

ROYAL AIR FORCE Souvenir Book 1972

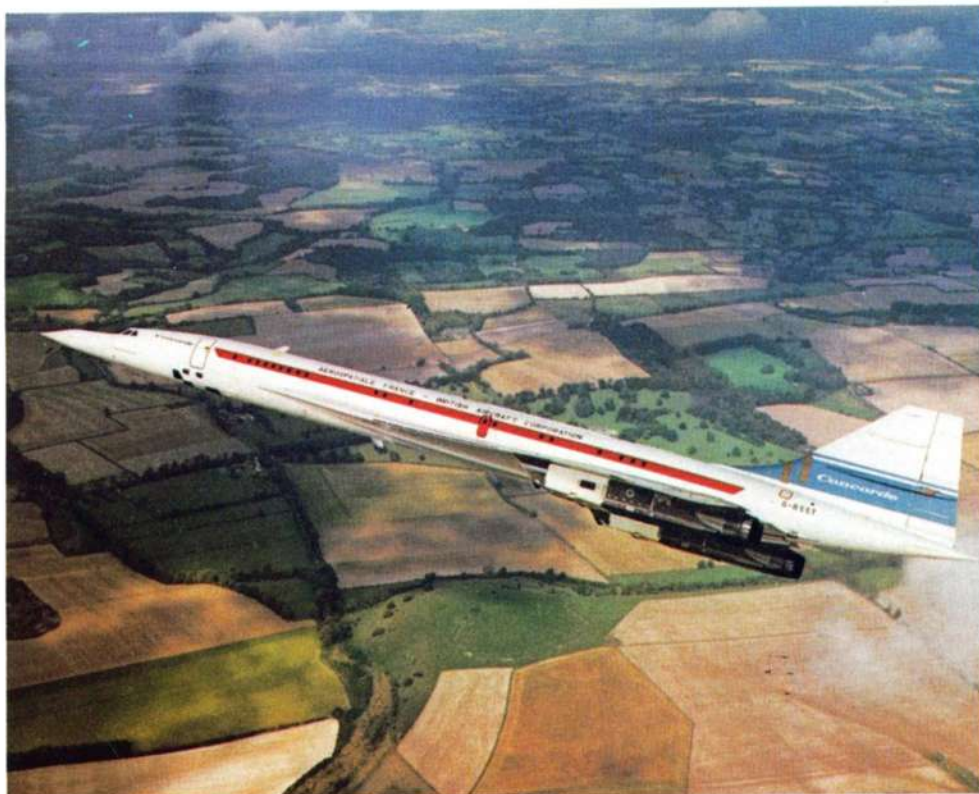


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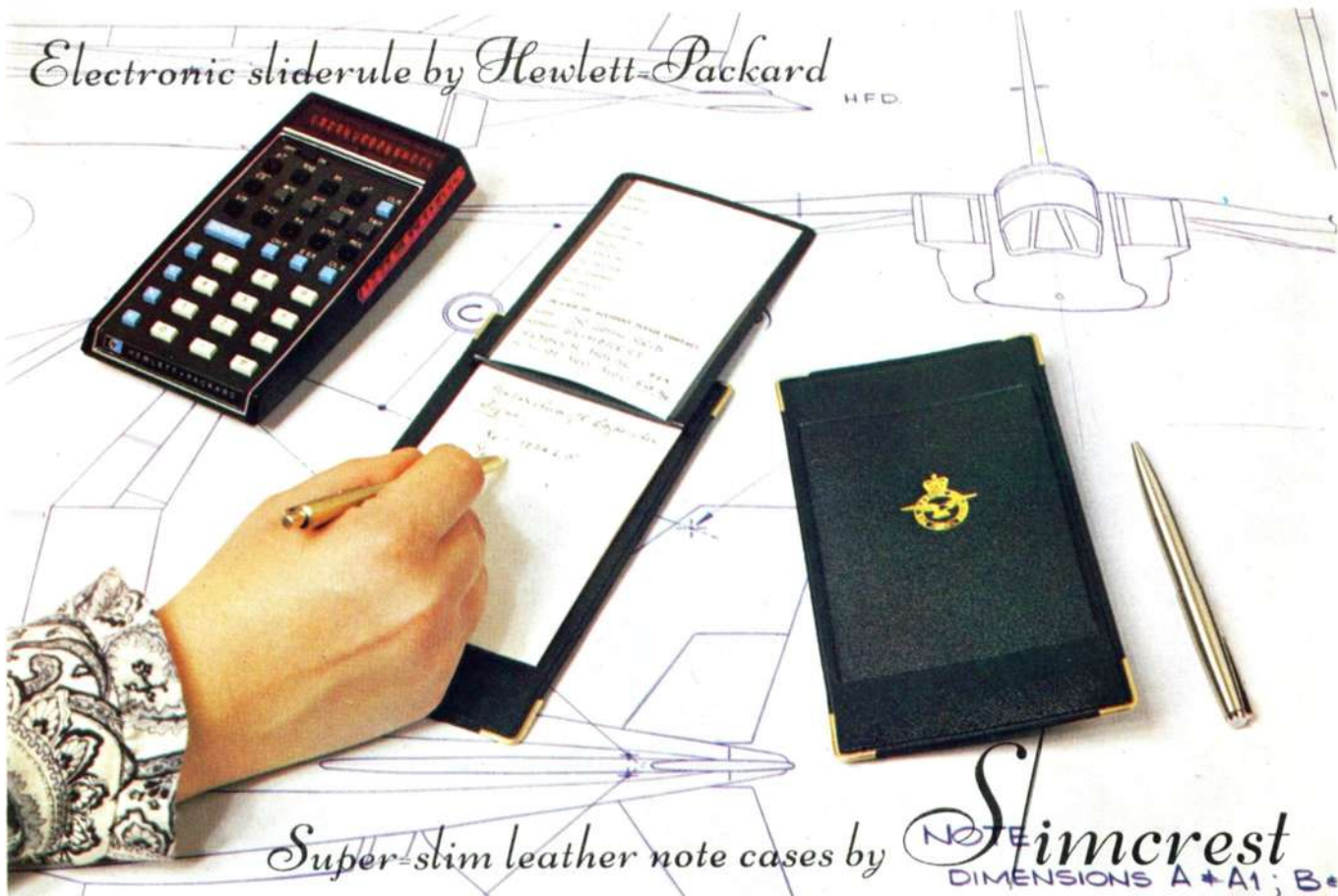
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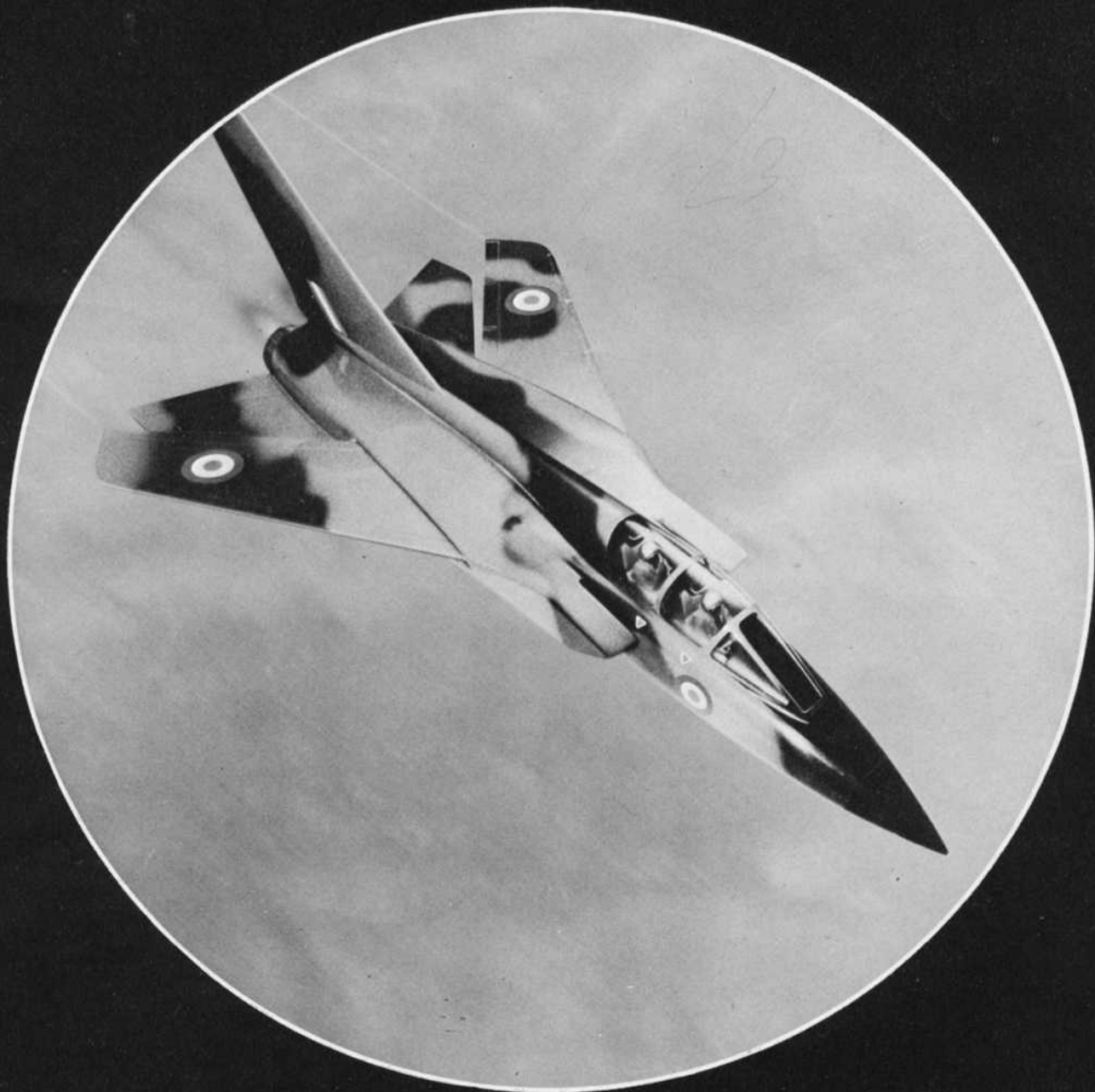
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PRINCESS MARINA HOUSE at Rustington, near Worthing, has been justly called the Royal Air Force's own "Savoy on the South Coast".

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THE ROYAL AIR FORCES ASSOCIATION



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Telephone: 01-994 8504

THE ROYAL AIR FORCES ASSOCIATION is an organisation with two sides, one side is a very active and very public social life at its 700 branches throughout the world whilst the other is the quiet and confidential welfare work which is the Association's main purpose.

The enormous scope of the welfare services, available to all who serve with the Royal Air Forces, past and present, can only be mentioned in very general terms. The field of pensions alone is vast and complicated. Advice on employment, housing, emigration and many other personal matters come within this very comprehensive service. The Association also maintains a home for the permanently and badly disabled at Storrington and a convalescent home at St. Annes-on-Sea.

The Association works in the closest possible conjunction with the RAF Benevolent Fund on whose behalf branch honorary welfare officers act as the Fund's representatives in local welfare matters.

The RAF Association is grateful to share the proceeds of the sale of this Souvenir Book with the Benevolent Fund and wishes to thank you all for your support.

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at Storrington,
Sussex



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Scottish Aviation climbing high ~with the Bulldog

The Bulldog will become a classic. This opinion comes, not from Scottish Aviation, but from independent aviation experts. It will be a classic aircraft because it fulfils completely its role as a tough military basic trainer. Quality control is meticulous. The design guarantees efficiency and reliability. The Bulldog is now being produced in quantity by Scottish Aviation who have drawn upon their 37 years of experience combined with every modern facility not only to produce the aircraft, but to provide the "after sales service" required by today's Air Forces.

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Scottish Aviation Limited, Prestwick International Airport, Scotland.



SIXTY YEARS OF AIR POWER . . .

Arthur Gibson's striking cover picture, taken from a Jet Provost over Little Rissington, illustrates 60 years of flying training at CFS, from the BE2 of 1912, built by Bristol and Vickers, to the current Jet Provost basic RAF jet trainer from British Aircraft Corporation, used by the Red Pelicans CFS Instructors' aerobatic team. The BE2 replica was built by RAF apprentices at St Athan

DR-ING JOHN P MILFORD REID
B Sc Eng (Hon) C Eng AFRAeS MSAE MIA
DESIGNER, EDITOR & PUBLISHER

ROYAL AIR FORCE SOUVENIR BOOK

1972

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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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A single Operational Command

Air Chief Marshal
Sir Denis Spotswood,
GCB, CBE, DSO, DFC, AFC,
Chief of Air Staff
announces new
organizational
changes for the
Royal Air Force



ALL STRIKE

Air Support Command to be ab-

IN LAST YEAR'S SOUVENIR BOOK, I wrote on the machinery of command and my belief that command arrangements must evolve to match the needs of the Service. This year will see further changes in the command structure of the RAF affecting the front line units in the United Kingdom. The changes take us a stage further in the process of streamlining and integrating the RAF's organization for command, in which I include in this context, engineering and administration. They follow the well-established pattern of recent years towards greater centralisation of control to achieve the maximum flexibility and economy in the use of resources.

In recent years, RAF front line forces in the United Kingdom have been organized into two operational Commands – Strike and Air Support. Strike Command has consisted of 3 Groups – No 1 Group, responsible for strike/attack, reconnaissance and tanker roles with Vulcans, Buccaneers, Canberras and Victors; No 11 Group responsible for air defence roles with Lightnings and Phantoms and the associated control units; and No 18 Group, responsible for the maritime patrol role with Nimrods and Shackletons and for Search and Rescue operations. Air Support Command, on the other hand, has contained only one subordinate Group – No 38 – responsible for tactical and offensive support operations with Harriers, Phantoms, Hercules, Andovers, Pumas and Wessexes; the remaining forces of the Command – the strategic transport VC10s, Belfasts, Britannias and Comets – have been controlled directly by the Command Headquarters.

Under the new command arrangements, Air Support Command Headquarters will disappear; the strategic and fixed wing tactical transport aircraft will be commanded by a new Group – No 46 (which older readers will recall has historic transport connections) – and this Group together with No 38 with its battlefield support and rotary wing



Corbed into Strike Command

aircraft will form part of a new enlarged Strike Command. Thus all RAF front line aircraft in the United Kingdom will come under a single Commander-in-Chief; this measure of concentration will ensure that they are tasked as flexibly, economically and efficiently as possible.

The RAF is a dynamic organization, constantly evolving under the stimuli of technological advance, political change and military experience. Failure to recognise and act on these pressures would ultimately lead to the RAF becoming unsuited for its deterrent or wartime role and for the many and varied peacetime tasks we are constantly called upon to undertake, often at very short notice. We therefore welcome reasoned change that fits us better for the task. Although operational advantage has been, and will I am sure continue to be the paramount justification for organizational change, welcome economies will none the less result from the amalgamation of Air Support and Strike Commands. Although, unlike our friends in industry and commerce, we may lack the motive and measure of profit, we are as concerned as they to ensure that resources are utilized efficiently and that modern tools of management are understood and exploited. Ultimately, however, necessary change will only bring real benefit if it is implemented by men and women who are convinced of the dynamic nature of their Service and the need for evolution. The RAF possesses this conviction.

expansion to meet new priorities

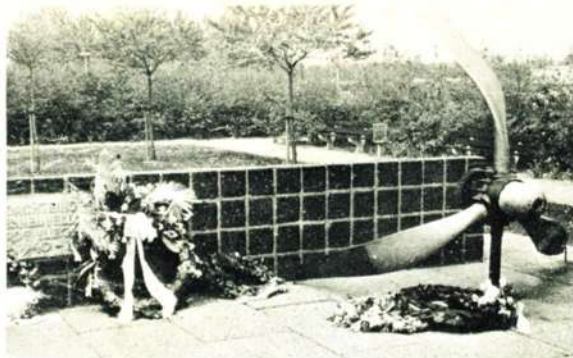
It also happens that 1972 marks for the RAF the beginning of a new period of challenge. No longer are we involved in retrenchment, cutback and withdrawal – these processes are largely complete. The new task for the RAF is adjustment and expansion to meet new priorities. The old 'trip-wire' strategy of NATO – which envisaged immediate nuclear response whatever the scale of aggression – has been discarded; in its place has emerged a more flexible concept



under which NATO must be prepared to counter aggression, at least initially, by conventional means. For this strategy to be effective, more conventional capability will be needed from all countries in the Alliance. The RAF must play its part. Those essential qualities of air power: speed of reaction, flexibility of employment, and mobility, will be much in demand whatever the scale of the battle from the snows of the Northern Flank, in the Atlantic, through the Central Region of Europe to the Mediterranean and beyond. The aircraft and equipment coming into service at this time, and planned for the future will be well suited to the task. Our new command arrangements will ensure that air power is used to the greatest effect whatever the call.

Increased conventional responsibilities ultimately call for more aircraft, and these aircraft must be paid for out of the RAF's share of the defence budget. The size of our front line therefore depends directly on ensuring that costs in other areas are kept as low as possible. This means that we all have a personal concern in whatever area we work to create the most efficient organization that we can for our particular task and to economise in the use of all resources, but perhaps more especially in that most costly of all resources – manpower.

In this article I have tried to convey to you the positive nature of the changes the RAF is currently undertaking. The need for men and women of will, intellect and ability remains as strong as ever and I am convinced that manpower economies and other measures to improve our efficiency are possible with no lessening of career prospects; indeed the converse is true. We have clear and challenging tasks, excellent aircraft and equipment and, above all, enthusiastic and dedicated men and women. With these assets no challenge is too great; and our new organization should widen the prospects of all who are prepared to meet the challenge.



In the centre of the newly reclaimed polder Oostelijk Flevoland a simple monument commemorates thousands of Allied pilots who gave their lives in the Netherlands during WWII. The smashed propellor belonged to Lancaster ED 357 of 12 Sqn excavated by the R Neth AF in 63 when the sea bed dried out

DUTCH AIR FORCE EXPERTS FIND WWII RAF AIRCRAFT IN THE SEA

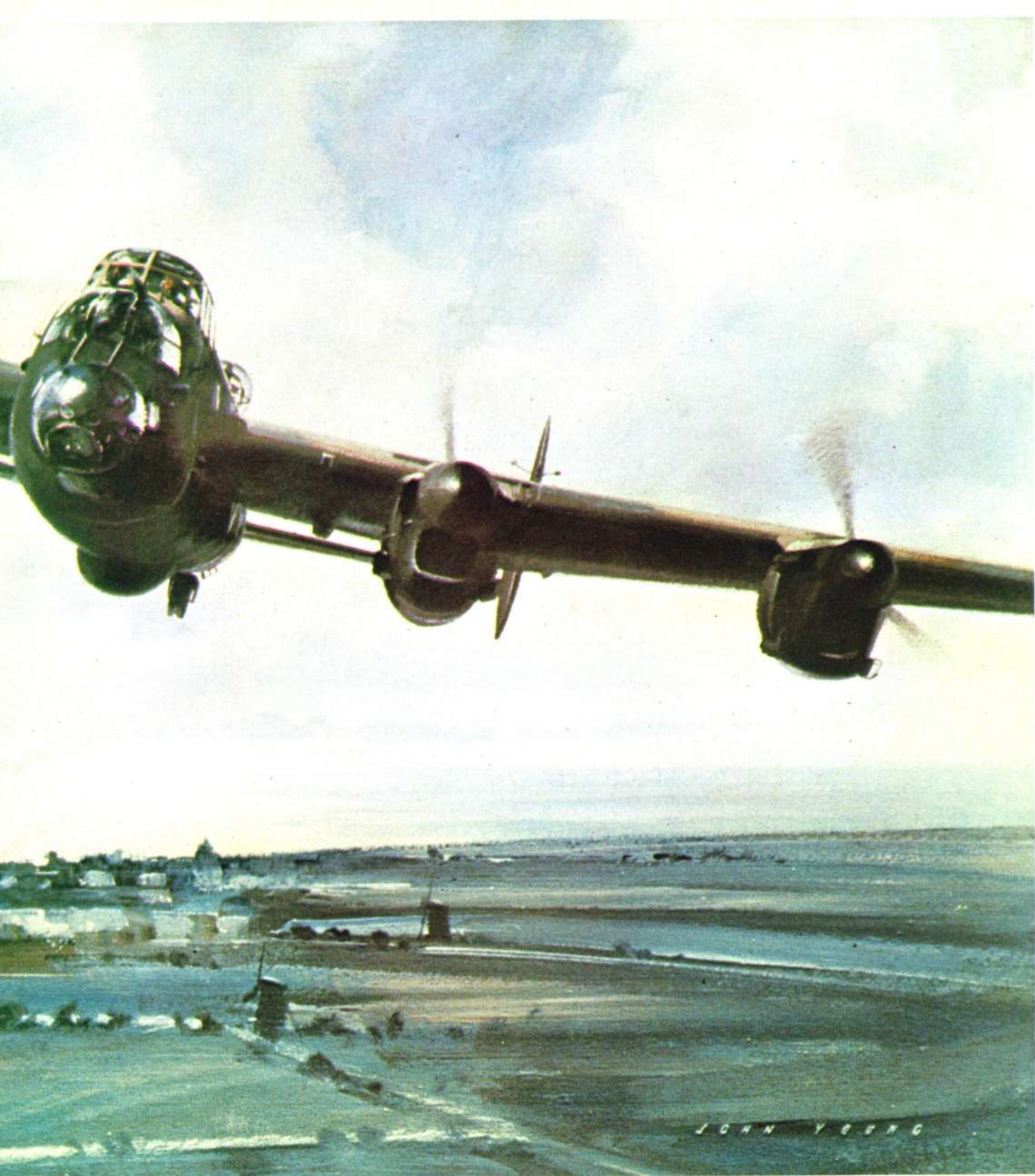
by Col A P de Jong, R Neth AF

ONE OF THE MAIN ROUTES of the Allied air offensive against Germany in WWII passed over Holland. The Netherlands became the graveyard of over 7,000 aircraft and during land reclamation in the IJsselmeer the Dutch have discovered the remains of 100 aircraft. The RAF alone lost 3,225 (incl 474 Lancasters and 442 Wellingtons) over Holland, hundreds in the IJsselmeer. Reclamation is undertaken to create more farm land, and the unforeseen crop of wrecks is being harvested by an extraordinary unit of the R Neth AF, the *Luchtmacht-bergingsdienst* or Air Force Salvage Unit, based at Gilze-Rijen. Since 1960 it has unearthed several Lancasters, Spitfires, Halifaxes, Fortresses, Junkers, Messerschmitts and other types, mummified on the sea bed for over 25 years. Before they are scrapped an identification team makes an intensive investigation to find out the identity of the aircraft and its crew members, who may still be listed 'missing in action'. Recognition of the aircraft is not difficult, but tracing its serial number and squadron is much harder. Who cares nowadays? Who still keeps records after 30 years? The RAF lost over 27,000 aircraft between 1939 and 1945. Is it still worthwhile to reduce the number of mysteries from the files of missing aircraft? Some authorities think so, if only for the families of the crews. Others consider it like emptying the sea with a baby-spoon. But the men of the Dutch Air Force Salvage Unit feel they are helping to solve a personal tragedy. Each excavation yields up a story in itself, which unfolds hour by hour as the operation continues. The gratitude evoked by the certain knowledge of what took place is the clearest indication of how humane their job is, especially when identification reveals the ultimate fate of individual crew members and often results in a proper burial in their own country. Many years of research and investigation still lie ahead. The job is both laborious and dirty, but gives the men tremendous satisfaction when, time after time, another case is solved.

When reclaiming new polders from the IJsselmeer (*Zuyder Zee*) hundreds of crashed WWII aircraft were discovered and the remains are constantly being salvaged by the R Neth AF Salvage Unit. A Bristol Hercules engine and parts of an RAF Vickers Wellington bomber appear as the sea recedes



This year's Guest Article is on the
Royal Netherlands Air Force
by the Commander-in-Chief
pages 14-19



'Lancasters Crossing the Dutch Coast'

by John Young MSIA

REPRODUCED BY COURTESY OF THE ROYAL AIR FORCE CLUB

ART REPRODUCTIONS OF THIS FINE PAINTING ARE AVAILABLE FROM THE EDITOR – SEE PAGES 20 AND 40



His Royal Highness Prince Charles R.G.



BUCKINGHAM PALACE

When, in April 1912, the Government accepted proposals drawn up by a Sub-Committee of the Committee for Imperial Defence under the Chairmanship of Lord Haldane, for the creation of a professional air force, one of the most significant innovations in the art of warfare since the use of gunpowder was unleashed upon the unsuspecting world. At last man could contemplate moving and fighting in the third great natural element and we owe more than we realize to the bravery, panache and perhaps, blissful ignorance of the men of the Royal Flying Corps, who conquered the unknown.

Those men knew their aircraft and flew them well - basic principles which are loyally continued by the Central Flying School today in an age when aircraft and equipment tend to be highly sophisticated and thus blind pilots to the need to be good "polers" of aircraft.

Despite the most advanced 'nav-attack' systems, a nation's air power is only as good as the standard of training and operational ability of its aircrews. For instance, well operated small light aircraft, adapted for less sophisticated attack systems, could under certain circumstances make an under-trained air force equipped with such aircraft as Lightnings, Migs, Drakens or Mirages seem fairly ineffective.

Sophistication, and vast expense, are by no means a guarantee of effectiveness, particularly when the equipment becomes so much more vulnerable to unserviceability or mismanagement. Arguments about air power and its role in modern warfare are carried on amidst furious intellectual combat in all the Staff Colleges, and will no doubt continue to take up many future hours of heated discussion.

Amongst others, there is an article in this book commemorating the 50th Anniversary of the R.A.F. Staff College at Bracknell, and another illustrating the development of air power over the last 60 years.

I should therefore avoid the Foreword and begin with these articles . . .

May, 1972.

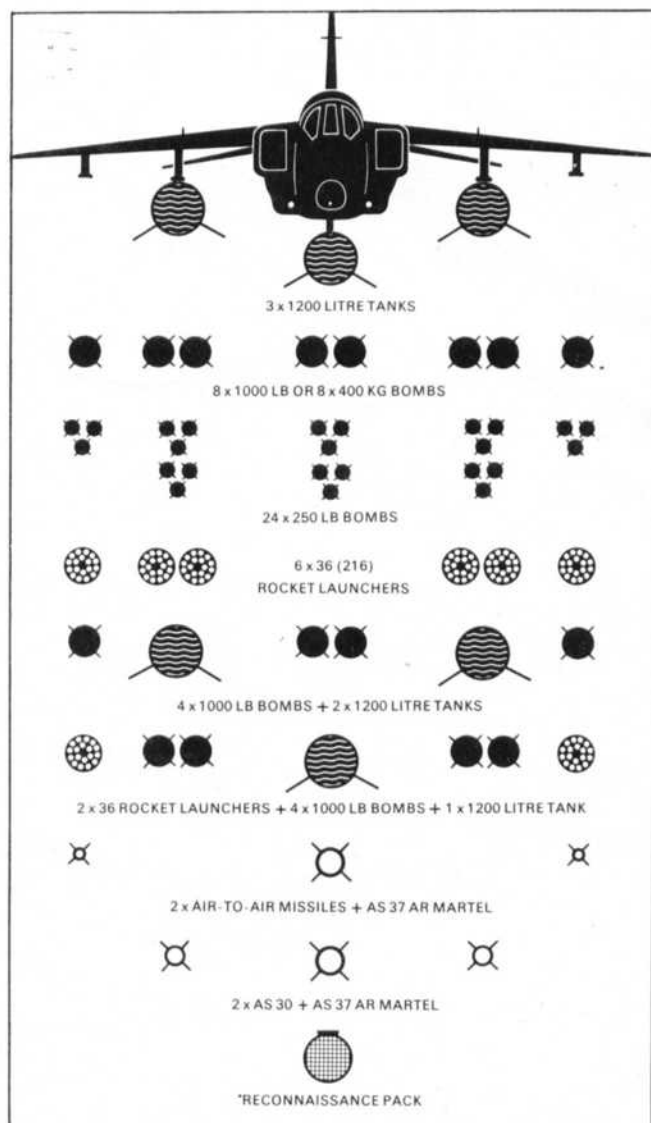
Charles

**the facts
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jaguar has many
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one of
which is **STRIKE**

The Jaguar has already been specialised to meet the problems of tomorrow.

It is supersonic. It is STOL. It has outstanding warload/range performance. It can look after itself in combat. It can accept long periods away from base maintenance and can stand the stresses of being used for advanced training.



POWER...the ability to strike in many ways and with many weapons

Jaguar sets new standards for economical strike power for air forces operating in support of ground forces in a fast-changing operational environment.

Jaguar's combination of high supersonic performance and exceptional payload/range capability from limited runways enables it—

*to carry a formidable weapon load
to penetrate to heavily defended targets
to strike with consistent accuracy
to sustain high mission rates with a minimum
of technical support.*

The aircraft has a large internal fuel capacity, leaving the five external strongpoints free for the carriage of up to 10,000 lb of weapons and stores in addition to two internally-mounted 30mm guns with 150 rpg. The wide range of weapon and store options available is indicated in the accompanying diagram.

Jaguar's excellent short-field performance ensures that missions can be flown from short, low bearing strength surfaces with the optimum warload/range mix for any of a wide band of tactical requirements. The mission profile can also be suited to the specific target and to the strength and nature of its defences. At altitude, Jaguar has a speed capability in excess of Mach 1.6; at low levels, advanced aerodynamic design ensures low gust response, making it possible to penetrate defences below the radar net at trans-sonic speeds at altitudes of 500 ft or less.

On lo-lo-lo tactical missions, the internal tankage alone is sufficient for a radius of action of over 300 nautical miles. With external tankage, this can be increased to more than 450 nautical miles.

For hi-lo-hi missions, the radius of action on internal fuel only is 450 nautical miles, increasing with external tankage to over 700 nautical miles. For ferry flights, Jaguar is capable of a range of 2,200 nautical miles.

With the permutations of weapon load and range available to him from grass strips or runways of low load-bearing characteristics, the tactical air commander can mount operations over a wide zone, including interdiction missions against the kind of the targets which tend to collect some distance behind the battle line. He can exploit Jaguar's performance and range capability to strike over long distances at high speed and low altitude or exploit the low altitude loiter capability of Jaguar for the close support of ground forces.

Jaguar is planned to be compatible with nav/attack systems ranging in standard from the simple to the sophisticated. The nav/attack system of the RAF single-seat tactical version, for example, is among the most comprehensive yet applied to a close-support aircraft. Its heart is the Elliott MCS 920M navigation and weapon-aiming digital computer, with outputs to a head-up display and projected map display. Feeding into the computer is an Elliott E. 3R inertial platform which makes the system self-contained, neither transmitting nor receiving signals that may be interfered with or jammed. A Westinghouse/Ferranti laser rangefinder provides the RAF Jaguars with an air-to-surface ranging system which significantly improves both accuracy and operational flexibility.

With its twin engine configuration, duplicated systems and structural concepts which reduce vulnerability to battle damage, Jaguar has outstanding survival characteristics. It out-performs existing in-service tactical strike aircraft in terms of airfield performance (and particularly of range/load capability from limited runways), accuracy of navigation and weapon delivery and ferry range.

Moreover, because Jaguar is essentially a supersonic design, it offers a development potential denied to aircraft of fundamentally subsonic design—a potential which can readily be exploited as increased engine thrust becomes available through the normal processes of development.



jaguar

S.E.P.E.C.A.T. Designed and built by **BRITISH AIRCRAFT CORPORATION** and **BREGUET AVIATION**
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Fokker T-5 bombers took off during first surprise attack on Schiphol and shot down 5 enemy aircraft, damaging 2 more

Right Latest attack-fighter in 1940, 23 Fokker G-1s were operational; with 8 mg. superior to Luftwaffe aircraft except Me109. 3 Sqn at Waalhaven shot down 13 in 60 mins on 10 May



IT WAS 03.59 HRS, 10 MAY 1940. Waalhaven airfield had already been under attack from the air for several minutes as Sgt Major Jan Buwalda took off in the 8th Fokker G-1 of No 3 Dutch Fighter Squadron: the whole squadron was now airborne and each aircraft fighting on its own. Buwalda climbed the twin-boom, two-seater up along the wall of fire from the blazing Koollhoven aircraft factory at the edge of the airfield and turned south west in a sky vibrating from the noise of fighting aircraft and explosions.

A few minutes earlier, 28 Heinkel HE-111 bombers led by *Luftwaffe* Kommodore Martin Fiebig had crossed the Dutch coast a few miles south of the Hook of Holland. With six other *Staffeln* (squadrons) of KG-4, they had left their home bases of Delmenhorst, Fassberg and Gutersloh in Germany to attack the Dutch airfields of Schiphol, Ypenburg and Waalhaven. Surprise was to be achieved by making a wide detour over the North Sea and approaching Holland from the West. Seconds after crossing the coast the German pilots reported heavy flak and spotted several Dutch fighters. But Fiebig, leading the Staff-flight spearheading the attack, made straight for Waalhaven with the aim of destroying as many Dutch fighters as possible on the ground. Minutes later the first bombs hailed down on the doomed airbase. The Heinkels turned south and Fiebig decided to make another run to blow up the remaining ground installations.

Flying over Zuid-Beyerland, ten miles south of Waalhaven, Jan Buwalda attacked the first enemy bomber he saw; firing his eight nose machine guns he immediately hit the port engine, which started to trail grey smoke. The bomber slowed and curved away to the north west, losing height rapidly. Seconds later three crew members bailed out, barely in time to land safely as their aircraft crashed in the fields near the village of Rockanje, and were taken prisoner by a coastal artillery unit. One of them was reported to be furious at ending his war so soon: he was Group-Commander Martin Fiebig of KG-4.

Returning to base, Buwalda spotted another enemy bomber close to the airfield and having sufficient ammunition left, started his second duel. After a long, southerly chase towards Dordrecht, he scored several hits and finally shot



Yesterday

down his second HE-111 at 04.25 hrs, but within seconds he was attacked by a large formation of Me 109s. Chased by nine enemy fighters, Buwalda tried to escape to the south while his airgunner, Sgt Wagner, made desperate efforts to keep the attackers at a distance. The starboard engine of the G-1 was hit and badly damaged, and the port engine began to lose power. Evasion was impossible; the Fokker was being continually hit and Sgt Wagner was wounded in one eye. Having no chance, Buwalda made a successful belly landing near Zevenbergen, ten miles south of Dordrecht. He then removed one of the machine guns from his aircraft and fought his way back to Waalhaven with a light AA group through an area where German paratroops had landed in the meantime . . . another story in itself.

This short but remarkable operational life of Fokker G-1 No 319 is but one example. Similar experiences were recorded by the other seven G-1 crews of Waalhaven and other Dutch Air Force units equipped with Fokker D-21 single-seaters, T-5 bombers, C-5 and C-10 biplanes and Douglas 8A reconnaissance-fighters. During the five-day war the Dutch lost virtually all their 125 aircraft in this struggle against overwhelming odds. Most of the gallant efforts by Dutch pilots in May 1940 are not well known, since for Holland the war ended with five years of occupation, when conditions were not conducive to wide publicity on such subjects. Little known, too, are the enemy's aircraft losses in the Netherlands during those five days - no less than 342 aircraft through fighters, anti-aircraft fire and forced landings, among them 34 BF-109s, 30 HE-111s, 21 Ju-88s, 8 BF-110s and 222 Junkers JU-52 transports. This tremendous loss of transport aircraft - 222 out of some 400 employed - was a heavy blow to the *Luftwaffe's* *Transportgeschwader* from which it took more than a year to recover, and may well have contributed to Hitler's decision to cancel operation 'Sealion', his plan to invade Britain in summer 1940.

