RAF   AIR POWER REVIEW   Vol 7 No 2   2004

THE ROYAL AIR FORCE

AIR POWER
Review

Volume Seven   Number Two   Summer 2004

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Published quarterly, *Air Power Review* is the professional flagship publication of the Royal Air Force

Gloster Meteor F.8 A77-851 (VH-MBX) Halestorm. Formerly VZ467, this aircraft now lives at the Temora Aviation Museum, New South Wales, Australia, where it is maintained in airworthy condition and is the only Meteor F.8 flying in the world. It is painted in the markings of a Korean War era 77 Squadron RAAF aircraft, representing the Meteor flown by Sgt George Hale who scored one confirmed MiG kill, plus one probable, on the same mission. Duncan Cubitt/FlyPast Magazine

CONTRIBUTIONS TO THE ROYAL AIR FORCE AIR POWER REVIEW

The Royal Air Force *Air Power Review* is published quarterly under the auspices of the Director of Defence Studies (RAF) and has the sponsorship of the Assistant Chief of the Air Staff. It is intended to provide an open forum for study which stimulates discussion and thought on air power in its broadest context. This publication is also intended to support the British armed forces in general and the Royal Air Force in particular with respect to the development and application of air power.

Contributions from both Service and civilian authors are sought which will contribute to existing knowledge and understanding of the subject. Any topic will be considered by the Air Power Review Management Board and a payment of £200 will be made for each article published.

Articles should be original and preferably not previously published, although those of sufficient merit will not be precluded. Between 2,000 and 10,000 words in length, articles should list bibliographical references as end notes, and state a word count. Lengthy articles may be published in instalments. Contributions from serving military personnel should be in accordance with DCI GEN 313 dated 26 November 1999.

Material should be submitted in Microsoft word, on floppy disk, Zip disk or CD and should be accompanied by numbered page copy plus any photographs and illustrations. Digital pictures should be saved as TIFFs or JPEGs @ 300dpi.

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FOREWORD

Readers will quickly notice that this issue of *Air Power Review* has a more historical flavour than normal. It is not intentional but merely reflects the balance of articles submitted for consideration. This time therefore, we have departed from the usual practice of starting with an article on a high visibility, contemporary topic, by leading with an essay by an officer attending the third course at the Royal Air Force Staff College in 1924 and 1925.

Squadron Leader G C Pirie's article describes the experiences of No 6 Squadron deployed to Mesopotamia (now Iraq) in 1920 to assist in countering the insurrection of that year and the names of many of the places described now have a very familiar ring. The essay addresses the problems of dealing with a small and disparate enemy. The initial air/land co-operation with air power acting as flank guards for columns appears simplistic in nature: if you needed to discuss something with the column commander you just landed and asked him. However, the conflict soon escalated to punitive operations; and the value of 'demonstration' flights — now characterised as air presence — soon emerged. What also stands out is the reliance of the land forces, particularly in cut-off garrisons, on the Royal Air Force for the resupply of ammunition and food. The article is rich with observations and lessons concerning the use of air power on expeditionary operations that are as valid today as when they were written. His main lesson is that operations must be joint and completely integrated with the policy of the civil administration. This is a characteristic of effects-based operations as we consider them today, but is also a lesson that had to be constantly relearned throughout the counter insurgency operations of the 20th Century.

The next article, by Group Captain Neville Parton, is derived from work he undertook last year at Cambridge University while studying for a Master of Philosophy in International Relations. Group Captain Parton poses the question as to whether current strategic air power doctrine has an adequate theoretical base and, if not, what implications that might have for air power in the coming century. In a thought-provoking analysis he concludes that the three types of exchange mechanisms prevalent in strategic bombing theory, i.e. moral, economic and leadership, have never really worked and therefore the idea of strategic conventional air power is dead. However, this does not detract, he argues, from the true value of air power. It is in its integrated use with land and maritime power and, indeed, the other national instruments of power (not precluding its use against 'strategic' targets such as the leadership and WMD targets attacked during Operation IRAQI FREEDOM) where its real strength lies. Readers may however, like to consider an alternative proposition which is that the tempo of modern warfare exemplified in Operation IRAQI FREEDOM, is so great there is not the time for subtle coercive mechanisms to work and that the theory of Robert Pape, in which the denial of a regime's military forces is the only way to coerce or defeat them, is coming back into favour.

The third article by Dr John Mordike is the second in the Cold War series. The article provides a very clear overview of the war, but in concentrating on the air/land aspects, it does not touch on strategic bombing or the aspect about which most people know more, that of the counter-air battle between the MiG 15s and Sabres. Of the many points that come out of the article, the following are noteworthy: it was the first war in which the independent USAF participated, and it was the first one in which political control of targeting and ROE, i.e. restrictions on attacking the Manchurian airfields, played a part. It provided a powerful lesson on the dangers of forgetting and then having to re-learn quickly the art of air/land co-operation. One such outcome was the further development of diverging air/land philosophies with the United States Army and Air Force on one hand, and the United States Navy and Marine Corps on the other. Dr Mordike also highlights the differences between the North Korean People's and the Chinese Armies' relative vulnerability to air interdiction, the key lesson being that air inter-diction only works well when linked to a ground campaign that increases an enemy's reliance upon his supply chain. Dr Mordike concludes that air

power was a vital component of the United Nations Command Forces in Korea. At times, its influence was decisive in providing, for example, close air support in the defence of the Pusan Perimeter. However, the most important role of air power was in maintaining control of the air, without which the outcome of the war would have been very different.
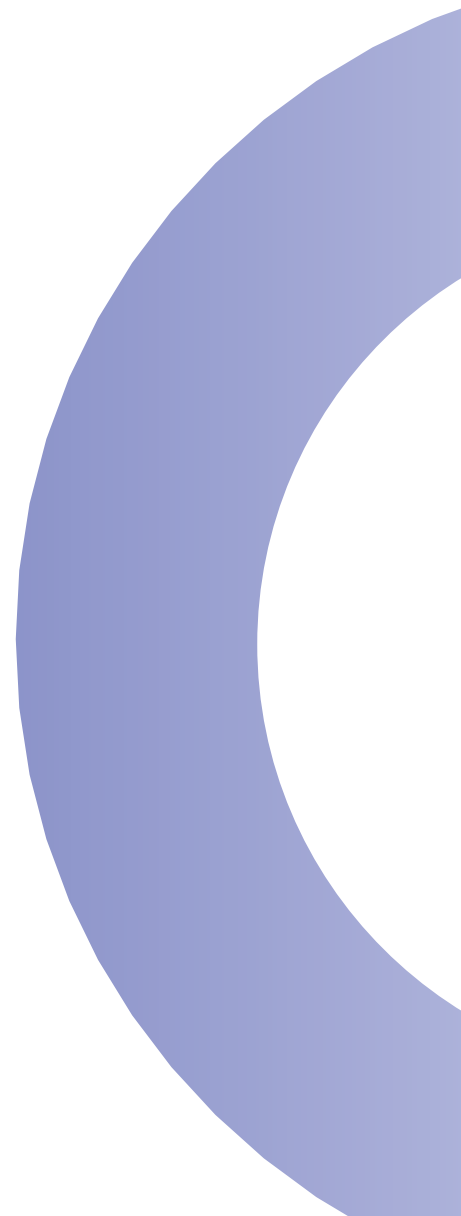
As Professor James Corum says, the Allied air war in the Mediterranean in 1943-44 was a sideshow for both the Luftwaffe and the Allied air forces. This is perhaps the reason why it is a little-known and studied campaign, at least as far as airmen are concerned. Consequently, Professor Corum's article on Luftwaffe operations against the Allied landings in Italy, i.e. those at Sicily, Solerno and Anzio is a useful exposé of that campaign. In this campaign the German and Italian air forces were outnumbered by the Allies by a ratio of five to one. One aspect that the article highlights is the disproportionate effect of both strong and weak leadership at all levels in circumstances where sheer mass is not an option. The Luftwaffe leadership not only correctly identified the Allies' operational centre of gravity as their shipping, without which they could not get troops onto the beaches, but also developed specific measures of effectiveness in order to analyse their anti-shipping operations — another fundamental tenet of effects-based operations. Finally, Professor Corum highlights the overarching importance of control of the air to joint and combined operations, making the point in particular that the level of Allied control of the air over the beachheads was enhanced by an OCA campaign forcing Luftwaffe and Italian Air Force fighters and bombers to operate from bases farther back into Italy and thus reduce their times over target.

The second contemporary article, by Wing Commander Mark Knight, was his Defence Research Paper while he was on the Advanced Command and Staff Course No 6 last year. The question posed in the paper is an eminently practical one: in terms of ISR, what can we do better with the equipment we have now and that which is shortly to come into service? Although very technical, Wing Commander Knight's paper is an informative examination of the unclassified ISR lessons of Operations DESERT STORM,

DELIBERATE FORCE and ALLIED FORCE. While his final conclusions are the obvious ones, in that we need to understand and actively manage both the data and the sensor — decision maker to shooter links — it is the detailed discussions underpinning the conclusions that are of value.

The final article, by Wing Commander 'Jeff' Jefford, is an interesting and well-researched history of the use of non-commissioned pilots in the RFC and RAF from 1912 to 1918. The underlying hypothesis of the article is that the debate about whether or not to have non-commissioned pilots was fundamentally a class argument, called into question by the need to double the size of the force in 1917 with the consequent inability of the Army to continue to supply all officer aircrew. The author concludes that this debate has never really died away since, and that the driving factor for having all commissioned pilots in the RAF is simply that of market forces. However, he suggests that decoupling pay from rank in 2003 may cause a re-examination of this policy.

D Def S (RAF)

AIR POWER
Review

Contents

A Bristol Fighter of No 6 Squadron in Iraq.
Photograph courtesy AHB (RAF)

Some Experiences of

No 6 Squadron in the Iraq Insurrection, 1920

An essay by an officer attending the Third Course at the Royal Air Force Staff College, 1924-1925

First published in Air Publication 1152, 1st edition, June 1925

By Squadon Leader G C Pirie

After four and a half years on the Western Front, and at a time when 90 per cent of No 6 Squadron were counting the days that separated them from civil life, instructions were received to move from Spa (in Belgium) to Baghdad. As the result of a flying visit to RAFHQ, I discovered that the Royal Air Force in Mesopotamia (as it was called then) had been reduced to one squadron, and that a second one was now urgently required. All sorts of problems had to be solved before the squadron could leave Europe. The personnel problem was a very difficult and an exceedingly delicate one; and when, five days later, the squadron entrained for Marseille, many capable officers and most of the experienced mechanics had to be left behind to await demobilization. It was also necessary to refit with RE8s, for as yet there were no Bristol Fighters in the East. We should have liked to see the RE8s packed in their cases, as a move from France to Italy in 1917 had shown the advantages of this precaution. Time, however, did not permit of this.

Within 96 hours of landing, over one hundred of the squadron were in hospital, suffering from sand fly fever

A speedy train journey to Marseilles and a fast voyage in the 'Malwa' to Port Said filled us with hopes that we might arrive at Basrah before the hot weather set in, and have our machines in the air within a month of leaving Spa. These hopes, alas!, were shattered by an order to disembark at Port Said, and proceed by train to Suez rest camp, as the situation in Egypt at the time was causing the gravest anxiety. After three weary weeks in this camp, we re-embarked and landed at Basrah in mid July, 1919.

Mesopotamia seemed to be quite a peaceful country, although the ravages of war were visible everywhere. Lieutenant General Sir George F McMunn KCB KCSI DSO was Commander-in-Chief, and had a force equal to about four divisions. Wing Commander O T Boyd OBE MC AFC was in command of the Royal Air Force, which consisted of No 30 Squadron and an Aircraft Park.

To those acquainted with the conditions under which we worked at Tanooma (Basrah) and with the climate for which Basrah is noted, it will not be a surprise to learn that within 96 hours of landing, over one hundred of the squadron were in hospital, suffering from sand fly fever. Not a single rigger was left, and the fact that within a week, six RE8s had been erected and flown successfully, speaks well for the rest of the squadron. But the machines had been so carelessly packed that it was only by depleting the others of necessary parts that it was possible to build eight complete machines in all. The remainder had to be re-embarked and shipped to Baghdad.

Early in August, after the squadron had recovered from the effects of fever, we moved to Baghdad. As it turned out, there was no urgency for our arrival and so for a little while there was every opportunity for the personnel to become accustomed to the peculiar flying conditions of the East.

No 30 Squadron was much dispersed. One flight was at Kasvin (in Persia), another at Mosul, and the third at Baghdad. Towards the end of August, 1919, one flight of No 6 Squadron moved to Bushire, a very pleasant winter station, 500 miles South-East of Baghdad. Shortly afterwards, another flight was dispatched to Dair-es-Zor, 350 miles North-West of Baghdad; and only a few days later half the third

flight had to reinforce No 30 Squadron's detachment at Mosul, where conditions were becoming unstable and the outlook threatening. Only two machines were left at Baghdad for inspection duties.

Early in the Autumn, it became evident that some sinister anti-British influence was at work. Our reception in the bazaars, in the towns and villages, and by the tribes appeared less cordial than it had been. The natives ceased to accord the respect due to the Political Officers, and failures to pay taxes and to carry out orders increased in number. To us, who moved among the tribes a good deal, this attitude of the natives was obvious. To the Army in general it was not so apparent. At this time, and indeed all through the insurrection, a close liaison existed between the High Commissioner, his staff, and the Royal Air Force. Sir Arnold Wilson carried out most of his inspections by air, and this enabled pilots to form an intimate acquaintance with the habits, customs, and superstitions of the natives, and to realize their attitude towards Great Britain and the occupation of their country.

