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SELECTED GLOSSARY

AHB	Air Historical Branch
AMWO	Air Ministry Weekly Order
AOC	Air Officer Commanding
BTF	Bomber Transport Flight
CAM ship	Catapult Armed Merchant ship
CDS	Chief of Defence Staff
CFE	Central Fighter Establishment
CGS	Chief of the General Staff
CIGS	Chief of the Imperial General Staff
ETPS	Empire Test Pilots School
FOB	Forward Operating Base
HDU	Hose Drum Unit
IAF	Interceptor Alert Force
IED	Improvised Explosive Device
JRUSI	Journal of the Royal United Services Institute;
JUSII	Journal of the United Services Institute of India
LRDU	Long-Range Development Unit
MiD	Mentioned in Despatches
NACA	National Advisory Committee for Aeronautics
NWFP	North West Frontier Province
OASC	Officer and Aircrew Selection Centre
PIRA	Provisional Irish Republican Army
RHAF	Royal Hellenic Air Force
QFI	Qualified Flying Instructor
SASO	Senior Air Staff Officer
SH	Support Helicopters
SHAPE	Supreme Headquarters Allied Powers in Europe
TDS	Training Depot Station
TNA	The National Archives

THE FIRST 100 YEARS – SELECTED MILESTONES

RAF MUSEUM, HENDON, 20 March 2018

WELCOME ADDRESS BY THE SOCIETY'S CHAIRMAN

Air Vice-Marshal Nigel Baldwin CB CBE–

Ladies & Gentlemen – good morning and welcome to our Society's attempt to mark the centenary of the Royal Air Force in an appropriate way. You will see from your programme that we've selected an eclectic range of subjects ranging from the earliest beginnings to more recent times.

Before I hand over to our Chairman for the day, our President Sir Richard Johns, let me give my usual thanks to Maggie Appleton and her colleagues here at the Museum for their welcome and great help. In a most busy year for them all, especially this spring, we take it as a privilege that they have been able to squeeze us in.

Our Chairman for the day, Sir Richard, hardly needs an introduction: an ex Chief of the Air Staff, Commander in Chief of Strike Command, Constable and Governor of Windsor Castle and the man who taught HRH Prince Charles to fly, he'll have no difficulty keeping us on track.

Sir Richard – you have control.

OPENING REMARKS BY THE CHAIRMAN

Air Chief Marshal Sir Richard Johns GCB CBE LVO FRAeS

Good morning ladies and gentlemen. It's a great pleasure to be here with you again.

In twelve days' time, at St Clement Danes Church, the Royal Air Force will celebrate and commemorate one hundred years of service to the nation. Service that, in wartime and in peacetime, has been illuminated by the deeds of great men whose names will resonate with every member of this Society. The good work of this Society, founded in 1986, will ensure that their accomplishments will not be forgotten and will continue to be studied to the benefit of the present and future Royal Air Force.

Very sadly, the recent death of Air Chief Marshal Sir Peter Squire adds another name to the exclusive register of those whose achievements of great distinction, in peace and at war, merit a permanent place in the records of this Society and, as your President, I will ensure that that is done. I am also able to announce that Sir Peter's memorial service will be held at St Clement Danes Church on 1 June. This was decided only yesterday, but there will shortly be a public announcement permitting those who wish to attend to apply for tickets.

Traditionally, the Society's seminars aim to explore, in detail, a specific theme in Royal Air Force history, leading to questions and discussion, all of which is recorded in its Journals. Thus far, its 85 publications have covered a lot of ground, that has included most, if not all, of the significant events in the Service's history that have merited a full day's examination. But – trying to cover one hundred years in just seven speaking slots cannot do justice to a century of achievement. The Committee decide, therefore, that this seminar would address representative historic milestones, broadly by decade – milestones that were, perhaps too narrow individually, to sustain a full day's study but which were, nevertheless, hugely important within the development of the Royal Air Force as a Service and its unique contribution to British air power doctrine. It was initially proposed that this seminar would be called 'Extending the Operational Environment' but, after discussion, and acknowledgement of the RAF's centenary and the composition of the programme, it was

decided to that it would be more appropriately entitled ‘The First Hundred Years – Selected Milestones’. So it is my pleasure today to welcome seven speakers who will address a specific milestone within their individual field of expertise and knowledge, beginning with the RAF’s current Director of Defence Studies, Gp Capt Jim Beldon.

THE CREATION OF THE RAF

Gp Capt Jim Beldon

Gp Capt Beldon was commissioned in 1997 and trained as a navigator. He has flown over 3,000 hours, mostly in the E-3D Sentry in support of operations in the Balkans, Iraq, Afghanistan and elsewhere, including a tour as OC 8 Sqn. Other appointments have involved posts at the MOD, in the Permanent Joint Headquarters and at the Joint Services Command and Staff College. He is currently the RAF's Director of Defence Studies.

Sir Richard, Sir Freddie, Air Marshals, Ladies and Gentlemen. A very good morning to you, and may I firstly express my sincere thanks to the Chairman and Executive Committee of the RAF Historical Society and, in particular, to Wing Commander Jeff Jefford and the Royal Air Force Museum for arranging today's RAF Centenary seminar. Naturally, I was enormously flattered to be asked to speak at the outset of such an impressive programme, during which you will be treated to a range of speakers who will be able to offer insights into various important milestones in the Service's history which will far exceed in interest and delivery my opening address. However, it is perhaps appropriate that as the RAF's Director of Defence Studies, and because of the dash of light blue that my uniform casts on the event, I should begin today's proceedings. And it is, indeed, a great honour to do so.

And where else to begin than at the beginning? Or, perhaps even more pertinently, *before* the beginning. I have been asked to speak about the creation of the Royal Air Force. And I am pleased to have been asked to speak about our wonderful Service's 'creation' rather than merely its 'formation', because the word 'creation' conveys an appropriate sense of innovation, imagination and vitality – indeed, of an entity that was conceived to *live* – whereas the rather utilitarian term 'formation' suggests a rather bureaucratic process of assembling disparate parts and putting them together somewhat functionally – as a machine might be. The RAF was indeed *created* as a daring idea – the idea that, even in its infancy, air power had the *enduring* potential

Left, General Jan Smuts and, right, Lt Gen Sir David Henderson.

(and, indeed, was required) to conduct offensive and defensive operations that were independent of the ties that had hitherto bound air power to the RFC's and RNAS's parent Services' parochial – albeit vital – spheres of operation.

Through the Zeppelin and Gotha raids on England, the German *Luftstreitskräfte* had demonstrated the potential for independent air operations for strategic effect, and it is well known, of course, that the commissioning of General Jan Smuts and his reports of summer 1917, which were so influential in the story of the RAF's creation, resulted largely from the clamour to find a way of neutralising the threat posed by German bombers, which had shaken public confidence and morale and provoked a political crisis.

It was not lost on Smuts (or, just as importantly, his seconded expert witness, Lt Gen Sir David Henderson) that we could also do to them what they had been doing to us. Moreover, the potential of such operations provided the clinching rationale for an independent air service. And not only did the motive exist, but, so Smuts believed, the means were also in the process of being realised, without adversely

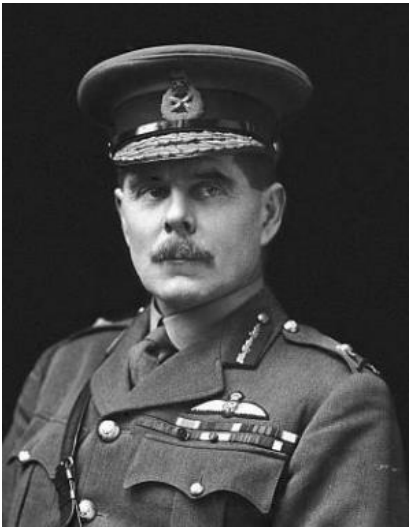
affecting air support to land and maritime operations. According to his analysis:

> 'Next spring and summer the position will be that the Army and Navy will have all the Air Service required in connection with their operations; and over and above that there will be a great surplus available for independent operations. Who is to look after and direct the activities of this available surplus? Neither the Army nor the Navy is especially competent to do so; and for that reason the creation of an Air Staff for planning and directing independent air operations will soon be pressing.'

In advocating for the initiation, effectively, of a new 'air-battle front' in the skies over Germany aimed at the destruction of the enemy's industrial centres and the dislocation of its lines of communication from the air above Germany, Smuts warned that 'The enemy is no doubt making vast plans to deal with us in London if we do not succeed in beating him in the air and carrying the war into the heart of his country.' And so the seed of strategic bombing, which would become the core *raison d'être* of the Royal Air Force for much of its existence, was sown, and with it the notion that air operations might not only be independent, but *strategically decisive* too.

The rationale for creating an independent Air Service had been persuasively laid out by Lt Gen David Henderson in July 1917 and, despite its obvious agenda to promote the creation of an independent air service, Henderson's staff work was sufficiently moderate, balanced and absent of inflammatory zealotry, that it succeeded in persuading policymakers (helped by the Gotha raids) that an independent air force was not only desirable, but inevitable. The principal point of moderation in his argument had been on the issue of timing.

And here it is perhaps necessary to switch from the imaginative term 'creation' to the rather more prosaic term 'formation'. Henderson had accepted that the practicalities of forming an independent air service would reduce – temporarily – the efficiency of the fighting air services, and that the judgement of whether to proceed with the amalgamation of the RFC and RNAS would need to be based on the Government's assessment of how long the war would last. Henderson posited that if it considered that the war would end around the turn of



Left, Maj Gen Trenchard and, right, Field Marshal Sir Douglas Haig.

the year, it would be most efficient to wait to form an independent air force until after the cessation of hostilities; on the other hand, if it was considered that the war would endure until June 1918, then any temporary loss of efficiency caused by the creation of a new service would be outweighed by the relentless gains that would be achieved in terms of organisation, equipment and procurement.

The question of efficiency was one that exercised the field commanders too – not least Field Marshal Sir Douglas Haig. Despite categorical evidence of Haig's and Trenchard's close professional relationship, Haig has often been dubbed as antagonistic towards air power, not least owing to Sir Frederick Sykes' un-corroborated recollection that Haig had stated in 1914 that the idea of using aeroplanes for reconnaissance in war was foolish and that cavalry would remain supreme for such purposes. But Haig was the man in the hot seat and, unsurprisingly, saw the threat to the efficiency of the delivery of air support to his command as being of critical importance, setting out in a letter to the CIGS in September 1917 that his concerns were limited to the successful conclusion of the present war, and that future considerations would need to wait until after *victory* – a conclusion which, incidentally, seemed not to be in doubt in Haig's

correspondence, although the failure of the Allies' 1917 offensives and Russia's subsequent withdrawal from the war following the October revolution, must soon afterwards have cast doubt on his optimism. Military pragmatism underpinned Haig's assessment which, in contrast to his alleged lack of air-mindedness, seems to my appreciation as highly conversant with the practicalities of air operations – one wonders how close to the pen Trenchard had been? Haig's attachment to air support for land operations was matched by his aversion to the use of air power as a strategic method of attack, based partly on pragmatic operational factors such as weather, payload and, significantly, the long transits over enemy-occupied territory that our own bombers would need to endure – factors that were, incidentally, to play so strongly against the RAF during its bomber offensive in the Second World War. Interestingly – and perhaps surprisingly, given his reputation for sending hundreds of thousands of men to their slaughter – Haig also opposed the strategic use of air power on grounds of morality and public opinion.

But, above all, Haig opposed the creation of an independent air service on the basis that air support would no longer be subordinate to his command.

According to Haig's analysis, it would be 'contrary to all experience' that the relationship between 'attached' air units and the Army commander could 'ever be quite the same as if these units belonged to the Army,' and that they should look 'to the other arms as their comrades, and the Army authorities as their true masters and the ultimate judges on whom their prospects depend.'

Trenchard, the father of the Royal Air Force, went further, stating that the establishment of a separate air force would be 'the successful culmination of a German plot aimed at dislocating the RFC in the field'.

Despite Haig's and Trenchard's misgivings, the logical desirability of creating a unified air service capable of conducting independent operations was largely agreed – not least because the creation of an independent air force was seen by many in Government as being the only obstacle preventing widespread popular insurrection. But the practical obstacles to its formation were formidable – the RFC and RNAS lacked all of the higher-level staff, logistical and procurement competences needed, or even to discharge the disciplinary functions

required of a new service. An Air Ministry would have to be formed; a general service staff would be required; technical, infrastructure, armament and financial functions would need to be developed too – and none of this was easy in a war of national survival where men, resources and staff horsepower were already desperately stretched. But despite these crippling impediments, the supreme need for strategic efficiency outweighed the immediate tactical efficiency deficit that was predicted for the RFC in France, and the path for the RAF's formation was laid, marked by the subsequent passing of the Royal Assent in November 1917, the convening of the first Air Council on 3 January 1918, and the RAF's birth three months later.

I will conclude by observing that not only did the nascent Royal Air Force overcome the obstacles ranged against its formation, but the loss of efficiency which had been predicted by even its most ardent supporters, failed to materialise. This was just as well, because by the time the RAF was born on 1 April 1918, the war hung in the balance, with the Germans' long-anticipated but grossly underestimated spring offensive, which aimed to bring the war to a swift and decisive conclusion before American might could be brought to bear, had yet to reach its high watermark. If Haig was concerned about the diversion of air resources away from the land battle, the Royal Air Force was immediately to prove him wrong: on 12 April 1918 – eleven days after its formation – the Royal Air Force was to fly more missions and drop more bombs on the enemy than on any other day of the war. The ability of the RAF to integrate with its sister Services as well as securing what Smuts had described as 'Air Supremacy' and independent offensive air operations had been confirmed, and with it the final push for victory later that year.

THE TRAINING OF PILOTS IN THE ROYAL FLYING CORPS/ROYAL AIR FORCE 1912-18

by Wg Cdr Jeff Jefford

'Jeff' joined the RAF in 1959 as a pilot but (was) soon remustered as a navigator. He flew in Canberras and Vulcans with Nos 45, 83 and 50 Sqns and as an instructor at No 6 FTS and filled sundry administrative and air staff posts at Manby, Gatow, Brampton and High Wycombe. He took early retirement in 1991 to read history at London University. He has three books to his credit, has been a member of the Society's Executive Committee since 1998 and has edited its Journal since 2000.

We should probably start by clarifying the significance of the Royal Aero Club (RAeC) Certificate and debunking some of the myths associated with it – and the £75 that it cost. The RAeC was the institution authorised to licence *all* pilots in the UK, civil and military, and from as early as 1910 it began to issue an appropriate 'ticket'. A variety of commercial schools soon began to offer suitable courses. A typical early contract involved flying instruction for £40 with an optional £35 surcharge to cover the cost of repairing any aeroplanes damaged by the pupil (of which £25 was refundable if no claims were made). But, as early as August 1911, still in the days of the short-lived Air Battalion of the Royal Engineers, the Government had authorised a payment of £75 to:

> '. . . an officer who has been selected by the military authorities as suitable for Army aviation work and has obtained an aeroplane pilot's certificate at his own expense [*and after*] he has completed satisfactorily [*a*] six months' probationary course.'[1]

The establishment of the Air Battalion had actually allowed for only fourteen officers,[2] but from then on the standard fee asked by all schools became £75 – for all comers. That was a considerable sum – about £6,000 in today's money – which led the writer of one recently published PhD thesis to conclude that the significant cost restricted entry into the RFC to those who could afford to pay, implying that all

RFC pilots were ‘toffs’. That simply was not the case.

At this stage, the ‘at his own expense’ clause was actually unnecessary, as it was the only way you *could* learn to fly in 1911. On the other hand, the ‘six months’ course’ was a significant constraint, as the first one didn’t actually start until as late as April 1912. In November 1911, therefore, the regulations were revised to read:

> ‘An officer selected for Army aviation work will be paid under instructions from the War Office a reward of £75 if he is in possession of a pilot’s certificate, or after he has obtained one.’[3]

Note that the ‘must have done the course’ clause had disappeared, so an Air Battalion pilot could now claim a refund of his £75 as soon as he had his ticket. In April 1912, in the run-up to the creation of the Royal Flying Corps (RFC), the regulations were revised yet again and they now read: ‘An officer […] who has obtained, or who subsequently obtains, the certificate of the Royal Aero Club, at his own expense’ will be able to reclaim his £75 when he is selected for the RFC.’[4]

But by this time the ‘at his own expense’ clause was very significant, because the military was about to begin training *ab initio* students itself at the Central Flying School (CFS) – which implied that some folk might not have to pay. The first man to qualify under the auspices of the CFS was Cpl Frank Ridd who gained his RAeC Certificate at Larkhill as early as June 1912. Only three more RFC men took their tests at Larkhill, all subsequent training being conducted at Upavon where eleven more certificates had been gained by the end of the year with a lot more in 1913. All of these men had been trained by the CFS at public expense, ie at no cost to the individual. So, while some folk did continue to acquire an RAeC ‘ticket’ privately, prior possession, and the outlay of £75, had clearly never been an *essential* precondition for joining the RFC. After all, at 4 shillings a day, which was only £73 a year, it would have taken Cpl Ridd, more than twelve months to save £75 – and that assumes that he spent absolutely nothing on anything else.

Regardless of how he gained his RAeC ticket, from as early as October 1911 it had always been intended that a military plot would then attend a course of ‘instruction in those branches of aviation which are of special value for military purposes.’[5] But 1911 was very early

The CFS flight line at Upavon in 1914, two Shorthorns, a Longhorn and three BE2s.

days, so this was more of a declaration of intent rather than an attempt to summarise a syllabus. In the event, the first military aviation course did not begin until April 1912 at South Farnborough, just a month before British military aviation was upgraded from Battalion to Corps status with the creation of the RFC in May.[4] Part of the new establishment was the Central Flying School which soon began to impose some structure on training.

The original, ex-Air Battalion Course ran on until August when it was succeeded by Upavon's No 1 CFS Course which ran from August to December 1912. There are twenty students in the initial course photograph, but four more had joined by the time that they graduated.

Folk who already had an RAeC Certificate were simply checked out by doing a few straights and circuits. Those who lacked the certificate – there were five of them – did the same with an instructor until they went solo and eventually acquired their tickets at Upavon. By this means fifty-three certificates were gained at the CFS during 1913. In addition to having acquired his obligatory RAeC Certificate, on completing the CFS course, a pilot was also awarded his RFC Flying (later Graduation) Certificate – his *brevet.*[6] The early training sequence is summarised in the top line of Figure 1.

The CFS Course included a good deal of practical experience in the workshops, about 50 hours of formal classroom time and, of course, examinations. To begin with the school was short of aeroplanes and feeling its way but by mid-1913 a formal syllabus, covering the theory of flight, map reading, strength of materials, military and naval history, practical work on Gnome and Renault engines and the rigging and repair of airframes, had been published.[7]

At the same time, 1913, the school had also spelled out the tests

1913	Civil school or CFS	CFS		
1914	Reserve Aeroplane Squadron	CFS or Service Squadron		
1915	Cadet Btn	Reserve Aeroplane Squadron	CFS or Service Squadron	
1916	Cadet Wg	RFC School of Instruction	Reserve Squadron	CFS or Service Squadron
1917	Cadet Bde	School of Military Aeronautics	Training Squadron	CFS or Service Squadron
1918	Cadet Bde	School of Aeronautics	Training Depot Stations replace Training and Service Squadrons	

Fig 1. Generalised illustration of the evolution of the training sequence 1913-18.

A Maurice Farman S.7 Longhorn (498) – typical of the aeroplanes on which RFC pilots first soloed until 1917.

that were to be passed. While it was relatively easy to lay down the standards that had to be demonstrated in the context of academic and technical issues, it was less easy to be specific in terms of practical aviation. Indeed, there was relatively little in the way of formal instruction, because no one really knew enough about flying to 'teach' anyone else. So it was largely a question of flying as often as you could and learning from your own mistakes. Under the circumstances, the requirements were – had to be – pretty broad brush, as in a pilot having to have logged 'an adequate' number of flying hours. During that time, he had to have demonstrated that he had a reasonable chance of pulling off a forced landing in the, quite likely, event of engine failure by gliding down deadstick from at least 1,000 feet. But that was the only specified proviso.

The report on No 1 Course does not provide any details of flying hours but the students on No 2 Course averaged a little over 10 hours each, rising to 18 on No 3 Cse and by the time that No 4 Cse graduated at the end of 1913, its students had logged an average of 21½ hours. The course in residence in August 1914, No 6, was interrupted by the declaration of war when many of Upavon's aeroplanes and pilots were promptly shipped off to France but by that time its students had already averaged more than 27 hours,[8] not far short of what would become par for the course for the next three years – about 30 hours.

The declaration of war had created an immediate, and urgent,

demand for additional pilots and it was clear that the CFS alone would be unable to cope. To provide extra training capacity, additional facilities were established at Netheravon, Farnborough and Brooklands and by January 1915 these units had been designated as numbered Reserve Aeroplane Squadrons (RAS). They were all intended to function as elementary flying schools, providing about 10 hours, typically on Maurice Farmans, including the acquisition of the RAeC Certificate, and all of the associated theoretical and technical ground instruction, before passing their students on to the CFS to complete the course.

But the numbers being inducted into the expanding system meant that it soon became impossible for all prospective pilots to complete even the final stage of the course at the CFS, as had originally been intended. To accommodate the surplus, as early as January 1915, Service Squadrons, that were still working-up to operational readiness prior to crossing the Channel, began to be co-opted to provide additional facilities for instruction in what became known as 'higher aviation'. This stage is represented by the second line of Figure 1.

While acting as a *de facto* flying school, the number of pilots on the strength of a Service Squadron gradually increased until it was significantly above establishment. At this point the surplus was detached to form the nucleus of a completely new unit, another prospective Service Squadron, leaving its parent free to mobilise and proceed overseas. The cycle then repeated itself, and it did so for the next two years, some quite lengthy genealogies being established.[9]

Unfortunately, the use, really the misuse, of Service Squadrons to provide additional flying training capacity was a compromise. The limitations which it might impose were recognised but it was considered that these would have to be accepted. The problem, which had certainly been foreseen, was that imposing a training commitment on units which were supposed to be preparing for active service just might overload them. Nevertheless, while these squadrons were still supposed to practise operational techniques, it was ruled that, where conflict arose,

> 'Training with artillery, and other similar duties, and the training of observers will be cut down to the lowest minimum possible.'[10]

Incidentally, although rapidly-increasing numbers of pilots were now gaining their 'wings' remotely, as distinct from *at* the CFS, all RFC Graduation Certificates continued to be signed, personally, by the Commandant.

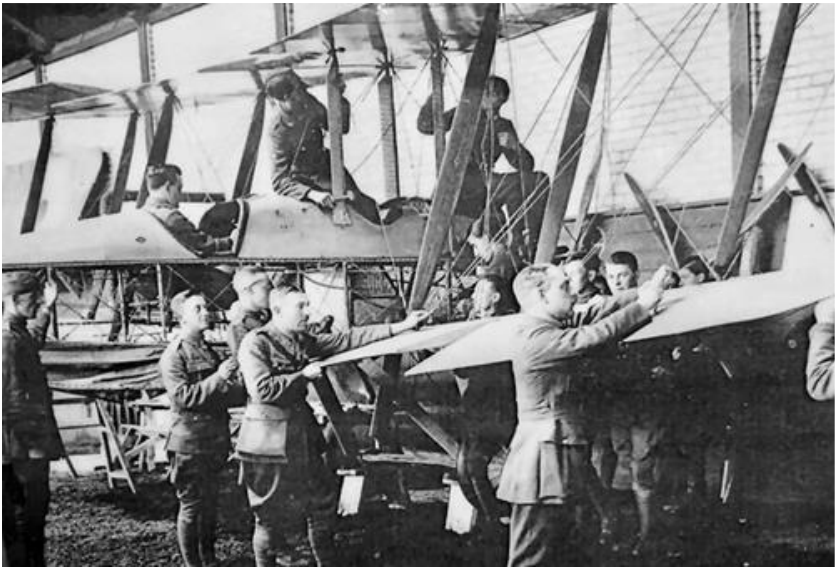
Another significant change implemented in 1915 (see Figure 1) was the establishment of Cadet Battalions to undertake the basic military training of direct entrant potential officers, and the commissioning of RFC NCOs and other ranks.

While this approach served to sustain a flow of new pilots, it became increasingly difficult to maintain a satisfactory balance between quantity and quality. The problem grew worse as the war progressed because the introduction of increasingly sophisticated aeroplanes, equipment and techniques meant that the amount that a new pilot needed to assimilate grew inexorably. Furthermore, while some of the flying instructors were *relatively* experienced pilots – at this stage very few pilots would have logged more than a couple of hundred flying hours – others, having only recently gained their 'wings' themselves, had been, not so much 'creamed-off' as, press-ganged into becoming first-tourist instructors. This was tantamount to the blind leading the blind. As Robert Smith-Barry would put it, the flying instructors of 1916 were those pilots who:

> '. . . were resting, those who were preparing to go overseas and those who had shown themselves to be useless for anything else.'[11]

The inevitable result was that the competence of most newly graduated pilots failed to meet the standards which were (should have been) required. This is not to say that the RFC had no capable pilots. It had, but they were either naturally gifted or lucky enough to have survived unscathed for long enough to have accumulated a worthwhile amount of experience.

By January 1916, there were seventeen RASs and their designations were shortened to Reserve Squadrons. Towards the end of the year – in October – the Cadet Battalions were also redesignated to become Cadet Wings. But the system needed a lot more than mere re-branding, because the War Office was receiving 'serious complaints' from Maj-Gen Trenchard in France 'concerning the insufficient training of some of the replacement pilots being sent out



Prospective pilots working on a BE2 instructional airframe at No 1 School of Instruction at Reading.

as reinforcements.'[12]

By this time a major initiative had already been implemented with the aim of improving training. RFC Schools of Instruction had been established at Reading and Oxford and from early 1916 these began to make a significant contribution by providing a comprehensive, but entirely ground-based, foundation course in aviation theory and technology.

Early in 1916, even before Trenchard's 'serious complaints', thought was being given to redefining the standard of airborne competence required for graduation. Among the interested parties who were consulted was the incumbent Commandant CFS, Lt Col Charles Burke. He expressed particular concern over two issues. First, while accepting that the proposed 15 hours solo might be an adequate minimum, he was firmly of the opinion that 'another 50' would be needed before a pilot could be considered competent, and secondly, he was concerned at the inadequacy of flying training, in that instructors were 'given no information as to the best way to obtain the required results.' Replying from the War Office, Sefton Brancker

John Salmond as a captain at the CFS in 1913. By 1916 he was a brigadier overseeing RFC training; a year later he was still doing it, but as a major-general.

acknowledged that, while an additional 50 hours was clearly desirable, it was simply out of the question at the time, as the system was barely keeping up with demand. As to advising flying instructors, Brancker agreed that something needed to be done, but what? – because he 'had never yet met two people who agreed closely on this subject.'[13]

Nevertheless, in an effort to improve the effectiveness of flying training, Lt-Col John Salmond was recalled from France in February 1916, promoted to brigadier and given overall responsibility for its conduct. One of the earliest indications of more positive control being exercised was a clear restatement of what was required to qualify as a pilot. From March he had to have:

a. flown solo for a minimum of 15 hours;
b. flown a service (as distinct from a training) aeroplane 'satisfactorily';
c. made a cross-country flight of at least 60 miles, making two landings en route;
d. climbed to 6,000 feet and remained there for at least 15 minutes before descending to land, touching down with his engine switched off, within a circle of 50 yards diameter; and
e. landed twice in the dark with the assistance of flares, although this requirement could be waived if delays would have been incurred by waiting for suitable conditions.

With hindsight, it is plain that this remarkably short list defined no more than a minimum standard. At the time, however, it was presented as a '*raising* of the standard of the graduation test' (*my italics*).[14] Clearly, quantity was still taking priority over quality, as evidenced by the fact that the graduation standard omitted any

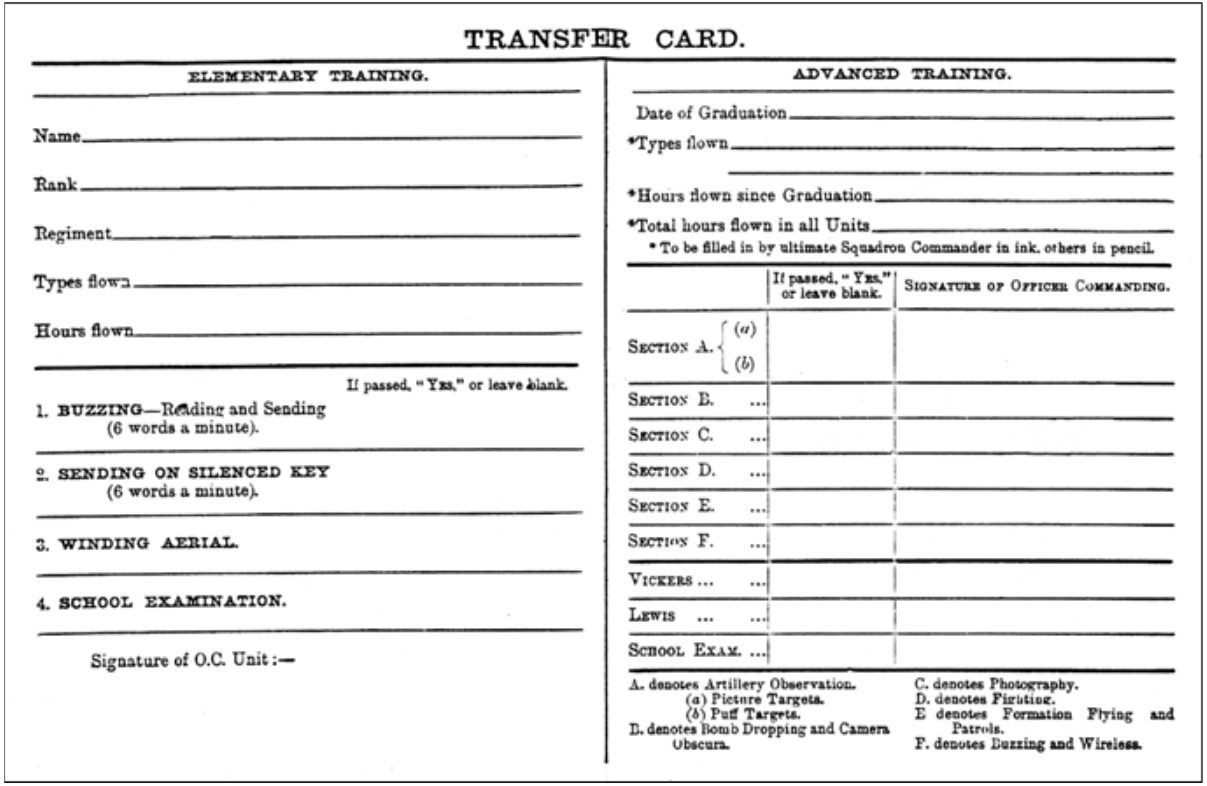
reference to combat manoeuvring, indeed of manoeuvring of *any* kind. Similarly, formation flying and practical experience of bombing, gunnery, photography and the use of wireless were all regarded as non-essential. Students were encouraged to indulge in such activities if time permitted but, all too often, it didn't.

At much the same time as the graduation standard was being 'raised', two academic qualification certificates were introduced to cover theoretical and practical tests on the ground, but by the summer all prospective pilots were now passing through one of the schools at Reading or Oxford. In June, therefore, the two tests were combined into a single certificate which had to be obtained before commencing practical flying training.[15] The training sequence in 1916 is represented in the fourth line of Figure 1.

By this time the level of skill required to fly the latest aeroplanes had made the very basic standard represented by the pre-war RAeC Certificate increasingly irrelevant and in August 1916 the Club waived its test for service pilots, although it would still issue its ticket to anyone who applied for one if he had previously been certified by the military.

The measures which had been introduced thus far were all worthwhile, but they had not addressed the fundamental problem. The training system was still failing to keep pace with the demands of front-line service, indeed the gap was becoming progressively wider. The first attempts to redress this deficiency were also made in 1916. For instance, in May, practical wireless work began to be introduced in Reserve Squadrons[16] followed, in August, by an increased focus on gunnery, including the introduction of ·22 firing ranges and the use of camera guns as these gradually became available.[17] These changes were given additional substance by the introduction of a personal Training Transfer Card that accompanied a student through the system and recorded his progress.

As previously noted, since mid-1916 qualification as a pilot had required the acquisition of a certificate from Reading or Oxford covering the theory of flight, RFC organisation, artillery co-operation procedures, etc and practical tests, involving aero-engines, airframe rigging, Morse and machine guns. This academic introduction was followed by flying instruction, to include at least 15 hours solo and *ideally* some experience of gunnery, bombing and photography.



TRANSFER CARD.

ELEMENTARY TRAINING.

Name_____

Rank_____

Regiment_____

Types flown_____

Hours flown_____

If passed, "YES." or leave blank.

1. **BUZZING**—Reading and Sending (6 words a minute).

2. **SENDING ON SILENCED KEY** (6 words a minute).

3. **WINDING AERIAL.**

4. **SCHOOL EXAMINATION.**

Signature of O.C. Unit :—

ADVANCED TRAINING.

Date of Graduation_____

*Types flown_____

*Hours flown since Graduation_____

*Total hours flown in all Units_____

* To be filled in by ultimate Squadron Commander in ink, others in pencil.

	If passed, "YES." or leave blank.	SIGNATURE OF OFFICER COMMANDING.
SECTION A. (a) (b)		
SECTION B. ...		
SECTION C. ...		
SECTION D. ...		
SECTION E. ...		
SECTION F. ...		
VICKERS		
LEWIS		
SCHOOL EXAM. ...		

A. denotes Artillery Observation.
(a) Picture Targets.
(b) Puff Targets.
B. denotes Bomb Dropping and Camera Obscura.
C. denotes Photography.
D. denotes Fighting.
E denotes Formation Flying and Patrols.
F. denotes Buzzing and Wireless.

The RFC Training Transfer Card as first introduced in November 1916.

But in December, all of the recent innovations were underpinned by the publication of a substantially expanded syllabus.[18] This revised the content of the practical flying tests, laid down the level of expertise that pupils now had to be able to demonstrate in the fields of bombing, gunnery, photography and signals, as appropriate to their role – so what had previously been desirable now became mandatory – and raised the minimum number of solo hours from 15 to 20, with further solo time 'on type' for pilots destined to fly certain nominated aeroplanes.[19]

Commanding Officers were now required to state, on the new Training Transfer Cards, how many hours a student had flown and to certify that he had completed all of the required exercises. This was actually the most valuable function of the card, because it made it more difficult for the COs of training units to short-change students. Before its introduction, there had been several documented cases of young pilots being sent to France in late 1915-early 1916, certified as being competent to fly a BE2c without their having actually ever flown one and/or with as few as 22 hours *total* flying time.[20]

But, despite the introduction of the Transfer Card and its embedded certificates, in September 1917, almost a year later, OC 22 Sqn was complaining that he was still being sent pilots who had never flown in formation or done any practical gunnery[21] and as late as February 1918, at least one Bristol Fighter pilot was sent to France without ever having flown with a passenger, let alone a trained observer or gunner.[22]

For the first few months following the introduction of the December 1916 syllabus the necessary facilities were not universally available, of course, and this and other circumstances, notably the heavy losses sustained in April 1917, meant that short cuts often had to be taken, including shortfalls in flying hours and as late as the autumn of that year some pilots were still being sent to France with less, or only marginally more than, the mandatory 30 hours flying time.[23]

Concerned at the incompetence of some of the replacement pilots he was being sent while commanding No 60 Sqn in the autumn of 1916, Maj Robert Smith-Barry had analysed their failings and concluded that the majority of new pilots:

Captain Robert Smith-Barry, as a Flight Commander on No 60 Sqn before taking over as CO in July 1916.

> '. . . have learnt only so much of airmanship as is necessary to leave the ground, and frequently to land, without doing damage to their machine.'[24]

That 'frequently' says it all really. Clearly this was grossly inadequate, and Smith-Barry advocated the creation of an appropriate 'inst ructional squadron' to teach pupils how to manoeuvre an aeroplane in combat.

He went on to develop a training philosophy which may be summed up as the use of aeroplanes with appropriate handling qualities *and* fitted with dual control *and* a comprehensive syllabus to be taught by experienced pilots who had themselves *first* been taught to *understand* what they were teaching.[25] While the need for such an approach may seem self-evident today, it was a revolutionary idea at the time. It was decided to allow Smith-Barry to test his theories and he was posted home to command No 1 Reserve Squadron at Gosport where he was to put his ideas into practice.

Smith-Barry promptly dispensed with many of the aeroplanes that he inherited, notably the docile old Farmans, soon to be followed by the obsolete BE2s and Moranes. By May the flying element of his course involved about ten hours (dual and solo combined) on an Avro 504, two more on a Sopwith 1½ Strutter, modified to have dual controls in the rear cockpit, and about five on a Bristol Scout. Interestingly, Smith-Barry had not found it necessary to add a great deal of flying time. Quantity was important, of course, but what really counted was quality.

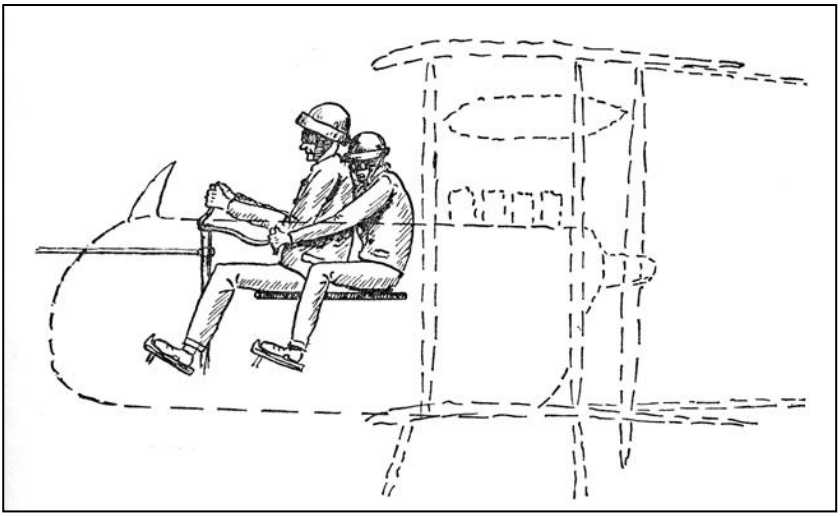
By this time Smith-Barry was confident that his approach worked and he explained his thinking in a pamphlet that was published in May of 1917.[26] The foundation of his concept was the use of the relatively high-performance Avro 504J because it was a reasonable approximation of the sort of aeroplane that his pupils would soon be flying in

An Avro 504J.

France. Its 100 hp rotary engine meant that they had, from the outset, to learn to cope with the gyroscopic effect of the large rotating mass of the engine and propeller so that they would anticipate and correct any tendency to swing on take off or to drop a wing. The Avro's narrow undercarriage was another comparatively demanding characteristic.

The basis of the course involved dual *and* solo flying on the Avro – and that in itself was an innovation. In the past, once a student had gone solo he was more or less left to his own devices to practise his mistakes. Under the new regime he would fly with his instructor relatively frequently so that his mistakes could be detected and corrected, and he could be shown the full range of aerobatic manoeuvres.