Manoeuvrable Fokker D-21, standard Dutch fighter in 1940



3 Sqn G-1 crews; Jan Buwalda 2nd on rhs

T-5 heavy bomber of BOMVA Sqn, Schiphol, escorted by sturdy D-21 fighters

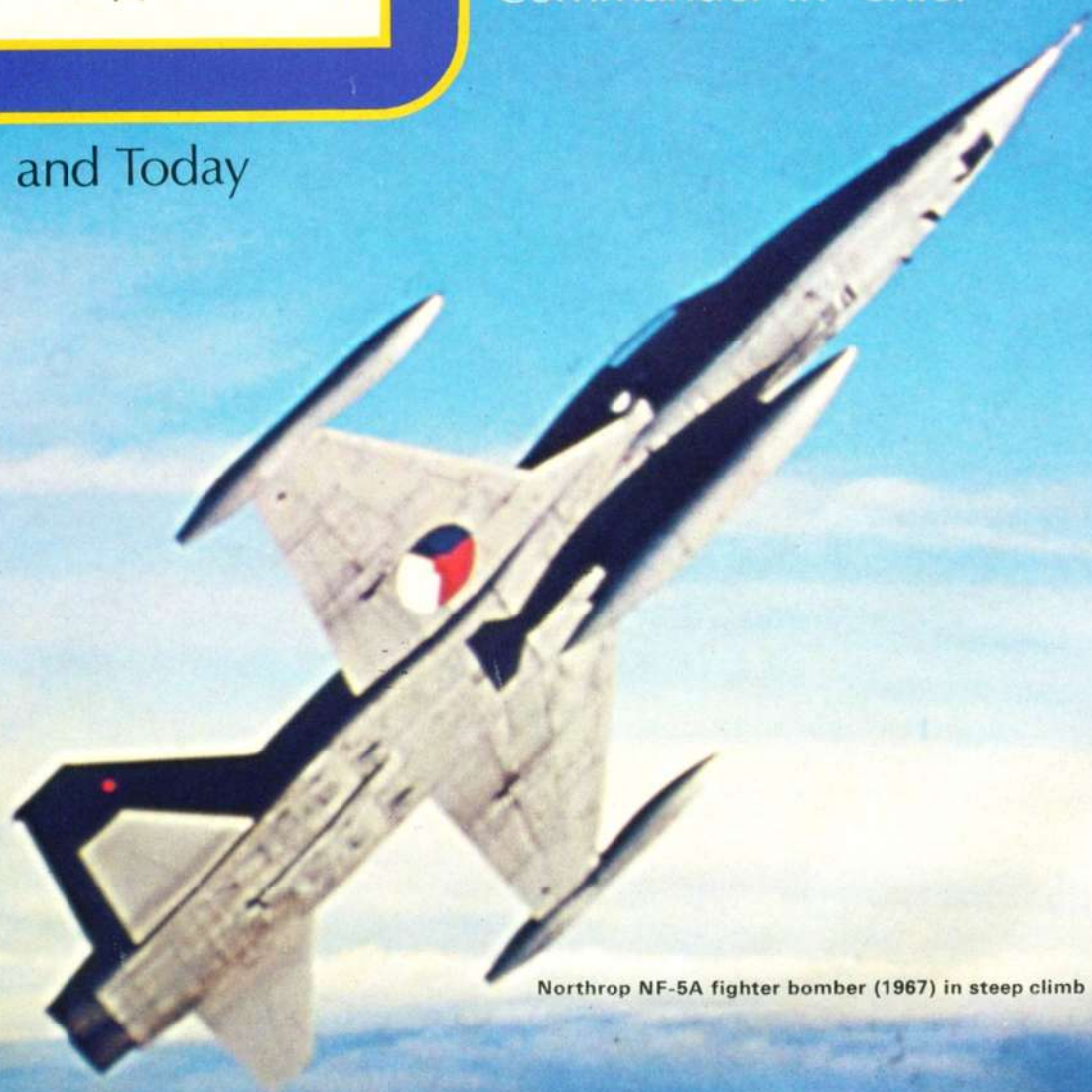




The Royal Netherlands Air Force

by Lt Gen G van der Wolf DFC
Commander-in-Chief

and Today



Northrop NF-5A fighter bomber (1967) in steep climb

PARVUS NUMERO, MAGNUS MERITO, reads the motto of the Royal Netherlands Air Force, *Small in numbers, great in deeds*. Small in numbers, since Holland itself is relatively small; great in deeds, as exemplified by many individual acts of heroism when the Dutch military aviation force was rapidly overrun in the early stages of World War II . . .

THE VERY FIRST NETHERLANDS INTEREST in the military possibilities of aviation was in 1886, when a captive balloon unit was formed at the artillery range near Oldebroek, 25 miles north west of Arnhem. Its existence was, however, short-lived and not until 1908 was there a reawakening of interest, when the Royal Aero Club of the Netherlands was granted an annual government subsidy of 1,000 guilders for training a small number of military balloon commanders. Two years later a 'military aviation committee' was set up and four army officers given leave to take flying training courses in Belgium. During army manoeuvres in Sept 1911, the first experiments held with civil aeroplanes proved the indisputable value of the military use of aircraft, and on 1 July 1913 Dutch Military Aviation was born. A Royal Decree established an 'Aviation Division' of the Royal Netherlands Army, which took over the sole aerodrome at Soesterberg near Utrecht.

Military aviation there started with a single aeroplane built by the Dutch aviation pioneer Marinus van Meel, whose aircraft, named the *Brik*, was purchased by the Ministry of Defence. Shortly afterwards another was bought from Van Meel and three Farman F-22 biplanes acquired from France. Thus, when WWI began, Netherlands Military Aviation comprised five aircraft operated by 42 officers and men. With this quintet, neutral Holland immediately started aerial reconnaissance along the Dutch-German and Belgian borders. Some months later three more Farman F-22s were obtained and the Dutch Trompenburg Company started to build others of this type under licence, which raised the strength of the Army Aviation Division to 18 Farmans in 1915; furthermore, six aircraft from the belligerent countries which had made forced landings in Dutch territory during this year were also added to the 'Soesterberg airforce'. During WWI some 107 foreign aircraft which landed on neutral Dutch territory were interned, 48 of which (28 different types) were flown by Dutch military aviators, thus giving the Army's technical staff an admirable opportunity to study the progress of international aviation in wartime conditions.

In 1917 20 Nieuport 17 C-1 and Fokker D-III fighters were purchased and the next year additional Nieuports and

Lieut-General G van der Wolf DFC is Commander-in-Chief and Chief of Air Staff of the Royal Netherlands Air Force. Born 1916, he entered military service in 35, escaped capture in 1940 and came to UK with Dutch military flying school. He flew 85 combat missions with RAF Sqns in WW II and became C-in-C in 1970



Caudron G-III reconnaissance aircraft obtained from France: from Germany the Dutch bought 40 Rumpler C-V aircraft and the Dutch Trompenburg Company built 36 Spijker training aircraft. Dutch military aviation had thus gained a moderate strength by 1918, and plans were prepared for further expansion to a strength of some 600 aircraft, but because of substantial reductions in defence expenditure, this first 'air force plan' was never achieved. Consequently the large orders for D-VII fighters and C-1 reconnaissance aircraft from Anthony Fokker's new aircraft factory in Holland were reduced to 20 and 56 respectively.

In the 20s the number of new aircraft was continually restricted by the limited funds voted for air defence. The force consisted of 15 Fokker D-16 and ten D-17 biplane fighters, one Fokker S-II, 30 Fokker S-IV trainers and three Fokker F-7A3m transport and bomber aircraft, which were continuously repaired and cannibalised until 1936, while some of them even flew operationally until 1940. During the mid-30s, despite obvious German, Italian and Japanese rearmament and increasing world tension, the demands of several senior officers for money to be spent on the air defence of Dutch territory largely went unheeded. A widely held view was that a strong air defence would only prolong Holland's



F-104G Starfighter (1962) current multi-role combat aircraft



Fokker F-27M Troopship of No 334 Transport Sqn



Formation of NF-5B (1967) fighter-bombers and ops conversion aircraft

The *BRIK* (1913) of Marinus van Meel was the very first Dutch military aeroplane



agony, should she become involved in full scale war, without affecting the ultimate issue, and that the traditional policy of neutrality should be maintained. The age of some Dutch equipment at this time is illustrated – rather amusingly perhaps – by a crash at Soesterberg in 1936. Soesterberg was still the sole military airfield in Holland and an old Army aircraft crashed on it due to engine failure. The board of inquiry examined the carburettor and found stamped in German *Garantiert bis 1918* – ‘Guaranteed until 1918’ . . .

In 1937 however, international tension had increased to such an extent that funds were voted for a limited expansion and modernisation scheme. One of the first steps was the transfer of fighter units from Soesterberg to the civil airport of Schiphol. Construction of new airfields began and in 1938 a complete reorganisation of the Dutch air defence began. The Army's Aviation Division was changed into an Army Air Service with three Air Regiments and new airfields were occupied, including Gilze-Rijen, Bergen, Valkenburg and Texel. Personnel strength rose to 98 officers and 524 men, and limited orders were placed for modern military aircraft, such as 36 Fokker G-1 two-seat attack fighters, 16 Fokker T-5 twin-engined medium bombers, 20 Fokker C-10 reconnaissance-bomber-biplanes, 20 Fokker S-9 and 44 Koolhoven FK-51 trainers. In addition to these demands on the domestic aircraft industry, orders were placed in USA for 35 Curtiss Hawk 75A single-seat fighters (later reduced to 24 after criticism in the Dutch parliament) and 18 Douglas DB-8A-3N attack-bombers; the latter arrived in time for the German invasion, but the Curtiss fighters were delivered too late and found their way to the French Forces.

the balloon goes up

Shortly before WWII, Dutch Forces were partially mobilised to protect Holland's neutrality: Soesterberg was evacuated and the Army Air Service's aircraft were spread over several military and civil airfields in Western Holland, the flying schools being transferred to Flushing-Souburg airstrip, Haamstede and Texel. During the following eight months Dutch fighters constantly patrolled Holland's frontiers with instructions to shoot down any foreign aircraft invading Dutch air space. Among foreign aircraft which went down in Holland during the eight months' neutrality were a No 77 Sqn Whitley near Rotterdam, two Blenheims of Nos 57 and 110 Sqn near Arnhem, a few Hampdens of 144 Sqn, and a Beaufort of 22 Sqn near the Dutch Frisian Isles: a German HE-115 floatplane came down near the isle of Ameland and a Heinkel HE-111 was shot down near Maastricht in the extreme south. Then on 10 May 1940 the bombers of *Luftflotte 2 Kampfgeschwaders KG-4* and *KG-30* started their systematic surprise attacks on Dutch airfields with the aim of destroying all Netherlands military aircraft before they could take off.

The Army Air Service on this day operated the following serviceable aircraft:

- 29 Fokker D-21 single-seat fighters
- 23 Fokker G-1 fighter-attack aircraft
- 9 Fokker T-5 medium bombers

First standard aircraft of the *Luchtvaart Afdeeling* were the Farman F-20s and F-22s, Soesterberg, 1914



- 11 Douglas 8N-3N attack bombers, employed as fighters
- 27 Fokker C-5 reconnaissance biplanes
- 11 Fokker C-10 reconnaissance-bomber biplanes
- 16 Koolhoven FK-51 trainers, used as observation aircraft
- 6 Fokker D-17 fighter biplanes of 1933 vintage

Only the first four types (72 aircraft) could be considered relatively modern. Twelve Fokker G-1Bs built for the Finnish Government and awaiting their armament at Schiphol were confiscated, although only three could be made operational in time for the fighting. In my introduction I described the vicissitudes of one of the G-1s which formed Nos 3 and 4 fighter squadrons of the First Air Regiment, Nos 1 and 2 being equipped with Fokker D-21 single-seaters with a fixed undercarriage. One bomber squadron (*Bomva*) of the First Air Regiment was equipped with Fokker T-5 medium bombers, while the only squadrons of the Second Air Regiment possessing relatively modern equipment were one D-21 fighter squadron and the reconnaissance squadron with Douglas 8As. Although greatly outnumbered, those Dutch aircraft which were not destroyed on the ground in the first onslaught fought valiantly against overwhelming, superior enemy formations and inflicted considerable losses despite the relative obsolescence of most Dutch types.

On the fifth day of the German invasion only a few airworthy Dutch combat aircraft remained and many of the flying personnel were either killed or wounded in action, but the Haamstede and Flushing flying schools succeeded in making their way to England through Belgium and France. During the first years of Netherlands air operations from England the majority of the escaped Dutch personnel, both air force and navy, were incorporated in Nos 320 and 321 Sqn of RAF Coastal Command, flying Fokker T-8W floatplanes and later, Ansons and Hudsons. Many Dutch youngsters were sent to USA, where a Dutch flying school was established at Jackson Field, Mississippi. This school received under the Lend-Lease programme numerous American training aircraft such as 50 Fairchild PT-18s, 48 Vultee BT-13s, 23 North American AT-6s, 24 Beech UC-45 Navigators, 11 Lockheed 12s and 20 North American B-25 Mitchells, and trained 460 Dutch pilots.

Among many Fokker types in service were a few Koolhoven FK-51 trainers



First post-war combat type in re-born Dutch air force was Spitfire Mk IX



Jets were introduced a few years later – 200 Meteors Mk 4, 7 and 8



ON 12 JUNE 1943 the first Dutch fighter squadron, No 322 (RAF) was formed at Hornchurch, by taking almost the entire Dutch personnel of No 167 Sqn; equipped with Spitfire VBs, it became operational immediately to fly local patrols and scrambles. After providing fighter cover during the Normandy campaign, the squadron was pitted against the V-1 'buzz-bombs' for two months, flying Spitfire XIVs; by the time it again re-equipped (Spits LF IXb) in August 1944 it had claimed 108½ V-1s destroyed, the top score being achieved by Flg Off Burgwal who destroyed five in one day on 8 July. On the last day of 1944 the Dutch fighter squadron personnel returned to the captured airfield of Woensdrecht on Dutch soil, and were heavily in action in their own country. A Dutch transport flight of C-47 Dakotas and No 6 AOP Sqn, operating Austers, were also active in Europe before the war ended.

years of build-up and training

Prior to Holland's liberation an Air Forces Directorate had been set up in London to prepare for the post-war revival of Dutch military aviation in Europe and to share in the war against Japan: both Army and Naval Air Services were included under one Directorate, and after V-E Day a special Command was established at Ypenburg airbase near The Hague for recruiting. As few Dutch airfields or installations were tenable in 1945, personnel were sent to Britain for training. Flying training was eventually transferred to Gilze-Rijen in 1946, although technical training was continued in UK at Langham until 1947 when the Technical Training School moved to Deelen near Arnhem. Gradually the new Dutch Air Force took shape. In 1947 an Air Force Staff was formed and efforts were made to combine the Army Air Units of the Dutch homeland with those of the Netherlands East Indies Army, while the Commands in Europe and the East Indies came under operational control of the Chief of Air Staff. A special Directorate of Flying Training was also instituted to supervise pilot training of both Army and Navy. Gradually, repaired and rebuilt airbases were taken over, such as Valkenburg, Twente, Gilze-Rijen, Woensdrecht, Deelen, Leeuwarden and Eindhoven. Grading and primary flying training was conducted on de H Tiger Moths at Woensdrecht, advanced and operational flying training at Twente, navigational, wireless and air gunnery training at Gilze-Rijen. We acquired from British war surplus stocks some 200 T-6 Harvard basic trainers, about 30 Avro Anson and 30 Airspeed Oxford twin-engined trainers, 50 Tiger Moth primary trainers, a dozen Percival Proctors, four de H Dominie communications aircraft,

five Lockheed 12s and a Lockheed 14 transport.

In 1948 the Army Air Force started to replace its 40 Spitfires with 40 Gloster Meteor F-4 single-seat jet fighters and 10 Meteor T-7 two-seat trainers. A decision was also taken to produce under licence 160 Meteor F-8s at the Fokker, Aviolanda and Schelde aircraft factories; Fokker also supplied the air force with 40 S-11 Instructors to replace the ageing Tiger Moths for primary training. 1950 saw the first steps in the long-awaited creation of an independent Air Force equal in status to the Army and Navy, although its promotion as the *Royal Netherlands Air Force* was not made official until 27 March 1953. As a member of NATO the Netherlands laid plans for a major modernisation and expansion programme, with emphasis on both interceptor and close-support elements. Subsequently Air Defence Command, Tactical Air Command, Air Material Command, Air Training Command and the Air Force Regiment came into being. At the 1952 NATO conference at Lisbon the future operational strength of the RNethAF was established at 15 squadrons of fighters and fighter bombers. Many Dutch pilots were sent to USA and Canada for training and Tactical Air Command got its first Wings of aircraft when 200 Republic F-84E and G Thunderjet fighter bombers were supplied under the Mutual Defence Assistance Programme. The six tactical fighter-bomber squadrons, each comprising 25 aircraft, formed a part of the 2nd Allied Tactical Air Force.

During the 50s the RNethAF also received 19 C-47 Dakotas, 35 Hiller HTE-2 helicopters, nine De Havilland DHC-2 Beavers and 100 Piper L-18 and L-21 Super Cubs.

Radical equipment changes came in 1956 when we began to re-equip the first of our Meteor squadrons with Fokker-built Hunter F-4 interceptors. All Thunderjets of the six tactical squadrons were supplanted by Republic F-84F Thunderstreaks and a photo-recce squadron equipped with RF-84F Thunderflashes; a total of 204 (R)F-84Fs were received under MDAP. Furthermore, three all-weather fighter squadrons were formed and equipped with North American F-86K Sabres. For training purposes 20 Fokker S-14 Mach trainers were delivered. In October 1961 the first two squadrons of a group of Nike ground-to-air missiles were established in West Germany near Munster-Handorf as the first Dutch contribution to the NATO Central European air defence missile belts, and it was decided to replace all the Hunters, F-86Ks, Thunderflashes and Thunderstreaks by a multi-purpose combat aircraft, the Lockheed F-104G Starfighter, the first of which entered service in December 1962.

royal netherlands air force today

Fifty-nine years after its creation (RNethAF will celebrate its 60th anniversary on 1 July 1973) the Dutch Air Force consists of some 22,000 personnel, eight combat squadrons, hundreds of operational and training aircraft, a number of SAM squadrons and a variety of support units. The Dutch Air Force contributions to NATO are in air defence and tactical offensive operations. Meantime, the Air Force Regiment has been dispersed, leaving a four-Command organisation: Air Defence Command, Tactical Air Command, Air Training Command and Air Force Material Command.

In the air defence role RNethAF takes part in the air defence of the 2-ATAF region, comprising the airspace of the Benelux and part of the German Federal Republic, for which role it operates both F-104G Starfighter interceptors

Ten F-104G Starfighters of Volkel airbase (Tactical Air Command) in formation





and Nike and Hawk surface-to-air missiles. At present air evaluation is being conducted to select a successor for the F-104G standard interceptor/fighter bomber in the late 70s. A Control and Reporting system plays its role in air defence training operations and interception exercises. A USAF F-4E Phantom II squadron stationed at Soesterberg operates jointly with interceptor units of the Netherlands Air Defence Command, thus being the world's only 'Royal United States Air Force Squadron'. The RNethAF Tactical Air Command is also operating under NATO command. Squadrons of Tactical Air Command are equipped with F-104G Starfighters and NF-5 fighter bombers. (The NF-5 is a Canadian-built Northrop F-5, modified to special Dutch requirements and succeeded the two remaining squadrons of F-84F Thunderstreaks.) One of the NF-5 squadrons has the dual task of providing operational conversion for young pilots, but becoming a fully front line squadron in war.

high flight

In 1967 the Netherlands Air Force decided to buy 105 NF-5 fighter-bomber and training aircraft produced under licence by Canadair, thus combining the production of a batch of CF-5s on behalf of the Canadian forces and the Dutch commitment. It was decided that Dutch pilots would fly the factory-new NF-5s by 'high-flight' to their bases in Holland. In November 1969 the first formation of four NF-5s flew from Canada to Holland via Goose-Bay, Sondrestrom in Greenland, Keflavik in Iceland and Lossiemouth. The final leg was to Twente air base in Holland. Several formations of four or six aircraft followed this trail in 1970 and 1971, all performing a successful and safe 'high-flight'. Only one flight proved hazardous, No. 16 in autumn 1971. Some 30 mins after take-off from Keflavik and approaching rendezvous with USAF C-130 Hercules 'Duck Butt', pilots knew that they reached the point of no return, with a further 300 miles to fly over ice-cold seas before reaching Scotland. At this time one of the pilots, Capt C J van Holstein, suddenly discovered that he had difficulty in maintaining formation and his vision became blurred. He selected 100% oxygen without any improvement, and his pair-leader, Lt Sneek, drew his attention to 'Duck Butt', with its parachutist-physicians. As van Holstein turned his head to look he immediately felt dizzy, and found it completely impossible to see outside. When he asked his pair-leader to close up, Sneek noticed that Capt van Holstein spoke with great difficulty and appeared not to hear well, only responding to his christian name and not to the flight call sign. In order to save fuel, Lt Sneek decided to maintain 33,000 ft while checking his friend continuously as the two NF-5s continued towards Lossiemouth in close formation. Approaching the Scottish coast, and having difficulty in contacting Morray radar, Sneek requested his formation leader, Capt Verdonk, flying 10 mins ahead, to relay an emergency call. At 180 miles Sneek himself made contact with Morray and shortly after, the pair began a slow descent to 20,000 ft. From the moment they started to fly in close formation, Lt Sneek led his colleague by giving instructions by radio, for most of the conversation between

the pair-leader and the ground station was not even heard by the handicapped pilot, whose vision was confined to the centre of his instrument panel and every movement of his eyes resulted in a 'snap-roll' manoeuvre which did not auger well for the landing.

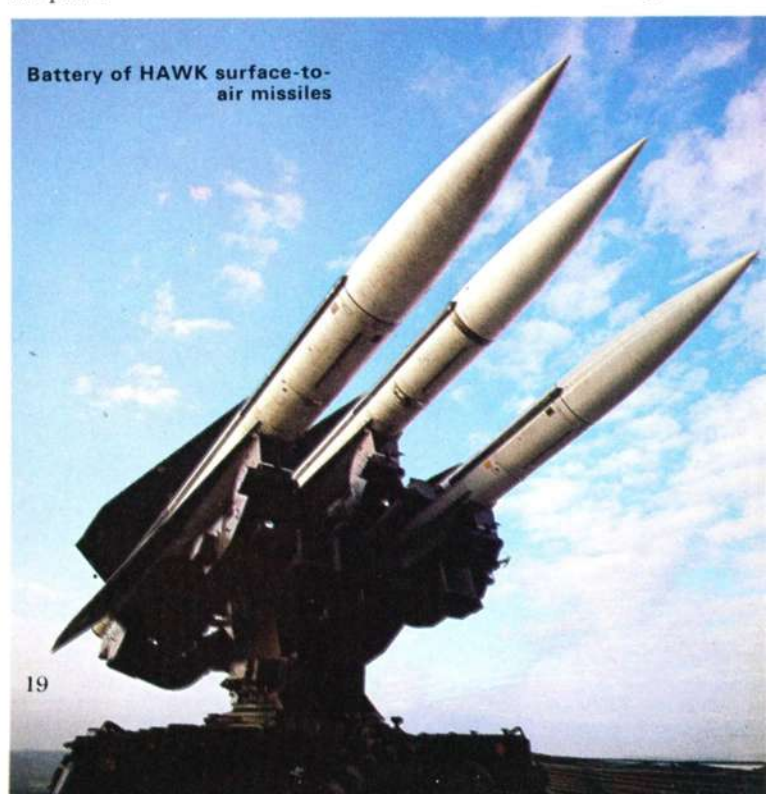
Fortunately, the weather at Lossiemouth was good and at 12 miles the pilots started a straight-in approach. Van Holstein's situation had slightly improved in that he was now able to focus his eyes at longer range and only right hand turns still caused dizziness. Sneek, familiar with Lossiemouth, took over from Ground Controlled Approach and talked his friend onto the runway, but although van Holstein had regained his depth of vision, it was most difficult to get his aircraft lined up. At 1,500 ft, with wheels down and flaps down at 180 kts, the actual landing began. The slow descent started six miles out. When reaching the approach lights, van Holstein's aircraft suddenly sank. 'Pull up, pull up!' Sneek roared. Hardly conscious, van Holstein obeyed and selected more power. Seconds later he was over the centre of the runway and instinctively pulled back the stick, touching down without difficulty. Nevertheless, Sneek had to shout three times before his companion activated his brake chute. After turning off the runway, van Holstein had to be hoisted out of his aircraft, being unable to climb out by himself. Medical experts later discovered that an acute malfunction of the balancing organs had caused the trouble, but luckily, Capt van Holstein has since completely recovered.

tomorrow

Europe has seen no fighting for more than a quarter century, and I believe the balance of power has played an important role in achieving this situation. Since the North Atlantic Treaty was signed in 1949 the security of each of the allied nations has been secured by the strength of this partnership. Whether, under pressure from rising costs, each of the partner nations will continue to devote the same proportion of its resources is a crucial question. As to the Netherlands air force, some important decisions will have to be taken. One is the selection of a successor for the Lockheed F-104G Starfighter, our present mainstay for air defence and tactical missions. The price of our investments for the insurance of freedom and security is a very high one. But when considering what the ceiling of this price should be, we should not forget the lessons of recent history. As Professor Toynbee said:

'Learning to understand the future is based on studying the past'. ©

Battery of HAWK surface-to-air missiles



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The Diamond Jubilee of the Birth of **AIR POWER** Sixty Years of CFS & Aeroplane and Armament Testing

The 'Memorandum on Naval & Military Aviation (Cmd 6067)' of April 1912 was the prosaic title of the Government document which laid the foundations of British Service flying, thereby creating the Royal Flying Corps with its Naval and Military Wings and the Central Flying School, which has long since been known as the World's finest flying training establishment, where not only the RAF, but virtually every air force, sends its best pilots to learn both the basis and the subtleties of the art and the science of pilot instruction at Little Rissington

Then, two years later, the decision was taken to form an Experimental Flight within CFS to ensure that the aircraft and equipment used by the flying services were right for the job, and from those small beginnings at Upavon in 1914, through the 20s and 30s at Martlesham Heath, the Unit which today is known as A&AEE has grown into one of the most advanced and comprehensive aircraft and armament experimental centres in existence at Boscombe Down

Thus, sixty years ago in Britain, air power was born



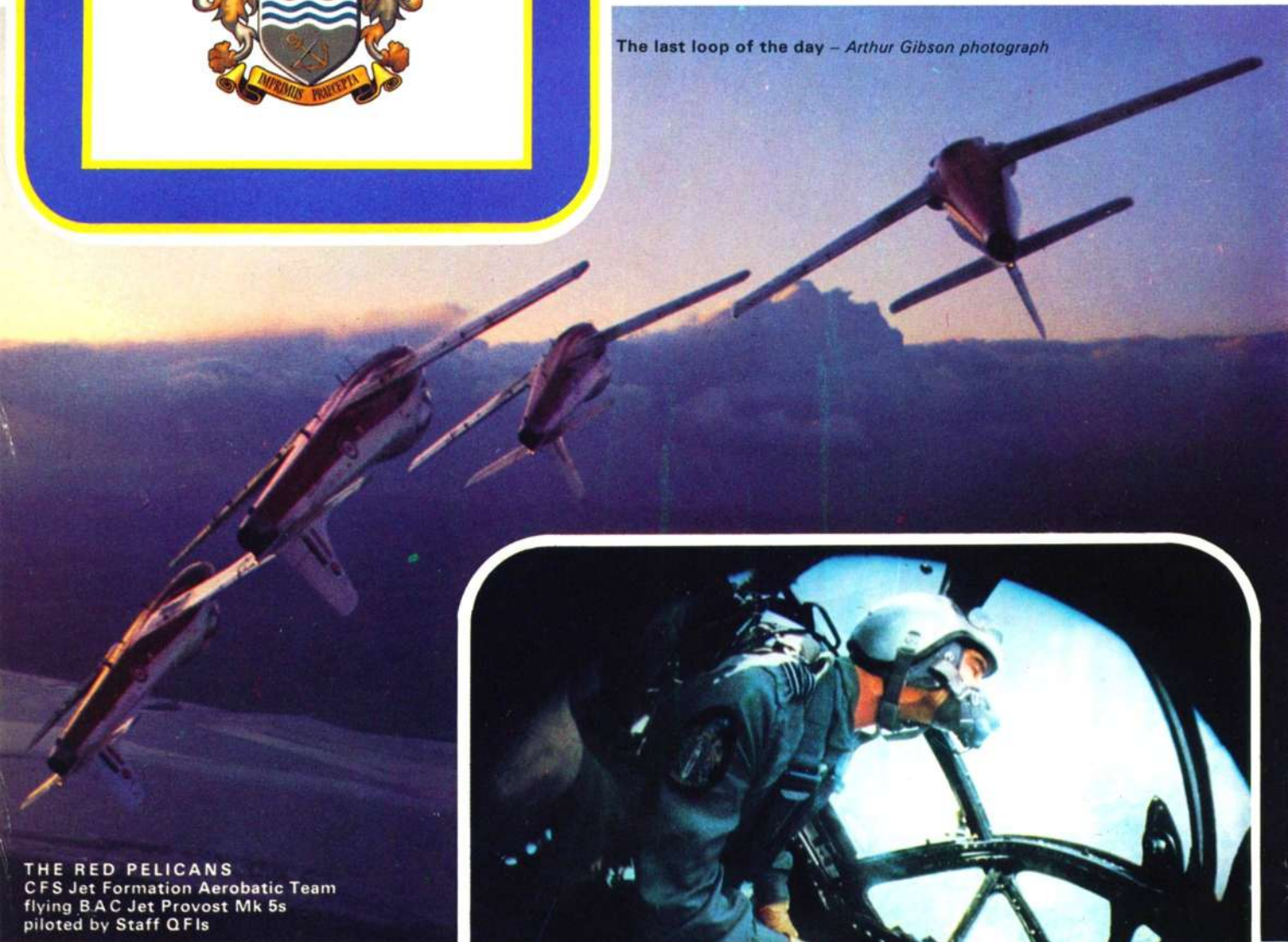
The Central Flying School

by John W R Taylor



Birthplace of Air Power

The last loop of the day – Arthur Gibson photograph



THE RED PELICANS
CFS Jet Formation Aerobatic Team
flying BAC Jet Provost Mk 5s
piloted by Staff QFIs

The team's aircraft are dual-controlled, now a universal practice, but an innovation when adopted by the newly-formed CFS in 1912.

'The object has not been to prevent flyers from getting into difficulties or dangers, but to show them how to get out of them satisfactorily, and having done so, to make them go and repeat the process alone. . . . Nothing that a pilot may do in the air is dangerous if he knows what he is doing and what the result will be. Almost all accidents are caused by ignorance!' – Col Smith-Barry, *Notes on Flying Training*, 1916

**CFS IS 'AT HOME' TO THE PUBLIC
ON SATURDAY 26 AUGUST**



Spin recovery – Richard Wilson photograph



THE CENTRAL FLYING SCHOOL is six years older than the Royal Air Force. It came into being in May 1912, at the same time as the Military and Naval Wings of the Royal Flying Corps, and was intended to make professional war pilots out of men who had already gained a Royal Aero Club Aviator's Certificate at their own expense. Its first home was a site of around 2,400 acres on some training gallops, two miles from the village of Upavon on Salisbury Plain, chosen, officially, because it was sufficiently isolated to avoid becoming an attraction for sightseers, was surrounded by open country and had a good road running through it. The fact that it was on top of a hill, surrounded by valleys, cliffs and dips, caused one journalist to comment: 'One may confidently expect that those aviators who survive the gorges and ridges, the upward and downward *remous* (air currents), the Arctic fridity and Saharic parchedness of the Upavon School will develop into aviators of unsurpassed hardiness.' Although facetious, that remark was to prove outstandingly apt. From the start, and throughout its sixty years, CFS has included among its staff and pupils most of the real 'characters' of British military aviation. Their hardiness has been matched by a sense of humour and a dedication to the highest possible standards of flying training that has made the CFS the Mecca of pilots from more than fifty of the world's air forces.

One of the volunteers for the very first course of instruction at Upavon in 1912 was an army officer named Major Hugh Trenchard. Having survived near-fatal wounds during the Boer War, in 1900, and a deadly bout of fever in Nigeria some years later, he was considered to be an ideal candidate for a nice quiet staff job. So, when he applied for a posting to CFS, his superiors replied, in July 1912, that they were agreeable provided he could get a Royal Aero Club Certificate by the end of that month. Within the ten-day deadline, Trenchard learned to fly at the Sopwith School at Brooklands and duly moved on to Upavon.

The standard training aircraft of the RFC in 1912 was the French-designed Maurice Farman biplane. With only 50 horsepower to push its multitude of struts and wires through the air, it never had any power to spare. When the tall figure of Trenchard was perched up on the petrol tank behind the pilot/instructor, increasing the head resistance, even the normal top speed of 59 mph was unattainable. There were sighs of relief from the instructor when his pupil progressed to the more streamlined front seat. Not long after this, Trenchard was appointed Station Staff Officer, which raised a problem as he had still not qualified for his military brevet. With little regard for red tape, he looked up the duties of a Station Staff Officer and found that they included the setting of examination papers, arranging and invigilating examinations, correcting papers and, finally, assessing the results and either passing or failing the candidates. So he simply set himself a flying and ground examination, was the invigilating officer, corrected his own paper and awarded himself the coveted

'wings'. From such unorthodox beginnings at CFS, emerged Marshal of the Royal Air Force Lord Trenchard, first Chief of Air Staff on the creation of the RAF in 1918 and widely regarded as the architect of the whole modern concept of air power.

Among his 25 fellow candidates on No 1 flying course was a Reserve officer named Lt Robert Smith-Barry, who was to become equally renowned as the creator of a revolutionary pattern of flying training that remains the worldwide standard to this day. His description of life at Upavon in 1912, in a letter, sums up well the spirit that had already been created by CFS: 'At first nobody knew anyone and everyone was very shy, but in a week or two 'twas great fun when one started in seriously to break the furniture. It is quite unnecessary to do any work, but the great secret is always to work fast and appear to be working hard. It's very cold and windy. One's quarters consist of a hollow cube with a stove the size of a Jerry and which smokes abominably. There's an exam at the end in which the most troublesome thing is a nonsensical book about the theory of flight. However, from what I afterwards heard, I think they give most marks for the paper about formations of troops.' This last supposition was, perhaps, understandable at a time when the aeroplane was regarded as no more than an aerial reconnaissance device, to bring army field commanders information on what was happening 'over the hill'.

Smith-Barry was more interested in discovering the capabilities of aircraft as flying machines than as a sort of aerial cavalry. His instructor soon realised that there was little that he could teach the gifted pupil and left him pretty much to his own devices. One day, the instructor collected a new type of aeroplane from the Royal Aircraft Factory at Farnborough. From the moment of take-off he felt unhappy about it. When the weather deteriorated, he began to be thrown out of his seat so violently that, each time it happened, he had to let go the controls, pull himself back and then hastily grab the stick again. At Upavon, he told his Flight Sergeant to put the beastly thing in the darkest corner of a hangar and allow nobody near it.