The months of October and November saw a further reduction in the forces garrisoning the country. The Royal Air Force, too, was a dwindling force. The claims of demobilization were absorbing the majority of the pilots and mechanics. Machines were becoming worn out, and there were no reinforcements coming out, either of personnel or equipment. GHQ did not appear to realize the seriousness of this state of affairs; nor did the violation of the principles of war appear to concern them as far as the Air Force was concerned. The principle of concentration was consistently ignored. The Royal Air Force made an effort to concentrate as many machines as possible at Baghdad, but with little success. As the result of a chance meeting with the British Minister at Teheran, permission was obtained to withdraw half the flight from Bushire. He insisted on the retention of three machines there, although there was really no call for them at all. Two machines attached to No 30 Squadron at Mosul were recalled, and only two machines were left at Dair-es-Zor. Finally, by 1 December, 1919, No 6 Squadron had three.

An incident, which was probably the precursor of the insurrection, occurred on the Upper Euphrates

Early in the Autumn, it became evident that some sinister anti-British influence was at work

about this time. It was a gigantic piece of bluff on the part of our enemies, but much to the astonishment of the originators of the plot, it succeeded.

About 10 December, at Dair-es-Zor, which was garrisoned by two very efficient armoured cars, and two RE8s, in addition to a few levies, one of our RE8s was flying around the village early in the morning, when the pilot noticed, about 10 miles to the North, a horde of Arabs approaching the town in some semblance of order. They numbered about 2,000, and when he arrived over them, they fired at him, so he returned to inform the Political Officer at Dair. Shortly before noon, the crowd arrived at the gates of the town, headed by the firebrand Ramadhan Shalash. It was quite a peaceful arrival.

West by a piece of high ground which serves as the aerodrome, whence machines can be taxied into the Serai at night for shelter. No fears, therefore, were entertained for its safety, but the decision not to re-occupy Dair was a fatal one. Our lines of communication began to cause us anxiety. On the 19th, convoys coming from Anah were sniped at, and the irregular forces under the leadership of Ramadhan Shalash were reported to be about to move on the village. The acting Commander-in-Chief flew up from Baghdad and reviewed the whole situation himself. Despite the impossibility of reinforcing the position, and the insecurity of the lines of communication, it was decided to remain in our present position pending receipt of instructions from HM Government. One or two cavalry and Indian infantry

Ugly signs of impending hostility were not lacking, and by nightfall on the day after our arrival the tribes were closing in around the village

Ramadhan Shalash asked to see the Political Officer, and informed him that he had come to take over Dair-es-Zor 'as arranged'. There had, as a matter of fact, been some talk of handing over the town to the Sharifian Government, but no instructions had reached our garrison. The Political Officer explained this to Shalash, who agreed to wait outside the town until such time as instructions were received from Baghdad.

Meanwhile a signal was sent to Baghdad, and an RE8 set off for the capital, where the pilot was able to explain the situation. The resultant decision was to evacuate Dair, as we could not possibly defend it. Ramadhan Shalash accordingly entered the town next morning, and we retired to Abu Kemal. Our retirement was wrongly interpreted by the tribes, and probably there were other influences at work to lead them to believe that we were retiring under pressure. Although no untoward incident occurred during the march to Abu Kemal, ugly signs of impending hostility were not lacking, and by nightfall on the day after our arrival the tribes were closing in around the village. Abu Kemal is, however, well laid out for defence. The Serai is bounded on the East by the Euphrates and on the

detachments were collected from outlying posts and dispatched to Abu Kemal. Colonel-Commandant F E Coningham CB CSI CMG DSO, who was destined to play a very large part in quelling the insurrection, was sent there to take command, and a flight from the squadron was now stationed there. Beyond carrying out a reconnaissance every second day, the machines were idle. The precarious nature of our communications, especially at this time of year, and the dearth of suitable transport made it impossible for us to maintain the detachment properly, and their operations were limited by the number of bombs that could reach the aerodrome. It was forbidden to use the machines located at Baghdad as a means of supply. When a suitable target did not present itself on the Upper Euphrates, GHQ could not allow a concentration of machines in that area for the day, fearing to be left without any aircraft at Baghdad.

The ultimate result of six weeks of spasmodic operations with our base at Abu Kemal was a further withdrawal to Anah, which was soon in a state of siege. Col-Cmdt Coningham well appreciated the situation when he left the village

The flight at Anah carried out petty raids, and made unprofitable excursions to bomb tribes at Wadis, which, when located, were found to be deserted

after a few days' occupation, and established his headquarters two miles west of it, on a piece of ground previously selected as an aerodrome. The supply difficulty was still serious, but arrangements were now completed for special convoys to leave once a week for Anah with bombs and aircraft spares. Very little could, however, be done to ease the situation, as the tribes operated in small bodies and did not belong to any particular section.

Fayad Beg, a shaikh with tremendous influence in the desert in ordinary times, did all he could to restrain the hostile feelings of his people, but foreign money and our loss of prestige as the result of continual retirements were factors which were very difficult to overcome. Fayad Beg was a very intelligent and interesting man. He had been educated at Constantinople and had lived in England in his early days.

One night at Anah, a terrific storm arose. So fierce was the gale, and so blinding the sand, that the officers and mechanics were unable to find their machines, although they were sleeping only 500 yards away. The aircraft had been securely pegged down, and when the storm subsided, they were still secure. But a closer examination next morning revealed the fact that every plane was broken and

been almost washed away, crossing the Euphrates at Fellujah, it encountered a very severe storm, and an aeroplane flying to Hit discovered it 15 miles North of Fellujah, with all the vans lying on their sides. Happily no damage was done to the planes, and after many vicissitudes, Anah was safely reached next day. Such incidents were typical of the difficulties we had to overcome. Meanwhile, the flight at Anah carried out petty raids, and made unprofitable excursions to bomb tribes at Wadis, which, when located, were found to be deserted. During all this time, the squadron was becoming more and more depleted of personnel. By the end of April, only seven officers and 70 airmen remained, and there were six machines serviceable. In the operations on the Upper Euphrates, there had been a lavish expenditure of machines. Early in April, 1920, No 30 Squadron began to re-equip with DH9As. It was, however, a slow process, and it was many weeks before even one flight could be completed.

During the first week in May, it became only too apparent, how seriously the situation was developing. Turkish ex-officers were known to be living with the tribes in the Shinafiyah district, and it was becoming clear that the period of the Ramadhan was quite likely to lead to a serious outburst of anti-British sentiment. Already at

Slowly but surely the Royal Air Force was preparing for the inevitable conflict. By 1 June 1920, there was concentrated at Baghdad the whole of No 6 Squadron

two of the four machines had broken their backs. Very little could be done till spare parts arrived. Meanwhile, under the supervision of a sapper officer, the building of semi-circular breastworks, three feet high, round each machine for future protection was commenced. These walls saved many machines from destruction by the storms that month. Two RE8s were at once ordered to replace the damaged ones at Anah, but it was no easy matter to send spares up for the damaged ones. The condition of the track to Anah rendered it impossible to dispatch even a tender for the relief of the flight. In the end, the services of some Ford vans were procured from a local MT Company. Each van carried two planes. After the convoy had

Rumaithah, one of the local sheikhs was suspected of passive disobedience. The Civil Commissioner himself, realizing the gravity of the situation, had laid in a six months' stock of provisions. People laughed at the idea, but as events turned out, he was not far wrong.

Unexpected relief in that anxious period came to us from the direction of Anah. There, operations quietened down, and the flight was withdrawn and permission obtained to withdraw the remainder of the flight stationed at Bushire. About this time too, there arrived from England a big draft for the Royal Air Force in Mesopotamia. To No 6 Squadron, eight officers and 60 airmen were

By 15 June, the conditions of the Squadron had improved enormously, for there were now six Bristol Fighters and five RE8s serviceable

posted. Unfortunately, only a few days later, four officers and 40 airmen left for home. Still, even this was an improvement although two new pilots both 'wrote off' an RE8 on their first flights.

Slowly but surely the Royal Air Force was preparing for the inevitable conflict. By 1 June 1920, there was concentrated at Baghdad the whole of No 6 Squadron, although only eight machines were serviceable. The new pilots had had sufficient experience in the country to be absolutely reliable, and the morale of the squadron was high. The Aircraft Park, after almost a whole year of inaction was once again ready to produce several machines a month. No 30 Squadron, busily engaged at Mosul and Kasvin had one flight at Baghdad. These three units did not total many machines altogether but they formed an efficient force. The state of the country was one of tension and uneasiness. Outwardly there were no signs of hostility, but one felt instinctively that all was not well. Lieutenant-General Sir J Aylmer L Haldane GCMG KCB DSO was now in supreme command. Sir Arnold Wilson was still acting High Commissioner, and Wing Commander (now Group Captain) C S Burnett CBE DSO commanded the three air force units in the country.

On the evening of 4 June, rumours began to fly about; the next morning the news of the Tel Afar incident became known. It was felt by many that this must be the signal for a general rising. As it turned out, there was no further trouble for four weeks, although the intervening period was a very disturbing one.

By 15 June, the conditions of the Squadron had improved enormously, for there were now six Bristol Fighters and five RE8s serviceable. The new pilots and airmen continued to do well and the outlook was bright. The Ramadhan was proceeding without incident and hopes ran high that the danger of a general rising might be tided over. But on 30 June, the storm broke, for that evening, a W/T message arrived from the Political Officer, Diwaniyah saying that the train from Basrah was 24 hours late; that he had been unsuccessful in getting into touch by telephone with Rumaithah, and that a friendly Sheikh had come in to say that Rumaithah was about to be surrounded. A few minutes later, there arrived a W/T message from the garrison at Samawah, with the information that a train bound for Baghdad had found the line cut, 10 miles North of Samawah, and a party who attempted to repair it, had been fired on. The train had therefore, returned to Samawah and had been sniped at, all the way to Barbuti Bridge. In view of this, orders were at once issued for a reconnaissance of the district to be made at dawn next day.

At 0400 hours, a machine left for Diwaniyah where the local Political Officer was first interviewed. No additional information could be obtained, and the pilot set out for Rumaithah, flying at 500 feet. He found the railway line intact, and everything appeared quite normal at Rumaithah. Landing quite close to the village, he was about to switch off his engine, when a crowd of 200-300 Arabs appeared a few hundred yards in front. They rushed towards the machine, firing as they advanced. In a moment, however, the aeroplane was off the ground, and when the pilot had reached 1,000 feet, the whole countryside appeared thick with apparently hostile Arabs, and the machine was hit in several places. The pilot wrote a note and dropped it into the Serai, where there were about 300 Indians lining the walls but not firing. The machine then turned south, and surprised a party of Arabs trying to tear up the line at Saiyia. Several other parties were scattered, and the pilot being short of petrol, landed at Samawah, seeing that it was quite safe to do so. Major Hay, who was in command there, was quite certain that this was the beginning of the expected rebellion. When the pilot took off after lunch he was heavily fired on before he had got to 500 feet, and when he landed at Diwaniyah he found that events had moved rapidly since the morning. The tribes were beginning to close in on the river towns from the southwest and our communications with Hillah were being threatened.

In order to appreciate the situation clearly, the very central position and the immense importance of Baghdad must be fully realised. From Baghdad there radiate five main routes, viz:

1. Baghdad— Basrah via the Tigris
2. Baghdad — Basrah via the Euphrates
3. Baghdad — Cairo via Ramadi and/or Hit
4. Baghdad — Angora via Mosul
5. Baghdad — Teheran via Karind, where all the British Officers' families were for the hot weather (These are the lines of communication)

A disaster was averted, firstly by the heroic resistance of certain British and Indian troops, many of whom died at their posts, and whose deeds are unrecorded; and, secondly, by the work of the Royal Air Force, too many of whose exploits are also unrecorded

During the insurrection, four of these five routes were closed by the insurgents. The only one that remained open was the first and at all times previously it had been the most insecure. In fact, it was fully expected that it would be the first to be cut in the event of internal trouble.

I feel certain that the seriousness of the insurrection in Mesopotamia in 1920 has never been realised in this country. The reason is probably a common one. Things went wrong. Mistakes were made, and forces employed often too small to achieve their object. A disaster was averted, firstly by the heroic resistance of certain British and Indian troops, many of whom died at their posts, and whose deeds are unrecorded; and, secondly, by the work of the Royal Air Force, too many of whose exploits are also unrecorded.

A detailed account of all the interesting incidents that occurred, and of the experiences of individual pilots, would be impossible to chronicle here, but a few events may be of value.

The weather at the time was very trying. At Baghdad, the shade temperature was between 110° and 118°. Even at dawn it was quite a feat to fly through the hot belt (from 500 ft to 1,500 ft) without losing too much water from the radiator. The new RAF authorities believed at first that it was impossible to fly after 0800 hours owing to the heat, and it certainly was difficult, until a tropical radiator was improvised. GHQ, on the other hand, required flying at all times, although they did suggest an extra ration of ice to keep the radiators cool.

The first stage in the campaign was an endeavour to relieve Rumaithah. Ever since it had been cut off, the Royal Air Force had kept up bombing attacks, twice daily, on targets in its vicinity. Intelligence, however, was bad, and it was left to us to select our own targets. Those days were very tiring. We would leave Baghdad at about 0400 hours and fly to Diwaniyah. There we would consult the Political Officer and the garrison Commander, and then proceed to Rumaithah. While one machine took messages off the Popham Panel in the Serai, the remainder of the flight bombed and machine-gunned any gatherings seen near by. After replies had been dropped to the Panel messages, the flight would proceed to Samawah, where the garrison was encamped on the aerodrome. Filling up our machines there, was a laborious and unpleasant task, for we had to sit on the top planes of the Bristol Fighters and fill the tanks from five gallon tins. The fierce hot wind from the North blew much of the petrol on to our clothes. These, consisting as they did of a pair of shorts and a shirt, were no protection against the scorching and stinging pain of evaporating petrol.

After a hasty lunch, which we had brought with us, we used to load up with bombs and proceed to attack the tribes West of Samawah.