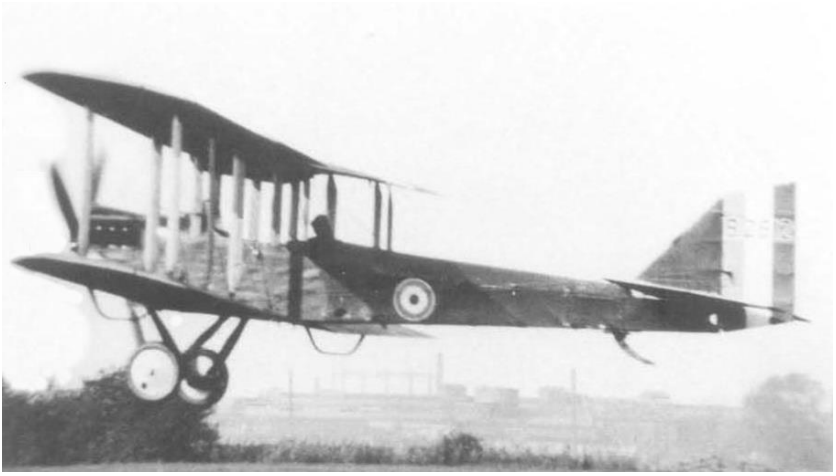
Not least among these was spin recovery. In 1916 the spin was still regarded with considerable trepidation by many pilots who considered that the best method of spin recovery was not to get into one. But Smith-Barry believed that a pilot had to be the master of his machine – not scared of it and, under his direction, by mid-1917 spinning would have become a routine training exercise.[27] Indeed, his pupils were encouraged to throw their aeroplanes about so that they would get into unusual positions, because, having been taught the effects of the controls and had them demonstrated, they would (should) be able to recover the situation. If they were overly reluctant to do this, they were likely to be suspended from training – and that was yet another innovation.



An impression of dual-control, 1916-style in a Shorthorn – from Stanley Vincent's Flying Fever.[28]

Under the current system, a trainee was generally allowed to continue flying until he made (what passed for) the grade or killed himself. That was more or less inevitable because the very limited amount of dual instruction meant that there had been no structured way to assess a pilot's post-solo level of competence. Smith-Barry's insistence that an instructor should continue to fly with his students regularly, provided the continuity required to permit progress to be monitored and, if a pilot failed to achieve a satisfactory standard, he would be suspended. By May Smith Barry was advising that it would be wise to anticipate an overall washout rate of at least 50% and he stressed that it was essential to play hard ball. Persevering with a no-hoper was unfair to the squadrons in France and clearly did no favours for the individual.

As to technique, earlier practice had often involved the instructor flying the aeroplane, typically a Farman, with the pupil clinging on as best he could in close-coupled tandem and reaching around him in the hope of getting a feel for the controls. Smith-Barry's system was predicated on the use of a dedicated two-seat trainer, the Avro 504 (although the DH 6 was also widely used until sufficient Avros could be produced) with the student invariably occupying the driver's seat,



A DH 6 being flown solo – from the back seat.

ie the rear cockpit, because it was from there that the lightly built – and balanced – aeroplane was always flown solo. Putting him in the back meant that he would not have to change seats before his first solo and that his perspective on his environment would not change at this critical juncture.

Apart from hand signals, the only way that an instructor could communicate was by throttling the engine and shouting. First used in June 1917, the solution was the 'Gosport tube'. It functioned rather like a stethoscope with a mouthpiece connected, via a 'voicepipe', to earphones in the flying helmet of the occupant of the other cockpit.

Finally, if a pupil crashed his aeroplane it was deemed to be the Flight Commander's responsibility. He did not necessarily have to take the blame, of course, but he might need to be able to show that when one of his charges broke an aeroplane it was through a misjudgement or a degree of incompetence considered to be acceptable for his stage of training. What would be less easy to explain away would be ignorance (why had he not been taught about the problem?) or a fundamental lack of ability (why had he not been suspended?).

Meanwhile, as early as February 1917, the War Office had begun to consider reorganising and expanding the pilot training system by introducing much larger Training Depot Stations (TDS), each of

which would be the equivalent of three Training Squadrons. In July authority was granted for the formation of the first seven TDSs, which were created by moving three of the existing Training Squadrons to a fourth location where they lost their original identities.[29] Some TDSs were to be dedicated elementary schools, initially equipped with DH 6s, while others were to provide training in 'higher aviation' – in the context of a specific role. All seven of the new TDSs had materialised by the turn of the year but most were not yet fully functional and by the end of January 1918 they had, between them, managed to produce only 33 pilots.

These new schools needed to be provided with competent staffs so, having convincingly demonstrated that his methods worked, Smith-Barry's next task was to produce the necessary flying instructors. In August 1917, his No 1 Training Squadron had been significantly expanded to become the School of Special Flying, with its first course being run in September. Ostensibly another TDS, the school's internal organisation was adapted to provide a HQ and six flights, five of which trained instructors while, in order to further refine procedures and techniques, the sixth continued, for a while at least, to train *ab initio* students.

The training sequence reflecting the changes introduced in 1917 is illustrated at Figure 1. These may look like more re-brandings, but they also represented a considerable expansion. For instance, by the time that the Reserve Squadrons became Training Squadrons in May 1917 there were sixty of them with more in Egypt and Canada and the original two Schools of Instruction would eventually become seven Schools of Aeronautics, with another in Egypt and a ninth in Canada. Similarly, the numbers of cadets at Hastings, was now so large that the organisation had expanded to become a brigade; there were more than 18,000 cadets in the system when the war ended.

In the meantime, in September/October 1917, the CFS had begun to run fifteen students through an experimental bespoke 'all-through' course of about five months' duration. The last of them graduated in March 1918 by which time they had, on average, logged 66 flying hours – 31 on Avro 504s, of which 8 had been dual, and 35 on service types (unspecified, but the CFS specialised in single-seat fighters).[30] Apart from the additional flying time, and the consequent inevitable improvement in the quality of the product, an all-through system was

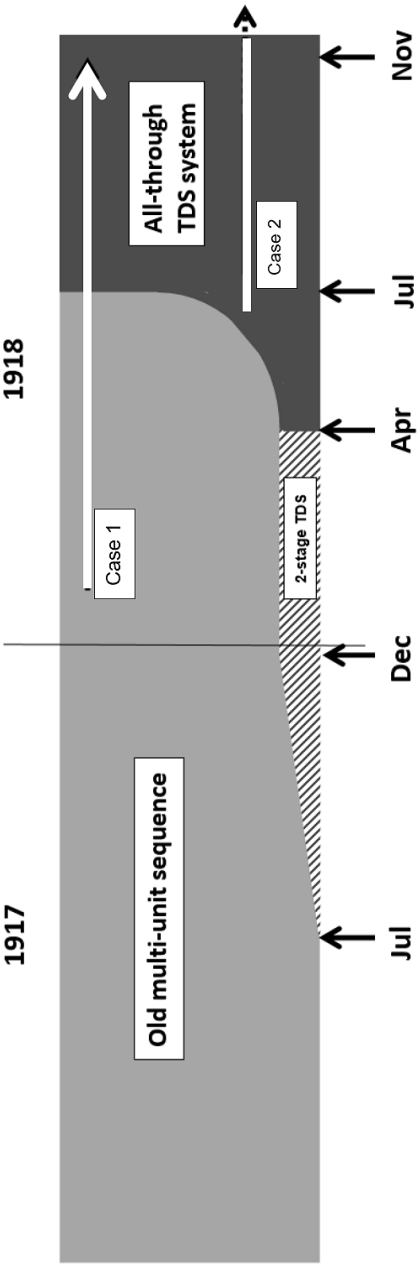


Fig 2. The transition from a multi-unit staged training sequence to a single-unit all-through system.

seen to be more efficient, easier to manage and (although this argument does not appear to have been made at the time) economic in terms of manpower – the establishment of a 24-aircraft Training Squadron was about 330 personnel, so three of them would require close to 1,000 whereas a 72-aircraft TDS required only 850 or so.[31] It was decided, therefore, to restructure the entire training machine on an all-through basis, and in short order.

Beginning in April, and ending with a rush in July (see Figure 2), all of the remaining Training Squadrons were combined to form new TDSs each of which now specialised in a particular operational role but now included an integral elementary stage – so this was 'all-through' training. There were 72 TDSs by the time of the Armistice, of which five were in Egypt and two in France. In the process, most (but not quite all) of the pre-mobilisation Service Squadrons that had

been used for advanced training ever since 1915, had been disbanded, in many cases by absorbing their resources into a TDS.

Based on the principles established at Gosport, very clear guidance had been published for the benefit of the instructors who would implement the new system – in effect, everything they needed to know to function as a QFI.[32] It will be recalled that the RFC had introduced a two-page Training Transfer Card back in 1916. The detail had been refined from time to time since then to reflect changes in the system, but it was still just a single sheet of foolscap folded in half until late-1917 when it began to acquire a few extra pages.

As soon as it was created as a separate service, in order to reflect the new and more complex all-through training sequence, the RAF replaced the RFC's Training Transfer Card with a new one that ran to fifteen pages and spelled out, in considerable detail, exactly what a pilot had to do to qualify. All of this was brought together in October 1918 when the training sequences to be followed by the majority of RAF personnel, including ground tradesmen, were published in a single manual, and it is interesting to observe that, rather than just being the general-purpose RFC aeroplane drivers of 1915-16, the RAF now recognised twelve distinct specialisations.[33] Adding the last line to the table at Figure 1, completes the evolution of the wartime training machine and, to provide some idea of what that involved, we need to consider an example, in this case, a student destined to fly single-engined day bombers.

Unless they were already commissioned, all pilots began their careers as Cadets with a couple of months of 'boot camp' with the Cadet Brigade at Hastings – vaccination, inoculation, square-bashing, personal hygiene, PT, military law and organisation, etc. That was followed by six or seven weeks of ground-based aviation theory and practice at one of the Schools of Aeronautics covering engines, instruments, rigging, navigation, photography, and artillery and infantry co-operation. From there our student would have gone to Uxbridge to spend a month at the Armament School learning about machine guns, synchronising gear, bombs and release gear, before going, now with the status of a Flight Cadet, to a Training Depot Station, where he would spend the first twelve weeks learning to fly, accumulating at least 25 hours on Avro 504s – and that was a minimum, you could expect to do more. On completing this stage,

Unit	Time (weeks)
Cadet Wing	8-10
School of Aeronautics	6-7
Armament School	4
Training Depot Station (basic phase – Avro 504)	12
Training Depot Station (lead-in phase – DH 4/9)	4-8
Fighting School	3
School of Navigation and Bomb Dropping	4-5

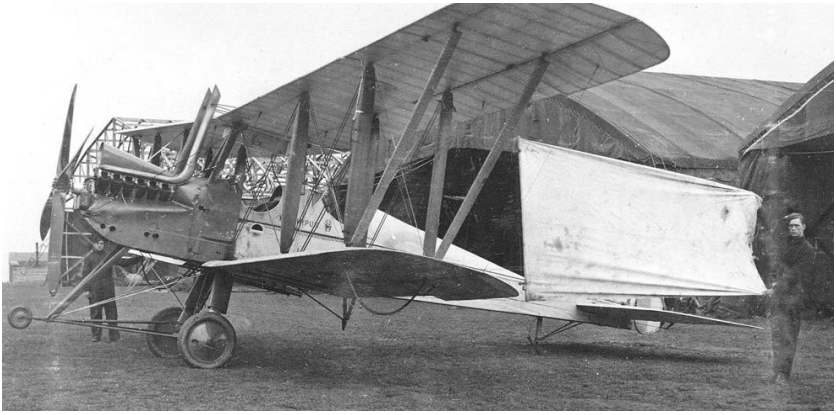
Fig 3. The notional duration of flying training for a DH 9 pilot in 1918.[32]

he would be rated as an 'A' Class pilot, and getting page 4 of his Transfer Card signed, now constituted his *brevet*, taking the place of the old CFS Graduation Certificate which ceased to be issued.

His applied flying would have begun with another two months at the same TDS now flying the DH 4 or 9 on cross-country navigation, bombing and photography exercises and flying with a passenger for the first time. This would have included another 10 hours (again this was a minimum) and at the end he would be rated a Category 'B' pilot and commissioned as a second lieutenant. From TDS he would have gone to one of the four Fighting Schools for three weeks of practical flying including air-to-air gunnery and more formation flying. The last stage was at the School of Navigation and Bomb Dropping at Stonehenge, where a final polish was applied on a course involving yet more bombing, gunnery, navigation and formation flying.

On completion of this course he would be rated as a Category 'C' pilot and allowed to put up his flying badge. This example was in the specific case of a day bomber pilot; the flying badge was awarded at the end of the final stage of whichever sequence a student had been earmarked to follow. Assuming no diversions or periods spent 'on hold', and not allowing for any leave, the training of our bomber pilot would have taken about 11 months (see Figure 3), during which he should have spent a minimum of 60 hours in the air, and he may well have been able to log more before he eventually went to France.[34]

By the summer of 1918 the training facilities were becoming quite sophisticated. At Lakenheath, for instance, there was a bombing range



Air-to-air gunnery was practised against towed banners, in this case by an RE7.

laid out with full scale representations of factories, railway yards, and airfields marked on the ground and extensive use was being made of the camera obscura for simulated bombing. Air-to-air gunnery was being carried out against towed banner targets and the Hythe camera gun was now in widespread use.

In France, at the Pilots Pool Range at Rang-du-Fliers, near Berck, there was a system of rail-mounted cockpits that provided synthetic gunnery training and it had been intended to duplicate this facility at Loch Doon in Scotland where construction of a large, state-of-the-art, gunnery school had begun in September 1916. Unfortunately, this project proved to be an embarrassing failure but, had the war gone on, something along these lines would surely have been built in the UK in 1919.[35]

Meanwhile, following the creation of the RAF, the Air Ministry had assumed responsibility for policy, through the office of the Director of Training, Brig John Hearson, with implementation and administration being devolved to the five geographical Area HQs into which the metropolitan air force had been divided.[36] Each Area eventually had its own Gosport-style Flying Instructors School.[37] By 1918, on completing the two-week course, a newly trained instructor was graded A to D. Each of the regional Flying Instructors Schools eventually sponsored an Examining Flight which periodically toured the TDSs in its area to oversee standards, fly check-rides on the staff

and upgrade an instructor's category as appropriate – the forerunners of the latter-day CFS 'Trappers'.

The wholesale adoption of the all-through TDS concept had a significant side effect. It was intended that when a new operational squadron was required it would be formed by taking elements from four TDSs and posting them to one of the newly-designated Mobilisation Stations, eg Upper Heyford, Kenley, Wyton, all of which were completely divorced from the training system. The four contingents would become the pilots for the new squadron; tradesmen would be drafted in, along with brand new aeroplanes and, after an eight-week work-up, the squadron would go to France. But the transition from the old to the new system of flying training created a hiatus in the expansion of the front line because the resources of most of the old-style pre-mobilisation Service Squadrons had been used to create the TDSs and it would take some time for the new system to mature. In the event, only six new squadrons actually reached France during the last four months of the war (Nos 94, 97, 108, 110, 115 and 152 Sqns) and they were all hangovers from the old system, rather than being created from the TDSs.

The first of the new-style ex-TDS squadrons, No 155 Sqn, formed at Chingford with DH 9As on 14 September. Allowing for a two-month work-up, it was scheduled to cross the Channel on 21 November, but these arrangements were short-circuited by the Armistice on the 11th. Since No 155 Sqn never went to France, the idea of a TDS-based squadron was never actually put to the test.

Furthermore, the quality of the pilots produced by the 'all through' TDS system was never really tested either. Consider the notional student at Case 1 in Figure 2. He embarked on the sequence in early 1918 and worked his way through an evolving hybrid system to graduate – just as the fighting stopped. His colleague at Case 2 had the nominal advantage of being embedded wholly within the all-through TDS-based system, but there was insufficient time for him to complete the sequence.

That said, there can be little doubt that, while it was still settling down, the system in place by the summer of 1918 was far superior to what had gone before, not least because newly qualified replacement pilots were routinely beginning to arrive in France with two or three times as many flying hours as their predecessors. Furthermore, the

Date	Authorised Strength	Pilots per Sqn	Total pilots required
Apr 12	7 squadrons	19	133
Dec 14	12 squadrons	20	240
Jan 15	50 squadrons	20	1,000
Dec 16	106 squadrons	21	2,226
Jun 17	200 squadrons	21	4,200
Mar 18	200 squadrons	21-27	ca 4,800

Fig 4. The progressive planned expansion of the RFC/RAF.

system, which had always been running to keep pace with the growth of the front line, had finally begun to catch up.

Figure 4 illustrates the way in which the RFC expanded, but, while doubling the number of squadrons can be authorised by the stroke of a pen, as in December 1916, which would require 2,226 pilots, it took time to expand the training machine and to recruit and train the additional manpower and that process had not been completed by June 1917 when the goalposts were moved again. When the authorised size of the RFC was doubled from 50 to 106 squadrons in December 1916, the system was actually producing roughly 250 pilots per month (3,000 per year) which would appear to have been more than enough to provide the notional 2,226 that would be needed.[38] But the calculation was far more complicated than that, because the 2,226 is a snapshot – it does not allow for turnover.

The duration of a tour of duty was not defined by statute but, in practice, it tended to be of the order of six months – for those who survived that long – and, on annual basis, that factor alone doubled the notional 2,226. The life expectancy of a pilot fluctuated throughout the war but at times it was measured in just a few weeks.[39] Apart from those being killed in action there were similar numbers being wounded, killed or injured in flying accidents and/or falling sick, all of whom also had to be replaced.[40] The upshot was that, while the 3,000 pilots per year being produced at the end of 1916 might – just – have been sufficient to sustain a 50-squadron air service, it was nowhere near enough for a 106-squadron force.

For the first three years of the war it had never been possible to

Cadet Brigade Pool	10%
Training Wings of the Cadet Brigade	10%
Schools of Aeronautics	5%
Armament School (Uxbridge)	0
Training Depot Stations	20%
Retained as instructors	10%
Finishing Schools	10%
Total Wastage	**55%**

Fig 5. Anticipated training wastage in late-1918.

achieve a satisfactory balance between quality and quantity. In order to sustain the front-line, however, quantity had always to take precedence, which meant that until late-1917 it had continued to be necessary to send inadequately trained pilots to France. But the situation was completely transformed during 1918, because the RAF was finally managing to balance the quality v quantity equation. Indeed, the Director of Training, was projecting, for the basic phase of the TDS course in 1919, the provision of 18 hours dual and 32 hours solo on Avros with another 20 hours on a service type during the second stage – 70 hours in all. When the flying involved with the subsequent role-related courses is added, no pilot would have been expected to confront the enemy in 1919 with fewer than 100 hours in his log book.

Considerable progress was also being made with respect to quantity. At the end of October, by which time output was running at more than 160 pilots per week, there were, including those in Egypt and Canada, more than 7,000 pilots under instruction as potential officers and close to 2,000 as other ranks with approaching 19,000 cadets (not all of them pilots) in the pipeline.[41] Hearson also had a fair idea of what his system would be able to produce – or not produce – which is to say that he was able to apply training wastage rates based on practical experience, as summarised at Figure 5.[42]

There is one other criterion that we ought to consider – accidents**.** Smith-Barry's approach could not prevent crashes, of course, and they continued to occur in training, and at a disturbing rate, throughout the

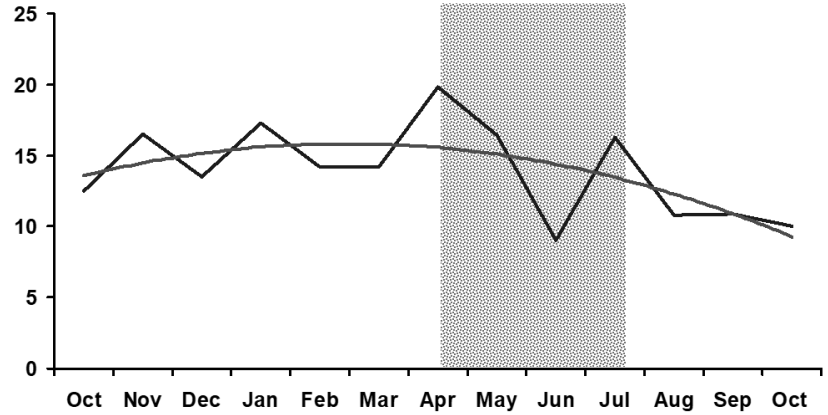


Fig 6. The accident rate per 10,000 hours during the last year of the war; the shaded area indicates the period during which the 'all-through' training sequence was introduced.

war. It was not unusual for monthly returns of fatalities to show that a very large proportion, about one third, of these were occurring in training rather than in combat.[43] But if we just consider accidents occurring in UK-based training units and take, as an example August 1917, the fatality *rate* was 13·7 per 10,000 flying hours. A year later, August 1918, fatal accidents had trebled, but flying hours had increased by a factor of five so the accident *rate* had fallen to 9·2 per 10,000 flying hours.[44] But these are snapshots, of course, and we really need to look at the long-term pattern.

Figure 6 shows the accident **rate** at UK-based training units during the last year of the war.[45] The period during which the RAF implemented the 'all-through' TDS system, now increasingly staffed by instructors trained under Smith-Barry's regime, is highlighted and, when the monthly fluctuations are smoothed out with a trend line it is clear that, having peaked early in the New Year, from then on, the gradient is steadily downwards.

What had the system achieved? According to the official post-war account, some 22,000 pilots had been trained.[46] The Air Force List for February 1919, records the names of almost 16,000 commissioned pilots (ranked as lieutenant-colonels or below), to which one should add a few hundred NCOs.[47] The difference of 6,000 between the two figures reflects fatalities and a variety of administrative issues, eg

resignation of commissions, dismissal from the Service on medical or disciplinary grounds, transfers to non-flying branches, and so on.

From a standing start, it had taken four years, but by the end of the war the RAF's conduct of flying training had matured to the extent that very little changed over the next twenty. In 1938 the requirement for the award of a flying badge was 'not less than 80 hours solo and dual, of which not less than 20 must be solo on service type aircraft.'[48] In its essentials, that is what was actually being achieved in late-1918. Furthermore, the RAF's instructional techniques, based on Smith-Barry's philosophy, and as taught by the post-war CFS, were generally recognised to represent the international standard – and having been adopted globally, the Gosport tube was still being used into the 1950s.

The creation of a sound basis for flying training – was, I submit, a significant aviation milestone with which to mark the beginning of this Society's 'Centenary Seminar'.

Notes:

1 TNA AIR19/91. Treasury letter 14687 of 5 August 1911.

2 Broke-Smith, P W L; *The History of Early British Aeronautics* (Bath, 1968 – reprinted extracts from the *Royal Engineers Journal* for Mar, Jun & Sep 52) p46. On its formation, in April 1911, only six of the fourteen officers had been certified by the RAeC.

3 Army Order 342 of 24 November 1911.

4 A Special Army Order of 15 April 1912 provided the authority for the creation of the RFC but, in practical terms, the effective date, ie the date on which Nos 1, 2 and 3 Sqns and the CFS came into being, was 13 May.

5 Hansard, Vol 30, cols 659-67; HC Deb 30 October 1911.

6 Note that a *brevet* is a certificate – not a flying badge. This is underlined by the fact that the first batch of RFC Flying Certificates, ie *brevets*, was printed in August 1912, six months before the pilots flying badge was introduced (by Army Order 40 of 1 February 1913).

7 TNA AIR1/811/204/4/1240. 'Central Flying School – Syllabus of Instruction' dated September 1913.

8 Taylor, John W R; *CFS – Birthplace of Air Power* (2nd Edn, London, 1987) pp50, 52 & 59.

9 For example, No 8 Sqn begat No 13 Sqn, which spawned No 22 Sqn, which provided the nucleus for No 45 Sqn, which passed on its genes to No 64 Sqn – by which time it was August 1916. A similar system was used in 1917 except that the parent unit was more likely to be a Training than a Service Squadron.

10 TNA AIR1/1288/204/11/53. War Office letter 87/4469(MA1) dated 9 January 1915.

[11] RAF Museum R018934. From a short paper, dated 10 December, written by Smith-Barry.
[12] TNA AIR1/387/15/231/28. Trenchard's complaints were referred to in War Office letter 87/7094 (MA1) of 23 March 1916.
[13] TNA AIR1/131/15/40/218. Lt-Col Burke's letter is dated 20 March 1916; Brig-Gen Brancker, the Director of Air Organisation, responded the following day.
[14] TNA AIR1/387/15/231/28. The qualifying standards were laid down in War Office letter 87/7094(MA1) dated 23 March 1916.
[15] TNA AIR1/130/15/40/211. War Office letter 43/FS/417 (AO1a) dated 22 June 1916.
[16] TNA AIR1/1266/204/9/61. HQ VI Bde letter 6BP/356 dated 26 May 1916 detailed the initial measures to be implemented to facilitate wireless training.
[17] TNA AIR1/1266/204/9/64. War Office letter 87/Schools/28(AO1a) of 26 August 1916 outlined the initial measures being introduced to improve gunnery training.
[18] TNA AIR1/131/15/40/218. War Office letter 87/7094(AO1a) of 16 December 1916 redefined the practical flying tests while Training Brigade letter TB/861 of 30 November (AIR1/676/21/13/1773) had laid down the tests to be passed in a variety of operational techniques.
[19] TNA AIR1/131/15/40/218. Before being sent overseas, pilots flying BE12s, DH 2s and FE8s were required to have logged at least 25 hours solo of which not less than 5 were to have been on type. For Sopwith 1½ Strutter, SE5 and Morane pilots the corresponding figures were 28 and 8. With the addition of a modicum of early dual, typically on Farmans, the total would (should) have been at least 30 hours in all cases.
[20] AIR1/131/31/15/218. Correspondence relating to the cases of Capt C H MacKay, and Lts G W T Garood and C Wigglesworth.
[21] AIR1/1135/204/5/2224. Letter from OC 22 Sqn to HQ 9th Wg, 26 September 1917.
[22] Vivian Voss, *Flying Minnows* (1935), p106.
[23] For example, among the pilots who joined No 45 Sqn in 1917, the year in which it switched from 1½ Strutters to Camels, were:

Name	Joined No 45 Sqn	Total flying time	On type before arrival
Lt G H Walker	14 Jun 17	30.00	6.00 × 1½ Strutter
2/Lt M P Lewis	17 Jun 17	30.40	11.40 × 1½ Strutter
2/Lt C A Barber	1 Jul 17	25.00	5.00 × 1½ Strutter
2/Lt J Burdekin	17 Jul 17	24.00	5.00 × 1½ Strutter
2/Lt A V Campbell	23 Jul 17	26.30	4.00 × 1½ Strutter
Capt I M M Pender	24 Jul 17	26.00	7.00 × 1½ Strutter
2/Lt S Waltho	30 Jul 17	30.15	7.30 × 1½ Strutter
2/Lt E J Brown	1 Aug 17	30.00	7.30 × 1½ Strutter
2/Lt L W Walsh	1 Sep 17	34.00	3.45 × Camel
2/Lt H J Watts	1 Nov 17	33.10	6.35 × Camel
2/Lt R R Renahan	12 Jan 18	29.50	5.00 × Camel

In this context, there is an interesting statement on page 502 of 'An extract from War Office Statistical Abstract. (Pt. VIII) on RAF subjects' (AIR1/516/16/16/1) that says, 'In April 1917, pilots proceeded overseas after 17·5 hours of instruction in the air. By September 1917 the average period of instruction in the air was 48·5 hours per pilot.' It is possible that the first (and possibly both) of these figures may have referred to solo, rather than total, hours.

[24] AIR1/997/204/5/1241. Smith-Barry wrote two papers, both dated 10 November 1916, in which he advocated a new approach to flying training. These were sent to the Acting OC III Bde, Lt-Col G S Shephard, who forwarded them to Advanced HQ RFC on the 20th. The quotation appears in the first of these.

[25] On 10 December 1916, Smith-Barry followed up his November papers by a third, in which he proposed the establishment of a 'school of training for instructors.' This paper, along with the second of the November papers, were eventually published in November 1917 (RAF Museum R018934).

[26] RAF Museum R018933. 'Notes on Teaching Flying for the Instructors Courses at No 1 Training Squadron, Gosport', May 1917. Retitled as 'General Methods of Teaching Scout Pilots', it was republished verbatim in the following October (TNA AIR1/2126/207/77/3).

[27] Interestingly, with hindsight, at the time Smith-Barry's advice was that '. . . all aeroplanes will stop spinning if the rudder be straightened out and the stick pushed forward . . .' This remained the teaching until the publication, in the USA on 1 February 1936, of W H McAvoy's NACA Technical Note 555, 'Piloting technique for recovery from spins,' which concluded that the key was actually to apply full opposite rudder. A revised edition of AP129, 'Flying Training Manual, Pt I Flying Instruction', appeared in November 1937; the advice now read: 'FULL OPPOSITE RUDDER. This may be applied sharply and must be maintained until the spin stops', the use of block capitals making the point that this was an innovation which differed markedly from the advice contained in the previous edition of AP129.

[28] Vincent, S E; *Flying Fever* (Jarrolds; London;1972), p17.

[29] As an example, in July 1917, No 4 Training Squadron at Northolt, No 26 at Turnhouse and No 39 at Montrose were all moved to Stamford (now Wittering) where they were combined to create No 1 Training Depot Station.

[30] TNA AIR1/2423/305/18/36. 'Flying training ground and aerial statistics'. The names of the fifteen members of this cohort, and the hours each of them flew, are tabulated on this file:

	Start	Finish	Dual	Total
Lt M Austin	Sep 17	Mar 18	9.45	72.05
2/Lt H G Bradshaw	Sep 17	Feb 18	9.40	58.35
2/Lt C L Frank	Sep 17	Mar 18	7.00	58.30
2/Lt C F C Wilson	Sep 17	Mar 18	7.25	84.45
2/Lt R J MacLachlan	Sep 17	Mar 18	10.50	72.35
2/Lt K P Campbell	Oct 17	Jan 18	2.20	35.45
2/Lt E W Christie	Oct 17	Feb 18	7.20	51.55
Lt E E Davies	Oct 17	Feb 18	3.35	71.40

Lt P L T Foster	Oct 17	Feb 18	2.35	58.45
2/Lt C P K Knobel	Oct 17	Mar 18	2.45	72.35
Lt G A Mercer	Oct 17	Mar 18	3.50	59.20
2/Lt H Towse	Oct 17	Mar 18	12.15	69.30
2/Lt F C B Wedgewood	Oct 17	Feb 18	6.35	51.35
2/Lt C Chambers	Jan 18	Mar18	13.45	98.25
Capt K A Lister-Kaye	Jan 18	Mar 18	14.15	75.25
Average	**4 months 3 weeks**		**7.35**	**66.45**

[31] TNA AIR1/30/15/1/149. In May 1916 an 18-aircraft Training Squadron had an authorised strength of 169 men of all ranks (Establishment 121/4015) but the size of all units inevitably increased with time and by August 1918 it had risen to 24 aircraft, 240 men, all ranks, and 92 women (Establishment/H/210). The manpower allocated to a TDS varied according to its role but, as an example, by the late summer of 1918, No 48 TDS at Waddington, which was established for 36 Avro 504s and 36 DH 4s or 9s stood at 643 men and 215 women (AIR1/452/15/312/26 Vol 1).

[32] TNA AIR1/700/27/3/521. Handbook 'Flying instruction', March 1918.

[33] TNA AIR10/64. FS 39, 'Training Courses in the RAF for Commissioned and Non-commissioned Personnel, showing Status and Pay', published in October 1918.

[34] To make the point that the specified hours really were a minimum, consider, as an example, the Training Transfer Card of 2/Lt R T E Wood. It records that by the time he was graded Category A, rather than a mere 25 hours, he had actually flown 40 hrs 40 mins solo and 17 hrs 20 mins dual on DH 6s and Avros and, in contrast to the required 10 hours to achieve Category B, he added another 55 mins dual and 21 hrs 15 mins solo on Avros and DH 4s. The final polish was another 6 hours of applied flying on DH 9As for a grand total of 86 hrs 10 mins by the time he was certified at Category C on 28 October 1918.

[35] The Loch Doon scheme had been approved as early as August 1916; civil engineering work began in September. It had originally been anticipated that the new School of Aerial Gunnery would open for business early in 1917 and Lt-Col L A Strange was appointed to command on 12 January. Since it was a peat bog, however, the chosen site was fundamentally unsuitable. Despite the efforts of Messrs McAlpines, who employed a labour force of 3,000 men and laid 56 miles of field drains, the airfield was never a practical proposition. Strange had little option but to start training at a temporary alternative location at Turnberry. With little of substance having been achieved at Loch Doon, Strange moved on in April, leaving his successor, Lt-Col E B Gordon, to supervise building work and capital expenditure, both of which continued remorselessly. By late 1917 No 6 School of Military Aeronautics was slated to move to Loch Doon but whether this was as a part of the original grandiose scheme, or merely a late attempt to find some practical use for the barracks which had been built, is uncertain. In any event the move was cancelled on 11 January 1918 and all further civil engineering work on the site had ceased before the end of that month.

TNA AIR6/16 contains a lengthy report detailing the inadequacies of the Loch

Doon site which, apart from anything else, suffered from a particularly poor weather factor. The budget originally authorised for the project had been £150,000. Various figures were bandied about in the wake of the project's cancellation but in a Commons debate held on 21 March 1923, by which time most of the dust would have settled, the Secretary of State for Air, Sir Samuel Hoare, stated that 'As far as I can ascertain, the expenditure on the construction and site of the aerodrome at Loch Doon was, approximately, £435,000 (about £24M in 2018 money), and the amount paid to Messrs McAlpine was £320,600.' (Hansard, HC Deb 21 March 1923, vol 161, cc2607-8W).

[36] The broad outline of the restructured training organisation in the UK was publicised by AMWO 401 of 5 June 1918. This identified all of the specialised and ancillary training units, both air and ground, but, oddly, omitted the 65 individually-numbered TDSs.

[37] On 15 May 1918, Smith-Barry's original unit at Gosport became No 1 School of Special Flying and the ex-RNAS Instructors School at Redcar became No 2. On 1 July they were both restyled Flying Instructors Schools (FIS) and others were established to provide one in each of the five administrative Areas: SW Area FIS at Gosport; NE Area FIS at Redcar; SE Area FIS at Shoreham; NW Area FIS at Ayr and the Midland Area FIS at Lilbourne. There were also FISs at Armour Heights (Canada) and El Khanka (Egypt).

FIS graduates were graded A – excellent, able to teach instructors; B – 1st class pilot, suitable for all types of instructional duties; C – licensed to instruct but needs supervision and experience; D – not suitable as an instructor. Each of the Area FISs maintained a mobile 'Examining Flight' which visited the TDSs to maintain standards by checking instructors and regrading them if appropriate.

[38] TNA AIR1/131/15/40/222, 'Personnel – trained pilots, Home and Egypt, June 1916-April 1918' notes that the actual output in December 1916 was 210 from schools in the UK plus another 30 in Egypt.

[39] TNA AIR1/818/204/4/1301. 'Statistics on flying, aircraft lifetime of pilots overseas and casualties'. A report, dated 1 November 1918, analysed the fates of 1,436 (mostly first tourist) pilots sent to France between July and December 1917. Of these, 38% had been killed or posted missing, 27% had been hospitalised and 25% had returned to the UK. The remaining 10% were still in action after ten months, but the average time spent in France by those who had been transferred to Home Establishment was six months.

[40] As an example, No 45 Sqn arrived in France in October 1916 and flew two-seat Sopwith 1½ Strutters for the next twelve months. Against an establishment of 21 pilots, it lost 38 (27 killed, 8 wounded and 3 taken prisoner). When administrative postings and sickness are added to the total, it is clear that the unit would have churned through approaching three times its notional manpower requirement in a year. Source: *The Flying Camels – The History of No 45 Sqn, RAF* by C G Jefford (privately published, 1995, ISBN 0 9526290 0 3).

[41] TNA AIR1/2423/305/18/36. 'Flying training ground and aerial statistics, 1917-1918'.

[42] TNA AIR1/33/15/1/196, 'Training Depot Stations – establishment of, and output of pilots from' dated 21 October 1918.

[43] TNA AIR1/680/21/13/2207. 'Returns of air and aircraft accidents, January 1917-November 1918'. Taking a random example to illustrate the gravity of the situation, the return for June 1918 reflect 93 fatalities having occurred in UK-based training units from a global total of 173 plus another 161 who had been posted missing. Statistically, about half of the latter were likely to be confirmed as having died with the balance having become PoWs or internees. That would make the final accounting 93 from a total of approximately 173 + 80 = 253, or 37%, of all fatalities being due to incidents in training.

[44] *Ibid.*

[45] *Ibid.*

[46] TNA MUN 5/212/1960/11. *Air Ministry Synopsis of British Air Effort during the War*, [Cmd 100], HMSO, 1919. On page 4 it states that '21,957 pilots have been trained and graduated as efficient for active service . . .'

[47] The *Air Force List* for February 1919. The award of flying instructional pay ceased on 15 February (AMWO 306 of 6 March 1919) which effectively marked the end of the wartime flying training programme; the last 'wartime' pilot to be gazetted was Lt C H Jones whose seniority was 9 December 1918. This table reflects all of the pilots in the February 1919 List:

Rank	**Aeroplane & Seaplane Officers***	**Aeroplane Officers**	**Seaplane Officers**	**Airship Officers**
Lt Col	13	55	4	9
Maj	32	205	16	12
Capt	137	1031	109	95
Lt	252	6764	44	56
2/Lt	1328	5494	101	147
Total	**1762**	**13549**	**274**	**319**
Total	**15585**			

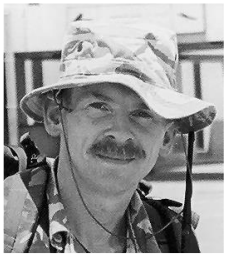
*__NB__ In the *List* dual-qualified aeroplane and seaplane pilots are recorded three times – once in the combined A&S List and again in the separate Aeroplane List and Seaplane List. The table above does *not* reflect this triplication, ie dual-qualified pilot are noted only once.

The RFC/RAF had made very little use of non-commissioned pilots and when the fighting stopped in November 1918, only 35 of the 1,879 pilots on the strength of the squadrons operating under the control of HQ RAF in France were NCOs, (see AIR1/1163/204/5/2532, 'HQ RAF return of numbers of aircrew by unit'), although there are indications that it was intended to increase their numbers significantly had the war gone on into 1919.

[48] King's Regulations and Air Council Instructions, 2nd Edn, 1938, para 811.

WAZIRISTAN 1936-39 AND ITS IMPLICATIONS FOR WWII STRATEGIC BOMBING POLICY

by Wg Cdr Andrew Walters

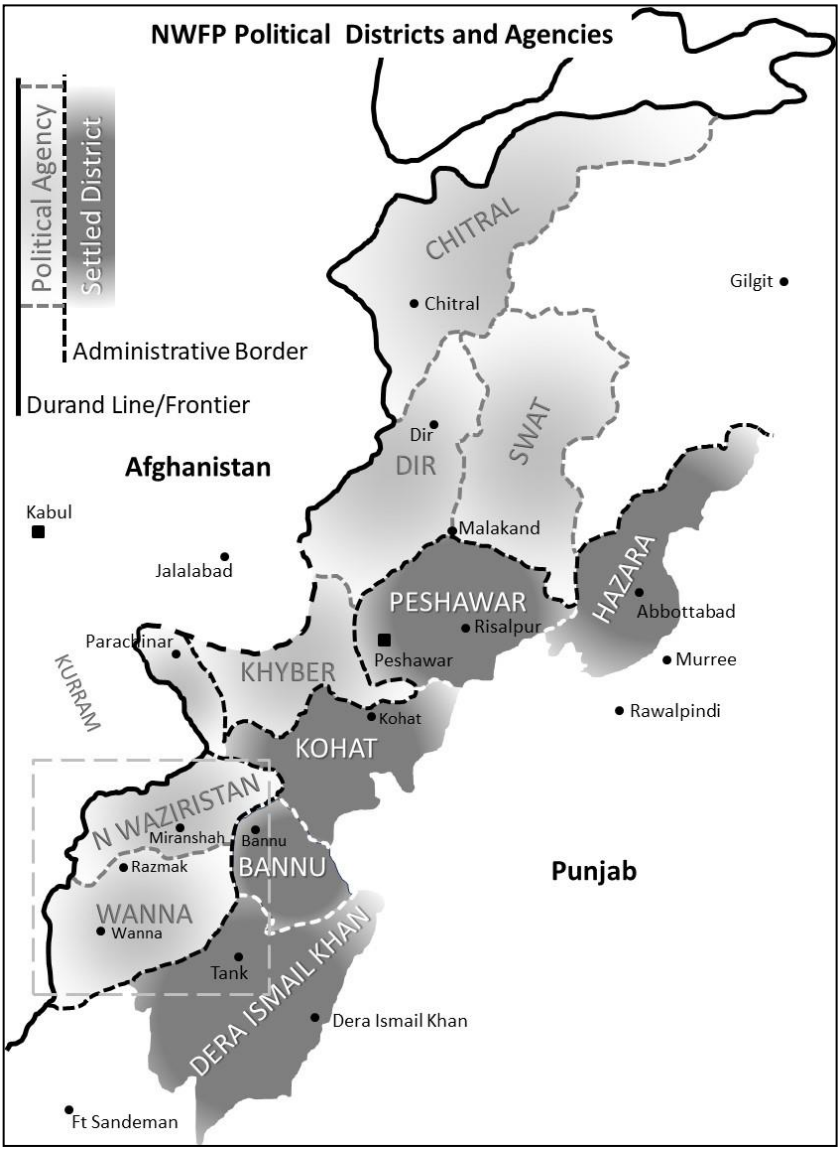


Andrew Walters joined the RAF in 1982. He completed 13 operational deployments in Iraq, Afghanistan and Bosnia on the Tornado GR1/4 as a Qualified Weapons Instructor, Electronic Warfare Instructor and Targeteer. Following Staff College and a tour on its Directing Staff , he was awarded an RAF Portal Fellowship researching the RAF's inter-war operations on the North-West Frontier of India, for which he was awarded a PhD in 2017. Retiring to the Reserves in 2008, he now flies transatlantic Airbus services for an upcoming Icelandic airline – WOW air.

