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SELECTED GLOSSARY

AAF	Auxiliary Air Force
AASC	Army Air Support Control
ACC	Allied Control Council
ADCC	Air Defence Cadet Corps
ADGB	Air Defence of Great Britain
AHQ	Air Headquarters
AOA	Air Officer Administration
BAFO	British Air Forces of Occupation
BAOR	British Army of the Rhine
BEF	British Expeditionary Force
BIOS	British Intelligence Objectives Sub-Committee
BYAL	Bournemouth Young Airmen's League
CAATO	Combined Army/Air Transport Organisation
CID	Committee of Imperial Defence
CIOS	Combined Intelligence Objectives Sub-Committee
DAO	Director/Directorate of Air Organisation
EAC	European Advisory Council
JIC	Joint Intelligence Committee
LOX	Liquid Oxygen
MOS	Ministry of Supply
MOSEC	Ministry of Supply Establishment, Cuxhaven
NACA	National Advisory Committee for Aeronautics
ONC	Ordinary National Certificate
ORB	Operations Record Book
OTC	Officers' Training Corps
PPL	Private Pilot Licence
RIB	Rigid Inflatable Boat
SBS	Special Boat Service
SIS	Secret Intelligence Service
SofTT	School of Technical Training
TEL	Transporter-Erector Launcher
UAS	University Air Squadron
VCP	Visual Control Party
VGS	Volunteer Gliding Squadrons

AN EFFORT OF BIBLICAL PROPORTIONS – THE BERLIN AIRLIFT 1948-1949

by Mr Sebastian Cox

In the beginning, God created Heaven and Earth. Then he created the Berlin Airlift to cure keen pilots of their sinful desire to fly aeroplanes.

Wg Cdr 'Mick' Ensor DSO* DFC* AFC RNZAF & RAF
A wartime veteran of Coastal Command, who flew 200 airlift sorties in No 206 Sqn's Yorks.

Relations between the victorious Allied powers, Britain, the USA and the USSR during the Second World War were not always entirely harmonious. However, they did, through summit meetings at Yalta and Potsdam and via a joint European Advisory Council (EAC), settle the outlines of their post-war intentions and policies towards a defeated Germany. Amongst the many issues they agreed in outline were the boundaries of the three occupation zones, soon extended to four with the addition of a French zone. Berlin had been the capital of Germany since German unification in 1871, and the boundaries agreed placed the city deep inside the Soviet Zone, but it too was to be sub-divided zonally between the four occupying powers. The EAC proposed that each occupation zone should have a military governor with wide powers and that they would act collectively through an Allied Control Council (ACC) to reach agreement on matters of common or wider interest such as German disarmament, de-Nazification, and the post-war German economy and government, including elections. Some western officials wanted to include formal agreement on access corridors to Berlin through the Soviet Zone but, partly because the US military regarded that as solely a matter for them, and partly because others were anxious to maintain good relations with the Soviets and believed any problems would be solved with patience and goodwill, no such agreement was included.[1] The only question of access on which the occupying powers reached agreement was in respect of the air. There was a general recognition that the immediate post-war situation, whereby pilots did more or less as they pleased in the airspace around Berlin (and which had led to a number of near misses), needed to be addressed.

Consequently, on 30 November 1945 the ACC approved a paper which created three air corridors into Berlin from the Western zones, each twenty miles wide and extending from the ground to 10,000 feet and meeting a circular zone above Berlin twenty miles in diameter. Traffic was directed by a quadripartite Berlin Air Safety Centre.[2] The deeper significance of this agreement was not recognised at the time, but it was to provide the firm legal basis for what followed and was to prove the key element in ensuring the Western Allies' continued position and presence in the city beyond 1948.

It was soon to become apparent that goodwill was notably absent from Soviet political discourse. Worse still, the EAC proposed that the ACC must reach unanimous conclusions, which effectively granted the Soviets the power of veto and significant scope for obstruction and delay should they be so minded, which, as it turned out, they frequently were. The requirement for unanimity was, as Ann and John Tusa point out, 'a destructive weapon whose use could prevent the formulation of common policies and bring fatal discord into four-Power government.'[3] The EAC also proposed that Berlin, though subdivided, would be governed by the three (later four) powers on the same principle, through a Kommandatura consisting of the three military governors. Here too, the Western allies had stored up trouble for themselves.

The 'Big Three' – Churchill, Roosevelt and Stalin – accepted the EAC proposals at Yalta. Once victory was secure, the leaders met again at Potsdam for a summit lasting just over two weeks, but now Roosevelt was dead and Churchill departed after just three days, defeated in the general election and replaced by Clement Attlee and his foreign secretary Ernest Bevin. Attlee was shrewd and had few illusions about Stalin, and Bevin was a socialist who had spent his life fighting against communists in the trades union movement. Neither harboured many illusions about the Soviet leader and Potsdam was where early signs of the Soviet attitude were first manifest, with Stalin unilaterally announcing his redrawing of Germany's eastern borders. If the western military harboured any expectations that some 'brotherhood of arms' from the wartime alliance would be evident in their relations with the Soviets, they were rapidly disillusioned. Colonel Howley of the US Army led the first convoy of military vehicles to cross into the Soviet Zone on 17 June 1945 expecting to form the advanced guard of the US Garrison in Berlin. As soon as they crossed the bridge from the

American zone they were stopped by Soviet troops who demanded that the size of the convoy be reduced by half. When they reached Berlin they were again stopped and redirected to the suburb of Babelsberg outside the city where they remained for a week before being allowed to proceed to their barracks in the city, which the Soviet Army then handed over with much parade-ground pomp and ceremony, only for the Americans to discover once inside that they had stripped the barracks of everything right down to the light fittings, toilets and hand basins. Had they but known it, the Americans had just received an early lesson in the Soviets' approach to 'reparations,' which included removing everything down to literally the kitchen sink. Howley's men camped out for a week in the woods. The first British column did not fare much better, being told that all the Elbe bridges had necessarily been closed for 'repairs'. A swift reconnaissance soon located an unguarded crossing and the column proceeded only to meet further bridge problems in Berlin where the Soviets had 'accidentally' destroyed a bridge over the Havel. The British too camped out – on the site of the 1936 Olympics.[4] The RAF party sent to occupy Gatow airfield met with an even more frosty reception, being promptly detained in a hangar for twenty-four hours and the commander of the initial unit, Wing Commander Ellis of 19 Staging Post, was kept under lock and key for a further twenty-four, ostensibly on the grounds that he had arrived 'too early'![5] These were the early manifestations of a deliberate obstructionism from the Soviet authorities, petty or serious, physical or bureaucratic or both, and the rationale, as with the bridges, was often transparently false: it was an attitude, indeed a policy, with which the western allies were to become all too familiar.

When the British and American troops reached Berlin they found it was a city in name only. Devastated by Bomber Command's and the Eighth Air Force's bombers it had also been pounded by Soviet artillery during the fierce and bloody battle inside the city which characterised the last days of the Third Reich. The urban landscape in large parts of the city consisted not of streets between buildings, but roads bulldozed between two piles of rubble, beneath which many of the inhabitants lived a troglodytic existence in the cellars below the ruins. Life for the inhabitants was especially grim, not merely because of their living conditions and the lack of basic amenities (for example, none of the city's eighty-seven sewage systems was functioning), but also because

of the behaviour of the occupying Soviet Army. The Soviets engaged in both official and unofficial looting on a gargantuan scale. As 'reparations', they stripped Eastern Germany bare of industrial plant, moving 3,500 factories and more than a million pieces of industrial plant to the Soviet Union. This left two million workers without jobs, but they may have been the lucky ones as thousands of individuals with technical or managerial skills that the Soviets lacked were themselves forcibly removed to the Soviet Union.[6] The Soviets also utilised former concentration camps such as Buchenwald for 're-education' of those who dissented, branding them as Nazis. It has been estimated that some 200,000 people were sent to these camps between 1945 and 1950 and that a third of them died.[7] These were the actions of Soviet officialdom: the behaviour of the Soviet troops was equally problematic for Berliners. The barbaric behaviour of the German invaders in Russia and the brutality of life in the Soviet Army bred a contempt and desire for revenge which the Soviet authorities had little inclination to curb.

There were undoubtedly instances of western occupiers engaging in such practices as looting and rape, though they also tended to use 'economic' muscle to obtain what they wanted from German women rather than physical muscle. Western armies, however, made at least some attempts to curb and punish such activities. The attitude of the Soviets was exemplified by Stalin himself, who when challenged on the behaviour of his troops, became tearful and told his interlocutor he could not understand the problem 'if a soldier has crossed thousands of kilometres through blood and fire and earth and has a little fun with a woman or takes some trifles.'[8] Soviet soldiers had little to offer economically in any case but were temperamentally disinclined to offer anything to a German in exchange for something that they could take by force. Rape was therefore a horrific fact of life for German women in any area controlled by the Soviets. Looting was equally condoned with anything valuable – watch, bicycle, jewellery, etcetera – simply appropriated at the point of a gun or bayonet. Items were not merely looted but often gratuitously smashed before their owners' eyes. This activity continued long after the trauma of combat had subsided. It bred in the German population, including the Berliners, feelings of utter contempt and hatred for the Soviets which were to prove of immense political importance as our story unfolds. One Soviet commissar did apparently comment: 'This will cost us a million roubles a day –

political roubles.'[9] He was an insightful exception, as Soviet troops effectively undermined the efforts of the cohort of German communists imported from Moscow to organise the political takeover of Berlin.

The Soviets and German communists did their very best simultaneously to appear true democrats, appointing members of other parties to administrative posts and publishing a manifesto devoid of Marxist dogma or even socialism. But theirs was a deliberate waiting game – they also gradually sought to intimidate opponents and tried hard to engineer a merger of the Communist Party of Germany with the Social Democratic Party of Germany as part of their long term strategy to undermine and take over government by stealth. The Social Democrats would have none of it and engineered their own referendum amongst their members on the proposed merger which was roundly rejected – except in the Soviet Zone where the result, defeat for the proposal, was declared 'irrelevant' and a forced merger instigated to form a new party, the Social Unity Party. In the 1946 elections to the City Assembly on 20 October 1946, the Social Democrats got 48 per cent of the vote and 63 seats, with the Social Unity Party getting only 19·8 per cent overall and just 21 per cent in the Soviet Zone despite rigging and intimidation, giving them just 26 seats. The Christian Democrats had 29 seats and the Liberals 12.[10] The attempt to manipulate elections to allow the Communists a 'democratic' takeover of the city had clearly failed. The Soviets attempted to circumvent the vote by stating that a phrase in the agreements requiring the Kommandatura to give permission for appointments to the City Government also applied to elected individuals. The Allies demurred, but eventually after six weeks allowed three Social Unity Party members to serve on the eighteen-man city executive and agreed to exclude three men that the Soviets vetoed.

The fate of Berlin was, however, not simply tied to local politics. Equally, if not more, important was the fate of Germany itself. At Potsdam it had been agreed that Germany would be governed as one economic entity. The Soviets had used this to demand, and continue to demand, that some production and resources from the western zones be transferred to them, but steadfastly refused to operate in a similar fashion in respect to food, at least until reparations had been settled. As eastern Germany had been the source of much of Germany's food supply this caused serious problems for the western allies. The British,

for example, had to import a million tons of food into Germany in the ten months after the war at a time when rationing in Britain was still in place and was actually set lower than the wartime level. The Chancellor of the Exchequer characterised the annual cost of £80 million as 'paying reparations to the Germans.'[11] Germany was on the verge of starvation and, as the American Military Governor remarked, 'There is no choice between becoming a Communist on 1,500 calories and a believer in democracy on 1,000 calories.'[12] The increasingly frustrated western Allies were realising that the prospects for German recovery in the face of Soviet intransigence were slim and that economic reform with or without the Russians was essential, not just for German recovery, but for Europe. In July 1946 the British and Americans announced that they would combine their zones to create a single economic entity – the so-called BiZone. A more far-reaching and fundamental reassessment of American policy soon followed the appointment of a new US Secretary of State, General George C Marshall, after whom a new regenerative policy to aid Europe was to be named. The Marshall Plan, announced in June 1947, offered economic assistance to all who desired it, including the Soviets.

Stalin predictably rejected it. His plan was, and always had been, to achieve a communist Soviet-dominated Germany, which in turn could be utilised to undermine liberal democratic government in Europe, particularly France and Italy. It was politically impossible for him to accept Marshall aid and the Soviets also prevented any satellite nation from accepting. In October 1947 the Soviet foreign office concluded that Britain and the US were moving towards dividing Germany and preventing Soviet access (which they were still demanding) to the resources of western Germany, notably the Ruhr.[13] Soviet attitudes hardened still further, as did those of the West. The US, the UK and France, together with the Benelux countries, held a conference in London in early 1948 which agreed to the economic merger of all three western zones and the establishment of a federal government – in other words, agreed to lay the foundations of the future Federal Republic of Germany. Division of Germany was now very close to reality. The Conference met during one of the coldest UK winters on record but, as it convened, the real chill came with the news of a communist coup carried out against the democratically-elected government of Czechoslovakia, with a Soviet Deputy Foreign Minister in Prague and

Red Army units on the border. The result in Prague may have pleased Stalin in the short term, but its long-term effects were less positive for him; after the agreements in London, several European powers signed a mutual defence agreement in Brussels in March and during the same month Western European and North American states began preliminary discussions on a possible Atlantic pact.

In addition, the British and Americans moved to introduce currency reform. The official currency in Germany, including Berlin, was the 'Occupation Mark' (O Mark), but the Soviets had insisted on being given a set of printing plates which they then used quite literally to print money which they paid to their troops, often including large amounts of backpay. At the same time, the official exchange rate for O Marks to the dollar was $1 to 10 O Marks, but the black market rate was $1 to 1,500. A US soldier could change $10 on the black market for 1,500 O Marks and then change those black market Marks back officially for $100 making a swift and profitable killing of $90 on his $10 investment.[14] The predictable result was rampant inflation, a nightmare for any German normally, but especially so for those with memories of the Weimar Republic.[15] The establishment of a Central Bank for the western zones presaged the currency reform that the British and Americans were planning.

In Berlin, the Soviets had started counter-moves following the London conference. They determined on a policy to harass and to restrict and 'regulate' western access to the city. Marshal Sokolovsky, the Soviet Military Governor, was summoned to Moscow on 9 March 1948. On his return, he attended a meeting of the Allied Control Council on 20 March looking, according to the British Governor, General Robertson, 'tired and grim', as well he might. He circulated a paper demanding details of the London conference and the British and Soviets each accused the other of taking unilateral actions. Receiving no satisfaction on the London conference, Sokolovsky walked out of the meeting declaring it closed.[16] Though the western Allies did not know it, the ACC was never to meet again. The previous day Stalin had remarked to German communist leaders 'perhaps we can kick them (ie the Western Allies) out'.[17] Late on 31 March, General Dratvin, Sokolovsky's deputy, delivered a letter telling the western powers of, 'certain supplementary regulations, governing traffic between the Western Zones and Berlin.' It gave twenty-four hours' notice that

goods and persons passing through the Soviet Zone were to be subject to inspection and approval by the Soviet authorities.[18] The harassment actually began much earlier. Two British military trains from opposite ends of the corridor were stopped that night, and when inspections were refused they were shunted into sidings. A British woman climbed down and, helped by soldiers, built a bonfire, and true to national form made food and, more importantly, tea. On the other train, the Britons made friends with the Americans on the next door train who had been similarly sidetracked, and also made bonfires and learnt how to eat US steak-and-kidney pudding using toothbrushes and nail files.[19] Eventually the trains returned whence they came and the British and Americans cancelled all further rail moves. Further harassment followed, and on 9 April the Soviets closed the autobahn. None of these measures yet added up to a full blockade and later in the month the military trains resumed. However, the Americans in particular, and the British to a limited degree, reacted by flying people and material in and out of the city. The British had only two Dakotas and an Anson available, whereas the Americans utilised thirty C-47s. In what was subsequently known as the 'Little Lift', the USAF flew in over a thousand tons of goods, including food, in April.[20] The British did not at this stage deploy more aircraft though the British Army of the Rhine (BAOR) did request that the HQ of the British Air Forces of Occupation (BAFO)* on 4 April investigate whether the garrison could in future be supplied by air. An Operation Order was drawn up allowing for a lift of 65 tons per day for a month and requiring the deployment of two Dakota squadrons from RAF Waterbeach to Wunstorf under the codename Operation KNICKER.[21] These measures were designed to support the military garrisons, not the city's population. The Soviets read the wrong lesson, concluding on 17 April that '(US) attempts to create 'an airlift' connecting Berlin with the Western zones have proved futile. The Americans have admitted the idea would be too expensive.'[22]

On 5 April there was a significant incident in the air when a Soviet Yak fighter performing aerobatics close to Berlin collided with a British European Airways civil Viking airliner which was making its approach

* British Air Forces of Occupation subsequently changed its title to the more familiar Royal Air Force Germany, though it remained BAFO throughout the Airlift.

to land at Gatow. Both aircraft plummeted to the ground and all those on board perished. General Robertson immediately ordered fighter escorts for all British transport aircraft and visited Sokolovsky to protest. The Marshal implausibly suggested that the Viking had struck the Yak whereas the former had been struck from below and behind, severing its right wing. Though firmly sticking to their narrative of blame, the Soviets were also perceived to be anxious to have the incident seen as accidental. Whilst harassment of aircraft in the corridors was to continue or even intensify during the later airlift, it was generally conducted with greater care and competence and no further collisions were to occur. The resolute Allied response, with US General Clay following Robertson in ordering fighter escorts, was thought by some to be crucial in persuading the Soviets that, whilst they might harass, bringing an aircraft down would potentially be a *casus belli*.[23]

The accident involving the Viking, whilst serious and having implications for the future, was a distraction from the main political events in April. These were to precipitate a full-blown blockade by the Soviets and turn a difficult situation into a major international crisis. Following from the decisions taken at the London Conference, the British and Americans moved to implement the currency reform, printing the new notes, and notifying the Soviets on 18 June that 'west' marks would be introduced in the Western zones of Germany, but ***not*** Berlin, on 20 June 1948. The Soviets immediately perceived the threat to their own position, hastily modified their own occupation currency with appliqued postage stamps and announced that only this currency would be accepted in Berlin. Meanwhile the blockade measures on rail and autobahn were further tightened with all surface transport from the West into Berlin effectively halted from 24 June. That same day, at the instigation of General Robertson, HQ BAFO ordered the implementation of Operation KNICKER. His message to the RAF was simple, 'Something must be done and something must be done at once.' Foreign Secretary Ernest Bevin's exhortation was even pithier, 'Do your best.'[24] As one RAF staff officer present at the time remarked later, '…something at once and do your best is hardly the way to start a staff exercise, but that was the direction we had.'[25]

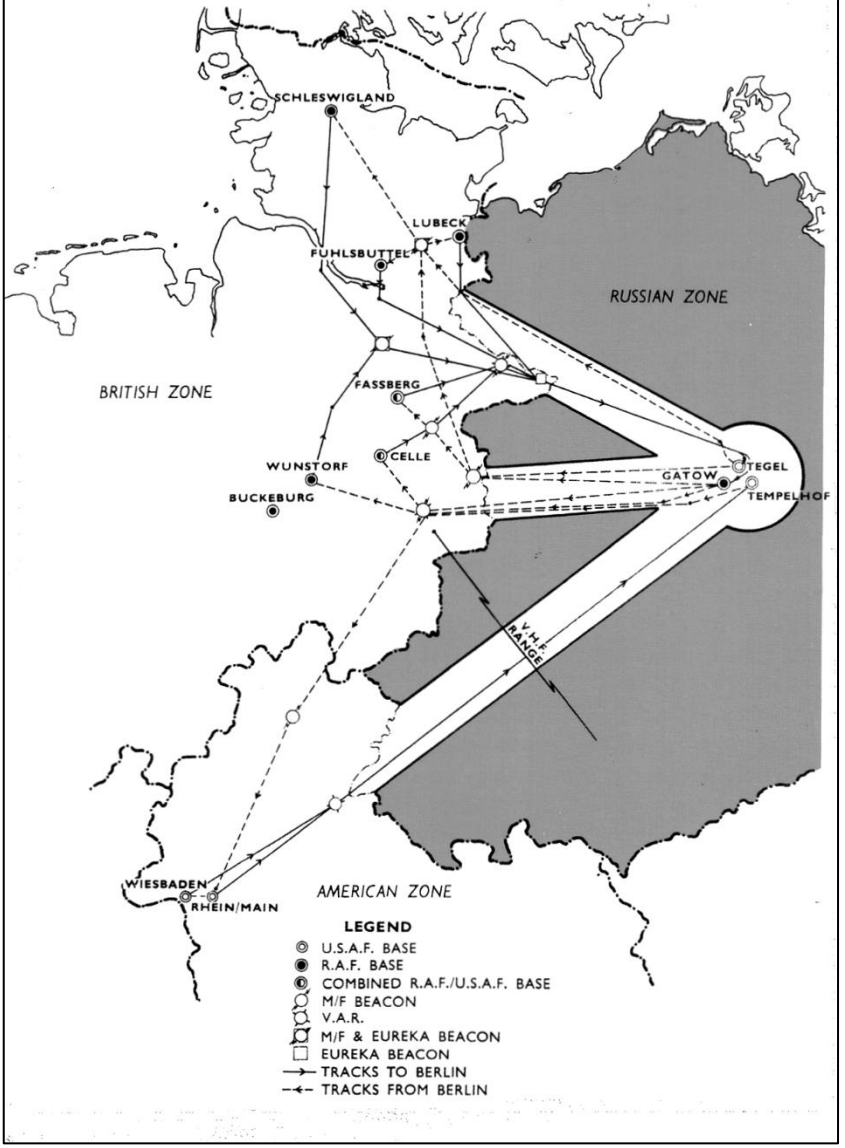
General Clay had initially favoured attempting to force a military convoy through to Berlin, but Robertson visited him on 24 June and made clear that this action would mean war with the Soviets and that

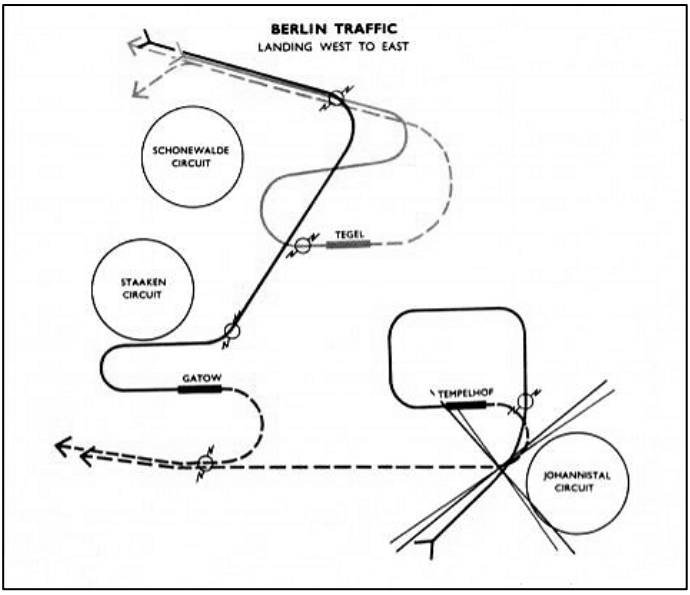
the British would not support such a move. Robertson had an alternative suggestion. Air Commodore Rex Waite was the director of the Air Branch of the British Control Commission for Germany (the *de facto* government in the British Zone) and had done some very rough calculations which suggested that an airlift could support the entire city for a short period of time. Robertson put Waite's proposal to Clay, who demurred, but the US Governor found the next day he had no support from Washington for his military plan and when he met with Berlin mayor Ernst Reuter later on 25 June, for lack of something better, he told Reuter that he would go with the proposal to feed the city by air, though he thought it a crazy scheme.[26] Bevin's determination not to be ousted from Berlin, Waite's 'back of a fag-packet' calculations, Robertson's demand for 'something to be done', and Clay's lack of an alternative acceptable to his superiors therefore coalesced into support for the idea of an airlift that went beyond merely sustaining the garrisons. Nevertheless, it is clear that in essence, at the start, this more than somewhat *ad hoc* operation was simply intended to buy time whilst a political solution to the problem was worked out with the Soviets.

In one of those peculiar happenstances of history, on 25 June, more or less as Clay spoke with Mayor Reuter, the only RAF air transport squadron in Germany left the country and flew back to England! The Dakotas of 30 Squadron had been involved in an exercise with the Parachute Regiment which had just finished and so, as planned, they ate lunch and departed from their German base at Schleswigland for their base in the UK. Meanwhile, at almost precisely the same time another Dakota squadron took-off from RAF Waterbeach and headed in the opposite direction to Wunstorf. Three of their number made the first lift of a meagre 6·5 tons into RAF Gatow in Berlin that evening.[27] At midnight on 27 June, 46 Group ordered a second Dakota squadron to deploy to Germany as soon as possible and the squadron left Waterbeach for Wunstorf on the morning of 28 June.[28] Each squadron had eight aircraft. To set that in context, the daily requirement of food alone was 900 tons of potatoes, 641 tons of flour, 106 of meat and fish, 51 tons of sugar, 32 of fat, 20 of milk and so on, amounting to around 2,000 tons per day. This did not include other essentials such as the daily requirement for 1,650 tons of coal to power West Berlin's power stations, or the fuel for the vehicles. The capacity of a Dakota flying into Berlin from the West was 2·5 tons.[29] The figures simply did not

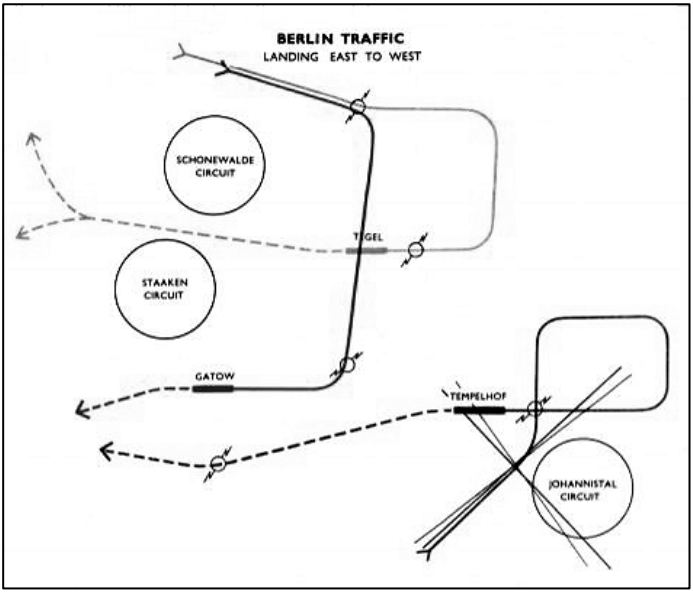
OPERATING ROUTES OF THE AIRLIFT

(This chart should be studied in conjunction with the Altitude Separation Chart on page 23.)





Traffic patterns for Gatow, Tempelhof and Tegel, Landing West to East above, East to West below.



stack up. The Americans had 100 such aircraft in Germany but still the figures did not add up. Shortage of aircraft was only one element of the equation.

In Berlin itself there were only two functioning airfields. RAF Gatow, the former *Luftwaffe* base, had one pierced steel planking (PSP) runway of 1,500 yards. This was designed for use on temporary airfields constructed during the war, and used mostly by single-engined aircraft or, at the most, Dakotas, and was certainly not intended for high intensity operations solely by heavily laden transport aircraft. A 2,000 yard concrete runway and taxi-track was under construction, but in June 1948 a shortage of materials (it being in the Soviet Zone) meant it was only three-quarters complete: it was put into use anyway and was completed on 16 August. The PSP runway was also renovated and extended to 2,000 yards.[30] The airfield in the US Zone was Tempelhof, which had some impressive Nazi-era terminal buildings with seven subterranean levels, but the 5,000 foot runway was also PSP. The approach to Tempelhof was also difficult, with aircraft passing a seven-storey block of flats, and pilots describe breaking cloud to find themselves peering into people's living rooms. Both airfields had new runways added and existing ones improved and extended.[31] At the other end of the air corridors, the RAF base at Wunstorf had concrete runways and hardstandings, but these proved insufficient when more aircraft arrived. Lübeck likewise had a concrete runway which had to be extended as were the existing hardstandings. The American bases at Wiesbaden and Rhein-Main had runways of 5-6,000 feet originally, but likewise lacked other facilities. All these airfields were subject to massive reconstruction works to extend and improve facilities, especially aircraft hardstandings, and in some cases additional runways. Other airfields at Celle, Fassberg, Fuhlsbüttel and Schleswigsland were also brought into use and improved and developed as the airlift progressed. In Berlin an entirely new airfield, with a runway built of compressed rubble (of which there was an inexhaustible supply) bound with asphalt was constructed at Tegel in the French Zone. Elsewhere new bulk storage, railway sidings and other airfield facilities were also built including six 12,000 gallon storage tanks and pumping facilities at Wunstorf.[32] Not the least of the Airlift's many achievements were these remarkable feats of engineering undertaken against an urgent requirement, often with inadequate equipment, and often whilst the

airfields continued to operate around them.

As the Allies began to react to the new political and military situation, aircraft began to fly into Germany from Britain and around the globe. The decision to expand Operation KNICKER was approved by the Cabinet on 28 June and saw it renamed Operation CARTER PATERSON, the name of a well-known UK removals firm of the era, but proved a gift to Soviet propagandists who quickly implied that the name presaged a British withdrawal from Berlin. It was rapidly changed again to Operation PLAINFARE.[33] The Chief of the Air Staff, briefing senior colleagues on the day the Cabinet met, stated that the RAF was capable of lifting 75 tons per day into Berlin and that extra aircraft due to arrive in Germany in the next two days would raise the total to 450 tons, and that would rise to 750 tons from 3 July when repairs to Gatow's runway were completed. The initial plan was to deploy 54 of the 112 Dakotas in RAF service to Germany. These would then reduce to 32 aircraft, to be replaced by Avro Yorks with a greater load carrying capacity of 7·5 to 8·25 tons. The aim was to achieve a capability for lifting 840 short tons by 7 July (1 short ton equalled 2,000lbs).† By 30 June the original 16 Dakotas at Wunstorf had been joined by a further 38 aircraft, including the returnees of 30 Squadron.[34]

Unsurprisingly perhaps, not all went entirely smoothly at first, especially in Germany. Wunstorf was soon crowded with aircraft which overflowed from the relatively restricted hardstandings and aprons onto the grass airfield. Unseasonably poor weather, with persistent heavy rain, meant the constant movements of aircraft, and particularly vehicles, turned the airfield into a sea of ankle-deep mud. The damp penetrated aircraft electric systems causing serious serviceability problems with 22 Dakotas at Wunstorf unserviceable on 3 July. A shortage of bowsers coupled with a single bulk fuelling point, along with a serious lack of ground handling equipment from wheel chocks to trolley-starters, exacerbated the problems.[35] There was also initially a shortage of labour to load and unload the aircraft, a problem not helped by the Treasury's refusal to fund the transfer by air of a Royal Army Service Corps company to accompany a deploying Dakota squadron: the soldiers were sent by sea and rail.[36] The officer in charge of Wunstorf's transport wing noted in his diary on 3 July that the British

† All tonnage figures given in this article are in short tons.

Dakotas at Lübeck. (British Berlin Airlift Association)

Army could not cope with the increased aircraft numbers.[37] The first Yorks had arrived at Wunstorf on 1 July with further aircraft scheduled on successive days, but the ground handling issue, and the state of the airfield led to a decision to postpone the deployment of the last twenty Yorks. Feverish work over the next two days saw several ditches filled and some of the parking area covered with PSP and arrangements were then put in place for the remaining aircraft to deploy on 4 and 5 July.[38]

As with the British, it was the American C-47s in Germany that shouldered the burden initially, but on 27 June Lieutenant General Curtis LeMay, commanding United States Air Forces in Europe (USAFE), requested the immediate deployment of a Group of Douglas C-54 Skymasters to Germany. Like the York, the Skymaster had a greater load-carrying capacity than the C-47, being able in theory to lift thirteen tons of cargo, although generally it was restricted to ten tons during the airlift to conserve brakes and tyres during the repeated landings. As there was little in the way of maintenance support for the C-54s in Germany they were to bring groundcrews and spares with them.[39] The first C-54 touched down at Rhein-Main airfield on 1 July and by the next day seventeen aircraft had reached the base with more to follow from around the globe. They began to replace the C-47s which returned to their bases, although their crews remained to fly the C-54s.[40]

LeMay, who flew a C-47 into Berlin in late June to better see the operation for himself, appointed Brigadier General Joseph Smith as the

commander of the US airlift, now codenamed Operation VITTLES. It was Smith and his staff who instigated the 'block system' whereby the different aircraft types operating on the air lift were allocated time slots with the bigger C-54s flying first, departing at four-minute intervals. Four minutes after the last C-54 took-off, the first C-47 would follow. In the air the aircraft were stepped up between five and ten thousand feet in steps of 1,000 feet.[41] The Americans too, experienced some initial problems. As with Wunstorf, the rain and constant movement churned up the grass surfaces at Rhein-Main, which quickly became known as 'Rhein-Mud'. At Tempelhof, the constant shuttle of C-54s soon caused the runway surface to begin to disintegrate under the pounding it received, and Smith asked for permission on 9 July to begin building a new runway, which meant using some of the available lift to fly in some of the construction material.[42]

The southern corridor was also longer than the northern route from the British Zone, so Smith asked Group Captain Kenneth Cross, Group Captain Operations at HQ BAFO, for permission to relocate some C-54s to the British Zone in Germany.[43] A new runway had been built at Fassberg and some of the Dakotas from the overcrowded airfield at Wunstorf had moved there in July, but following Smith's request to Cross these were moved again to Lübeck, and C-54s moved in to take their place and utilise the shorter northern route, allowing them to fly more sorties per day. The first C-54s arrived at Fassberg on 20 August and PSP hardstanding was constructed sufficient to accommodate sixty-five C-54s of the 65th Troop Carrier Wing.[44]

Fassberg thus became an RAF Station under the command of an American officer, an arrangement which was to become familiar in the UK during the Cold War at bases such as RAF Mildenhall. It did not, however, start well. The Americans were appalled by everything from the beds to the food, which was apparently kippers, fried tomatoes and overcooked sprouts and insufficient quantities at that, and the RAF forbade the Americans from drinking or gambling in their RAF quarters, whilst the NAAFI would not sell them whisky as it was bonded and only for sale to British servicemen. The first three USAF commanders rotated in and out at bewildering speed with the last of the three communicating only in writing with Group Captain Biggar, the senior RAF officer. His replacement was Colonel John Coulter, a man possessed of far greater diplomatic skills, and it was he who persuaded

Sunderlands of No 230 Sqn on the Havelsee.

the RAF to give him effective control. He was also possessed of a wife with film star good looks, mainly because she was indeed a famous film star, Constance Bennett. Unlike so many of that breed, however, she had the human touch and no 'airs and graces'. She was cheerful, despite the spartan surroundings, high-spirited and, according to a USAF General, 'no mean scrounger'. She astounded the RAF wives by using a standard 'service issue brown earthenware slops basin as a suddenly chic salad bowl.' A PX was opened, supplies of US whisky found, and facilities improved, if only a little, but morale definitely improved.[45]

The RAF found one novel way of sidestepping the problem of airfield capacity. On 4 July, two squadrons of Sunderland flying boats landed on the waters of the River Elbe at the old Blohm and Voss works at Finkenwerder in Hamburg.[46] The next day they flew their first sortie into Berlin, carrying three and a half tons of spam, and landing on the River Havel near Gatow.[47] Although they did not require airfield facilities at either end of the lift, the Sunderlands had their own problems. The Elbe at Finkenwerder was littered with wartime wrecks and obstructions, many of them unmarked, the waters of the river were usually rough and the aircraft had to be loaded from small boats, which was time-consuming. The aim was to fly three missions per day which represented six hours in the air, plus loading and refuelling time which made for a long day. The lack of approach aids and navigation equipment for the flying boats also hampered their operations.[48] In theory, the Sunderlands could carry up to 10,000 lb of freight. They

were used to carry a variety of goods into Berlin including salt, meat, sanitary towels and cigarettes, and then fly passengers and industrial goods in the opposite direction. The goods carried out included boxes of lightbulbs from the Siemens factory which filled the capacious fuselage but posed no problems of weight or centre of gravity.[49] The carriage of salt was presumably on the basis that the hulls were anodised for better protection against salt water, but in fact that only applied to the fuselage exterior surfaces, not the interior, though the control cables did run along the roof of the aircraft and not along or beneath the floor.[50]

Two Short Hythes, the civil version of the Sunderland, joined the lift flown by Aquila Airways. The Sunderlands and Hythes were withdrawn from the airlift in December because the rivers were icing up, but in any case, there were problems trying to fit them into the block scheme. In all, the big flying boats lifted 6,709·5 tons of goods into Berlin, 5,429·5 by the Sunderlands and the balance by the Hythes.[51] The flying boats did perform one other valuable service, which was considerably to improve the morale of the Berliners, who would flock to the banks of the Havel, especially on Sundays, to watch the big birds alight gracefully on the water.[52] The Soviets protested that these activities were conducted outside the quadripartite agreement, in which they may well have been correct, but the British simply ignored them.[53]

There was still a need for more aircraft and crews and the British began to contract civil airlines to assist. At first the focus was on the need to transport liquid fuel. Attempts had been made to carry fuel in 55 gallon drums but each weighed 365 lb and they were bulky and not easily secured in the aircraft, making transporting them hazardous.[54] The solution was tanker aircraft, but at the time the RAF possessed none. However, one British aviation pioneer had entered the field. Sir Alan Cobham had formed Flight Refuelling Limited specifically to investigate the art of refuelling in the air, but his Lancastrian (modified Lancaster) tankers were now required not to refuel others whilst flying, but to carry fuel to be discharged in Berlin. The first Lancastrian flew direct from Tarrant Rushton to Berlin on 27 July 1948. A second Lancastrian arrived and the aircraft initially operated from the airfield at Buckeburg but moved to Wunstorf on 27 July and most 'wet' lift subsequently flew from Wunstorf or Schleswigland.[55] The latter did have a *Luftwaffe* system for pumping fuel but it was relatively slow and, although a modern facility was built at Wunstorf capable of rapidly

Some of Flight Refuelling Ltd's twelve-strong fleet of Lancastrian tankers. (Cobham)

fuelling twelve aircraft, it was not completed until April 1949. In Berlin initially the fuel was offloaded at Gatow into underground tanks and then pumped to barges on the Havel and moved to Berlin. Later Tegel was also used. The offload at Gatow was through gravity feed and, depending on the aircraft type, could be slow. Eventually the civil 'wet' lift consisted of 14 Lancastrians, seven Tudors, 17 Halifaxes/Haltons and two Liberators capable of lifting 550 tons per day.[56] Nevertheless, in the winter of 1948 fuel stocks became dangerously depleted. The target had initially been set at 220 tons per day but the average had been only 128 tons and in November the city would have run out of fuel if the Allies had not resorted to the simple expedient of purloining Soviet stocks which happened to be stored in the Western Zone![57]

It was not only the 'wet' lift which employed civil aircraft. A series of contracts were also let to other civil operators, some with just one or two aircraft, and the first of these arrived at Wunstorf on 4 August. A Handley Page Halton (a converted Halifax bomber) of Bond Air Services flew the first sortie into Berlin at 0300 hours and this aircraft

flew five return trips in the next twenty-four hours. There were problems integrating the hotch-potch of civil aircraft types into the lift, exacerbated by the fact that they lacked sophisticated navigation aids and had radios operating on the wrong frequencies. Many of the firms also ran on shoestring budgets and had few groundcrew and lacked spares, so resorted to scrounging both from the RAF whenever they could, though their unserviceability rate remained generally high.[58] The 46 Group Report, having listed all the maintenance facilities and equipment provided to the airlines, commented drily: 'It is submitted … that Civil charter companies cannot be regarded as entirely self-supporting from the engineering point of view…'. Indeed so.[59]

Many, if not most, of the civil aircrew were ex-RAF and some would have flown over the city in military variants of the very same aircraft just four years previously, but with very much more hostile intent. In some respects, however, they may have felt little had changed. Especially during September, the Soviets chose to conduct military exercises along the fringes of the corridors and even above them, as formally under the quadripartite agreement they extended only to 10,000 feet. Amongst other activities, the Soviets conducted live anti-aircraft firing exercises alongside the corridor and fighters 'buzzed' or flew in close formation on airlift aircraft. One anti-aircraft exercise continued for three hours but was only announced to the Air Safety Centre one hour after it commenced.[60] At night they also shone searchlights into the eyes of pilots on approach, especially at Gatow. 'No less than fifty-five airlift aircraft recorded hits by Soviet ground fire', though none was ever shot down. The RAF did not apparently keep a record of incidents although the USAF did, recording 733 occurrences of harassment of various sorts in the corridors between 10 August 1948 and 15 August 1949.[61] Eleven of the 733 incidents are recorded as 'balloons' but precisely what type of balloon or their exact method of use is not recorded in the USAF list; they may have been released as free balloons such as those used by meteorological staffs for recording upper air data.[62] The Soviets reportedly flew barrage balloons above their airfields at Kothen, Dalgow and Brandenburg at some point, though how sustained this activity was is not clear.[63] Allied aircrews were certainly fearful that the Soviets would deploy barrage balloons on the airfield approaches in Berlin but they did not, 'possibly because it would have been difficult to claim that a collision with a

Representative of the civil airlift, this Bristol Wayfarer of Silver City Airways, seen here at Gatow, flew 38 sorties. In the background, beyond the Yorks, work is underway on the runway. (Silver City Airways)

tethered balloon on the approach to an airfield was the fault of the pilot!'[64]

The last of the RAF aircraft deployed on the airlift were the brand new Handley Page Hastings which arrived at Schleswigland on 1 November shortly after the airfield had been reopened as an Operation PLAINFARE base for civil aircraft. The Hastings crews started hauling coal on 11 November, thus quickly coating their shiny new aircraft, and indeed themselves, with a fine layer of coal dust. 'Coal dust was particularly insidious. It covered not only the occupants with its soot but also worked its way into instruments and corroded electrical wiring. Both coal and flour dust swirled around the inside of an aircraft during flight and both could be explosive under the right conditions.'[65] Though it could lift some eight tons, and accommodate awkward loads like large girders for Berlin's power station, the Hastings, unlike the nose-wheel configuration of the C-54, was a 'tail-dragger' and awkward to handle in any sort of crosswind.[66] Its configuration also meant pushing loads uphill through the length of the fuselage.