This accomplished, we returned to Samawah, fixed on more bombs and started on the homeward journey. Practically every afternoon at this time, a tremendous sandstorm began to blow about 1400 hours. Through this we had to fly — no simple matter. Even at 8,000 feet, the sand swirled about the machines, and only by straining one's eyes to the utmost, could the winding course of the Euphrates be followed. It was almost impossible to control an aeroplane under these conditions, and when we all descended over Rumaithah to see that the garrison were all right, and to bomb the gatherings near by, we felt more than anxious about the ability of the machines to stand the buffeting of the storm. Landing at Hillah on the homeward journey to report, we usually arrived at Baghdad at about 2000 hours — long and trying days, but inevitably so, in view of the shortage of machines and pilots.

The type of bomb generally used for these operations was the 25 lb Cooper bomb. It was found that this kind gave the best results for the targets were either personnel or lightly constructed shelters. The number of bombs carried used to vary with the time of day. In the cool hours of the morning it was possible to carry eight bombs provided that there was no other load to be taken. But almost every morning there was food, or

It is no exaggeration to say that the whole column would have been massacred had it not been for the efforts of these aeroplanes

ammunition, or stores to be carried to the various garrisons and this reduced the number of bombs taken. On the mid-day flights, it was often just possible to get off with two bombs, so that the average weight of bombs dropped per day was small — about 250 lb in all. The results, however, justified this policy, for while the Arab did not seem to mind very much what weight of bombs was dropped, the continual visits disturbed him considerably. The actual damage to material was small.

On 8 July we were told, while lunching at Samawah, that Rumaithah had reported by helio that they had just had a protracted fight with a party of about 500 Arabs who had attacked them. The enemy had been beaten off, but the garrison were getting anxious about their ammunition. Four of us immediately set off for Hillah. We knew Diwaniyah were anxious about their supply of SAA, so did not attempt to get any boxes from them. Just as the machines were about to land at Hillah, it was noticed that the aerodrome was being attacked. There was no alternative but to fly on to Baghdad where each machine was loaded with two boxes of SAA on the bomb racks. It was, however, too late to do anything more that day. Next morning three machines set out specially for Rumaithah, and dropped three boxes on the garrison. One fell inside the Serai, unfortunately killing a Naik, and the other two fell just outside, and were recovered later in the day.

The next day as we were on our homeward run, the garrison at Rumaithah reported that they were running short of food. All that night, along with the local supply officers, we endeavoured to devise a suitable method of packing food and dropping it from the bomb racks. After many ways had been tried, six large sacks were filled with chapattis, dates, ghee, flour, salt, medical comforts; these sacks were enclosed within others for safety. In the early grey of the dawn it was a quaint sight to see these six Bristol Fighters leaving the ground with their enormous sacks of food. The first day's efforts were not too successful. Three sacks fell in the Serai, and the other three stuck on the bomb racks and fell off several minutes later.

Meanwhile, on 6 July, a small column under Lt Col McVean had set out from Diwaniyah to relieve Rumaithah, but the force was inadequate for this

purpose, and not even the efforts of No 6 Squadron were of any avail. It has to be acknowledged that on this occasion, the only one in the history of the insurrection, co-operation with aircraft was not very successful. This was due to two causes, firstly, because the operation was so urgent that no arrangements could be made beforehand, and secondly because on 9 of July, aeroplanes watched his force being surrounded but were not able to convince him of his danger until it was almost too late. When at 1400 hours that day, he gave the order to retire, four machines for three hours under the most adverse weather conditions acted as his flank and rearguards, and drove off, wave after wave of well-led tribesmen seeking to cut him off. It is no exaggeration to say that the whole column would have been massacred had it not been for the efforts of these aeroplanes.

There was now a period of waiting while General Leslie concentrated a force sufficiently large to undertake the relief of Rumaithah. Meanwhile the garrison was becoming perilously short of food, and it was impossible to expect the Royal Air Force with its few machines to carry out its normal role and feed the garrison as well. Even without being called on to feed the garrison, we were unable to cope with all the demands that were being made. The numbers in the Serai had increased to over 500, owing to an influx of refugees. A novel plan was conceived. We warned the garrison of our plan by dropping operation orders on them the previous day.

On the day of the operation, 12 July, five Bristol Fighters from No 6 Squadron, reinforced by two old RE8s and two DH9As from No 30 Squadron set out in formation. One machine dropped two 112 lb bombs in the middle of the village. The remainder, one after the other, dropped four 25 lb bombs on the houses round the Serai, from about 300 ft. This caused a panic in the village, and the inhabitants rushed out into the countryside, where they were attacked with bombs and machine-gun fire. Meanwhile the garrison made a sortie and succeeded in collecting 20 sheep and 12 goats, in addition to enough chickens and other food to sustain them for three weeks. This, of course, solved the food problem until the relief took place.

By 17 July, Col-Comdt Coningham was on his way from Diwaniyah with a force of about 4,000 of all

Before assistance could reach Samawah it was cut off and besieged by several thousand tribesmen

arms for the relief of Rumaithah. The country between these two places is ideal for aeroplane co-operation, and for almost the whole distance it was possible to land beside the column. The Column Commander, after his experiences on the Upper Euphrates, relied entirely on his aeroplanes for reconnaissance. After several days fighting, during which period well constructed trenches were captured, the Column reached Rumaithah, withdrew the garrison, and retired to Diwaniyah. The tribesmen followed, but constant bombing attacks on their homes and on them, ensured that they kept at a respectful distance.

While these operations were in progress, the garrisons at Kufa and at Kifl had been practically isolated, and on the 24th had occurred the unfortunate disaster to the Manchester Regt on the Rustumiyah Canal. Wildly exaggerated statements, which it was impossible to discount, now began to be broadcasted throughout the country. No sooner had this phase of the crisis occurred, than it was reported one evening that Kut was surrounded. A post on the Dyalah had been sniped at, and a large party of hostile horsemen had been seen 10 miles North-East of Kut. The news was not unexpected. The Muntifik tribes in the area between the Hai and the Tigris are always a cause of anxiety, and it was indeed surprising that they had not already risen.

Never have I seen anxiety written to plainly on anyone's face as it was on those of the Civil and Military authorities on the receipt of this news. If it were true, it meant the complete isolation of Baghdad and a long and bitter siege. Two machines were immediately sent out to make a reconnaissance. It was a terribly hot evening and both pilots had already done 7 1/2 hours' flying that day. They found the garrison at Kut in a state of panic and the bazaar full of the wildest rumours. They reconnoitred the country around Kut at 500 feet for over an hour.

There was not a sign of human life anywhere, except at two places where one machine landed while the other circled overhead. Neither of the two parties could talk any language known to the pilot but they appeared quite peaceful, and had only four rifles between them. They had large flocks of sheep with them and had been shooting gazelle. This probably accounted for the shots heard, and the

concentration seen. This information was negative but absolutely reliable, for there was no possibility of concealment. About the 25th an arrangement was made by the Political Officer in the Hai area with the Muntifik confederation. This arrangement guaranteed (if this were possible) the security of the Tigris tribes (the Bani Lam and Bani Rabia) quiet. This was an immense relief, and one of the most marvellous features of the insurrection was the comparative security of this line. Barges were constantly sniped at, and occasional fire fights took place between the armed guards on the barges and the tribes, but nothing more serious happened.

Slowly, however, the insurgents were gaining confidence, and even in the bazaars in Baghdad there was a look of contempt and a sneer on the faces of the buyers and sellers. Serious delays had occurred in sending off reinforcements to Diwaniyah and it was now cut off and surrounded by the tribes.

This news spread like wild fire through the country, and now on the Lower Euphrates, events moved rapidly. Before assistance could reach Samawah it was cut off and besieged by several thousand tribesmen. There was however an element of luck in the situation of the besieged camp. Inside it was quite a fair-sized piece of ground and this was used as an aerodrome. The camp was also on the river. It was impossible to relieve the detachment there for some time, but with the assistance of the Royal Air Force the garrison was able to hold out. Every day we took quantities of food and SAA, while they in return were able to give us bombs, for a large stock had been brought in by the last train before the line was cut. With the bombs we were able to raid the hostile encampments in the vicinity. It was therefore considered safe to leave the garrison isolated to wait for the day many months ahead when a relief force could be dispatched from Basrah.

Luckily, on the Upper Euphrates, an agreement was arrived at whereby Ali Sulaiman undertook to garrison Hit until such time as it could be reoccupied. Both Ali Sulaiman and Fayad Beg remained loyal to us all through the insurrection, and our troops although isolated were safe enough at Ramadi and Fellujah.

Still, the situation was bad, for Baghdad, the seat of government and the garrison town of the country

There came a day when every able-bodied white man was called up, armed with a rifle and required to defend the capital

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was practically isolated. Sixty miles south was the Hillah garrison also virtually cut off. Eighty miles south-west a detachment at Kufa was besieged in the Serai. Near Kufa a small force at Kifl was similarly situated. Seventy miles west of Baghdad was Fellujah, isolated but with friendly tribes close by. One hundred miles north, Samarrah contained a small detachment; while at Karind, 130 miles to the north-east, the wives and families of the garrison had only a company of young soldiers to protect them. Precarious communication to Basrah existed via the Tigris, but the amount of river transport available was insufficient to cope with the supplies required. Only in actual fact was Baghdad not besieged. From Khadimain there emanated a steady stream of seditious propaganda which found its way into the Baghdad bazaar, and poisoned the minds of those whose support had previously never been doubted. Sites were selected around Baghdad for a series of earthworks, and work was begun on them at one. This was about 29 July, and within a fortnight 40 brick blockhouses were completed on the perimeter of the city. They were located at 1/2-mile intervals and were manned day and night.

Our inner aerodrome was surrounded with barbed wire, and before a machine could take off, a way had to be cleared in the wire in order to gain access to the outer aerodrome. On several occasions natives were caught armed with tins of petrol and matches near the sheds; and at times the aerodrome was sniped. There came a day when every able-bodied white man was called up, armed with a rifle and required to defend the capital. The nights were reminiscent of France. All night long, the sky on the perimeter of the defences of Baghdad was illuminated by Very lights sent up by the garrison. Intermittent rifle and Lewis gun fire broke the eerie silence of the night. It was unsafe to sleep on the roofs as usual, and one often heard the thud of a bullet hitting the mud walls of our bungalows.

It was now realised that Diwaniyah must be evacuated and after all the preparations had been made for what must inevitably be a desperate venture, Col-Cmdt Coningham left the town with a very long railway train on 30 July. As was expected, the retreat was a harassing operation. The pace of the column was limited by the speed of the train that had to be taken to Hillah. All the rails

had been torn up and the sleepers removed by the rebels. Consequently, progress was only possible half a mile at a time, for the rails over which the train had passed had to be lifted and relaid in front. Time was also an important factor, for no supplies of water could be obtained after leaving Diwaniyah until the Jarboyah Bridge, 30 miles north, was reached.

The aeroplane co-operation was most efficient. Four machines of the squadron were released from all other duties in order to remain with the column. Communication was of course excellent, for it was possible to land beside the column the whole time. When the column was halted, waiting for the next bound of the train, there were always two aeroplanes on the ground ready to deal with any threat on the flanks or rear. When it moved, aeroplanes acted as a rearguard and bombed and attacked with machine-gun fire the enemy on the flanks and rear. Even with this assistance the peril to the column was considerable, as the numbers of hostile tribesmen had risen to 6,000 or 7,000. After eight days, Hillah was reached, but the terrible anxiety caused by this harassing retreat under a pitiless sun, left few of the column fit for further action, until many days had passed.

In the midst of these operations, about 2 August, the Baghdad-Hillah railway was cut at Babylon and next day at Mahmudiyah. Working parties repaired these breaks and for a few days the presence of an armed guard on each train prevented any further incidents. But even this service broke down and within a week of the first cutting of the line, all communication with Hillah, except by air and wireless, ceased entirely and the intervening country became unpleasantly hostile.

Simultaneously with the closing of the Baghdad-Hillah route, there was a rising of the tribes along the Baghdad-Quraitu line, and the rails were torn up. Stations were burned down, and all intercourse except by air with the wives and families of the British garrison was stopped.

Operations for the relief of our besieged garrisons and the crushing of the insurrection began about the third week of August. A column set out for Hillah, accompanied by a trainload of sandbags, SAA, water and supplies. Every half-mile it stopped, and after repairing the line, erected a

circular blockhouse of sandbags. This was a slow, tedious and uninteresting operation and required little air assistance, for there was very little opposition. About 19 August, this column met a similar column, which had set out from Hillah, and the railway was opened again. 120 blockhouses each manned by five soldiers rendered the operation of the railway secure.

About this time the Aircraft Park completed the erection of three Bristol Fighters and four DH9As. No 84 Squadron were beginning to operate, and they now relieved No 6 Squadron from the arduous task of co-operating with the Samawah garrison from Baghdad. And as additional Bristol Fighters were becoming available in No 6 Squadron, our days became less tiring.

For the remaining days of August, much less work was required of the Royal Air Force. Punitive columns had gone out to retake the Hindiyah Barrage which had passed into Arab control early in the month, and to relieve the post at Jarbuiyah, which it was found unnecessary to hold in the meantime. Little air co-operation was required for those expeditions, and the very tired pilots and mechanics were enabled to rest after their strenuous exertions of the past two months.

It was now decided to reopen the route to Karind. It had been left alone since its isolation, except for a daily visit by air. It was a pleasant break for the weary pilots, for with Baghdad sweltering under a shade temperature of about 115°, it was a great joy to fly to the east for an hour and a quarter, and land at Karind, 3,000 feet high, with a shade temperature of about 95°, and always a cooling breeze. The relief of Karind and the subsequent evacuation of the families to England was carried out without incident, and required only the usual aerial co-operation. One night a late reconnaissance forced a pilot to land beside the relieving column, where he had to sleep. During the night he was badly bitten by a jackal, and another pilot flew up in the morning and took him straight to Basrah where he caught a boat for Bombay next day. By any other method, it would have been a week's journey.

There were now few aerial operations until the second week of October, when a column set out to relieve Kufa. For many weeks Kufa had been visited three times weekly by an aeroplane, which dropped bombs on the enemy surrounding the garrison, and food supplies on the garrison itself. Messages were taken off the Popham Panel, and operation orders dropped as required.