While London focused on the growing Nazi threat in the late 1930s, the RAF was involved in its largest inter-war counter-insurgency operation, with 61,000 Imperial troops and eight squadrons engaged in an enduring conflict on the North-West Frontier of India (NWF). The 1936-39 Waziristan Campaign, building on previous Imperial policing operations, had significant implications for the RAF's initial strategic bombing policy during the Second World War.

The NWF was an area of vital importance to the British Empire. It formed the border between British India and Afghanistan, the trade route historically taken by repetitive historical invasions from the north-west. The British fixated on Frontier problems, many believing it was the one place that the Empire could suffer a knock-out blow from either external invasion or internal revolt.[1] The 'major threat' to India was the 'Great Game', a Russian advance across Afghanistan (a buffer state separating the Russian and British Empires) via the NWF, while the 'minor' threat came from irregular warfare by the indigenous Pathan tribesmen inhabiting the mountainous, unadministered, Frontier Zone.

The British had established the NWF Province (NWFP) in 1901 to govern the area between the formal border with Afghanistan (the 1893 Durand Line) and the pre-existing Indian states. The NWFP was divided into two very different areas, separated by an Administrative



Map 1 – NWFP with, inset (dashed area bottom left) the disputed Waziristan area of Map 3.

Border. To the east of the Administrative Border were the relatively prosperous 'Settled Districts' on the fertile Indus floodplain, blessed with agriculture, rule of law, police and taxes. To the west were the mountainous, impoverished 'Political Agencies' inhabited by fiercely independent, armed tribesmen who often raided the Settled Districts (see Map 1). Each agency was governed by a Resident, supported by a Political Agent who liaised directly with the tribes, often acting as a referee in settling tribal disputes. Prior to the 1919 Third Afghan War, no Imperial forces had been based in the political Agencies and the Administrative Border had been closed.[2] The mountain tribes were left to largely self-govern, although punitive columns were dispatched across the Administrative Border to punish aggressive misbehaviour.

The tribal uprisings that followed the Third Afghan War shocked the Government and precipitated a change in Frontier policy. The subsequent Modified Forward Policy garrisoned two brigade groups in the Political Agencies (at Wana in South Waziristan and Razmak in North Waziristan), and two more just east of the Administrative Border at Bannu and Tank. Although expensive, it was hoped that future economies could be made by maximising the use of the RAF.[3] This policy was characterised as 'peaceful penetration'; direct rule was not applied over the tribes and regular Army patrols into tribal territory were avoided. However, the Waziristan garrisons could quickly deploy all-arms mobile columns, enabled by a new, costly network of roads.[4] These roads were very much a double-edged sword; while they enabled trade and were 'the great carriers of civilisation', the tribes perceived them as facilitating the movement of troops. As such, roads increased tribal unrest.[5] The British employed the *Maliki* system to govern the tribes, whereby the head of each tribe (the *malik*) was paid to uphold Governmental policy and held responsible for any transgressions, a system called 'tribal responsibility' or 'control from within'. The *malik* was expected to provide and equip non-uniformed tribal police called *khassadars* to maintain local control. However, the authorities did not fully trust the *khassadars*, and so also recruited local levies, known as Scouts, who were officered by the Indian Army but controlled by the local political officer. The Scouts, in turn, were backed by the regular Army garrisons.

The role of the armed forces in India generated persistent tension between the British and Indian Governments. London viewed them as Imperial assets to deter Russian aggression and to act as an Imperial reserve for use throughout the Empire. India, faced with enduring local issues, viewed them more parochially as an internal security force. Funding was a critical issue, given India's austere inter-war economic state. This was exacerbated by the first Secretary of State for Air's 1919 decision that the cost of India's squadrons should be borne by India, which effectively placed air power under the control of CinC India, rather than the RAF.[6]

Prior to the advent of air power, the primary method of dealing with intransigent tribal behaviour beyond the Administrative Border was to dispatch a punitive column to raze the tribe's village. These expeditions were expensive and took time to muster, so were only used for significant misdemeanours. A typical punitive column, as used in Staff College Mountain Warfare exercises, consisted of fifteen companies of troops, 568 mules, twenty ponies, fourteen camels and even a veterinary section.[7] These columns reached up to twelve miles long and could cover about eight miles a day off road. In mountainous terrain, the heights had to be 'picqueted' by Scouts to deter tribal harassing fire. As the name suggests, the punitive column's aim was to punish previous unacceptable behaviour and thereby deter future wrongdoing. To do this, the punishment had to be proportionately severe. Villages were specifically razed because they were static and, being valued, would be defended by their inhabitants, thereby forcing the normally elusive tribesmen to stand and fight where they would become vulnerable to western firepower. Wood was a prized commodity in barren Waziristan and Staff College students were taught how to burn the village's sought-after roof beams, as well as how to destroy field irrigation systems.[8] The combination of frustration over an often-elusive opponent and the tribesmen's barbaric treatment of Government casualties resulted in the Army adopting a policy of maximum lethality, both in formal orders and the soldier's local practice.[9]

RAF 'small wars' doctrine had developed rapidly since aircraft were first used for colonial control. Early Air Ministry doctrine revolved around emulating the effect of a punitive column:

> ‘The Air Force must, if called upon to administer punishment, do it with all its might […] The attack with bombs and machine guns must be relentless and unremitting and carried on continuously by day and night, on houses, inhabitants, crops and cattle [...] No news travels like bad news.’[10]

CD22, the RAF’s first significant doctrine manual, published in 1922, echoed this theme, recommending the targeting of wells and water supplies.[11] However, while the use of punitive, lethal force by troops was generally accepted, accusations of the ‘unsportsman-like’ use of asymmetric air power against tribesmen who could not easily retaliate caused the Air Ministry to refine its doctrine. The result was the ‘air blockade’, a minimum-force tactic designed to coerce tribesmen into compliance by the dislocation of everyday life.[12] This developed into a sophisticated technique, whereby an *ultimatum*, printed on pink leaflets, would be dropped on the village warning that air action would commence unless the offending tribes complied with Governmental demands. If the tribe did not comply, red *bombing notices* would be dropped warning the inhabitants to evacuate by a specific time, not to return until informed, and warning about unexploded bombs. After the deadline, the headman’s house would be bombed, followed by sporadic light bombing of the village (often with practice bombs) designed to keep the villagers from returning to their homes. Propaganda would be aimed at the displaced villagers, who generally started off defiant. However, over time, they would begin to squabble amongst themselves, and finally slip into a state of boredom and helplessness. Since all the tribesmen had to do to end their discomfort was to accede to the Government’s stated demands, their fate was in their own hands – a much more coercive technique than pure punishment. Once they conceded, the political officer would fly in, urging the tribe to resume its peaceful coexistence with the Government. Medical parties would fly in and unexploded ordnance would be defused.[13] However, this ‘air method’ was not without its challenges. Firstly, it was often small numbers of ‘bad-hats’ that caused trouble, who the *maliks* would often claim they could not control (contrary to the system of tribal responsibility). Paradoxically, whilst the air blockade could be initiated quickly, it often took longer to generate results than pure punishment (because it employed

minimum force to generate morale effect). Additionally, the political authorities often disliked swiftly declaring terms for compliance, as this reduced their room for diplomacy, while relaxing the conditions could be interpreted as a sign of Governmental weakness.[14] Finally, the Army were more comfortable with simple destructive punishment and less convinced about the less tangible effectiveness of psychological coercion. In contrast, 'morale effect' had long been held as core doctrine by the RAF.[15]

Thus, the 'air method' and 'Army method' were very different. Whilst the RAF emphasised the use of minimum force to compel the tribes to comply, Army Staff College was teaching company commanders in 1929 that the aim of frontier warfare was 'an air and ground fight with a view to killing'.[16] Another problem was that aircraft tended to disperse tribesmen, whereas the Army method attempted to make the normally elusive tribesmen stand and fight where they would succumb to Western firepower. Another precept of the air blockade was that the relative invulnerability of aircraft not only removed the incentive of loot and sport from the tribesmen, but also left them feeling helpless and vulnerable, which increased the coercive 'morale effect'. However, the presence of ground troops would provide the tribesmen with someone to fight, thereby raising their morale. Whilst the RAF repeatedly highlighted this, Army commanders normally deployed troops into the vicinity of recalcitrant tribes even when the air method was employed, much to the RAF's dismay. As Portal explained, *'. . . either* do it with the Army *or* by the air method; it is a fact that the two methods are like oil and water in that they will not mix.'[17] This immiscibility led to inter-Service friction over the control of air power on the NWF. But, as the Chief of the General Staff, India told AOC RAF, India in 1937, '. . . all operations on the Frontier are combined operations and […] the Army as predominant partner must always be in control.'[18] Importantly, much of the Indian Army's sensitivity towards the RAF was a backlash against repeated, but unsuccessful, Air Ministry calls for the substitution of troops by aircraft and the imposition of 'air control' on the NWF with all forces under the command of an AOC, as had proved effective in Iraq.[19] It was left to adept AOC RAF, Indias to make amends; Sir Edgar Ludlow-Hewitt wrote to CinC India on his arrival in 1935 that:

Formation	Units	Aircraft	Location	Role
HQ RAF, India	No 28 (AC) Sqn	Audax	Ambala	Army Co-op
	No 31 (AC) Sqn	Wapiti	Quetta	
	BTF	Valentia	Lahore	Bomber-Transport
No 1 (Indian) Gp	Nos 27 (B) & 60 (B) Sqns	Wapiti	Kohat	Bomber
	Nos 11 (B) & 39 (B) Sqns	Hart	Risalpur	
No 3 (Indian) Gp	No 5 (AC) Sqn	Wapiti	Quetta	Army Co-op
	No 20 (AC) Sqn	Audax	Peshawar	

Table 1 – RAF, India ORBAT, 1935, prior to the Quetta earthquake.

> 'I am not here to compete with the Army on any ground whatever, but simply to co-operate on the best terms under your orders [...] I believe that one of the causes of anti-Air Force feeling out here is fear of substitution.'[20]

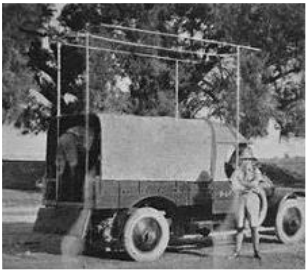
Despite the subsequent inter-Service friction, the Indian military had quickly recognised the utility of air power after aircraft first demonstrated their capabilities over twelve generals in 1911. By 1914, an Indian Central Flying School had been established.[21] Although all of India's aircraft and associated personnel were deployed overseas at the outbreak of the First World War, the Viceroy requested that aircraft be deployed to the NWF as 'one of the most valuable' measures of mitigating his garrison's depleted strength.[22] No 31 Sqn subsequently deployed to India in November 1915. Following the Armistice, four more squadrons arrived as the 1919 Third Afghan War developed, during which they were extensively used, including Captain 'Jock' Halley's famously pivotal V/1500 Empire-Day raid against Kabul.[23] By 1935, there were eight RAF squadrons and a Bomber Transport Flight (BTF) in India, as shown in Table 1, along with an aircraft depot at Karachi.

There were three types of squadrons deployed on the NWF. Bomber squadrons were normally controlled by AOC RAF, India. Although the air blockade was the Air Ministry's favoured tactic, the AOC rarely allowed it to be used on the Frontier, one notable exception being 'Pink's War' in 1925. Instead, local manuals prescribed the use of tactics not recognised by the Air Ministry.

A Hart of No 39 (Bomber) Sqn.

'Destructive air action' involved the use of heavy bombs against particularly recalcitrant tribes to inflict a specified measure of material punishment for previous offences. Warning and bombing notices would be dropped defining the offences and the duration of punishment, but this was a punitive, rather than coercive, tactic.[24] Another tactic was 'proscriptive air action', which was designed to separate friendly tribesmen, women and children from hostiles by declaring 'no go' areas, allowing anyone found within the proscribed area to be engaged by aircraft. Proscription took two forms: 'tactical' and 'punitive'. The villages of hostile leaders could be tactically proscribed to stop them meeting, and influencing, other tribes. Similarly, areas around friendly land forces, or ahead of tribal war parties (*lashkars*), could be tactically proscribed to allow aircraft to freely engage transgressors. The purpose of punitive proscription was to punish tribes by denying them the use of an economic area (such as grazing lands), especially when the tribe had no adequate targets for destructive air action.[25] Bomber squadrons normally bombed from level flight above 4,000 feet to avoid ground fire. Interestingly, bombs were aimed by part-time, locally-trained air gunners recruited from the squadron's pool of engineers, using a bomb sight in the rear cockpit's floor behind a sliding aperture.[26]

Army co-operation squadrons were allocated to each Army General Officer Commanding and worked closely with their associated Army units on a daily basis. In addition to the roles of the




An improvised Crossley RAF R/T tender and an RAF cavalry R/T pack set.

bomber squadrons, army co-operation squadrons also conducted close reconnaissance and close support for their associated land formations and convoys. Due to the proximity of friendly troops, close support required accurate weapon delivery, so dive bombing was employed, with the bombs aimed visually by the pilot without a bomb sight. This profile was known locally as the 'VBL' (Vickers-bomb-Lewis) attack, with the front Vickers gun being used to cover the approach prior to bomb release, while the rear gunner's Lewis kept heads down as the aircraft returned to the sanctuary of height.

One of the significant challenges for army co-operation squadrons was communicating with their supported ground units. Troops could use ground markers, such as Popham panels and direction arrows to indicate the position of hostiles. Army co-operation squadrons were trained to pick up messages using a hook from about 10 feet, as well as dropping messages, although both message pick-up and dropping were limited by the NWF's terrain. Wireless telegraphy (W/T, ie Morse) and radio telephony (R/T, ie voice) were gradually introduced on a limited number of aircraft, although some types of aircraft proved unsuitable for the large, delicate R/T sets due to interference from their unscreened engines. It was the responsibility of each army co-operation squadron to provide their associated Army units with the necessary R/T sets, operators and transportation. Squadrons improvised scavenged tenders to establish an R/T capability for Army advanced HQs. RAF, India sent wireless operators on equitation courses and deployed aircraft R/T sets, protected by rubber pads, on specially trained pack animals which accompanied the column's advanced HQ when the terrain became impassable for tenders.[27] All of

Above, K2340, one of the BTF's invaluable Valentias which could deliver supplies, bombs (below left) or troops (blow right).

this was accomplished by local improvisation, rather than central RAF funding. In an emergency, army co-operation squadrons could also drop water, rations and ammunition to troops.[28] Overall, there was significant competition between bomber and army co-operation squadrons, with the latter feeling their role was more complex.[29]

The Bomber Transport Flight (BTF) had formed in 1932 at Lahore and by 1936 operated two Vickers Valentias. These aircraft were used for troop carrying, resupply (including aerial drops), casualty evacuation and bombing. In 1937, the BTF transported 5,000 men, many of them casualties, and resupplied the Wana garrison, removing the need for vulnerable resupply convoys.[30] They were fitted with Lewis guns and multiple bomb racks for a wide variety of bombs, allowing them to loiter over tribal areas for considerable periods. Given the significant multi-role capability of these aircraft, the RAF

Map 2. RAF stations in India, 1935.

proposed expanding the BTF to a ten-aircraft squadron, but this was never approved by the Government of India due to the high unit cost.[31]

Map 2 shows the location of RAF stations in India during the period, which illustrates the perceived threat axis.[32] These permanent stations were supported by numerous advanced landing grounds, many of them simple, unmanned airstrips.

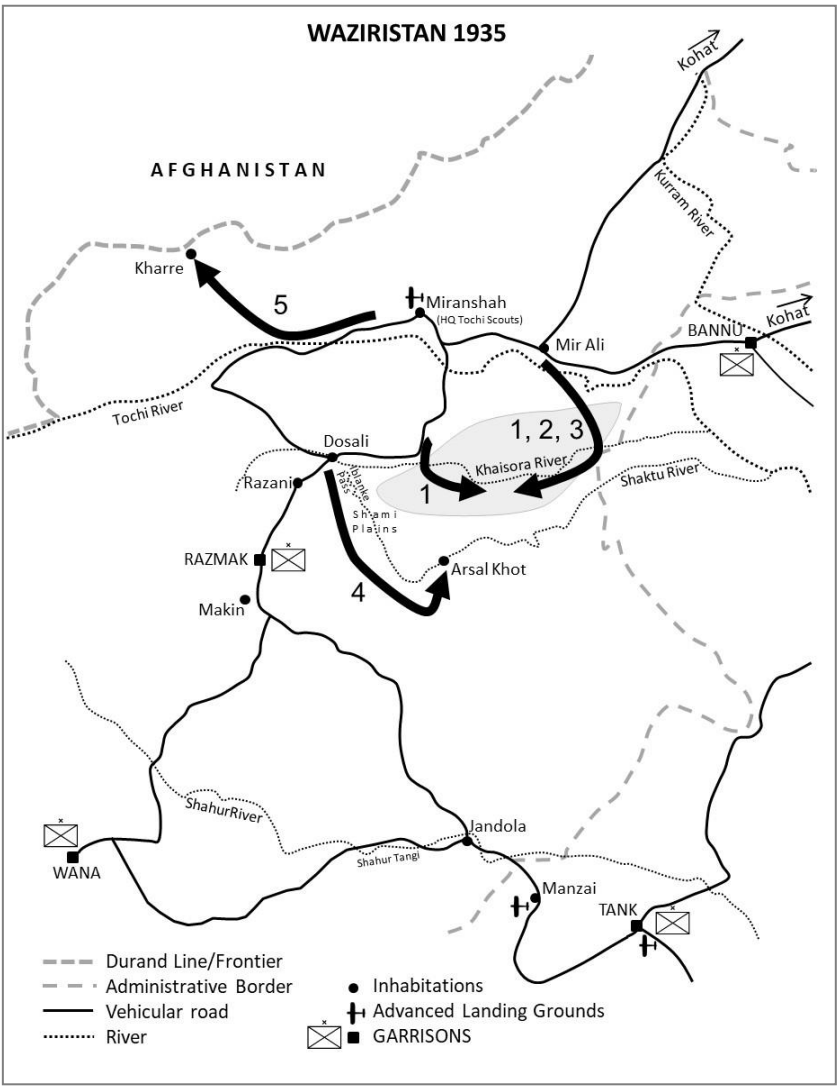
Mirza Ali Khan, the Fakir of Ipi.

The main protagonist in the 1936-39 Waziristan insurgency was the Fakir of Ipi. Born Mirza Ali Khan in the 1890s, the charismatic Pathan became an influential religious figure in Waziristan. Outraged by the British ruling over the 1936 'Islam Bibi' case (which involved the forcible return of a young Hindu girl who had eloped across the administrative border and converted to Islam), he resisted all outside influence in his vision of establishing an independent Pashtun state. Uniting the, often disparate, tribes under the banner of 'Islam in danger', he used cunning, persuasion and opportunism, gradually acquiring a reputation for saintliness and miraculous powers. A 1937 British intelligence report recorded:

> [*His men were*] followers of Islam, and not mere plunderers and adventurers in search of private gain;
> His followers had only to cut off trees and the Faqir would turn the sticks into rifles;
> Gas, if loosed by the troops, would be dissipated by divine breezes;
> Divine power would turn bombs dropped from aircraft into paper.[33]

While the West focused on the growing threat of Hitler and Stalin, British India was faced with an uprising in Waziristan as Pathan tribesmen struggled for independence, united for once by the Fakir's divine powers. The subsequent Waziristan Campaign, which ultimately involved 61,000 Imperial troops and all of RAF, India's squadrons, occurred in four phases: the pacification of the Tori Khel Wazirs; operations to expel Ipi; the withdrawal of additional units in late 1937; and the 1938-39 flare-up.[34]

The first Khaisora operation commenced in November 1936 when two punitive columns entered the Lower Khaisora valley from either end. Intended as a show of strength against the Fakir's growing anti-



Map 3 – Waziristan, 1936.

British propaganda and to strengthen the authority of the local pro-British *maliks* (see Map 3, arrows 1), the two columns were heavily engaged and failed to make the planned evening encampment, requiring emergency re-supply by air.[35] Only a single flight of aircraft

had been allotted to support the two, 15-mile-separated, columns. To avoid inflaming the local population, aircraft were forbidden to engage hostile tribesmen unless directed by the column commanders. The RAF's offer of deploying a liaison officer with each column had been declined and, as the column commanders had seldom had the capacity to request air support:

> '. . . pilots had the unenviable experience of seeing tribesmen in considerable numbers in the act of opposing the columns, but were precluded by their very definitive orders from rendering […] assistance.'[36]

The tribesmen interpreted this lack of air action as 'a manifestation of the Fakir's piety and miraculous powers'.[37] However, more aircraft were urgently summoned and, during the columns' premature withdrawal, the RAF commander rescinded the restrictions on his own initiative, resulting in 'effective and heartening' close support on several occasions.[38] Overall, the operation undermined, rather than emboldened, British prestige, handing the initiative to the Fakir.

In December 1936, the second Khaisora operation was launched to regain the initiative (see Map 3, arrow 2). Responsibility for air operations was devolved to OC 1 (Indian) Group, (Gp Capt Norman Bottomley), side-lining AOC RAF, India. This time, Slessor (who was OC 3 (Indian) Wing at Quetta) accompanied the column.[39] Contradicting RAF doctrine, air action against villages was prohibited and a 5-mile area around the column was tactically proscribed. Aircraft resupplied troops, dropped orders from Army HQ and, on occasion, effectively substituted for ground picquets along potentially-vulnerable passes.[40] Independent air action then demolished the Fakir's Arsal Kot refuge with 230-pound bombs and incendiaries; the Fakir declared he had caused the bombing to cease, so sporadic bombing re-commenced with smaller bombs, generating a cognitive, rather than material, effect.[41] Co-operative land-air action finally dispersed Ipi's remaining Afghan tribesmen in late January 1937, ending the second Khaisora operation.

February 1937 saw renewed tribal unrest which fixed Army units on defensive road protection duties.[42] This led to a significant change in Army policy, whereby troops remained concentrated in 'war

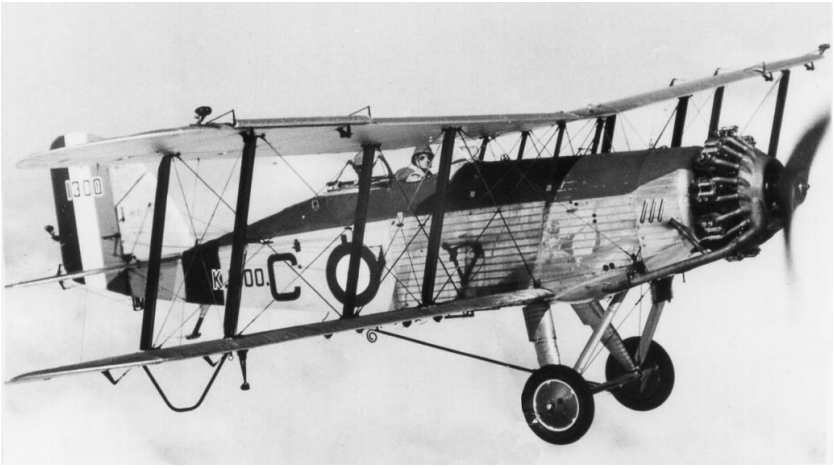
stations', while air dealt with outlying areas. As AOC RAF, India explained:

> 'This plan permits the Commander-in-Chief to guage [*sic*] the nature and strength of the hostile movement before he commits his troops, meanwhile applying heavy pressure by air against some of the most troublesome and inaccessible centres of revolt.'[43]

The Army's *Official History* recorded this policy change slightly differently: 'Action by land forces [...] was avoided until political means to restore the situation had proved fruitless.'[44] The Fakir started employing tactics now known as 'hybrid warfare', using a loosely coordinated mix of conventional weapons, irregular tactics, terrorism and criminal behaviour to undermine the authority of the Indian Government and demonstrate his authority. The Government's strategy nested comfortably with air power. To stabilise unrest, political pressure was first applied on the *malik*s, followed by progressive punitive and proscriptive air action. Examples included the progressive punitive bombing of three offending tribal villages by the AOC's bomber squadrons (including the BTF's first offensive use of 540-pound bombs) for the murder of two British officers in February 1937, which secured the surrender of three accomplices.[45] Similarly, the Fakir's refuge at Arsal Kot was proscribed in March to prevent hostile gangs assembling there.[46]

Notwithstanding the prominence of independent air action, air co-operation remained important. In April, 5 (AC) Squadron provided support following a significant ambush of forty-nine lorries in the Shahur Tangi defile, during which 52 troops were killed.[47] Following this, most convoys were suspended, leaving the Wana garrison reliant on resupply by the BTF, demonstrating the use of air transport as a force protection measure.[48]

Despite their proscription, *lashkars* continued to assemble in the Khaisora and Shaktu valleys and the Government decided to engage them on ground favourable to British all-arms. During the late-April third Khaisora operation (Map 3, arrow 3), 3 (Indian) Wing's Advanced HQ accompanied 1 Division, coordinating air support under OC 1 (Indian) Group.[49] The Fakir's *lashkars* declined battle, but air-land synergy inflicted significant casualties on tribesmen flushed out



A Wapiti of No 60 (Bomber) Sqn.

by advancing troops. Nonetheless, Ipi claimed 1 Division's subsequent withdrawal as a victory and his Arsal Kot *lashkar* grew, despite its proscription.[50] This third operation exposed different perspectives within the Air Staff, whose India desk officer highlighted the:

> '. . . wasted effort & misemployment of aircraft [...] Much ammunition was wasted on close support work [...] 'targets' i.e. hilltops – patches of bushes, rocks etc were plastered with bombs & Small Arms Ammunition.[51]

However, Slessor, who had just been posted back to the Air Ministry as Deputy Director of Plans, retorted:

> 'I don't think [*this*] is quite a fair picture. If they must carry out these column operations I do not think close support is a "waste" [...] Close support pilots do not bomb or use their guns except (a) against tribesmen seen and (b) areas where the troops know tribesmen are.'[52]

This exchange demonstrates that, despite the India desk officer's less-than-full appreciation of NWF all-arms tactics, the in-theatre perspective was nevertheless represented by officers with first-hand experience.

The escalating insurrection triggered operations to decisively defeat the *lashkars* and capture or evict Ipi. The aerially-proscribed areas were extended to herd *lashkar-walas* into the Shaktu valley where they would become vulnerable to Imperial massed firepower. New procedures were developed to overcome friction in the orchestration of army co-operation, mainly concerning poor communications, as Slessor's replacement had found himself isolated from his squadrons during the third Khaisora operation. This time, the Army Co-operation Wing HQ deployed to Miranshah and army co-operation liaison pilots accompanied the columns, while locally-improvised RAF R/T tenders deployed to Army Advanced HQs, with RAF R/T pack sets at each Brigade.[53]

These new procedures proved effective. On 11 May 1937, a daring moonless-night advance through the Iblanke Pass outflanked the *lashkars* (see Map 3, arrow 4). The next morning, the BTF parachuted a day's rations to the lightly-equipped troops. The tribesmen commenced a general withdrawal, with army co-operation aircraft significantly depleting the *lashkars*. When the columns occupied Arsal Kot, the Fakir had fled; the previous destructive air action had left the fortified village completely ruined.[54] Many tribesmen left Ipi's cause following the Iblanke assault. Thereafter, although the Fakir maintained a small group of acolytes, large-scale fighting ceased, marking the end of the first phase of the Waziristan Campaign. Convoys recommenced, but the permanent road picqueting tied-up large numbers of troops, requiring army co-operation aircraft to escort nine trains during May and nineteen in June, with the BTF continuing to resupply the Wana garrison.[55]

Renewed road-building to encircle Waziristan's tribal *sanctum sanctorum* provided Ipi with ammunition to stir up further low-scale unrest during the second half of 1937, including sniping camps at night, raiding the settled districts and taking civilian hostages.[56] During this second phase of the Waziristan Campaign, the Fakir was driven from place to place by bombing, making him an unwelcome guest to local tribes, and he often had to shelter in flea-ridden caves to avoid air action.[57] The improving in-theatre situation abated neither the Army's scepticism over air power's decisiveness nor the Air Staff's disapproval of Army strategy, with the Army using aircraft to punish, rather than coerce, tribes, and the RAF voicing concern over

excessive weapon expenditure. The Air Staff's Indian desk officer commented that:

> 'It would be difficult to imagine more confused action than this. Constant suspensions of operations took place, there [*are*] no true air blockade[*s*] & the aims & terms [*are*] constantly changing.'[58]

Aerial pressure forced Ipi into increasingly small, but widespread, insurgent activity in the late summer. This had implications for the RAF, requiring 50% more sorties in September than the previous month. Insurgents reacted by sniping at aircraft operating from Miranshah, whose garrison had to be augmented as a force protection measure. Road attacks increased, leading Army HQ to issue orders that 'the greatest possible loss was to be inflicted on any lashkar.' To suppress gangs, several large areas, including the Fakir's locations, were proscribed using delayed-action bombs. However, by December 1937, this constant aerial pressure had reduced tribal hostilities to 'normal' levels, allowing most of the reinforcements to be withdrawn, marking the end of the third phase of the campaign.[59]

Sporadic hostilities by Ipi's lieutenants continued into 1938. Insurgents avoided direct confrontation, instead commencing a campaign of IEDs against roads, railways, parade grounds and airfields, damaging a taxiing aircraft at Miranshah. The RAF increasingly became the main offensive weapon, with troops restricted to small punitive columns.[60] This was, in effect, Army-imposed substitution driven by troop shortages, albeit with air power directed by Army commanders in an unsophisticated, reactive, punitive manner in contrast to the Air Staff's doctrine designed for independent, coercive operations to control tribal behaviour. The Air Staff noted that:

> 'Until control of air operations in India is made over to an Air Staff, misuse of aircraft will continue. There is no doubt that proscription and destructive air action used as a punishment is popular, perhaps because no terms are announced and action can be broken off at any time.'[61]

In June 1938, a Syrian-born pretender to the Afghan throne, the 'Shami Pir, attempted to incite a rebellion against the Afghan Amir

An Audax of No 20 (Army Co-operation) Sqn.

from South Waziristan, probably sponsored by Germany. As his *lashkar* moved towards the Afghan border, it was dispersed by rigorous low-flying demonstrations by Basil Embry's No 20 (AC) Sqn.[62] This was the first time that independent air action had been used to stop *lashkars* crossing into Afghanistan and generated a direct political effect beyond the range of land forces. The combination of aerial coercion and diplomatic pressure convinced the Shami Pir to leave India.

A dramatic increase in 'outrages' through the summer of 1938 catalysed another campaign against Ipi, with almost all of India's eight squadrons fully committed to this final phase of the Waziristan Campaign. Embry's squadron flew the column commanders over the area of impending operations at Kharre, the Fakir's new refuge adjacent to the Afghan border (see Map 3, arrow 5). Inter-service liaison was facilitated by deploying a 20 (AC) Squadron officer with each brigade and two Army officers to Miranshah. The RAF officers deployed with the columns communicated with aircraft via W/T pack sets, Popham panels, picqueting strips and message dropping, while the Army column commander communicated with his Miranshah liaison staff via an Army W/T set deployed with the column and an RAF mobile set at Miranshah. This proved 'extremely successful', inflicting unusually high tribal casualties, primarily because Ipi's new recruits were largely Afghan who, unaccustomed to aircraft and

dressed in white, failed to conceal themselves. After strong tribal opposition, both sides withdrew.[63] Kharre was subsequently inconclusively proscribed to deter the Fakir's return. The Air Staff noted that: 'At the end of nearly two years of operations trouble appears to be more widespread than ever [...] an alteration in frontier policy is urgent.'[64] The operation illustrated that, despite effective air-land co-operation and local tactical successes, the effect of both punitive columns and aerial proscription was temporary and required constant engagement to counter insurgent activity.

Despite the Air Staff's disapproval, many tribes were subjected to punitive air proscription and destructive air action between September and December 1938 for supporting the Fakir, all without invoking tribal responsibility.[65] In one case, the proscription of the Fakir's own Tori Khel grazing grounds took almost seven months for the tribe to concede and required a joint political, economic and land blockade. HQ RAF, India summarised this action thus:

> 'Although the original aim [...] was of a punitive nature, it was hoped at the same time that air action and other punitive measures would bring sufficient pressure to bear on the tribe to induce them to settle [...] This hope, however, was not to be realised as the hostiles repeatedly declared their inability to submit until the FAQIR himself makes his peace, but the tribe has nevertheless shown their desire to divorce themselves completely from their hostiles in the future.'[66]

The Air Staff at RAF, India were in an unenviable position: educated in RAF doctrine and convinced about the efficacy of the 'air method', they were nevertheless largely constrained by their Indian chain of command to supporting the Army and applying tactics with which they disagreed. Nevertheless, the Tori Khel proscription indicates that the local Air Staff were actively fostering doctrinal convergence by manipulating the Army's punitive policy into a coercive action akin to the Air Ministry's doctrinally-pure air blockade. It is apparent that RAF, India viewed air action in terms of 'effects', using its resources to achieve the Army's objectives (the compliance of the tribes) but via a different causal mechanism (coercion, rather than punishment) based on the use of minimum, rather than overwhelming, force. AOC RAF, India's commentary also

indicates that joint action was generating tension between the tribes and Ipi despite the cohesive tribal bonds. It also highlights the close association between air and political action, with the blockade extending to the political and economic domains.

With the Army largely confined to road protection duties, harassing Ipi and his supporters required 300% more sorties in February/March 1939 than the previous year.[67] The RAF seemed to be gaining increasing traction, as the Government then imposed a successful, forty-three-day air, ration and financial 'blockade' on the Madda Khel tribe's village (south west of Kharre).[68] This only differed from the Air Staff's pure air blockade in that the terms were a little vague. In London, Embry, who had recently returned from India to become the Air Staff's India desk officer, described it as 'an epoch making event' as it was the first true air blockade since Pink's War in 1925:

> 'It is interesting that it took only six weeks to bring about the complete submission of the tribe, whereas the proscription and half hearted air blockade of the Tori Khel which has been undertaken in conjunction with land operations has taken over six months to bring about the desired results.'[69]

Embry's comments are interesting, as they show that a recently-returned Squadron Commander felt comfortable criticising India's Army-dominated application of air power.

By April 1939, AOC RAF, India assessed that constant aerial harassment and action against Ipi's supporting tribes had nullified his influence, leaving the tribes wanting peace and allowing Waziristan aircraft strength to reduce to peacetime levels. Although the Fakir flitted from one side of the Afghan border to the other, constant aerial harassment denied him respite; he had been conditioned to move as soon as leaflets were dropped. He had also been made 'an unwelcome lodger' with the local tribes and his influence over them had been largely nullified by three years of near-constant air action.[70] Despite a few naïve attempts by Italy and Germany to court the Fakir during the Second World War, he maintained a parochial perspective and remained largely aloof towards non-Muslims.[71] Interestingly, following the Partition of India in 1947, Pakistan adopted the recommendations of the British 1944 Frontier Commission,

withdrawing all regular forces from the tribal agencies.[72] Thereafter, security, including the containment of the Fakir, was provided by irregular forces backed by the Pakistan Air Force until the events of 9/11 changed the paradigm.

So much for the Waziristan Campaign itself. But what, if anything, was its legacy? Observers have recognised the influence of RAF inter-war air policing on its subsequent Second World War strategic bombing policy. Saundby observed in 1961 that air control:

> '. . . encouraged the specialization of the training and equipment of the Royal Air Force along the lines that seriously prejudiced its effectiveness in a major war [...] all British bomber aircraft, bomb-sights, bombs, and the training of bomber crews, were specialized for use in air control operations.'[73]

At the outbreak of the Second World War, Brooke-Popham suggested retaliating against Germany with a bombing policy adapted from 'dealing with recalcitrant tribesmen.'[74] Amongst several other references to the influence of air policing was a 1941 Air Staff paper that stated that Bomber Command's strategic bombing policy was:

> '. . . an adaption, though on a greatly magnified scale, of the policy of air control which has proved so outstandingly successful in recent years in the small wars in which the Air Force has been continuously engaged.'[75]

The archive indicates that, from the Air Staff's perspective, the NWF was the most influential and highest profile Imperial theatre in the mid and late-1930s due to the number of squadrons deployed, the high tempo of operations and concomitant weapon expenditure associated with containing the Fakir of Ipi during the immediate pre-war period. It therefore represented the RAF's largest and most recent source of operational experience. Furthermore, a significant number of pivotal Second World War senior RAF officers had 'cut their teeth' in India. Sir John Steel had been AOC RAF, India immediately before becoming AOCinC Bomber Command in 1936. His replacement during the crucial 1937-40 period, Sir Edgar Ludlow-Hewitt, had also been AOC in India immediately before his appointment. Ludlow-Hewitt's replacement, 'Bomber' Harris, had been OC 31 Squadron in India in 1921-22 where he had nearly resigned over the Army's

attitude towards the RAF.[76] Sir Norman Bottomley, who was appointed Bomber Command's Senior Air Staff Officer in 1938, then AOC 5 (Bomber) Group, before becoming Deputy Chief of the Air Staff from 1941 to 1945, had been OC 1 (Indian) Group in 1934-37. Sir Philip Joubert de la Ferté, who was Assistant Chief of the Air Staff in 1940, had been AOC RAF, India immediately beforehand during the Waziristan Campaign. Several wartime AOCs, such as Slessor and Embry, had been Squadron or Wing Commanders on the NWF. Overall, there is significant evidence that NWF operations had, at the very least, reinforced the RAF's belief in the efficacy of morale bombing, especially since the Air Staff interpreted the ineffectiveness of the Army's application of Frontier air power as a vindication of their own doctrine, despite true air blockades only being employed twice (albeit successfully).

As Saundby reflected in 1961, '. . . the preservation of the Royal Air Force as a separate Service had resulted in its bombing activities becoming specialized along the lines needed for successful air control operations . . .'[77] So, what were the implications for Bomber Command's initial strategy entering the Second World War?