The early days of airlift operations were very much an *ad hoc* affair such that it was not, in truth, planned in detail. In the early days both

in the American and British lifts it was often a case of an aircraft being declared ready and loaded and a crew being found to fly it. Squadron Leader Johnstone of 30 Squadron brought seven Dakotas into Wunstorf from Oakington but no-one marshalled them in and, finding nobody to direct him on what he was to do next, he went to Station HQ seeking answers. 'Every corridor and stairway seemed alive with harassed blue-clad pilots vainly seeking instructions, 'like Victoria Station in the rush hour.'[67] One Australian officer, Wing Commander Norman Lampe, was an experienced transport pilot, but was officially a staff officer at Royal Australian Air Force Headquarters when he was sent to England on temporary duty in July 1948. He somehow contrived, almost certainly without higher authority, to get to Germany and fly five sorties out of Wunstorf in August.[68]

Wunstorf was officially home to 123 Wing, a fighter-bomber Wing equipped with Vampires and Spitfires which were flown out between 22 and 28 June to make room for the airlift. The domestic accommodation normally housed just over 900 personnel but Operation PLAINFARE increased it to over 2,000 without including civilian operators and at its peak there were 3,200 personnel permanently on site and another 1,000 present in the day. Initially crews bedded down where they could, with some sleeping in the Station Church and mattresses on floors or simply under or on desks. Attics in accommodation blocks and all the messes were pressed into use and eventually specifically converted to provide more bed space.[69] It was a similar picture on the American side. Pressure to fly was intense and normally desk-bound staff officers were pressed into flying missions.[70] However, this type of frenetic but somewhat unstructured activity inevitably led to increasing fatigue amongst aircrew, particularly when they were getting no proper rest.

In large part this was the inevitable result of a largely unplanned operation thrown together at the last minute with increasing resources thrown at it, but little in the way of long-term planning, not least because no-one initially thought it would last more than a few weeks. The command and control arrangements reflected this. On the British side, Group Captain Noel Hyde, Station Commander at RAF Waterbeach, received a formal directive from his Group Commander at 46 Group on 30 June appointing him 'to command the Transport Command Force detached within British Air Forces of Occupation

(Germany)'. He was to, 'operate under the control and direction' of the AOCinC British Air Forces of Occupation.[71] When he reached Wunstorf, the Station Commander and Group Captain A J Biggar (an officer on BAFO staff) told him BAFO had made them 'directly responsible for all transport operations.' Group Captain Cross arrived from Air Headquarters (AHQ) BAFO on 1 July and told Hyde he was to be responsible to the Station Commander Wunstorf and the latter was to report to Group Captain Biggar who would be forming a skeleton HQ at Wunstorf and given acting air rank. On the basis of his own directive, Hyde demurred but said he would co-operate in the interests of the operation until a ruling came from Transport Command. Hyde and Cross visited AHQ BAFO where the Senior Air Staff Officer (SASO), Air Vice-Marshal Spackman, told Hyde his directive from 46 Group stood, that he was not to be responsible to the Station Commander, and that Biggar was to be regarded as a forward staff officer attached to the Army Air Transport Organisation at Wunstorf, although details of work to be carried out would come through him. This was itself hardly a crystal-clear chain of command, but when Hyde returned to Wunstorf from AHQ, Biggar and the Station Commander stated that Group Captain Cross had telephoned and re-stated that they were in command. Farce followed farce as the AOCinC visited Wunstorf on 2 July and reiterated the C2 arrangement outlined by Air Vice-Marshal Spackman, only to issue a contradictory Operation Instruction 14/48 the following day.[72] This stated that a BAFO Advanced HQ had formed at Wunstorf (though it didn't say when!) and that the Officer Commanding (Group Captain Biggar) 'is to exercise operational control of the Transport Forces allotted to him by Air Headquarters BAFO. This he will do through the Officer Commanding, RAF Station Wunstorf, who will in turn exercise control through the Officer Commanding the RAF Transport Wing located at Wunstorf.' It added that Hyde was to 'command the transport aircraft under the direction of the Officer Commanding, RAF Station Wunstorf.'[73] A more convoluted chain of command would be hard to imagine.

The underlying problem here was that BAFO's operational element consisted almost entirely of tactical fighter-bomber and reconnaissance squadrons. There was a distinct lack of expertise relating to transport operations which did not normally impinge on their daily life, and this was reflected in the officers serving in senior positions in the AHQ. The

CinC, Air Marshal Sanders, had spent the early part of the Second World War as Director Ground Defence in the Air Ministry then went to Bomber Command; the SASO, Air Vice-Marshal Spackman, had been in air defence throughout the War; and Group Captain Kenneth Cross had enormous wartime experience in the realm of fighter and tactical air operations but not air transport. BAFO clearly felt that, as the operation was taking place within their area of responsibility, they should control it, which was understandable, but they also appear to have recognised that they did not necessarily possess all the right expertise.

In attempting to square that circle, they appear to have acted initially on the premise that they were simply temporarily moving Wunstorf's tactical wing out and replacing it with a transport wing which would then function through the normal chain of command via the resident station commander with the incoming transport force operating under him. Whether they expected a transport-qualified group captain to accompany the Transport Force deployment is a moot point, but, if they did, they clearly assumed he would be subordinate to their station commander. They then further complicated matters by inserting their own 'Advanced HQ' at Wunstorf under Group Captain Biggar, which was to form part of a wider joint organisation set up in conjunction with the British Control Commission for Germany and BAOR to be known as the Combined Army/Air Transport Organisation (CAATO) which was clearly intended to co-ordinate the Army and RAF effort in support of the airlift. As the BAFO Report candidly admitted, 'Under this organisation the Station Commander Wunstorf was responsible for operations to a Group Captain appointed to the staff of CAATO. In effect, this meant that three Group Captains were located at Wunstorf, each having a responsibility for operations.'[74] However, it would seem from Hyde's report of his conversation with Cross that Biggar had arrived at Wunstorf in advance of the creation of CAATO and this added further confusion. The evidence from Hyde, quoting Cross, was that there was initially some intention to give Biggar acting air rank, but this never seems to have happened, perhaps because the head of CAATO was an Army brigadier! Meanwhile, Transport Command, recognising the size of the force they were deploying, sent a transport force station commander, the unfortunate Group Captain Hyde, with his own directive to exercise command over the deploying squadrons.

Again, *per se*, not an unreasonable move when ninety-four Transport Command aircraft from sixteen squadrons and two OCUs were deploying to mount what was an entirely air transport operation.

Thus, thrown into the mix were: a high profile, politically-charged, fast expanding multinational operation for which there was no precedent; an HQ lacking experience and expertise in mounting transport operations but conscious that the operation was in their area with the potential to go 'hot' at any moment; a desire by the resident HQ to exercise tight control; and a more distant HQ owning the assets and the operational expertise. All of which led to the plethora of group captains and conflicting directives and instructions, some emanating from the very same headquarters. Add in the normal confusion endemic in fast-moving situations and the muddle is more understandable, although AHQ BAFO did not come out of the early period with its reputation greatly enhanced. Hyde, who must have been immensely frustrated and was clearly under intense pressure to ensure that the operation got under way promptly and effectively, appears to have exercised great tact and forbearance in the circumstances, accepting the unsatisfactory C2 arrangement temporarily in the interests quite literally of getting the operation off the ground. Large numbers of ground crew were also deployed to support the Transport Force and the duplication apparent at the top of the C2 chain was mirrored lower down. At this level, however, the goodwill and flexibility exercised by Group Captain Hyde and his equivalents seems less apparent. Hence, 'At Wunstorf in the beginning there were, in effect, two Technical Wings (and thus two Wing Commanders). The local Technical Wing was not familiar with the types of aircraft in use nor the system of servicing. Neither part was prepared to merge with the other, with the consequence that there was no central co-ordination to enable the fullest use to be made of local manpower resources.'[75] This reluctance probably stemmed initially from the uncertainty over the length of the operation and the view that it would soon come to an end.[76]

As the operation expanded and with it showing every sign of continuing it was recognised that the C2 was unsatisfactory and after discussion between BAFO, Transport Command and the Air Ministry it was finally decided that a new operational HQ should be detached from 46 Group and established at Buckeburg. The AOC 46 Group, Air Commodore J W F Merer, was appointed to command, and his directive

US Navy R5Ds of VR-8 sandwich an Air Force C-54 as they queue for take-off from Rhein-Main in January 1949. (US Naval Institute Archive)

charged him with the control and execution of PLAINFARE operations, including co-ordinating with the USAF and ensuring the most effective utilisation of aircrew, aircraft and maintenance personnel.[77] This HQ formed on 22 September 1948. In the event, as will become clear shortly, 46 Group was not destined to exercise unfettered control of the RAF lift. Many of the same sorts of C2 issues which had plagued the early British effort were replicated on the American side. Like BAFO, the overall USAF HQ in Germany, USAFE, under Lieutenant General Curtis LeMay, was tactically orientated. With the exception of the two C-47 Troop Carrier Groups, which in any case were rapidly withdrawn, USAFE, like BAFO, had no air transport assets. The majority of the C-54s deployed to the airlift belonged to a different command, Military Air Transport Service (MATS), a joint USAF/USN air transport organisation roughly analogous to Transport Command. LeMay was pleased when the USAF sent an experienced air transport expert from MATS, Major General William L Tunner, to take charge of the US airlift replacing USAFE's Brigadier General Smith.

In the Second World War, Tunner had commanded the USAAF airlift over 'The Hump', ie the Himalayas, from India and Burma in support of Chinese forces fighting the Japanese. He arrived in Germany on 28 July exactly one month into the airlift. His vision for an airlift was ordered efficiency with aircraft either flying, loading or unloading, or being serviced, and crews either flying or resting. Aircraft and crews standing around idle waiting for something or someone was anathema to him. 'Tunner's approach required the careful co-ordination of every aspect of the airlift, including detailed procedures and exact duplication and precise execution.'[78] Tunner, with LeMay's connivance,

Approximately thirty Yorks, mainstay of the British airlift, on the ramp at Gatow – Hangar 4 on the left, Hangar 5 in the distance.

established direct communications with MATS and Air Materiel Command so that he could tap quickly into the resources in personnel, spares, and equipment he required. He and LeMay quickly became convinced that the American and British efforts should be merged under a single operational command, particularly once USAF C-54s began operating from the British base at Fassberg. The British, however, were initially determined to 'run their own show' and were conscious that any combined organisation would inevitably have a US commander. LeMay worried away at the British, but got little joy from Air Marshal Sanders so tried going via Washington to London without success.[79]

LeMay was forced at first to accept the British preference for a combined control centre at the Berlin end of the operation and this was established as the Joint Traffic Control Centre at Tempelhof which handled traffic into both Tempelhof and Gatow.[80] Eventually, with C-54s operating alongside a wide variety of RAF and civil types along the northern corridor and landing at both Tempelhof and Gatow the British were compelled to accept the logic of the US position. Sanders conceded the principle of combined control at a conference on 30 September, but the British then fell into arguing about its location which they wanted to be Buckeburg, arguing that the main effort in future would be from British bases.[81] The Americans wanted Wiesbaden where Tunner's USAF airlift HQ was established, arguing,

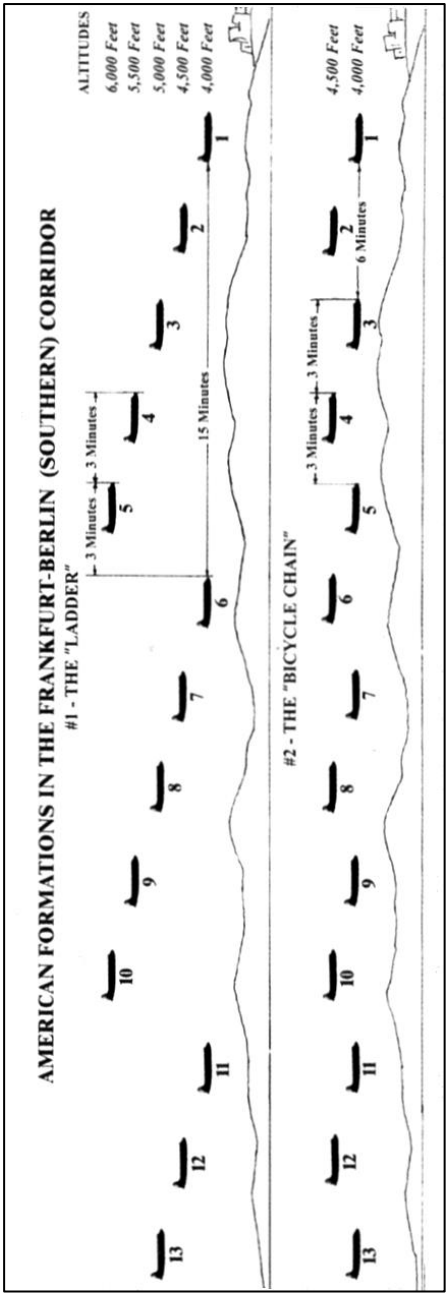
quite correctly, that there were not enough senior officers for two HQs and that dual-hatting would be best.[82] The British finally accepted on 7 October and LeMay and Sanders signed a joint directive on 15 October establishing the Combined Airlift Task Force (CALTF) under Tunner with Air Commodore Merer as his Deputy.

In fact the Americans were right. Essentially CALTF was Tunner's HQ rebadged. Merer was busy at his own HQ and only made the trip to Wiesbaden every two or three weeks. A handful of RAF officers were posted to CALTF including two or three operations officers, an air traffic controller and a signals officer. One important post, however, was that of Director of Plans and this was filled by Group Captain Noel Hyde who brought the same expertise combined with diplomatic skills he had shown at Wunstorf in the airlift's early days. He was, in Tunner's words, 'a particularly welcome adjunct to the staff.'[83] Eighty-three USAF operations officers were posted to 46 Group's HQ at Buckeburg and co-ordinated the flights of the C-54s from Fassberg and later Celle. The British could be somewhat dismissive towards CALTF with BAFO concluding that the, 'Combined Headquarters did not develop much beyond regulating the traffic flow into the Berlin airfields and co-ordinating their traffic pattern.'[84] In fact, of course, as Tunner appreciated, this was the very activity which was crucial to making the airlift successful.

We have seen how Brigadier General Smith introduced the basic 'block' system on the airlift. Soon after his arrival, Tunner was to gain first-hand experience of another problem. He was flying on a C-54 into Berlin in August when the weather deteriorated with very low cloud and driving rain affecting visibility and the radars. A C-54 crashed, another burst its tyres braking to avoid the blazing wreck, and a third landed on an unfinished runway and ground looped. The controllers followed standard procedure and began stacking aircraft which soon saw a mass of aircraft milling around in very restricted airspace and poor visibility from 3,000 to 12,000 feet. Tunner quickly saw a bigger disaster looming (it was, of course, Friday the 13th) and radioed the controller himself and ordered him to send every other aircraft in the stack back to its take-off base.[85] From then on, any aircraft missing an approach was not slotted back into the circuit but flew back to its departure airfield to start the entire process again. A one-way system also funnelled all aircraft into Berlin airspace along the northern and

southern corridors with all aircraft departing Berlin along the central corridor. Gradually much greater discipline was introduced into the airlift where, early on, corners had been cut, literally and figuratively. Crews who had been flying until they nearly dropped and snatching snacks were instructed that they could fly no more than two sorties without a proper meal.[86] It became mandatory to follow a Ground Controlled Approach (GCA) and not fly a visual approach even in good weather.[87] RAF crews carried a navigator and better navigation aids and could fly the corridors to arrive to the minute at the Frohnau beacon, the reporting point at Berlin at which all aircraft reported and were identified and switched to the GCA controller who talked them onto the runway. USAF aircraft had no navigators and fewer aids, so tended to fly from Medium Frequency beacon to beacon using their radio compass and calculating time and distance.[88] The introduction of CPS-5 radar at Tempelhof with moving target indication made the identification and control of aircraft approaching Berlin much better and improved flying discipline still further.[89] In the southern corridor, where all aircraft were C-54s, the separation between aircraft in good weather was reduced to 500 feet in height and three minutes in flow rate. This pattern had five aircraft stepped up with the sixth aircraft at the same height as the first and fifteen minutes behind. In March 1949 this was changed to just a simple five hundred foot, three minute separation with only two height bands which made landing at Berlin simpler. With the many different aircraft types in the Northern corridor, all but the C-54s continued to operate the 'block' system. There were a number of aircraft accidents during the airlift but only one mid-air collision and that occurred between two USAF C-47s very early on.[90]

The improvements in the air were mirrored by much greater organisation and efficiency on the ground. The logistics of delivering supplies to the airfields and the packing, loading and unloading of freight was an Army responsibility utilising large numbers of German civilians. The Army/civilian loading teams were always supervised by RAF Air Movements personnel who were responsible for the documentation and the lashing and weight distribution of loads. Backloading from Berlin in British aircraft was the sole responsibility of RAF movers. The Army/civilian loading teams were eventually organised into specific ten or twelve man teams under the same individual and an element of competition was introduced with rewards



Schematic of the block system and separation within it.

such as prizes of cigarettes or coffee given to the best teams. By the end of the airlift it took an average of 25 minutes to load a C-54 with a 'standard' load of coal or flour.[91] Aircraft marshalling on the ground at both ends of the airlift was improved and systemised. Aircraft repored their loads as they approached Berlin and the unloading teams were waiting as the aircraft taxied in. Greater use was made of dried goods, for example dried potato and powdered milk which weighed a fraction of the 'real' item. Coal, however, which formed a major part of the total lift, could not be reduced, though every scrap of coal dust was swept from the aircraft and aprons and compressed into briquettes. Coal sacks were supposed to be recycled but many just disappeared, and others began to disintegrate. More than 1,300,000 sacks from Britain, costing £12,500, had been supplied by the end of October.[92]

The real concern

came with the onset of winter. During November the weather worsened and fog at the bases became a particular problem and tonnages began to drop with the British lift falling from 1,000 tons a day in the previous month to just over 850, with the USAF showing a similar drop.[93] The Russians confidently believed that 'General Winter' would come to their aid and defeat the Allies as he had done with Napoleon and Hitler. General Robertson himself doubted that the airlift could sustain the city through the winter and he was by no means alone, though General Clay was optimistic.[94] Clay was perhaps pinning his hopes on the US President approving his request for extra C-54s, and in late October President Truman came through and approved the transfer of an additional 66 of these most valuable aircraft.[95] But there were other positive factors too. The new airfield at Tegel in the French zone received its first aircraft on 18 November, after the French dynamited a Soviet-controlled radio station's masts located on French territory on the approach![96] Tegel formally opened on 1 December. RAF Hastings started operations on 11 November from Schleswigland, and C-54s moved into the newly opened RAF Celle on 15 December.[97] The C-54s authorised by the President began arriving with the last of them reaching Europe in January.[98] That month the daily average tonnage began to climb again, with the British lift again climbing above 1,000 short tons and the USAF nearly meeting 4,500.[99] The crisis passed and tonnages steadily climbed from March onwards. In April, Tunner staged what became known as 'the Easter Parade'. His planners at CALTF published the daily quotas for each airfield for 16 April calling for a maximum effort and Tunner visited USAF and RAF bases to cajole and harry. The response exceeded his expectations with the lift delivering 12,849 tons in one day.[100]

General Winter had failed. On 12 May 1949 the Soviets lifted the blockade. The Allies continued the airlift until September 1949, in part because they wished to insure against any sudden re-imposition of the blockade by the Soviets once it had wound down, in part to build up stocks in Berlin, and in part to demonstrate that they could maintain the airlift indefinitely if they chose.

The achievements of the airlift in statistical terms are impressive enough. The total tonnage lifted into Berlin by British and American aircraft was 2,325,808·7 tons. Of this, the British lift carried 542,236 tons, of which the RAF carried 394,509 tons. The Yorks carried the

Considering the numbers of aircraft involved and the relentless tempo of the operation, there were remarkably few incidents and accidents. This Hastings, TG534 of No 297 Sqn, caught fire on start-up and burned out on the ramp at Schleswigland on 6 April 1945.

largest tonnage, 233,144·6 tons, with the Dakotas hauling just over 100,000 tons and the Hastings some 55,000 tons, whilst the Sunderland managed some 5,400 tons. The British carried 241,000 tons of food, 165,000 tons of coal and 92,000 tons of wet fuel, all the latter in civil aircraft. They also carried 35,000 tons of freight, including 12,800 tons of economic goods, and 131,436 passengers out of the city. British aircraft flew more than 32 million miles, consumed over 35 million gallons of Avgas and spent over 200,000 hours in the air.[101] They helped sustain a city of more than two and a half million inhabitants for many months including through the winter. Just as importantly, however, was that in the first real test of the Cold War they demonstrated immense western resolve in the face of Soviet provocation and intransigence and dealt a significant blow to Soviet prestige and influence with incalculable effects on Western European communist parties, particularly those in France and Italy. The western presence in Berlin was maintained and it remained as a beacon of freedom inside the Communist bloc, not to mention acting as a very useful centre for intelligence gathering. The airlift also demonstrated to a Service dominated by airmen from an offensive bomber and tactical air background that the RAF's air transport capability could be deployed as a strategic asset to considerable effect.

We should also recognise the Royal Australian Air Force, Royal

New Zealand Air Force and South African Air Force crews who flew with the RAF on the airlift, as well as the civilian operators, many of them ex-RAF. Eighteen British Commonwealth servicemen died in the course of the airlift; fifteen RAF, one Royal Australian Air Force and one South African Air Force and one British Army sergeant. The civil lift suffered twenty-one fatalities. Thirty American servicemen and one civilian died, and six Berliners died in accidents on the ground and seven died when an RAF Dakota crashed near Lübeck.[102] In comparison with the scale of the airlift and the difficulties involved, not to mention the potential casualties had the dispute turned 'hot', these losses were astonishingly small.

All told, the RAF lifted in about seventeen per cent of the tonnage and the civil lift contributed six per cent, with the rest being carried in USAF aircraft. The reasons for this disparity are varied and are not simply down to the numbers of aircraft deployed. It was recognised that the most efficient aircraft on the airlift was the C-54 and thus these were given priority both in the block system, but more especially when the weather was bad and the rate at which Berlin could accept aircraft dropped, then RAF Dakotas were grounded in favour of flying C-54s from Fassberg or Celle. The British also accepted far greater responsibility for backloading goods and passengers out of Berlin. This meant longer waiting times on the ground in Berlin whilst aircraft were loaded, whereas the C-54's usually turned straight round to fly back empty. The British took the view that flying goods produced in Berlin out was important for the local economy, a view not shared by the Americans. Passengers did not always have a comfortable trip and could be idiosyncratic. One elderly lady was settled on some mailbags in the back of a Dakota and suffered a turbulent trip to Lübeck without complaint, but resolutely refused to board the 'dangerous' truck waiting at the other end to take her to Hannover.[103] On 23 September 1949 at 1830 hours, a Royal Air Force Dakota took off from Lübeck and after making its way along the northern corridor and calling up Berlin overhead the Fronhau beacon it landed at Gatow fifty-two minutes after it took off. Emblazoned on the nose of the Dakota were the words '*Positively the last load from Lübeck, 73,705 tons. Psalm 21, Verse 11*'. If anyone on the apron had a bible to hand and turned to the quote they would have realised that the biblical reference was aimed squarely at the Soviets – *For they intended evil against thee; they imagined a*

mischievous device, which they were not able to perform.[104]

Notes:

1 On the EAC's proposals and policy differences among officials see Tusa, Ann and John; *The Berlin Airlift*, (London, 1998) chapter 1 passim.

2 *Ibid*, p48, and Air Historical Branch, AP3257, Headquarters British Air Forces of Occupation Report on Operation Plainfare, p20.

3 *Ibid*, p11.

4 Schrader, Helena P; *The Blockade Breakers – the Berlin Airlift*, (Stroud, 2010) pp9-10.

5 Air Historical Branch. Copy of station history by Squadron Leader R E Miller, *A Bridge Yesterday – the story of Royal Air Force Gatow in Berlin*, p17.

6 Miller, Roger G; *To Save a City – the Berlin Airlift 1948-1949* (College Station, 2000) pp11-12.

7 Tusas, p59.

8 Quoted in *Ibid*, p24.

9 Quoted *Ibid*.

10 *Ibid*, p74.

11 *Ibid*, p66.

12 *Ibid*.

13 Miller, p19.

14 Schrader, p27.

15 The rampant inflation which affected the Weimar Republic inter-war ran into thousands of per cent and destroyed the savings of the German middle class and was in part responsible for the rise of the Nazi party. So searing were the effects that fear of inflation continues to exert a very strong influence on German financial policy to this day.

16 Diptel 434, Military Governor to Foreign Office, 20 March 1948, in Keith Hamilton (Ed), Documents On British Foreign Policy (DBPO), Series III Volume VI, Berlin, document 5.

17 Quoted in Miller, p19.

18 Diptel 494, Military Governor to Foreign Office, 31 March 1948, DBPO document 6.

19 Tusas, pp107-8.

20 Miller, p21.

21 AP3257, British Air Forces of Occupation, A Report on Operation Plainfare, the Berlin Airlift, 25 June – 6 October 1949, p5.

22 Miller, p23.

23 Tusas, pp115-7.

24 Presentation by Air Chief Marshal Sir Kenneth Cross to the RAF Historical Society seminar on the Berlin Airlift. Proceedings of the Royal Air Force Historical Society, Number 6, September 1989, pp53-4. At the start of the Airlift the then Group Captain Cross was Group Captain Operations in BAFO.

25 *Ibid*, p54.

26 Miller, pp43-4.

27 Cox, Sebastian; 'Britain and the Berlin Airlift' *in Air Power Review*, Vol 7, No 1,

Spring 2004, pp28-9.
[28] AP3257, Appendix B, Report by Group Captain N C Hyde, Officer Commanding Transport Force on First Three Weeks of Operations Knicker, Carter Paterson and Plainfare for period 27 June 1948 to 19 July 1948, p117.
[29] Tusas, p144.
[30] AP3257, Appendix C, Report by Number 46 Group on Operation Plainfare, pp148 & 151-152.
[31] AP3257, Appendix G, Combined Airlift Task Force (CALTF) Report, pp324-7 and Schrader p55.
[32] AP3257, CALTF Report pp323-327.
[33] Tusas, p150.
[34] Cox, p29.
[35] AP3257, Report by Group Captain Hyde, p120-2
[36] Tusas, p149. The Army were initially responsible for providing the manpower for loading the aircraft.
[37] Cox, p30
[38] AP3257, Report by Group Captain Hyde, p117.
[39] Miller p55.
[40] *Ibid*,pp58-9.
[41] *Ibid*, p60.
[42] *Ibid*, p61.
[43] *Ibid*.
[44] AP3257, CALTF Report, p323.
[45] Collier, Richard*; Bridge Across the Sky*, (London, 1978) p122 and Tusas, p253.
[46] AP3257, BAFO report p14 and Cox pp31-2.
[47] Schrader, p79.
[48] AP3257,Appendix C, Report by Number 46 Group on Operation Plainfare, p140.
[49] Cox, p32.
[50] Miller, p155.
[51] AP3257, BAFO Report, Appendix R, Statistical Summary, p520.
[52] Huschke, Wolfgang J; *The Candy Bombers* (Metropol, Berlin, 1999) p86.
[53] Cox, p32.
[54] *Ibid*.
[55] Tusas, p179, and AP3257, No 46 Group Report, p140.
[56] AP3257, Number 46 Group Report, pp199-200.
[57] Cox, p33.
[58] *Ibid*, pp32-3.
[59] AP3257, Number 46 Group Report, p196.
[60] Cox, p32-3 and Tusas, pp248-9.
[61] Schrader pp95-97. NB: When this paper was originally published in *Air Power Review*, Vol 21, No 2, Summer 2018, the total number of incidents of harassment was noted (on p23) as 733; the correct figure, as presented here, was 726.
[62] Launius, Roger D; 'The Berlin Airlift: Constructive Air Power' in *Air Power History*, Spring 1989, p18.
[63] Collier, p95.
[64] Cox, p33.

[65] Schrader, p88.
[66] Tusas, p254.
[67] Collier, p146.
[68] Clark, Chris; O*peration Pelican: The Royal Australian Air Force in the Berlin Airlift, 1948-1949* (Tuggeranong, 1978) p20.
[69] Air Historical Branch, RAF Wunstorf Folder, 'RAF Wunstorf Interim Report on Operation Plainfare', p9, n.d. circa August 1949, and Collier p69.
[70] Tusas, p150.
[71] AP3257, Report by Group Captain Hyde, Appendix A, p129, No 46 Group Directive dated 30 June 1948.
[72] AP3257, Report by Group Captain Hyde, p118.
[73] AP3257, Annexure 4 to Appendix A, to BAFO Report, p110 AHQ/BAFO Operation Instruction 14/48, 3 July 1948.
[74] AP3257, BAFO Report, p7.
[75] *Ibid*, p82.
[76] *Ibid*,Number 46 Group Report, p179.
[77] *Ibid*, BAFO Report, p8.
[78] Miller, p91.
[79] *Ibid*, p101.
[80] *Ibid*, pp101-2.
[81] AP3257, Number 46 Group Report, p146.
[82] Harrington, Daniel F; *The Air Force Can Deliver Anything! A history of the Berlin Airlift* (Ramstein, 1998) p66.
[83] Tunner, William H; *Over the Hump* (Washington DC, 1985) p210.
[84] AP3257, BAFO Report, p19.
[85] Miller, p115. Tusas, p186,
[86] Tusas, p186,
[87] Miller, p116.
[88] *Ibid*, p182-4.
[89] AP3257, BAFO Report, p161.
[90] Miller, p147.
[91] *Ibid*,
[92] Tusas, p243.
[93] AP3257, BAFO Report, Appendix R, Statistical Summary, p519.
[94] *Ibid*,p162.
[95] Miller, p161.
[96] Tusas, p305.
[97] AP3257, Number 46 Group Report, p147.
[98] Miller, p163.
[99] AP3257, BAFO Report, Appendix R, Statistical Summary, p519.
[100] Miller, pp174-5.
[101] Figures compiled from AP3257, BAFO Report, Appendix R, Statistical Summary.
[102] Miller, p187.
[103] Cox, p37.
[104] *Ibid*, p25.

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 2019. ***Ed***

LOST IN SPACE: THE DEFEAT OF THE V-2 AND POST-WAR BRITISH EXPLOITATION OF GERMAN LONG RANGE ROCKET TECHNOLOGY

by Wg Cdr Bryan Hunt

The Battle of London is over … sort of

On the evening of 7 September 1944, Duncan Sandys MP (1908-1987), chair of the government rocket and flying bomb counter-measures 'CROSSBOW' committee, confidently announced that the Battle of London, comprising the V-1 flying bomb attacks, was now over and that the public could now relax; and, because of Allied advances through northern France, he discounted the apocalyptic predictions of 'rocket' (ballistic missile) attacks. The fear of these attacks had caused the Home Secretary, Herbert Morrison (1888-1965), grave concern because of alarmist intelligence assessments of the size of warheads and predicted scale of attacks.[1] Starting in August 1943, Bomber Command and the US 8th Air Force had bombed research sites in Poland and dropped 120,000 tons of bombs on the monumentally large reinforced-concrete 'large sites' and 'rocket projector' sites on the Cherbourg Peninsula in northern France and in Belgium that were believed to be crucial to the operational deployment of long-range rockets.[2] Allied forces had now overrun the distinctive, curved assembly and launch 'ski site' buildings where V-1 flying bombs had been launched at Britain. The Chiefs of Staff Committee also believed that all potential rocket launch sites were now in Allied hands.

However, a scant 24 hours later on 8 September 1944 a mysterious explosion occurred in Chiswick, west London, killing three people and injuring a further 20. A second similar explosion occurred a few seconds later in Epping, though with no casualties. Described officially as 'gas leaks', these explosions were the first ballistic missile attack on

the United Kingdom. The weapon was the A4, a 46 ft/14 m tall single-stage liquid-fuelled rocket carrying a one ton high-explosive warhead. The A4 – *Aggregat* (experimental) Bombardment Rocket, later renamed by the Nazi Propaganda Ministry, and universally known as the V-2 (*Vergeltungswaffen* – vengeance or retaliatory weapon) – had been launched from a mobile position in The Hague, in the occupied Netherlands.[3] It took just under five minutes to travel the 200-odd nautical miles to southern England. Although the British Government maintained the story of gas leaks for two months on security grounds,[4] it was recognised across Whitehall that this was the commencement of a ballistic missile (code word BIGBEN) bombardment that had been expected – and feared – from late 1943.[5]

Origins of the V-2

The A4 had been developed in great secrecy at purpose-built research facilities at the German Army Rocket Research Centre on the Baltic peninsula of Peenemünde, near the Polish town of Świnoujście.[6] The origins of the A4 can be directly linked to Germany's defeat in the First World War. The Versailles Treaty of 1919, which formally ended the Great War, imposed severe limitations on the rearmament of Germany, including retaining and developing large calibre/long-range artillery. To avoid these restrictions, covert research and rearmament commenced in the early 1920s and, contrary to popular belief, a decade before Hitler came to power. However, under the National Socialists, defence research and development 'was accentuated' and disinformation was used to disguise the true purpose of military matériel and technical developments.[7] Encouraged by Hermann Oberth (1894-1990), an astrophysicist and space-flight visionary, who had established links with the National Socialists in Munich in the 1920s, amateur rocketry clubs were formed with state sponsorship.[8] By the 1930s, German scientists and engineers led in the field of ballistic rocketry to circumvent the ban on heavy artillery.

One of Oberth's students was a talented engineer, Wernher von Braun (1912-1977). On completion of his doctorate on liquid-fuel rockets in 1933 (and through Oberth's influence), von Braun was recruited by Colonel Walter Dornberger (1895-1980), the German Army's Director of Artillery, and put to work developing long-range artillery rockets. The pinnacle of these developments was the liquid-

fuel propelled *Aggregat* 4 which was first launched successfully – after many setbacks – on 3 October 1942. Whilst Dornberger organised the development programme and marshalled military support and resources, von Braun used his charm, his technical knowledge and his political astuteness to secure advancement and funding – and ultimately the endorsement of a doubtful Adolf Hitler – to turn an expensive and esoteric research programme into a new weapon of war.

The British Joint Intelligence Committee (JIC) was aware of a nascent rocket programme from 1942 (although intelligence pointing to a rocket weapons programme had been around since 1939) but understanding the extent of the programme and defeating it proved to be challenging. This lack of understanding was down to tensions across the scientific intelligence community, but through a combination of a dedicated intelligence-led investigation, involving photographic reconnaissance and signals intelligence, coupled with heroic espionage by the Polish Resistance movement, 'torpedo like objects 38 feet (12m) long' were discovered, confirming British suspicions of German development of 'remotely controlled pilotless aircraft', although the items that were seen were probably long-range rockets.[9]

This led to the RAF conducting a devastating 600-strong bomber raid on Peenemünde on night of 17/18 August 1943 (Operation HYDRA), with a loss of 41 aircraft. Unknown to the RAF, Peenemünde consisted of two separate (and rival) research institutions. The V-1 was being developed by the *Luftwaffe* at Peenemünde West, along with rocket powered aircraft such as the Me-163 *Komet*, whereas long-range rocketry at an adjacent and larger site was being carried out by the German Army. Although the research laboratories were largely undamaged, the destruction of production workshops and logistics facilities, and the loss of several key propulsion staff, along with much of the housing, resulted in the near-immediate relocation of A4 production and some test facilities to underground centres.[10]

After the raid, which RAF Bomber Command thought had delayed the programme by four to six months, research continued at Peenemünde and at sites in Blizna, Poland, about 550 miles/900 km south east of Peenemünde. Although the damage was extensive, Dornberger (by now a major general) believed that the delay in research and development was only four to six weeks, and elaborate camouflage techniques were applied to make the site appear abandoned.[11]

Production moved to a former gypsum mine near Nordhausen in central Germany. A state-owned company was established for production of the V-2, with staff brought in from the engineering companies of Siemens and AEG, under the dynamic, yet deranged leadership of Gerhard Degenkolb (1892-1954).[12] Other major sites included the Zeppelin Works, near Friedrichshafen, on Bodensee (Lake Constance), with sub-components built across Germany. The Nordhausen mine, which ultimately expanding to include several forced-labour camps, including the notorious '*Dora'* camp, was known as '*Mittelbau'* (also known as '*Mittelwerk'*). Here A4 designs were put into industrial-scale production and testing, prior to the completed V-2 missiles being moved to launch sites. Reports vary, but it is thought that between 15,000 and 25,000 slave workers died at *Mittelbau-Dora* due to appalling living conditions and brutal treatment.

After the July 1944 assassination attempt against Hitler, on 8 August, Heinrich Himmler ordered that the V-2 programme was to be taken from German Army control[13] and moved across to the *SS*, under *SS–Obergruppenführer* Hans Kammler.[14] Kammler then directed production and V-2 operations from September 1944, whilst issuing up to 100 'ignorant, contradictory, irreconcilable' telegrams a day, and in doing so arguably damaging development, production and deployment of the weapon system.[15] From early 1945, Kammler also took over from the German Air Ministry and the *Luftwaffe* direction of the V-1 programme, in addition to oversight of all jet aircraft production.

Rocket in a Bottle?

Debate amongst intelligence and scientific circles raged for 18 months, from early 1943 until autumn 1944, as to the size, range and potency of the rockets. This was only partially resolved when the first rocket landed to the west of London. The arguments were fierce and obtuse. Churchill's friend and scientific advisor, with the sinecure of Paymaster-General, was the German-born and irascible Professor Frederick Lindemann (1886-1957, later 1st Viscount Cherwell).[16] He was convinced that no single-staged liquid-fuelled rocket could reach out 150-200 miles and assumed (and contrary to the scientific intelligence and Allied research and development) that such a device would be launched from a projector – akin to launching a sky-rocket from a milk bottle. His protégé, Dr Reginald Jones (1911-1997, known

universally as 'RV Jones'), who had been appointed to the Air Ministry in 1939 as a scientific advisor and in February 1941 became Assistant Director of Intelligence (Scientific Intelligence), challenged this and interpolated from scant intelligence and scientific input, that a liquid-fuel rocket could deliver up to a ten ton warhead on London. He was later to revise this in 1944 to a 12-metre long body with a one ton warhead. Although Jones reported to the Assistant Chief of the Air Staff (Intelligence), he combined this role with a more covert position as a scientific adviser to the Secret Intelligence Service (SIS/MI6), giving him immediate and privileged access to 'CX' intelligence reports from agents and ULTRA decrypts – intercepts of sensitive Nazi radio communications that had been encrypted using the Enigma machine.

Duncan Sandys MP, a former artillery officer and Financial Secretary to the War Office (appointed by his father-in-law, Winston Churchill) who led the BODYLINE Committee established to counter the rocket threat, used his political acumen to persuade the government and the Chiefs of Staff to acknowledge the threat. But Lindemann was bullish and to prove that his theories on the method of launching long range rockets were right, he convinced the Chiefs of Staff, and in particular, CAS, Air Chf Mshl Sir Charles Portal (1893-1971), probably with the intervention of Churchill, to search for these mythical projectors on the Cherbourg peninsula and around Calais. Many sites were incorrectly identified as rocket projector sites and received the attention of Bomber Command and the USAAF from August 1943 to early 1944. Post-war analysis showed that the heavy bomber campaign had had almost no impact on the eventual operational deployment of the V-2, because of the rapid advance of Allied forces through France, coupled with delays in producing an operational variant, the missiles were not to ready to deploy in large numbers – from mobile convoys – until September 1944, and that the vast concrete structures in the Pas-de-Calais, at Wizernes and the nearby 'Blockhaus d'Éperlecques', were unlikely to have been used.[17]

Lindemann also remained unconvinced that the German war machine would invest so heavily in what he saw as a grossly inefficient and inaccurate weapon, given competing operational requirements and set against a deteriorating war situation.[18] However, from 1939, the Nazi leadership – principally through the Propaganda Minister, Josef Goebbels – had promised 'secret' weapons that would win the war and

destroy 'England'. The V-2 was a manifestation of Nazi technological supremacy and a symbol of raw, unfettered power; as the situation deteriorated Hitler, who had initially been unconvinced by the V-2, saw the missile as a panacea to defeat the British, given that there were no defences against it.[19]

In addition to coping with Lindemann's bullying behaviour and his frequent attempts to undermine the BODYLINE Committee, the team had to contend with a dizzying array of conflicting intelligence. For example, a JIC paper on 'German Long-Range Rocket Development' dated 21 April 1943 variously reported that the rocket had been test-launched in South America, had a 100 (or 200) km range and with a five (or ten) ton warhead, was launched from a metal tube projector or could be fired from a ship. One German prisoner of war (POW), a tank expert who had provided otherwise detailed and reliable information on a variety of other German technological advances, reported to interrogators a rocket of 120 tons with a 60-80 ton warhead (with a 30 km blast radius), propelled by hydrogen and with a range of up to 1,800 km, and guided by a 'direction finding' beam. Although this POW had provided useful information in the past, his credibility was doubted in a most colourful way by the JIC:

> (POW) 164 gives the impression of a one track, furiously working brain mounted on a neglected over-grown child's body (…) it is a case of morbid genius close to insanity by ordinary standards.[20]

A later BODYLINE report of 4 November 1943, outlining targets to interrupt the production and launch of the V-2 established that the 'projectile (*would be*) fired from a mortar tube of considerable dimensions (…) made up of multiple sections' and that 'the method of operation may require the incorporation in the design of a high-pressure pump or compressor driven by some form of motor of very high horsepower.' This high-pressure pump or compressor would be used to propel the missile from the projector. The source of these 'facts' is unclear – or may have been German misinformation – but they helped to distract the intelligence collection and analysis effort for some months, searching for the mythical launch tubes much favoured by Lindemann.[21]

Defeating the Unknown

Defeating the V-2's operational deployment proved to be very difficult for the British. The destruction by bombing of the huge assembly, storage and launch facilities in the Pas-de-Calais region of France, led to a wider belief that the threat from rockets had been eliminated, even though the Allies had little information to distinguish between the V-1 and V-2 programmes, having never encountered weapons of either type.

