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SELECTED ABBREVIATIONS

ACI	Army Council Instruction
AEAF	Allied Expeditionary Air Force
AFVG	(The abortive) Anglo-French Variable Geometry project
AI	Airborne Interception (radar)
AMO	Air Ministry Order
AMWO	Air Ministry Weekly Order
AOP	Air Observation Post
BEF	British Expeditionary Force
CAOC	Combined Air Operations Centre
CAS	Chief of the Air Staff
CFE	Central Fighter Establishment
DCI	Defence Council Instruction
DPS	Director of Personal Services
EFTS	Elementary Flying Training School
ELINT	Electronic Intelligence
IAEA	International Atomic Energy Agency
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
JSF	Joint Strike Fighter (*aka* the F-35)
MEZ	Missile Engagement Zone
MRCA	Multi-Role Combat Aircraft (eventually Tornado)
NCA	Non-Commissioned Aircrew
NGO	Non-Governmental Organisation
QFI	Qualified Flying Instructor
SAM	Surface To Air Missile
SDSR	Strategic Defence and Security Review
TNA	The National Archives
WMD	Weapons of Mass Destruction

Our Guest Speaker at the RAF Club, following the Society's AGM on 15 June 2011, was the Commander of the UK National Contingent during Operation TELIC

Air Chief Marshal Sir Brian Burridge

whose topic was:

AIR POWER IN THE 2003 IRAQ WAR

INTRODUCTION

The 2003 Iraq war will rank highly among historians as one of Britain's most unpopular interventions. The seeds lay in the then Prime Minister Tony Blair's Chicago speech advancing the doctrine of preventative diplomacy. Talking of Kosovo, he said:

> 'This is a just war, based not on territorial ambitions but on values. […] We have learned twice this century that appeasement does not work. […] We need to focus in a serious and sustained way on the principles of the doctrine of international community […]. (*Not the international community but international community*). Now our actions are guided by a more subtle blend of mutual self-interest and moral purpose in defending the values we cherish. In the end, values and interests merge.'

So, the notions of 'moral purpose' and 'mutual self-interest' after the Al-Qaeda 9/11 attacks in mainland US drove British security policy towards interventions in Afghanistan in 2001 and Iraq in 2003. In both cases, the UK was a junior but significant partner in a US-led coalition. The Chilcot Inquiry which is now due to be published in the summer of 2012 will doubtless expose imperfections in the planning and conduct of the Iraq campaign, focusing particularly on failures in intelligence and in the machinery of Government. Against this backdrop, it is conceivable that some of the important aspects of the role of air power would become lost in the fog of political recrimination.

This paper therefore seeks to record aspects of the combat phase of the 2003 Iraq war where the significance of the employment of air power may not have been immediately obvious at the time. This is an important aspect of historical analysis in that the 2003 Iraq war is the

most recent example of a high-intensity, joint manoeuvre campaign. In illustrating this analysis, the paper considers the strategic complexity of the theatre in order to provide a context for air power's contribution at both the operational and tactical level of war.

STRATEGIC COMPLEXITY

Throughout the Iran-Iraq war, the 1990 invasion of Kuwait and in the run-up to the 2003 Iraq war, much effort was expended on assessing the degree to which Saddam Hussein represented a rational enemy. Such analysis was made more complex by the fact that Iraq's interface with the international community was controlled by a very small, tight-knit group whose consensus was guaranteed through fear. Nevertheless, the planning for the 2003 war required an understanding of three facets of Iraq's security policy. First, how solid was regime support? Secondly, in what circumstances would the regime resort to the use of weapons of mass destruction (WMD)? Thirdly, to what extent would post-conflict recovery be achievable in an acceptable timescale? From a regional perspective, we also needed to assess the degree to which Iran and Syria would remain non-belligerent and the extent to which Turkey, as a pivotally important ally, would co-operate.

In terms of the fragility of Saddam's regime, intelligence largely but not exclusively based on the views of Iraqi émigrés pointed to a situation of near internal collapse with a population ready to come together in the event that the regime was unseated. Other forms of military intelligence indicated that Iraq's military capability had deteriorated through a lack of training and maintenance and, given the rates of desertion, that moral was low. While the military assessment was broadly correct, the removal of the regime actually inspired violent fragmentation rather than peaceful cohesion. While it is arguable that the views of many Iraqi émigrés were fuelled more by self-interest and wishful thinking than hard information, it is nevertheless surprising that, given our history in that theatre, we knew so little in granular detail about the way in which the regime actually worked and the nature of Iraqi society. While we had few human intelligence sources inside Iraq, we had been flying over the country for thirteen years maintaining Operations NORTHERN and SOUTHERN WATCH. As such, we had squandered the opportunity

to build a proper strategic picture. With hindsight, throughout that period, we tended to address each issue in isolation as it arose whether it was an Iraqi attempt to engage a coalition aircraft or the expulsion of the UN arms inspectors. Taken together, our assumption in 2003 that the regime would crumble and be replaced by a benign environment was wrong.

A related assumption was that post-conflict government of Iraq would be feasible. To this end, in the second half of 2002, the US State Department led a comprehensive range of work covering all aspects of the reconstruction and governance of the new Iraq. This drew on the knowledge and experience of a wide range of experts, including former citizens of Iraq. The work was comprehensive, pragmatic and feasible but assumed that a benign vacuum would exist. However, towards the end of December 2003, tensions in the US National Security Council reached breaking-point and, at the insistence of Don Rumsfeld, the Secretary of Defense, responsibility for planning was transferred from State to the Pentagon. On the basis of 'not invented here', the previous post-war planning work was discarded along with the human expertise that created it. Thereafter, post-war planning was afforded a low priority and was delegated to the former General Jay Garner's Office for Reconstruction and Humanitarian Assistance which lacked both the level of resources and the depth of expertise to confront the problem. In the event, it is arguable that the post-war sectarian chaos would have rendered either approach impotent. Nevertheless, this second assumption on post-war reconstruction was wrong.

As for the presence and potential use of WMD, for the UK, this was the *casus belli* and we were in no doubt of their existence at least in terms of a tactical capability. Neither were we in any doubt over Iraqi intent given the 1988 use of chemical weapons in Halabja in the Kurdish Autonomous Zone and their extensive use in the Iran-Iraq war. Given this mindset, our assessment of Saddam's potential courses of action (see below) was heavily skewed and the underlying assumption, too, was wrong.

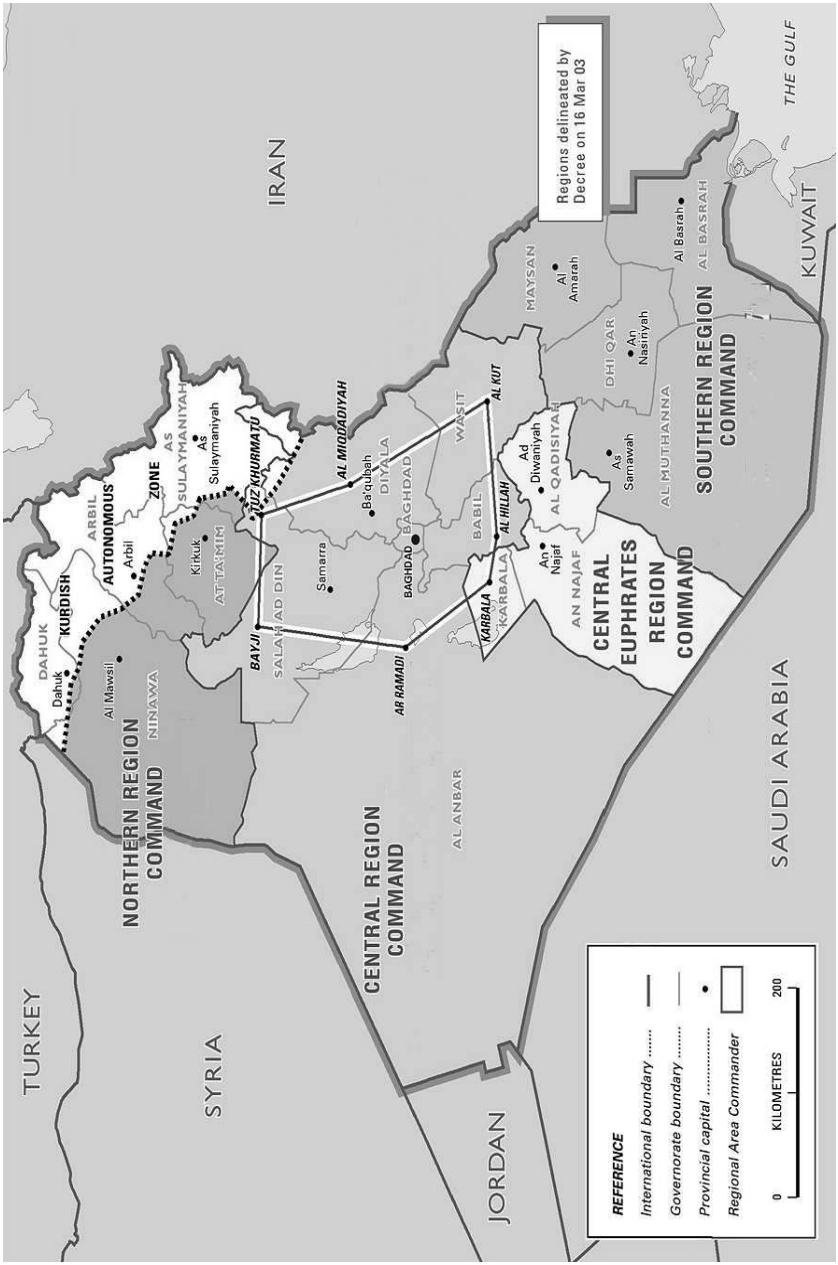
In terms of regional powers, it was assumed that Turkey would co-operate. As a result, military planning proceeded on the basis that there would be two axes of approach into Iraq, one of which would be mounted from the north through Turkey. There were two reasons for

this requirement. First, the operational intent of the campaign was to generate such a high momentum of military activity thus generating multiple problems in both time and space to the extent that the Iraqi regime's command and control capability would simply be overwhelmed and unable to react. Secondly, a northern axis had the virtue of fixing the Republican Guard divisions positioned on the 'Green Line' along the boundary of the Kurdish Autonomous Zone. This, in turn, also acted as a disincentive to any Kurdish adventurism aimed at the Kirkuk oil field. But Turkey had returned a new AK Party Government in November 2002. All members of the previous coalition had lost their seats. Understandably, this new religiously conservative and centre-right government took time to find its foreign policy feet. In the event, after extensive negotiations running into January 2003, the Turkish government decided not to allow coalition basing and logistic access. This fourth assumption was thus also wrong.

The final strategic assumption was that Syria and Iran would remain non-belligerent. As a neighbouring Ba'athist nation, Syria might have seen ideological merit in active opposition to coalition action though for little practical gain. In the event, Syria provided a safe haven for a number of the senior members of the Iraqi regime and their families but took no active part beyond rhetoric. As for Iran, there was advantage for the Shia government in seeing the removal of a Sunni regime from neighbouring Iraq. However, there was always a danger that Kurdish adventurism in the north might have been a threat to the Turkmen population around Kirkuk with the result that Turkey might have been motivated to come to the latter's aid. Such a scenario might then have caused Iran concern over its own security with the danger of a regional conflict developing. In the event, the integrity of the Kurdish Autonomous Zone was maintained through some delicate management by US Special Forces and Iran remained non-belligerent in line with the assumptions.

PLANNING THE CAMPAIGN

Against this complex strategic backdrop, the underpinning requirement of military success was permanently to separate the Iraqi regime from its people. Thus, in our view, the operational-level centre of gravity was the regime's ability to exercise command and control.


TURKEY
SYRIA
IRAN
JORDAN
SAUDI ARABIA
KUWAIT
THE GULF
NORTHERN REGION COMMAND
CENTRAL REGION COMMAND
CENTRAL EUPHRATES REGION COMMAND
SOUTHERN REGION COMMAND
DAHUK
KURDISH AUTONOMOUS ZONE
ARBIL
AS SULAYMANIYAH
NINAWA
AT TA'MIM
SALAHAD DIN
AL ANBAR
DIYALA
BAGHDAD
WASIT
BABIL
KARBALA
AN NAJAF
AL QADISIYAH
AL MUTHANNA
DHI QAR
MAYSAN
AL BASRAH
Dahuk
Al Mawsil
Arbil
Kirkuk
As Sulaymaniyah
KHURMATU
BAYJI
Samarra
Baqubah
AL MIQDADIYAH
BAGHDAD
AR RAMADI
KARBALA
AL HILLAH
AL KUT
An Najaf
Ad Diwaniyah
As Samawah
An Nasiriyah
Al Amarah
Al Basrah
Regions delineated by Decree on 16 Mar 03
REFERENCE
International boundary
Governorate boundary
Provincial capital
Regional Area Commander
0
KILOMETRES
200

Saddam's analysis was broadly similar. The notion of 'Fortress Baghdad' was prominent in his response planning but he had little in his locker by which to conduct defence in depth. Predictably, the regime planned a close-in defence of concentric rings of conventional and Special Forces with the Republican Guard on the outer perimeter at some 100 kilometres.

However, it was clear that the regime forces would not simply allow the coalition to approach Baghdad at our own pace. Rather, the Iraqis could deploy one or more of three courses of action. Self-evidently, the most dangerous of the plausible options would be the use of chemical weapons against coalition forces, either in concentration areas in Kuwait or at choke points on the advance to Baghdad. It was also possible that they would mount chemical attacks against the Shia population of southern Iraq thereby creating a humanitarian disaster and fixing the advancing coalition forces. Against this, given the uncertain diplomacy leading to a potential second UN resolution, Saddam anticipated that the international community would react adversely to the initial coalition action, particularly a high-intensity air campaign. His perverse logic led him to believe that he occupied the moral high ground which militated against his early use of WMD. At the other end of the spectrum, the Iraqi regime could have planned to employ all-arms, conventional manoeuvre but the readiness and combat power of the armed forces rendered this an unlikely option. The most likely option was assessed to be that they would deploy irregular forces in urban areas so as to attenuate the speed of the coalition advance. This approach was also reinforced by a mistaken Iraqi perception that coalition forces were reticent to engage in urban operations for fear of casualties. While this proved to be the chosen option, we did not foresee the extent to which the regime would 'front-load' the southern cities with irregular fighters from the Republican Guard and the Saddam Fedayeen.

Against this backdrop, we anticipated that we would have two axes of approach by which to split the Iraqi defensive effort and overwhelm their command and control capability. With the northern axis option now removed, we needed to be certain that we could generate such a high tempo of manoeuvre on the southern axis that the effect on the regime would be broadly the same. This generated two requirements. First, it was necessary to maintain the deception that there would be an

approach from the north. Secondly and more importantly, the two US corps penetrating from the south would need to be relatively light but their lethality would be greatly enhanced by the deep integration of air power into their scheme of manoeuvre. In this way, it proved possible to generate the necessary combination of agility and firepower that allowed them to reach Baghdad Airport after a combat phase of just seventeen days.

AIR POWER AT THE OPERATIONAL LEVEL OF WAR

While the integration of air power was a compelling factor in the combat capability of the land force, it did present a number of operational-level dilemmas. First, in terms of apportionment, the fixed targets associated with Saddam's command and control had to be dealt with quickly and efficiently. In addition, it was vital to write-down the capability of his air defence, especially around Baghdad. This all had to be conducted against the need to avoid damage to Iraq's infrastructure to the extent that recovery would be inhibited. While this latter aspect was deeply embedded in the targeting philosophy, it did not prevent the term 'shock and awe' entering the US political lexicon, subsequently to be hyped-up by the media. Students of Clausewitz and Sun Tzu would immediately associate such terminology with attritional warfare rather than the agile manoeuvre on which the campaign was based. However, the need to generate such high rates of manoeuvre meant that the presence of six Iraqi Republican Guard divisions and seventeen Regular Army divisions could not be ignored. In the event, 80% of the campaign's air effort (measured by sorties) was in support of the Land Component either as Close Air Support or as Kill-box Interdiction. In addition, we were clear that many targets, particularly those associated with regime command and control would be time-sensitive and fleeting to the extent that they would have only minutes to respond.

More broadly, the nature of the combat phase of the operation was a significant factor in setting the tone for the aftermath. The notion of 'fighting amongst the people', a term coined by General Sir Rupert Smith[1] is a characteristic of post-Cold War intervention operations.

[1] Smith, R; *The Utility of Force: The Art of War in the Modern World* (Allen Lane, London, 2005).

Iraq was no different other than being differentiated by the fact that, for many in the population, the action of the coalition could be seen as an invasion. Furthermore, the likely use of irregular forces by the regime would guarantee the most gruesome scenes of battle. In these circumstances, the conduct and intensity with which coalition military violence was to be delivered both by ground forces and from the air would have a direct influence on the ease with which the 'hearts and minds' of the people could be won-over in the reconstruction phase. This is a profound point because the civilian population has no option but to become a close-quarters audience of events. Most will be physically unaffected but the spectre of what might seem to them as indiscriminate violence would stay with them. Equally, some would bear an additional scar from the loss of their livelihoods either through physical destruction or the dismantling of the state institution that employed them. More problematic would be the implications when collateral damage resulted in death or injury. In addition, those who chose to join the fight against the coalition, notwithstanding their potential lack of adherence to the law of armed conflict, would at some stage have to be rehabilitated. Taking all these factors together, air power needed to be used with delicacy as well as with absolute precision. As a counter to the media hype on 'shock and awe', we spoke of a campaign where our intent was 'not to break the china'.

Against this backdrop, it was fortunate that we had high-fidelity simulation systems that allowed the coalition to war-game the plan at theatre level. In particular, Exercise INTERNAL LOOK took place in December 2002 as a command and control 'rock-drill' which allowed us to test the configuration, manning and connectivity of both the UK headquarters and the US headquarters as well as providing an assessment of the degree to which the plan would meet our objectives. In the event, our analysis showed that the approach was too kinetic when judged against the 'delicacy' criteria. The targeting list was thus de-tuned and phased so as to allow opportunities for the regime to capitulate. This approach also placed a greater emphasis on Information Operations. The phasing of the plan was also adjusted to reduce the coalition's strategic exposure and to preserve tactical surprise for as long as possible. Planning activity to refine the co-ordination of the air and ground campaigns continued well into mid-March as both the Iraqi intent and force disposition became clearer. In

particular, we needed to obscure our intent to avoid Saddam using the Southern oilfields as either a quasi-military weapon against our advance or to promote an ecological disaster as had been the case in Kuwait in 1991. In addition, his firing of Scud missiles into neighbouring states with or without chemical payloads would have had immediate strategic consequences. Moreover, given our broader expectations on his use of chemical weapons, we needed to maintain the initiative over the timing of the start of the combat phase, or more accurately, his ability to perceive that the combat phase had begun. Uniquely perhaps, we therefore ultimately started the ground campaign ahead of the main air campaign. This ran contrary to Saddam's expectation of a prolonged air campaign ahead of any land action, a perception based on his experience in 1991. This placed a considerable burden on the Air Component Commander in that tasks which should have been addressed sequentially such as first achieving air superiority then providing counter-land sorties had to be executed simultaneously.

After the combat phase, Human Rights Watch[2] conducted a field analysis of the conflict, firstly, to identify and investigate potential violations of International Humanitarian Law (otherwise known as the Law of Armed Conflict) and, secondly, to identify patterns of combat which may have caused civilian casualties and suffering that could have been avoided if additional precautions had been taken. Whilst condemning Iraqi forces for gross violations, they noted that coalition air attacks on pre-planned targets apparently caused few civilian casualties and generally avoided civilian infrastructure. They further noted attacks on dual-use facilities such as power generation (which they deemed to have caused significant civilian suffering) and media facilities (which they asserted to have been of questionable legality). The report also heavily criticised the use of cluster munitions because of the danger of civilian casualties from 'dud' bomblets. Here, the report cites the US as using 10,782 such weapons and the UK 2,100 ground-launched munitions and 70 air-launched cluster weapons. More strident criticism is aimed at the time-sensitive targeting of senior Iraqi leadership. Here, the report asserts that, 'all fifty acknowledged attacks targeting Iraqi leadership failed. While they did

[2] Human Rights Watch Report *Off Target* (HRW, New York, 2003).

not kill a single targeted individual, the strikes killed and injured dozens of civilians.' The report continues with condemnation of the quality of intelligence on which the attacks were based. While not commenting on the accuracy of the data on which the report was based, it is worth recording that the air campaign consisted of 40,842 sorties of which the UK flew 2,519 (of which 1,353 were offensive) with 29,155 weapons expended overall. Of the UK attacks, 85% were by precision weapons. The UK's air deployment consisted of 113 fixed-wing aircraft and 27 helicopters, operating from six principal deployed operating bases, a rate of effort well in excess of the extant Defence Planning Assumptions.

AIR POWER AT THE TACTICAL LEVEL OF WAR

Starting the Campaign

In detail and from a UK perspective, the sequence of events at the beginning of the campaign commenced with the vote in Parliament on the evening of 18 March in favour of military action. This was precipitated by Saddam's announcement rejecting the coalition ultimatum that he should relinquish power. Shortly thereafter, covert action began both to position in the Western Desert as part of the counter-Scud operation and to prepare the Kuwait-Iraq border in preparation for the ground campaign. The following day, intelligence indicated that Saddam was at the Dora Farms compound in Baghdad which, in the early hours of 20 March, was subsequently attacked from the air with Tomahawk Land Attack Missiles and US F-117As. It was also necessary to attack the associated air defence installations. The intelligence on Saddam's whereabouts proved incorrect and, later that same morning, the regime fired Silkworm cruise missiles into Kuwait, hitting a shopping precinct but fortunately without casualties. In the hours that followed, the regime set fire to the Southern oilfields which was the final trigger to launch the coalition ground campaign with the main air campaign commencing hours later. It was clear that the regime was confused by the way in which events unfolded and thus allowed the coalition to preserve a degree of tactical surprise. At that stage, the Air Component Commander had five tasks: counter-Scud operations for which he was the Supported Commander; strategic attack against regime targets; counter-air; support to the land forces; and support to Special Forces. The way in which the Joint

campaign started resulted in task compression meaning that less priority could be given in the early stages to strategic attack and counter air. In this latter respect, it is arguable that we did not recover the situation. It was undeniably the case that we did not succeed within the war-fighting phase of the operation in securing air superiority over the entire area of Iraq. The Baghdad 'super-MEZ' was a very tough nut to crack. There were 2,855 surface-to-air firing events on coalition aircraft of which about 50% were SAMs or rockets. It is worth reflecting that, even in the case of unsophisticated enemies, control of the air cannot be assumed as a given. Both Balkan air campaigns had previously shown the difficulty in eradicating the threat from even quite elderly SAMs where the adversary is adept at concealment, deception and enhancement through the application of off-the-shelf technology.

Weapons of Mass Destruction

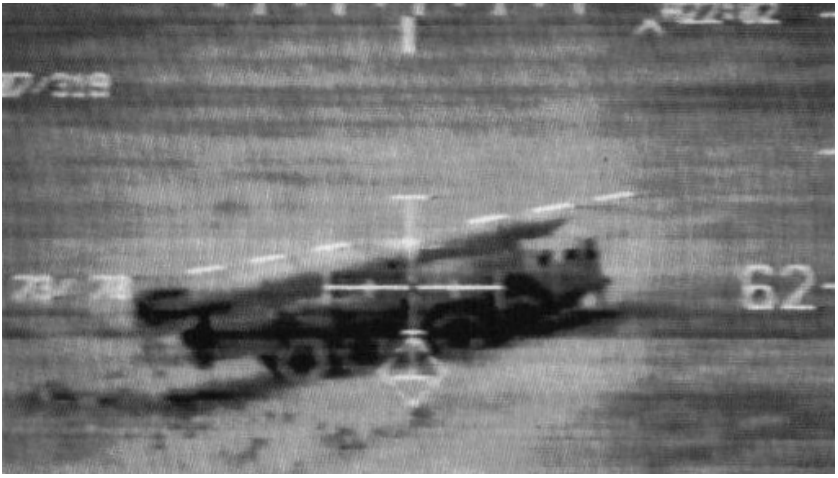
In those early stages, uppermost in commanders' minds was the risk from Saddam's presumed WMD capability. On 8 November 2002, UN Security Council Resolution 1441 was passed which called for Saddam to give 'immediate, unconditional and active co-operation' with the UN and IAEA inspections. In late January 2003, Hans Blix, the head of the inspection teams, stated that the Iraqi regime 'had not genuinely accepted UN resolutions that it disarm.' Some WMD material and components that were once known to have existed could not be accounted for. As we now know, no evidence of operational WMD was found either during the campaign itself or subsequently by the Iraq Survey Team. It transpired that, contrary to our beliefs, much had been destroyed by, or dismantled after, the 1998 coalition air operation, Operation DESERT FOX, which itself was triggered by earlier Iraqi obstructionism of the arms inspection team. On note, ahead of the 2003 war, the regime adopted a highly federated and regionalized command and control structure that would have been amenable to continuing operations after significant use of WMD. In fact, this same command and control model was actually optimised for waging a counter-insurgency war using asymmetric methods and irregular forces. However, a compelling factor in our belief in the existence of Iraqi WMD was intelligence imagery of the activity at the Al-Kut military hospital. An underground facility, imagery over a

An EC-130 Commando Solo.

significant period showed industrial-scale activity involving the movement of what appeared to be drums of chemicals. This we determined would be the source of the chemical payload for artillery shells that might have a minimum out-load time of 45 minutes. It seemed plausible that, as part of the defence of Baghdad, once the coalition advance crossed the trip-wire line running between Al-Kut and Karbala via Al Hillah, battlefield chemical weapons would be used against us.

Information Operations

Information operations were a very important line of operation in the requirement to regenerate Iraq's economic capacity after hostilities. The country's oil production capability was an important tool by which to restore export income. It was thus important to generate this understanding in the broader population, not least among those who worked in Iraq's oil industry, in an attempt to minimise the likelihood of the regime damaging the oil production facilities. To that end, some 32 million leaflets were dropped in order to make the point that the oilfields represented the future of the nation and the neighbourhood. The message was also reinforced in the entertainment radio broadcasts from the USAF *Commando Solo* EC-130E, an aircraft that was used extensively both before and during the combat phase. In the event, regime forces did seek to set fire to the well-heads



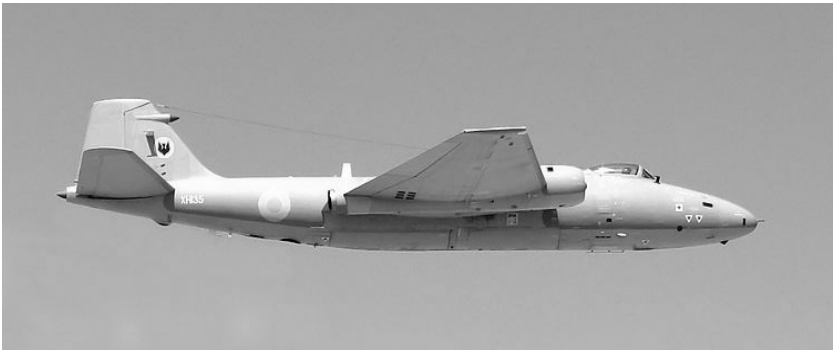
An Iraqi Scud about to be destroyed by a helicopter gunship.

yet the resulting damage was less severe than might have been expected. On inspection by coalition experts, it appeared that the oil installations had been subtly configured to produce the necessary impression of raging fires but with the avoidance of permanent damage.

As ever in information operations, linking cause and effect was notoriously difficult. To what extent were the oilfields configured in this way in response to our messaging? Was it simply the fact that the staff consisted of professional engineers who took pride in their role and could not bring themselves to damage the infrastructure irrevocably? Alternatively, it was entirely possible that Saddam and his regime were so loathed by the population of Southern Iraq that they would do anything to frustrate his intent. The outcome may well have rested on a combination of all three but creating measures of effectiveness in these ambiguous circumstances is very difficult.

Counter-Scud Operations

In the 1991 Gulf War, much effort was expended on 'Scud hunting'. These relatively unsophisticated weapons based in the sparsely populated Iraqi western desert had the potential, both in 1991 and in 2003, to tip the strategic balance, with or without chemical payloads. In 1991, 42 Scuds were fired into Israel, 44 at targets in



Despite its age, the Canberra was still able to make a valuable contribution to Operation TELIC. (Adrian Pingstone)

Saudi Arabia (where the attack on Dhahran killed 29 US Army personnel), and one each into Qatar and Bahrain. In spite of the extensive effort, only three launchers were targeted by offensive aircraft. As a result, planning for the 2003 war placed a high premium on neutralizing the Scud threat. The UK became engaged in developing coalition counter-Scud tactics as soon as the Government had given permission for a 'without prejudice' involvement in the planning process. At the outset, the Air Component Commander was designated the 'Supported Commander', an unusual arrangement for an all-arms battle. However, the need for the associated command and control system to maintain highly granular situational awareness and very fast reaction times meant that the Air Component Commander was nearest to the obvious point of fusion. A wide range of coalition air assets was allocated to this Task Force, including RAF Harriers and the Canberra. Scud deployments in 1991 of the 'shoot and scoot' variety required the launcher to be hidden in culverts, beneath road bridges and in wadis. Ground forces' reconnaissance thus remained vital.

The plan was designed and developed on the basis of the need to compress 'detection-to-destruction' time to single-digit minutes, well inside the thirty minutes required for the positioning and erection of the Scud launcher on leaving its hiding place. The plan was rehearsed and experimental enhancements added on the basis of highly realistic exercises on the Nevada ranges. In the event, no Scuds were fired in the 2003 war but the approach underlines the complexity of dealing

with an unsophisticated enemy's use of low-technology weapons. Arguably, dealing with such threats takes a disproportionate amount of effort and resources but the strategic impact of such weapons can also be disproportionate to their actual capability.

Weapon to Target Matching

An audit of weapon characteristics in conflicts since the end of the Cold War points to an ever-increasing proportion of precision weapons as a percentage of total expenditure. Self-evidently, the 1999 Kosovo air campaign represented a watershed for the RAF where the inability to drop through cloud because of the lack of GPS guidance thwarted a number of attacks. This limitation had been addressed by 2003 although we lacked a low-yield bomb that was optimised for urban warfare. Nevertheless, given that we were 'fighting amongst the people' and seeking not to cause them to reject post-conflict nation-building, all UK targeting was scrupulously determined in order to minimise collateral damage and the risk of civilian casualties. But, such an approach does rely on accurate and timely intelligence. The Human Rights Watch report mentioned earlier asserts that the high level of civilian casualties arising from attacks on Iraqi leadership resulted from questionable intelligence, particularly that arising from the interception of Thuraya satellite phone communications with an asserted radius of accuracy of 100 metres. The report points out that, without additional corroboration, this represents a target area of 31,400 square metres. Equally, poor intelligence or the lack of precision weapons places a commander in an invidious position in discharging his or her responsibilities under the Law of Armed Conflict. The nature of 24 hour media with real-time communications and unhindered access to much of the battlespace allows constant scrutiny by NGOs of the conduct of battle. In this respect, I received a letter dated 8 March 2003 from the Public Interest Lawyers (a legal firm configured to take-on cases deemed to be of benefit to society) reminding me of my responsibility towards the protection of human shield volunteers (*sic*) under the Geneva Convention and stating that, 'You will be aware of your personal liability under international criminal law were those provisions to be breached'.

One of the UK's most sophisticated precision weapons used in 2003 was the Storm Shadow missile, launched from Tornado GR4.

Above, the Storm Shadow and, left, members of the Weapons Effects Team indicating the final trajectories of two missile that shared an impact point.

The weapon was still in development in the run-up to the conflict but was the only solution to neutralizing many of the Iraqi's hardened air defence bunkers. A Herculean effort by industry, the RAF Testing and Evaluation units and the MOD acquisition community saw it available for operational service at the outbreak of the war. In addition, sufficient confidence had been generated to allow the Government to include its use in the targeting directive. This combined effort and the ability rapidly to generate a body of knowledge to allow the weapon to be used both safely and legally, underpins the value of having on-shore industrial capacity plus the underpinning intellectual property to which UK armed forces can gain unfettered access. Such was the precision of the weapon which embraces seeker and target-matching technology from both MBDA and SELEX Galileo, that on one occasion, two weapons aimed at the same target but time-separated, penetrated an Iraqi air defence bunker with the second weapon 'flying through' the entry hole of the first weapon. Twenty-seven Storm Shadow missiles were fired overall, proving stunningly effective. However, on one occasion, the targeted bunker was empty and abandoned, the air defence facilities having been moved above ground into a nearby 'soft' portacabin. Again, this emphasises the need for accurate and timely intelligence.