Aeroplanes co-operated most successfully. The Column Commander relied almost entirely on them as flank guards. Such was the nature of the country here that it was possible to give him five to six hours warning of any impending move against the column. On one flank, guards were necessary as the country is covered with camelthorn, and negative information not always reliable. Aircraft were also very successful in rounding up the retreating Arabs, and as a result, the column had very few casualties. Many of the insurgents were killed by fire from the air. Early in the morning of 17 October, the outskirts of Kufa were reached, but the road into the town passes through a maze of palm trees. I have seldom known such close co-operation take place as on this occasion. Low flying aeroplanes, by means of signals, kept our advanced infantry in view, and bombed and machine-gunned the gardens ahead. One hour of this was more than enough to put to flight a force of Arabs, estimated at over 2,000 strong.

In the action which ended in the capture of Tawairij aeroplanes did excellent work with bombs and machine guns on the fugitives from Kerbela.

Towards the end of October, the Baghdad-Hillah-Fellujah area was much denuded of troops and aeroplanes were most effectively used to keep the peace. Daily flights took place over the disaffected areas, and although no troops were stationed nearer than Hillah or Baghdad, no further incident occurred. Those demonstration flights consisted of as many machines as it was possible to muster, for the idea that one or two aeroplanes could overawe the Arab, had gone for ever. This was a valuable lesson and was not lost sight of.

On 1 December, a large column set out from Hillah to join up at Rumaithah with a column that had set out from Samawah, which had just been relieved. At Diwaniyah, a halt for a week was made to carry out punitive expeditions in the Daghara and Afej regions. Those were spectacular operations. The column would leave Diwaniyah at about 0200

hours. Aeroplanes, leaving their base so that they would arrive over the column when its outposts were 1/4 mile from the village to be attacked, would swoop down on it, drop 30 or 40, 25 lb bombs and pour hundreds of rounds of SAA into it. Panic-stricken, the inhabitants fled, and in a few minutes the column would enter the village without a shot being fired. The usual procedure then was to drive towards Diwaniyah all the flocks and herds, setting fire to all that was left. This had a most salutary effect on the tribes north of Diwaniyah.

South-west of Diwaniyah the tribes were very slow to hand in their rifles and continued to preserve a rather contumacious attitude as regards compliance with the terms of the peace. Here again aeroplanes were most useful. They were employed to bomb the villages of the recalcitrant tribes. Some of them were very stubborn, and continued to hold out. The nights at this time were clear and the moon was full. Hardly anyone in the squadron had flown by night, and no one had done so in Mesopotamia or on a Bristol Fighter. But one evening six machines flew after dinner, and then for 60 hours the villages belonging to the refractory tribes were bombed incessantly. This was too much for them, and they submitted, having the distinction of being the last to give in.

This was the end of the insurrection, as far as active operations were concerned. Subsequent air attacks were delivered for purposes of control under conditions which approximate to these that now exist.

The past six months had been a very full half-year's flying for the squadron, which acquitted itself splendidly. The earlier part of the insurrection, although not the most serious part, had been more full of incident, and reflected greater credit on the squadron. From 30 June to 21 August six pilots and six Bristol Fighters had been practically the total available force, and the pilots had averaged 4 3/4 hours daily for that period. The first six Bristol Fighters in the country had done equal service, and there was not a single forced landing that was not due to enemy action. There were of course other machines available, for No 6 Squadron had on an average six Bristol Fighters and 5 RE8s serviceable. The flight of No 30 Squadron at Baghdad averaged 3 DH9As and two

RE8s serviceable. But the RE8 was so unreliable owing to lack of engine spares and to trouble with the oiling system, that it could not be employed on important operations, while the DH9As were fully employed keeping in touch with Samawah.

As I have already stated, the seriousness of the insurrection in Iraq was not realised at home. The GHQ at Baghdad realised it, only when every approach to the capital had been closed except the Tigris line, and that was the only one that had previously given trouble. It was thought inevitable that it would share the same fate. But Ali Sulaiman and the tribes on the Upper Euphrates remained loyal, and their influence on the Muntifik confederation, combined with the work of the Royal Air Force saved a disaster.

One lesson from this period stands out above all others, and though it is not a new one, it is continually being neglected. At all times, it is absolutely essential for the civil administration and the three services to work in harmony and in sympathy with each other. Each must understand thoroughly and be personally acquainted with the other. We can do much to achieve this end, especially in the East, where the great distances between units and individuals prevent much association except by air. The efficiency of the Royal Air Force in Iraq in 1920 was largely due to the assistance given by officers of the other services, by political officers, and by certain sheikhs, all of whom were personally acquainted with the squadron officers before the Insurrection broke out.

Lockheed Martin's Joint Strike Fighter (JSF), X-35

Strategic Air Power Theory in the 21st Century

By Group Captain Neville Parton

"Air power is the most difficult of military force to measure or even to express in precise terms. The problem is compounded by the fact that aviation tends to attract adventurous souls, physically adept, mentally alert and pragmatically rather than philosophically inclined."
(Winston Churchill)

This article seeks to examine whether current strategic air power doctrine has an adequate theoretical base, and if not, what implications this might have for air power in the future. The idea for the subject arose from a long-standing interest in the theory underpinning air power doctrine in order to understand the mechanisms that determine how effective air power actually is at the strategic level. This line of attack has a parallel in the approach of the social sciences towards international relations. An ongoing debate exists between those who see social science as a genuine science with regularity in behaviour allowing laws to be developed that can be applied to predict actions, and the more traditional view of trying to understand why particular actions occurred.

A B-52 unloads
its deadly
cargo over
Afghanistan

The 1990-1991 Gulf War . . . the Bosnia and Kosovo campaigns . . . the anti-Taleban war in Afghanistan and the recent war in Iraq, have all demonstrated that air power creates the battle-space within which the other arms operate

As Waltz cogently pointed out, a purely pragmatic approach "suggests that the hope for improvement lies in policy divorced from analysis, in action removed from thought. Yet each attempt to alleviate a condition implies some idea of its causes".[1] Therefore, whether acknowledged or not, some assumed model of behaviour will be behind the most pragmatic of approaches, so even if such an approach is proclaimed, analysis to determine the assumptions that were made will be worthwhile.

The international security situation has become far more complex over the last decade as unwieldy coalitions attempt to coerce rogue states or sub-state actors by force, with the minimum possible body count, and under the constant scrutiny of the world's media. Such a situation represents the most likely reality for the use of armed force over the forthcoming decades, and it could therefore be argued that the key role for armed forces in the near future will be to act as coercive agents in a strategic environment that will be both complex and 'messy'. However even as the security environment has become more complicated, it seems that the promise of air power is perhaps closer to being realised than at any time since its inception. The 1990-1991 Gulf War, the Bosnia and Kosovo campaigns, the anti-Taleban war in Afghanistan and the recent war in

Iraq, have all demonstrated that air power creates the battle-space within which the other arms operate. Furthermore, the ubiquitous aspects of air power, generally accepted as height, speed, and reach, translate into the ability to react rapidly and flexibly in changing situations, frequently making air power the first weapon of choice for politicians worldwide.

How do theoreticians see that air power should be used, as this forms the basis of the doctrine that is used to generate the actual war-fighting plans in any campaign? The last 15 years has seen a resurgence of interest in the development and use of air power doctrine, which therefore makes this an apposite time to review where we are. The question of whether incorrect or poor doctrine has any impact on an air force is a legitimate one, and certainly during the 1970s and 1980s, which for the RAF at least was a period of general doctrinal sterility, it would have been difficult to answer. Looking back further to the 1920s and 1930s perhaps, provides a more concrete example of a situation in which doctrine significantly adversely affected the development of air power due to an emphasis on the invulnerability of the bomber and the effect that such aircraft would have on civilian morale. There was certainly no lack of doctrine in

Tornado GR4A

The last 15 years of air power doctrine have . . . shown a return to 'classical' theories regarding the strategic use of air power, or 'air power for strategic effect' as it is now termed

this case, but the doctrine was poorly conceived. There is a danger that our current doctrine may be similarly poorly conceived when it comes to the strategic use of air power.

Why is air power theory important?
To summarise the historical sweep of air power doctrine and its underlying theory is not straightforward. What is certain is that much doctrine has been based upon on theory that is, to say the least, built on shallow foundations. Mueller summed this up neatly:

"From Guilio Douhet to John Warden and beyond, the evolutionary history of air power theory is littered with strategies built on fatally flawed, or just severely underdeveloped, coercive mechanisms."[2]

The RAF's experience between the two World Wars clearly demonstrates the perils of having incorrect doctrine, and its experiences during World War 2 showed the effect of not only poor underlying theory, but also of not having translated doctrine into a technological reality in which it was not alone. Following the doctrinal sterility of the Cold War period, or perhaps more accurately a period where tactical doctrine received most of the attention of both theorists and practitioners, the last 15 years of air power doctrine have shown a return to 'classical' theories regarding the strategic use of air power, or

"air power for strategic effect' as it is now termed: all are generally coercive in nature. What is also clear is that the doctrine and hardware need to be compatible, and that the doctrine must have more than simply wish-fulfilment behind it if it is to be of any value: '… the trick is to get a better 'fit' than the opponent between hardware, doctrine and operational concepts and, to make things work in the real world, appropriate organisational adaptions."[3]

"Although the post-war years have again reiterated the point that air power cannot act alone and nor can it be the sole determining factor in the development of strategies, it has become abundantly clear that operations must be supported by effective and efficient air power."
(John Buckley)

Examination of recent conflicts, together with a historical analysis of World War 2 bombing campaigns, points inevitably toward the concept of the 'exchange mechanism' as being at the very heart of strategic air power theory. In other words, how is the damage caused by high explosive and metal, or even concrete and metal in these collateral-damage sensitive days, translated into the strategic effect that is required?[4] Consideration should be given to the overall models for strategic air power that have become obvious so far.

Bombing needs to be combined with psychological warfare to heighten fears and sense of futility . . . as we have seen in the Gulf War campaign against Iraqi forces in Kuwait and Republican Guard in Iraq

Members of the Republican Guard surrender in Iraq

The first model can conveniently be thought of as the Morale Model and is represented by the thoughts of such pioneers as Trenchard and Douhet. This was originally predicated upon the reactions of civilian populations to attack from the air, considered 'proven' by the response of the British populace to German attacks in 1915 and 1917, albeit the French response in Paris appeared to be significantly different.[5] Although further experiences between the wars saw this theory strengthened within the RAF, the case remained effectively unproven in World War II, although the morale effect was noted as significant in bombing surveys.[6] The exchange mechanism for this model has been identified as Combat Stress Reaction[7] (CSR), with both positive and negative consequences for the theory: bombing needs to be heavy enough to affect significant proportion of the population, and frequent enough for the cumulative effects to build up. Ideally, such bombing needs to be combined with psychological warfare to heighten fears and sense of futility. This can be extremely effective, as we have seen in the Gulf War campaign against Iraqi forces in Kuwait and Republican Guard in Iraq, but it is unlikely to be acceptable for use against civilian populations due to legal, moral and public opinion restraints. However in a truly dire situation in which survival of the nation is at stake it might, be acceptable. If the alternative is long-term use of sanctions, a case might also be made that a short morale bombing campaign could be ultimately less costly in terms of lives than a long period of sanctions.

The Economic model that was most cogently expressed by the American Army's Air Corps Tactical School was based on the 'economic web' theory: within any advanced economy there will be node points that are so critical that, if taken out, the entire economy will collapse. The exchange mechanism here then is incremental degradation of the enemy's material ability to fight. This certainly drove the American bombing campaign during World War II, as well as influencing the RAF campaign, when it had reached the point where targets of less than city size could be effectively targeted. Both British and American reports on strategic bombing concentrate on the efficacy of the campaigns against particular target groups such as the armament industry, energy or the transportation systems. While these attacks clearly had an impact, in almost all cases this was far less than that desired or estimated, due to the degree of substitution and resilience displayed in the target systems. Furthermore, although attacks on the transportation systems towards the end of the war are credited with having appreciably affected the ability of Germany to fight on, it could be argued that this only had strategic effect due to the land wars that Germany was being forced to fight. Certainly experience in the both the case studies appears to indicate that this is not a method that will easily or rapidly lead to strategic effect.

Finally, the Leadership Model, based upon theorists such as Warden and Boyd, looks at either removing or reducing the ability of the enemy's leadership to carry out the classic leadership roles of planning, directing, commanding and controlling. In both the case studies again this turned out to be a far harder concept to bring to fruition than originally anticipated. While the recent Iraq War may have seen the ultimate application of this theory, in terms of the possible assassination of Saddam Hussein, even here it does not appear to have led to an immediate impact on the ability to fight of those left behind.[8] Furthermore, as Meilinger pointed out

The repeated use of area bombing provided both the concussive assault and the images of brutally killed and injured comrades. This was particularly successful in terms of producing a state of mind in which fighting efficiency had virtually disappeared; the only thoughts in most individuals' minds was how to survive

while Professor of Strategy at the US Naval War College, air strategists have a difficult enough time producing strategy to deal with a 'similar enemy' where effects and reactions can reasonably be guessed at. If the complications of a dissimilar enemy with very different motivations and state structures are introduced the problem is magnified considerably.[9]

When a bomb explodes on a target two very different areas are affected: the first being the physical realm and the second being the social realm.[10] The former is the one which practitioners of air power concentrate on. It is possible through calculation, trials, careful analysis and target matching to be highly confident regarding the degree of damage that will be inflicted on a particular target. This can be seen in the language used by such practitioners. Probability of kill [p(K)], probability of serious damage [p(SD)], CEP — terms used by those who take a scientific approach to weapons effects. This approach has been read across into the targeting world with the concept of 'effects based warfare' in which a commander will now be asked not just what sort of targets he wants to hit, but what sort of damage is required.

The classic example is that of the power plant where differing levels of damage can be inflicted that will remove it from use for a week, a month or a year — and there can be no doubt that this approach has its utility. At the tactical or operational level, the ability to inflict a certain level of physical damage in order to produce a particular tactical or operational effect, is absolutely critical. At the same time it is also far easier to work out the equation. If all the enemies' second echelon forces are on the far side of a bridge and he has no bridging equipment, destroying the bridge will remove his capability to reinforce or counter-attack. However, at the strategic level this type of cause and effect is generally not what is being sought.

