFSA Finn squad are now competing all over the country and the Continent (last year in Portugal and Germany) to try to make the British Olympics team for 1972 at Kiel in Germany. Other notable major competitions entered are the annual Inter-Services, eg a four-cornered match for the Victory Trophy held at Littleton, near Chertsey, and including a Civil Service team. Every July at Seaview in the Isle of Wight, a two-day Inter-Command Competition precedes an inter-club competition when 27 Service Clubs - 10 of them RAF - race in Seaview Mermaids (three-man keel boats owned by the Seaview Yacht Club) for the Association of Service Yacht Clubs' Gold Cup, a gold-plated trophy presented to the Royal Yacht Sqn by the German Kaiser just before WWI, which disappeared until 1946 when it was re-presented for annual competition at Seaview. The Gold Cup event is followed by the Inter-Services four-boat team competition for the Coningham Cup, also in Mermaids, and at the end of the season the Inter-Services Dinghy Team Championship takes place, sponsored by each Service in turn at Portsmouth (RN), Chatham (Army) and the Welsh Harp (RAF). In 1969 and 1970 all three team events were won by the RAF, whilst in 1970 the Gold Cup was won by RAF Maintenance Command YC, the fourth year in succession that the Cup has been won by an RAF club. Let us now turn to the big boats and off-shore racing.

FIREFLIES setting course



FIREBALLS racing off Plymouth



**ALBACORE before the start - not
Blue Peter on committee boat**



SLIPSTREAM
racing at
Cowes —
Beken



off-shore
sailing

SPURLING off
Mountbatten
— now 25
years old



Services off-shore sailing got under way after WWII when volunteer crews manned the fine fleet of yachts which formerly belonged to Hitler's *Luftwaffe* and sailed them as 'prize ships' from Kiel to UK through the North Sea minefields, a hair-raising passage known as Operation *Windfall*, by which name the boats have since been called. Shared out amongst the three Services, the RAF's quota went to the major Commands, where the yachts did sterling service for almost 20 years. One of them, *Spurling*, now over 35 years old, is still in use at Mount Batten where the Station Water Sports Club enters her in local races and cruises along the beautiful Devon and Cornish coastlines. Amongst the first RAFSA entrants in a post-war Royal Ocean Racing Club event were three *Windfalls*, *Kuckuck*, *Kranich* and *Rasmus*, retained at Kiel for use by the RAF in Germany. Two entered the 1950 RORC races in the Baltic and met with some success. In 1951, in a 200 mile race from Kiel to Copenhagen three *Windfalls* took 1st, 3rd and 4th places in their classes, and *Kranich* was sailed over to the Solent for the Cowes-Dinard and 600 mile Fastnet races. Already RAFSA had begun to prove itself in ocean racing.

Not until 1961, however, did we re-enter the UK top league of competitive offshore racing, when the Nuffield Trust generously provided the funds to build *Jethou*, a Class III ocean racer. *Jethou*'s design features attracted large handicap penalties which prevented her from ever entering the prize lists, but it was in *Jethou* and the *Windfalls* that hundreds of RAF and WRAF sailors had their first taste of deep-sea sailing, mainly off the South Coast and in the Channel approaches between Cherbourg and the Channel Islands. Cruises, originally sponsored and arranged by Commands, were organised by the RAFSA Offshore Committee in the 1960s, but Transport Command YC continued to run its own 12 ton cruiser *Lady Corinne* (replacement for a lost *Windfall*) and she still provides good sailing for many newcomers in Air Support Command. Yachts are chartered to members by RAFSA with fees shared amongst the crew, usually about £4 a head for a week's sailing with food and drink as the only extras. Each boat carries a qualified skipper and mate and to keep up the supply, skippers' and mates' courses are run early in the season. The usual way aboard for a newcomer is to get his name on one of the lists maintained by the skipper, but many beginners' berths are also available on cruises arranged throughout the season under the RAF Expedition Training Scheme, with no charter fees. After a season or two as crew member, with a few 'trips' to one's credit, the next step is to apply for one of the qualifying courses for a mate's ticket, first for inshore sailing and then for the higher offshore qualification; for a fair number the course for a skipper's ticket will follow after the necessary experience.

For most RAF offshore sailors the ultimate achievement is a place in one of the ocean racers. In 1962 first place honours were achieved in the UK area in *Blue Charm*, a second-hand Class III yacht which handled like a large racing dinghy and quickly proved herself in RAFSA hands during a successful season culminating in winning the race from Dartmouth to Belle Isle, France, and led to RAFSA commissioning the well-known team of Illingworth and

Primrose to design and build *Dambuster*, a Class II development of *Blue Charm*; numbered '617' after the famous Sqn, she was exhibited at the 1963 International Boat Show in London. Naturally, great things were expected from this advanced design; she was certainly fast and furious and achieved some notable successes in her first season, but a change of rig to reduce her handicap rating led to handling problems which made her no match for the ever-improving new American Class II yachts. In 1965, again thanks to the Nuffield Trust, a new yacht was built, this time in the smaller Class III, named *Contrail*, which proved to be the most successful to date, her most notable achievements being 2nd in RORC's Class III Championships in 1967 and 1968, although the RORC's Class Championship still eluded RAFSA. US designs were steadily intruding into UK ocean racing and sadly it became obvious that RAFSA would have to pick an American design to remain competitive. Thus we decided to take a gamble on a brand new Sparkman and Stephens Class III in the hope we should be first on the scene with this new fibreglass design and stand the best possible chance in the RORC Championship, and the Nuffield Trust yet again came to the rescue with the SS34 Class *Slipstream* of Cowley. Unfortunately delivered late, her many teething problems were not rectified until mid-1969, and inevitably other yachtsmen spotted the potential of this new racer and competition proved tougher than ever from sister ships, *Morning Cloud* in particular, in the hands of that redoubtable ex-dinghy sailor, the Rt Hon Ted Heath, who at the end of 1969 went to Australia to win the famous Sydney-Hobart race. Despite the opposition and other difficulties, *Slipstream* still ended the season having won several races and took 3rd place overall in the Class III Championship.

The 1970 season was eagerly awaited since RAFSA's chances of winning the ultimate prize were better than ever, and a 'first team' was selected from our most experienced ocean racing members. To everyone's delight, *Slipstream* more than lived up to our hopes and expectations; she won her class in 5 of the 11 major RORC events entered, her lowest placing being 6th! As a yacht's championship score is compiled from her best 4 results, *Slipstream* was able to discard a 1st place, in order to earn the coveted RORC Class Championship and the new Alan Paul Trophy for the most consistent international ocean racer in 1970 — a very proud feather indeed in RAFSA's cap. In October, she sailed to Malta to take part in the 700 mile Middle Sea Race, came 4th overall and won the trophy for the best Service yacht in competition with yachts from the RN, Army and Italian Navy. Thus the story of the first 10 years of RAFSA participation in offshore racing has been one of steady progression from almost dismal failure to triumphant international success.

sailing overseas

RAF sailing clubs overseas are controlled by the respective overseas Command and not RAFSA, but their sailors are given free membership during the year of their return to UK. Dinghy clubs — some run by combined Services — exist in Germany, and an offshore sailing club on the Baltic at Kiel; in Gibraltar and Malta, dinghies and Folkboats (small cruiser/racers) are sailed; in Cyprus there is an offshore cruiser section at Akrotiri; in the Persian Gulf Stations, and at Masirah, in Gan and Singapore, several strongly supported clubs have existed with excellent facilities since before the war, and there are ample facilities at most overseas bases for experts and newcomers alike to enjoy sailing, racing or pottering under ideal conditions and with first class equipment supplied through the Nuffield Trust and the RAF Central Fund.

In its 23 years existence RAFSA has done much to achieve its objectives: thousands of serving officers, airmen and airwomen of all ranks have learnt to sail successfully in all types of yacht from 10 ft dinghies to 10-ton ocean racers. Many have taken part in offshore sailing within the RAF official Expedition Training programme and have benefited from sailing as an integral part of a team, often under extremely tough and demanding conditions. Many successful yachtsmen's first experience has been a spin in a dinghy with the local RAF club on a Wednesday afternoon. It is a tribute to RAFSA and the generosity of the Nuffield Trust that numerous ex-RAF Servicemen continue to apply the sailing skills they were fortunate enough to acquire at negligible expense during their Service careers. In UK, as elsewhere, the sport has snowballed in popularity since WWII because the man in the street is better off and has more leisure time. But in the RAF, boats and clubhouse facilities are provided free and for most people there is ample leisure time, so all you have to do is to turn up in suitable togs and show some enthusiasm and a willingness to learn, and in a few years, any Serviceman could be competing for a place in the 1976 Olympics or helming the RAF's latest ocean racer with the Prime Minister as his fiercest competitor.

ALBACORE
in Plymouth
Sound



FIREFLIES, FIREBALLS, ALBACORES on the
old Flying Boat slipway, and an
ASR launch at Mountbatten



A remarkable school

by SIR ARTHUR BRYANT



On a lovely Saturday afternoon in July I had the privilege of giving away the prizes at the RAF Benevolent Fund's famous school for the sons of deceased and disabled Warrant Officers, Non-Commissioned Officers and Aircraftmen — Vanbrugh Castle, Greenwich. I am not good at giving away prizes, being, like most persons of a literary turn, on the clumsy side and given to dropping things. And speaking to a mixed audience of small boys and their teachers and parents is among the more exacting forms of oratory and one considerably above my reach. I am always reminded on such occasions of P. G. Wodehouse's harrowing account of Gussie Finch-Nottle's prizegiving speech at Market Snodbury Grammar School after both Bertie Wooster and Jeeves, without realizing that the other was doing so too, had liberally — indeed, far too liberally — laced the teetotal and apprehensive speechmaker's lemonade with gin in order to overcome his diffidence, and with such electrifying results. I therefore usually resist suggestions that I should assume the rôle of visiting prize-distributor at seats of juvenile learning.

But requests from the RAF Benevolent Fund are not requests which anyone can properly refuse, certainly not anyone with any memory. For, if it hadn't been for the RAF in those grim years between 1939 and 1945 none of us would be here or, if we had still somehow managed to survive, our lot would be a pretty sorry one. It is just a quarter of a century since in this very month the pilots and ground crews of the RAF saved the world. It is more than twice that time since that man of vision, Hugh Trenchard — Marshal of the Royal Air Force and Chief of the Air Staff — founded the RAF Benevolent Fund to meet the needs of RAF widows and disabled survivors and their families. No act by any man in our time can have been productive of more unqualified good. It is scarcely an

exaggeration to say that every pound subscribed over the past 50 years to this great and beneficent Fund has lightened the burdens and widened the opportunities of those over whom the shadow of deprivation or poverty had fallen as the result of the selflessness and sacrifice of men who, in Trenchard's words, had "covered themselves with glory and thought of nothing except to work for others". To aid their bereft dependants is not charity; it is an act of obligation and requital. "The Royal Air Force Benevolent Fund," said Winston Churchill in a broadcast in 1951, "is part of the conscience of the British nation. A nation without a conscience is a nation without a soul. A nation without a soul is a nation that cannot live."