Next day, Smith-Barry saw the strange aeroplane and asked if he could fly it. Reluctantly, the instructor agreed,



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feeling that the risks were offset by the possible value of a second opinion. But he insisted that the machine should be flown warily, to his precise instructions. Off went Smith-Barry and promptly did all the things he had been told to avoid. After landing safely, and confronting the reproachful instructor, he observed: 'You know, Captain, I felt much safer flying that machine dangerously.' When CFS mechanics later subjected the aircraft to a thorough inspection, they found that its tailplane had been set at a highly-lethal angle in an effort to make up for the fact that the centre of gravity was in the wrong place for safe control. Their report ended the career of that particular type, and CFS gradually acquired the job of testing new aeroplanes intended for use by the RFC, as well as being responsible for training. By the outbreak of the First World War, in August 1914, it had passed out 93 of the 153 men who did their basic flying training with the Service, in addition to its original task of improving the standard of qualified pilots. As the war progressed, it became just one cog in the mighty machine that turned out pilots by the thousand, and its test flying was taken over by a new experimental centre at Martlesham Heath, in Suffolk, shortly after Christmas 1916, which was eventually to become the Aircraft and Armament Experimental Establishment. At much the same moment in time, Smith-Barry re-entered the picture.

For nine months in 1915-16, the Royal Flying Corps had endured what came to be known as the 'Fokker Scourge'. By perfecting an interrupter gear which enabled machine-gun bullets to pass between the blades of a spinning propeller, and fitting it to their little monoplane scout, Anthony Fokker's designers had produced the first really potent fighter-plane. The RFC was almost driven from the sky over the Western Front in France. Much of the disaster stemmed from the poor fighting qualities of British aircraft that had been designed to meet the very different requirements of steady, straight and level reconnaissance. This could be put right by designing and building better aeroplanes. Smith-Barry believed that this was only part of the remedy and that it was just as important to improve the standard of pilot training. In particular, he argued that instructors should be specially trained for their job and that a sound syllabus of standardised training methods should be laid down.

In a letter to his superiors in England, he wrote from France on 21 November 1916 that the answer seemed to be to start a school for flying instructors to which all potential RFC instructors would be sent before being turned loose on pupils. A few weeks later, in a further letter, he added: 'Up to the end of last May, when the writer left the country, no attention whatever was paid to the fundamental importance of instruction in the mere manual part of flying. This was left to those who were resting, those who were preparing to go overseas, and those who had shown themselves useless for anything else. . . . They looked upon their work as the merest drudgery. Pupils were therefore occasionally sent up

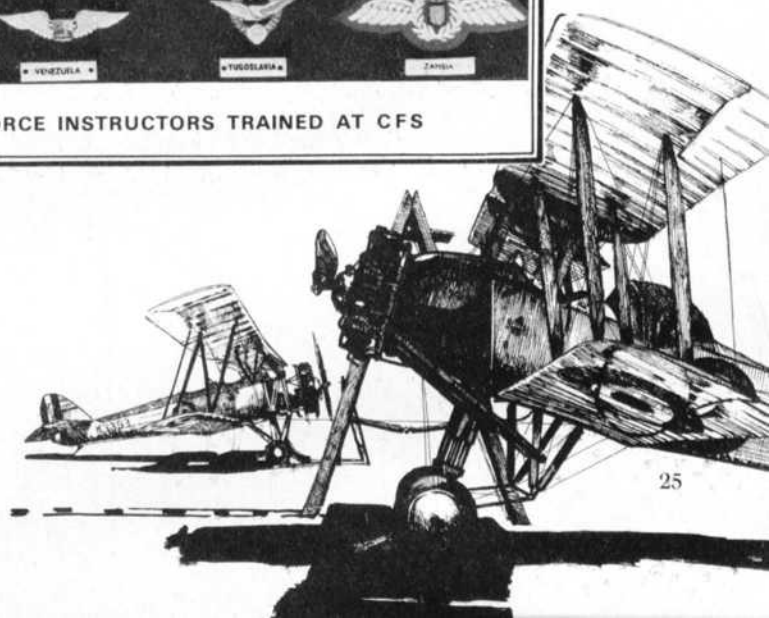
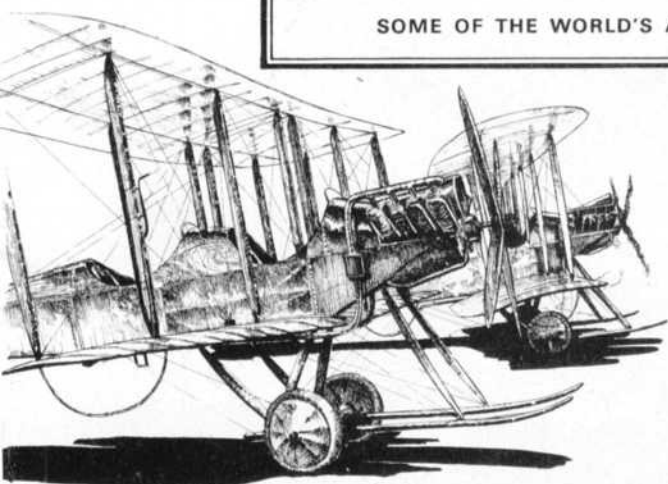
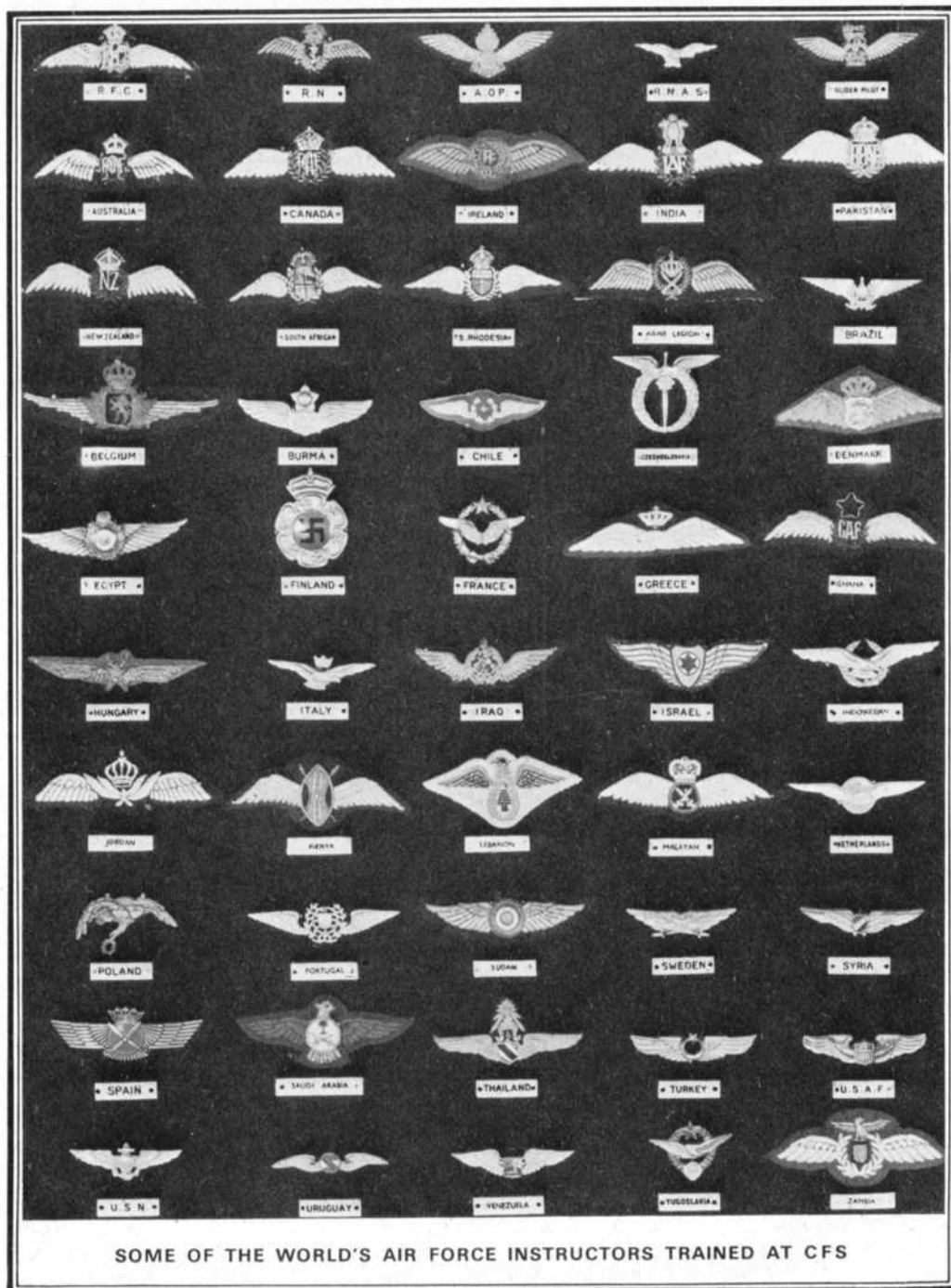
and told to fly round an aerodrome continuously for several hours without landing.

'The writer has been surprised to notice how little interest in flying is taken by many young pilots who come out to the Front. Though very young, and quite fresh, they have to be ordered to go up from the very first; they never ask permission to go up even for a practice flight. Before the war young flyers were always begging to be allowed up. It is thought that this, though in part due to the difference between voluntary and impressed labour, is largely due to the mental supineness of instructors in England. It is suggested that the mental attitude towards flying of an instructor is reflected in all the pilots he turns out.' This was only the start. Smith-Barry emphasised the vital importance of proper dual controls, so the pupils could take charge of the aircraft gradually, could go up with an instructor safely in practically any weather, and could be shown that steep turns, high rates of climb and even spins were not fatal manoeuvres.

To their credit, the officers in charge of the Training Division in England decided to let the revolutionary try out his theories in practice. He was given command of No 1 Reserve Squadron at Gosport, near Portsmouth, allowed to choose anybody he liked from among the best pilots in France for his staff, and to equip his Squadron with dual-control Avro 504s, which were flown by the pupils from the pilot's seat, with the instructor in the passenger's cockpit. The two could communicate in flight by means of a pliable tube with two earpieces for the pupil at one end and a funnel-shaped mouth-piece for the instructor at the other end. It took little time for the value of this 'Gosport tube' to prove itself, by comparison with the former hand signals, in the days before radio intercom. The first batch of pupils subjected to Smith-Barry's scheme were not specially selected in any way, being simply the next sixteen due for training. When the official inspectors travelled to Gosport some time later, to check progress, they could hardly believe their eyes. They saw pupils flying in formation and doing aerobatics and the kind of landings never dreamed of by their counterparts elsewhere. Thirteen of the new pilots were sent off solo in various types of aircraft that were in front-line service in France. Once again they looped, spun and landed with considerable skill.

Gosport was renamed the School of Special Flying and became the instructors' school for which Smith-Barry had campaigned. To help the men who staffed it, he wrote a booklet entitled *Notes on Flying Training*. His methods were summed up in two sentences: 'The object has not been to prevent flyers from getting into difficulties or dangers, but to show them how to get out of them satisfactorily, and having done so, to make them go and repeat the process alone. If the pupil considers this dangerous, let him find some other employment, as whatever risks he is asked to run here, he will have to run a hundred times as many when he gets to France.' Later, he added: 'Nothing that a pilot may do in the air is dangerous if he knows what he is doing and what the result will be. Almost all accidents are caused by ignorance.'

When Trenchard produced his blueprint for the future of the RAF in December 1919, he began one key section of his White Paper with the words: 'We now come to that on which the whole future of the Royal Air Force depends, namely the training of its officers and men.' It was hardly to be expected that he would overlook the potential of the School at which he had begun his meteoric climb to leadership of the first great independent air force in the world, or that he would discard any of the theories of his former fellow-pupil, Robert Smith-Barry, which had proved so right. Thus, when Central Flying School went back into business on a major scale at Upavon, in March 1920, it was as the RAF's training centre for flying instructors. Its basic training technique, which became famous as the 'CFS pattern', was basically sheer, unadulterated Smith-Barry. And its primary equipment was the Avro 504, which the School of Special Flying had shown to be the finest training aircraft of its generation.





...and sixty years later

Today the CFS is still 'on top of a mountain', although no longer at Upavon. Its base is RAF Little Rissington, in the heart of the lovely Cotswold country of Gloucestershire. Standing on a sort of plateau, 750 ft above sea level, this is the highest operational airfield in the United Kingdom. An advantage is that aircraft can often take off and land in the early morning when all the surrounding countryside is hidden under a blanket of fog. A disadvantage is that the weather can change for the worse, with visibility reduced from several miles to zero, literally within ten minutes. But 'nothing is dangerous if a pilot knows what he is doing' and training aircraft are very adequately equipped with radio nowadays, so that no pilot need feel cut off from help in an emergency.

By the time these words appear in print, Courses No 260 and 261 will be under training at Little Rissington, each made up of some 40 pilots. The majority will be wearing the blue of the Royal Air Force, but there will be a few from the Royal Navy and the Army; about one in five will be from places overseas such as Australia, Canada, Kenya, Malaysia, Nigeria, Saudi Arabia and Singapore. New intakes arrive four times each year, for a course that lasts six months. As in the very earliest days, the syllabus includes ground as well as air training, but Smith-Barry would find it very different from his 'nonsensical book about the theory of flight'. Even the greenest pupil whom these men will train when they leave CFS must be a little exceptional when the aircraft in which he takes his first lesson is a jet with a speed far higher than that of a Battle of Britain Spitfire fighter.

Standard equipment at CFS in 1972 is this same Jet Provost. Twelve of the 21 trainers of this type currently at Little Rissington are Jet Provost Mk 3s; the others are pressurised Mk 5s. There are six fat twin-engined Varsities for specialised training of those who will instruct on multi-engined types, and a dozen Chipmunks for basic flying. By the end of this year the 'Chippies' will begin to be replaced by Scottish Aviation Bulldogs, and next year turboprop Jetstreams are expected to supersede the Varsities. Helicopter training is done at RAF Tern Hill, with mountain flying and retrieval from the sea practised from Valley in Anglesey. The other base linked with Little Rissington is RAF Kemble, where the jet pilots go for their final sessions on Gnats.

Kemble, too, houses the best-known of all specialist units in the modern Royal Air Force – the Red Arrows aerobatic team, which is maintained with CFS support, although its pilots are kept so busy during the exhibition season that they can no longer double as instructors. It is, however, no coincidence that this year's Red Arrows team manager, Flt Lt Bruce Donnelly, flew as No 2 in Little Rissington's own 'part-time' aerobatic team, the Red Pelicans, in 1971. The Pelicans perform in Jet Provost 5s, less spectacular than the Gnats in

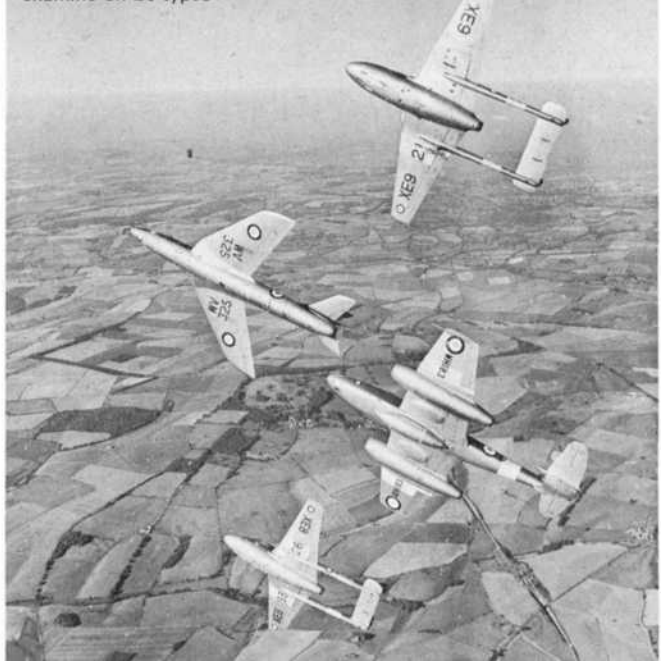
terms of speed and noise, but unsurpassed for precision. These pilots – one of them Captain Dick Land of the USAF on an exchange posting – inherit all the traditions that CFS has built up since 1912 and show that the modern RAF lacks none of the verve and skill of those who served at the School between the wars.

Think of any of the great names of the RAF two, three or four decades ago, and somebody will tell you a story of when they were at Upavon, or Wittering, which housed the CFS from 1926 to 1935. There was D'Arcy Grieg, the Schneider Trophy pilot, whose favourite trick was to wing-walk out to the wingtip of an Avro and sit there reading a newspaper, to the discomfiture of raw pupils from nearby Netheravon, who dived for the safety of home on seeing such a horrible apparition. Sir Dermot Boyle, a later Chief of the Air Staff, was best remembered for years as the pilot who once performed a stylish slow roll in a Tomtit and was a little too close to the ground when its engine cut. Then there were George Stainforth, who set up the first over-400 mph speed record in a Supermarine S6B Schneider Trophy seaplane in 1931, and a young man named Frank Whittle who patented his jet-engine ideas at the prompting of his instructor at CFS in 1930... the list of names is as endless as the men's achievements in peace and war. Flt Lt W E P Johnson, Whittle's adviser on patents, was responsible for much of the early, sound training for 'blind flying' in the RAF, reaching the standard of proficiency where he could take off with his cockpit shrouded under a hood, climb to height, perform a couple of aerobatic manoeuvres, including a spin, and then glide down to 200 ft, open the hood and land without using his engine.

Little wonder that, since 1927, the CFS has had to maintain an Examining Wing whose job is to fly out all over the world, wherever the RAF and its friends operate, to check that training techniques and instructors are up to the high standards which the School itself pioneered. What those standards mean is summed up in a Charter, drafted by Air Chief Marshal Sir Ralph Cochrane when he was C-in-C Flying Training Command and displayed still in the Commandant's office at Little Rissington, which begins: 'The tradition of organised flying instruction, which was born at Gosport in the days of the first war, has grown with the passage of time, and is now a major factor influencing RAF efficiency, in peace and war.'

'The Central Flying School is the guardian of that tradition...'

Mixed jet formation aerobatics by Examining Wing pilots – some qualified to examine on 20 types





THE RED PELICANS
Central Flying School's own formation aerobatic team



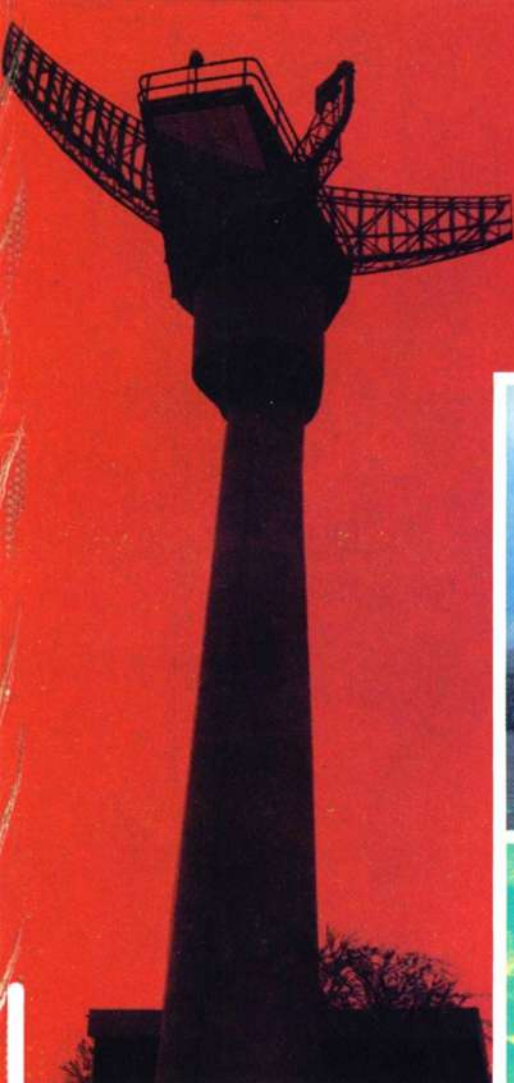
THE NEW ONE—HAWKER SIDDELEY 1182
Hawker Siddeley have just been awarded a contract for their HS 1182 design which will be the RAF's next advanced jet trainer. Instructor and pupil will have an excellent view and an economical turbofan power plant provides an hour's duration at low level



THE RED ARROWS
The RAF's premier aerobatic team of nine Hawker-Siddeley Gnats is also piloted by CFS staff instructors. This summer they are touring the USA. 22" x 17" artprints of Michael Turner's dynamic painting of the famous low-level cross-over can be obtained from Studio 88 Ltd., 95 West End Lane, Pinner, Middlesex, for £1.75

The Aeroplane and Armament Experimental Establishment

by T H J Heffernan C Eng AFRAeS



Long range radar control of Boscombe Down aircraft is provided by this Cossor 901D radar which operates over a radius of 160 nautical miles.



The Weighbridge hangar has dominated the Boscombe Down skyline since its construction in 1954 and although its massive size enables indoor servicing of the largest aircraft to be undertaken irrespective of the weather outside it contains an essential test facility for A&AEE work in the form of a very sensitive weighbridge enabling aircraft of up to 60 tons load per undercarriage to be weighed to high accuracy.

The airfield in 1944. The scorch marks on the grass were caused by the jet efflux from the prototype Vampire. The railway siding at the bottom of the photograph was used in connection with the building of the main runway.



Properly to Test

The series of coloured drawings are by Flt Lt J Fletcher RAF and were commissioned in 1968. The originals hang in the Officers' Mess A&AEE and are a small cross section of nearly 1000 types evaluated by A&AEE and its predecessors.

**Bristol Type 105 Bulldog
Prototype 1927**
450 hp Bristol Jupiter VII

Westland Wallace 1933-1941
680 hp Bristol Pegasus IV

The 'General Purpose' specification was popular in 1930s, and the Wallace, as the Westland G4/31, was one of several designs to that specification flown at A&AEE in 1932 and '33 to find a successor to the Wapiti. It equipped some County & City Squadrons in the Central Area.

Hawker Hart 1930-1939
525 hp Rolls-Royce Kestrel 1B



Entering Service in 1930 as a day bomber, the Hart had a top speed of 185 mph, well above that of current fighters! The Hart formula was the basis for a number of two-seat designs.



**Hawker F36/34 Hurricane
Prototype 1935**
1025 hp Rolls-Royce Merlin C

K5083, the prototype, was first flown by A&AEE at the end of Feb. 1936, three months after its first flight. Tests on various marks continued at A&AEE for another ten years. One variant, flown here in Sept. 1943, was the Slip Wing Hurricane which had a jettisonable upper wing.

B.E. 2c - 1915
90 hp RAF 1A



Two BE 2's were the first aircraft to be used by Experimental Flight CFS, the origin of A&AEE, at Upavon in the winter of 1914/15.



The Bulldog was one of five types tested competitively by A&AEE in 1927. After Squadron trials large scale re-equipment took place in 1929 and the Bulldog remained in Service until 1936.



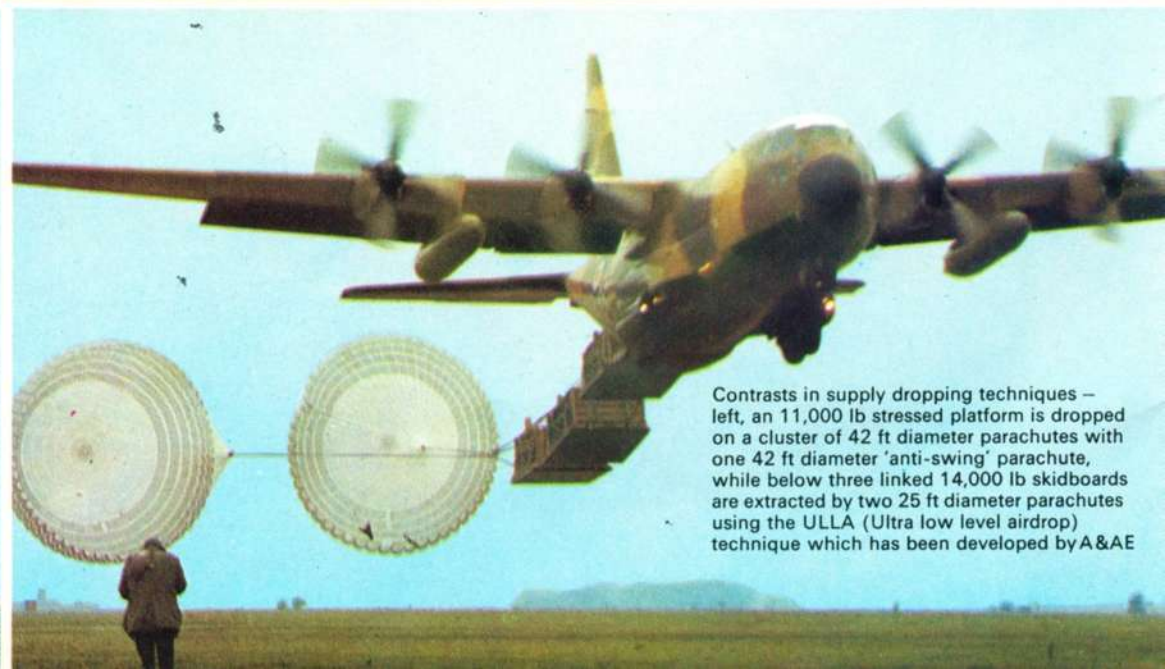


Pilots' eye view of the refuelling hose and drogue of a Victor tanker. Flight refuelling trials involve close teamwork between Flying, Engineering, Performance, and Navigation and Radio Divisions.

A rocket powered ejection seat with fully equipped dummy is fired from the static test rig.



The distinctively coloured Javelin Mk 9 pacer aircraft with its three special pressure heads for speed and height calibrations. A&AEE has used the pacer technique since the early 1950s when a Venom was operated.



Contrasts in supply dropping techniques – left, an 11,000 lb stressed platform is dropped on a cluster of 42 ft diameter parachutes with one 42 ft diameter 'anti-swing' parachute, while below three linked 14,000 lb skidboards are extracted by two 25 ft diameter parachutes using the ULLA (Ultra low level airdrop) technique which has been developed by A&AEE

A Brief History

The Staff of Experimental Flight Upavon 1915. Lts Bourdillon, Dobson and Tizard are on the right of the front row.



CFS had been established for over two years when the decision was taken by the War Office to establish an additional flight to be known as Experimental Flight CFS. It was staffed by one pilot, Capt A H L Soames, formerly of the 3rd Hussars, and one scientist, Lt Gordon Dobson RFC formerly the civilian meteorologist at Upavon. Dobson and Soames had as their terms of reference the devising of methods of mounting guns in aeroplanes, developing visual signalling, bomb dropping apparatus and sights. Just before Christmas 1914 they were joined by Robert Bourdillon, a pre-war Oxford don who joined the Army at the outbreak of war and while serving in the Intelligence Corps in France had devised an elementary bomb sight. This bomb sight was subsequently developed by Experimental Flight and was used by the RFC in the first world war, its first operational use being in a raid by Nos 5 and 7 Squadrons in September 1915 on some locomotive sheds at Valenciennes.

This small team was later strengthened by the arrival of several other University dons including one who was to play a particularly prominent part in defence research in years to come, Lieutenant (later Sir Henry) Tizard. The Experimental Flight then launched into the scientific assessment of aircraft performance in parallel with its work on bombing, signalling and photography, but unfortunately Soames was killed in June 1915 when a 500 lb bomb with which he was undertaking ground experiments exploded and a decision was made to remove armament testing from Upavon to Orfordness. Experimental Flight subsequently became the Testing Squadron Royal Flying Corps while still based with the CFS at Upavon, and undertook comprehensive trials of all new military aircraft and captured German ones. By January 1917 the Squadron's task had become too big to be accommodated at CFS, which was itself quite severely stretched with its training function, and the Squadron accordingly moved to Martlesham Heath in Suffolk where permanent hangars, offices, workshops and living accommodation were erected. The Squadron's status was recognised by the appointment of Martlesham Heath as the Aeroplane Experimental Station and it was organised into three flights, A Flight covering single seater fighters, B Flight heavy aircraft and C Flight the single-engine multi-seat aircraft. The Armistice in November 1918 and subsequent demobilisation led to a general run down at Martlesham. Tizard and Bourdillon had left to resume their University careers, Dobson had become Head of Physics at the RAE and the only tests being actively pursued were on the SE5 where various rudder shapes were being tested. However, in 1919 the Air Ministry came into being with the responsibility for all military and civil aviation in this country. One of its first actions was to sponsor a competition for commercial aircraft which was held at Martlesham Heath in 1920. The whole of the resources of what had now become the Aeroplane Experimental Establishment (AEE) were devoted to this competition and the winning aircraft was the Handley Page W8 which subsequently gave 10 years service with the many airlines which were beginning to spring up. This competition marked the beginning of the Establishment's work on civil aircraft which was to continue with the exception of the war years until the 1950s.

In June 1921 Orfordness closed down as a separate Establishment and its work came under Martlesham's control. So began the combined testing of the aircraft and its armament, 50 years of which the Establishment marks this year. In 1923 the lease of the land on which the Establishment was built was due to expire and a committee set up to review its future considered a number of alternative positions, one being to merge Martlesham with the Royal Aircraft Establishment. This met with violent opposition from the War Office which considered that such a move would lead to excessive flying over Laffans Plain! In the end a new lease was negotiated with the land owner and with this the future of the Establishment seemed assured, particularly since the Government of the day had embarked on an expansion programme for the Royal Air Force to allay public fears that defence was being run down too much following the Armistice. The expansion included two Squadrons to be formed at Martlesham Heath. These were not Squadrons in the conventional sense but were merely a convenience for the organisation of Martlesham's task. The two Squadrons were No 15 which included aircraft involved in armament testing and No 22 Squadron for performance testing. These two aspects of the Establishment's work were recognised by a change in title on 20th March 1924 to that by which it known today, the Aeroplane and Armament Experimental Establishment. The 1920s saw the beginnings of two other aspects of the Establishment's work which were not concerned primarily with the acceptance flying of the aeroplane or its armament but more in the nature of research and development. Two officers on the staff developed the McKenna-Potter container which became the standard supply dropping canister of the inter-war years and the Establishment was also to take on research tasks in support of routine acceptance testing. These changes coincided with the appointment of the first civilian Chief Technical Officer, the equivalent of today's Chief Superintendent, in the person of Mr R S Capon who had held that position as a Flight Lieutenant (the Officer Commanding Martlesham Heath in those years held the rank of Wing Commander).

The 1920s and 1930s also saw the Establishment taking part in record attempts and demonstrating new aircraft at the popular Royal Air Force displays at Hendon. Thus pilots from Martlesham Heath took part in the Schneider trophy races on secondment to the High Speed Flight and Flight Lieutenant Jenkins with Squadron Leader Jones Williams (the Commanding Officer of No 23 Squadron) made a gallant attempt in April 1929 to break the long-distance record; they flew 4,130 miles non-stop in just over 50 hours but were prevented by head winds from beating the existing record. Two pilots from A&AEE flying in the 1929 Hendon display were the first to use coloured smoke.

One aspect of Martlesham's work which stands out in any review of the inter-war years was the competitive evaluation in which a number of firms would produce prototypes to a given specification and Martlesham Heath would fly each one on a comprehensive series of tests in order to arrive at the recommendation for the best product, an early example perhaps of consumer research. The opinion of Martlesham Heath was widely sought by the aircraft industry, in fact 'OK by Martlesham' took its place with 'A1 at Lloyd's' as the accolade of approval.

By the middle 1930s a real expansion of the Royal Air Force was getting under way and aircraft manufacturers were beginning to set up shadow factories to produce a whole range of new aircraft, monoplanes with retractable undercarriages and other improvements which marked a very great change from the biplanes with fixed undercarriages which had been the mainstay of operational squadrons up to that time, and in 1936 A&AEE was honoured by a visit by His Majesty King Edward VIII who came to inspect the many prototypes which were being evaluated there at the time. Although the skies over Suffolk were full of these new and sophisticated aircraft the older aeroplanes still had their uses as indeed today the Establishment still flies 'hack' aircraft. Some were used regularly for what the quarterly research progress reports described as 'co-operation with Bawdsey Manor radio experiments', in other words the early work on radar. These aircraft were allocated to D Flight which subsequently formed the flying side of what was to become in later years the Royal Radar Establishment. The '30s, too, saw a steady increase in the evaluation of civil aircraft. The Air Ministry was responsible for all certification of civil aircraft and Martlesham Heath was the Establishment which carried out trials for the Certificate of Airworthiness. This work continued as far as light aircraft were concerned until the formation of the Air Registration Board in 1937. The ARB then took over the certification of light aircraft but large aircraft, for instance air liners, were still assessed at Martlesham Heath and this work continued until the outbreak of war.

When war started in September 1939 A&AEE left Martlesham Heath for Boscombe Down in accordance with the pre-arranged War plan. This left Martlesham clear as an operational airfield. Boscombe Down itself having recently had its operational squadrons transferred to East Anglia. So after a gap of 23 years the testing establishment returned to Salisbury Plain. The move posed many problems because although Boscombe Down had been an operational station since 1930 it was not equipped for experimental flying. There were no runways, no stop butts and range facilities were limited in practice to the ability to use nearby Army ranges where the Army was able to make them available. Domestic accommodation, too, was short because Boscombe Down had been built to accommodate two Bomber Squadrons and the arrival of nearly 40 experimental aircraft created difficulties with hangarage. To make matters worse the first winter of the war was locally the most severe in living memory, its severity being not exceeded since, not even in 1947 or 1963. Although Boscombe Down was not an operational station it nevertheless played host to operational squadrons and additional difficulties of accommodation arose during that first winter from the presence of Whitleys of No 58 Squadron.



This Orfordness Group, taken in 1917, includes Major Bertram Hopkinson (front left) who, as a Deputy Assistant Director, Military Aeronautics in the War Office, was one of the keenest supporters of the work being done at Martlesham and Orfordness.

The Beardmore Inflexible was flown by A&AEE in the late 1920s. At the time it was the World's largest all-metal landplane with a span of 150 ft.



In 1940 the first stop butts were constructed and land and sea ranges were established at Crichel Down in Dorset, Ashley Walk in the New Forest and in Lyme Bay. Additional land was requisitioned to form dispersals and to allow the main grass runway to be extended. The scope of A&AEE's task was widened considerably and several new sections were formed within the establishment. 15 and 22 Squadrons had been disbanded in 1934; since then the flying effort had been divided between two squadrons known as Armament Testing Squadron or Arm T for short, and Performance Testing Squadron or Per T, and these were split into A Flight for fighters, B for Bombers and, in the case of Per T Squadron, C Flight for multi-seat single-engined aircraft. To these were now added a blind approach training and development unit and in 1941 a High Altitude Flight to investigate problems associated with the operation of aircraft above 30,000 ft. At this time also the Navigation Section started with a staff of one, Squadron Leader Waghorn, the brother of the 1929 Schneider Trophy winner. The scientific effort was also augmented by an influx of graduates from universities who, unlike their predecessors of World War I, remained as civilians except for a few who held pre-war VR commissions. The Blind Approach Unit later became 109 Squadron and as such was the first to operate with 'Oboe' the long range blind bombing aid. In the Spring of 1940 some aircraft were detached from A&AEE to France to reinforce the British Expeditionary Force and the

100th heavy bomber to ensure that the production aircraft, particularly those from the shadow factories, were up to the standards achieved by the prototype. Pilots and technical staff from the Establishment were frequently called to operational stations to assess aircraft which the squadrons considered to be 'rogues' and while the evaluation of new aircraft continued additional effort had to be devoted to the assessment of modifications which were introduced as new roles were evolved for aircraft already in Service use. In 1945 there were at one time no less than 176 aeroplanes on the strength of the Establishment to the delight of schoolboy spotters; as in the First World War captured enemy aircraft were flown at A&AEE and tests were made on the Messerschmitt 109, the Heinkel 111 and the JU 88. The increasing complexity of A&AEE's task meant that it was no longer possible for selected pilots to become test pilots by 'learning on the job' so in May 1943 the Test Pilots' Training Flight was formed here which the following year became the Empire Test Pilots' School.