The Republican Guard

The Republican Guard divisions retained considerable combat

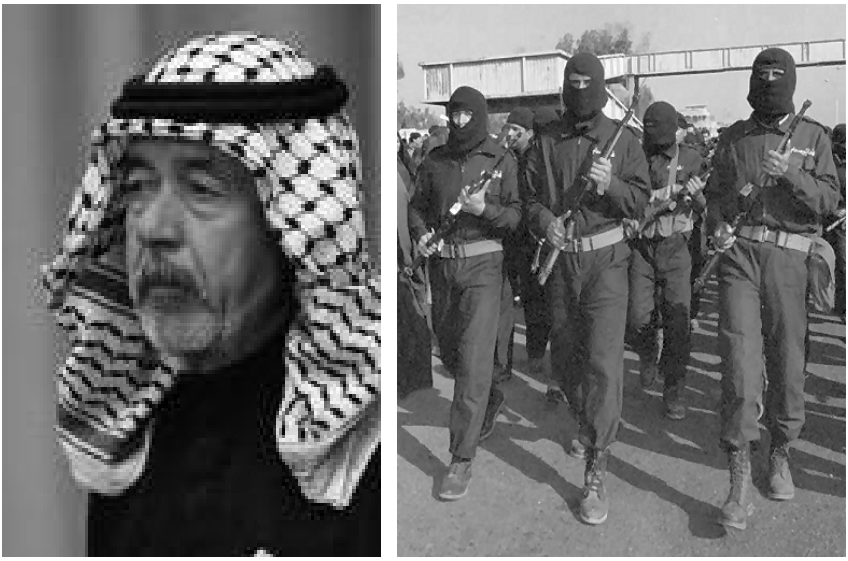
capability and a reasonable level of training throughout the period running-up to 2003. As such, they were a significant asset in terms of the defence of Baghdad. Their commanders demonstrated both determination and considerable flexibility in the face of the coalition's superior fire-power and, more importantly, vastly superior ISTAR capability. Initially, four divisions were positioned for the defence of Baghdad (two divisions close-in and two more distant) with the remaining two (the Adnan and the Nebuchadnezzar divisions) positioned along the Green Line on the boundary of the Kurdish Autonomous Zone to prevent any unwelcome Kurdish interest in a move towards the Kirkuk oil fields. These latter divisions, along with eleven Regular Amy divisions of very limited combat capability, were also the main defensive force for any coalition ingress via Turkey. By 24 March (D+5), it became clear to the regime leadership that a catastrophic collapse was underway and the close-in defence of Baghdad was the priority. In particular, the nature of the coalition scheme of manoeuvre made it clear that US V Corps was likely to approach Bagdad via the Karbala Gap some 100 kilometers south-west of the city. As a result, the Medina division moved into a well-configured blocking position with heavy artillery. Consequently, US V Corps planned a counter-manoeuvre at night using the Apache attack helicopters of the 11th Attack Helicopter Regiment armed with Hellfire missiles and 30 mm cannon. The plan was conceived at speed and the weather was poor. The Apaches were late arriving at the Forward Refuelling Point (FARP) and there was insufficient time to provide full fuel loads. A communications error between headquarters meant that the planned fast-jet support did not arrive as expected. Nevertheless, thirty Apaches departed for the objective flying at less than 100 feet over terrain consisting mainly of farming compounds. As the Apaches approached the targets, the Iraqis within the protection of the farming compounds used a vast number of bright searchlights to render the aircrafts' night vision equipment unusable, not to mention the dazzle effect for the pilots. As if by a single command, the searchlights were extinguished to be replaced by a wall of lead from small arms and larger calibre weapons. Of the thirty Apaches that left the FARP, one was shot-down and the crew captured to be paraded on international television. The other 29 helicopters sustained battle-damage to varying degrees yet not a single Hellfire was fired: the

Medina Division sustained no damage. This cameo with its roots in the Vietnam War represents a classic asymmetric approach to a sophisticated adversary and speaks volumes about the Republican Guard's ability to improvise.

Conversely, the Republican Guard divisions suffered badly from a lack of understanding of the coalition's networked ISTAR capability. By 30 March (D+11), the Iraqi defence of Baghdad became an absolute priority and three further Republican Guard divisions were to be moved into blocking positions. In the event, they perceived that they had a tactical advantage in that the weather deteriorated because of an extensive sandstorm. While the coalition ground forces took an operational pause, the Republican Guard manoeuvred at pace believing that the low cloud and zero visibility rendered them immune from air attack. This was a grave miscalculation in that it was coalition air power that was immune from the effects of the weather. Throughout this period, the coalition maintained full ISTAR situational awareness and mounted some 750 sorties per day against the Republican Guard Divisions with lethal effect. Republican Guard commanders later admitted under questioning that they had no real understanding of the coalition's all-weather, precision capability. They were ignorant of the technology that was routinely deployed in modern air operations and ascribed the coalition's advantage to the presence in their own midst of spies and informants. Overall, Iraqi commanders pointed to this period as the time at which their collective morale was broken. These were battle-hardened, creative and determined commanders who could improvise at the drop of a hat yet they had absolutely no grasp of where technological advantage now lay.

Dealing with Basra

In many ways, solving the situation in Basra brought together many of the earlier observations in this paper. To set the scene, the local area commander was the infamous Ali Hassan Al-Majid, otherwise known as 'Chemical Ali'. As the commander responsible for the 1998 chemical weapon attack on Halabja, he was deeply feared by the southern Iraqi population. He was subsequently executed by the post-war Iraqi Government for this crime. The irregular campaign in Basra was conducted principally by the Saddam Fedayeen. They paid



Left, Ali-Hassan al-Majid, 'Chemical Ali', and, right, the Saddam Fedayeen.

absolutely no heed to the Law of Armed Conflict, did not wear uniform and were unrecognizable in most instances from the rest of the population whom they employed as human shields without compunction. Equally, they would use coercion and extreme violence against the families of Regular Army personnel who had deserted to encourage them to return to the fight. For good reasons, therefore, there was a deep climate of fear among the population.

Coalition forces thus had to tread carefully in the approach to stabilizing Basra and wresting control from the grip of the Regime. On the one hand, we wanted the broader population of Iraq to recognise that the coalition's approach to Basra would be repeated elsewhere and thus build their confidence for the future. On the other hand, the population was suffering badly from the Regime's indiscriminate violence. Inaction would have been seen as indifference as indeed it was in the months following the 1991 Gulf War. Yet, initially, we had only very limited granular intelligence of what was happening on the ground, of where Regime resistance might be the strongest and how we might motivate the population to support us. This situation was

further complicated by the ever present media. Most embedded journalists were new to war and had little contextual understanding by which to calibrate unfolding events and distinguish between a minor skirmish and a major firefight: every pin-prick was reported as a mortal haemorrhage.

It was to the great credit of the UK's Divisional Commander (the then Major General Robin Brimms) that we succeeded in stabilising Basra without traumatizing the population. His subtlety and patience in creating humanitarian aid distribution points through which to gather information and the application of surgical armoured thrusts by which to gauge the resolve of both the opposition and the indigenous population paid dividends. But the culminating point for the Regime in Basra was a single US air attack. Intelligence revealed the location of Chemical Ali's Basra headquarters where he was known to be permanently located. The building was in a densely populated area where high-order precision was required to avoid collateral damage and the prospect of civilian casualties. In the event, the initial weapon attack acted to alert the occupants and weapon-system video showed people fleeing the building but the second weapon was a direct hit which destroyed the functioning of the building. Several charred bodies were seen being taken away. Local rumour spread rapidly that Chemical Ali had been killed in the attack which generated the resolve in the local population to support the coalition thus setting the conditions for the UK Division to enter the city and deal with the Saddam Fedayeen. In fact, Chemical Ali had escaped as the first weapon dropped but, as so often is the case in war, rumour outweighed reality.

CONCLUSIONS

The overall conduct of the UK's intervention in Iraq from 2003 to 2009 has attracted much criticism. The publication of the Chilcot Report in the summer of 2012 will undoubtedly have much to say on the machinery of Government aspects and the robustness of intelligence at every level. But it would be unfortunate if, among the resulting discourse, the significance of the contribution of air power was lost. There were indeed some new lessons which reflect the changing nature of adversaries and how they choose to fight. But there was also some compelling evidence to support the traditional

understanding on the underpinning contribution of air power to the success of the combat phase of the campaign.

First, in this latter category, the fundamental significance of Control of the Air needs to be emphasised, without which freedom of action for maritime and land forces is attenuated. Iraq's air defences were by no means as extensive as they had been in 1991 but, in 2003, we did not achieve total air supremacy. The Baghdad Super-MEZ remained a significant hazard throughout, underlining yet again the complexity, time and sheer weight of effort required to address threats from even quite elderly equipment when it has the advantage of mobility. The same syndrome applied in both Balkan air campaigns where commercial off-the-shelf processors had been inserted into old Soviet equipment to give it unexpected bite.

Secondly, air-land integration had been at the heart of Central Front doctrine for the Allied Tactical Air Forces during the Cold War yet, by 2003, our expertise had waned. Achieving the necessary momentum and the high-rates of manoeuvre required by the campaign plan rested heavily on the timely and forensic application of air power. In addition, the beginnings of a networked-enabled battlespace raised the high-jump bar in terms of desired speed of response. Given that the support of ground troops is in their DNA, it was telling just how adept the US Marine Corps aircrews were in this area compared with both their USAF and RAF counterparts. Much has been achieved since 2003 in terms of tactics, techniques and procedures to improve the RAF's capabilities yet technology will allow the pursuit of ever greater agility alongside higher tempo and will undoubtedly raise expectations as to what can be achieved.

While these two observations have their roots in the past, the issue of intelligence gathered from the air links the past with the present and with the future. Our 13 years of operations in Iraq's No-Fly Zones, represented a lost opportunity. Although part of the extant policy of containment, there was no concerted attempt to generate a level of situational understanding beyond that required solely to discharge the mission. While we developed good tactical understanding of Iraq's air defence doctrine and capability, we did not capitalise on the ELINT and SIGINT opportunities to gain a strategic understanding of the regime and its functioning. In mitigation, there was virtually no HUMINT available by which to generate a properly fused

understanding. Equally, the nature of the technology available in these vital aspects of ISTAR at the outset was labour-intensive and, by 2001, the reaction to 9/11 had first call on resources. However, it bears emphasising that, in flying an air vehicle over or near enemy battlespace, the opportunity to gather intelligence across the entire electromagnetic spectrum (including the visual end) should not be missed. The RAF's air power doctrine now embraces the notion of Combat ISTAR which has its roots in this observation. In the JSF era, such an approach is deemed to be axiomatic because we are now entering an age where mission systems and their information management capabilities allow an air vehicle to 'hoover' and fuse all the available intelligence without detriment to the primary mission.

This aspect is very much at the core of the future application of air power, be it manned or unmanned. Iraq was a classic example of fighting in non-linear, ambiguous battlespace. General Rupert Smith's 'fighting amongst the people' and General Charles Krulak's 'three block war' were both prominent facets of the campaign. Combat stretched right across the spectrum from all-arms conventional engagement to counter-insurgency against irregular forces. One common factor prevailed: the need for high-grade, continuous ISTAR to enable this full range of operational activity. Conventional engagement in these circumstances requires high tempo and, at the other end of the spectrum, even an asymmetric enemy has to become a symmetric enemy for a fleeting moment in time in order to move, communicate or run its logistics. Hence, effective time-sensitive targeting against dynamic objectives will determine success or failure in future conflicts. Yet, this must be achieved against ever more stringent rules of engagement, often against an enemy unconstrained by the Law of Armed Conflict and with the ability to adapt cheap off-the-shelf technology to achieve their ends with a breathtaking lack of discrimination. Air Power's response thus has to rest on the combination of robust Combat ISTAR and highly-flexible precision weapons.

In turn, such capabilities rest heavily on the dogged pursuit of advanced technologies which, of course, come at a price. The financial cost of wars of choice is arguably becoming more prominent in public debate given the age of austerity in which we now live. But there really is no other plausible approach given the examples we saw in

A sophisticated ISTAR capability, as exemplified by the Sentinel R1, will be essential in any future engagement. (Crown Copyright/MOD reproduced with permission of the Controller HMSO.)

Iraq which relied on the type of timely, granular intelligence that Combat ISTAR provides. Addressing the Western Desert Scuds, using expensive Storm Shadow weapons effectively and constraining the risk to which aircrews are exposed , such as in the case of the Apache attack on the Republican Guard, all point to the premium that we must expect to place in future on our Combat ISTAR capability.

Finally, and as a footnote for potential commanders, this relentless pursuit of agility, tempo and precision adds a new level of complexity to Air Command and Control. As we demonstrated in Iraq, the art of the possible brings with it the prospects of task compression such that the old notion of the linear progression through intelligence preparation of the battlespace, the generation of air superiority, followed by offensive action has probably gone forever. This places a much higher premium on a commander's ability to assess the risk to which aircrews are being exposed and, perhaps, being alert to the danger of promising more than you can deliver.

DISCUSSION

Wg Cdr Jeff Jefford If you had been a senior commander in WW II, so long as you were making reasonable progress, Mr Churchill would probably have left you pretty much alone. With today's instant communications, things are not quite like that. Did you feel Whitehall looking over your shoulder all the time?

Air Chf Mshl Sir Brian Burridge. No. But there are two distinct differences. First, Iraq was a war of choice; there was no threat to our vital national interests and, secondly, I spent a lot of time preparing Ministers so that they would fully understand the nature of war and what to expect when it actually began. And I have to say that, having spent a lot of time with the Law Officers and the Secretary of State, I was given far greater delegated authority over targeting than the National Commanders in any previous campaign.

As a case in point, in the light of some adverse criticism in the media, particularly on TV, when the advance stalled during that awful sandstorm, 'No 10' made it clear, and the Secretary of State called me personally, to assure me that he was content to leave setting the pace to me. So – no – I did not feel any pressure and, in that respect, I was well served.

Gp Capt Jock Heron. Towards the end of our time in Iraq, Basra got quite a bad name. Could you tell us a little about that?

Burridge. I have no first-hand knowledge, of course, as I had left by then, but I think that is quite clear that, in terms of force density, the UK's commitment to Basra had simply been too light. The situation had needed more troops, for longer. It was a difficult situation with the problems being generated by two groups of people. One was a really radical Shia element – the Mahdi Army – and the degree to which it was prepared to take control. The other was organised crime and the extent to which the vacuum in governance allowed it to operate in a way that provided a cover for its own activities. Against this background, there was no growth of the political process. In short, Basra was already 'a mess' and arguably we made it worse when we decided, because our force levels were so low, to coalesce at the airport, rather than at our original headquarters in the old palace. Commanders did their best in difficult circumstances but that move

sent a strong message, to the Mahdi Army in particular, who saw our withdrawal from the city as an invitation to a free-for-all.

Air Mshl Ian Macfadyen. I was struck by the similarities between some aspects of Gulf War One and those of Gulf War Two, notably the Scud problem, the problems with the press and, above all, by WMD. I recall attending a high level, in-theatre meeting in 1991 at which we debated how to deal with WMD. We considered simply bombing the sites, with or without using incendiaries, although in either case there was bound to have been a degree of residual fallout downwind, and it was even suggested that we might minimise that hazard by cordoning off the area with mines. In the end General Chuck Horner, the Air Commander, decided that we would just bomb the installation and see what happened. The strike was successful, but when they examined the site later on, there was no sign of chemical weapons ever having been there. For some reason, they must have taken the stuff out before the war and got rid of it in some way. How much of that experience was read across to the second war?

Burridge. I think that a lot of progress had been made between the two campaigns in terms of scientific analysis. I was very fortunate to have three dedicated scientists on my staff, along with some very elegant computer models created by Porton Down. Any target that had, even a low probability of, a WMD presence was fed into the programme which projected the resultant plume. This was acknowledged as a collateral damage issue which was factored into the equation that eventually determined whether we would attack – or not. There is a school of thought that maintains that, if you can get the temperature high enough, it will do the trick completely – so that there will be no fallout at all – but, in practice, it is very difficult to guarantee such a degree of destruction. In short, we were extremely careful about targeting anything that might have been associated with WMD. That said, our problem was not quite the same as in 1991. In 2003 our campaign involved far more extensive ground manoeuvre, so we were able to overrun many potential WMD sites without having to risk an air strike. So, we probably had less of a problem – and we certainly had much better professional – technical – advice.

Air Chf Mshl Sir David Cousins. Thank you for a super talk. I was impressed by the emphasis that you gave to the importance of very high technology, which I absolutely accept, and the contrast with human intelligence – HUMINT – which is equally important but is, somewhat paradoxically, at the other end of the technological spectrum. I am the Honorary Air Commodore of the RAF's only HUMINT squadron – 7630 Squadron. It has just twenty members and they feel under threat at the moment – there are concerns about the unit's future. I believe that the Navy and Army have similar-sized outfits. So, on a national scale, we can actually field very few people who specialise in HUMINT. Is it your sense, moving in the circles you do, in the context of the Chilcot Inquiry for instance, that the importance of HUMINT, that you have stressed so strongly this evening, is now recognised by government, and the other agencies responsible for it? Or is it something that people feel they can get away with by using hi-tech equipment?

Burridge. It *is* recognised by the people who have to make decisions about how you will conduct operations, or, indeed, whether you conduct operations at all. But, in a rather perverse way, it is *not* recognised by governments – and by our government in particular. If you recall, in the National Security Strategy, and in the SDSR, it talks about 'Britain's enlightened national interests'. To Tony Blair, as articulated in his Chicago Speech in 1999, values and interests converged. In the Blair era, they were the same thing and we rode with that up to about 2006-07. Today it's 'Britain's enlightened national interests'. So, when I was doing a course for MOD, I asked Liam Fox, 'What, exactly, do you mean by "Britain's enlightened national interests"?' and he said, 'Less of the feeling of your hands going into the mangle.' Now I can identify absolutely with that, because that was my experience in Bosnia; that was my experience of Kosovo; that was my experience of Iraq and it was certainly my experience of Afghanistan. So, the notion that there needs to be a calmer, more objective judgement about the extent to which you commit to going into an ungoverned space, about which you have very little understanding – or intelligence – really did seem to have taken root.

But then we had Libya.

Macfadyen. Out of interest, and in that general context, Chuck Horner also adds – URINT, which he defines as 'a feeling in the water.' (*Laughter*)

AVM Nigel Baldwin. How much were you able to draw, consciously or subconsciously, on your previous experience of working for very senior officers in very stressful appointments – CDS, Paddy Hine, CinC Strike. When you were in that sort of lonely position yourself, out there in charge in Iraq, how valuable had that experience been?

Burridge. There are, I think, three strands to what I relied on – and working for senior officers in the past was certainly one of them. Sitting at the feet of Paddy Hine in the Cold War in WINTEX, which were proper, big, joined-up exercises, in which politicians played, was a very formative experience. As was working for the then CDS, Lord Inge, at the very top of the policy level, at the interface between operations, and defence in general, and politics. That created a huge database of experience upon which I could call.

The second aspect was some excellent training provided, believe it or not, by NATO. I spent two tours in senior NATO appointments, one as the CAOC Commander at High Wycombe, dual-hatted as DCinC, and one as COMMAIREASTLANT, dual-hatted as AOC 11/18 Group. While NATO was struggling its way out of the Cold War, it did what only NATO could then do – it threw money at us. So we had really great command and control exercises.

The third strand was the experience I gained by having done the Higher Command and Staff Course four times – once as a student and three times as Commandant of the Staff College. That meant that I really did have a pretty good understanding of all this sort of stuff.

But, in addition, and underpinning it all, was the operational decision-making, made in the maritime force during the Cold War, when one did things that, in the cold light of day, not everyone would have agreed with. But, it was that – being brought up, conditioned, to be an operational decision-maker – that was the absolute – the bedrock of it all.

SUMMARY OF THE MINUTES OF THE TWENTY-FIFTH ANNUAL GENERAL MEETING HELD IN THE ROYAL AIR FORCE CLUB ON 15 JUNE 2011

Chairman's Report.

AVM Baldwin, Chairman, noted that the recently distributed Journal 50, had contained the minutes of the 2010 AGM and the record of Dr Fopp's address on the Battle of Britain. The journal also contained the winning 2009 Two Air Forces Award paper along with other articles and book reviews.

The Society had held two seminars during the year; the first, in October at the BAWA, at Filton, had covered the history of the relationship of the Bristol Aeroplane Company and Bristol Engines with the RAF, and the use made of their many products operated by the Service. The second seminar, held at Hendon in April, considered the many aspects of support for air operations. The morning programme had been assembled by AVM John Browne and his colleagues from the RAF Airfield Construction Branch. Many other aspects, including the enormous efforts of the aircraft repair and salvage teams during WW II, were also covered. The Society was yet again grateful for the use of the splendid facilities at the RAF Museum.

The autumn seminar, to be held at the RAF Museum on Wed 19 October 2011, would start with a presentation by Dr Hermione Giffard, the first recipient of the Henry Probert Bursary, on her recent PhD thesis on the development of the jet engine. This would be followed by presentations on the testing and operations of the early jet aircraft in RAF service.

The finances of the Society remained stable and healthy, with some £31,000 in the accumulated fund at the year end. In addition to the Bursary, the Society had made a grant of £1,000 to the Bomber Command Memorial appeal. The Society continued to keep the costs of seminar attendance and journals to a minimum, and was grateful for the support from BAe Systems and Rolls Royce which would permit the proceedings of the event held at Filton to be recorded in hardback. Annual subscriptions would be maintained at £18.

All Society journals up to No 42 were now on-line and could be downloaded from the RAF Museum's website. Members were

encouraged to recruit new members where possible. Application forms were available on the Society's page of the MOD website or that of the RAF Museum.

Secretary's Report.

Gp Capt Dearman, Secretary, reported that since the last AGM, 32 new members had joined the Society, of whom two were serving in the RAF. However, twelve had died, four had resigned, and ten had been deleted as journals had been returned without a forwarding address or other details, leaving total membership at about 730. Journal sales had amounted to £30. Journals were no longer being sent to those few members still paying the old subscription rate of £15. The Society continued to meet its aims of placing its proceedings in the public record, and supporting appropriate scholarship and projects associated with RAF history..

Treasurer's Report.

Mr Boyes, Treasurer, tabled the 2010 accounts and noted that for financial year 2010, a surplus of £2,707 had been achieved. This offset, to some extent, the loss made in 2009, but subscription income was slightly reduced in 2010, and Gift Aid would reduce to 20% in the future. The Society had made a grant of £1,000 to the Bomber Command Memorial. The accumulated fund stood at £31,259. Proposed by Air Mshl Macfadyen and seconded by Air Chf Mshl Cousins, a motion that the accounts be accepted and that J R G Auber Ltd be reappointed as Independent Examiner was carried.

Appointment of Executive Committee.

The chairman noted that all members of the Executive Committee had offered themselves for re-election. A proposal by Sir Frederick Sowrey, seconded by Gp Capt Madelin, that all members be re-elected was carried. The Executive Committee members so elected were:

AVM N B Baldwin CB CBE	Chairman
Gp Capt J D Heron OBE	Vice-Chairman
Gp Capt K J Dearman FRAeS	Secretary
Dr J Dunham PhD CPsychol AMRAeS	Membership Secretary
Mr J Boyes TD CA	Treasurer
Wg Cdr C G Jefford MBE BA	Editor & Pubs Manager
Air Cdre G R Pitchfork MBE MA FRAeS	

Wg Cdr C J Cummings

The *ex-officio* members of the committee were:

J S Cox BA MA	Head of AHB
AVM P Dye OBE BSc(Eng) CEng ACGI MRAeS	DG RAF Museum
Gp Capt M Hart MA MPhil RAF	DDefS(RAF)
Wg Cdr S Hayler MA BSc(Eng) RAF	JSCSC

Discussion.

Mr Galazka questioned whether it might be possible to provide an index for the Journals held on-line by the RAF Museum. The Chairman would raise the issue in committee.

Mr Bateson, noting the demise of the Aircrew Association as a national organisation, questioned the future of its archive. Air Cdre Pitchfork, the Aircrew Association Archivist replied that the archive would continue to be housed at Elvington. Moreover, many local branches of the Association would continue as independent entities *sine die*.

Wg Cdr Ryan noted that some 10,000 items of squadron silver had now been identified as being held by units. However, there was little doubt that much had disappeared from Donnington. There was still an urgent need to fund a curator so that storage and recording of the silver inventory could be taken over by the RAF Museum.

The Chairman noted that the winner of the 2010 Two Air Forces Award, Lt Col A M Roe, had been unable to attend the meeting to receive his award. The Chairman would therefore forward the award to his Commanding Officer for presentation.

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 officer or airman. It is intended to reproduce some of these papers from time to time in the Journal. This one was the winning RAF submission in 2010. ***Ed***

'PINK'S WAR' – APPLYING THE PRINCIPLES OF AIR CONTROL TO WAZIRISTAN, 9 MARCH TO 1 MAY 1925

By Lieutenant Colonel A M Roe

Don't you worry there's nought to tell
'Cept work and fly and bomb like hell
With hills above us and hills below
And rocks to fill where the hills won't go
Nice soft sitting for those who crash
But WAR you call it? – don't talk trash
War's a rumour, war's a yarn
This is the PEACE of Waziristan

Wing Commander R C M Pink, chorus to 'Waziristan 1925'

Introduction

Before the arrival of the aeroplane in India, there was only one method of applying armed force on the North-West Frontier when political initiatives or the threat of force failed: the employment of ground forces, either temporarily or permanently, in tribal territory to restore order or to inflict a sharp lesson on the tribesmen.[1] These so-called 'punitive expeditions' – referred to as 'Burn and Scuttle' or 'Butcher and Bolt' operations – killed innumerable tribesmen and sought to achieve a considerable amount of damage: villages were burned or razed to the ground; cattle were confiscated or killed; and in some cases fruit trees, irrigation channels and wells were destroyed or poisoned. This was an unsophisticated, protracted and expensive means of enforcing discipline.[2]

The emerging technical capabilities of the aeroplane, for the first time, provided the government with the potential to enforce compliance upon the tribesmen in a timely, inexpensive, comparatively humane, and relatively safe manner from the air.[3] This

was especially true against law-breakers in remote or mountainous locations. Even the most isolated tribes could now be reached with relative ease. The employment of aeroplanes – with their speed over great distances, complete indifference to the state of ground communications and detachment from prying war correspondents – was to secure a 'change of heart' with the minimum amount of force. By reacting selectively and without procrastination to tribal disturbances, it was hoped that operations could occur without loss of life, through continuous and even prolonged air activity.

This outcome was achieved by interrupting the normal pattern of life of the tribes to such an extent that a continuance of hostilities became intolerable.[4] Known as 'air control,' in which the tribesmen were often blockaded out of their territory instead of into it, the tactic aimed to compel a tribe to abandon their grazing grounds and villages.[5] This forced them to hide in caves or relocate themselves (and their herds) as unwanted guests in a neighbouring village, preventing harvesting and other work, until a *volte-face* occurred. Unlike a traditional retaliatory army expedition, the RAF hoped that operations would be conducted against an empty village or vacated area. Such an approach also prevented the tribesmen from having a fight on equal terms; the only truly honourable occupation of a tribesman. It also negated the prospect of loot, particularly capturing a good British service rifle, or replenishing their supply of accurate ammunition.[6]

Unsurprisingly, the employment of airpower in this manner was not without its critics, limitations or challenges.[7] It was, however, an attractive option and an intelligent way of securing the RAF's future against a backdrop of a post-war struggle for resources between the three Services. Moreover, at a time when the military defeat of the tribesmen was the principal objective of army operations, the RAF's goal of attacking the morale of those who had disturbed the peace to hopefully secure long-term political stability and pacification was exceedingly attractive in some quarters. Air Commodore C F A Portal DSO MC points to the apparent subtlety and dexterity of the air method:

> 'The problem, then, is to get this change of heart without occupying the country of the delinquent tribe, and indeed

> without having any physical contact with them at all. If you can avoid even temporary contact, which means fighting, your remedy has the great advantage that it does not in itself inflame passions and obscure reasons, nor does it extend the original trouble to tribes that may have had nothing to do with it in the first instance, and the whole basis of this police method is that the idea of military occupation and, if you like, of military supervision, rankles much more with a proud and independent people than does the idea of observing the Government's standard of law and order, and that if you can avoid the former you will more easily achieve the latter.'[8]

In March 1925 the RAF was presented with a unique opportunity for testing the utility of air control against the troublesome Mahsuds in South Waziristan. This article overviews events prior to the start of operations, and offers a detailed account of RAF bombing and strafing activities from 9 March to 1 May 1925. It concludes by analysing the outcomes of the 54 day missions, which in due course became known simply as 'Pink's War.'

Events Prior to the Start of RAF Operations

The Mahsuds were a constant source of turbulence and unrest to the Government of India, primarily due to the inaccessibility of their country and their insolent, aggressive and warlike behaviour. Prior to 1919, their territory had not been visited since 1901-02, when a series of military operations against the tribes for raiding and murder resulted in their subjugation, the restoration of order and the construction of new motorable all-weather connecting roads.[9] Although unsettled by these events, the resulting 'peace' remained largely unchanged until the outbreak of the Third Afghan War of 1919,[10] when the somewhat hasty evacuation of most of the forward militia posts in the Gomal and Tochi areas, especially in Wana,[11] resulted in over 100 well-planned raids and offences being conducted by the tribesmen. With authority in Waziristan – lying on the western border of the Indian Empire, and forming the connecting link on the Afghan frontier between the districts of Kurram and Zhob – increasingly tenuous, the situation looked bleak for the government. As a result of the deteriorating security situation it was deemed necessary to undertake punitive operations against the Mahsuds to

restore order. These occurred throughout 1919, 1922 and the beginning 1923 resulting – after some extremely bitter fighting – in peace terms with the majority of the tribal sections, but not the intractable Abdur Rahman Khel; the last remaining pocket of tribal resistance. The RAF took an active part in all operations over the period, not only in direct action against the tribesmen, but also in raising Army morale and lowering that of the tribes.[12]

The Abdur Rahman Khel, therefore, became the chief section against whom most RAF activities of 1925 were directed in South-East Waziristan. A turbulent sub-section of the Nana Khel Bahlolzai tribe, the Abdur Rahman Khel included a significant proportion of young hotheads ineligible to receive government allowances – determined to make mischief and almost professional trouble-makers – as well as a number of bothersome fugitives, known as *hamsayas*, who had committed crimes inside the administered districts bordering tribal lands.[13] Of significance, many of the tribesmen possessed grazing land in Afghanistan, and summer migration across the permeable international border was commonplace.

On 27 December a full Bahlolzai *jirga* (assembly or parliament of tribal representatives) was held at Tank to make clear government terms to the tribesmen. This sought to obtain compensation for offences committed and for the 'exaction of promises to prevent further offences.'[14] Used as a means to resolve civil, criminal, and intertribal conflict, a *jirga* possesses neither a dominant leader nor chairman; participants sit cross-legged in a circle in order to avoid a prominent position and decisions are reached through dialogue and consensus. The democratic character of the Bahlolzai meant that the *jirga* had little control over the hot-headed elements and therefore was not truly representative of tribal opinion. Regrettably, the gathering was unsuccessful. On 16 January, a group of Abdur Rahman Khel representatives was interviewed. The deputation demanded an official pardon for recent offences, an increase in allowances from Rs 3,000 to 6,000 and unconstrained access to their tribal share: these demands were dismissed outright. Thereafter, the Abdur Rahman Khel, assisted by the Guri Khel, Maresai and Faridai sections of the Manzai Mahsuds, committed further offences and outrages. The first occurred on the night of 24/25 January, when four Hindus were kidnapped from Manzai. This was followed by a second incident during the hours of

darkness on 1/2 February, when two more Hindus were abducted from the *coolie* (unskilled labour) camp at Spli Toi. Eighteen days later, the Gomal Post was raided by a gang containing members of the hostile tribes. During the initial break-in, 27 European ·303 Lee Enfield service rifles belonging to the police were stolen and taken to the Spli Toi area.

Prior to these events, on 16 December, the Resident in Waziristan asked the government to sanction the employment of airpower against the intractable sections.[15] Keen to establish the RAF's credentials, the request was reinforced by Air Vice-Marshal Sir Edward Ellington KCB CMG CBE who had recently become the Air Officer Commanding (AOC), India, and who was a strong advocate of Sir John Salmond's policy of 'air control' and wider RAF employment on the frontier.[16] He believed that, if properly used, the squadrons on the frontier could achieve results out of all proportion to numbers and to effort expended. The official account of events recalls the growing necessity of the request and initial moves: 'By the end of this month it appeared probable that operations would be necessary; a plan was therefore drawn up by No 1 Wing, and the force to be employed was decided on.'[17] *Jirgas* with the affable sections of the tribes were undertaken, but despite demonstrations conducted by RAF units on 7 and 24 February, outrages continued, and the hostile elements still persisted in unrealistic demands and bargained for time.

On 1 February the Resident applied for the go-ahead to warn the Guri Khels that, unless they agreed and complied with the terms to be stated, air action would be undertaken against them. Judging that hostilities were now inevitable, Headquarters, RAF approved the use of airpower and allocated the force to be employed. Following two further outrages, the government sanctioned the issue of a final warning to the sections concerned by coloured warning leaflets on 25 February; these were printed in the tribal language – *Pashtu*. Only five days before, Wing Commander R C M Pink CBE, the Officer Commanding No 2 (India) Wing, had flown to Rawalpindi for a conference with the Northern Command Headquarters' Commanders to discuss the nature of independent air operations. As the appointed commander, and with operations at least agreed in principle with the army commanders, Pink set about re-deploying his forces and forward based supplies. The official report notes:

Wg Cdr Richard Pink, having just alighted from a DH 9A of No 27 Sqn.