I am not suggesting that a few halting words in a garden marquee on a July afternoon at a school prizegiving is in any sense a form of requital for the debt which every Briton — and many others besides — owe to those who in two world wars, and in preparation between those wars and since, have guarded this country and her great cause of liberty from the destruction and enslavement which mastery of the air by an enemy would have brought, and still could bring, to us all. Yet to have refused this small service would have seemed a mean and shabby thing. So I steeled myself to bear my well-founded lack of confidence in my oratorical capacity to hold an audience of sharp-eyed little boys and their mums — to say nothing of several kindly air-marshals and commodores — and the all too probable contingency of my dropping at the moment of presentation some handsomely bound volume or silver sports-cup.

I need have had no fears. For the afternoon was a sheer delight. Thanks to the quality of that school, of its boys and masters, and the atmosphere of obvious happiness which pervaded the whole place, I forgot my own clumsiness, dropped nothing, and even made a tolerable speech which, if it did

not, like that of Gussie Finch-Nottle's, cause plaster to fall from the ceiling, at least evoked polite applause. But it was not the speaker who impressed the audience, but the audience which impressed the speaker. For, having been in my time, though long ago, a schoolmaster and even, for a short while, a headmaster, I am not without experience of schools and the capacity to judge them. From the start I realized that I was being privileged to share in the traditional gala day of a very great school indeed.

Vanbrugh Castle, following the presentation by Alexander Duckham in 1921 of the architect, Sir John Vanbrugh's, old home to the RAF Benevolent Fund, was the latter's most cherished pioneer establishment in the days when the Fund was still struggling to obtain support from a Britain which had temporarily forgotten the needs of the fighting men who had saved her. And pioneering has always been the RAF's speciality. After the war, when Vanbrugh suffered from the blitz and its former pupils served almost to a man in the Forces, most of them in the RAF, it was reopened as a boarding school recognized by the Ministry of Education. By the early 1960s it had become a fee-paying preparatory school of the highest quality, with the RAF Benevolent Fund making it possible for the fees to be paid by the widows of those who had died in 'the RAF's service. Under its present Headmaster, John Corner, who came to it 15 years ago from King's College, Canterbury — England's oldest public school — it is without question one of the most inspiring establishments of its kind I have ever seen. It is all that a great school should be — a germinative oasis of civilization, good manners, happiness, comradeship, and eager industry and learning.

After the prizegiving, two of the boys took me round their haunts, showing me with immense pride their classrooms and dormitories, games' room and

the library, laboratory, hobbies room, and the wonderful view from the windows over the river and the great city beyond. It was impossible not to be deeply impressed by the astonishing variety of literary, scientific, technical, and artistic tasks — "projects", as they call them — on which the boys had been engaged, far in advance of anything my own excellent preparatory school taught me and my contemporaries 60 years ago.

The fruits of the term's labours were on exhibition in every room, making a delightful and richly variegated museum and art gallery in miniature. And outside in the garden the school band, its oldest member no more than 13, played orchestral selections with splendid verve and spirit under their conductor-teacher. But of all the afternoon's sights of youthful happiness and healthy vitality the one that delighted me most was the unanimous rapidity with which, after the school had lined up according to custom to cheer the visiting prize-giver on his departure, the whole happy concourse, their courteous duty done, turned as one boy and raced towards the tea tent where a glorious repast had been prepared for them by the school's cook.

Vanbrugh is in need of additional funds to improve the accommodation and extend its magnificent work for fatherless children in need of a school to take a father's place. As one widow wrote to the controller of the RAF Benevolent Fund:

"I know as the time approaches for my son to leave Vanbrugh he will have a heavy heart. I feel sadness that school years could pass so rapidly . . . He has learnt respect, loyalty, and to share the joys and disappointments that a boarding school holds. How lucky to reap a harvest from a very deep sadness. My children have much to be thankful for, and so have I."

It is not only the bereaved mothers who benefit from the work of this splendid school, it is England and civilization. ☉

Please give generously

THE ROYAL AIR FORCE BENEVOLENT FUND
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air operations effectively. Reconnaissance aircrews fly Phantoms on numerous daily photo reconnaissance sorties over the UK and Europe to help them maintain a combat-ready status. Sabre, Phantom, and F-111 tactical fighter crews are engaged continually in practice sorties over Holbeach, Wainfleet and Jurby RAF bombing ranges, keeping themselves proficient in weapons delivery techniques. USAF aircraft also take part in local, Command-wide and NATO exercises designed to strengthen our abilities to function as a tactical air strike force. To provide this force with the necessary mobility, C-130 Hercules transport crews are constantly training to provide airlift support. In co-operation with the RAF and the British Army, USAF aircraft also supply close air support in various training exercises. Aside from its combat mission, Third Air Force also acts as a 'single point of contact' with HM Government for negotiating financial and technical arrangements between the USAF and UK.

Under its present organisational structure, Third Air Force resources of aircraft and supplies in UK amount to nearly one billion dollars (\$1,000,000,000). Of more than 22,000 US military personnel in Britain, some 13,000 belong to Third Air Force, and another 4,600 work either in direct or indirect support of this tactical air operation. The remainder belong to US Army or Navy elements in UK. The annual budget for the overall operation of Third Air Force totals about 150 million dollars.

However, the most valued asset of Third Air Force is its people, and as we enter the era of advanced aviation technology inherent with such complex aircraft as the F-111 fighter now assigned to Upper Heyford, the need for a highly specialised work force becomes even greater. Whereas it took only 35-40 men to maintain a WWI aircraft, about 74 are required to keep an F-100 Super Sabre operational; the F-111 demands the expert care of some 339 maintenance personnel involving 1,875 skills in such fields as electronics, aircraft mechanics, airframe repair and personal equipment. The challenge to maintain an effective technically-oriented force in the face of reduced defence spending will be great indeed.

In moves toward greater austerity, a number of posture changes have already been made and will continue in attempts to achieve maximum Command control through streamlined and efficient management of available resources. Major changes in the past year included the moving of the 67th Aerospace Rescue and Recovery Sqn from Moron Air Base in Spain to RAF Woodbridge in Suffolk, this bringing it nearer the centre of its area of rescue and recovery support responsibility for USAF operations in the UK. The 66th Tactical Reconnaissance Wing at Upper Heyford was disbanded and one of its Squadrons - an RF-101 Unit - re-located at Shaw Air Force Base, South Carolina, while the other Squadron, equipped with RF-4C Phantoms, was shifted to Zweibrücken Air Base, Germany.

Perhaps the most significant change to take place is the conversion of the 20th Tactical Fighter Wing from F-100 Super Sabres to the latest and most sophisticated weapons delivery system in the USAF inventory, the F-111 tactical fighter. At the same time the 20th Wing was moved to Upper Heyford from Wethersfield. When the programme is completed this summer, the F-111 will give the 20th Wing greater tactical strike power as a result of the new aircraft's long-range, night and all-weather strike capability, its use of automatic, low-level terrain-following radar, and its single aircraft penetration capability.

Regardless of these changes, the USAF presence in Britain - working in close and direct partnership with the RAF - has acted as an important deterrent in the continuing cold war. Moreover, its presence since 1948 has been a constant reminder that the US is firmly committed to a strong Western alliance of nations who are determined to preserve the basic values of human freedom and dignity we all share. ©

move towards this more efficient process has already begun and will gather momentum over the next few years.

The development of officer training is overshadowed by the Air Force Board's decision in 1968 to replace the Cranwell Flight Cadet form of entry by drawing on university graduates. The implications of this decision for the whole concept of the RAF College are far reaching and have not yet been fully explored, but enough is clear for the future pattern to be outlined. The last Flight Cadet entry has already entered Cranwell and is due to pass out in 1973. The first graduate entry assembled at the College in September 1970 will pass out in the middle of 1971. The form of the graduate entrant's training course has not yet been decided in every detail, but it will differ considerably in style and content from that familiar to generations of Flight Cadets. The students will of course be more mature and more advanced academically than their predecessors, and the way has to be found to give them a good grounding in the old Flight Cadet virtues and tenets without stifling the independence of disciplined thought which has been implanted and cultivated in them by their university education. This presents us with a considerable (though not entirely novel) challenge, but the rewards of success will be great. It is important to remember, however, that, as in the past, the bulk of our officers will come to us not through Cranwell or the universities, but by direct entry from school or civil life. The great change, however, is that graduate and direct entrants now take their place in the same list and each in his separate way will be trained and prepared to compete for promotion to senior rank.

As in flying training, the future pattern of trade training in the Command is being shaped by the need to achieve the same results at less cost, *ie*, to produce trained men more efficiently than hitherto. Although it swamps flying training in terms of numbers, the trade training commitment currently absorbs rather less than $\frac{1}{3}$ of the Command's total resources, and no single item in the resources employed is spectacularly expensive; so the drive towards greater efficiency in this field is developing along evolutionary rather than revolutionary lines. We are depending upon improved methods of management, on better organisation and on advances in the technology of training to take us progressively to our objective. We have already gone some way in concentrating the trade training schools into a few large, well-found Stations, and in exploiting improved teaching methods, such as programmed learning: the most promising field for further progress seems to lie in the direction of squeezing more use out of the resources we already have.

We have been studying this problem for some time now and have developed a concept known as 'continuous flow' training. This process will aim to replace the traditional but somewhat inflexible training methods of fixed intakes of trainees, rigid syllabuses of instruction and standard progress rates by a system of modular instruction designed to accept entrants when they wish to join, to pass them through the schools at a learning rate suited to each individual, and to graduate each man when he is ready. In other words, by using modern programming and teaching techniques, we aim to suit the system to the individual rather than to require each individual to adjust himself to the system. A start has already been made by doubling the frequency of intakes to most of our schools.

So, in sum, it's 'all systems go' in Training Command and those of us who are currently in the training game count ourselves lucky to be there when things are really moving. Our concern is with men and manpower. Only the best commands the attention of the Royal Air Force, and the trainer's job is to fit it for the exacting demands of our Service. We aim, by good management and imaginative methods, to do this at least cost to the air force's share of our national defence resources. ©



Airman/Feltham



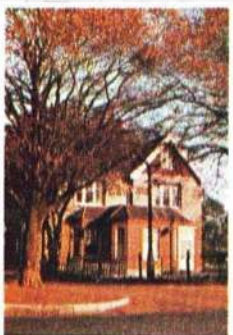
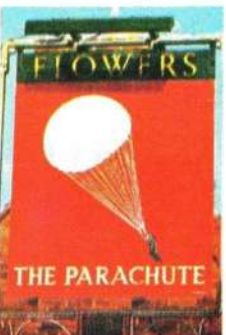
Tiger Moth/Rochester



Canopus/Rochester



Parachute/Henlow



Battle of Britain/Northfleet



Air Pubs

*Competition Entry
by Leslie Hunt*

Reproduction by courtesy of Air BP

MANY A KNOTTY PROBLEM has been unravelled, the seeds of a new idea germinated or a pleasant hour of relaxation from the problems of aviation spent in the hostleries of our land.