Air Chf Mshl Sir Roderic Hill, AOCinC Air Defence of Great Britain (ADGB) noted that by summer 1943 Ministry of Supply (MOS) scientists, working against a theoretical model of a rocket (as supplied by the BODYLINE Committee), determined that it could be identified by modified early-warning radar during the boost phase and both points of launch and impact could be identified by use of both electronic and mechanical predictors, although the rockets could not be tracked in flight. Hill took over as the Air Defence Commander on 15 November 1943; coincidentally the role of devising counter-measures was moved from the Ministry of Supply to the Air Ministry on the same day. By that time, five radar stations between Ventnor (Isle of Wight) and Dover on the South Coast had been modified to detect rockets fired from northern France, and 'operators had been trained to identify the characteristic trace which a rocket was expected to produce.'[22] Alongside the radar, anti-aircraft units of the Royal Artillery employed sound-ranging and flash-spotting teams to observe for launches, as they were to do in Belgium from September 1944 when the V-2 campaign commenced. From early 1944, however, the rocket threat was assessed by the BODYLINE Committee as reduced, so the radar watch was dropped. Hill, concerned that such relaxation was premature, insisted that the radar operators should remain in place and train others; two further radar stations were included in the chain from June 1944 as the V-1 flying bomb campaign commenced, in what Hill described in his-post war report as 'an intermittent drizzle of malignant robots (*that*) seemed harder to bear than the storm and thunder of the Blitz.'[23] Collier notes that ground-based electronic counter measures were established to jam 'control beams' that had been postulated, but were never employed.[24]

In the meantime, arguments still raged in London over the possible size of the warhead and, in July 1944, the Home Secretary Herbert

Morrison urged the War Cabinet to commence the evacuation of one million people from London and the provision of over 100,000 'Morrison' table shelters. His Ministry estimated over 100,000 fatalities a month and, in August 1944, evacuations from London commenced.[25] Fortunately, a stream of intelligence derived from documents and prisoners captured in France independently confirmed that the warhead was about one ton, and not ten tons as was previously assumed.[26] Advancing Allied troops in northern France had discovered a number of sites, and as Hill noted, these did not resemble the 'large sites' but were merely rough concrete slabs.[27] But by August 1944 Jones had refined the rocket model through intelligence – principally photographic and by examining the remains of two A4s: one that had crashed in Sweden and been recovered by the British Air Attaché, and another that had been launched from Blizna and fallen in Poland whence it was heroically smuggled to Britain by the Polish Home Army.[28] Jones and his team determined the size of the warhead and deduced that no special launch facilities were needed, apart from a small concrete launch pad to hold the launch table and missile upright and the distinctive 'lemon squeezer' blast deflector, which sat underneath it; the latter two items had been identified on test stands in Peenemünde by photographic reconnaissance.

Contrary to intelligence reports reiterating the extant threat, but rather based on the assurance from the Chiefs of Staff that the tactical situation meant that there were no suitable launching sites left from where missiles could reach London, on 7 September 1944 Duncan Sandys felt comfortable enough to dismiss a large-scale attack. Five weeks before the JIC had outlined the continuing threat of attack in a Top Secret report:

> 'We have no physical reasons preventing the launching of BIGBEN in the immediate future. It may well be that about a thousand of these rockets exist.'[29]

The report detailed the training of personnel, launch procedures, the availability of liquid oxygen, anti-aircraft protection for storage and launch sites, and, citing a 'senior source' (probably an ULTRA decrypt), that launches against Britain would start in 'mid-September (1944)'. Dornberger, separately, reported that a bombardment campaign would not start until September. Just two weeks before the

V-2 campaign was launched – and Duncan Sandys' premature declaration of victory - the Security Service's (MI5) Deputy Director General, Guy Liddell (1892-1958) expressed his grave concern about the imminent V-2 campaign and suggested to the Chief of SIS (MI6) 'C', (Sir Stuart Menzies) that:

> '. . . the uranium (atomic) bomb (…) be used as a threat of retaliation to the Germans if they used the V.2. 'C' said that he had no reason to think the V.2 was imminent although it was possible to think that it might start in the near future.'

Menzies agreed to put the suggestion to the Prime Minister, Sir Winston Churchill, but his reply is not recorded.[30] At any rate, the British TUBE ALLOYS project (which, by now, had combined resources with the US Project MANHATTEN) to develop nuclear weapons was still eight years away from delivering a working British device and the decision to construct a viable warhead was not made until 1947.

Coupled with the worsening operational situation and with little faith in the invulnerability of the monumental static launch sites so favoured by Hitler, by August 1944 von Braun and General Dornberger had developed mobile Transporter-Erector-Launcher (TEL) convoys (*Miellerwagen*) which were easily camouflaged and practically impossible to locate. Now V-2s could be launched from any piece of open ground, although the movement and storage of the rockets proved to be difficult under the chaotic wartime conditions.[31] As observed 14 years later by Constance Babbington-Smith, a senior RAF Photographic Interpreter who first identified the V-2 on its launch stand at Peenemünde, 'General Dornberger's almost ridiculously simple concept of how the V-2s should be launched defeated Allied photographic reconnaissance.'[32]

There was fierce debate in secret over whether to warn the public about V-2 attacks. However, the inaccuracy of the rockets, coupled with the limited warning time raised concerns that the public would soon lose confidence in false alarms. The Home Secretary believed that this would erode public confidence in the system; conversely, given the little warning time, public panic could result in chaos and injuries as people rushed to enter deep shelters. A missile attack warning system was developed with clusters of maroons (signal rockets) positioned

across London and the south east of England that would be fired to warn of an impending attack. This, in effect, resurrected an air raid alarm system that had been belatedly introduced in London in July 1917, in response to Zeppelin and Gotha bombing raids on the capital.[33] However, the performance of the V-2 was so erratic (operational analysis showed that 50% fell within a 200 square mile/16 × 13 mile box) that alerts would be vague and, furthermore, by the time the semi-automated system was activated, the public would have little time to react and public and private shelters offered scant protection in the event of a direct hit.[34] Morrison's other major concern was the event of a missile breaching the underground rail network, leading to extensive flooding and inevitable loss of life, as thousands of people were continuing to spend their nights in the deep tunnels because of the V-1 bombardment. Transport planners anticipated that up to 57 miles of tunnels of the underground rail network would be inundated at a speed of 15 mph/24 km/h if the tunnels at Charing Cross or London Bridge were breached.[35] On receipt of a radar report of a V-2 launch, ADGB Headquarters at RAF Bentley Priory in Stanmore (NW London) would alert the London Passenger Transport Board of an impending attack and the Board would remotely close water-tight doors on the underground network.[36]

General Sir Frederick Pile, commanding Anti-Aircraft Command and serving under Hill, proposed on a number of occasions a 'wall of lead' to disrupt the warheads during the terminal phase of flight. Scientific estimates of the number of shells, and therefore the number of AA guns, needed to fill the radar-predicted airspace varied widely and the proposal was eventually dropped as the V-2 campaign ended, but it should be remembered as the first attempt to develop an anti-ballistic missile system.[37]

The Deceptive Role of Intelligence

Intelligence was not only essential to understanding the V-2 and the influence it might have, it was also key to defeating it. MI6 and MI5 devised a complex and highly sensitive deception plan under the jointly-run Twenty or 'XX' Committee.[38] In this plan, 'turned' Nazi agents broadcast false reports on the impact points and exaggerated the accuracy of the attacks, resulting in the mean point of impact being shifted away from central London, as had been done during the V-1

campaign. The plan also relied on the British press not publishing the rocket attacks in any detail, hence the need for initial official silence about the attacks.

The Ministry of Home Security assessed that a further 1,300 people would have died and a further 10,000 been injured if the mean point of impact had not been moved from central London through an elaborate deception plan.[39] In a 1951 interview in the *New Yorker* magazine, von Braun described his unexpectedly pleasant treatment by the British during his visit to London in September 1945.[40] Demonstrating the on-going secrecy of the deception plan, when confronted by the damage caused in parts of London by the V-2, his only concern was the fate of the German agents who radioed damage reports back to the *Abwehr* (German military intelligence) who passed it on battery commanders and to von Braun. The range of the missiles was then adjusted by altering the burn rate and fuel cut-off of the engines, as well as setting the gyros used to tip the missiles, directly under the guidance of von Braun and his team. Even in 1951, he was unaware that all Nazi agents in Britain had been 'turned' or captured, imprisoned, tried and executed. This deception plan remained secret until the 1970s.

The RAF takes the Battle to the V-2

V-2 convoys were elusive, yet vulnerable if caught in the open, but attacking them presented Air Chf Mshl Hill organisational challenges. As part of the restructuring of Allied commands ahead of the invasion of Europe (OVERLORD), Fighter Command had reverted to the pre-war title of ADGB in late 1943 and was under the aegis of the Allied Expeditionary Air Force, commanded by Air Chf Mshl Sir Trafford Leigh-Mallory, who reported directly to the Supreme Allied Commander, General Eisenhower. ADGB, in addition to defending Britain's airspace against conventional attack, was tasked with providing air defence over Allied forces when they landed in France, as well as preparing for the expected V-1 attacks. Hill had at his disposal Anti-Aircraft and Balloon Commands, as well as fighter/ground attack aircraft from Nos 11, 12 and 13 Groups. As the V-1 campaign began in June 1944 (just as OVERLORD landings commenced in Normandy), despite many requests, Hill was unable to draw fully on either the additional resources of Bomber Command or the Second Tactical Air Force to attack possible V-2 launch locations, as both formations had

their own target priorities supporting OVERLORD, such as providing close air support to allied forces, paralysing the French rail network as well as continuing the strategic bombing offensive. Hill also described his relationship with Air Chf Mshl Sir Arthur Harris, AOCinC Bomber Command, as being 'less than to be desired', which may have influenced the outcome of ADGB's request for heavy bombers. Hill, instead, relied on several groups of fighter-bombers assigned to ADGB, (Spitfires, Tempests and Typhoons) engaged in armed reconnaissance which could be tasked to reconnoitre possible V-1 and V-2 launching sites and attack targets of opportunity. However, the ongoing strategic bombing offensive across Germany would have had a major disrupting effect on missile production and distribution, as well as a second order effect on fuel and liquid oxygen production.

By mid-September 1944, it was clear that the V-2s were being launched from built-up areas in The Hague so, to minimise civilian casualties (and after consultation with the Dutch Government in Exile), Hill's fighter-bombers practised accurate dive bombing in order to attack convoys and complexes believed to house missiles, equipment and personnel. They would be vectored onto possible locations based on radar plotting from a Royal Artillery Mobile Air Reporting Unit, and more frequently, by reports from Dutch operatives. But these attacks had only a limited, short-term effect; targeting was switched to the local rail network and possible storage areas which had a greater, long-term impact. Collier noted that on 7 March 1945 the, 'German Rocket Organisation in Holland reported its casualties since air attacks began as 51 dead, 117 wounded, and 58 lorries and cars, 11 oxygen-trucks and 48 missiles damaged.'[41] Hill also sought assistance from 100 Group, which flew electronic intelligence gathering missions up and down the Channel, with Hill's fighters escorting, in a vain effort to detect both 'control beams' and radio guidance for the rockets.[42] Post-war analysis showed that no such methods of guidance existed, although Dornberger acknowledged that unsuccessful attempts had been made to incorporate such control systems and that a remote guidance system had been installed in an A4 that fell in Sweden and was subsequently recovered to England.[43] This led investigators, including Jones, to conclude that remote guidance would be used.

Allied advances in the Low Countries in March 1945 forced Kammler to withdraw the V-2 batteries eastwards into Germany, where

they were then broken up and personnel dispersed. From March 1945 the threat rapidly diminished. A JIC report of 23 April 1945, examining the continued threat posed by V-weapons, pointed out that as 'V-weapons were produced in widely dispersed areas, many of which we have overrun (…) we do not believe that the enemy will be able to continue production on any considerable scale. Moreover, the provision of fuel would be extremely difficult.'[44]

The Campaign – and the Costs

'There is no siren warning now. No time to take shelter, for this is the most indiscriminate weapon of this or any other war. It is a sinister, eerie form of war.'

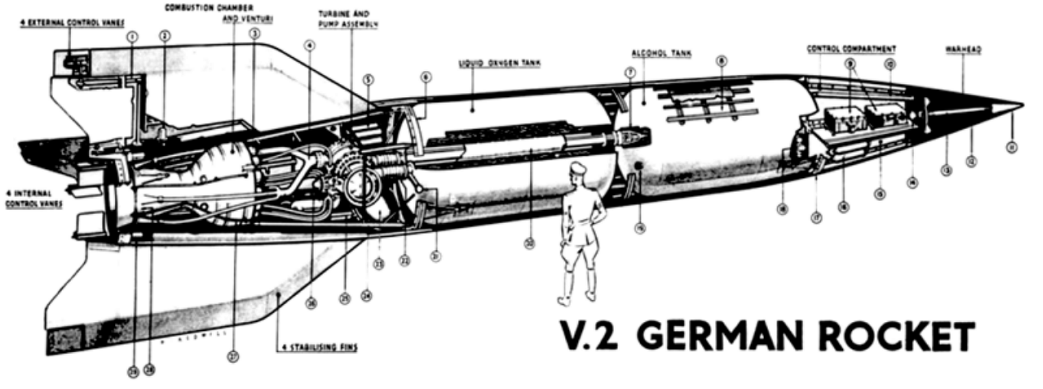
Daily Herald, London, January 1945.

The A4 was a 46 feet (14 m) tall, vertically-launched, single-stage, liquid-fuelled rocket, with the production variant weighing 12·65 tons (12·85 tonnes), with a one ton/tonne (nominal) warhead, although this was later reduced to 1,650 lbs (750 kg). Maximum range of its ballistic trajectory was about 220 miles (350 km). Monthly production was 300 in May 1944 rising to 616 between September 1944 and March 1945, with a total of circa 6,000 launch bodies produced. Apogee (top of trajectory) was 38 to 60 miles (60-96 km) and achieved a maximum speed of up to 3,600 mph (1,600 m/s; 5,800 km/h) and, due to atmospheric friction, dropping to between 2,200-2,500 mph on impact. The missiles used an early two-dimensional gyroscopic stabilised inertial navigation system, that also fed the stability system. Fuel cut-off, and therefore trajectory and range, was pre-programmed although later (but unsuccessful) attempts of radio control were made. The rocket incorporated most of the design features that are seen in ballistic missiles today.

German records show that up until 7 April 1945, 1,190 V-2s were launched against Britain (with a further 169 failures) with 501 of those falling on Greater London. However, the first operational launch was against Paris, on the morning of 7 September 1944, but batteries then withdrew as Allied troops advanced. Antwerp was the target for 1,610 V-2s.[45] Casualty figures vary slightly, but according to British Ministry of Home Security reports, 2,754 civilians were killed in Britain by V-2 attacks with another 6,523 injured. The single largest loss of life in the

UK was on 25 November 1944 and saw 160 killed, with a further 108 seriously injured, when a Woolworths department store on New Cross Road in south London was hit. In greater Antwerp, missile attacks between October 1944 and March 1945 left 1,736 dead and 4,500 injured, including 682 Allied service personnel. Thousands of buildings were damaged or destroyed as Antwerp was struck by 590 direct hits. The largest loss of life occurred on 16 December 1944, when the roof of a crowded cinema was struck, leaving 567 dead and 291 injured. The German offensive came to an end at 1645 hrs on 27 March 1945, when the last rocket fell to earth at Orpington, in Kent, killing 34-year-old Ivy Millichamp, the last British civilian casualty from enemy action in World War II. The campaign had lasted seven months.[46]

Although the V-2 was a technical triumph over Allied developments and despite the terror imparted and the casualties inflicted, the V-2 had no demonstrable impact on the outcome of the war. Indeed, the expense and scope of the programme diverted resources from conventional weapons production, such as fighter aircraft and surface-to-air missile systems. Furthermore, the synthetic fuel for the rocket required 30 tons of potatoes to distil one ton of alcohol, at a time of chronic food shortages in Germany. The relatively small warhead and the lack of a proximity fuse (which would have permitted a more effective 'air burst') compared unfavourably with the mass effect of conventional bombing. The V-2, delivering a one tonne/ton warhead per missile, was set against the Combined Bomber Offensive that could deliver thousands of tons of bombs every day – with considerably greater accuracy and effect. Even during the London Blitz (October 1940-May 1941), the *Luftwaffe* dropped over 35,000 tons of bombs in 70 separate attacks, equating to some 35,000 V-2 attacks. Churchill eloquently pointed out that the de Havilland Mosquito bomber, with similar construction costs to the V-2, delivered on average 125 tons of bombs within a mile during its operational life, compared with the missile delivering just one ton with an error radius of c15 miles.[47] However, contemporary accounts of the V-2 'Blitz' in London graphically illustrate the fear, horror and destruction that these weapons engendered. There was no public warning of their approach, thus many casualties were civilians in the open who were unable to seek shelter, and a one ton warhead, travelling at between 2,000 and 3,000 mph



1 CHAIN DRIVE TO EXTERNAL CONTROL VALVES.
2 ELECTRIC MOTOR.
3 BURNER CUPS.
4 ALCOHOL SUPPLY FROM PUMP.
5 AIR BOTTLES.
6 REAR JOINT RING AND STRONG POINT FOR TRANSPORT.
7 SERVO-OPERATE ALCOHOL OUTLET VALVE.
8 ROCKET SHELL CONSTRUCTION.
9 RADIO EQUIPMENT.
10 PIPE LEADING FROM ALCOHOL TANK TO WARHEAD.
11 NOSE PROBABLY FITTED WITH NOSE SWITCH OR OTHER DEVICE FOR OPERATING WARHEAD FUZE.
12 CONDUIT CARRYING WIRES TO NOSE OR WARHEAD.
13 CENTRAL EXPLORER TUBE.
14 ELECTRIC FUZE FOR WARHEAD.
15 PLYWOOD FRAME.
16 NITROGEN BOTTLES.
17 FRONT JOINT RING AND STRONG POINT FOR TRANSPORT.
18 PITCH AND AZIMUTH GYROS.
19 ALCOHOL FILLING POINT
20 DOUBLE WALLED ALCOHOL DELIVERY PIPE TO PUMP.
21 OXYGEN FILLING POINT.
22 CONCERTINA CONNECTIONS.
23 HYDROGEN PEROXIDE TANK.
24 TUBULAR FRAME HOLDING TURBINE AND PUMP ASSEMBLY.
25 PERMANGANATE TANK (GAS GENERATOR UNIT BEHIND THIS TANK).
26 OXYGEN DISTRIBUTOR FROM PUMP
27 ALCOHOL PIPES FOR SUBSIDIARY COOLING.
28 ALCOHOL INLET TO DOUBLE WALL.
29 ELECTRO HYDRAULIC SERVO MOTORS.

Cutaway drawing of a German V-2 rocket. Air Ministry Collection, courtesy of the Imperial War Museum. © IWM (C 4832)

Ruined flats in Limehouse, East London. Hughes Mansions, Vallance Road, following the explosion of the last German V-2 rocket to fall on Greater London, 27 March 1945. (IWM HU 88803)

created massive destruction, albeit localised (because of the deep crater), with the attendant shockwaves creating widespread structural and shock wave damage.[48]

Long-Range Rocket Development

Greater Mobility. Towards the end of the war, even more radical – some might say desperate – weapons were considered by Dornberger, von Braun and their staffs, reflecting the changing fortunes of war and Allied air superiority. One proposal – code-named Test Stand XII – envisaged V-2s being launched against New York City and Washington DC from U-boat-towed submersible canisters. In 1943, the *Kriegsmarine* conducted experiments towing up to three 100 ft/30 m long cigar-shaped submersible containers. Dornberger later claimed that Bodo Lafferenz (1897-1974), Head of the Institute for Physical Research, visited Peenemünde in autumn 1943 and urged that they examine the possibility of launching the A4 from these floats, with the obvious strategic impact that this development would have.[49]

Chinatown (Limehouse, East London) V-2 combustion chamber and venturi which separated from a missile on impact. March 1945. http://www.wikiwand.com/en/Limehouse_Causeway

Experiments had been conducted from the decks of submerged submarines (at a depth of between 30-50 feet/10-15 m) firing short-range *Nebelwerfer* solid-fuel rockets.[50] These tests in 1942 had been successful, though never deployed operationally because of the adverse effect on submarine performance and increased acoustic signature underwater caused by the on-deck structures.

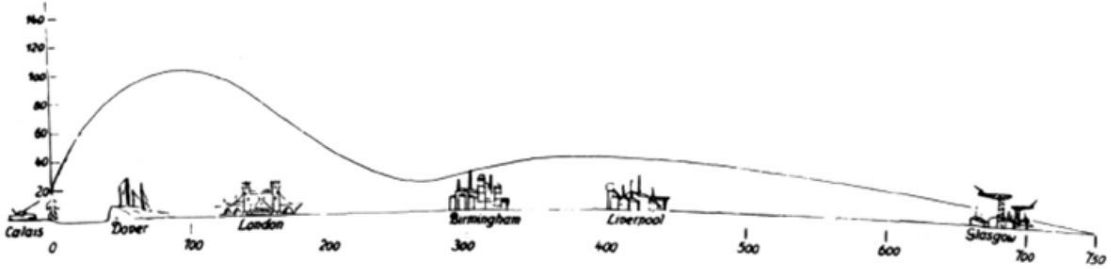
Further research at Peenemünde determined that a submarine could tow three V-2 missiles in floats – at a total weight of 500 tons – for 30 days at 12 knots. On arrival at the launch area, the canisters would be partially flooded to a vertical position, the gyro-stabilised missiles fuelled (the fuel was apparently to be carried in these cannisters) and then launched. Dornberger anticipated no major problems and he thought the work was promising; however, missile reliability in general (principally premature bursting of warheads)[51] delayed further work on this concept. There are no references to how liquid oxygen would be carried or produced for the missiles, given that LOX evaporates from

storage very rapidly; perhaps Dornberger did not include this in his account, given that both the US and USSR were attempting to develop submarine-launched missiles, and this would have been a key technical advantage.[52] Research recommenced in November 1944, but the progressive evacuation of personnel, equipment and records from Peenemünde to Upper Bavaria from February 1945, ahead of the Russian advance, stopped further development.[53]

At about the same time, German agents captured in the US revealed, under interrogation, a supposed plan to deploy V-1 flying bombs from submarines against US East Coast targets. In early 1945, the US Navy launched Operation TEARDROP to counter this, technically ambitious albeit mythical, threat which had previously been discounted by the JIC in London.[54]

Work had been underway until 1942 to launch the V-2 from special railway wagons, envisaging missiles being prepared for launch in tunnels and then being wheeled out and erected on firing tables clamped on to the tracks. Greater cross-country mobility of the *Meillerwagen* Transporter-Erector-Launcher convoys and the inherent vulnerability of the rail network stopped development, but in late 1944 Kammler resurrected it. Dornberger claimed that he went about the work half-heartedly and the programme was abandoned in January 1945, but not before dry-firing trials from special trains took place.[55]

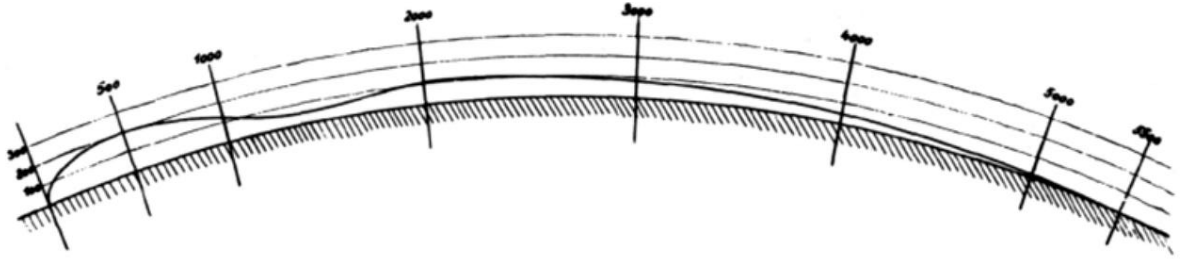
Greater Range. Despite the many setbacks encountered while developing a working A4/V-2 missile, von Braun's team had two research strands to increase the range of the A4. One test launch of an A4 reached an apogee of 118 miles/190 km, according to Dornberger, with a scaled increase of range anticipated. Documents and photographs held by US National Aeronautics and Space Administration (NASA), show wings were fitted to the A4, creating the A9 (sometimes designated the A4b) which had an extended range of 500 miles/800 km, with the same one ton warhead. Work had commenced in 1940 but ceased in 1943 because of ongoing problems with the A4, but demand for greater range from rockets caused by the deteriorating war situation saw work recommence in January 1945. After one unsuccessful launch, Dornberger reported that on 24 January 1945 a swept-wing A4b (A9) with a wing area of 145 square feet/13.3 m^2 reached an apogee of 50 miles/80 km at 2,700 mph/



Oben: Flugbahn einer geflügelten Fernrakete des A 9-Projekts

Unten: Flugbahn des zweistufigen Projekts A 9/10

(Höhen- und Entfernungsangaben in Kilometern)



Captured diagram of potential range of the A9 and A10 rockets. Courtesy of NASA Historical Office, George C Marshall Space Flight Centre.

4,350 km/h. The missile levelled out on the upper edge of the stratosphere at 12-16 miles/19-26 km and flew in a controlled glide, until a wing failed. A captured diagram shows the missile trajectory over London and then gliding past Birmingham and Liverpool and landing just beyond Glasgow.

The final wartime research programme that got underway was the A10, a winged two-stage rocket that could have had a trans-Atlantic reach of 3,500 miles/5,600 km, taking about 40 minutes to cross the Atlantic. The theoretical design consisted of an A9 carried by a booster with a projected all up weight of 100 tons/tonnes, with an engine delivering 200 tons/tonnes thrust (compared with a mere 25 tons/tonnes of the A4/V-2). The overall height was to be almost twice as high as the V-2 at over 80 ft/26 m but still with only a one ton/tonne warhead.[56] As with the A9, there was insufficient time or resources to develop the concept further. Dornberger commented in 1952 on these developments, noting that, 'we had taken a long stride forward in developing the first intermediate stage preceding the space ship.' He also tantalisingly referred to discussions in 1943 with the leading nuclear physicist Professor Werner Heisenberg (1901-1974) on the use of 'atomic energy for rocket propulsion' but Heisenberg was uncertain.[57] Another proposal – which has captured the imagination of fantasists – was preliminary research commenced under the orders of Hitler on a 'ten ton' warhead rocket, nicknamed '*Amerika-raket*' – an order of magnitude bigger that those missiles in service. This theoretical work was carried out in Oberammergau just prior to American forces overrunning the area.[58]

End of the War

As Russian forces swept into Germany in early 1945, von Braun and Dornberger gathered up 400-500 of their key technicians and engineers, and with their families, and an SS escort, made their way in stages to barracks in the picturesque Upper Bavarian town of Oberammergau by 1 April 1945, under the direction of Kammler.[59] Once established at the 'Upper Bavarian Research Centre', run by the Messerschmitt Aircraft Company with an attendant forced-labour camp (and now the site of the NATO School Oberammergau)[60] his team was engaged on 'make work' tasks and conceptual development – such as the A10 multi-stage rocket – to keep them occupied. Von Braun's team also

evacuated a reported 16 tons of A4 reports, designs and other documentation from Peenemünde, hiding this archive in another disused mine north of Nordhausen before they moved to Oberammergau. Key research equipment, such as the Peenemünde supersonic wind tunnel, had been moved to a small lake resort town 20 km east of Oberammergau, where there was a hydroelectric plant that could have powered it.[61]

Von Braun was well-known in the nascent rocketry circles in the US and the UK, and secret British Air Ministry Technical Intelligence Summaries from 1943 onwards frequently referred to 'Herr von Braun's' work on ballistic missiles, including references to the hitherto unknown launch of V-2s in late 1943 against Russian targets (although this probably referred to test launches from Blizna, in Poland).[62] Von Braun was detained near the Austrian border on 2 May 1945 by US Counter-Intelligence Command (CIC) personnel and taken to Garmisch Partenkirchen via Oberammergau in what was probably a pre-arranged event.[63] He was treated as a celebrity; in return, he later claimed to have hosted a champagne-fuelled party for his captors at his mountain retreat.[64]

Exploiting the Technology

Allied Tensions. As the V-weapon threat developed, one of the dilemmas facing BODYLINE was what information Britain should share with the Americans about the Nazi long-range rocket programme. In a JIC report of 26 October 1943, the opening paragraph made an appeal:

> 'We feel that it is becoming necessary for a ruling to be given as to what information regarding our knowledge of German long-range rockets should be disclosed to the Americans, and by whom.'[65]

The report pointed out that US scientists had been consulted by BODYLINE scientists (over such issues as the potential of liquid-fuelled rockets) and that there had been inadvertent leakage from British personnel working alongside US staff; moreover, the US Army Air Force had carried out attacks against 'heavy sites' in France. It was agreed that each Service intelligence chief would brief orally their opposite number, and the respective service attachés in London would

be informed by the permanent chairman of BODYLINE, Commander Ian Fleming RNVR, later the creator of James Bond. At the same time, although allied military cooperation was increasing, there was concern over what to tell the Soviet Union. The advances on the Eastern Front meant that Soviet forces would soon encounter A4 test ranges and facilities. R V Jones minuted CAS, Air Chief Marshal Sir Charles Portal, recommending that Air Intelligence officers should be sent to the range at Blizna and, as it was of such importance, that Churchill should make a personal approach to Stalin. Stalin agreed in a letter of 25 July 1944, but at that point numerous bureaucratic obstacles were put in the way of the team by the Soviets. Blizna (also referred to as Dębica) was taken by Soviet forces on 6 August 1944 and their scientific teams scoured the site for material of intelligence value. The British team travelled via Teheran but, with visa delays and illness, they were unable to reach Blizna until about 20 September. Although the site had been well-picked over, the team found and identified a number of components, and impressed the accompanying Russians with their knowledge of guided missiles. However, crates of salvaged equipment were delayed en route; when the cases were opened at Farnborough, the contents had been substituted with old aircraft parts.[66]

A curious report of the JIC sub-committee dated 6 February 1945 revealed a personal offer from a Soviet colonel to arrange for an Allied team to investigate the main research site at Peenemünde, once Soviet troops overran it. The colonel had assisted the 'Anglo-American team working on the experimental rocket site in Poland (Blizna) last summer (*and*) had been very impressed by the ability of some of the team members. The colonel had offered to facilitate a similar event in the future if he was approached direct.' The sub-committee agreed that Assistant Chief of the Air Staff (Intelligence) would write the Head of the British Mission in Moscow, Admiral Ernest Archer, who in turn would write to the colonel and accept this offer.[67] As an aside, present at the meeting and representing MI5 was Major Anthony Blunt (1907-1983). Blunt was an officer in the Intelligence Corps but had been recruited as a Soviet agent in 1937 and was one of the five members of the infamous Cambridge Spy Ring. Given his duplicity, it is highly likely that Blunt would have passed this information to his Soviet handlers.[68] In any event, the Russians did not allow access to the Americans or the British when Peenemünde fell to the Russians in May

1945.

The Race for Space Scientists. From 1944, British and American planners sought to exploit, after the war, German technological advances across all fields resulting in the Combined Intelligence Objectives Sub-Committee (CIOS) set up between the US and the British Chiefs of Staff Committees. CIOS also prepared lists of what scientific and industrial intelligence would be shared with the Soviet Union. The British Intelligence Objectives Sub-Committee (BIOS) identified a bewildering range of industrial and scientific intelligence objectives for exploitation on a national basis. To collect this military-industrial technology, an *ad hoc* organisation of regular army units was established to escort civilian experts, known as 'Investigators', to seize archives, equipment and personnel on a 'Black List' of prioritised targets. Commander Fleming had been the driving force behind the Royal Navy's 30 Assault Unit (30AU) technical intelligence and exploitation team which had operated successfully in the Mediterranean and during the early stages of Operation OVERLORD.

Fleming's team was the inspiration for T-Force, which was subsequently developed and directed by BIOS, and commenced work in early 1945. T-Force consisted of several infantry battalions, with Royal Engineer bomb disposal experts and extensive transport support, escorting teams of civilian 'Investigators' who searched for equipment, archives and personnel. T-Force moved with the front-line and gathered material as it went. On occasion, its personnel engaged in combat if they got ahead of friendly troops, most notably accepting the surrender of the *Wehrmacht* and *Kriegsmarine* garrisons in Hamburg.[69]

What were the British Prizes? In the British Zone, there were two great technical prizes. One was the *Walterwerk* complex near Hamburg. Here, under the mercurial engineer Dr Hellmuth Walter (1900-1980), air-independent propulsion systems were developed, principally for the *Kriegsmarine*, such as hydrogen peroxide-powered torpedoes and submarines, but also the turbo-pumps needed to deliver 50 gallons/225 litres of fuel per second into the V-2 combustion chamber. He also developed the turbine pump for the Me 163 Komet rocket-powered fighter, also developed at Peenemünde. The second great capture was the *Luftfarhtforschungsanstalt Hermann Göring* (Hermann Göring Aeronautical Research Institute), four miles west of

Brunswick. Ben Lockspeiser (1891-1990), Director-General of Scientific Research at the UK's Ministry of Aircraft Production, after visiting the institute (which was a collection of semi-autonomous research establishments), described what he found:

> Aerodynamic, supersonic and high-speed equipment is far ahead of anything in this country (…) it is probably true to say that in several directions the technical equipment (…) is unsurpassed anywhere.[70]

Lockspeiser immediately requested a team be sent to Völkenrode to secure the site, equipment and personnel. He and his team realised the vital importance of swept-back wings for supersonic flight. This led him to cancel the UK's first supersonic experimental aircraft project, the straight-wing Miles M.52. According to his 1993 obituary, he was much criticised for this decision as he had been earlier castigated for placing the contract with the Miles Aircraft Company in 1943.[71] Scientists at Völkenrode, and indeed on other research and development sites, were immediately re-engaged in completing their research work and writing up their results as scientific papers. Most, it seems, were happy to do this as it temporarily guaranteed food and safety for themselves and their families.

Meanwhile, after his capture von Braun was questioned at length at Garmisch about the rocket programme and his National Socialist beliefs by US officers, as well as personnel from the CIOS. On 15 May 1945, von Braun wrote a futuristic report for British investigators, led by Dr William Cook, outlining his aspiration for larger, multi-stage, longer-range, crewed and reusable rockets that could orbit the Earth.[72] Dr Cook (1905-1987), who was appointed in 1940 as Deputy Controller of the British Rocket Projectile Establishment under Sir Alwyn Crow (1894-1965), had agreed with Professor Lindemann in 1943 that a liquid-fuelled missile, as proposed by R V Jones, was impractical and a solid-propellant rocket would be unfeasibly large. Perhaps still influenced by this prejudice, Dr Cook seems to have reported little of what von Braun had said under interrogation. On 17 June 1945, von Braun was taken back to Nordhausen to locate other members of his team and to recover what equipment they could from the site before it was due to be handed over to Soviet forces. In addition to the archives, over 6,500 tons of equipment, including components to assemble 75

V-2 rockets, were to be shipped to the US.[73]

Von Braun and several of his colleagues were also taken to London for two weeks in September 1945 for further questioning by Ministry of Supply and JIC officials. Sir Alwyn Crow, who also doubted the viability and future of ballistic missiles, interviewed von Braun and reportedly made a half-hearted attempt to recruit him, which von Braun did not accept.[74] Unfortunately, no detailed records of his interviews in London have been found. When he was taken to an impact site in south London, von Braun was confronted, for the first time, with the damage that V-2s had caused. His observations were of a technical nature and he expressed frustration that debris had been cleared from one site preventing him from gaining an accurate impression of the damage the warhead had caused. He seemed to demonstrate little remorse or emotion; this lack of emotion was also noted by von Braun's interrogators at Garmisch.[75] Although not mentioned in biographies of von Braun, during this period it appears that he was also taken to the Hermann Göring Aeronautical Research Institute at Völkenrode, and possibly to Cuxhaven, south of Hamburg. He demonstrated the potency of the A4 turbo pump steam generation components (potassium permanganate and hydrogen peroxide), which had been developed at *Walterwerk*, to British T-Force staff, who subsequently reported on this meeting.[76]

At the end of July 1945, approval was given by the US War Department under Operation OVERCAST (later renamed Operation PAPERCLIP) for von Braun and 350 other scientists, engineers and technicians to be moved to the US and re-commence the development of V weapons for use against Japan. It appears that about 125 of his team in Oberammergau were selected, probably on von Braun's advice, to travel to the US.[77]

Von Braun was to enjoy celebrity status in the United States as a rising star in the National Advisory Committee for Aeronautics (NACA), culminating in leading the Apollo programme, which landed men on the moon in 1969. The US Authorities, although aware of his Nazi party and SS membership (he had been promoted to SS-*Sturmbannfuhrer* (Major) in June 1943), quietly ignored his background, and accepted his explanation of membership of both organisations 'as a political necessity' and he was granted US citizenship in 1955. He was last investigated about his Nazi links by

the Federal Bureau of Investigation in 1971 and in recent years evidence has emerged of his complicity in the thousands of deaths of slave labourers by starvation, execution and ill-treatment at *Mittelbau-Dora*, forever damaging his reputation as the twentieth century's preeminent space scientist.[78]

Operation BACKFIRE

BACKFIRE was a British plan, but authorised in June 1945 by General Eisenhower as Supreme Allied Commander, to test-launch captured V-2s. Under the War Office's Special Projectiles Operations Group, between July and October 1945, 30 unarmed launches were planned to take place at the Ministry of Supply (MOS) Establishment, Cuxhaven (MOSEC), south west of Hamburg. The War Office commented in the official account of the launches:

> (*Backfire*) might save years of development work, and…it was agreed that the launching and control of rockets was a complicated operation which it was necessary for the German technicians to demonstrate in the near future before they lost their skill.[79]

T-Force was tasked with locating V-2 components, documentation, support vehicles, equipment and technical personnel across the British and US sectors. This took longer than expected and many of the rocket components had been hidden, suffered from poor assembly, looting and corrosion from many months of open storage.[80] US authorities, who had earlier stripped *Mittelwerk* in Nordhausen of most of its useful equipment, sent 640 tons of components to the British by rail. The volatile hydrogen peroxide, used to produce steam for the turbine that drove the fuel pumps, was conveyed from the *Walterwerk* site near Hamburg.

Around 570 German personnel were employed to prepare and launch the rockets. However, competition with US authorities had made assembling the group more difficult. About 130 of the staff had practical experience of launching rockets and another 85 were scientists or engineers who had worked at Peenemünde.[81] The first launch took place on 1 October 194. It was regarded as a failure, but on 2 October a successful launch over the North Sea was made. A final launch, captured on film by the British Army Directorate of Kinematography,

took place on 15 October in front of a large audience of senior Allied officers. The film covers the whole process from receiving the rocket from the factory by rail, through its transportation to the technical storage site, preparation and transfer to the *Meillerwagon* TEL, erection on the launch pad, fuelling and the launch. The work was done by German personnel, often still in uniform, but under the watchful eyes of British soldiers, generally standing at a discreet distance.[82] Adverse weather and deteriorating components saw the operation draw to a premature close. The BACKFIRE project was summarised in a five-volume secret technical report and, after the test launches, the remaining equipment and five assembled rockets were shipped to the UK. The BACKFIRE reports noted that the V-2 heralded a new type of warfare, but only if the rocket was able to deliver an 'atomic' warhead to mitigate errors in accuracy.