'Explosives were forwarded from the Ordnance Depot, RAWALPINDI; petrol, oil and other supplies came from the Depots at PESHAWAR, KOHAT, RAWALPINDI and LAHORE. All supplies for both MIRAMSHAH and TANK [*the two main operating stations*] were delivered at MARI INDUS, transported across the river INDUS to KALABAGH and forwarded by rail either to TANK direct, or to BANNU for MIRAMSHAH. The average time taken for the delivery of supplies by this route was 14 days for TANK and 21 days for MIRAMSHAH.'[18]

On 2 March the advanced parties moved to Tank and Miramshah.[19] Although some 60 miles apart, resulting in certain administrative difficulties, it was deemed necessary to employ two airfields as there was insufficient room for the number of aircraft required for the operations at either location. The squadrons selected moved to their respective operating stations on 3 March. This consisted of three squadrons:[20] one of Bristol F2B Fighters and two with de Havilland DH 9As.[21]

On 5 March Pink's Operational Headquarters was established at Tank. The establishment of the aviation headquarters coincided with the issue of demands to the tribes in the clearest possible terms.[22] The alternatives to being bombed were:

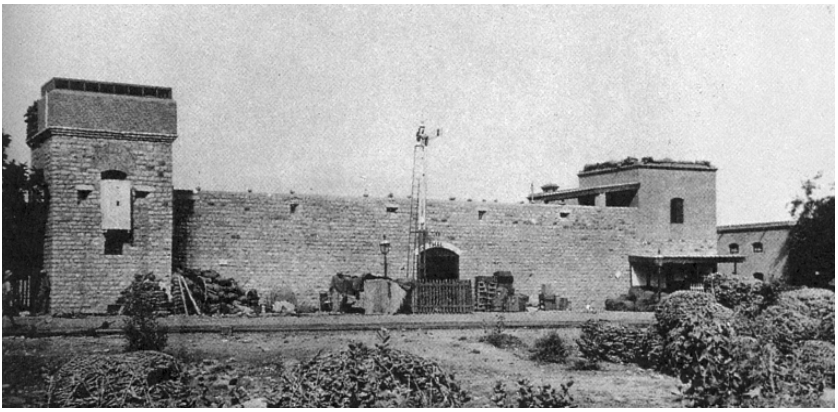
- Abdur Rahman Khel – a complete *jirga* of Abdur Rahman Khel, including hostile tribesmen, as well as the Jalal Khels and others who lived with the Abdur Rahman Khel, was to gather at Jandola at 12:00 hours on 7 March, bringing the two captive Hindus. In the event of nonconformity disciplinary measures would start after sunrise on 9 March.

- Guri Khel – the Guri Khels were required to comply with the terms already announced to them. For the Karim Khel sub-section, this was: Rs 1,600; two government rifles; the return of three bullocks and seven camels; and the deposit of eight country rifles as security. For the Biland Khel sub-section, eight government rifles and the deposit of four tribal rifles was demanded as security. In both cases, compliance was demanded by 12:00 hours on 7 March. In case of disobedience, punitive measures would start after first light on 9 March.
- Faridai – a complete *jirga* of Faridais was to assemble at Jandola at 12:00 hours on 7 March. In the event of non-compliance retaliatory measures would start after daybreak on 9 March.
- Maresai – a complete *jirga* of Maresais was to convene at Jandola at 12:00 hours on 7 March. In the event of non-cooperation castigatory measures would also start after dawn on 9 March.[23]

As no reply was forthcoming from the Abdur Rahman Khel, and the Faridai, Maresai and Guri Khel simply attempted to negotiate, it was decided on 8 March to begin air action against all sections concerned at sun-up on 9 March, based on the tribal principle of communal responsibility for crimes committed. The rationale behind this approach was that each tribe, sub-tribe, village, *malik* (a tribal leader or elder) or mullah (a religious leader who takes prayers) was responsible for its own people and for what went on in its area. There was no distinction between combatants and non-combatants or those who were guilty or innocent.

Area of Operations and Tactics

The planned area of operations was *circa* 50-60 square miles of wild mountainous terrain, precipitous gorges and isolated small valleys, including approximately 40 targets varying in height from 3,000 to 6,000 feet above sea level. This necessitated aircraft with full war-loads to limit fuel loads to approximately 60 per cent in order to attain bombing heights.[24] The targets varied from good-sized villages consisting of mud-built, flat-roofed houses and fortified watch-towers, relatively susceptible to bomb attacks, of the Faridai and Maresai, to



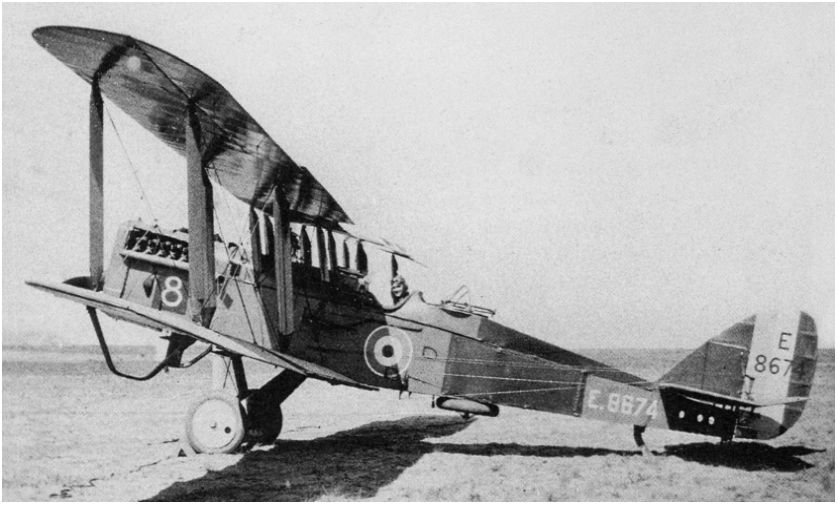
Fort Tank, North West Frontier Province.

the inaccessible cave homes of the Abdur Rahman Khel, furnished with personal belongings, food and water, and the distributed huts and enclosed compounds of the Guri Khel.[25] Most sections lived by necessity as independent economic units. Tribesmen in the open or their livestock were equally fair game. However, as was customary in Waziristan, all villages possessed access to a protective cave system nearby, where tribesmen and their families could live in comparative comfort for long periods.[26] Furthermore, all tribes possessed a sizable head of livestock. Throughout the hostilities these were mostly secured in the surrounding caves during daylight hours and watered and fed under the cover of darkness. At the headquarters in Tank, all objectives were carefully numbered on a master map, with specific targets allocated to the squadrons. For the air staff, this proved to be a primary means of recording and conveying information, calculating moves and directing action. Pink quickly knew every inch of the map as if he had been flying over it daily for weeks.

The tactical unit employed against the tribesmen was a 'flight' of three machines, as the targets were so small that it was often not economical to attack with more than three aircraft at a time, with bombing normally occurring at a height of 3,000 feet over the target on a signal from the formation commander. The tactics employed could roughly be divided into: *intensive air attack*, *air blockade* and *night bombing*. In each case, every effort was made to avoid setting

patterns, in order to keep the tribes in a constant state of insecurity and apprehension. Taking tactic each in turn:

- *Intensive air attack* was regularly conducted by a series of coordinated flight raids. The hours of daylight were divided into periods and these periods were allocated to squadrons in rotation. This form of attack varied by directing more than one squadron on a selected target during a defined period, thereby increasing the intensity of the attack by concentrating all available force at a predetermined time and place. Attempts were made to achieve tactical surprise by altering the times and order of attack on targets.
- *Air blockade* consisted of deploying aircraft over the target area at irregular intervals during the hours of daylight to attack certain objectives, or to assault any target which might present themselves with 112 lb and 20 lb high explosive anti-personnel bombs.[27] The *raison d'être* behind this method was to harass the tribes constantly, thus creating a general feeling of uncertainty, insecurity and apprehension. Such activities sought to encourage the tribesmen to capitulate by causing intolerable inconvenience to their daily lives, cutting off communication, and preventing them from cultivating their crops or grazing their flocks for an indefinite period. Routes were carefully planned so that tribes with a history of trouble-making were also covered; aircraft often descended over them to leave the villagers in no doubt that they were being watched.[28]
- *Night bombing* (30 March onwards), although limited, was undertaken by individual aircraft employing moonlight to enable pilots to fix their positions accurately. Attacks took place either against an observed target, or on localities where it was advantageous to enforce the blockade. Reconnaissance flares were used to assist the pilot in identifying targets, but it was recognised that 'no great material damage' could be expected from night bombing.[29] To be effective, night bombing had to be continuous. However, the tactic prolonged the blockade into the hours of darkness, and in consequence disorganised the normal pattern of life of tribesmen still further. On nights when



A DH 9A of No 60(B) Sqn circa 1923, still wearing its wartime camouflage; it would doubtless have been redoped in silver at some stage. (Chaz Bowyer)

bombing was not viable, the RAF relied on delay-action bombs dropped during the previous day.

To prevent pattern setting, a number of variations to the above methods were introduced during the campaign. For example, 'desultory' bombing was carried out for a number of days, followed by an intensive and focused assault.[30] Orders were also given to stop all raids at a set hour, in order to give the impression that attacks for the day had ceased, before a resumption of activity prior to last light. Moreover, the times of attack were continually varied, as were the type of bombs employed, the time of delay-action fuse used, and the number of aircraft selected. Night bombers were ordered to attain maximum height over the aerodrome and then to 'throttle down' their engines in order to appear over the target as silently as possible and a reserve was always maintained at high readiness to permit a heavy attack against an identified target. In addition, and to help negate any forced landings in tribal territory, raids were carried out at sufficient height to allow pilots a realistic chance of being able to reach one of the three emergency landing grounds adjoining the operational area,

should they encounter engine failure.

Forced landings in tribal territory were something to be feared. Capture by the tribesman could entail mutilation, followed by death; although more routinely pilots were held for ransom. The prospect of being found or rescued was negligible; aircraft carried bedding, emergency rations and water. Moreover, 'every officer-airman carried a letter in *Pashtu* [and *Urdu*], signed by the Chief Commissioner, … offering a reward of Rs 10,000 to any tribesmen who brought the bearer to safety in the event of his having to make a forced landing in tribal territory.'[31] These safety certificates were known commonly as 'gooli chits,' as castrations without the benefit of anaesthetic was not unheard of. However, the actual treatment of the captured aircrew depended greatly on individual circumstances and particularly on the role they had just been undertaking.

Behind the scenes, preparations for the forthcoming operations continued apace. Chaz Bowyer writes in *RAF Operations, 1918-38* that:

> 'Pink wasted no time, and once Miramshah [Fort] had received its squadrons he flew to the fort from Tank to brief all personnel on the imminent operations – in itself a somewhat novel procedure at the time. Seating *all* crews, air *and* ground, in a semi-circle around him Pink proceeded to explain in detail the tactics and objectives intended – to such good effect that on concluding his talk the whole audience, quite spontaneously rose to their feet and actually clapped their applause!'[32]

Bowyer goes on to report that: 'This unprecedented gesture of appreciation momentarily took Pink aback – in the words of one NCO present, "Pink became scarlet – but I don't think he was displeased really ..."'[33]

The Terror that Flies: Operations Commence

As the government was absolutely sure of the culpability of the tribes, activities began on 9 March with heavy attacks against all sections concerned; any movement, human or animal, seen within the proscribed area was liable to be bombed or machine-gunned from the air without warning. As expected, the main focus of activity during the initial stage of the operation was directed against the Abdur Rahman

A DH 9A of No 27(B) Sqn.

Khel, who had sensibly taken to the hills, moving everything they could. A number of villages in Dre Algad were set ablaze and a fortified watch-tower was completely destroyed in the Spli Toi area. Four days' later operations came to a temporary halt, as various hostile sections, after expressing contempt for the effects of the bombings, promised to comply with government demands. This was a ruse by the defiant tribesmen to buy time, and air attacks resumed on 14 March.

The following day two captured Hindus were brought into Spli Toi Post, and on 17 March the Abdur Rahman Khel *jirga* arrived at Jandola for negotiations.[34] As was normal, operations against this section were immediately suspended to allow negotiation to take place. During the ensuing *jirga*, the Resident announced the terms to the tribesmen, 'and an agreement was in sight when internal dissentions caused a breakdown of negotiations.'[35] Operations against the Abdur Rahman Khel were immediately reinstated and those against the remaining intractable sub-sections continued.[36] However, under the tribal code of *pashtunwali*, and specifically the tenet of *nanawatai*, the obligation to offer open-handed sanctuary without thought of reward, it was found that various friendly villages were giving shelter to the hostile tribesmen and their flocks; these villages were promptly warned by the Resident to cease such support.

During the following days, the friendly section of the Abdur

Rahman Khel departed the Spli Toi area altogether, convincing various hostile sections to return to their own tribal areas. RAF operations had by this point forced the majority of unreceptive tribesmen into hiding and completely upset their routine pattern of life.

On 21 March, Flying Officer N C Hayter-Hames and E J Dashwood, while carrying out a bombing raid in a DH 9A of No 27(B) Squadron, were forced to crash land in hostile tribal territory from an unknown cause, most probably accurate rifle-fire, although *The Times* reports simply that the 'machine caught fire.'[37] Flying Officer Hayter-Hames, 23, was killed during the heavy landing, which completely destroyed the aircraft. Flying Officer Dashwood, 22, the youngest son of Sir George and Lady Mary Dashwood, who was thrown clear, fell into the hands of Guri Khel friendlies but died shortly afterwards.[38] Chaz Bowyer recounts the incident:

> 'Dashwood immediately went into the burning wreck attempting to extricate his pilot but suffered serious burns. Dashwood was then taken in hand by some friendly Guri Khel who lavished elaborate care on the mortally injured man, even slaughtering several of their precious goats and using the goat fat and skins to wrap the dying Dashwood – an example of a form of chivalrous mercy for any brave man sometimes displayed by the mountain tribesmen even to his foes.'[39]

Flying Officer Dashwood's body was brought into Sorarogha on 22 March, despite considerable opposition from the Karim Khel. Three days later, the Karim Khels, after serious haggling, recovered Flying Officer Hayter-Hames's body with a number of rifles. Subsequently, a *jirga* occurred at Jandola, where the Karim Khels surrendered their leading *malik* as security for the payment of the money fines.

Despite a number of small successes, it became clear that operations were likely to become drawn-out. Social fragmentation and economic backwardness made the efficient imposition of collective punishment difficult. It was, therefore, deemed prudent to restrict the intensity of the attacks in case further operations became obligatory, or that the present operations had to be conducted for an indefinite period. Attacks on the tribes now developed into an air blockade,

A Bristol Fighter of No 20(AC) Sqn.

conducted by a pair of aircraft patrolling a designated area. However, the Abdur Rahman Khel remained a focus of activity, particularly as rumours suggested that they were planning on migrating across the Afghan border for safety.[40] In addition, routine activity continued unabated against all hostile sections, but often with only limited short-term success. For example, the RAF destroyed a prominent fortified watch-tower in a Maresai village, which proved to be a catalyst for negotiations. As was customary, bombing was suspended against the tribe for one day to allow their *jirga* to appear at Jandola. However, despite some positive signs of a breakthrough, nothing came of the meeting and operations resumed.

On 30 March a single Bristol Fighter from No 31 Sqn, Ambala, commanded by Flying Officer Reginald Pyne and fitted out for night-time flying, arrived at Tank to carry out night bombing raids. With ground crew despatched to the landing grounds at Sorarogha and Khirgi, employing searchlights and paraffin landing flares, the first flight occurred on 4 April with notable results. Prior to this attack, the tribesmen had considered themselves relatively safe under the cover of darkness, and the discovery that the RAF could operate effectively at night proved alarming, playing on the minds of the tribesmen. Encouraged by the success of this new tactic, two more Bristol Fighters were flown from Ambala to Tank for further night sorties. The arrival of these machines resulted in a partial re-organisation of

the operational force.[41]

To achieve a greater effect and to give evidence of the force which lay behind the government's word, the government decided to launch a large offensive on 4 April immediately prior to the first hours of darkness raid. Accordingly, 38 soties were coordinated during the hours of daylight, totalling 52½ hours flying. The combined action resulted in numerous tribal casualties, with the night-time raid killing an infamous Faridai, named Tormarchai. However, the attack occurred with one incident of note involving Squadron Leader T F Hazell, who had only recently been appointed Officer Commanding 60(B) Squadron.

> '[S]hortly after taking off from Miramshah he noticed the engine cowling of his DH 9A coming loose. Jettisoning his two 230 lb bombs – which landed near an army scout post to the alarm of its troops – Hazell decided to land as quickly as possible and chose Sorarogha where its sloping landing strip ended abruptly in a sheer drop into a deep *nullah* (valley). With no option but to land down the sloping strip Hazell skilfully ran his Ninak into a stone breastwork on the very edge of the precipice. The DH9A was a write-off but Hazell and his petrified gunner walked away from the wreck with minor bruises.'[42]

In addition, the official report recalls that on 4 April: 'A friendly ABDUR RAHMAN KHEL jirga appeared at TANK on this day with various irrelevant suggestions which were rejected.'[43]

Five days later an afternoon patrol sighted a large gathering of Faridai tribesmen moving up the Dre Algad in open country. This slow-moving target was immediately engaged by bomb and strafing machine-gun fire, with additional aircraft from Miramshah reinforcing the ongoing assault. With numerous casualties inflicted on the dispersing tribesmen, and the opportunity for a rout at hand, the weather took an unexpected turn for the worse, making it impossible to press home the attack. The circling aircraft reluctantly returned to base. This was the only reported gathering of hostile tribesmen encountered in the open during the entire operation.[44]

By this stage in the operation, a number of friendly tribes were beginning to refuse refuge to the radical tribesmen and their flocks,

but some still persisted in offering sanctuary, despite the dangers. As a result of multiple source information received from the political authorities, warnings were issued to the following villages: Galli Punga, Pasti Khan, Jullamdar Pari Khel, Jemadar Didai's village, Shinkai and Wazirgai. Intelligence reports also suggested that a large number of hostile Abdur Rahman Khel were sheltering with friendly tribesmen in the Sarela, and a warning was issued to the district on 12 April. At about this time information came to light to suggest that hostile families were sheltering in the Barwand area, and that the Abdur Rahman Khel were likely to move to the Baddar Algad *en route* to Afghanistan. Authorisation to extend the operation to all these areas was requested in writing; however, this was approved for the Baddar area only on 20 April.

With operations continuing at a brisk pace, representatives from the Abdur Rahman Khel proposed a peaceful conclusion to events on 12 April. These proposals were considered to be genuine by the Resident and, as a result, bombing of the Spli Toi area was stopped from 14:00 hours on 13 April to midnight on 14 April. A *jirga* subsequently appeared, but no agreeable outcome was obtained, despite extensive negotiations; calculating the tribesmens' bluff and sifting the wheat from the chaff during a *jirga* was a trying experience. Operations resumed the following day, with 57¾ flying hours expended. Two more night raids were also undertaken.

Around this time contradictory reports were being received of the proposed intentions of the Faridai and Maresai sections. To clarify matters and to avoid unduly prolonging operations, the political authorities despatched a representative to Ahmedwam to attend a tribal *jirga*. A brief message was received on 15 April from the envoy that the *jirga* would only convene under certain conditions, which were immediately dismissed. However, on the morning of 18 April, the fine of seven government rifles was met and three rifles looted from the Gomal Police Post were then turned in. At this point, operations ceased against these sections. Meanwhile, a constant reconnaissance was maintained over the Baddar area to identify signs of tribal migration. Constant bombing of the Abdur Rahman Khel hostiles continued.

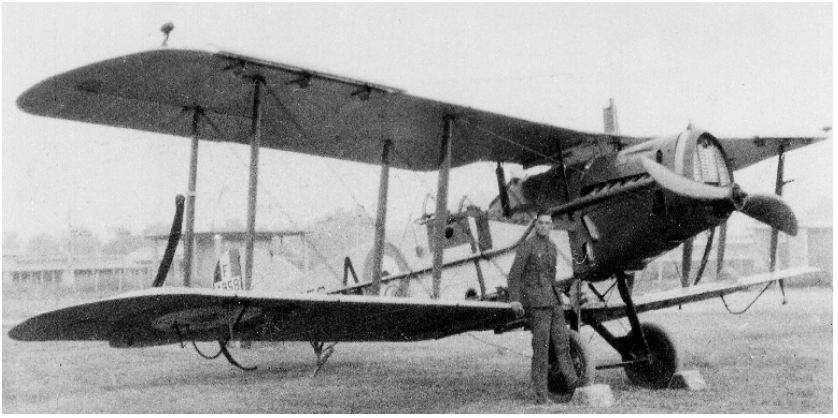
On 17 April, a deputation of Abdur Rahman Khel mediators presented peace terms to the authorities, but their proposals were

deemed unrealistic and, therefore, unacceptable. They returned at night-time on 20 April; this time there was an agreeable promise of security, and they were granted a 24-hour lull in operations. The official report notes:

> 'It was now discovered that the hostiles had actually left the SPLI TOI for BADDAR, but had been turned back by sections living *en route* who were afraid of being bombed. This forced them to return either to SPLI TOI or BARWAND, and it was reported that, if peace was not concluded, they intended to go direct to AFGHANISTAN *via* KHAISORA, to avoid further bombing. The three security rifles were not produced by the time allocated, and bombing was begun again, only to be suspended the same evening on the receipt of the rifles.'[45]

This was followed by a preliminary meeting with both hostile and friendly members of the tribe at Sarwekai on 23 April, followed by a representative *jirga* on 28 April at Jandola. After three days of prolonged and exhausting discussion, due to the conflicting interests of all parties, terms were agreed on 1 May in Jandola, with practically no ill-will.[46] The full fine of 16 rifles was accepted and guarantees for payment within a practical timeframe given. An honourable – if fragile – peace ensued.

After 54 days of unremitting air action, and with all government terms accepted, except for one rifle which was remitted to the Biland Khel as a reward for their assistance in recovering Flying Officer Dashwood's body, RAF operations ceased against all hostile sections. Having barely covered the campaign, *The Times* reported: 'The operations of the Royal Air Force in Waziristan have been crowned with complete success.'[47] The total number of casualties inflicted on the tribesmen was never officially quantified, not least as tribal losses were usually concealed and there were no reliable means of confirming rumours. However, in a despatch from the government to the Secretary of State from India dated 15 October 1925, it was 'estimated' that there were '11 human casualties only, killed and wounded, caused by 154 tons of bombs and 100,000 rounds of ammunition,' as most tribesmen left their villages and took shelter, with their livestock, in caves, only allowing their cattle to graze under the cover of darkness.[48] Additionally, there was considerable damage



Bristol Fighter of No 20(AC) Sqn. (MAP)

to tribal flocks, but only moderate harm to houses; although constructed only of mud brick, tribal homes were remarkably resilient against even the heaviest bombs. In comparison, *The Times* report of a routine punitive reprisal in 1922 notes: 'On the 17th [December] a column of ground troops from Kotkai attacked a hostile Mahsud gathering two hundred to three hundred strong. At least eight Mahsuds were killed and twelve wounded. Our casualties were six killed and twenty-eight wounded, all Indian.'[49] The contrast was stark. Moreover, operations in Waziristan over six-months in 1919-1920 alone cost the government 1,800 lives, 3,675 wounded and 40,000 sick casualties.[50]

The wider psychological effect of the action on the tribesmen was also difficult to determine, but the inconvenience of denied access to his villages was great, 'especially when some vigorous and unforeseen allies of the Raj, myriads of fleas, made life in the caves unendurable.'[51] A feeling of helplessness and an inability to reply effectively to the constant attacks was particularly soul-destroying. Moreover, the official report notes with some assurance: 'The moral effect of the bombing on tribesmen not included in the actual area of operations has also been considerable: various fines which were imposed before and during the present operation have been paid up, and the decisions of the Political Authorities have been carried out with exemplary promptitude.'[52] This included the Bahadur Khel and

Shabi Khel paying outstanding fines, and a section of Malikdinai, led by an infamous outlaw, Shamdai, handing over 13 rifles as well as paying an outstanding fine. Therefore, there appeared little doubt in the effectiveness of becoming subject to air operations. In summarising the RAF operations of 1925, the *Official History of Operations on the NW Frontier of India, 1920-35* notes: 'They were an instance of complete success being achieved in securing submission of NW Frontier hostiles by air action alone, thus achieving the desired result at very small cost in casualties and money by comparison with a punitive expedition carried out by the Army ...'[53]

As was to be expected from an operation of this magnitude, a number of gallantry and distinguished service awards were approved by the King and officially gazetted. Squadron Leader A J Capel, later to reach the rank of Air Commodore, was awarded the Distinguished Service Order. Flight Lieutenants J W Baker, already in receipt of a Military Cross, W N Cumming, and Flying Officer R Pyne all received the Distinguished Flying Cross.[54] Three sergeants, of whom two were pilots, a corporal, and a leading aircraftsman, were awarded the Distinguished Flying Medal. In addition, 14 RAF personnel were mentioned in dispatches, including Wing Commander R C M Pink CBE. In addition, he was granted accelerated promotion to group captain as a reward for his skilful handling of the campaign,[55] 'apart from being accorded a form of immortality in RAF annals by having these operations thereafter referred to as 'Pink's War.''[56] Moreover, all those who had served under Pink during the period 9 March to 1 May 1925 inclusive became entitled to wear the India General Service Medal, 1908 with a clasp imprinted 'Waziristan, 1925.'[57] This was by far the rarest clasp given with the medal and was only awarded after Sir John Salmond succeeded in overturning the War Office decision not to grant the decoration. Forty-seven officers and 214 airmen received the award.

Events in Perspective

Although the campaign was a success, it was not without its lessons. The first important deduction was that the period of time over which the campaign was conducted was unfavourable. Final approval for the start of operations was issued by the government on 25 February, with the first attacks against the tribesmen occurring on

9 March. By early March the worst of the cold weather was over, and flying had to be undertaken in ever-increasing temperatures (April was unusually hot) and seasonable storms added considerably to the strain on the aircrew and supporting ground personnel.[58] The timing also made the blockade more bearable for the tribesmen and their families, as daily conditions were ever more pleasant and agreeable. Likewise, as the passes into Afghanistan were now open, those who owned land or had somewhere to stay in Afghanistan could simply leave the area in question uncontested.

However, there were more profound challenges with the timing of operations. By early March the RAF was nearing the end of a particularly busy training season, which had made considerable demands on aircrew and on the reserves of ageing fabric-covered machines, engines and technical stores. The official report notes poignantly: 'This [the training season], combined with an under-estimate of the financial requirements of the RAF in India for the year 1924-25, resulted in a shortage in the necessary number of serviceable aeroplanes and engines: on the eve of the operations this amounted, for the RAF as a whole, to 27 aeroplanes and 40 engines, the former being due to the latter.'[59] Cannibalisation and local improvisation were commonplace in order to bring a single aeroplane up to flying standard for operations, and workshop shifts were kept going day and night to enable the squadrons to have aircraft available. Despite these challenges, 2,700 hours were flown during the campaign over a demanding 54 day period; a significant achievement by any standards.[60] Nevertheless, by 1 May this shortage had increased to 85 aeroplanes and 44 engines. A breakdown of flying hours over the period of operations by squadron is at Figure 1.

Equally, there were challenges with the number and experience of available aircrews. All the knowledgeable pilots due to be rotated out of India in the trooping season of 1924-25 had departed, and those who had replaced them were not available to take part in the operations, 'since they had not had time to complete their training under Indian conditions, which differ from those at Home on account of the low density of the air and the height of the landing grounds.'[61] For those travelling by troopship to India a flying break of over two months needed rectifying. This initially occurred at the Aircraft Depot at Karachi, before transferring to the squadrons and the mentorship of

Squadron	Total hours flown inclusive, *plus* one hour to operating stations (hrs mins)	War flying including travelling flights (hrs mins)	No of machine flights
No 5 Sqn	671.05	463.20	363
No 20 Sqn	558.35	405.55	139
No 31 Sqn (night flying)	97.00	46.20	29
No 27 Sqn	661.45	554.50	333
No 60 Sqn	724.45	600.30	358
Totals	**2,713.10**	**2,070.55**	**1,222**

Fig 1. Operational Statistics.[62]

an experienced pilot, enabling the aircrew to become familiar with the aircraft, local conditions and the unusual layout of the frontier stations. This could take up to a month to complete, including a series of solo flights, until deemed ready for operations.

Despite such practical challenges, a total of 2,700 flying hours in antiquated aircraft only resulted in one fatal incident on 21 March, resulting in the death of Flying Officers Dashwood and Hayter-Hames. However, there were a number of recorded crash landings. In addition to Squadron Leader Hazell's heavy landing on 4 April at Sorarogha, Flight Lieutenant R C Savery also made an emergency landing at Sorarogha on 8 April, while on 15 April a third aircraft force-landed with engine trouble in open country. Although exclusively referring to the deaths of Flying Officers Dashwood and Hayter-Hames, the official report notes positively: '… previous experience of frontier fighting shows that this is a small price to pay for enforcing our will on such hardy mountaineers as the tribes concerned, living in the difficult country of WAZIRISTAN. Nor do I believe that the cost would have been less had any other method of coercion been employed, indeed I think it must have been much more.'[63]

In spite of the impressive tally of flying hours, on several occasions during the campaign, bombing was temporarily stopped to conduct

peace *jirgas* or to allow property to be collected as security; primitive methods of tribal communication and transport often resulted in significant breaks in operations to permit effective dialogue with tribal emissaries. In a number of these instances, the sections failed to comply with the stated conditions within the specified timeframe and attacks resumed. The official report notes: 'The disadvantages of such respites are obvious; they enable the enemy to recover from the strain which the bombing attacks inflict, they facilitate the removal of valuable property [and flocks to a place of safety], they give the tribesmen the impression that our resolution is weakening and provide opportunities for those who wish to do so, to slip away out of reach of further attacks.'[64] Of significance, on more than one occasion the tribes came to terms without any initial break in activity, or after bombing had been resumed on the cessation of a respite. For example, between 15-18 April the Faridai and Maresai complied with government terms without a pause of operations against them. Similarly, the Abdur Rahman Khel surrendered three rifles required as a guarantee of peaceful behaviour on 21 April after bombing had recommenced against them. These examples demonstrated to the authorities that a lull in activity was not always necessary and, whenever possible, that operations should continue unabated, until the initial terms had been complied with in whole or adequate security for the fulfilment of the conditions given. However, as soon as the period of apprehension and the initial shock waves are over, evidence suggested that it was not the way force was applied but its effectiveness that was feared the most.

As to be expected 'with a method that was often criticized on the score that it was brutal'[65] the thorny issue of the delineation between hostile and friendly tribesmen reared its head in the official report. This was noteworthy as the operations appeared to have few constraints placed upon them; the idea was simply to get the tribesmen to come to terms in the quickest time possible. Pushing the issue firmly to one side with a preamble that states: 'It is unnecessary to deal at length with the difficulties which are created for the Royal Air Force by the division of the MAHSUD tribes into hostile and so-called friendlies,' the official report notes, 'all are agreed that such differentiation is undesirable, and that full tribal responsibility should be enforced.' The issue is concluded simply by saying: 'It is hoped

that such a policy will prove practicable in the future.'[66] However, the reality was that the well-disposed elements of the tribe suffered by necessity with those whose transgressions had brought about the operations in the first instance. This was despite a perceived familiarity with the terrain and tribesmen. *The Times* notes optimistically: 'In consequence of the detailed knowledge of the country acquired since the occupation, it has been possible to isolate the offending tribes, and the result has been greatly to increase the effect of the operations.'[67] However, this was not always true. A lack of information was an important factor in prolonging operations. As this was the first time that independent air action was used on the frontier, the inadequacy of the RAF intelligence structure and poor mapping and photographic intelligence played a major role in the extended duration of operations.

Conclusion

In 54 days the RAF demonstrated that a proven alternative to costly, protracted and elaborate punitive expeditions existed to control the frontier tribes: no ground troops were used. Against a particularly intractable section of the Mahsuds, the continuous operations of the air arm, despite severe aircraft and engine shortages, also secured considerable respect from the army and the civil authorities. This was particularly noteworthy as air control was often opposed in that it was thought to be solely punitive and contrary to a policy that aimed to 'civilize' the tribes through personal contact.[68] Many senior British officers, including some Viceroys, disliked the concept of airpower for this reason alone.[69] Moreover, the lessons learnt from operations against the Abdur Rahman Khel and other Mahsud tribes ensured that the technique of air control in the future would be even more effective and efficient. The official report concludes by stating:

> 'This is the first occasion in INDIA that the RAF has been used independently of the Army for dealing with a situation which has got beyond the resources of the political officers. It is at present too early to judge how lasting will be the effect or how permanent will be the impression of this display of air power on the stubborn tribesmen of the North-West Frontier, but it is claimed that the operations prove that in the RAF the Government of INDIA have a weapon which is more

> economical in men and money and more merciful in its action than other forms of armed force for dealing with the majority of problems, which arise beyond the administrative frontier. That they have not been without effect on sections of the MAHSUDS who were not included in the area of operations is shown by a number of settlements which have been effected during the progress of the operations, notably the case of the surrender of the rifles looted from the GOMAL Police Post.'[70]

It is significant that during the next eleven years, a combination of regular troops, scouts, *kassadars* (tribal policemen) and the RAF succeeded in substantially reducing the violence in Waziristan, with only minor tribal raids to upset the peace. The political authorities realised that air power, when properly employed, provided an effective means of helping to control the tribesmen. However, despite a number of well-argued proposals, the army high command never again gave the RAF responsibility for an independent air campaign on the frontier, confining Pink's War to the chronicles of history.

Notes:

[1] Roe, A M; 'Friends in High Places: Air Power on The North-West Frontier of India', *Air Power Review*, Vol 11, No 2 (summer 2008), p31.

[2] Nevill, H L; *North-West Frontier: British and Indian Army Campaigns on the North-West Frontier of India, 1849-1908* (London: Donovan Publishing, 1912) p21; Roe, A M; *Waging War in Waziristan: The British Struggle in the Land of Bin Laden, 1849-1947* (Kansas: University Press of Kansas, 2010), pp71-75.