Today, vertical take-off occupies many minds. The first link in the chain of its realization was forged as long ago as 1766, when Henry Cavendish defined the properties of 'inflammable air'—later to be known as hydrogen—and demonstrated that it provided the lifting force necessary to let men follow the birds. Seventeen years drifted by before a successful ascent was made in a hydrogen-filled balloon, in December 1783. By then, somebody else had got in first, for Pilâtre de Rozier had ascended on 15 October 1783, in a captive hot air balloon of the Montgolfier type.

In conservative and sceptical Britain it was left to an Italian, Vincenzo Lunardi, to make the first successful free flight on 15 September 1784. The first ascent by an Englishman, at Oxford on 9 October 1784, is attributed to James Sadler.

Inns which recall the days of the balloon are to be found at Abingdon, Berks; Bilston, Staffs; Gloucester; Oxford; Portsmouth, Hants; Wollaton, Notts; and Birdlip, Glos, and it is the 'Air Balloon' at the latter place which has a particularly attractive wrought iron sign depicting a balloon and basket.

Whilst its name recalls the early pioneers, the 'Balloon Tavern' at Fulham, SW6, has an interesting story quite unconnected with aviation. A sign board over one window gives the information that '... these premises are permitted to be open between 6 o'clock and 8 o'clock in the mornings of all days ...'. It seems that Charles II, passing early one morning in his carriage, had the landlord of the tavern knocked up in order that he might slake his thirst. Furthermore, he instructed that from henceforth this particular tavern was to open at 6 a.m. each day in case he passed that way again. What goes up must come down, and with the advent of heavier-than-air craft, the down was frequently disastrous. The means of escape from a disastrous 'down'—the parachute—can be traced way back to Leonardo da Vinci, but it was not until the end of the

PUBS

First World War that it came into general use. 'The Parachute' inn at Henlow, Beds, perpetuates the 'brolly' to which so many people owe their lives, the inn sign depicting a parachute descent. At nearby Shefford is one of two inns which recall the parachute user—'The Airman'; the inn sign here shows a pilot and a two-bladed propeller is affixed above the entrance door. The landlady of 'The Airman' recalls that many of her early customers were members of the RNAS, in the days before the RAF was formed, and tells amusing yarns of Henlow in the 1920's, when parachutes were tested there. Sometimes the locals would rush out of the bar, tankards in hand, to render assistance to men entwined in silk and rigging lines, occasionally returning to the bar with a thirsty pup which had been tossed from a balloon or biplane in special harness. When your snack at the 'local' includes a hot dog, remember our four-footed friends who helped to make military flying safer! Memories of an early aircraft are perpetuated at Bristol, where 'The Bristol Bulldog', unfortunately without a pictorial sign, recalls this famous biplane which made its maiden flight on 17 May 1927, and was still in operational service in the Russo-Finnish war of 1938–9. An aircraft with an even longer service record, the DH Tiger Moth, was used for the *ab initio* training of thousands of airmen. This little biplane trainer entered service with the RAF in 1932 and was still providing invaluable training some 23 years later. It is remembered at Rochester, Kent, where the inn sign depicts on one side the entomological moth, and on the other its man-made namesake. It was unveiled by Colonel 'Mossy' Preston, of the Royal Aero Club, who toasted the house from the cockpit of a Tiger Moth, which had been drawn up outside for the purpose.

Happy landings are the wish of every airborne traveller, and at Knowle, Bristol, adjacent to Whitchurch airfield, the 'Happy Landings' inn sign carries a fine painting of a Britannia. Many are the stories this inn could tell of men and women who, during the Second World War, took their first, or last, drink on British soil at this inn. It was from here that aircraft arrived and departed *en route* for Lisbon, running the gauntlet of the Bay of Biscay. Many an escaper raised a glass to the crew who had brought him to safety, following adventures which have since formed the basis of a best-selling book or an exciting film.

Another 'Britannia' is to be found in Mare Street, Hackney, E8—an unlikely spot, you'd imagine, for the



Firefly/Hayes



Happy Landings/Stanwell



Happy Landings/Bristol



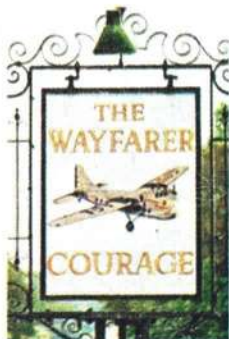
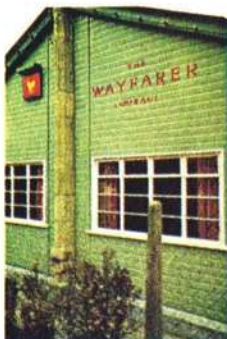
Flying Lancaster/Desford



Britannia Inn/Bristol



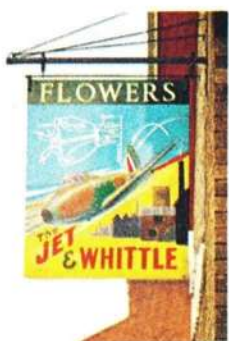
Britannia/Hackney & Balloon Tavern/Fulham SW6



Wayfarer/Bristol



Welcome Stranger/Lympne



Jet & Whittle/Leamington Spa



Jet/Oxhey

airliner to be immortalized. Here, a double-sided signboard faithfully portrays the 'Whispering Giant', and so it should for the artist, S. G. Court, was helped during his commission by BOAC stewardess Jean McLaren, who held a model Britannia at the required angle for his guidance. When this house was re-opened in 1958, another stewardess, Jennifer Kingsley-Evans, unveiled the sign and Captain O. P. Jones, the bearded doyen of British airline pilots, wished the Britannia a smooth journey.

'The Air Hostess', herself, is remembered at an inn of that name, formerly the 'Bricklayer's Arms', on the fringe of London Airport. It was in 1954 that Sir Miles Thomas unveiled the signboard which depicts a beautiful girl in the uniform of a stewardess.

Only a short distance away stands the first circular hotel in Europe, the 'Hotel Ariel'. It is linked with William Samuel Henson, who built a remarkable steam-powered model aeroplane named the Aerial Steam Carriage, in 1842, as the prototype of a full-size passenger aircraft. It was the first-ever design for a complete powered aeroplane, but was too far ahead of its day for success. Nevertheless, Henson's inspired dream forms a fitting subject for the hotel's interior decor.

Naval airmen are not forgotten and in the delightful village of Newlyn, Cornwall, the sign of 'The Swordfish' inn depicts the fish of that name on one side, and a 'Stringbag' of the Fleet Air Arm on the reverse. It was painted by Peter Penn of St Ives, a former member of the FAA, as is the landlord, Hugh John Galpin. It was declared well and truly launched, in proper wardroom tradition, by Admiral Sir Denis W. Boyd, who achieved fame as captain of the aircraft carrier *Illustrious* at Taranto in 1940.

Curiously enough, no inn has yet adopted the name of the Hurricane or Spitfire, though 'the Few' are recalled by two Kentish houses named 'The Battle of Britain'. The inn sign of one has a neat montage of an RAF roundel pierced by a pilot's brevet; that at the other depicts two scenes from the Battle.

Two wartime mounts of Bomber Command are recalled. At Hastings, Sussex, 'The Wellington' illustrates the Vickers bomber of that name—paying particular honour to No.75 (NZ) Squadron—instead of the more usually chosen portrait of the Duke. At Desford, Leicestershire, 'The Lancaster', once a coaching house, is misnamed locally 'The Flying Lancaster', and the inn sign portrays a Lancaster bomber of No.50 Squadron.

POST

With the development of the jet engine during the war, it was inevitable that production of jet-powered civil airliners would not be long delayed. In the event, airline passengers flew into the jet age in the DH Comet, and it is little wonder that this world-leading aircraft should be honoured on the sign board of the 'Comet Hotel' at Scunthorpe, Lincs. The attractive painting shows a Comet 1 in BOAC livery though, in fact, the particular aircraft portrayed went into service with Canadian Pacific.

A delta-wing research aircraft graces 'The Jet' at Oxhey, Herts, and two fairly recent FAA tributes include 'The Firefly' at Hayes, Middlesex, toasted on opening by Group Captain Gordon Slade, Fairey's chief test pilot of post-war years, and 'The Buccaneer' at Brough, Yorks, which features the Blackburn (Hawker Siddeley) aircraft of that name.

As we enter the space age, inn titles strive to keep up-to-date. There is a 'Telstar' at Billingham, Durham; while Addington, Surrey, has beaten both the Russians and the Americans with a 'Man on the Moon'. Since time immemorial, the inns of this country have offered refreshment and good company; never more than during 1939-45, when our servicemen found a welcome and warmth which provided well-earned relaxation from the stresses and strains of war. Perhaps the words of the poem 'In the Local' by W. A. G. Kemp, father of a Hurricane pilot, best express this atmosphere:

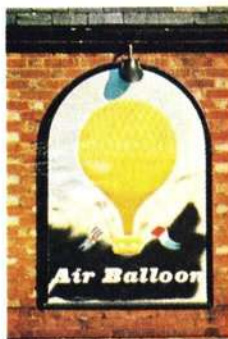
YOU see them in the 'local' anywhere,
In town or country near a fighter station,
In flying boots and scarves — their ruffled hair
Like schoolboys out for jolly celebration;
Eight in a car for four had raced along,
And miracles were wrought to bring them here,
To pass an hour with banter, darts and song,
And drink a pint or two of English beer,
And talk of 'binds' and 'dime' with lots of natter,
Of 'ropey jobs' and 'wizard types' and 'gen',
Amid much laughter, glasses' clink and clatter.
Deep underneath was hid the real men,
Who saw their comrades fall out of the skies,
And knew too well the look in dead men's eyes.

(from 'Men like These' — Chapman & Hall)

The very fact that we are free to name our inns in this manner, and in so doing pay tribute to the immense achievements of British aviation, would be considered adequate reward by the men and women whose deeds are remembered in this uniquely British way ☺



Air Balloon/Birdlip



Air Balloon/Abingdon



Air Balloon/Portsmouth



Wellington/Hastings



Buccaneer/Brough

Scaffolding comes down as the great RAF Museum building is completed for hand-over to the Trustees in April. Finished on schedule at remarkably low cost by Geo Wimpey & Co, as main contracting member of Industrial Development Group Ltd, the immense task of arranging the exhibits now faces Dr John Tanner and his museum staff . . . funds are still urgently needed

Editorial concluded from page 6



Mr Peake's words: 'Lord and Lady Portal's interest in and support of the Fund's work since the last War have been unsurpassed. He will be greatly missed as Deputy Chairman and by none more keenly than by me. On many occasions I have sought his advice or assistance and this has always been forthcoming.'