The aim of strategic air power is to be able to reach over fielded forces and directly attack the heart of the nation in the form of the general populace and the opposition's leadership. However, in this case, the second area is being targeted — the social realm. Here the damage mechanism is far less well

understood, perhaps because it does not lend itself to analysis in the same scientific manner as physical damage, or because it deals with the effects of high explosive on flesh, blood and spirit: this is not considered to be a suitable area for study. Indeed this may be a reflection of the general distancing effect that air power has in terms of separating those who deal out destruction from those who experience it. Irrespective of the cause it is this area upon which theories of strategic air power are balanced, whether they include it or not. Both World War II bombing studies, as well as GWAPS, included a significant element of data-gathering and analysis on the subject of the morale of those subject to strategic bombing. However the intervening years have seen little work in this area, or at least not by air forces. Significant work has been carried out by the armies of a number of nations in this area. Only here it is not normally considered as the effect of bombing on morale, but of combat on the ability of the individual to function, or CSR as it is more commonly known. Examination of the reports of the USSBS in particular, together with the work done under RAND's auspices on air war and emotional stress with particular reference to civil defence when compared with the GWAPS findings, clearly shows that CSR is the missing link in the exchange mechanism.

If CSR is the vehicle that turns explosive power into action in the social sphere, just what relevance does this have for air power theory? The answer comes from work carried out during the Blitz. This was also backed up by the USSBS reports in that two different experiences can arise from the experience of being bombed. In the first case, where individuals have gone through the emotional turmoil of sitting and listening while an attack takes place, but then finds themselves to be unharmed, there is an emotional release resulting in a feeling of invulnerability. Amongst those who have had this experience, morale is generally higher after an attack than before: the worst case scenarios that had played on their minds before have not been realised. In the second case, those who have suffered near-death or injury during a raid, or have had to deal with the immediate aftermath, there are a number of severe, albeit generally short-lived, psychological effects ranging

from persistent irritability to a much reduced capacity for work.[11]

In the case of the Gulf War, the bombing campaign against the Iraqi troops in the Kuwaiti desert was specifically designed to heighten the latter effects: leaflet drops gave the time of the next attack and repeated use of area bombing provided both the concussive assault and the images of brutally killed and injured comrades. As the interviews with Iraqi prisoners referred to previously attests, this was particularly successful in terms of producing a state of mind in which fighting efficiency had virtually disappeared; the only thoughts in most individuals' minds was how to survive. However, the experience in major cities in Iraq, as in Belgrade during the Kosovo crisis, was completely different. Here the use of PGMs for precision bombing allowed the vast majority of the population to go about their business unharmed, and, to a significant degree, unaffected by the war. Therefore, most individuals' experience would be in line with the first case, where their worst fears would prove to be groundless, and as a result morale would be likely to improve. This certainly seems to be in line with what actually happened, as in neither case was there any sign of lowering morale or a popular uprising. Furthermore, the most recent action in Iraq which commenced with the 'shock and awe' air campaign appears to have been equally ineffective in terms of producing any discernible adverse results, other than damaging infrastructure and proving that a city could be heavily bombed every night with almost no civilian casualties.

Therefore, the crux of the matter is that an 'exchange mechanism' for the Morale Model of strategic bombing does exist, but it is not as simple as proponents of 'classical' strategic air power seem to believe. It can be extremely effective in destroying morale and bringing about a state of mind where survival of the individual is the prime concern of all, but only if used in the correct

Strategic air power may well prove to be extremely humane in terms of minimizing collateral damage, but completely ineffective in producing any effect in the populace supposedly targeted by such a campaign

A Iraqi missile factory destroyed in the recent conflict

Looking at the recent conflict in Iraq . . . If the aim was to force a regime change without military intervention on the ground, it seems to have failed, even in those areas that had previously shown themselves to be least-loyal to the Iraqi leadership

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manner. Yet this would require a strategy that is not only contrary to common humanity but also to the rules of war. If it is not used in this way, strategic air power may well prove to be extremely humane in terms of minimizing collateral damage, but completely ineffective in producing any effect in the populace supposedly targeted by such a campaign.

Of course strategic air power could be used to target the enemy leadership directly, again as appears to have been the case in the recent war in Iraq in which case a different mechanism comes into play, namely decapitation. However, while one might presume that such an approach is on questionable legal grounds, as attacks specifically on civilian leaders are forbidden under the laws of war, there appears to have a been a shift in some legal areas to consider attacks on specific enemy leaders as being allowable.[12] On a more practical level as seen in Iraq, it is difficult to be certain regarding the death of a specific individual in an air raid, and the rumoured death of Saddam Hussein certainly did not seem to lead to any break down in law and order or any other form of general revolt although it may have affected the cohesion of actions aimed at resisting the invading forces.

Where does this leave the use of strategic air power? The obvious answer is that it is likely to be effective only in particular situations. The target and terrain allow a campaign to be designed to induce CSR in the majority of the enemy's forces, and where the loss of fighting ability amongst the fielded forces is likely to be a significant cause for concern amongst the enemy leadership. This of course agrees with Pape's views on the most effective use of strategic air power, albeit from a different perspective. Even here, such an approach is unlikely to always be acceptable to public audiences who appear to be coming ever more intolerant of high levels of casualties on either side. In terms of affecting a civil population directly, the use of strategic air power is likely to have the opposite effect to that intended. Morale will remain high or even increase while a sense of hatred for those imposing the punishment is also likely to increase. The most important factor is that doctrine should reflect these more complex realities in order to ensure that the strategies devised stand a reasonable chance of working.

The latest edition of AP3000 does contain some cautionary notes regarding the use of PGMs:

"If the fear of air power and the uncertainty created by the unexpected can enhance the ability of air power to be exploited for strategic effect, the very accuracy of PGMs may work against military utility. The fact that Western nations are sensitive to loss of life on both sides of a conflict and that forces will be required to limit collateral damage, could reduce the coercive nature of PGMs."[13]

The production of a revised theory of strategic air power therefore needs to be considered. Group Captain Lambert, in particular has not only identified the psychological element in the coercive use of strategic air power but has also considered some of the effects on coercive theory ending up with a list of 10 key points.[14] Looking at the recent conflict in Iraq, many of these points appear to have been fulfilled in the air campaign. If the aim was to force a regime change without military intervention on the ground, it seems to have failed, even in those areas that had previously shown themselves to be least-loyal to the Iraqi leadership.

It is difficult to conclude that strategic air power, disregarding its use in the nuclear deterrence role, is anything other than a poor instrument for coercion due to the limitations placed upon it. From a political view it provides many useful attributes such as allowing highly visible signalling of intentions, a rapid response to events and the ability to be seen to be doing something without long-term commitment of forces; it is unrealistic to expect it to achieve significant coercive effect. However, the recent Iraq conflict has perhaps shown a new approach which is to utilise the deterrent effect of strategic conventional air power. While the air campaign within cities clearly did not incite the type of social unrest that was perhaps sought in Kosovo, it could be seen as providing a clear signal to members of the Iraqi armed forces regarding their best hope of survival. The 'shock and awe' campaign appears to have been deliberately targeted at highly visible symbols of the Iraqi regime, not to try and coerce the population into rising against it, but to clearly demonstrate the overwhelming precision, lethality, and freedom of operation of coalition air force.[15]

A reusable hypersonic cruise vehicle (HCV) would be capable of taking off from a conventional runway and striking a target 9,000 miles away in less than two hours, using a 12,000 lb payload

The FALCON (Force Application and Launch from CONUS) programme is to design, build, and demonstrate a FALCON system that can effectively and affordably conduct responsive and flexible global strike missions. In practical terms this is envisaged as a reusable hypersonic cruise vehicle (HCV)

However, it should be noted that such an approach is not of course strategic air power in the classical sense, as it is only effective as a prelude to a ground-based invasion where persuading a large proportion of the defending armed forces to either desert or simply not fight is in their best interests. If this was the aim, it certainly appears to indicate that the air campaign had never been intended to operate in a strategic manner, but simply as a means of shaping the battle-space for the ground forces. Of course this is in effect a repetition of what happened during the Gulf War of 1990-91, but then Warden's plan was based around forcing the Iraqis to comply with the relevant UNSCRs without committing any ground troops, although other considerations led to the perceived need to extend the mandate beyond simply the liberation of Kuwait and restoration of peace and security in the region.

Where does this then leave current and future strategic air power theory? Perhaps the first step is to produce a far more concise definition of what strategic air power actually is. Much of the ongoing debate has to do with what actually constitutes strategic air power and confusing the issue with such terms as 'air power for strategic effect' is unhelpful. A definition that provides a useful starting point is that *strategic air power represents the use of air power alone for coercive effect*. This has the benefit of making the strategic use of air power instantly identifiable, and Operation Eldorado Canyon instantly springs to mind as an example. As this idealised situation is unlikely to exist often

in the real world, a more realistic definition perhaps is that *strategic air power represents the use of air power as the primary armed force in a theatre campaign with coercive intent*, or, alternatively, *the strategic use of air power is reflected in a coercive theatre campaign where air power is the supported arm*.[16] This removes the problem of defining what type of air power is to be used, although as the effect that is sought is coercive in nature this is likely to require the application of force, hence 'aggression' in a general manner is contained within the definition.It also covers both compellent and deterrent activities, and the fact that it is being used as the primary mechanism is what differs this use of air power from all other forms.

What sort of theoretical base needs to be associated with such a definition, as this will provide the guidance that is required for application? From the history of air power in general and the case studies in particular, it is possible to derive a number of propositions regarding the use of strategic air power: firstly, deterrence is much easier to achieve than compellence; secondly, genuine coercion cannot be achieved in a bloodless manner; thirdly, attacks on economic infrastructure are unlikely to significantly affect an enemy's will to resist; fourthly, attacks on transportation and communication systems are unlikely to be effective unless combined with other action that requires close coordination and movement of enemy forces; and finally, it is extremely difficult to plan and carry out a genuinely strategic air power campaign.

Strategic air power in the proposed new definition is air power that is being used alone, that is, without any associated land or sea operations . . . It is also being used solely for coercive effect in order to either compel any enemy towards or deter an enemy from a particular course of action

RAF Tornado GR1 aircraft equipped with laser guided bombs

Taking these elements to a logical conclusion, if the definition of air power operating alone is accepted, given the limitations associated with each of the models of strategic air power already discussed, strategic air power has little or no relevance to future conflicts. The very damage mechanisms that make it effective also makes it unusable in most scenarios.[17] However, those same mechanisms, as have been clearly demonstrated in recent conflicts, can be devastatingly effective when used as part of a co-ordinated, joint, theatre campaign: this is where air power's emphasis should now lie. Effective, strategic air power is dead, but as a battle-space shaping force, strategic air power theory — if correctly utilised — has the potential to afford such superiority that battle-winning performance will be a natural consequence. Or, as a recent Chief of the Defence Staff stated, "Integrated joint operations are our asymmetric advantage".[18]

Such a view is clearly not universally accepted, particularly on the other side of the Atlantic. The US DoD has recently placed a programme solicitation in the public domain for FALCON (**F**orce **A**pplication and **L**aunch from **CON**US). The aim of the programme is 'to design, build, and demonstrate a FALCON system that can effectively and affordably conduct responsive and flexible global strike missions'. In practical terms, this is envisaged as a reusable hypersonic cruise vehicle (HCV) capable of taking off from a conventional runway and striking a target 9,000 miles away in less than two hours using a 12,000 lb payload of common

aero vehicles (CAVs), cruise missiles and smart bombs.[19] The rationale for such a system is that:

'The US Strategic Command has a critical need for responsive, effective and affordable conventional strikes to provide deterrence, power projection and coercion, delivering munitions in minutes to hours globally from CONUS . . . the intent is to hold adversary vital interests at risk at all times . . . a system capable of responsively and effectively performing these objectives would provide a 'no win' tactical deterrence against which an enemy's defenses would be ineffective.[20]

As can be seen from even this brief description, the theoretical basis underlying the doctrine that has called for this technology is an understanding that the delivery of conventional munitions from the air with pinpoint accuracy will in some way provide both deterrent and coercive effect. And yet such a system, even if capable of responding within a timescale of two hours, and with accuracy similar to that of current cruise missiles, will still face the same problem of turning explosive power into a required effect. Reading between the lines, it would appear that the 'leadership' model is at the heart of this proposal, with the ability to effectively threaten any enemy's leadership anywhere in the world. The question is how morally and legally acceptable such an approach is, which certainly seems to be almost an assassin-like threat aimed at any would-be enemy's leaders. As recent experience appears to have shown, even with real-time targeting the

one of the most central, although generally unstated, reasons for strategic air power theory and doctrine has been to justify the need for independent air forces as opposed to aviation arms of the land and sea forces

elimination of an individual can rarely be absolutely certain, and therefore the viability of such a system against rogue actors must be suspect. The solicitation may have more to tell the world about the collective American psyche regarding defence in the new millennium than it actually offers in terms of coercive or deterrent power. However it does offer a further vivid illustration of the close linkage between theory, doctrine and technology.

"Air power means the use of the air to enforce the national will . . . the primary agent of air power is a weapon system capable of delivering enormous fire power over long distances."
(AP 1300 Operations)

Conclusion
The bottom line is that over the last hundred years of air power thinking, there has been a gap in the main theories underlying strategic air power doctrine: there has been little or no analysis of the exchange mechanisms that were required to turn explosive power into the desired strategic effect. Three models of strategic bombing theory have been identified: morale, economic and leadership, each of which is dependent upon a different theory, and therefore uses a different exchange mechanism.
In the case of 'leadership' — perhaps the most recent model — the mechanism is straightforward. If a leader can be removed or sufficiently isolated from his forces, particularly in non-democratic societies, then there is a strong likelihood of confusion that can be exploited. However, unless an opposition group is immediately ready to take over the reigns of power, such an approach will require some form of surface action to utilize the subsequent opportunity; in this case it does not fulfil our criteria for strategic air power. Furthermore the status of such an approach under international law is still potentially problematic, and as the results obtained thus far with this approach have been largely negative, it is unlikely to succeed.