[3] Hostilities against aircraft were poor sport, resulting in few casualties. Although one flying officer wrote in 1928 that 'their (Mahsud) rifle fire … was uncomfortably like that of a machine-gun, and almost as effective.' *Anon*; 'The Mahsud Operations, 1920 (No 31 Squadron)', *The Hawk: The Annual Journal of the RAF Staff College*, Vol 1, No 1 (1928), p127.

[4] This generally followed a predictable pattern. Initially the tribesmen were excited, defiant and boastful of the revenge they would take afterwards. Next came internal quarrels, blaming each other for having caused the trouble in the first instance, and fierce protests at the injustice of the government. This was followed by boredom and frustration as the tribesmen watched their homes being destroyed and crops deteriorate from the relative safety of their caves. Finally came the stage of reluctant – but often good-natured – peace offers, generally by sections in order to save face and avoid complying with government terms.

[5] As a means of controlling the Empire's outer reaches within the economic constraints of the day, air control became the system by which an area was dealt with primarily by air action, in which the RAF was the predominant arm and the

responsible commander an airman. This method was honed over time in response to complex situations on the frontier, disorder and banditry in Iraq, disturbances in Aden, and uprising in Palestine and Transjordan.

[6] Mackay, C J; The Influence in the Future of Aircraft upon Problems of Imperial Defence' *Journal of the Royal United Service Institution*, Vol LXVII (February to November 1922), p299; Roe, *Waging War in Waziristan*, pp23-28.

[7] For example, consecutive British Ministers in Kabul disputed the effectiveness of air control and questioned the morality of its employment. Sir Francis Humphrys believed that aerial attack would increase the extreme dislike and bitterness of the British amongst the tribes. Sir R Maconachie, Humphry's successor, believed that the RAF was simply unable to distinguish from the air between friendly and unfriendly villages.

[8] Portal, C F A; 'Air Force Co-operation in Policing the Empire', *Journal of the Royal United Service Institution*, Vol LXXXII, No 526 (May 1937), p350.

[9] To open up the country a central road was built from Bannu to Razmak, headquarters of a brigade group, then to Wanna on the west of the Mahsud territory, and from Wanna a circular road to connect up with the Derajat frontier.

[10] See Robson, B; *Crisis on the Frontier: The Third Afghan War and the Campaign in Waziristan 1919-20* (London: Spellmount Ltd, 2004); Molesworth, G; *Afghanistan, 1919* (London: Asia Publishing House, 1962); and *The Third Afghan War, 1919: Official Account* (Calcutta: Government of India Central Publishing Branch, 1926).

[11] The British were compelled to retire from Wana Fort, where a small element of the South Waziristan Militia mutinied and seized the armoury, capturing 1,200 rifles and approximately 700,000 rounds of ammunition.

[12] *Official History of Operations on the N.W. Frontier of India, 1920-35* (Manager of Publications, Delhi, 1945), pp33-35.

[13] Of note, during 1910 1,000 Mahsuds were allowed to enlist in the Regular Army and in 1911, owing to a drought that resulted in the failure of the autumn harvest, 2,000 Mahsuds were given work on the construction of the Pezu-Tank branch of the Kalabagh-Bannu railway.

[14] Ellington, E; *The London Gazette*, supplement, 17 November 1925, 7596.

[15] The head of the political hierarchy on the frontier resided in Peshawar. He wore two hats: he was Chief Commissioner (in 1932 upgraded to Governor) of the cis-frontier districts, but in his dealings with Tribal Territory he was Agent to the Governor General (AGG), having under him the Resident, Waziristan (Waziristan had been under military command since 1919 but on 31 March 1924 a political resident was appointed), established in Dera Ismail Khan, and Political Agents for North Waziristan in Miramshah, South Waziristan in Tank, and the Kurram in Parachinar. Under the Political Agents were Assistant Political Agents in Wana, Sararogha and Miramshah.

[16] Young, A J; 'Royal Air Force North-West Frontier, India, 1915-39', *Journal of the Royal United Services Institute* 127 (1982), p61.

[17] Ellington, *The London Gazette*, 7596.

[18] *Ibid*, 7596-7.

[19] Built at the end of 1924 as an extension to a scouts' fort, Miramshah was to

become a favourite outpost with the air and ground crews. A fort strongly reminiscent of the film 'Beau Geste,' with strong outer walls and battlements, it had an inner 'keep' into which aircraft were wheeled at night and secured. The ground outside the fort was levelled on the north and west to give an L-shaped landing area, the surface being gravel on rock.

[20] The force was located as follows: No 5(AC) Sqn – Bristol Fighter – Tank (10 aircraft, 14 officers and 69 airmen); No 27(B) Sqn – DH 9A – Miramshah (8 aircraft, 15 officers and 58 airmen) and; No 60(B) Sqn – DH 9A – Miramshah (8 aircraft, 13 officers and 67 airmen). Including the Headquarters in Tank (5 officers and 20 airmen) the total force consisted of 26 aircraft, 47 officers and 214 airmen.

[21] The Bristol F2B Fighter was a two-seat biplane fighter and reconnaissance aircraft, which had seen service on the Western Front. Often referred to as the 'Brisfit' or 'Biff,' the F2B proved to be an agile and manoeuvrable aircraft, with a maximum speed of 123 miles per hour. It was capable of carrying 240 pounds of bombs and had a forward-firing Vickers ·303 machine-gun and a movable Lewis gun in the observer's cockpit. The de Havilland DH 9A, also known as the 'Ninak' (from the designation 'nine-A'), was a single-engined bomber and reconnaissance biplane powered by a 400 hp Liberty engine. In contrast with its predecessor, the DH 9, the DH 9A had an enviable reputation for reliability. The aircraft had a maximum speed of 123 miles per hour and could carry up to 740 pounds of bombs on under-wing and fuselage racks. It also had one Vickers gun facing forward and a Lewis gun mounted aft.

[22] This included a warning that long-delay action bombs would be used (set to explode at uncertain intervals), and that it was advisable to remove woman and children from tribal villages should operations commence.

[23] Ellington, *The London Gazette*, 7596.

[24] Bowyer, C; *RAF Operations, 1918-38* (London: Kimber., 1988), p172.

[25] 'The Air Campaign in Waziristan', *The Times*, 21 November 1925.

[26] Roe, *Waging War in Waziristan*, p37.

[27] After a number of experiments, the best bomb-load for the purpose on the DH 9A was found to be eight 20 lb bombs under each wing and two 112 lb bombs under the centre section. The 20 lb bombs were used for harassing action generally, and the 112 lb bombs against any major targets observed.

[28] Blockade action was frequently extended to include 'wireless telegraphy' patrols, which signalled back news of any important activity to reinforcing flights standing by at ten minutes notice to move.

[29] Ellington, *The London Gazette*, 7597.

[30] *Ibid*.

[31] Wylly, H C; *The Green Howards in The Great War* (London: Butler and Tannes Ltd, 1926), p26.

[32] Bowyer, *RAF Operations, 1918-38*, p171.

[33] *Ibid*.

[34] This was a relatively unusual occurrence, but it was far from unique. Frank Baines recalls a more common outcome: 'And then there was the story of the Hindu *baniya* who was caught outside Mirali …. He had the skin from the soles of his feet slit off,

and, having been deprived of his sandals, was sent back sixteen miles into camp where he arrived after two days, covered in flies, having crawled every inch of the way, in a temperature of 105° in the shade, on his hands and knees and his belly.' Baines, F; *Officer Boy* (London: Eyre & Spottiswoode, 1971), p145.

[35] Ellington, *The London Gazette*, 7598.

[36] One flight from No 20(AC) Sqn was sent to Tank on 18 March to reinforce No 5(AC) Sqn.

[37] 'Two RAF Officers Killed', *The Times*, 24 March 1925.

[38] The RAF made it a principle 'never to relax pressure' against a wayward section just because they had hostages in tribal territory. Slessor, J; *The Central Blue: Recollections and Reflections* (London: Cassell, 1956), p67.

[39] Bowyer, *RAF Operations, 1918-38*, p172.

[40] The international border, marked along its length by infrequent white stone markers, was inviolate to government troops or aircraft, except in an emergency.

[41] The redistribution was as follows: Operational Headquarters – Tank; 1 Flight – No 31(AC) Sqn – Bristol Fighter (for night flying) – Tank; 1 Flight – No 5(AC) Sqn – Bristol Fighter – Miramshah; 1 Flight – No 20(AC) Sqn – Bristol Fighter – Miramshah; 2 Flights – No 27(B) Squadron – DH 9A – Miramshah; 2 Flights – No 60(B) Squadron – DH 9A – Miramshah; Searchlight Party – Sorarogha; and Searchlight Party – Khirgi.

[42] Bowyer, *RAF Operations, 1918-38*, p175.

[43] Ellington, *The London Gazette*, 7598.

[44] *Ibid*., 7599.

[45] *Ibid*.

[46] The tribesmen regarded the aeroplane as an impersonal agent of government. It is worthy of note that throughout the campaign the attitude of the *jirgas* was relatively friendly, and for officers of the RAF the Mahsuds showed a marked respect based on admiration for the work they conducted.

[47] 'Pacification of Waziristan', *The Times*, 4 May 1925.

[48] Air Historical Branch; Principles to be adopted in flying on the frontier, Despatch from the Government of India (Foreign and Political Department), (No 11 of 1925), to the Secretary of State for India, 15 October 1925, p1.

[49] 'Sharp Fight with Mahsuds, *The Times*, 23 December 1922.

[50] Slessor, *The Central Blue*, p54.

[51] 'The Looker-On,' "The North-West Frontier in the Thirties – I," in *The Army Quarterly* (January 1969), p253.

[52] Ellington, *The London Gazette*, 7599.

[53] *Official History of Operations on the N.W. Frontier of India, 1920-35* (Manager of Publications, Delhi, 1945), p34.

[54] Baker performed 69 hours of war flying, including 35 bombing raids; Cumming undertook 72 hours of war flying, including 41 bombing raids; and Pyne conducted 9 night-time raids.

[55] In July 1931 Pink was promoted to Air Commodore but was taken ill shortly after and eventually died of cancer on 7 March 1932.

[56] Bowyer, *RAF Operations, 1918-38*, p178; Torpy, G; 'Counter-Insurgency: Echoes

from the Past' in *Journal of The Royal United Services Institute*, Vol 152, No 5 (October 2007), p20.

[57] The British Government awarded a campaign medal, or a 'clasp' to an existing medal, for the following campaigns: Waziristan, 1894-95; Chitral, 1895; Malakand, 1897; Samana, 1897; Tirah, 1897-98; Waziristan, 1901-02, Mohmand, 1908; Third Afghan War, 1919; Mahsud, 1919-20; Waziristan, 1919-21; Waziristan, 1921-24; Waziristan, 1925; North-West Frontier, 1930-31; Mohmand, 1933; North-West Frontier, 1935; Waziristan, 1936 and; Waziristan, 1937-39. The Waziristan campaign of 1925 was the only one to be conducted solely by the RAF, without army participation.

[58] Except in the morning and evening, atmospheric turbulence made accurate bombing problematic. The official report notes: 'MIRAMSHAH is 3,000 feet high and is surrounded by hills. It is liable to very sudden and severe storms, which, when accompanied by hail, made flying both difficult and dangerous. These storms usually came up about 12 noon and lasted until 3 pm. The aerodrome was rendered unserviceable for a long or short period after such storms according to their intensity and endurance. TANK was not affected by these storms, but was very much hotter than MIRAMSHAH, recording shade temperatures over 100 degrees during part of March and April. Operations were interfered with on 6 occasions by rain and hail storms. Atmospherics interfered considerably with the W/T communications between MIRAMSHAH and TANK.' E. Ellington, *The London Gazette*, supplement, 17 November 1925, 7597.

[59] *Ibid*, 7600; Philip Towle recalls: 'One officer who arrived in India about this time found that tyres, inner tubes, shock absorbers and other essential spares were all in short supply. He also noted with indignation someone from another squadron trying to steal wheels from one of his aircraft.' Towle, P A; *Pilots and Rebels: The Use of Aircraft in Unconventional Warfare, 1918-1988* (London: Brassey's Defense Publishers, 1989), p40.

[60] Captain J B Glubb notes that '…. like all mechanical devices, aeroplanes require a certain amount of time for overhaul or repair. Should the minimum time necessary for such attention not be allocated to the machine, their efficiency very rapidly decreases.' Glubb, J B; 'Air and Ground Forces in Punitive Expeditions' in *Journal of the Royal United Service Institution*, Vol. LXXI (1926), p779.

[61] *Ibid*.

[62] Ellington, *The London Gazette*, 7601.

[63] *Ibid*.

[64] *Ibid*. However, breaks in operations also allowed the squadrons to conduct necessary aircraft maintenance, complete a multitude of routine – but important – administrative tasks and bring their intelligence up-to-date.

[65] Slessor, *The Central Blue*, p66.

[66] Ellington, *The London Gazette*, 7601.

[67] 'Pacification of Waziristan'; *The Times*, 4 May 1925.

[68] Slessor, *The Central Blue,* p54.

[69] Towle, *Pilots and Rebels*, pp40-43.

[70] Ellington, *The London Gazette*, 7600.

TRAFFORD LEIGH-MALLORY – COMMANDER OF CONTROVERSY

Gp Capt Andrew Thompson

Magdalene College produced two of the most prominent airmen of the Second World War, Arthur Tedder and Trafford Leigh-Mallory. However, whilst the former rose to be one of the best respected leaders of his generation, retiring in glory and ending his days as Chancellor of the University[1]*, the latter remains one of the more controversial wartime leaders. It was in his role as one of Air Chief Marshal Dowding's principal commanders in the Battle of Britain that Leigh-Mallory first came to real prominence and some notoriety, and his subsequent wartime career, in Fighter Command and as Allied Air Commander for OVERLORD, the invasion of Europe, did little to ameliorate his ambivalent reputation. And, having had the misfortune of being killed in 1944, he was never able to put forward a case in his own defence. The younger brother of the noted mountaineer George Mallory, it was perhaps ironic that he should meet his death in an air crash in the French Alps where his brother had honed his climbing skills*.

Trafford Leigh-Mallory was the son of a clergyman (his father had adopted the double barrelled surname in 1914, and Trafford (though not George) followed suite. He came up to Magdalene to read History in 1911, but after a poor examination showing in 1913, he switched to Law and graduated in 1914. Whilst at Magdalene he was a member of the Kingsley Club (like his brother and Arthur Tedder) and also was President of the Debating Society. On graduation, Leigh-Mallory intended to read for the Bar, but the Great War intervened and he joined a Territorial battalion of the Kings Liverpool Regiment as a private. He was soon commissioned and transferred to the Lancashire Fusiliers, though officer training had kept him in England when his battalion embarked for France. However, he went to the front with the South Lancashire Regiment in the spring of 1915, and was wounded during the Second Battle of Ypres.

After recovering from his wounds, Leigh-Mallory joined the Royal

[1] See Journal 50, pp74-86 for Gp Capt Thompson's (unfortunately accredited as Thomas) appreciation of Tedder.

Left - 2/Lt Leigh-Mallory of the Lancashire Fusiliers in 1915 and, right – Maj Leigh-Mallory as OC 8 Sqn in 1918. (RAF Museum)

Flying Corps in January 1916 and, after pilot training, he was posted to 7 Squadron where he flew on bombing, reconnaissance and photographic operations during the Battle of the Somme. He was then transferred to 5 Squadron before assuming command in November 1917 of 8 Squadron, involved primarily in the Army cooperation role. He was noted for his energy and efficiency as a commander and was mentioned in dispatches and awarded the Distinguished Service Order and Bar.

After the war, Leigh-Mallory had initially thought of re-entering

the legal profession, but then decided to stay in the recently created Royal Air Force. He progressed rapidly, passing through the RAF Staff College and commanding the School of Army Cooperation before eventually being posted to the Army Staff College as an instructor. He became a leading authority on Army cooperation and, in 1930, lectured at the Royal United Services Institute on air cooperation with mechanised forces. Thereafter his career followed the pattern of a rising star. He attended the Imperial Defence College, the most senior of the staff colleges, before commanding No 2 Flying Training School. He was posted to Iraq as a staff officer in 1935 and was present during the *coup d'état* of 1936, before returning to England in December 1937, to become the commander of 12 Group, Fighter Command, an appointment he held until the end of the Battle of Britain. He then transferred to 11 Group, before taking over command of Fighter Command itself in 1942. In August 1943, Leigh-Mallory was appointed Commander-in-Chief of the Allied Expeditionary Air Forces for the Normandy invasion. Finally, he was selected as the Air Officer Commanding in Chief for South East Asia Command and it was while *en route* in November 1944 to take up this appointment that his aircraft crashed in the Alps, killing all on board, including his wife. He was the most senior RAF officer to die on active service in World War Two.

One might have thought that such progress through the higher echelons of the RAF (he was promoted Air Chief Marshal in January 1944) and allied command appointments was a testament to a most successful career, yet Leigh-Mallory never gained the level of respect that was accorded to other major wartime leaders. Most references to him in the numerous books covering the air war are at best lukewarm over his performance, with many levelling serious criticisms at his record. The one major attempt to rescue his reputation, a biography by his great nephew,[2] was reviewed for the *Magdalene College Magazine* in 1993 by Ronald Hyam (an eminent historian and Fellow of the College), who concluded that the book did not appear likely to succeed in its aim. There were a number of causes for his unflattering reputation: his conduct in the Battle of Britain and his alleged part in

[2] Dunn, Bill Newton; *Big Wing* (Shrewsbury; Airlife; 1992).

the removal of Dowding and Park after the battle; his handling of fighter operations in 1941-43; and his role as CinC Allied Air Forces for OVERLORD. But it was undoubtedly his behaviour during and directly after the Battle of Britain that did most to damage his standing, both professional and personal: his tactical acumen came in for much criticism and he gained a reputation as a political schemer.

Sir Hugh Dowding, the CinC of Fighter Command since 1936, had by 1940 put in place what would now be called an 'integrated air defence system', marrying early warning (radar) with effective command and control arrangements, which allowed the modern Spitfire and Hurricane fighters to be used efficiently. Under the Dowding System, the UK was divided in to four defensive regions. No 10 Group covered the South West and southern Wales, 11 Group the South East, London and the southern portion of East Anglia, 12 Group the Midlands as far north as Manchester and 13 Group the North and Scotland. The Groups in turn were subdivided into Sectors, each with their own allotted bases and squadrons. In essence, the system worked by collecting and filtering the raw tactical information (mainly provided by radar) at Fighter Command HQ and then cascading the data to the Group HQs, which in turn tasked the Sector stations and fighter squadrons to intercept the raiders. The overriding concept was command and control, exercised by the Controllers based in the Operations Rooms at Command, Group and Sector level. Fighter Command HQ would determine the overall strategic direction of the battle, while the Group commanders would be given the detailed data needed for the conduct of their own operations, with the Sectors responsible for allocating aircraft to meet the incoming raids. The system was both flexible and efficient, enabling fighters to be committed only when needed, without recourse to wasteful standing patrols.

The air operations of 1939 and early 1940 had taught both the *Luftwaffe* and the RAF that unescorted daylight bombing raids were not possible in the face of determined fighter opposition and the limited range of the *Luftwaffe's* principal fighter, the Me 109, even when operating from the newly-captured French bases, meant that escorted raids could not reach much further north than London. Given these geographical and tactical realities, it was clear that 11 Group, commanded by the New Zealander Keith Park, would bear the brunt

of the battle, with Leigh-Mallory's 12 Group cast in primarily a supporting role. For a very ambitious officer like Leigh-Mallory, this was a cause of great disappointment and some resentment, especially as Park was junior to him in the Air Force List. Moreover, he soon became vociferously critical of the tactics adopted both by Dowding and Park.

The Battle of Britain marked a turning point in warfare. It was the first time that air action would be of strategic rather than purely tactical significance. After the fall of France, Germany needed to knock Britain out of the war to concentrate forces for the coming campaign in Russia. If persuasion or intimidation failed to convince the British to sue for peace, an invasion of Britain would be required. In such an eventuality, the destruction of the RAF was the essential precursor to invasion, to establish the air superiority that would allow the *Luftwaffe* free range over the invasion areas and beyond, and which would prevent the Royal Navy from opposing any landings effectively. But no one had fought a strategic air war before, so there was no blueprint for the attackers or defenders to follow. However, Dowding had been considering the coming battle for some years and though his task had been made immeasurably harder by the *Luftwaffe* operating from France, Denmark and Norway, rather than just from Germany, he knew the sort of battle he intended to fight. And so did Park. Dowding knew that the *Luftwaffe* would need to establish effective air superiority quickly, because once autumn set in, the reduced daylight hours and autumnal weather (especially difficult sea states in the Channel) would effectively close the window for invasion by mid to late September 1940. He therefore needed to keep the RAF in being until the threat had receded and then use the winter months to rebuild before a resumption of major air operations in spring 1941. This strategy argued for the careful husbanding of resources, particularly the stock of trained pilots, and the avoidance of unnecessary combat; in early July, he instructed his Group commanders to operate accordingly. He required them to exercise 'pretty good control' over their squadrons, to issue precise orders on where and what to attack; at all costs a Great War style aerial 'free for all' was to be avoided. In 11 Group, individual squadrons would generally be tasked to intercept incoming raids, with further squadrons committed serially, to keep raiders under sustained harassing attack.

Enemy losses might not be maximized, but the RAF would be able to mount a continuing defence; moreover, such tactics greatly lessened the risk that large numbers of RAF fighters would be caught on the ground whilst rearming and refuelling. Squadrons from the other Groups were expected to play primarily a supporting role, for example, helping to protect the 11 Group airfields, and generally acting as a reserve pool for 11 Group, from which relatively fresh squadrons could be called on to replace units worn down by the intense fighting expected over south-east England.

Park understood and agreed this approach, but Leigh-Mallory did not. He argued that what mattered was that German aircraft should be shot down in the greatest numbers possible, irrespective of the damage that the bombers might be able to inflict before interception. He also wanted greater operational freedom for his own forces with more emphasis on allowing 'the chap in the air' to make the tactical decisions rather than relying on the Controllers to determine where interceptions should take place. He thus was challenging the very essence of the Dowding System of close directed control allied to economy of force.

There was, of course, a perfectly legitimate argument to be had about the tactics, given that there were no precedents to call on as air fighting on this scale was a new phenomenon, but it was the manner in which it was played out that caused great rancour both at the time and during subsequent analyses of the Battle. Leigh-Mallory's role in the debate was instructive. He was not by experience a fighter pilot; Johnnie Johnson, the RAF's top-scorer in WW II who served as a 12 Group pilot in the Battle, remarked that Leigh-Mallory 'did not pretend to know about fighter tactics', yet this lack of knowledge did not seem to deter him from advancing forceful opinions on the subject. Moreover, in the spring of 1940, he had told Park that 'he would move heaven and earth to get Dowding sacked'. He had already earned Dowding and Park's ire for the perceived failure of his squadrons to play a supporting role in protecting the 11 Group airfields whilst its squadrons were engaged (in contrast to the co-operation shown by 10 Group). He now sided with an element in the Air Ministry, led by the Deputy Chief of the Air Staff (DCAS), Air Vice-Marshal Sholto Douglas, which was advocating a more aggressive policy. Douglas and his fellow partisans of the 'offensive

defence' approach argued that it was better to 'shoot down 50 of the enemy bombers after they have reached their objective, rather than shoot down only 10 before they do so'. However, to achieve high kill rates, it would be necessary for the defending squadrons to be grouped together, with 3, 4 or even 5 squadrons operating as one unit – the so called 'Big Wing'.

This was the very antithesis of the Dowding/Park doctrine, which paid little regard to the 'scoreboard' attitude to tactics. Their concept was essentially for an attritional Fabian battle (though later, as enemy penetrations went deeper, they were able to introduce 'paired' squadron intercepts) In contrast, the 'Big Wing' was in effect an argument for an aerial Trafalgar; a decisive engagement that would change the air war at a stroke. With no personal experience to draw on, Leigh-Mallory was swayed by the arguments of others to bolster his critique of the Dowding System; in particular, he was greatly influenced by of one of his more ebullient squadron commanders, the legless ace Douglas Bader. Already a legend in the RAF, Bader had many outstanding qualities: great personal bravery, determination and a burning desire to get to grips with enemy. However, he was no great tactical thinker – he just wanted to shoot down Germans, without 'interference' from the Controllers, and he chafed at the limited opportunities afforded by 12 Group's secondary role. Bader's squadron adjutant was an MP, Peter MacDonald, and he reported the arguments of the Big Wing advocates, particularly Leigh-Mallory, to the Under-Secretary of State for Air, Harold Balfour, who in turn raised them with Churchill. Dowding had never been a favourite of Churchill – he was too cool and analytical to appeal to Churchill's warrior spirit – and he had effectively thwarted Churchill's attempts to deploy more RAF fighters to France in May and June 1940. It was perhaps not surprising that Leigh-Mallory's ideas began to gain traction in high places.

For Dowding and Park, the major problem with the Big Wing was time – or the lack of it. Assembling these large formations took considerably longer than scrambling single squadrons, so that the raiders might well have hit their targets before they could be engaged. And as these targets included Park's airfields, it was a contentious tactic. However, without any serious consideration of the implications, Leigh-Mallory sanctioned the *ad hoc* formation of a Big Wing in

12 Group (led by Bader) and much play was later made of its claimed 'successes', though subsequent analysis showed that the Wing habitually over-claimed excessively even by the standards of the time (not surprisingly given the chaos of large scale aerial engagements). Moreover, to shoot down large numbers of the enemy, the attackers first had to be intercepted but, according to one historian, 12 Group Big Wings only succeeded in engaging the enemy on seven occasions out of 32 attempts. And as far as Park was concerned, time lost in forming up the Big Wing left his bases open to attack when he had every right to expect that 12 Group would be defending them, and several were badly damaged when 12 Group squadrons arrived too late.

However, the real facts were not fully known at the time, and the pressure exerted by the various siren voices briefing against Dowding and Park eventually had their effect, culminating in a meeting at the Air Ministry on 17 October 1940, which though ostensibly called to discuss 'Major Day Tactics in the Fighter Force', soon became seen as an indictment of the two commanders. Chaired by Sholto Douglas, the meeting was attended by the Group Commanders, members of the Air Staff – and Sqn Ldr Bader. His presence alone has been seen as proof of Leigh-Mallory's bad faith – no other operational pilots were present. As a recent history of the Battle has observed, Bader seemed to be playing 'Iago to Leigh-Mallory's Othello.' The meeting itself came to no startling conclusions on the tactical issues, acknowledging the different priorities and pressures of the Groups, but it had malign effects. Firstly, it strengthened the hands of Sholto Douglas and Leigh-Mallory for the future direction of fighter tactics and secondly, it was a significant factor in the replacement of Dowding and Park by Sholto Douglas and Leigh-Mallory as the commanders of Fighter Command and 11 Group respectively later in 1940. The prosecutors had replaced the prosecuted.

Posterity has largely vindicated the handling of the Battle by Dowding and Park and the latter has been acclaimed as the 'Defender of London' both by historians and eminent *Luftwaffe* alumni. Moreover, a staff exercise 'replay' of actual attacks during the Battle, conducted by Leigh-Mallory in 1941 using Big Wing tactics, showed conclusively that for 11 Group at least, such tactics would have resulted in the destruction of the fighter defences within a few days.

The handwritten inscription reads: 'To Van – My Deputy in the AEAF, with many thanks for all the support he gave me. Trafford Leigh-Mallory, Air Chief Marshal, 14/9/44.'

Of course, there was to be no replay of the Battle of Britain, for by the summer of 1941, the Germans had turned on Russia, leaving only a relatively few aircraft in Western Europe. The offensive policy subsequently adopted by Sholto Douglas and Leigh-Mallory in 1941 of 'leaning into Europe' did little to provoke a response on the scale that might have eased pressure on the Soviet forces, but it did condemn the RAF fighter wings employed on day sweeps over France to fight under extreme tactical dis-advantage for no real strategic gain. The *Luftwaffe* had more than sufficient radar warning of RAF operations, and, given that the targets that could be attacked were of limited import, could elect whether to engage or not; when they did, they invariably were able to inflict considerably greater losses than they incurred. Moreover, it was arguable whether the growing RAF fighter strength was best used in this way, when other theatres, notably the Mediterranean and North Africa (and later the Far East) were starved of modern aircraft, and the dogged continuation of this approach is perhaps another question mark against Leigh-Mallory's professional judgement. But the RAF had, from its earliest days, espoused the doctrine of the offensive and Leigh-Mallory remained a true believer, both whilst in command of 11 Group and later as CinC of Fighter Command, despite the adverse loss ratios suffered by his squadrons. But the reputation he earned of being a 'hard charger' no doubt helped further his career progression.

His appointment in August 1943 as CinC of the Allied Expeditionary Air Forces (AEAF) for the invasion of Europe, a post for which he actively lobbied, promised to be more successful, at least initially. The AEAF was tasked with the coordination of the air assets deployed to support OVERLORD, though this did not include the full command and control of the strategic air force elements involved.

Here his Army Co-operation background was very relevant and he and Montgomery appeared to work well together, the latter commenting that 'he is the only airman who is out to win the land battle'. His primary aim for the use of the air forces was to seal off the invasion area, to prevent German movement of reinforcements and supplies – the 'Transportation Plan'. He fought hard against the 'Bomber Barons' (Air Chief Marshal Harris of Bomber Command and General Spaatz of the US Army Air Force) for the use of the strategic bomber fleets in these vital operations, and he was right to stand his ground, though it was Eisenhower's Deputy Commander, Air Chief Marshal Tedder who was the key player in brokering the eventual compromise over their use. Indeed, throughout the Overlord planning phase and the campaign itself, it was clear that Eisenhower (and the Americans generally) much preferred to work with Tedder who they liked and respected, than with Leigh-Mallory, who did not enjoy such warm relations with his US colleagues. In particular, General Spaatz had little time for Leigh-Mallory, whom he found overbearing and brusque. Moreover, in many ways, with a very senior and greatly respected airman as the Deputy Commander, and with the strategic bomber commanders semi-autonomous, the role of the CinC AEAF was inevitably fraught with great difficulty. A senior US officer on Eisenhower's staff, acknowledging the real contradictions inherent in the AEAF structure, noted in his diary that 'the air side stank beyond belief' and it is hard to disagree.

In truth, HQAEAF was an unnecessary formation that was wholly unwanted by the most senior British and US air commanders, and it would have taken a figure of much greater stature than Leigh-Mallory to have had a chance of making it work. He had been handed a poisoned chalice and he knew it. However, an inherently difficult situation was exacerbated by Leigh-Mallory himself. He managed at the higher command level to incur and inflame the hostility of the bomber barons and many of the Americans (one US commander, General Quesada, noted that 'nobody wants to be under Leigh-Mallory') whilst at the same time – and possibly because of his difficulties with Harris and Spaatz – treading on the toes of his very able and experienced subordinate tactical air commanders. Furthermore, Montgomery's initial enthusiasm for Leigh-Mallory (probably driven partly by Monty's correct perception that Tedder was

Leigh-Mallory addressing P-47 pilots of the USAAF's 373rd FG at A29/St James in Aug/Sep 44.

no fan of his) soon began to pall and, unable to get the air support he desired, especially for his operations around Caen, he vented his frustrations on Leigh-Mallory, calling him 'gutless'. Unfortunately, the allied armies had become very reliant – some thought over-reliant – on air support, especially the use of the 'heavies' and became reluctant to advance without massive preparatory air attacks. However, these could be counter-productive, as mass raids by heavy bombers often left the advancing forces confronted by impassable terrain well-suited to defence. Tedder believed that Leigh-Mallory was 'insufficiently firm' in his dealings with the Army, failing properly to explain the limitations of airpower in direct support of the land battle. Tedder strove to limit army support to medium bombers and especially fighter-bombers, and this inevitably led to further tension with Leigh-Mallory. Nevertheless, it is difficult not to have some sympathy for his predicament; he was adrift in politico-strategic currents, through which he was ill-equipped to navigate. Many of his colleagues had learnt their trade in North Africa and the

Mediterranean, or in the rarefied reaches of the strategic bombing campaign; he was an outsider and he could not adapt to the situation; as Professor Zuckerman observed, 'it was simply not his world'. As Tedder became increasingly the *de facto* air commander, Leigh-Mallory himself recognised that his own role had become largely redundant and was probably relieved when, in mid-October 1944, AEAF was dissolved and he prepared for his ill-fated journey to his new command in South-East Asia.

History has tended to judge Leigh-Mallory in a somewhat unflattering light. Most commentators, historians and participants alike, have agreed that he did deserve his reputation as a 'political' airman. Part of the reason for this unsympathetic verdict probably lay in his own personality. In his review of *Big Wing* Ronald Hyam cited A C Benson's diary (Benson was a Fellow at Magdalene when Leigh-Mallory was a student) in which he recorded that he thought Leigh-Mallory was essentially 'nice', but also saw contradictory character traits: he could be 'fluent and self-confident' as well as 'shallow, pretentious, self-assured.' Benson would not be the last to comment on these characteristics. Frequently described as 'remote and pompous' he had difficulties in relating easily to the men under his command, unlike for example, Keith Park, who often visited his units flying his own personal Hurricane, or Tedder who had an easy way with the operational crews and would often visit forward bases to seek the views of the men at the sharp end. Whilst Leigh-Mallory was often well-liked by his immediate staff officers and unit commanders, he could seem stiff and awkward with the junior operational pilots. Portly, with slicked hair and a toothbrush moustache, he had the look of a provincial bank manager or the captain of the local golf club. And he was not a fighter pilot – a distinct handicap during his lengthy period in Fighter Command. An interesting commentary came from the enemy camp. A German appraisal of allied commanders in 1944 referred to him as 'a pedantic worker' who afforded his subordinates little room for manoeuvre; accordingly, he was nicknamed 'The Flying Sergeant'. But he did have some supporters, apart from Bader and Sholto Douglas who continued to fight his corner after the war, though their backing was often on a personal rather than professional level; for example, Johnnie Johnson thought Leigh-Mallory a 'good' man and a 'fatherly' figure to the wing leaders who led the sweeps

over Europe from 1941 onwards; however, Johnson was firmly in the Dowding/Park camp on the Big Wing controversy. Moreover, some of the obituaries and assessments written after his untimely death, while fulsomely noting his contributions to the Allied cause, have more than a hint of *de mortuis nihil nisi bonum* about them.