In October 1969, when the Fund celebrated its 50th Anniversary, Lord and Lady Portal acted as the Fund's hosts at a Royal Charity Premiere of the film *The Battle of Britain* when they welcomed HM the Queen, The Prince of Wales, Princess Anne, The Duke and Duchess of Kent, The Duchess of Gloucester, Prince Michael of Kent and Princess Alexandra. Lord Portal was appropriately the senior guest at Lancaster House on 21 April 1970 when MoD held a Reception, attended by the Duke of Kent, President of the Fund, to commemorate its Golden Jubilee. No one has done more to ensure the prosperity of the Fund and the continuity of its work; while he was Deputy Chairman the Fund expended over £15 million on relief of distress among serving and ex-serving members of the RAF, their families and dependants, and he undoubtedly derived as much satisfaction from that achievement as the Fund has taken in his long Deputy Chairmanship. Lord Portal will remain a Vice-President, an office he has held since retiring as CAS in January 1946.



THE SOUVENIR BOOK HAS LONG CLAIMED to be the widest-circulating charity publication on sale to the general public. Another claim can now be added. Starting last year, copies were distributed to the chiefs of all air forces, and every one has asked for this year's edition, and more copies, to be sent to them. So that we can now state that *The Royal Air Force Souvenir Book* is read by every Air Force Staff in the World.

ROYAL AIR FORCE AT HOME DAYS are not the only public events at which the Souvenir Book will be sold this year. The RAF Stations 'At Home' on Saturday September 18 are listed on page 54, together with a list of United States Third Air Force Open Days and Air Displays organised by RAFA throughout the summer. The Souvenir Book will be available at all these events.



THIS ENLARGED EDITION OF THE SOUVENIR BOOK is still not big enough to contain all the excellent material received, especially from competition entrants, so enthusiastically solicited by the MoD (Air) representative on the Souvenir Book Committee, Gp Capt T Stafford, OBE. In fact, despite the inclusion of the special colour supplement on Jaguar, severe lack of advertising support caused us to eliminate eight pages just before going to Press. Apart from the six prize-winning entries published, the Committee unanimously agreed to the Gp Capt's suggestion that awards should be sent to the following entrants whose contributions had perforce to be omitted. Some of these are being retained for possible inclusion next year.

Prize Winners Articles—John W R Taylor, RAFA, Gp Capt Tom Harvey, Flt Lt Leslie Hunt, Flt Sgt J Hinde. **Illustrations**—J G Robins, W Jackson, EDDU. (Mr Jackson also submitted a painting of Brisfits over the NW Frontier which will be used for our centre spread next year.)

Additional Awards Articles—Flt Lt Richard Slogrove, Gp Capt F C Griffiths DFC AFC, Wg Cdr P F Steib DFC, Flt Lt F H Green (Rtd), Cpl (W) Stuart-Mills, Gp Capt H Vernon Jessop LDS, Sgt D Linley, Flg Off J M B Ritchie, W Obs J Barden ROC, Flt Sgt R A Honeybone, Michael J Getling ATC, Flt Lt C G Davies. **Paintings**—Sgt C J Spicer. **Cartoons**—Flt Lt J J Sinclair, Cpl Bill Bush, Obs M E Jones ROC, Cpl Lindon. **Poems**—W O B Matthews BEM WRAF. ©

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Art prints of the 1971 SB centre-spread painting of Jaguar by Derek Bunce of Gibson Gilbert White, measuring 18" x 14 1/2" inc. white border, to fit standard frames, available at 95p (inc. p & p). See also page 54

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RAF Mountain Rescue

Competition Entry by John Hinde

EIGHT RAF MOUNTAIN RESCUE TEAMS exist to deal with Service and Civil aircraft incidents (although 90% of their rescues involve victims of mountaineering accidents) . . . six in UK, one at Akrotiri in Cyprus to cover Turkey and Iran, and a Mountain and Desert Rescue Team at Sharjah in the Persian Gulf; each has a permanent staff of five, with up to 36 volunteers who train in their own time. Mountain Rescue became the special province of the RAF because so many aircraft crashed into British hills during the war, the first team having been formed by the SMO at Llandwrog, N Wales, in 1942, and saved many lives from aircraft wrecks; only two have been saved in similar incidents during the past ten years, but there are still too many calls for help, especially from other mountain accidents – perhaps once a fortnight – and an emergency can last from a few hours to a long search for ten days or so.

help for civilian climbers

In 1949, RAF mountaineering techniques were not so advanced, but even then, teams could help civilian climbers: four mountain rescuers from RAF Kinloss had just climbed Crumbling Cranny, a snow gully on Lochnager, when the cornice of nearby Raeburn's Gully collapsed and swept down four climbers from Aberdeen. The RAF men descended by the corrie lip and crossed the avalanche debris to reach the injured who had fallen 700 ft, although only one (torn by the rope from his belay in an ice cave when his leader was dragged past him by the force of the avalanche), was badly enough injured to require a stretcher carry. Ice-axes were used to improvise splints and he was treated for a fractured leg and ribs and injected with morphia. Two of the RAF party had gone down to the valley, alerted their team mates and the Police, and started back on the 3,000 ft slog with a stretcher. The casualty evacuation across the bealach of Meikle Pap and down to Spittal of Glenmuick lasted well into the night, when the pressure lanterns of the rescue cavalcade made a great flarepath down the snowy hillside.

long searches for crashed aircraft

This was one of the spectacular rescues, to be contrasted with long, weary days of search; in May 1964, some 80 men from Kinloss, Leuchars, Leeming, Stafford and Valley spent ten days of cloudy, wet weather searching the mountains of Inverness and Argyll for a crashed USAF Voodoo on 2,600 ft Maol Odhar, north of the Great Glen;

but sometimes conditions were good, with perfect days of sunshine on hard snow spent combing the Achnashellach hills for a false aircraft Call Out in April 1966. There was always help and co-operation from the Highlanders and often a gamekeeper led the team in darkness to the wreck, where it was often simply a matter of mounting an initial crash guard, carrying down the victims, ensuring that ejection seats and explosive bolts were safe and then assisting in the accident investigation by making a detailed layout of major components and initial impact markings of radomes or propellers, and sometimes extensive sweeps had to be made for components shed before the crash.

hill-walkers who get lost

The longest searches were for solitary hill-walkers who failed to turn up; during one year alone, Kinloss Team spent 20 full days on six such incidents, and one walker who left Ardvreck Castle at Loch Assynt to walk over Ben More is still not accounted for! Searches were often speeded up by dogs, usually owned by members of civilian mountain rescue teams: Hamish MacInnes of Glencoe first started to use his Alsations for rescues in the mid-1960s and now runs an annual course, so that there are many search dogs available – particularly useful for avalanche accidents. Often, the rescues that made the headlines were the least interesting and when teams worked hardest they were hardly reported at all, yet one Scottish newspaper was so accurate with its accounts that it was sometimes hardly necessary to take notes for the team's report . . . mountain climbing isn't all that dangerous, but mountain rescues seem to have more glamour than the more numerous sea incidents and road casualties.

the enjoyment of training

Operations kept the teams on their toes, and doing a worthwhile job every so often helped morale generally, but team members were happiest when there were no actual rescues, since training was so enjoyable. As the general standard of British climbing improved and the number of climbers increased so rapidly, so the rescuers' standards had

Stretcher lower at Kantara



Ian Sykes climbing *Drakula* – a great overhanging 'roof' near Inverness, which juts out 35 ft from the crag. Wedges are driven into the crack



Improvised ragsitz rescue – the patient sits in a rescue seat formed from coiled rope



to rise: annual standardisation courses for rock- and snow-and-ice climbing were held in N Wales and the Highlands and every team trained practically every weekend. RAF Mountaineering Association expeditions to the Himalayas and the Arctic, and Joint-Service expeditions to Antarctica and Alaska had a proportion of RAF Mountain Rescue members: many of the 'troops' spent their leaves climbing in the Alps when they could tear themselves away from the British hills. Parties from the Scottish and Welsh teams started great marathon walks across the Highlands in summer and winter, E-W from Mt Keen in Aberdeenshire to Sgurr na Banachdich in Skye, or N-S from Ben Hope to Ben Lomond, crossing 40-50 mountains *en route*. Perhaps the finest RAF climber of them all was Ian Clough, who spent his National Service with Kinloss MRT and later made the first British ascent of the N Wall of the Eiger with Chris Bonington. Ian was also in the team which succeeded on the great S glacier of Annapurna in 1970 but was killed by an avalanche of ice seracs during the descent. Generally the rescuers knew well the results of mountain accidents and so learned to become the safest of climbers, and made great contributions to the standards and techniques of the sport. Several team leaders became professional guides, and other ex-members earn their living as Outdoor School instructors.

helicopters can help—sometimes

Helicopters make a big contribution to Mountain Rescue, particularly in overseas theatres with more reliable weather; in Cyprus, the Helicopter Flight often undertakes jobs which might be thought only possible for trained mountaineers, such as plucking a casualty from the foot of a vertical 180 ft cliff, using a newly-developed 'long-rope' technique. The helicopter is also useful for the rapid transfer of searchers and for final evacuation of casualties, but when clouds are low on the summits or winds are excessive, and in most cases at night, the choppers must leave the job to the mountaineers. Some important jobs exceed the operating altitude of existing helicopters, such as the destruction of secret equipment at 14,000 ft on Mount Suphan in Turkey, which had to be carried out by climbers of Nicosia MRT. The equipment was in an Avro Tudor flying to Woomera in April 1959 and the demolition was completed only ten days after the crash—five days after the wreckage had been spotted by a Hastings—still with the mountain in full winter conditions. Whatever the job, the location is important. On flat ground and in fine weather other rescuers can cope... Police, firemen or, at sea and on the cliffs, perhaps coastguards and lifeboatmen; but *mountain* is the essential part of 'mountain rescue' and the mountain rescuer must first be a mountaineer. ☉



Searching for Eleanora's Falcons' chicks on a 180 ft sea cliff at RAF Akrotiri with radio control

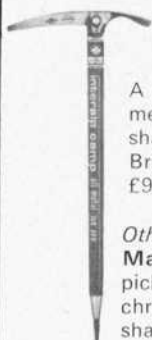
A climber of a Scots RAF Mountain Rescue Team tackles an 'artificial' pitch

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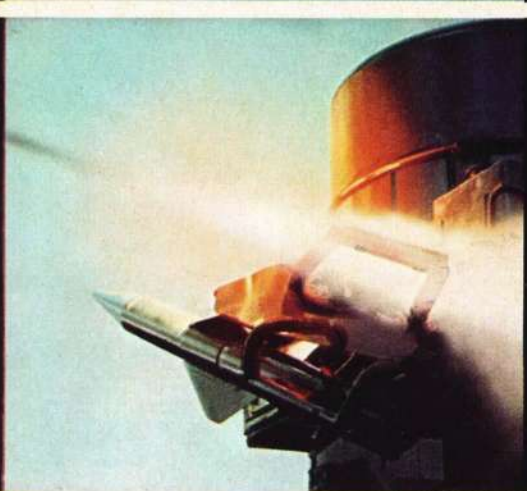
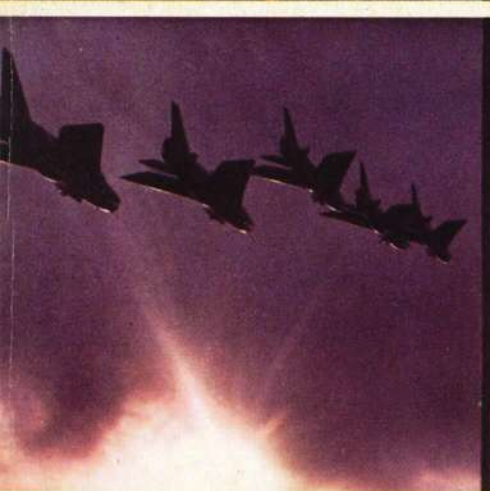
TRAINING

Nearly every jet pilot in the RAF has been trained on BAC aircraft. In the 1970s, vital roles will be played by the Jet Provost Mk 5—which is now in full service—and the Jaguar operational trainer.