As the Waziristan Campaign was escalating in India, the threat of war was looming in Europe. Using the parlance of the day, the RAF required 'parity' in numbers and a credible 'shop window' to deter (rather than fight) a war. The Treasury's desire for 'defence on the cheap' resulted in 'a politician's window dressing scheme'. The RAF, though unconvinced, was forced to accept an unreal distinction between a deterrent force and a force capable of fighting.[78] When Ludlow-Hewitt was appointed AOCinC Bomber Command on his return from India in 1937, he summarised that the RAF's rapid pre-war expansion had 'failed to address the crucial issues of night flying training, navigational aids, and the vulnerability of bombers to enemy fighter attack during daylight raids,' concluding that Bomber Command was 'entirely unprepared for war, unable to operate except in fair weather, and extremely vulnerable [...] in the air'.[79] Thus, until immediately before the Second World War, inter-war RAF bomber squadrons were trained for peacetime flying rather than combat operations against a peer opponent. As Webster and Frankland stated, it was hard to discover in peacetime what the wartime obstacles would be, especially when the most recent combat in Waziristan was

generating false lessons.[80] Slessor later commented, '. . . our imagination was not sufficiently flexible and our experience too limited to comprehend quickly enough the very far-reaching technical requirements of a modern striking-force.'[81]

As early as 1932, it was widely publicised that 'the bomber will always get through'.[82] The Air Staff envisaged massed, unescorted bomber formations operating in daylight, fending off hostile fighter aircraft with co-ordinated, overlapping defensive machine guns from their multiple-gunned turrets. Indeed, the fighter was perceived to be at a disadvantage, as it had to point precisely at the bomber to aim its forward-firing weapons, whereas the bomber's turrets could engage fighters from almost any direction. This invulnerability would allow the bomber to penetrate hostile airspace in daylight, when navigation was relatively simple, then drop weapons accurately using relatively simple bombsights where the effect of the bombs would prove devastating.[83]

The advent of the Second World War quickly revealed the vulnerability of the bomber. On 4 September 1939, six of ten Blenheims were lost during a low-level attack on the *Admiral Scheer* off Wilhelmshaven; five out of twelve Wellingtons were lost attacking three German destroyers on 14 December; and twelve out of twenty-two Wellingtons were lost attacking naval targets at Wilhelmshaven on 18 December. After initial analysis that these losses were due to poor formation keeping, it became apparent, as the RAF's *Official History* noted, that 'the whole conception of the self-defending formation had been exploded.' By May 1940, Bomber Command's heavy bombers were operating exclusively by night.[84]

Probably the most misleading characteristic of air policing was the lack of a hostile air threat which created a largely permissive operating environment. This obscured the true vulnerability of the bomber to fast, agile monoplane fighters and the need for defensive armament, armour and fighter escort. Bomber Command's ·303 inch-armed turrets proved no match for the German fighters' longer-range, highly lethal cannon, while the challenges of coordinating defensive fire between formating bombers had been overlooked. Like most air policing operations, Bomber Command had been expected to operate in daylight, but the switch to night operations revealed the inadequacies in both night navigation training and target acquisition.

The First World War-vintage unstabilised Course Setting Bomb Sight (CSBS) had been adequate on the NWF; it was relatively simple to train the air gunners locally-recruited in India to use it and provided adequate accuracy to hit relatively large targets such as tribal villages when the bomber could attack into-wind (to minimise cross-wind errors) and in steady, level flight. Indeed, the ability for air policing squadrons to locally recruit and train 'air gunners' to an adequate level of competence in bomb aiming, photography and wireless operating obscured the requirement for specialist aircrew such as observers and bomb aimers.[85] The unstabilised CSBS quickly proved inadequate when the bomber was restricted to a line of attack and had to manoeuvre around anti-aircraft fire while attempting to hit small, defended targets – Bomber Harris described the CSBS as 'junk'.[86] Thus, air policing obfuscated the development of precision bombing. It also hindered the development of the large bombs required to disrupt industrial targets, as relatively small bombs had been sufficient for air policing.[87] This also thwarted the development of aircraft capable of carrying larger bombs; a requirement for 1,000 and 2,000-pound bombs was shelved in 1932 due to pressure from aircraft designers and lack of Air Staff support.[88] Furthermore, the RAF failed to draw lessons concerning the relatively high failure rate of bombs from its air policing experience, largely because enough ordnance detonated to achieve the desired effect.[89] It took the 1941 *Butt Report* to reveal all these inadequacies, and the establishment of Bomber Command's Operational Research Section, to turn Bomber Command into the effective weapon system that had been envisaged in the 1930s.

In conclusion, Indian air policing not only affords an interesting insight into the inter-Service challenges associated with the application of air power in small wars, but also provided the formative operational experience for many influential Second World War RAF commanders. The 1936-39 Waziristan Campaign was amongst the most significant inter-war operation, but the internecine friction between the Indian Army and the RAF squandered the opportunity to test independent air power. This reinforced the Air Staff's misconceptions about the effectiveness of aerial bombing against a peer adversary which were only revealed during the Second World War. The Waziristan Campaign underlines the need for thorough

analysis and experimentation to avoid inappropriately transposing lessons from one operational theatre to another.

Notes:

(TNA – The National Archives; JRUSI – Journal of the Royal United Services Institute; JUSII – Journal of the United Services Institute of India)

[1] Marsh, Brandon D; *Ramparts of Empire: India's North-West Frontier and British Imperialism, 1919-1947* (University of Texas at Austin, 2009), pvii.

[2] This 'Modified Close Border' policy had been instigated by the Viceroy, Lord Curzon, in 1899; its central theme was co-operation and reconciliation with the tribes, rather than coercion and subjugation. See Curzon's Freedom of the City of London Speech, 1904, in Lord George Curzon's *Lord Curzon in India: Being a Selection from his Speeches as Viceroy & Governor-General of India 1898-1905* (London: Macmillan, 1906), p43.

[3] See Marsh, *Ramparts of Empire*, pp41-48.

[4] Taunton, Brigadier D E in G Moore; *Just as Good as the Rest: a British Battalion in the Faqir of Ipi's War, Indian NWF, 1936-37* (Huntingdon: Published privately by the author, 1981), p3.

[5] Coatman, J; *Years of Destiny: India 1926-1932* (London: Jonathan Cape, 1932), p130 and Bruce, Colonel Charles E; *Waziristan, 1936-1937: The Problems of the North-West Frontiers of India and their Solutions* (Aldershot: Gale & Polden, 1938), p36.

[6] Hansard, Vol 123, cols 131 & 137, House of Commons, Parliamentary Debates, *Pay of the Air Force*, 15 December 1919. Winston Churchill was the first Secretary of State for Air.

[7] Army Staff College Camberley. 'Mountain Warfare Exercise', Senior Division Directing Staff Lecture Notes (1929), File 26, Annex A.

[8] Camberley Army Staff College, 'Mountain Staff Tour, DS Notes on Exercise No 3', Senior Division Directing Staff Lecture Notes (1923).

[9] See: *Official History of Operations on the N. W. Frontier of India 1936-37*, [hereinafter *Official History*] (Delhi: Manager of Publications, 1943), p204 and Masters, John; *Bugles and a Tiger: A Personal Adventure* (London: Michael Joseph, 1956), pp208-209.

[10] Chamier, Wg Cdr John A 'The Use of the Air Force for Replacing Military Garrisons' in *JRUSI*, Vol LXVI, No 462 (1921), pp209-210. Chamier had been an officer in the 33rd Punjabi Regiment before joining the Royal Flying Corps. In 1921, he was Deputy Director of the Directorate of Operations and Intelligence, responsible for RAF doctrine.

[11] Air Council, CD 22: Operations Manual, Royal Air Force (London: Air Ministry, 1922), pp128-130.

[12] Amongst the first mentions of the blockade tactic were from India in TNA AIR 5/1328, Air Staff, Employment of Aircraft on the North-West Frontier of India, 1 March 1924.

[13] Portal, Air Cdre C F A; 'Air Force Co-operation in Policing the Empire' in *JRUSI*, Vol LXXXII, No 526 (1937).

[14] TNA AIR 5/1326, Darvall, Wg Cdr L; Memo, FO5 to Deputy Chief of the Air Staff through Deputy Director Plans, 26 January 1939.
[15] See, for example, Trenchard Maj-Gen H; 'Despatch from Commander, Independent Force, Royal Air Force' in *Tenth Supplement to The London Gazette*, 31 December 1918, p135.
[16] TNA AIR 9/12 Enclosure 104, Air Staff RAF, India Memo No 1: Tactical Methods of Conducting Air Operations Against Tribes on the North-West Frontier of India, April 1935, p1. Camberley Army Staff College, 'Mountain Warfare Exercise', Senior Division Directing Staff Lecture Notes (1933): p27.
[17] Portal, 'Air Force Co-operation in Policing the Empire', p356.
[18] TNA AIR 23/688, Joubert de la Ferté, Air Mshl Sir Philip; Letter, AOC RAF, India, to SASO, India, 16 June 1938. Charles Chenevix Trench recorded another, tactical, example whereby an outspoken Frontier Officer attending a high-level operations conference by a 'very senior' officer on air control responded with: 'Listen, chum, your job is to drive the f*****g aeroplane' [see Trench; *Viceroy's Agent* (London: Jonathan Cape, 1987), p77].
[19] The Air Ministry had formally proposed the imposition of air control on the NWF in 1922, 1925 (following 'Pink's War') and 1929 (Trenchard's 'swansong'). See: TNA AIR 8/46, E1, AVM Sir J M Salmond, 'Report by Air Vice Marshal Sir John Salmond on the Royal Air Force in India', August 1922; AIR 1/2399/283/1, Air Staff, 'The Progress of the Development of Air Power in India, Appendix A: Outline Scheme for the Control of the North-West Frontier of India by the Royal Air Force', July 1925 and TNA CAB 24/207, MRAF Sir Hugh Trenchard, Cabinet Paper 332 (29): 'The Fuller Employment of Air Power in Imperial Defence', November 1929.
[20] Waldie, D J P; 'Relations Between the Army and the Royal Air Force, 1918-1939' (unpublished PhD Thesis, King's College London (University of London), 1980), p211.
[21] Macmillan, Norman; *Sir Sefton Brancker* (William Heinemann, 1935), pp14-19 and 'Flying School for India' in *Flight*, 11 April 1914.
[22] TNA AIR 1/31/15/1/165 E2, USofS for India, 'Copy Telegram from Viceroy to Secretary of State. Dated 20th August 1915', 28 August 1915.
[23] For a first-hand account of the raid, see: Halley, J; 'The Kabul Raid' in *Aeroplane Monthly*, August 1979.
[24] Bottomley, Air Cdre Norman H; 'The Work of the Royal Air Force on the North-West Frontier' in *JRUSI*, Vol LXXXIV, No 535 (1939), p774. TNA AIR 23/5370, India Defence Department, 'Frontier Warfare – India (Army and Royal Air Force)' 1939, pp31-32.
[25] *Ibid*. Bottomley, 'Work of the RAF on the NWF', p775 and TNA AIR 23/5370 'Frontier Warfare – India', pp30-31.
[26] For a description of air gunner training and bomb aiming (albeit in Egypt), see Conroy, Dennis; *The Best of Luck, In the Royal Air Force 1935-1946* (Trafford Publishing: 2006).
[27] Chamberlain, Flt Lt G P; 'The Adoption of R/T for Close Reconnaissance Aircraft in India, in *RAF Quarterly*, Vol IV, No 3 (1933) and Slessor, Sqn Ldr J C; 'RAF and

Army Co-operation – The Other Point of View' in *JUSII*, Vol LVI, No 243 (1926): pp126-127.

[28] Stevenson, Flt Lt R L; 'The Army Co-operation Squadron' in *JUSII*, Vol LV, No 240 (1925).

[29] See, for example, Morley-Mower, Geoffrey; *Flying Blind: A Memoir of Biplane Operations Over Waziristan in the Last Days of British Rule in India* (Yucca Tree Press, 2000), p124.

[30] Bottomley, ' Work of the RAF on the NWF', pp777-78.

[31] TNA CAB 24/287/16 and AIR 8/255, Lord Chatfield, 'Cabinet Paper 133(39): Report of the Expert Committee on the Defence of India, 1938-39 [Chatfield Report]', 30 January 1939, pp41-43 (also published as ID(38)10 in CAB 27/654). See also AIR 23/687, Air Staff, 'Proposal to Form a Bomber Transport Squadron'.

[32] There was also a permanent RAF flight detached to Miranshah in North Waziristan, which each squadron rotated through. Recently-arrived aircraft were assembled at the RAF aircraft depot at Karachi.

[33] Hauner, Milan; 'One Man against the Empire: The Faqir of Ipi and the British in Central Asia on the Eve of and during the Second World War', http://www.khyber.org/publications/021-025/faqiripi.shtml (accessed 3 October 2013). The Fakir continued a low-level insurgency throughout the Second World War, with varying degrees of German and Italian sponsorship. He continued his resistance against the Pakistan Government after Partition, eventually dying in 1960. For more information about the Islam Bibi case, see Jahangir Khan Sikandri, 'The Brief History of Bannu', http://www.bannubiradari.com/index.php?option=com_content&view=article&id=117:the-brief-history-of-bannu&catid=30:history&Itemid=99 (accessed 11 August 2018), pp23-28.

[34] Moreman, T R; "'Passing it On': The Army in India and the Development of Frontier Warfare, 1849-1947" (PhD Thesis, King's College, University of London, 1995), p163.

[35] TNA AIR 5/1335, 'RAF, India Monthly General Summary of Work [hereinafter 'Summary of Work']; No 216: November 1936', pp3-5. *Official History*, pp5-7, 13. Cassels, General R A; 'Report on Operations in Waziristan 25th November 1936 to 16th January 1937 (1st Phase)' in *Supplement to The London Gazette*, 2 November 1937, 6812. In March 1935, the Government had increased the Khaisora tribe's allowances in return for the right of access to the Lower Khaisora and their other territories in the North Waziristan Agency. See *Official History*, p3.

[36] TNA AIR 75/31, Slessor, Wg Cdr J C; 'Operations in Waziristan. 24 November 1936 to 15 January 1937', January 1937, pp3-5.

[37] *Official History*, p20.

[38] Slessor, *Operations in Waziristan*, p5. TNA AIR 5/1335, 'Summary of Work No 216: November 1936', pp3-5. *Official History*, p13. For further descriptions of this engagement, see Coningham, Simon; 'Air/Ground Co-operation between the RAF and the Indian Army in Waziristan 1936-37' in *British Commission for Military History Summer Conference 2012 – Indian Armies* (Keble College Oxford: British Commission for Military History, 2012), pp5-7 and Warren, Alan; *Waziristan, the*

Faqir of Ipi, and the Indian Army: The North West Frontier Revolt of 1936-37 (Oxford: Oxford University Press, 2000), pp114-122.

[39] Slessor was assigned as air advisor to the Army HQ, with four flights deployed to Miranshah as well as Nos 27(B) and 60(B) Sqns from No 1 (Indian) Wing, Kohat, at his disposal.

[40] Aircraft dropped 10,000 lb of supplies to the newly-established Khaisora Camp when rain made the road impassable Aircraft routinely provided continuous close reconnaissance, twice-daily deeper reconnaissance sorties, photographic reconnaissance, supply dropping, 'travel sorties' and a daily air service to distribute orders to the deployed units which 'proved to be the only way of circulating written orders in time'(see TNA AIR 5/1335, 'Summary of Work No 217: December 1936', pp4 & 26).

[41] *Ibid*, 'Summary of Work No 217: December 1936', pp5-6; 'Summary of Work No 218: January 1937', pp3 & 5. *Official History*, p31.

[42] *Official History*, p38.

[43] TNA AIR 23/688, Ludlow-Hewitt, Air Mshl Sir Edgar; Letter, AOC, RAF, India, to Sir Edward L Ellington, CAS, 5 March 1937, p4.

[44] *Official History*, p38.

[45] TNA AIR 5/1335, 'Summary of Work No 220: March 1937', p4-6. For more information about the murder of Captain Keogh and Lieutenant Beatty (the Assistant Political Agent in North Waziristan), see *Official History*, pp38-39 and Trench, *Viceroy's Agent*, pp68-69. By April, the murderers had been expelled and the tribe had accepted a fine (see *Official History*, p40).

[46] TNA AIR 5/1335, 'Summary of Work No 220: March 1937', p5; 'Summary of Work No 221: April 1937', p3.

[47] This event made headlines and even made copy in social commentary magazines, such as *Life* magazine (see 'Sudden Death on India's Northwest Frontier' in *Life*, 3 May 1937). For a detailed description of the ambush, see Trench, *Viceroy's Agent*, pp70-71.

[48] The BTF was reinforced by a flight from 70(B) Squadron from Iraq from June to September 1937.

[49] During the advance, 20(AC) Squadron conducted air action around 1 Division, while the rest of the area was proscribed by 27(B) and 60(B) Squadrons (see TNA AIR 5/1335, 'Summary of Work No 221: April 1937', p7).

[50] *Official History*, pp76-77. Cassels, 'Report on Operations in Waziristan, 16th January 1937 to 15th September 1937' in *Second Supplement to The London Gazette*, 15 February 1938, 1059. TNA AIR 5/1335, 'Summary of Work No 221: April 1937', p8.

[51] TNA AIR 5/1335, covering minute to 'Summary of Work No 221: April 1937'.

[52] *Ibid.*

[53] *Ibid*, 'Summary of Work No 222: May 1937'. *Official History*, pp79, 83-86.

[54] *Ibid*, 'Summary of Work No 222: May 1937'. Cassels, 'Report on Ops in Waziristan, 16th January to 15th September 1937', 1060. *Official History*, p111. For another description of the Iblanke Pass assault, see Newman, Lt-Col H E M; 'Waziristan 1937 to 1939' in *Royal Engineers Journal* 98, No 2 (1984).

[55] Johnson, Rob; *The Afghan Way of War: Culture and Pragmatism: A Critical History* (London: Hurst & Co, 2011), pp197-198. *Official History*, pp96, 103-105, 111-113 & 116. TNA AIR 5/1335, 'Summary of Work No 222: May 1937', p8 and 'Summary of Work No 223: June 1937', p4.

[56] Cassels, 'Report on Ops in Waziristan, 16th January to 15th September 1937', 1061.

[57] TNA AIR 5/1335, 'Summary of Work No 223: June 1937', p8. *Official History*, pp153-154.

[58] *Ibid*, Darvall, Sqn Ldr L; Minute to 'Summary of Work No 227: October 1937'.

[59] *Ibid*, 'Summary of Work No 226: September 1937', pp4-7, 10; Darvall, Minute to 'Summary of Work No 227', p7. *Official History*, pp170-171, 176-179, 204 & 207.

[60] TNA AIR 5/1336, 'Summary of Work No 230: January 1938', p3; 'Summary of Work No 232: March 1938', p3; 'Summary of Work No 236: July 1938', p3; 'Summary of Work No 234: May 1938', p4.

[61] *Ibid*, Darvall, Minute to 'Summary of Work No 234: May 1938'.

[62] *Ibid*, 'Summary of Work No 235: June 1938', pp3, 9-11. Embry, Air Chf Mshl Sir Basil; *Mission Completed* (London: Methuen & Co, 1957), pp80-82. For a good description of the whole episode, see Hauner, 'One Man against the Empire'.

[63] *Ibid*, 'Summary of Work No 236: July 1938', pp5-6,8-10. See also Cassels, 'Report on Operations in Waziristan, 16th December 1937 to the 31st December, 1938' in *Supplement to The London Gazette*, 15 August 1939, 5669.

[64] *Ibid*, Darvall, Minute to 'Summary of Work No 236: July 1938'.

[65] *Ibid*, 'Summary of Work No 238, September 1938', p8; 'Summary of Work No 239: October 1938', pp6-9; 'Summary of Work No 240: November 1938', pp5-7; 'Summary of Work No 241: December 1938', pp7-8.

[66] *Ibid*, 'Summary of Work No 234; May 1938', p6.

[67] TNA AIR 5/1337, 'Summary of Work No 246: May 1939', p9.

[68] *Ibid*, 'Summary of Work No 243: February 1939', pp11-12; 'Summary of Work No 244: March 1939', p13; 'Summary of Work No 245: April 1939', pp7-8.

[69] *Ibid*, Embry, Wg Cdr B E; Minute to 'Summary of Work No 245: April 1939'.

[70] *Ibid*, 'Summary of Work No 250: September 1939', p4.

[71] See Hauner, 'One Man against the Empire'.

[72] Cotton, Lt-Col H E M; 'Operation Curzon – The Evacuation of Waziristan' in *The Royal Engineers Journal* 62 (1948). For good explanations of the Tuker Frontier Committee Report, see: Tripodi, Christian; *Edge of Empire: The British Political Officer and the Tribal Administration of the North-West Frontier, 1877-1947* (Farnham: Ashgate Publishing, 2011), pp214-217 and Marsh, *Ramparts of Empire*, pp228, 235-236.

[73] Saundby, Air Mshl Sir Robert; *Air Bombardment: The Story of its Development* (London: Chatto & Windus, 1961), p46.

[74] TNA AIR 20/438, Brooke-Popham, Air Chf Mshl R; Cypher Message, Brooke-Popham to CAS, 15 September 1939.

[75] TNA AIR 19/186, Air Staff, 'Development and Employment of the Heavy Bomber Force, 22 September 1941', p1.

[76] Probert, Henry; *Bomber Harris: His Life and Times* (London: Greenhill Books, 2001), pp49-50.
[77] Saundby, *Air Bombardment*, p46. Saundby was Senior Air Staff Officer and then Deputy AOCinC Bomber Command from 1940.
[78] Baughen, Greg; *The Rise of the Bomber: RAF-Army Planning 1919 to Munich 1938* (Fonthill, 2016), p172. Smith, Malcom; 'The Royal Air Force, Air Power and British Foreign Policy, 1932-37' in *Journal of Contemporary History* 12, No 1 (1977), p162. TNA AIR 41/39; RAF Air Historical Branch, 'RAF Narrative: The RAF in the Bombing Offensive Against Germany: Volume I: Pre-War Evolution of Bomber Command, 1917 to 1939', 1948, p107.
[79] Royal Air Force Website, 'Air Chief Marshal Sir Edgar Ludlow-Hewitt: C-in-C Bomber Command 1937-40', http://www.raf.mod.uk/history/bombercommand commandersofworldwariithecommandchief.cfm (accessed 1 May 2017). (This page is no longer accessible - **Ed**)
[80] Webster, Sir Charles and Frankland, Noble; *The Strategic Air Offensive Against Germany, 1939-1945, Vol I: Preparation* (Uckfield: Naval & Military Press, 1961), p108.
[81] Slessor, MRAF Sir John; *The Central Blue: Recollections and Reflections of Marshal of the Royal Air Force Sir John Slessor* (London: Cassell, 1956), pp203-204.
[82] As averred by Baldwin in his famous speech (Hansard, Vol 270, col 632, House of Commons, Parliamentary Debates, *International Affairs*, 10 November 1932).
[83] The RAF's confidence in the defensive ability was mirrored by the Royal Navy, who dismissed the vulnerability of the battleship to bombers.
[84] Webster and Frankland, *The Strategic Air Offensive Against Germany, Vol I*, pp192-197, 213.
[85] The RAF abandoned the observer role in 1920 and only resurrected it in 1935 (see Jefford, Wg Cdr C G; *Observers and Navigators and other Non-Pilot Aircrew in the RFC, RNAS and RAF*, Revised 2nd ed. (London: Grub Street, 2014); pp130-131, 145-149.
[86] Portal Archive 1, Folder 9, Item 32: Air Mshl A T Harris, Letter, Air Officer Commanding-in-Chief, Bomber Command, to Chief of the Air Staff, 12 June 1942.
[87] RAF stocks of general purpose bombs at the outbreak of the Second World War were limited almost exclusively to 250 and 500-pound variants. See Huskinson, Air Cdre P; *Vision Ahead* (London: Werner Laurie, 1949), p68.
[88] Huskinson, *Vision Ahead*, pp67-68. TNA AIR 10/7477, RAF Air Historical Branch, *Armament: Volume 1: Bombs and Bombing Equipment (SD719)*, 1952, pp6, 10-11.
[89] Allen, Wg Cdr Hubert R; *The Legacy of Lord Trenchard* (London: Cassell, 1972), p50. 'Dizzy' Allen's work was republished more recently as *British Bombing Policy During the Second World War* (Fonthill Media, 2016).

EXTENDING THE OPERATIONAL CAPABILITY – FURTHER, HIGHER AND FASTER

by Air Cdre Graham Pitchfork

Following an initial Canberra tour in Germany, in 1965, Graham Pitchfork, a Cranwell-trained navigator, was seconded to the FAA to fly Buccaneers. Thereafter his career was inextricably linked with that aeroplane, culminating in command of No 208 Sqn. He later commanded RAF Finningley and was Commandant OASC before a final tour as Director of Operational Intelligence. He has written many aviation-related books and is an active member of this Society's Executive Committee.

At the beginning of the First World War, aircraft were primitive, unarmed artillery spotters that could barely take offensive action. Four years later they had become modern fighters capable of flying at 150 miles per hour and powerful bombers able to reach Berlin.

In the peace that followed, the dramatic advances in technology, capability and experience, triggered by the needs of war, created new opportunities for Britain with overseas territories under imperial and mandated control. Over the next twenty years the RAF was to work hard to extend its operational capabilities by flying further, higher and faster.

Further

First, I want to address the capability to fly further. I am, of course, aware that there were many private enterprises and numerous long-distance records set by individuals but here I am addressing only the RAF's efforts.

It is perhaps not surprising that the RAF, and indeed the country, recognised the opportunity to build on the advances and experiences gained by the development of the long-range bomber. On the day the Armistice was signed, three four-engine Handley Page V/1500 bombers of No 166 Sqn were standing by at RAF Bircham Newton in Norfolk to take off to bomb the German capital. With a far-flung empire and large military commitments in Egypt, the Middle East and in India the use of such aircraft to reach these areas quickly had major

HP O/400, C9681, and (L to R) Maj Archie MacLaren (with 'Tiny'), Sgt R G Goldfinch, AM J A Francis and Brig Gen A E 'Biffy' Borton.

operational advantages. Establishing routes and staging posts to these areas also created many opportunities for the exploitation of those routes for commercial benefit.

Before looking at two particular long-range achievements, it is worth reminding ourselves of some of the early flights that helped establish these routes.

The first significant long-range flights actually took place before the end of the war. A Royal Naval Air Service Handley Page O/100, piloted by Sqn Cdr Kenneth Savory, and with four other crew-members, left Manston on 22 May 1917 and two weeks later landed at Lemnos having flown 1,955 miles in a flying time of 31 hours 30 minutes. The aircraft was used to bomb Turkish positions.

On 24 July 1918, an RAF Handley Page O/400, flown by Brig-Gen 'Biffy' Borton and Maj Archie MacLaren, and with two tradesmen drawn from the Cranwell establishment, took off from Cranwell to fly, via France, Italy and Crete, to Egypt. It reached Cairo on 8 August having covered a distance of 2,592 miles in an airborne time of 36 hours and 15 minutes. In due course, this O/400, a single aircraft, made a significant contribution to the final defeat of Turkish forces in

The Fairey IIIDs that flew from Egypt to Cape Town in 1926.

Palestine.

Within weeks of the end of the First World War, another O/400 and a much larger V/1500, the latter being named *Old Carthusian*, were flown all the way to India via France and Egypt. On 24 May 1919 Capt Jock Halley and Lt Villiers took off from Risalpur in *Old Carthusian* and bombed the Emir Amanulla's palace in Kabul and within days, the short-lived Third Afghan War was over. This was a powerful demonstration of how the long reach and rapid response made possible by one just aircraft, could influence a major outbreak of political unrest that might otherwise have taken months to resolve with just ground forces.

During the 1920s there were a number of 'long distance flights' along remote routes, which extended the RAF's horizons. A good example is the creation and establishment from 1921 of the Cairo to Baghdad Air Mail route, which is so well described by Jeff Jefford in the Society's Journal 66. Pioneered and operated by the RAF for a number of years, it was eventually taken over by Imperial Airways and by 1927 the route had become part of the company's Egypt to India service.

In October 1925, Sqn Ldr Arthur Coningham – later Air Mshl Sir Arthur of Desert Air Force fame – led three DH 9As of 47 Squadron on a flight from Helwan in Egypt to Kaduna in Nigeria. They returned in mid-November having covered 5,300 miles over very inhospitable terrain.

A much more ambitious flight took place in 1926 when four Fairey IIIDs flew from Heliopolis, also in Egypt, to Cape Town. This involved the pre-positioning of spares at various en-route airstrips. Led by Wg Cdr (later AVM) Pulford they transited through 22 landing

J9807, the first, of two, modified Horsleys. This one ditched in the Persian Gulf, the second one in the Danube.

grounds and arrived after six weeks on 12 April. The return flight began a week later arriving back at Heliopolis at the end of May. In Egypt, floats replaced their undercarriages and the four then headed for the UK, landing at Lee-on-Solent on 21 June. They had flown almost 14,000 miles. These two flights in Africa soon became regular training exercises for RAF squadrons based in the Middle East.

Early in 1927, the then Chief of the Air Staff, MRAF Sir Hugh Trenchard, directed that an RAF aircraft should be prepared and flown as far east as possible in order to establish a world long-distance record, held at the time by the French. He also ruled that a standard aircraft, suitably modified, was to be used. The aircraft chosen was a Hawker Horsley fitted with a 665 hp Rolls-Royce Condor engine and modified to carry seven fuel tanks.

After a series of practice flights of eight to nine hours duration, Flt Lts Carr (later Air Mshl Sir Roderick) and Leonard Gillman were the crew and they took off from Cranwell's long grass runway during the morning of 20 May 1927. There were occasional sightings of the aircraft, but nothing was heard until a report was received on 23 May that the aircraft had ditched into the Persian Gulf, 45 miles south-east of Bandar Abbas and the crew had been rescued. The aircraft had been airborne for 34 hours 35 minutes and had covered 3,419 miles, a new

The Far East Flight's Southamptons on the hard at Seletar.

world record. A few hours later, however, Charles Lindbergh landed in Paris at the end of his flight from the USA. He had covered a distance of some 3,600 miles so the RAF record was short lived.

The most spectacular of the long-range flights in the 1920s was the first formation flight from England to Singapore. Under the command of Gp Capt Henry Cave-Browne-Cave, the Far East Flight was established in 1927. Four specially modified Supermarine Southampton flying boats were prepared, and after a trial run to Egypt and back, the four left Felixstowe to fly to Mount Batten ready to depart on the 17 October.

The flight had a number of aims in addition to showing the flag and demonstrating the RAF's worldwide capabilities. These included conducting surveys of sites as possible seaplane bases, gathering information on local conditions and possible support, and conducting a largely unsupported expedition all under very varying conditions.

The route took the flight through the Mediterranean to Egypt and on to Baghdad before heading down the Persian Gulf to Karachi and on through India to Calcutta before heading for Rangoon. The four flying boats landed in formation at Seletar on 28 February 1928 having completed a flight of 10,500 miles in 140 hours of flying time.

The second stage of the expedition, after a period servicing the aircraft in Singapore, was a circumnavigation of the Australian continent. This was successful and on 1 September the four aircraft left Darwin to return to Singapore. There was one more 'cruise' and that was to Hong Kong and back via the Philippines and when they

returned to Singapore on 11 December 1928, 14 months after leaving the UK, they had covered 27,000 miles. The Far East Flight remained at Singapore and in the following January it became 205 Squadron, the first RAF squadron to be permanently based in the Far East.

Following the failed attempt by Carr and Gillman to reach India in the Hawker Horsley, the Air Ministry's Directorate of Technical Development issued a draft specification 33/27 in December 1927 for an advanced aircraft with a range of 5,000 miles. The result was the Fairey Long Range Monoplane, powered by a single 570 hp Napier Lion engine, which made its first flight from Northolt on 14 November 1928.

Due to a number of problems with the engine, it was not until March 1929 that a 24-hour proving flight could be made. The initial plan to create a long-distance record was to fly to South Africa but delays meant that wind and weather conditions were no longer favourable, so it was decided to try for the record by flying to Bangalore in southern India.

The aircraft was flown to Cranwell and the attempt on the world record began at 0937 hours on 24 April with Sqn Ldr Arthur Jones-Williams and Flt Lt Norman Jenkins as the crew. With a fuel load of 1,043 imperial gallons carried in eight wing tanks, the aircraft was airborne after a take-off run of 3,705 feet.

Flying at 8,000 feet, all went well until the aircraft was overhead Baghdad when it ran into a series of headwinds. As it headed towards India the headwind remained. South of Karachi, and with a groundspeed of only 97 mph, it became obvious that the record could not be broken and the attempt was abandoned. The aircraft turned back for Karachi and landed after a flight of 4,130 miles in 50 hours 48 minutes.

After returning to the UK, various changes were made to the aircraft in preparation for another attempt later in the year, including modifications to the fin and rudder to improve directional stability and the fitting of a radio transmitter for position reporting. With the same crew, the aircraft took off from Cranwell at 0800 hours on 16 December heading for Cape Town but disaster struck 12 hours later when the aircraft struck high ground at 2,300 feet south of Tunis and both men were killed. The flight log and the barograph were recovered, which highlighted a discrepancy, with the crew believing

The second Fairey Long Range Monoplane, K1991.

they were 2,000 feet higher.

Six months later, in July 1930, the Air Ministry issued Specification 14/30 for another long range machine and it was decided to improve the performance of the original Fairey aircraft rather than spend two years designing and producing a new aircraft. The fin/rudder modification was retained, wheel spats and improved fairings were fitted and the fuel system was modified to reduce losses due to evaporation. Better flight instruments were provided and a two-axis autopilot, for directional and lateral control, was fitted. The aircraft first flew on 30 June 1931 and was delivered to the RAF a month later.

Sqn Ldr Oliver Gayford and Flt Lt David Bett were the selected crew and they carried out a proving flight in October. They took off from Cranwell on 27 October and flew to Abu Sueir, a distance of 2,857 miles in 31 hours – the first non-stop flight from England to Egypt.

Weather conditions to fly to South Africa were unsuitable early in 1932 and it was not until the following year that another attempt on the world record could be made. This time, Flt Lt (later Air Mshl Sir) Gilbert Nicholetts accompanied Gayford who was in charge of the flight.

On 6 February 1933 the second Fairey Long Range Monoplane left Cranwell at 0715 hours. An average ground speed of 110 mph was achieved for the first twelve hours and a sextant check confirmed that the aircraft was on track over Tunis. Over northern Nigeria the autopilot failed and dust storms prevented visual navigation. Adverse

winds south of the Bay of Biafra confused the crew. When they reported their position as 30 miles north of Walvis Bay they were probably 300 miles north. When they eventually landed at Walvis Bay after a flight of 5,309 miles in 57 hours 25 minutes, less than ten gallons remained of the 1,150 gallons of fuel they had taken off with. Nevertheless, they had established a new record.

The aircraft was flown to Cape Town and later completed a 9,200-mile flag-waving tour of Africa returning to Farnborough on 2 May. Three months later, their record was broken.

Four years after the Walvis Bay record-breaking flight, the Air Ministry decided to make another attempt to capture the distance record, which was now held by the Russians with a non-stop flight of 6,306 miles. The RAF was keen to develop the Fairey but after a detailed study and cost appraisal it was decided to design and build a new aircraft using the latest techniques but little more was heard of the project. However, within a year, a new aircraft manufactured by Vickers, the first of the geodetic bombers, made its first flight. With a low weight, high-aspect-cantilever wing, retractable undercarriage and clean lines, the single-engine, low wing Wellesley monoplane, with an estimated range of 8,000 miles, was an obvious candidate for any further record-breaking attempts.

Initially, it was thought that the aircraft would fly non-stop to Singapore, a distance of 7,300 miles before proceeding to Sydney to coincide with the 150th anniversary celebrations of the founding of Australia.

The Air Ministry appointed Wg Cdr Gayford, the veteran of the record-breaking flight to South Africa, to command a new RAF unit to recapture the world's long-distance record. He was given a free hand to select the air and ground crews. Gayford chose four crews with three to make the record attempt. Each crew consisted of three pilots to share the flying load. One would be the first pilot and captain of the aircraft, the other a navigation expert and the third was to be an airman pilot with the basic trade of wireless operator mechanic. In the late 1930s, airman pilots were all drawn from the engineering trade so each crew would have a pilot skilled in maintenance.

A meeting with representatives of Vickers and Bristols was held at the end of October at Weybridge to discuss the technical aspects. The unit was to be equipped with a special version of the Wellesley, the

Type 292, modified for extended range. They were to have all the military equipment removed, additional fuel tanks installed and a 1,010hp Pegasus XXII engine with improved engine controls powered the aircraft. A Rotol constant-speed airscrew and a basic autopilot were fitted.

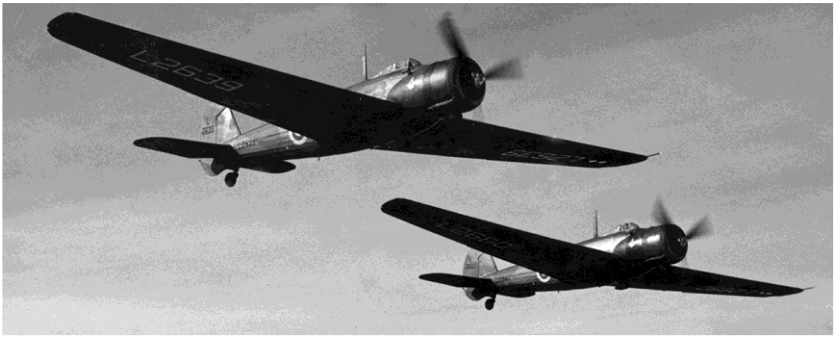
The standard Wellesley had a crew of two so there was going to be a degree of congestion in the already limited space. Arrangements also had to be made so that the three men could change positions in order to take their turn to pilot the aircraft. A system was devised and drills carried out so that a changeover could be completed in 20 seconds.

It was recognised that a forced landing at sea was a possibility (the aircraft only had one engine) so flotation gear would be taken but over land there was less risk attempting a force landing than baling out when survival aids would be lost, so parachutes would not be carried. The flight would be at 10,000 feet so there was no requirement for oxygen equipment and the only de-icing equipment would be for the pitot head and the carburettors.

On 1 January 1938 the Long Range Development Unit (LRDU) was formed at RAF Upper Heyford. Initially two standard Welleselys were provided and training began on these. Flights of six hours at 10,000 feet were carried out before more extended flights of twelve hours were flown. It was during one of these that a crew disappeared off the north of Scotland and no trace was ever found.

In April the modified aircraft arrived. The fuel capacity had been increased from 400 gallons to over 1,200, all carried in the wings. Each crew was allocated a specific aircraft and they flew a series of trial flights checking equipment, fuel consumption, the autopilot and cockpit layouts. By the end of May all the tests were completed and aircraft and crews were ready to carry out an extended trial flight of nearly 4,500 miles. The route chosen was Cranwell to Ismailia in Egypt, across to Basra and on down the Persian Gulf for some 200 miles before returning to land at Ismailia.

All four aircraft left Cranwell at dawn on 7 July and flew the Great Circle route to overhead Ismailia before heading for the Persian Gulf. They had become separated after a few hours since all were flying according to the optimum engine rpm and boost for each individual engine. All four aircraft had landed at Ismailia by noon on 8 July after a flight of about thirty-one hours. They returned to Upper Heyford a



Two of the LRDU's modified Wellesleys, L2639 and L2680, identifiable by the cowling of non-standard Pegasus XXII engine and the absence of the customary underwing bomb nacelles.

fortnight later.

The aircraft were serviced, new engines were fitted and a few modifications were made based on the experience of the trial flight. It was also decided that the record attempt would start at Ismailia and end at Darwin, before the aircraft headed for Sydney and a tour around Australia.

All five aircraft flew to Ismailia arriving on 26 October. Each crew had created a strip map of the route, the aircraft were serviced, compass swings were carried out and on the evening of 4 November, the aircraft were fuelled ready for a dawn take off.

The three Wellesleys took off as soon as it was light enough to see the runway, turned east and started the climb to 10,000 feet, which took 32 minutes. The route took them over Arabia and they reached the Persian Gulf after six hours. Darkness fell as they headed towards India, but the sky was clear, allowing astro fixing for navigation. They reached the Bay of Bengal after 20 hours, nearly 3,300 miles having been covered. For the next five hours they flew in and out of heavy cumulus making navigation difficult, but they got a brief glimpse of the Andaman Islands before reaching Malaya as night fell again.