Given his somewhat patchy record, it is tempting to speculate on how Leigh-Mallory managed to rise to such heights. Partly his success can be attributed to the poor judgement of his superiors, who were overly impressed by his energy and offensive-minded spirit – Churchill for one was always attracted to a 'fighter' – that blinded them to his evident shortcomings as a senior commander. Moreover, it is probable that his own ambition and self-regard drove him on past the point where a more self-aware character might have realised his limitations. His own brother, shortly before his death in 1924, spoke of him looking forward 'without doubt to success and promotion in the future'. Others have referred to him as 'a man of driving egoism'. He also had honed the knack of being able to get on better with his superiors than his colleagues or subordinates. However, he rarely showed any evidence of the depth of intellect and the inspirational force of personality needed for very high command in war; the contrast with Tedder could not have been starker. It is hard to resist the conclusion that Leigh-Mallory was not in the same league as the best of his contemporaries; indeed, some have seen him as an 'ambitious intriguer' who owed his elevation at least as much to energetic self promotion as to any real ability. He was certainly no Tedder or Dowding

Of course, Leigh-Mallory never got the chance to evaluate his own performance and record, by way of a memoir, like those published by his contemporaries after the war. Perhaps he could have explained his roles in the controversies in Fighter Command and the AEAF that would have shown him in a better light. That opportunity was denied when on 14 November 1944 his aircraft hit a mountain above the village of Le Rivier d'Allemont in the French Alps. So perhaps the last word should go to Sir Trafford Leigh-Mallory himself. During the lowest point of his difficulties as CinC AEAF, he had been on the point of resigning, but refrained from doing so 'because he hoped his duty lay in doing his utmost to make the system work'. There are worse epitaphs.

A POLISH EPIC

Dr J T Cliffe

Flight Lieutenant Boleslaw (Boles) Klecha was born at Warzno in Poland and now lives with his wife in Cheshire. He served in the Royal Air Force/Polish Air Force in Britain from 1940 until December 1948 and, among other things, played a significant part in the bombing campaign in North-West Europe. I have known him for many years and have been fascinated by the stories of his wartime experiences which began with the German invasion of Poland The following account is based on discussions I have had with him and on a detailed study of his log book and other material which he has lent me. This is a story of one man's courage and determination which also exemplifies the indomitable spirit of the many Polish airmen who fought by our side in the Second World War.

On 1 September 1939 Hitler invaded Poland and, in effect, precipitated the Second World War. At that time the Polish Air Force had some 900 front-line aircraft but was heavily outnumbered. A key feature of the German strategy was an all-out assault on the military airfields which led to many Polish aircraft being destroyed on the ground. When hostilities began Boles was at Deblin (to the south-east of Warsaw) where he had recently completed the Air Force Officer Cadets Course and qualified as a pilot. Deblin was subjected to the full fury of the *Blitzkrieg* and sustained heavy damage. Nine training aircraft survived the onslaught and these were hastily formed into a squadron. Since they were unarmed, their operational value was strictly limited but Boles was able to undertake four reconnaissance missions over the German lines. During this baptism of fire he had little opportunity to celebrate his 22nd birthday.

When Russian troops moved into Poland on 17 September it was clear that the situation was hopeless and the makeshift squadron was ordered to seek refuge in Romania which was still technically neutral. With defeat now inevitable, thousands of Polish airmen crossed into Romania and Hungary, generally with the aim of continuing the war on Germany's western flank. At Bucharest the Deblin party were in danger of being interned but they exchanged their uniforms for civilian clothes and were issued with travel documents by the Polish

Flt Lt Boleslaw 'Bolas' Klecha.

embassy. One night they boarded a train which took them to the Black Sea port of Balchik. After a long boat journey they disembarked at Beirut in the Lebanon and from there they travelled on a French ship, the *Strasbourg,* to Marseille.

On 30 October Boles and his comrades arrived at the military airfield at Salon, near Marseille, to join a considerable number of Polish airmen who were already there. Some of these men joined the French Air Force which before the war had enjoyed close relations with the Polish Air Force. Boles was offered a commission but declined. In the autumn of 1939 it must have seemed inconceivable that France. with its powerful army. would suddenly collapse within a matter of months. Nevertheless Boles considered that his best course was to press on to England. Having come to this conclusion he managed to secure a passage on a British ship which conveyed him from Cannes to Chatham.

On 27 January 1940 Boles enlisted in the Royal Air Force Volunteer Reserve at RAF Eastchurch which was a reception and training centre for Polish airmen. Most of these recruits had little or no grasp of English and his initial training included language tuition as well as familiarisation with RAF methods and techniques.

The Polish Air Force in Britain was under the general operational command of the Royal Air Force but enjoyed a considerable amount of autonomy. Its aircrew and ground staff were virtually all Polish and it had its own bomber, fighter and maritime squadrons together with maintenance and training units. One of its many key functions was to carry on a bombing campaign against Germany's industrial and coastal towns and strategic ports in France and the Netherlands. In the course of the war there was a continuing flow of recruits from

One of No 300 Sqn's Wellingtons being prepared for a sortie.

occupied Poland and elsewhere and by 1943 it had over 12,000 personnel.

After completing his flying training Boles was posted to No 300 (Polish) Sqn which was based at Hemswell in Lincolnshire. The squadron had been formed as a light bomber unit in July 1940 and re-equipped with the twin-engined Wellington in the following October.

When Boles joined No 300 Sqn on 29 June 1941 he was very quickly assigned the role of captain or senior pilot. On his first operational sortie he was involved in an attack on Boulogne where the Germans were making preparations for the invasion of England (Operation 'Sea Lion'). During the course of July he took part in raids on Bremen (twice), Rotterdam, Cologne (three times), Bielefeld, Frankfurt, Mannheim and Hamburg.

On 25 July 1941 Boles took part in a highly successful raid on the port of Hamburg but it was very nearly his last mission. During this operation one of the Wellington's engines had apparently been hit by *Flak* and it was starting to lose power. In these circumstances two stark options were rapidly debated – land on enemy soil or try to reach England and run the risk of ending up in the North Sea. With characteristic brio it was decided to take on the challenge which the

latter option presented. As they flew over Holland they encountered heavy anti-aircraft fire. In an attempt to confuse the enemy Boles ordered a flare to be discharged and was pleasantly surprised when the barrage immediately stopped. By the time the Germans realised their mistake the aircraft was well out of range. By a superb feat of airmanship Boles managed to keep the Wellington on course for most of the return leg but as they were approaching the Norfolk coast it finally gave up the struggle. In this desperate situation he succeeded in carrying out a relatively smooth ditching in the sea about ten miles east of Cromer. He and his five-man crew all escaped injury and were eventually picked up from their dinghy by a trawler employed on naval duties. In his log book Boles inserted the briefest of notes: 'Forced landing in the sea'. After two weeks' leave he and his crew were soon back in action over Germany.

On 7 November 1941 Boles participated in a bombing raid on Berlin which was shrouded in thick cloud. The distance covered on this occasion was virtually at the extreme limit of the Wellington's operational range. Other towns which featured in his assignments included Duisburg, Essen, Emden and the French port of Brest.

In March and April 1942 there was a brief interlude when he was attached to Boscombe Down for trials work on the Baltimore. On returning to 300 Squadron he undertook several more missions over Germany. On 30 May he took part in the first 1,000 bomber raid. Cologne was chosen as the target for this new type of bombing offensive and no fewer than 1,130 aircraft were involved. His last operation was undertaken on 19 June 1942 when an attack was mounted on the port of Emden.

In all, Boles flew 34 operational sorties as a bomber pilot. To have completed a full tour of operations was no mean achievement, given the extent and quality of the German air defences and the adverse weather conditions which were often experienced. It is well known that the enemy's night fighters and anti-aircraft batteries were a formidable combination; and, as Boles has stressed, their searchlights were much more powerful than our own. The actual duration of a Wellington sortie called for exceptional powers of concentration and endurance. As the captain of his aircraft Boles was often at the controls for 5, 6 or 7 hours from take-off to landing. Such factors as the state of the weather and the tactics employed could add

considerably to the amount of time spent in the air. On 16 February 1942 when Bremen was targeted the total elapsed time was no less than 8 hours 5 minutes. In contrast, Boles's previous Bremen missions had lasted 6 hours 10 minutes, 6 hours, 5 hours 40 minutes and 5 hours 45 minutes.

Boles speaks with great affection of the Wellington and lays particular stress on its resilience. It was not unusual on returning from a raid to find holes in the fuselage but these hits had never had serious consequences.

After his departure from 300 Squadron Boles was employed for a year on flying training duties, first at Upavon with the Oxford and then at Bramcote and Finningley with the Wellington. In August 1943 he was posted to No 45 (Atlantic Transport) Group at Dorval, near Montreal, in Canada where he remained until the end of 1945. Here he was engaged in the long-range ferrying of aircraft supplied by the United States under the Lend-Lease arrangements which had been approved by Congress in March 1941. In the entries which he made in his log book during this period there are references to such places as Washington, New York, Gander, Reykjavik, Prestwick, Casablanca, Rabat, Cairo, New Delhi and Karachi. The aircraft which he ferried embraced a wide range of types, including the Liberator, Boston, B-25, C-46, C-54 and Dakota. This vital work was not without its hazards. By modern standards the navigation aids were generally rudimentary and there were occasions when Boles had to contend with severe weather conditions such as extremely low temperatures on the North Atlantic route and sandstorms over the Libyan and Egyptian deserts. In the event every aircraft was safely delivered.

Looking back on the war, Boles would have been entitled to feel proud of the contribution which he and his countrymen had made to the Allied cause and he would also have been drawn to marvel at the many twists of fate on the long road from Deblin to Hemswell and Dorval. For his distinguished service he was awarded several Polish decorations: the Silver Cross Virtuti Militari, the Cross for Valour with three bars and the Air Force Medal. His British awards consist of the 1939-1945 Star, the Aircrew Europe Star, the Defence Medal and the War Medal 1939-1945.

THE INVENTION OF THE JET ENGINE

Alec Collins FRAeS FIMechE

Introduction

Sixty years ago, in May 1952, the world's first commercial jet aircraft, the Comet, entered service and so fulfilled the dream of a young RAF Flight Cadet, Frank Whittle, 24 years earlier. Having ushered in the era of mass travel, the jet engine has since gone on to change the lives of almost everyone on the planet.

Most of the literature concerning the invention of the jet engine has been written by authors who, while they may have a sound grasp of technical matters, tend to be less familiar with the complexities of the thermodynamic and aerodynamic factors which are key to an understanding of the potential of the concept of a gas turbine using jet propulsion. This paper is an attempts to interpret Whittle's early thinking for the layman.

The source documents are Whittle's Cranwell thesis of 1928, his patent of 1930 and a paper which he circulated to industry in 1931.

Frank Whittle – his early years

When Frank Whittle left school his aim in life was to join the RAF. This was not surprising as, having been born in 1907 he was at an age when his enquiring mind was thrilled by the advances made in aircraft design during the First World War. After the war he spent many hours in the library at Leamington Spa reading avidly the latest books on aviation, particularly those giving technical explanations of the mechanics of flight. After two unsuccessful attempts to join the RAF he was finally accepted as an apprentice and reported to Cranwell in 1923 at the age of 16. As such he was to be trained as a highly skilled technical tradesman. After two years of the three-year course, however, he was selected, along with just four others, to transfer to the RAF College where he would become a pilot and be commissioned.

At the end of his two-year course in 1928, he was required to submit a thesis on which he had worked during his training. In examining the thesis, which consists of 34 hand-written pages with drawings, I have referred to several significant events which occurred while he was writing it which would have influenced his thoughts on future aircraft design

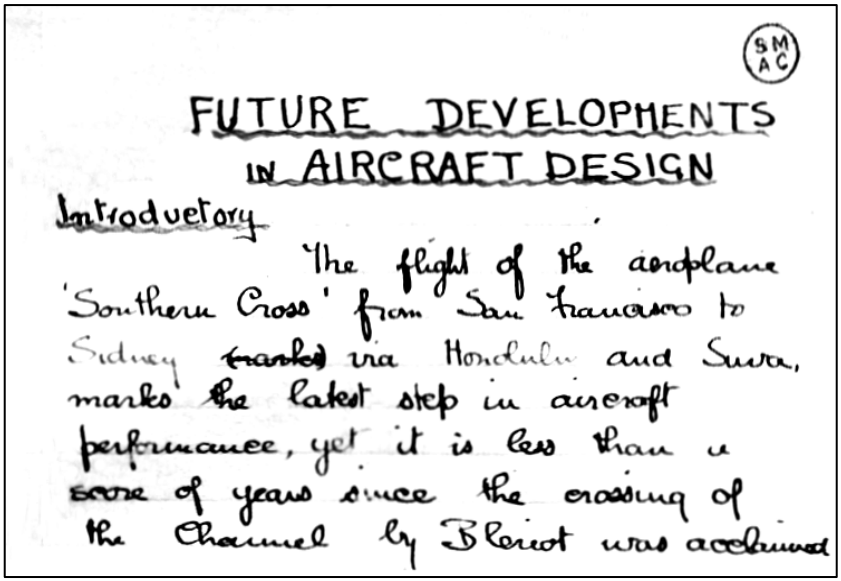

FUTURE DEVELOPMENTS
IN AIRCRAFT DESIGN
Introductory
'The flight of the aeroplane 'Southern Cross' from San Francisco to Sidney ~~marks~~ via Honolulu and Suva, marks the latest step in aircraft performance, yet it is less than a score of years since the crossing of the Channel by Blériot was acclaimed

Fig 1. An extract from Whittle's manuscript thesis.

The Frank Whittle Thesis

The first paragraph in Whittle's thesis (*Fig 1*) was obviously a late addition to his thinking as the flight of the 'Southern Cross', a three-engined Fokker F.VIIb/3m piloted by the Australian Kingsford Smith across the Pacific Ocean from Oakland, California to Brisbane, Australia via Hawaii and Fiji completed its journey on 9 June 1928, only a few days before Whittle would have submitted his paper. The fact that he took the trouble to add this introduction so shortly before the thesis had to be submitted emphasises that he was fascinated by long range flight.

In the introductory chapter of his thesis on the future of aircraft Whittle wryly observes that:

> '. . . it is a hazardous business to forecast the future, especially in these days of discovery, where science may at any moment make revolutionary discoveries.'

It is unlikely that, in his wildest dreams Whittle thought that he would, in the near future be making one of those revolutionary discoveries.

He goes on to list the lines along which aircraft will develop – note range is the first in the list:

'1) Increase of range
2) Increase of speed
3) Increase of reliability
4) Decrease of structural weight
5) Economical flight
6) Increase of ceiling
7) Increase of load carrying capacity
8) Greater ability to withstand the elements

Many of these will be interdependent, for instance a decrease in structural weight will result in increased range etc.'

Methods of Obtaining Lift

Whittle discusses the method of obtaining lift from an aerofoil and gives the equation for it, concluding that 'Aerofoils are now of high efficiency having attained as high an L/D of 21. It doesn't seem likely that a more efficient method of obtaining lift is likely to be evolved' – the wing is here to stay. He then comments on each of the items in his list – below I have only included those which are relevant.

Range

It is perhaps pertinent at this point to draw attention to another significant event that occurred at that time. That was the flight of the Ryan NYP, better known as the 'Spirit of St Louis', from New York to Paris (a distance of 3,600 miles) by Charles Lindberg in May 1927. This feat captured the imagination of the world and certainly would have impressed the 19 year old Whittle and roused his desire to understand what determines the range of an aircraft.

So, Whittle, in considerable detail, independently derives a formula which is now better known as the Breguet range formula:-

$$\textbf{Range} = K.\eta_{th}.\eta_{prop}.L/D.\log(W_1/W_2)$$

Where η_{th} = thermal efficiency of the engine
η_{prop} = propeller efficiency
L/D = aircraft lift/drag ratio
W_1 = aircraft weight at take-off
W_2 = aircraft weight on landing

Whittle points out that $\eta_{th}.\eta_{prop}$ is engine overall propulsive efficiency, **L/D** is aircraft aerodynamic efficiency and to maximise **log W_1/W_2** requires good aircraft structural efficiency.

Increase of Speed

> 'Except for racing purposes it is not likely that increases in speed will be sought at normal altitudes as increase of speed means a lower overall L/D ratio owing to the increase of the proportion of passive drag.'

Whittle is here merely stating that due to the conflicting influences of profile drag or, as he calls it, 'passive drag', which increases with speed and induced drag which decreases with speed, lift/drag ratio (L/D) reaches an optimum at a particular aircraft speed at a given altitude and going beyond that speed at that altitude will merely worsen L/D and hence range. The chart at Fig 2 (*not part of his thesis*) shows how L/D varies with aircraft speed at sea level for a typical aircraft of the day and illustrates the point he was making. Whittle goes on:

> 'I intend to show later that greater speeds will probably be attained by very high altitude flights.'

Here he is stating that the dynamic force term, $1/2\rho V^2$, appears in the equations for both lift and drag so if velocity is increased as air density decreases with altitude to keep $1/2\rho V^2$ constant, then optimum L/D will occur at a higher aircraft speed at altitude and the structural forces on the aircraft will be unchanged; this is commonly referred to as Equivalent Air Speed (EAS). For example, the density of air at 40,000' is roughly a quarter of the sea level value, so the optimum value of L/D occurs at twice the optimum sea level speed. This increase in true air speed at a constant EAS is illustrated in the chart at Fig 3 (*again not part of his thesis*).

Whittle recognises the problems of the pilot at these altitudes by stating:-

> 'Of course at altitudes greater than 30,000ft, or even less, a totally enclosed cockpit into which warmed air is pressure fed would be necessary. Thus it may be seen that if practical difficulties could be overcome an aeroplane which could fly at

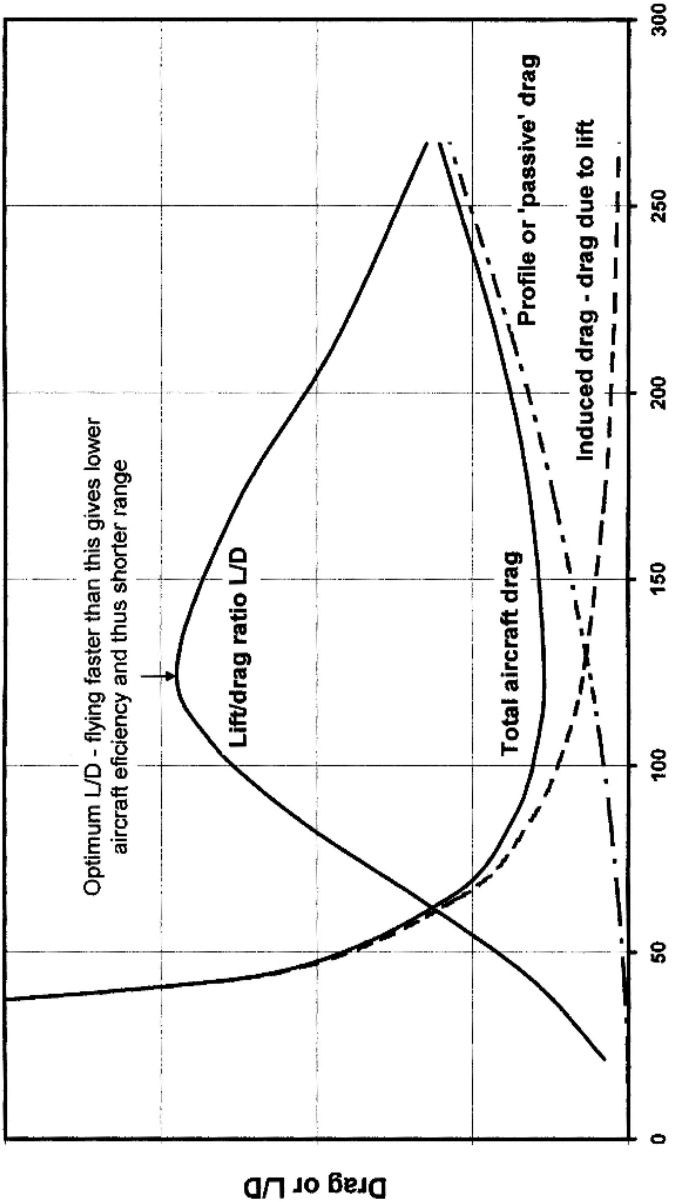


Fig 2. Graph (not included in Whittle's thesis) illustrating the relationship between Lift/Drag ratio and speed.

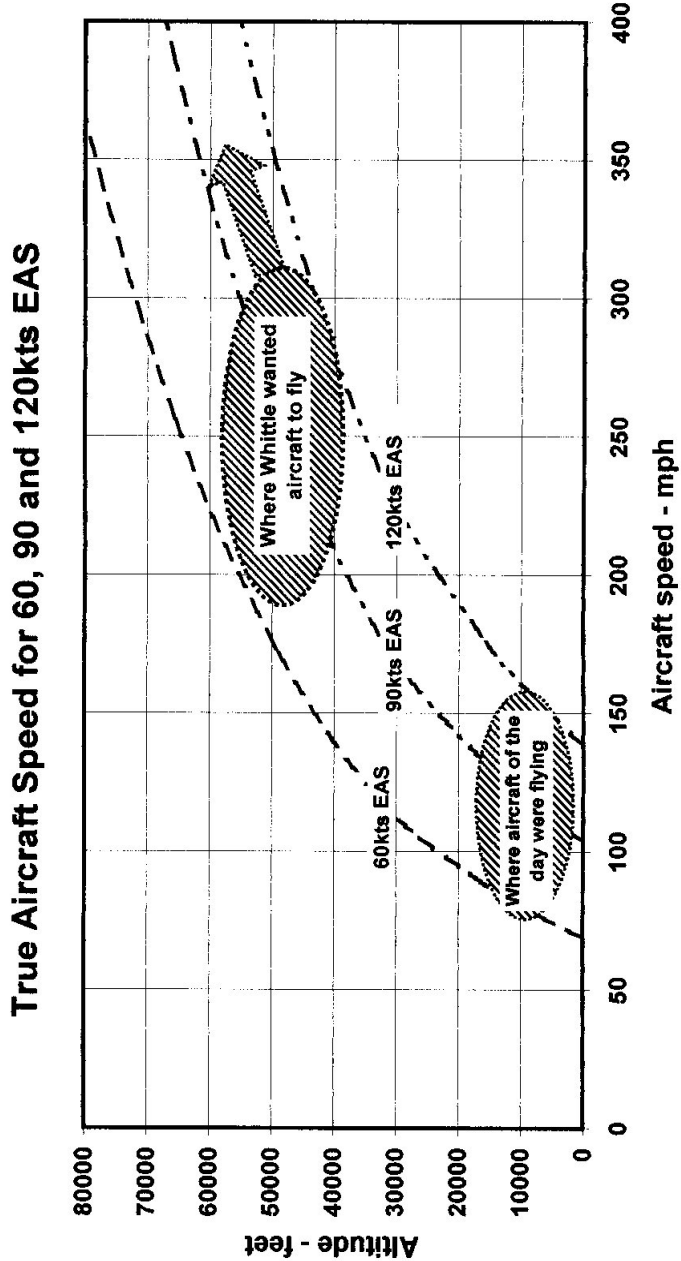


Fig 3. Graph (not included in Whittle's thesis) illustrating the increase in speed that can be gained by flying at greater altitudes.

> 60mph at ground level would be able to fly at 600mph at 120,000'if the horse power was available.'

In writing of speeds of 600mph and altitudes of 120,000' Whittle is really stretching the limits of current practicality but theoretically he is correct and he then acknowledges the problem in achieving high altitude flight in the phrase – 'if the horse power was available'. He discusses the problem of the piston engine which loses power disproportionately with altitude due to friction losses and does not believe supercharging would be effective above 30,000 feet. The chart at Fig 4 (*also not in his thesis*) illustrates the problem he faced.

Power Units

At this point he naturally turns to a discussion of power units. The first paragraph of this section reads as follows:

> 'Before discussing various power units we will examine the 'Rocket Principle'. One has read a lot about cars being propelled by rockets and projected schemes for driving aircraft by rockets and even schemes for leaving this homely planet through the same principle. (*Robert Goddard, the American rocket pioneer had launched his first rocket in 1926.*) It is true that this at present seems to be the only likely means of exerting a thrust in space but I hope to show that for terrestrial purposes the 'rocket principle' is hopelessly inefficient.'

He then goes through an elegant thermodynamic argument, concluding that:

> 'It seems that as the turbine is the most efficient prime mover known that it is possible that it will be developed for aircraft, especially if some means of driving a turbine by petrol could be devised.'

Before describing Whittle's theories on the use of turbines for aircraft propulsion it is important to mention the work of Aurel Stodola a Slovak mathematician, engineer and physicist who in 1903 published, in German, a book on the theory of steam turbines (much of it derived from the work of Charles Parsons the inventor of the steam turbine) and in the second edition (1906) he added chapters on combustion engines (gas turbines); Whittle frequently mentions the

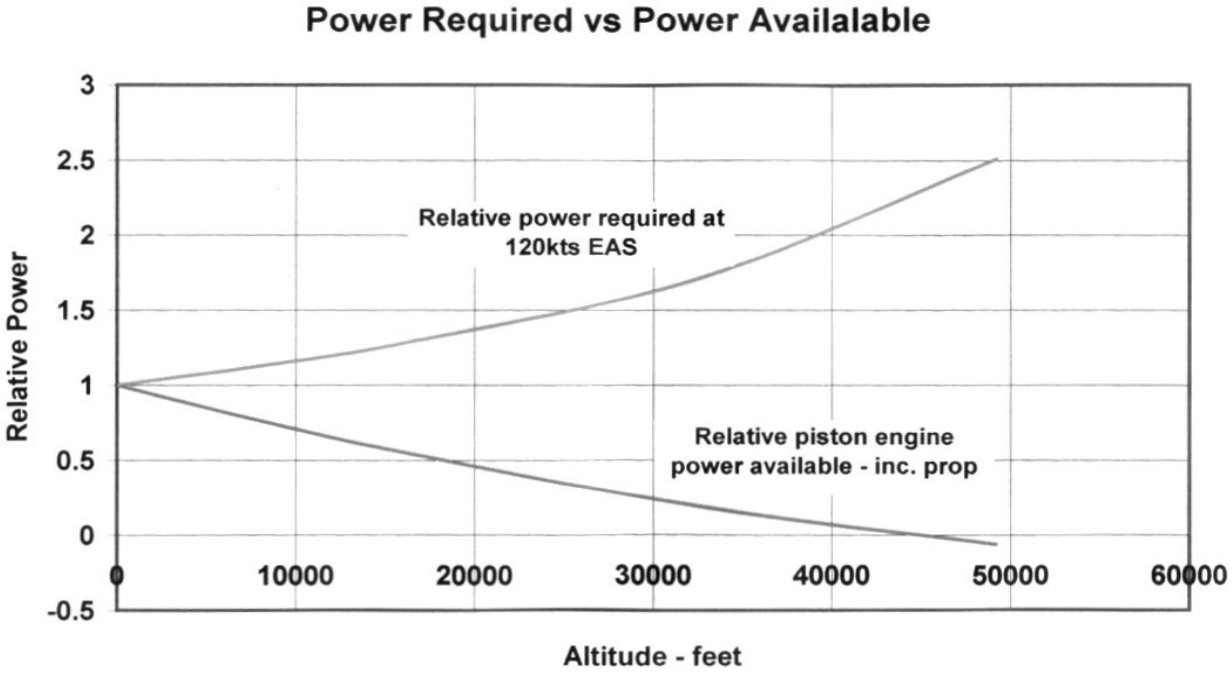


Fig 4. Graph (not included in Whittle's thesis) illustrating the power shortfall at altitude due to the inefficiency of the piston engine.

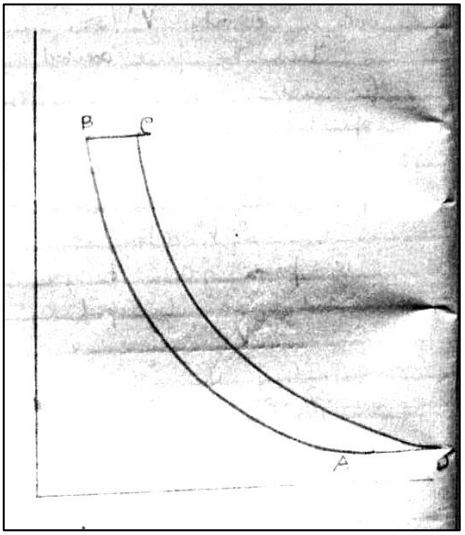


Fig 5. Hand-drawn diagram from Whittle's thesis illustrating the concept of the constant pressure cycle.

work of Stodola

> 'The cycle for a petrol driven turbine is shown (*at Fig 5*). It is a constant pressure cycle. Air is compressed adiabatically (AB) into a chamber where it is heated at constant pressure by burning petrol. It then expands adiabatically through the nozzles (CD) and escaping into the atmosphere cools at constant pressure (DA).'

He then discusses in some detail the various mechanical problems which will be encountered in the design of a gas turbine, including the bursting stress of the turbine rotor for which he gives an equation, and the gas temperatures on the turbine rotor blades:

> 'The maximum temperature limits the power which may be obtained from 1lb of air, but more power could be obtained by heating a large quantity of air. The limits to the quantity of air which could pass through an engine/sec is a question for experiment but I estimate that 10lb/sec at ground level could be achieved.'

Nine years later his first gas turbine, the Whittle Unit (WU) passed 26lb/sec.

At this stage he still sees the gas turbine as a means of providing power at altitudes where the piston engine is inadequate but regards the propeller as 'hopelessly inefficient at high altitudes'. Although he shows a rudimentary diagram of a turbine driving a propeller, one senses that he realises that he has not yet produced the complete

answer to the problem of providing the means to propel an aircraft at the altitudes and speeds which he had called for in the early part of his thesis. His summary concludes:

> '. . . the range of an aircraft depends on its weight and efficiency and that it will only be improved by careful streamlining and better structural design and also a more efficient prime mover. Speed is best attained at great altitudes which in turn can only be done by the development of a more suitable prime mover. The prime mover which will apparently lead to the desirabilities described above is an air (*ie gas*) turbine as this gives back the energy given in supercharging, has a greater efficiency at high altitudes. The most important developments which will take place will follow as a result of the development of a more suitable prime mover, ie an air turbine.'

When reading the above thesis it is easy to forget that it was written by a 20 year-old – indeed much of the work was done when he was still a teenager – and though a lot of what he discusses is relatively commonplace in today's world, the idea of aircraft flying at 40,000 feet, or higher, at speeds in excess of 500mph was completely beyond anything that the leading aircraft and engine designers of the day were thinking. In addition, although he had read avidly anything relating to flight from an early age, he was largely self-educated and completely outside the sophisticated world of the aircraft and engine designers of the day. Yet he had examined the fundamentals of flight and quite independently come to the conclusions detailed above. Another important point to recognise is that, although he was very much an RAF cadet, he was aiming his predictions at aircraft in general – not just military aircraft

The Germination Of A Brilliant Invention.

Following his graduation from Cranwell, Whittle was posted to No 111 Sqn for a year and in September 1929 to the Central Flying School at Wittering to train as an instructor. During this period he continued to wrestle with the problem, eventually realising that exhausting the excess energy from a gas turbine directly as a jet of hot gas to provide propulsion, rather than using that energy to drive a

propeller through an additional turbine and gearbox, would give an engine that was much lighter and more efficient at high speeds; indeed, the faster it flew the more efficient it became. His calculations convinced him that this was exactly the arrangement that he was looking for; like most great, yet simple ideas he wondered why he had not thought of it before.

The Meeting With Griffith

One of Whittle's instructors Fg Off W E P Johnson, was very interested in his proposal and with the help of his Commandant, Group Captain Baldwin, arranged for Whittle to present it to the Air Ministry – first to a technical officer, Mr W L Tweedie and then to one of the most forward thinkers in the Air Ministry at that time, Dr A A Griffith. The meeting took place at Adastral House in London in late 1929; no copy of the paper presented by Whittle to Griffith exists but his patent and a paper which he circulated to various aero-engine makers do.

The meeting with Griffith was very disappointing for Whittle as Griffith was unenthusiastic and pointed out a mistake in his calculations. It was not that Griffith was opposed to the use of a gas turbine, as he himself had proposed its use at the same time as Whittle in 1928 but coupled to a gearbox driving a propeller – the arrangement that Whittle had also looked at but rejected. Why Griffith rejected Whittle's ideas has been the subject of much speculation over the years.

Griffith, although trained as an engineer, was basically a scientist and tended to leave the work of engineering to others. In examining Whittle's proposal it appears he concentrated on only the engine itself and made no attempt to consider the engine/aircraft combination where the synergies of the gas turbine and jet propulsion enabled aircraft to fly at optimum conditions – high and fast. In this Whittle was at least one step, and possibly two ahead of Griffith. Eight years later in 1938, when jet engines were very actively under development in both Britain and Germany, Griffith still had not fully grasped the significance of the proposal as he wrote 'in its present form the jet propulsion system cannot compete with the conventional power plant where economical flight is demanded.'