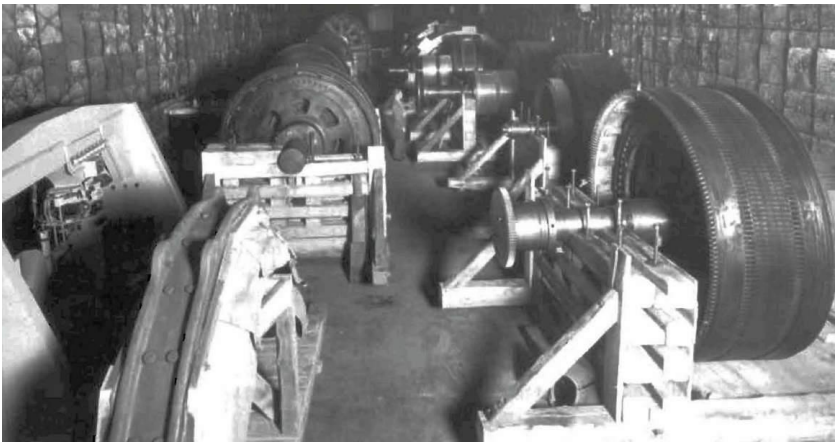
BACKFIRE: A V-2 rocket at the moment of launch during British tests in Germany. (IWM BU 11149)

Most of the German workers returned to a US internment camp at Garmisch, a number of them subsequently being recruited to work in the US or France. Fifty Germans were retained on site after the launches, but the MOS made it clear that no UK-based employment contracts would be offered. MOSEC wound up on 1 May 1946. In a policy reversal just six days later, the MOS offered 15 contracts, but

most of the team had already dispersed: six joined the French programme, two refused the offer, two couldn't be found, one went to the USSR and only two readily went to the UK, joined by another two who had initially agreed to join the French. General Dornberger also assisted in the test launches, but instead of being welcomed to the UK, he was still held as a POW. He was transferred from the Artillery Kaserne in Garmisch and detained at Farm Hall and Wilton Park detention centres in England, both special camps for senior German officers and scientists thought to be associated with the German nuclear programme. He was interrogated by the British War Crimes Investigation Unit and then held in a POW camp in Bridgend, Wales and not, it seems, offered employment. British and US investigators were particularly concerned that the Nazi regime had hidden nuclear material and had developed nuclear warheads for the V-2 and went to great lengths to find out whether this was the case, under Operation EPSILON.[83] Coincidentally, cubes of uranium isotopes – part of a nascent Nazi nuclear weapons programme – were recovered by US forces in the river adjacent to the barracks in Garmisch, where both Dornberger and von Braun were initially held by US forces.[84] In 1947 Dornberger travelled to the US, ultimately ending up working for the Boeing Aircraft Corporation; he died in Germany in relative obscurity in 1980.

Another Ministry of Supply establishment was set up at Trauen, on the site of the former *Sänger Raketentechnische Forschungsinstitut* (Sänger Rocket Technology Institute) German scientists from *Walterwerk*, Peenemünde and Trauen were assembled there and conducted research into oxidising rocket fuels, producing reports that were subsequently published by the Royal Aircraft Establishment (RAE) at Farnborough.

By the time T-Force was wound up in 1947, it had seized huge quantities of documentation and equipment, which was shipped back to the UK. By the end of the removal phase, over 14,000 tons of equipment was removed to Britain, along with 4,600 volumes of aerospace research from Völkerode and 3,300 reports from the Focke-Wulf library. Anecdotally, it seems much of it was never exploited and was progressively destroyed in the 1950s. Amongst this equipment was a large number of high-speed, high-altitude test facilities which eclipsed



German heavy wind-tunnel motors acquired via Op SURGEON and stored at Thurleigh, near Bedford, for possible use in a projected aeronautical research establishment. (Science Museum archives)

anything available in Britain or the US. Most of these were delivered to the new RAE research centre at Bedford.

The Russian Dilemma

By early 1945, there was considerable hand-wringing in bureaucratic circles about the exploitation of German technologies and its proponents. BIOS noted the technological advantages that German industry and science offered, but there were equal concerns about the 'remunerated employment of ex-enemy aliens' and security aspects of employing former adversaries. In April 1945, the Deputy Chiefs of Staff Committee (DCOS) established Operation SURGEON, under which hundreds of scientists and engineers were held by the British and interrogated about their technical knowledge and their Nazi party affiliations. Yet, those who encountered the Germans – both British and American – noted a willingness to continue their research and work for the West. As the European war ended, the US and British authorities were increasingly concerned with denying scientific knowledge and novel military technologies to the Russians, although this did not appear to become official British policy until December 1946.[85] However, a decision to actively employ 'alien scientists' in the UK was not made by DCOS until 31 August 1945, thus almost four months were lost after

VE Day, during which many personnel were recruited by the US, USSR or France.

Contrary to popular belief, although millions of German nationals streamed West, justifiably fearing occupation by the Red Army, many scientists willingly accepted very lucrative offers made by the Soviets who were prepared to overlook previous Nazi affiliations.[86] This caused concern in Whitehall, as revealed by the JIC minutes of early 1946 regarding the disposal of German scientists, based on the British interrogation of three naval scientists at DUSTBIN, the British interrogation and processing centre for senior Nazi officials and scientists detained under SURGEON. Three scientists were questioned by staff from the Directorate of Naval Intelligence attached to the British Naval Gunnery Mission. They were asked about scientists being transferred to the Soviet Union and they claimed that the Russians wanted all German scientists and technicians to work for them:

> '(*The Soviets e*)mployed the Germans regardless of their political creed or antecedents and have placed them in positions of high authority with the right to issue orders to their Russian subordinates. Russians offer enormous monetary attractions in addition to houses and food on the most luxurious scale to the Germans who they need.'
>
> 'Experts in V weapons are among those whose services the Russians are anxious to acquire (…) The common belief in England that Russia will have its hands full with reconstruction is incorrect (…) the low standard of life for Germans in the American Zone and the absence of any unified Anglo-American policy will prove an inducement for the German scientists to seek service under the Russians.'

The paper acknowledged that the US had first pick on scientists, and the UK second, but that the Russians were targeting scientists in the UK and US sectors of occupied Germany, as were the French. An 'atomic physicist', Dr Albert Joos, also held at DUSTBIN, stated that he was ready to return to the Russian Zone, and that a Soviet mission, led by a General, to recover a small number of Russian 'displaced persons' within the British sector was actively recruiting scientists.[87] In response to this, in January 1946, the JIC suggested policy options for the retention of key German scientists to the Chiefs of Staff:

1. To return to the United Kingdom for employment there.
2. To keep them under permanent detention in the British Zone.
3. To offer the conditions at least as attractive as those of the Russians and hope they will remain in our Zone.

The JIC noted, not surprisingly, that scientists preferred the third option.[88] A report six months later confirmed further Russian recruitment in the British sector.[89]

Progressively, observers both in Germany and London became concerned about the predations of the Soviet Union. The vast majority of experts in the British and American sectors were not well-treated; most were unemployed or misemployed as labourers and on near-starvation rations. A May 1946 letter from the Royal Navy's Flag Officer Schleswig Holstein, concerning the loss of great technical knowledge, summed up the problem:

> Nine or even six months ago the idea of working for the Russians or going to the Russian Zone was completely abhorrent to virtually every German of any mental capacity in the British of American Zone. Many of the ablest scientists and technicians from the Western Zones have already entered the services of the Russians and many more are clearly contemplating doing so in the near future unless future prospects in the British or U.S. spheres improve considerably for them at a very early date. The food situation in the British Zone will undoubtedly accelerate this Russia-ward trend, but it is doubtful whether the prospects of physical starvation weigh heavily with these men as the virtual certainty of mental starvation if they remain in Western Germany.

From December 1946, reflecting a changed emphasis in British policy – from the exploitation of German technology to denying it to the USSR – attempts to contract German experts began in earnest, but it was a mere shadow of the American and Russian programmes. Numbers were low in comparison. By the end of SURGEON, 87 scientists had been contracted to work in the UK, of whom 38 had worked on rocket-related technology.

Security Concerns. There was a clear shift in attitudes and policy in the immediate aftermath of the war. Whereas there had been an

unbridled desire to exploit Nazi technology long before the war had ended through CIOS (for the US to potentially use V-1s against Japan), both the morality and the security implications of employing former Nazis were questioned. Within JIC meetings, MI5 expressed obvious concerns about the loyalty of these individuals and the risk that they could return to Germany – or elsewhere – and share their knowledge of sensitive British programmes, and potentially help in covert German rearmament. Moreover, offering 'aliens' (as they became increasingly referred to from 1946) work was problematic. Most scientists in Britain were employed in the public sector across a plethora of civilian-run government research establishments or at universities. Civil Service employment rules specifically forbade 'aliens' from being employed on government work and there was considerable bureaucratic lethargy in having short-term contracts awarded to those scientists who wanted to come to Britain. The contracts were by no-means generous in an austere post-war Britain that was functionally bankrupt and aliens were paid less than British equivalents and given particularly austere ration books. Those who came to Britain were deliberately separated from their previous colleagues and worked on highly compartmentalised projects. Living conditions could also be grim. The Guided Projectile Establishment in Westcott, Buckinghamshire, was typical. Scientists were housed in damp, unheated wooden former-RAF dispersal hutments within a barbed wire enclosure, initially with little freedom of movement. They occasionally met hostility amongst the local populace (as recorded against naval scientists in Barrow, Cumbria) [90] yet in work they appeared to integrate well with fellow scientists and engineers.

There was a cultural bias as well, as demonstrated in a report bemoaning the lack of a suitable policy on the employment of aliens on defence work, reiterated in a 1948 report:

> 'The view of the JIC is that in principle no aliens should be employed on secret defence work unless it is essential to achieve a particular result and no British Subject of comparable ability is available. Aliens are (*an*) undoubted security risk.'[91]

Referring to an earlier 1947 study on the same subject, the JIC suggested that aliens engaged on defence work could move to less sensitive research-related projects or to 'universities in the Dominions', rather than continuing to increase their knowledge of British defence

secrets and technical skills that 'they could take back to their native country.' The report further noted:

> Even if not disloyal most aliens are temperamentally less discreet than British Subjects, while in the UK they tend to mix with and talk freely with their compatriots.

In the same paper, Polish workers were given special attention:

> The employment of Poles on defence work merits special treatment. It is not unfair to say of Poles generally, and particularly of those who are now in the UK that they are temperamentally unstable.

Heads of research establishments had voiced their collective concerns about removing key personnel and the damage that this would do to projects but were advised by the JIC to remove them from sensitive posts as soon as practicable. Nonetheless, a January 1947 report noted that of a group of Germans at the Völkenrode research facility who were offered contracts 'most had been members of the Nazi Party, but denazification was passed as a mere formality'.[92]

The MI5 warnings mainly came from Lt Col Martin Furnival-Jones (1912-1997), later to become Director-General of the Security Service from 1965 to 1972. He may have been echoing concerns less about Nazi sympathies but more of Soviet penetration of the British establishment. Though not well-publicised at the time, MI5 had been active in breaking up Communist 'entryist' cells in pre-war Britain and remained concerned about Communists in senior government and academic positions.[93] Since the early 1940s, there had been an extremely sensitive Anglo-American programme to decrypt Soviet diplomatic traffic – VENONA – and, through this, by around 1947, a very small group of senior personnel within the FBI and MI5 learned of Soviet attempts to penetrate sensitive Western establishments. As an example, Klaus Fuchs (1911-1988) was a German émigré to Britain in 1933 and was recruited as a Soviet agent in 1941. He worked on the British TUBE ALLOYS and the American MANHATTAN nuclear weapons projects and felt a moral duty to share the research with the Soviets. Fuchs was unmasked in 1950, although his espionage had been identified several years earlier in VENONA decrypts.[94]

There was particular sensitivity around the pioneering technology of

the V-2 and its accuracy. In a 1946 Top Secret report, a JIC sub-committee recommended that the time, date and location of particular V-2 impacts remained secret:

> 'It is known that experiments in V-1 and V-2 weapons are being carried out by a certain Power (USSR) using captured equipment, and possibly, German personnel. It is, therefore, important that no information which might assist these experiments should be released.'

In referring to the elaborate deception 'XX' plan run jointly by MI5 and MI6:

> 'Certain measures were taken during the V-2 attacks to deceive the enemy as to the results of his firings. To conceal the fact that a cover plan was used, it would be necessary to avoid any publication of details which might be a link to a particular shot fired with a particular fall of shot marked (on an unclassified map).'[95]

Contribution to Astronautics

About 38 rocket scientists travelled to Britain between the end of 1945 and 1948.[96] Most were offered either a six- or twelve-month initial contract to work in supernumerary appointments in government research establishments. They were split up between four main sites: the former *Walterwerk* staff went to Admiralty Department Establishment Barrow (ADEB), via Vickers-Armstrong, to work on underwater air-independent propulsion systems; five went to Waltham Abbey to the Explosives Research and Development Establishment (ERDE) on the site of the former Royal Gunpowder Mills; twelve went to the RAE at Farnborough; but the majority went to the newly-established Guided Projectile Establishment (GPE) at Westcott, Buckinghamshire. Others may have been directly recruited into industry, but details are scant. By 1950 about 23 were still in the UK. Those on longer contracts were permitted to bring their families to the UK, which led to an improvement in housing.

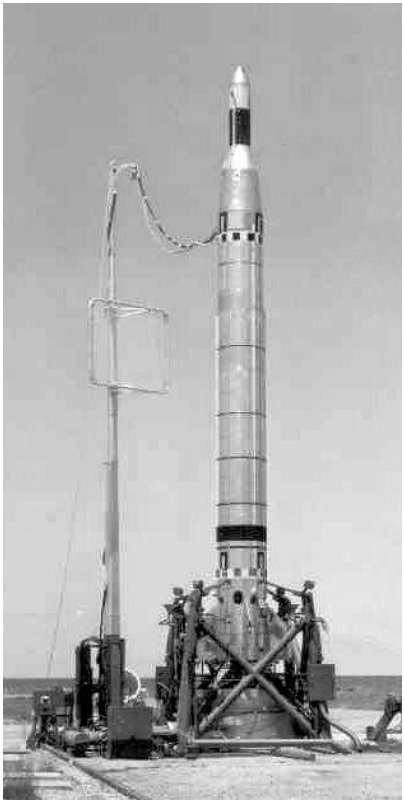
In 1945, Sir Alwyn Crow, as Controller of Projectile Development, had produced a report on the future organisation of 'Guided Projectiles' within the Ministry of Supply. This report outlined areas of research, where it would be conducted and how many staff would be allocated.

Liquid fuel rocket research was focussed on hydrogen peroxide systems and 'monofuels' that did not require an external oxidiser. Most of the projects were looking at short-range missiles for the Admiralty, but the General Staff had submitted two requirements: the first was for a long-range rocket with a 100 mile/160 km range with a three ton warhead (and high degree of accuracy); and the second requirement was for a 'rocket for use as a strategical weapon' with a range of up to 300 miles/480 km also with a high degree of accuracy and a high rate of fire. A marginal comment notes that the Army requirements were under review and that weapons with considerably longer ranges would be specified.[97]

GPE was the hub of most British post-war rocket research and exploitation, and was responsible, under Dr William Cook, for guided missile development for the British Army and Royal Navy. The leading engineer was Dr Johannes Schmidt, who had been responsible for development of the 'Walter' rocket engine for the Me 163 Komet fighter, which first flew at the *Luftwaffe* Peenemünde West research centre. Unfortunately, there was to be a major setback. In November 1947, a German-designed Rocket Assisted Take-Off unit exploded during a test run, killing two British technicians and decapitating Dr Schmidt.[98] Perhaps the most significant recruit was Walter 'Papa' Riedel (1902-1968) who, having originally been employed by the MOS at Cuxhaven and Trauen, emigrated to England in 1947 to work initially for the RAE at Farnborough and later at the MOS establishment at Westcott, until his untimely (and slightly suspicious) death in a hit and run accident in East Berlin in 1968, shortly after his retirement. From 1937, Riedel had headed the Technical Design Office as Chief Designer of the A4 at Peenemünde and was probably the most senior scientist on the programme after von Braun.

In contrast to Westcott, RAE Farnborough was primarily interested in exploiting German aeronautical and trans-sonic technology, and in 1946, 26 Germans were offered contracts of varying lengths to work at the RAE. Accommodation was reportedly better than at Westcott, but the staff were still dispersed and few of their names appear on research papers until the 1950s. However, their immediate impact, following the cancellation of the M52 straight wing supersonic aircraft, was to design a 55º swept-wing transonic aircraft in 1948. Dietrich Kuchemann (1911–1976) became more prominent by contributing to supersonic

research (in particular, the Concorde) and others took part in the 'swing wing' variable geometry programme which eventually resulted in the Tornado. But few at the RAE were involved in rocketry as the RAF (the RAE's major customer) had little interest in such work apart from missiles used in various anti-aircraft and air-to-ground roles. One proposal for a long-range Ballistic Missile – 'Menace' – which may have been an oblique reference to the General Staff requirement of 1945, was abandoned as being patently unaffordable.[99] An indication of the pervading atmosphere of austerity was measuring manpower down to ½ person labour units in Alwyn Crow's paper on the guided projectile organisation. In contrast, and hidden from Parliamentary estimates until the 1950s, in 1947 the Labour Government had committed £100 million to independently developing viable and indigenous nuclear warheads.[100]



The UK's very successful BLACK KNIGHT rocket.

Perhaps the greatest rocket engineering technology transfer was the extensive use of hydrogen peroxide as an oxidiser in the BLACK KNIGHT test vehicle rocket and the BLACK ARROW two-stage satellite launch body, which were developed in the mid-1950s. From 1958, 22 successful test launches were conducted in Australia until the programme was cancelled in 1965. The Gamma power-plants for both launch bodies were derived from an earlier design produced by the German staff at Westcott, under Walter Riedel. The BLACK KNIGHT was also considered as a launch body for the BLUE STREAK indigenous Intermediate Range Ballistic Missile, carrying a British-

designed thermo-nuclear device. The BLUE STREAK was derived from Air Staff Operational Requirement, OR 1139 of 1953, for a nuclear-armed ballistic missile with a 2,300 mile (3,700 km) range, with design work commencing at RAE Farnborough in 1954. At Westcott, the vulnerability of missiles on the ground was studied; launch options considered included V-2 style trailers, floating or submerged platforms, and massive underground silos. In 1958 work started on designing 60 silos dispersed at 6 mile (10 km) intervals, ensuring survival of most missiles if there was 20 megaton strike within 800 yards/metres, and at Westcott, a one-sixth mock-up of a silo was constructed.[101] Partial construction of a full-sized silo is thought to have taken place at RAF Spadeadam in Cumbria, where rocket engines were also tested. However, inter-service rivalry, and spiralling costs saw BLUE STREAK cancelled in April 1960. Smaller, shorter range missiles using a bi-propellant system included the forerunner of the Bloodhound surface-to-air missile (known as RED DUSTER) and the naval Sea Slug missile, were also developed at Westcott.[102]

Conclusions

The post-war exploitation of German technologies and scientists by Britain is often regarded as a signal failure compared to the achievements of German teams in the Soviet Union and America. Greater attention was given to the German presence in the US; indeed, von Braun's capture in 1945 was widely publicised in a positive light by the US Army. Similarly, the achievement of the Soviet Union's Sputnik satellite launch in 1957 was ascribed in the West to the contributions of German scientists and engineers; in reality almost all had been expelled in a fit of Stalinist paranoia in 1952. The reasons for the apparent lack of exploitation by Britain are many-fold.

First, agency played a role. Professor Lindemann (now Lord Cherwell), who was hugely influential as Churchill's scientific advisor (and to return in the same role in 1951 in Churchill's first post-war Conservative government), doggedly saw little practical future in long-range rockets. Even at the height of the V-2 campaign, Lindemann wrote to Churchill and remained sceptical of the future of missiles:

> Although rockets may play a considerable tactical role as long-range barrage artillery (…) I am very doubtful of their strategic value.[103]

A scant two weeks after the last German V-2 was fired at the UK, Lindemann still remained unconvinced of the value of long-range rockets. Sir Alwyn Crow, Director of Guided Projectiles, like Lindemann, regarded rockets as a very inefficient form of artillery and did little to exploit von Braun and his team. In his defence, Crow focussed on improving accuracy through better guidance mechanisms, although he did not exploit German scientists who had expertise in this area. In contrast, R V Jones wrote to the US Army Air Force in late 1944 outlining the potential for two-stage rockets with a uranium bomb (nuclear warhead) that had a range of 3,000 miles – mirroring work that Dornberger and von Braun were undertaking on the A9 and A10 projects.[104]

Additionally, two of the Service ministries showed little interest in the need for a long-range rocket system. The RAF had built a huge strategic bomber force (by this time being replaced by the Lincoln heavy bomber), which by the end of the war could deliver devastating bomb loads with relative accuracy at relatively long range, but the aircraft and crew remained vulnerable. In spite of garnering considerable technical information and assembling a V-2 at Farnborough from smuggled components in August 1944, there seemed to be no attempt to exploit this technology during the war for use against either Germany or Japan, unlike in the USA. Perhaps, in Britain, it was seen that there was no need, as Germany was all but defeated and the Pacific war was very much dominated by America.

The Tizard Report of 1944, whilst urging the development of nuclear weapons, still envisaged that they would be delivered by fast, high altitude jet-powered bombers. Ambitious Air Staff plans, such as OR 230 of November 1946, led to the V-Force of nuclear armed bombers; ironically the V-Force would soon become obsolete in the strategic role because of surface-to-air missiles developed by the Soviets using technology, in part developed from the German developments such as the *Wasserfal* surface-to-air missile designed at Peenemünde. Furthermore, by 1946, given that it was known that the Soviet Union was experimenting with ballistic missiles and considering the huge aircrew losses during the wartime strategic bombing campaign, it is equally difficult to understand why the RAF did not seek a long-range rocket that would be largely invulnerable to countermeasures – especially as the British TUBE ALLOYS nuclear programme was

working towards a fission device that could conceivably be carried by a missile, largely obviating concerns about accuracy. It was not until 1953 that the RAF showed any interest in developing a long-range missile system. The Royal Navy seemed to show even less interest, even though the US Navy had successfully test launched a V-2 from the deck of a carrier in September 1947. At the time, the only British interest in a long-range rocket came, as in Nazi Germany, from the Army's General Staff. However, this was short-lived and the Army requirement for a long-range rocket described by the Director of Guided Projectiles in his 1945 report, did not progress beyond discussion papers.

Secondly, by the end of World War II, Britain's financial, industrial and intellectual resources were exhausted and the cost of debt servicing and of maintaining huge overseas garrisons was crippling. There was also a need to replace most key items of military equipment. This, along with US diplomatic pressure, in part, led to the rapid decolonisation of the British Empire. Additionally, an ambitious long-range rocket programme would have been financially demanding on a post-war Labour government which was more focussed on domestic reconstruction and social reform – such as creating the NHS – but was also prepared to invest covertly in a domestic nuclear weapons programme, relying on aircraft delivery.

Thirdly, there was the paradox that although the Nazis were acknowledged as having advanced technologies, there was official resistance to harnessing their knowledge. MI5 were clearly concerned that UK defence technology secrets might be stolen but many reports contain a somewhat patronising view of the Germans, leading the few scientists and engineers to be kept at arm's length and not retained in their wartime teams. Furthermore, the financial inducements offered to scientists and engineers were unattractive compared with those offered by the USSR, the USA and France, and, coupled with a sclerotic bureaucratic lethargy, few Germans found them attractive. Security concerns about a re-emergent and belligerent Germany were unfounded, as were concerns over extensive Communist penetration of the defence research and industrial community. There is no evidence to indicate that any of those Germans who were brought to the UK posed a security risk, and the establishment of a 'Positive Vetting'

system of assurance, introduced by MI5 in 1951, further mitigated the risk.

Authors Professor Matthew Uttley and Dr John Becklake have produced detailed studies of the net contribution to British aerospace research and development of the German infusion and paint a more positive picture. In the astronautic and rocketry fields it was primarily in the area of hydrogen peroxide liquid fuel engines, but the value of the intellectual property that was transferred across to the defence sector, is described as 'incalculable'. Dr Becklake, a former RAE scientist who has extensively researched the German contribution to aerospace technology in Britain, has written that although Britain received several very good general engineers they were too few in number, and as seen above, they were often kept at arm's length, could not collaborate with former colleagues, and were compartmentalised from major defence research programmes. Work at Westcott, where most of the engineers and scientists worked, was focussed on projectiles rather than manned flight. Rockets – including the V-2 – were seen merely as projectile bodies and not aerospace vehicles. Furthermore, industry had little contact with these experts, although captured equipment was transferred to many companies and was often destroyed without exploitation. He believes that, overall, while the German input saved 'about 18 months R&D (Research and Development), they had little long-term influence on British rocket technology.'[105] In sum, although there were significant contributions by German scientists in trans-sonic aerospace research and development and in liquid-fuelled rockets, the Britain of the late 1940s had greater concerns. But, in a tired, war-weary and austere post-war nation, there was no vision; there was simply no perceived need for strategic long-range rockets.

Epilogue

In a retrospectively cruel and rather late turn of events, in March 1957 Duncan Sandys, now Minister of Defence, produced his White Paper, entitled the 'Outline of Future Policy'.[106] This paper recognised the parlous economic conditions at home, the inefficiencies of the domestic aerospace industry, the rapidly emerging military technologies deployed by the Soviet Union and a changing geo-political landscape with the pre-eminence of the US (especially in the wake of the Suez Crisis) and the importance of alliances such as NATO. The

report recognised the ascendency of long-range ballistic missiles with nuclear warheads and the vulnerability of manned aircraft to surface-to-air missiles. Sandys proposed the progressive replacement of manned fighters with missile systems, that strategic bombers should be supplemented by nuclear-armed ballistic missiles and the intensification of research collaboration with America to develop anti-ballistic missile systems. In addition to swingeing reductions in the Royal Navy and the Army, as well as overseas commitments (which saw still saw 150,000 service personnel deployed overseas outside of Germany), his report forced the amalgamation of much of the British aerospace industry and cancelled most aircraft development programmes. The report concluded with assurances, in somewhat familiar terms:

> (a) The Government have adopted this new defence plan in the confident belief that it will not only give relief to the country's sorely strained economy, but will produce compact military forces of the highest quality.
>
> (b) All three Services will be provided with the newest weapons. The reduced Fleet will be composed of the most modern vessels; the Army will be equipped with atomic artillery and given a high degree of strategic mobility; the Air Force will be supplied with a British megaton bomb; a missile system of air defence will be developed; and ballistic rockets will be introduced to supplement the V-bombers.

As an interim measure before BLUE STREAK was expected to enter service, in February 1958 the UK and US governments agreed to deploy 60 US SM-75 Thor missiles, which meant that US warheads could reach targets in the Soviet Union. Under code-name EMILY, twenty RAF Thor squadrons were established on wartime airfields on the east coast from Yorkshire to Suffolk, and across East Anglia. The RAF provided the infrastructure and workforce, but the warheads remained under USAF control, with the launch of missiles controlled under a 'two-key' system.[107] The Thor had a range of 1,500 miles (2,400 km) and was designed by a colleague, and later rival, of von Braun from Peenemünde, Adolph Thiel (1915–2001). Like the V-2, Thor was fuelled and launched from a transport-erector launcher

system, however in Britain they were launched from fixed locations; the TEL and missile were stored under a shelter that would slide back prior to righting, fuelling and launching the missile. The first missiles – designed to be air-portable – arrived in September 1958 and the last left in August 1963. None were ever launched in the UK.

The BLUE STREAK did not enter service; in its stead the British-designed BLUE STEEL cruise missile was developed to be launched from the V-bombers. It entered service in 1963 (allowing the Thors to be returned to the US) and was finally withdrawn in 1970. Subsequent missile programmes relied on US technology with the Polaris submarine launched ballistic missile, introduced in 1968, finally replacing the V-bomber force in the deterrent role with, from 1982, a British-designed enhanced re-entry vehicle and warhead system, Chevaline.[108]

The reality was that by 1957 Britain was technologically and industrially at least a decade behind America and the Soviet Union in missile development. The industrial and scientific resources applied to the UK rocket programme were orders of magnitude smaller than those committed by the US and the USSR. As a hegemonic actor on the world stage, global leadership had slipped away since the early 1940s and Britain had to contend with being a second-order power, largely reliant on the US for strategic research, development and technologies.

Acknowledgements. I wish to thank Dr John Becklake for his support and detailed knowledge of German scientists employed in the UK after the war. I would also like to extend my gratitude to the Mr Kevin Ball of Taylor and Francis Group, who have made National Archives *Secret Files from the Cold War* available on line to assist my research at www.secretintelligencefiles.com

Notes:

[1] CROSSBOW was originally the codename for the committee looking at measures to counter the V-1 flying bomb and BODYLINE fulfilled a similar function to defeat rockets. The committees were merged in November 1943 under the name CROSSBOW, although reports relating to BODYLINE continued to be produced until mid-1944. The term 'Operation CROSSBOW' is a post-war expression.

[2] Collier, Basil; '*The Battle of the V-Weapons 1944-45'* (Hodder and Stoughton, 1964) pp138-150.

[3] In this paper, the experimental models of the long-range rocket are referred to as the A4; operational use by the more recognised name of V-2.

[4] An official statement by the Prime Minister, Winston Churchill, wasn't made until 10 November 1944, two days after the German Propaganda Ministry announced the attacks.

[5] The A4/V-2 was code-named BIGBEN by the BODYLINE Committee, but frequently referred to as 'Big Ben', 'long-range rocket' or simply 'rocket'. Hill, Sir Roderic (1948): *'Air Operations by Air Defence Great Britain and Fighter Command in connection with the German Flying Bomb and Rocket Offensives, 1944-45'* in The London Gazette Supplement 19 October 1948, para 148 https://www.thegazette.co.uk/London/issue/38437/supplement accessed 7 Mar 19; CAB 176/2 'Most Secret' JIC/1737/43 *'J.I.C. BODYLINE Intelligence Machinery'*. The permanent chair of the BODYLINE Committee was Commander Ian Fleming RNVR.

[6] Known at the time by its German name of Swinemünde.

[7] CAB/81/132 Confidential JIC(48) 33 report dated 20 Oct 1946.

[8] Biddle, Wayne, '*Dark Side of the Moon'* (W W Norton NY & London, 2009) pp39-42. Oberth worked at Peenemünde during World War II. Between 1956-1961, he worked with von Braun at the US Army Ballistic Missile Agency, developing multi-stage rockets.

[9] Babington-Smith, Constance; *'Evidence in Camera'* (Chatto & Windus, London,1957), p204-205. Initially Duncan Sandys, Chairman of the War Cabinet Committee for defence against German flying bombs and rockets, led the belief that the V-1 'flying bomb' and V-2 missiles were part of the same programme. Although testing of both took place at Peenemunde, they were separate and uncoordinated projects. On p207 the V-1s are also referred to as 'airborne rocket torpedoes' (a direct translation of the German name from signals) revealing – inadvertently – knowledge of the rocket programme through signals interception and codebreaking, which was still 'Top Secret ULTRA' when the book was published in 1957.

[10] For technical aspects of the search for the V-2, see Robert V Jones (1978) *Most Secret*, Hamish Hamilton, London, pp430-461.

[11] Dornberger, Walter; *V2* (Hurst & Blacket, London, 1954) pp151-168.

[12] Dornberger, pp79-83.

[13] Dornberger, p222.

[14] *SS–Obergruppenführer* Kammler – Dr-Engineer Heinz (Hans) Friedrich Karl Franz Kammler (1901-1945) – was appointed by Hitler in July 1944 to be responsible for all missile technology, including the V-2 ballistic missile programme, and was additionally assigned the grandiose title of 'General Plenipotentiary of the Fuehrer for Jet Propelled Aircraft'. This gave him full control over the production, distribution and utilisation of jet aircraft and vengeance weapons. Kammler, a civil engineer, was infamous for directing construction of the gas chambers and crematoria at Auschwitz. His rank (equivalent to General) was an appointment in the *SS* – he had no military experience and was known for his cruelty. He is thought to have died, possibly by suicide, near Prague in May 1945 (although pro-Nazi conspiracy theorists have suggested that he survived the war and moved to South America – or Antarctica).

[15] Dornberger, p224.

[16] JIC papers regularly refer to Professor 'Linstead', rather than Lindemann, perhaps avoiding any potential awkwardness arising from his German origins. Occasionally

his name is given the more Anglicised 'Linderman'.

[17] Collier, p147.

[18] Lindemann was not alone in this view. According to Churchill, the Nazi Armaments Minister Albert Speer deplored the efforts and the waste of resources to produce the V-2. Winston Churchill (2000) *'The Second World War: Volume VI Triumph and Tragedy'* Folio Society, London, p 45

[19] Collier, pp138-140.

[20] CAB 176/1 J.I.C./492/43 '*German Long-Range Rocket Development'*, 21 April 1943.

[21] CAB 176/2 *'BODYLINE Targets in Germany'* 4 November 1943.

[22] Hill, para 152.

[23] Hill, para 66.

[24] Collier, p404.

[25] Andrew, Christopher; *'The Defence of the Realm: The Authorized History of MI5'* (Allen Lane/Penguin, London, 2009) p313.

[26] Jones, R V (1978): *'Most Secret War'* Hamish Hamilton, London, pp447-448.

[27] Hill, para 163.

[28] Churchill claims that the Swedish rocket was to be remotely controlled in tactical trials, but the operator was not expecting the ballistic trajectory, and tried to correct its flight to that of a glider bomb. Analysis of the wreckage did reveal remote-control equipment. Churchill (2000), p43.

[29] CAB 81/124 *Imminence of Attack by Bigben*. J.I.C (44) 366 (0) dated 31 July 1945

[30] Guy Liddell Diary, vol 10, 25 August 1944. TNA KV 4/194 in Andrew, p313.

[31] Dornberger's book shows a V-2 being erected into the launch position from special railway wagons (p97). Work began in 1942 but it is thought that no operational launches were made; by late 1944 the railway network very vulnerable to Allied air interdiction, both in search of V-2 rockets but also as part of the wider Allied offensive against German forces. Dornberger, p235.

[32] Babington Smith, p232.

[33] Wright, Jerry, *'Zeppelin Nights: London in the First World War'* (Vintage Books, London, 2014) p250. A fascinating read.

[34] This alert system would be resurrected in 1955 and initially operated by the Royal Observer Corps (ROC) and then from 1965 by the UK Warning and Monitoring Organisation – also based at Stanmore (RAF Bentley Priory) - and would be activated by ROC posts who would launch three 'maroons' to warn of the local approach of radioactive fallout. The system remained serviceable until about 1991.

[35] Longmate, Norman: *Hitler's Rockets* (Hutchinson, 1985) p128.

[36] Collier, pp127-129.

[37] Hill, paras 220-221; Collier, p150.

[38] Perhaps the greatest intelligence coup in WW II after breaking the ENIGMA codes was the complete penetration of the German spy network in Britain by the 'Twenty (XX) Committee'. For accounts of the deception associated with the V-2 programme, see: John Masterman's official report, *The Double Cross System* (Reed, Wellington, 1972) pp180-183; Keith Jeffrey's official history, *MI6 – the History of the Secret Intelligence Service* (Bloomsbury, 2010) pp571-572; Andrew, pp310-316. For technical intelligence on the V-2, see Jones, pp430-460.

[39] Howard, Michael; *British Intelligence in the Second World War, Vol 5*, (Cambridge University Press, 1990) pp182-3, in Andrew, p316.
[40] Biddle, pp142-143
[41] Collier, Basil (1957) *'The Defence of the United Kingdom'* HMSO, London, Chap XXV, pp418-419.
[42] Hill, paras 201-220.
[43] Dornberger, p248.
[44] CAB 81/128 J.I.C (SHAEF) (45) 18 (Final) *'Ability of Enemy to continue to use V-Weapons'*, 23 April 1945.
[45] Jones, p459.
[46] RAF Fighter Command counted 1115 missiles falling in the UK or within sight of shore. Hill, para 223.
[47] Churchill (2000), p49.
[48] For harrowing contemporary accounts of the V-2 'blitz' against London, see Walker, Maureen, *London 1945* (John Murray Ltd, London, 2004) pp17-71.
[49] Part of the German Labour Front, a central economic planning function of the Nazi Party
[50] A short-range mortar-type rocket, normally in a multi-barrel arrangement, initially designed to deploy a smoke barrage. From images available, the tests were conducted using 28/32 cm rockets. http://www.uboataces.com/articles-rocket-uboat.shtml accessed 7 March 2019.
[51] Collier (1957) p399.
[52] Submarine Launched Ballistic Missiles typically have solid-fuel engines.
[53] Dornberger, pp231-232.
[54] Lundeberg, Philip K (1994). 'Operation Teardrop Revisited' in Runyan, Timothy J and Copes, Jan M (Editors), *To Die Gallantly: The Battle of the Atlantic* (Westview Press, Boulder CO, 1994).
[55] Dornberger, p235; picture p97.
[56] Schulze, p54.
[57] Dornberger, pp236- 237. The Nazi nuclear programme was, at best, in its infancy and never posed a real threat, although considerable Allied resources were committed to dismantling the programmes and seizing both research documents and fissile material. Not only did Nazi Germany lack the resources to develop weapons, Hitler appeared to abhor nuclear physics, which he referred to as 'Jewish Science.'
[58] Neufeld, Michael J, *von Braun* (Smithsonian Institute, 2007) p188-189. Piszkiewicz, Dennis, *Wernher von Braun* (Praeger, Conn, 1998) p39.
[59] Neufeld, p196.
[60] Hunt, Bryan, *'The Most Beautiful Barracks in Germany' A History of the Barracks in Oberammergau 1935 – 1975.* Unpub MSS; NATO School Oberammergau, 2013.
[61] Biddle (2009), p129.
[62] A complete set of weekly Air Ministry Technical Intelligence Summaries are held by the MOD Air Historical Branch, RAF Northolt, London.
[63] During General Dornberger's internment in Farm Hall, Wilton Park and other POW detention centres in England between 1945 and 1947, he disclosed in a secretly-recorded conversation with another German general that he and von Braun had travelled

to Lisbon in October 1944 for secret talks with two officials who claimed to be from the General Electric Corporation, about the surrender of all Germany's top scientists to US forces. Although there may have been some bravado on Dornberger's part, and none of von Braun's biographers refer to any visit to Lisbon during the war (an event he was likely to keep quiet), it is most likely that von Braun's surrender was carefully orchestrated.

[64] Biddle, p129.

[65] CAB 81/118 '*German Long-Range Rocket Report'* JIC.

[66] Jones, pp440-442.

[67] CAB 81/93 JIC(45) *9th Meeting Air Intelligence Targets under Russian Control*. Para 8.

[68] Andrew, p173. Blunt (1907-1983) was unmasked by MI5 in the 1950s and publicly exposed in 1979. In Nigel West & Oleg Tsarev (2009) *'Triple'* Yale, which draws on Soviet archives on what documents Blunt *et al* sent to Moscow, there is no mention of him attending this meeting, which is a matter of record. However, Blunt reveals, citing a letter between the Swedish Naval Attaché in London and Swedish Naval HQ in Stockholm, the presence of a 'German secret weapon' that could destroy SE England, that would be deployed from November 1943. West & Tsarev, p8.

[69] Longden, Sean, *T-FORCE: The Race for NAZI war secrets, 1945* (Constable, London, 2009)

[70] AVIA 15/2216 minute by DSR 11 May 1945. In Uttley, Matthew, 'Operation 'Surgeon' and Britain's Post-War Exploitation of Nazi German Aeronautics' in *Intelligence and National Security, vol 17, No 2* (Summer 2002) pp1-26.

[71] https://royalsocietypublishing.org/doi/pdf/10.1098/rsbm.1994.0015 accessed 20 March 2019.

[72] Neufeld, p205. In Thom Burnett's 2005 work, he is erroneously referred to as 'Colonel William Cook'. British investigators reportedly wore uniform in the field, however Dr Cook never formally served in the British Army.

[73] Longmate, p376.

[74] Burnett, Thom, *'Who Really Won the Space Race?: Uncovering the Conspiracy That Kept America second to the Russians* (Collins & Brown, London, 2005) p154.

[75] Biddle, pp142-143.

[76] Longden, p273. Von Braun reportedly spent two days at the former *Luftwaffe* airfield at Völkenrode under British guard.

[77] Biddle, p142. This group did not include the 'father' of the V-2 programme, General Dornberger, but did include the much less experienced brother of Wernher, Magnus von Braun.

[78] Piszkiewicz, Dennis, *Wernher von Braun* (Praeger, Connecticut, 1998*)* pp50-54.

[79] *'Official Report on Operation Backfire', vols 1-5,* (War Office, London, January 1946) in Becklake, John, 'German rocket engineers in Britain – Their influence revisited' in *Acta Astronautica, Vol 59* (2006 updated 2014).

[80] Longden, pp271-274. The Operation *Backfire* reports noted that the V-2 heralded a new type of warfare, but only if the rocket was able to deliver a nuclear warhead.

[81] Becklake, (2006, updated 2011, 2014).

[82] https://www.iwm.org.uk/collections/item/object/1060020906

[83] Much of what was said by the POWs and captured nuclear and missile scientists at

Wilton Park and Farm Hall camps was secretly recorded under Operation EPSILON, and some of the recordings and transcriptions were declassified in the 1990s.

[84] Sayer, Ian & Botting, Douglas, *'NAZI Gold'* (Granada, London, 1984) pp239, 240. Now the home of the US-run George Marshall European Center for Security Studies, located on the US Sheridan Garrison and coincidentally, where the author's daughter went to school.

[85] Uttley, p9.

[86] The terms Soviets and Russians are synonymous in the reporting, and this convention is followed in this paper.

[87] The Soviet title for their equivalent operation to SURGEON was 'OSOAVIAKHIM', an acronym.

[88] CAB 81/132 *'Disposal of German Scientists and Russian Activities in connection therein.'* JIC (46) 8(0) 18 January 1946.

[89] CAB 81/133 JIC (46) 51 *'Russian Attempts to Entice German Scientists and Technicians from the BRITISH Zone of Germany.*' 2 July 1946.

[90] *Barrow News*, 12 January 1945, in Becklake, 2006.

[91] CAB 158/4 JIC (48) 73 (0) *'Employment of Aliens on Defence Work.'* 3 August 1948.

[92] Uttley, p9.

[93] Sir Ben Lockspeiser, previously Director-General of Scientific Research within the Ministry of Supply, was investigated in the 1950s by MI5 because of pre-war Communist associations, according to his 1993 obituary.

[94] https://www.mi5.gov.uk/klaus-fuchs accessed 7 March 2019.

[95] CAB 176/11 *'Publication of Details of Fall of Shot of V.1 and V.2 Weapons.'* JIC/953/46 10 July 1946.

[96] Becklake, p6; Uttley, p9.