Throughout that night the weather deteriorated as they flew through heavy clouds, thunderstorms and rain. Each aircraft maintained its engine settings for minimum fuel consumption and maximum performance, so speeds varied slightly. It was not possible to maintain formation but all three were in constant touch by wireless.

At dawn, the three rendezvoused at Lomblen Island in the Dutch East Indies to complete the flight together. Fuel checks indicated that two had sufficient to reach Darwin but it was very marginal for the third to make a landfall, so Flt Lt Rupert Hogan reluctantly diverted to Koepong to refuel. The other two crossed the Timor Sea and arrived at Darwin in formation at 1400 hours local time on the 7th of November having been met by four Ansons of No 4 Squadron RAAF.

The two aircraft had been airborne for 48 hours and 5 minutes having flown 7,159 miles; they had broken the Russian record by some 950 miles. The aircraft at Koepong had flown 6,658 miles so it too had beaten the previous record and it soon joined the other pair at Darwin. After landing, the No 1 aircraft, flown by Sqn Ldr Richard Kellett, had 44 gallons of fuel left and No 3, flown by Flt Lt Andrew Combe, had just 17 gallons.

The aircraft, and crews, had performed superbly. The autopilots behaved well and one pilot said, 'The flight was no strain on the crews. This is borne out by the programme for the rest of the day in Darwin; a late lunch, followed later by a cocktail party on a French sloop, guest night dinner in the Staff Corps Mess and a dance at the Victoria League.'

The Wellesleys left Darwin five days later for Brisbane, where they received a great welcome and were joined by Wg Cdr Gayford. On 17 November they headed for Sydney in time for the Anniversary celebration and where a colossal and even more enthusiastic crowd greeted them, and another formidable social programme awaited.

Later, the aircraft set off on a tour of Australia but two failed to complete the journey. The crews returned to the UK and the LRDU was awarded the Royal Aero Club Britannia Challenge Trophy for the most meritorious flight of 1938. Five of the officers that completed the whole journey were awarded the AFC and Sgt Gray, the third pilot in the No 3 aircraft received the AFM.

Five of the men reached air rank, one being Air Chf Mshl Sir Brian Burnett, two others were killed in action and one died in a training accident. Sgt Hector Gray was captured in Hong Kong and made heroic efforts to smuggle medical supplies for the POWs. He was discovered and executed by the Japanese. After the war he was posthumously awarded the George Cross.

In the 20 years since the end of the First World War, the RAF was

at the forefront of establishing long-range flights and creating world records. In due course, these routes became standard for the RAF as it supported the maintenance, policing and operational capability of its very widespread global commitments.

Higher

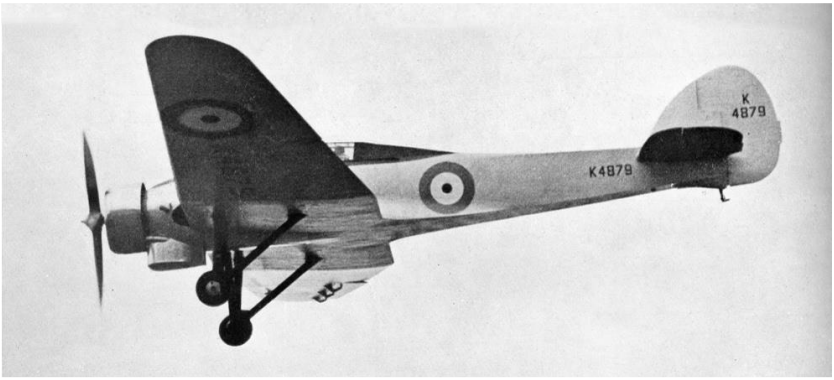
It seems incredible to me that during the latter stages of the First World War, open-cockpit aircraft were engaging each other at heights above 15,000 feet.

The newly-formed RAF recognised the advantages of flying high, particularly for reconnaissance and this was seen to great effect in the Second World War with the use of unarmed Spitfires and Mosquitos that relied on speed and altitude. However, many years earlier, the RAF medical services had already recognised the need to study the physiological aspects of high flight.

It was not until Prime Minister Stanley Baldwin announced, in July 1934, the first of a series of Expansion Schemes for the Home Defence Air Forces, that the need to explore high altitude flight attracted great interest. In 1932 the Bristol Aeroplane Company's chief test pilot, Cyril Uwins, reached 43,976 feet in an open-cockpit Vickers Vespa biplane, a world height record at the time. He used a standard RAF oxygen system, but it was clear that something more sophisticated would need to be developed for sustained flight at those sorts of heights. The RAF Physiological Laboratory was to play a key role in the development of oxygen systems. They also recognised that above 33,000 feet there was a need to provide oxygen under pressure and this, inevitably, led to investigating the need for pressure suits.

A suit of rubberized fabric was made in two parts, securely joined together around the waist. The helmet, also made of rubberized fabric, incorporated a large double-layered, curved visor. A closed-circuit breathing-system with a chemical absorber for expired carbon dioxide was fitted to the helmet and the suit was inflated with oxygen to a maximum pressure of 2½ pounds per square inch. It was tested on volunteers in a chamber at Farnborough to an altitude of 80,000 feet.

Sqn Ldr Francis Swain carried out the first flight with the suit on 28 September 1936 when he reached 49,957 feet in a Bristol 138A. This flight established a new world record, which was bettered in June the following year by Flt Lt Maurice Adam flying the same aircraft to



Above, the Bristol 138A and, right, Sqn Ldr Swain being sealed into his pressure suit. (BAE Systems)

53,937 feet.

The pressure suit was never popular and it was not considered to be necessary for the heights flown on operational sorties for the next few years. Nevertheless, these remarkable flights by RAF pilots in the 1930s stand alongside those made by the long-range pioneers.

Faster

By the end of the First World War, the latest fighters were able to reach speeds approaching 150 mph. Two decades later, the speed had almost trebled. This dramatic increase can, largely, be put down to the RAF's involvement in the series of Schneider Trophy events of the late 1920s and early 1930s.

The Schneider Trophy Contest was first held in Monaco as early as April 1913 for the award presented by Jacques Schneider – a patron of French aviation. The event was to assume the greatest significance and exert a profound influence on the design and development of both aircraft and engines, in addition to claiming the attention and

resources of several nations. The British defeat of 1925 was held to be the result of technical inferiority and lack of organisation and a team did not compete in 1926 when both Italy and the United States used military pilots.

The Air Ministry agreed to support a team for the tenth Schneider Trophy to be held at the Lido, Venice in 1927. The RAF formed the High Speed Flight at the Marine Aircraft Experimental Establishment at Felixstowe with Sqn Ldr (later Air Mshl Sir) Leonard Slatter in command.

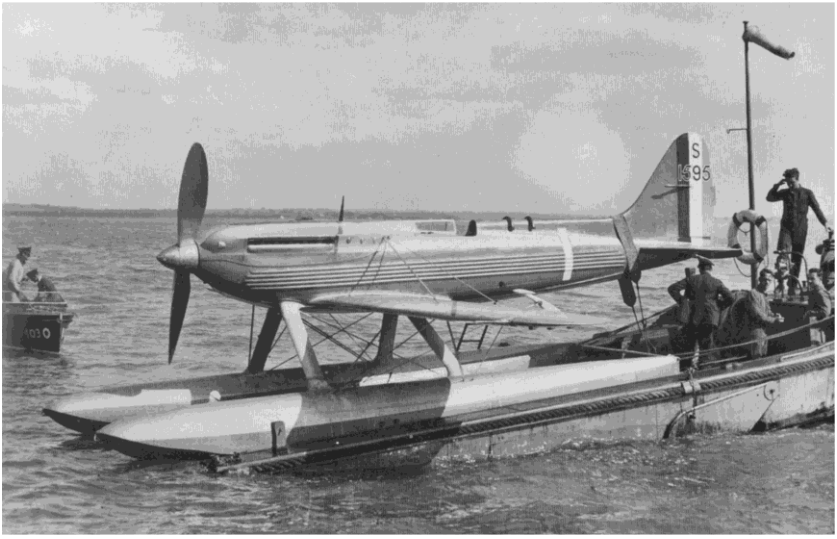
Five pilots were selected and three aircraft types were to be used – two Supermarine S.5s, three Gloster IV biplanes and a Short Crusader. The Crusader was slower than the others and it crashed during a training exercise. The great majority of flying training and preparation was carried out at Calshot on the Solent.

Flt Lt Sam Kinkead, a highly decorated First World War pilot, flew the elegant Gloster IV biplane but he was forced to retire on the sixth lap. However, with Flt Lt Sidney Webster at the controls, a Supermarine S.5, powered by a Napier Lion engine, won the event with an average speed of 281 mph. This aircraft also set a 100-kilometre closed circuit record of 283 mph. This victory was a first for Supermarine's designer, R J Mitchell. The 1927 event proved to be the last annual competition and, as the winning nation, the UK would host the following event to be held in 1929.

In March 1928, Kinkead flew the Supermarine S.5 in an attempt to break the world airspeed record but, as he approached the start line, the aircraft plunged into the water and he was killed.

Sqn Ldr Augustus 'Orly' Orlebar was appointed to command the High Speed Flight for the 1929 competition to be held at Cowes. Rolls-Royce had developed a supercharged R engine, which developed 1,900 hp for Mitchell's new S.6. The sleek new monoplane Gloster VI kept the Lion engine, but now supercharged.

The race took place on 7 September in near perfect conditions with the start and finish off Ryde pier. The winner was Fg Off Henry Waghorn in an S.6 with a speed of 329 mph. One of the RAF's more charismatic entrants, Fg Off Richard Atcherley, later an air marshal, was disqualified for cutting inside a pylon but he established a speed of 332 mph on one of his legitimate laps. The Gloster VI had been withdrawn before the race, but Flt Lt George Stainforth used it to set a



S1595, the Supermarine S.6B that won the 1931 Schneider Trophy and in which Flt Lt George Stainforth subsequently established a world airspeed record of 407·5 mph.

new speed record the following day, a record that lasted only a few days. Flying one of the S.6's, Sqn Ldr Orlebar achieved a speed of 358 mph.

Under the rules of the competition, a third win was an outright win and the magnificent trophy kept in perpetuity. The RAF was keen to participate in the next competition to be held in 1931 in order to secure the trophy but the effects of the Depression and the inevitable need for economies, prompted the Cabinet to veto RAF participation. However, the wealthy shipping heiress, Lady Houston, offered £100,000 and with the financial burden lifted, approval was given to enter a team.

Time had been lost so it was decided to modify the S.6 design by increasing the output of the R engine to 2,300hp, which required some strengthening of the airframe, and so the S.6B was born. Two were built to this specification and the two remaining S.6s were upgraded to a similar standard to become S.6As.

The event proved to be an anti-climax since no other countries chose to participate. However, to secure the trophy, the RAF had to fly

and on 13 September, Flt Lt John Boothman flew an S.6B and took the trophy with an average speed of 340·08 mph, twelve mph faster than in 1929. This third victory enabled the RAF to permanently retain the Schneider Trophy.

With the trophy secure, it was decided to make an attempt on the world speed record and on 29 September Flt Lt George Stainforth captured it with an average speed of 407·5 mph making him the first man to travel faster than 400 mph. The High Speed Flight was wound up very soon after, having achieved its aim.

The great Schneider Trophy contests were over, but their influence on the development of airframes and engines for high-speed flight was profound. The brilliant Supermarine designer, Reginald Mitchell, used the experience gained by the successes of the winning aircraft to design a high-speed monoplane fighter, which became the Spitfire. In addition, the Rolls Royce engineers had learned a great deal in developing the engine for the Supermarine aircraft and further development led to the Merlin, which ultimately powered world-beating aircraft including the Hurricane, Spitfire, Lancaster, Mosquito and the North American Mustang.

It is worth mentioning that the RAF High Speed Flight was resurrected for a brief period in 1946. On 7 September, Gp Capt Teddy Donaldson, flying a Meteor F.4, established a world speed record of 615.81 mph over a course off the Sussex coast.

Today, to mark the great achievements of the RAF High Speed Flight, the Schneider Trophy, and the S.6B in which it was won for the final time, are in the collection of the Science Museum.

MORNING DISCUSSION

Chris Brockworth. I would be interested to know what the squadrons did with these lamentably poorly trained pilots in the early stages of the war. How did they prepare them for combat?

Wg Cdr Jeff Jefford. In the early days, it was pretty much self-help. The whole business of military aviation was still feeling its way, and there wasn't a great deal of air combat until 1916. By 1917 we had begun to create specialist post-graduate schools that began to teach tactics, aerial gunnery and the like but for the first two years of the war, pilots were just sent cross the Channel with their 30 hours and they picked it up as best they could. Similarly, with the back-seaters – they just picked up the tricks of the trade on the squadrons. By late 1915 Trenchard had come up with a 'list of things that you ought to know' but they were still pretty much self-taught and it was 1916 before anything serious began to happen in the field of observer training when, like pilots, they started to attend the Schools of Instruction at Reading and Oxford – that was, I think, the big change – the 6/8-week ground-based course on aviation theory and technology before attempting to grapple with an aeroplane. And that only applied to observers being trained at home, of course, until 1917 most were recruited in the field and 'trained' on the job.

By mid-1916 a Squadron Commander could reasonably expect a newly arrived pilot to have some idea of how to conduct an artillery shoot from a BE2c – which was the core task. His chief concern would have been the rate at which replacement pilots damaged aeroplanes. It was more or less taken for granted that they would break two or three before they got the hang of it, so I think that COs would have been far more preoccupied with reducing the write-off rate by consolidating basic flying skills than teaching combat techniques which, in a BE2c, probably amounted to little more than running away.

Mike Meech. For Andrew Walters. You referred to the wireless vans. How effective was air/ground communication, and were there any blue-on-blue incidents?

Wg Cdr Andrew Walters. That's a really good question – I could have devoted my whole slot to the challenges involved in air-to-

Pack animals provided mobility in the field for the wireless sets of the 1930s that were clearly too big and heavy to be manhandled.

ground and ground-to-air communication, especially when red and blue forces were in close proximity. It was quite a problem, because things that we take for granted today – like R/T – simply didn't exist, or at least, not in practical terms.

RAF, India actually put a lot of local effort into providing wireless facilities, particularly for the army co-operation squadrons where real-time coordination could be critical. These devices were relatively heavy, fragile and scarce, so only a few aircraft were fitted with them, and crews wore topee helmets which had to be modified to accommodate earphones. While Morse was cumbersome to use, airborne W/T equipment was relatively easy to install, but the provision of R/T was much more challenging due to earthing problems and interference from the magnetos.

Towards the end of the campaign they were still using Popham panels and the like, which took time to lay out, of course. There would also be wireless, both air-to-ground and ground-to-air, using Morse – and the RAF put a great deal of effort into installing R/T and W/T facilities on Crossley tenders. There was no funding for this from an

Air Staff that was often still critical of what was happening in India, so this was all done on a strictly self-help basis. Some airmen were even sent on equestrian courses with the cavalry, so that they could handle the pack animals that were also used to carry mobile wireless equipment.

Communication and co-ordination was always a challenge, and it still can be, even today, and in the 1930s it could certainly slow down an operation. In practice, simple ground panels were often the most effective way to get things done. For example, it was fairly easy for the covering troops deployed as picquets along the sides of the valleys, to lay out some basic ground signals – for instance, a 'V' to point in the direction of the enemy, a 'T' to mark their own location and an 'X' meant that they were about to be overrun, which, in effect, invited aircraft to strafe right up to their position. So, under some circumstances, the old methods were still the best because, while not quick, it was relatively easy for a hilltop piquet to display a panel, compared to coaxing a pack animal up the mountain with a radio. But none of this was easy. What was remarkable was the amount of local innovation involved.

One problem that was never really solved was the best location for the local Air Commander. Slessor was keen that he should be with the column, which worked if there was only one column. But what if there were two, or three, as happened in the third Khaisora operation? Apart from air-to-ground and vice versa, you now had a problem communicating with the remote columns, which could be moving at up to eight miles per day – or perhaps not moving at all. In short, it was complicated, as it still can be today, but in the 1930s they lacked modern technology while fighting what was, at times, a really nasty little war – and not really so 'little' – three years, eight RAF squadrons and 61,000 imperial troops. Compare that with the size of the relatively recent British deployments in Afghanistan.

Frank Haslam – of the Association of, the soon to be resurrected, No 207 Sqn, because the squadron is to reform next year as the F-35 OCU. Shortly before this seminar I received an email about Gordon Flavelle DFC who served with the squadron in 1917-19. 'I am seeking information about an incident in my grandfather's pilot's log for 25 May 1918. He was at Larkhill learning night flying on O/400s. His

log states baldly – "Practised night flying; landed too fast; hit hangar, deleted machine." (*Laughter*) Do the archives throw any further light?' I just thought you find might find that amusing, but my question is – did the RAF learn anything, or seek to learn anything, from the way the Germans and the French did their flying training?

Jefford. At one point, Smith-Barry went over to France to see what they were doing and he wanted to adapt some aspects of their approach and introduce them at home. He wasn't impressed by their actual methods of instruction, but he did like the way it was organised. He wanted to replace the British system, which consisted of dozens of independent flying schools operating in isolation, with a couple of French-style very large flying schools with a number of satellite landing grounds clustered around each to create a kind of beehive of concentrated activity. It never happened, of course. In passing I would say that the French did a lot of training of Americans; we did some, of course, but I think that the French probably did more. In fact, the British actually set up a flying school in France too – at Vendôme. Initially run by the RNAS, although it also trained RFC pilots, until it was inherited by the RAF. Interestingly, the Admin Officer was J C Nerney who became Head of AHB when it was re-established in 1941.

What did we learn from the Germans? Nothing much really. It was not a lot different from what we did. They made rather more use of civil schools operating under commercial contracts, so a pilot might do his initial training with a military or a civil school, but the applied stage was all military – and you didn't get your 'wings' until you had flown in combat. That applied to pilots, not just observers. We gave our pilots their wings as soon as they completed the course, whereas, until mid-1918, observers had to undergo a ritual baptism of fire. The Germans also flew rather more than we did – or at least, the syllabus and the course structure called for more hours – whether they always achieved it may have been a different story.

So, what did we learn from the French? Possibly a good way to organise training, but we didn't pursue it. And, from the Germans? That more flying time was a good idea. But we already knew that – the problem was providing more time while still maintaining the

strength of the ever-expanding front-line and it took us three years to get the balance right.

Wg Cdr Terry Hayward. You focused on the inadequacy of the training provided before people joined operational squadrons. I was looking at the records of No 37 Sqn recently. They lost ten pilots during the war, only one of them on operations; all of the others in training incidents. I wonder how much of this was down to the inadequacy of training or whether it could have been mechanical or other failings in the construction of the aircraft. Do we have any feel for that?

Jefford. I'm groping a bit here; this is mostly opinion, rather than statistically-based fact, but I don't think that it would have been the aircraft. You can pull the wings off any aeroplane if you try hard enough, of course, but their construction was basically sound. Most accidents would have been due to the ham-handedness of the pilot and, possibly, engine failure – although contemporary aeroplanes were relatively easy to land dead-stick – the wheels were already down and stalling speeds were probably little more than 40 mph with a very short ground run with the tailskid acting as a brake.

I think you said 37 Sqn? – so that would have been UK-based home defence. They were somewhere in East Anglia defending against not a lot of traffic, hence only one operational loss, so they were just flying for the sake of it, possibly losing control while 'stunting' or low-flying, and, because home defence implied night flying, which had its own hazards, some of the incidents may have occurred in the dark. But I don't think that aeroplanes would have been the root of the problem – it was the pilots who killed themselves mostly through inexperience, incompetence or ill-discipline.

Sir Richard Johns. Before we break for lunch I would point out that there are two excellent books on the operations in Waziristan, *Bugles and a Tiger* by John Masters and Air Marshal Sir David Lee's splendid autobiography, *Never Stop The Engine While It's Hot*, which says something about air communications – 'zogging' – a form of semaphore. I would recommend both of those to anyone who wanted to follow up on Andrew's presentation.

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RAF AID TO RUSSIA, 1941

by Air Cdre Phil Wilkinson

Phil Wilkinson's 40 years of RAF service began with a National Service Commission in 1956 and finished with three and a half years as Defence and Air Attaché in Moscow. In between he flew Canberras, Hunters, Buccaneers (and Chipmunks) at home and abroad, including exchange tours in France and the USA, had a stint on arms control at SHAPE, and commanded RAF Gatow as the Berlin Wall was coming down. The Moscow period brought him into contact with veterans of earlier RAF presence in Russia which resulted in his forthcoming book, Red Star and Roundel.

A little over 18 months ago – at the end of August/beginning of September 2016 – a series of ceremonies took place in, first Archangel, and then St Petersburg. British royalty – the Princess Royal – was in attendance. The cause for such an event was the marking of the 75th anniversary of the arrival at Archangel of the first Arctic Convoy of the Second World War. As well as royalty, there were also two star-performers – former members of the Royal Air Force's No 151 Wing, the principal cargo of that first convoy – 75 years on, and still going strong!

Naturally, and as always at such events marking some or other aspect of the Arctic Convoys. the focus of attention was on Royal Navy and Merchant Navy veterans of wartime action in Arctic waters. As usual, therefore, there was considerable interest, or perhaps curiosity, as to why there were airmen involved, and indeed given rather special treatment and respect. This is not a new phenomenon. I had been moved to write something about it all as a lead-in to the article about 151 Wing I wrote for this Society's journal in 2006, recalling the events of 2005 – the 60th anniversary year of VE-Day.

Here in the UK, and more intensively in Russia and other parts of the former USSR, there were ceremonies to mark that 60th anniversary. The Prime Minister had just announced the decision to award an Arctic Emblem for veterans of service in Arctic areas in the war. There was still a total Government refusal to issue a specific

Arctic medal – veterans of arctic service were usually awarded an Atlantic Star. This new Arctic emblem was to be worn as a lapel badge and the original instructions said it should only be shown thus, but a later decision was that it could be pinned through the ribbon of the Atlantic Star or of the 1939-45 Star if the Atlantic one was not held. There was a Downing Street reception planned for the announcement of this emblem, and RAF veterans awaited a call to attend. When none came – but in time to correct the omission – a call to Downing Street revealed that the MOD had not mentioned anybody other than Royal Navy and Merchant Navy veterans. The correction was made and two RAF men were in Downing Street on the day. But there was clearly a need to get the story out – and a film was made that year, which has since been extended and upgraded and now tells the story of 151 Wing in Russia in a 60-minute DVD format.[1]

There had in fact been no shortage of mentions of that RAF deployment to Russia: in the 1954 official history of the RAF in World War II; in the 1942 account of the Wing's successful activity written by Hubert Griffith, the Wing Adjutant; in the autobiographies of two of the wing's pilots – Marshal of the Royal Air Force the Lord Cameron (a freshly-minted pilot officer on No 134 Sqn at the time) and Ray Holmes (a slightly more senior pilot officer on the other squadron, No 81); as a vignette by Freddie Crewe (a sergeant pilot, also on No 81 Sqn) in the compilation history of the RAF edited by Tony Ross; in the full-length book by John Golley; and finally in the ghost-written story of the wing, centred on the memories of another pilot, Eric Carter[2] There have also been many articles in the professional aviation press. And yet . . .

With this presentation headlined as RAF Aid to Russia, it may seem odd to concentrate entirely on the short-term deployment of one small unit. It is in no way intended to overlook the other RAF units and individuals who spent time in and over Russia and the Arctic between 1941 and 1945: maritime patrol Hudsons, Catalinas and Liberators; courier flights by Catalinas, Mosquitos and Liberators; recce units with Spitfires and Mosquitos, particularly those engaged in monitoring the position of *Tirpitz*; the Lancasters that staged through Russia on their various attacks against that battleship; the Hampden squadrons that deployed to provide anti-submarine and anti-shipping torpedo capability after the disaster that befell convoy PQ17. Nor

should we forget the transfer to Russia of a multitude of aircraft – not least the 3,000 or so Hurricanes for which 151 Wing's instructor pilots and engineers helped prepare the Russians. There were also P-39 Airacobras, with a group of RAF men out in Russia to assemble them, and test fly them. Spitfires were delivered through Persia. Albemarles were provided and flying instruction given in Scotland for their pilots.

So – back to DERVISH, the first Arctic Convoy. It was to be the object of astonishing tribute and commemoration in Archangel, on the 75th anniversary of its arrival. It was modest in size: just seven commercial vessels – six British and one Dutch – which formed up and sailed from Liverpool on 12 August 1941, heading first for Scapa Flow, then Iceland and then further east, much further. The Convoy Commodore, Royal Naval Reserve Captain J C K Dowding, was aboard the SS *Llanstephan Castle*. Also aboard that Union Castle liner were some 550 or so men of No 151 Wg, codenamed FORCE BENEDICT. Elsewhere in the group was the principal cargo – the 15 crated Hurricanes that would be operated by the wing once on shore after landfall at Archangel. Also at sea that August was a Royal Navy group of 11 warships, centred on the fleet carrier HMS *Argus*, sailing as Operation STRENGTH. On board were 24 further Hurricanes. These were to be flown off, by the no doubt slightly quizzical pilots of the wing's two squadrons, to land at a Soviet naval aviation airfield outside Murmansk – Vaenga (now Severomorsk and, usually, very much off-limits).

The plan, that had been so rapidly put together, was duly executed so that once again the RAF was operational over the inhospitable terrain of North Russia. Almost exactly 22 years before, the last of the British forces, including RAF, who had been involved in the Intervention of 1918-19, embarked at Archangel and Murmansk for their journeys back to Britain. Now, once again, the cemeteries at both places would be the last resting places of British servicemen. What was it that brought them to Russia this time? And this time as a benevolent ally, not as aggressors?

The simple answer is Stalin's call for help following the German invasion of the USSR on 22 June 1941 – Operation BARBAROSSA. Churchill's immediate reaction to the news of the German attack was to compose and broadcast a speech on the BBC at 9 o'clock that same evening. With the Soviet Union's regime as his intended audience, he

AVM Conrad Collier.

did not disguise his distaste for Communism, but stressed that there was '. . . but one aim and one single, irrevocable purpose. Any man or state,' he continued, 'who fights on against Nazidom will have our aid. […] It follows therefore that we shall give whatever help we can to Russia and the Russian people.'

There was, initially, very little response to this stirring rhetoric. A few extracts from the speech were published in the newspaper *Pravda'* and the British Government was asked to receive a Russian Military Mission. In return, a similar Mission was sent to Moscow to reinforce the Service attaché team already in place in the Embassy. That Mission – composed of 11 officers – had been very rapidly assembled and arrived in Moscow on 27 June. The senior air member of the Mission was AVM A C (later Sir Conrad) Collier CBE He was an interesting choice. He had been the British Air Attaché in Moscow in the mid-1930s. Before that, as a First World War RFC pilot, he had been shot down and imprisoned, finding himself in a camp with a large number of Russian (ie Imperial) officers. He found them pleasant enough – even though the regime they served was demonstrably authoritarian – and learned Russian while in their company. On release, and after the Armistice, he served in Russia with one of the RAF contingents aiding the White Russian counter-Revolutionary armies. This taint was to create some problems for the Mission during its existence in Moscow, but in Collier's case, he got in and did his job until relieved in 1942.

Eventually, on 18 July, Stalin made a direct response to Churchill's initial and follow-up messages of support. In a theme that he returned to endlessly, Stalin suggested that the best help Britain could provide would be the opening of a Second Front, in fact two Fronts, one in Northern France and one in the North – the Arctic. Churchill wryly observed that this showed Stalin's 'monotonous disregard for physical facts.' Nevertheless, on 20 July Churchill replied in detail and said, in particular:

> ‘We are also studying as a further development the basing of some British fighter air squadrons on Murmansk […] some [aircraft] of which could be flown off carriers and others crated.’

That same day, 20 July, staffs in the Air Ministry were studying two assessments of, first, infrastructure, logistic support, and airfield characteristics for potential bases in and around both Archangel and Murmansk. The second outlined planning assumptions for the movement of an ‘air force contingent’ (at that time expected to comprise both a Beaufighter and a Blenheim squadron as well as two Hurricane squadrons). The plan, at that stage, had all the Hurricanes being flown off a carrier. The others would be assembled at Archangel after transit as crated cargo. Gp Capt Davies, the Air Plans man, estimated that ‘from the time the executive order is given’ the squadrons would be ready to operate in 41 days. By his reckoning, therefore, the wing could have been in action – assuming instantaneous executive action – by 1 September.

Whatever order was issued, the formation of the two squadrons followed parallel courses. No 504 Sqn at Fairwood Common, west of Swansea, gave up its entire ‘A’ Flight – CO, Adjutant, nine operational pilots and the entire ground echelon – who all moved to Leconfield on 28 July 1941. Over the next few days the complement was increased by the arrival of two pilots from each of Nos 402, 43, 615 and 605 Sqns and one from No 123 Sqn. The pilots were then split into two groups, one to travel with the convoy and the other to proceed for their first ever carrier take-off from the *Argus*. Similar antics were experienced by No 17 Sqn, up at Elgin, with detachments at Sumburgh and Dyce. The CO, plus Adjutant and ten pilots, left for Leconfield on 28 July, where they were joined by individual incomers, and similarly split into two groups for the journey to Russia. Command of the wing was in the hands of New Zealand-born Henry Ramsbottom-Isherwood – 35 years old and a highly experienced test pilot.

Operationally ready by 1 September? So said the estimate. In fact, the 550 men and 15 crated Hurricanes arrived in Archangel on 31 August – not bad at all. Unloading, assembling, air testing and ferrying across the White Sea to the airfield at Vaenga, just a few

No 81 Sqn's BD792.

miles north-east of Murmansk, took ten days. *Argus* launched her 24 aircraft on 7 September.

The launch instructions noted that, with a wind over the deck of 22 knots, the take-off run for a loaded Hurricane would be 396 feet, and that no less than 400 feet of deck would be available – the best bit was the accompanying advice that the place for spectators would be in the starboard side netting. There were one or two snags for the initial group of three but they all got off and set course over the destroyer off the bow which was pointing in the right direction for Vaenga. An hour and a quarter later – through fog and low cloud – they were all on the ground. But operations had to wait until the spares and ammunition support had been transported across from Archangel. The first day of operations was eventually 11 September. Front-line patrols were undertaken – the German ground forces were less than 35 miles from Murmansk, with air cover being provided from bases in northern Norway and further up the Kola Peninsula, north-west of Murmansk. The short daily report stated simply, 'Nil combats; nil casualties.'

The tempo of operations for the two squadrons was to be slightly different: No 81 Sqn had the lion's share of bomber escort and patrol, and No 134 Sqn was tasked, from the outset, with providing instruction on the aircraft so that the Russians could take them on as the advance guard of the intended delivery of what would eventually number close on 3,000 further Hurricanes during the war. But both

units were busy and in action in the first days after arrival. No 81 Sqn's Form 540 has the following for the afternoon of 12 September, the second day of operations:

OC 81 Sqn, Sqn Ldr Tony Rook.

> 'The patrol took off at 1505 hours and intercepted at 1525 hours, height 3,500 feet. Flight Sergeant Haw, Red Leader, put a ten-second beam burst into the enemy aircraft leader which crashed in flames. Plt Off Walker, Red 2, then attacked an Me109 which was on Red Leader's tail, giving it two bursts of a few seconds each after which it crashed in flames. Sgt Waud, Blue Leader, put two bursts into the Henschel from which smoke poured. He then broke away owing to the Me109s being close, attacking one of them at ground level. This enemy aircraft then crashed in flames after the third attack.'

Sadly, Sgt Norman 'Nudger' Smith was unable to escape from his damaged Hurricane after engaging an Me109 and he was killed in the ensuing crash. He was buried in the Vaenga cemetery on 14 September. Given the close proximity of the front line and of the *Luftwaffe* bases, it is remarkable that Smith's loss was the only fatal combat casualty of the deployment.

Two days later there were three more 81 Squadron victories, and from the F540 in this case one can read:

> 'The commanding officer – [*Sqn Ldr Tony Rook – on his third sortie of the day*] – was leading eight aircraft, four from each flight, which took off at 1830 hours to cover the withdrawal of Russian bombers. At 1855, eight Me109s were intercepted when about to attack the Russian bombers. The commanding officer attacked an Me109E with a two second burst (quarter/stern) hitting the radiator. He then chased it for about five minutes slowing it to about 150 miles per hour and using up all his ammunition. It was then attacked by Red 2 (Sgt Sims) and Green 1 (Sgt Anson) and crashed in flames. Green 1 was then attacked by four Russian fighters and had to take evasive

> action. Yellow Leader (Flt Sgt Haw) made a stern attack on a 109 without visible effect. He then made a quarter attack with a 150 yards three second burst which set the machine on fire, the pilot bailing out. Blue Leader (Plt Off Bush) attacked a 109 and out-turned it, getting in a two second starboard burst and setting it on fire. After another short burst the enemy aircraft crashed.'

Boris Safonov with his I-16.

Rook's log book says all of this took place in just 45 minutes airborne time. This early activity had been reported back to London and the Chief of Air Staff, Sir Charles Portal, sent a congratulatory telegram to the Soviet Northern Fleet Naval Air Force commander – Major General Alexander Alexeyevich Kuznetsov. The General's reply was swiftly sent to London, and he stressed the inflexible will of two freedom-loving peoples who have mobilised for a decisive fight against the invaders. He made one good inter-Service point:

> 'I am sincerely happy at the fact that the lucky chance of beginning operations against the common enemy side by side with the RAF on an important part of the Front has fallen to the Air Force of the Soviet Navy.' [*ie not to those lesser mortals from the Army Air Force!*]

The balance of effort was still favouring 81 Squadron, in terms of combat contact and thus success, but No 134 Sqn also engaged in bomber escort while they also continued their instructional work. Soviet pilots were starting to try their hands at the Hurricane and the first to get airborne was the, already combat-hardened, Capt Boris Safonov, who had been the first Russian to shoot down a *Luftwaffe* aircraft in the Northern region, on 24 June 1941, just two days after the German invasion. With at least five further confirmed victories to

Maj Gen Kuznetsov taking possession of the, red-star embellished, Z5252. Shot down in 1942, the wreck was salvaged, substantially intact, in 2004 and moved to Moscow where it has been undergoing a lengthy restoration.

his name, he and his 72nd Squadron colleagues, with their I-16 fighters, were already based at Vaenga airfield when 151 Wing arrived. Soon after Safonov's first flight, and after the next couple of Russian pilots had been sent up, it was the turn of Major General Kuznetsov. He was a very experienced pilot and had no difficulty in making his first solo flight, despite the onset of winter weather by then. His aircraft – originally one of 81 Squadron's, Z5252 – was decorated with a big red star and this marked the start of the run-down of the wing's efforts and the steady transfer of their aircraft to the Russians. But not before it was the turn of 134 Squadron to get on the score sheet.

The squadron's Form 540 for 5 October records 'No operations'. The weather, bright in the morning, had deteriorated to snow and sleet by midday. The airfield was sodden, with some 20% covered with pools, and the temperature had fallen to below zero by 1700 hours. The officers had a specially organised visit to the Murmansk House of Culture for a concert and dance in the evening and, no doubt invigorated by that, the ops diary for 6 October is full of action.

'A' Flight had six aircraft airborne on routine patrol when enemy aircraft were seen approaching the airfield. Plt Off Neil Cameron was now Acting Flight Commander after a shocking accident to Flt Lt Vic Berg. In his haste to get airborne during a raid that was already under

No 81 Sqn's Z3577 and an example of one of Vaenga's many pools of standing water.

way on the airfield, Berg had scrambled straight from dispersal and failed to notice two airmen who were lying across the tail of his aircraft to prevent its nosing over in the muddy potholes. He got the aircraft off the ground, but stalled and crashed from 150 feet. Berg was seriously injured and the two airmen were killed. They too are in the Vaenga cemetery.

As Red 1, Cameron settled for a trio of Ju88s and had a pass at each of them in turn, claiming one as damaged and another, with both of its engines clearly damaged, as a probable. His No 2, Plt Off Rex Furneaux, got into a tangle with another Ju88 and had inflicted some damage when he was joined by an 81 Squadron player – Flt Lt Mickey Rook (cousin of No 134 Sqn's CO, Tony Rook) – who added some damage and the aircraft was seen to crash. They claimed half each. Meanwhile, one of the squadron's Australian pilots, Sgt Nat Gould, flying as Yellow 1, mixed it with another Ju88, diving in from his position as top weaver, and saw his rounds catching the target between the port engine and the fuselage, with pieces falling off. This was

claimed as at least ‘damaged’ with Yellow 2, Sgt Kirvan, in the low weaver position, observing the Ju88 descending with one engine apparently on fire. White section – Australian Sgt Bart Campbell and Rhodesian Sgt Hector Keil – were unable to engage because they were pre-empted by another element of 81 Squadron.

‘B’ Flight launched a first three-ship formation at 1610 hours, by which time the airfield was under attack and bombs were falling. Plt Off Tim Elkington, as Green 1, had already got several hits on a Ju88 when Black 1, FSgt Barnes, joined in and, firing from above and astern, made more hits. The enemy aircraft returned heavy fire but was seen to be well alight as it neared the ground, as confirmed by nearby FSgt Thomas ‘Paddy’ McCann.

As the excitement was dying away, No 81 Sqn’s Mickey Rook – separated from the rest of his formation, saw a gaggle of fighters heading in the direction of the airfield and dropped down to join them, waggling his wings in greeting. Only when the leader pulled up and turned in on him did he see its yellow nose and the recognisable silhouette of an Me109. The resulting few minutes of twisting and turning, and a descent to very low level in the Kola river mouth, left him in a state of near collapse as he finally evaded the chase and made it back to a safe landing. He sat for a few moments in the cockpit, shaking and unable to get out of the aeroplane. A lucky man. His log book merely records a basic 45-minute sortie – no doubt the squadron line book had something more pointed!

Steadily deteriorating weather conditions meant that little operational flying was achieved over the next two weeks, but more Russians were having their first flights in Hurricanes. By the last week of October, the Russians had been formally handed ownership of a squadron of Hurricanes, and it was placed under command of (now) Major Safonov. On 26 October, the Russian squadron could claim its first combat victory – an Me110.

Preparations for the return home were now starting in earnest. Earlier in October there had been hints about preparing for a very different move – south and east to an unspecified destination in the Middle East. But, almost as soon as the move was signalled, the impossibility of achieving it by surface transport was recognised – the German advance had already cut the rail lines to the south-east that would have been the means of moving the men and equipment. So, the

No 134 Sqn's Z5263.

administrative section in Wing HQ started to make lists of personnel and probable ships on which they would deploy for the journey back to the UK. Other administrative tasks also started to present themselves: OC 134 Squadron, (Sqn Ldr Tony Miller) and his Adjutant (Fg Off S R Palmer) are noted in the Ops Record Book as having been 'appointed as President and Member of Court of Inquiry to investigate various losses, deficiencies and thefts of foodstuffs, equipment and stores.' The 'administrivia' persisted, even in a war zone and under fire.

On 16 November, Plt Off Tim Elkington found himself in charge of a party of officers and men, from both squadrons and the Wing HQ, ordered to proceed to the docks and board a trio of minesweepers in preparation for the convoy home. Weather conditions led to a number of injuries as men slipped and fell as they tried to march down the steep slopes to the wharves and docks. Three days later another group were ferried by tugboat to join the cruiser HMS *Kenya,* anchored in the Kola inlet – some 200 men all told were to travel home on this vessel. Next day another large group boarded the destroyer HMS *Intrepid*. Others went aboard the destroyer HMS *Bedouin*.