What is more, it cannot have helped that Whittle, a mere 22 year

old flight lieutenant who was largely self-educated was addressing Griffith, who no doubt had become accustomed to being regarded as one of the world's leading experts on future methods of aircraft propulsion.

The Whittle Patent

Late in 1929 Whittle, with help from W E P Johnson, who had qualified as a patent engineer before joining the RAF, wrote his Patent Application (1521/30) which he submitted on 16 January 1930. He added to it on 16 October and it was accepted on 16 April 1931 (No 347,206). The following extract clearly outlines his intention to enable aircraft to fly high and fast:

> 'The main object of this invention is to provide means whereby the principle of obtaining propulsive force in the one sense of direction by the reaction caused by expelling fluid in the opposite sense of direction, may be applied to aircraft and other vehicles.
>
> It is believed that an embodiment of this invention will provide a large thrust in proportion to its weight, that it will perform at greater altitudes than are at present obtainable, that it makes possible higher speeds than have up to the present been obtained, that it will operate with any fuel now in use, and that it will have a reasonably low fuel consumption. Further, that simplicity and convenient external form is achieved.'

The drawing which accompanies the patent (*Fig 6*) shows a centrifugal compressor preceded by a two-stage axial compressor. At that time he was aiming for a pressure ratio of about 6:1 and was aware that it could not be achieved with a single centrifugal rotor. However it is likely that he had no idea how to design an effective axial compressor – probably no one had at that time.

A very interesting and prophetic paragraph of the patent reads:

> 'In another form, a portion of the air only may expand through the expansion apparatus which drives the compression apparatus, and the remainder expands to the atmosphere providing fluid reaction.'

This clearly indicates that he was already thinking of a bypass engine, without doubt to improve propulsive efficiency - there is no

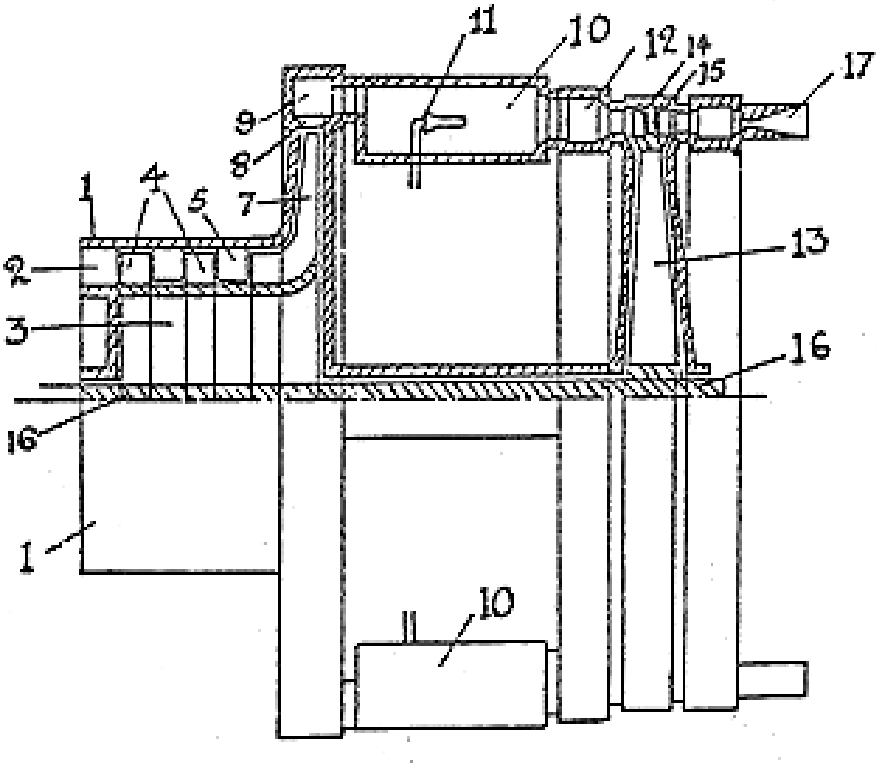


Fig 6. The drawing of a jet engine which accompanied Whittle's Patent No 347,206.

1 Casing. 2 Intake passage. 3 Rotor. 4 Bucket rings (ie blade rotors today). 5 Stators. There is no No 6. 7 Centrifugal compressor. 8 Diffusers. 9 Header or collector ring. 10 Combustion chamber. 11 Fuel jets. 12 Collector or header (ie nozzle guide vanes today). 13 Turbine rotor. 14 Turbine blades. 15 Turbine stators. 16 Spindle (or shaft today). 17 Nozzle – note that Whittle has shown a convergent/ divergent nozzle which implies that he understood supersonic flow, which very few people in Britain did in 1930.

other interpretation. This was written when he was 22 and shows incredible foresight and just how much he already understood the whole process of jet engine design and aircraft propulsion.

Another short statement reads:

> 'The final emission of the gas may perhaps be directionally controlled for manoeuvring purposes.'

The first thoughts on vectored thrust?

The 1931 Paper

Undeterred by having failed to convince Griffith of the merits of his invention Whittle prepared a paper outlining its advantages which he submitted to various aero-engine designers. It is likely that he sent one to Rolls-Royce, Armstrong-Siddeley and, possibly, De Havilland but there is no record of this. However he certainly sent one to Roy Fedden of Bristol in February 1931 as it is now in the possession of Rolls-Royce. It is a lengthy paper of some 30 pages containing a wealth of technical detail.

The first part of the paper concentrates on the merits of the gas turbine against the piston engine and lists the many advantages, such as high power/weight ratio and power/volume ratio as well as throwing away such items as the cooling system, radiators, etc. At that time the commonly held belief was that the thermodynamic efficiency of the gas turbine was too low for it to be of any practical use in aviation, but Whittle gives a detailed theoretical analysis to show that its thermal efficiency improves at altitude due to the lower ambient temperature whereas the piston engine loses efficiency due to friction losses and concludes:

> '. . . the gas turbine may be only 16% efficient, say, at ground level but owing to the fact that its efficiency increases with altitude and that it is not affected by internal friction . . . there is a height, somewhere around 30,000ft when the gas turbine becomes more efficient than the ICE.[1]

<u>High Altitude Flight</u>

Whittle now gets to the crux of the matter with a section which follows on from the work in his thesis. He shows that an aircraft can

[1] ICE – Internal Combustion Engine

fly at 40,000 feet at twice its sea level speed yet still have the same air-miles per gallon – this, he states is the route to long distance flying. However, he recognises that to achieve that speed the power required at 40,000ft is twice the sea level power, hence the need for the lighter weight and smaller size of the gas turbine; he also recognises that to absorb the required power the propeller would be huge. This brings him on to his next topic.

Jet Propulsion

> 'Jet propulsion is a favourite idea for high speed flight at high altitudes but the rocket offers no solution. […] A more hopeful method seems to be to use the surrounding air as a propellant, taking it in and expelling it with increased velocity. […] In this method, only the means of giving the increased velocity has to be carried, whereas in the case of rockets the propelling substance has also to be carried.
>
> By this method the thrust obtained is given by:-
>
> T = W (V-U) where:
>
> T = thrust in lbs.
> W = weight of air/second
> V = jet velocity
> U = aircraft forward speed
>
> and the efficiency of propulsion = 2U/V+U
>
> ie the nearer V may be brought to U the greater the efficiency, but the greater the value of W to produce a given thrust.'

This is one of the most important paragraphs in the history of aviation. Not only does Whittle give the basic equations for jet propulsion, but he identifies the dilemma aero-engine designers would have, and still face today. Namely, that of achieving the correct balance between improving overall engine efficiency (lowering jet velocity by raising bypass ratio) against increasing airflow, which incurs drag and weight penalties. This is truly amazing; Whittle was only 23 when he wrote this. The chart at Fig 7 shows the problem, which still exercises the designers of commercial engines.

Whittle then looks at the design of the engine. He discusses the

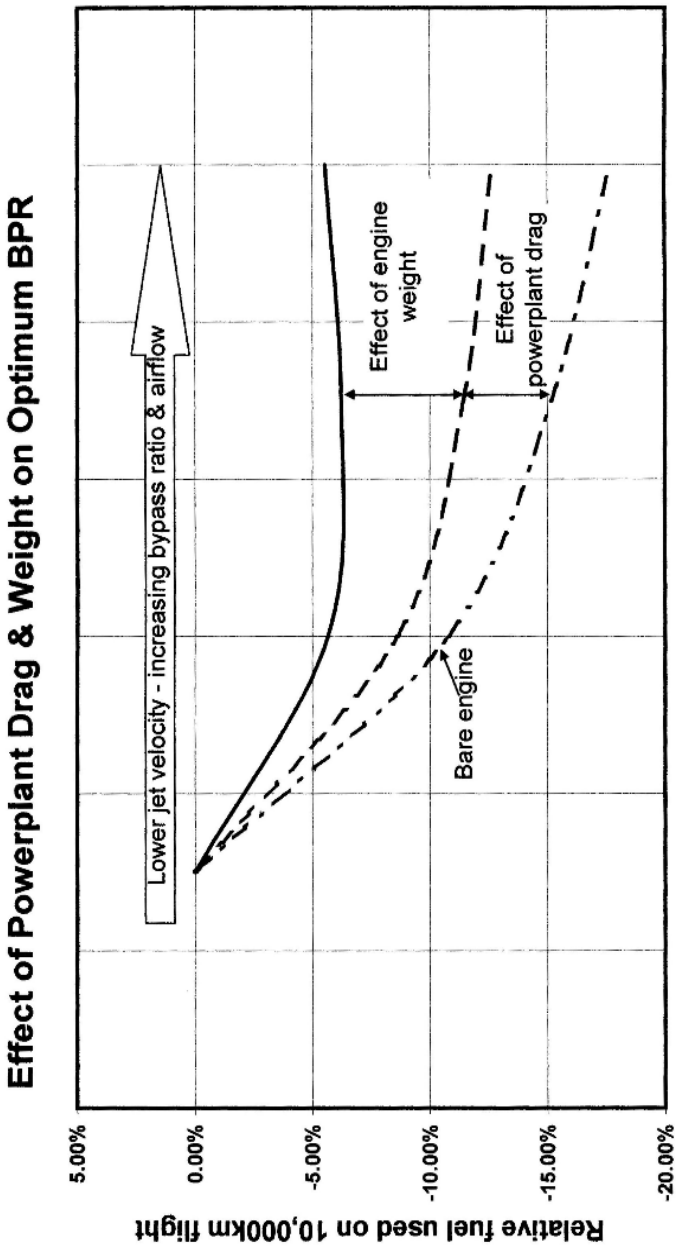


Fig 7. Graph (not included in Whittle's thesis) illustrating how engine efficiency is affected by increasing airflow.

design, both aerodynamic and mechanical of centrifugal compressors at some length. No doubt he chose to use a centrifugal compressor, rather than an axial, as the former were already in use to supercharge piston engines and at that time no one had successfully designed an axial compressor (though Griffith had proposed some ideas in a paper of 1926). Later in the year (1931) Whittle's lengthy and erudite paper on the subject of centrifugal compressor design was published in the Journal of the Royal Aeronautical Society (pp1047-1074). He suggested various means for improving efficiency and commented that increasing the capacity, a requirement of the gas turbine versus the piston engine supercharger, would increase hydraulic mean depth[2] and hence improve efficiency. Then follows a similar treatise on turbine design and he comments:

> 'A serious limitation to the gas turbine is the maximum temperature to which the blades may be subjected for long periods. There are many methods for cooling the blades:-
>
> 1. Use of hollow blades cooled by internally circulating fluid (*as in sodium cooled valves*).
>
> 2. Cooling of blades by gusts of cool air (*as in modern cooled blades*).
>
> 3. Injecting water into the gases before meeting the blades (*as in water injection*).

He goes on to reject Option 1 as being . . .

> '. . . unable to provide adequate cooling. In case 2 there would be heavy 'fan' losses (*pumping losses*?) as well as structural difficulties and in case 3 would require large quantities of water.'

He then suggests the use of silica aerofoils with inner and outer shrouds slid over rods on the turbine rotor and held in place with a metal shroud ring riveted to the outer ends of the rods. This would put

[2] 'Hydraulic mean depth' is a term relating to flow channel depth. Losses in a pipe are caused by friction at the wall. In a narrow channel friction losses contribute a bigger proportion of the total loss than if the channel is deep and hence the flow is large.

Fig 8. Sketch from Whittle's 1931 paper showing how a jet engine facilitates a clean, minimal drag installation.

the silica in compression rather than tension – probably because he recognised the brittle nature of silica. He lists the properties of silica:

> '(i) Fused quartz slowly crystallises to crystoballite above 1250°C
> (ii) Is second only to diamond in hardness.
> (iii) Melting point about 1680°C. (though plastic at a much lower temperature).
> (iv) Unaffected by any substances normally in the combustion products of fuel.
> (v) Specific gravity about 2.9.
> (vi) Very low coefficient of expansion.
> (vii) Very low co-efficient of thermal conductivity.'

Again he is way ahead of his time and he goes on to show (*Fig 8*) that the use of a gas turbine and jet will produce a much better aerodynamic installation than a piston engine and propeller.

Using the above data Whittle produces a thermodynamic cycle design for a gas turbine and shows that it would produce more than twice the power of a piston engine at 40,000ft at a fraction of the weight. We then get to the real meat of the paper which he entitles 'The Gas Turbine as a Jet Propulsion Engine'.

He provides the equation for overall thermal efficiency of the engine and states that the measures taken to improve thermal efficiency could increase jet velocity which would worsen propulsive efficiency, concluding:

> 'Thus the best cycle will be very dependant on the efficiencies of the compressor and turbine, and will have to be a compromise such that thermal efficiency × thermodynamic

efficiency (*component efficiencies?)* × propulsive efficiency equals a maximum.'

Again he has exactly defined the compromise that engine designers still face to this day.

He then presents two examples of jet engine/aircraft performance one at sea level and the other at 40,000ft.

'Two cases will be calculated, each for an aircraft assuming:

Weight = **3000lb**.
Thrust required at 500ft/sec (341mph) = **1000lb** at ground level
Turbine efficiency = **70%**
Compressor efficiency = **70%**
Pressure ratio = **11·9**
Maximum temperature **1555°abs**.(*Both these figures are very optimistic* – AC)

Ex 1. At ground level (*detailed calculations follow, concluding*): Thrust per pound = **60·6lb** and, for a thrust of **1000lb,** the weight of air/sec = **1000/60·6 = 16·3lb/sec** (*further calculations show*) fuel consumed = **217galls/hr**
= about 1·573 miles per gallon

Ex 2. At 40,000ft (*detailed calculations of gas turbine performance follow, demonstrating*): Thrust per pound = **74lb**. Now thrust required for 500ft/sec at 40,000ft equals **250lb** (L/D = 12) since density is 0·25 that at ground level, therefore weight of air/sec = **250/74 = 3·38lb/sec** (*further calculations show*) fuel consumed = **49·5galls/hr**
= 6·9 miles per gallon

These figures are sufficiently encouraging, in view of the lightness of the type of engine, and the maintenance of thrust independently of speed to make such an engine a good proposition, where high speed and fast climb are the most desirable characteristics.'

The fact that Whittle has used optimistic figures for maximum Turbine Entry Temperature (TET) and compression ratio does not

invalidate this argument. Indeed his calculations can be verified. Furthermore, if they are modified, by inserting a pressure ratio of 6 and a TET maximum temperature of 1100°K (a more realistic value, though still advanced for that time), they produce figures of 1·226 mpg at sea level and 7·5 mpg at 40,000ft – in other words even better than Whittle's calculations. However the airflows required to produce the necessary thrust are higher, which would make the engine heavier, but still much lighter than a gas turbine/propeller combination.

Thus Whittle had shown that using a jet propelled gas turbine engine, an aircraft flying at 341 mph at 40,000ft could fly more than four times further than if flown at the same speed at sea level. Not only that but it would be lighter than a piston engine and propeller and much more aerodynamic. The L/D of 12 that is implicit in his calculations for an aircraft flying at 341mph at 40,000ft would have been readily achievable on a smooth aircraft design under consideration at that time, ie a monoplane with retractable undercarriage.

Summary of Whittle's work at that time and reaction to it.

In his 1928 thesis Whittle had shown that to be efficient and achieve long range, aircraft needed to fly high and fast and his 1930 patent and 1931 paper clearly identify the jet engine as the means to achieve this.. He also established the method of calculating the performance (with the precision of Newton, as Sir Stanley Hooker later wrote), gave component aerodynamic and mechanical definitions for the design of such an engine and even pointed to where decisions on compromises needed to be made – which are still valid today. He also showed how such an engine could propel aircraft efficiently at high altitude and at high speed. In other words, by 1931 he had invented the jet engine and shown in broad terms what it could do and how one could be made – it wasn't just a vague idea.

From the absence of any evidence to the contrary there was clearly no positive reaction to his paper and the obvious question is 'Why not?' Although Griffith had rejected his proposal, why did no other aero-engine designers realise its merit? It has to be recognised that the design of piston engines in those days was carried out by very talented mechanical engineers who in general had only rudimentary knowledge

of thermodynamics or aerodynamics. The performance calculations for piston engines were largely empirical, based on previous experience and the business of aircraft performance was left to the aerodynamicists in aircraft firms. Even Stanley Hooker admitted that it took him several months to understand what the jet engine offered[3] and so Whittle's paper lay dormant and his patent lapsed due to lack of finance to renew it.

It is easy to speculate but, had any senior person in either government or industry been prepared to provide the capital and resources to develop such a machine at that time, Britain could have had jet fighters at the Battle of Britain. Although some have questioned the availability of high temperature materials, in 1932 Kayser and Ellison of Sheffield produced an exhaust valve material KE 965 which Rolls-Royce later used in the Griffon and Merlin engines. It had a tensile strength of 17·2 tons per sq in at 1173°K – that would have been perfectly adequate for turbine blades.

However at that time Britain was in the throes of a recession so severe that all work on gas turbines was at a standstill at the RAE and even Rolls-Royce had to fund the development of the Merlin privately. So it was not until four years later, when the possible threat of war encouraged some people in the City to speculate, that Whittle was offered very limited finance to develop his engine.

But Whittle did not invent the jet engine to wage war, even though war paid for its development and where it first saw service. His dream, expressed in his 1928 thesis, was of aircraft flying high and fast to the far corners of the world and the first commercial flight of the Comet 60 years ago was the initial realisation of that dream.

Acknowledgments

This paper could not have been written without the co-operation of the Science Museum, who granted access to Whittle's original 1928 thesis, and of Rolls-Royce who permitted me to see (what may be the only surviving copy of) the paper that Whittle circulated to industry in 1931.

[3] Hooker, Sir Stanley; *Not Much Of An Engineer* (Airlife, Shrewsbury, 1984) p63.

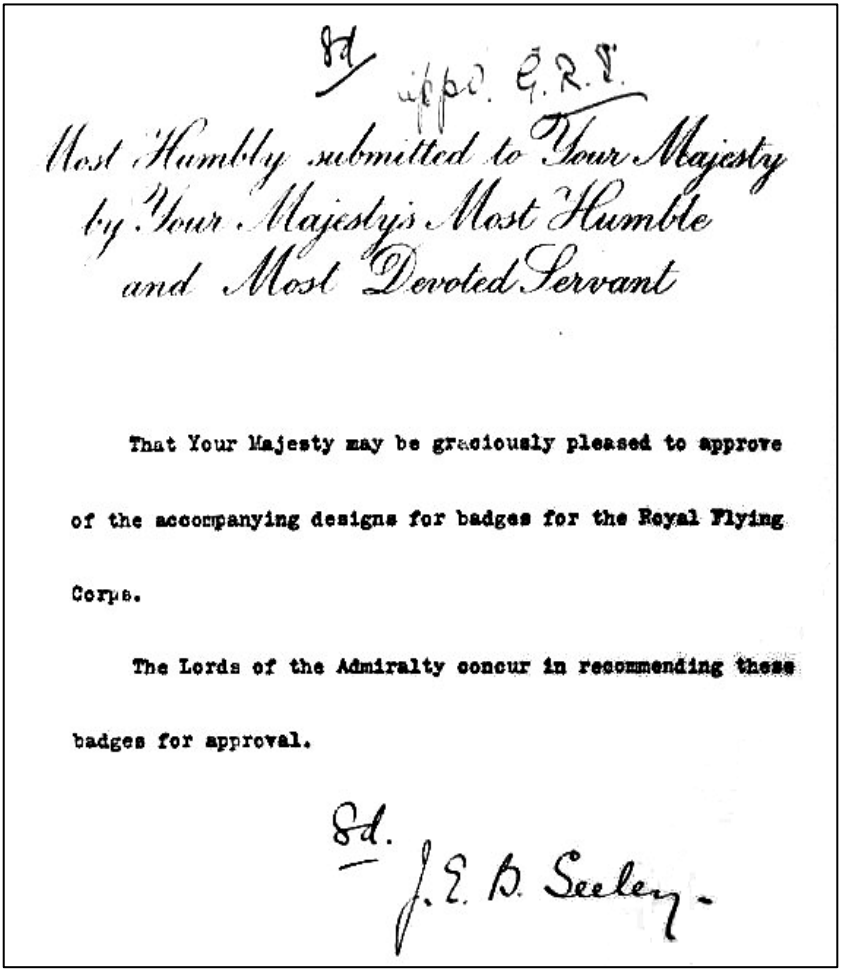
THE LAW, AND LORE, OF RAF FLYING BADGES

by Wg Cdr Jeff Jefford

The first point that needs to be made is that flying badges are *not* 'brevets'. From the mid-19th Century the British Army used the term brevet, to indicate accelerated, but unpaid, promotion in recognition of particularly notable service (as in a captain becoming a brevet major). A *brevet* – French for a certificate – was actually the document authorising such an advance. Its use in the context of aviation arose as a result of a number of early British aviators learning to fly at French schools where they gained the certificate – the *brevet* – of the *Aero Club de France*. It became common practice to refer to the equivalent Royal Aero Club Certificate, which all British pilots (including, until mid-1916, all military pilots) were required to obtain, as a brevet.[1] Later, this was evidently (mis)understood by some non-Francophone pilots to refer to a flying *badge* and they have been getting it wrong ever since. Although 'brevet' has long been current within the crew room *argot*, it has never featured in authoritative documents which, until very recently (*see pages 124 and 126*), have always reflected the correct nomenclature, eg King's and/or Queen's Regulations, Air Ministry Orders and Defence Council Instructions.

The second point to make is that, since it becomes a feature of 'the King's uniform', the design of a flying badge requires (or has until relatively recently required – *see page 120*) the personal approval of the Sovereign. Thus when Maj Frederick Sykes, CO of the

With only the monogram, changed, the RFC flying badge, became the RAF flying badge and is currently the RAF pilot's badge; always, colloquially, 'wings', it has never been a 'brevet' – not really.



81

Appd. G.R.I.

Most Humbly submitted to Your Majesty
by Your Majesty's Most Humble
and Most Devoted Servant

That Your Majesty may be graciously pleased to approve of the accompanying designs for badges for the Royal Flying Corps.

The Lords of the Admiralty concur in recommending these badges for approval.

Sd. J. E. B. Seely.

Fig 1. The memorandum submitted to the Palace by the Secretary of State for War, Jack Seely, on 24 August 1912. Note the King's scribbled 'Appd. G.R.I.' at top right. (AIR2/3)

RFC's Military Wing, proposed that pilots should be permitted to wear an appropriate badge, protocol required the submission of an explanatory memorandum to the Palace. This was done by J E B Seely, the Secretary of State for War, on 24 August 1912 and promptly approved by HM King George V (*Fig 1*).[2] Authority to wear

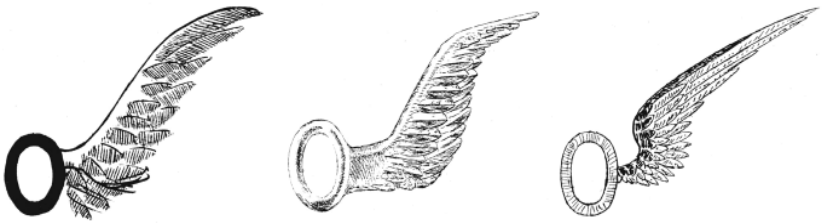


Fig 2. L-R : the observer's badge as envisaged by Sir David Henderson, Sir John French and Col Brancker. (AIR2/15/55/RFC/16)

the new badge was subsequently granted with effect from 1 February 1913 by the publication of Army Order 40 of that date.

At the time of its introduction, retention of the flying badge required the wearer to 'remain efficient' as a pilot of aeroplanes or airships. As the wartime RFC expanded, many of its earliest members rose rapidly through the ranks which inevitably meant exchanging the cockpit for an office and that had the potential to hazard an individual's claim to continue to wear his badge. In 1916, therefore, this rule was relaxed to the extent that a badge could now be worn permanently, even if the wearer ceased to be employed on flying duties, so long as he continued to serve with the RFC. For a pilot who had ceased to be employed by the RFC, ie one who had returned to his original regiment, to retain his badge, however, required the permission of the Army Council. This permission was to be granted only if the individual had left the RFC as a result of wounds or some other disability directly attributable to flying.[3]

By this time, a second flying badge had been authorised. The instigator in this case was Sir David Henderson, GOC RFC in the Field. He had recognised that, while observers attached to (but not yet members of) the RFC were becoming increasingly numerous, they were a somewhat ill-defined group because they were drawn from a variety of regiments and corps. Henderson decided that it was time to provide them with a corporate identity by introducing an appropriate badge. His proposal, of June 1915, covered a sketch (*Fig 2*) of a lop-sided, single-winged design.[4] The CinC, Sir John French, concurred and a fortnight later he wrote to the War Office recommending the adoption of a slightly modified design which could be 'worn in the same way as the existing pilot's badge'.[5] After a little more refinement

the Deputy Director of Military Aeronautics, Col W S Brancker, placed an initial order for 100 badges in July and authority for it to be worn was promulgated by Army Order 327 of 23 August.[6]

Interestingly, there is no record of royal approval having been sought for this badge. This may have been because the War Office considered that the pre-existing approval of the pilot's badge could be extrapolated, as had been implied by Sir John French, to cover an equivalent emblem for observers. Since there is no specific reference whatsoever to this issue in the surviving correspondence, however, it is considered that it is just as likely to have been an oversight.

Equally interestingly, while nothing overt seems to have been said at the time, the not-so-subtle implication of a *single*-winged badge was self-evident. An observer was not considered to be a fully-fledged aviator. He would become one only when he qualified as a pilot, which most were expected to do, at which point he would be given the 'other half' of his badge.

The next significant event was the creation of the RAF. With effect from 1 April 1918 all personnel serving with, or attached to, the RFC and RNAS were transferred to the new Service. This transfer was executed automatically under the terms of an Order in Council and did not require the consent of the individual. There was, however, a proviso that anyone who applied within three months (later extended to six) would, without prejudice, be permitted to return to his original Service.[7]

Over the next year or so there was a steady trickle of Orders ironing out differences between inherited RN and Army practices, rationalising RAF procedures and generally tying off loose ends. One of these concerned the wearing of flying badges by those aviators who exercised the option of rejoining their original Service, and those who had already done so prior to 1 April. The Air Ministry was content that they should retain their badges, but the War Office took the view that all flying badges were now air force business and that it was no longer appropriate for soldiers to wear them. The Admiralty adopted a similar line and in May 1918 it was ruled that flying badges were to be worn only by RAF personnel.[8] As will become clear later, this ruling was to have some unfortunate consequences during WW II.

Another early Air Ministry directive was a regulation governing dress. This stated that pilots were to wear:[9]

> 'The "Wings" of the R.F.C. on the left breast, with the substitution of the letters "R.A.F." for "R.F.C."'

while observers were to wear:

> 'The "Half-Wing" with the letter "O" as at present worn by observers in the R.F.C.'

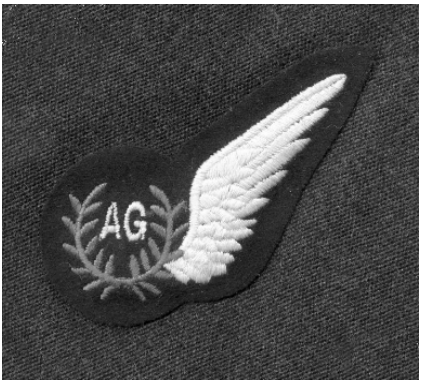
There can be no doubt that referring to a pilot's badge as 'wings' was commonplace (after all, how else would one describe it?) but the fact that it was presented in inverted commas suggests that officialdom may not have been entirely comfortable with this practice. By July there were instances of wings appearing without the inverted commas, but they were frequently still present a year later.[10] By 1920 the dead hand of the Stores Branch had made its contribution with its precise, if soulless, 'badges, embroidered, pilots (silk)'.[11]

While it may already have cropped up elsewhere at some stage, the definitive answer as to the correct usage was provided in 1924 with the publication of King's Regulations (KR) 198 and 682 which laid down the conditions for the award of 'the flying badge'. While 'wings' remained, and remains, in the colloquial lexicon, subsequent formal documents referred to the pilot's flying badge.[12]

The award of the observer's badge had ceased abruptly with the suspension of the wartime flying training programme in February 1919 and it was not reinstated until 1937.[13] The only other inter-war development of any relevance was the introduction, in 1923, of a brass 'winged bullet' to be worn on the upper right sleeve of airmen qualified in aerial gunnery, but this was a 'trade', as distinct from a 'flying' badge.[14]

Introduced in 1923, the 'winged bullet' was superseded by the air gunner's badge at the end of 1939.

War was declared in September 1939 and before the year was out it had been accepted that it would be necessary to grant air gunners a

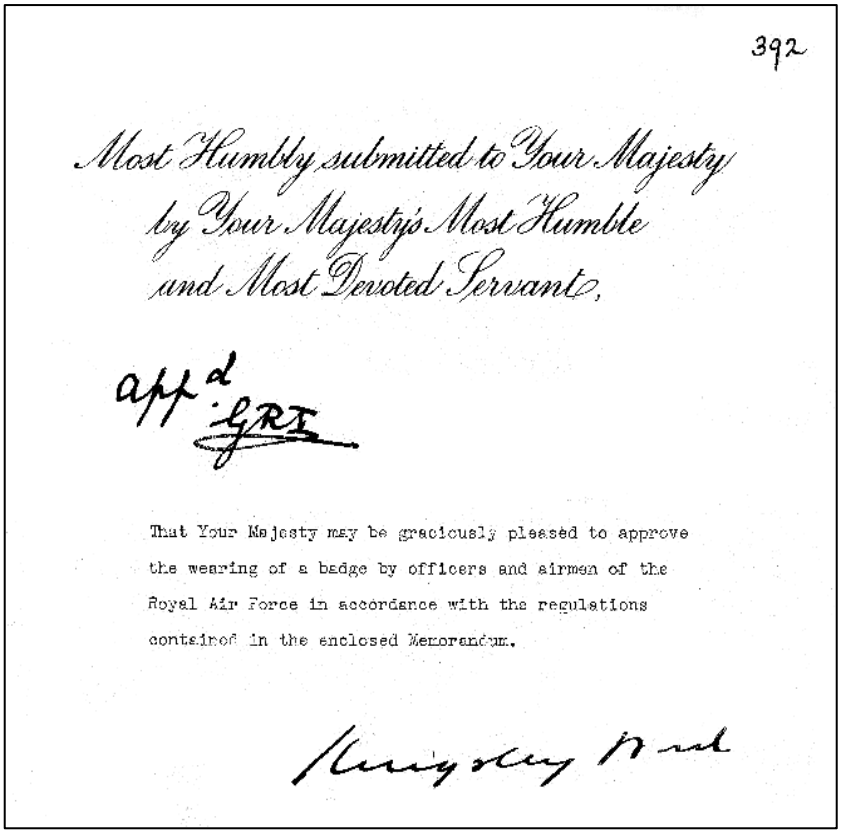


The air gunners badge of 1939, which established the pattern for all other non-pilot aircrew badges for the rest of the century.

far greater degree of recognition than the air force had afforded them in the past. The first step in this process was to introduce a dedicated badge. Following the same procedure as the RFC in 1912, the Secretary of State for Air, Sir Kingsley Wood, submitted a proposal to the Palace seeking the King's endorsement of the new emblem. In addition to explaining why it was required, the submission included an example of the proposed new badge. It was a single-winged design, similar to, but subtly different from, the observer's badge with the monogram 'AG' in white surrounded by a brown laurel wreath.

Wood's submission (*Fig 3*) was approved by HM King George VI, to became King's Order 392[15] and introduction of the badge was announced on 21 December 1939.[16]

The new 'AG' emblem rendered the brass 'winged bullet' obsolescent and pre-qualified gunners were directed to relinquish their old badges in favour of the new one, although old school air gunners who were no longer employed as aircrew could continue to wear them.[17] This Order went on to extend this concession to anyone in possession of a flying badge or an observer's badge so that they too could retain the brass winged bullet. Unfortunately, this came to be interpreted as meaning that a pilot or observer who, for whatever reason, had actually been recategorised as an air gunner, had the option of continuing to wear his original badge in preference to the new-fangled 'AG'. That had led to some confusion and it was subsequently ruled that, regardless of which badges they may have been awarded, aircrew were to not 'under any circumstances' to wear a badge other than that appropriate to the duties for which they were currently being employed. Only on ceasing to be employed as aircrew could an individual wear any of the badges for which he had been qualified.[18] This rule would be reiterated from time to time[19] and



392

Most Humbly submitted to Your Majesty
by Your Majesty's Most Humble
and Most Devoted Servant,

appd GRI

That Your Majesty may be graciously pleased to approve the wearing of a badge by officers and airmen of the Royal Air Force in accordance with the regulations contained in the enclosed Memorandum.