[97] CCGP (45)2, November 1945. www.peoplescollection.wales/item/381651.

[98] The Ministry of Supply assessed Dr Johannes Schmidt, amongst others, as an 'active Nazi' during security screening. Uttley, p9.

[99] Becklake, p10.

[100] Andrew, p325.

[101] Cockroft, Wayne & Thomas, Roger, *'Cold War: Building for Nuclear Confrontation 1946 – 1989'* (English, Heritage, Swindon, 2003) p46.

[102] Uttley, p12.

[103] Longmate, p377.

[104] Longmate, p378.

[105] Becklake, p12.

[106] CAB/129/86 1957 Statement on Defence, March 1957.

[107] Cockroft, pp47-51. The US designation for the Thor missile was PGM-17.

[108] The United Kingdom's next generation of nuclear warheads, to be carried on the 'Dreadnought' class of submarines from the mid-2030s, will initially use existing US-supplied Trident II D5 missiles, subject to a mid-life upgrade programme. The Trident launch bodies are maintained in the US and there is no domestic military launch body development programme.

THIRD TACTICAL AIR FORCE

by Air Cdre Graham Pitchfork

By June 1942 the retreat of the British and Commonwealth forces in the face of the Japanese onslaught in Burma was virtually complete. Apart from a number of individual initiatives to mount small-scale offensive operations, the aim of the Commander-in-Chief, General Sir Archibald Wavell, was to provide adequate defence for India and to consolidate and reinforce his forces prior to mounting a major offensive to recapture Burma. Throughout 1943 a steady build-up of ground and air forces took place, allowing commanders to start considering a more positive strategy for the following year.

Following the retreat to the Indian border, the RAF's primary roles could be described as the air defence of Bengal, in particular the crucial area around Calcutta, the airborne re-supply of the 14th Army, the provision of close-air support for the ground forces, and the long-range bombing of Japanese airfields. For many of these operations the squadrons were equipped with old aircraft since priority for the newer types was given to the European and Mediterranean theatres. Hurricanes, Blenheims, Wellingtons and Dakotas were the predominant types. As 1943 progressed, the Blenheims gave way to Vengeance dive-bombers and Beaufighters and more advanced Hurricanes started to arrive, with Liberators joining in the long-range bombing war.

A Mohawk IV of No 155 Sqn. (Liz Dent)

Particularly important was an increase in the number of Dakota squadrons. By the end of 1943, the number of RAF and Commonwealth squadrons in the Burma theatre had risen from 34 to 52.

Formation of Third Tactical Air Force

The latter part of 1943 witnessed a number of important events that would eventually lead to victory in Burma. Without doubt, the formation of South-East Asia Command (SEAC) under the supreme command of Admiral Lord Louis Mountbatten was of particular significance. Appointed as Air Commander-in-Chief of South East Asia was Air Chief Marshal Sir Richard Peirse who was convinced that an integrated command structure along the lines of the successful arrangements in the Mediterranean was essential. After considerable debate between London and Washington on this important issue, Major General George E Stratemeyer USAAF was appointed Peirse's deputy. The main focus of air activity in the SEAC area of operations was in eastern India controlled by the RAF Air Headquarters, Bengal Command and the US Army's 10th Air Force. Under the new arrangements these two operational authorities were integrated to form Eastern Air Command (EAC) with Stratemeyer appointed as the Commander. Two other important developments in the latter half of 1943 were the steady achievement of allied air superiority over Burma and the arrival of the first Spitfires.

During November and December 1943, the 14th Army was busy regrouping in preparation to take the offensive, and as air superiority had been gained, it was decided to increase the tempo of air attacks against the Japanese lines of communication. It was also recognised that the original role of static air defence was no longer the main function of the Air Forces, but there was a need to increase significantly the scale of close air support and airborne air supply in support of the ground offensive. Therefore, as part of the reorganisation and integration of the various air headquarters to form Eastern Air Command it was decided to form the Third Tactical Air Force (3 TAF). The decision was partly influenced by the success achieved in Italy by the Mediterranean Allied Tactical Air Force, where the effectiveness of having an Air Force formation on a corresponding level to an Army Group had proved so successful.

The Third TAF was one of four subordinate formations in the new Eastern Air Command, the others being the Strategic Air Force, comprising the medium and heavy bomber force, Troop Carrier Command, with Photographic Reconnaissance Force coming under command in February 1944. Third TAF was formed on 18 December 1943 with its Headquarters at Comilla under the command of Air Marshal Sir John Baldwin. It comprised the fighter and light bomber squadrons of 221 and 224 Groups with headquarters at Imphal and Chittagong respectively, with the third component, the USAAF's 5320th Air Defence Wing (soon to be named Northern Air Sector Force), based at Dinjan. No 221 Gp retained command of the fighter force of 293 Wing whose primary responsibility was the defence of Calcutta, but the remote control of the wing proved inefficient and it was transferred to 224 Group. This proved just as difficult for a group whose primary responsibilities were on the India-Burma border so 293 Wing was placed directly under 3 TAF on 18 March 1944. On 1 January 1944, the US Air Commando Force, which had been sent to India to work alongside General Wingate's Special Force, was placed under the operational control of 3 TAF. Thus, the greater proportion of the offensive Allied Air Forces opposing the Japanese on the Burma front were under Air Marshal Baldwin's control.

The disposition of tactical units in Bengal and Assam was designed to provide defence and support over the three main areas of land operations. The two RAF Groups supported the 14th Army, with 221 Group covering the area of the Naga Hills north and east of Imphal, and 224 Group assigned to the Arakan. The USAAF Northern Sector Force was tasked with the defence of the air ferry route to China, and with responsibility for close support of General Stilwell's ground forces operating in the Ledo sector of northern Burma.

The steady build-up of ground and air forces during 1943 allowed the Allies to plan for an offensive into the Arakan by the end of the year. Key to these operations was the maintenance of the air superiority already gained. The arrival of the first two Spitfire squadrons in November 1943 (Nos 607 and 615 Sqns) began an era of successful interceptions in which the enemy discovered for the first time the efficacy of modern fighter aircraft backed by a well-developed system of warning and control. More squadrons soon converted to the Spitfire, and by the end of February 1944, four Spitfire squadrons supplemented

A Hurricane IIc of No 79 Sqn.

the nine Hurricane squadrons; the latter being used increasingly on fighter-bomber and transport escort operations. The Japanese Air Force (JAF) suffered some sharp defeats at the hands of the Spitfires losing eight aircraft for every Allied aircraft lost. The tactics employed to gain this dominance over the Arakan battlefield centred on the three forward squadrons equipped with Spitfire Vs, and a few Spitfire VIIIs. The Hurricanes were used for airfield cover when the Spitfires were being re-armed and re-fuelled, and for standing patrols.

Command and Control

Before turning to the major battles of 1944, it is worth highlighting the problems of ground attack operations, tactics and control. A number of factors made the air war for 3 TAF very different from the experiences pioneered by the Desert Air Force and the operations of 2 TAF in northwest Europe. In Burma, Allied forces faced a tenacious, sometimes fanatical, enemy whose code of fighting was very different to other theatres. The weather, terrain and the long distances involved created unique problems for the air and ground commanders, the controlling and tasking authorities and, above all, the aircrew flying with inaccurate maps over such an inhospitable terrain.

Attempts to develop a command and control system along the lines successfully employed in Europe soon highlighted major difficulties and a system had to be devised for 3 TAF that took account of the unique conditions in Burma. In Europe a mobile Group Control Centre (GCC) operated on a front of 40 miles with squadrons closely located

and served by good road and telephone communications. In Burma, roads were very few and poor with mountains and jungle preventing cross-country movement, and telephones were notoriously few and unreliable. Distances were enormous. For example, at one stage 221 Group supported a front of 200 miles with squadrons deployed 200 miles deep. For months at a time in 1944, numerous squadrons were cut off and surrounded by territory occupied by the enemy. Under all these circumstances, the centralised control of army/air operations and the tasking of squadrons at 3 TAF/Army Group level was impossible. Responsibility for the control of aircraft in the air had to be delegated to lower formations. Group commanders drew up a programme of operations each day, in consultation with the appropriate military headquarters, for the employment of the majority of the squadrons. Control of a limited portion of the available tactical air strength, including the tactical reconnaissance squadrons, was given to a unit known as an Army Air Support Control (AASC) with one of these units located with Corps and Divisional headquarters. A wing commander was located with each AASC as the RAF operations officer and he made the final decision on the employment of the aircraft allotted to him without further reference to Group headquarters. When a Group Commander, or the appropriate military commander, wished to lay on a scale of air support, which was outside the Group's resources, the request was passed to Headquarters 3 TAF. If the request was approved, the Strategic Air Force was tasked to meet the requirement and given authority to co-ordinate the task directly with the appropriate Group Commander.

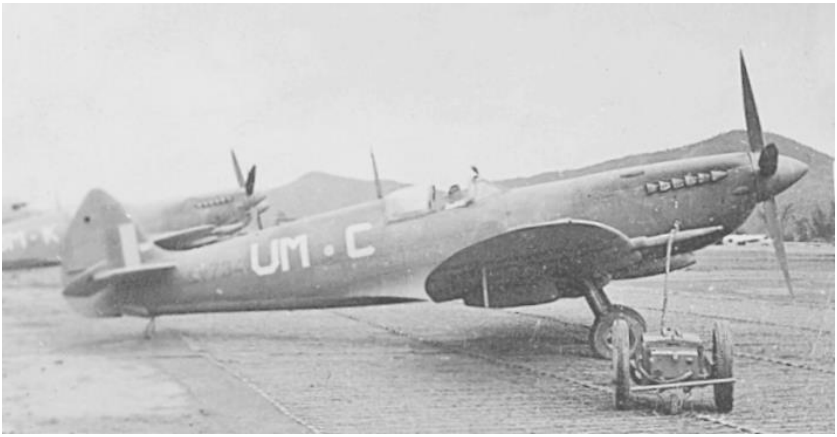
Close liaison between RAF and Army staffs at all levels was the key to the most effective use of the available air assets. A group captain was eventually established as the air advisor at Corps level where army requirements were assessed and air assets allocated through the AASC. Air tasking cells at Divisional headquarters, run by squadron leaders, then tasked specific sorties to meet army requirements. By late 1944, Visual Control Parties (VCP) were established at Army unit level and manned by experienced 'tourex' pilots who provided close control of air sorties. Army Liaison Officers (ALO) were established on each squadron to provide briefings on intelligence and the specialist advice on the ground situation.

Having achieved a high degree of air superiority, allied to the

A Vengeance, AN656, of No 45 Sqn. (No 45 Sqn)

allocation of five B-25 squadrons of the 12th USAAF Bomb Group, 3 TAF had sufficient striking power for nearly all tactical targets. The chief difficulty was to find good targets. The Japanese covered their movements extraordinarily well. Traffic was rarely seen during daylight on roads and tracks, while supply depots and strong points were well camouflaged with the help of the jungle. With friendly troops often in close contact with the enemy, careful target identification and accurate attacks were essential.

The terrain surrounding the target dictated attack tactics. In thick jungle country the approach had to be made at sufficient height to enable targets to be located by reference to a visual identification point making it necessary to attack the targets in a dive attack. It was usually possible to carry out low-level attacks against lines of communication where identification was easier, and the element of surprise was vital. The Vengeance employed a very steep dive attack and developed an excellent reputation for accuracy, often being employed when the enemy target was just a few hundred yards from friendly troops. Although the Hurricane was obsolete by 1944, it was very versatile and rugged and gave excellent service as a fighter-bomber when air superiority was achieved. The B-25s operating in very close support of forward troops had a much greater bomb load but were less accurate than the dive-bombers. However, it also had a devastating ground strafing capability. Successful attacks were also achieved by the use of



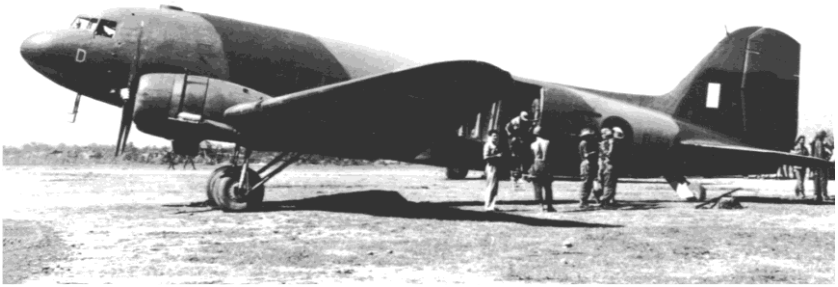
A Spitfire VIII, LV734 of No152 Sqn. (Ron Patterson)

delayed-action bombs exploding throughout the night to wear down the enemy's resistance. A further development was the dummy attack, which made the enemy go to ground in his bunkers and foxholes allowing troops to mount a closely co-ordinated assault on their positions.

Target indication was a major problem in the jungle. Artillery and mortar smoke shells were used and proved effective, but the enemy soon learned to put down diversionary smoke. To counter this, coloured smoke was used and pilots were briefed before take-off on the appropriate colour. The establishment of VCPs, with an air controller in radio communication with support aircraft, solved the problem, and close control of air strikes became well established and very effective.

Operations in the Arakan and at Imphal

The Japanese launched a fierce counter attack against 15 Corps in the Arakan on 3 February accompanied by air strikes, and rapidly achieved some major gains including cutting off the 7th Indian Division. The Spitfires of 224 Group achieved a resounding success against the enemy bombers with the result that JAF attacks declined rapidly allowing Allied close support, reconnaissance and supply dropping operations to continue. The latter were crucial, particularly in re-supplying the isolated 7th Indian Division, a task that could not have been completed without local air superiority. Similarly, the great demand for close support sorties by the RAF and IAF Vengeance and



Dakota, FL512, of No 31 Sqn in 1944.

Hurricane squadrons could only be mounted if the fighters maintained air superiority. More than once the two Vengeance squadrons of 224 Group, Nos 82 and 8 IAF, mounted nearly 50 sorties in a day. By the end of February over 600 Vengeance and 800 Hurricane sorties had been directed against Japanese troop concentrations, bunkers and lines of communication.

By 4 March the battle in the Arakan had been brought to a successful conclusion. In his official Despatch covering this period, Air Chief Marshal Sir Richard Peirse wrote:

> 'There is little doubt that our overall air supremacy was largely responsible for this, since it enabled transport aircraft to drop food and ammunition to 7th Indian Division, which could not otherwise have maintained the fight, the Strategic Air Force to lend its weight against tactical targets, and close support squadrons to break up many attacks to maintain a constant harassing of the enemy's line of communication, and to pin him down in his bunkers while our troops moved in deployment or to attack.'

No sooner had the emergency passed in the Arakan than Operation THURSDAY was launched on 5 March to fly Major General Wingate's 3rd Indian Division some 200 miles behind Japanese lines into Burma, complete with guns, mules and light mechanical transport. The Air Commander of 3 TAF was appointed to control the air element. Air power was critical for the success of the operation in terms of both air

transport and air superiority. The US Air Commando Force, led by Colonel Cochran and comprising 12 B-25 medium bombers, 30 P-51 fighters, 25 transport aircraft, 100 light aircraft and 150 gliders was placed under 3 TAF's control for the operation. With this large force dedicated to Wingate's operation, the direct RAF contribution was limited. The Vengeances and Spitfires of 221 Group were involved in providing close support and fighter escort, and a detachment of 81 Squadron Spitfires operated from 'Broadway', one of the jungle airstrips hacked out of the jungle to receive Wingate's force. The RAF made another valuable contribution to the Second Chindit Campaign. Sixty officers and 162 airmen of the RAF Component Special Force accompanied the expedition to provide a 'talk down' service for close support aircraft. Such was their accuracy that they were able to direct firepower onto enemy positions a few hundred yards from Allied positions.

As final preparations were being made to execute Operation THURSDAY the Japanese launched a major attack on the 4 Corps front across the Chindwin against the Imphal area and the vital Assam railway. The main enemy units crossed the Chindwin on the night of 7/8 March just as the fly-in for THURSDAY was being completed allowing important air assets to be released to meet the new threat. The first task was the urgent air transportation of the 5th and 7th Divisions from the Arakan to Imphal and to bring forward reinforcements from India. Having crossed the Chindwin, the enemy pushed on towards Imphal by the Tamu and Tiddim roads and then on to Kohima further north soon encircling the whole area. Divisions were isolated and relied entirely on air supply. Without air superiority, the task of reinforcement and re-supply could never have been completed with the subsequent loss of the crucial campaign.

To maintain air superiority eight Spitfire squadrons from 224 Group reinforced 221 Group with some operating from airstrips within the encircled Imphal valley. The air defence environment in the Imphal region was more difficult, and the Spitfires did not immediately repeat their successes of the Arakan campaign. The chain of early warning sites was steadily over-run by the Japanese offensive and others had to be abandoned as it was impossible to provide sufficient security manpower. In addition, the rugged terrain created many blank spots in the radar coverage. Nevertheless, the squadrons maintained local air

superiority allowing the vital transport aircraft to continue their crucial re-supply sorties. By the end of May, the fighters had destroyed 31 enemy aircraft, including three by the Beaufighters of 176 Squadron operating at night from advanced airfields near Imphal, with over 80 others claimed as probables or damaged. This was achieved for the loss of 17 Allied fighters.

A unique feature of 221 Group's air defence operations was that every night more than half of the operating squadrons flew from their airstrips in the Imphal plain to neighbouring airfields in the secure rear areas where they rested, refuelled and rearmed. At first light the next day, they flew back into their forward airstrips. The availability of long-range USAAF Mustangs and Lightnings partly offset the reduced early warning cover since they were able to mount long-range interception patrols and leave the Spitfires for purely local defensive work. The USAAF fighters achieved a notable success on 8 March when they surprised a large concentration of aircraft on the Shwebo group of airfields and destroyed 46 of them. Three days later the Lightnings of 459 (US) Squadron attached to 224 Group scored 15 against the enemy at Heho. The squadron went on to destroy 121 enemy aircraft on the ground or in the air by the end of May.

Other effects of the Allied air superiority were that the Japanese army was kept without air support and British fighter-bombers and dive-bombers were almost unhampered in providing their concentrated support to the Allied ground forces. Creating and maintaining a situation where close air support could be provided to the maximum by the resources available was one of the keys to the success of holding Imphal and Kohima. The two resident Vengeance squadrons (Nos 45 and 110 Sqns) were reinforced by Nos 82 and 7 (IAF) Sqns from 224 Group, and in April they flew over 2,000 sorties providing close support, and also attacking enemy dumps and camps. There was also a welcome increase in the number of Hurricane fighter-bomber squadrons. In the same period the four Hurricane squadrons (Nos 34, 42, 60 and 113 Sqns) flew over 2,200 sorties, the majority against enemy troop concentrations threatening the road to Kohima. Throughout May, the Hurricanes and Vengeances maintained the same scale of operations attacking bunker positions, slit trenches, troop concentrations and vehicles. The Air Commander, Sir Richard Peirse commented in his Despatch:

> ‘The enemy’s efforts to deploy in the Imphal Plain during the month were decisively defeated by the Hurricanes and Vengeances which attacked at extremely short intervals any concentrations in the foothills reported by our troops through the AASC (…) the effectiveness of air attack in thick jungle had impressed on (*the Japanese army*) the futility of advancing over open country without overwhelming force.’

During the intense operations in the Arakan and the Chin Hills, the Northern Air Sector Force was providing vital and successful protection of the air route to China. While carrying out its defensive duties the Force fought a very successful air action on 27 March when an enemy formation attempted to attack in the Digboi area. Twenty-six aircraft were claimed destroyed, half of them twin-engine bombers, for the loss of two fighters. This action had a profound effect on future Japanese bomber operations, which became very rare, and on a very small scale. The Northern Force was also increasingly called upon to support General Stilwell’s Chinese Divisions advancing towards Mogaung and Myitkyina from the north when the medium bombers dropped 2,848 tons of bombs in four months.

Lines of Communication

One of the most remarkable features of the war in Burma was the Japanese failure to appreciate the crucial importance of air supply. The Allied forces demonstrated that it was impossible to exist without a massive effort of constant re-supply from the air – 400 short tons were delivered each day during the siege of Imphal. Yet, with extended lines of communication, and very limited road and rail links to the north of Burma, the Japanese made no effort to provide air supply to their forward troops. Incredibly, they embarked on their attacks in the Arakan and at Imphal with just the supplies that they could carry or transport by mule in the full expectation that they would over-run Allied positions and be able to replenish their supplies from the stockpiles they captured. The Allied air planning staff soon recognised the extreme vulnerability of the Japanese lines of communication. Beaufighters of 27 and 177 Squadrons equipped with four 20 mm cannon and six machine guns had been attacking these targets throughout 1943. A third Beaufighter unit, No 211 Sqn, using rocket projectiles, joined 3 TAF in February 1944.

Beaufighter X, NE285, of No 177 Sqn.

The Burma-Siam railway was opened in November 1943 and, although it did not provide a direct link to the battle areas in the north, it was a crucial strategic link that fed the lines of communication to northern Burma. The Beaufighters with their long range were ideal for attacking river craft, vehicles, rolling stock and locomotives on these routes, and they regularly attacked targets on the Burma-Siam railway and as far south as Rangoon. The arrival of the rocket-firing 211 Squadron significantly enhanced the capability against locomotives and fixed installations on the railway system. Another valuable addition to the forces available for interdiction sorties were the 40 mm cannon-equipped Hurricane IIDs of 20 Squadron which did great damage to hundreds of assorted river and coastal craft. The damage and hindrance of these attacks against the Japanese lines of communication are difficult to assess, but it was very noticeable that they significantly increased their efforts to defend their vulnerable supply lines.

Air Supply

In his post-war Despatch of the period, Air Chief Marshal Sir Richard Peirse placed air transport operations second only in importance to the maintenance of air superiority. The vital need for air re-supply, most notably at Imphal and Kohima, was the key to ultimate success during the three great offensives of early 1944. It also demonstrated the need for closer co-ordination and on 1 May the transport aircraft of Troop Carrier Command were transferred to the operational control of Commander 3 TAF. The force consisted of four

Thunderbolt II, KL281, FL.S, of No 34 Sqn.

RAF and eight USAAF C-47 squadrons.

By the end of May, the Japanese attack against Imphal had been blunted. The area was still surrounded and dependant entirely on air supply, but the onset of the monsoon prevented any further Japanese advances. It was then that the vital role of the Dakotas, supplemented by Wellingtons and B-25 Mitchells, turned the battle in favour of the Allies. Despite the treacherous weather, the re-supply operations continued, and 4 and 33 Corps were able to advance, culminating in the opening of the road between Imphal and Kohima on 22 June. Notwithstanding the weather, the shortage of all-weather airfields and the sporadic shelling of the airstrips, the amount of supplies delivered by air increased, permitting the 5th Indian Division to force the Japanese back across the Chindwin to the edge of the Burma Plain by the end of the monsoon and ready for the final offensive.

Re-structuring and Re-equipment

During the monsoon period in the summer of 1944, air operations continued on a limited scale allowing other changes to take place in 3 TAF. Air Marshal Sir John Baldwin relinquished command and was replaced by Air Marshal W A Coryton. An extensive programme of re-equipment started with nine squadrons of Hurricanes steadily replaced by Thunderbolts and the Vengeance squadrons started to receive Mosquitos. Both programmes suffered some initial setbacks with spares for the Thunderbolts limited and a number of structural failures

Mosquito VI, RF711, of No 211 Sqn. (D Leggatt)

of the wooden Mosquitos. However, these problems were overcome and both aircraft, with their far superior performance over the Hurricane and Vengeance, gave outstanding service throughout the rest of the Burma campaign.

With the Japanese retreating, other changes in the 3 TAF structure were implemented. During August and September it had become clear that the planning and day-to-day control of air supply operations needed an organisation separate from 3 TAF. Planning staffs were also considering future operations for the oncoming offensive, which included the possible use of airborne forces. Thus, in October, an integrated British/US Headquarters, Combat Cargo Task Force (CCTF) was formed and became responsible for the air transport support of the 14th Army and 15 Corps. While the transport forces no longer concern this account of 3 TAF it is worth recording that they continued to give outstanding service for the rest of the Burma campaign and their contribution can best be summarised by quoting Lord Mountbatten who wrote to Churchill and the United States Chiefs of Staff: 'There is no doubt that these aircraft turned the tide of battle against the Japanese.'

On the Offensive

As the monsoon period passed and the 'campaign season' started in earnest in October 1944, 221 Group was co-located with Headquarters 14th Army at Imphal and was responsible for providing close support for ground operations. No 224 Group at Cox's Bazar continued to

One, of several, railway bridges dropped by Mosquitos of No 45 Sqn. This one is north of Pyu on the Mandalay-Rangoon line. As they have done here, the Japanese would promptly re-lay the track, provide a new bridge and restore the service. (No 45 Sqn)

support 15 Corps in the Arakan. In both cases the close relationship of the headquarters of the two services was an essential element in their successful co-operation. The US 10th Air Force, controlled directly by Headquarters Eastern Air Command, continued to provide support for Stillwell's Northern Combat Area Command. The backbone of the close air support continued to be the Hurricanes with or without bombs. Four squadrons of Mitchells of the 12th Bombardment Wing were placed under the operational control of 224 Group when they frequently operated in the close support role blasting enemy bunkers.

As the Japanese retreated short of supplies, Hurricane, Mitchells and Beaufighters, carried out attacks against dumps and troops. With the Japanese Air Force an increasingly rare presence in Burmese skies, some Spitfire squadrons were tasked with ground support operations. Thunderbolts and Mosquitos also commenced operations. Limited attacks against the enemy's lines of communication had continued throughout the monsoon period, but they were stepped up as the Japanese retreated. The Chindwin river became a primary route for the Japanese during their retreat and Beaufighters and Hurricane bombers mounted a series of concentrated attacks against river traffic and riverside ports used as points of supply. Mitchells laid mines to catch traffic moving at night, and it was estimated that almost 500 river craft were attacked in August, with Beaufighters accounting for over half.

Attacks against the railway system continued with Mosquitos joining the Beaufighters in the long-range operations. After the heavy

Liberator VI, 'Queenie', of No 357 Sqn. (J Rickard)

losses of engines and rolling stock earlier in the year, enemy defences had increased and trains practically ceased to operate by day. Their component parts were hidden and camouflaged during the day with engines hidden in specially constructed shelters. Nevertheless, many were attacked and destroyed with Beaufighters accounting for over half. The frequent air attacks against the railway system of Burma and Siam forced the Japanese to make greater use of the sea route between Bangkok and Burma as an alternative for carrying supplies and reinforcements. Beaufighters maintained a daily patrol to the Gulf of Martaban, some 500 miles from their base at Chiringa, searching for and attacking shipping. Over a two-day period in September, Beaufighters of 177 and 211 Squadrons sank 28 small coasters with rockets and cannon during dawn and dusk strikes.

During the last few months of 1944, the long-range offensive mounted by 3 TAF was greatly increased with the increasing number of Thunderbolts and the availability of USAAF P-38 Lightnings. They were able to attack targets in the Rangoon area, 430 miles from their bases near Cox's Bazar. Spitfires with 90-gallon drop tanks operated up to 250 miles into enemy territory. Japanese aircraft were seen less and less in the skies over Burma so the long-range fighters sought them out on their airfields. The new generation of fighters also provided a long-range escort capability for Dakotas and Liberators. However, as the Japanese fighter force became greatly reduced, the use of the

significant ground-attack capability of the Allied fighters proved to be a more worthwhile and rewarding option.

A feature of the air war in Burma was the outstanding achievement of the Dakotas and the light aircraft of 3 TAF Communications Squadron, a number of which were modified to carry stretcher cases, in evacuating casualties. The Tiger Moths and L-5 Sentinels used temporary landing strips, which had been carved out of jungle or paddy in two or three days. Many of the strips were often within sight and range of enemy troops and had a difficult approach demanding great skill by the pilots as they landed and took off. On 8 November, during a Japanese air attack, a Dakota was shot down and made a forced landing close to a strip. A Tiger Moth and two L-5s succeeded in rescuing the crew from the strip while it was still under mortar attack. In the period August to December 1944, the light communications aircraft evacuated 837 wounded. As Air Marshal Coryton said in his Despatch; 'Air evacuation of casualties was a very great stimulus to the morale of the advancing troops.

Throughout the existence of 3 TAF the RAF Regiment played a key role in its successes despite being under-resourced in manpower and equipment in the early days. The Regiment provided an anti-aircraft capability together with five field squadrons, and they were responsible for guarding airfields and advanced radar and early-warning sites. Some of the latter were in particularly remote areas well in advance of the main front line and within range of the enemy's guns and night patrols. The Commander of 3 TAF commented, 'It says much for the RAF Regiment personnel that the radar crews (at forward early warning sites) enjoyed undisturbed conditions in which to carry on their work under such trying conditions.' With the Army unable to protect airfields and radar sites, 'if their locations did not happen to fit into the tactical schemes adopted by the local Army formations', a significant expansion of the RAF Regiment was approved. By the end of 1944 their strength had increased to 20 field squadrons and 10 for anti-aircraft duties. For the rest of the war in Burma they provided a very valuable capability for the defence of forward airfields and they drew warm praise from the Air Commander.

Re-organising Command Authorities

Following the successful land campaigns through the monsoon

period, General Slim's 14th Army supported by Air Vice-Marshal S Vincent's 221 Group mounted a major offensive. In the meantime, 15 Corps continued operations in the Arakan supported by 224 Group. The 14th Army advanced beyond the mountainous area of the Chin Hills and broke on to the north Burma Plain via Kalewa where the Chindwin was crossed and a bridgehead established. This was the prelude to the main offensive that culminated in the recapture of Burma. The campaign in Burma had changed from a static, defensive role to one of mobility and rapid movement. Distances between rear headquarters and the battlefields became even greater and communications, which had always been tenuous, were more difficult. The success of delegating operational control to Groups, co-located with the army headquarters, indicated the value of allocating Groups and Wings to Army Corps commanders for operational purposes, whilst an RAF geographical unit at command level could supply the administrative services.

With a new style of warfare, restructuring of Eastern Air Command was also necessary, and it became clear that Headquarters 3 TAF, which had no administrative capability, no longer possessed a proper role. As a result of the restructuring review, 3 TAF was disbanded on 3 December 1944 leaving the RAF's two tactical groups answering directly to Eastern Air Command. Air Marshal Coryton became General Stratemeyer's deputy and also took command of a new administrative command, Headquarters Bengal-Burma, which brought together the administrative aspects of all the RAF's Groups and Wings in the Burma theatre and the support areas in Bengal. These changes were all in place for the commencement of the 1945 offensive in which the RAF's tactical formations would play such a major role in the final conquest of Burma.

No account of the brief history of 3 TAF would be complete without mentioning the crucial work of other support organisations and the ground crews. Working and living in appalling conditions, often with the bare minimum of spares and facilities, they kept the aircraft flying and provided the critical levels of support for a very large air force. Without doubt, they earned far too few accolades and little recognition yet their comradeship and trust in each other ensured that their morale never flagged and they fulfilled what was asked of them; and in many cases, much more. They certainly earned their Burma Stars.

Review

The war in Burma has often been described as 'The Forgotten War' and there is much evidence to support this claim. In London's political and military circles there was a remarkable degree of ignorance of the peculiar characteristics of the war in southeast Asia. The theatre was always the last on the list of priorities for new equipment, capabilities and reinforcement. Despite this, having started with virtually nothing in 1942, a strong Air Force, covering all the roles of air power, was built up by the middle of 1945. Third TAF existed for barely a year of this period, yet its role in the final victory in Burma was immense, having established the pattern for joint operations that eventually led to ultimate success. In the mountains, jungles and wide river valleys that make up the geography of Assam and Burma, only troops capturing and occupying ground as the offensive developed could lead to final victory. However, without the crucial contribution made by the air forces, it is doubtful whether the 14th Army could ever have been victorious. The close support provided by the Hurricanes and Vengeances provided crucial firepower to the ground commanders. Without air supply, the army could never have survived the desperate fighting for the Arakan, Imphal and Kohima nor could it have sustained its final advance without the Dakotas. None of these vital contributions could have been made without the fighters first achieving and maintaining air superiority. As the distinguished air historian Air Commodore Henry Probert said about the Burma campaign, 'it provided a classic demonstration of what air power could do when properly dedicated to joint operations.'

‘THE CHURCHILL WING’

by Andrew Thomas

The attack on the port of Darwin by almost 200 Japanese aircraft on 19 February 1942 sent profound shock waves throughout Australia. It was the first of sixty-four raids on the town and the surrounding area over the next 20 months. With the war in the Pacific little more than two months’ old, and with the seemingly invincible Japanese sweeping all before them, there was a genuine fear of a landing in northern Australia itself. This fear was compounded by a devastating attack on the harbour at Broome in Western Australia nearly 700 miles to the south west of Darwin on 3 March.

The paucity of fighter defences in the area resulted in the Australian Government requesting the return of two RAAF Spitfire squadrons then based in England. Winston Churchill immediately recognised that he would be obliged to respond to this request, as a matter of faith, and directed that a wing of Spitfires be sent to Australia with all haste. The two RAAF squadrons, Nos 452 and 457, were ordered to return home, together with the RAF’s No 54 Sqn, with a promise that two more RAF squadrons would be sent to complete a fully manned three-squadron RAF wing. No 54 Sqn left Britain, accompanied by the two Australian units, on 21 June; they eventually reached Melbourne on 13 August. However, much to Churchill’s irritation, their original complement of Spitfires had been commandeered for the Middle East while in transit! A consignment of tropicalised Spitfire Vcs finally arrived in Australia in early October and the three squadrons reassembled to form No 1 Fighter Wing that was often thereafter known as ‘the Churchill Wing’. It was initially commanded by Gp Capt Allan ‘Wally’ Walters with the leading RAAF ace, Wg Cdr Clive Caldwell, as the Wing Leader. In mid-January 1943 No 54 Sqn

Wg Cdr Clive ‘Killer’ Caldwell at Strauss. (AWM NWA0309).

A Spitfire Vc on one of the dusty airstrips in the Northern Territory in 1943. (RAAF)

began moving up to the Darwin area, followed by the Australian units, although the oppressive humidity and thunderstorms made life difficult for both men and aircraft at the remote strips in the bush. The first, albeit uneventful, scramble came on 26 January but the Spitfire's first action in Australia was not long in coming. On 6 February, Flt Lt Bob Foster of No 54 Sqn shot down a Mitsubishi Ki 46 *Dinah*. It was the first of 65 Japanese aircraft credited as destroyed by No 1 Wing's Spitfires over the next nine months, albeit for the loss of 15 pilots in combat.

Frustrations in Darwin

With the change in Japanese priorities in the face of Allied successes elsewhere in the Pacific, on 12 November 1943 the Japanese made their 64th and final bombing raid on the Australian mainland; it caused only slight damage. However, the Japanese continued to make occasional reconnaissance sorties over northern Australia so the Spitfire squadrons remained on standby. Thus there were still occasional encounters between the Spitfires and Japanese reconnaissance aircraft over Darwin into 1944. This situation resulted in considerable frustration for the

pilots of the three squadrons as No 452 Sqn's Flt Lt Ron Cundy – a Western Desert veteran – summed up:

> 'The monotony of sitting around the flight hut on readiness waiting for the Japs, who never came, was relieved from time to time with line astern chases, battle climbs in squadron formation, shadow shooting and aerobatics. We had some outstanding young pilots who would have made excellent combat pilots but were destined to serve without ever clashing with enemy aircraft.'

So as to cover the vast expanse of the Northern Territory small detachments were often mounted to other areas such as on 2 December when three Spitfires of No 54 Sqn detached to Drysdale Mission in Western Australia to take over standby. While stationed there, Fg Off Gray went missing during a sortie on the 22nd; he was eventually found, having force landed on a mud flat, whence he was rescued by a Walrus of No 6 Comms Unit. The Spitfires returned to Darwin in January.

Churchill had promised the Australians an RAF wing and so additional pilots and aircraft were posted to Australia and at Lawnton, Queensland on 15 December 1943, Nos 548 and 549 Sqns were formed. They would eventually join No 54 Sqn, although the RAAF provided the groundcrews. The COs were, respectively, Sqn Ldrs Alec Wright and Eric Bocock and during January they proceeded to Strathpine, near Brisbane, to await their Spitfires – the latest Mk VIIIs. Many of the pilots were experienced veterans, such as Fg Off Dennis Tickner of No 549 Sqn who recalled:

> 'It was a frustrating life for 549 and its pilots, especially since most of us came from 234 at West Malling engaged on sweeps over France. All the RAF pilots in 234 were posted to form 549. In Australia we went up to Lawnton and on to Strathpine. We were able to fly Tiger Moths a little before the Spitfires arrived. I flew my first Spitfire VIII (No 343) on 16th April.'

On 11 January 1944 Sqn Ldr Eric Gibbs, who had successfully led No 54 Sqn throughout 1943 handed over to Sqn Ldr Robert Newton. Up at Darwin, No 54 Sqn (along with Nos 452 and 457 Sqns) was still flying the Spitfire Vc, although Newton conducted his first Mk VIII familiarisation in mid-February, at the same time as Wg Cdr Dickie Cresswell, previously CO of an RAAF Kittyhawk squadron, was appointed as Wing Leader. However, it was not until early April that

Although the newly-arrived RAF units were directed to re-camouflage their aircraft before they moved to Darwin, it would seem that at least one, Flt Lt Glaser's A58-379 of No 549 Sqn, arrived still in its natural state. (E D Glaser)

No 54 Sqn began re-equipping with Mk VIIIs, flying its last Spitfire Vc sortie on 19 May.

At much the same time, early April, the first Spitfires finally arrived for Nos 548 and 549 Sqns. These were further delayed by a dock strike, but Alec Wright managed to get some released. The first aircraft was test flown on 12 April and others soon followed with No 549 Sqn flying its first three on the 16th. Sadly, during a training sortie on the 19th, Wright's aircraft collided with FSgt Alan Chandler's and both men died in the crash. It was a tragic start for No 548 Sqn. Sqn Ldr Ray Watts was appointed as the new CO. Both squadrons had been ordered to remove the camouflage from their aircraft but, in late May, just as they were about to head north to the operational area, they were specifically forbidden to fly un-camouflaged aircraft there! Yet another frustration for the keen RAF pilots who were eager to see action

The last victory

Whilst the new squadrons were working-up at Darwin, in part to relieve the monotony, on 18 April Spitfires from Nos 54, 452 and 457 Sqns mounted No 1 Fighter Wing's first offensive mission across the Timor Sea. A harassing attack was planned against the Japanese camp at Tepa on Babar Island and the nearby W/T station, along with installations on the adjacent Wetan Island. The Spitfires were led by a

Beaufighter of No 31 Sqn RAAF for navigational assistance; it was No 54 Sqn's swansong on the Spitfire Vc.

Red Section comprised Sqn Ldr Newton and FSgt Knapp of No 54 Sqn; Blue Section, led by Wg Cdr Cresswell, was provided by No 452 Sqn. Green Section comprised Gp Capt Peter Jeffrey (who had taken over from Allan Walters as OC 1 Wg in September 1943) leading FSgts Donaldson and Finney; Yellow Section came from No 457 Sqn. All aircraft refuelled at Bathurst Island and then attacked the target in loose line abreast formation. The fighters strafed as sections from 350 feet with Newton and Knapp going for the radio station and some accommodation huts, despite one of the CO's cannon jamming. The attack was over in under ten minutes when they reformed for the long 325 mile overwater return flight. However, although judged successful, it would be some months before another 'Rhubarb' was approved. In the event this operation proved to be the last on which No 54 Sqn would accompany the two RAAF squadrons and on 10 May it was deployed to Learmonth for ten days to protect refuelling facilities for the new British Pacific Fleet against a possible Japanese attack.

On 15 May Nos 548 and 549 Sqns finally began moving up to the Darwin area, the former relocating to Livingstone, some 25 miles south of the town, alongside No 54 Sqn, with No 549 Sqn setting up shop at Strauss. They were declared operational on 4 July and thereafter maintained day and night readiness.

At the same time, 15 May, No 80 Wing had been formed at Darwin with the initial intention of mounting offensive operations over the Dutch East Indies. When No 1 Wing's two new RAF squadrons were declared operational on 4 July, the two RAAF units, Nos 452 and 457 Sqns, were transferred out to form the initial equipment of the newly established No 80 Wg. There were now five squadrons of Spitfires operational in Australia, three of them (nominally at least) in a wholly RAF-manned wing – Churchill's promise had been honoured.

The first scramble for the newly arrived squadrons was on 16 July when Flt Lt Webb led three others from No 549 Sqn to investigate an unknown 'plot' that was eventually identified as friendly. No 54 Sqn was still maintaining a detachment in the Drysdale area, at Truscott, and four days later it too was in action. At 07.30 on the 20th Lt Kiyoshi Izuka and his observer, Lt Hisao Itoh, of the 60th Independent Chutai lifted their Mitsubishi Ki 46 *Dinah* off from Koepang and headed for

Spitfire VIII, A58-393, of No 549 Sqn at Strathpine in April 1944.
(via Mike Markovic)

the Australian mainland. Just over an hour later the radar station at Cape Leveque detected the intruder and at 08.45 three Spitfires of No 54 Sqn flown by Flt Lt Jim Gossland, leading Flt Lt Freddie Meakin and FSgt Knapp, were scrambled. They intercepted the intruder at 27,000 feet and, having identified it as a Ki 46, Gossland's initial pass hit both of its engines, the port wing and the fuselage. The *Dinah* dived away, closely followed by Meakin whose fire resulted in the port wing detaching. Gossland reported:

> 'I saw a *Dinah* approaching from 3 o'clock about 1,500 ft above, so I tallyhoed and turned port, which positioned me 7-800 ft astern and below the *Dinah*. I gave a short burst and saw strikes on the port engine along the fuselage and the starboard engine. The *Dinah* started burning and went into a very steep dive, with smoke pouring from both engines, right in front of Red 1 who followed him down, firing at his belly. I saw strikes from his burst on the port wing which went up in a sheet of flame and shortly after fell off outboard of the port engine. The *Dinah* went into a flat spin burning furiously. I saw a disturbance in the sea off shore. The port wing was still airborne, it settled in the sea about half a mile from the main crash.'