The jet age came to Boscombe Down on 19th March 1944 with the arrival of the first prototype of the de Havilland E6/41 'Spider Crab' the forerunner of the Vampire, although A&AEE had in fact been involved with jet aircraft for some months as a result of flying the F9/40, the prototype of the Meteor, at Morton Valence. Later in 1945 one of the

PB 592/G, the Lancaster I used for 'Grand Slam' trials, showing the bomb in position in the modified bomb bay, with B Sqn hangar in the background. The /G marking was used on all aircraft requiring special security safeguards.



Solid ice encasing a Whitley of -58 Sqn during the Boscombe Down winter of 1939/40.



Hurricanes and Demons of A Flight Arm T Squadron moved to Exeter where they remained for the rest of that year. These detachments reduced the total number of aircraft on strength to 36, the minimum during the War. This reduction was no doubt welcome as in the course of the Battle of Britain two Fighter Squadrons, 56 and 249, were stationed here, Flight Lieutenant Nicholson of 249 Squadron gaining Fighter Command's only VC of the War when flying from here.

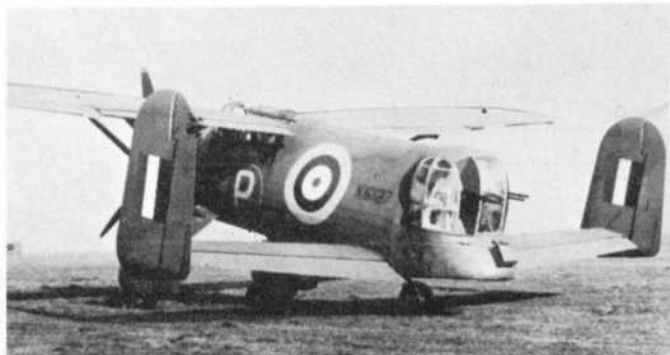
1941 saw a marked increase in the number of aircraft on strength as aircraft bought from America under the Lease Lend Agreement came here for evaluation. These were not the first foreign aircraft to be tested by A&AEE as some American and French aircraft had been tested in the middle 1930s as part of an Air Ministry policy to evaluate foreign aircraft in competition with the home product. 1942 saw the formation of Intensive Flying Development Flight which was intended to provide an opportunity for aircraft to be flown intensively so that some idea of long-term reliability could be obtained. In addition, with the increase in output from the aircraft industry, tests were made on every

This Hurricane had an extra wing, which could be jettisoned in flight, in an attempt to extend the aircraft's load-carrying capability.

K6127, the prototype Lysander was modified to take a four-gun rear turret and the tailplane span was increased to 40 ft. It was flown by A&AEE in 41

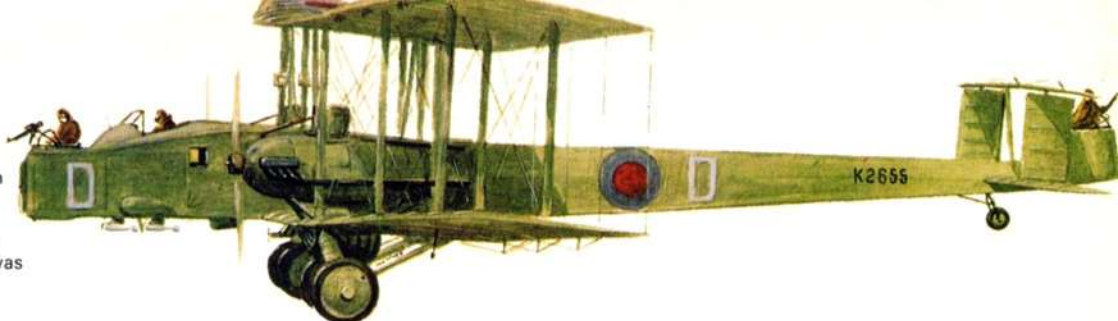
prototype Meteors was converted to a two-seater and it seems likely that a Boscombe Down 'boffin' had the honour of being the first non-pilot crew member of a jet aeroplane, certainly in Allied Countries.

The record of Boscombe Down in the Second World War was a proud one and there can be no doubt that A&AEE contributed much to the advance of military aviation, unfortunately not without some tragedies. The years had their lighter side, however, and the story is told of a demonstration being laid on to show the improvements in take-off performance which could result from the use of rockets. Unfortunately when the button was pressed the aircraft stood still and the rockets sped on over the heads of the assembled VIPs including the then Minister of Aircraft Production. The war years, too, will be remembered for the tempo of the work here and perhaps nowhere is this better illustrated than in the case of 'Grand Slam' the 22,000 lb bomb which was the heaviest conventional weapon dropped by any Air Force during the war. A&AEE had started the Grand Slam programme by evaluating the performance and handling of the specially modified Lancaster when carrying this weapon and the trials culminated in a live drop at Ashley Walk in the New Forest which was then used as a bombing range. The drop was made on the morning of 13th March, 1945 and following its success a despatch rider motor-cycled from Boscombe Down to the Ministry of Aircraft Production in London carrying



Vickers Virginia X 1922-1935
Two 570 hp Napier Lion XI

The Virginia followed closely the design of the Vimy of World War I. It was the standard bomber for many years in the 1920s and 30s and was later used as a parachute trainer. An A&AEE Virginia was used in early radar trials.



Fairey Postal 1928
570 hp Napier Lion XIA

Sqn Ldr Jones-Williams OC 23 Sqn and Flt Lt Jenkins of A&AEE Martlesham, left Cranwell in J9479 on 24.4.29 hoping to reach Bangalore, and break the long range record. Headwinds forced them to return to Karachi where they landed with eighty gallons of fuel having flown 4130 mls non-stop in 50 hrs 37 mins.



De Havilland D.H. 82A Tiger Moth
1932-1951
130 hp De Havilland Gipsy Major

The first A&AEE trials on the Tiger Moth as a military trainer were in 1932. In 1940 tests were made with 8 x 20 lb bombs under the wings. The type was used extensively before and during the War and is still popular with civil clubs.



Handley-Page Heyford
1933-1938

Two 525 hp Rolls-Royce Kestrel IIIs

The Heyford was the last biplane bomber to come into Service with the RAF and equipped several night bomber Squadrons, amongst them No. 10 Sqn which was stationed at Boscombe Down in the 1930s.



Supermarine F37/34 Spitfire
Prototype 1936
1029 hp Rolls-Royce Merlin C

K5054, the prototype, was first flown by A&AEE in the summer of 1936. Tests on the many variants, including the two-seater, continued here for another 12 years.

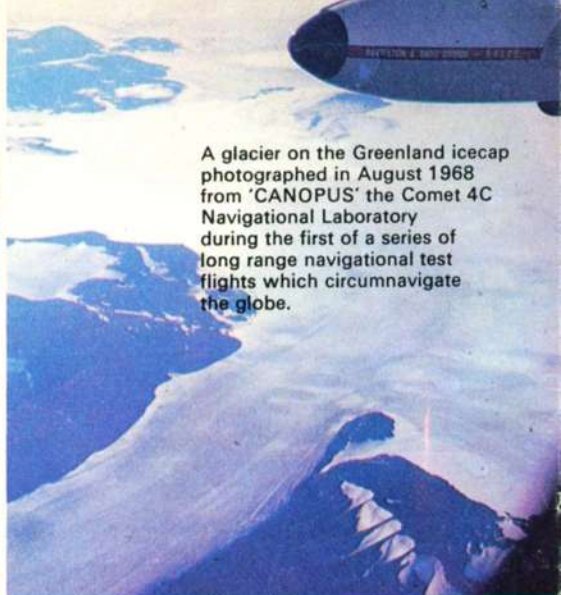
Short S.29 Stirling
Prototype 1939
Four 1375 hp Bristol Hercules 2

The Stirling was the first of the 4-engined heavy bombers developed during World War II, and had bomb storage in the wings as well as the fuselage. It was later used as a glider tug and paratroop carrier. A half scale model (4 Pobjoys) was flown by A&AEE in 1938.





Hot weather trials on the Harrier T Mk 2 were undertaken at Sigonella in Sicily.



A glacier on the Greenland icecap photographed in August 1968 from 'CANOPUS' the Comet 4C Navigational Laboratory during the first of a series of long range navigational test flights which circumnavigate the globe.

the clearance for the use of the bomb. The clearance was passed immediately to Air Staff and thence to Bomber Command in time for a successful operation to be mounted on 14th March by 617 Squadron on the Bielefeld viaduct.

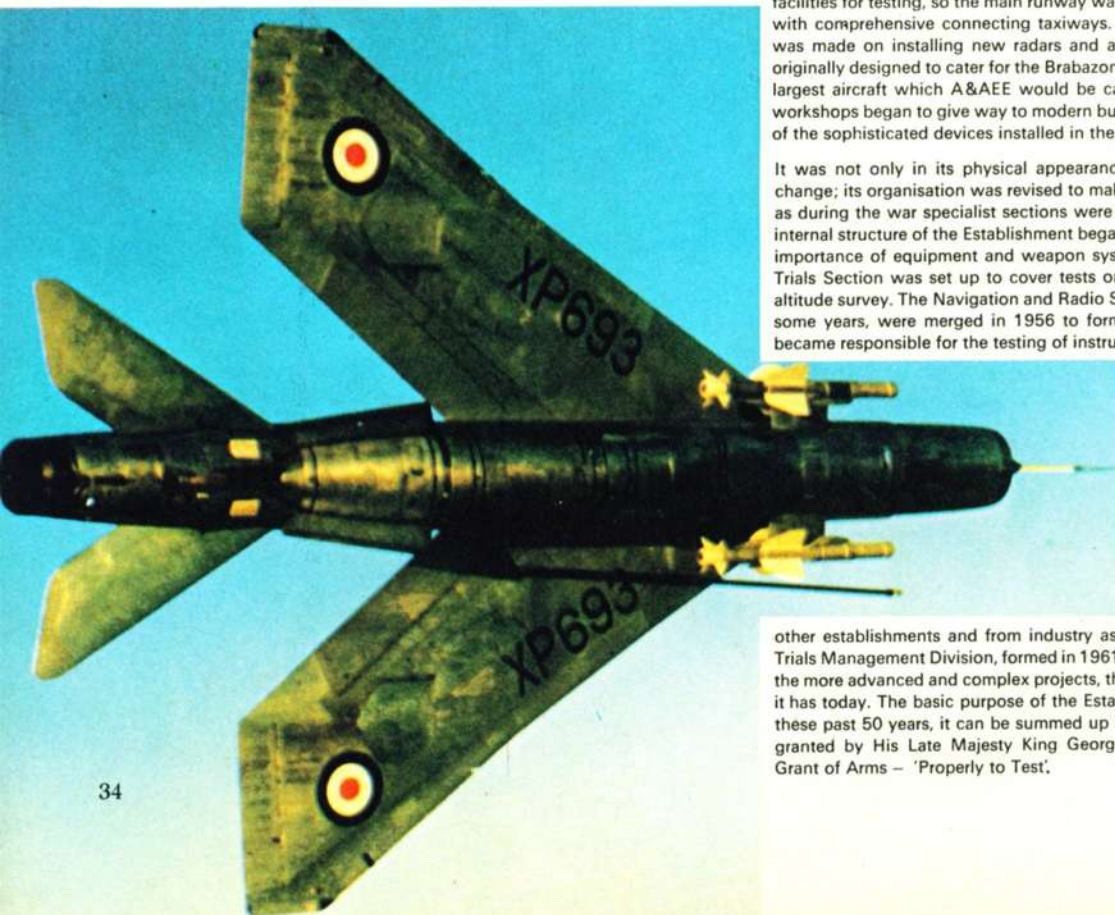
In the five years that the war lasted aircraft speeds had doubled, operational ceilings had increased by 50% and maximum take-off weights were double and sometimes treble the figures that were common at the outbreak of war. The techniques of aircraft testing needed to match the complexity of the aeroplane and a first step towards improving the facilities at A&AEE came with the construction of the first concrete runway in 1945. The decision to go ahead with such an undertaking, which gave Boscombe Down one of the longest runways in the country, could not of course be taken until the major policy decision to keep A&AEE at Boscombe Down had been made. Another decision not directly related to A&AEE but of some importance to its work in the immediate post-war period was that of the Brabazon Committee which recommended that a range of civil aeroplanes would be needed to equip British air lines after the war. As a result early in 1945 a civil aircraft test section was started with the objects of evolving flight test techniques to determine airworthiness standards and subsequently testing the new aircraft.

With the end of the war the work of the Establishment naturally reduced; service personnel were demobilised and the scores of young graduates who had been directed to establishments such as Boscombe Down went back either to take up post-graduate careers in

Universities or to apply their skills to the problems of reconstructing Britain, but the Establishment was nevertheless left with a useful nucleus of skilled aircrew and technical staff including the Civil Aircraft Test Section, referred to earlier, which now began to come into its own, and the decision to build the main runway began to pay off as many of the civil airliners, both Brabazon Committee types and private venture designs came to Boscombe Down for Certificate of Airworthiness testing. The Establishment's direct interest in the civil field was destined to be short lived as a result of the decision to transfer C of A testing wholly to the Air Registration Board and yet the overall Establishment task soon grew almost to war-time proportions, for with a re-appraisal of Britain's defence situation Boscombe Down once more found itself engaged in competitive evaluations comparable with those which had exercised Martlesham Heath before the war. The Balliol and Athena were produced to the same specification as intermediate trainers, the HP(R)2 and the Provost were offered to meet the needs of a basic trainer and the Blackburn GR17 and the Fairey GR17 (the Gannet as it was later called) came to Boscombe to be compared as anti-submarine aircraft for the Royal Navy. In 1951 the Airborne Forces Experimental Establishment (AFEE) was absorbed within A&AEE as the Airborne and Helicopter Division, so A&AEE's task increased to include helicopters, parachuting and supply dropping.

Tests were already in progress on the first of the new generation of heavy jet aircraft the Valiant; the aircraft which were to form the mainstay of Bomber Command in years to come, the Vulcan and the Victor, had not yet flown, but these and the transonic fighters, more advanced than anything flown by A&AEE up to that time, needed to have suitable facilities for testing, so the main runway was joined by another in a north south direction with comprehensive connecting taxiways. The airfield aids were improved and a start was made on installing new radars and approach systems. The Weighbridge hangar, originally designed to cater for the Brabazon, was completed in time to accommodate the largest aircraft which A&AEE would be called upon to handle. The cramped pre-war workshops began to give way to modern buildings equipped for the servicing and testing of the sophisticated devices installed in the new aircraft.

It was not only in its physical appearance that the Establishment was beginning to change; its organisation was revised to make the best use of the effort available and just as during the war specialist sections were set up to fulfil particular needs, so now the internal structure of the Establishment began to change to take account of the increasing importance of equipment and weapon systems in aircraft. Thus in 1950 Photographic Trials Section was set up to cover tests on new cameras for reconnaissance and high altitude survey. The Navigation and Radio Sections, which had existed independently for some years, were merged in 1956 to form the Navigation and Radio Division which became responsible for the testing of instruments and radar equipments emanating from



Weapon carriage trials – Red Top missiles on a Lightning Mk 6.

other establishments and from industry as well as radio matters. With the addition of Trials Management Division, formed in 1961 as Weapons Systems Division to co-ordinate the more advanced and complex projects, the organisation of A&AEE took the shape that it has today. The basic purpose of the Establishment has, however, been constant over these past 50 years, it can be summed up by the translation of the motto on the badge granted by His Late Majesty King George VI in 1939 and now incorporated in our Grant of Arms – 'Properly to Test'.

Avro 689 Tudor II Prototype 1946
Four 1770 hp Rolls-Royce Merlin 600

Designed during the War the Tudor II underwent Certificate of Airworthiness testing at A&AEE in the late 1940s. It was in limited use with charter companies, although the Mk IV version was in Service with British South American Airways.

Westland Whirlwind Prototype 1938
Two 885 hp Rolls-Royce Peregrine 1

This aircraft was first tested at Boscombe Down by A&AEE pilots from Martlesham Heath during the Munich Crisis of 1938. Although advanced for its time, only two Squadrons of the type were formed and used for anti-shipping strike duties in the early years of the War.

De Havilland D.H. 98 Mosquito Prototype 1940
Two 1460 hp Rolls-Royce Merlin 21

The prototype, shown here with its maker's number, was flown at A&AEE in February 1941, but tests were curtailed by a fuselage failure which involved a rebuild. The type developed into one of the most successful and versatile aircraft of the War.

Supermarine Type 392 Attacker F.1 Prototype 1946
5100 lbs st Rolls-Royce Nene 3

The Attacker was the first jet aircraft to enter service with the Royal Navy. The first A&AEE deck trials of the type were in HMS Illustrious in October 1947.



Blackburn GR 17/45 Prototype 1949
2000 hp Rolls-Royce Griffon 56

WB 781 was the Griffon engined prototype of a design by Blackburns to meet specification GR 17/45 for a naval general reconnaissance aircraft. It was in competition with a Fairey design which eventually became known as the Gannet.



Our Job and how we do it

Our three Harvards, the last flying in this country, over Stonehenge en route to photograph a supply dropping trial. The Harvards are used extensively for photo-chase duties.



The Aeroplane and Armament Experimental Establishment is the Government's official centre for the acceptance testing of all military aircraft and associated equipment intended for use by the Services. Other Establishments of the MoD Procurement Executive are responsible for the research and development of many of the items which equip a modern aircraft, the Royal Aircraft Establishment for instance being responsible for much fundamental research in aerodynamics, structures, aviation electronics (or avionics) and weapons, but it is here at Boscombe Down that the complete aircraft is evaluated against the requirements laid down for it. The requirement for a particular type of aircraft arises initially from a survey of the likely world situation some years ahead which is made by the appropriate staffs in the Ministry of Defence and associated departments. At the same time a review is made of the 'state of the art' in aerodynamics, structures, engines, weapons and the like, and an assessment is made of the feasibility of producing a particular type of aircraft. Once that has been done the MoD Procurement Executive produces a specification based on the Staff Requirement and the aviation industry is then invited to produce an aircraft to meet the specification; Boscombe Down gets involved even at this early stage by offering advice based on experience with similar types of aircraft. The MoD Procurement Executive, which acts as the buying agent for the Ministry of Defence, the 'customer', then instructs the manufacturer to build the aircraft.

The manufacturer undertakes initial flying trials of the new aircraft and then Boscombe Down does a 'preview' or preliminary assessment of the type. The object of the preview is to enable the Establishment to advise the Ministry on the broad progress of the project and to point out any problem areas. Later, a production aircraft with all its complex equipment is tested comprehensively against the requirements; in fact more than one production aircraft is generally involved in these full clearance trials because it would be virtually impossible to do trials at one and the same time on one aircraft on, say, the navigation and engineering systems. Again, certain tests will require the aircraft to be flown overseas, so while one is undergoing tropical or winterisation trials another here at Boscombe Down will be carrying on with a different schedule of tests. At suitable stages in the course of Boscombe Down's tests A&AEE makes reports on progress in the form of 'CA clearance' recommendation to enable the Royal Air Force, the Royal Navy or the Army, as the case may be, to use the aircraft in operational service. The trials we do here demand all the many skills of A&AEE and are designed to ensure that the aircraft operated by the Services are safe and efficient in use. The way that these skills are employed and the facilities at our disposal are described in the pages that follow.

The Establishment is composed of nine Divisions each headed by a Group Captain or civilian equivalent and supported by administrative services and a small Royal Air Force Unit. The head of the Establishment is an Air Commodore, and the Chief Superintendent, who is responsible for all the trials Divisions, is a civilian. Six of the nine Divisions are assessment Divisions, that is to say that they plan, carry out and report on trials work. Of the remaining three Divisions one is concerned with servicing of aircraft and equipment, one carries out the flying required by the assessment Divisions, and the third is the Empire Test Pilots' School.

Trials Management Division is responsible for the planning, control and co-ordination of the Establishment's effort on the more advanced and complex projects, and it also provides information for the effective control of that effort through the application of modern management techniques. It gives support to the specialist divisions in providing a mathematical service and it is also responsible for the development of test instrumentation used in flight trials which varies from simple mechanical installations up to the most modern magnetic tape and tele recording.

Performance Division is responsible for assessing the handling and performance of fixed and rotary wing aircraft to provide recommendations on operating limitations and operating data. Its work includes tests peculiar to specific categories of aircraft and it is closely involved in the integrated testing of aircraft and flight systems including full automatic landing. It is responsible for a measure of control on manufacturers' flight trials and test methods and it includes sections which specialise in the operation of shipborne aircraft and a research section responsible for forward thinking on test techniques.

Engineering Division conducts tests to assess the safety, efficiency and reliability of all systems in an aircraft, apart from those specific to armament, navigation and photography. The Division maintains close liaison with the

manufacturers from the design stages until full release to the Service has been given. It specialises in the performance of hydraulic, electric and air-conditioning systems with particular reference to extreme climates and is responsible for operating several of the Establishment's test facilities described later. Engineering Division is also responsible for the development and clearance of paratrooping and supply dropping methods and equipment.

Armament Division is concerned with the safe and reliable carriage and release of weapons from aircraft. This work involves assessing the electrical and mechanical engineering aspects of weapon installations, the integrity of weapon carriage in flight, safe separation, the satisfactory functioning of the weapon in the target area and the electro-magnetic compatibility between the weapon and the aircraft.

Navigation and Radio Division conducts acceptance trials of navigation/attack and radio/radar installations in new military aircraft and of equipment introduced into existing aircraft. It is also concerned with the evaluation of new equipment and systems being considered for installation in future military aircraft and for the evaluation of selected civil and navigation systems. It tests airborne radar and other avionics such as Doppler, radio altimeters and electronic reconnaissance systems.

Photographic Division has two functions: on the one hand it is responsible for the testing of new photographic equipment and photographic reconnaissance installations and for this it has a well-equipped trials section and optical laboratory, on the other hand it provides photographic and optical services in support of the rest of the Establishment. Its facilities include full cine and colour processing and it has specialist personnel for air-to-air photography.

Flying Division carries out all flying for the assessment Divisions of A&AEE. It is divided into squadrons according to the role of the aircraft. High performance and trainer aircraft are flown by A Squadron, bombers, maritime and transport aircraft by B Squadron, D Squadron flies all helicopters irrespective of the Service user and E Squadron flies aircraft on supply and personnel dropping trials and also operates a Support Flight which provides transport facilities within the United Kingdom and in support of overseas trials which are often mounted away from normal air service routes. In addition to the provision of flying effort in support of the assessment Divisions the test pilots themselves make a unique contribution by making qualitative assessments of the suitability of aeroplanes for particular roles.

Technical Services Division's main task is to keep serviceable the constantly changing A&AEE fleet of many different aircraft types, to service and repair airborne equipment, to install instrumentation and special equipment in trials aircraft. The Division also services weapons and maintains the airfield installations, the motor transport fleet and a wide range of ground equipment. The Establishment's apprentice training scheme is controlled by this Division.

Administrative and Accounting Services, headed by the Secretary, interpret Headquarters administrative and financial policy locally and provide an administrative backing to the other Divisions, operating mainly in the field of personnel, provisioning and finance. They embrace a number of other supporting activities such as security, transport, stores, fire brigade, typing, printing services, telephone and telex, branch training and accommodation and co-ordinate local action on building works and maintenance with the Department of the Environment.

Royal Air Force Unit is responsible for RAF administrative matters, providing administrative and accounting services for RAF personnel and medical and dental facilities for all Service personnel. The administration of Royal Navy and Army personnel is covered by appropriate parent units elsewhere.

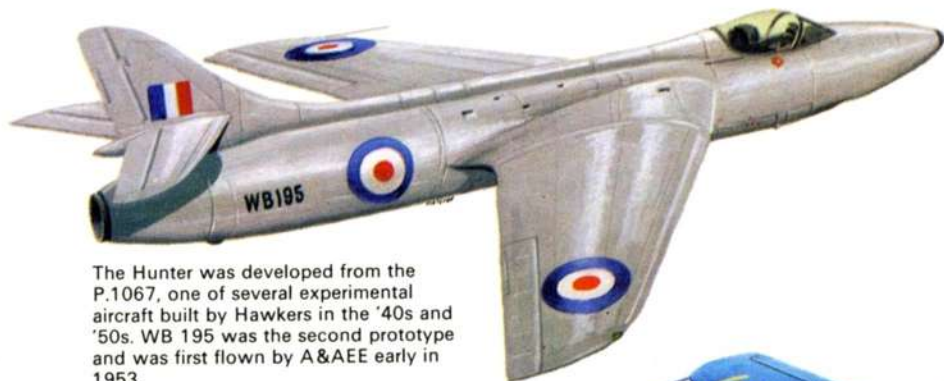
The descriptions given outline briefly the structure of the Establishment and the function of its constituent Divisions. A&AEE is staffed mainly by civilians, with officers of the three Services providing the aircrew effort and filling specialised posts in the Navigation and Armament Divisions. All servicing is carried out by civilian personnel.

The location and organisation of A&AEE makes it suitable to act as hosts to other units when the need arises. At present Handling Squadron, a Ministry of Defence Unit responsible for compiling the Aircrew Manuals, is based on the Establishment as a lodger unit, the Joint Services Trials Unit responsible for the evaluation of the Martel weapon is also located here, and there is a small cell from the Central Tactics and Trials Organisation of the Ministry of Defence.



Westland Wessex H.A.S. 1 1958
1450 shp Napier Gazelle 160

The Wessex HAS Mk. 1 entered service with the Royal Navy in 1961 as the Fleet's primary anti-submarine aircraft. XM 331 came to A&AEE in 1961 and was used for cold weather trials in Canada during 1961/62 and for Doppler trials in 1965/66.



The Hunter was developed from the P.1067, one of several experimental aircraft built by Hawkers in the '40s and '50s. WB 195 was the second prototype and was first flown by A&AEE early in 1953.

Hawker P.1067 Hunter Prototype 1951
7500 lbs st Rolls-Royce Avon 7

Folland F.O. 139 Midge Prototype 1954
1640 lbs st Armstrong-Siddeley Viper 101

The Midge was the smaller, Viper powered, prototype which was the forerunner of the Gnat. It first flew on 11th August 1954 and only five weeks later came to A&AEE for Preview trials, 10 flights being made here in three days.



Bristol 171 Sycamore HR 14 1953
520 hp Alvis Leonides 173

XE 308 was used during 1964 by A&AEE for blade de-icing trials in the spray rig at the National Aeronautical Establishment in Ottawa. Belvedere blades were used for the trial but the aircraft was subsequently restored to normal form and used at Boscombe for SAR duties until 1965.



The Mk 4 with a Python turbo-prop was the only version of the type to see Squadron Service and the Royal Navy's only turbo-prop strike aircraft. A Mk 4 flown by A&AEE pilots was the first aircraft to get a deck clearance using the mirror sight. (HMS Illustrious. November 1953).

Westland Wyvern S.4 1949
4110 shp Armstrong-Siddeley Python 3



Tools of the Trade



In clear blue skies a Nimrod flies into the icing Spray from the Canberra. The Argosy was used at the time of these trials to calibrate the Spray.

Boscombe Down's basic tool in its trade of aircraft testing is of course the airfield. From a small grass airfield in 1939 it has now developed into one of the most comprehensively equipped in the country. It has two major runways one 3,500 yds long the other 2,100 yds long, both of them considerably wider than average at 100 yds, and a third runway 1,400 yds long and 60 yds wide. All three are connected by a system of taxiways which also connects with the technical area and the hangars. Airfield arresting gear and barriers are provided on the major runways and there is a comprehensive range of airfield and surveillance radars and approach aids with full airfield and approach lighting.

The stop butts have been a feature of the A&AEE since 1940, looking rather like giant long barrows. While not as extensive as in the past because of the progressive change from fixed guns and gun turrets to rockets and other missiles, the present-day butts nevertheless provide all the facilities required for fixed gun installation testing on the ground and for the firing-in of guns of up to 30 mm calibre at 300 rounds/minute. Two butts are currently in use, one having aircraft tie down points at 50 and 300 metres and the other with covered accommodation for a single Aden gun on a stand. Much of the space occupied by the older butts is now taken up by the radio frequency generator. This is a relatively new facility which enables specially instrumented armament stores or complete aircraft to be subjected to the appropriate radio frequency emissions.

One of the oldest fixed test facilities on the Establishment is the open jet blower tunnel which is capable of producing airstreams up to 350 kts (405 mph) depending on the size of nozzle employed. It dates from 1942 when it was built to test aero-engine exhaust systems with a view to cutting down the amount of flame shown by these systems at night; exhaust flames on our bomber aircraft were a source of guidance to enemy night fighters. Its use, however, was extended progressively during the war and at one stage the engine of a V1 flying bomb was tested in the tunnel. Since the war it has become used more and more for the ground testing of such items as jettisonable canopies, ejection seats and air turbines. Being an open jet tunnel with adequate space surrounding it complete aircraft can be mounted in front of the jet which is adjustable in height and pitch. A recent addition is an icing spray rig in the nozzle chamber, enabling icing tests to be undertaken under controlled conditions. Liquid nitrogen is used to obtain a temperature drop of approximately 20°C below the ambient air temperature, and rain can also be simulated.

Much smaller in scale but capable of surprising diversity is the Environmental hangar located south of the main runway. Adapted from an existing aircraft hangar it provides a usable test area 90 ft long, 90 ft wide and 18 ft high in which small and medium size aircraft or industrial equipment can be tested in conditions of high temperature and high humidity. The air inside the hangar can be heated to 75°C (165°F) by four special heaters and the temperature can be maintained at any level with an accuracy of $\pm 2^\circ\text{C}$. The moisture in the air, too, can be varied to provide 100% relative humidity, and thus the formation of cloud, up to a temperature of 34°C (93°F) with correspondingly high humidity above this temperature. Solar radiation can be simulated up to 90°C and tropical rainfall can be provided over an area 250 sq ft for up to half an hour. Internal combustion and small jet engines can be run in the hangar. One advantage of this particular facility is that some tropical conditions can be simulated and hence shortcomings highlighted in this country with consequent saving in time and money on tropical trials overseas.

The radio installation of a modern aeroplane is a far cry from those early days in 1910 when the first successful air-to-ground wireless transmissions took place over Larkhill a few miles from here, and Navigation and Radio Division maintains the Radex facility on the south side of the airfield which is a large complex of aeriels and associated laboratory

equipment which measures the performance of all airborne aerial systems for communications, identification and non-radar navigation systems. There is also a long range two-way communications system operating in HF SSB (high frequency single side band) the uses of which include communication with A&AEE trials aircraft overseas.

Navigation and Radio Division also operates two navigational flying laboratories. One is a modified Comet 4C which is fully instrumented to record the performance of navigational systems under test and to provide a standard against which test subjects can be assessed in a realistic environment. Similar facilities for equipment destined for use in helicopters are provided by a Wessex.

As aircraft performance has increased so has increasing emphasis to be put on the means of ensuring that in the event of an accident the crew can escape satisfactorily. Some tests of ejection seats are done in the Blower Tunnel already described, but the full performance of an ejection seat can only be tested in the air. For this purpose Engineering Division operates a Canberra from which since March 1964 over 130 ejections of many types of seat have been made. It is flown by a crew of one, the rear compartment being modified to provide accommodation for the ejection seats under test. The dummies used in the ejection seats are representative of the human body in terms of weight, balance, and even the movement of limbs. Tests can be made in flight over the speed range 130 to 450 kts (150 to 520 mph) and on the ground at speeds up to 100 kts. The aircraft itself has comprehensive instrumentation and cine cameras, and the dummies can be fitted with telemetry so that data on the force experienced during ejection can be transmitted to a ground station.

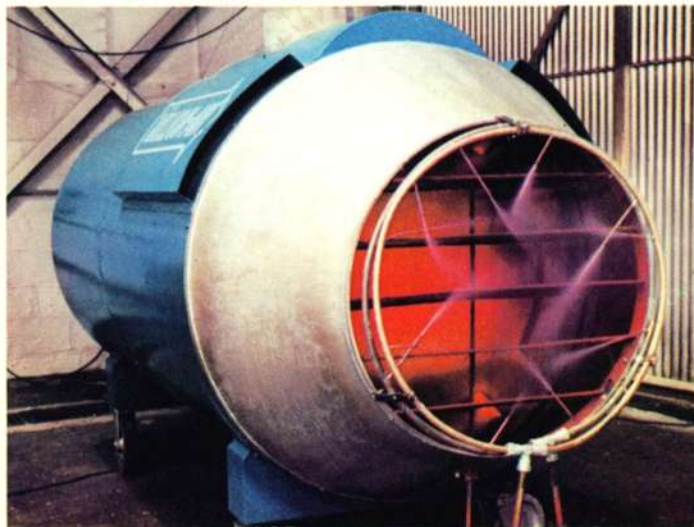
Icing was once one of the major hazards experienced on any aircraft flying in bad weather. Over the years devices have been developed which are now incorporated on all aircraft likely to fly in icing conditions. It is possible to test such devices in actual icing conditions but it is difficult to make controlled tests in such circumstances. Boscombe Down has accordingly converted a Canberra bomber into an icing tanker. It has a water capacity of 900 gallons, and the water flow from a specially designed rake at the rear of the aircraft can be varied up to 60 gallons per minute to give a localised icing cloud comparable with natural icing. As with the other test facilities here this aircraft is fully instrumented for its particular task with continuous trace recorders and a zoom lens closed circuit television system. While the Canberra produces the icing spray the test aircraft is flown astern of it and ice is built up on the airframe, the engine intakes or any other area which requires to be assessed.

Most motorists are aware that the speedometers on their cars have to be accurate to within ± 3 mph at 30 mph, that is they can have an error of up to 10%. This may be all very well on the road but such an error is far too great in the air, where accurate knowledge of an aeroplane's speed is essential if the best use is to be made of its performance. One of the sources of error in an aeroplane's airspeed indicator is known as the 'pressure error'; there are many ways of measuring this but for most high performance aircraft it is important to measure it under typical conditions, say at high altitude. Boscombe Down has a specially equipped Javelin for this purpose, its own airspeed and altitude measuring systems having been calibrated to a very high order of accuracy so that it can be used as a datum with which other aeroplanes can be compared. The Javelin makes it possible to carry out calibrations of airspeed and altimeter systems up to 50,000 feet and it can be used for both military and civil aeroplanes.

The delivery of personnel and equipment by air to a battle zone is one of the functions of the Royal Air Force, and one of Boscombe Down's many tasks is the development and clearance of delivery methods which range from the parachuting of troops to the landing of heavy stores and vehicles on platforms and skid boards. Before any system can be used in Service extensive trials are necessary to develop and prove all parts of that system. The Hercules is used extensively here for aerial delivery development and the Argosy for personnel dropping trials. The Beverley, although no longer in Service with the Royal Air Force, is a most useful additional tool in such trials.

All who fly in aeroplanes on trials must of course be physically fit but they must also be trained in the use of the personal equipment which is provided for their safety and well being in the air. Such training is the job of the Aero Medical and Safety Training School which comes within the overall control of Engineering Division. It is headed by a civilian Medical Officer and provides courses geared to suit all requirements including training in the use of high altitude equipment. Personnel on these courses are drawn not only from this Establishment but from others within the Ministry and include flight test staffs from Industry. The facilities of the School include a decompression chamber and a dinghy training tank.

In addition to the Specialist facilities described above, the Establishment has an extensive range of workshop facilities and data processing equipment including an Elliott 503 Computer (soon to be replaced by an ICL 1904A). Although not part of the Establishment itself, nearby land and sea ranges are available to A&AEE.



This Kerosene heater, one of four in the Environmental hangar, produces 1,000,000 BTU's, enough to centrally heat 25 average size houses. Note the water sprays used to produce high humidity conditions.