To add to the novelty of the expedition, on 24 November, *Kenya* with the two British destroyers and two Russian destroyers, *Gremyashchi* and *Gromki,* headed out of the Kola for what was reported as being the first joint Anglo-Soviet naval operation of the

Wg Cdr Isherwood with his Order of Lenin.

war. Mission: to intercept a German supply convoy, heading in to North Norway, do as much damage as possible, then enter a Norwegian fjord to bombard the German installations at Vardo, a seaplane base, ammunition dump and oil storage centre. No 134 Sqn's Operations Record Book notes laconically that, 'All RAF personnel were enthusiastic at having the privilege of being able to accompany the Navy and witness this operation.' Individual reminiscences seem less enthusiastic, however, although there was recognition of the nature of naval warfare. Sergeant Pilot Peter Knapton remembered:

> 'We were at action stations from the off. There are no passengers on a Royal Navy ship so all of us RAF personnel were given tasks. I was put in a gun turret with some Royal Marines. The Navy cooks knocked up a fantastic sausage and mash […] which settled my stomach nicely for what was to follow.
>
> I had never seen, let alone been in, a six-inch gun turret during a naval action so I had no idea what to expect but the noise when the guns opened fire was almost tactile. I felt it throughout my body; it echoed in my chest and shook me to the core. Inside that turret, it felt like the room where God practiced shouting.'

The British ships fired seventeen tons of shells at the shore targets in the few minutes of the engagement. Then it was back to the Kola Inlet to await final departure. They eventually sailed on 28 November, and BBC radio was heard to announce that three officers and a senior NCO had been awarded the Order of Lenin. This was correct: Wg Cdr Isherwood, the two Squadron Commanders – Tony Miller and Tony Rook – plus FSgt Haw, the wing's top scorer, would all receive their awards from the Russian Ambassador back in London, in the spring of

1942. *Kenya* arrived in Rosyth on 6 December. So it was 'all over by Christmas.'

Some of the 600 or so men would not see much more of the war and, as the New Year opened, it would be 1942 that took a large number of 151 Wing's veterans. Flt Lt Jack Ross, who had been the first up on the first day of operations in Russia, and who had been the principal instructor for the conversion of the Russian pilots, returned to his squadron in Northern Ireland (as did Tim Elkington), and converted to the Spitfire, but he failed to return from a convoy protection patrol – lost without trace – on 6 January. Sgts Barnes and Griffiths were killed in North Africa, along with Fg Offs Dicky Wollaston, and newly-commissioned Fg Offs Hector Keil and Paddy McCann, all in 1942. Still in 1942, one of the Australians, Fg Off Mark Sheldon, was killed after returning to Australia, in a 75 Squadron Kittyhawk engaged in combat over Papua New Guinea. Plt Off 'Jimmy' Walker, one of the Canadians in the wing, on 81 Squadron, was one of the first to claim a victory in Russia – an Me109 on 12 September. After Russia, his rank and combat successes increased, until – by then a wing commander with a DFC and two bars, commanding No 144 Wing – he was killed in an accident in an Auster, near Marlborough. Of such is war.

Sgts Freddie Crewe and Bart Campbell – another Australian – finished their war as POWs in one or other of the *Stalag Lufts*. The CO – Ramsbottom-Isherwood – survived the war but was killed in a Meteor crash in April 1950, when he was Station Commander at West Malling. Peter Knapton, however, served on, with action across North Africa, Italy and Burma – allowing him the chance to sign himself as 'Four Fronts' – and retired as a group captain, having served as Assistant Air Attaché in Moscow and later as Defence Attaché in Bangkok, with responsibilities for Phnom Penh and Rangoon. Plt Off Cameron, after his cheeky anticipation of commissioning, and despite links to Russia, went on to very high things indeed. After serving as Chief of Defence Staff, and being advanced in rank to Marshal of the Royal Air Force and ennobled as Baron Cameron of Balhousie, he was installed as Principal of King's College London. Sadly, he died of cancer just five years later, aged only 65.

Tim Elkington also continued in the Service – after Russia he had a brief spell as a Hurricane pilot on a CAM ship – including time later

in Burma, and retired as a wing commander in 1976. He was still around when the Government finally decided that Arctic service was deserving of a medal and on 19 December 2012 announced the award of an Arctic Star. The first of these were presented by Prime Minister David Cameron in Downing Street, and four Arctic airmen were there: Vic Bashford, Eric Carter (a pilot on 81 Squadron), Peter Knapton (now sadly no longer with us), and Tim Elkington. Not to be outdone, the Russians then announced that surviving Arctic Convoy veterans were to be awarded a prestigious Soviet award for gallantry on, under, and over the Arctic Sea – the Ushakov Medal. By then there were only five airmen veterans alive to receive it: Nat Gould in Australia, and four here in UK, including Tim Elkington and Vic Bashford.

As mentioned at the beginning of this article, those latter two were both in Archangel for the 75th anniversary of the start of this small RAF adventure. Probably less than a small fraction of one percent of the RAF's operational tally for the war was involved. Yet the commemoration of the arrival of DERVISH was in every way an extraordinary event, and in some ways unique – with the greatest interest focused on the recollections of those who had sailed and flown in 75 years before. They had been the spearhead of a massive transfer of weapons, goods and treasure – and not a little blood – that reflected Churchill's firm intent to keep Russia in the war. The first and most significant element of his response to the German assault on Russia – and a reminder of the readiness and flexibility of air power – was the sending of those Hurricanes to Murmansk.

Notes:

1 DVD *Hurricanes to Murmansk* – see Journal 51, p166.

2 Richard, Denis and St George, Hilary; *Royal Air Force 1939-1945, Vol 2* (HMSO; 1953) pp78-80.
Griffith, Hubert; *RAF in Russia* (Hammond; London; 1942).
Cameron, Neil; *In the Midst of Things* (Hodder & Stoughton; London;1986).
Holmes, Ray; *Sky Spy: From Six Miles High to Hitler's Bunker* (Airlife; Shrewsbury; 1997).
Ross, Wg Cdr A E, Ed; *Through Eyes of Blue* (Airlife; Shrewsbury; 2002) pp 116-118.
Golley, John; *Hurricanes Over Murmansk* (Patrick Stephens; Cambridge; 1987).
Carter Eric, with Loveless, Antony; *Force Benedict; (*Hodder & Stoughton, London; 2014).

THE DEVELOPMENT AND EXPLOITATION OF ROTARY WING AIRCRAFT IN THE RAF

Wg Cdr Colin Cummings

Commissioned in 1964, Colin Cummings is a former supply officer who spent several tours 'out of branch'. On one of these he contributed to the development of PANDORA, the RAF's first Flight Safety Management System. This gave him a lasting interest in such matters and he is the compiler of a series of books recording some 9,000 accidents (and 6,000 fatalities) involving RAF aircraft between 1945 and 2009. Since retiring in 1994, he has served in the RAF Reserve and continues to hold a commission in the recently constituted RAF Air Cadets. He is a long-term member of this Society's Executive Committee and is currently its Membership Secretary.

For a service which spent much of its early life fighting off raids on its autonomy, it is perhaps surprising that the Royal Air Force should have started flirting with the concept of rotary winged air vehicles within five years of its formation.

This paper seeks to trace the development and exploitation of rotary winged craft for the RAF. Attempting to cover 95 years in 35 minutes means that some stones will have to be left unturned or, at best, just lifted sufficiently to see what lies beneath. The following topics will be covered:

- The initial interest in the rotary wing concept
- Early offerings and the transition from concept to practical propositions
- The United States and the Sikorsky dimension
- Malaya, the emergency and the catalyst for action
- Expansion and acceptance
- Training, Manning and Regulation

It is 18 years since this Society spent a day exploring helicopters in the RAF and for those with a greater interest I recommend Journal 25.

The Brennan helicopter with its unique prop-driven rotor.

We have, of course, also covered specific aspects of rotary wings in a number of other seminars.

In 1923 the Air Ministry decided to explore the feasibility of rotary winged aircraft and offered prizes totalling £50,000 for successful designs. The terms and conditions were published in *Flight* for 17 May but the Editorial in the same edition expressed the opinion that, '. . . we could have wished to see the £50,000 devoted to research in other directions.'

Undeterred, the RAF went ahead but the Brennan helicopter project, which was already being investigated by the Royal Aircraft Establishment and involved rotor blades which were themselves powered by propellers at the tips, driven from a central engine, was specifically excluded from the competition. That idea was, as one commentator put it, a product of 'the mind of a genius in torment'! Twenty years later, on 8 April 1943, *Flight* recorded that the competition had attracted. 'Some 15 or 16 entries […] but no competition ever took place, and presumably the offer is now 'dead."

Based on an Avro 504 fuselage, the C.6 was the first of Cierva's autogyros to be moderately successful. This one, J8068, was acquired by the RAE in 1926 and demonstrated at that year's Hendon Display.

As progress began to be made by the experimental engineers, one name came to the fore – Juan de la Cierva. De la Cierva was able to produce a realistic rotor craft but it was a gyroplane rather than a helicopter.

At this point we should define the difference between the two approaches:

- A gyroplane, or autogiro, derives the power to move forward from an engine, whilst the rotors generate lift as they are driven by the forward motion of the vehicle. Helicopter pilots will be well-versed in this concept because engine-off landings are conducted by retaining the kinetic energy in the revolving rotor blades as the aircraft descends and this energy is then converted to cushion the landing at the appropriate moment.
- The difference with a helicopter is that its rotor is powered and it is that characteristic that provides it with its unique ability to hover – which the autogyro cannot.

As early as 1924, de la Cierva took an Avro 504, removed the

The first of a dozen Cierva C.30s acquired by the RAF in the mid-1930s.

upper wing and installed a rotor mechanism in the front cockpit, controlled from the rear seat via a long lever. As progress was made the sophistication of the main rotor assembly improved and de la Cierva eventually produced a practical rotor craft. A major breakthrough, the ability to tilt the rotor disk, obviated the need to retain wings, or rather the ailerons they held, and the need for a traditional rudder and elevators was also eventually eliminated.

A major limitation with the early autogyros was their inability to take-off vertically but this was eventually overcome by the 'jump start'. This involved the rotor being spun at a flat pitch with power taken from the engine. To take off, rotor pitch is suddenly increased; lift is instantly generated and the machine 'jumps' into the air, the tractor engine pulls it forward and the rotor begins to generate lift in the normal way – in some respects this is not unlike the, much, later fixed-wing VTOL concept.

The autogyro eventually went into production and the RAF acquired a batch for use in army co-operation work. Unfortunately, the whole rotary wing movement in the UK, which was heavily reliant on de la Cierva, suffered a catastrophic setback in 1936 when he was killed in an aircraft accident at Croydon. With the onset of war, several machines were deployed to France but they were not successful when exposed to what we now call 'contested airspace'. Nevertheless, a use was found for the aeroplanes and they were

The Sikorsky R-4 Hoverfly I.

employed on radar calibration throughout the war.

We now need to turn to the USA, the Russian émigré Igor Sikorsky and the Royal Navy, for the next, and very significant advance in rotary wing development. The RN had observed autogyro trials conducted by the Italian navy in the 1930s and on merchant vessels in the early stages of the war and they recognised their potential as an anti-submarine tool. At this stage, Sikorsky was developing the powered rotor concept and so this was naturally of some interest. As the navy had no experience in this field, they asked for RAF help and this was forthcoming in the guise of Wg Cdr Reginald Brie. Brie, a former RFC observer, held the first rotary wing licence to be issued in the UK, had been de la Cierva's chief test pilot and had commanded No 529 Sqn – which operated the RAF's autogyros.

Brie went to the USA in 1941, initially in connection with autogyros, but he soon became aware of Sikorsky's work on helicopters and in 1943 he was eventually able to fly the production prototype of what would become the Hoverfly I. Its powered rotor provided obvious advantages compared to the relatively crude autogyro so Brie approached the Controller of Technical Development with the British Air Mission in Washington DC, Air Mshl Roderic Hill, who negotiated a substantial order for Hoverflys under Lend-Lease. In 1943 the US Navy opened a helicopter training school at Floyd Bennet Field, Dayton OH, which was attended by pilots from the USN, USAAF, RAF and RN.

At about this time, the Royal Navy's interest in rotary wing aircraft began to wane, as they had found other ways of countering the U-boat threat. An intended trial to prove the worth of the helicopter in this role during the delivery of the first two aircraft was thwarted by adverse North Atlantic weather.

With war in Europe at an end and mass demobilisation underway, there could not have been a less favourable moment for the new technology to reach our shores and post-war austerity ensured that the exploitation of helicopters attracted little priority. In 1946, the RAF and RN split the remaining assets between them. The navy took the Hoverfly Is while the air force had the notionally more advanced Sikorsky R-6s – the Hoverfly II – but it had backed the wrong horse, as this version tended to leak oil onto the magneto.

With the number of enthusiasts declining and neither service having a real role for the helicopter, they could well have been deleted from the inventory. Amongst the makeshift tasks given to the crews was a shuttle between Aberdeen airport and Balmoral, carrying mails for the royal household. Brian Trubshaw – of Concorde fame – was one of those involved, which might explain why he soon left the RAF for something more satisfying.

Interest in the potential of the helicopter was restored by Operation FIREDOG – the campaign against the communist insurgency in Malaya. Much of the country was covered by dense jungle and soldiers were obliged to undertake prolonged patrols during which they were supported by air drops of supplies. When a man was injured or taken ill, however, it could be many days before he could be extracted. This often prevented the patrol from continuing, as the focus was on getting the casualty to treatment. The time and difficulty might even mean that the likelihood of his survival could be compromised, with seriously adverse implications for morale.

The need for speedy evacuation was obvious and the US Army had shown the way to do it by using helicopters – Sikorsky R-4s – in the closing stages of the war in Burma. The problem was finding a helicopter with the necessary range and payload. The only British options were Raoul Hafner's Bristol 171, which would become the Sycamore, Saro's Skeeter and Fairey's Gyrodyne but none of these was available in quantity at the time, and the Skeeter lacked both capacity and performance. The eventual answer was the Sikorsky S.51

A Dragonfly of the Casualty Evacuation Flight.

– which the British called the Dragonfly.

As the Casualty Evacuation Flight, the first Dragonflys reached Malaya in 1950. The task inevitably expanded as the utility of the helicopter was recognised and the unit also began to undertake communications flights and deliver freight. The Dragonflys began to be supplemented, and were eventually replaced, by the Sycamore. The flight also gradually expanded to become No 194 Sqn.

Royal Navy and RAF Whirlwinds were added to the Malayan mix and towards the end of the emergency, the Whirlwinds of No 155 Sqn and No 194 Sqn's Sycamores were merged to form No 110 Sqn, which, having been re-equipped with the turbine-powered Whirlwind 10, whilst retaining a few Sycamores for a while, was to remain in the Far East until 1971.

In a decade of operations, the Casualty Evacuation Flight and Nos 194, 155 and 110 Sqns had evacuated 4,000 casualties, and moved 100,000 troops and 1,000 tons of freight. There were many instances that highlighted the value of the helicopter but, to take just one example, in February 1952, Flt Lt John Dowling extracted from deep in the jungle, seventeen men of the Cameronians and a terrorist prisoner, after the patrol had been in a swamp for 29 days and was still

The Belvedere may have had some drawbacks but, in its day, there were some things that only a Belvedere could do.

13 days march from help by conventional means.

Thus far, this presentation has been essentially an account of the emergence of rotary wing aircraft in a military guise, culminating in the Malayan campaign which had established the helicopter as an essential RAF tool. This was equally true of the RN and the Army, of course, which was to lead to a number of inter-Service squabbles, which time does not permit me to explore in detail. Suffice to say that each Service fought its corner, while also having to fend off common enemies represented by the Treasury, political interference and vested interests.

When the Dragonfly was retired from front line service in 1956, the RAF was left with two types: the Sycamore and the Whirlwind, both piston engined, underpowered for most tasks, of limited range and each with its peculiarities, which, in the case of the former, included a transverse collective pitch lever. The short-term solution to the future development of the helicopter in the RAF came in three – not necessarily coherently thought through – innovations. The first, and by far the easiest to achieve, was installation of the Gnome gas turbine engine in the Whirlwind. Whilst this did not endow the type with a startling increase in performance, it did provide a significant improvement.

The second was the Bristol 173, a twin-rotor design which had been under development for several years. Before the RN lost interest in the project, it had had a significant influence on its design which left the eventual result – the Bristol 192 – with a stalky undercarriage, which meant that the fuselage was high off the ground, which meant, in turn, that it was not ideally suited to carrying casualties or troops, especially with a side door which made loading awkward. However,

The Wessex, a stalwart of the SH and SAR forces for many years.

as somebody observed, it would be ideal for those occasions when the RAF wanted to carry a torpedo!

At a cost of £390K each, the aircraft – known in the RAF as the Belvedere – was twice the price of a Sikorsky S.58 and, although the RAF took delivery of twenty-six, further development was not pursued. The Belvedere had a number of drawbacks, including the use of Avpin – isopropyl nitrate – as a starter agent and this volatile fuel caused a number of incidents, including the loss of two aircraft by fire. Another problem related to the control cables, which ran over a series of pullies; if the cables jumped off, control was lost. There were further issues with the vertically mounted Napier engines, the gearboxes and transmission systems. All that having been said, however, the Belvedere could do things that were quite beyond the capabilities of the Whirlwind and Sycamore and it was an invaluable asset in FEAF.

The third innovation was the acquisition of the Sikorsky S.58 for which Westlands, who had taken over practically all of the UK's rotary winged business, had obtained a production licence. The RN and RAF were equally impressed but, while the navy replaced the

original Wright piston engine with a single Napier Gazelle gas turbine, the RAF opted for a pair of Bristol Siddeley Gnomes, making it twice as powerful. As the Wessex, it was a considerable success and, apart from widespread service in the UK, it equipped the last two helicopter squadrons in the Far East, as well as units in Aden, the Gulf, Cyprus and Germany. Late in its life, the RAF took over surplus Gnome-powered Wessex Mk 5s from the navy.

Thus far I have made little reference to the importance of the helicopter in the context of search and rescue (SAR). The RAF created two search and rescue squadrons; one each in Fighter and Coastal Commands, operating the Sycamore and Whirlwind. The nature of the role was such that SAR and short-range transport (SRT) – as support helicopters were originally known – diverged, although, if necessary, support helicopters could also undertake SAR tasks when required.

The Sycamore and Whirlwind employed on SAR did splendid work, despite their inherent limitations in terms of range and payload. This could lead, on occasion, to the engine being started inside a hangar because the wind outside was gusting beyond the starting limits and the image of a Whirlwind emerging from a hangar with its rotors already turning is a sight to remember!

The Sycamore having been withdrawn from frontline operations by 1964, it was left to the Whirlwind 10 to provide the core of the SAR force and this it did, alongside an increasing number of Wessex, until the introduction of the Sea King, essentially a Sikorsky S.61 powered by a pair of Gnome engines, with No 202 Sqn in 1978, having been ordered three years earlier. The Whirlwind was retired in 1982 and a further order for six more Sea Kings with an improved avionics fit led eventually to an all-Sea King SAR force, comprising Nos 22 and 202 Sqns. Until their withdrawal in 2016 they operated in dispersed flights from bases around the UK with the SAR Force headquarters functions, along with a training unit and second line maintenance, eventually being concentrated in a purpose-built facility at Valley.

Despite an inevitable degree of healthy rivalry, the RAF and RN SAR units worked together and some may recall a TV series of a few years ago titled ‘Helicopter Rescue’ – perhaps it is churlish to observe that the RN units at Lee-on-Solent and Prestwick, seemed to have had more than their fair share of exposure to the cameras!

The decision to transfer SAR to a commercial contract, brought an

Sgt Eric Smith being lowered onto the capsized wreck of the Jeanne Gougy *from a Whirlwind of No 22 Sqn.*

end to an important aspect of military rotary wing activity. Whilst I have not found statistics of lives saved, the SAR crews had been a major plus in terms of 'civilian engagement' and wearing a tie with a Whirlwind helicopter motif, could sometime attract the offer of a free beer in the pubs of Ilfracombe!

During the early years of RAF helicopters, they were afforded little publicity, but that changed in 1962 as a result of two widely publicised events. In the spring, John Dowling, then OC 72 Sqn was tasked with putting the spire, and a further device, on the roof of Coventry Cathedral. This apparently straightforward – to the layman – task, required the most intricate planning and practice. It was not simply a case of lowering the spire and then going back to fetch the adornment and repeating the exercise. It required an intricate combination of ground work and precise flying. So precise in fact that one pilot operated the cyclic stick and yaw pedals, whilst the other handled the collective lever and manual throttles. A third pilot acted as crewman.[1]

The second episode was captured in the full gaze of TV crews and the public. A French trawler, the *Jeanne Gougy*, had run aground at Land's End and, at first, it was thought that all aboard had perished. However, it was realised that there was movement within the vessel's

[1] For a detailed account of this episode, see Dowling, John; *RAF Helicopters – the First Twenty Years* (HMSO; 1992) pp256-261.

wheelhouse and Sgt Eric Smith, the 26-year-old crewman, made a series of exceptionally dangerous descents, releasing himself from the winch cable each time in order to work on board the ship. He, eventually recovered two men and a corpse; a lifeboat was able to take off four more survivors.

Smith received the George Medal, the pilot – Trevor Eggington (holder of the world airspeed record for a helicopter) was awarded an AFC but the navigator, Jack Canham, who, incidentally, wrote Smith's citation, received nothing! As a warrant officer Pathfinder navigator, Canham had won a DFC with 97 Squadron and in the years immediately after the war, he was seconded to the task of finding the graves of missing aircrew. By a cruel stroke of misfortune, he was killed in Borneo flying the last sortie of his service career, when a Whirlwind, searching for a missing army helicopter, suffered a structural failure

The training of helicopter pilots was rather haphazard in the early years, as was the setting of standards and the rating of crews. In the mid-1950s, however, the Central Flying School began to impose some order on the chaos and this led to proper training for instructors and their formal categorisation. It also led to the CFS being made responsible for training RAF pilots and the instructors from all three Services along with those of some overseas air forces. A school was formed at South Cerney and in 1963 it migrated to Ternhill, where two training squadrons and a standards unit operated until a further move to Shawbury where the school became No 2 FTS. Further rationalisation led to the unit becoming the kernel of the Defence Helicopter Flying School (DHFS) – a function it continues to fulfil.

For many years, an appointment as a helicopter pilot was considered, officially or otherwise, to be the preserve of the 'old and bold' and very few first tourists were assigned to rotary wing posts. This attitude changed only gradually, the greatest impetus being provided by the increasing use of helicopters overseas and particularly in Borneo during the Confrontation with Indonesia. A course photograph of No 43 Basic Course, in 1963, for example, shows many young men, straight from flying training schools, most of whom were destined for the Far East. The demise of the Valiant led to another cohort, this time surplus co-pilots who saw helicopters as a means of escaping from the V-Force.

The Puma entered service in 1971 and it is still going strong 47 years later.

The end of the 'class distinction' associated with helicopters finally occurred in 1966 when three officers, newly graduated from the RAF College at Cranwell, were posted to Ternhill to fly helicopters. Clearly, much had changed since Plt Off Hugh Lake was interviewed in the early 1960s by his Flight, Squadron and Station Commander – each of whom stopped just short of suggesting that he was 'lacking moral fibre' when he requested helicopters at the conclusion of his flying training.

During the late 1960s there was much enthusiasm, particularly among politicians, for collaborative international aircraft projects. With hindsight, one wonders where the costs of some of these Anglo-French projects, notably the Gazelle, Lynx and Puma, actually fell and which national industries benefited most. From the RAF's point of view, the Puma was the most significant of these helicopters. Forty-eight were ordered initially with a few more subsequently being acquired from a variety of sources. Originally billed as a replacement for the Whirlwind, it was much bigger and equipped two squadrons, Nos 33 and 230. It was not without its faults; its engines had a nasty habit of 'backing off' if a power increase was demanded rapidly, but it did have a useful payload. A relatively recent life extension programme has seen a raft of improvements being embodied and about two dozen of the surviving aircraft were trucked to Romania where the work was carried out, and to a high standard. The result is a very capable aircraft but whether it will be retained after the next

Chinook ZA718, 'Bravo November' of the Falklands campaign of 1982, seen here discharging flares over Afghanistan in 2006. It is still in service today.

defence review is uncertain.

The helicopter which everybody seems to like is the Boeing-Vertol CH-47 – the Chinook. The RAF's quest for this aircraft could probably make a seminar in its own right, the machinations behind its acquisition, the political toing and froing, and the various intrigues and inter-Service issues – all of which tended to be underpinned by the Treasury – are too numerous to explore, and too complicated to explain, here. Suffice to say that the Chinook was only acquired at the third attempt.

The RAF's interest in the Chinook goes back to the mid-1960s when the Belvedere was coming to the end of its days and it had long since been decided not to attempt to develop it any further. The RAF needed a replacement medium-lift helicopter and there were relatively few options from which to choose – certainly nothing home grown. The prime candidates were the US Army's CH-47 or the Marine Corps' CH-53. In seeking to acquire the Chinook, the initial case hinged on the Far East requirement but the government's decision to withdraw from east of Suez, effectively nullified that argument and the fifteen aircraft ordered in March 1967 were cancelled that same November. The case was pressed again in 1971 and once more the

order did not reach fruition but a third attempt succeeded in 1978 when thirty-three new-build Chinooks were ordered and these began to enter service when No 18 Sqn was reformed in 1981.

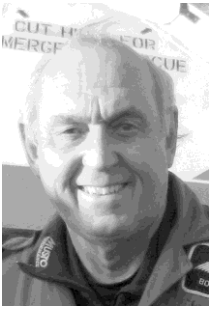
It is hardly necessary to describe the Chinook's remarkable operational record, much of which will, I am sure, already be familiar to this audience. Attrition replacements and purchase of additional airframes, including eight HC3s, which were the source of much controversy when first delivered, although they have since been reworked and are now in service, means that the RAF is currently operating a fleet of some sixty aircraft, all of which have been brought to a common standard under Project JULIUS. It is, perhaps, worth noting that some of these aircraft have been on charge for approaching forty years so some of them resemble an 'original' broom that has had 'three new handles and four new heads.' They have also been hard used and it may not be possible to sustain the fleet size in the medium term.

Whilst the Chinook has been a great success, the saga of the Merlin has been one of mixed fortunes and, from an RAF perspective, relatively brief. Suffice to say that, having entered service in 2001, the RAF's Merlins were all transferred to the RN in 2015 where they were used to replace the Sea Kings of the Commando Helicopter Force.

In the time available it has only been possible to scratch the surface of the RAF's involvement with rotary winged aircraft. An initiative, which attracted only superficial interest when first launched, it spent some time with a slow burning fuse until an operational requirement overseas finally permitted it to demonstrate its potential. Over the next sixty years, the technology matured, permitting the military helicopter to realise its full potential and become an indispensable asset. Originally attracting little regard, the helicopter and its air and groundcrews are now afforded the respect that they have earned and have always deserved.

A HISTORY OF AIR-TO-AIR REFUELLING

by Sqn Ldr Bob Tuxford



Bob Tuxford graduated from Cranwell in 1970. Apart from a brief interlude instructing on Jet Provosts, his career focused on air-to-air refuelling with the Victor K1s and K2s of Nos 214, 55 and 57 Sqns and a USAF exchange posting on the KC-135 Stratotanker. Having been awarded an AFC in 1982 'for gallantry for the part played during BLACK BUCK 1,' he attended the ETPS course in 1983 and subsequently undertook trials work on the Victor, VC10 and TriStar. He left the service in 1987 to fly with Monarch Airlines, retiring in 2010 with close to 19,000 hours and 70 types in his log book.

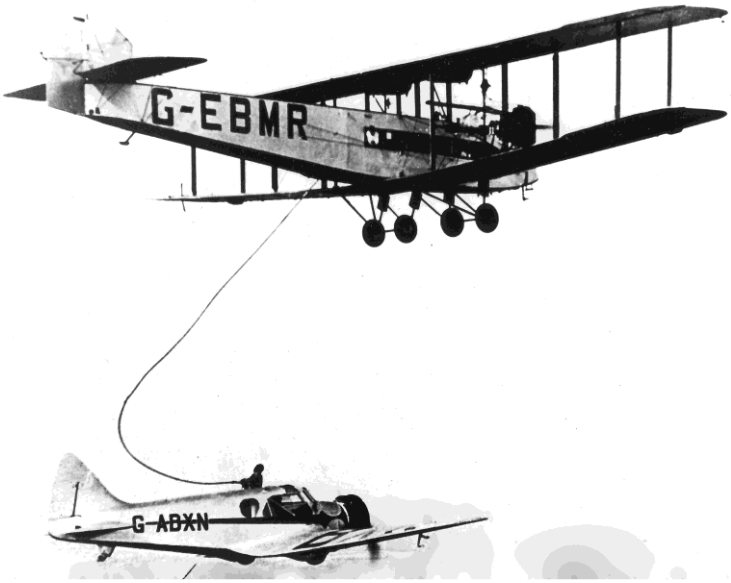
Introduction

I am delighted to have been asked to give this presentation today, during this Centennial Year of the Royal Air Force. I should add that it gave me the opportunity of accompanying the Society's Vice President, Air Mshl Sir Freddie Sowrey, as he kindly offered me a ride to and from the event. After chatting non-stop for a couple of hours about P-51s and Javelins, I hope my voice will hold out. I propose to cover early developments in air-to-air refuelling (AAR) along with the pioneering part played by Sir Alan Cobham, the advent of the jet tanker and specifically Air Chf Mshl Sir Michael Beetham's input as OC 214 Sqn, a snapshot of BLACK BUCK I – the raid on Port Stanley airfield during the Falklands War – and outline the generations of operational tanker aircraft and their capabilities to the present day.

The Pioneering Years

The first attempts at transferring fuel whilst in the air were nothing more than aerial stunts. As early as 1909, *Punch* magazine published a cartoon showing a blimp, displaying the fictional name of 'Petrol Supply Co Ltd', lowering, by hand, a can of fuel on the end of a flexible rod to a receiver aircraft below.[1] A crewman standing on the

[1] *Punch*, 20 October 1909, p288.



A Handley Page W10 refuelling a modified Airspeed Courier. (RAF Museum)

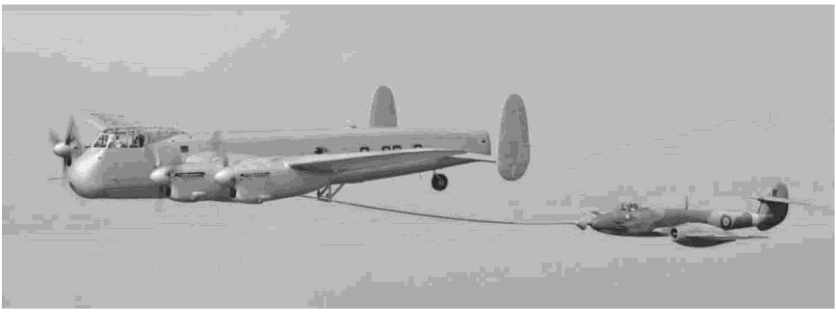
aeroplane's wing, is attempting to capture the can in a device like a fisherman's keep net! Nevertheless, by June 1923, a successful fuel transfer between two Airco DH 4Bs of the United States Army Air Service was accomplished. Although interest in aerial refuelling was lukewarm at best in the UK, the Royal Aircraft Establishment had been instructed to run similar experiments. Despite the fact that mid-air fuel transfers were achieved, the process was not considered to be a practical proposition.

Fortuitously, the celebrated aviation pioneer, Sir Alan Cobham, took a personal interest in the prospects of AAR and conducted his own development trials using the resources of his company and his RAF contacts. Initial attempts were conducted using a Handley Page W10 tanker which lowered a refuelling hose terminating in a hand-operated trigger. This was captured by a brave crewman positioned at the open roof hatch of the company's modified Airspeed Courier. Cobham was determined to take on the challenge of developing a safer and more practical refuelling capability.

A considerable amount of development work had been undertaken by Sqn Ldr (later Air Mshl Sir) Richard Atcherley using his so-called 'Cross-Over' system. In this method, a 'receiver' aircraft trailed a grapple hook on a length of line. A 'tanker' aircraft, flying above and to one side of the receiver, lowered a weighted line and, by moving laterally to the other side of the receiver, made it cross the receiver's trailed line and eventually engage the grapple. The tanker would then haul in both lines and attach a refuelling hose to the end of the grapple line. As the hose was then fed out, the receiver aircraft could haul in its grapple line, now connected to the refuelling hose, which it then attached to its fuel tanks. With the tanker aircraft still positioned above the receiver, refuelling could then take place by gravity. Cobham embarked upon a series of improvements to this basic method. He was encouraged by the vision of Imperial Airways who were interested in the possibility of in-flight refuelling with a view to employing it on their Empire Routes. Different methods of line capture were investigated, and Cobham's company (Flight Refuelling Ltd) conducted further trials on behalf of Imperial Airways and the Air Ministry. By 1938, a revised 'Looped Hose' system had been used successfully on sixteen Atlantic crossings.

The following year, Handley Page Harrows were refuelling Short 'C' Class Flying Boats and crossing the Atlantic non-stop, albeit with very limited payloads. Aware of the shortcomings of the looped hose system, Cobham worked on further improvements during the later years of the war. This led to a revolutionary new design which incorporated a refuelling hose mounted on a motorised drum to trail and wind-in the hose. This was dubbed the 'Hose Drum Unit' (abbreviated to HDU and pronounced 'Hoodoo'). The HDU was fitted in the bomb bay of a modified Lancaster. A cone-shaped basket was connected to the end of the hose which, in turn, could receive a probe mounted on a suitable receiver. After flying the probe into the conical basket, referred to as the 'drogue', a mechanical latch locked the probe and drogue together. The hose could then be pushed forward, and the motorised HDU would wind in the excess length. At that point, the necessary conditions had been met and fuel began to flow from the tanker's fuel system to the receiver's.

The vehicle for these trials was a Meteor F3 which Cobham had borrowed from the RAF. The first successful 'dry' contacts were



A Lancaster tanker refuelling a Meteor in 1949. (RAF Museum)

followed by 'wet' transfers of fuel in May 1949 signalling the arrival of the first 'Probe and Drogue' refuelling capability. Transfers were now possible without the need for additional crew members to man-handle the refuelling lines and connectors. Further developments were planned using the Lincoln, but incompatibility between the speeds of a propeller-driven tanker versus jet receivers limited the utility of this combination. Although the Air Ministry had been ambivalent during the early 1950s, following Cobham's fierce advocating of in-flight refuelling for the new V-bombers, the Air Staff's interest was rekindled and it was decided to convert some Valiant bombers into dedicated tankers and to adopt the probe and drogue principle for the whole of the V-Force.

The Jet Tankers – Valiant and Victor

Trials of the proposed jet tanker began using Meteor and subsequently Javelin receivers. In 1958, OC 214 Sqn, the then Wg Cdr, Michael Beetham was given two years in which to develop AAR techniques and procedures for the Valiant. His bomber crews were not at all happy about the prospect of relinquishing their hard-earned and well-respected bomber credentials. Nevertheless, by November 1959, No 214 Sqn had become the first dedicated operational tanker squadron. What followed was a remarkable series of long-distance and duration flights by Valiants which clearly demonstrated the viability and advantages of in-flight refuelling.

In establishing all of these records, Valiant tankers were used for the in-flight fuel transfers. In the process, long-range air-to-air communications, rendezvous procedures and associated navigational

Valiants of No 214 Sqn refuelling.

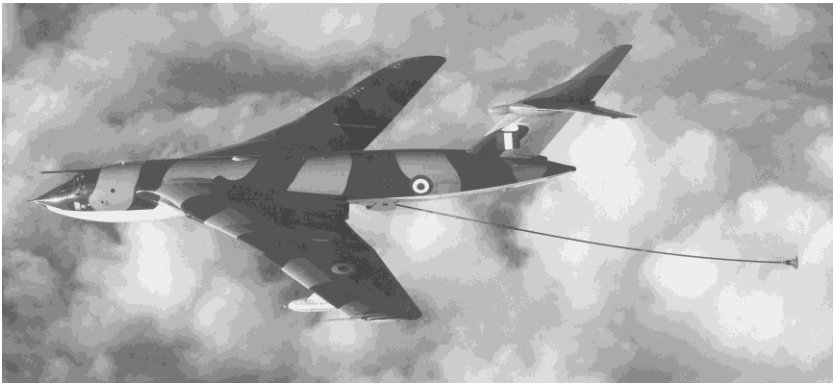
Date	Destination	Distance	Time
Feb 59	Valiant Round-Robin around UK,	1 uplift of fuel	12 hrs
Mar 59	Marham to Embakasi, Nairobi, Kenya	4,350 miles	8:30 hrs
Apr 59	Marham to Salisbury, S Rhodesia	5,320 miles	10:12 hrs
Jun 59	Marham to Pretoria, S Africa	—	11:15 hrs
Jul 59	Marham to Johannesburg, S Africa	6,060 miles	11:28 hrs
May 60	Marham to Changi, Singapore	8,110 miles	15:35 hrs

A selection of early long-distance/duration flights made by Valiants of No 214 Sqn.

practices were refined and proven. In many ways, Wg Cdr Beetham and his crews of No 214 Sqn were the architects of the principles of air-to-air refuelling which still underscore the procedures used today. It is no coincidence that, as Chief of the Air Staff and acting CDS in 1982, Beetham's refuelling experience and visionary thinking was so influential in the success of the remarkable refuelling operations undertaken in the South Atlantic. It was his impetus and drive which were behind the ambitious plans for the radar reconnaissance and long-range bombing missions mounted from Ascension Island. But more of that later.

By 1960, No 23 Sqn had started receiver training with its Javelin FAW9s. In Exercise POUNCE, the squadron utilised the principles of in-flight refuelling during a deployment to Karachi and back. The success of this exercise had convincingly tried and tested the complex logistics of moving a large number of tactical aircraft over long distances, without the need for stopovers. The Vulcan should also be mentioned at this stage. The Service Chiefs had always planned for the Vulcan to be involved in the refuelling trials. In 1961, a Vulcan, flown by a No 617 Sqn crew, was refuelled nine times in mid-air by No 214 Sqn's Valiants and flew non-stop from Scampton to Richmond, Australia. The distance covered was 11,500 miles in just a fraction over twenty hours. The days of the Valiant however were numbered after the discovery of metal fatigue in the main wing spars. Since it was not feasible to repair the extensive fleet-wide corrosion, the Valiant was withdrawn from service in January 1965. It had already been decided to replace them with Victors in 1967 so the plan was promptly brought forward and conversion of the bombers began immediately. The first Victor tanker flew, in an interim fit, before the end of April 1965.

By the late 1960s, the futuristic-looking Handley Page Victor K1 was gracing the Norfolk skies – I am not at all biased of course! The tanker wing at RAF Marham consisted of three squadrons, Nos 55, 57 and 214, backed up by No 232 OCU; a total of around three dozen aircraft. The fin flash on No 214 Sqn's Victors was Flight Refuelling Ltd's logo of two linked speedbirds – itself synonymous with in-flight refuelling. With the addition of two 15,000lbs fuel tanks in the bomb bay, the fuel capacity was increased to 85,000lbs of Avtur, considerably more than that of the Valiant. The HDU mounted in the bomb bay could be lowered into the airflow and retracted to a flush fit using the former rear bomb bay door jack. An 80-foot centreline hose was ideally used for larger receivers, and for Victor-Victor mutual refuelling in particular. Flow rates of up to 4,000lbs/min could be achieved through this large-bore hose. The restricted field of vision from the Victor's cockpit was perhaps not the best for formation flying. However, a centrally-mounted probe situated on top of the cockpit roof was ideally placed in the pilots' eye line, making station-keeping whilst in close line astern, and during contact, straightforward. To Marham's tanker pilots, the making and breaking



Victor K1, XA939, of No 214 Sqn.

of contact – or prodding – was 'The Sport of Kings'. A Mk 20B wing refuelling pod mounted under each wing enabled pairs of fighters to be refuelled simultaneously, along with fuel flow rates of around 1,500lbs/min. Significantly, with three hoses available to choose from, the Victor K1 was a much more viable and flexible tanker than the single-hose Valiant had been.