Fred Meakin also described the action in his post-flight report:

> 'I turned sharply to port and quickly climbed to the *Dinah*'s level. I was then about 1,500 feet behind and saw White 1 some 700 yards ahead to port and quickly caught up to make my attack

Sqn Ldr Bocock's Spitfire VIII, JG655, 548 Sqn, Darwin 1944.
(E D Glaser)

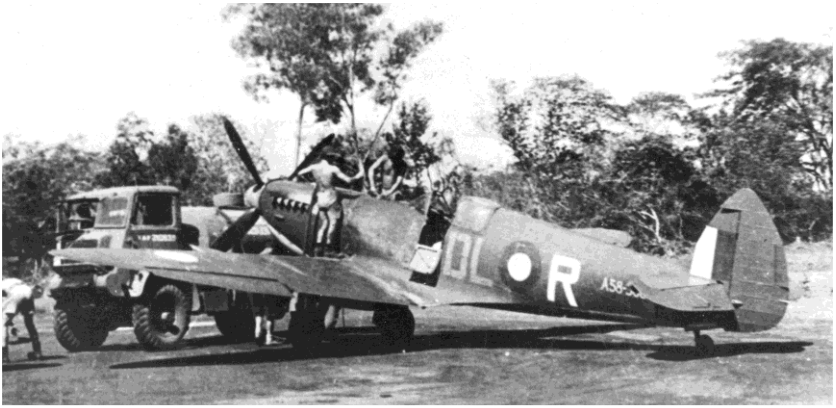
> from the starboard side. I noticed several puffs of black smoke from the *Dinah*'s tail and several explosions appeared below. We closed to about 350 yards and the bandit turned slightly to port. I saw White 1 make an attack and saw strikes on the fuselage and mainplanes. The *Dinah* started to dive and I fired at about 300 yards and saw strikes on the port mainplane and fuselage. The port wing fell off, and the a/c was completely enveloped in flames.'

They also noted that the *Dinah* was coloured green with red roundels above the wings and took no effective evasive action. Izuka's loss was the last of almost 160 Japanese aircraft shot down over Australia during the war and was the air combat swansong for 'The Churchill Wing'.

Sadly, only a week later, on the 28th, Freddie Meakin was killed when his aircraft crashed on take off.

Long range 'Rhubarbs'

A week after No 54 Sqn's significant victory, Bob Newton was succeeded as OC 54 Sqn by Sqn Ldr Sid Linnard, another desert veteran. On the moonless night of 4 August, a pair of No 549 Sqn's aircraft were scrambled. Although they spotted something, they were unable to close and identify the intruder. Led by Flt Lt Dave Glaser, there was another scramble after an unidentified aircraft on the 21st but it proved to be friendly. There was a similar false alarm, this time led



Spitfire VIII, A58-360, No 54 Sqn, Darwin late 1944. (No 54 Sqn)

by the CO, on 30th.

Towards the end of August, the three Squadron Commanders approached Gp Capt Jeffrey seeking authorisation for some operations to, in Sqn Ldr Ray Watts opinion: '… prevent the black dog from leaping on our backs, as the Irish say.' Their plea worked and on 3 September Sqn Ldrs Linnard, Watts and Bocock were briefed for an attack on a camp at Lingat Bay and an airfield on Selaroe Island, an operation that would involve a lengthy flight across the Timor Sea.

The fourteen-aircraft 'Rhubarb' was mounted on the 5th, Gp Capt Jeffrey, accompanied by Flt Lt Robertson as his wingman, led four aircraft from each of Nos 54, 548 and 549 Sqns with an RAAF Mitchell from No 2 Sqn providing navigational assistance and an air-sea-rescue Catalina orbiting 20 miles south of the island.

Lifting off at 10.45, Sqn Ldr Linnard led the 54 Sqn section with Flt Lts Ogden and Gossland and WO Rayner. No 548 Sqn's quartet was led Sqn Ldr Ray Watts, the others being Flt Lt Aiken (who eventually rose to became Air Chief Marshal Sir John), Flt Lt Chick and WO Isaac. No 549 Sqn's element comprised Sqn Ldr Bocock, Flt Lts Glaser and van Wedd and Fg Off Turner. The force rendezvoused over Darwin and set course on the transit flight of almost 300 miles. No 549 Sqn's section was first over the target, followed by No 54 Sqn's quartet and then No 548 Sqn's. All strafed the target successfully, raising a lot of dust and starting a number of fires. The Mitchell followed up by delivering a 4,000 lb load of incendiaries noting some heavy anti-

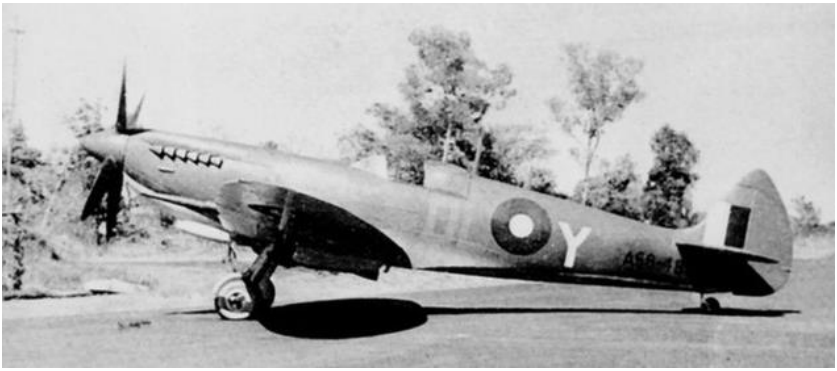
aircraft fire from the airstrip. No 548 Sqn's report summarised the attack, as follows:

> 'The navigation was good, and the landfall was made slightly west of the intended point, but the target was approached as briefed. The R/T was fairly satisfactory, except that the frequencies from the Mitchell were very loud and distorted. 549 Sqdn went over the target, then 54 Sqdn, and then our pilots. Very little was seen of a military nature in the target area. The CO and F/Lt Aiken, having sprayed the target, were following along a motor transport track to the north of the village. F/Lt Aiken called over the R/T to say that there appeared to be absolutely nothing on the road, when suddenly a bullet came whizzing through his cockpit. There must have been something on the road, or very near it. Nearly famous last words. The bullet passed out again near his left arm. The electrical installation was badly damaged and the R/T went unserviceable. The fuselage was damaged and there was a small fire and some smoke in the cockpit. He turned for base and actually got home first. Meanwhile the others finished their run, had a look around, and returned. The CO had a look at the strip and he and others noticed some heavy ack ack fire fifteen to twenty rounds at the Mitchell. Over the target there was dust and smoke, but nobody saw any Japanese. Altogether 1282 rounds of 20mm and 4978 rounds of .303 were fired.'

Late in October all three squadrons concentrated at Darwin Civil airfield where, in the pilots' mess bar, there was a pub sign showing a picture of a black swan and the words 'Ye Olde Sucke Inne' in response to the story that the Prime Minister of Australia had sent Churchill three black swans and he had sent three Spitfire squadrons in return!

Longest operational sortie

During that month Gp Capt Brian 'Blackjack' Walker assumed command of the wing. He too was keen for more offensive work and planned an attack against two Japanese radar stations, at Cape Lore on Portuguese Timor, the destruction of which would assist RAAF Catalina operations in the area. The force would comprise a dozen Spitfires and four Mitchells of No 2 Sqn RAAF. Walker directed that No 549 Sqn would carry out the mission and that he would lead, along

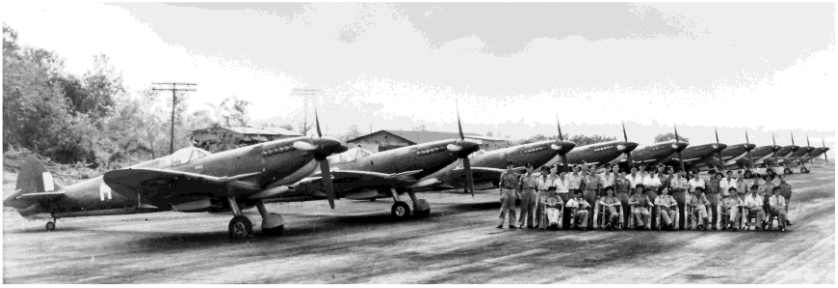


A Spitfire VIII, A58-480, of No 54 Sqn at Darwin in 1944.
(No 54 Sqn)

with the new Wing Leader, Wg Cdr Royce Wilkinson, a Battle of France veteran. In the event, because of unserviceabilities, only seven Spitfires participated, the other pilots being Sqn Ldr Bocock, Flt Lts van Wedd and Webster and WOs Franks and Beaton. In his report Eric Bocock wrote:

> 'The orders were to strafe and destroy the two enemy radar installations near Cape Lore on the SE coast of Timor. Originally the attacking force was to consist of 4 B-25s from No 2 Squadron, ten Spitfires from 549 Squadron and two Spitfires from No 1 Fighter Wing. The Spitfires were to strafe the installations first and then the B-25s were to bomb and strafe what was left. All Spitfires were to refuel en route at Austin Strip and out of a total of 14 Spitfires, which included two spares from this squadron, only 7 aircraft were able to take off from Austin, the two aircraft from the Wing and five from this squadron. The trouble was caused by fuel air locks. However, the reduced force arrived safely and it is considered that the target was destroyed. There was no interception and there were no casualties. Two bursts of light mg fire were observed from a position in a tree 70 yards north of the installation.'

At a press briefing afterwards the local AOC said: 'The longest operational flight ever made by Spitfires, stands to the credit of the Royal Air Force squadron at Darwin, which smashed the installations on Timor recently. The round trip was more than eight hundred and



No 548 Sqn's Spitfire VIIIs on parade (nearest is A58-482/TS·M) at Darwin Civil in July 1944. (R A Watts)

fifty miles and there was no loss or damage to the Squadron.'

However, after this excitement, in late November corrosion of the glycol feed pipes was discovered to have affected most of the wing's Spitfires. As a result, flying was severely restricted and this, together with the knowledge that the war had moved further north, far away from Darwin, caused morale to suffer. Nonetheless, despite the lack of flying, Sqn Ldr Bocock wrote to his HQ: 'I am supremely confident that given a job to do this squadron can do it as well as any other fighter squadron in the Empire Air Forces if it were only given the equipment necessary and a brief period of refresher training.'

There was little significant activity in early 1945, although on 14 February, David Glaser was promoted to command No 548 Sqn and in early June there was some naval co-operation with the frigate HMS *Helford*.

In late May another offensive 'Rhubarb' was planned in conjunction with RAAF Liberators of No 23 Sqn against aircraft reported on Cape Chater airfield on Timor. Sqn Ldr Glaser was to lead the strafer flight and Eric Bocock the top cover. At 06.35 on 3 June Spitfires from all three squadrons left Darwin for Austin Strip at Snake Bay on Melville Island to refuel before taking off for the target on Portuguese Timor. Flt Lt Grierson-Jackson had to turn back with a malfunctioning belly tank, leaving Flt Lt Nicholas and Fg Off Booker to represent No 54 Sqn. No 548 Sqn contributed six aircraft led by Sqn Ldr Glaser followed by Flt Lts Saunders, Aiken, Hilton, Price and Everill. Sqn Ldr Bocock was No 549 Sqn's sole participant.

After their long flight over the Timor Sea led, once again, by Mitchells of No 2 Sqn, the Spitfires rendezvoused at 09.15 over Jaco

Spitfire VIII, A58-482, of No 548 Sqn in 1945. (R Tickner)

Island, off the eastern tip Timor, with four Liberators of No 23 Sqn. The bombers went in first, striking the aerodrome and destroying three of the five aircraft seen on the ground in their revetments. In the process, however, even though they had been slightly delayed by a minor radio problem with the Liberators, the bombers had raised a lot of dust and smoke that caused difficulties for the six Spitfires of the strafing flight that followed them in. Nevertheless, they were able to strafe the airfield buildings with cannon and machine gun fire. The top cover flights experienced some medium AA fire while the Spitfires made a second run on a bomber in a camouflaged revetment that was identified as a Mitsubishi Ki 67 *Peggy* (but was more likely to have been a Ki 49 *Helen*). The fighters then withdrew and headed back for Darwin where they landed at 11.35. It was No 1 Wing's final offensive mission.

Back at Darwin, and the ongoing detachment at Truscott, the three squadrons continued to hold standby and conduct training flying. On 26 July Fg Off Lane was scrambled twice, but the 'bogey' turned out to be a false 'blip.' This would be the last operational sortie of the war for the 'Churchill Wing' and, following the Japanese surrender, all three squadrons moved to Melbourne where they were disbanded and their pilots returned to Britain.

Acknowledgements: The author is grateful to the former members of The Churchill Wing squadrons for their assistance: David Glaser DFC, Brian Hicks, Vic Moore, Dennis Tickner and Air Cdre Raymond Watts CBE AFC.

RNAS + RFC = RAF – HARMONISATION OF THE DISPARATE AIRCREW STRUCTURES

by Wg Cdr Jeff Jefford

When the RFC was created in May 1912 it was intended to be a joint service institution but, while it had Naval and Military Wings, it is notable that the three squadrons that were initially authorised were all to be army units. Since the War Office was clearly going to be the major shareholder, the Admiralty was never very deeply committed to this enterprise. By July 1914 it had already sponsored an Order in Council, the Schedule of which opened by stating that

> '. . . Officers and Warrant Officers appointed to serve in the Naval Wing of the Royal Flying Corps (which will be designated the Royal Naval Air Service) . . .'[1]

Note that it was still acknowledged to be the Naval Wing, so this was essentially a cosmetic exercise, rather than a substantial revision of its constitution. That said, this declaration had been accompanied by a range of distinctive new rank titles and badges, which indicated that the Admiralty was serious about this separation.

The War Office saw no need for such distinctions and its aviators simply used the existing military rank structure. Nevertheless, the Navy's arrangements could be seen as the *decree nisi* stage of an impending divorce – and it certainly represented the thin end of a wedge. A wedge that was driven home a year later by an Admiralty Weekly Order which stated that 'The Royal Naval Air Service is to be regarded in all respects as an integral part of the Royal Navy . . .' thus making the divorce from the Army *absolute*.[2] So what implications did all that have in the context of the aircrew sponsored by the two Services?[3]

The RFC

It is axiomatic that, irrespective of whether he was a soldier or a sailor, an aeroplane had to have a pilot and they were, broadly-speaking, interchangeable. What made the difference was how the aeroplane was operated and that involved other members of the crew, so the difference between the RFC and the RNAS was more to do with the way they treated their back-seaters. So, while we do need to pay some attention

to pilots in this context, we need to focus on the observers and gunners who flew with them. That said, it is notable that, while W E Johns saw fit to grant Biggles technical support, in the shape of Flight Sergeant Smyth and Ginger, he never saw the need to provide him with any dedicated back-seat aircrew).

When the fighting began in 1914, the only realistic function of aeroplanes was reconnaissance – in essence, permitting the general to see over the hill. Similarly, at sea – for someone standing on the beach, the horizon is only 3 miles away; a sailor 100 feet up in a crow's nest can see 12 miles but the crew of an aeroplane at 3,000 feet can see, notionally at least, more than 60 miles – and if they fly out for 60 miles they can see another 60 miles from there. So air reconnaissance was a game-changing capability, both for armies and for navies. But there was a difference in approach between the two air services. The Army had concluded that it would be useful for the pilot to be accompanied by a second man who could keep track of where they had been, make notes and draw sketch maps. He could be another (expensive) pilot, but this was not essential, and a handful of officers was being trained to function purely as observers even before war was declared.

Having deployed to the continent with the BEF in August 1914, the RFC soon made a major contribution by detecting the German advance which led to the Retreat from Mons thus avoiding the British Army's being outflanked. The RFC began to really spread its wings in September during the Battle of the Aisne, when (pre-war experiments aside) it made its first attempts to direct artillery fire, to take photographs and to use air-to-ground wireless. These activities made the involvement of a second man even more critical and by the end of the year there were nineteen officers, graded as qualified observers, flying with the RFC in France with more in the pipeline undergoing a somewhat informal process of on-the-job training.

Not long after this, sufficient observers were available to permit HQ RFC to rule that that, 'Two qualified pilots are not to ascend in the same aeroplane, except by special permission of a Wing Commander.'[4] Numbers continued to increase, and the original *ad hoc* collection of cameras and wireless sets soon began to be replaced by bespoke equipment while operating procedures and techniques were defined and progressively refined. By August 1915 the status of the observer was such that a badge, a single-winged 'O', was introduced to distinguish

them from non-flying personnel.

The RFC eventually acquired a second generation of far more capable aeroplanes but, even while still obliged to rely heavily on its increasingly obsolescent BE2s, its capabilities were gradually extended to embrace day and night bombing, aerial fighting and supply dropping – but reconnaissance and artillery co-operation remained the core functions of contemporary air power throughout the war. Rather than the all-purpose BE2, the new aeroplanes, like RE8s, DH 4s and 9s, and the Bristol Fighter, were optimised for specific functions and the training of pilots, and observers, gradually became increasingly specialised to meet the peculiar demands of each role.

What of the status of these aircrew? Pilots were almost exclusively officers. There had always been non-commissioned pilots, indeed there were 47 of them on the RFC's books when war was declared and a steady trickle continued to be trained, but very few of them ever saw combat. The employment of sergeant pilots on operations peaked during 1917 – see Figure 1. In August there were forty-seven squadrons in France, reflecting an overall requirement for 987 pilots, all notionally officers. There were actually 967 officers and twenty-eight sergeants, a ratio of officers to NCOs of the order of 35:1.[5] But by this time, the RFC's practice of employing (almost) exclusively officer pilots had morphed into policy. In June 1917 the War Office had announced that, with immediate effect, '. . . the training of non-commissioned officers and air mechanics as pilots will be discontinued.'[6]

Sergeants had never represented more than 3% of the available pilots in France and the new universal commissioning policy meant that their numbers steadily declined. By January 1918, there were only fourteen of them, this figure contrasting markedly with that for non-commissioned back-seaters of whom there were no fewer than 231.[7] So why the difference?

In the early days it had been more or less taken for granted that, to be effective in the air, one would need the degrees of education, intelligence and initiative that were generally associated with a commission, so the observers of 1914-15 were all officers. Indeed, in the early days, flying as an observer was seen, by some, to be an option well worth exploiting and by December 1914 50% of all observers attached to the RFC were captains or even majors. These were no wartime conscripts – they were pre-war professional soldiers who had

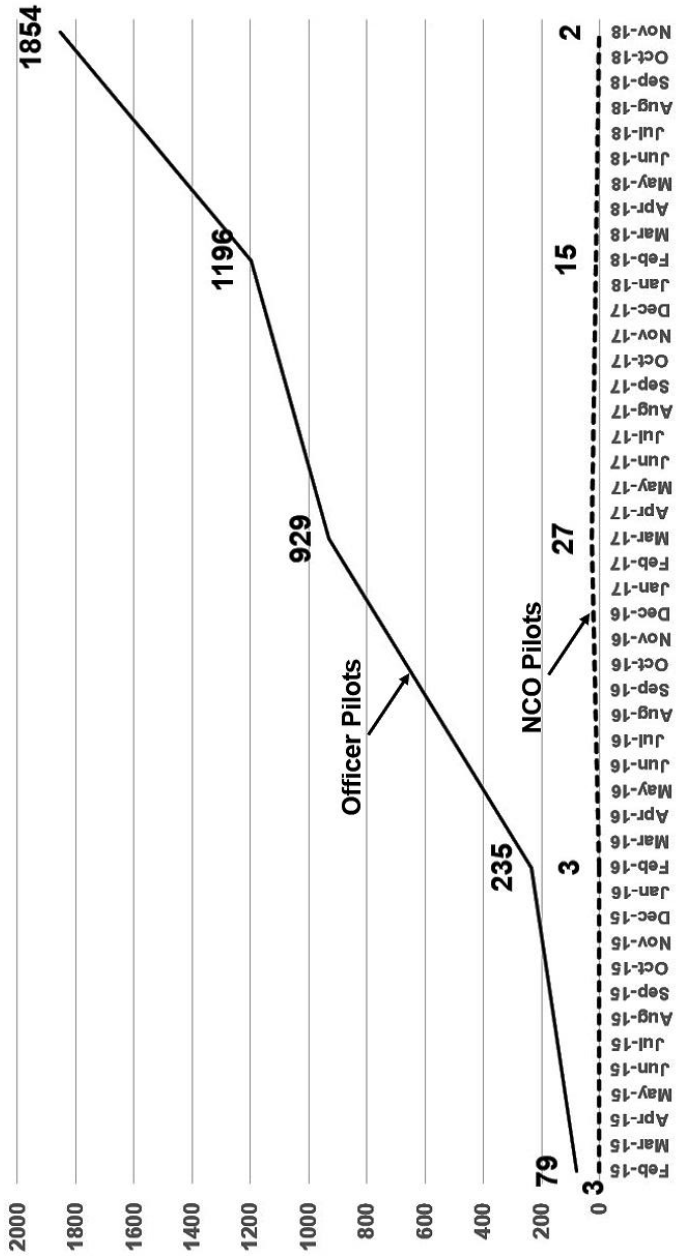


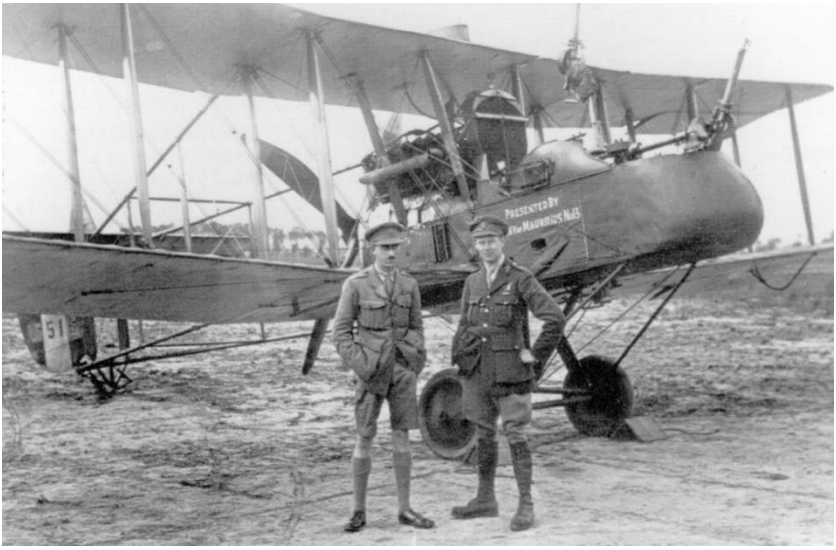
Fig 1. Pilots subordinate to HQ RFC/RAF in France, Feb 15-Nov 18

perceived an opportunity. But, by the following August there were no majors and the proportion of captains had declined to a mere 10%; a few months later there were none at all. Why? Because by that time any officer wise enough to consider the practical implications of the RFC's *manning* policy had concluded that volunteering to fly as an observer was not a smart career move after all because, by mid-1915, being an observer was already perceived to be a job for mere subalterns.[8]

The root of the problem was the interplay between three technical terms – attached, transferred and graded – each of which had a particular meaning in the context of employment. In short, internally-recruited observers, mostly volunteers from the trenches, were 'attached' to the RFC, unlike internally-recruited pilots (the majority until 1917) who were 'transferred' to it and then 'graded'.

This rather esoteric distinction had significant implications in terms of career management because most of the observers who were merely *attached* to the RFC were actually serving on the General List of Kitchener's New Armies.[9] Since these officers had effectively severed their connections with the regiment or corps with which they had originally been serving, they no longer figured in the promotion lists which were periodically raised by their previous sponsors. Unfortunately, their *attached* status meant that they did not figure in the RFC's calculations either so that, in practical terms, no one had any direct responsibility for fostering their further advancement and it was December 1915 before RFC commanders were formally required to consider recommending 2nd lieutenants of the General List for promotion to lieutenant.[10]

In real terms the problem of promotion for observers, or the lack of it, was far more significant for career officers of the Regular Army, all of whom would have had reasonable expectations of fairly rapid advancement in time of war. To avoid being overtaken in the promotion stakes by their less enterprising colleagues, who had kept their feet firmly on the ground, an increasing number of older, more senior, observers began to drift back to their original units. The loss of these capable, ambitious and experienced men caused some concern, but nothing could be done to alleviate the situation within the existing regulations, because RFC policy dictated that promotion leading to executive appointments was restricted to personnel *graded* as Flying



A typical two-seater crew in 1917. Capt F D Stevens (left) with his observer Lt W C Cambray with an FE2d, A6516, of No 20 Sqn. (W C Cambray via Cross & Cockade)

Officers, that is to say, to pilots.

The obvious solution was to arrange for observers to be *transferred* to the RFC, like pilots, so that they too could be *graded*. From November 1915, therefore, it was ruled that all seven fully accredited observers held against the establishment of each squadron could be formally gazetted to the RFC. But there was a catch – or two catches. First, all observers graded as Flying Officers were to undertake to be retrained as pilots at 'the first opportunity'. Secondly, any observer selected for Flight Commander grade (which implied an automatic captaincy) would be obliged to retrain as a pilot *before* he could fill such an appointment (and thus be promoted).[11]

What this meant, in practical terms, was that all significant posts in the RFC, even including the first rung on the ladder – Flight Commander – were actually reserved for pilots which meant that the rank ceiling for observers was lieutenant. Thus, despite most observers being commissioned, they had absolutely no prospects of advancement, other than by becoming a pilot. That, however, was generally considered, certainly by the RFC hierarchy, to be a logical progression

Sgt James McCudden, one of the handful of NCO observers who were badged during 1916.

– transfer out of the trenches to become an observer, fly as such for a few months, then return to Home Establishment to train as a pilot before returning to France to become a Flight and then Squadron Commander. What was wrong with that?

What was wrong with it was that being an observer came to be seen as a transitory stage, which did not encourage people to think long-term and grapple with the problems inherent in early aviation – navigation, weapon aiming, operating at night. Progress was made, of course, but how much more might have been achieved if the RFC had regarded the observer as a professional and granted some of them a rank that would have permitted their voices to be heard? That was precisely the conclusion drawn in 1916 by Mr Justice Bailhache's *Committee on the Administration and Command of the RFC* which specifically recommended that, 'Observers should receive promotion without having to become pilots and that a corps of observers be formed with a regular establishment graded for promotion among themselves.'[12] Sadly, this recommendation was never implemented, so the observer's rank ceiling remained at mere lieutenant.

Having considered the lot of commissioned back-seaters, what of the NCOs – like the 231 noted above? From the outset the RFC had always permitted those of its air mechanics who wished to fly to do so. They were not trained as aviators, but in 1912-15 their familiarity with aeroplanes sufficed. The most notable case was that of Sgt James McCudden[13] whose formal appointment as an observer, in January 1916, had made him one of the first of a mere trickle of NCO observers – see Figure 2. In the following April, the RFC acknowledged its use of non-commissioned crewmen by introducing the, somewhat informal, category of the aerial gunner – see Figure 2. In June the establishment of a squadron was amended to authorise up to six gunners per squadron to supplement the, by now, twelve commissioned observers, but it was December before formal courses began at home, so most of these men

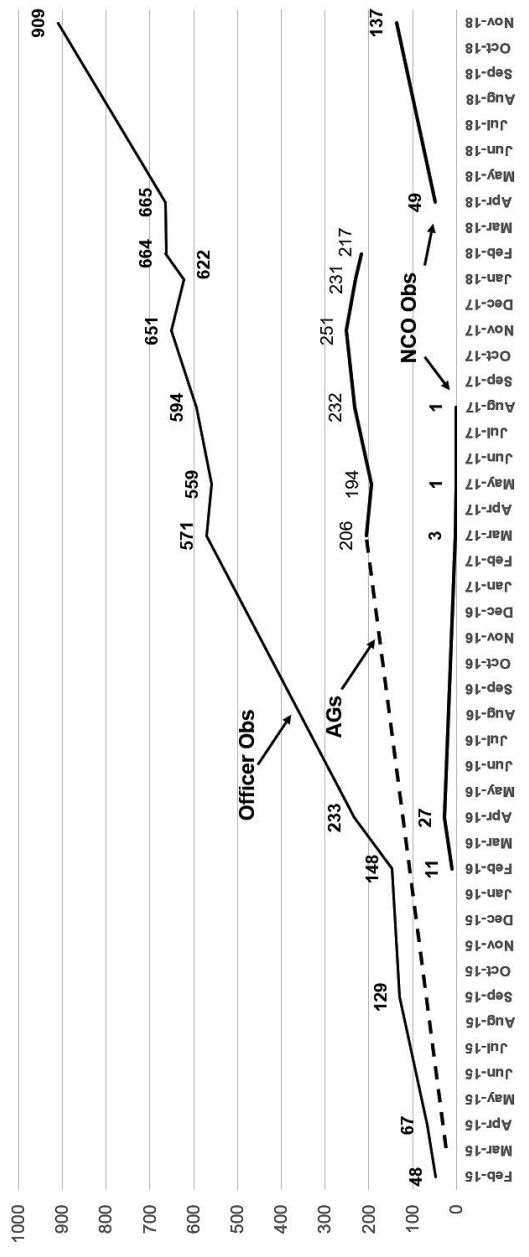


Fig 2. Observers & Aerial Gunners subordinate to HQ RFC/RAF in France, Feb 15-Nov 18

were trained on-the-job. The availability of gunners meant that there was no longer any need for NCO observers so no more were trained and the handful that had qualified for an 'O' badge had faded away by the summer of 1917.

There do not appear to be any readily accessible figures relating to the employment of gunners during 1916, since they are not reflected in periodic returns of aircrew – because, technically, they weren't 'aircrew'. Hence the dotted line in Figure 2. Aerial gunners were either misemployed RFC air mechanics or volunteers escaping from the trenches – bombardiers, riflemen, fusiliers, sappers and the like. Some, a few, were sent home to attend the Machine Gun School at Hythe, but most were 'trained' on-the-job. In February 1917 the aerial gunner was formally recognised as an aircrew category and thereafter they were reflected in periodic returns, permitting the dotted line to firm up. By March there were 206 NCO gunners on the strength of the two-seater squadrons in France, compared to 571 commissioned observers (see Figure 2).[14] Because of the substantial numbers still being recruited, and trained, in the field, it was quite usual for about half of the gunners on strength – and flying operationally – to be, as yet, unqualified; furthermore, while they are being loosely referred to here as 'NCOs', they were nearly all corporals or below.

However, things changed at the turn of the year when, in December 1917, it was announced that on two-seater Army Squadrons 'the 6 NCO Aerial Gunners will be replaced by 6 NCO Observers (Sergeants) to be trained in the same way as Officer Observers' and that on Corps Squadrons, ie those co-operating with the guns, 'the 6 NCO Aerial Gunners will be withdrawn and will not be replaced.'[15] This 'second generation' of sergeant observers began to feature in returns from April 1918 onwards – see Figure 2. Their introduction eclipsed the trade of the aerial gunner, which was effectively abolished, so their numbers immediately began to decline. Some were sent home to be recycled as observers and by March gunners had ceased to be reflected in unit returns. The sergeant observer never really caught on, however, and, although, their numbers did increase, when the fighting stopped in November 1918, there were still only 137 of them on the strength of the 54 multi-seat units, compared to more than 900 officers. Furthermore, their employment had been largely confined to DH 9s and Bristol Fighters, where their chief function was as a gunner – only nine of the

An RFC kite balloon about to ascend – Ypres October 1917. Note the static-line parachute at the side of the basket. (Australian War Memorial)

137 were flying in the, still critical, corps reconnaissance role.

So, to recap, practically all RFC pilots were officers and up to 90%, of its back-seaters were also commissioned. So much for the soldiers who flew the Army's aeroplanes, but what of the men who crewed its balloons?

Balloonists

By 1915 the Germans were making increasing use of observation balloons and the British CinC, Sir John French, eventually requested a similar facility. That was a bit difficult, because the Navy had had exclusive responsibility for all lighter-than-air aviation since January 1914.[16] This dictated, initially at least, an exercise in inter-Service co-operation and the first balloons to be deployed operationally in support of the BEF, in May 1915, were provided, and operated, by the RNAS.

In October, by which time there were four RNAS balloon sections in France, they were taken over by the Army,[17] although it was still heavily reliant on the Navy for training. Arrangements were made for some of the original RNAS personnel serving with the units in France to be transferred to the RFC but from 1916 onwards new sections deploying to France were wholly Army-manned.

While the RFC had been content to introduce the aircrew category of the balloon officer in October 1915, there was a problem over the award of an appropriate flying badge. The War Office ruled out a dedicated new badge, so it had to be the observers single-winged 'O', but qualification, against a syllabus devised by the Navy, required free ballooning. That wasn't a problem for people being formally trained at home, but free ballooning was simply not a practical proposition for

men who were obliged to learn the ropes in the field – while being shot at! There was over a year of bureaucratic Army/Navy arm-wrestling, during which the original *Drachen*-style balloons were superseded by the French-designed Caquot, before the mandatory free ballooning requirement was finally dropped in February 1917.

Having dealt with the Army's aeroplane crews, and its balloonists, what of the Navy's fliers?

The RNAS

Compared to the RFC, the RNAS was much smaller, but more complex. It operated conventional landplanes and employed them in a similar fashion to the RFC – as fighters and bombers and to direct artillery fire, including ship-to-shore bombardment. But it also flew seaplanes, operated aeroplanes from ships and made extensive use of airships as well as balloons. In contrast to the Army, however, in the early days the Navy saw little need for aircrew other than pilots. Furthermore, it did not even distinguish between who flew what. Anyone in charge of a device that flew – landplane, seaplane, airship – even a balloon – was graded as a Flight Officer and wore the RNAS eagle on his cuff.

Although many early naval aeroplanes were two-seaters, the RNAS showed no interest in observers until early 1915 when it acquired the services of four, just four, officers of the Royal Marine Artillery who joined the Dunkirk-based No 1 Sqn which employed them spotting for the guns of HMS *Revenge* and HMS *Bustard* bombarding the Belgian coast. By June there were still only four commissioned observers flying with the RNAS, but by this time two of them were RNR officers who had replaced two of the original marines.[18]

In the autumn of 1915 Capt Oliver Swann complained that, while commanding the seaplane carrier HMS *Campania*, in the absence of any appropriately trained personnel, he had been obliged to employ totally in**e**xperienced RNR midshipmen as air observers.[19] This had not been an isolated instance. Cdr Charles Samson had encountered a similar problem while commanding No 3 Wg in the Aegean. He subsequently recalled that, prior to the arrival from England of the first two observers – both on loan from the Army – 'three midshipman were obtained from the Fleet for this work, but they were not very efficient.'[20]

The prevalent view in the upper reaches of the naval hierarchy seems

to have been that flying was simply an *avant garde* form of seamanship. The captain of an aeroplane was expected, therefore, to be in possession of a notional equivalent to a 'Master's Watchkeeping Certificate' which endowed him, much like the captain of a ship at sea, with the ability to undertake all manner of airborne activities. The reality, of course, was that a pilot, even one who had once been a sailor, could not actually *do* everything himself and he often needed to be accompanied by an assistant, ideally, a competent one. Prior to 1917, however, many naval back-seaters were co-opted officers, petty officers or ratings, who had received little, if any, specialist training in aviation.

The classic example, from the Battle of Jutland, was the Short 184 that reported back to HMS *Engadine*, by wireless, the position and movement of the German Fleet. Flown by Flt Lt Frederick Rutland – the guy in the other seat, the one who actually did the reporting, was Assistant Paymaster George Trewin. Assistant Paymaster?! It is also worth recording that, while the pilot was promoted and decorated with a DSC, Trewin's contribution received no formal acknowledgement.

Nevertheless, despite their lack of recognition, the number of commissioned observers serving *with* (as distinct from being members *of*) the RNAS gradually increased. By the end of December 1915 there were fifty-seven of them, of whom only twenty-four were actually available for duty (although none of this group had been formally trained). The other thirty-three were on the books of a recently established training school based at White City. The front runners from this cohort, the first batch of naval air observers to benefit from, what passed for, formal training, emerged in February 1916.

By this time, the Navy was clearly beginning to come to terms with the idea of observers and from April 1916, still running nine months behind the Army, they were authorised to wear the RNAS eagle. It is perhaps worth pointing out that, at this stage, the eagle was not an exclusively pilot emblem – it was also worn by any officers attached to the RNAS who were 'under a continuous liability to make ascents in aircraft'[21] – which included observers.

Despite these positive developments, however, the naval aircrew problem was actually getting worse, because, in contrast to the RFC, the RNAS was beginning to operate relatively large aircraft. These flying boats, heavy bombers and airships, required crews of three, four or even more men. Although the RNAS was a smaller-scale operation

The RNAS tended to require large crews which were inherited by the RAF. These are personnel associated with the airship NS-12 in late 1918. Since she was quite capable of carrying out 24-hour patrols (NS-11 held the record at a little over 100 hours) she normally flew with a complement of ten, two five-man watches. (J M Bruce/G S Leslie collection)

than the RFC, its pilots tended to need much larger numbers of competent airborne assistants than their opposite numbers in the Army – wireless operators, gunlayers,[22] flight engineers, as well as observers. Having been slow to acknowledge the need for professional observers and thus to provide them with adequate instruction or any tangible status, the Admiralty finally came to terms with reality in 1917.

A major factor in persuading the Navy to accept that it really did need competent professional back-seaters was the experience gained during No 3 Wg's pioneering attempt to establish a strategic bombing force in eastern France during 1916. Although this enterprise was terminated before it had been able to realise its full potential, it taught many lessons. One of the aeroplanes involved had been the Sopwith 1½ Strutter. Probably better known as an RFC two-seat reconnaissance-fighter, many of those operated by the navy were single-seaters with an internal bomb bay.

On his return to England in January 1917, No 3 Wg's erstwhile

senior pilot, Wg Cdr Richard Bell Davies, wrote a paper in which he noted that, despite their success, the Sopwiths had not been ideally suited to their appointed task. This was partly because their, 'pilots all have great difficulty in working any kind of sight while flying the machine' and partly because the lack of a gunner made them extremely vulnerable. Davies recommended that future bombers should be two-seaters with the 'passenger' (*sic*) having responsibility for both bomb-aiming and defence.[23]

If this advice was going to be acted upon, it was clear that the RNAS would require many more back-seaters and, since they were to have a clearly identified and crucial function, that they would have to be taken far more seriously. It is not known to what extent Davies' report served as a catalyst in provoking action along these lines, but what is certain is that a comprehensive career structure for naval observers was introduced shortly after it was submitted.

At a single stroke, with effect from 2 April 1917, the Navy introduced: direct recruiting into the RNAS (in place of the previous use of RNR and RNVR officers); distinctive rank titles (up to captain RN equivalent); continuous rates of flying pay; and a realistic prospect of advancement because Observer Officers were to be 'eligible for command of Air Stations in the same way as Flight Officers.'[24] Having previously been even less enlightened than the Army in its attitude towards its back-seaters, the Navy had suddenly raised the inter-Service stakes significantly, because the rank of RFC observers was still constrained to that of lieutenant and they continued to be ineligible for any executive appointments.

In June 1917 the enhanced status of the naval observer was further endorsed by the introduction of a distinctive badge, a gilt winged 'O' – two wings, not one.[25]

The RAF

It will be apparent from the foregoing that the soldiers and sailors who flew had wandered off down different paths which had, by 1918, resulted in two quite different systems reflecting different attitudes towards aircrew. In April, sorting out these disparate arrangements became an RAF problem.

The terms under which the RAF was constituted meant that *all* personnel serving with, or attached to, the RFC and the RNAS were

	Officers	ORs	Total
RNAS	5,378	49,688	55,066
RFC	18,700	131,637	150,337
RAF	24,078	181,325	205,403

Fig 3. Manpower (ie excluding 6,792 ex-RFC boys) as at 31 March 1918.

automatically transferred to the new Service with effect from 1 April 1918.[26] So, how many people did that involve? A number of figures may be found among the records but those considered likely to have been the most mature, and thus the most accurate, are those cited by the Head of AHB in 1943 – see Figure 3.[27]

These figures indicate that, on Day One, 73% of the RAF was ex-Army or, to put it another way, an overall ex-Army to ex-Navy ratio of the order of 3:1. But that understates the RAF's potential *fighting* strength – its aircrew. It is difficult to establish the situation regarding the relatively small numbers of NCOs and other ranks but the position with respect to officers is clear enough. While recognising that there may be some minor inaccuracies, the Air Force List for April identified a grand total of 12,030 qualified junior – ie captain and below – commissioned aviators of all kinds, which included the 2,023 pilots and observers of equivalent rank, in the Navy List for March.[28] If we subtract the ex-RNAS contingent, the RFC must have provided 10,007 – see Figure 4. That was an Army to Navy ratio of almost 5:1 – so the RFC's contribution to the RAF's combat element had been significantly greater than suggested by its proportion of the overall manpower.

But it was complicated. Not least because the Navy had categorised all of its commissioned aviators as Flight Officers, irrespective of their specific 'trade'. The Army most certainly had not and, since they were to be the major RAF shareholder, soldierly practice prevailed. There was no dispute that, regardless of whether they had wheels or floats, so long as they were proper *aeroplanes* – with wings and things – the folk who flew them were all pilots – and there was no problem imposing a straightforward read-across from RNAS ranks to the army-style ranks retained by the RAF. But airships did not fit within the RAF's RFC-derived structure, so it had to create the new category of the Dirigible (later Airship) Officer, who was permitted to wear the RAF flying badge.