On the economic front, the mechanism is based upon an understanding of the highly interdependent nature of modern societies, whereby identification of key or nodal points will allow either the reduction of essential supplies to an enemy's armed forces such that they are unable to fight, or will produce such dire conditions amongst the civil population that

they will rise up against their leaders. However experience has shown that even modern societies are quite resilient to the effects of air attack and whiles the former is easier to achieve than the latter, again it only works if surface forces are putting the enemy's forces in a position where they have to fight, and therefore cannot be considered as truly strategic air power.

This leaves the morale model. Analysis of studies that have closely examined the actual effects of strategic bombing provides a strong clue to the area of this closely studied and understood mechanism. Although similar in many respects, it stands some distance from that of air power. The mechanism relates to the psychological/social/personal effects of bombardment rather than the physical, which of course makes it a great deal more difficult to analyse as these effects are not quantifiable in the same way as material damage.

When used correctly, as in the campaign against Iraq's fielded forces in Kuwait and the Republican Guard units on the Kuwait/Iraq border, it is an extremely effective method of warfare. However, constraints placed by legal and moral considerations make it unlikely to be acceptable for anything other than attacking an enemy's fielded forces. Again, such an approach is not really strategic air power, although it could be argued that it is using air power for strategic effect.[21] Understanding that this is the mechanism of exchange in strategic bombing allows a much better analysis of the effectiveness, or otherwise, of recent strategic bombing campaigns in the post-Cold War era. The predictions that a revised theory of strategic air power make appear to stand up well, but have severe implications for the utility of strategic air power in the future.

Strategic air power in the proposed new definition is air power that is being used alone, that is, without any associated land or sea operations, except as may be necessary to create the conditions for the air campaign to proceed. It is also being used solely for coercive effect in order to either compel any enemy towards, or deter an enemy from, a particular course of action. It is not strategic air power if the purpose of the campaign is to shape the battle-space for exploitation by surface forces at a later date. Examination of the three models of strategic air power show that it can be extremely effective when used against tangible COGs, where generally a

clearly determined link between cause and effect can be drawn but is far less effective when used against intangible COGs. The latter case is strengthened by the fact that the exchange mechanism at the heart of attacking intangible COGs lies in directly threatening the audience from whom a reaction is sought, and yet political, moral and legal constraints make this mechanism unlikely to be acceptable.

Taking all of these points together, and applying them to the case studies examined as well as both historic and even more recent campaigns seems to clearly imply that the idea of strategic conventional air power is dead. The Elysium of making war which utilised an approach that bypassed an enemy's fielded forces and took the conflict to the heart of the enemy's nations has never worked, and is increasingly less likely to do so in the face of messy conflicts involving rogue states and sub-state actors. However, this should not be seen as an attack on the value of air power overall. While it is contended that strategic air power has no future, the use of air power to create the battle space within which surface forces operate has, arguably, become the prime role for air forces. No surface force in recent years has triumphed in a conflict unless it has had air supremacy, and in two notable cases the battle space was so shaped by air power that land forces in particular enjoyed casualty ratios that would have been undreamt of only a few decades ago. Furthermore, the synergistic use of air power, with parallel campaign lines and an integrated theatre plan, clearly provides results that no single force could produce by themselves. The greatest success requires a clear understanding of the applicability of the theories and exchange mechanisms behind of all three models of strategic air power.

Of course one of the most central, although generally unstated, reasons for strategic air power theory and doctrine has been to justify the need for independent air forces as opposed to aviation arms of the land and sea forces. This has been true from the painful birth and early gestation of the RAF in the 1920s through the formation of the USAF in the late 1940s, and has even risen in the wake of the Iraq war where calls have again been heard for the reintegration of the RAF into the British Army to allow for better close air support. While the lessons of history with regard to strategic air power are

clear, they are equally clear with regard to the value of the independent air arm. The Luftwaffe at the beginning of World War II plainly represented the evolution of an air arm that was subordinated to the land and left itself unable to conceive of control of the air as being the most important requirement for any air force — and eventually paid the price for such a mistake.

The death of 'true' or 'classical' strategic air power should therefore not be seen as a threat to the need for independent air forces. Rather, it should be seen as a springboard for air power theory and doctrine to concentrate on more productive areas such as how best to shape the battle space within which surface forces will have to operate, in which much of what lay at the heart of strategic air power theory has a great deal to offer. As Williams stated in his thoughts on NATO in the 21st century,

"Air power acting as a single component of military power by itself is almost certainly unlikely to repel or defeat a ground invasion launched by sophisticated high intensity forces. But the use of air power can erode the material strength and will of forces on the ground to an extent unimaginable in the Second World War, for example."[22]

This reality needs to be applied to our current doctrine of strategic air power that simply does not reflect the true strategic situation and could be considered as simply a repository for airborne tasks that do not fit into any other categories. Bearing in mind that the same theories that are discredited as far as strategic air power is concerned could and should represent a vital element of campaign planning against an enemy's armed forces, it could be argued that all the discussion of strategic air power is simply a matter of semantics, but this would be a gross oversimplification. The doctrine possessed by the RAF, whether formal or informal, will drive the use of air power in the next conflict. If at the heart of that doctrine is a belief that a conflict can be won by the use of air power alone, this is likely to result in a considerable wasting of scarce resources which can be ill afforded. Alternatively, if the doctrine contains a clear exposition of the ways that air power can operate with surface and sub-surface force to greater synergistic effect, it is likely to increase the chances of success and decrease the overall costs.

Notes

[1] Waltz, *man the state and war*, p2.

[2] Mueller, 'The Essence of Coercive Air Power: A Primer for Military Strategists', p53.

[3] Watts, 'Doctrine, Technology and Air Warfare', p34.

[4] In order to minimise collateral damage in Iraq, in some cases LGBs were used that had a concrete (i.e. non-explosive) centre, relying on kinetic energy only for destructive effect. Unattributable interview at RAF Wyton 2 May 03.

[5] Perhaps because the population in Paris had already experienced artillery bombardment, and hence the same initial shock was not so evident.

[7][6] The official Report of the British Bombing Survey unit quotes Speer, the German Armament Minister, as saying that "the outlook of the people was often poor, but their behaviour was always excellent." ('The Strategic Air War Against Germany 1939-1945: Report of the British Bombing Survey Unit', p77.)

[7] This term is arguably the most recent to be used to describe the psychological as opposed to physical effects of war; previous terminology has included shell-shock, battle fatigue, and Lack of Moral Fibre (LMF).

[8] Although the implied change in the American view on assassination (see previous chapter) is noteworthy.

[9] Meilinger, 'Air Targeting Strategies: An Overview' p65.

[10] Or alternatively, the physical (kinetic) effects, targeted against capability, and the cognitive effects, targeted against will. McNicoll, 'Effects Based Air Operations: Air Command and Control and the Nature of the Emerging Battle-space', p39.

[11] Janis, *Air War and Emotional Stress*, p83.

[12] In cases where an enemy leader is also the *effective* head of the armed forces, they are considered to be a legitimate target for attack.

[13] Air Publication 3000 (3rd Edition), p2.6.11.

[14] Lambert, 'Coercion and Air power', p292.

[15] Codner, 'An Initial Assessment of the Combat Phase', p10.

[16] Correspondence from D Def S dated 10 June 2003.

[17] Although in a situation of dire extremity, such as a war of national survival, such limitations might not have such force. The current RAF force structure is unlikely to allow such application of conventional force however, which would only leave the coercive effect of the Royal Navy's SLBMs.

[18] Boyce, 'Achieving Effect; Annual Chief of Defence Staff Lecture', p34.

[19] DARPA Solicitation 03-XX, p1.

[20] *Ibid*, p3.

[21] And notwithstanding the argument that a short brutal war may in the long run be more humane than a drawn-out set of economic sanctions.

[22] Williams, 'NATO and the Transatlantic Alliance in the 21st Century', p203.

Douglas B-26 Invaders.
The B-26 light bomber served in the
night intruder role throughout the war

The Korean War 1950-1953

Land-Air Aspects

By Dr John Mordike

In 1986, the current United States Air Force Historian, Dr Richard Hallion, wrote *The Naval Air War in Korea.* In the final chapter, Hallion commented on the debate arising out of the war between "those who denigrated air power as marginal and those who saw it as decisive". To understand the origins of this debate one should be aware that the Korean War broke out in a period when America was rationalising the roles and missions of its fighting services. One significant result of this rationalisation was that, in 1947, the United States Air Force achieved its independence from the Army as a fighting force in its own right. In a climate of change and inter-service rivalry, it was inevitable that the war should raise questions about the relative contributions of the services and their roles. It was a debate which continued throughout the war and has subsequently influenced various historical accounts.

According to Hallion, both parties in this debate "missed the point". In the first instance they failed to acknowledge "the importance of the rules of engagement in determining the outcome of air power application" in Korea. Hallion, a scholar with a profound understanding of the contribution air power can make to combat, was referring to political strictures which prevented strategic bombing missions against bases in Manchuria. Accordingly, air power simply could not function

F9F Panther, the stalwart of US navy operations in Korea

At the time North Korea launched its invasion its Air Force completely outclassed the diminutive South Korean Air Force. Yet the advantage was not maintained for long . . . United Nations command deployed some 650 aircraft to the theatre in the first month of the war, gaining immediate control of the air

in the same way as it had in World War II. In addition to ignoring these particular rules of engagement, Hallion believed that the debate all too often omitted a fundamental realisation about the very nature of warfare itself. Warfare, he observed, is "inevitably a *combined arms* exercise". Air power, like land power and sea power, was only one part of "the war-fighting triad". "Air power on its own could not win the Korean war, any more than the other two," Hallion emphasised.[1]

The Korean war, like other wars of the modern era, was conducted by forces operating in the land, sea and air environments. But air power gave United Nations Command forces a distinct advantage over the North Korean and Chinese forces. It cannot be stressed too much that United Nations Command enjoyed control of the air from the first few days of its involvement. At the time North Korea launched its invasion its Air Force completely outclassed the diminutive South Korean Air Force. Yet the advantage was not maintained for long. The invaders possessed less than 200 propeller-driven Russian aircraft of World War II vintage, but United Nations Command deployed some 650 aircraft to the theatre in the first month of the war, gaining immediate control of the air. Within six months, United Nations Command air assets numbered in excess of 1,400 aircraft, many of them jet fighters and jet fighter-bombers.[2] Significantly, these air assets also maintained control of the air

for friendly forces after China entered the war with its force of modern MiG-15s. This meant that the land forces of United Nations Command could operate with little fear of enemy air strikes.[3]

Control of the air meant that friendly air power could concentrate to a high degree and punish the enemy ground forces quite severely. At certain stages during the war, the tactical application of air power was decisive. Understandably, it is in this tactical role — specifically the close air support role — that land forces are most aware of air power's contribution to the battle. John Terraine commented on the land force perspective when he observed that "[f]or the ordinary soldier, air support is the support that he can see".[4] Yet there are other forms of air support that are rarely seen by the ordinary soldier which, nevertheless, can have a decisive impact on the battle. In Korea, interdiction consumed a significant amount of effort in an attempt to use air power to deny the enemy supplies and reinforcements by cutting his lines of communication with his rear areas. However, air power used in this role did not achieve the same success as it did in close air support. Hallion believed that interdiction operations "resulted in large numbers of aircraft lost for relatively meager [sic] gains". "While it is an exaggeration to state that it failed," he concluded, "it clearly did not succeed. At best, interdiction complicated the Communists' efforts to supply their front."[5]

This paper discusses aspects of land-air operations, specifically the way in which the two air roles of close air support and interdiction contributed to the battle. However, before discussing these roles, the conduct of the war is reviewed.

A review of the war

The North Koreans gained the element of surprise. The invaders organised and assembled their forces for a sudden, all-out attack across the 38th parallel with the aim of subjugating the Republic of Korea. At 0400 hours on 25 June 1950, to use General Douglas MacArthur's words, some 10 divisions of the North Korean People's Army "struck like a cobra". Columns of invading infantry, spear-headed by Soviet-made T-34 tanks, stabbed deep into the southern republic.[6] An underarmed Republic of Korea Army was hard-pressed to hold the well-armed invaders. Quickly reinforced by ill-prepared American Army forces which had been part of the occupation force in Japan, the defending forces, now nominally under United Nations Command, found themselves holding a perimeter around the south Korean port of Pusan.

In early September more substantial reinforcements arrived including the 3rd Battalion, The Royal Australian Regiment. The Australian battalion was a component of the 27th British Commonwealth Brigade. Although the situation was at first desperate, these reinforcements began to tip the balance in favour of the defenders of the Pusan perimeter, who had been organised as a United Nations force called the Eighth Army. But the commander-in-chief of United Nations Command took a daring step. On 15 September, MacArthur landed X Corps, comprised predominantly of the First Marine Division and the Seventh Infantry Division, at Inchon midway up the west coast of Korea, effectively outflanking the North Korean invaders. One week later, the Eighth Army broke through at the Pusan perimeter, scattering the North Korean Army before it.[7]

Encouraged by these developments, President Truman decided upon the objective of the reunification of Korea. MacArthur went on the offensive. As the Eighth Army pushed its way north along the western side of the Korean peninsula, the X Corps was withdrawn from Inchon to be landed, towards the end of October, at the North Korean port of Wonsan on the east coast of the peninsula. The commander-in-chief's aim was the complete destruction of the communist forces in Korea, a task which would take United Nations Command troops across the 38th parallel into North Korea and up to the Yalu River, the northern border with Manchuria. By mid-October the North Korean capital of Pyongyang was taken. It appeared that MacArthur was well on the way to achieving his objective.