Westland (Bristol) 192 Belvedere 1958
Two 1650 shp Napier Gazelle 100



XG452 was used for most of A&AEE's trials flying which included tropical trials at Idris in 1960. En route to Idris a helicopter Point-to-Point record was attempted between Gatwick and Rome/Gatwick and Malta and although no confirmed the aircraft averaged 100 knots including refuelling stops.

English Electric P.1A Prototype 1954
Two 7500 lb st Armstrong-Siddeley Sapphire



WG 760 was the first of two P.1A's from which the Lightning, the RAF's first supersonic aircraft developed. It was assembled at Boscombe Down and made its first flight here on 4th August, 1954. The A&AEE Preview trials followed in March 1955.

Hawker Siddeley Kestrel F(GA) 1
Prototype 1964
18000 lb st Bristol
Siddeley Pegasus 6



XP 980 was one of the Development Batch P1127s used for development of the later Kestrel. Preview trials were carried out by A&AEE on XP 980 between November 1963 and March 1964.

B.A.C. (Vickers) VC 10 C.Mk 1 1966
Four 22500 lbs st Rolls-Royce
Conway 301



The military VC 10 began to enter Transport Command, as it then was, in 1966 and early in 1967 took over the Comet schedules. XR 806, the first aircraft, was used by A&AEE during 1966 for performance and handling trials including Air-Air Refuelling.

The Belfast evolved from a proposal by Shorts for a transport aircraft using many components of the Britannia. In 1966 XR 366 with an A&AEE crew, took an SRN-5 Hovercraft to New Zealand and later carried the rear fuselage and other components of Concorde 001 from Filton to Toulouse.



Short SC5/10 Belfast C.1. 1964
Four 5730 ehp Rolls-Royce Tyne Mk 101

The 'Biff' or 'Brisfit': 1917-1932

Often described as the greatest two-seat fighter, the Bristol F2B was designed by Capt Frank Barnwell, RFC and L G Frise (who went on to design the Brabazon) in 1916. With a 250 hp Rolls-Royce Falcon water-cooled V-engine and its fuselage mounted high between the wings, the pilot had an excellent view above and below the top wing, with his observer/rear gunner close behind him facing aft. The design turned the WWI conception of a reconnaissance two-seater into a powerful and effective offensive weapon, and some 4,500 were built, many in shadow factories of the time. Capt W Leefe-Robinson VC commanded the first squadron (No 48) during the Spring Offensive in France in 1917, but its exceptionally long, useful and varied life extended to eight foreign air forces and continued in the RAF on the NW Frontier of India and in Iraq until 1932.

The RAF's presence in India, with only a handful of squadrons, contributed greatly to Churchill's policy that 'The first duty of the RAF is to garrison the British Empire,' and from the Afghanistan 'holy war' in 1919 through endless uprisings of hostile tribes, particularly in Waziristan, preserved the peace at a fraction of the cost of maintaining Army garrisons and punitive expeditions, and saved the lives of thousands of British soldiers. The RAF's success on the NW Frontier was a major contribution to Trenchard's ability to achieve and maintain complete independence for the young air force as a third Arm of the Military Services, equal in status to the Army and the Royal Navy.

Art reproductions of S B paintings

This new painting of the Biff is a very valuable addition to our collection of art reproductions, framed and titled, and with white surrounds, mostly measuring 18 in by 14½ in, ready for framing in standard size frames obtainable everywhere in a variety of styles and prices, which can be obtained from the Editor. John Young's painting of the Lancaster on page 9 is another new addition, and the very popular *Spitfires - 1940* by Norman Hoad has been reprinted to meet a widespread demand. This painting and others in the series are reproduced in miniature on page 20.

Due to increased postal and packing charges, the price of a single print has had to be increased to £1.10, but the more you order, the cheaper they become: Two prints £2.05, three £2.95, four £3.80, five £4.60, six £5.35, seven £6.05, eight £6.70, nine £7.30, ten £7.85, eleven £8.35, twelve £8.80, thirteen £9.20, fourteen £9.55, fifteen £9.85, sixteen £10.10, seventeen £10.30, all eighteen prints, only £10.50.

The reproductions represent remarkably good value and could not be sold commercially at these prices. They make marvellous presents for young and old alike, and are very suitable for decorating the walls of clubs and messes.

Please tick off the prints required on the coupon below and enclose your cheque or postal order for the correct amount, calculated from the details above. Kindly allow a week or two for our small office to dispatch them to you.

NB. Many of the prints are also available as trays and table mats - please see the Slimcrest display on page 44.

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'Bristol Fighters over the N W Frontier'
by W Jackson

ART REPRODUCTIONS OF THIS PRIZE-WINNING COMPETITION ENTRY HAVE BEEN ADDED TO OUR VERY POPULAR SERIES - SEE ALSO PAGE 20



Recognition of the symptoms produced by lack of oxygen (hypoxia) is vital to flight safety. Here in A&AEE's decompression chamber the Medical Officer carefully supervises the behaviour of a Course student whose oxygen supply has been deliberately interrupted.

Like a large fly trapped in a web, this Vulcan sits in the test rig which is used to assess the effects of electro-magnetic interference on aircraft and equipment.



A Dominie mounted in front of the Blower tunnel for pitch vane calibrations and crew door opening tests prior to low-speed handling trials.



Terry Heffernan, the author of this article, is a Senior Scientific Officer at A & AEE, Boscombe Down, who has been engaged on aircraft performance and handling flight testing for 28 years, both in Government service and in the aircraft industry. His flight observer experience covers aircraft from the de Havilland Mosquito to the Hawker Siddeley Buccaneer, and the British Aircraft Corporation VC10 to the new Scottish Aviation Bulldog primary trainer.

Flt Lt Joe Fletcher, who painted the aircraft, has been doing so since he joined the RAF as an Apprentice Armament Fitter at Halton in 1939. He has served as an armament specialist on numerous Squadrons since then, was commissioned in 64, and engaged on armament trials at A & AEE from 67-69. He also paints aircraft to raise funds for the RAF Museum. He is now Staff Armament Officer at HQ RAF Germany.

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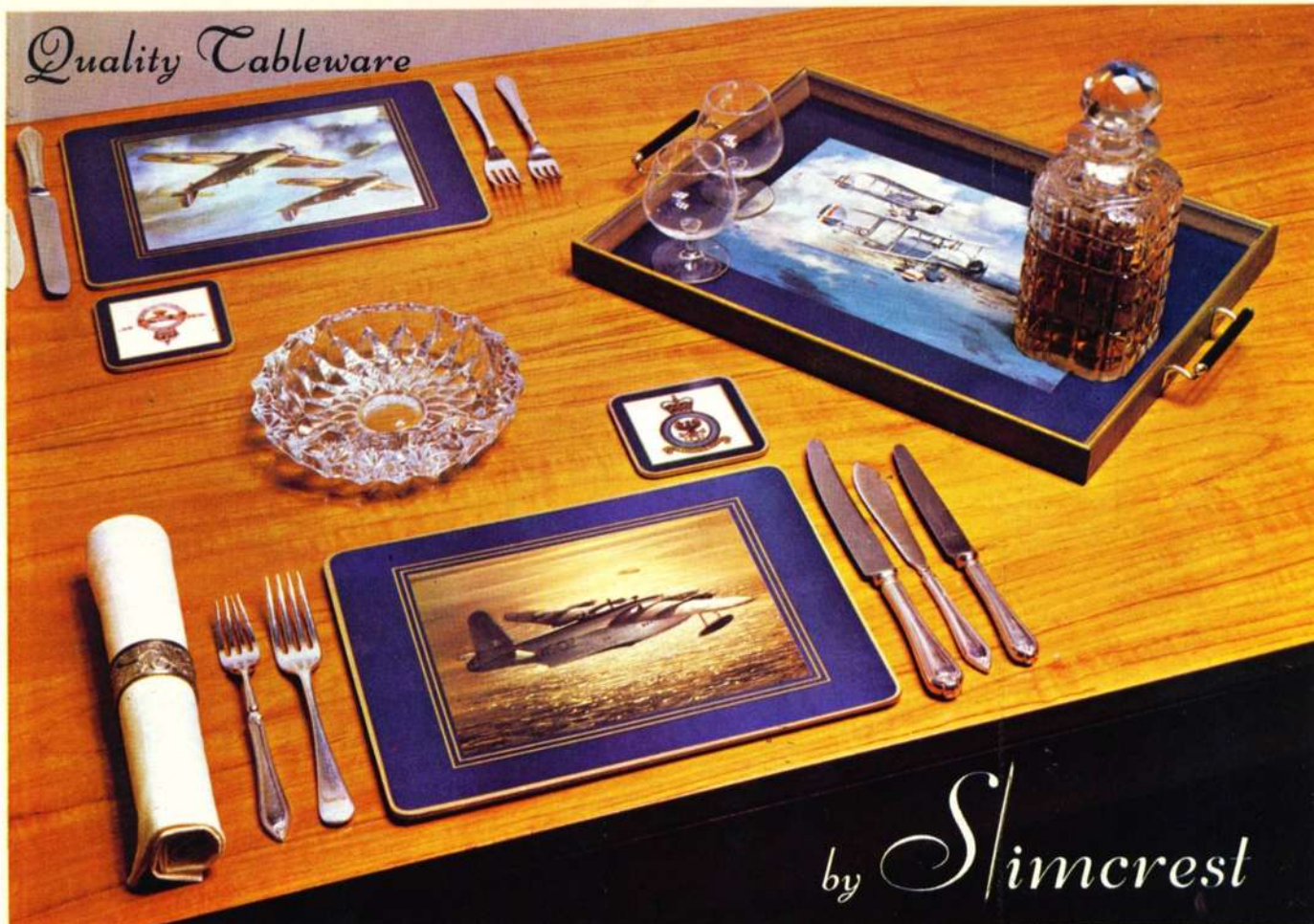
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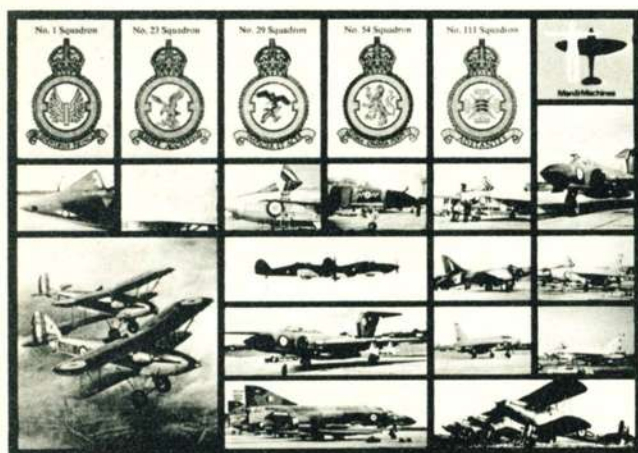
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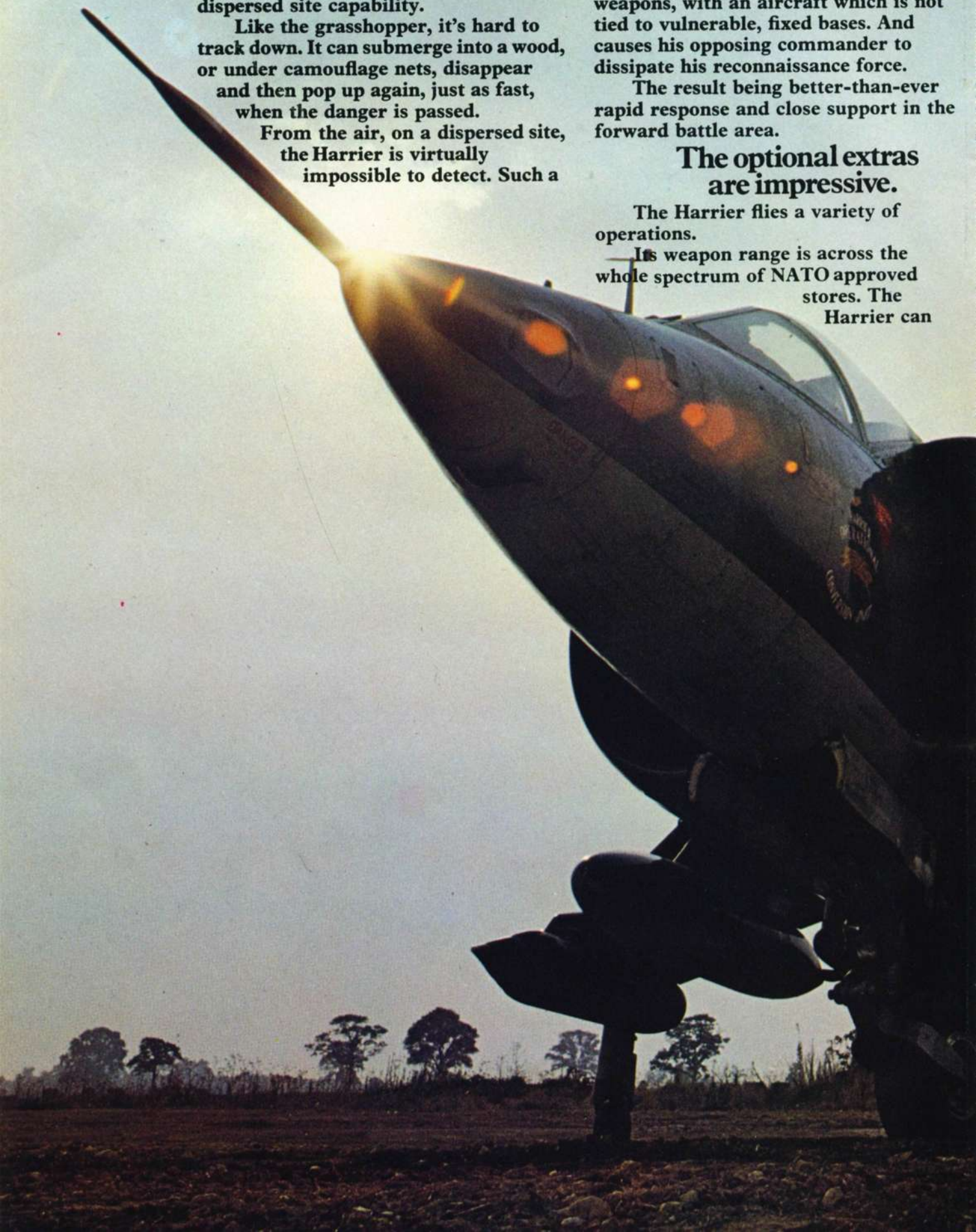
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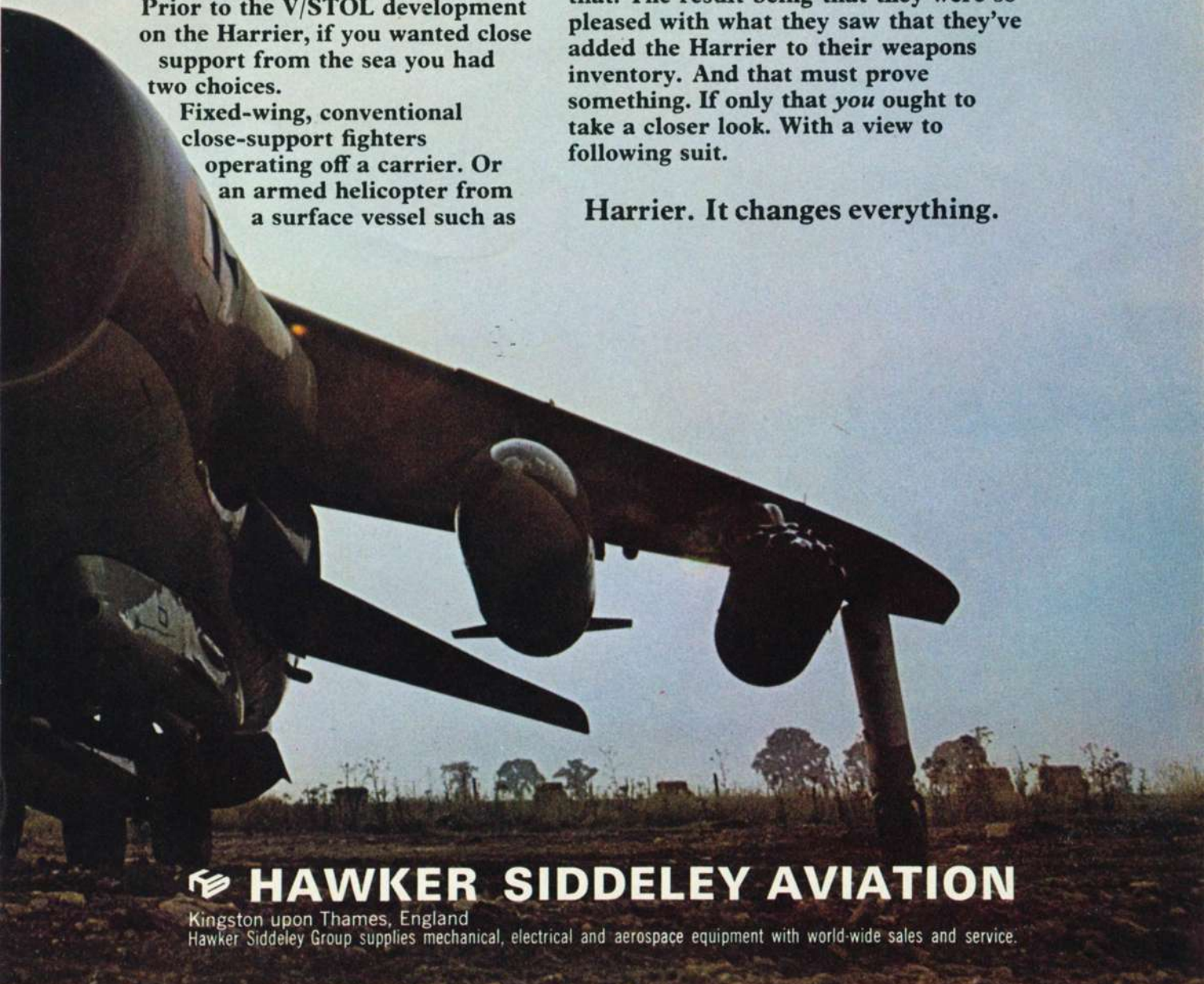
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Left 'The Command has become the major RAF user of . . . the Phantom'. Two FGR 11 strike/attack fighter-bombers of No 14 Sqn streak past Schloss Hohenzollern in southern Germany. One of the most potent aircraft in the RAF's inventory, it can carry a vast and varied array of weaponry over considerable distances, and is almost instantly convertible from fighter-bomber to reconnaissance fighter to pure interceptor. RAF Germany operates a strong force in the strike/attack role and one squadron in the recce role

RAF GERMANY TODAY

NEARLY THIRTY YEARS AGO, Britain's 2nd Tactical Air Force, in the greatest and most devastating air campaign the world had then seen, provided visible proof of the realities of air power when its Spitfires and Typhoons, Mitchells and Mosquitos smashed a path across Europe for the allied armies advancing after D-Day

Today, the direct successor of that force, by its presence in West Germany, provides similar proof of Britain's total commitment to the allied air defence of Western Europe and to NATO

Roger Goodwin describes a typical day in the life of Britain's biggest and strongest overseas airforce



a Harrier slides forward out of its hide. A Hawkeye shadowy Harrier GR1 of No 4 Sqn moves out from the tree line now to take off. The Command's Harrier squadrons constantly operate in such conditions. In war they would operate completely independently of fixed and vulnerable airfields

RETAINING THE TITLE OF THE OLD FORCE in its badge but calling itself *Royal Air Force Germany* to avoid confusion with NATO's 2nd Allied Tactical Air Force, of which it forms part, the Command is more fully integrated into the NATO structure than any other RAF organisation. Thus NATO's switch from a nuclear trip-wire posture to one of flexible response a few years ago plunged the Command into one of the most thorough re-appraisals of role and equipment since the war, and it is still in the final stages of a two-year re-equipment programme under which its Canberras and Hunters have been replaced by Harriers, Phantoms and Buccaneers – versatile aircraft which have enabled it to return to its traditional tactical role whilst still maintaining the nuclear capability which has been its primary contribution to NATO since the late 50s.

RAF Germany's national commitment is a legacy of World War II, defined as 'the defence of the integrity of the airspace of the northern half of the Federal Republic of Germany, and with the United States and French Air Forces, the maintenance of access to Berlin in the three air corridors', for which purpose the Command has a force of Lightning supersonic interceptors (based at Gutersloh, the only RAF station east of the Rhine) whose task is to police the northern half of the Air Defence Interception Zone. However, the greater proportion of RAF Germany's effort goes towards the provision of conventional and nuclear attack/strike, reconnaissance and air defence forces. The aim here is to help fight and win the air battle; to ensure that the ultimate nuclear strike systems survive; to defend the capitals of Europe and the main base areas; and to keep the enemy's air force 'off the backs' of friendly ground forces.

Although a completely autonomous Command in peacetime, the squadrons of RAF Germany train and exercise continuously as part of the Second Allied Tactical Air Force, whose area of responsibility is the northern half of Germany plus Holland and Belgium. To defend this area in wartime, TWOATAF would have under its command fighter aircraft for defence against a hostile air threat, fighter-bombers to strike at enemy airfields and troop formations, reconnaissance squadrons to provide rapid intelligence information for army and air commanders, and strike/attack bomber squadrons, provided by RAF Germany, to deliver heavier conventional or nuclear bombardment of enemy targets. 'Nike' and 'Hawk' ground-to-air missile battalions and RAF 'Bloodhound' missiles also form a vital part of the air defence pattern.

These forces are provided by squadrons from four separate air forces – *Luftwaffengruppe Nord* of the German Air Force, Royal Air Force Germany, the Royal Netherlands Air Force and the Belgian Air Force. To the south, a similar formation, the Fourth Allied Tactical Air Force, comprises squadrons from the German, American and Canadian air forces, and together, these two Allied Tactical Air Forces form the air element of Allied Forces Central Europe.

The extensive re-equipment of RAF Germany with multi-role Harrier, Phantom and Buccaneer aircraft has enabled the Command to offer TWOATAF a far wider range of operational roles, while still retaining its nuclear capability. Already the major RAF user of the Harrier and Phantom, it is now building up a strong force of Buccaneer low-level strike/attack bombers, and later, will receive the new Jaguar ground attack aircraft. The Command also includes a squadron of Wessex HC Mk 2 tactical transport helicopters based at Gutersloh, and assigned to the support of No 1 (BR) Corps, BAOR, and a squadron of Pembroke communications aircraft. All the other squadrons could be employed in support of any Allied ground forces operating within the TWOATAF area.

No description of RAF activities in Germany would be complete without reference to Berlin, where the RAF maintains the airfield at Gatow and has a representative at the Air Safety Centre (one of the few surviving aspects of four-power organisation) which controls all movements in the air

corridors leading to Berlin from the west, those in the northern and central corridors being handled by the RAF and in the south by the USAF: there are about 100 scheduled daily services in and out, and the British controller handles up to 80 movements a day. This, then is RAF Germany today: the largest and strongest of Britain's overseas air forces, it will, for the foreseeable future, continue to play an influential part in the affairs of the allied forces in Europe.

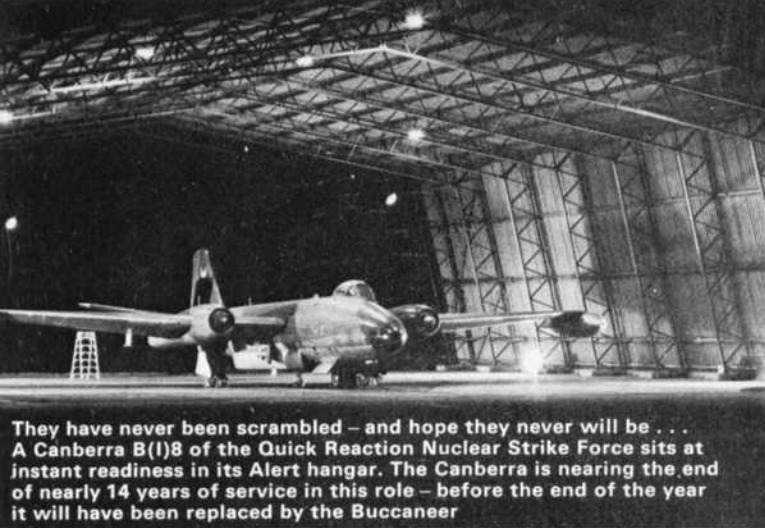
a normal day's flying

Perhaps the best way of portraying everyday life in the Command is to follow through a normal day's flying. On every Station, some personnel will have been on duty throughout the night – in the Ops Room, the guardroom and so on. But at Gutersloh, just 80 miles from the East German border, the centre of quiet activity is a warmly-lit, miniature hangar a few yards from the runway threshold. Inside, behind heavy steel doors that open electrically at the touch of a button, sit two silver Lightnings – fuelled, armed and ready to go. In a small annex two pilots, dressed in bulky rubber immersion suits, pressure vests and all the other paraphernalia of a modern jet fighter pilot, have probably been playing cards all night; a few feet away in another room, the groundcrew doing the same thing. This tiny world is the Battle Flight, RAF Germany's first line of defence, and the scene is much the same 24 hours a day, 365 days a year, be it Christmas, Easter or April Fool's day.

While the rest of the Station begins its daily tasks, life in the hangar continues along the same lines. Across the airfield, the pilot's colleagues are beginning their day's work by attending the daily weather briefing, and the long-suffering met man is enduring his daily dose of ribbing from the crews. (With the possible exception of the NAAFI, the met men are the pilots' favourite Aunt Sallies.) Within the hour, the first wave of Lightnings is roaring into the sky, and the day's training programme is under way. In pairs or singly, the Lightnings accelerate down the long runway with an ear-splitting roar, twin jets of flame from their re-heated engines scorching the concrete as the wheels leave the ground, some heading for special areas where, at great heights, they are allowed to go supersonic. Then they will chase each other around the sky on practice interceptions, guided by the disembodied voice of a man sitting miles away in a darkened room, watching the green blips that are the Lightnings on his radar set. The days when fighter pilots depended on the evidence of their own eyes are long past; with two Lightnings approaching head on at supersonic speed, by the time the pilots spot each other it would be too late to avoid a collision. Others will be practising similar interceptions at a much lower level, while still more could be heading for a rendezvous with a converted Victor V-Bomber from Britain, its bomb-bays now heavy with fuel. Once in contact, the Victor streams three long hoses, each with an inverted cone at the tip, and the thirsty Lightnings nose in, their pilots carefully juggling the controls in order to spear the cone with their refuelling

Air Marshal Sir Harold Martin KCB DSO DFC AFC, C-in-C RAF Germany and Cdr 2nd Allied TAF since 1970, was AOC 38 Gp from 67. During the war he flew Hampdens, Manchester, Lancasters and Mosquitos. From Air Attaché, Israel, he joined NATO Planning Staff, Fontainebleau and was Gp Capt Air, RAF Medmenham before commanding RAF Nicosia (Cyprus) in 61/62. After being SASO 38 Gp, he passed IDC and became SASO at NEAF as an AV-M. His 47 Mosquito London-Cape Town p.e. record of 21 hrs 31 mins stands, & guiding 54 Sqn (Vampires) in the 1st Atlanticjet fighter crossing in 48 won his AFC





They have never been scrambled - and hope they never will be . . . A Canberra B(1)8 of the Quick Reaction Nuclear Strike Force sits at instant readiness in its Alert hangar. The Canberra is nearing the end of nearly 14 years of service in this role - before the end of the year it will have been replaced by the Buccaneer

probes. Once 'plugged in', the fighters guzzle fuel at a fantastic rate and within a remarkably short time, gorged, they pull back and swing off to continue their exercise. The Victor, much, much lighter, turns for home, reeling in its hoses as it does so.

Meanwhile, away to the east, a small civilian aircraft, carrying businessmen from Southern Germany to a conference in Lubeck on the Baltic, is creeping slowly eastwards away from its planned route; the pilot's radio navigation instruments are giving him a false reading. Eventually the aircraft crosses an invisible border in the sky, and inadvertently enters the Air Defence Identification Zone, within which aircraft must not fly without special authority: its purpose is to prevent just such an occurrence from turning into a border incident. In another darkened room, another man at another radar set has been monitoring the aircraft for some minutes. Attempts to contact it by radio have failed, and as it enters the ADIZ the controller reacts. An alarm bell rings loudly in the miniature hangar near Gutersloh's runway, and cards and magazines fly in all directions as pilots and groundcrew sprint for their aircraft. The heavy steel doors are already rolling back as the pilots leap up the ladders to the cockpit. Less than a minute has passed since the bell sounded, and already the engines of one of the Lightnings are winding up. Around the second, the frantic activity ceases; this one will be held at immediate readiness in case No 1 needs assistance.

As his engines come to life and his instruments come on line, the pilot of No 1 is receiving, through his earphones, essential instructions - which controller to contact, initial heading, climb rate, altitude and so on. The flow of information comes to an abrupt halt as the aircraft, ready to go, rolls forward and disconnects from the telephone line plugged into its side. From here on, communication is by radio. The Lightning rolls swiftly to the runway and swings on to it. While still in the turn, the noise from the engines increases to an ear-splitting crescendo and as the aircraft straightens, twin tongues of flame shoot from the jet pipe. The gleaming fighter screams down the runway, lifts off and within seconds dwindles to a tiny dot in the sky. A little more than two minutes have passed since the bell sounded. Three minutes later, the pilot of the civilian aircraft gets the shock of his life as the Lightning thunders across his nose, swings round and

closes up to formate on his right wing-tip, and his stomach muscles contract as the awful realisation of his error dawns. He swings away westwards. Ahead, after landing, lies a highly embarrassing interview with an official from the aviation authorities; but for the Lightning, he would have been heading for a far more uncomfortable time on the other side of the border!

Nearly 200 miles to the west, RAF Laarbruch sits on the edge of an escarpment overlooking the Dutch border and the River Maas. Carved from virgin forest in just 11 months during the mid-50s, the Station is one of the biggest and most powerful in the RAF. Here, as at Gutersloh, air and groundcrews sit and wait beside their fuelled and armed aircraft, ready to go - but with a difference: both men and aircraft wait in a fenced and guarded compound, and unlike their colleagues of the Battle Flight, they have never been scrambled - and hope they never will be, for these are some of the crews of RAF Germany's Quick Reaction Nuclear Strike Force. Their Canberras, weighed down by the deadly missiles slung in their bomb-bays, are nearing the end of 14 years of service in this role, and before the end of the year will be replaced by fast, deadly, low-level Buccaneers.

Outside the quiet world of the compound, as the distant Battle Flight Lightning turns for home, Laarbruch is preparing to receive back its first wave of training aircraft. Within minutes, the quiet sky is filled with the distinctive sound of Spey and Avon jet engines, and one after another, Canberras, Buccaneers and Phantoms join the circuit and swoop down to the runway. This is a dual purpose station: it houses the last Canberra squadron still in RAF Germany service, the Buccaneer force working-up to replace it, and a squadron of Phantom reconnaissance aircraft. On the different squadron dispersals scattered around the airfield the scene is one of ordered but rapid activity. In one corner of the airfield groundcrew wait on a circular dispersal pan almost hidden from sight by tall pine trees, as a Phantom taxis rapidly in. It enters the pan, swings round to face the way it has come, and brakes to a stop, with men ducking below the wings to get at the massive white pod slung from its belly like some obscene growth. This pod, almost as long as a WWII Spitfire, gives the Phantom, basically a fighter-bomber, a reconnaissance capability second to none.

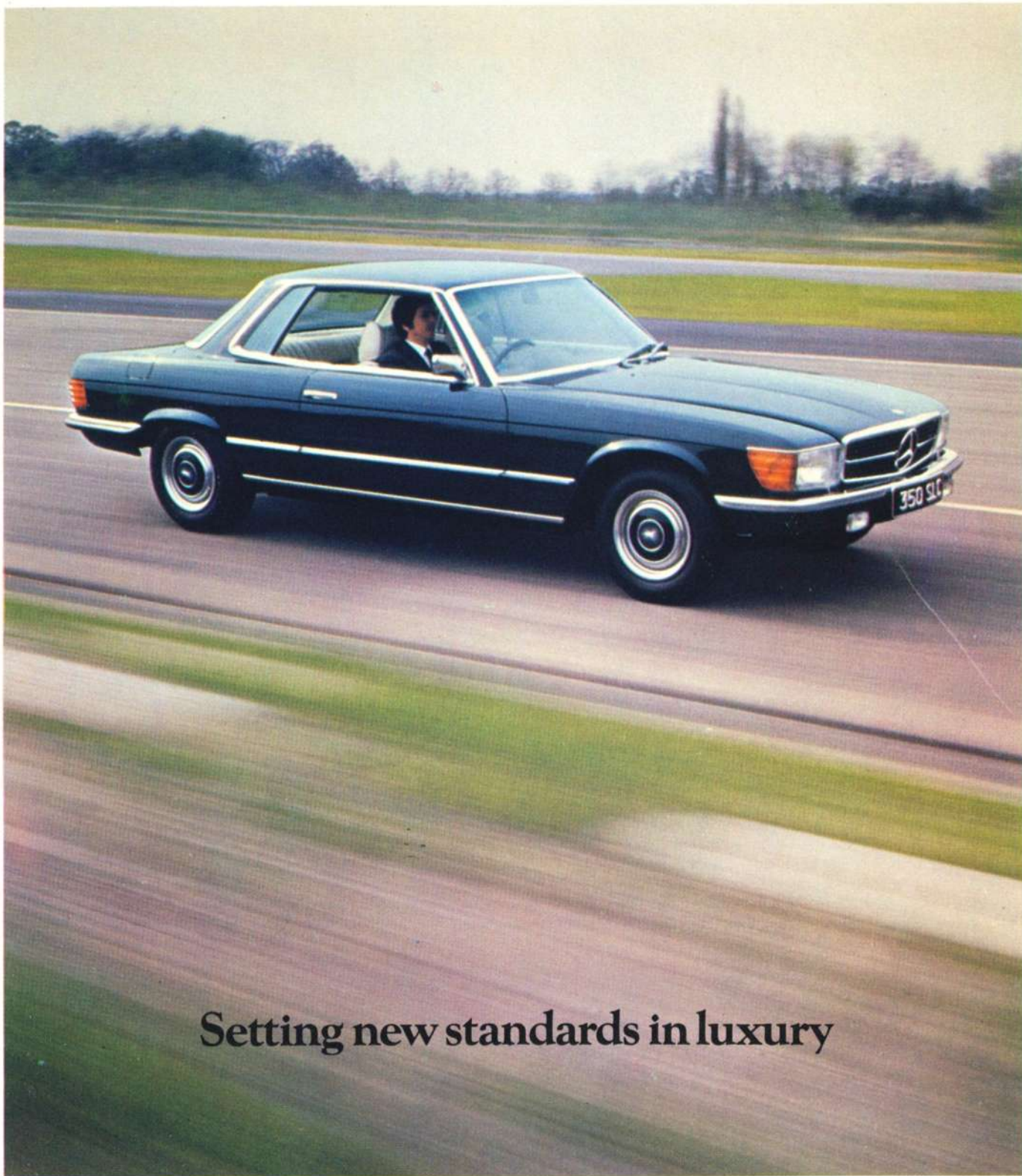
1200 rolls of film in 15 mins

This has been a photographic sortie, and in less than 2 minutes men are sprinting through the trees with the film magazines, heading for a complex of interconnected, single storey prefabricated buildings housing the Reconnaissance Imagery Processing Flight. For obvious reasons, the capacity of the Phantom recce pod cannot be revealed, but try to imagine going into your local Chemist's shop with 1200 rolls of ordinary camera film and asking for them to be ready in 15 minutes! That is what the RIP Flight can be faced with every time a Phantom lands. In fact, the first films are on the interpretation benches within four minutes, being studied by the aircraft's crew and expert photographic interpreters. If they ask for a print, the first will be ready within 90 secs and they will arrive after that at 15 second intervals. And in less than 30 minutes from the time the aircraft stopped, detailed intelligence reports on the contents of the film are on their way to the air or army commanders first requested the sortie.