	Capt	Lt	2/Lt	Total
Aeroplane & Seaplane Officers	584	8,866	8	9,458
Dirigible Officers	12	139	3	154
Kite Balloon Officer.	30	621	3	654
Observer Officers	2	1,728	34	1,764
			RAF Total	12,030
			RNAS element	-2,023
			RFC element	10,007

Fig 4. Breakdown of commissioned RAF junior aircrew as reflected in the April 1918 edition of the Air Force List.

But balloons were a more contentious issue. Both services had sponsored balloonists and, although the RNAS had pioneered their use, the RFC had become the major employer – and the Army certainly did not regard balloonists as pilots, whereas the Navy did. There was a bit of a scuffle over that, but the Army won and anyone who went aloft in charge of an aerostat was deemed to be a Kite Balloon Officer (KBO) in RAF-speak – and they wore the single-winged 'O' flying badge inherited from the RFC.

And then there were the aeroplane observers. This group had two significant characteristics. First, its substantial size – there were more than 1,700 of them (see Figure 4). Secondly, its very restricted, again RFC-derived, rank structure (see Figure 5). It will be recalled that, until mid-1917, the RNAS had had very few observers but when it decided to sponsor some more, and to take them seriously, it decided that, since they were people too, just like pilots they could be ranked up to captain RN equivalent and that they could command units. The RFC who were, as with balloonatics, the major employer of observers, did not see them that way at all. The underlying, albeit unstated, Army philosophy was to regard observers as pilots-in-waiting. Despite having been deemed suitable for commissioning, their real value was seen to be in their potential as pilots and, until they became one, they had no executive authority. Observers were expected to spend some time being shot at, after which most of the survivors would be recycled to emerge from their observer chrysalis as fully fledged pilots mysteriously endowed, overnight, with the infinite wisdom and powers of command that they had previously lacked.

Once again, since the Army had been the major employer, the RAF

RFC/RNAS grades	RFC ranks (pilots)	RNAS ranks (pilots)	RFC ranks (observers)	RNAS ranks (observers)
		Wing Captain		Observer Captain
Wing Commander	Lt-Colonel	Wing Commander		Wing Observer
Squadron Commander	Major	Squadron Commander		Squadron Observer
Flight Commander	Captain	Flight Commander		Flight Observer
Flying Officer	Lieutenant	Flight Lieutenant	Lieutenant	Observer Lieutenant
	2nd Lieutenant	Flight Sub-Lieutenant	2nd Lieutenant	Observer Sub-Lieutenant
Trainee/Probationer	2nd Lieutenant (later Flight Cadet)	Probationary Flight Officer	2nd Lieutenant (later Flight Cadet)	Probationary Observer Officer

Fig 5. RFC/RNAS equivalent grade/rank structures.

RNAS	RAF
4 × Squadron Observer	2 × Captain (temp Major)
6 × Flight Observers	4 × Lieutenant (temp Captain)
46 × Observer Lieutenant	42 × Lieutenant (hon Captain)
125 × Observer Sub-Lieutenant	129 × Lieutenant
Total 181	**Total 177**

Fig 6. Absorption of ex-RNAS observers into the RAF.

adopted RFC practice. But that was a real problem, because the RAF's initial complement of 1,764 observers had included 181 ex-RNAS men, four of whom were already ranked as squadron observers – the equivalent of majors – another six were flight observers and 46 were observer lieutenants, all of whom were considered, by their Lordships of the Admiralty at least, to be fully equivalent to an Army captain. That all looked *very* top heavy to folk accustomed to the Army way of doing things, so how was the new-fangled RAF going to get around that one? It allowed a tiny crack to appear in its Army mould – just sufficient to permit two of the squadron observers to be accepted as substantive captains ranked as *temporary* majors, and four of the six flight observers to become RAF lieutenants with *temporary* rank of captain. Forty-two of the observer lieutenants became RAF lieutenants with *honorary* rank of captain and all the rest became RAF lieutenants (see Figure 6).[29]

What was the difference between temporary and honorary rank? In essence, while held, temporary rank came with all the associated bells and whistles – status, rate of pay and executive authority. Honorary rank had little substance; apart from being able to wear the appropriate badges, it carried no executive authority and salaries were paid at the substantive rank. In effect, the RAF had successfully short-changed many of its ex-RNAS observers.

Four months later, by which time the RAF had gained another thousand observers – it now had 2,783 of them – the Air Force List for August 1918 contained three observers now actually ranked as substantive majors and fifty-four as captains, although forty-seven of the latter had an asterisk signifying that they were: 'Graded for pay as Lieutenant and employed as such'; in effect they were only *honorary* captains. Needless to say, the ten observers whose executive status had

been formally acknowledged by the RAF were all ex-naval officers – because, having inherited the RFC's manning policy (and the generals that still oversaw it) the RAF had been unable to promote any of its ex-Army men.[30]

Or perhaps disinclined, rather than unable, because by August 1918 the inability to promote observers was no longer an issue. However, as is clear from Figure 5, the grade versus rank structures prevailing in the RFC and RNAS had been seriously mismatched and these arrangements simply had to be rationalised. The problem was considered by the Air Council at a meeting held on 1 May 1918 and, after due consideration, it decided to round up, rather than down.

It ruled that, possibly subject to their having to complete a brief flying training course, all RAF observers should now be eligible to hold appointments as Flight, Squadron or Wing Commanders, thus raising their potential rank ceiling to lieutenant-colonel – exactly the same as RAF pilots.

Both of the senior air commanders in France were appalled at this prospect. Generals Trenchard and Salmond both 'laid strong protests before the Air Ministry in regard to this decision (*expressing*) the opinion that the efficiency and morale of the RAF in the Field would suffer serious damage in consequence.'[31] The Air Council dismissed these objections, evidently taking the view that, as a matter of principle, ex-RNAS observers ought not to have their prospects blighted as a result of their having been press-ganged into the RAF. Conversely, it followed that ex-RFC observers could not be seen to be disadvantaged by comparison with their ex-naval colleagues. At a meeting of the Air Members of the Air Council held on 5 June the original decision was endorsed; the minutes recording:[32]

> 'In connection with the eligibility of observers for appointment as flight, squadron, or wing commander, it was agreed that each case should be considered on its merits.'

That was clear enough; like pilots, an observer could hold an executive appointment if he was good enough, and there had been no further mention of the tentative requirement for a nominal amount of pilot training. This outcome was publicised a few weeks later via a routine Air Ministry Weekly Order.[33]

So – at long last – game, set and match to the observer. Or was it?

Had they reflected a little more deeply, before blowing a fuse, the two outraged generals would probably have realised that they need not have been quite so concerned. It would soon become apparent that the system had a built-in bias so strong that (apart from the handful of ex-RNAS men who had already slipped through the net) it proved to be virtually impossible for any observer to gain even a footing on the RAF's promotion ladder.

This was an inevitable consequence of the RFC's long-standing aircrew employment policy which had ensured that all senior RAF appointments (and in this instance 'seniority' began at captain) were held by pilots. Pilots, therefore, both made and approved all recommendations for promotions and appointments. The record plainly shows that, regardless of the Air Council's enlightened ruling, that the RAF was to be an equal opportunities employer, those in positions of influence and authority were quite capable of keeping the back-seater very firmly in his place. It was to be another half-century before navigators (or officers of any other trade for that matter) began to break through the 'glass ceiling' in any significant numbers.

The Air Force List for August 1918, names 2,783 commissioned observers, of whom 57 (all of them ex-RNAS) had been, at least nominal, majors or captains. The largest Air Force List of the era was the February 1919 edition which identifies no fewer than 4,478 observers, so the total had increased by 61% since the summer. One could reasonably expect, therefore, that the 57 captains and majors would have increased in proportion to at least 92 captains and majors. 'At least' because it would be equally reasonable to expect a rather larger number, since observers were supposed to have had the same promotion prospects as pilots since the previous June.

In fact, despite the substantial increase in overall numbers, there were *fewer* captains and majors. The RAF could now boast only two majors and 49 nominal captains among its back-seaters, 32 of the latter actually being graded as lieutenants. Predictably, with but one exception, they were all still the ex-RNAS interlopers.[34] Thus, while the ranks had been swelled by an additional 1,695 observers in the six months since August 1918, the proportion afforded any substantial degree of recognition had been halved, from 2.0% down to 1·1%. If that was 'equal opportunities' in action, it boded ill for the future.

And so it came to pass, because the post-war RAF would soon forget

Left, Capt D F Stevenson DSO MC, a Flight Commander with No 4 Sqn in May 1918, with his observer, Lt J W Baker MC. But what were their career prospects in the RAF?.[37] (AVM H G White via Chaz Bowyer)

the lessons taught by WW I. As early as November 1914 it had been found necessary to provide every squadron with a fourth Flight Commander to assist the CO with the handling of administrative and technical business on the ground.[35] That was an inefficient use of a pilot, of course, so these spare Flight Commanders were soon replaced by dedicated administrative and technical officers. The December 1918 Air Force List represents the manning situation at or about the end of WW I; it contains the names of 21,018 nominal aircrew, plus 9,198 commissioned technicians and administrators.[36] In other words, for every 2·3 officers *notionally* available as aircrew, the wartime RAF had needed one on the ground. This aircrew:groundcrew relationship was no late-wartime, new-fangled, 'air force' phenomenon incidentally, as the Air Force List for April 1918 reveals that the new Service had inherited a ratio of 2·4:1 from its forebears.

But what of the observers? There was no mention of them in Trenchard's famous Memorandum of December 1919[38] and, in case

anyone 'hadn't got that memo', a month later an AMWO was published stating categorically that 'no provision has been made for observers in the peacetime Air Force.'[39]

The same fate was to befall most of the officers who had been engaged on ground duties. By 1917 a squadron never had fewer than three officers established in support roles, a Recording Officer, a Stores Officer and an Armament Officer. Needless to say, as operations became more complex, and units continued to multiply – and expand – these numbers had tended to increase. If a wartime squadron had so recently required three, four, five and sometimes as many as six, ground-based specialist officers dedicated to sustaining its operations it seems remarkably short-sighted to have assumed that this would not be the case in the future.

Nevertheless, apart from dedicated, but relatively small, Stores and Accounts Branches, Trenchard's air force soon dispensed with all officers other than pilots who, now categorised as 'General Duties' officers, were expected to do everything else. By 1930 the aircrew:groundcrew ratio had risen to 5·5:1, more than double the 2·3:1 that had been required during the war.[40] Nevertheless, it sufficed until 1940 by which time reality had bitten again – hard. The RAF had to reinvent the wheel. Having already reintroduced back-seat aircrew, it was now obliged to reinstate professional engineers and administrators too.

Notes:

1 *London Gazette* (LG) LG 28852 of 24 July 1914 publishing an Order in Council of 16 July.

2 ADM1/8408/7. Admiralty Weekly Order 1204/1915 dated 29 July 1915 which published Naval Law Division statement NL 18597/15 of the same date. Nevertheless, despite the *de facto* independence of the RNAS, until 1918, the Army Lists and Navy Lists of the period reflected the *de jure* situation, which was that the RFC continued to be formally constituted as a Military Wing and a Naval Wing until 1918.

3 The primary focus of this paper is to consider the issues to do with ranks and status that arose from the separation of the RFC and RNAS and their subsequent re-amalgamation. The constitutional aspects were discussed in greater detail in RAFHS Journal No 50, pp115-9 *qv*.

4 AIR1/831/204/5/225. HQ RFC's Routine Orders for 10 May 1915. This order was actually couched as a reminder, indicating that there may have been some reluctance to comply with an earlier edict.

5 AIR1/1301/204/11/158. Officers and aircrew on the strength of units stationed in France and operating under the control of HQ RFC in mid-August 1917.

[6] AIR1/391/15/231/32. DAO letter 87/RFC/564 (O.2) dated 7 June 1917.

[7] AIR1/1214/204/5/2630. Nominal roll of officers and non-commissioned aircrew serving with the RFC overseas, dated January 1918.

[8] Subaltern was/is a generic term technically embracing commissioned ranks below that of captain. In practice, by WW I this was largely confined to 2nd lieutenants but until, they were abolished in 1871, it had also included the likes of cornets and ensigns.

[9] While it was possible to play a number of variations on the theme of becoming a commissioned army aviator, in the context being considered here, there were only two basic wartime options – the General List or the RFC (Special Reserve). The fundamental difference was that an appointment to the General List involved a temporary, but open-ended, 'for the duration' undertaking whereas the Special Reserve was a permanently constituted body into which a candidate was commissioned for a fixed period, initially of four years.

[10] AIR1/404/15/231/45. The earliest (pre-war) reservists, having been called up and commissioned as 2nd lieutenants in August 1914, were becoming eligible for consideration for promotion a year later. War Office letter 100/RFC/46(MA1) dated 9 August 1915 therefore requested that recommendations be made regarding the promotion to lieutenant of 2nd lieutenants of the RFC (Special Reserve). Letter 100/RFC/103(MA1) of 1 December extended this provision to cover officers of the New Armies holding temporary commissions on the General List who happened to be serving with the RFC.

[11] *Ibid*. Authority for observers to be graded was contained within War Office letter 100/FC/95(MA1) dated 13 November 1915, although the regulation was made effective retrospectively from 21 October.

It should be appreciated that, despite their having been gazetted as Flying Officers, observers (and pilots) who were *transferred* to the RFC, ie those who had not been directly recruited as aviators, retained some tribal loyalty to their parent regiment or corps. This was reciprocated and, despite their names being included in the RFC section of the Army List, they continued to appear under their original units as well. It was well into 1917 before 'straight through' RFC flyers began to outnumber the transferees.

[12] AIR1/2405/303/4/5 contains a copy of the Committee's Final Report, one of at least three preserved at The National Archives; AIR2/9/87/7661 contains a copy of the final draft, which included several less widely published Annexes. The report's recommendations and final remarks were reproduced in *Flight* for 21 December 1916. The section of the body of the report dealing specifically with observers was reproduced in the issue of 4 January 1917.

[13] Later, of course, to become Maj James McCudden VC DSO* MC* MM.

[14] AIR1/1297/204/11/139 includes details of officers and aircrew on the strength of units stationed in France and operating under the control of HQ RFC in March 1917. At that time 116 of the 206 gunners (56%) available to the 34 two-seat squadrons were RFC men, the balance being soldiers drawn from other organisations.

[15] AIR1/1039/204/5/1468. Note 87/RFC/1018 (SD2) dated 31 December 1917 to CinC British Armies in France.

[16] CAB38/27/22. CID Report 190B of 9 May 1914. This document notes that in October 1913 the War Office and Admiralty had agreed to the transfer of all airships to the Naval Wing and that this transfer had been affected in the following January (when

the Military Wing's No 1 Sqn had been re-roled as an aeroplane unit). This change in policy had made the Naval Wing responsible for all lighter-than-air craft thereafter and, although not specifically stated at the time, this had included ballooning.

[17] AIR1/832/204/5/226. A Royal Warrant of 4 November 1915 amended that of 1 December 1914 (which laid down conditions of service and pay for the wartime Army) by recognising the addition of 'a Kite Balloon Section to our Royal Flying Corps (Military Wing)' with effect from 16 October 1915. The Warrant was promulgated by Army Order II of 10 November and published in HQ RFC's Routine Orders of the 25th.

[18] The first four were 2/Lts R F Ogston, A R Collon, J H D'Albiac & L Innes-Baillie – all RM. By June the first two had been replaced by Sub Lts H W Furnival & F D Casey – both RNR.

[19] AIR 1/636/17/122/132. Letter 31/E/15 of 8 October 1915 from Capt Schwann (he anglicised his name in 1917 by deleting the Teutonic 'ch') to Vice-Admiral Commanding 2nd Battle Squadron dealing with a number of issues concerning the utility of his ship, HMS *Campania*, 'to the Royal Navy as a seaplane carrier.'

[20] AIR1/724/76/6. Notes, dated 16 March 1923, on an interview conducted with Air Cdre Samson the previous day. Samson identified the first two Army observers as Lts Jenkins and Hogg. According to a nominal roll of all officers known to have served with the RNAS 'at the Dardanelles' (AIR1/675/21/13/1563) these would appear to have been Maj R E T Hogg (Central India Horse) and Capt J H Jenkins (2nd Highland Ammunition Column, RA).

[21] AFO 756 of 21 April 1916.

[22] Although the RNAS had been employing *de facto* non-commissioned gunners ever since the beginning of the war, as with its observers, the Admiralty had been slow to acknowledge them. A specific date for the introduction of the rate of aerial gunlayer has, thus far, eluded this writer, but it was probably in 1916, as an appropriate badge was authorised for them late in that year; see Admiralty Monthly Order 3319 of 1 December.

[23] AIR1/113/15/39/35. Paper entitled 'Remarks on Experience Gained in Air Raids and on Probable Requirements as to Types of Machines in the Future' by Wg Cdr R B Davies, dated 4 January 1917.

[24] Admiralty Monthly Order 1648, which published the details of the observers rank and career structure, was not actually promulgated until 5 May 1917 so its effective date of 2 April was retrospective. It was superseded on 6 December by Monthly Order 4359 which provided further amplification of the arrangements.

[25] The wearing of the RNAS observers badge was authorised with effect from 1 July 1917 by Admiralty Monthly Order 2322 which was promulgated on 22 June.

[26] AIR10/171. Air Force Memorandum No 1 of 1 March 1918, which spelled out the overall arrangements governing the creation of the new air force noted that all RNAS and RFC personnel were to be transferred to the RAF 'without his consent', but it went on to say that any individual could, within the next three months, revert to his original service. This grace period was later extended to six months by AMWO 426 of 12 June 1918, HQ RAF RO 815 of 3 October 1918 declaring 6 October to be the final cut-off date.

[27] Establishing a definitive headcount for 1 April 1918 is problematic. For example, the RAF Muster Roll as at 1 April (AIR1/819/204/4/1316) identified, by name and

trade, in Service Number order, 181,625 NCOs & ORs, but this figure was clearly not precise because the document was subject to several subsequent amendments. Similarly, this writer's personal trawl through the April 1918 edition of the Air Force List yielded a total of 24,926 officers of all ranks/categories, but this early edition (there had been an even earlier, presumably trial, edition in February) is bound to have involved bureaucratic errors in its compilation. Added together these two figures produce an all-ranks RAF total of 206,551. However, file AIR20/6191 contains an early post-war note raised by AHB on 18 May 1923 (reflecting figures produced by S5 on 24 May 1922) stating that RAF manpower on 1 April 1918 had amounted to 24,158 officers and 184,910 ORs, a total of 209,068. The same AHB note also states that the ex-RNAS element embedded within these figures had been 5,378 officers and 49,688 ORs, a total of 55,066. But twenty years later, on 30 March 1943, in a letter (on file AIR1/686/21/13/2252) responding to a question asked by Lord Trenchard, the Head of AHB, J C Nerney, provided the figures at Figure 3. Since Nerney's figures were the most mature, they have been accepted for the purposes of this paper as being the best available.

[28] AIR1/2111/207/49/9. Disposition of RNAS Officers, January-September 1918. Note that, in addition to the 2,023 *qualified* men, the RNAS contributed another 1,449 pilots and 125 observers to the RAF's overall total. In the Air Force List, however, while these men do feature in the General Lists, because they were still under training, they are not listed under their respective aircrew categories.

[29] It will be noted that the RAF total was four short of the RNAS input. This was because, of the two missing flight observers, one transferred as a pilot, ranked as a captain, while the other switched to the technical branch ranked as a mere lieutenant (temporary captain). Of the two missing squadron observers, one became a staff officer (temporary major) the other, became a technical officer but, since his rank was substantive, Maj Thornton Haggerston, might reasonably be regarded as the outright winner of the inaugural RNAS v RFC game of snakes and ladders.

[30] By March 1919 the Air Force List still included 46 ex-RNAS captains (plus, by now, the one and only ex-RFC example) of whom 34 were asterisked.

[31] AIR1/683/21/13/2234. AHB Precis AM/C1025 summarising the generals' objections and their consideration and rejection by the Air Council.

[32] AIR8/5. Minutes of the 59th Meeting of Air Members of the Air Council, ie not the full Air Council, held on 5 June 1918.

[33] AMWO 577 of 26 June 1918 proclaimed the policy that RAF Observer Officers, specifically including those not qualified as pilots, would be eligible for consideration for appointments as Flight, Squadron and Wing Commanders.

[34] There were several other acting and honorary captains (honorary rank carrying neither the associated level of command nor rate of pay) scattered among the listed lieutenants but the only ex-soldier listed as a substantive captain was Capt A D Wright (ex-RFA and RFC) who had seen service as a kite balloon officer prior to his becoming an observer officer.

[35] AIR1/366/15/231/6. The addition of a fourth Flight Commander to act as assistant to the Squadron Commander was sanctioned by War Office letter 20/Royal Flying Corps/56(MA1) of 6 November 1914.

[36] The 21,018 'aircrew', which excludes officers above the rank of lieutenant-colonel,

broke down as: 14,111 aeroplane officers; 689 seaplane officers; 412 dual-rated aeroplane and seaplane officers; 339 airship officers; 1,033 kite balloon officers; and 4,434 observer officers. The corresponding division of the 9,198 officers of ground branches (three of whom were full colonels) was: 783 staff officers; 5,276 technical officers; 3,109 administrative officers; 25 motor boat officers and 5 gymnastic officers.

[37] As a pilot, Stephenson had virtually unlimited prospects and he retired as an air vice-marshal. By contrast, his observer, Lt John Baker had already reached his rank ceiling by May 1918. However, he subsequently became a pilot, permitting him to rise through the ranks to become Air Chf Mshl Sir John – had changing his badge really transformed his capabilities?

[38] AIR1/17/15/1/84. A copy of the 'Trenchard Memorandum' is on this file, and it was reproduced verbatim in *Flight* for 18 December 1919.

[39] AMWO 19 of 8 January 1920.

[40] **Analysis of the RAF officer corps as at January1930**

	GD	Stores	Accts	Med	Dent	Legal	Chplns	QM
MRAF	1							
ACM	1							
Air Mshl	3							
AVM	9			1				
Air Cdre	17			1			1	
Gp Capt	51	2		7			6	
Wg Cdr	135	13	9	19	1	1	7	
Sqn Ldr	281	36	16	50	4	2	21	
Flt Lt	745	118	59	86	16	1		6
Fg Off	878	135	59	25	5			2
Plt Off	465	9	7					
Branch totals	**2555**	**313**	**150**	**187**	**26**	**4**	**34**	**8**
Totals	**2555**	**463**		**259**				
Sub totals	**3018**			**259**				
Grd Total	**3277**							

2555:463 is a ratio of 5·5:1

THE DEVELOPMENT OF THE AIR CADET MOVEMENT

by Wg Cdr Colin Cummings

It is quite likely that a significant number of members of this society will have had some connection with the Air Training Corps (ATC). It may have been as a cadet or as a staff member or whilst serving in the RAF and holding a secondary duty as a unit's liaison officer handling cadets visiting the station for air experience flying or a week's camp. The latter were the highlight of a cadet's year, of course, but they took an enormous amount of organising, as this writer can attest, having played for both teams.[1]

Collectively known today as the Air Cadet Organisation (ACO), the ATC and the RAF Sections of the Combined Cadet Force (CCF) are among the best youth organisations in the UK. The difference is that ATC squadrons are community-based, whereas CCF units are sponsored by specific schools.

This paper does not pretend to be a definitive history of the ATC so much as a broad brush attempt to trace the air cadet movement from its origins to the present day.

Since time immemorial boys and young men have been involved in the militias and armies raised for various conflicts, including those being fought on home soil. However, the first mention of youths being formed into organised groups of their own, appears to have been during the scare surrounding a possible invasion by Napoleonic France. Large numbers of disparate groups were formed and equipped to varying degrees and at Rugby School, for example, two companies of boys were raised. They drilled on the school grounds and were uniformed in blue coats with red collars and cuffs; they may have looked splendid, but they were armed with wooden broadswords! Fear of invasion lapsed after the defeat of the French fleet at Trafalgar and these *ad hoc* defensive groups soon disbanded.

In response to yet another perceived French threat, on 12 May 1859 the War Office authorised the county Lord-Lieutenants to form Volunteer Corps. In association with this initiative, nine public schools formed cadet corps most of which were affiliated to local army volunteer units. The Volunteer Act of 1863 made the cadet corps liable to be 'called out' and from 1868, in addition to boy NCOs and officers, the senior officers were drawn from among a school's masters.

Charles Longman and Robert Weller, whose creation of the BYAL pointed the way towards what would eventually become today's ATC.

Responsibility for oversight of the cadet units was subsequently withdrawn from the Lord-Lieutenants and they were then administered directly by The War Office. Thereafter little changed until 1908 when, as an element of the post-Boer War Haldane reforms, the Officers' Training Corps (OTC) was established. It had two divisions, the Senior dealt with universities and the Junior with school-based units, the officers being commissioned into the Territorial Force.

The austerity of the 1920s made it difficult to create facilities for young men who wished to learn about flying and the RAF. Nevertheless, in 1928 two former members of the Royal Flying Corps, Charles Longman and Robert Weller, set up, on their own initiative, the Bournemouth Young Airmen's League (BYAL). It started with just six boys, but soon had forty, each paying 2/6d to join and 3d per week. They met one evening and one weekend afternoon each week in Longman's house before, and at his own expense, he acquired a surplus army hut which was re-erected in a field. A uniform, comprising a double breasted blazer and peaked cap, was introduced along with a winged badge worn on the breast pocket. The two principals had boundless energy and they acquired several aero-engines, along with a surplus Hawker Woodcock biplane and other useful equipment; they even built a non-flying aeroplane, complete with engine. Whenever possible, flying was arranged at Hamble and the group succeeded in attracting significant local support. The enterprise was endorsed by the Director of Civil Aviation, AVM Sir Sefton Brancker; Amy Johnson became its President and sponsored the formation of a girls' wing.

Longman and Weller had hoped to extend their organisation across the entire country and a fund-raising campaign was started. Unfortunately, the Air League of the British Empire was soon obliged to withdraw its promised assistance, because it was in financial

The aeroplane built by the BYAL; it was a non-flyer, but looks as if, with bit of luck, it could have been.

difficulties itself, and in 1930 Brancker died in the loss of the R101. Not long afterwards, Longman became unwell and the whole venture foundered. While it had, initially at least, been very successful the BYAL had probably been a decade or so before its time but it is sad, nevertheless, to observe that Longman and Weller's contribution to the evolution of the air cadet movement is probably less well known than it deserves to be.

In 1933 Air Cdre J A Chamier was appointed Secretary-General of the Air League and, along with many others, he recognised that the Nazi repudiation of the restrictions placed on Germany following the First World War, had the potential to cause further strife. He was also conscious of the need to encourage 'air mindedness' in the youth of the time. By the end of 1937, Chamier had conceived a plan.

Air Cdre Chamier.

In brief, he envisaged a national organisation of some 20,000 cadets organised into something like 200 squadrons administered on a regional basis by a small full time staff. He estimated the overall annual cost of the enterprise to be of the order of £50,000 (about £3·5M today), the cost of a typical 100-strong squadron being about £200, which would have to be raised locally. Chamier

set about raising the necessary additional funds and involving local 'movers and shakers' in the creation of squadrons and in identifying suitable men prepared to volunteer to form a cadre of officers, who would be commissioned (into the Air League) but required to buy their own uniforms. Leading citizens were also encouraged to assist in recruiting cadets who would be taught discipline and aviation related subjects and, what was termed, 'patriotism', in preparation for eventual employment in civil aviation or the military.

Chamier proposed that the name of the organisation should be the Air Defence Cadet Corps (ADCC) and, at a luncheon hosted by the President of the Air League, the Duke of Sutherland, in January 1938 his ideas were accepted and the ADCC was launched. The Air Ministry agreed to pay an annual grant of 3/6d per head, which was matched by a similar contribution from the Air League. The ADCC was endorsed by the Secretary of State for Air, Sir Kingsley Wood, who addressed a gathering of important city business men, encouraging them to support the establishment of this initiative. By April MRAF Sir John Salmond had been appointed Chairman of a Council and Committee, set up within the Air League, to manage the ADCC, with Chamier as Commandant and Simon Marks (of Marks and Spencer) as Treasurer, with a number of other influential people as members.

There was a great deal of initial work to be done, including drafting the rules and regulations, creating a rank structure and designing and manufacturing uniforms and distinguishing badges. Chamier set up a small team, lodged in the Air League's London offices, whence a fund-raising appeal was launched with a target of £25,000. Lord Nuffield was asked to support the appeal and he agreed to provide £10,000, on condition that the balance could be raised. The still ongoing appeal had already secured more than £10,000 and Marks agreed to underwrite any possible shortfall.

As an incentive, to encourage the formation of squadrons, which could be community- or school-based, it was decided that the first fifty units to register should be distinguished by the suffix 'F' (for Founder). No 1F (Leicester) Squadron was formed in July 1938 and it took only six months to reach No 50F (Lambeth) Sqn. If a founder squadron disbanded, however, its number could be reassigned to a newly formed unit, but without the 'F'. Before a unit was authorised to form, its own committee had to raise £200 for its first year and more or less guarantee

that a similar sum would also be forthcoming in the following two years. It also had to be able to recruit enough officers to organise and run the unit adequately and attract and train sufficient cadets aged between 15 and 20, each of whom would be required to pay a weekly subscription of 3d.

The ADCC badge.

An obvious problem, faced by all new squadrons, was finding accommodation and the premises acquired ranged from school buildings, via large houses and disused commercial properties to stables, and even a cowshed! A great deal of ingenuity and self-help were required to make the less salubrious accommodation habitable and the newly recruited cadets were not averse to rolling up their sleeves and cleaning and painting the sites, generating *esprit de corps* in the process. Some units were more fortunate than others, of course, and one squadron's fund-raising effort, and a generous benefactor, permitted the purchase of a significant parcel of land, for use as a sports field and drill area, on which a drill hall was erected.

Once it was underway, the ADCC developed and matured quite rapidly. Fund-raising remained a major preoccupation if the units were to remain financially viable, so tins were rattled at parades and collections taken up at football matches and similar sporting events. Some squadrons formed bands of various kinds and these played at events ranging from parades to dances. A badge, reflecting the Air League's art deco albatross, was designed and squadrons were permitted to have 'colours' (later called 'banners') on which the squadron number and motif could be displayed and, in 1939, the motto 'Venture Adventure' was adopted.

In anticipation of the Air League's offices being damaged if war should break out, the ADCC's administration was decentralised, the seven original regions being merged to become four areas. A further development saw squadrons being grouped geographically into 'wings', commanded by a Cadet Wing Commander, to facilitate sharing of assets and mutual support.[2] With a war seemingly increasingly likely, the importance of training in aviation subjects became paramount but some otherwise suitable cadets were too poorly educated

for service as aircrew or in a skilled trade. Most squadrons, therefore, offered remedial academic training, particularly in maths and science subjects. Candidates for aircrew and potential apprentices both benefitted from these opportunities, which were of equal value to the RN's Fleet Air Arm as they were to the RAF.

The declaration of war on 3 September 1939 was a two-edged sword as far as the ADCC was concerned. The downside was that many adult volunteers were called up for war service and some of the premises were requisitioned for purposes more directly related to the war effort. On the positive side, the enthusiasm and positivity displayed, at all levels, permitted the ADCC to demonstrate its worth. Cadets and their remaining staff provided a ready supply of manpower, both to the RAF and to various civil authorities. For instance, cadets served as messengers for the police, the fire service and, in due course, the Home Guard. Others helped at barrage balloon and AA gun sites or became involved with Air Raid Precautions (ARP) activities, assisting Air Raid Wardens and 'fire watching'. Cadets who lived near airfields were allowed to help with a wide variety of tasks, ranging from administrative work to assisting with aircraft handling 'and they filled thousands of sandbags'![3] There were a number of incidents in which cadets demonstrated bravery in the face of significant danger. For example, one cadet rescued a child that had fallen into a river; another assisted in the rescue of the occupant of a crashed car and a group of cadets broke into a shop which had been bombed and managed to control the blaze until help arrived. Selected heroic actions of this nature were recognised by the Air League Gallantry Medal.

Pre-dating the ADCC, and even the BYAL, another air-oriented organisation had been created during the 1920s, the RAF-sponsored University Air Squadrons (UAS) which operated alongside, but were specifically not part of, the Army-oriented OTCs. There were still only three UASs by 1939 and on the outbreak of war, they were disbanded. A year later, however, the Air Ministry became aware that the War Office was offering suitable young men a six-month university course prior to the award of a commission. It promptly set up a broadly similar scheme which involved the re-establishment of UASs, but many more of them, an eventual total of twenty-three.

There were now, in effect, three pre-entry air-related organisations, the schools-based Junior Training Corps (of which some units had

begun to include an air section in the 1930s), the local community- and/or school-based Air Defence Cadet Corps and the University Air Squadrons. It was decided to rationalise and unify these arrangements under the auspices of a new Air Training Corps which was established on 1 February 1941.[4] It adopted, the ADCC's motto, 'Venture Adventure' and, as its badge, a falcon with spread wings surmounted by an astral crown. Air Cdre Chamier, who had been recalled to service in September 1939, became the ATC's Commandant and from 1942, its Inspector, filling both appointments until his retirement in 1944. Later that year his contribution was recognised by a knighthood.

The ATC badge.

Exclusive of the UASs, membership was intended for boys aged 16 to 18 and the new organisation was launched in a flurry of media interest, including radio coverage. It was recognised that the enthusiasm with which the ADCC had been received, needed to be sustained by the new organisation, since it still relied on local support, so mayors, school authorities, town councils and the like were canvassed for their support. This campaign was so successful that, before the end of February, the original 200 units that had been inherited from the ADCC had become 465 ATC squadrons[5] – and they continued to multiply. The size of the ATC peaked in the summer of 1942 at just shy of 221,000 cadets organised into 1,753 squadrons staffed and sustained by approximately 8,800 officers, 1,100 warrant officers and 9,960 civilian instructors.[6] It is possible that as many as 400,000 men may have joined the armed forces (or become 'Bevin boys') having first served in the ATC or its forerunners, although the only official figure appears to be the 153,000 whose membership of the ATC was specifically noted when they were attested.[7]

The ATC continued its work throughout the war, but it came at a cost. In any organisation with so large a membership, there were bound to be deaths from illness or natural causes. But there were, in addition, about four dozen air cadets killed in aviation related incidents, including one in which transport was strafed by an enemy aircraft. A number of cadets and staff received state awards for bravery, including several

BEMs, the first of these was awarded to a cadet in Scotland who continued his task as a messenger despite falling bombs and collapsing buildings. In another case, a cadet saved the life of an RAF pilot who was trapped in the wreckage of his burning aircraft. Other cadets were awarded a King's Commendation for Brave Conduct and several received various life-saving awards from the Royal Humane Society or letters of appreciation from the likes of Chief Constables.

Whilst the posthumous award of a Victoria Cross to F/Sgt Arthur Aaron, who had already been awarded a DFM, is probably the best known case of a former air cadet being decorated, there were numerous awards of other gallantry medals to ex-cadets.[8] Sgt Arthur Banks, for example, was awarded a George Cross for his courage fighting with partisans in Italy.[9] In 1944 a remarkable forty former cadets were decorated in a single month and in just five weeks in 1945 four former cadets from the same squadron received decorations.[10]

There had been no pre-war equivalent to the ADCC for girls but, as in WW I, once war had been declared women began increasingly to take on work previously confined to men and there was an associated demand for some sort of quasi-military organisation for girls. This eventually led, in 1941, to the establishment of the Women's Junior Air Corps (WJAC) although, since girls could join the WAAF at 17½, the Air Ministry withheld its support beyond providing, in order to avoid unintentional breaches of the law, advice on matters relating to uniform, badges and ranks. In 1942 the WJAC, along with similar Army- and Navy-associated girls cadet organisations were taken under the wing of the Ministry of Education-sponsored National Association of Training Corps for Girls. WJAC cadets studied Morse, aircraft recognition and other air-related topics, while fund-raising and providing much the same sort of assistance to local authorities as their ADCC predecessors had done. Despite the Air Ministry's keeping its distance, it was not uncommon for WJAC units to work alongside and co-operate with an ATC squadron.

As early as 1943, the Secretary of State for Air, Sir Archibald Sinclair, indicated that the ATC would be sustained on a permanent basis, although the details remained to be determined. The end of hostilities brought a significant reduction in its size and by January 1946 membership had fallen to well below 100,000.[11] While a National Service obligation remained of course, there was no longer the

While not formally endorsed by the Air Ministry, the WJAC was up and running by 1941 and often worked alongside the ATC.

enthusiasm that the prospect of wartime service had stimulated and, understandably, the new priority for young people was preparation for a peacetime occupation rather than a military career.

In late 1945, the Government reaffirmed its intention to retain cadet forces and in 1946 the administration of the ATC was passed to the newly created Reserve Command. By 1948 the ATC had been reorganised into wings, mostly based on existing county boundaries and generally larger and more formally structured than the wartime wings. For example, the two former Stoke-on-Trent Wings, which together had fewer than a dozen squadrons, became part of the newly created Staffordshire Wing. Although the overarching regional structures have been revised several times over the years, the wing and squadron arrangements have remained largely the same, alterations to county boundaries having had a relatively marginal impact. For example, in 1974 five squadrons within South Cheshire were added to the Staffs Wing, whilst several units within the boundaries of the new West Midlands conurbation were retained within the wing.

Another early post-war development saw the UAS's wartime ties to the ATC severed when its personnel were transferred to the RAFVR in 1947.[12] A year later, all ATC squadrons established within schools which had cadet contingents of other services, were re-brigaded to form the RAF Sections of the newly constituted Combined Cadet Force (CCF); this involved a nett loss of about 90 ATC squadrons.

Throughout most of the 1950s, the ATC was very much focused on pre-entry training for National Service and/or regular employment in the RAF. The training syllabus was largely devoted to that aim; there were three grades of 'proficiency', with formal examination at the 'leading' and 'advanced' grades. Shooting, with ·22 calibre pistols and ·303 rifles was always popular, and the marksmanship standard achieved with the latter led to the award of an RAF-style crossed musket badge, retention of which required annual requalification. A wide range of sports was available and visits to RAF stations were often made during half-term breaks. The highlight of every squadron's year was the annual camp, held in the school summer holidays and sometimes involving the entire wing, if the receiving unit was large enough to cope.[13]

The end of the 1950s saw the demise of National Service and an inevitable reduction in the attraction of, and need for, 'pre-entry training', although young men were still encouraged to choose the RAF as a career. The Duke of Edinburgh's Award was embraced with enthusiasm along with several other worthwhile activities endorsed by, but outwith, the official auspices of, the ATC. In 1967 The Morris Report led to further changes and 'loosened the strings' tying the ATC to its parent service.[14]

The rank of Cadet Warrant Officer (CWO) was introduced for high grade cadets over the age of 18 and trials in the mid-1980s soon led to the admission of female cadets into the Corps. There was, however, a serious issue with the adult NCO structure, as there was only a single rank of Adult Warrant Officer (AWO). It will be readily apparent that a cadet on reaching the compulsory leaving age of 22 and immediately being accepted as a warrant officer, with all that that rank implies, invited ridicule from regular RAF personnel for whom that rank was only attained after a lengthy period of service and exemplary conduct.

A major study conducted in the London & South East Region (and hence referred to as The LASER Report) in 2003, brought a series of

changes to terms of service, for both cadets and staff. For cadets, membership would now end at 20, rather than 22 and any cadets retained beyond the age of 18 would have to have already attained the rank of cadet sergeant. For adults, including former cadets, joining as uniformed non-commissioned staff, the ranks of Sgt (ATC), FS (ATC) and WO (ATC) provided for experience to be gained and achievement measured, backed-up by minimum periods of service, before promotion. Later refinements saw the process for commissioning require a period of service as an officer cadet until professional training was complete. Officers who were not Squadron Commanders or staff officers, could nonetheless be promoted at the 8-year point to become 'time served flight lieutenants' but more recently, this constraint was removed and an officer appointed to command a squadron could be promoted after only 4 years.

Needless to say, the air cadets value the contributions of its volunteers and this demands a robust approach to investigating and resolving complaints. The ATC was, therefore, obliged to adopt the processes used in the regular service. This was not a success and complaints dragged on, sometimes for years, involving numerous iterations whilst leaving the parties involved disenchanted and, regrettably, triggering undesirable resignations.

Meanwhile, there had been many evolutionary changes to the management and organisational structure of the post-war ATC. This paper is too brief to discuss these in detail, but the following provides an overview of the current arrangements.

- HQ Air Cadets, commanded by an air commodore in the RAF Reserves, is located at Cranwell and is part of 22 (Training) Group within Air Command.
- There are six Regional HQs (RHQs), each led by a group captain reservist, with a small staff.
- The RHQs share between them some 35 wings, each of which is headed by a wing commander commissioned within the recently reconstituted RAF Air Cadets. There are nearly 1,000 squadrons and detached flights distributed between the wings. Some wings in more remote locations supervise no more than a dozen units whilst, in urban areas, there might be several squadrons in the same city. As an example, there are four squadrons in

Following a grounding of all 146 Viking sailplanes and Vigilant motor gliders in 2014, a much-reduced capability has been restored. This involves only the Viking, and less than half of the 100-strong fleet that had originally been acquired back in 1984/85.

Wolverhampton which are part of a larger wing, until recently comprising 31 squadrons.

- Apart from the core squadrons, there are several other units supported by HQ Air Cadets, including outdoor adventure centres, the RAF Central Gliding School at Syerston, several volunteer gliding squadrons (VGS) operating the Viking sailplane, and a number of air experience flights (AEFs). The latter share access to their aircraft, the Tutor or its replacement, the Prefect, with the UASs and, in one case, the Central Flying School.