Although progress was encouraging, there were ominous signs from 25 October to 6 November that the war could assume disturbing proportions. Elements of the Eighth Army and X Corps were

The commander-in-chief's aim was the complete destruction of the communist forces in Korea, a task which would take United Nations Command troops across the 38th parallel into North Korea

suddenly attacked by Chinese troops — a new force on the battlefield. Not pressing on with these initial attacks, the Chinese withdrew. Pausing briefly to take stock, the United Nations Command force resumed its northward advance, but on the night of 26 November the Eighth Army and X Corps were subjected to intense attack by Chinese forces of considerable strength. This time the Chinese offensive was sustained, putting the United Nations Command force under a severe test.

The entry of Chinese forces changed the character of the war dramatically. In the west, the United States Second Division, an element of the Eighth Army, was surrounded by Chinese forces in the Chongchon valley, and, in the east, the X Corps' First Marine Division and parts of the Seventh Infantry Division were also surrounded at the Chosin Reservoir. Although the Marines would manage their subsequent withdrawal with greater competence, the Second Infantry Division suffered

a casualty rate of some 30 per cent and lost virtually all of its equipment. In a recent analysis of the war, Eliot Cohen and John Gooch referred to this episode and its immediate outcome as a series of 'costly and humiliating defeats'. Such was the debacle that in the period leading up to Christmas the United Nations Command forces "tumbled south, and the Joint Chiefs of Staff authorized [sic] MacArthur to begin planning for the liquidation of the Korean commitment".[8] It was a complete turnaround of military fortunes; the defeat and reversal of the North Korean invasion during July to September now appeared a futile effort.

At the close of 1950, the appointment of General Matthew Ridgway as commander of the Eighth Army brought a new phase in the war. Revitalised by Ridgway's leadership and his insistence on applying the fundamentals of sound tactical procedures, Eighth Army took stock of itself and, in a few months, completed a successful advance

No 77 Squadron was one element of FEAF that was proficient in the ground attack role . . . The squadron was to play a part far out of proportion to its modest size

No 77 Squadron was initially equipped with F-51 Mustangs which were perceived to be better armed and more durable for ground attack than the Lockheed F-80 Shooting Star

The Australian squadron demonstrated their particular proficiency by blasting the train off the rails . . . It was not until after they had returned to their base in Japan that the Australian pilots learned that the trucks had been carrying South Korean soldiers and American troops of the 24th Division

north regaining Seoul in March and adopting a position close to the 38th parallel. From about mid-1951 a seesaw war of stalemate followed until the armistice of July 1953. It was during this phase in April 1952 — that the 1st Battalion, The Royal Australian Regiment, arrived in Korea. It was relieved by the 2nd Battalion a year later.

Land-air operations
The air component of United Nations Command was comprised of three separate organisations: the United States Air Force's Far East Air Forces (FEAF), principally its Fifth Air Force which included the RAAF's No 77 Squadron equipped with the F-51 Mustang; the 1st Marine Air Wing; and the United States Navy's carrier air groups belonging to the Seventh Fleet's Task Force 77.[9] Among these, the principal component was FEAF.

Formerly responsible for the air defence of Japan against a possible Soviet attack, FEAF was not well prepared for the war it suddenly found itself engaged in. Commanded by Lieutenant General George Stratemeyer, FEAF's training had concentrated on air defence and air superiority roles. It was taken by surprise when President Truman authorised MacArthur to use this air force to supply the South Koreans with ammunition and equipment and to assist in the evacuation of non-combatants on the very day the invasion commenced. One day later, the American president removed all restrictions on operations by United States' air and naval assets in providing support to South Korea on the southern side of the 38th parallel. On 29 June MacArthur was authorised to extend air operations into North Korea.[10]

The commitment to battle of land forces also came without warning. Like FEAF, the first ground force component to be thrust into the battle — the United States' 24th Infantry Division — was ill-prepared for active service and undermanned. Each of its regiments had had one infantry battalion removed from its strength, and the divisional allocation of artillery, armour and automatic weapons had been slashed to accommodate reductions in appropriations." It was

the initial shortage of organic fire support which was to make air support critical in the first six months of the war. But putting problems with the fighting units to one side, it quickly became evident that there were problems with the force's command structure.

The command structure for the United Nations Command force evolved out of the command organisation established for the occupation of Japan. General Douglas MacArthur, as the Supreme Commander of Allied Powers in Japan, became the Commander-in-Chief, United Nations Command. Yet, as Robert O'Neill points out in the Australian official history on the Korean war, the command system that MacArthur had established in Japan "possessed some glaring deficiencies". The most notable omission was the absence of a joint service headquarters.[12] This was contrary to the thrust of American post-World War II defence developments where, as Robert Futrell, the American official historian of the air war, explains: the "theater [sic] commander was expected to stand separately from his own service and to provide the command authority over the theater ground, sea, and air forces, which would cooperatively employ their capabilities to attain the theater mission".[13] As early as 1946 the American Joint Chiefs of Staff had directed the establishment of joint staffs, but MacArthur had made no real effort to implement this direction within his own command system. This deficiency was taken into the Korean war, leading to problems in utilising United Nations Command forces to their full effectiveness. Not only did the force consist of army, navy, air force and marine components but it also included significant air elements from the marines and the navy. Indeed, indicating the potential problems for organising and implementing air operations, the three air components were not under the direction of any single air commander.[14] Robert Futrell believed that:

"*at the outset of the Korean war, the defective theater [sic] command system prevented the fullest employment of air power, delayed the beginning of a comprehensive air-interdiction program for more than a month, and . . .*

With the brigade's air group of three Corsair squadrons — some 48 aircraft — providing dedicated air support, the result was an arresting display of combat power

caused confusion and loss of effectiveness at the very time that every single aircraft sortie was vital to the survival of the Eighth Army in Korea."

"Had he possessed a joint headquarters staff," Futrell asserted, "General MacArthur might never have encountered these mischievous problems."[15]

Not only did the command system result in inefficiencies, such as navy and air force components independently selecting and attacking the same targets, but it also led to confusion and, for aircraft at least, a degree of danger as they operated in an unfamiliar environment and relatively restricted air space. The system also produced extensive delays between the reporting of targets and the assignment of strike aircraft. This was to have tragic consequences for No 77 Squadron on the second day of its operations in the war: 3 July 1950.[16]

No 77 Squadron was one element of FEAF that was proficient in the ground attack role. This was a particular strength which led O'Neill to say that in the early stages of the war the squadron was to play a part "far out of proportion to its modest size". No 77 Squadron was also equipped with F-51 Mustangs which were perceived to be better armed and more durable for ground attack than the Lockheed F-80 Shooting Star then in service with American squadrons.[17] Therefore, it was probably no accident that No 77 Squadron was alerted when the Fifth Air Force headquarters in Itazuke, Japan, received a report of a North Korean convoy heading southwards through a particular area. This information had taken several hours in its passage through MacArthur's headquarters in Tokyo before it reached the air force operations officers. As a result, the assignment of the target to No 77 Squadron was based on an estimate of the likely location of the convoy when the aircraft arrived in the area of operations. Despite doubts by the pilots and reassurances from forward air control aircraft, an attack against a southward bound locomotive and a road convoy was subsequently authorised. It was their first ground attack mission, but members of the Australian squadron demonstrated their particular proficiency by blasting the train off the rails, onto its side, and hitting many of the trucks on the road during 20 minutes of rocketing and strafing. It was not until after they had returned to

their base in Japan that the Australian pilots learned that the trucks had been carrying South Korean soldiers and American troops of the 24th Division. Furthermore, the train had been laden with American ammunition. Making matters worse, the attack had been witnessed by several newspaper reporters, one of whom identified the aircraft as Australian. The tragic incident was the subject of extensive reporting in American newspapers on the following day.

The subsequent investigation revealed serious defects in the Fifth Air Force's target allocation system. The delay was attributed to MacArthur's command system, which forbade direct contact between the forward air operations staff in Korea and Fifth Air Force Headquarters in Japan. Effectively, this meant that requests for tactical air support in Korea were to be passed back through Eighth Army channels to MacArthur's headquarters in Tokyo before being referred to Air Force operational staff. One senior American officer described it as "a shameful way to operate". MacArthur authorised direct contact on the following day. Responsibility for the whole disastrous episode was accepted fully by the Americans. Along with other problems in those hectic first few weeks of the war, it resulted in improved procedures.[18] For example, within a few days of this incident, MacArthur issued instructions for the establishment of a realistic bombline and the need to report changes in this line at periodic intervals during each day.[19] Steps were also taken to rationalise the command system. "Belatedly," Futrell observed, "at the end of July, improvised procedures brought some order to the fantastically confused command situation in the Far East, but these extempore arrangements never achieved the full fruits of unification."[20]

The intense activity which resulted from attempts to halt the well-organised invasion of South Korea also produced another controversy over the subject of close air support for land forces. Fighting a desperate battle from the beleagured position of the Pusan perimeter, close air support played a vital role in the defence. However, the debate which followed — it lasted almost for the duration of the war — concerned the relative benefits of two different systems of providing close air support. One system had been developed during World War II by the

United States Army Air Forces (as it was then called) and the other system had evolved out of Marine Corps and Navy operations in the same war.

The Army and the Air Force had developed a tightly structured approach to close air support which was intended to have the capacity to deal with a battlefront spread over a wide front, perhaps covering hundreds of miles. Because the operations involved Army and Air Force, Air Force doctrine provided for the establishment of a Joint Operations Centre (JOC), staffed by Air Force and Army personnel. An Air Force Tactical Air Control Centre (TACC) would be located adjacent to the JOC. Tactical Air Control Parties (TACP), which included a Forward Air Controller (FAC), would be located forward with the land force. Normally, the FAC was an Air Force pilot who was supported by two airmen in a radio-equipped vehicle. When close air support was required, the FAC would pass the request by radio to the headquarters of the division being supported. Division would then relay the request up to corps headquarters, who would pass it to the JOC. Subject to competing priorities for air support, the TACC would then contact the appropriate airfield and aircraft would be scrambled. The pilots might also receive a pre-flight briefing. In flight, the aircraft would report to

the TACP and receive final instructions before attacking the target. As an indication, this process might take 40 minutes if handled expeditiously.[21]

The Army-Air Force concept of close air support had evolved on a very important premise: the Army's requirement for close fire support would be provided in the first instance by its own organic artillery. Within its effective range, the Army considered artillery to be the principal source of fire support. Beyond the range of the guns, the Army considered air support to be the principal weapon. For this reason, in Korea, the bombline tended to coincide with the range limit of artillery support. Similarly, Air Force considered that, in delivering support, it would seldom be closer than one kilometre to ground forces. Therefore, there was room for debate whether this form of close air support could be considered to have been integrated with land force operations in the intimate way that artillery close support was. According to its accepted definition at that time, close air support was "air action against hostile surface targets which are so close to friendly forces as to require detailed integration of each air mission with the fire and movement of those forces".[22] Despite any conjecture about the Army-Air Force concept of close air support, it had been

The Marine air strikes were quick, devastating North Korean defensive positions. It was the kind of close air support Marines expected, but it came as a revelation to the Army Officers who shared the experience

US TBM-3R Avenger

The interrogation of some 2,000 North Korean prisoners indicated that more than half of North Korea's equipment losses and one-third of their casualties were the result of damage inflicted by aircraft

developed to accommodate the requirements and preferences of the Army while reflecting certain established principles for the employment of air power. In his study of close air support in Korea, Allan Millett observed that:

"the Army did not expect integrated close air support, and the Air Force did not intend to deliver it except under carefully circumscribed conditions: clearly marked targets and readily identified friendly troops positions, positive observed direction from Air Force ground or air controllers, near absolute safety from friendly artillery fire, and employment only against targets that could not be attacked with heavy artillery."[23]

The Marine-Navy concept of close air support had been developed in the war in the South-West Pacific. Unlike the system developed for Army, this form of close support was in the first instance a substitute for artillery, and, therefore, a fundamental necessity for lightly-armed Marines who lacked the traditional land force artillery support. Accordingly, a Marine division could normally expect the support of a Marine air wing, which was a small-scale tactical air force. During amphibious landings, Marines could utilise naval gunfire to some extent but, as there were limits to its application, close air support was still recognised as vital. In a similar fashion to artillery support, Navy and Marine strike aircraft would deliver fire support within 50 to 200 metres of ground forces. These air strikes were controlled by Tactical Air Control Parties (TACP) located with the forward troops, normally at battalion level. TACPs would radio requests for close air support direct to a Marine brigade's Tactical Air Direction Centre (TADC), which had direct contact with aircraft carriers and the aircraft.[24]

The vital aspects of the Marine-Navy close air support system were its rapid response time and its decentralised control of sorties. By eliminating the requirement for intervening ground force headquarters to process requests, the Marine-Navy system was able to deliver an air strike within minutes. Response times were further reduced because Marine operations were generally conducted within a relatively contained geographic area, perhaps in close proximity to aircraft carriers; without the requirement to conserve fuel for extensive transit between air bases and the area of operations, aircraft could be kept airborne and 'on-call' over ground troops for long periods. In an emergency, execution of Marine-Navy air strikes proceeded on the assumption that liaison between ground and air representatives at the battalion level had determined that air support was to be utilised in the particular instance rather than artillery or naval gunfire, thus removing the complication of seeking clearances.[25]

There were benefits in both the Army-Air Force and the Marine-Navy systems of close air support, but, when they witnessed the latter system in operation in the first six months of the war, some Army officers, notably General Almond, commander of X Corps, argued that the Marine-Navy system should be adopted as the standard with Army having its own organic air support.[26] The case put by these Army officers gained inspiration from such operations as the 1st Provisional Marine Brigade's defence of the Pusan perimeter in August 1950. With the brigade's air group of three Corsair squadrons — some 48 aircraft — providing dedicated air support, the result was an arresting display of combat power. Allan Millett referred to the operation as a "four-week virtuoso performance in close air support".[27]