Some two miles away, in the opposite corner of the airfield, a Buccaneer is taxiing out of dispersal. It has been on the ground less than an hour, in which time it has been carefully checked over for faults, refuelled and re-armed. Now, with a different crew, it is off on a 1-hour low-level sortie during which it will traverse several hundred miles of NW Europe. Soon, it is racing just a few feet above the ground, the navigator in the back cockpit working overtime as the aircraft follows a dog-leg course across northern Germany at 250 feet - not as low as it would be in wartime, but low enough

The author, Roger Goodwin, 28, became Deputy Command PRO, RAF Germany in 1970. Starting on his home-town weekly newspaper in Barry, Glamorgan, he specialised in aviation journalism, joining *Wolverhampton Express* and *Star* as Air Correspondent in 64. When he joined RAFPR in 67, he was the youngest-ever Service PRO and served at 38 Gp as Deputy Air Support Command PRO before going to Germany





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... the thirsty Lightnings nose in, pilots carefully juggling the controls as they try to spear the cones with their refuelling probes. Two Lightnings from No 92 Sqn close with a Victor tanker flown out from Britain. Regular training in the intricate techniques of air-to-air refuelling is essential if the high level of pilot skill called for by this manoeuvre is to be maintained. Air-to-air refuelling increases the Lightning's endurance time by a considerable factor, thereby correspondingly increasing its usefulness



to provide realistic training without causing too much annoyance and disturbance to the civil population. After 50 minutes, the aircraft reaches its target, and turns in for a series of practice attacks on the air-to-ground firing range at Nordhorn, about 80 miles from Laarbruch. Wheeling and diving, the aircraft makes a series of rocket attacks on an old British Army tank, followed by more runs on the conventional bombing target. On each run it releases a small glass-fibre practice bomb which explodes in a puff of smoke as it hits the ground, allowing the RAF team in the tall towers on the edge of the range to plot the accuracy of the attack.

As the Buccaneer turns for home, its crew looking forward to a late lunch, the men of one of the Command's Harrier jump-jet squadrons are finishing theirs in camouflaged tents pitched just inside the tree-line which borders an area of flat plain not far from the River Weser. Around the tents, the Harriers stand silent—for the moment—in tiny clearings carved for them in the woods; a roof of camouflage netting protects them from the prying eyes of any reconnaissance aircraft. The advent of the Harrier has revolutionised the thinking of military air commanders. Its ability to operate from such sites as this, independent of fixed and vulnerable runways and airfields, has put a potent new weapon into the NATO armoury. It has also meant that the RAF's fighter pilots have had to re-learn the art of living under canvas, neglected very largely since the end of WWII by nearly all except helicopter squadrons, the RAF Regiment and No 38 Group, the RAF's 'have tents, will travel', go-anywhere force.

As the sweating cooks begin the preparations for the next meal—tea—in their open-air cookhouses, the whine of a Pegasus pierces the air and a Harrier slides forward out of its hide for the first of the afternoon's sorties. Its wings weighed down by fuel drop-tanks and rocket pods, and the smooth contour lines of the fuselage broken by the two blister-pods which house its 30 millimetre cannon, it taxis out and swings to line up on a ridiculously short-looking length of grass, not much more than the length of a football pitch. As it sits at the end of the strip, the four nozzles of its vectored thrust engine rotate to the half-down position. Then the engine

winds up to full power and it surges forward, trailing a plume of dust behind it. In less than 300 yards it literally jumps into the air as the pilot deflects the nozzles further downwards, and the sleek camouflaged aircraft climbs rapidly away to begin its sortie. Less than an hour later, it too will be at Nordhorn range, firing its concrete-headed practice rockets at the old tank and its cannon in short, rapid bursts at large squares of white canvas set up as targets.

In another camouflaged hide in the trees, a practice engine change is under way. Operating independently, away from their normal airfield facilities, the Harrier squadron's engineering personnel must still be able to undertake all the complex work of keeping a modern fighter airworthy. The aircraft sits on a mat of interlocking steel planks, as the mechanics manoeuvre into position an odd-looking hydraulic crane. Specially designed for the job, the crane, which looks like a capital U laid on its side, soon has the aircraft's entire wing assembly hanging from its jaws, and is trundled away to deposit the wings in a special cradle. In about six hours the old engine is out, the new one installed, and the wing section replaced.

Meantime, one of the squadron aircraft has been on a photographic sortie, and as it slides into its hide a sort of miniaturised version of the scene at Laarbruch takes place. Under its belly it carries a much smaller version of the Phantom pod, and within seconds the film is on its way to the processing section. But no vast complex here! Working in a collection of green-painted trailer caravans, the photographers and interpreters nevertheless soon have the films under scrutiny, the prints printed, the reports written out. As they finish, the German dusk brings flying to a halt, and the Harriers are snugged down with anchoring cables and the entrance to the hides have more camouflage netting drawn across them. Ahead, for the crews, both air and ground, lies an evening of cards, magazines and chat under the glow of kerosene lamps. After that, a sleeping bag and a camp bed. The squadron will spend another week in the field before it returns to its base at Wildenrath. And elsewhere in Germany, night also calls a halt. But many will stay on duty, for this Command never entirely sleeps. ©

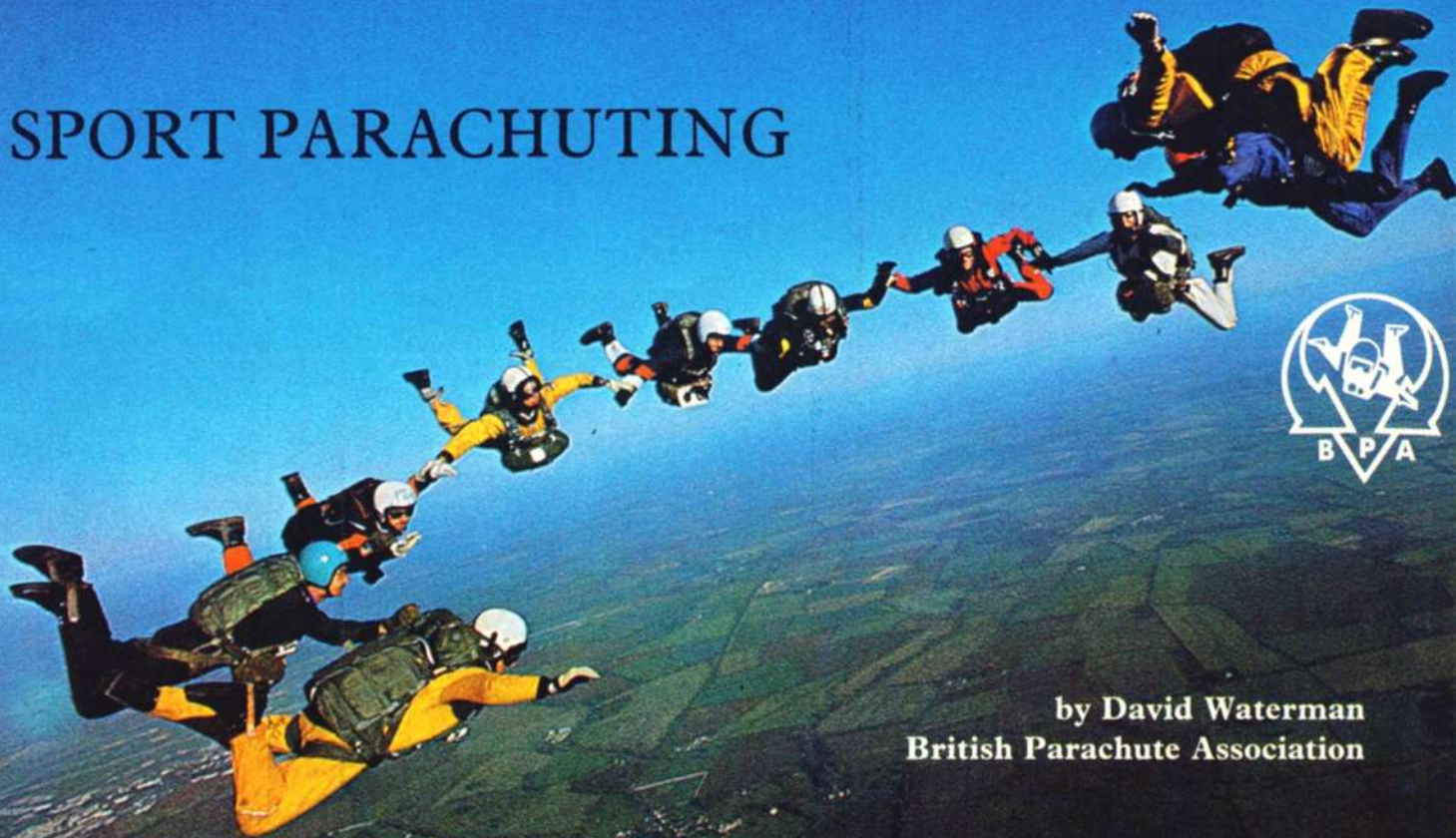
Twin jets of flame from re-heated engines scorch the concrete as the wheels leave the ground... A Lightning F Mk 2A lifts from RAF Gutersloh's runway at the start of a training mission. Although in RAF service for over 10 years, the Lightning remains one of the world's most effective interceptors



Buccaneer over the firing range after a high-speed, low level training sortie carried out at 250 ft. No XV Sqn is equipped with the S Mk 2. The Command's force of Buccaneers is currently being built up, primarily to replace the Canberra in the long range strike/attack role



SPORT PARACHUTING



by David Waterman
British Parachute Association

David Waterman's fine free-fall photo of the British 10-man Star Team won him 1st British Sport and 2nd World Press Feature Awards

SKY-DIVING OR FREE-FALL PARACHUTING may be thought of as a space age sport but in fact the first scientific approach to the art is found in the sketches and writings of Leonardo da Vinci in the fifteenth century. He wrote: 'If a man takes a piece of canvas treated with lime 12 fathoms wide and of the same height, he can let himself fall from no matter what height without coming to harm'. Prudently, however, he advised that such an apparatus should be tested over water.

Modern parachuting started with Lesley Irving, who in 1919 made the first free-fall parachute descent from an aircraft 3,000 ft over California. Soon after, when the American government invited designers to submit their designs for a manually operated parachute, Irving devised an assembly that was so simple yet so obviously feasible, that it was accepted with joy by most authorities. It consisted of a harness to which a bag was attached containing the canopy and rigging lines; the parachute was activated by pulling a rip-cord device which opened the bag and exposed a small spring-loaded pilot chute

which pulled the rest of the assembly from the bag. Until then parachute assemblies had been attached to the aircraft or balloon. By delaying for 10 seconds during this demonstration, Irving also dispelled the belief that man would faint during free-fall and thus opened the sky to a new breed of parachutists.

Now thousands of men and women have taken to the sky in search of something different in the way of sport. The French played a big part in the development of free-fall techniques with such men as Leo Valentine, who served with the British Special Air Service during WWII. He developed the stable 'spread' position in which the free-fall parachutist present a symmetrical shape to the air flow and is thus able to control his position whilst falling at 120 mph. Together with other French 'bird-men' such as Clem Sohn, he then started experimenting with canvas and balsa-wood wings, but like Sohn, he fell to his death while participating in an air show near Liverpool in 1956.

These deaths brought stiffer governmental controls and the *Federation Aeronautique Internationale* set up new safety regulations, which wisely decreed that parachutists in future must wear a reserve as well as a main parachute, which must be fully opened at a minimum height of 1,200 ft. Subsequently the British Parachute Association, the governing body of parachuting in this country, has amended that rule to 2,000 ft. The objects of the BPA (whose offices are in Artillery Mansions, 75 Victoria Street, London SW1) are the control and safety of the sport, insurance of its expansion and through negotiations with appropriate government departments, the provision of a national and regional centres. Over 8,000 parachutists have joined BPA since its formation in 1962 and its current membership is over 3,000. The Parachute Association of America, incidentally, has 25,000 members.

At any of the clubs able and willing to take beginners, a



A pupil
makes his
first static
line jump

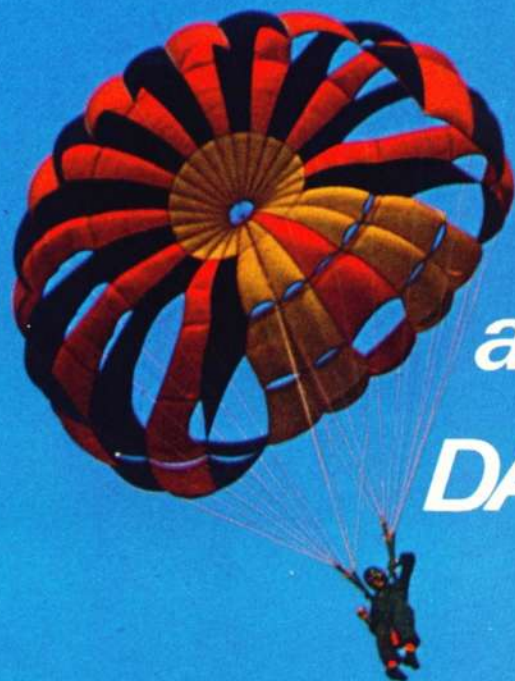


DAVID WATERMAN

Made his first parachute jump in the Army in 1952 when he was just 17. He was also in the last drop in action over Suez in 1956. Our only professional photographer who sky-dives, he has made over 1,000 jumps, and was in the European record 11-man Star Team last year. Has recently formed the *Chuting Stars* 10-man team to raise money for the Save the Children Fund, and is now PRO for the British Parachute Association



Team member landing right on the disc



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student parachutist will first be given about 12 hours ground training, spread over a couple of days or a weekend, during which he will be taught all the techniques involved in making an automatic parachute descent, in which the parachute is opened by a static line attached to the aircraft. Such techniques include instruction in the basic spread position before he leaves the aircraft, parachute land fall (PLF) canopy handling to enable him to guide the chute after opening, operating the parachute itself and of course, emergency procedures, all to standards laid down by the BPA.

After completing a minimum of six automatic jumps, pulling a dummy or simulated ripcord on the last three days, he progresses into free-fall at the discretion of his instructor, when his success will depend entirely on his ability to hold a stable face-to-earth position throughout. If he has the requisite control of his body position for at least three stable five second delays, he will probably be allowed to progress to longer delays. On reaching a terminal velocity of about 120 mph about 12-15 seconds after jumping, the student is taught to turn horizontally in a controlled manner and later to perform other manoeuvres such as back-loops, forward loops and barrel rolls, emphasis being always placed on

incorporating various principles of aerodynamic design; it contains 36 slots, vent and louvres to direct the air trapped under the canopy rearwards so as to thrust it forwards at 13 mph: four slots on each side can be closed by the jumper causing the sheet to turn, and pulling both control lines simultaneously will invert all the turning slots and reduce the forward speed to zero. Due to the forward drive, elliptical shape and the use of low porosity material, it actually glides, much like a glider aircraft. In a 'style jump' the competitor has to perform a set of manoeuvres in free-fall, such as 360° right and left turns, a back loop followed by a 360° loop, then a right turn and another back loop. Points are awarded for speed and deducted for getting off heading or badly performed back loops: the current world best is about six seconds, in this country some eight seconds.

The evolution of the parachute itself is interesting. At first, sky-divers used government surplus equipment, modified by cutting away panel sections to give it drive and render it steerable. Then a Frenchman, Le Moine, designed the ascending parachute which when towed would actually gain height. This design was bought by the Pioneer Parachute Company in USA and the 'para-commander' was born.



LL training chute



TU advanced trainer



Para-commander



Irving Δ 2 parawing



Gliding paraplane



1971
British
champion
John
Meacock
landing
on disc

control of the body position and stabilisation.

Once a student has completed a number of jumps from 7,000 ft with a 30 second delay, and thereby opening his parachute at the required height of 2,000 ft, he will be allowed to take part in one of the more enjoyable forms of sky-diving 'relative work'. This is the ability to work in relation to other jumpers while plunging earthwards at 120 mph. He may be working with up to 10 other jumpers and will leave the aircraft fourth or fifth, with some 300 ft separating him from the last man to jump. He must then fall in a tighter position to increase his speed until he is nearly at their level before adjusting his posture to adjust his speed to theirs.

In free-fall you have as much control as you have in an aircraft; you can turn, loop, barrel roll, and cross the sky horizontally - in fact, you can do everything except climb. The mecca of the relative jumper is undoubtedly California and the Western States of the USA, where they hold the record for the largest number of parachutists to link up in free-fall - 24. Eight and ten-man stars are an every-week occurrence there, while in this country we are still struggling to put a regular eight-man star together, but then, of course, we haven't a Mediterranean climate! Relative work is now being considered here for inclusion in competition work - the more serious side of sport parachuting. Relative work competitions are already an annual event in USA, but at present only two events are included in international competitions, accuracy and style.

On a parachute jump, the main object is to get as close as possible to a 10 cm disc in the middle of a 50 m gravel field circle. With the use of the 'para-commander' or similar parachute, jumpers of international standard are able to put their feet on the disc on an average three times out of four. The 'para-commander' is a revolutionary concept in canopies,

Several parachute companies throughout the world quickly followed with a variation on the same theme, including the Eastern European countries, the EFA Company in France and our own GQ Parachute Company.

The break with tradition came three years ago with the perfection of the Irwin Delta 2 'parawing', which is triangular in shape and has a cross section like an aircraft wing to impart buoyancy in flight. This gives it a three-in-one glide ratio, compared to the 'para-commander' which has a one-in-one ratio. Then came an even more radical change with the 'parafoils' and the 'paraplane': these rectangular canopies look like inverted air beds in flight, and aerodynamics plays an even bigger part in their performance; both are twice as fast as the 'Deltawing', having a speed of 30 mph in still air. Their design is so far from the accepted conical shape of the early parachutes that the Department of Trade and Industry has not yet decided whether to classify them as gliders or parachutes.

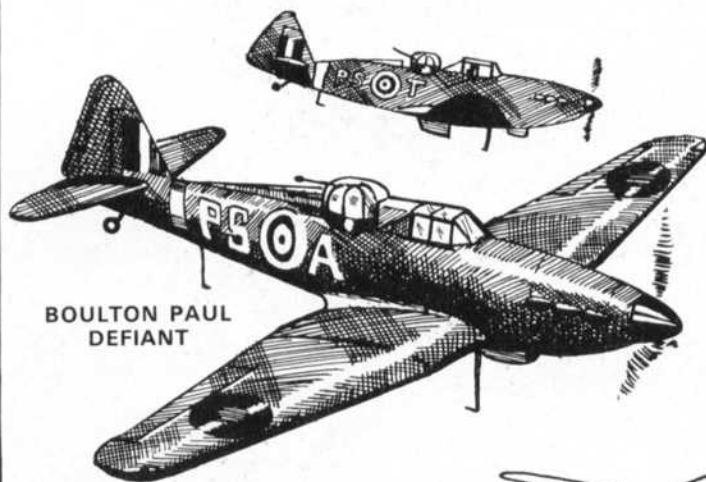
The general public can see some sky-diving at all sorts of air shows, carnivals and other events, since parachute displays are becoming increasingly popular each year. It may be the RAF free-fall team, *The Falcons*, or the Parachute Regiment's *Red Devils*, or even parachutists from a civilian club. Each year thousands are thrilled with their sophisticated free-fall performances, leaving coloured smoke trailing the sky as they plunge at 120 mph until their parachutes snap open with a bang. Then they steer their canopies in to land in the middle of a tiny arena at a County Show in front of a Royal Party, or it might be a local Donkey Derby organised to raise funds for an old folks' home, demonstrating a skilled and mainly space-age sport, which thankfully is flourishing at a time when all too many are tempted to find their sole entertainment in front of the television set!

©

THE FORGOTTEN FEW

Competition Entry by M E Jones

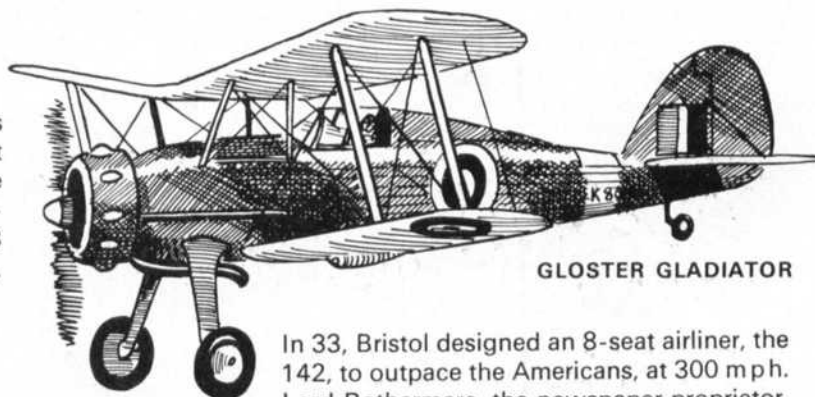
To most young people who have read about the Battle of Britain or seen the film, or even to those of us who actually lived through it, recalling the epic air defence of Great Britain during the summer of 1940 usually conjures up only two names—*Spitfire* and *Hurricane*. Yet during that dramatic period there were other fighter squadrons, and different aircraft, actually engaged in the vital struggle . . .



BOULTON PAUL
DEFIANT

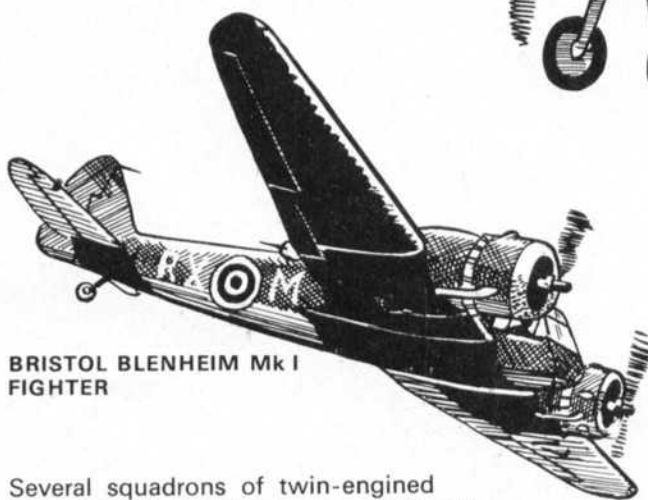
With the same Rolls Royce Merlin V-12 liquid-cooled engine as the *Spit* and *Hurry*, the two-seat Boulton Paul Defiant with a bomber type four-gun power operated amidships had proved very successful against Stuka dive bombers over France, with a speed of 310 m.p.h. But after a remarkable initial success on May 29, when 264 Sqn shot down 37 enemy aircraft, they were decimated a few days later in head-on attacks, since they had no forward-firing guns.

A 'handful' of Gloster Gladiator biplanes were engaged in the Battle—one Flight of 247 Sqn. The epitome of biplane fighters, pilots loved its manoeuvrability, but it had only four .303 machine guns and could do 255 m.p.h.



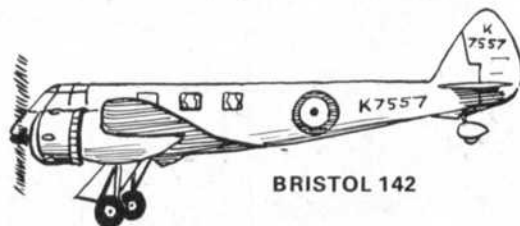
GLOSTER GLADIATOR

In 33, Bristol designed an 8-seat airliner, the 142, to outpace the Americans, at 300 m.p.h. Lord Rothermere, the newspaper proprietor, presented one to the nation, *Britain First*, which became the Blenheim medium bomber.



BRISTOL BLENHEIM Mk I
FIGHTER

Several squadrons of twin-engined Bristol Blenheim fighters fought in the Battle; they were improvised by mounting a box of four mg under the bomb bay in order to

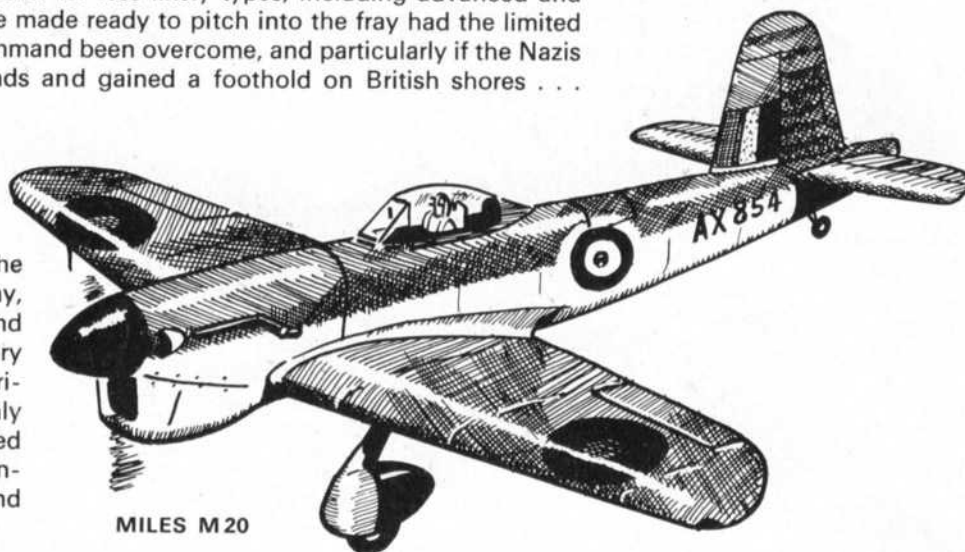


BRISTOL 142

create a long-range fighter for standing patrols and long sweeps, especially at night. The airliner conversion meant an unusually short nose, which greatly restricted pilots' sideways vision.

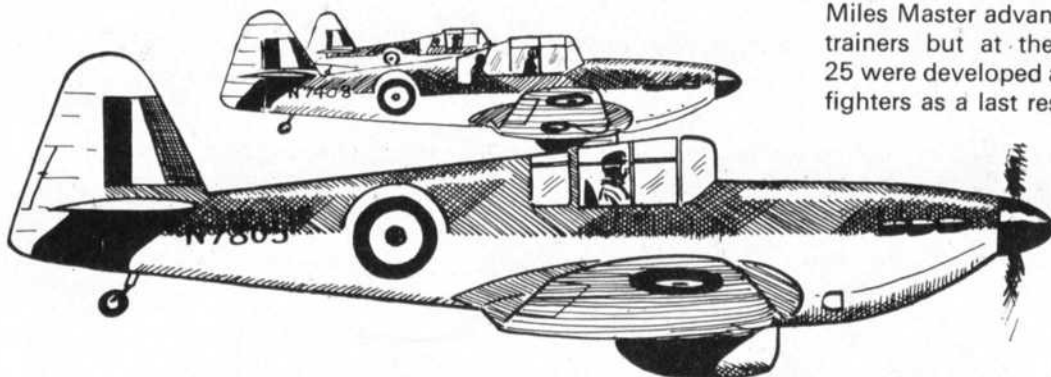
Not only fighters, but other far less likely types, including advanced and even basic trainers, were made ready to pitch into the fray had the limited resources of Fighter Command been overcome, and particularly if the Nazis had invaded these islands and gained a foothold on British shores . . .

A remarkable aircraft by the Miles Aircraft Company, the M20 had 12 guns and was a faster contemporary of the Spitfire and Hurricane. It was doomed only because an overburdened aircraft industry was concentrating on Spitfire and Hurricane production.



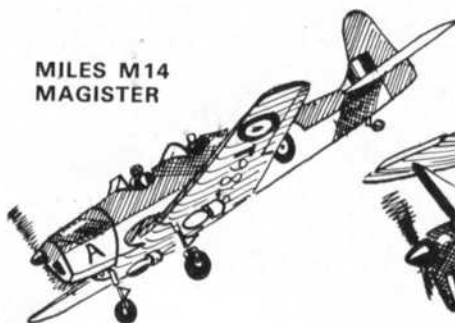
MILES M20

Many fighter pilots had trained on Miles Master advanced two-seat trainers but at the last minute 25 were developed as single-seat fighters as a last resort.

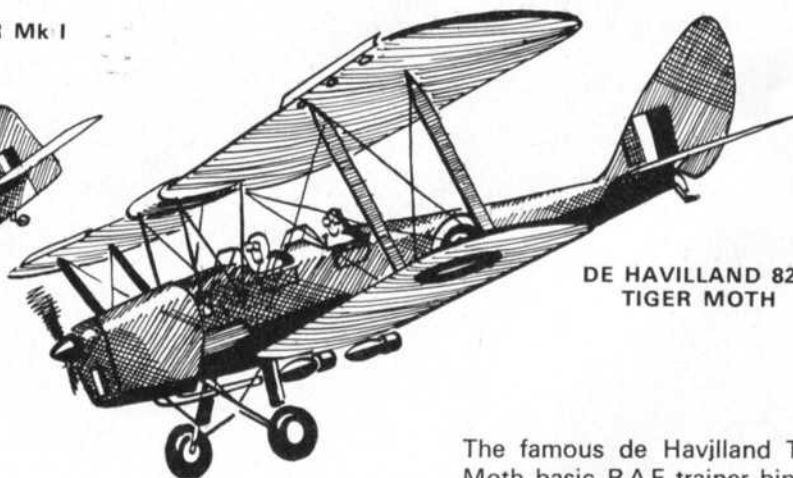


MILES M9A MASTER Mk I

MILES M14
MAGISTER



DE HAVILLAND 82A
TIGER MOTH



In case the Germans succeeded in landing in Britain, another Miles aircraft, the plywood Magister primary trainer, had already been modified as a light close support bomber, for a last ditch stand.

The famous de Havilland Tiger Moth basic RAF trainer biplane had already been used on coastal patrol, *The Scarecrow Patrol*, as it was called. The Moth could carry several small bombs for use in action against invasion.

JONES

The RAF Museum Philatelic Consortium starts a fascinating new hobby . . . and raises a mint of money for the RAF Museum Appeal Fund

AERONAUTICAL EVENTS have long since been marked by the carriage of souvenir mail or envelopes. Alcock and Brown, Hawker, Kingsforth Smith and Lindberg all contributed to postal history by taking with them commemorative mail which is now prized by collectors. From the early '20s onward the Royal Air Force also marked certain flying achievements in this way, although not on a regular basis. With the issue of the 50th Anniversary of the Royal Air Force stamp in May 1968 there was a widespread renewal of interest in flown envelopes (covers) within the Service. More than 20 Stations sponsored their own special design on the first day of issue of the stamp. Later in the year, with the aim of raising funds for the RAF Museum, a step was taken to co-ordinate Service philatelic activity by getting Stations to produce a series of flown covers now widely known as the RAF Museum Lines.

The first cover marked the 50th Anniversary of the inauguration of UK passenger and cargo flights which began at RAF Hendon (the site of the new Museum) on 10 January 1919. The British Forces Postal Service opened a post office at Hendon on 10 January 1969 and used a pictorial handstamp to cancel all mail received for dispatch that day. They also serviced 7,050 covers which depicted the DH4a used on the pioneer flight and which were franked with the RAF 1/- 50th Anniversary stamp. These were then flown on a training flight by No 32 Squadron over the original passenger carrying route to Villacoublay outside Paris. On return the covers were sold for 5/- each. This trial cover was followed by others commemorating the 50th Anniversary of the First UK Air Mail (1 March 1969) and the now famous Transatlantic Air Race in which they were flown by Victors of No 543 Sqn and a Harrier. The results were so successful that it was clear a start could be made on regular issues.

Altogether 46 RAF stations agreed to participate. Philatelic officers and helpers were enlisted to work in their spare time on the preparation of the covers, affixing stamps and selling the finished product. The design of the cover and handstamp and the printing of covers was undertaken by RAF Biggin Hill on behalf of the Museum. It was agreed at the first meeting of what has now become known as the RAF Museum Philatelic Consortium, attended by representatives of more than 40 Stations, that each issue would comprise a minimum of 15,000 covers.

The First Series The series began in June 1969 with a cover sponsored by RAF Brize Norton commemorating the 50th Anniversary of the First Direct Crossing of the Atlantic and pictured Alcock and Brown's Vickers Vimy. This was followed by RAF Binbrook (R34), RAF Chivenor (DH2), AAC Middle Wallop (Bristol Boxkite) and RAF Abingdon (Nieuport 12). In all it was planned to show 40 different aircraft used by the RFC and RAF ranging from the BE2 of 1912 to the Gloster Meteor of 1945. The last cover in the series was timed to be issued on the Opening Day of the Museum, now expected to be in November of this year. The whole series has been highly successful and is collected in most parts of the world. More than 650,000 covers have been produced to date and a very large amount of money raised thereby for the RAF Museum Appeal Fund.

Some quite notable flights have been commemorated, as covers were flown on the record-breaking Harrier crossing of the Atlantic from New York's Manhattan Pier to the coalyard at London's St Pancras railway station, in the Wessex helicopter which made the first helicopter flight from UK to Australia, in the Phantom making the world record flight non-stop from Coningsby in East Anglia to Singapore, in Concorde when it actually first passed Mach 2 and on the winning flight in the World Aerobatic Championships in 1970. These particular covers are now fetching very high prices, but even some of the ordinary ones which were issued in 1969 for 5/- are now commanding as much as £4.

This first series will be completed this year, but as funds are still urgently needed for the RAF Museum it has been decided to continue issuing flight covers. On 13 May 1972 Nos 1, 2 and 3 Sqn will celebrate their Diamond Jubilee and these will be marked by the issue of the first three covers in the new Squadron Series. These too will be cancelled with special handstamps and flown and the second series is expected to include 40 covers to be issued over the next three years. When the Museum opens in November this year the covers will be available there; in the meantime they will be on general sale from the Philatelic officers of respective squadrons or through most of the principal stamp dealers. Persons wishing to obtain them in due course from the Museum on a regular basis or to purchase examples of the present series can now contact the Public Relations Officer, RAF Museum, Aerodrome Road, Hendon, London NW9 5LL. ©

For the past 17 years, the RAF Souvenir Book has been sold as the official souvenir programme at all the RAF Stations 'At Home' to the public on the Battle of Britain anniversary in mid-September: indeed, it started out as the *Battle of Britain Souvenir Book*, and all copies still have a local flying display programme inserted free of charge. Carringtons, the jewellers, kindly presented a Spitfire Trophy, which is awarded annually to the 'At Home' Station which sells the most copies in relation to the numbers attending, and is hotly contested for. The record is remarkable, approaching one copy for every four visitors.

But whereas the number of Stations holding an official 'At Home' during *Battle of Britain Week* was once over 30, only seven will be open to the public on Saturday 16 September this year - Abingdon, Biggin Hill, Finningley, Leuchars, St Athan, St Mawgan and Wattisham.

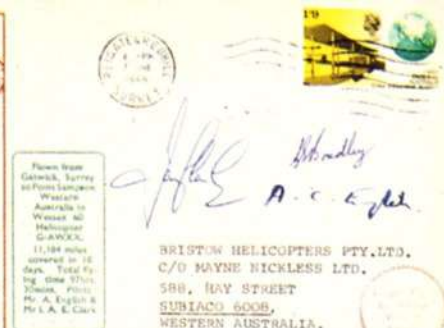
However, many Stations organise their own flying displays, open days, fetes and other events to which the public are invited throughout the summer months, where admission is usually free and the Souvenir Book is available. To encourage sales at all these events, another trophy is now to be awarded on the same basis as the Carrington Trophy, and is to be known as the Portal Trophy, after the late Marshal of the RAF Lord Portal, who was Chief of Air Staff throughout the war, and was closely associated with the RAF Benevolent Fund for many years.