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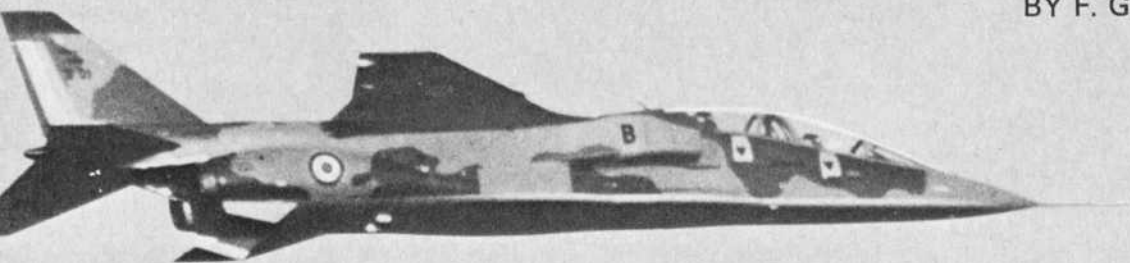


STRIKE

In the 1970s, the main increase in RAF strikepower will derive from two advanced aircraft developed by BAC in collaboration with European partners—Jaguar and the Panavia MRCA.



BRITISH AIRCRAFT CORPORATION



THE JAGUARS



ARE COMING

SOME TIME DURING THE NEXT YEAR OR SO, an RAF pilot will strap himself into the cockpit of a sleek, purposeful-looking aeroplane for a sortie which will be a little more than just routine. It will mark the RAF's formal acceptance of the first example of its newest warplane, the BAC/Breguet Jaguar. With operational conversion units receiving their first aircraft before the end of 1972, the Jaguar is expected to phase into full-scale operational RAF service in the UK and Germany in 1973-74, adding a potent new tactical support capability to the Service.

Although in the early days of project design Jaguar was regarded by the RAF primarily as a two-seat trainer, with only a secondary application in the strike role, changes in Britain's aircraft procurement policies and defence commitments have resulted in steadily increasing emphasis upon the tactical support version. The final step was the new government's decision in 1970 to delete Jaguar from its planned application as an advanced trainer but to increase the force of single-seat strike versions to nine squadrons. As a result, only sufficient trainers to equip an operational conversion unit and provide one for each operational squadron are now retained in the programme.

Numerically, therefore, the Jaguar is the most significant

combat aeroplane purchased from the home aircraft industry since the Hunter. Qualitatively, it shows every promise of being just as significant in its contribution to modernising the RAF's ground-attack inventory. But Jaguar is notable also as the first warplane designed and built as an international project to reach operational service.

The concept of international collaboration in aeroplane ventures was embraced wholeheartedly by Britain during the 'sixties, for sound reasons. Launching a single new aircraft project to meet the combined requirements of two or more nations means that the certain market is enlarged from the start, thereby reducing both the unit cost of production aircraft for each customer and the initial investment required from each country to cover research and development costs.

It is a matter of history that not all Britain's attempts to collaborate with European partners have been successful. Nevertheless, the trio of Anglo-French helicopters (Gazelle, Puma and Lynx), the Panavia MRCA and Jaguar itself show every sign of vindicating the concept. Jaguar is not only cheaper than it would have been as an all-British programme, because of the longer production run, but also benefits from the combined inputs of two fine design teams and two highly respected fighting forces.

The operational role

Jaguar's role in the RAF is as a tactical strike and close support aircraft. This role calls for a number of special qualities. To understand the requirements, it is necessary to consider the kind of battle situation for which aircraft of this type are primarily needed.

That situation is likely to be one in which opposing ground forces are in close contact in a non-nuclear battle – typically represented by the Vietnam war and the Arab-Israeli conflict and not really so very different, in terms of the fighting environment, from the Allied offensive into Europe after D-Day. Tactical air support is needed to attack small, specific and possibly moving targets close to the front line – troop concentrations, gun emplacements, tanks, radar and missile sites, and so on. Aircraft for this mission will be required to fly at low altitudes, in a hostile environment. Target information may come from forward air controllers, or from recon-

seaters and will be used at the OCU and in the squadrons for continuation training.

When any new aircraft is introduced into service, it is usually looked upon as a replacement for an older type, but Jaguar has no real predecessor in the RAF. The last aeroplane adopted by the Service for the close-support role was the Hunter. In No 38 Group, ASC, the ground-attack Hunters have been replaced by the much more specialised V/STOL Harrier, whilst in Germany the responsibility is shared between Harriers and Phantoms. The latter type, purchased primarily as a replacement for the Lightning in its original interceptor and air superiority role, has also proved effective in tactical roles, notably in Vietnam and the Middle East. But the Phantom remains pre-eminently an interceptor and is far from being optimised for the tactical support role. In terms of airfield performance, navigation and weapon-aiming accuracy and ferry range, the Jaguar can out-perform the Phantom; in terms of range/load performance from limited runways, Jaguar again has the advantage.



RAF requirements for the single-seat Jaguar called for ability to carry a heavy and varied weapon load

naissance sweeps, or 'targets of opportunity' may be spotted by the pilots during standing patrols.

To react quickly to calls for attacks on specific targets, aircraft must operate from bases close to the front line, which presupposes the ability to fly from small fields with semi-prepared surfaces. A heavy and varied weapon load must be accommodated, and an accurate navigation and weapon delivery system is vital because of the transient nature of the targets. The aircraft must also be capable of longer sorties for reconnaissance behind the enemy's lines, suggesting the need for external fuel as an alternative to weapons.

To keep under the enemy's radar net, the aircraft must operate for much of the time at altitudes below 500 ft, where it must have excellent manoeuvrability coupled with a high subsonic speed. It must also be able to resist a high degree of battle damage from small arms fire or heavier calibre weapons. A built-in gun armament is valuable, for attacking primary targets, to make defenders 'keep their heads down', and for self-defence against interceptors.

This is the kind of tactical situation which it is part of the RAF's responsibility to anticipate. Such a battle might have to be fought on the European mainland; but in other parts of the world, too, the threat of possible British involvement remains. The RAF units equipped for tactical ground support are therefore divided between No 38 Group of Air Support Command, which maintains maximum mobility for deployment to any part of the globe, and RAF Germany, which is part of Britain's commitment to NATO. It is expected that the nine squadrons of Jaguars will be divided approximately equally between these two commands. Two-seaters with full operational equipment and capability will be bought by the RAF in the ratio of one for every five single-

To the extent that the Jaguar replaces anything in the RAF, therefore, it replaces the Phantom and the squadrons of the latter type now in Germany are scheduled to join Strike Command in the air defence role once the Jaguars get into service. The eventual tactical 'mix' by the end of the decade, therefore, will comprise Jaguars and Harriers for tactical support and the MRCA for longer-range interdiction/strike, while the Phantom will have become the basic interceptor. Beneath this front-line structure will be the new advanced trainer which is at present the subject of a design competition between Hawker Siddeley and BAC, and which is being bought to fulfill the training role in which, five years ago, the RAF had cast the Jaguar.

Evolution of the programme

Although Jaguar has been a joint Anglo-French programme since 1965, its roots lie in independent studies in the Operational Requirements branches of the Royal Air Force and the French Air Force (*L'Armée de L'Air*) going back to 1963 or earlier. During 1963, RAF studies of the then-current training sequence pointed up the need for a new type to replace the Gnat and Hunter in the advanced training role. The sequence then (and still today) began with a short period on the piston-engined Chipmunk for pilot suitability assessment, followed by basic training to 'wings' standard on the BAC Jet Provost. Then followed 70 hours on the Gnat, after which pilots destined for fighter squadrons required another 75 hours on the Hunter.

This is a costly arrangement and, with both Gnat and Hunter nearing the end of their RAF lives by 1975, there was obvious scope for a single aircraft to replace both. An Air



The French Navy's Jaguar M during trials on the carrier *Clemenceau* in July 1970

Staff Target requirement was therefore drawn up outlining this need, to stimulate design activity within the aircraft industry, and noted that the new aircraft might have a secondary counter-insurgency role. Project designs were prepared in several drawing offices, full integration within BAC and Hawker Siddeley not at that time having been achieved. Within the BAC group were the English Electric (Warton) P45, the Hunting (Luton) H.155, and some designs by the former Supermarine design team at Weybridge. In the Hawker Siddeley group were the Hawker HS.1173 and Folland Fo.147 projects. Before formal consideration of these designs by the Air Staffs was possible, however, Anglo-French collaboration had been approved at government level and new plans were adopted.

France had begun studying a new advanced trainer somewhat earlier than Britain. In its very early stages, the French

requirement also placed emphasis on the training role, with a secondary interest in the tactical combat possibilities of the aircraft, called the ECAP (*école appui*, or support trainer). However, by 1963, this had changed to ECAT (*avion d'école et d'appui tactique*) and the emphasis has switched firmly to the tactical role with a secondary application as a trainer.

A principal reason for this change of emphasis was the realisation that the Mirage IIIV V/STOL close-support project would not reach the operational targets set for it. An important part of this role was 'carpet-sweeping' ahead of the nuclear-armed Mirage IVs of the *force de frappe* – ie, knocking out enemy radar and anti-aircraft missile sites along routes to the targets. This remains today as part of the mission for the French Air Force Jaguars and explains some of the differences in equipment between French and British versions.

A full-scale design competition for the ECAT was launched in France, projects being submitted by the two nationalised concerns, Sud and Nord, and by three 'independents', Breguet, Dassault and Potez. (Through rationalisation of the French industry, Sud and Nord have become a single entity in Aérospatiale, Breguet is owned by Dassault, and Potez has quit aircraft production.) As a result of this competition, the Breguet Br 121 project was selected by the French Air Staff early in 1965.

Apart from the difference in emphasis on roles, the British and French requirements differed at this stage in other significant respects. France wanted the trainer version of ECAT in service by the end of 1970, with the tactical version following about two years later, while the RAF was talking about 1974 as the earliest in-service date for its new trainers. Both Services were interested in good field performance but the RAF specified a top speed of Mach 1.7 (1,123 mph) at high altitude while the French would be satisfied with Mach 1.1 (726 mph). France also made the unit price one of the most



In the RAF, the two-seat Jaguar will be used for operational training

important design objectives, with the ceiling price pegged (in 1963) below £0.5 million; the RAF was more willing to accept a higher cost for its higher performance aeroplane.