Fig 3. The memorandum submitted to the Palace by the Secretary of State for Air, Sir Kingsley Wood, on 9 December 1939. Note the handwritten '392' at top right – the serial number of what had become a King's Order following the addition of the King's 'Appd GRI'. Note also that this submission had (as would all later examples) mirrored precisely, the format of Fig 1, except that the originator in that case had been the War Office rather than the Air Ministry. (AIR 30/271)

by 1953 (at the latest) it had been enshrined within QR206, as it still is today.

At the end of 1940 the RAF was still managing with just three categories of aircrew – pilots, observers and air gunners – distinguished by their three separate badges. Rapid technological

advances meant that military aviation was becoming increasingly complex, however, and this created a demand for personnel with the specialist skills required to operate the new equipment. These men would eventually gain recognition as new categories of aircrew and, as such, they expected, like their colleagues, to wear an appropriate badge.

The first bid for a new badge was provoked by the introduction into service of the four-engined heavy bomber. Although the RAF had had plenty of notice of this event, and had long-since acknowledged that the crews of these aircraft would require some form of 'engine watcher', it had done absolutely nothing about providing itself with these men. This resulted in the temporary misemployment of ground tradesmen until arrangements could be put in place to remuster them as aircrew.[20] As early as December 1940, these negotiations had included a recommendation that 'An aircrew badge should be struck for the Flight Engineer.'[21] By the following February this had been refined into a specific bid for a badge modelled on that of the air gunner, with the 'AG' replaced by 'FE'. At this stage, however, the 'AG' badge was still a unique design and it was deemed undesirable to 'deface or disfigure' it by changing the lettering. However, since flight engineers were to attend an abbreviated course (entirely ground-based and of about two-week's duration) in aerial gunnery, this was considered to be sufficient to permit them to wear the air gunner's badge, and for the time being that had to suffice.[22]

The advent of an operationally viable radar system to assist in airborne interception (AI) during 1940 was another instance of a makeshift approach. The earliest equipment, which was installed in Blenheims, was handled by volunteer ground tradesmen with an appropriate technical background or with practical experience as wireless mechanics or operators, and by air gunners, most of whom were actually qualified wireless operators, ie WOp/AGs. To impose some order on these *ad hoc* arrangements, a new aircrew category, the radio operator (air), was introduced in January 1941.

Arrangements were put in place to permit WOp/AGs who elected to become radio operators (air) to be remustered to the new category, retaining their existing rank, while others were recruited from among serving ground tradesmen and direct entrants all of whom would become temporary sergeants on completion of their training. The

The four options that were offered for consideration as the badge for the radio operator (air). That chosen was the third from the left – a minimum change to the pattern established by the earlier 'AG' badge. AIR2/6225.

WOp/AGs could retain their exiting 'AG' badges, but that would not be appropriate for the new men who would not be trained as air gunners. So, in April 1941, AOCinC Fighter Command, Air Mshl W S Douglas, wrote to the Air Ministry to 'strongly urge that very early approval' be given to the introduction of an appropriate badge, the letter being accompanied by a drawing of a suggested single-winged design.[23]

In due course, four variations on the theme of a unipinioned badge were produced for consideration. Unfortunately, prevailing, if informal, policy at the Ministry at that time was to minimise the authorisation of new badges, not least because so many were being introduced (by all three Services) that the embroidered badge industry was having problems meeting the demand. Had there been no other considerations, therefore, it is likely that relatively little priority would have been afforded to solving Fighter Command's problem.

Coincidentally, however, while meeting a number of aircrew in the course of a visit to Middle Wallop on 7 May, HM King George VI commented on the fact that some of No 604 Sqn's AI operators were wearing air gunner badges while others had no badge at all.[24] The difference was explained and the King subsequently 'expressed (*a*) wish that a badge should be awarded to this class of aircrew personnel.'[25] That was all it took to fast-track the authorisation of the new badge and, nothwithstanding the reservations of the gunnery fraternity, who had only recently successfully resisted an attempt to high-jack their emblem for the benefit of flight engineers, the new badge was modelled on that of the air gunner with the 'AG' motif simply being supplanted by an 'RO'. CAS approved the design on 14 May and an example of the proposed badge, accompanied by the

During a visit to Middle Wallop on 7 May 1941 HM King George VI, seen here talking to some of No 604 Sqn's radar operators, was curious as to why some of them wore an 'AG' badge while others did not.

Secretary of State's customary explanation, was submitted to the Palace on the 20th. It was promptly endorsed by the King to become King's Order 439.[26]

It is evident, however, that while protocol had dictated that it was necessary to follow this procedure, it had been taken for granted that there would be no difficulty in gaining royal approval. Despite the problems allegedly being experienced by the industry, 'exceptional measures' had been taken to order 150 'RO' badges, which Messrs Hobson & Sons had undertaken to deliver by 21 May. Since that was just one day after the King had initialled the submission, it is quite clear that the order must have been placed prior to that.

Before the month was out an AMO had been published announcing the introduction of the new badge.[27] Only six weeks later, however, the category was redesignated to become that of the observer (radio), but the badge remained 'RO'.[28]

In the spring of 1942 the first of a series of new equipments that had the potential to enhance significantly the accuracy of both navigation and bombing (eg the Air Position Indicator, GEE, the Mk XIV bomb sight and H2S) began to enter service. These innovations, and a year's accumulated experience of operating four-engined heavy bombers, indicated that it was necessary to review and reallocate responsibilities within a bomber crew. These deliberations took several months, not least because it was necessary to liaise with the governments of the Dominions who were participating in the Empire Air Training Scheme, since the personnel of their air forces were interchangeable with those of the RAF and it was essential that everyone was trained to the same agreed standard.

The flying 'O' continued to be worn, quite illegally, throughout the war and for many years thereafter. This is Sqn Ldr T W Blair of No 83 Sqn. The juxtaposition of a flying 'O' with a pathfinder badge was, technically, impossible because the former had been declared obsolete in September 1942, two months before the latter had been introduced. This picture actually dates from no earlier than November 1944, but who was going to argue with someone who had flown almost 100 ops and was wearing the ribbons of the DSO and a DFC and Bar?

One of the more significant consequences of this process was that the categories of the observer and the observer (radio) were declared obsolete in July 1942 and replaced by the air bomber (actually introduced in May[29]) and several sub-categories of navigator.[30]

These changes would render the WW I-style observers 'O' and the year-old 'RO' badges redundant and thus create a demand for several new ones. Designs for these were forwarded to the Palace in the usual way by the Secretary of State for Air, Sir Archibald Sinclair, on 27 July 1942. Duly initialled by the King, this submission became King's Order 480.[31] The new emblems, all of which followed what had by now become the standard pattern established by the air gunner's badge of 1939, were introduced in September.[32] The letters were 'B' for air bombers; 'N' for all five sub-categories of navigator[33] and 'E' for flight engineers who, better late than never, had finally been provided with a distinctive badge of their own to replace the, never really appropriate, 'AG'.

Reinforcing the standing regulation to the effect that aircrew were to wear only the badge of the category in which they were being employed, the Order that introduced the new badges stated, quite categorically, that the only people who could now wear the 'O' and 'RO' were 'those who were no longer available by reason of age, medical standard, or otherwise, for posting to one of the new categories of aircrew.' It was to no avail. Folk who had qualified for an 'O' (and some who had not) were very proud of their badges and/or

determined to show that they were old-hands and they could still be seen well into the 1960s.

Two more badges would be required before the war ended. The first arose from a November 1943 decision to dispense with the dual-qualified category of the WOp/AG and replace it with the wireless operator (air) – the WOp(air)[34] – who would be joined by the wireless operator mechanic (air) – the WOM(air) – in the following September.[35] Since gunnery was no longer a pre-requisite for qualification, however, the 'AG' badge would not be applicable, leaving newly trained men without any kind of aircrew emblem. There was clearly a need for yet another badge and this, a standard pattern single-wing with the letter 'S' within the laurel wreath, had been submitted to the Palace on 5 October 1943 when it became King's Order 521.[36] The 'S' stood for signals and, although it would be more than a year before this would be reflected in the official title of the wearer, the badge was introduced in January 1944.[37.]

Long before this an entirely new breed of *de facto* aircrew had been recognised when, as early as September 1942, the Air Ministry had acknowledged the qualified meteorologists who flew to make their observations.[38] The first batches selected for flying duties were given a fairly cursory introduction into the world of practical aviation, comprising three weeks of navigation and a two-week ground-based Air Gunners (Emergency) Course, which, after subsequently demonstrating acceptable scores in practical air-to-air firing, was deemed to be sufficient to warrant the award of an 'AG' badge. The requirement for formal gunnery training was soon dropped, however, leaving later, and what soon became the majority of, flying 'Met men' without a badge. Needless to say, this caused some discontent and several attempts were made to gain sanction for a dedicated badge but it would be two-and-a-half years before this was obtained.

In the spring of 1945 the uncertain status of these men was finally rationalised with the formal introduction of the new aircrew category of the meteorological air observer.[39] They were to wear an 'AG'-pattern badge featuring the letter 'M' within the laurel wreath which was approved by HM King George VI on 3 April. This became King's Order 562[40] and three weeks later the badge was authorised to be worn.[41]

In the meantime, in January 1944, the Air Ministry had specified

that 'aircrew badge'[42] was to be used as a generic term to embrace all of the emblems worn by aircrew, 'flying badge' now being associated solely with that worn by a pilot.[43] While that had removed any doubts as to the terminology to be used, it had done nothing to resolve another problem that had been simmering since the beginning of the war. By 1945 this had become such a contentious issue that it eventually provoked a Parliamentary Question.

It will be recalled that in 1918, following the establishment of the RAF, the Army had decided that it wanted little more to do with air matters and that it would be inappropriate for officers returning to the regimental fold to continue to wear their flying badges (*see page 106*). This policy proved to be short-lived, however, because a steady trickle of army officers was seconded to the RAF for flying duties during the inter-war years. Since the Army no longer had a pilot's badge of its own, it was agreed that these soldiers should wear the RAF flying badge while actually serving with the RAF and for the next four years, during which they were liable to recall in an emergency. In 1938 the position was reviewed and it was agreed that these men could wear their badges permanently, even after the RAF had ceased to have any claim on them.

Following the outbreak of war in 1939, some of the soldiers who re-enlisted in the Army were veterans who had flown as pilots during WW I. After some deliberation the Air Council conceded that these volunteers were covered by the 1938 decision. From June 1940, therefore, any army personnel whose documents showed that they had qualified for RFC, RNAS or RAF 'wings' were granted the privilege of wearing the current pattern RAF flying badge on their army tunics.[44]

Once all ex-pilots had been given the right to wear their 'wings', it was only natural that ex-observers serving with the Army expected to be granted a similar dispensation. One would have thought this a reasonable proposition but, although the Air Council had decided, within days of the outbreak of war, that an ex-WW I observer could wear his 'O' badge on an RAF uniform,[45] it ruled that it was quite inappropriate for it to be worn on khaki. The rationale for this decision was that, unlike *some* army pilots of the inter-war years, ex-observers had never had any obligation to fly with the peacetime RAF. While this was a defensible argument, its logic was stretched beyond its

breaking point by the concession which had permitted soldiers upon whom the RAF no longer had any claim, or, even worse, upon whom it had *never* had a claim, to continue to wear their flying badges.

The Air Council's policy was seriously compromised by this inconsistency and the repeated rejection of soldiers' requests to wear the observer's badge rankled.[46] By 1942, in an effort to shore up its case, the Air Ministry had resorted to exploiting some of the more esoteric aspects of military dress regulations. It was contended that the flying badge worn by an RAF pilot was not 'a decoration', but an integral element of the unique RAF uniform and that inter-Service cross-dressing was quite inappropriate.[47] To support this argument, it was pointed out that the RN did not permit the wearing of any RAF-sponsored badges on its uniforms and, likewise, that the Army did not permit air force or naval badges to disfigure its immaculate khaki.

Since the RAF flying badge represented a glaring exception to the latter rule, this argument was so transparent as to be totally unconvincing, especially to ex-observers. Furthermore, while the Admiralty may not have permitted RAF badges to be worn on RN uniform, it did recognise their status and a pilot, observer, navigator, air gunner or WOp(air) who had qualified as such in the RAF, but who subsequently served in the RN, was permitted to wear the equivalent FAA badge. This option was not available to the Army, since it no longer sponsored any appropriate forms of aircrew badge.[48] On the other hand, the War Office had endorsed the wearing of the 'AG' badge by properly qualified army officers while flying with the RAF. Furthermore, the Admiralty had permitted its naval gunlayers badge to be worn by soldiers serving with the Maritime Royal Artillery as 'acting gunlayers (defensively equipped merchant ships)'.[49] Going back to WW I, of course, one could also cite the fact that the Admiralty had been content that army officers seconded to fly with the navy as observers should wear the RNAS eagle.

So much for the Air Ministry's contention that there was no precedent for cross-dressing within the military, but its willingness to misrepresent the facts did not end there. Determined to deny the back-seaters of WW I the right to wear their badges, the Air Ministry had claimed that the flying 'O' was an exclusively RAF emblem. This was patently not the case, of course, as it had initially been sponsored by the Army and as such had narrowly missed being manufactured in

khaki (*see Note 6*). Indeed some of the men who were asking to be allowed to wear their old badges on their *army* uniforms had actually earned the right to do so as *pre-RAF* soldiers.

Public concern over the prohibition on the wearing of badges having first been expressed as early as 1941,[50] in January 1945 official intransigence over this matter was eventually raised in the House of Commons. A plea for recognition of the veteran observers by Mr Edgar Granville (Eye) was supported by Col T G Greenwell (The Hartlepools) and Maj F W Cundiff (Rusholme).[51] It was, said Granville, 'a very niggardly thing to take away a treasured distinction from men who had worthily earned it'.[52] Furthermore, even if the badge was no more than a piece of uniform, until 1918 it had been a piece of *army* uniform, so, it was argued, there were no grounds to prevent its being worn on khaki.

It fell to the recently appointed Parliamentary Under-Secretary of State for Air, Cdr R A Brabner, to present the case for the defence. He had nothing new to say, however, and it was clear that over the previous five years the Air Ministry had painted itself into a corner over this issue. Brabner did his best with the arguments available to him but it was plain that he failed to persuade the House of the justice of his Ministry's position.

This was of little consequence, however, as it was not a matter of debate. No vote was to be taken. Brabner's task had simply been to respond to a question that had been asked. It did not matter that he had been obliged to present an unconvincing answer. He had been required only to make it plain that the answer was final.

Meanwhile, however, the Air Ministry's preferential treatment of erstwhile pilots had opened a Pandora's box. If soldiers, including the Home Guard, could wear RAF 'wings' what of such paramilitary forces as the Royal Observer Corps? Then again, could a policeman wear a flying badge? Along with other similar organisations, both of these were ruled out of court. But in 1944 this policy was inadvertently subverted by HM King George VI who, in effect, personally authorised the Commissioner of the Metropolitan Police, Sir Philip Game, a retired air vice-marshal, to wear his flying badge on his police uniform. Sir Philip promptly passed on the good news to half-a-dozen lesser members of the constabulary who had also been pilots at one time. This called for a degree of delicate diplomacy

Probably unaware that he was breaking the rules, throughout WW II, Capt Alfred de M Severne wore on his RAMC tunic the observer's badge that he had earned flying with No 53 Sqn in WW I. (AVM Sir John Severne)

which eventually succeeded in righting the regally upset applecart. Sir Philip and his men dutifully toed the party line and took their badges off again.[53]

The reason for recording these arcane rulings and esoteric arguments here is to make the point that, in days of yore, the Air Ministry was meticulous over obtaining formal approval for any new aircrew badge, dogmatic to a fault over the terminology to be used when referring to them and jealously protected their status by fencing them around with regulations that specified precisely who could, and who could not, wear them. As we shall see, this is far from being the case in today's air force.

The first badge-related post-war event of any significance was the grant of honorary aircrew status to parachute training instructors in November 1945.[54] This was accompanied by the introduction of an appropriate badge, a parachute within the laurel wreath of the standard single-winged 1939 pattern. As always, this had been submitted to the Palace by the Secretary of State for Air, now Viscount Stansgate, on 7 October following which the approved document had become King's Order 577.[55]

The early post-war air force was afflicted by the ill-conceived 1946 'Aircrew Scheme' (*see Journal 42, pp57-93*). To avoid any potential confusion with the new aircrew rank badges that this would involve, it was decided to change the generic term for the badges worn by all flying personnel from 'aircrew badge' to 'flying badge'. This, in turn, meant that what had been the 'flying badge' would now become the 'pilot badge'.[56] Apart from the adoption of 'signaller' for the 'S' badge and the engineer losing his 'flight' prefix, none of the others had been renamed, although by this time, the only current single-

winged badges were the 'N', 'S', 'E', 'AG' and 'M'. That is not to say, of course, that many of the now obsolete badges, especially the 'O', were not still being worn by the die-hards.

There were no further developments until 1956 when, in order to cope with the complexity of the V-bombers, the new category of the air electronics officer (AEO) was introduced.[57] The badge, a standard-pattern 'AE', was submitted to the Palace by the Secretary of State for Air, Nigel Birch, on 10 January 1956. It was the first RAF flying badge to be approved by the Queen, the document becoming Queen's Order 767.[58] Sadly, it also appears to have been the last.[59]

Whether this was because the requirement to submit badges for approval was waived by the Palace at some stage or whether the practice was simply allowed to lapse (perhaps as a consequence of a dilution in a single-Service RAF identity in the wake of the absorption of the Air Ministry into the MOD) is not known. The Royal Archives at Windsor Castle and the Secretariat at Buckingham Palace have both been approached in the hope of enlightenment, but neither have been able to shed any light – except to confirm that other Government Departments still continue to submit proposals for the Sovereign's approval, still using the time-honoured format at Figures 1 and 3.[60]

To complete the picture, it should be recorded that two redundant flying badges were given a second lease of life. The first was the 'RO'. In an attempt to alleviate perennial problems with the recruiting of navigators, the category of the radio observer. was reinstated in 1956.[61] They were given a navigation course of limited scope before being trained as radar operators to fly in night fighters. The advantage of this was that it took only a notional fifty-one weeks to turn a civilian into a productive sergeant radio observer, compared to ninety-five for a commissioned navigator. Unfortunately, this had ignored both the wartime experience that had persuaded the Air Ministry of 1943 that AI radar operation needed to be treated as a post-graduate skill for a fully trained navigator (*see Note 33*), and that it had been recognised in 1950 that all navigators should be officers. This cheap and cheerful approach was not a success. A little over 100 radio observers were trained in 1956-57 but they had practically all disappeared by the mid-1960s. Some had returned to civilian life; some had reverted to their ground trades, some, having been given the additional training which had originally been withheld, had been

rebadged and commissioned as navigators, while a few had become pilots.

The second badge to be reinstated was the 'S'. While the 'S' had been superseded by the 'AE' for newly trained officers in 1957, it was still being awarded to airmen aircrew. At the time it was the practice for air signallers to attend a post-graduate course that upgraded them to air signaller (A).[62] In 1962 it was announced that all future graduates of this course, and all current air signallers (A), were to be remustered as air electronics operators (AEOp)[63] and exchange their 'S' badges for an 'AE'.[64] Tradesmen with appropriate technical qualifications who remustered as aircrew could also graduate as AEOps, although *ab initio* direct entrant air signallers continued to be trained for another four years, the last 'S' badges being awarded in 1966. With the aim of upgrading *all* remaining air signallers, permitting them to be rebadged as AEOps, a conversion course continued to run until as late as 1972.

Meanwhile, while some of the personnel who crewed the ELINT aeroplanes flown by No 51 Sqn were badged AEOps, others, the so-called 'Special Operators', actually linguists – radio operators (voice) – flew without having aircrew status. In 1969 the opportunity was taken to regularise their situation by remustering them as air signallers (radio calibration), thus reinstating the award of the 'S' badge, albeit for a very small and select group within the aircrew fraternity. That said, the authority for this remains obscure, probably as a result of the sensitivity of No 51 Sqn's role.[65]

Sandwiched between these two reinstatements, in 1962 the air quartermaster had, after a campaign that had begun as long ago as WW II, finally been recognised as an aircrew category. As was customary, the associated Order stated that the 'flying badge will be the same as the navigator badge except that the letter "N" will be replaced by the letters "QM"'[66] There appears, however, to be no evidence to indicate that this badge was ever referred to the Palace for approval. Unless it can be shown that the Queen had waived the necessity for such a procedure, this omission may have amounted to a case of *lèse-majesté.* Only eight years later the air quartermaster was restyled as the air loadmaster, the monogram on the badge being changed to an 'LM'.[67] Again – was this badge ever submitted to the Palace?

Whether it was, or not, both the 'QM' and 'LM' were, at least authorised by an appropriate directive, but they appear to have been the last to have ticked even that box. Since then the waters have become increasingly murky with regulations apparently being circumvented or simply ignored.

So what are the rules? Well the rule book is *Queen's Regulations for the Royal Air Force*. The references change with time but three snapshots will suffice to show that the gist remains constant.

a. In the 3rd (1953) edition of QRs, para 206 lists the flying badges that had been authorised to date and states that they are 'for wear by flying personnel who have successfully completed their flying training', while para 815 says that 'flying personnel become eligible for flying badges (…) under conditions prescribed from time to time by the Air Council and notified in AMOs.' Since it is similar to, but not actually, a flying badge, the special case of the parachute training instructor's badge is covered by QR207.

b. Following a major revision of the 4th (1957) edition in 1998, QR206 still included, at clause (1), the list of current and obsolete[68] badges followed by the following statement: 'Service personnel are not to wear any of the badges listed in clause (1) unless authority for them to do so has been granted in accordance with the regulations prescribed from time to time by the Defence Council.' QR727 enlarges on this by laying down that the 'term "flying badge" (*not 'brevet', you will note*) is used to include all badges worn by personnel who have successfully completed a prescribed course of flying training.' The regulations governing the parachute training instructor's badge have migrated to para 434.

c. As at 2011, QRs206 and 727 of the 5th edition were substantially the same as in 1998.[69]

Bearing in mind these provisions, the status, indeed even the legality, of several more recent badges would appear to be, at least, suspect. The first to be introduced, in November 1983, was a standard-pattern, single-winged 'FC' which has been worn ever since by those fighter controllers who fly in airborne early warning aircraft.

But was this a flying badge? Had the wearers completed 'a prescribed course of flying training'? At the time, responsibility for

the supervision and conduct of all aspects of flying training, including the publication of the associated syllabi, was vested in the Air Officer Training at HQ Support Command – and Support Command had not published a syllabus dealing with fighter controllers. Indeed it was not even aware of this development until the award of the first 'FC' badges was publicised several months after the event.[70] Clearly, these men had not completed 'a prescribed course of flying training'.

This deficiency was compounded by the fact that fighter controllers were members of the General Duties (Ground), as distinct from the General Duties, Branch,[71] or in the case of NCOs, Trade Group 12. As such, fighter controllers were clearly not aircrew.

Those rather uncomfortable anomalies aside, if the 'FC' really was a flying badge where was that essential 'regulation prescribed from time to time by the Defence Council' – the DCI – that should have authorised its introduction? There was no such regulation and when this was pointed out to the concerned department at the MOD, that of the Director General of Training, in 1988, no action was taken to regularise the situation – perhaps because the 'FC' badge was by this time a *fait accompli* and this unfortunate circle simply could not be squared.

In 1989 the status of the NCO fighter controller was enhanced by making it a specific trade (rather than the previous specialist annotation) within Trade Group 12.[72] The enabling DCI stated that about one third of the anticipated requirement for fifty such personnel could expect to fly in the forthcoming Boeing Sentry and that they would draw flying pay, but only 'when employed on flying duties'. This proviso underlined the fact that they were not mustered as 'aircrew'; if they had been they would have drawn flying pay on a permanent basis. Surprisingly, or perhaps not (because the trade sponsor would have been aware that it had never been officially sanctioned) the DCI made no mention of the award of a flying badge. After having been worn for some fifteen years with no apparent authority, the 'FC' was eventually added (in 1998?) to the flying badges listed at QR206. But was this appropriate? Is it a flying badge? Can it be, if it is worn by personnel who are not aircrew?

There was (and still is) a way to resolve this issue. To avoid the need to cut corners and bend rules, the 'FC' badge should have been treated as a discrete entity, as had been done in the case of the

parachute training instructor's badge of 1945. Or, and perhaps more appropriately, a suitable emblem could have been introduced to be worn on the sleeve as a qualification badge. The 'winged bullet' of 1923 was the first example of this practice and it was later mirrored by, for instance, the 'badge, arm, parachutist with wings' worn by qualified RAF Regiment personnel[73] and the air steward's badge of 1967;[74] there are others.

Meanwhile, with a precedent having been established by the 'FC', the technical personnel who flew in order to maintain the complex equipment carried by the Sentry also sought a badge. The first 'AT' (for airborne technician) badges were awarded in August 1989, although they do not appear to have been sanctioned by a DCI and it was another eleven years before this crack was papered over by adding 'AT' to the list at QR206,[75] but, again, was this really appropriate? Is the 'AT' a flying badge? Unless the personnel who wear it are mustered as airmen aircrew (or, since 2003, as non-commissioned aircrew) can it be?

At much the same time, August 2000, the Air Force Board Standing Committee announced that the navigator, AEO, AEOp and air signaller specialisations were to be combined.[76] In future, they were to be known as weapons systems officers (WSO) or operators (WSOp), depending upon whether or not they were commissioned. In the event the first people to graduate under the new system (which had been extended to embrace the erstwhile air loadmaster and the handful of air engineers that was still being trained) did not appear until 2003. Irrespective of their specialisation, when they did, they all now wore the same flying badge. Still single-winged, it did at least have the long overdue addition of a crown. This badge superseded the 'N', 'AE', 'S', 'LM' and 'E' badges and all current aircrew were encouraged to adopt the new emblem, although, if they preferred, old hands were permitted to retain the badge for which they had originally qualified. The WSO badge was certainly listed under QR206 by 2011, but had it

originally been sanctioned by that essential DCI?

Incidentally, while QR206 lists this emblem as the Weapons Systems Operator's badge, AP1358 (*Uniform Dress and Appearance Regulations for the Royal Air Force*) identifies it as the 'Rear Aircrew Brevet'. Yes – brevet! Whatever it is called, was it not exquisitely ironic that the traditional-style badges that used to be worn by 'proper aircrew' had all been declared redundant while those that *appeared* to be flying badges, the 'FC' and 'AT', were still current?

As long ago as the late-1990s it was being conjectured that there might soon be an airborne role for imagery analysts or, as they used to be called, photographic interpreters. It was hoped that, if this ever did happen, their 'PI' in the sky would be formally authorised by a DCI. In 2008 this came to pass when the first of the traditional-style 'IA' badges was awarded. It is understood that this one can be worn by airmen of Trade Group 11 and soldiers of the Army Intelligence Corps. So much for the party line laid down by the Air Ministry that precluded (with the exception of the pilot's badge) the wearing of any RAF badges on army uniforms. But, that aside, was there a DCI to validate this new badge?

The pattern of authorisation of flying, and pseudo-flying, badges is reflected in the table at Figure 4. In 2011, having exhausted the sources available within the public domain, an attempt was made to fill in the gaps by invoking the Freedom of Information Act. Authoritative advice was sought as to whether the 'QM', 'LM', 'FC', 'AT', 'IA' and WSO's badges had been the subject of Queen's Orders and the dates and reference numbers of the DCIs authorising the last four of these. The response stated, quite categorically, that 'such documentation does not exist'.[77] That being the case, it confirmed that the last four badges had not been introduced in compliance with Queen's Regulations which raises serious doubts over the status of all of them, but especially the WSO badge.

However, the speed with which this enquiry had been dealt suggested that little real effort had actually been made to answer the questions and it was suspected that they had probably been misdirected in any case. So inadequate was the initial response that the question was resubmitted, this time with specific suggestions as to the directions in which enquiries should be pursued. As before, little light was shed, apart from the case of the 'IA'. That revealed a great deal,

Flying Badges Worn By Aircrew

Aircrew Category	Badge	Royal Approval	Promulgation
Pilot	'wings'	24 June 1912	Army Order 40 of 1 Feb 13
Observer	O	–	Army Order 327 of 23 Aug 15
Air Gunner	AG	King's Order 392 of 9 Dec 39	AMO A.547 of 21 Dec 39
Radio Operator (Air)/Observer (Radio)	RO	King's Order 439 of 20 May 41	AMO A.402 of 29 May 41
Navigator	N	King's Order 480 of 27 Jul 42	AMO A.1019 of 17 Sep 42
Air Bomber	B	King's Order 480 of 27 Jul 42	AMO A.1019 of 17 Sep 42
Flight/Air Engineer	E	King's Order 480 of 27 Jul 42	AMO A.1019 of 17 Sep 42
Wireless Operator (Air)/Air Signaller	S	King's Order 521 of 5 Oct 43	AMO A.3 of 6 Jan 44
Meteorological Air Observer	M	King's Order 562 of 3 Apr 45	AMO A.409 of 26 Apr 45
Air Electronics Officer/Operator	AE	Queen's Order 767 of 10 Jan 56	AMO A.18 of 9 Jan 57
Air Quartermaster	AQ	?	AMO A.117 of 16 May 62
Air Loadmaster	LM	?	DCI(RAF) S159 of 30 Sep 70
Weapons Systems Officer/Operator	RAF	?	? (First awarded in 2003)

Badges Conferring Honorary Aircrew Status

Parachute Training Instructor	parachute	King's Order 577 on 7 Oct 45	AMO A.1079 of 8 Nov 45

Badges Worn By Other Personnel Who Fly

Fighter Controller	FC	?	? (First awarded in 1983)
Airborne Technician	AT	?	? (First awarded in 1989)
Imagery Analyst	IA	?	Unratified 2003 AFBSC paper

Fig 4. Table indicating the decline, over time, in the degree of formal endorsement associated with the badges worn by RAF personnel who fly.

specifically that the badge arose:[78]

> '. . . from the Aircrew Structures Review Paper. Although this paper was not agreed in full by the Air Force Board Standing Committee, the Chief of the Air Staff accepted much of the submission and the following line was assumed to be the AFBSC approval in February 2003:
>
> > '*Following the precedent set by Fighter Controllers and Airborne Technicians, Imagery Analysts will be awarded a brevet and receive the NCA rate of flying pay while in a flying appointment*.'

So there it is. The badge was not authorised by the Defence Council, not even by the single-Service Air Force Board. It clearly never went anywhere near the Palace and, to cap it all, it's a 'brevet'.

Conclusion

Does any of this matter? Certainly not in a material sense. People can fly equally well wearing the correct badge, no badge at all or one that they have made up and awarded to themselves. A better question is, 'Should we care?' It has been said, somewhat unkindly, that the Army has traditions, which are respected and observed, whereas the RAF has mere habits – which can be broken. While this ought not to be true, and periodic statements are made within the Service about the need to promote and nurture its 'ethos', it is only too easy to trample roughshod over tradition and that is demonstrably what has happened in the case of flying badges, surely a fundamental manifestation of what the RAF is all about. The Army takes pride in, and as a result, derives considerable benefit from, its splendid bearskins and scarlet tunics; the RAF, it seems, cannot even manage to get its badges right.

POSTSCRIPT

The increasingly careless attitude towards badges, and correct nomenclature (this is not mere pedantry – translating *brevet* as 'badge' is just wrong), and the disregard of Queen's Regulations (and, quite possibly, royal protocol) are not the only grounds for concern.

What is perhaps even more worrying, in the overall context of air force history, is that increasing reliance on computers and electronic communications means that record-keeping is becoming ephemeral. The Air Force Board may have decided that there is no longer any

need to publish the Air Force List, because its members can access the current situation on-line. But that is an exclusively in-house military facility. What used to be an annual document of *public* record is no longer available to *the public*. That in itself is regrettable, but what of the long-term implications? For the last 100 years it has been possible, by reference to the Air Force (and Army and Navy) Lists, to reconstruct the essential features of the career of any individual officer – the dates of his promotions and (to an accuracy of a year) when he went to staff college, became a QFI, was awarded a decoration and so on, and for those working in the higher levels of the hierarchy, the dates of their appointments. How will that be done in the future?

Another series of documents that are essential to an understanding of the way in which the Service administers itself, and the way in which these arrangements evolve, are the erstwhile AMOs and later DCIs that introduce these changes. These used to be routinely deposited with the National Archives at Kew which holds an (almost) unbroken run from 1918 to 1975, but there the trail currently goes cold, although the equivalent Army collection runs on to 1997. It is to be hoped that, at some stage, the later documents in the RAF sequence will also be released. It is understood, however, that, from a relatively recent date, DCIs are no longer being published as hard copy and that administrative changes are now notified via electronic messages. Since there are no longer any documents to be sent to Kew, that is another source that will dry up.

The RAF's heritage is its history. Its history is reconstructed from the records that are preserved. If, like the Air Force List and DCIs, key documents are not even written, there can be no history and thus no heritage. 2012 marks the centenary of the beginning of serious military aviation in this country and sufficient material has survived to permit us to understand the way in which it developed throughout the 20th Century. Unless the Air Force Board takes positive steps to reverse the current trend, the 21st Century will resemble a new Dark Age.