Souvenir Book Trophies - 'At Home' Days and Flying Displays



RAF MUSEUM

FLOWN COVERS



Above
1 of 379 flown
from Redhill to
Point Samson,
Australia
by Wessex
helicopter.
Cost 30/-.
Now worth £75.

The 1st Cover
(Pre-series)
Northolt to
Villacoublay.
Cost 5/-.
Now worth £4.

The Harrier
cover:
1 of 250 carried
in XV744
when it won the Trans-
Atlantic
race May 69.
Now worth
£125.

Catalina Flight
from Denmark
to Greenland
and back.
Sgd Viscount
Portal, wartime
chief of RAF.

Aerobatic
Championships
1970 - flown
by World
Champion
Russian
Igor Egorov.



NEW SERIES
Starting
13 May 1972,
Diamond Jubilee
of the RFC.
Why not start
collecting
yourself?
It's fun and
profitable.
Write to the PRO
RAF Museum,
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Hendon, NW9 5LL.



60th Anniversary
of the Birth of
AIR POWER - 1912

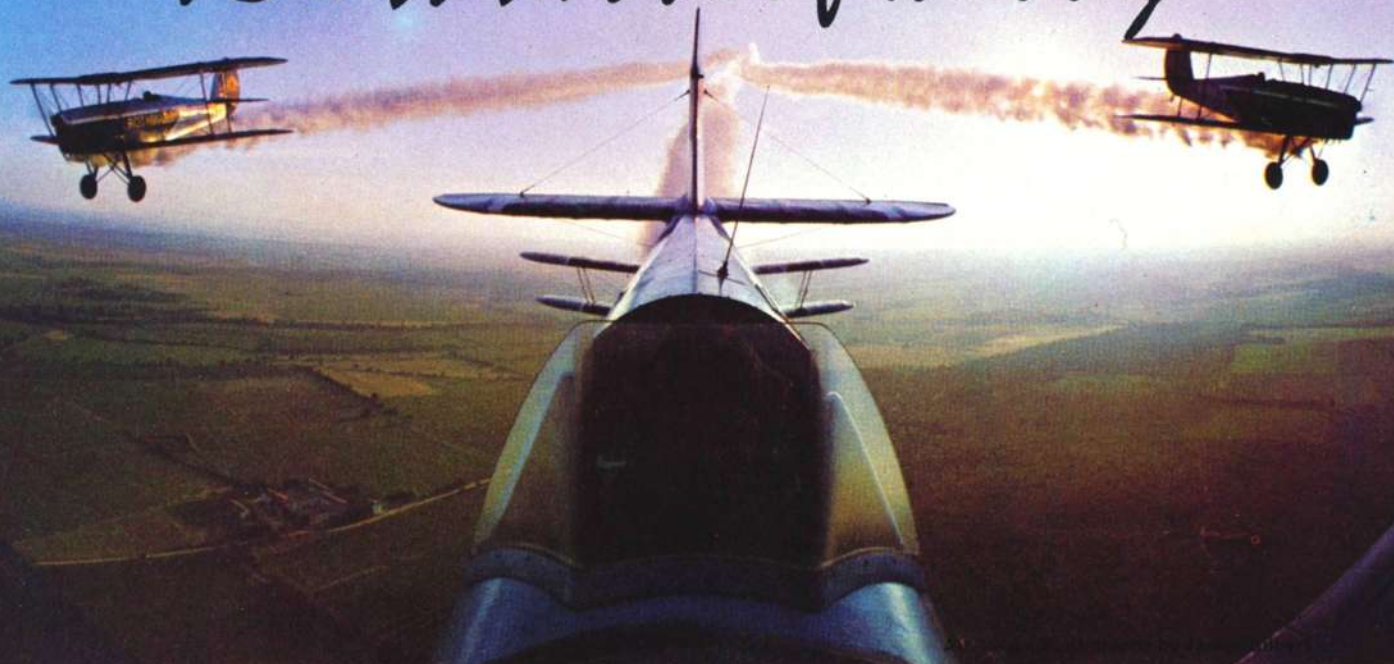
Don't miss out on
this rare
 Squadron Series?

Write to the PRO, HENDON



Manx Kelly tells the story of how he built up a world-beating bi-plane civilian air force at Booker

The last smoke of the day



2 YEARS AGO AT THE AGE OF 38 I left the RAF, in which I had had a very good time, because it didn't appear that I was going to become Chief of Air Staff before I was too old to enjoy the post. The opportunity of becoming boss of a slightly smaller air force arose through an advertisement in *Flight*. Unfortunately I couldn't obtain written terms of reference making me directly responsible to the most promising political figure in the country concerned (who must incidentally be congratulated on his recent coup), therefore I had to look at other possibilities. I considered becoming a portrait painter; but glimpses of my annual reports showed poor marks for tact, so I realised that this ambition was unwise.

'When Homer smote 'is bloomin' lyre
'E'd 'eard men sing by land and sea
And what 'e thought 'e might require
'E went and took. . . ' (Kipling?)

The Red Arrows were obviously running a great promotion for the RAF and the nation. Using my Pilot Attack Instructor training in evaluating bangs per buck I researched the air display market and the advertising budgets of numerous branded goods. Having listed potential results against costs I drew it all up in good military appreciation: *Enemy Forces: Nil*, and submitted it to the first company I could think of as I drew heavily on my last Rothmans King Size.

Investigations had revealed that civilians were keeping some remarkable aerobatic aircraft secret. They were called Zlin, Pitts and Stampe, were stressed well in excess of any current military machines and could do all manoeuvres upside down as well as right way up. Rothmans picked the Stampe SV4 as our aircraft because they understood the British reverence for the past. The Stampe biplane is over 30 years old, made of spruce from the masts of scrapped clipper ships, and Toledo steel provided by survivors of the Armada. We have five; four plus one reserve. To go with these lovely old biplanes I got some lovely old pilots who were born around the same time and suitably trained in the RAF, Ray Hoggarth, Neil Williams and Iain Weston, with quite a few hours and types between them ranging from Bleriot to Mig 17. Also they had between them served in every theatre and role and acquired every sort of qualification, Test Pilot, Qualified Flying Instructor, Pilot Attack Instructor, etc. Their combined experience appeared sufficient to keep me out of trouble. This was rather necessary as I had only done about a dozen formation aerobatic trips in my life when we started . . . and two of these were back seat rides with the Red Arrows. Civilian expertise was drawn on for the commentary which is done by Nick Daniel who is checked out on formation aeros so that he knows what he is talking about.

I had to form a company to run the operation. For those who are interested this requires £2.00 and two people, and while we have kept the staff at that level to fight inflation, I have increased the capital to avoid being called 'two bit'. Maintenance is done on a special basis. We need 100% serviceability five days a week and then want the aircraft set upon by a squadron. Luckily we work weekends, so the troops can get at them on Mondays and Tuesdays. This is organised by Doug Bianchi's Personal Plane Services at Booker near High Wycombe. I thought he was the right man as he was looking after machines of the same vintage such as Spitfire, Mosquito and Fieseler Storch. In his spare time he wanders



Sqn Ldr Manx Kelly, leader of Rothman's Aerobatic team and British Aerobatic Champion 1971, took up competition aerobatics only three years ago. Graduating from RAF College Cranwell in 51, he has 2,500 hrs on 25 jet and piston-engined aircraft



Their double mirror is perfected by endless practice



and carried out with bags of smoke at the Paris Air Show

round his hangar singing the Horst Wessel song, building replicas and plotting to steal and fly aircraft from the RAF Museum at Hendon.

It was a bit hard to get taken seriously in our first year . . . well, we were the only full-time civilian aerobatic team in the world. But in 1971, having been duly vetted by Colonel Lafont, the director, we appeared at the Paris Air Show. From a pilot's point of view that is the best organised air show we have been to (though the Barnstormers from Irchester in Northants run as tight a programme), and this year we will have an opportunity to sample the expertise of Farnborough. By the end of 1971, when I went to America wearing my *Director of Operational Requirements* hat to sample the latest and greatest American biplane, the Pitts S-2, I found that we were well known over there and that there was no equivalent in the USA.

So with the Red Arrows and Rothmans, Britain holds the top slots in military and civilian formation aerobatics. It's all done by strict adherence to the principles of war of course. The *principles* work equally well if you are in business or chatting up a dolly. And if you wonder about the aim we have selected and intend to maintain . . . well, security forbids!

MANX KELLY

Rothmans Aerobatic Team

2 Mar 72

Both 'top slots' in military and civilian formation aerobatics are British — the Rothman's team overflying the RAF's Red Arrows at Paris

—Arthur Gibson photograph





STAMPE SV4B BIPLANE

Wooden structure, fabric covered, 2-seater built in Belgium in 30s, French Air Force basic trainer, AUW 1,700 lb. 'G' limits +6 -4. de H Gipsy Major 10 inverted air cooled 4-cyl in line engine, OHV, direct drive. 20 galls 80 oct fuel, 2 galls oil. Fuel consumption 7 gph cruising and 10 gph during aerobatics. Endurance 2½ hrs, range 215 nm. Fuel system permits inverted flying and outside manoeuvres.

Maximum Diving Speed	148 kts, 2,675 rpm
Max Cruising Speed	106 kts, 2,400 rpm
Normal Cruise	95 kts, 2,250 rpm
Climbing Speed	56 kts, 2,100 rpm
Approach Speed	53 kts —
Stalling Speed (power off)	38 kts —
Maximum Rate of Climb	up to 1,150 fpm

TYPICAL AEROBATIC DISPLAY

Manx starts with a loop in box formation (it impresses all the experts that 4 such lightly powered biplanes can even do a formation loop!) and a Prince-of-Wales feather burst; then a tailchase and rejoin in box, with the leader inverted; then a stack, or double mirror; another loop in which No 4 goes straight on, rolling, then loops separately, diving to rejoin the formation. Then a kind of finger four, 2 up and 2 back, and another complex burst in which Nos 1 and 2 hammerhead while Nos 3 and 4 do half-Cubans. And great quantities of smoke all the while (well, it's cigarettes they're promoting, after all). All this, plus 2 mins climb, fills a 10-minute slot. If more is required, Manx fills in with a solo show that contains some fine hairy-chested lomevaks. Manx has spent much time practicing his solo Stampe flying, to such good effect that he is 1971 British national champion, beating the great Neil Williams into second place — a formidable achievement.

1972 DISPLAY PROGRAMME

APR	2, 3 Sywell, 29 Liverpool, 30 Elstree
MAY	5 Bicester, 7 Doncaster, 13 Blackpool, 19, 20, 21 Biggin Hill May Fair, 28 Blackbushe, 29 Oulton Park and Sleep
JUN	11 Malory Park, 17 Colerne, 24 Woodford, 25 Paul (Hull)
JUL	1, 2 Goole, 4 Tattenhill, 8 Topcliffe, 9 Rochester, 15 Wycombe Air Park, 16 Sywell, 23 Shobdon, 30 Weston-super-Mare
AUG	5, 6 Southsea, 13 Portsmouth, 19 Goodwood, 20 Barton (Manchester), 27 Coventry
SEPT	8, 9, 10 SBAC Farnborough, 12, 13, 14 Channel Islands, 21 Thame, 24 Wycombe Air Park
JUL	20 to AUG 12. Beaches in Torbay area



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A quarterly journal of aerospace history and affairs

AEROSPACE HISTORIAN contains articles, book reviews, museum news, photographs and other features emphasizing air force history and stressing the importance and relevance of the lessons of the past for the present and future of all aspects of aviation.

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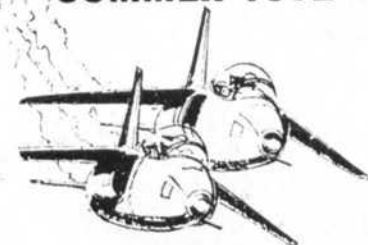
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TABLE, WINE and BEER MAT SETS IN NEAT PRESENTATION PACKS



'AT HOME' DAYS & DISPLAYS SUMMER 1972



FREE FLYING DISPLAY COUPON

As the purchaser of a Souvenir Book, you are entitled to a FREE Flying Programme on any of the 7 RAF 'At Home' Stations on Sept. 16th in exchange for this coupon. If you don't wish to cut up your Book, take it and show him.

To Dr John Reid, Editor, RAF Souvenir Book, Flyover House, Great West Road, Brentford, Middx.
Please supply me with _____ Wallets _____ Diaries
I enclose my cheque/PO for the correct amount

SLIMCREST

COLOUR Ambassador Blue ☐ Midnight Blue ☐
Burgundy Red ☐ Raven Black ☐
CREST Army ☐ Navy ☐ RAF ☐ US III AF ☐

INITIALS (for blocking) _____ Other _____

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Please supply as ticked below ☐
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Choice of crest _____

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Choice of picture _____

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Choice of picture _____

Surround: Blue ☐ White ☐
Frame: Wooden ☐ Plastic ☐ Metal ☐

Name _____

Address _____

(In caps please)



RAF Abingdon
RAF Biggin Hill
RAF Finningley
RAF Leuchars
RAF St Athan
RAF St Mawgan
RAF Wattisham

RAF ASSOCIATION
May 29 North Weald
Jun 3 Prestwick
17 Cottesmore
24 Woodford
24 Exeter

US THIRD AF
May 20 Bentwaters
Aug 12 Upper Hayford
Oct 14 Mildenhall

Other RAF & Civilian
Open Days & Flying
Displays occur all over UK
throughout the summer.
Watch local newspapers
etc for dates & details.

SOUVENIR BOOK TOP QUALITY TABLEWARE (SEE PAGE 44)

Our exclusive range of Melamine Tableware featuring Souvenir Book paintings and Unit Crests and Badges has been designed in conjunction with the renowned designer of houseware products MICHAEL MARCH in traditional style to display the prints to best advantage, and is hand-made to order by a famous manufacturer.

How highly individual and attractive they will look on your own dining table, bar and occasional tables is beautifully illustrated in the Slimcrest advertisement on page 44, and how perfectly appropriate they are for any Mess or Club with RAF or flying connections can readily be imagined — especially with an individual crest on the wine mats, which can be specially produced if the quantity ordered is sufficient. (The prices quoted below for individual sets and standard items can be further reduced for larger orders, too!) And remember that they will stand up well to very heavy use and retain their elegant appearance almost indefinitely. Please drop us a line if you have a requirement for a bulk quantity.

Almost all the Souvenir Art Prints illustrated on page 20, including the reprint of 'Spitfires 1940' and this year's new paintings on pages 9 and 41, can be made up into trays of different styles and prices. (Please note carefully which pictures are available against each item listed below.) The crested wine and beer mats, which will also serve as coasters, are illustrated full size on pages 7, 14, 21, 22, 29, 48, 66 and 75 (all available in full colour). Others are listed below.

Customers should note that many table and wine mats, although superficially glossy, are lacquered, varnished or sprayed with cellulose, and are liable to scratch, chip and stain, and soon become shabby. Their cork backs can scratch polished table tops, too.

The Souvenir Book Range is of superb quality, with a highly durable Melamine protective surface (hard enough for cutting and chopping boards!), resistant to heat (up to 180°C dry) and all food and drink stains, with hand-applied edges sealing in a four-layer resin core for strength and durability. They are backed with finest quality grey felt for table protection and resistance to heat transfer.

Being very long-lasting and almost undamageable in normal use, they are particularly good value at our mail order prices at least 20% below equal quality standard ranges on sale in leading stores. All prices include purchase tax, postal and packing charges.

Table and wine mats all have matching blue borders with double gilt lines to frame the prints and hand-applied gilt borders for extra elegance. Table centres match the table mats but are much larger (16½" x 12½") and contain bigger prints. Trays are available with gold-bordered prints and either a matching blue or a white surround. The less expensive versions can be fitted with either a white plastic or a fine gilt metal surround. The luxury trays have gilded wooden moulded frames and ornamental gilt metal handles as illustrated on page 44 and would grace the most elegant room.

PLEASE STATE ALL CHOICES ON COUPON WHERE ALTERNATIVES ARE OFFERED

WINE MATS Set of six, 3½" square, attractively boxed **£1.95**

Choice of Crests and Badges: Royal Air Force, US Third Air Force, RAF Strike, Support, Maintenance and Training Commands, Royal Netherlands Air Force, The Central Flying School, Aircraft & Armament Experimental Establishment (A & AEE), RAF Germany, The RAF Staff College, The RAF Regiment and the RAF College Cranwell (not illustrated — also in full colour)

TABLE MATS Standard set of six, attractively boxed, 10" x 8" **£4.35**

Art prints of Spitfire Pair, Hurricane Patrol, The Dambusters, Wellingtons Setting Course, Sunderland on Convoy Patrol, and Vildebeests over Singapore

FULL DINING SET Standard set of six table mats, 10" x 8", as **£5.55**

above, plus two Servers, 12" x 9", in presentation pack
Table mats contain the above art prints, plus 'Successful Sortie' and 'Scramble' in the larger serving mats

DE LUXE TABLE MATS Set of eight super-size table mats, **£6.75**

12" x 9", in presentation pack
Contains all eight prints listed above, in larger size, and with wider blue border to match. Additional different pictures may be included when larger quantities are ordered

DE LUXE TRAYS AND TABLE CENTRES IN TOUGH MELAMINE

Prints available: Spitfire Pair, Hurricane Patrol, Falcon Formation, Lancasters en route, Sunderland on Convoy Patrol, Vildebeests over Singapore, In Battle Joined — 1940, Spitfires 1940, Bristol Fighters over the NW Frontier, Lancasters Crossing the Dutch Coast and Jaguars Hunting. NB Wellingtons Setting Course, The Dambusters, and 50th Anniversary Review are available with smaller size prints and wider surrounds

TABLE CENTRES 16½" x 12½" (nominal) with larger prints having a gold border and edge, matching blue surround, and grey felt backing as above **ea. £1.75**

TRAYS 16½" x 12½", generally as table centres above, but with either blue or white surrounds, and either white plastic or gold metal frames (not illustrated) **ea. £2.45**

DE LUXE TRAYS 16½" x 12½", with gilded wooden frames and ornamental gilt handles as illustrated on page 44 **ea. £4.75**

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PLEASE ALLOW ABOUT 4 WEEKS FOR MANUFACTURE and DELIVERY

Perfect for Presents.....

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EVENING DRESS Raven Black

RAF & US 3rd AF Ambassador Blue

RN Midnight Blue

ARMY Burgundy Red

(Any crest supplied on any colour – see list below)

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PRICES



Craftsmen made in finest Morocco leathers with rolled gold corner mounts and gold-blocked with your Service Crest and own initials. (Please state precisely when ordering)

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Wafer-thin, companion, Executive Planner Diary Cases (shown top right) match the Wallets perfectly. A fold-out personal telephone directory is also included. Both inserts replaceable at 15p each, incl. p. & p. (72/73 supplied now).

Special Offer. Either separately or as matching sets, specially reduced prices are available for direct mail orders quoting 'SB'. Please allow 2/3 weeks for gold blocking initials.

Wallets £3.90 Planning Diaries £2.90
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MATCHING DIARY CASES for 72/73 contain improved fan-folded planner diary, each day across two pages. Personal phone directories now have a thumb index. Both renewable every year

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Two pockets
for bank
notes

★
Personal identity
card revealed
when crested
leather flap
opened to
use the
note-pad
(SEE ALSO
PAGE 2)

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Airborne Forces

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Women's Royal Army Corps

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WRAF

★ ALL CRESTS LISTED HELD IN STOCK. OTHERS MADE FREE FOR BULK ORDERS EXCEEDING 24 ITEMS ★



The Hawk of Horus, sky god of ancient Egypt, was adopted as our emblem in 1928 and incorporated in the official badge in 37. The bronze statuette, c 600 BC, from which it is derived is in the British Museum. The motto *Visu et Nisu* (by vision and effort) was adopted at the same time

Former staff and students of the RAF Staff College Andover subscribed towards the grant of this Patent of Armorial Bearings to mark the amalgamation of the Colleges of Bracknell and Andover. The Armorial Bearings, devised by Windsor Herald of the College of Arms, incorporate the Hawk of Horus, the Staff College motto and features from the Arms of Marshal of the Royal Air Force The Viscount Trenchard and of Air Chief Marshal Sir Robert Brooke-Popham, the first Commandant. The inclusion of stars, in this case the constellation Aquila, follows precedent and reflects the motto of the Service, *Per Ardua ad Astra*. A major break with tradition, however, is the use of a flying helmet instead of a knight's helmet to surmount the Shield



Wg Cdr A E Sylvester, MA, AMBIM, DS,
tells the story of fifty years of

THE ROYAL AIR FORCE STAFF COLLEGE



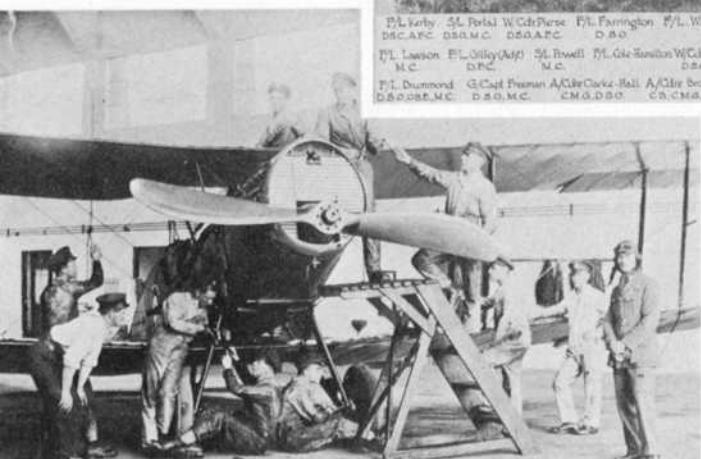
AIM - To provide an advanced Service education for selected officers, thereby fitting them for Command and Staff appointments appropriate to their present rank and preparing them for higher appointments — *Ministry of Defence Directive to the College*



The first Commandant, Air Cdr Brooke-Popham, pays a visit to France in 1922

1922

The College had its own aircraft from outset - 2 Bristol fighters & 2 DH9 as in 1923



No 1 RAF STAFF COURSE - ANDOVER - 1922



The Commandant, AV-M M J Beetham, tours Cape Kennedy Space Centre in 1971

1972

Today's students return to Bracknell by helicopter after a day in the field



ON 4 APRIL 1922 TWENTY STUDENTS, all ex-operational pilots from the RFC or RNAS, presented themselves at Andover Air Station for the opening of the world's first air force staff college. Not for them, however, the Italianate grandeur of the Army Staff College at Camberley or the Palladian splendour of the RN College at Greenwich; the guinea pigs for the new venture had to be content with brick and cement hutments which once housed a WRAF detachment but had long since fallen into disuse. The roofs leaked and the doors let in the draught. A correspondent of *The Aeroplane* made virtue out of necessity: 'The RAF Staff College itself, far from being a home of sybaritic luxury for the edification of budding brass-hats, is in fact rather a lodging for stoic philosophers who may thus fittingly combine hard lying (physical!) and high thinking.' The students had reservations of their own on selection for the 'gilded staff'. To those who had fought in Flanders the red-tabbed staff officer had too often been a figure of fun, resentment and scorn, a man remote from the front line, insensitive to the needs of the troops in the trenches and unversed in any of the arts of war. Such a caricature did less than justice to the graduates of Camberley, who had put into the field the largest army in British history. Nevertheless the apprehension of the students of No 1 RAF Staff Course was understandable;

were they to be the office-minders of the newly formed Service?

Their fears were unfounded; 'Boom' Trenchard, himself a ruthless pruner of unwanted staff officers, had a broader charter for the College. Sir John Salmond deputised for the CAS at the opening ceremony and read the address that Trenchard had prepared: 'Many officers will pass through this College and in the future from their brains, I hope, will emanate new and brilliant ideas for the development of the Air and its power. Remember that the one great thing to which you should at all times apply your thoughts and brains is the expansion of the power of material and personnel without increasing either. That way lies economy. Do not always be biased in favour of the development of Air at the expense of the other Services. What you have to weigh and weigh carefully is the balance between cost and efficiency. If efficiency is equal in each case, which is the more economical?' The injunction to economy was timely, for the Geddes Committee had called for a 20% reduction in Service expenditure. The call to resist single-Service bias was also timely but it may not have been what some students expected to hear; a month before the opening of the College a bitter inter-Service wrangle had come to a head and only after acrimonious Parliamentary debate had the Government declared the continuing autonomy



of the Royal Air Force.

An official memorandum described the purpose of the College in prosaic terms: 'The course of study at the Staff College is at present devised with two objects in view: first, to train officers in staff duties whether in peace or war; secondly, to afford a general education which will serve as a sound foundation for the building up of a school of thought in the Royal Air Force. It aims at the habit of steady reading and thinking rather than at the acquisition of a mass of detail.' The list of subjects to be studied on the one-year course was formidable: the nature of war and its principles, Imperial strategy, the tactics and organisation of air, ground and naval forces, supply and communications, the relationship of economics, commerce and science to RAF affairs, intelligence, home and international affairs. Basic staff duties were not forgotten; the students, like their successors today, found themselves writing letters, reports, précis, papers and signals. Thus the College had a home, a charter and a curriculum; it had the experience and precedent of Camberley on which to draw. It had an establishment of 75 airmen and its own Flight of two Bristol Fighters and two DH9as on which staff and students could keep in flying practice and, if need be, put their own tactical theories to the test.

But the success of the enterprise rested largely upon the officers who had been selected to be the first directing staff (DS) and students. The Commandant was Air Cdre H R M Brooke-Popham, a pre-WWI graduate of Camberley, who had been one of the very first Army officers to transfer to the RFC; an able pilot, squadron commander and administrator, he had earned distinction as the principal 'Q' officer of the RFC and RAF. His deputy, Gp Capt Clark-Hall, was a very experienced naval pilot who had spent most of the war at sea and had commanded *Ark Royal*. Wg Cdr Joubert de la Ferte had completed a post-war course at Camberley after active service in France, Egypt, Palestine and Italy. Wg Cdr W R Freeman, ex-Infantryman and an early RFC pilot, was one of the very few wartime aviators who could claim that he had walked back after having been shot down in enemy territory. Sqn Ldr C H K Edmonds, like Clark-Hall, had been in the RNAS; he had taken part in the famous Cuxhaven raid on Christmas Day 1914 and had later become the first pilot to sink a ship with a torpedo dropped from an aeroplane. Sqn Ldr B E Sutton, the youngest member of the staff, had joined the RFC direct from Oxford University; perhaps he might be regarded as one of the first RAF graduate entrants. The choice had been well made; all the staff were to reach Air rank and, in course of time, three were to become Commandants of the College which they had helped to found. Equally impressive was the calibre of the students. Tragically, one graduate, Sqn Ldr Smythies, was to be killed in a flying accident soon after he had completed the course and two others were to die in WWII; Flt Lt Drummond was lost over the Atlantic and Sqn Ldr Pulford, a pioneer of the Empire air routes, was killed at the fall of Singapore. However, many members of No 1 RAF Staff Course were to gain distinction in the highest appointments in the Service, none more so than Sqn Ldr C F A Portal, who was destined to lead the Royal Air Force from 1939 to 1945.

The College set to work. 'Classroom' instruction, more often a seminar or conference than a formal lesson, took place

in the morning and individual studies were pursued in the afternoon. Exercises and essays had to be completed, lectures given and attended and visits made. The programme was anything but dull; one day would see the Course bicycling over Salisbury Plain surveying sites for airfields; the next might find them listening to a lecture by a prominent trade unionist; the next on a visit to the railway yards at Kentish Town or out in the Channel with the Royal Navy. A library was founded and when the initial grant proved insufficient the DS contributed their own books. Students were made to work under pressure but sports and social activities were not neglected. The College ran a squash, hockey and sometimes, a rugby team; the Tidworth hounds had a lawn meet at Andover; receptions and parties were held. The Commandant made it known that 'the Staff College must set a standard for the whole Air Force, not only in the quality of work but in all other respects, including social duties.' Lest it should become too parochial in its views, students from the Army, Royal Navy and Commonwealth Air Forces attended the second and all subsequent courses. By 1939 nearly 500 RAF officers and some 70 officers of the other Services had graduated from Andover and had been awarded the symbol *psa* in the Service lists. The College roll included the names of many men who were to hold the highest positions in the RAF - Baldwin, Peirse, Sholto-Douglas, Park, Slessor, Leigh-Mallory, Saundby, Tedder, Embry, Boyle.

The pattern of instruction changed from time to time in response to Service needs; new concepts and tactics were discussed and evaluated. The basic ideals remained constant; the fostering of a healthy respect for sound staff work and the encouragement of objective thought on all RAF matters. ACM Sir Ronald Ivelaw-Chapman, a student in 1932 and a DS at the outbreak of war, reminisced: 'On one exercise, for which the Staff College moved, complete with Drawing Office, to a hostelry in Devizes for the inside of a week, I was deputed as Secretary, which involved writing up the minutes of a long drawn out and complicated conference that had started after dinner about 9 p.m. The conference ended, I did my homework and presented my piece to the appropriate DS just after midnight. He tore it in shreds - metaphorically - and I was up half the night revising it since he wanted the re-written minutes before breakfast the next morning. I often thought of that incident when, much later, I was working on the fringe of the inner circle of Whitehall planning during the war and when I was frequently given the job, maybe at midnight, of preparing a paper on a complicated proposal for the use of air



Right
VIP VISITORS
Generals Eisenhower and Montgomery at Bulstrode Park during the war
Prince Philip opens the new tutorial wing at Bracknell
Left
A tactical exercise on the sand table in 50s



FORMER HOMES
(l-r) Ex-WRAF hutments at Andover, 1922
The College that never was – the design for Ramridge, cancelled by WWII
Overseas College – Hotel Telsch, Mt Carmel, Haifa
Bulstrode Mansion, Gerrards Cross, 1942 – home of War Courses

power emanating from the Prime Minister with his courteous note: 'Pray action this day'. Thus in no small way did the College prepare the leaders of the Royal Air Force for a war in which the planning, organisation and execution of air operations were to prove of decisive importance.

the war years

The outbreak of war frustrated plans for the College to have its own properly designed home. Only six weeks before war was declared the CAS, ACM Sir Cyril Newall, turned the first sod on a new site at Ramridge House, some three miles from Andover. But the splendid classical building, designed by Sir James West, the architect of Cranwell, was never built. By September 1939 only a small administrative staff remained at Andover; DS and students had taken up their war appointments. However, the College did not remain inactive for long. Trained staff officers were needed by the much expanded RAF and War Courses, each of two to three months' duration, were begun at Andover in November 1939. Among the 35 students of the third War Course was HRH the Duke of Kent, who was later killed on active service with the RAF. In May 1940, staff training was again suspended; the Fall of France was imminent and every available officer was needed for the front line. The College was still in recess when, on 16 April 1941, the *Luftwaffe* bombed Andover; the huts which for so many years had barely withstood the ravages of wind and weather proved no defence against high explosive: although the College buildings were badly damaged, much College property and many of its records were saved.

In January 1942 War Courses began again in a new home at Bulstrode Park, Gerrards Cross. By mid-43, student numbers had risen to 60, including officers from the Army, Royal Navy and Dominion and Allied Air Forces. The staff was supplemented by an Army officer (1943), a USAAF officer (1944) and an officer of the Royal Navy (1945). These valued links with the other Services and with the United States are perpetuated to the present day. Instruction on the War Courses was intensive and largely restricted to the basic elements of staff work; nevertheless time was taken to study the immediate lessons of the war and the strategic implications of the battles in progress. During 43 and early 44 all attention was focused on preparations for the invasion of Europe. Gen Eisenhower, the Supreme Allied Commander, twice addressed the College and the one Course took part in the preparatory exercise Spartan. After the Normandy landings, the DS kept close touch with the progress of operations and paid frequent visits to front line squadrons. By this time the College had

Wg Cdr Silvester joined the RAFVR as an airman and was engaged on special duties in the Middle East and E Africa before going up to Cambridge. On graduation he was commissioned in the Education Branch and was SEdO and instructor in Bomber Command during the inception of the V Force. After appointments at Officer Cadet Training Unit and Air Ministry, he attended RAF Staff College Andover. While senior education officer at Steamer Point, Aden, he led a Joint Service expedition to the Kuria Muria Islands. He was a selector at the Officer and Aircrew Selection Centre and held staff posts at Flying Training and Training Commands before joining the Directing Staff of the Staff College



re-constituted its own Communications Flight at Denham airfield; by 1945 the Flight had 13 aircraft ranging from an Auster to a Spitfire.

Not all wartime staff training took place in England. The Army's Middle East Staff School, set up at Haifa in 1940, acquired an 'RAF Wing' in 1942. Wg Cdr Yarde, the first DS, was the sole mentor to eight air force students. The 'RAF Wing' grew until in September 44 it became the RAF Staff College (Overseas), and by the time it disbanded in October 46 some 340 students, including officers from the S African, Greek and Egyptian Air Forces, had graduated from the Wing or the College. Meantime, changes had been made at the Staff College in England. In July 45 the main part of the College moved from Bulstrode to Bracknell and took up residence at Ramslade, a combination of mid-19th-century country house and late 30s residential club, which had previously served as the HQ of the 2nd Tactical Air Force and Army Co-operation Command. Ninety-six students attended No 16 War Course, the first to be held at Bracknell. Bulstrode was retained, however, to provide a parallel 'International Staff Course' for students from allied and friendly air forces; No 16 War Course there had 20 RAF and 16 foreign students. Bulstrode very quickly became a College in its own right; instruction was on the same general pattern as that at Bracknell and, indeed, some instruction was shared. However, for administrative and security reasons, the two Colleges were to be run as separate entities for 24 years. In 1948 the College at Bulstrode moved to Andover and occupied the buildings, much restored, in which the first RAF Staff Course had been held.

bracknell and andover

The progressive extension of the length of Staff Courses after the war, first to six months, then to nine months and finally in 1948 to a full year, reflected the wish of the Air Council to re-establish staff training on the pre-war model. Some of the pressures of the wartime courses were relieved: more time was given over to visits and inter-Service activities and more study was devoted to the lessons of the war and to the problems of the uneasy peace. Not least among the concerns of staff and students was the new dimension in strategy and exploitation of air power manifest at Hiroshima and Nagasaki. But the pre-war training pattern could not be reproduced in its entirety. Six years of war had brought a revolution in aircraft and weapons technology, tactics, logistics and organisation. Gone were the days when the tactics of aerial combat or bombardment could be argued in an Andover





An Andover tradition – the College Flag Room; students of 51 countries are represented here

classroom in the morning and practised over Salisbury Plain in the afternoon. Tactics had become the province of such formations as the Central Fighter Establishment and the Empire Air Armament School. The RAF Flying College, predecessor of the RAF College of Air Warfare, was formed in 1949 and assumed much of the responsibility for teaching tactical doctrine and weapons employment. A revolution had also occurred in the ground support organisation of the Service; the complexity of support activities, particularly engineering, had led to the creation of highly professional ground Branches each with its own School or College. Against this background of increasing specialisation in the air and on the ground, the role of the RAF Staff Colleges in providing a 'higher Service education' assumed new importance. The officer aspiring to higher command could be given the opportunity to broaden his horizons and consider the aims and problems of the Service as a whole.

A strong school of thought argued that the process should be taken a stage further and that the single-Service Staff Colleges should be amalgamated. A Joint Services Staff College (now the National Defence College) was formed in 1947 but schemes for the combination of the single-Service Colleges and even their co-location proved impracticable. Nevertheless the practice of holding 'joint study periods' between the single-Service Colleges was firmly established and in 1962 the Chiefs of Staff directed that at least 20% of the syllabus of each College should be devoted to joint training. Tri-Service exercises were held at Bracknell, Camberley and Greenwich; DS and students from all the Colleges worked together in mixed groups and came together in the large Alanbrooke Hall at Camberley for lectures and presentations. Particular problems were attached to staff training within the RAF itself. The Officers Advanced Training School, founded in 1943 and the forerunner of today's Junior Command and Staff School, prepared Flt Lts for staff appointments but only a small proportion of the RAF's permanent officer cadre could progress to the Staff College. Entrance to the Staff College became then, as now, highly selective; a qualifying examination was re-introduced in 1950. Hopefully the officer, in studying for promotion and qualifying examinations, would keep abreast of developments in RAF organisation and procedures, in the changing uses of air power, and in military and international affairs.