However, international collaboration had become politically desirable, and the two Air Staffs were not unwilling to discuss rationalisation of their needs. As early as March 1964, the first joint Anglo-French provisional operational requirement was issued to industry, for a dual-purpose, advanced, two-seat pilot-training/light strike aircraft. This document specified the interest of the French Air Force primarily in the operational version, and of the RAF and Royal Navy in the trainer, and also indicated that the aircraft might use variable geometry.

At that time, variable geometry tended to be regarded as a panacea for all problems, following the launching by the US Department of Defense in November 1962 of the TFX programme, in the polymorphic shape of the General Dynamics F-111. Variable geometry would indeed be valuable for the close-support aeroplane, by combining good short-field performance (wings forward) with excellent gust alleviation (wings back) at the very low altitudes required for under-the-radar penetration. But a 3% weight penalty, for the wing hinges, was a high price to pay in this kind of aeroplane, and a more definitive joint requirement document dated October 1964 indicated that the vg aeroplane would be difficult to achieve in the proposed time scale.

Early in 1965, therefore, Anglo-French studies diverged along two independent lines – one for a variable geometry interdicator/strike aircraft (the AFVG) and the other for a fixed-wing trainer/tactical support aircraft (Jaguar). These programmes became the basis of the Memorandum of Understanding signed by the respective Ministers of Defence, Messmer and Healey, on 17 May 1965.

By this time, France had selected the Breguet 121 as the ECAT aeroplane; and Dassault was working on variable-geometry versions of its Mirage fighter. Among the British design studies were a series of alternatives by the former English Electric Company at Warton whose partnership with Vickers on the TSR-2 had provided the foundations for British Aircraft Corporation. These parametric studies, under the design number P.45, included single and twin engined, fixed and vg layouts. The May agreement named BAC as the British partner both to join with Breguet for the smaller aeroplane based on the existing Br 121 designs, and with Dassault on the vg type, taking the P.45 as the basis.

Breguet had originally designed the twin-engined Br 121 around alternative engine proposals while the P.45 studies used either a single Rolls-Royce RB 168 or two RB 172s. Correctly interpreting the trend of official thinking, both RR

and Bristol Siddeley concluded agreements with French companies – Turbomeca and SNECMA respectively – to collaborate in developing new engines. When the Anglo-French agreement was signed, however, it provided for engines for both the new aircraft to be jointly developed. Bristol Siddeley (now a division of Rolls-Royce) would work with SNECMA on a version of the French company's M45 for the AFVG and Rolls-Royce with Turbomeca on the engines for the strike-trainer.

The deal was a tidy package, equitably sharing responsibilities, but two years later France unilaterally pulled out of the AFVG. Among the consequences of this decision were a further delay in the in-service date of the RAF's new interdicator/strike aeroplane (now the Panavia MRCA – a further descendant of the P.45), and a bias in favour of France in the spread of design leaderships on the Anglo-French programmes. But work on the Jaguar continued smoothly and, if the AFVG highlighted the difficulties inherent in international collaboration, then it can be said that Jaguar proves the advantages.

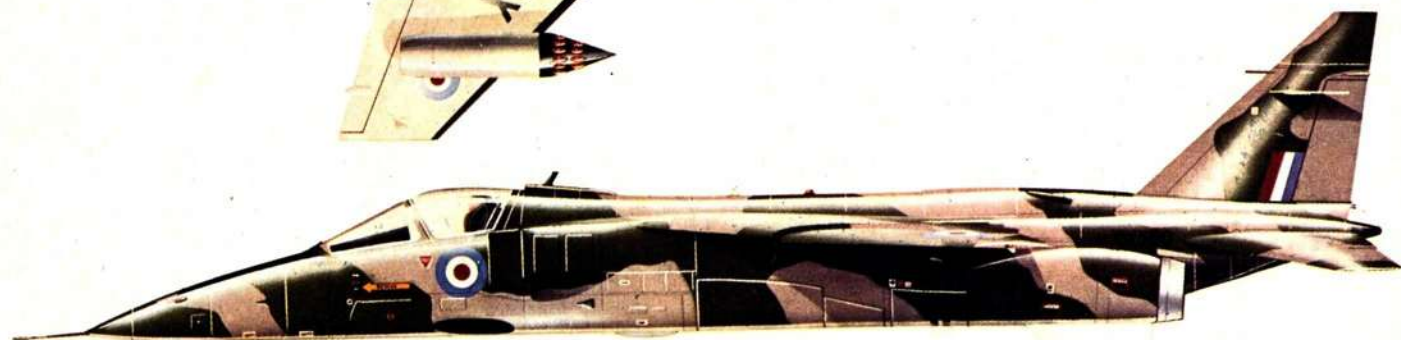
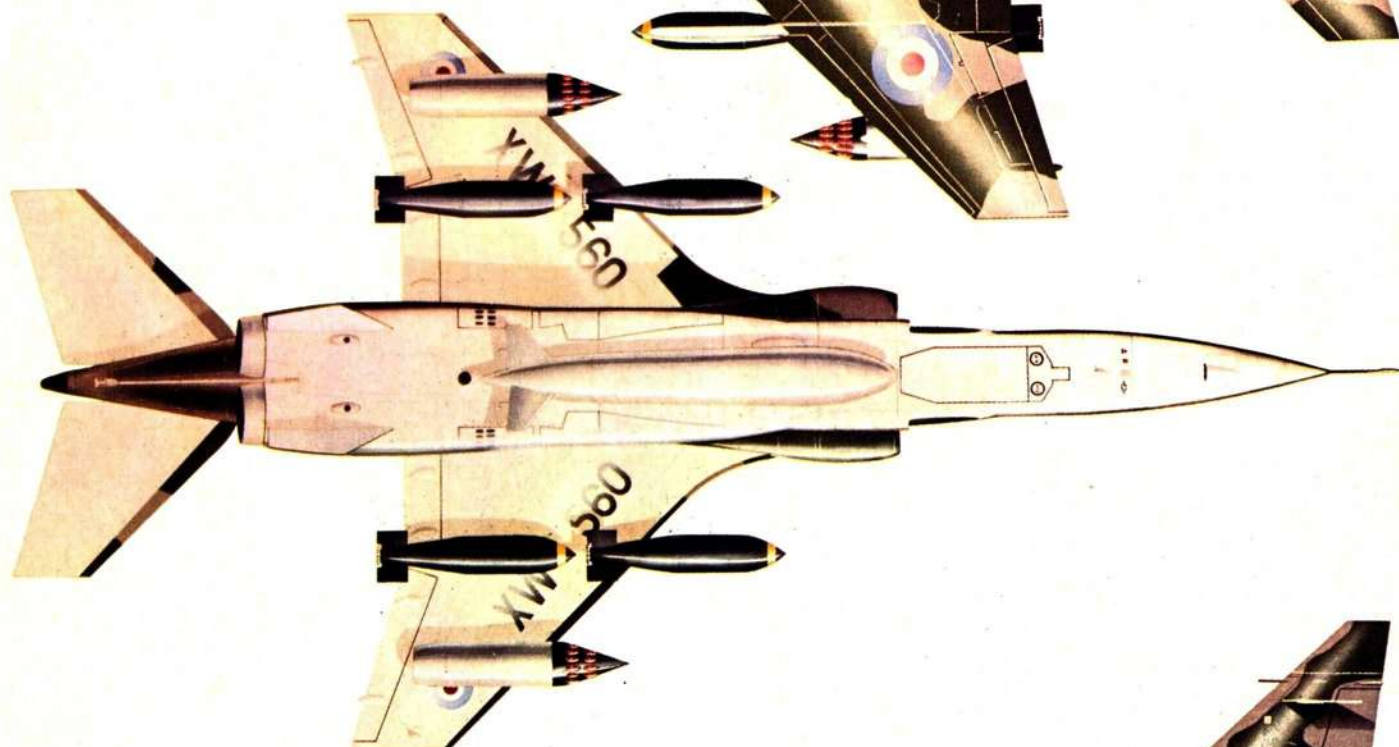
The Jaguar variants

Three versions of the Jaguar were projected at the time of the original 1965 Memorandum of Understanding. These comprised the French single-seat tactical aeroplane, and two-seat trainers in both French and British variants. The two signatories to the agreement committed themselves to the purchase of 300 aeroplanes – 150 trainers for the RAF and 75 of each variant for the French Air Force. The RAF continued to study the tactical version without any commitment to buy.

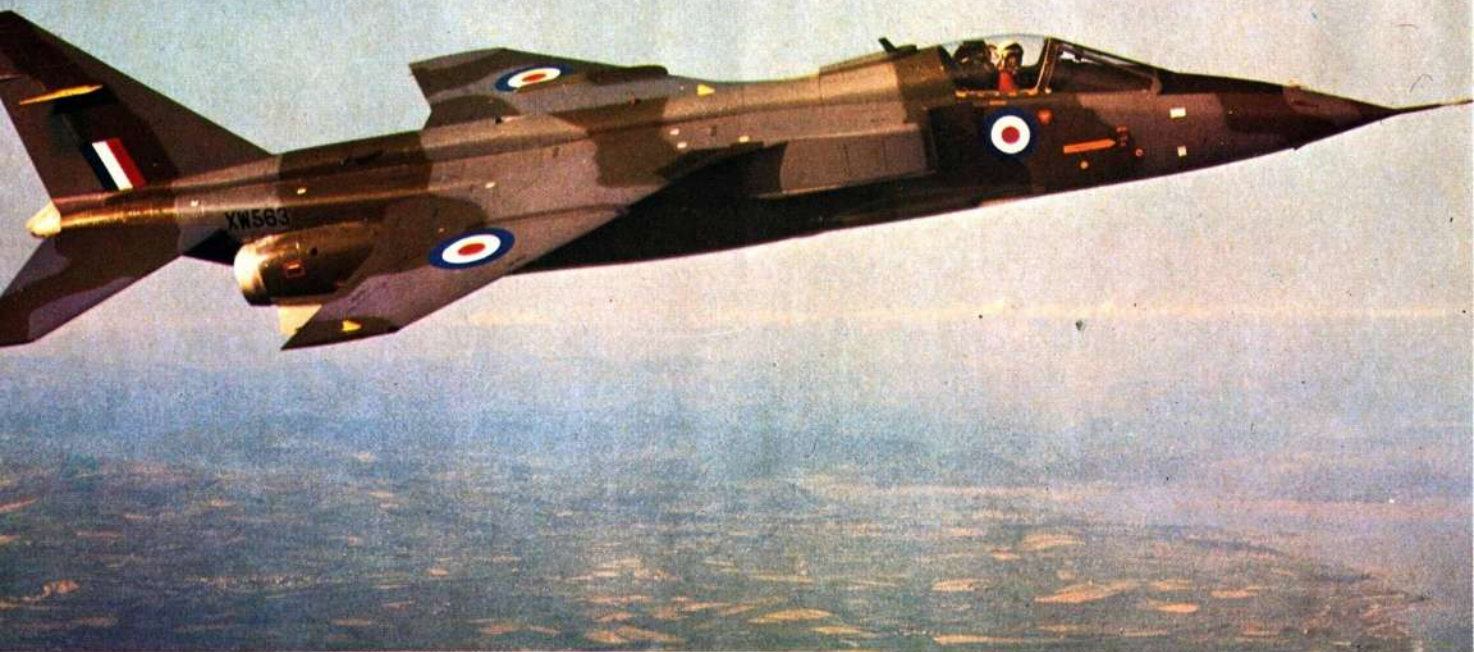
Little time was lost by the Breguet and BAC design teams in refining the basic Breguet 121 design to meet the new combined requirement. Whilst overall layout remained unchanged, major redesign was needed to increase the supersonic performance and permit a more extensive nav/attack system to be carried. The RAF initially insisted on the latter to obtain a trainer to cover the full spectrum of operational flying, with the useful result that no significant changes were needed when the RAF decided to buy the tactical Jaguar.