In 2018, yet another new arrangement saw the SNCO and officer cadre reorganised, with components being transferred, with a few exceptions, into the RAF Air Cadets and carrying with it a better method of addressing complaints.

Flight safety has been a major concern in recent years, leading to a selective, and prolonged, grounding of both gliding and powered flying; resolution of the associated issues has been a long and painful process.[15] Nevertheless, despite its trials and tribulations, the ATC continues to flourish and to offer cadets opportunities to gain a range of qualifications that are recognised by the wider community. Within the Corps, the introduction of a more formal approach to training has been

backed up by extensive use of IT. Senior cadets are encouraged to develop their leadership and management abilities via courses designed to stretch them to their limits. While the Corps may seem to be in a constant state of flux, this is driven by the need to address new challenges which, in turn, provides motivation for cadets and staff alike.

Whilst relatively few cadets now join the armed forces, the skills and experience they acquire stand them in good stead wherever their careers lie. Consider, for example, a prospective employer faced with two candidates, one who spends a significant part of his free time playing computer games, and another who has learned to fly a glider, and possibly flown solo in a powered aircraft, and/or has participated in an exchange visit to one of 30 or more countries, or has served as an aide to a Lord-Lieutenant. Which would you choose?

The ATC, born of a need in wartime, has matured over the nearly 80 years of its existence throughout which it has provided opportunities and personal development for young people by the thousands – it really is one of the best youth organisations in this country and indeed the world.

Notes:

[1] This writer joined the ATC in 1958 and five years later entered the RAF, being commissioned in 1964. Over the next 30 years he often filled the post of Air Cadets' Liaison Officer (ACLO) and, following his 'retirement', he maintained, via a commission in the RAFVR(T), his connection with the air cadet movement until 2019, mainly in association with Rugby School CCF and HQ Staffordshire Wing ATC, his service being recognised by the award of a Cadet Forces Medal.

[2] While serving as an administrative officer in the early 2000s, this writer discovered a number of trophies bearing the title, '1st Stoke-on-Trent Wing', which had been donated by Staffordshire folk.

[3] Kidd, Ray; *Horizons: The History of the Air Cadets* (Barnsley; 2014) p15.

[4] The ATC was established with effect from 1 February 1941 on the authority of AMO A81/1941 of 30 January which states, *inter alia*, that, 'The Air Training Corps will comprise the university air squadrons and units organised on a school or local basis.' It went on to say that 'No change is contemplated in the organisation and system of administration' of the UASs, and that membership is open to 'air sections of the Junior Training Corps and to squadrons of the Air Defence Cadet Corps . . .'

[5] Philpott, Bryan; *Challenge in the Air* (Hemel Hempstead; 1971) p21.

[6] Kidd; *Horizons*, p31.

[7] Kidd; *Horizons*, p46.

[8] *The London Gazette* No 36235 of 2 November 1943, p4859. F/Sgt Arthur Aaron VC DFM died, 13 August 1943, of wounds sustained on air operations.

[9] *The London Gazette* No 37776 of 1 November 1946, p5403. Sgt Arthur Banks GC died on 20 December 1944; having been forced to land his Kittyhawk in northern Italy on 29 August 1944, he joined a partisan band but was captured, tortured and murdered.

[10] Philpott; *Challenge in the Air*, p55.

[11] The rate of decline in membership may be judged from the following figures: 220,960 in July 1942; 195,000 in December 1942; 156,000 in mid-1943; 133,000 in October 1944 and 78,500 in October 1945 (*Challenge in the Air*, pp36, 50, 52, 68 and 63). In January 2012 membership of the Air Cadet Organization stood at stood at 32,757 in the ATC plus approximately 10,000 in the RAF Sections of the CCF (Kidd, *Horizons*; p368).

[12] For an account of UAS activities while embedded within the ATC, see 'The University Air Squadrons in WW II' by Wg Cdr Gerry Margiotta in this Society's publication *Royal Air Force Reserve and Auxiliary Forces* (2003) pp67-68.

[13] When this writer attended a week's camp at Thorney Island, the numbers were such that they were conveyed on a specially commissioned train.

[14] TNA AIR2/18221-18223, papers relating to the 'Review of the Air Training Corps', 1967. This report was written by Air Mshl Sir Douglas Morris, not to be confused with his brother, Air Cdre E J Morris, who was, coincidentally, Commandant Air Cadets 1966-68, and must have been intimately involved in the report's production.

[15] On 11 February 2009, two Grob Tutors of No 1 AEF collided, resulting in the deaths of all four on board, including two ATC cadets. On 14 June 2009, a Tutor of No 6 AEF collided with a civil Standard Cirrus glider, resulting in the death of two of the three occupants, one of the fatalities being an ATC cadet. This resulted in a prolonged cessation of cadet flying. It was eventually reinstated, but under revised, and more stringent, rules. Not long after this issue been resolved there was another crisis when, in April 2014, in the light of 'airworthiness concerns' the RAF grounded all of its Viking gliders and Vigilant motor gliders. This resulted, in 2016, in a major restructuring of the facilities for flying cadets, including the disbanding of 14 of the 25 VGSs. At a very measured pace, beginning in 2017, examples of the Viking and Vigilant gradually began to be restored to flying status but in May 2018 the remaining fleet of Vigilants was suddenly, and permanently, grounded in the light of further safety concerns.

ERRATUM

Journal 74, page 77, last line of second para.
Delete 'In Ceylon, the same STI . . .'
Insert, 'At St Thomas Mount (Madras) the same STI . . .'

BOOK REVIEWS

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

RAF and East German Fast-Jet Pilots in the Cold War: Thinking the Unthinkable by Nigel Walpole. Air World (an imprint of Pen & Sword); 2020. £19.99.

Group Captain Nigel Walpole already enjoys a considerable reputation as the author of eight well-received books on a variety of military aviation topics, a reputation that will surely be enhanced by the publication of *Thinking the Unthinkable*. A chapter entitled *Orange* in one of his earlier books, *Swift Justice*, is almost a blueprint for this latest volume which is the product of exhaustive personal research 'on the ground'. The work involved much more than mere reviewing of archival and other 'paper' sources and includes wide-ranging conversations with those on both sides of the Cold War divide who might have been players in the major drama that happily never occurred. The book is well written and readable, if dense in content. It is encyclopaedic in detail and must surely rank as the author's magnum opus.

In preparation for writing *Thinking the Unthinkable*, Nigel Walpole assembled a small Anglo-German team of military specialists, 'to explore the lives of RAF and East German fighter and fighter-bomber pilots, in the air and on the ground, at work and play, during the Cold War in North Germany'. Naturally, much more is known about the former than of the latter and this book makes a major contribution to understanding the working routine, effectiveness, equipment and attitudes of servicemen in the former German Democratic Republic (GDR). Extensive contacts made on the far side of the Inner German Border of Cold War days, were facilitated by Oberst Gerd Overhoff, an experienced *Luftwaffe* fighter-bomber pilot and senior member of the *Gemeinschaft der Flieger deutscher Streitkräfte*, the flourishing *Luftwaffe* Aircrew Association. The resulting inputs by members of both Cold War air forces have resulted in a book that was ten years in gestation.

Students of the Cold War have generally been well served by many autobiographical and biographical works from western authors. By contrast, little has been written from 'the other side of the hill' and

certainly not with benefit of systematic, focused research by a specialist author and his team. *Thinking the Unthinkable,* which runs to 332 pages with circa 275 b/w plates and 14 b/w diagrams, begins by describing the geopolitical background to what followed the Second World War with the emergence of two opposing military blocs. The creation of the East German Air Force (EGAF) from scratch and of the Second Tactical Air Force, out of BAFO – the British Air Forces of Occupation – sets the scene for what followed. The author describes in careful detail the building of a new air force and the personnel, infrastructure, equipment and training problems that had to be tackled, all in a very different social, political and security environment to that facing the post-War RAF or, for that matter, the new *Luftwaffe* of the Federal Republic.

A lengthy chapter entitled *Defence of the Homeland* gets to the heart of Walpole's study, for at least initially, this was the principal task of the EGAF. Understandably, he dwells more on the largely unfamiliar history of its organisation and operations than on the better-known Royal Air Force story. Aircraft and system performance are covered in great detail and, most interesting of all, is a critical assessment of standards achieved, despite limited annual flying hours, relying on a very structured and methodical approach to training. Readiness requirements were, to western eyes, cripplingly demanding and reflected the discipline of life in a totalitarian state, besides an ingrained suspicion of NATO intentions. First mention is made in this section of the book of extensive and routine use of dispersal (often grass) airfields and autobahns for fast jet operations. The contrast with the almost total reliance on airfield hardening and main base operations by RAFG (and NATO) is stark.

Succeeding chapters describe in depth the individual air defence fighter wings of the EGAF, their operations and training, highlighting accident rates that were not out of the way. The admittedly small number of hours flown by pilots is seen to have been offset by achieving worthwhile sortie content through careful preparation and rehearsal and by avoiding the long transit times to ranges that often beset RAFG squadrons: 'Every minute of flying was very well spent'. However, it is also noted that interceptions were largely conducted at medium and high altitudes while the NATO opposition (of whose aggressive intent EGAF pilots were absolutely convinced) would have been expected to attack at low level.

Fighter control on both sides of the Inner German Border is well described and, as an aside, the redundancy offered by the numerous radar systems east of the Inner German Border is compared favourably with the less numerous, static systems in RAFG. The mobility of EGAF Command and Control assets is stressed. Finally, a chapter is devoted to fighter-bomber and attack helicopter units of the EGAF, the latter falling victim to a not unfamiliar 'ownership' dispute! The possibility of nuclear operations by the EGAF is discussed briefly.

No one could boast a deeper understanding of air operations in North Germany than Nigel Walpole and the exhaustive research undertaken by him and his team has resulted in a book of considerable authority. It seems churlish to be critical of odds and ends that escaped the proof readers' eyes; happily these are few and far between. It must be noted that Wilhelm Pieck, whose name was the honorific title bestowed on JG-7, was not, as stated, a fighter pilot, but in common with many others whose names were given to units of the new air force, a communist leader who had taken shelter from the National Socialists in Moscow during WWII. Our Editor would not forgive me, were I not to mention this minor blemish!

Thinking the Unthinkable is undoubtedly a major and very valuable work, not least in the quality of analysis with which the author brings the book to its conclusion. Would that such a wealth of information had been available to the Intelligence Staffs during the Cold War itself. Had it existed, one wonders if it would have been allowed to see the light of day!

AVM Sandy Hunter

Clipped Wings (Vol 4) by Colin Cummings and Bill Walker. Nimbus Publishing (October House, Yelvertoft, NN6 6LF); 2020. £20.

With publication of Vol 4, the indefatigable Cummings has finally reached the end of his Herculean labours which began back in 2016. It is inevitable that much of what follows must reflect much of what was said about previous editions (see Journals 64, 66 and 71). Vol 1 of the *Clipped Wings* series covered *Pre-Operational Training Aircraft Losses* at units such as EFTSs, SFTSs, AOSs, B&GSs, AGSs, (P) and (O)AFUs, etc based in the UK, Rhodesia, India and minor territories between 1939 and 1942. Vol 2 did the same for units based in Canada, South Africa, New Zealand, Australia and the USA over the same

period. Vol 3 covered the Vol 1 units for 1943-45 and Vol 4 completes the set by updating Vol 2 to the end of the war.

Whereas Vols 1 and 3 were wholly chronological, Vols 2 and 4 are chronological but sub-divided by territory. That is to say that, while they are recorded in sequence, accidents that occurred in Australia, Canada, South Africa, New Zealand and the USA are presented separately. Vol 4 covers some 1,600 incidents and for each one we get the standard Cummings dataset: date and location; type of aircraft, identified by serial number and unit; details (generally full name, rank, age and aircrew category) of fatalities, all of this being amplified by a brief description of what happened. For ease of reference there is an index (for each territory) entered by aircraft type, and serial number in numerical order, which yields the date of the incident.

The content is as comprehensive as is practical, although there are some unavoidable anomalies, largely arising from 'colonial' record-keeping; for instance, South African sources provide only initials for SAAF fatalities, whereas RAF men have their full given names. All of this comes in a 454-page softbound volume but, despite the book's substantial size, the binding is remarkably robust.

The author, who to be precise, actually styles himself as 'compiler and editor', generously acknowledging the assistance he has received from a number of individuals and institutions, especially his, now late, collaborator, Bill Walker.

Although it means repeating myself – for a third time – I have no hesitation in observing that 'Books of this nature may be a niche market but for those of us who lurk in this niche, this series is an invaluable resource. Furthermore, a proportion of the proceeds goes to charity.'
CGJ

Thunderbolts over Burma by Angus Findon with Mark Hillier. Air World; 2020. £19.99.

The explanation for this book's dual authorship is that, at the request of someone who had purchased his log book in a second hand shop in 1987, Findon made an audio recording of selected recollections of his RAF service, focusing heavily on his wartime experience. More than 30 years later, the tape was passed to Hillier who undertook to turn it into a book. This 213-page hardback is the, only partially successful, result.

The original material, Findon's personal account, runs to only 95 pages, less than half of the book's content. It is amplified, at least in part, by a 62-page appendix, presumably furnished by Hillier, that reproduces selected pages from Findon's log book. The photocopying deserved a little more TLC – it didn't have to be so dark, although it is legible. We are provided with the pages covering his grading on Tiger Moths, at Ansty in 1943, and his first 11 hours of elementary flying training in Canada. The extracts then skip the rest of his training. He gained his 'wings', as a sergeant, towards the end of the year, followed by an instructor's course at Moncton; we are provided with a couple of pages relating to this, but there are at least 30 hours missing. Following his return to the UK, Findon spent a couple of months at Peterborough flying Masters with No 7 (P)AFU but, again, we are not provided with the pages relating to this interlude. In August 1944, Findon sailed for Egypt where his log book extracts resume to cover his conversion to the Thunderbolt with No 73 OTU, followed by a move to India and more Thunderbolt flying at Yelahanka. With some 500 hours under his belt, he joins No 34 Sqn in June 1945, is commissioned in July and transfers to No 42 Sqn in September. He flies a Thunderbolt for the last time in November, by which time he has logged 150 hours on type, half of them operational. The log book then covers conversion to Spitfires at Bhopal prior to a four-month posting to No 28 Sqn at Kula Lumpur, before demob in September 1946.

Findon re-enlisted in 1952 and his log book reflects a refresher course on Harvards with No 2 FTS and the start of a Prentice/Harvard CFS course, but the extracts stop again in July, two months before he is certified as a QFI. Thereafter, we are provided with only one more random page, a month's worth of Chipmunk flying in March 1953 – but from where? According to Findon's narrative, having graduated from the CFS, was subsequently posted to Cranwell and Syerston before returning to Little Rissington where his service ended. He doesn't tell us when, but the *London Gazette* records his transfer to the Reserve on 29 April 1958.

Apart from the extensive, but frustratingly incomplete, log book extracts, the appendices include two extracts (paras 121-154 and 415-439) from Sir Keith Park's May-September 1945 Despatch, 15 pages reproducing No 34 Sqn's F540 for July-September 1945 and another seven reflecting the F541 entries for the missions in which Findon

participated. On top of all this, the book opens with a lengthy Introduction (another 14 pages) which consists, in the main, of lengthy extracts from the F540 – so we get those passages twice, because they are in the appendices. That said, there are occasional differences in detail between the two versions, so one cannot be sure which is correct.

Unfortunately, this lack of attention to detail is all too apparent elsewhere. There are uncorrected edits, eg '. . . before being showing them the cockpit . . .' and typos, eg '. . . learn about he problem . . .', goffers (for gophers) and Medicine Halsoe (for Hat). But the most serious flaws are in Hillier's failure to edit, or to provide corrective endnotes to, Findon's personal contribution. It is a classic illustration of why history has to be written from primary sources – personal recollections provide colour, of course, but all too often memories are actually *mis*remembrances.‡ Not surprisingly, recorded 30-40 years after the event, Findon's narrative contains numerous errors. For example: he flew Spitfire Mk 8s (not 9s); OC 73 OTU was Gp Capt Carey (not Kerry) and he misidentifies, as 'Wycombe', the Sqn Ldr (later Gp Capt) Peter Wickham, who was his CO on No 28 Sqn in 1946, and he compounds this confusion by believing that he eventually became CinC FEAF; not the case, of course, that was Sir Peter Wykeham. It goes on – the CFS aerobatic team was not called the Pelicans in Findon's time nor did it become the Red Arrows when it switched from Meteors to Hunters . . .

The dust jacket painting is an excellent representation of a Thunderbolt II, although the white cowling band is far too wide, and it lacks a unit identification code (this reviewer has yet to see a picture of an uncoded Thunderbolt II in squadron service). There are some photographs, mostly of aeroplanes, and a tendency for these to have been over-inked. Few are of direct relevance, however, that is to say that most belonged to units with which Findon never flew, and some of Hillier's captioning is careless. For instance, the line-up of Cornells on page 28 belonged to No 31 (not 1) EFTS, and the Thunderbolt on page 81, was with No 261 (not 161) Sqn. If the picture of a crashed aeroplane on page 75 really was a Mohawk of No 5 Sqn, as conjectured, it clearly had no place in this book because Findon never flew a Mohawk and he never served with 5 Squadron – that said, while still irrelevant, the

‡ See 'The Moss on the Rolling Stone of History', Journal 55, pp121-4.

aeroplane is, quite clearly a Thunderbolt, wearing No 5 Sqn's OQ codes. Furthermore, I seriously doubt that the aeroplane illustrated on page 44 really was KJ136, the first Thunderbolt that Findon ever flew – in Egypt, with No 73 (not 27) OTU – because it is wearing the white nose band that was a theatre marking peculiar to ACSEA.

Enough (too much?) said. If, constrained by its title, the content of this book had been confined to an appropriately annotated reproduction of Findon's reminiscences and, perhaps, the extracts from No 34 Sqn's F541, this book could have been a useful, if brief, addition, to the annals of the RAF. The provision of an excessive, and unnecessary, amount of additional material and a random collection of pictures has diluted, rather than enhanced, the end result – and provided more scope for errors and oversights, which might have been corrected if the book had been proof read. Flawed and disappointing, there is, nevertheless, some value to be found in Findon's first-hand account, provided that the reader is sufficiently up to speed with air force lore to spot the errors.
CGJ

Sub Hunters by Anthony Cooper. Fonthill Media; 2020. £30.00.

With the outbreak of war in 1939, the Australian Government agreed to transfer operational control of its No 10 Sqn to the RAF. A significant element of the unit was already in the UK, as the Australians had recently purchased Sunderlands and the crews were familiarising themselves on type. On the wider stage, the Commonwealth nations soon agreed a comprehensive package of measures to support the prosecution of the war against Germany. This, the Riverdale Agreement, covered both the Commonwealth Air Training Plan and committed the individual dominions to providing national squadrons, manned by their own servicemen, to fight alongside the British. These were known as Article XV squadrons and one of those contributed by Australia, No 461 Sqn, would be the second RAAF flying boat unit.

Sub-titled *Australian Sunderland Squadrons in the Defeat of Hitler's U-Boat Menace 1942-43*, this 288-page hardback (the author's sixth book on aspects of Australian military history) with its insert of 30 black and white photographs, discusses the histories of Nos 10 and 461 Sqns in the UK.

Cooper employs a very broad canvas and there is plenty of space devoted to the more interesting operations flown by the two units.

However, he covers every aspect of their existence, including the political and military background. He addresses such issues as: petty squabbles within the military, both British and Australian; policy arrangements providing for the dilution of No 461 Sqn with British personnel; the mixing of 'professional' Australian officers with their 'hostilities only' colleagues, making it sometimes feel as though the Australians, of all people, had a prejudice against some of their own!

Despite its previous use as a base for civilian flying boats, the location of 461 Squadron at Poole harbour, aka RAF Hamworthy, in September 1942 was not a success. The widespread dispersal of squadron facilities was wasteful of resources and the environment could sometimes make handling a Sunderland difficult. Having persevered for eight months, the squadron moved to Pembroke Dock, where the recently introduced planned maintenance arrangements improved the availability of aircraft.

The Australian hierarchy in the UK seemed to favour No 10 Sqn over 461 and, despite the transfer of experienced personnel between them, an 'us and them' atmosphere persisted. Nevertheless, by the third year of the war, things had improved with new weapons and training. Cooper covers all of this and more and the book's ten chapters have frequent 'topic headings' to highlight specific matters.

Of course a book of this sort needs to deal with the 'bang for buck' situation and this is admirably covered, the 16 pages of endnotes and a large bibliography, of some 55 titles, providing ample evidence of the breadth of the author's research.

The content focuses on two years in the middle of the Battle of the Atlantic, on which it sheds much light. It is an easy read, not unduly complex and I shall certainly keep the review copy on my shelves.

Wg Cdr Colin Cummings

RAF WWII Operational and Flying Accident Casualty Files in The National Archives: Exploring the Contents by Mary Hudson. Air World; 2020. £25.

Although at first sight a niche volume, dealing with a single series of documents at The National Archives (TNA), the scope of this work is actually much broader than it seems. The Air Ministry Casualty Files contain the paperwork raised by the Air Ministry and the RAF after the loss of individuals or aircraft during the Second World War. They

contain copies of official signals, correspondence relating to estates, allowances, and pensions, letters to and from the families, and copies of the investigations made into the fate of the lost personnel. In many cases, this includes the reports submitted by the RAF Missing Research and Enquiry Service (MRES), who combed the world after the war to trace missing personnel. Over the last few years these files have begun to be transferred to TNA, where they constitute series AIR81. The files are being released in chronological order, and although (at the time of writing this review) the files have only reached into 1942, the rest of the war will be released in due course. The files contain a wealth of information for genealogists as well as RAF researchers.

It might seem ambitious to write a guide to a series of which only a small fraction of the files have so far been released, but Mary Hudson is more than familiar with the contents of the Casualty Files. Through 14 years working at the Air Historical Branch she was in regular contact with hundreds, if not thousands, of these files, and used them for a variety of purposes. She has used the knowledge she built up over this time to provide what can only be described as a 'comprehensive' guide to the files. Each document type is deconstructed to demonstrate the sort of information that can be gleaned from them, and common abbreviations or jargon are translated into plain English. Copious illustrations, most of them copies of full documents extracted from the files, add further clarification. More than this, in many cases the policies underlying the paperwork or decisions made are mapped out. Everything from the decisions on where to bury and how to mark the graves of the war dead to the intricate world of allowances, gratuities, and pensions is laid out to clearly show the evolution and implementation of the particular policy or regulation. Likewise, the strict remit of the book is exceeded by references to other TNA files that might complement certain information, or may provide further details.

Unfortunately, Air World is an imprint of Pen & Sword (P&S) and suffers from that publisher's tendency towards skimping on proof-reading. Glaring errors in the first line of the cover blurb and the first photo caption do not bode well, but thankfully they prove far from typical. For the most part, annoying little errors creep in such as units being differently referred to as 'No. 57 Wing' in one sentence and just '57 Wing' in the next, or The National Archives being called variously

'the National Archives' or just 'National Archives', despite the consistent use of the correct 'TNA' acronym. A more serious problem is a typical P&S lack of index, which limits the usefulness of any reference book. However, this is to a great extent mitigated by a contents list that would make H A Jones proud, covering seven pages in all.

Overall, these niggles are far outweighed by this book's usefulness. It is packed with interesting and useful information, and is a must, not only for those specifically using AIR81, but for anyone researching RAF casualties more generally. As someone who has also routinely used the Casualty Files for many years at AHB I can perhaps say no more than this: I have learned some very useful things from this book.
Stuart Hadaway

No Ordinary Hercules by Alan Kidson. Honeybee Books; 2020. Available from the author via email at oldpompey@gmail.com for £9.95 inc P&P (£1 of which goes to RAFA Wings Appeal)

After a couple of tours as a technician, ex-Halton apprentice Alan Kidson opted for aircrew. He eventually racked up 10,500 hours as an air engineer, logging time on most of the RAF's heavier transports from the Hastings to the VC10 via, and especially, the Hercules. He encountered the Hercules – and one in particular – twice, initially at Changi with No 48 Sqn, and subsequently with the Meteorological Research Flight's unique W Mk 2 'Snoopy'. The sub-title of this small (20cm × 12.5cm), 66-page softback is *The Story of Hercules XV208*.

I should get the bad news out of the way first. What is, at its core, an interesting account, is an uncomfortable read because the author's grasp on the apostrophe is slippery at best, so they are often inserted where not needed and omitted where they are, and, as a variation on that theme, there is an 'Armies' which should have been an 'Army's'. Some place names are misspelled, eg Yakota (for Yokota), Wolvis (for Walvis) Bay; the title of the Australian 28th (not '208') Infantry Brigade Group is scrambled; the NERC is the Natural (not National) Environment Research Council; Marshall often gets an inappropriate final 's' and sometimes only a single 'l'; and pedants (like me) may bridle at the use of 'crest' for 'badge'. It's a classic case of a ha'porth of tar, because the syntax could easily have been rendered watertight if the draft had been independently proof-read.

All of that having been said, what of the content? This biography of an aeroplane is presented in three parts. The first summarises its relatively brief career as a C Mk 1. Delivered to FEAF at the close of 1967 its operating patch was bounded by Gan, Japan, Hawaii, sundry other islands in the Pacific, New Zealand, Australia and most places in between. This highlights of this section are an account of an exercise that involved dropping an SBS team and a RIB to a submarine, HMS *Onslaught*, and a description of tactical arrivals/departures to/from Saigon (this was during the Vietnam War – we are told that only one of No 48 Sqn's aeroplanes collected a bullet hole). The UK withdrew from the Far East in 1970 and, with less than 2,500 hours on the clock, XV208 was selected to become 'Snoopy'.

The second part of the book describes the lengthy conversion process that began in 1972 and saw a much-modified XV208 start its second career, which ran from 1974 to 2001 with the aeroplane, and its world-class capabilities, taking part in (sometimes international) trials and research projects from locations as disparate as the USA, Canada, Iceland, Namibia, Scandinavia, the Persian Gulf and all over Europe. Based at Farnborough and, from 1994, Boscombe Down, brief details (year, location, event title and a two or three word description of the activity) of Snoopy's travels are summarised in an appendix. The dates between 1989 and 1993 are asterisked but the significance of this is not explained (possibly those events in which the author participated?) Following its retirement from Met research, XV208 was given third lease of life in 2005 when its appearance was restored to something like standard but with the port inner T56 replaced by a TP400 turboprop, the engine destined to power the Hercules' replacement, the A400M. XV208's first and last flights in this configuration were made in December 2008 and August 2009 after which she was broken up. She had flown fewer than 15,000 hours, not a lot for a C-130, but it is quality, not quantity, that counts and XV208 had seen more of the world, and done more interesting things, than most Herks.

Supported by 60 photographs, the majority in colour, and one or two diagrams, this slim volume, with a Foreword contributed by Sir John Cheshire, is a worthy tribute to the Hercules in general and XV208 in particular.

CGJ

Korean Air War – Sabres, MiGs and Meteors 1950- 53 by Michael Napier. Osprey; 2021. £30.00.

With *Korean Air War,* Osprey has published yet another beautifully presented volume that is, perhaps, best described as a 'hybrid'. It is expensively produced and lavishly illustrated, matching up to the highest standards of coffee table books of the sort gracing the homes of many aviation enthusiasts. On the other hand, this is a book resulting from exhaustive and very wide ranging research, the density of which is quite daunting. As Michael Napier observes in his introductory note, 'The war was fought by the air forces of nine countries, so the primary source documents are scattered across four continents and are written in four languages.' Clearly, this was not a task for the faint hearted but the result is encyclopaedic. However, at the interface between this splendid album of photographs and Napier's detailed chronological narrative, the reader will find a significant deficiency in the editing of the volume. That it boasts only two maps, one of which is of a scale that is almost unreadable to the elderly eye and the other thin on detail makes digesting the book's contents far more difficult than need be. By contrast, *Korean Air War* enjoys a full glossary of terms, a good index and appendices listing air kills and the many British and Canadian pilots who served with USAF and RAAF units.

Michael Napier describes the political and military context of the air war over Korea in an eminently readable style, offering analysis and comment in very clear language. His account runs chronologically, chapter by chapter, from the North Korean invasion on 25 June 1950, through various United Nations' and Chinese offensives in 1950 and '51, to the ultimate stalemate and reversion to static ground warfare in early 1952. The year saw armistice negotiations falter but reach a successful conclusion with the eventual signing of an agreement on 27 July 1953. The chapters describing the conduct of air operations are rich in detail and read like a collated version of the Operations Record Books of the nations involved. It is here that the absence of maps illustrating the phases of battle becomes evident. The chronological chapters lay out what the publishers rightly describe as a 'complex narrative of events'. In addition, Napier provides many valuable insights into a coalition war involving 'the first large-scale jet-versus-jet combat', which was notable also as 'the first war fought by the newly independent United States Air Force'.

At the outset, the UN air effort was limited by the availability of suitable aircraft and of forward bases on the Korea peninsula. The former, for example, resulted in the bizarre use of B-29s for armed reconnaissance and close air support and the latter was constrained by the operational radius of Japan-based F-80s. The young USAF struggled to assert its independence from the Army and distinct doctrinal differences emerged between it and the US Navy and Marine Corps. Not for the last time for the United States, political imperatives inhibited the fullest use of air power. Despite combats between large formations of opposing fighter aircraft, where the superiority of the MiG-15 over the F-86 at height was an important factor, air-to-air losses were relatively insignificant by comparison with losses to AAA at lower levels.

In many ways, the most useful and readable chapter of this book is the final one, entitled *In Retrospect*. Here, Michael Napier is liberated from the shackles of ORB sources and writes analytically about the air war as it unfolded, following the early days of improvisation, when great flexibility was shown. He argues that it was air power that held the line in 1950. Success in the counter air battle was in sharp contrast to the failure of various interdiction campaigns where the resilience of the North Koreans was matched by their ability to repair damage and to create alternative logistic options. These and other lessons had not universally been remembered by the time of the Vietnam War. The contribution of the air forces of Australia and South Africa, no doubt motivated by geopolitical considerations, were significant if limited. Tellingly, the performance of the RAAF's Gloster Meteors highlighted the limitations of the contemporary Royal Air Force front line. Similarly, the equipment of the Fleet Air Arm which fought doggedly alongside the US Navy, was dated and had yet to enter the jet age.

Napier argues that Britain was under-represented in the Korean War, no doubt due to residual responsibilities elsewhere. That said, the Sunderlands of the Far East Flying Boat Wing played a 'vital but unglamorous part in the war' and the Fleet Air Arm squadrons punched above their weight. Exchange officers and advisors from the RAF were widely deployed as were some 70 pilots who flew with USAF and RAAF units – optimistically described as 'equivalent to the strength of five squadrons'. These made their mark by their 'professionalism, aggression and effectiveness' and brought home many lessons from this

first ‘jet age’ conflict, lessons that were both needed and carefully digested.

In completing this ambitious task in just 320, profusely illustrated (more than 260 b/w & colour photographs) pages, Michael Napier has produced yet another well written and meticulously researched book. It is a major work and it avoids falling between two stools – if only just!

AVM Sandy Hunter

War Amongst the Clouds by Air Vice-Marshal Hugh Granville White and Group Captain Chris Granville-White. Grub Street; 2019. £20.

This fascinating book is in two parts. The first, written by Hugh White when he was in his early 80s, describes ‘My flying experiences in World War I’. It ends with his appointment to a permanent commission in August 1919 but, because he was still only 21, reduced in rank from acting squadron leader to substantive flying officer. The second part was written by his younger son, Gp Capt Chris Granville-White. Using his father’s logbooks and extensive collection of photographs, supplemented by his own research, Chris describes ‘the follow-on years, 1920-83’. First-hand accounts of the first war in the air are always absorbing, and Hugh’s tale does not disappoint. However, I found the second part equally interesting as it illustrates how Trenchard’s vision for the RAF was played out in the career of a particular individual.

In July 1916, with a total of 33 hours solo, 18-year old 2/Lt White, was posted to France to fly FE2ds with No 20 Sqn at Clairmarais. He soon learned that, apart from the threat from AAA and enemy aircraft, he had to contend with inadequate flying clothing, frostbite, the weather and unreliable engines. State of the art instrumentation was another hazard, as White would discover when, returning from an early patrol, his formation encountered low cloud and fog. He descended through the murk until his altimeter read 100ft at which point he bounced off the ground. At his second attempt he landed successfully in a wheat field. He later learned that, ‘except for one other aircraft (Sgt McCudden’s) all the others in the formation had crashed and were either dead or seriously injured.’ Such was the casualty rate at the time, he was soon leading missions and, when it was ruled that all servicemen under 19-years of age were to be repatriated, he was exempted on the grounds that he was one of only two pilots with sufficient experience to

lead. There is an interesting episode while he was with No 20 Sqn when White spent four months carrying out operational trials on a three-seat RE7 fitted with interrupter gear, a telescopic bomb sight and a new type of 500lb bomb – none of which were seen to explode! He continued to defy the odds until, having been appointed a Flight Commander in April 1917, he was sent home in the following June to spend the next eight months as a flying instructor. After another three-month stint of active service as a Flight Commander with No 29 Sqn (Nieuports and SE5as) in the spring of 1918, it was back to instructing until early 1919 when he returned to France in time to oversee, now as CO, the demise of Nos 64 and 29 Sqns.

Hugh's account provoked two questions. First, how did he survive when so many of his colleagues did not? His logbook lists 75 aircrew casualties on 20 Squadron in 11 months. Secondly, why was he never decorated? Perhaps part of the answer to the first question is, aside from luck, which he acknowledges, his meticulous attention to detail. Having suffered problems with the FE2d's complicated fuel system he 'studied the pressure system in detail, and learned also how to take the pressure-release valve to pieces and reassemble it again when in the air.' As to decorations, White was credited with seven victories (one captured, three destroyed and three out of control), more than sufficient to warrant an MC or DFC, and Appendix A reproduces a May 1918 letter recommending an immediate award. None was forthcoming, however, which seems to this reviewer, to have been a considerable injustice.

Chris Granville-White takes up the story from 1919 when, reflecting Trenchard's policy that practically all officers in the peacetime RAF would be pilots and that those holding permanent commissions would have to specialise in an additional field such as navigation, engineering or signals, Hugh was sent to Cambridge University on a special engineering course. His subsequent postings included appointments at: Halton; as an instructor at the School of Army Co-operation; four years on Bristol Fighters with No 28 Sqn in India followed by another engineering course, at Henlow, and technical posts at Cranwell and HQ ADGB. During this period he found time for sport, including representing the RAF at rugby. After 16 months with the AAF, as OC the Wallace-equipped No 501 Sqn, Hugh was promoted to wing commander and spent 1936-39 as the Senior Staff Officer Equipment

and Engineering at HQ RAF Far East in Singapore. Having (been) transferred to the newly established Technical Branch in April 1940, the wartime years saw him filling increasingly senior appointments in Technical Training Command, including over three years as Commandant of No 1 SofTT at Halton, but he kept his hand in as a pilot, flying himself to RAF units around the country. After the war he spent two years with AHQ BAFO at Bad Eilsen, during which he was involved in the Berlin Air Lift and in contingency planning for a similar operation to re-supply Vienna in case the Soviets blockaded that city too. Returning to Britain in 1948, Hugh spent the remainder of his career with Maintenance Command. He had been expected to become its AOCinC, but in 1952 he was seriously injured in a road accident. He was not expected to survive, but he did, and he filled the less demanding role of AOA until he retired in 1955. Hugh then had 28 years in retirement pursuing his passion for gardening.

This, well-produced and very readable, 239-page book, with its 152 pictures (many of them published for the first time), eight maps and an index, has clearly benefitted from thorough proof-reading – I found no obvious errors. The foreword was contributed by Hugh's nephew, the late Air Marshal Sir Fredrick Sowrey (obituary in Journal 73). *War Amongst the Clouds* gives a particularly good insight into the life of an RFC/RAF officer at home and abroad, at work and at play, from 1916 to 1955. Although the broad picture will be familiar to most readers, the personal detail brings the period to life. Another good reason for buying this book is that all the author's proceeds are being donated to the RAF Benevolent Fund. Strongly Recommended.

Air Cdre Bill Tyack

Vulcan on the Line by Brian Carlin. Independently published, 2019. Available via Amazon at £6.99.

Brian Carlin joined the RAF as a boy entrant in 1956. Trained as an electrician his first stint of productive service was on Chipmunks at Cranwell. From there he moved to the Vulcan B2s of No 230 OCU at Finningley before transferring to the (electrically very different) Vulcan B1As of No 50 Sqn at Waddington, where he married. In 1964 he embarked on a 15-month tour with the Anglo-American-German Kestrel Squadron at West Raynham before returning, by now a corporal, to the Vulcan B2, this time at Scampton. In 1966 he was sent

to Labuan on a 'one year unaccompanied' but, with the end of Confrontation, that was soon converted into an accompanied tour at Changi. With only six months left on his 10-year engagement, he returned to Scampton in 1968 where he soon discovered that his RAF qualifications carried little weight in civilian circles. He needed an ONC and an obliging air force granted him a two-year extension during which he was able to tick that box. By then a sergeant, he left the RAF in 1971 where this story ends, suffice to say, however, that he had a successful subsequent career in the industrial gas turbine industry, eventually relocating to the USA where he retired in 2000.

Compared to the memoirs of aircrew, especially pilots, relatively few groundcrew have written of their experiences while in uniform. This account provides a view of the RAF from the very different perspective of an NCO technician. Since the author was 'a lecky', the occasional anecdote, inevitably, involves terms like, and interactions between, inverter, voltage regulator, generator, transformer, load controller, etc – but, even this electrically illiterate reviewer was able to cope. Most of the narrative, however, is non-technical, while still proving a good impression of the procedures involved in, for instance, V-Force style QRA with its Exercise EDOMs and the complications associated with BLUE STEEL and its highly corrosive, and potentially unstable, fuel; Carlin notes that, 'HTP scared the hell out of anyone who had anything to do with it.' There are other insights into V-Force life, like: Vulcans that ended up as tail-sitters when insufficient attention was paid to the CofG while refuelling; the procedures involved, from an airman's point of view, in managing a four-aircraft scramble; MICKEY FINNS at Leconfield, Kinloss and Machrihanish; the hazards involved with the 'Pee Tube, aircrew for the use of';[§] excursions to 'the Gut' in Valletta during a SUNSPOT; the cramped conditions while working in the Vulcan's Power Compartment; since the inflatable bladders weren't quite up to the job, using the backs of airman to lift a belly-landed Jet Provost high enough to be able to get its wheels down; insights into marshalling, picketing and raising a Vulcan on jacks; the trials and tribulations of keeping Waddington's aeroplanes ice-free and its runway clear during the 'big freeze' in January 1963 – and so on. It will be apparent that the content of this book focuses on the author's experiences associated with the Vulcan; beyond noting his posting, there is little reference to the Kestrel because that was the subject of a

dedicated book, *Kestrel Squadron*.

The author co-opted a couple of contemporaries who have also contributed some interesting impressions. One involves Goose Bay in its heyday, with its 8,000 strong resident USAF and RCAF presence dwarfing the, RAF's 'one year unaccompanied' contingent. Again, there is much that will jog the memories of ex-V-Force men, like the extreme cold in winter, the annual Snow Carnival and the Vulcan that fell though the hangar floor! Remarkably, the teller of these tales, another electrician, then a 20 year-old J/T, learned to fly at 'the Goose' and, having acquired a Canadian PPL and extended his tour, spent two years effectively moonlighting as what amounted to being a bush pilot in his spare time.

Moonlighting is also the focus of the second additional contribution, but in this case, in the UK and as a necessity in order to supplement the RAF's parsimonious rates of pay, especially for lower ranks. This reviewer has no recollection of this, perhaps because 'centralised servicing' meant that aircrew had little routine contact with airmen at the time, but it seems that it was commonplace for junior ranks to be driving HGVs or taxis, working in bars, packaging poultry in Lincoln for Swift's Butterball Chickens or, in this specific case, recovering metals in a Grantham scrapyard.

This 212-page softback, with its more than 40 illustrations, is a well-written and informative addition to the annals of the RAF and a trip down memory lane for V-Force folk of the 1960s. Recommended – and we need more like this.

CGJ

§ In discussing pee tubes, the author observes that they would have been of little use to anyone in 'dire need of a 'number two" and that anyone caught short would have had to 'sit on it' until his return to *terra firma*.' Your Editor has personal experience of such an incident. By constructive use (don't ask) of the robust plastic bag used to convey our bone domes and electric hats, I managed this (worthy of the Guinness Book of Records?) feat, with moderate success, at better than 40,000ft in a Vulcan, but with three hours of the trip still to go, the other members of my crew wouldn't speak to me for the rest of the week . . . **Ed**

ROYAL AIR FORCE HISTORICAL SOCIETY

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

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

The Society normally holds two 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 to members. Individual membership is open to all with an interest in RAF history, whether or not they were in the Service. Although the Society has the approval of the Air Force Board, it is entirely self-financing.

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

THE TWO AIR FORCES AWARD

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

:

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
2011	Wg Cdr S J Chappell BSc
2012	Wg Cdr N A Tucker-Lowe DSO MA MCMI
2013	Sqn Ldr J S Doyle MA BA
2014	Gp Capt M R Johnson BSc MA MBA
2015	Wg Cdr P M Rait
2016	Rev Dr (Sqn Ldr) D Richardson
2017	Wg Cdr D Smathers
2018	Dr Sebastian Ritchie
2019	Wg Cdr B J Hunt BSc MSc MPhil

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
Wing Commander C G Jefford MBE BA

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)

Wg Cdr C J Cummings
October House
Yelvertoft
Northants
NN6 6LF
Tel: 01788 822124

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