The Progressive Education Programme, begun in 1966, sought to close the gap between the training given at the Junior Command and Staff School and that afforded by the Staff Colleges. A two-year correspondence course conducted by the Individual Studies School, Bracknell, served to extend

the training given at JC&SS, to qualify more officers for staff appointments and to replace the qualifying examination for entry to Staff College. Control of the whole programme was vested in the Commandant of the College at Bracknell. The last stage in the evolution of the present pattern of staff training was realised in 1970 when the Staff College at Andover merged with its sister institution at Bracknell. The opportunity was taken for a comprehensive review of a syllabus which had remained substantially unchanged since the 50s; some of the work hitherto undertaken by the Staff College was given to the Individual Studies School, leaving the College free to concentrate upon professional air force management and on the command and control techniques for single and joint Service operations.

the college today

For the first time in its history the RAF Staff College now has accommodation and facilities appropriate to its task. The tutorial building, which was officially opened by HRH The Duke of Edinburgh in June 1970, contains well-provided syndicate rooms, staff offices, discussion rooms, a large library, a lecture hall seating 220 and a drawing office. The Flag Room, in which the whole of the staff and student body can gather before lectures or for social functions, perpetuates an Andover tradition; the flags which hang in the room are representative of the 51 countries whose officers have studied at Andover, Bulstrode, Haifa or Bracknell. Symbols of tradition – paintings, badges, photographs and trophies – have blended well into their modern, highly functional surroundings. A graduate of the first RAF Staff Course visiting the present College would probably be surprised at the number and diversity of the students; the 144 students in residence today are drawn from nine officer Branches of the Royal Air Force, from the Army, Navy, Royal Marines and the Civil Service and from no fewer than 24 Commonwealth, allied and friendly air forces. Our visitor would be equally surprised at the diverse qualifications and experience of the directing staff and the presence among them of representatives from the United States and Canadian Air Forces, the Royal Navy and the Army. He would find an even wider range of subjects to be studied than in the syllabus which he knew – electronic warfare, nuclear strategy, communication by satellite, operational analysis, multi-national defence projects. The terminology might seem strange and he might raise an eyebrow at some of the mathematical and scientific techniques which the present day student employs.

But our 'psa' of 1922 would find much in common with the 'psc' of 1972. Strategy, tactics, techniques and terminology have changed but ideals and personal relationships have not. The basic teaching unit of the College remains the syndicate of six students in the day-to-day charge of a Wg Cdr DS; emphasis is still laid upon the fundamental skills of command – clear thinking, decision, speaking and writing; there is still the same lively interest in the further development and exploitation of air power. Indeed, the present situation of the Royal Air Force evokes memories of 1922. Money is short, resources are few and expensive, but commitments are many and threats to security are ever-present. As it has done for the past 50 years, the RAF Staff College still seeks fresh paths for 'expansion of the power of material and personnel without increasing either.'

©

The author with his present syndicate, which includes a Nimrod development engineer, a carrier-borne Buccaneer pilot, a NATO Lightning pilot, a Supply officer computer specialist, Iranian Air Force Supply officer and USAF airborne electronics specialist navigator
Students examine Rapier missiles during a weapons presentation





A place for you with the flying team.

Engineer

Mike Gilding, B Sc (Eng), 23, Flying Officer, started with an RAF Scholarship while he was still at School, took his degree as an RAF Cadet (current rate as an undergraduate, £1,132 a year). Now in Cyprus in his first job, working with Lightnings as 'assistant manager' of a 150-man servicing team.



Pilot

Cliff Willmer, 24, Flying Officer, began as an RAF apprentice, was selected for aircrew training as soon as he was qualified. His comment: "A lot of people are walking around with no idea what they could do if they tried. The RAF finds out your potential, and helps you to develop it".

Fighter Controller

Rosalind Taylor, 22, Flying Officer, joined the RAF at 18, straight from school. Her job in Cyprus: keeping a radar watch and directing fighters by radio—even, perhaps, giving orders to her husband. He is a Lightning pilot, they met and married in the RAF.

£2,398 at 22

Very attractive rates of pay on the new military salary. One example: a pilot or navigator, on reaching the rank of Flying Officer, can now earn £2,398 a year.

Royal Air Force

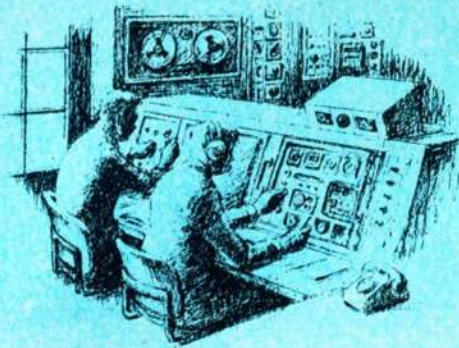


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With this coupon please enclose a separate note giving your school address
and your home address. Give your home address, or your school, including
postcode, in full. Enclose a recent passport-size photograph, if you can, and
your current qualifications. (Delete whichever does not apply)





'Steely Magroo watched as the enemy aircraft cartwheeled slowly out of the sky, belching flames and trailing smoke: his grip slowly relaxed on the control column as the tension ebbed out of him. Another "kill"! As his vanquished opponent struck the sea and disappeared from view, Steely levelled his aircraft, set a course for home and switched on the automatic pilot. Then, pushing back his chair, he peeled a cut-out aircraft symbol from its non-stick backing paper and pressed it carefully on to the side of the TV screen in front of him below the other 11. Humming thoughtfully to himself, he got up to stretch his legs, leaving his remotely controlled fighter to come home by itself . . .'

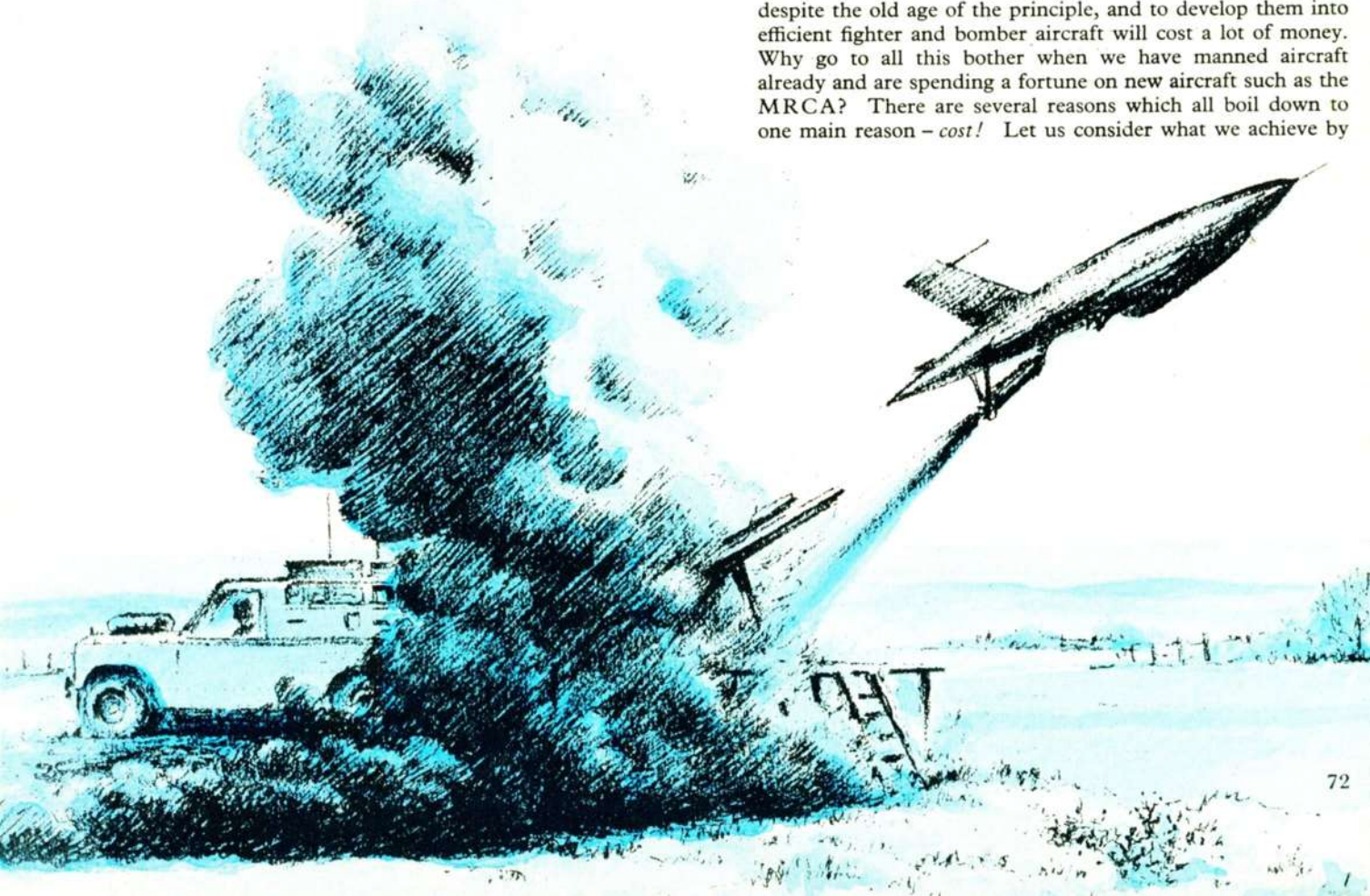
THE CONCEPT OF REMOTELY CONTROLLED aircraft is by no means new and model aircraft makers of all ages have been flying radio controlled models for several years. Not long ago one such model was used to take aerial photographs of an archaeological site during excavations to help locate different artifacts, and of course larger radio controlled aircraft have been developed in recent years to carry out aerial reconnaissance missions for military purposes. One of the main advantages of not having a pilot in the aircraft is that the aircraft or *drone*, as they are usually called, can be used effectively under heavy anti-aircraft fire without endangering a pilot. Indeed, one such American drone was able to take useful aerial photographs of a target in Vietnam which two previous missions of manned reconnaissance aircraft had been unable to get because of very heavy anti-aircraft defence.

The photographic drone, however, suffers from one major disadvantage in that after taking its photographs it must return home, land, and the film be removed, processed and analysed before anything can be done about it, *eg* a ground attack fighter scrambled to bomb the target. If the drone could send back TV pictures then we could react immediately to the information received. This ability to see things as they are happening and react accordingly is referred to (in jargon) as

real-time operation. The *Apollo 15* mission demonstrated real-time remote control of the TV camera on the moon buggy and since that was accomplished satisfactorily it must be possible remotely to control a TV camera in an aircraft, and indeed, the aircraft itself. Using such a system, the pilot on the ground, seated at an operating console, will be able to fly an aircraft, using TV to see out of the 'cockpit' windows, as if he were actually in the cockpit.

Having developed such a system, why restrict its operation to reconnaissance? Why not use it for other dangerous missions such as ground attack and aerial dogfighting. Last summer the US Navy demonstrated a dogfight between a specially modified *Firebee 1* target drone and a *Phantom F4* fighter. The pilot of the *Phantom* fired his weapons at the unmanned *Firebee* which escaped unharmed, outmanoeuvred the *Phantom* and in turn scored several simulated 'kills' against the *F4*. The *Firebee* pilot on the ground probably thoroughly enjoyed himself, but I doubt whether the crew of the *Phantom* were very happy. A similar *Firebee* was demonstrated to the US Army about the same time in the ground attack role, in which it dropped 2x500 lb bombs. No details have been released on the accuracy of the system but there is no reason why it could not be made extremely accurate.

Now such remotely piloted aircraft are an innovation, despite the old age of the principle, and to develop them into efficient fighter and bomber aircraft will cost a lot of money. Why go to all this bother when we have manned aircraft already and are spending a fortune on new aircraft such as the MRCA? There are several reasons which all boil down to one main reason - *cost*! Let us consider what we achieve by



Sounds a bit dramatic doesn't it?! But, says Flt Lt Heath-Whyte, it is not as far away in the realms of science fiction as one might think. The last 12 months have seen exciting demonstrations of the possible future applications of remotely piloted unmanned aircraft, and their use in many roles in tomorrow's Air Force is now a certainty

RPVs

Competition Entry by



Flt Lt R W Heath-Whyte

removing the pilot from the aircraft. The pilot has three main needs, space, instruments and 'life support', *ie* things to keep him alive at high altitudes and accelerations. He needs space to sit in, move his head, arms and legs and generally control the aircraft and see what he is doing, without suffering too much from claustrophobia! He needs instruments to tell him what the aircraft is doing and such items as radio, radar and navigation instruments; he also needs controls and control panels. Finally for life support he needs oxygen, pressurisation perhaps, and an ejection seat. Because of the stress and strain through which aircraft are put during their operational life all this equipment has to be built to very high specifications and is therefore not easy to mass produce and is expensive.

If we don't have a human pilot in the aircraft we can take all this equipment out, and replace it with an automatic pilot, TV equipment and radio control equipment or, to use more jargon, *data link* equipment. This will undoubtedly take up a lot less space than the human pilot and will weigh a lot less, so we can then have a smaller and more manoeuvrable aircraft which will be able to be accelerated beyond the limits which a man can withstand up to the *g* limits of its airframe. We can therefore produce a smaller, more manoeuvrable fighter capable of carrying the same weapons as the manned fighter and of being operated by remote control, thus keeping the human pilot out of the line of fire. For these reasons such a remotely piloted vehicle (RPV) or *telecraft* should cost considerably less than the modern fighter aircraft, in which case we can either cut our costs or have more aircraft. The MRCA is not going to replace all our front line aircraft because the cost would be astronomical, and development of yet another generation of manned fighter aircraft more costly still. The RPV provides the alternative.

One of the present problems of using ground attack aircraft for close air support is the time it takes for the aircraft to get to the scene when it is called up. The use of *Harriers* will greatly reduce this problem, but using remotely piloted aircraft operated by the forward artillery units would solve the problem completely. The *Canadair CL 89* reconnaissance drone is launched from the back of a lorry using rocket motors, flies off on its mission powered by an internal jet engine and when it returns, lands by parachute on inflated air bags which it deploys as it descends. An exactly similar system for a ground attack RPV would provide artillery or infantry units with their own immediately available close air support which they could recover, re-load and use again and again. Alternatively a remotely piloted helicopter could be used for ground

attack and would provide a stable platform for the TV camera, giving a steady picture for the remote operator to improve his aim. The USAF is working on such a helicopter, the *Gyrodyne QH-50D*, which has a control range of about 20 miles and is armed with a high velocity gun and laser-aided rockets. It may sound a little like science fiction, but it is a military fact and has already flown.

The interceptor RPV could use the rocket launch and parachute recovery system mentioned above and would therefore need no runways or associated fixed installations. It can perhaps be considered as employing the advantages of both the surface-to-air missile system and the air-to-air missile system (the manned interceptor). Being boosted off the ground by rockets it would get to its operational height quickly, and if mounted on the back of a lorry or tracked vehicle the system could be mobile and not a sitting duck for a pre-planned strike attack. Sending *real-time* pictures of its target back to the operator would enable him to identify the target visually before shooting it down, and if armed with both long range and dogfight missiles it would be a very formidable opponent. In addition, the interceptor would be recovered intact at the end of its mission, re-armed and equipped for the next mission.

The remote control of these aircraft could be carried out either from the ground or from a mother aircraft, which could also launch and recover them. It has also been suggested that one pilot could operate more than one RPV, perhaps in a bombing attack on a single ground target. Certainly the pilot need not fear for his job as there would be plenty of aircraft to control, and the job would be both exciting and exhausting. However, as the *voyeur pilot* would be removed from the danger of the battle he *might* suffer a cut in flying pay?

Holy cow! I was only joking, Batman! . . . but flying pay or no flying pay, the remotely piloted aircraft is the interceptor, ground attack fighter, and reconnaissance aircraft of the future – and that future is not far away. At the beginning of World War II our aircraft were able to operate from grass airstrips, but since then we have become more and more static and reliant on ever-larger concrete runways and more complex fixed installations. The aircraft themselves have become more and more complex and costly. The remotely piloted aircraft offers the opportunity to reduce costs and improve the mobility of our tactical air force. Steely Magroo will be one of our next generation of fighter aces, and the worst he will suffer from his 36 victorious missions is a sore backside! ©

POPULAR RAF HISTORIES do not agree with the words of St Paul: The greatest of the three, or at least the longest enduring, is *Faith*, the surviving member of a trio of Gloster Gladiator fighters whose exploits in defence of Malta made one of the best stories to come out of WWII.

The story is simple and dramatic. When Italy entered the war Malta had no fighter defence. Four Sea Gladiators, crated in the seaplane base at Kalafrana, were hastily assembled and manned by RAF pilots (in some versions of the story much is made of the conversion of venerable, 'chairborne' staff officers to fly them). One was soon lost, but for weeks the remaining three fought off wave after wave of Italian bombers until the island's defences could be reinforced. The three gallant biplanes were dubbed *Faith*, *Hope* and *Charity* by the Maltese people and, when the siege was over, the sole survivor, *Faith*, was presented to the grateful populace and is still preserved in a place of honour in Valletta. Several aviation writers have investigated this tale, commemorated in a full-length book and many official and semi-official histories, and it seems that 'the contribution of the Gloster Sea Gladiators to the defence of Malta has been rather exaggerated'. This article attempts to unravel the rather tangled threads of the story.

On 24 May 39, 18 Sea Gladiators, serial numbers N5518 to N5535 were delivered to Kalafrana, a seaplane base in Malta, and stored in crates. The aircraft were intended for carriers and Admiralty records show that, between Oct 39 and Feb 40 at most ten (probably six) of them were so embarked leaving, at worst, eight in storage. No Sea Gladiators were taken aboard carriers after February 1940.

HMS *Glorious* should have collected four of them for service in the Indian Ocean and, in May 40, PO Collins of the Aircraft Repair Section at Kalafrana was instructed to erect four of the crated aircraft for this purpose. N5519, N5520, N5524 and N5531 were duly assembled, but *Glorious* was sunk while ferrying 263 Sqn back from Norway and could not take delivery. There is some confusion at this point, for *Glorious* was sunk on 8 June while a recently published history of 261 Sqn (see later) records the formation of Fighter Flight, Malta, and the take-over of the Gladiators by the RAF, as 6 June 1940. Nevertheless, four were available for the air defence of Malta in early June. Two of the quartet were badly damaged in accidents before a fortnight was up; however, four fully serviceable Gladiators are recorded in the battle order figures for 14 June and, since these include N5523 and N5529, two more of the crated aircraft must have been erected. The two early casualties were evidently not beyond repair, indeed, the first to be damaged, N5519, features as *Faith* in the legend.

The first Italian air raid on Malta took place in the morning of 11 June and the unescorted force of Savoia bombers was intercepted and broken up by two of the Gladiators. Their pilots seem to have been instructed to concentrate on disrupting bomb-aiming, to avoid combat with Italian fighters and not to pursue departing enemy formations – pursuit would have been difficult with their lack of speed, although early versions of the story tell how throttle gates were removed so that engines could exceed the permitted speed. During this period, Italian aircraft activity was relatively light – almost desultory; three air raids took place between 11 and 30 June and for the first three weeks of the war Regia Aero-

*Competition
Entry by
Wg Cdr
D B Thomas*



'And now abideth faith, hope, charity, these three; but the greatest of these is charity.'

I CORINTHIANS XIII 13

FAITH, HOPE, AND CHARITY

navia records indicate a total of less than 100 sorties. Thus the skies were not 'black with Fascist bombers' and the Gladiators did not 'knock down the raiders like flies' – they shot down three in three weeks!

Italian raids might not have been as heavy as popularly imagined, but did the total air defence of Malta ever comprise only three Gladiators? This appears unlikely. As mentioned above, six were certainly made airworthy – the others appear to have been used as a source of spares. Spares were difficult; at least one of the aircraft (historian William Green says N5519) was fitted with a Mercury engine and Hamilton Standard variable pitch airscrew destined for a Blenheim bomber on 22 June. This aircraft is recorded as lost in action on 24 June. N5520 was destroyed on 26 June but N5523, N5524, N5529 and N5531 were still operational at the end of the month, two being lost in mid-July. However, by this time there were Hurricanes in Malta: four had been delivered on 21 June and were ready for action by 28th. On 12 August, 12 Hurricanes (ex 418 Flight at Abbotsinch) were flown off HMS *Argus* and combined with the Gladiators and Hurricanes of Fighter Flight, Malta, to form 261 Sqn. So, by the time the airworthy Sea Gladiators were reduced to three there was a fairly substantial representation of Hurricanes.

Where then was the origin of the *Faith*, *Hope* and *Charity* fable? If the RAF succeeded in keeping only three of the six Gladiators serviceable at any one time or if they still flew the pre-war 'Vic' formations, the sight of the three ancient biplanes in the sky over Malta could suggest St Paul's Epistle to the islanders (everything in Malta seems to suggest St Paul to the Maltese). But the names

Faith, *Hope* and *Charity* were *not* used when the Gladiators defended Malta. These appeared in the Maltese Press months later, indeed, Air Marshal Maynard, AOC Malta in 1940, recalls first hearing of *Faith*, *Hope* and *Charity* when he returned to Britain in 1941.

The Sea Gladiator presented to the people of Malta to commemorate the episode is also an enigma. Still in existence in Valletta, red lead inhibits the wing attachment points, the condition of its stringers is 'ex-works' and the engine was almost certainly fitted after delivery to the display hall. Wherever the constructor's number should appear, it has been sanded away and painted over. There is no sign of battle damage in this aircraft, reputedly *Faith*, the only survivor. Another inconsistency is found in the descriptive plaque which refers to the aircraft as N5520; N5520 was lost on 26 June 40 while N5519, the *Faith* of the popular story, is recorded as destroyed on 24 June. Valletta's Gladiator evidently survived the siege, but probably in a crate in the repair depot.

Sadly, it seems that the true story of Malta's Gladiators differs considerably from popular legend. Malta's air defences against Italian attack were never restricted to three Gladiators, Italian bombing raids were not particularly intense, the names *Faith*, *Hope* and *Charity* were invented by an enterprising newspaperman after the event and the aircraft preserved as a monument never saw any action. Still, at that stage in the war, we needed a legend – we got one, and who is to say that the story of *Faith*, *Hope* and *Charity* did not contribute largely to final victory.



The Commandant-General, Air Vice-Marshal B P Young CBE, looks at airfield defence since the RAF Regiment was formed in 1941 and over the next decade, when the Hawker Harrier poses new problems, and the BAC Rapier low level air defence missile offers new solutions . . .

THE REGIMENT IS 30

"Every airfield should be a stronghold of fighting air-groundmen, and not the abode of uniformed civilians in the prime of life protected by detachments of soldiers". Winston Churchill, 29 June 1941.

IT IS AN AXIOM OF AIRPOWER that air operations must be mounted from secure bases. This principle was born of the German blitzkrieg and fostered by subsequent experience of Allied tactical air operations during the Second World War. Its validity has since been endorsed in contemporary terms by American experience in Vietnam and, most dramatically, by the events of the Arab/Israeli Six Day War of June, 1967.

Vietnam has shown that in limited, conventional war there is an ever-present threat of sabotage, infiltration and guerrilla attack upon air bases. It has demonstrated that crippling damage can be done to aircraft and vital airfield installations by very small bodies of determined men – often with impunity by stand-off attacks with mortars or rockets. It has also highlighted the vulnerability of modern aircraft to defensive fire from the ground.

In the Six Day War, Israel's air force assured early victory to her ground forces by destroying 416 Arab aircraft – 393 of them on the ground – in the first 48 hours of hostilities. This illustrated once again the importance of air superiority to military success and demonstrated that the quickest and most economic way to achieve it is to destroy the enemy's aircraft where they are most vulnerable – on the ground. It emphasised, if any emphasis were necessary, the vital importance of airfield defence, and particularly of low level air defence in modern war. Above all, it provided a timely reminder to the Western powers of the penalties of neglect in this field.

policies and concepts

In the context of the concept of nuclear confrontation with which the West had for so long been pre-occupied, there was military and economic sense in concentrating our effort – and our money – upon quick reaction alert measures, instant nuclear response and the credibility of the nuclear deterrent, rather than upon the physical protection of our airfields and our 'single strike' capability. Now, however, with the adoption by NATO of a policy of 'flexible response', the wheel has turned full circle. Indeed, the need to be able to sustain a period of conventional war while maintaining our nuclear capability intact, places greater importance upon effective airfield defence than ever before.

Needless to say, this has not been lost on the Soviets whose

massive airfield defence measures provide evidence of the importance they attach to this aspect of air operations. Nor, indeed, has it escaped the attention of the NATO planners who have placed high priority upon both active and passive defence measures in Europe. The capability of the Royal Air Force in this context is, therefore, of immediate and topical interest. It is also vital to the security of our operational aircraft and to the viability of our front line squadrons as an effective force in war.

the royal air force solution

The Royal Air Force can regard with some satisfaction its efforts to come to terms with the demands of airfield defence over the years. It proved itself ahead of its time when, recognising that air base security was an essential element of air operations, it assumed responsibility for the defence of its own airfields and installations early in World War II. While demanding that all its personnel should be capable of bearing arms and defending themselves, it also recognised that to avoid too great a diversion of skilled tradesmen from their normal work, a nucleus of trained fighting men was essential. It foresaw, too, that every airfield would require a defence organisation effectively integrated within its normal command structure – and within which the training, organisation, and control of its airfield defence units must be adapted to meet air force requirements. Thus, it formed the Royal Air Force

AV-M Young won the Sword of Honour at Cranwell in 38, was shot down and badly wounded flying Hurricanes over France in 40, but flew Sunderlands later in WWII before commanding RAF Masirah and attending Staff College Haifa. Back in UK, after 3 years at AM, he became Wg Cdr Flying Hemswell and Wg Cdr Ops No 1 Gp. In 55, Gp Capt Young commanded Gaydon and 232 Valiant OCU before joining Bomber Cd as GC Ops. After ACOS (Int) at NATO, he attended IDC in 63 and became AOC of CRE in 64 before being appointed Commandant-General of the RAF Regiment in 1968.



Regiment as its own specialist airfield defence Corps on 1 February 1942.

the record

During the Second World War the Regiment grew to a strength of some 85,000 officers and men – and a front line of 240 Field and Light Anti-Aircraft squadrons – and earned its spurs in every operational theatre. Since the war it has been deployed wherever the RAF has been required to operate and, in this uneasy period of so-called peace, has been engaged in active operations or internal security duties in all the 'hot spots' round the world from Hong Kong to the West Indies – and including Palestine, Malaya, Cyprus, Suez, Borneo, Aden, The Gulf and Northern Ireland. Thus the Regiment has learned its trade in the hard school of experience. It has developed and refined its operating doctrine and procedures and has actively exercised its specific responsibilities for both ground and low level air defence over more than a quarter of a century. As a result, it is probably true to say that the Royal Air Force now has greater experience and expertise in these specialised and exacting tasks than any other air force in the world today.

It is also generally true, that the Royal Air Force has put this experience and expertise to good use in the postwar years and it can claim that, on the whole, it has heeded and applied the lessons of the past. Although the Regiment's strength has fluctuated with changing commitments and changing policies, it has until now, maintained generally adequate levels of ground and low level air defence for its operational airfields. However, one of the direct effects of the adoption of a nuclear based strategy in 1957, was a drastic pruning of the Regiment's size and, during this nuclear deterrent phase of our national defence policy, it has been maintained at force levels geared essentially to the requirements of contingency operations outside Europe. The change to a philosophy which accepts the possibility of conventional war in Europe has, therefore, necessitated a review of the Regiment's tasks and deployments – and, as a first step, has resulted in the recent return of Regiment units to RAF Germany.

the threat

In modern war, the threat which an enemy can pose to our airfields is a formidable one. The importance of air power to military success means that air bases and their supporting installations will be high on any targetting schedule, and the options open to the attacker have been multiplied and enhanced by modern developments in weapons and techniques. While the greater effectiveness of missiles, radar and interceptor aircraft have combined to make the upper airspace decidedly unhealthy, advances in navigational and terrain-following radar systems have made really low level attacks a viable and

attractive proposition. At the same time, the increasing size and complexity of airfields have made them more susceptible to attack by ground forces – whether by sabotage, guerrilla raids or the use of mortars or rockets from a distance.

Thus, as in the past, an adequate level of defence must be provided against two separate and distinct threats. The one is air attack at very low level employing cluster or lay-down weapons which combine maximum effect with minimum exposure to defensive fire. The other is the ground threat from airborne raiding parties, swift-moving mechanised groups, or specially-equipped teams able to carry out high-explosive bombardment without warning. Airfields and other RAF installations are particularly vulnerable and attractive targets for attacks such as these, and with the high cost – and therefore small numbers – of modern aircraft, it is more important than ever that we should not lose them before they have even become airborne.

the tasks and the tools

These then are the tasks for which the operational wings and squadrons of the RAF Regiment are provided – and they have been tailored for the job. Regiment field squadrons are roughly the size of independent infantry companies but have considerably greater fire power and mobility, and their extensive VHF radio communications enable them to be used with greater flexibility. Their purpose is to ensure that air operations may continue without interference from enemy ground forces – or the unnecessary diversion of station personnel from their primary duties. To this end, their principal task is to secure the approaches to the airfield up to and beyond enemy mortar and rocket range – a vast area which in Army terms equates to something like an infantry Brigade front. Should the situation escalate to one of full-scale deliberate defence, then the field squadrons provide the Station Commander with his mobile reserve, counter-attack force and heavy fire support.

Airfield defence against low level air attack is the job of the Regiment's LAA units, at present equipped with power-operated L40/70 Bofors guns, or with Tigercat surface-to-air missiles. The latter is the land-based version of the highly successful Short Seacat system, and has given the Regiment an effective and readily air-transportable low level air defence capability for a variety of contingencies. All the LAA units can, of course, be employed in the field role should the need arise.

the next decade

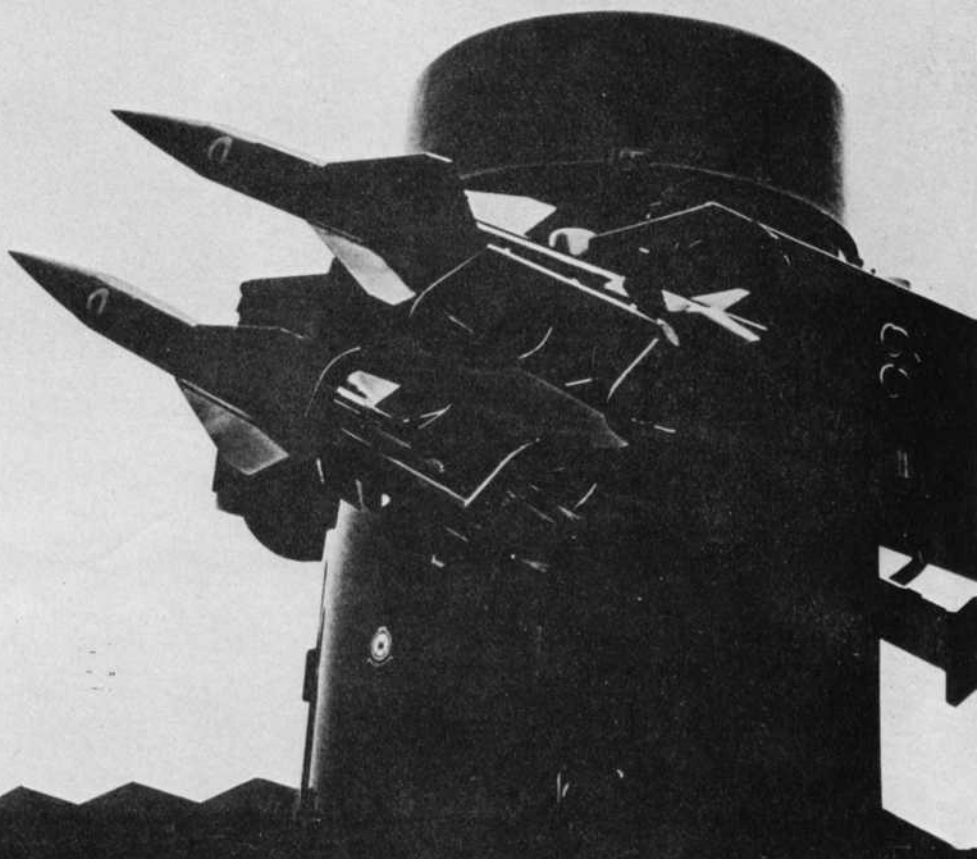
There are two main developments which will significantly affect the capability and the task of the RAF Regiment in the 1970s. The first is the planned re-equipment of its LAA units with the BAC Rapier low level air defence missile

Tigercat surface-to-air missiles in the Middle East



81 mm Mortar Detachment defending RAF Salalah

pass, friend, all's well



When this aircraft was no more than a spot in the sky, its credentials had been checked by Rapier's surveillance radar *and IFF*. Rapier is ceaselessly on the alert, ready to identify and act instantly against any raider, supersonic or subsonic.

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Firing an 81 mm mortar



Regiment personnel refuelling a Harrier during a rapid operational turn-round

system to replace its L40/70 guns. The second is the advent of Harrier, and the associated problems of its local defence in the field.

The impressive performance of Rapier ensures an effective defence against low level attack by the most advanced of modern aircraft – and one which could only be matched by a considerably greater number of guns. The deployment of such a lethal weapon in defence of our airfields will, however, also bring its own problems – particularly in the field of command and control. It will place even greater emphasis upon the need for its full and effective integration with the other elements of the air defence system – early warning radars, fighters and medium level SAM defences – and for the co-ordination of friendly aircraft movements with air defence procedures. The high degree of mutual confidence which already exists between Regiment units and flying squadrons when deployed together augurs well in this respect – but regular and frequent practice of co-ordinated procedures within the overall air defence environment will be vital.

The new approach to future tactical air operations necessitated by the introduction of Harrier also poses the problems of their local defence when dispersed to their forward operating sites. It is planned that small groups of these aircraft will operate from these dispersed sites in the STOL/VTOL mode, with a minimum of support – and that concealment will be their main protection against attack, particularly from the air. However, the fluid conditions of mobile warfare will inevitably increase the risk of ground attack by infiltrating

enemy forces and, as these Harrier sites will be Royal Air Force locations responsible for their own protection, Regiment field units will have to be earmarked for this task. To this end, Harrier and Regiment squadrons have already been collocated in anticipation of this need and are working together.

conclusion

Royal Air Force experience has confirmed the validity of its airfield defence concepts – and the wisdom of forming, in the RAF Regiment, its own specialised airfield defence units, tailored for the job and under full Royal Air Force command and control. This tool, forged in the heat of war and since tempered in a variety of operational situations around the world, has proved economical, effective and reliable – and has stood the test of time.

The Regiment now stands on the threshold of a new and challenging era. While national defence priorities and the implications of the philosophy of flexible response have greatly increased its task in Europe, it must continue to maintain units in the Near East and to undertake standing and contingency commitments elsewhere in the world. At the same time, the introduction of more advanced and costly aircraft means that the stakes are now higher and the penalties more severe than they have ever been. Thus the sum of the Regiment's tasks in the coming decade is formidable indeed – and its importance to the Royal Air Force's operational capability will be greater than ever before. ©



Harrier dispersal raises new defence problems

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