The changes to the Breguet 121 design, primarily to accommodate the 'British' parts of the requirement, included a thinner wing, higher gross weight (the original French target was about 16,000 lb), higher engine thrust, improved fatigue life, redesigned forward fuselage to improve the instructor's view from the rear cockpit, and internal redesign to accommodate the British nav/attack system. Inevitably, the aircraft unit cost rose, but the fully-equipped RAF strike Jaguar today is still less than £1 million per copy.

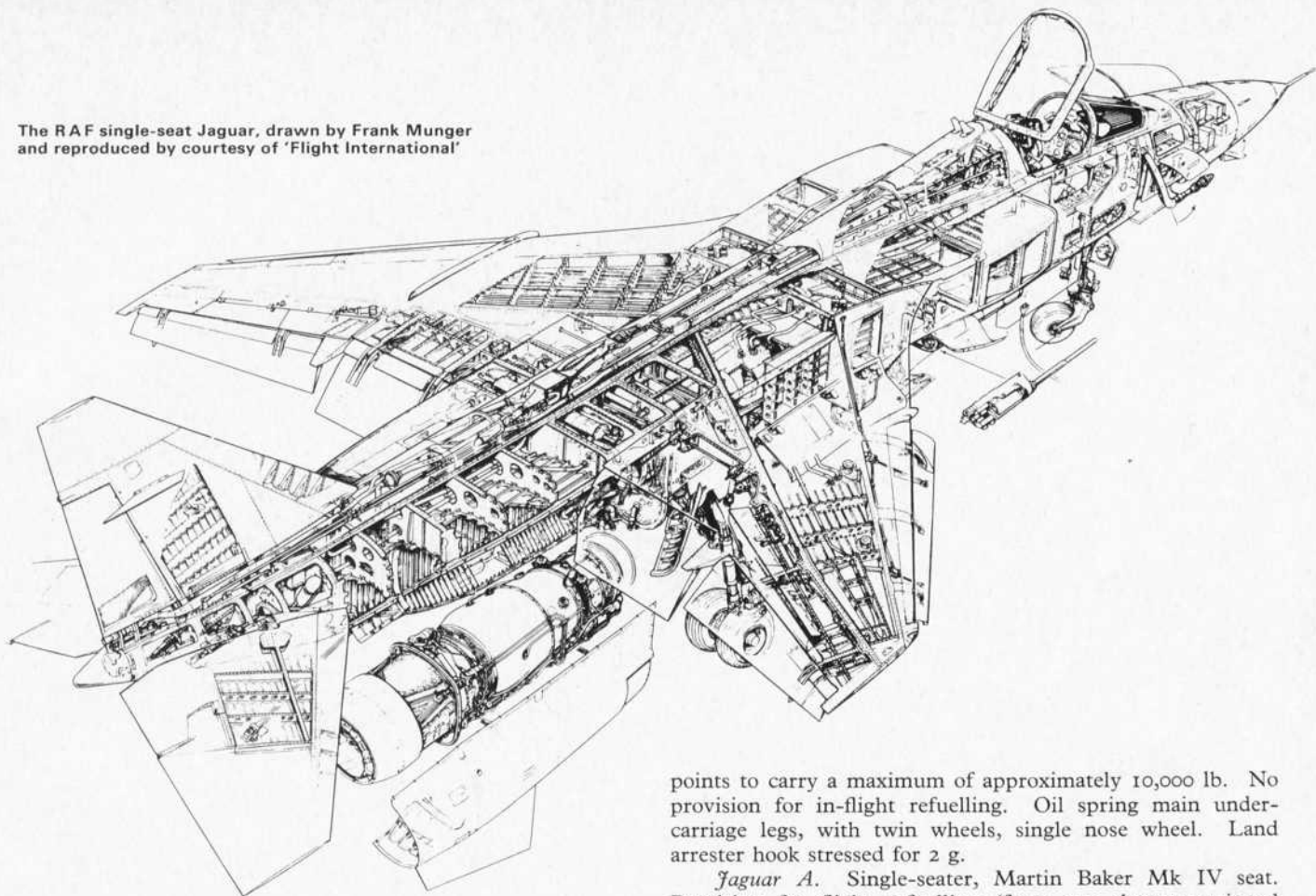








The RAF single-seat Jaguar, drawn by Frank Munger and reproduced by courtesy of 'Flight International'



The three initial versions were identified as Jaguar A (for *appui*) the French single-seater; Jaguar E (*école*) the French trainer; and Jaguar B, the British two-seater. Two more variants were officially added early in 1967. On January 16, an amendment to the Memorandum of Understanding increased the two countries' commitment to a total of 200 each and changed the distribution of variants. The extra French aircraft were for the Navy (*Aéro-navale*), comprising 10 trainers and 40 single-seaters to a new specification for operation from aircraft carriers, called Jaguar M (*maritime*).

The cancellation, during 1965, of new British aircraft types, including the TSR2 and the HS.1154, had by now increased the significance of the strike Jaguar. The British 'buy' therefore changed to 110 trainers and 90 of a new single-seater version, the Jaguar S (for strike). The trainers were still intended to replace the Gnat/Hunter sequence, while the single-seaters were earmarked to equip five squadrons – three in Germany, two in No 38 Group.

Then, in October 1970, the first White Paper on Defence by the new Conservative government increased the number of single-seaters to 165 and assigned 35 trainers for use in support of the Jaguar S force.

The differences between the five Jaguar variants now in production can be summarised as follows:

Jaguar E. The 'basic' aeroplane, a two-seater designed for advanced flying training rather than operational training. Martin Baker Mk IV ejection seats for each occupant, cleared for use at zero level and speeds down to 90 knots. Twin gyro platform with compass facility but no automatic navigation equipment. TACAN and an independent gyro gun sight are carried. Two DEFA 30 mm guns, with 150 rounds each, in fuselage gun-bay on port side, and five external stores

points to carry a maximum of approximately 10,000 lb. No provision for in-flight refuelling. Oil spring main undercarriage legs, with twin wheels, single nose wheel. Land arrester hook stressed for 2 g.

Jaguar A. Single-seater, Martin Baker Mk IV seat. Provision for flight refuelling (from any drogue-equipped tanker) via retractable probe in forward starboard fuselage. Two DEFA guns with 150 rpg, in fuselage bays. Five external strong points and same weapons as Jaguar E. Nav/attack system based on that in Mirage IV, with a twin gyro platform and Doppler providing inputs to a navigation computer and bombing computer. Other equipment includes a computer for the AS 37 Martel anti-radar air-to-surface missile, an air data computer, TACAN, VOR/ILS, an incidence probe, radio altimeter and ECM (radar detection).

Jaguar M. Single-seater with Martin Baker Mk IX rocket ejection seat for zero-zero operation. Provision for flight refuelling and for carriage of buddy-pack for operation as refuelling tanker. Two DEFA guns; weapons and nav/attack system similar to Jaguar A with addition of laser rangefinder. Carrier deck and hard surface undercarriage, with large-diameter single wheels on oleo main legs and twin nose wheel on extensible leg for higher absorption rates and high angle of attack for catapult launching. Structural beefing for catapulting and for a 5.5 g arrester hook.

Jaguar S. Single-seater, Martin Baker Mk IX seat. Provision for flight refuelling. Two Aden 30 mm guns in fuselage bays with 150 rpg. Five external points and total weapon capability as for Jaguar A. Nav/attack system built around inertial platform and central navigation digital computer, with projected map display and head-up display, plus laser rangefinding. Other equipment includes TACAN, radio altimeter and incidence probe.

Jaguar B. Two-seater with Martin Baker Mk IX ejection seats. One Aden gun, in fuselage port side bay, with 150 rpg. Weapons provision and nav/attack system to same standard as Jaguar S without laser rangefinder. No provision for in-flight refuelling.

Up to 2,000 lb can be carried on the centreline strongpoint and each inner wing strongpoint



Weapons and weapon systems

All Jaguars (except the Jaguar B) are armed with two 30 mm guns with 150 rounds. The five strongpoints – one on the fuselage centre line, two beneath each wing – provide Jaguar with an overall external load capability, in round terms, of 10,000 lb.

The centreline point and two inner wing positions can each carry up to 2,000 lb weight, while the outboard wing points are capable of carrying about 1,100 lb (these weights are exclusive of pylons, bomb carriers, etc). Fuel tanks can be carried on the three inboard points only. The pylons themselves are made by BAC as part of the wing assembly and incorporate ML Aviation weapon ejection release units in the British Jaguars and Alkan units in French aircraft.

In common with most modern tactical aeroplanes, Jaguar can carry a very large variety of external stores, but the more immediate requirements of the initial customers call for a relatively conservative range of weapons to be cleared for use. In the case of the RAF, the maximum planned load is eight 1,000 lb free-fall or retarded bombs (pairs on the three inboard pylons, singles outboard). Alternatives are thirteen 540 lb bombs (triples inboard, pairs outboard), SNEB air-to-ground unguided rocket pods, 28 lb practice bombs or reconnaissance flares.

For the French anti-radar role, Jaguar A will carry Martel air-to-ground guided missiles on the three inboard pylons. Provision is made for Sidewinder air-to-air missiles and other weapons which may be required by future Jaguar customers.

As already indicated, the navigation/attack system for the RAF Jaguars is among the most comprehensive yet applied to a close-support aeroplane. The heart of the system is the Elliott MCS 920M navigation and weapon-aiming digital computer, with outputs to a head-up display and a projected map display. The inputs to the computer include position, distance and directional navigation information from Elliott's E.3R inertial platform; TACAN; radio altimeter and air data from the separate Elliott unit.

The MCS 920M unit is the smallest of a range of Elliott digital computers, with a word store capacity of 8,192 words and a weight of only 28 lb. Use of a digital unit was regarded as essential by the RAF in order to obtain the necessary flexibility and capacity for all future needs. Only an inertial velocity sensor can provide such a computer with inputs of sufficient accuracy.