Disrespect for its badges, and an evident lack of appreciation of the value of the Air Force List, and of the long-term significance of administrative instructions are all symptomatic of an underlying lack of concern for the history and traditions of the Service. So, 'Does any of this matter, and should we care?' This writer believes that it does,

Notes: Army Orders referred to may be found at TNA in the WO123 series, Army Council Instructions in WO293 while Air Ministry Orders and Weekly Orders, and Defence Council Instructions are available in the AIR72 series.

[1] In a report on various aspects of aviation in France, including the relative cost of flying training compared to the UK, *Flight* magazine for 24 September 1910 noted that 'Almost all the great French constructors guarantee the brevet for £100, or even a little less . . .' Within a matter of weeks, the term had been imported into England, as evidenced by *Flight* for 19 November which noted, in an article describing recent activities at Brooklands, that '[*Mr Greswell*] put in his qualifying flights for his brevet', ie his Royal Aero Club Certificate.

Even more specifically, under the headline 'A British General Gets His Brevet', *Flight* for 26 August 1911 reported that 'The British Army, as well as the French, can now boast a General as a certificated pilot, as on Wednesday, the 16th inst, Brigadier-General David Henderson – Chief Staff Officer to Sir John French – who had been learning under the name of Henry Davidson at the Bristol Company's School at Brooklands, made the necessary flights to get his certificate.' Not his *badge*, which would not be introduced until 1913 – his *brevet* – his certificate.

[2] TNA AIR2/3. This file contains correspondence relating to the design and introduction of uniform and badges for the early RFC.

[3] TNA AIR1/818/204/4/1308. This file contains correspondence relating to the refinement of the regulations governing the wearing of 'wings'.

[4] TNA AIR2/15/55/RFC/16. Letter CRFC 1701(A) dated 15 June 1915 from Maj-Gen Henderson to the Adjutant General at GHQ BEF.

[5] *Ibid*. Letter Q/3276 dated 26 June 1915 from FM French to the War Office.

[6] *Ibid*. Although the badge that was eventually introduced was embroidered in white on a black ground, it is interesting to observe that this file contains two examples of early prototypes which are embroidered in beige on khaki.

[7] TNA AIR10/171. Air Force Memorandum No 1 of 1 March 1918, the full text (but without the appendices) of which was published in *Flight* for 14 March.

[8] AMWO 168 of 2 May 1918.

[9] TNA AIR10/172. Air Force Memorandum No 2, which was subsequently given wider circulation as Air Ministry Monthly Order 162 dated 1 May 1918.

[10] For example AMWO 585 of 3 July 1918 omitted the inverted commas, whereas they still figured in AMWOs 794 of 5 August 1918 and 783 of 10 July 1919,regulations.

[11] AMWO 938 of 28 October 1920.

[12] In 1925 revised regulations governing the award of the flying badge were promulgated by AMWO 376, these provisions subsequently being incorporated into KR811 (in succession to KR682). Following its reinstatement in 1937, the award of the observer's badge was authorised by KR817.

[13] AMO A.347/1937 of 21 October.

[14] AMWO 204 of 12 April 1923.

[15] Each submission to the Palace (which covered a wide variety of topics other than

badges) is (was?) assigned a serial number following its approval by the Sovereign to become a King's (or Queen's) Order for the Royal Air Force. The application for approval of a badge for air gunners was the 392nd such submission raised since 1918. The original of King's Order 392 may be found within AIR30/271.

[16] AMO A.547/1939 of 21 December.

[17] AMO A.552/1939 of 28 December.

[18] AMO A.440/1940 of 4 July.

[19] For instance in AMOs A.1019/1942, A.3/1944, A.337/1947 and A.631/1949.

[20] For a more detailed account, see 'The Evolution of the Flight Engineer in WW II' in *RAFHS Journal No 47*, pp86-109.

[21] TNA AIR2/8348. Memorandum A.54893/40/TMech dated 10 December 1940.

[22] AMO A.300/1941 of 1 May.

[23] TNA AIR2/6225. Letter FC/365 dated 18 April 1941 from AOCinC Fighter Command to the Under-Secretary of State.

[24] See Rawnsley, C F and Wright, R; *Night Fighter* (Morely, 1976 Edn) pp129-130.

[25] TNA AIR2/6225. Memo from DPS (Air Cdre D Colyer) to AMP dated 12 May 1941.

[26] TNA AIR30/273.

[27] AMO A.402/1941 of 29 May.

[28] AMO A.503/1941 of 10 July.

[29] AMO A.505/1942 of 21 May.

[30] AMO A746/1942 of 23 July.

[31] TNA AIR30/274.

[32] AMO A.1019/1942 of 17 September .

[33] The responsibilities of wartime navigators varied with both time and the role(s) in which they were employed, but it is generally true to say that the plain Navigator handled navigation plus gunnery in an emergency. As the suffixes suggest, the Nav(B), Nav(W), Nav(BW) and Nav(R) were additionally qualified as air bombers, wireless operator (ie Morse at professional speed) and/or in the operation of AI radar. The last category, the Nav(R), was provided with a relatively brief period of instruction in navigation until late 1943 when it was accepted that, if they were to be categorised as navigators, they should do the full navigation course, training as an AI operator becoming a post-graduate specialisation.

[34] AMO A.1242/1943 of 2 December.

[35] AMO A.916/1944 of 21 September.

[36] TNA AIR30/275.

[37] AMO A.3/1944 of 6 January.

[38] AMO A.973/1942 of 10 September.

[39] AMO A.409/1945 dated 26 April.

[40] TNA AIR30/277.

[41] AMO A.409/1945 of 26 April.

[42] To be pedantic, 'air crew' was supposed to be rendered as two words until February 1946 when AMO A.158 standardised on one. Since it is more familiar today as one word, however, it has been used that way throughout in this paper.

[43] AMO A.3/1944 of 6 January. A month later this Order was amended to state, yet

again, that, regardless of which badges an individual may have, at some time, been entitled to wear, aircrew currently employed as such were to wear *only* the badge of the category in which they were presently mustered or listed.

[44] Army Council Instruction (ACI) 660 of 29 June 1940. These regulations were subsequently refined and restated, the final wartime iteration being ACI 1263 of 20 September 1944, although by 1942 they had also been enshrined within KR198.

[45] AMO A.402/1939 of 28 September.

[46] Although the prohibition on the wearing of the flying 'O' by soldiers was publicised from time to time throughout the war, this did not prevent the more determined ex-observers from sporting their badges.

[47] In October 1944, the Air Ministry buttressed its arguments by enshrining them within KR198 (Amendment List 135 to the 2nd Edition), thus providing them with the legal basis which they had previously lacked.

[48] To be strictly accurate, ACI 768 of 11th April 1942 had introduced an Army flying badge, but this was to be worn only by AOP and glider pilots.

[49] ACI 1380 of 18 September 1943.

[50] *Sunday Dispatch* for 14 August 1941.

[51] Cundiff had flown as an observer with No 2 Sqn in 1917.

[52] ZHC2/915, *Hansard* for 18 January 1945.

[53] TNA AIR2/4062. The correspondence relating to this affair, in which the key players were AMP (Sir Bertine Sutton), the Secretary of State for Air (Sir Archibald Sinclair) and the King's Private Secretary (Sir Alan Lascelles) is on this file.

[54] AMO A.1079/1945 of 8 November.

[55] TNA AIR30/277.

[56] AMO A.337/1947 of 1 May.

[57] AMO A.54/1956 of 8 March.

[58] TNA AIR30/290.

[59] The last Queen's Orders at Kew are dated 1956. That does not conclusively prove that there were no later ones, only that, if there were, they have not been deposited with TNA. Other documents filed within the AIR30 Series (which covers all air force-related papers submitted to the Sovereign) run on to 1972 before the trail goes cold.

[60] Interestingly, in correspondence with this writer as recently as March 2012, the Chief Clerk at the Palace, having taken advice from the MOD, has stated that the Queen's approval is sought only if a badge features a crown. He had clearly been misinformed, but, even if that were true, why can the MOD not produce the authorisation for the 'crowned' WSO badge? – *see Note 77.*

[61] AMO A.192/1956 of 8 August.

[62] In the early post-war air force, individual airmen aircrew were graded (A) or (B), as in 'signaller (B)', those graded (A) being more technically competent than the (B)s. These suffixes were related to sub-divisions within the groundcrew trade structure which was broadly divided into A, B, C and D groupings for pay purposes. The A Group comprised fitter-grade tradesmen; B covered the less skilled mechanics and their equivalents; C embraced clerical trades, and D unskilled aircrafthands. For airmen aircrew, the (B) suffixes were dropped in 1948 but a pay differential was sustained between air signallers (A), who possessed superior levels of technical

expertise, ie those drawn from related advanced ground trades, and those who did not. In 1956 the Air Signallers Advanced Course was established to permit less well-qualified air signallers to acquire the expertise associated with an (A) suffix. In 1962 this course was redesignated to become the Air Electronics Conversion Course, its graduates now being rebadged as AEOps.

[63] TNA AIR6/134. The proposal, as originally submitted to the Air Council Standing Committee by AMP, Air Mshl Sir Walter Cheshire, in his SC(62)23 of 3 July 1962, had envisaged the new trade being designated as the Air Signaller (Air Electronics).

[64] AMO N.894/1962 of 5 December as amplified by AMO A.6/1963 of 2 January.

[65] Although it is known that the first five 'S' badges were awarded to personnel of No 51 Sqn in October 1969, so far as this writer has been able to establish, there is no reference to this event, or to the negotiations that led to it, in the F540s maintained by the squadron or by RAF Wyton (or in the station's monthly magazine, *The Wyton Eye*) or by their controlling authority, the Central Reconnaissance Establishment.

[66] AMO A.117/1962 of 16 May.

[67] DCI(RAF) S159 of 30 September 1970.

[68] For the record, the 'QM' was omitted from the list of obsolete badges at para 206 of the 4th edition of QRs, nor is it currently listed in the 5th edition.

[69] As at 2011, the regulations still contained embedded references to HQ Personnel and Training Command, which had been absorbed into Air Command in 2007, so there may have been some subsequent amendment.

[70] See *Air Clues*, March 1984, p93.

[71] After a major internal reorganisation of the RAF's officer structure in 1997, fighter controllers ranked as squadron leader and below became members of the Operations Support Branch, not the Flying Branch. That is to say that, they are still not listed as aircrew. Furthermore, since 2008, the erstwhile commissioned fighter controller has been an Aerospace Battle Manager and his Trade Group 12 NCO counterpart an Aerospace Systems Operator.

[72] DCI RAF 31 of 10 March 1989.

[73] QR435.

[74] DCI(RAF) S119 of 14 June 1967 introduced a badge to be worn on the sleeve by selected personnel or Trade Group 19 (ie Catering) who were trained to act as cabin staff for VIP flights.

[75] In the course of an exchange of correspondence with the MOD, in an unsuccessful attempt to ascertain the authority for the introduction of the 'FC' and 'AT' badges, this writer pointed out that the latter was not even listed at QR206. As a result, in his D/DAO/3/4/4 of 2 August 1999, the responsible desk (AEW1 within the Directorate of Air Operations), noted that he had arranged for it to be included.

[76] *RAF News*, 18 August 2000.

[77] HQ Air Command letter FOI 171359-009 dated 18 August 2011.

[78] HQ Air Command letter RB115/2011 dated 29 September 2011.

FEEDBACK

Members may recall that on p115 of the Society's 2009 publication, covering the Canberra's career in the RAF, this photograph appeared with the caption, 'Who? Where? When?' We still don't know the specifics but it has emerged that it is an RAAF (not RAF) aeroplane, and clearly somewhere hot.

ERRATA

There were a couple of problems with Journal 51. One of our eagle-eyed readers has pointed out that the caption to the photograph on page 49 is incorrect. The date should, of course, be 1948, not 1938.

The other problem was less obvious but rather more significant. The maps reproduced on pages 14 and 21 are the same. The second of these should have shown the movements of No 5357 Wg as it advanced from Normandy to the Netherlands, thus complementing the map on page 27 which shows its onward progress into Germany. The map that should have been on page 21 is reproduced here.

Once again, the Editor is obliged to apologise. This sort of thing didn't used to happen. Now it does. Is someone trying to tell me something?


D-Day to VE day
RAF Airfield Construction
5357 (Light) Wing
NORTH SEA
NETHERLANDS
BRITAIN
BELGIUM
GERMANY
FRANCE
ENGLISH CHANNEL
LUX
CHANNEL ISLANDS
Norwich
Cambridge
Ipswich
Oxford
London
Bristol
Dover
Southampton
Portsmouth
Brighton
Calais
Boulogne
Dunkerque
Bruges
Ghent
Brussels
Antwerp
The Hague
Amsterdam
Utrecht
Arnhem
Rotterdam
Nijmegen
Breda
Tilburg
B78 Eindhoven
Bourg Leopold
B64
Diest
B66 Blankenberg
Lille
B51
Lille-Vendeville
A84 Chièvres
Charleroi
Namur
Liege
Osnabruck
Münster
Dortmund
Essen
Düsseldorf
Cologne
Bonn
Koblenz
Wiesbaden
Mainz
Trier
Luxembourg
Saarbrücken
Abbeville
B54 Achiet
Dieppe
Amiens
B48
Amiens-Glisy
Fécamp
Cherbourg
Guernsey
Jersey
Le Havre
Rouen
Arromanches
B19
Lingèvres
Caen
Lisieux
B28
Evreux/Fauville
Condé-sur-Noireau
B30
Créton
St.-Malo
Argentan
Versailles
Paris
Reims
Verdun
Metz
Nancy
Strasbourg
Fontainebleau
0
50
100 Miles

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.

Bombers Over Sand And Snow by Alun Granfield. Pen and Sword; 2010. £30.00.

Bombers Over Sand And Snow is an account of the wartime career of 205 Group. Strictly speaking, HQ 205 Gp was not established until October 1941, but the book actually begins with the outbreak of hostilities against the Italians in Libya in June 1940 and thus tells the story of the RAF's Mediterranean-based heavy bombers from then until 1945. After some early sorties by Bombays, the Group was slowly built up on Wellingtons, supplemented by a handful of early Liberators and a few Halifaxes, but it was mid-1944 before re-equipment with late-model Liberators began and February 1945 before the last of the 'Wimpys' was finally withdrawn from operations.

In many ways 205 Group was Bomber Command in miniature and it did much the same things. Its squadrons flew (mostly) at night; they attacked industrial and tactical targets; they laid mines (especially in the Danube) and they used similar techniques. There were, of course, many differences, the most obvious being scale; whereas the Bomber Command of 1944-45 would routinely launch raids of 500 aircraft, 205 Group's nightly effort was more likely to be about 70. Technology was slow to filter down to the Mediterranean, so it was the summer of 1944 before a GEE chain was set up in Italy and, while the Pathfinder Halifaxes of No 614 Sqn were provided with H2S, it never became available to the Main Force squadrons. The aeroplanes that equipped No 205 Gp precluded the dropping of really heavy bombs, but the Wellington could handle a 4,000 lb 'Cookie' and, having dropped a few while still operating from Tunisia, many more were delivered after the squadrons had moved to Italy. Losses were not insignificant, although the casualty rate was far lower than that of the UK-based bomber force. On the other hand, the domestic arrangements were far worse, ranging from the heat and dust of North Africa to the quagmires of two Italian winters, and even when the weather was less extreme, accommodation was often extremely

primitive – frequently under canvas or, in Italy, in ruined or requisitioned buildings.

All of this becomes apparent as the narrative unfolds and, while there is, inevitably, a degree of repetition, this is moderated by setting the events in context, so that one has a clear impression of the part being played by the night bombers in the wider campaign. Interest is also sustained by the changing nature of operations as the squadrons move from Egypt and the Western Desert, with detachments operating from a besieged Malta, via Cyrenaica, Tripolitania and Tunisia to Italy, finally settling relatively permanently in the complex of airfields on the Foggia plain at the end of 1943.

The story is broken down chronologically into ten chapters, each of which ends with a statistical summary of what had been achieved during the period covered in terms of sorties flown, losses sustained, days/nights operated and a broad analysis of the types of targets attacked. There are useful appendices, one presenting the Group's ORBAT, broken down by wings and squadrons on various dates, the other summarising the history of each of the squadrons involved, including the two South African Liberator units, while they were assigned to No 205 Gp. Apart from noting changes of base and equipment, each one has a tabulated summery of the squadron's effort – recording, on an annual basis, total sorties launched; number effective; number that attacked the alternate target; number that failed to complete the mission and the number lost, plus the overall wartime total of men killed, injured and taken prisoner. There is a comprehensive bibliography, reflecting all of the secondary sources that one might expect to see, and listing the ORBs of all of the units involved, and it is clear that these have been studied in some depth. Finally, there are five maps (which look very familiar to this reviewer) indicating the locations of the aerodromes which provided a wartime home to the squadrons of 205 Group.

I have observed on several occasions in the past that writing a successful unit history is a lot harder than it seems. Such a book needs to be comprehensive, accurate and readable. The first two of these characteristics demand application and effort. The third requires a gift, because it is not easy to present what must often be a recycling of very similar events without losing the reader's attention. *Bombers Over Sand And Snow* is an admirable example of the genre. The book is

presented in quite a small point size, so there is a lot of information compressed into its 383 casebound pages, and the story is told in sufficient detail to inspire confidence. I found very few typos and no howlers. Alun Granfield has a way with words that kept me engaged, and the structure of his book, with its appendices and periodic summaries, makes it very handy reference work.

Strongly recommended.

CGJ

Javelin From the Cockpit by Peter Caygill. Pen & Sword; 2012. £19.99.

Some ten years passed from the statement of requirement to the delivery of the first Javelin FAW 1 to No 46 Sqn at RAF Odiham in February 1956. Twelve years later the Javelin, by now the FAW 9, was retired from squadron service at RAF Tengah in April 1968.

During its comparatively short front line service the Javelin was operated principally as a night all weather fighter within the UK Air Defence Region. In later years Javelin squadrons also served in the Middle East, Africa and most notably in the Far East during the 'Confrontation' with Indonesia. The Javelin certainly earned its keep and its value to the Service is admirably summed up by Wing Commander Dusty Miller in the conclusion to Chapter 12 which records his personal account of ten year's association with the aircraft. He wrote '(The Javelin) was an excellent bomber destroyer which was what it was really meant to be. It also tackled unusual demands in the Far East and it did all it was expected to do, and more.'

Peter Caygill's book records, at a smart pace, the troublesome period of design and development of the aircraft and its introduction to service. Thereafter Caygill's history of the Javelin is largely constructed around the personal recollections of pilots and navigators who tell some exiting and most readable tales of triumph and disaster. For me they bring back many happy memories of my tour on No 64 Sqn at Duxford, Waterbeach and – less so! – Binbrook all interspersed with detachments to Cyprus.

The idiosyncrasies of the aircraft are well detailed. Spinning is deservedly given a chapter of its own, while the chapter on Accidents and Incidents (super stalls, centre-line closure, jet pipe fractures, start up fires, etc) gives some feeling for the excitation generally associated

with a tour on Javelins. The early marks were underpowered for high altitude operations, while the later versions were equipped with a reheat system that reduced power at low altitudes. On the early marks toe brakes, without a self-centring mechanism (introduced with the FAW 7), posed particular difficulties while taxying and landing in cross winds; the answer was to get the control locks in before touching the brakes!

While pilots and navigators tell their individual stories they fail to emphasise the simple fact that the operational effectiveness of the Javelin depended on the closest cooperation of constituted crews who teamed up at the OCU. As the first 'first tourist' on the Javelin I was particularly lucky to fly with an experienced navigator, as the whole process of an interception and kill rested on his skill in interpreting his radar picture and my competence in accommodating his instructions with a standardised piloting performance response in terms of turning, height and speed control. Mine was the easy bit. And while the arrival of Firestreak missiles dramatically improved kill capability, practice interceptions continued after 'missile launch' down to a visual ident and guns attack. Firestreak did not replace guns as stated in the cover blurb – they augmented the Javelin's firepower such that it was, I believe, the heaviest armed all weather fighter of its generation.

One issue not addressed in Caygill's book still bothers me. After in-flight refuelling training the first overseas deployment was UK to Cyprus. For this deployment we were required to RV with the tankers over northern France and then to accompany them to Malta at around 30,000ft at an IAS of 230 kts. This needed three refuellings and a top-up, one of which was above the Rhone valley, which is notorious for clear air turbulence. The squadron's preferred plan was to refuel over northern France and then climb and accelerate to best range speed to arrive over Malta (we reckoned we could find it) for a second RV and refuel before turning east and cruise climbing to 50,000 ft to annoy Cyprus-based Hunters trying to intercept us. This plan, much more economical in terms of fuel burn and resources, was rejected by Fighter Command and to this day I still don't know why. I had rather hoped Peter Caygill's book would enlighten me, but then, as the title indicates, it's all about a view of the *Javelin From The Cockpit*, not policy decisions from a Command HQ.

I enjoyed flying the Javelin and I enjoyed reading Peter Caygill's 224-page hardback, which has refreshed many past memories: QRA (Operation HALYARD if I am right) at two minute's cockpit readiness, with 1¾ hours strapped in and 1¾ hours out, through the long winter nights; the thrill of collimator tail chasing at night; the challenge of flying in really filthy weather; air-to-air gunnery during Cyprus detachments and so on. For Javelin aircrew this book is a 'must' while for others with an interest in military aviation it tells the tale of an 'unsung hero' of the hot days of the Cold War. As Peter Caygill writes in his Introduction, his book 'attempts to redress the balance'. He succeeds.

Air Chf Mshl Sir Richard Johns

Sniffing and Bottling by Dave Forster. 2011; 'print on demand' at £4.00 plus p&p from www.lulu.com

In a letter covering a review copy of this 150-page, A5(ish) softback, the author explains that it was written primarily to provide, for the benefit of ex-members and their families, a history of No 1323 Flt and No 542 Sqn during the 1950s when they were engaged in harvesting samples of atmospheric debris following nuclear tests. It is clearly a DIY production and apparently lacks an ISBN, or even an identified publisher, hence the somewhat restricted availability. None of this is to say, however, that it is an amateur affair. Nor is it as parochial as might be inferred from the writer's motivation. Indeed the book provides a very comprehensive account of what has been a particularly obscure aspect of RAF activity. The paranoia of the mid-1950s meant that work associated with nuclear weapons was heavily classified and this certainly extended to air sampling. As a result, despite the release of their ORBs several years ago, the units involved have received little publicity.

Sniffing and Bottling will tell you just about everything that you need to know, including providing some insight into the extent of US/UK co-operation in this field, and into the domestic inter-departmental arm-wrestling as to 'who pays?'. Well laid-out tables and explanatory passages unscramble all of the code names involved, including Operations BONEDOME, DOGSTAR, HAREM, RAKISH, UNSPARING and many others. The story covers all of the detached operations, which apart from those mounted from bases in the UK,

included Singapore, Goose Bay and Gibraltar and the even more exotic Laverton and Kwajalein. The book is very well-illustrated with a couple of dozen photographs, useful maps to show fall-out patterns and the like and diagrams of sampling equipment. There is a list, with dates, of the COs and the narrative includes sufficient references to personalities to convey a reasonable impression of, at least the aircrew, who participated in the monitoring programme. There is a list, with dates, of all US and Soviet tests conducted between 1954 and 1957 and a one-page appendix that summarises the very first air sampling mission, Operation HOT BOX (*for a first-hand account of this, see Journal 43*).

Criticisms? I found the structure of the book a little confusing, but not excessively so. The photographs, most of which appear to be of excellent quality, really deserved to have been reproduced on a higher grade of paper. There is little wrong with the syntax although a reference to 'outside time' on page 82 is clearly a proof-reader's oversight and there is some occasional confusion over directions, for example, Cumbria has no east coast (page 87) and on page 47 there is something wrong with the headings (reportedly) flown by the crew of Canberra WH967 while endeavouring to establish their position. That hiccup aside, incidentally, I was fascinated by the detailed account of WH967's wheels-down forced landing on the beach of an island in the Pacific at low tide and the heroic, if ultimately unsuccessful, attempts to salvage the aircraft – a remarkable incident of which I was previously quite unaware.

Sniffing and Bottling tells a story that was long overdue for telling and it does it well. It is also remarkable value for money. Recommended.

CGJ

From Schoolboy to Station Commander by Jock Heron. Rolls-Royce Heritage Trust; 2012. £20.00.

Anyone who knows Jock Heron would expect him to have written this account of his careers in the Service and in Industry in an honest, direct, straight-from-the-shoulder way and that is exactly what he has done. The result is something much more than a mere narrative of these complementary careers and the reader will find that, at every turn, the author provides much by way of context and background to

his story. It is one of passion for flying, of dedication to the Royal Air Force and the Nation's defence and of firmly held and sometimes controversial views.

Jock's story will resonate with many of our generation, who were once schoolboys with an obsessive interest in aircraft and the air. For many of us, the Dukes, Cunninghams and Lithgows of the '50s were as iconic as David Beckham, Ant and Dec or Lady Gaga are today – and with more reason! That fact jumps from the pages of this memoir. His route to the cockpit was via the admirable 'old' Cranwell where, one suspects, the straightforward instincts and attitudes of his Presbyterian upbringing were reinforced. Thereafter, as the book records in careful detail, he became a much respected fighter pilot, oxymoronic though that description may seem! 'Jock is no mean poler' was the verdict of one of his fellow fast jet Wing Commanders at Gütersloh in the late 1970s. His own account is more modest, but none the less revealing of his talent and passion.

Taken chronologically, the schoolboy's path to the Station Commander's office – twice, at RAF West Drayton and RAF Stanley – was typical of Jock Heron's generation. An apprenticeship on the Hunter led to a demanding and varied tour at the Air Fighting Development Squadron of the CFE, flying the F-105 on exchange with the USAF, a first MOD appointment dealing with the aborted AFVG project and the new MRCA, before his first association with 'the little jet', his beloved Harrier, and STOVL of which he was and is a passionate advocate. Especially in describing life in the MOD, he offers pungent comment about procurement, politicians and the Civil Service. There is also the occasional whiff of carefully suppressed prejudice where navigators, test pilots and the V-Force are concerned, all giving colour to this workmanlike account. His second career with Rolls-Royce as 'the lubricant in the company's military business gearbox' is equally carefully described.

From Schoolboy to Station Commander contains more than 100 B&W plates, but boasts no index although, in truth, one is scarcely needed, given that in its 328 pages fewer than twenty individuals are mentioned by name, the majority of whom are notables from the worlds of test flying and industry. This is a curious and largely unnecessary decision, given that the author deals in a kindly way with most of those whom he describes, in any case with sufficient accuracy

to allow his contemporaries to identify themselves, their peers and erstwhile superiors.

This is a valuable book, not only for its carefully drafted account of a Cold War military career, but also for the detailed observations of the wider military, industrial and political contexts in which it ran. Jock Heron has a canny, sometimes naive, sometimes opinionated view of failures in all these spheres, driven by his passion for flexibility which is, after all, one of the cardinal virtues of Air Power and one often sidelined for economic or dogmatic reasons. Above all, it will remind Jock Heron's contemporaries in a very readable way, of life as it was in a very much larger Service than is the Royal Air Force today.

AVM Sandy Hunter

The Sopwith Dolphin – various authors. Cross and Cockade; 2012. £25.00.

At a ceremony held at Hendon on 16 March 2012 the RAF Museum added a splendid example of a Sopwith Dolphin to its steadily expanding collection of Great War exhibits – there are more to come. To coincide with the occasion the Museum also launched a book dealing with the Dolphin, which has been produced in collaboration with Cross and Cockade International (C&CI), indeed the latter have actually been the major players in the joint enterprise. Since the membership of C&CI includes virtually anyone who has a serious interest in British aviation of the period, it follows that the writers who contributed to the book are all experts in the field. They include: Philip Jarrett, who describes the design, development, construction and flying characteristics of the type; Norman Franks, who provides an account of the Dolphin's combat career; and Peter Dye, who delivers two essays, one dealing with the pros and cons of the aeroplane's Hispano-Suiza engine, the other describing the conduct of the restoration project. Other, equally knowledgeable, contributors are Mick Davis, Trevor Henshaw and Mike O'Connor who between them provide all the detail that one could possibly want in terms of statistics relating to Dolphin 'aces' and casualties, the units (schools as well as squadrons) that operated the type, a discussion on colours and markings, and a listing of all Dolphin serials, including, in many cases, a surprisingly detailed summary of their service record.

Presented as a 180-page A4 softback, printed on high grade gloss paper, the package is rounded off by 1/48th scale drawings of every variant of the type, thirty-six of Juanita Franzi's colour profiles of individual airframes and well over 300 photographs.

This is C&CI's third publication of this nature, earlier titles having dealt with the Nieuport in British service and the FE2, and all three are equally comprehensive and reflect the same degree of quality. Biographies dedicated to an aeroplane type simply do not come any better than these.

CGJ

Nimrod – Rise and Fall by Tony Blackman. Grub Street; 2012. £20.

The Nimrod gave outstanding service to the RAF for over forty years in a number of crucial roles; yet authors have shied away from writing a history of the aircraft. Perhaps the largely secret work of the 'Mighty Hunter' has proved too daunting. However, this gaping hole in the library of books about RAF aircraft has now been addressed and there can be few better qualified to do so than Tony Blackman. After service in the RAF, the author joined A V Roe and rose to become the Chief Test Pilot during which time he tested virtually every Nimrod that was manufactured.

Well known to the Society, and author of the acclaimed book *Vulcan Test Pilot,* he charts the history and capabilities of the aircraft from its earliest development, outlines the various roles and operations it fulfilled concluding with the final controversial, and to many, criminal destruction of the Mark 4 shortly before it was due to enter RAF service.

In addition to drawing on his own activities, the author has also enlisted the experiences of the operators whom he quotes to illustrate various operational issues and events. After a brief history of the Nimrod and of anti-submarine warfare he embarks on a detailed description of the Mark 2 and its sensors and weapons. As an expert in aviation electronics he provides a detailed insight into these complex systems with the descriptions enhanced by some superb colour photographs.

After describing the Nimrod's anti-submarine and anti-surface unit warfare capabilities, he embarks on a fascinating chapter describing some remarkable search and rescue missions. He follows this with an

outline of recent conflicts where the versatile Nimrod embarked on some critical overland operations, including the Balkans, the Gulf War and the implementation of the subsequent No-Fly Zone. The Iraq War of 2003 and the on-going operations in Afghanistan provided further opportunities to exploit the Nimrod's enhanced capacity for intelligence gathering and surveillance.

Not surprisingly, the Falkland's Campaign attracts a full chapter where the Nimrod's considerable, and little known, contribution is described in full and fascinating detail. The work of industry to modify the aircraft adds further interest.

The author does not shirk the more unfortunate aspects of Nimrod's life and he devotes a chapter to the accidents suffered, some with heavy loss of life. Also, the unhappy saga of the Nimrod AEW is described.

The final chapter is an intriguing and extremely interesting insight into the Nimrod MRA 4 and its untimely demise. With his intimate knowledge of the programme and the aircraft's outstanding capabilities, this chapter alone must rank as the most definitive account of what might have been. In the event, our island nation is left without a capability to support the country's nuclear deterrent, protect its sea lanes and prosecute unfriendly forces.

This is not a book for bedtime reading but it contains a wealth of information not previously published. The author is not afraid to express his personal opinions and some of his conclusions will not be welcomed by everyone. It all adds up to an absorbing account.

The book, a 224-page hardback, is extremely well presented. Grub Street normally include photographs in a centre section, but in this case the 140 illustrations, almost all in colour, are embedded within the text, allowing the reader more easily to assimilate the author's descriptions, although I struggled a bit with one or two of the small schematic diagrams and maps.

This is an excellent book and one which the Nimrod itself, and the outstanding air and ground crews who operated it, fully deserve. I suspect it will be a long time before anyone else ventures into a history of the Mighty Hunter. Highly recommended.

Air Cdre Graham Pitchfork

ROYAL AIR FORCE HISTORICAL SOCIETY

The Royal Air Force has been in existence for more than ninety 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 inter-war period, and in the era of Cold War tension. Material dealing with post-war history is now becoming available under the 30-year rule. 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, Dr Jack Dunham, Silverhill House, Coombe, Wotton-under-Edge, Gloucestershire. GLI2 7ND. (Tel 01453-843362)

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 officer or airman. The RAF winners have been:

1996	Sqn Ldr P C Emmett PhD MSc BSc CEng MIEE
1997	Wg Cdr M P Brzezicki MPhil MIL
1998	Wg Cdr P J Daybell MBE MA BA
1999	Sqn Ldr S P Harpum MSc BSc MILT
2000	Sqn Ldr A W Riches MA
2001	Sqn Ldr C H Goss MA
2002	Sqn Ldr S I Richards BSc
2003	Wg Cdr T M Webster MB BS MRCGP MRAeS
2004	Sqn Ldr S Gardner MA MPhil
2005	Wg Cdr S D Ellard MSc BSc CEng MRAeS MBCS
2007	Wg Cdr H Smyth DFC
2008	Wg Cdr B J Hunt MSc MBIFM MinstAM
2009	Gp Capt A J Byford MA MA
2010	Lt Col A M Roe YORKS

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
Air Commodore H A Probert MBE MA

SECRETARY
Gp Capt K J Dearman
1 Park Close
Middleton Stoney
Oxon
OX25 4AS
Tel: 01869 343327

MEMBERSHIP SECRETARY
(who also deals with sales of publications)
Dr J Dunham
Silverhill House
Coombe
Wotton-under-Edge
Glos
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