The main role of the tanker force during the Cold War years was Air Defence and the protection of the UK's airspace. The Lightning squadrons of the Interceptor Alert Force (IAF) were frequently tested, sometimes on a daily basis, by the principal protagonists – the Soviet long-range bomber and reconnaissance fleets. Marham's tankers were at constant readiness to respond at short notice in support of the IAF. By the time that the supersonic Lightnings had been directed onto their prey and seen off their quarry, they would be desperate to mate with the ever-present Victor tankers. Many a time on CAP in the northern reaches, the fighters would be flying on fumes and we would offer them whatever fuel we had, diverting into Kinloss or Leuchars should the situation warrant it. On one occasion, I transferred 10,800lbs to an F6 whose internal capacity was, from memory, of the order of 10,200lbs. Of course, in the process of replenishing, the thirsty receiver would burn around 1,500-2,000lbs during contact. The trust and mutual respect that existed between the Lightning and Victor aircrews was perhaps never quite replicated with our other customers.

Aircraft intercepted included the Tupolev Tu-95, known to NATO as the *Bear D*. Although a serious game of cat and mouse, they would

A Victor K2 of No 57 Sqn refuelling a pair of No 5 Sqn's Lightning F6s.

usually turn-tail when intercepted by a Lightning armed with a brace of live Red Top air-to-air missiles. This was not without humour – when photographed at close quarters for the mission debrief and 11 Group records, it was not unknown for a brazen tail-gunner to hold up a centrefold from *Playboy* magazine! As recently as a few months ago, the Russians were still probing our airspace to test our Air Defence capabilities. Along with the Lightning IAF, by the late 1960s, the McDonnell Douglas Phantoms of No 43 Sqn, the 'Fighting Cocks', had joined the fray. Apart from the UK Air Defence role, we routinely practised with our chicks, accompanying them on cross-country exercises in preparation for overseas deployments.

At this point some Super 8 film was played. Shot at Gan during Phantom 'Ghost Trail F25' in October 1982, it showed the launch of three Victor K1s at about 45-second intervals, and a subsequent snake climb towards the en route refuelling track. After joining up with a pair of F-4s, they are seen refuelling simultaneously, and then remaining in contact to the end of the refuelling 'bracket'. The clip finishes with a Victor returning to Gan and deploying its brake parachute after landing on the somewhat shorter than normal runway.

A few months after the film was shot, as I was positioning through Gan, I landed at night and decided to keep the brake 'chute attached rather than drop it on the runway. As I turned through 180 degrees on the turning circle, a severe tug was felt through the airframe. It happened again a second later but. there being no abnormalities with the hydraulics or brakes, I continued to taxi back along the runway to the intersection turn off and parked. I jettisoned the parachute off the edge of the ramp close to Operations. On reporting the next day, our ground crew started to quiz us, asking if we had encountered any issues with the brake parachute after landing. We were led outside to view the 'chute on the apron. To my horror, the webbed parachute lay in tatters, ripped to shreds, and amongst the debris was a splintered set of goal posts! Gan's 1st XI were not amused!

Operation BLACK BUCK I – The Falklands War

Back at Marham, by the late 1970s, the Mk 2 Victors had replaced the Victor K1s. 'El Adem with Grass' was then home to two operational squadrons – Nos 55 and 57 Sqns. Slipper tanks under each wing held an additional 28,000lbs of fuel, increasing the Victor K2's fuel capacity to 123,000lbs. On my return to the home of the tanker force in 1980, the fast jet customers were much the same – Lightnings, Phantoms, Buccaneers, Jaguars and Harriers. However, by the spring of 1982, there was more than a hint of sabre rattling in the South Atlantic. On 2 April, Argentina invaded the Falkland Islands. During the remainder of April, Marham geared up for war at a frenetic pace. Three selected crews, mine included, refreshed their skills in low-level (LL) flying. Within a couple of days, an F95 camera rig had been fitted in the nose of selected aircraft to provide a new operational capability – photo-reconnaissance (PR). A third string to the tanker bow was added with the arrival of Vulcan maritime radar reconnaissance (MRR) specialists from the recently disbanded No 27 Sqn. Within the half-a-dozen allocated training sorties, we became proficient in the LL, PR and MRR roles in addition to our core refuelling skills. On 18 April 1982, the first wave of tankers deployed to Ascension Island in the South Atlantic, assisted by in-flight refuelling from sister aircraft abeam the Iberian Peninsula. Four more tankers followed the next day, and by the end of the month, almost 75% of the UK's tanker force was located on the remote forward

Victor K2s on Ascension Island. (Dave Davenall)

operating base. Needless to say, parking space on the single apron was reaching saturation point. This was made even more taxing on 29 April with the arrival of two sinister shapes in the form of 'Tin Triangles'. Plans for the retaking of the Falkland Islands were already underway as the Task Force sailed south. However, the focus on Ascension Island was centred on an audacious plan to mount a bombing raid against Port Stanley airfield on East Falkland Island. Less than 24 hours later, the execution order was received to put that plan into action – under the codename Operation BLACK BUCK.

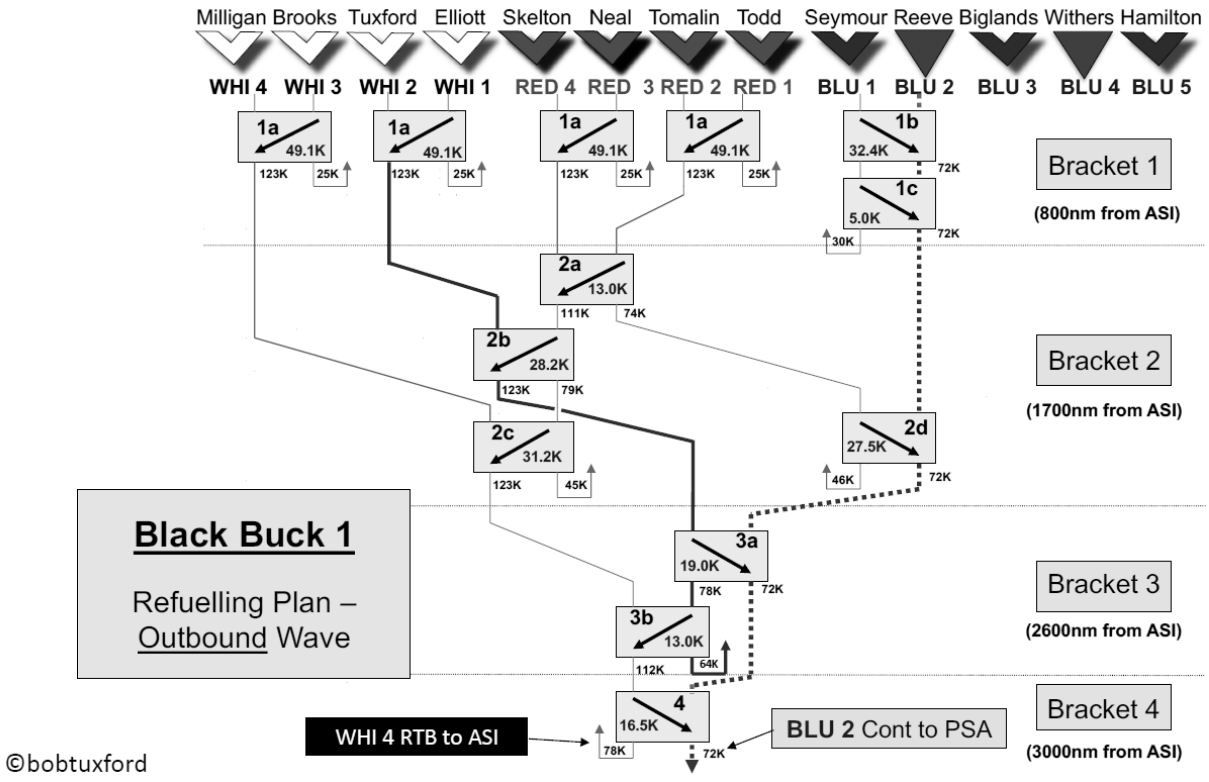
The aim of this mission was to bomb the runway at Port Stanley using a single Vulcan armed with 21 × 1,000lb iron bombs. The purpose was to deny Argentinian offensive air operations from the strip and disrupt the air re-supply of munitions and logistics for the occupying invasion forces. The extreme distances involved in mounting such a mission could not be undertaken without considerable air-to-air refuelling support. Marham's tankers and their crews would clearly provide the lynchpin upon which the whole ambitious plan would depend. In essence, an outbound wave of Victors would be needed to get a single Vulcan to the target.

The great circle route contained four refuelling brackets, during which the tankers would mutually refuel in a cascading fashion. With its smaller fuel capacity, the bomber would be topped up more

frequently outbound by dedicated tankers. The final remaining Victor, called the 'Probe', would accompany the Vulcan to its final refuelling transfer at Bracket 4 prior to casting it off towards the target. After each transfer of fuel, it was planned that the offloading tankers would be left with sufficient 'chicken' fuel to be able to return direct to Ascension. Following the attack on the target, the Vulcan's return route took a dog-leg via the so-called 'Rio RV', a point about 150nm off the Brazilian coastline. This was the planned rendezvous where the bomber would meet two laden tankers courtesy of the second wave of Victors launched around 6 hours after the departure of the outbound wave. The two tankers would provide redundancy in the event of one aircraft suffering an unserviceability with its refuelling equipment,

The fuel planners from Bawtry came up with an ingenious master plan which was compressed onto an A4-sized sheet of paper. The diagrammatic layout contained all the necessary information as regards: the formation make-up; all tanker/receiver refuelling combinations at planned refuellings; bracket start and end geographic coordinates; fuel transfer quantities; required chicken fuels and so on. The easily-assimilated format provided the seasoned tanker crew members with instant access to the plethora of detailed information they needed to accomplish the mission. The Vulcan crews looked on with some confusion – and trepidation!

In order to achieve the ultimate in flexibility, which is the hallmark of AAR operations, each tanker crew was issued with a copy of this master plan. Thus, any tanker crew would be in a position to replace, and fulfil the task of, another tanker slot in the event of an individual sortie failure. In summary, four Victors would make up Red Section (numbered 'Red 1' through 'Red 4'), another four made up White Section. In the third section, three tankers ('Blue 1, 3 and 5) would accompany the Primary Vulcan ('Blue 2') and its airborne reserve aircraft ('Blue 4'). Eleven tankers were thus needed in the outbound wave (backed up by three ground reserve aircraft) to deliver the Primary Vulcan to its target. A further seven tankers would be generated, some having flown the 'short slots' in the outbound wave, to make up the inbound recovery wave. This second wave was tasked with meeting the post-strike Vulcan at the Rio RV, where it would be refuelled one last time to enable it to recover to Wideawake Auxiliary Airfield on Ascension Island. At least, that was the plan!



Operation BLACK BUCK I – Fuel Plan Schematic. (Bob Tuxford)

During the start-up sequence, ‘Blue 5’ had an engine wind down, necessitating one of the two manned ground reserve tankers to take its place. Shortly after getting airborne, the ‘Probe’ tanker, ‘White 4’, found to his horror that the HDU would not trail. Steve Biglands, accompanying the reserve Vulcan in Blue Section, was directed by Operations to replace ‘White 2’ in the ‘Probe’ tanker slot. Thirdly, as if to test the resilience of Tanker Ops to the limit, the Primary Vulcan crew announced that they were unserviceable because of an inability to pressurise their aircraft. Martin Withers in the airborne reserve bomber then had to step up to the mark and assume the role of Primary Vulcan, ‘Blue 2’. An inauspicious start!

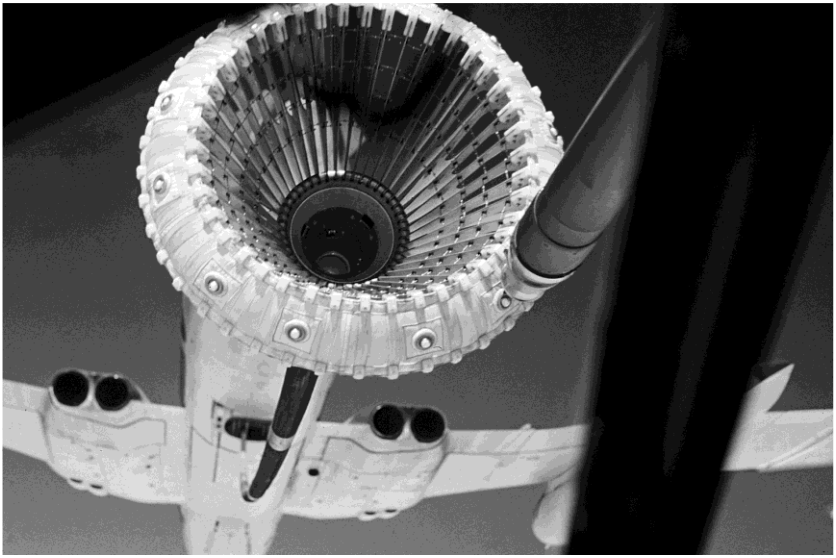
Around 900nm, and two hours, south of the Island, the four pairs of K2s in Red and White Sections refuelled each other at Bracket 1. Along with the Vulcan and his escort tanker ‘Blue1’, the six aircraft then set course towards the second batch of fuel transfers. At Bracket 2, after some four hours’ flying time, and around 1,700nm south of Ascension, the tankers shared their fuel once more. ‘Red 3’ topped up the bomber and sent the remaining formation on its way. It was at this point that my crew, as ‘White 2’, took over as formation leader for the first time, in company with Steve Biglands (‘White 4’) and Martin Withers (‘Blue 2’). Our three-ship continued towards refuelling Bracket 3, a distance of 2,600nm from our departure point after nearly 6½ hours’ airborne time. I refuelled the Vulcan, which, in the benign and calm conditions, had no difficulty taking on around 20,000lbs of fuel. It should be mentioned that up to this point, all refuellings had been conducted at night, and in a ‘no R/T’ environment to avoid alerting any enemy surface vessels which might have been listening below. Even our H2S radars had been left switched off to avoid announcing the presence of the formation, which left us rather exposed when it came to anticipating the likelihood of any significant cloud or weather.

As ‘White 4’ positioned astern my trailed centreline hose, I became aware for the first time that the stars above had disappeared from view. No longer was there a distinct horizon illuminated by the starry backdrop of a clear night sky. Recalling the Met officer’s brief that there might be some frontal activity around 40° South, our worst fears started to become a reality. Not only was the in-flight forward visibility markedly restricted in the upper cloud that now enveloped

Ronald Wong's '40 Degrees South' captures the drama of Bracket 3.
(ronaldtkw@aol.com)

us, but an ever-increasing turbulence was now starting to throw the three aircraft around like bucking broncos. Intermittent blinding flashes of lightning started to punctuate the angry sky and revealed the presence of towering cumulo-nimbus clouds. A particularly active St Elmo's fire enveloped all my forward transparencies to a degree that I had never witnessed before. After several aborted approaches to my basket, Steve Biglands eventually made contact in the prevailing dire conditions. Before long, and with barely half the allocated fuel passed, he became very unstable, and the gyrations of a whipping hose sheared off the tip of his probe. The former quiet R/T environment was rudely interrupted by a desperate call from 'Biggles' announcing that he had broken his probe. It seemed, at that moment, that the likely success of the mission was in serious jeopardy.

My immediate thought was that, if there was any likelihood of salvaging the mission, I would have to take back the fuel that I had just passed so that I might be able to proceed with the Vulcan to the final bracket. With that in mind, I called Steve Biglands to overtake on my port side, and trail his hose. I found the degree of difficulty in



Victor K2 closing-up for contact. (Bob Tuxford)

trying to stabilise behind his flailing basket close to impossible. With no sign of the conditions abating, I pressed home a number of unsuccessful approaches. I was acutely aware that my flying was becoming increasingly erratic.

Finally, with my frustration and tiredness approaching desperate limits, I was able to make a successful contact with the tanker's gyrating hose. This was short-lived however as I quickly found that maintaining contact was becoming increasingly more demanding and bordering on dangerous. Reluctantly, I had to break contact to take a brief respite. Just at that moment, as if by magic, the stars started to reappear and surround the silhouette of the Victor ahead of me. The turbulence began to abate, and a defined horizon came back into view. Not wishing to look a gift horse in the mouth, I immediately remade contact, albeit for only a couple of minutes. The flashing HDU lights up ahead signalled that I had been given all the fuel that could be spared. I had taken only part of the planned transfer, and we were already significantly past the end of the prescribed bracket.

Pausing for a moment to take stock of matters with my crew, it soon became apparent that we were low on fuel by some 20,000lbs. With less than thirty minutes to the Vulcan's final transfer, we had to

decide whether or not to abort the mission at that point before matters got even worse, or press on for the time being. Either way, there was still the possibility that my basket might have been damaged, or indeed the reception coupling blocked by, for instance, a lodged broken probe tip. Continuing to the final bracket before the integrity of my basket had been proven was therefore pointless. I. therefore, called Martin Withers astern to assess the serviceability state of the basket of my rapidly-trailed hose. A visual inspection proved somewhat inconclusive, so I cleared him for an unscheduled wet contact to prove my refuelling equipment. After a successful transfer of 5,000lbs, we were buoyed with a renewed vigour to continue the mission. Barely twenty minutes later, some 3,000 miles from Ascension, the final fuel transfer was offered to our playmate. Barely 400nm from the northern coastline of the Falkland Islands, I turned XL189 towards our safe haven. A definitive fuel check confirmed categorically for the first time that with seven hours still to go, we had barely five hours' worth of fuel in the tanks! We were unable to make any immediate calls for help on the HF for fear of announcing the presence of our colleague and prejudicing the Vulcan's intentions. There was no option but to await the possibility of intercepting a post-strike message. Approximately 45 minutes later, my excited AEO announced 'SUPERFUSE' over the intercom – signifying a successful bombing run by the Vulcan. I rendezvoused with a tanker, flown by OC 55 Sqn, three hours south of Ascension, with barely one hour's worth of fuel remaining in the tanks. The rest, as they say, is history.

From VC10 to TriStar

Although unable to accelerate the programme during 1982, while the situation in the South Atlantic intensified, the planned replacement of the ageing Victor tanker fleet was well under way. The prototype Vickers VC10 tanker made its debut in June 1982. By mid-1983, the VC10 K2 had received its first refuelling clearances. Having graduated from the ETPS in December 1983, it was not long before I became involved in continuing AAR clearances with other aircraft types in service. The K3 version had a fuel load of 172,000lbs, significantly greater than that of the Victor K2. Flight Refuelling Ltd were still very much at the helm with developing the refuelling equipment for the new aircraft. The centreline HDU, the Mk 17B, was

A VC10 tanker refuelling a Tornado GR4.

essentially a Mk 17 unit, like that in the Victor, modified to fit inside a revised fairing in the VC10's lower fuselage. The modified underwing refuelling pod was the Mk 32/2800 capable of transferring fuel at a much-improved rate of 2,800lbs/min. The 'Tens' participated in the First Gulf War (alongside the venerable Victors), deploying RAF combat aircraft to the Middle East. All nine VC10 K2s and K3s supported Operation GRANBY, amassing some 381 sorties. They also supported operations in the Balkans, refuelling Tornado GR1s from RAF Germany engaged in long-range strikes against Serbia. Nos 101 and 10 Sqn aircraft also played their part in Operation TELIC during Gulf War II. Based in Oman for a dozen years or so, the VC10s were subsequently involved in Operation HERRICK over Afghanistan, and Operation ELLAMY as part of the British contribution to the Allied response to the war in Libya.

As part of the legacy of the Falklands War, the versatile VC10s played a major part in maintaining the South Atlantic Air Bridge, which constantly resupplied and reinforced the newly established garrison. A single tanker detached to the Falkland Islands provided refuelling support for the permanently established Air Defence Phantoms based on the Islands.

In the aftermath of the Falklands Conflict, and the not-insignificant demands of the Air Bridge, a new Air Staff Requirement was drawn

Hercules C1P undergoing receiver trials against a TriStar K1.

up for a strategic wide-body tanker/cargo aircraft. In February 1993, it was decided to purchase nine TriStar 500 civil airliners. Modifications to the basic aircraft fuel systems included additional fuel tanks fitted below the floor, a cockpit roof-mounted refuelling probe, and a side-by-side twin hose drum unit designated the Mk 17(T). The internal fuel load was increased to over 300,000lbs, making it a very capable refuelling platform. By mid-1985, in my role as the Senior Test Pilot on the Heavy Aircraft Test Squadron at Boscombe Down, I was tasked with making the first contacts on the new hose combinations. Using a 'B' Sqn Canberra fitted with a dummy probe, I was able to demonstrate fifteen 'dry' contacts on both hoses at speeds between 210 and 290 kts. Fast jet clearances followed in order to prove compatibility with the Phantoms stationed at the newly built RAF Mount Pleasant on East Falkland Island.

The other workhorse involved with the Air Bridge was the C-130 Hercules. Anticipating the primary role expected to be played by the new wide-body tanker in the South Atlantic, it was imperative that compatibility between the TriStar and Hercules be proven. Again, with my background and experience, I found myself in pole position for the next high-priority refuelling trials. By January 1986, I had embarked upon an extensive and quite exhausting series of demanding clearances for the turboprop Hercs. Not surprisingly, the strong downwash from the 'Heavy' TriStar resulted in propeller interference and significant fuselage flexing and torsional twisting of the Hercules' fuselage. On several occasions, this resulted in broken HF aerials, whose whipping wires caused considerable superficial damage to the

rear wing areas. The reduced refuelling speeds demanded by the slower C-130s necessitated the need for redesigned ‘Slow-Speed’ baskets. This caused a further delay before trials could be continued.

Later in the year, I flew some 40 hours in the course of ten flight refuelling trials, during which I made 170 ‘dry’ and 45 ‘wet’ contacts on the TriStar hoses. Other clearances followed by flying the new wide-body tanker against the other in-service tankers – the Victor K2, and the VC10 K2 and K3. No 216 Sqn had reformed in 1984, allowing its crews to familiarise themselves with the TriStar in its passenger/cargo role. Once the TriStar K1 tanker had arrived on the squadron, it was not long before it was intent on setting new AAR records. In 1988, four Tornado F3s, supported by two TriStar K1s, deployed to Australia and returned to the UK by continuing eastbound to circumnavigate the globe – another first for the RAF’s AAR community. Alongside the VC10s, the TriStars routinely supported the Air Defence forces in the protection of UK airspace. The TriStars were also involved in both Gulf Wars, the Balkans, Afghanistan and Libya. Battle honours earned reflected great credit on the personnel of No 216 Sqn. To mark the final fleet disbandment, after three decades of service, a final air-to-air refuelling exercise took place on 20 March 2014 between a 216 Sqn TriStar K1 and a Typhoon FGR4 of No 3 Sqn.

The Multi-Role Voyager to present

The arrival of the current generation of RAF tankers brings us up to date. Airbus Military’s Voyager is a state-of-the-art multi-role tanker transport which provides the RAF with an enhanced operational capability. AirTanker Services Ltd aims to provide a ‘core’ fleet of nine aircraft, with an additional five available in the event of a ‘surge’ requirement. The aircraft features: fly-by-wire digital flight control technology; advanced air-to-air refuelling systems, which includes a ten-camera panoramic day/night viewing capability; secure anti-jam communications and advanced self-protection countermeasures. The aircraft comes in two variants. The 2-point tanker, designated Voyager KC2, is fitted with two Cobham 905 under-wing refuelling pods. Each 90-foot hose is capable of delivering fuel at 3,000lbs/min. The 3-point Voyager KC3 is fitted additionally with a fuselage-mounted hose drum unit, now referred to as an ‘FRU’, or fuselage refuelling unit! It

A Voyager K2 refuelling a Tornado GR4 and a Typhoon FGR4.
(Airbus Military)

can dispense fuel at a rate of around 5,000lbs/min. The standard internal fuel load of the Airbus A330 at 111 tonnes/245,000lbs makes the Voyager a very capable refuelling platform, without modification to the fuel system. Moreover, it has an under-floor cargo capacity of 45 tonnes and an automated military and civil cargo handling system. In the aeromedical role, it can accommodate 40 stretchers, together with three critical care patient facilities.

Two squadrons fly the Voyager: No 10 Sqn, which re-formed in 2011, and No 101 Sqn in 2013. To offer some idea of the aircraft's operational capability, a single Voyager can stay on task for five hours at a distance of 500nm from its FOB, and transfer 60 tonnes/132,000lbs of fuel. Putting this into the perspective of an overseas deployment, a single Voyager can refuel four Tornados across the Atlantic, while also carrying 5 tonnes/11,000lbs of freight. The latest priority for the Voyager is clearance for it to refuel the RAF's latest acquisition – the F-35B Lightning II. To date, trials are going well, and clearances are being granted ahead of schedule. Flight trials at the US Naval Air Station at Patuxent River continue as we speak. Although I offered my services to AirTanker on my retirement

a few years ago, sadly they were not interested. Despite having accrued several thousand hours on the A330, I regret to say that this is one of the few tankers against which I have not had the opportunity to prod.

In praising the skills and opportunism of the tanker pilot, and in a nod to the tanker pilots' mantra of flexibility, I leave you with this one last slide depicting a TriStar tanker prodding on the hose of a Buccaneer tanker.

The flexibility of air power. (Bob Tuxford)

AFTERNOON DISCUSSION

Simon Bachelor. A question for Bob Tuxford. I have often wondered about the change in centre of gravity when aircraft are refuelling – both the donor and the receiver. How is that controlled?

Sqn Ldr Bob Tuxford. It rather depends upon the type of aircraft but, taking the Victor as an example, before taking on a large uplift of fuel, you would aim to spread the existing fuel around the fuselage and bomb bay tanks so that you could accept a large transfer without the aeroplane becoming significantly unbalanced. One of the issues with changing places with Biglands on BLACK BUCK I was that we had the fuel in completely the wrong positions – having planned to give it away, we were suddenly having to receive it! Ideally, to do that, you would first have emptied the bomb bay tanks which would permit you to accept the transfer in the shortest possible time. But, in general terms, the Victor's centre of gravity could be a bit of a problem, especially with large transfers when we were 'filling to full'. As the tanks filled, the Cof G would gradually move forward, making the aeroplane increasingly 'heavy' to fly, and when you had already been in contact for 30 minutes you didn't really need that complication.

On other aeroplanes it was much less of an issue. The VC10 had more flexibility in terms of its tankage and the TriStar was probably one of the most delightful aeroplanes that I have ever flown. But, overall, while managing the CofG was an issue, it was never critical.

Gerry Pye. I was stationed at Benson with the Joint Helicopter Force in about 2000 and we seemed to spend all our time just ferrying soldiers about. Why doesn't the Army make a case for running its own support helicopters?

Wg Cdr Colin Cummings. The Army did fly a few of the first-generation Sycamores for a while in the early 1950s, but they soon faded away and the question of who should own and operate proper support helicopters has led to frequent squabbles between all three Services. There have been several occasions on which the Army has made a bid to take over SH and, you may recall that, two or three years ago, there was even a campaign in some of the newspapers advocating that the RAF should be done away with altogether! That

was being contended by folk who were arguing that the air force no longer had an independent role – so it is possible that it's not just SH that the Army might like to acquire . . .

Sir Richard Johns. Perhaps I could provide a little amplification. I first became personally involved in the helicopter ownership debate in about 1986 when the Commander Aviation at HQ 1(BR) Corps made an overt bid for control of the RAF's support helicopters in Germany. This was, as Colin said, the start of a long and rather puerile battle that was, in reality, little more than an Army-style cap badge issue. Some very silly things were said at the time; for example, the Army claimed that it could maintain its Lynxes with far fewer numbers than the RAF required to look after the Pumas and Chinooks at Gütersloh. But, apart from the obvious question of size and scale, the Army neglected to acknowledge that the RAF serviced and maintained all of the Army's avionics and safety equipment, so it was fairly easy to provide a counter argument.

That particular campaign died down but it cropped up again from time to time until the Strategic Defence Review in 1997-98, when I was CAS. Much had changed since the end of the Cold War and, led by the Secretary of State for Defence, George Robertson, the Government's policy was to emphasise 'Jointery' – how the Services might deploy on much smaller operations but with much greater cohesion than we had achieved in the past. Clearly, command and control of support helicopters was going to be a central issue. I suggested to the CGS that, if he and I didn't do something about this ourselves, others probably would, and the outcome could well be a solution that neither of us would like! I argued that we would be better off taking the initiative and proposing to Ministers that we should explore the options ourselves, permitting us to come up with a solution that we could both live with. To be honest, I actually had up my sleeve the ideal man to lead this study – a very experienced operator who had done exchange tours with both the navy and the army. The eventual outcome was that, without delving into the intricacies of what these specific terms actually involve, Operational Command should go to CinC Land while Full Command would remain with the RAF. There was some concern within the SH Force who feared that they would be left outside the mainstream RAF with

adverse consequences for career management, but within a few years the three most senior appointments in the Service were all filled by air officers with an SH background.

As to the question of the other Services taking over the RAF – that never worried me in the slightest. Frankly, it is arrant nonsense, even to suggest that the navy and the army, both of which, in essence, look upon air power merely as a tactical extension of their own fighting dimensions, could ever embrace the *strategic* aspects of air power, that lie, past, present and future, at the core of the functions of the Royal Air Force and its responsibilities to the nation!

Sorry chaps – I just had to say that (*Laughter – and applause*).

Richard Bateson. When 151 Wg flew its last sorties in October 1941, the *Wehrmacht* was poised to take Moscow, obliging the Soviet Government and the foreign Diplomatic Corps, including the British Military Mission and AVM Collier's Air Section, to evacuate to Kuibyshev. The situation was so critical that much of the 'air' documentation, including the War Diary, was burned. How did all this affect 151 Wg, isolated up at Vaenga and – were some members of the wing later posted to Operation SHALLOW at Kineshma, where the RAF ran a three-month Hurricane erection and pilot training programme for the Soviet Air Force?

Air Cdre Phil Wilkinson. Two questions. One – what happened when the Germans advanced towards Moscow? Firstly, yes, the urgency of the move did mean that – as AVM Collier wrote to ACAS(I) on 5 November 1941 – 'the war diary was destroyed in error.' Secondly, no effect was felt on the daily routine of the wing in the North, although the German advance did mean that the rail routes southeast from Murmansk were cut. This stymied the wing's planned move to the Mediterranean, which was to be their lot after handover of Hurricanes was complete, thus a seaborne journey home instead.

As to the posting-on – a few people were transferred down from the north to Kuibyshev, to help the Mission, because it was very understaffed.

The second question concerned Op SHALLOW, which was a completely separate undertaking. It was associated with the second convoy that arrived in September 1941 with an additional team of engineers and a further batch of aeroplanes. These were taken to an

airfield at Kineshma, about 180 miles east of Moscow, where they did, indeed, erect the Hurricanes, and helped a party doing the same with Airacobras, but people began to return to the UK in about April 1942.[1]

Wg Cdr Jeff Jefford. For Bob Tuxford. You had a picture of a C-130 refuelling from a TriStar in straight and level flight. But, as I recall, maintaining the initial Air Bridge with the Victor and the C-130 involved a relatively dramatic exercise of refuelling in a dive. Could you enlarge on that?

Tuxford. 'Dive' is a bit strong! The problem was that the minimum speed for a heavily-laden Victor 2, at a reasonable altitude, say 20,000 feet – which was about the top end for a loaded Hercules – was about 235 kts, which was about the maximum flat out speed of a C-130. That meant that the Hercules lacked sufficient excess power to make level contact when we met them at the RV south of Ascension en route for the Falklands. Within a few days my colleagues on B Sqn at Boscombe Down came up with what they called 'the toboggan'. That involved the Victor setting up a steady 500 ft/min rate of descent which provided the trailing Hercules with some potential energy, in effect sufficient excess power, to be able to make approaches – to catch up or back off – in the descent. The toboggan became the standard procedure for refuelling in the South Atlantic and the technique is still probably used.

In the case of the Vulcan pilots, who had little experience of AAR, a Victor pilot was added to the crew to assist them during the refuelling contacts. Hercules pilots were equally inexperienced, of course, but they just had to get on with it. On several occasions, having initially overtaken a C-130 at 23,000 feet we would be down to 7,000 or 8,000 feet before it managed to make contact, by which time we would be dodging in and out of the cumulus cloud. But it worked – the toboggan manoeuvre gave the Hercules just enough excess power to permit them to make contact and then to refuel in level flight.

Sir Richard Johns. I would just add that the Air Bridge to the Falklands went on for three years after the cessation of hostilities and I have always felt, very strongly, that the Hercules and tanker crews

[1] Op SHALLOW was the subject of a paper in *Journal 38*, pp133-144.

who maintained that service over such immense distances without the loss of a single aircraft was a remarkable feat of airmanship for which neither community has ever had due recognition and I am pleased to be able to say that in public today – with Bob sitting here beside me. (*Applause*)

CLOSING REMARKS

To wind-up. I think that we have seen today that air power has been a product of technology and that this has shaped the RAF into a service that has been quick to learn from its mistakes and able to accept the need for change when weaknesses became apparent. Moreover, while the significance of air power once suffered from over-optimistic expectations, advances in technology would eventually transform both its utility and its effectiveness. This has been clearly demonstrated in recent years.

But, getting back to basics, the Royal Air Force is in the business of winning battles and, throughout its history, it has needed its people to do difficult and dangerous things. But we must never forget that, without adequate equipment, the bravest of people can accomplish little and, conversely, without brave people, the most sophisticated equipment has no value. These simple truths should be writ large on the consciousness of all concerned with our national security and international clout.

From time to time, as a former Chief of the Air Staff, I still wear my uniform, and I do so with great pride as I share, with many others, memories of the RAF's accomplishments in peacetime and at war. Some of which have been so brightly illuminated by our speakers today. Meanwhile, we should all remember that, since the end of the Cold War, not a day has gone by when the Royal Air Force has not been committed to operations somewhere in the world, ranging from high intensity conflict at one end of the spectrum to humanitarian relief at the other. Men and women of the Service, in every branch and trade, have done, and continue to do, their duty with admirable discipline and no small measure of courage. So – 100 years after its formation, as the world's first independent air service, the RAF now faces a future clouded by strategic uncertainty. But, I am confident that, size for size, it remains second to none – and long may it remain so,

All of that having been said, it only remains for me to close this seminar by thanking, once again, the Royal Air Force Museum for hosting us, and to extend your thanks to our speakers, who have given us a series of most interesting and informative presentations.

IN THE BEGINNING . . .

by Air Mshl Sir Freddie Sowrey

Having seen the Committee's eclectic choice of subjects to commemorate the centenary seminar, I wondered whether the formation of our Society might qualify as a mini-milestone. Surprisingly, we have been going for a third of the life of the Royal Air Force.

CENTO, in Turkey in the 1970s, was good for thinking – no great day-to-day pressures. It provided the opportunity to look in detail at the way the other Services handled their long and illustrious histories over centuries. This was obviously not for us and a more participative pattern, recording those who had 'been there – done that' or who had 'studied – will speak' seemed to be more in keeping. A paper proposing a self-sustaining Society, on the lines of what we have now, was sent to the Air Member for Personnel, but the time was not right. Apparently, there was concern that it might need bailing out financially or fail to attract sufficient members.

However, in 1986, Henry Probert, Head of the Air Historical Branch, asked whether I would be prepared to run the idea again. I realised that evidence of concrete support was going to be needed to carry the day and asked Lord David Craig, who was chairing the RUSI lecture by John Terraine on his *The Right of the Line*, if I could have two minutes at the end to make a pitch. He readily agreed and the lists for names and addresses immediately gathered some sixty supporters.

With the great help of the AHB, the Society's inaugural lecture, by Professor R V Jones on the 'The Intelligence War and the Royal Air Force', was delivered on 20 October 1986. The proceedings subsequently appeared in print in the first of, at the time of writing, 67 editions of what became the *Journal* – plus, of course, another 18 stand-alone hardback publications. The papers from this formative period were lodged with that most helpful venue, the Royal Air Force Museum. Lastly, we needed a President of authority and standing. After consultation, I approached Sir Michael Beetham. 'Who else did you have in mind?' he asked. 'Sir Frank Cooper' (Spitfires and PUS at the Ministry of Defence). 'I'll do it,' was the response – the rest is history.

BOOK REVIEWS

Note that the prices given below are those quoted by the publishers. In most cases a better deal can be obtained by buying on-line.

Bolts from the Blue – From Cold War Warrior to Chief of the Air Staff by Sir Richard Johns. Grub Street, London; 2018. £25.00.

Until now, only four Chiefs of the Air Staff have written their own biographies: Lord Tedder, Sir John Slessor, Sir Dermot Boyle and Lord Cameron (the latter dying before he had completed the text). Now we have a fifth, that of our own Society's President Sir Richard Johns. In our 32-year history, we have encouraged biographies of our first President, Sir Michael Beetham and our Vice-President, Sir Frederick Sowrey so we now have a neat trilogy for future historians. Who knows, one day the Folio Society may produce a combined edition.

Sir Richard's effort runs, not surprisingly, chronologically from his early years through his time as a flight cadet at the RAF College Cranwell, flying tours on the Javelin, Hunter and Harrier, training as a QFI, teaching His Royal Highness the Prince of Wales to fly at Cranwell up to 'wings' standard, commanding a Harrier squadron in Germany culminating with command of RAF Gütersloh, and making a major contribution to utilising the Harrier's unique characteristics 'in the field'. With short chapters covering Staff College at Bracknell and his first experience of the Ministry of Defence, that takes up half of the book (itself over 300 pages long, plus a comprehensive index).

Attending the Royal College of Defence Studies as a newly promoted air commodore, and then in 1986 posted back to RAF Germany as Senior Air Staff Officer (SASO) at the HQ, the Cold War and the pressures of high readiness states, complicated by nuclear alert, broadened his experience and helped develop friendships, not least with NATO allies, which were useful in the years to come.

With the pressures of the Cold War fading, he was soon an AVM and SASO at HQ Strike Command ready for the sudden challenge of Gulf War I which emerged, like a bolt from the blue, in the summer of 1990. Operating for many months from the newly-built Primary War Headquarters (PWHQ) at High Wycombe, he was the Director of Operations there throughout the campaign. In the underground Joint

HQ, Sir Richard worked directly to the Joint Commander of all UK forces, Air Chief Marshal Sir Patrick Hine, who exercised Operational Command (OPCOM), throughout Operation GRANBY. Readers will enjoy Sir Richard's clear descriptions of the developing campaign against Saddam Hussein's forces which sometimes, it seemed, were easier to deal with than some of the personalities and attitudes in Whitehall. Because I was part of his team throughout the experience, I was very well aware of the exhausting amount of effort that he and his colleagues had to put in to explaining why we needed to do what we did.

Soon after Gulf War i, Sir Richard then describes becoming AOC 1 Group and finding himself planning air operations under Operation SAFE HAVEN to help the Kurds who were being threatened by Saddam.

Promoted to air marshal in 1993, and back at High Wycombe, he was appointed DCinC Strike Command. Then another 'Bolt from the Blue' strikes. In June 1994, he became Commander-in-Chief of Strike Command when, with the creation of the new Allied Forces North West Europe (AFNW), Sir John Thomson became the latter's first CinC. A fortnight later, as most readers of this book will know only too well, Sir John died suddenly. The RAF's most illuminated star was cruelly extinguished.

Almost at the same time, the senior ranks of the RAF were hit by a 'maelstrom of bad publicity for the service.' a couple of forced retirements; the Chinook crash at the Mull of Kintyre; and a series of HM Treasury-led studies seemingly determined to radically reduce the Defence budget. All these events Sir Richard describes clearly and dispassionately, not realising at the time that, having replaced Sir John Thomson as the CinC of NATO's AFNW and thinking that he was about to retire, another 'Bolt from the Blue' would thrust him into the RAF's top job. He became CAS in 1997.