The projected or moving map display is based on work undertaken at the RAE, Farnborough. The computer maintains a constant check on aircraft position in relation to the known starting point, for which the inertial platform can

be calibrated with high accuracy. This position is then projected on to the screen against back-projected colour maps, automatically selected by the computer. Maps covering a total of 750 nautical square miles can be stored in the unit as 35 mm transparencies, at the standard scales of quarter million or half million, which can be selected by the pilot.

A feature of the central computer is that it can be used to fly the aeroplane to any pre-selected point. A pilot finding a target of opportunity when flying at, say 600 mph at 200 ft would have difficulty in returning to attack such a target without the computer's help. However, if target bearing and distance are fed into the computer as soon as it is seen, the aircraft can be flown back to the right position for target acquisition and successful aiming and release. The addition of the Westinghouse/Ferranti laser rangefinder closes one of the most significant gaps in weapon-delivery accuracy.

As visual search remains an important part of the Jaguar mission, a head-up display is essential. This equipment, produced by the Specto Division of Smiths Industries, projects on to the windscreens the information needed for the particular phase of flight and makes it unnecessary to refer to the conventional cockpit instrumentation.

Head-up information is presented either as numerals or symbols. The projection system is so arranged that these symbols are focussed at infinity ahead of the pilot, allowing him to scan the outside world without continually refocussing his eyes. The information presented includes height, airspeed, heading, vertical speed, time-to-go and weapon aiming information. Target information having been fed to the central computer, the head-up display will provide commands to the pilot whose task, put simply, is to fly so that a projected dot remains in the centre of a symbol representing the aircraft.

Development of the nav/attack system for the British Jaguar has proceeded in phase with prototype testing of the aircraft itself. The full system has been extensively tested on ground rigs both by Elliotts and by BAC. Components have undergone flight testing in Hastings and Comet aircraft provided by RAE, Farnborough, and a complete system has been installed in a Canberra for additional flight testing.



Typical stores 'mix' of fuel tank, bombs and SNEB rocket pods

Power plant development

Rolls-Royce Ltd began the project studies which eventually provided the basis for the Jaguar power plant in the early 'sixties. Initial interest was in the potential commercial market for a relatively small turbofan, of 4,000-5,000 lb thrust, designated RB.172. In 1963-64, military versions began to be considered for the British AST 362 design studies, and about this time also the engine was offered to the French companies involved in the ECAT design competition. The possibilities of joining with a French partner also began to be explored, on the initiative of Rolls-Royce Ltd.

On 11 February 1965 Rolls-Royce announced its agreement with Turbomeca SA to develop a 2,000 kg (4,400 lb) thrust engine, designated RB.172/T.260. Rolls-Royce and Turbomeca agreed to share design, development and production equally. The agreement was confirmed in official agreements between the two governments, and a joint company, Rolls-Royce Turbomeca Ltd was set up.

A small joint team of design engineers worked at the Turbomeca works in Bordes to establish the final specification during 1965. Named the Adour, the new engine was conceived as a compact, robust, two-shaft turbofan with a 1:1 bypass ratio and a short tailpipe incorporating a reheat system giving fully-modulated boost from 30% to 50% of maximum dry thrust. Competitive designs were prepared by the two companies, the best design being selected after detailed comparative tests and rig testing of major components.

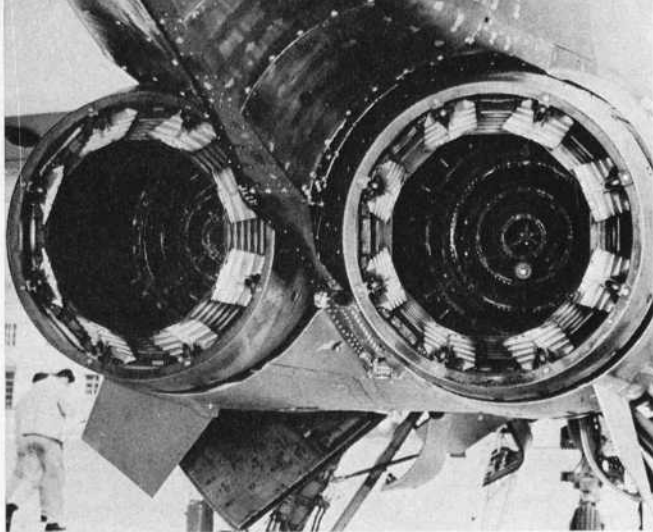
Adour production is based on a single source for each component. Broadly, Turbomeca is responsible for the front end of the engine and Rolls-Royce for the rear end, while the jet pipe, including afterburner, is designed by Rolls-Royce but produced in France under sub-contract to SNECMA. Separate assembly lines have been set up by Rolls-Royce at Derby and Turbomeca at Tarnos, near Biarritz.

The Adour first ran in May 1967 and about 12,000 hrs had been accumulated by March 1971, including 7,650 hrs on the bench and 1,850 hrs in facilities used extensively to simulate high-altitude conditions. A 150-hr endurance test was completed at the French facility at Saclay in August 1970 and a second similar test was concluded more recently as part of the Type Approval Programme. Following inspection of the test-run engine during January 1971, Type Approval is expected to be obtained at a basic dry thrust rating of the order of 5,000 lb and a reheated thrust rating of more than 7,000 lb.

A development batch of 36 engines preceded the production units and includes the engines for the first seven prototype Jaguars. Delivery of production Adour Mk 101 engines began early in 1971. Apart from five more engines earmarked for development work and two for the B-08 prototype, all these early engines will power French production Jaguars, regardless of country of build. All engines are completely interchangeable.

Flight testing

The task of bringing a new combat aeroplane to the point of operational use is a complex one. Flight testing naturally represents a major part of this task, and eight prototypes have been assigned to the programme. The first five were built by Breguet at Villacoublay, followed by three assembled by BAC at Warton. Of these, the final aircraft – the first British trainer – is assembled from the first set of production components, whereas the other seven prototypes were hand-built as experimental aircraft. Two additional airframes have been assigned to static test programmes to establish structural strengths and fatigue life.



Jaguar's twin-Adour installation



Above and below, characteristic ground views of Jaguar



The two-seater shows off its clean lines



The flight test programme is fully integrated so that any phase can be covered by more than one prototype – an essential precaution against possible delays – and is shared between the two manufacturers, being centred upon Warton and Istres.

By early 1971, the total of Jaguar flying was approaching 800 hours, including nearly 200 hours on the two British single-seaters. Almost all the basic flight envelope had then been covered and the flutter programme was almost complete. Some engine testing still had to be done but most of the development flying in the middle months of 1971 was to be concerned with weapon carriage and release.

In the course of flight testing, some small external changes have become evident on Jaguar. In particular, two ventral fins have been added, and the height of the original fin has been increased to improve stability when the largest external weapon loads are carried. Small strakes were added to the nose of the prototypes for spinning trials but are not a feature of the production aircraft. Other changes have been associated with the flying control system – for example, changes in the angular settings of the outer flap portions and in the degree of leading edge slat used for combat. The air brakes have been changed from plain to perforated type and enlarged.

One significant change is the introduction of a part-throttle reheat system. Originally, following conventional practice, reheat could be selected only when the engines were at maximum dry thrust and gave an immediate thrust boost of about 30%, which was then variable up to maximum reheat boost of 50%. However, Jaguar's lift and drag characteristics in the approach configuration were such that, if one engine was inoperative, the power required from the remaining engine was more than the maximum dry figure but less than the minimum reheat figure. The part-throttle reheat system makes it possible for the pilot to select any thrust from minimum dry to maximum reheat.

Other development areas involving various aspects of the engines and equipment have been no different in scale or nature from those encountered by other new aircraft. Certainly no special difficulties appear to have resulted from the bi-national nature of the programme. Both British and French ideas have been adopted with advantage, especially the French practice of allowing Air Force teams to check the maintainability of the aircraft at an unusually early stage. Project pilots from all three Services with Jaguars on order are attached to the manufacturer's test teams and the three customers have also set up a joint servicing team (*équipe de marque*) to help ensure that Jaguar meets servicing requirements from the outset.

Performance

Full details of Jaguar's performance are classified, but the information available gives a good indication of the aircraft's purposefulness. Typical gross weights for representative combat missions are between 22,000 lb and 23,000 lb and over 30,000 lb carrying maximum external loads.

Figures which follow are based on an engine thrust rating of about 4,600 lb dry and 6,900 lb with full reheat, and at weights for typical tactical missions. The take-off distances are a ground roll of less than 2,000 ft with the total distance to clear 50 ft of under 3,000 ft. Landing distances are less.

Flying a lo-lo-lo tactical mission with no external fuel, the range is over 300 nautical miles, and this can be increased by 50% using external fuel. Further increases in range – to more than 700 nautical miles – are possible using a hi-lo-hi mission profile. For ferrying, with maximum fuel and no armament, the range is well over 2,000 nautical miles. Max

speeds are Mach 1.1 at low altitude (a true airspeed of about 836 mph) and Mach 1.6 at high altitude (1,056 mph).

Jaguar B can fly a 3-hour training sortie at high altitude. For the low-altitude training mission, it has an endurance of 1 hr 20 min, including 20 min at Mach 0.9 at heights below 500 ft.

Programme and service introduction

Jaguar E is scheduled to enter service with the French Air Force early in 1972 following initial deliveries by the end of this year. Initial production for France comprises 25 each of the E and A versions, deliveries of the latter starting during 1972. The first 10 aircraft, with early production engines and without part-throttle reheat, will form a trials squadron in France.

The 40 Jaguar M ordered by the French Navy are earmarked for service with Flotilles 17F and 11F, at present equipped with Etendard IVMs for service aboard the carriers *Foch* and *Clemenceau*. Ten Jaguar E will similarly replace the Etendards used by Flotille 59s for training.

The RAF's first production Jaguar S is scheduled to fly in mid-1972. The first batch of aircraft, probably including some trainers, will be assigned to the Operational Conversion Unit to be formed at Brawdy, in Pembrokeshire. According to present plans, the first operational Jaguar squadron will start to form in No 38 Group, ASC, during 1973.

An active sales campaign is now under way to sell Jaguar round the world. Marketing the aeroplane is the responsibility of SEPECAT (*Société Européenne de Production de l'Avion d'Ecole de Combat et d'Appui Tactique*), the company set up jointly by BAC and Breguet to manage the Jaguar development and production programme.

Market surveys indicate as many as 70 nations having a potential requirement for an aeroplane of the Jaguar type in one or other of its major roles within the next decade, so the export potential is clearly good. Jaguar's actual introduction into service in a few months' time can be expected to crystallise the interest of several potential customers, especially in those areas where BAC and Dassault/Breguet influence is already strong, such as the Middle East and South America. ©



Main emphasis in current development flying is on weapon carriage and release



British Aircraft Corporation is proud to play a central part in the continuing development of the strength and efficiency of the Royal Air Force. Today, as at every time in the RAF's history, aircraft designed and built at the factories of BAC are serving with squadrons at home and overseas, meeting wide-ranging commitments. And in the years ahead the Corporation — both in its own independent right and through major collaborative programmes — will continue to provide the aircraft and weapons essential to maintain the fighting strength of the Royal Air Force.

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