In the late summer of 1995, as CinC AFNW, he was SACEUR's senior airman and was sent by the latter to CINCSOUTH's HQ in Naples to be briefed on and report back on the air campaign being developed to attack the Bosnian Serbs (to become Operation DELIBERATE FORCE). Triggered by the massacre of some 8,000 Muslims at Srebrenica, this offensive forced the Serb leaders to the negotiating table and led to the Dayton Agreement which, in turn, led

to the cessation of violence in Bosnia and Herzegovina. The descriptions in this chapter include an extraordinary story which will be new to most readers: Sir Richard's successor as CinC Strike Command, Sir William Wratten, was sent by HMG to tell General Ratko Mladic of the Bosnian Serb Army to stop all military activities. If he did not do so, his army would be bombed ceaselessly. Shortly afterwards, there was a mortar bomb attack on Sarajevo market place killing 38 civilians. Op DELIBERATE FORCE was launched: 3,515 NATO attack sorties in 21 days. Sir William subsequently wrote a 3-page summary of his experience calling it Eyeballing Ratko. It is reprinted as an appendix to *Bolts from the Blue* and, with the author's permission, it will be reproduced in the next edition of the Journal. Those of a nervous disposition will need to take a deep breath.

Preceding his chapter on his experiences as CAS, Sir Richard reflects, in a chapter underpinned by his lifelong study of military history, on his 'attitudes and prejudices'. Looking candidly into his mirror, he gives us 15 pages of thoughtful analysis which, were I to be Commandant of an RAF Staff College, would be near the top of any reading list for those wishing for high command.

The final chapters of the biography cover Sir Richard's time as CAS including the 1997 Strategic Defence Review (SDR), his views on 'jointery' and his concern for the RAF's personnel. Towards the end of the book, the pilot in Dick Johns' character comes out crystal clear as he describes, in a chapter called 'Flying Visits', many of the exciting moments he had in the air (when CAS) both within the RAF but also with many aircraft of a dozen or so 'friendly' air forces. The reader will soon find a favourite my own being a description of a hair-raising low-level aerobatic sequence in a very tired Romanian Air Force MiG-21 flown by an enthusiastic base commander. Sir Richard, having already noted that squadron pilots were flying no more than 4 hours a month and that the price of spares from Russia had increased by 300% since the end of the Cold War, tried to strap in tightly. During the final inverted pass at about 100' agl, he regretted the lack of negative G straps.

Sir Richard concludes his biography at the point in late 1999 when he completes his time as CAS and is told he has been asked to become Constable and Governor of Windsor Castle (a post he then holds for 8 years). Perhaps there will be a Volume 2 one day.

In recommending this well-written and often page-turning story to the Society's membership, I am sure you will enjoy Sir Richard's writing style. Always more than ready to give often fulsome credit to colleagues, both above and below, (and happy to quote names and posts), he is nevertheless no soft touch although, probably wisely, he forebears to name those who probably deserve his criticism.

Our recent Chief of the Defence Staff, Sir Stuart Peach, writes in the Foreword to the book, '. . . there is a strong and attractive blend of the practical and the philosophical. Honesty, integrity and resilience shine through his whole career […] a gap in our knowledge has been filled.' That is nicely put.

AVM Nigel Baldwin

Spirit of the Royal Air Force by Michael Fopp. The RAF Club (www.rafclub.org.uk/shop); 2018. £35.00 plus p&p.

As its publicity leaflet proclaims, *Spirit of the Royal Air Force* 'features 102 full colour plates by iconic aviation artists such as Frank Wootton, Michael Rondot, Mark Bromley and David Shepherd, along with 20 specially commissioned pencil vignettes by Mandy Shepherd' and 'each work of art is captioned with interesting details about the subject.' The paintings have been selected from the private collections of the RAF Club and BAE Systems and, reflecting the book's subtitle, *One Hundred Years of Excellence*, they are presented chronologically in twelve chapters, each of which opens with a narrative which reflects something of the essence of the period in question.

It is a most impressive volume but, regrettably, the text does contain some inaccuracies – some may think rather too many. For instance, while the trail-blazing flights made by Vimys in 1919-20 were impressive, they were not made by the RAF so their inclusion seems a little inappropriate and, with respect to the Bristol Fighter, did the RAF really have 'over 1,500 in squadron service' at the end of WW I? – 150 would be a lot closer to the mark. Were Battles really sent to the USSR? Tito died in 1980, not 1990. There are errors in the description of some of the paintings too, for instance: the Shackleton in the painting on p144 is a Mk 2, not a Mk 3; the aeroplanes featured in the painting of 'Venoms over Aden' on p169 are clearly Vampires, and they would not have belonged to No 249 Sqn; and the Typhoons shown refuelling from a Voyager on p257 are wearing the markings of

No 1453 Flt, not No 1 Sqn. All of these, and others, could have been corrected by an informed and independent proof-reader who might also have picked up one or two textual anomalies, like inconsistent use of hyphens and the V-1 being described as fearful, rather than fearsome.

But, while these niggles do detract somewhat from the overall effect, they will only disturb the occasional, and perhaps overly pedantic (discerning?) reader and this book is not really about the words. It's about the pictures, and these are splendid. The book runs to 277 pages in landscape format and it's big, really big – 13½"×10" – and it weighs in at a hefty 5 lb 8 oz. An appendix contains biographical details of most of the artists and another is a very useful flow diagram illustrating the way in which the British aircraft industry expanded and contracted over the 100 years since 1910 showing when each manufacturer came into being only to be taken over by increasingly large conglomerates until there was only BAE Systems, and there is a very comprehensive index.

Chris Andrews Publications are to be congratulated on the production standard; the book is printed on heavy, coated paper with the paintings reproduced at a high resolution and with close attention having been paid to colour fidelity. This book would grace any coffee table and at only £35, each picture costs less than 35p which is real value for money.

CGJ

Air War Northern Ireland by Stephen Taylor. Pen & Sword; 2018. £19.99.

Having, over many years, researched and written about military aviation in Northern Ireland, I very much looked forward to reading this book. The sub-title sets out its scope with clarity – Britain's Air Arms and the 'Bandit Country' of South Armagh, Operation BANNER 1969-2007.

Aircrew and ground personnel from all three Services tend to remember their time in the Province as, in the main, fulfilling and enjoyable. Aldergrove was widely accepted as one of the best messes as regards catering and had a lively (if somewhat geographically restricted) social life. There was plenty of flying in fairly challenging weather, many tactical lessons had to be learned, with spares and

technical support not normally being an issue (though it was claimed that the Wessex, for example, needed only a swift bang with a hammer in the right place to sort out most defects and that you only needed to worry if there were no oil leaks visible). There was also the feeling that there was a real job to do and one which could not be done without the hard-won expertise of the helicopter crews. All in all it was as much satisfaction, and indeed fun, as could be expected in a 'small war'. Though it always had to be remembered that for those serving on the ground, patrolling city streets and country roads, laying up in covert observation hides or waiting in a cold, wet, dark and muddy field to be extracted by air, it was more deadly than fun.

As this book amply demonstrates there was a definite specific threat, as PIRA had a great ambition to shoot down, what was so often termed in the Republican press as, a 'British Army helicopter' regardless of its being RAF, AAC or FAA. The key incidents and weapons are all described in sufficient detail. This ground-to-air threat was by no means as high as would be encountered in hot and dusty places in the 21st Century but dealing with it certainly concentrated minds, developed skills and was useful preparation for what was to come over Iraq, Afghanistan and Libya.

The author's concise introduction in the chapter 'Troubled Times' is excellent in setting the scene and context between 1919 and 1969. The only minor point of detail I would make here is that 105 and 106 Squadrons began operational patrols in the spring of 1918 and were equipped with RE8s until the end of the year. He then turns to the meat of the book – South Armagh – 'Bandit Country' – a small geographical area with beautiful scenery but highly dangerous to the non-local. To put this in context, despite growing up in Co Antrim, I only visited South Armagh by helicopter (Chinook, Lynx and Gazelle) during the whole 38 years of Op BANNER. Neither I, nor my family, nor anyone else in their right mind with any connection to the Security Forces, would have gone there sightseeing. The author sketches-in the historical background and explains just why South Armagh is different, even for Northern Ireland, and will help the reader to a better understanding of the Irish Question. One point that could have been drawn out more is that the existence of the border was not only an advantage for PIRA tactically, but also economically, as without a border there would have been no highly profitable smuggling of fuel,

cigarettes and livestock. In reading this account you are left in absolutely no doubt that PIRA in Bandit Country was very well-organised, motivated and skilled. It was interesting to learn that that term was coined by Secretary of State Merlyn Rees in 1975. The malign influence of supporters in the USA and the Libyan Government is also described as also are the countermeasures by the FBI, the RN and the Irish armed forces.

Bearing in mind that much material is still highly sensitive, that a terrorist threat still exists and that the author limits his scope to one particular geographic part of the conflict, this is a timely, informative and accurate account. It is well-researched, very readable and concise. I certainly learned new facts and details about incidents during Op BANNER, such as the dropping of CS gas canisters on rioters at Long Kesh and the IRA's hijacking of civilian aircraft in unsuccessful efforts to carry out bombardment from the air.

A small quibble would be the author's reference to DS10 in MOD as 'liaising between the Army and the British Government'. I worked in a DS branch and we regarded ourselves as the Civil Service jam in the sandwich trying to make sense of the wilder ambitions of the military and politicians alike. Also, the picture section is disappointing – if the author had contacted me I could have supplied him with many more and much better images.

The concluding section 'Operation BANNER: an analysis of the air war' is excellent. It certainly makes me repeat a call which I have made many times to deaf official ears – an appropriate Battle Honour should be added to the relevant Squadron Standards.

Guy Warner

The Man who Took the Rap – Sir Robert Brooke-Popham and the Fall of Singapore by Peter Dye. Naval Institute Press; 2018. No UK edition as yet, but available via Amazon at £43.50.

Of many fine books reviewed over the years in this Journal, few can match Peter Dye's 410-page (with 22 b/w plates) biographical account of the life and professional downfall of Sir Robert Brooke-Popham. Its rigour and balance are exemplary, something that might not have been so given the author's undisguised admiration for his subject. In his earlier work, *The Bridge to Airpower* (Journal 62), Dye makes no bones of his respect for Brooke-Popham's achievements in

the embryonic field of logistics during the Great War and this volume extends that opinion to other areas of a career that made a substantial impact on our Service. One of those offering an endorsement of this important work has described the author as '*both a professional disciple of Brooke-Popham and a meticulous historian who writes clearly and with great authority*' and I would not argue with that view.

Inevitably and as suggested in the title, *The Man Who Took The Rap*, Sir Robert Brooke-Popham is widely remembered as the somnolent, elderly villain upon whom much of the responsibility for the loss of Singapore – and ultimately the loss of Empire – has been dumped. The first half of this book serves by way of background to his appointment as the first Commander-in-Chief Far East, a command unified in name only. Dye's masterly account of B-P's varied career serves in part as justification for that appointment for which, *ex post facto*, he has been judged unsuited.

That career was indeed varied. He played an important part in developing early airpower doctrine and he was a central figure in the creation of the first 'modern' logistic system. As Director of Research in the Air Ministry in the immediate post-war years, he displayed an instinct for engineering and a flair for resolving technical problems that was perhaps untypical of many of his peers. His legacy as first Commandant of the RAF Staff College, a four-year stint during which over one hundred student took the course, was to create what Trenchard described as the backbone of the post-war Air Force, a direct influence that survived well into WW II and probably beyond.

Brooke-Popham's subsequent appointments as AOC Fighting Area and, later in the 1930s, as CinC, Air Defence of Great Britain, gave him exposure to the technical and scientific challenges of air defence and an understanding of its developing processes. As AOC Iraq Command and, curiously, in his later appointment as Inspector General, he became familiar with diplomatic matters at the highest level, including his important contribution to the Anglo-Egyptian Treaty of 1936. In (his first) retirement from uniformed service, he became Governor of Kenya, a post he held until shortly after the outbreak of war in 1939. His short tenure saw much achieved and much still to be done and he left Kenya with regret at his departure. His experience there, combined with his professional background,

prepared him well for further employment in uniform.

It would be wrong to dismiss B-P's employment in the year or so before his departure for Singapore as that of an odd job man, although his last four months were spent as 'CAS's unofficial trouble shooter', during which time he was responsible for a review of lessons learnt from 'the RAF's disastrous campaign in France'. At the height of the Battle of Britain, he toured Fighter Command. Thus, by the time of his departure he may be argued to have been more *au fait* with the realities of *Blitzkrieg* and with contemporary air defence than any other airman.

The story of the Fall of Singapore has been well recorded but, despite general recognition that commanders in the Far East had been dealt a poor hand (and had played it badly), the pursuit of individuals as scapegoats was perhaps an inevitable consequence. Coupled with that was an equally unedifying distancing of themselves from any share of responsibility on the part of major figures such as Churchill and many lesser players. The scapegoating of Brook-Popham was perhaps the most extreme example of such behaviour, something from which, to his great credit, he made no effort publicly to defend himself.

Far East Command was a less than full-blooded unified command, giving Brooke-Popham operational control only of land and air forces, that of naval forces remaining under the Admiralty. His staff was tiny and the 'gapping' of the Chief of Staff post for five critical months further complicated his task. Personal and professional animosities made life even more difficult for him with CinC China, Admiral Layton, the unattractive Duff Cooper and even the Governor of Burma, Sir Reginald Dorman-Smith, briefing against him behind his back. In a sense, the ground was prepared for scapegoating well in advance of his removal, only thirteen months after assuming his dysfunctional and under-resourced command.

Peter Dye's achievements in writing this biography are manifold. He writes not uncritically of someone of whose professional achievements he so clearly approves: this is no mere hagiography. He writes clearly and the result is very much one of objectivity and balance. The depth and scope of his research are reflected in no less than 87 pages of endnotes, many of the references mined from family papers. For members of our Society, the real significance of this book,

paradoxically, may lie in its detailed account of Brooke-Popham's achievements before appointment as CinC Far East Command when he was sacrificed on the altar of political indecision and indifference in the neglected and probably indefensible Malayan Peninsula. Brooke-Popham left an indelible mark on the Royal Air Force and deserves better than the fate of a scapegoat. As Professor Brian Farrell, an acknowledged expert in the circumstances of the Malay Campaign has so accurately put it, '*Dye rescues an RAF pioneer from scapegoating obscurity with this fine, thoughtful biography*.'

AVM Sandy Hunter

Cold War Shield, Vol 3 by Roger Lindsay. Available direct from the author/publisher at http://www.coldwarshield.co.uk. £75 (inc UK p&p).

In his *Cold War Shield* series, Roger Lindsay set out to tell the story of the RAF's fighter squadrons, at home and abroad, throughout the 1950s, a remarkable decade bookended by the demise of the Spitfire and the advent of the Mach 2 Lightning. Vol 1 covered the Spitfire, Tempest, Hornet, Mosquito and Meteor. Vol 2 dealt with the Vampire, Venom and Sabre. Vol 3 completes the story with the Swift, Hunter, Javelin and the Lightning F1. I enthused about the first two volumes in Journals 47 and 57. This one maintains the superlative standard set by its predecessors, so this review will, inevitably, recycle much of what has gone before.

Vol 3 is a 384-page A4 hardback containing some 900 – repeat 900! – photographs of which about 180 are in colour. Also in colour are the late Alan Carlaw's excellent interpretations of contemporary bar markings confined, specifically, to those squadrons that feature in Vol 3.[1] Some of the photographs suffer from an imbalance in their representation of hue, but this is a result of the still-evolving state of colour photography in the 1950s, not the standard of reproduction, which is excellent throughout. Any anomalies are resolved by an annex containing fifty coloured profiles of aeroplanes representing most squadrons.

The bulk of the book is a blow-by-blow account of each

[1] A complete set of Alan Carlaw's bar markings was issued as a supplement to Journal 60.

squadron's activities presented as, typically, three- or four-page narratives. These are much enriched by the embedded recollections of those who were there, and it is notable that many of these have been contributed by groundcrew, not just aviators. They all add considerable contemporary 'atmosphere', some conveying a vivid impression of what it was like to be on a fighter squadron in the 1950s. For each squadron, the dates on which each individual aeroplane was taken on charge are tabulated along with the date of its disposal and where it went. When an aeroplane was written off, there is a brief note indicating why and identifying fatalities where these occurred.

But, rather than relying on my attempt at description, you can sample the book on-line at http://www.coldwarshield.co.uk – click on the Vol 3 icon and you can examine eight representative pages of the narrative and another eight of the coloured content.

While the focus is on squadrons, the ancillary fighter units are also covered, so the CFE and its various sub-units, the OCUs and a variety of stand-alone units, like the Fighter Weapons School, the Guided Weapons Development Squadron, the Fighter Command Modification Centre and the Javelin Mobile Conversion Unit are all acknowledged. In most cases there are photographs of representative aeroplanes, although, unlike the squadron entries, there are no 'in and out' dates for the aircraft that were allotted.

Errors? In a book of this size and complexity there were bound to be a few, but those that I found were of little significance, eg No 111 Sqn moved to Wattisham on 18 June, not July, 1958 (p92 – but he gets it right on p94) and No 56 Sqn returned to Wattisham from Cyprus in January 1975, not 1972 (p317 – but he gets it right on p323); Sir John Grundy (p117) should be Grandy; Air Mshl Edwardes-Jones is a bit short-changed as Edwards Jones on p141 (but he gets it right on p165), Op Marino (p222) should be Merino; there no 'e' in the Clark of Clark Field (p194) and, while the flypast at Tengah in 1962 was to commemorate the stand down of No 75 Sqn RNZAF, the Canberra B2s that took part were contributed by No 45, not 75, Sqn (p 189). Since these issues are of little consequence, why mention them at all? Simply to show that I did actually read the book, not just skim it – and if this is the worst I could find in 384 pages, that in itself is surely a *de facto* accolade.

Apart from its intrinsic value as a source of information, and a stimulus for reminiscing, the *Cold War Shield* series is turning into a sound investment. The last time that any were available on the second-hand market the asking prices for Vol 1 were approaching £150 but, at the time of writing, there are none on offer . . .

The Foreword to Vol 3 was contributed by AVM George Black who wrote that it is an 'historical volume of immensely interesting material, excellently compiled. Thoroughly recommended reading . . .' This reviewer warmly concurs, while adding 'comprehensive' and 'authoritative'.

CGJ

A Thousand And One by Humphrey Phillips (with Sean Feast). Mention The War Publications; 2017. £11.99.

Humphrey Phillips DFC (and twice MiD) is a member of the RAFHS and, in reviewing this book, I must declare an interest. Not only do I know the author, I actually encouraged him to commit his RAF experiences to paper. The result, a 155-page softback, subtitled, *A Flight Engineer Leader's War from the Thousand Bomber Raids to the Battle of Berlin*, was developed in collaboration with Sean Feast, another Society member, so this is all beginning to appear somewhat incestuous!

This autobiography is presented in a personal style, as if Phillips were talking to the reader, which produces an account which is easy to follow and with the minimum of complexities. The first chapter traces his childhood and youth up to the point where circumstances push him into the armed forces, probably a little earlier than might otherwise have been the case. As a motor mechanic in civilian life, he naturally gravitated towards engines and he was well placed when the decision was made to include a flight engineer in the crews of the new four-engine bombers, later using them, in effect, to replace the co-pilot.

Having been accepted as aircrew, Phillips spent the first part of his flying career training others, although he did participate in the 1,000 bomber raids in mid-1942. His application for transfer to operational flying was eventually accepted and, having been commissioned in April 1943, he joined the newly-forming No 626 Sqn at Wickenby in the following November, which coincided with the start of the Battle of Berlin so many of his sorties were to 'the Big City'.

His role at Wickenby was as the squadron's Flight Engineer Leader. As such, most of his flying was done with the CO or one of the Flight Commanders and the reader is taken through the long winter of 1943/44 and into the spring and early summer. Shortly after D-Day he was 'screened' and he returned to instructional duties for the remainder of his service.

In describing his flying experience, Phillips does not allow himself to be drawn into dramatic stories, nor does he exaggerate his own contribution rather, in my opinion, he is overly modest. In some areas, both in the RAF and in later life, he is critical of the actions and behaviour of others, some of whom became quite famous or reasonably well known, in later years.

The post-war chapters tell of Phillips' return to civilian life, his family and his professional career, leading ultimately to his retirement and the loss of his wife. The story concludes with some thoughts and comments followed by several appendices dealing with the aircraft flown by Phillips and short biographies of some of the individuals with whom he served.

Sadly, Phillips died, aged 97, in April 2018 but not before he had seen his book in print and I believe that he would have been pleased with the outcome, which benefits from a significant number of footnotes, probably contributed by his co-author.

This book is not some great cerebral work by a famous person, possibly intent on securing their reputation and lasting legacy. Rather, this is a straightforward account by a man, typical of his generation, who 'stepped up to the plate' when required and who, at considerable risk to his life, contributed to the bomber offensive, when he might so easily have chosen less hazardous service.

Wg Cdr Colin Cummings

An Eye in the Sky by Bob Cossey. Pen & Sword; 2018. £25.00.

An Eye in the Sky is an account of the career of Air Cdre Henry Crowe MC CBE. A native Dubliner, he joined the Army via Sandhurst in 1915 and spent a year in the trenches with the Royal Irish Regiment, seeing action at the Battle of Messines before, in the autumn of 1917, transferring to the RFC. He flew with No 20 Sqn (Bristol Fighters) as an observer for six months, during which he was shot down several times while being credited with four confirmed

victories. He retrained as a pilot immediately after the Armistice and spent two years in Ireland, before joining No 39 Sqn at Spittlegate (DH 9As). Now with a permanent commission, he specialised in photography and, in that capacity, he was posted to HQ Iraq in 1925. In 1926 he became OC C Flt with No 14 Sqn at Amman (DH 9As). After two years in post he returned to the UK to attend Staff College leading to a three-year stint at the Air Ministry in the Directorate of Staff Duties. In 1933 he was appointed OC 23 Sqn at Biggin Hill (Demons), a tour that morphed into command of the newly, and somewhat surreptitiously, reconstituted No 74 Sqn at Hal Far (Demons again) in 1935. That was Crowe's final flying appointment. By now a wing commander, he spent 1936-38 back at the Air Ministry before being posted to command No 1 (Indian) Wg at Kohat. After a little over a year in post, he was recalled to the Ministry in 1940. Two years later he returned to the sub-continent, now an air commodore, as Deputy Air Officer Administration with Air HQ India at New Delhi. In October 1944 he was appointed AOC 223 Gp at Peshawar, with responsibility for all RAF and IAF units on the North West Frontier. He returned to the UK in August 1945 and left the Service early the following year.

All of this is recounted in a 408-page hardback illustrated by about 200 photographs. Most of the latter are of the inter-war years; the majority will have been taken by Crowe himself and most, if not all, of these are being published for the first time. There are one or two problems with captions, for instance, despite the name of its manufacturer, the Henry Folland-designed Nieuport Nighthawk (p137) was entirely British (not French), and the aerial view of aeroplanes of the RFC 'in 1917 somewhere on the Western Front' (p43) is actually of a pre-war Netheravon in 1914 (and the aircraft identified as Caudrons are really Farmans). One could take issue with a few points in the narrative, eg 'A' in the WW I phonetic alphabet was either Ack or Apples, not Archie (p49); in 1926 Cobham picked up No 84 Sqn's Sgt Ward at Shaibah, not Baghdad (p139); stationed during WW II at Gibraltar and in Northern Ireland, and in West Africa, respectively, Nos 202 and 204 Sqns would not have operated from Koggala (p331) and the Vega Gull that Crowe flew in India in 1943 could hardly have belonged to the Hendon-based No 24 Sqn (p333).

The main sources for the narrative were a memoir written by Crowe, personal correspondence preserved by the family and the subject's flying log book. Perhaps to compensate for a lack of material in places, the author has occasionally indulged in some, in my opinion, overlong 'scene setting' exposition, sometimes running to more than 10 pages, during which I found that I tended to lose sight of Crowe altogether. But that aside, Crowe had a very satisfying career, which Cossey has recorded comprehensively. The story is, of course, far more interesting prior to the late 1930s. Thereafter he became a staff officer and, while his contribution to WW II will obviously have been important, it was, inevitably, less colourful than the time he spent flying Biffs, Ninaks and Demons.

CGJ

Flying in Father's Slipstream. Leaves from Our Flying Log Books by Tom Eeles. Arena Books; 2018. £12.99.

By the time that Gp Capt Tom Eeles finally hung up his flying helmet in 2010, he and his father, Air Cdre Harry Eeles, had served during eighty years of the RAF's existence. This was a period of great change ranging from biplanes and weapons of limited capacity and accuracy to supersonic jets and powerful weapons delivered with unerring precision. This immense range of capability is covered by the author but in a novel and fascinating manner by comparing entries in his father's and his own flying log books.

Both Eeles senior and Eeles junior began their flying careers as flight cadets at the RAF College Cranwell. Eeles senior went on to fly biplane fighters and the Fairey IIIF in Egypt before becoming a flying instructor. He flew during the Battle of Britain, commanded one of the few Whirlwind twin-engine fighter squadrons and later converted to jet fighters. His final appointment was as the longest serving Commandant at Cranwell.

Eeles junior was one of the first to complete the all-jet pilot training sequence before flying Canberra strike aircraft in Germany. He then embarked on a long career flying the Buccaneer, first on exchange to the Fleet Air Arm and then on numerous RAF units culminating in command of the OCU. He was a flying instructor, commanded the Examination Wing at CFS and was then appointed as the Station Commander at RAF Linton-on-Ouse. After retiring from

the regular RAF he flew with the Cambridge University Air Squadron and for six years flew cadets with one of the Air Experience Flights. He had amassed 8,500 flying hours over almost fifty years.

From a carefully selected number of entries drawn from his father's and his own log books, the author not only charts their various flying experiences but also reflects on the state of the RAF and of the nation at those particular times. It is fascinating to compare Eeles senior practising 'landings and take off into wind' in an Avro 504 with Eeles junior instructing 'maximum rate turns' in a Gnat. Later we read of Eeles senior carrying out 'air to ground firing' in a Hart and the author conducting 'night shallow dive bombing under flares' in a Canberra B8 on China Rock Range off Singapore.

In relating these, and other equally fascinating and varied flights, the author highlights how a simple single-line entry in their flying log books opens up a wider picture of RAF service and operations. In bringing together two very different eras of flying in the RAF, Eeles evokes many memories and also captures the essence that provides a common bond amongst those who have enjoyed the flying and companionship that service in the RAF offers.

Flying in Father's Slipstream, is an evocative and highly appropriate title and this well-written, 130-page softback, with its many b&w photographs, will appeal to all who have enjoyed flying in the RAF. I recommended it.

Air Cdre Graham Pitchfork

Flying To The Edge by Matthew Willis. Amberley; 2017. £12.99.

The subtitle of this 128-page softback, *the groundbreaking career of test pilot Duncan Menzies*, neatly sums up the content. Born into a Scottish farming family in 1905, Menzies spent a few years working in the family business in Sutherland, but he broke away in 1927 when he took a short (later medium) service RAF commission. He trained at No 4 FTS in Egypt and then flew DH 9As with No 45 Sqn for seven months before moving to the Sudan to spend two years flying Fairey IIIFs with No 47 Sqn. In 1930 he was sent back to the UK to attend No 32 Course at the CFS before spending another two years in Egypt as an instructor with No 4 FTS at Abu Sueir. Having taken part in a notional reinforcement exercise in the summer of 1932, when he flew one of five Atlases from Egypt to Kurdistan and back, and achieved an

'Exceptional' rating as a QFI, he returned to the UK. In April 1933 he was posted to the A&AEE at Martlesham Heath. There he flew a variety of different aeroplanes but became specifically involved in the assessment of the candidates submitted by Messrs Blackburn, Gloster and Fairey to satisfy Specification S.15/33. This resulted in production orders for the Shark and, most significantly for Menzies, the Swordfish because he was head-hunted by its manufacturer. Having resigned his commission, he joined Richard Fairey's company in 1935.

To meet the increasing demands of the successive expansion schemes, Fairey established a new factory at Stockport using the aerodrome at Barton, but soon switching to Ringway when this became available in 1937. Menzies was assigned to this northern enterprise. He was initially involved in the testing and delivery of Hendon bombers, but this was soon replaced by routine testing of Battles which were being churned out in large numbers. This work was supplemented, and later supplanted, by development work and production testing of the Fulmar and Barracuda along with production testing of Beaufighters being turned out by a Fairey-run 'Shadow Factory'. By 1943, while he was still active as a pilot, Menzies was more concerned with liaison with the FAA than with test flying and, in that capacity, he continued to make a major contribution, easing the entry into service of the Barracuda and Firefly. In the early post-war years, he continued to act as Fairey's liaison officer, often using the protype Fulmar as his personal taxi, and became involved in the further promotion of the Firefly, particularly the dual-control trainer variants. He stopped flying in 1952 and eventually retired from the company in 1964.

The only point over which I am inclined to take issue is on page 59 where the author says that, on returning to the UK, Menzies spent some time in early 1933 at the Home Aircraft Depot at Henlow 'to bolster his technical knowledge before becoming a test pilot'. Training in engineering in the inter-war air force was the exclusive preserve of officers on permanent commissions and I think it far more likely that Menzies' time at Henlow was more apparent than real. At the time, it was standard practice, as a matter of administrative convenience, for officers returning from a five-year stint overseas to be held on Henlow's nominal strength as 'supernumerary' during their disem-

barkation leave and/or while awaiting a posting. Menzies would probably have been there in the flesh only briefly, if at all.

While Duncan Menzies clearly made a substantial contribution to Fairey's success, and thus to the war effort, he has received little formal recognition and has been a relatively obscure figure among test pilots and, as the author, observes, there are few references to him in aviation literature.[2] This book, with its 50 photographs, about half of them unfamiliar to this reviewer, goes some way to restoring the balance. While his involvement with Fairey was significant, of course, it will probably be the forty-odd pages devoted to his time in Egypt and the Sudan that will be of particular interest to members of this Society.

CGJ

Bomber Losses in the Middle East and Mediterranean, Vol 2, 1943-45 by David Gunby and Pelham Temple. Air Britain; 2018. £19.99.

Due to policy changes on the part of the original publisher (Midland Counties Publications), it has been twelve years since Vol 1 appeared. Fortunately, Air Britain has stepped into the breach so, better late than never, we now have Vol 2.

Vol 1 was reviewed in Journal 39 and the format of Vol 2 remains the same, mirroring that of Bill Chorley's eight-volume series detailing Bomber Command's WW II losses. That is to say that every bomber aircraft identified as having been lost while serving with, or in transit to, a squadron (ie not a training unit) within the Middle East/Mediterranean theatre is listed, in chronological order, by serial number and unit, along with a brief account of what happened and the names and fates of the crew. Units include those of the RAAF, SAAF and RHAF and the title is broadly interpreted to embrace bombers lost on other than bomber operations, notably those engaged on special duties and/or supporting the Warsaw uprising.

The compilation of Vol 1 was handicapped by the inadequacy of

[2] Apart from one or two mentions in *Flight*, I did find one. In Tim Mason's account of pre-war activities at Martlesham Heath, *British Flight Testing* (Putnam, 1993) he notes, on page 31, that 'Flg Off Duncan Menzies often seemed to be in trouble, but later became Prime Minister of Australia.' As *Private Eye* might have it, shome mishtake shurely.

contemporary record-keeping under, often primitive, field conditions, especially during periods of hectic, and highly mobile, campaigning in Libya, Greece, East Africa and elsewhere. By comparison, most of the bomber unit ORBs for 1943-45 were maintained under relatively stable conditions in Italy and are reasonably comprehensive.

The research has been painstakingly thorough and, apart from the support provided by recognised experts in various aspects of this subject, the authors acknowledge the assistance of the RAF Museum and the AHB. Even so, there are some loose ends, notably aircraft that were struck off charge for no known reason. It is just possible that some of these may have suffered damage in combat which was subsequently deemed to be not worth repairing and, since the crew had been uninjured, the incident lapsed into obscurity without being noted in the record. On the other hand, these aeroplanes may simply have outlived their usefulness and been put out to grass. This 235-page softback includes sixteen pages of additional information related to Vol 1 – new entries, amplified entries, deletions, and corrected and/or additional details.[3] The authors hope that publication of Vol 2 may tie off some of the loose ends that it contains.

The authors, are to be congratulated on unearthing all of this data, which completes the known record of regional wartime bomber losses, as is the publisher for making this information accessible. It may be stating the blindingly obvious but, as with Vol 1, if you need this sort of information, then you just have to have this book.

CGJ

Helicopter Boys by Richard Pike. Grub Street; 2018. £20.00

In recent years there has been a steady increase in the number of aviation books dealing with the subject matter as a series of vignettes, rather than a coherent story. Grub Street are a leading exponent of this popular genre and this Society has already reviewed fifteen books in its 'Boys' series, each one devoted to a particular type of aeroplane and comprising a selection of tales told by people who had been associated with it.

[3] There is at least one additional error in Vol 1 that was not picked up (although it was pointed out in my earlier review) – Blenheim Z6156 of No 45 Sqn was lost on 29 August 1941, not 1942.

Richard Pike is a former RAF officer, who flew Lightnings and Phantoms before leaving the Service for civil aviation and rotary wing flying. This 175-page hardback (with two 8-page inserts of monochrome and colour photographs) is his fifth 'Boys' essay. Sub-titled, *True Tales from Operators of Military and Civilian Rotorcraft*, it comprises 21 chapters, most of them contributed by individuals, although three are described as 'heli-miscellany', with several people participating more than once.

In my judgement, a few of the stories are almost 'non-events' and their inclusion detracts from the end product. More importantly, however, the book is biased towards civilian operations, with the Sikorsky S.61 – wonderful piece of kit that is (was) – taking more than its fair share of the book.

For me, the book lacks balance and, whilst accepting that few pre-1960 rotary wing operators are still with us, those who are might have been able to offer accounts of some notable events, such as the rescue of French trawlermen off Lands End and the placing of a spire on Coventry Cathedral. There is no mention of the formative years in Malaya, Aden and Borneo nor of operations in Northern Ireland over a period of almost 30 years, and the RAF and RN search and rescue organisations are almost completely absent.

All of the 'Boys' books are not so much written, as edited, by their authors whose primary functions have been, broadly speaking, to persuade acquaintances to put pen to paper to produce a themed anthology. In this case, while the stories that have been told will be of interest to anyone who has had little or no involvement with helicopters, there may not be sufficient military content to satisfy members of this Society.

Wg Cdr Colin Cummings

History of the Gloster Javelin by Ian Smith Watson. Fonthill; 2018. £25.00.

As the author acknowledges, there have been a number of recent books on the, previously relatively unsung, Javelin.[4] This one does add something to the story, not least through the personal recollections

[4] See Journals 52, 64 and 69, plus the extensive coverage of the Javelin's service in *Cold War Shield, Vol 3* (see page 165 of this edition).

contributed by folk who flew, or flew in, the aeroplane and/or who administered to its needs on the ground. But, for this reviewer, there are problems with the book's structure and with the manner in which it has been presented.

The Javelin's story was short – just twelve years – but very complicated because the eight FAW variants wore the markings of nineteen squadrons and the organisational kaleidoscope was given an occasional vigorous shake which could result in wholesale reassignment of aeroplanes between units and/or squadrons being renumbered. To permit the reader to keep track of this shifting pattern requires some form of logical, compartmentalised approach, but this has not been attempted in favour of a free-wheeling narrative. This has, inevitably, involved a significant amount of repetition, which some may find actually confuses, rather than clarifies, the evolving picture. Repetition crops up in other respects too; for example, while we did need to be told that AI Mk 22 was the British designation for the American AN/APQ-43 radar, we do not need to be reminded of this on at least five subsequent occasions.

There are a number of significant factual errors. For instance, the Javelin did not have an 'all-moving fin' (pp53 and 81) and the last OC 64 Sqn on Javelins was Wg Cdr Basil de Iongh, not De Iength (p196). I will take some convincing that Red Dean and Blue Jay were intended to have nuclear warheads (p135) and the Sapphire's centre-line closure problem was solved by lining the compressor casing with an abrasive material known as Rockide (not Rockhide) and allowing the blades to wear themselves down if/when their tips came in contact with it – the abrasive material was not applied to the blade tips (p125).

The writing style is very informal, with frequent references to the aeroplane as the 'Flat Iron' and 'the beast' and conversational interjections, such as 'so to speak' and 'for the chop' add to the previously-noted impression of a 'free-wheeling' account while at the same time tending to undermine its authority. There are far too many instances of misspelt, or just plain wrong, words being used, eg rerolled (for re-roled), Rotex (for Rotax), lesson (for lessen), climbs (for climes), confined (for consigned), vain (for vein), all together (for altogether), compliment (for complement), breach (for breech) and (on this side of the Atlantic) practice is a noun and practise is a verb, but here we have both being used as verbs on occasion, sometime, eg

p163, in the same sentence! If regarded as a collective noun, ‘squadron’ can be treated as singular, as in ‘The squadron was informed . . .’ or plural, as in ‘. . . were informed . . .’ An author is at liberty to decide how to deal with this, of course (personally, I would almost always opt for the singular), but he needs to be consistent and in this book there are instances of both – which jars. As does the omission of initial capitals for proper nouns, as in the case of institutions, like the air ministry (*sic*), or units, like the defence helicopter flying school (*sic*), and the AFDS was the Air Fighting (not Fighter) Development Squadron.

Despite these issues, this 223-page hardback is not a ‘bad’ book. The writing oozes enthusiasm and, having been drawn from private sources, many of its 150 photographs, 32 of them in colour, will not have been seen before. The problem is the conversational style, which some may enjoy but others will, I suspect, find irritating. The text really needed editing, to smooth out some of the clumsier passages, and to eliminate typos and inappropriate words, like those noted above (there are others). This obviously cannot be delegated to an author, because an author is unable to detect his own mistakes. If he could, he would correct them – obviously. Proof reading simply has to be done independently and responsibility for this must surely lie with the publisher – Fonthill.

All of that having been said, if you are a Flat Iron fan, this book will be a ‘must’, but if you want a single coherent reference, I would opt for one of the others that were already out there.

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ROYAL AIR FORCE HISTORICAL SOCIETY

The Royal Air Force has been in existence for one hundred years; the study of its history is deepening, and continues to be the subject of published works of consequence. Fresh attention is being given to the strategic assumptions under which military air power was first created and which largely determined policy and operations in both World Wars, the interwar period, and in the era of Cold War tension. Material dealing with post-war history is now becoming available under the 20-year rule, although in significantly reduced quantities since the 1970s. These studies are important to academic historians and to the present and future members of the RAF.

The RAF Historical Society was formed in 1986 to provide a focus for interest in the history of the RAF. It does so by providing a setting for lectures and seminars in which those interested in the history of the Service have the opportunity to meet those who participated in the evolution and implementation of policy. The Society believes that these events make an important contribution to the permanent record.

The Society normally holds three lectures or seminars a year in London, with occasional events in other parts of the country. Transcripts of lectures and seminars are published in the Journal of the RAF Historical Society, which is distributed free of charge to members. Individual membership is open to all with an interest in RAF history, whether or not they were in the Service. Although the Society has the approval of the Air Force Board, it is entirely self-financing.

Membership of the Society costs £18 per annum and further details may be obtained from the Membership Secretary, Wg Cdr Colin Cummings, October House, Yelvertoft, NN6 6LF. Tel: 01788 822124.

THE TWO AIR FORCES AWARD

In 1996 the Royal Air Force Historical Society established, in collaboration with its American sister organisation, the Air Force Historical Foundation, the *Two Air Forces Award*, which was to be presented annually on each side of the Atlantic in recognition of outstanding academic work by a serving RAF officer or airman, a member of one of the other Services or an MOD civil servant. The British winners have been:

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2017	Wg Cdr D Smathers

THE AIR LEAGUE GOLD MEDAL

On 11 February 1998 the Air League presented the Royal Air Force Historical Society with a Gold Medal in recognition of the Society's achievements in recording aspects of the evolution of British air power and thus realising one of the aims of the League. The Executive Committee decided that the medal should be awarded periodically to a nominal holder (it actually resides at the Royal Air Force Club, where it is on display) who was to be an individual who had made a particularly significant contribution to the conduct of the Society's affairs. Holders to date have been:

Air Marshal Sir Frederick Sowrey KCB CBE AFC
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