One of the Corsair squadrons operated from Japan, but the other two squadrons were launched from two escort carriers. The carrier-launched squadrons were only minutes from the 1st Provisional Marine Brigade's position and could remain on-station for up to four hours, ready for immediate response. The Marine pilots, 70 per cent of whom were World War II veterans, were extensively trained in close air support, the stock-in-trade for their squadrons. An FAC was located with each battalion, a TACC was located adjacent to the brigade fire support coordination centre (FSCC), and the brigade's deputy commander was an aviation officer. The Marine air strikes were quick, devastating North Korean defensive positions, their mobile formations and their artillery positions. More than half of the Marine sorties were directed against targets about 1 kilometre from the forward troops. "It was the kind of close air support Marines expected", Millett observed, "but it came as a revelation to the Army Officers who shared the experience."[28]
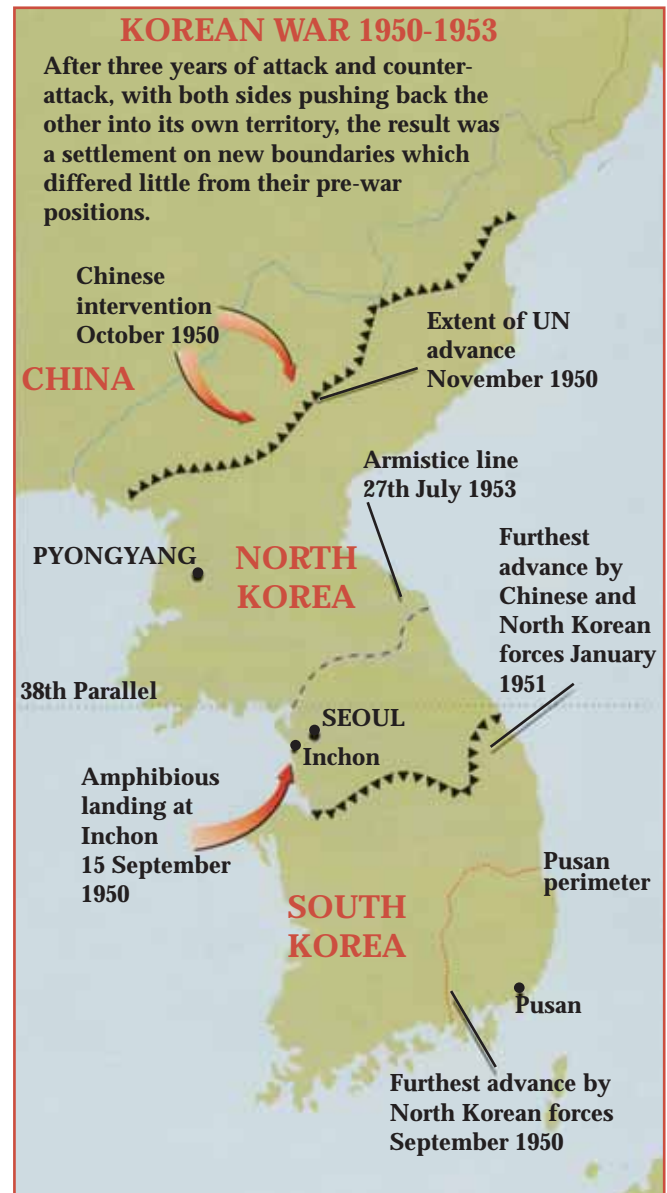
With air superiority assured by FEAF's dominant air power capability and the competence of its pilots, the North Korean forces suffered overwhelming damage

Boeing B-29s of the Yokota-based 92nd bomb group prepare to attack targets in North Korea

Hallion records that the effectiveness of Marine close air support in the Pusan perimeter "astonished Army troops fighting alongside the Leathernecks". The apparent ease of calling in an air strike and the "overwhelming response added fuel to the [close air support] fires raging between the services". But Hallion points out that there were a number of reasons favourable to the Marine performance. The prime ones were the short distance from the carriers to the battle, the small size of the battle front, bad weather interrupting Air Force support (which at that stage in the war had to come from Japan), the superior endurance and load-carrying capacity of the Corsairs, and the proficient relationship between the controller of the strike and the aircraft.[29] Other considerations that Hallion did not mention were that such a level of air support was dependent upon maintaining control of the air, that the dedicated support of 48 Corsairs was extremely expensive in terms of financial cost and asset distribution, and that there was a requirement for other air assets to conduct concurrent operations. Yet the Marine performance made "an indelible impression on the young infantrymen confronting a seemingly invincible foe". "They cared little about the details of [close air support]," Hallion concluded, 'they only knew that it saved their lives."[30]

In the first six months of the war there were other notable displays of the Marine-Navy system of close air support. The two most significant being the Inchon landing, which saw the landing force supported by an overwhelming application of Navy and Marine close air support, and the other being the withdrawal of the First Marine Division from the Chosin Reservoir.[31] These episodes added

KOREAN WAR 1950-1953

After three years of attack and counter-attack, with both sides pushing back the other into its own territory, the result was a settlement on new boundaries which differed little from their pre-war positions.

Chinese intervention October 1950

CHINA

Extent of UN advance November 1950

Armistice line 27th July 1953

PYONGYANG

NORTH KOREA

Furthest advance by Chinese and North Korean forces January 1951

38th Parallel

SEOUL
Inchon

Amphibious landing at Inchon 15 September 1950

Pusan perimeter

SOUTH KOREA

Pusan

Furthest advance by North Korean forces September 1950

The Chinese were a lightly armed and equipped peasant army, able to infiltrate through the countryside and to survive on provisions requisitioned from local farmers; in the short term, they were not dependent on convoys of trucks for resupply . . . In short, the Chinese force was a completely different type of opponent

further impetus to calls for changes to the Army-Air Force system of close air support.

The chief Army proponent for changing the close air support system was General Almond, commander of X Corps. In December 1950 and July 1951, Almond recommended that each corps commander should have operational control over a force of fighter-bombers equivalent to one group for each division. He also recommended that each infantry battalion should have a TACP, with the battalion commander having the power to send requests for air support direct to a TADC at corps headquarters, which, in turn, would order the mission flown.

Despite such arguments and the general acceptance that the Marine-Navy system had performed impressively in Korea, there was not a universal call for change. Firstly, it was recognised that this war was one where United Nations Command enjoyed control of the air. If this were not the case, then the Marine-Navy system would not have looked so impressive. Also World War II experience had demonstrated the problems of dividing air support into 'penny packets'. Furthermore, the adoption of the Marine-Navy system to support a force of 60 to 100 divisions would be prohibitively expensive. Most significantly, it was only the Army-Air Force system that had the capacity to concentrate all available air power — the FEAF Bomber Command, the Fifth Air Force, the Seventh Fleet, and the 1st Marine Air Wing — on specific sectors of the front line. In addition to all of these considerations, it was considered important to understand that the Marine-Navy and the Army-Air Force systems had been developed to accommodate the requirements of two distinct sets of circumstances. In August 1952, General Mark Clark, the then Commander-in-Chief of United Nations Command, rejected demands for changes

in the Army-Air Force system of close air support, effectively ending the debate.[32]

The debate over the benefits of two systems should not draw attention from the important role air power played in the early months of the war. General Walker, as commander of the Eighth Army, asserted that it was tactical air support which allowed United Nations Command to remain in the Korea in the hectic first few months of the war and then to advance towards the Yalu River.[33] An analysis of this period of the war by Eliot Cohen and John Gooch supports this view and reveals that, in the few weeks before China entered the war, "intelligence confirmed what American commanders had long believed: American air power had paralyzed [sic] the North Korean People's Army".

The interrogation of some 2,000 North Korean prisoners indicated that more than half of North Korea's equipment losses and one-third of their casualties were the result of damage inflicted by aircraft. This was twice the rate of damage to equipment and the same rate of damage to personnel as inflicted by artillery. The Far East Command intelligence assessment concluded that "tactical air support was the greatest single factor contributing to the successful conduct of UN ground operations against the . . . invader". Emphasising its importance, Cohen and Gooch claimed that "[a]ir power, not the Inchon landing . . . blocked the success and weakened the grip of the North Koreans investing the Pusan perimeter". Eighth Army thought very highly of its air support, they observed, "and analysis proved it right to do so".[34]

The North Korean force was particularly vulnerable to air attack. It was a conventional mechanised army, organised and equipped on Soviet lines, and dependent upon fuel, ammunition

A large Chinese force was located and substantial casualties were inflicted on it, promoting a sense of confidence in the Eighth Army and encouraging Ridgway to proceed with planning for a major offensive

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and stores in large quantities. Resupplied by truck convoy and railways, its logistical tail provided many targets. It was also apparent that the North Koreans were not trained to deal with air attacks.[35] With air superiority assured by FEAF's dominant air power capability and the competence of its pilots, the North Korean forces suffered overwhelming damage. It all served to make MacArthur and his staff extremely optimistic as the United Nations Command forces broke out of the Pusan perimeter and headed for North Korea. Yet, in their study, Cohen and Gooch are at pains to point out that, while air power had a dramatic, perhaps decisive, impact on the North Koreans, it was a mistake to expect that air power would have the same impact on the Chinese. "MacArthur did not simply discount Chinese intervention," they asserted, "but he thought he had the antidote to it, in the form of broken bridges, strafed roads and tracks, and if necessary, incinerated villages and towns." Reflecting his confidence in United Nations Command air power, the Commander-in-Chief assured President Truman in October 1950 that "if the Chinese tried to get down to Pyongyang there would be the greatest slaughter".[36] He believed that the Chinese armies would be crushed at the Yalu River. Yet it should be noted that MacArthur's claim was not supported by Lieutenant General Stratemeyer, commander of FEAF, and Major General Partridge, commander of the Fifth US Air Force.[37]

There were some important differences between the North Korean forces and the Chinese forces. The average North Korean division had some 200 hundred vehicles but a Chinese division had none. Where the North Koreans had some 40 artillery pieces in each division, the Chinese had nine light 76 mm howitzers. The North Koreans had four times the number of heavy machine guns as the Chinese and more anti-tank weapons. However, the Chinese had more light machine guns and more light mortars. Essentially, the Chinese were a lightly armed and equipped peasant army, able to infiltrate through the countryside and to survive on provisions requisitioned from local farmers; in the short term, they were not dependent on convoys of trucks for resupply. Their tactics were also different, capitalising on their strengths and diminishing their weaknesses. They attacked

mainly by night, probing, enveloping and intimidating the opposing force, using large quantities of hand grenades, light machine guns and mortar fire. In short, the Chinese force was a completely different type of opponent. When Far East Command intelligence assessments concluded that the Chinese force was an inferior version of the North Korean force, they missed this vital point. The North Koreans were a conventional force susceptible to the type of war the United Nations Command force expected to fight, the type of warfare that had been experienced in World War II. The North Koreans were extremely vulnerable to air warfare as it was conducted by FEAF, but the Chinese were not; at least not to the same degree. While Cohen and Gooch identified a number of United Nations Command failures in their explanation of the reverses of November and December 1950, they nominate two critical failures at the theatre level: excessive belief in air power as a solution and the faulty intelligence assessment that considered the Chinese force to be an inferior version of the North Korean force.[38]

These conclusions by Cohen and Gooch do not mean that air power did not have an effective role to play once the Chinese entered the war. What the two analysts were intent on illustrating was that the Chinese were organised and fought in a way that allowed them to minimise the impact of air power on their operations, thereby confounding MacArthur's unbounded optimism that he would achieve his objectives despite China's entry into the war.[39] This was only one of a number of failures in MacArthur's force. At the tactical level there were other, more fundamental, reasons why Eighth Army found itself withdrawing over ground they had won only weeks before. These were immediately obvious to General Matthew Ridgway when he assumed command of Eighth Army at the end of December 1950.

Ridgway takes command of the Eighth Army
Ridgway was a highly experienced infantryman. What he found in Korea disturbed him deeply. After touring his forward units and talking to his field commanders, he realised that:

"before the Eighth Army could return to the offensive it needed to have its fighting spirit restored, to have pride

Mosquitoes organised and controlled napalm and rocket attacks from the air

in itself, to feel confidence in its leadership, and to have faith in its mission."[40]

Ridgway had been chosen as the successor to Walker some time earlier but he had not been told. With the untimely death of Walker, Ridgway, who was working in Washington, received short notice to proceed to Korea. Arriving in Tokyo on Christmas Day on his way to the battlefront, he had discussions with General Douglas MacArthur, Commander-in-Chief United Nations Command. According to Robert O'Neill, Ridgway found MacArthur "to be discouraged at the turn of events in Korea". The reversal of the United Nations Command's thrust into North Korea towards the Yalu River was the cause. MacArthur's former mood of optimism had turned to despair in late November 1950, and he had ordered a withdrawal to the south by the Eighth Army and X Corps to avoid being outflanked by the Chinese counter-offensive.

United Nations Command troops faced the depressing task of withdrawing over ground that they had won in battle only weeks before. It was obviously an outcome that MacArthur had not contemplated. During his discussions with the Commander-in-Chief, Ridgway "discovered that remarkably little specific planning had been done for the future operations of the Eighth Army". Furthermore, it seemed that no strategic policy had been developed. When Ridgway asked MacArthur if he had any objections to his mounting an attack against the enemy forces, the Commander-in-Chief responded: "The Eighth Army is yours, Matt. Do what you think best."[41]

Arriving in Korea, Ridgway spent time talking to his men. He recorded that they "all conveyed to [him] a conviction that this was a bewildered army, not sure of itself or its leaders, not sure what they were doing there, wondering when they would hear the whistle of that homebound transport".[42] In Ridgway's opinion, the force had been ill-prepared, suffered major shortages in weapons, lacked warm clothing for the freezing Korean winters and, due to no fault of their own, had been spread across an area "far too wide for them to maintain an effective front". But Ridgway also found that many of the fundamentals of sound tactical operations were being neglected. He told his field commanders that

On the night of 11 February, the Chinese 40th and 66th Armies and the North Korean V Corps launched a counter-attack along the Hoengsong-Wonju axis. The attack by the communist forces did not take Ridgway by surprise

their forces had become road-bound, that they were failing to assess the terrain and to use it to their advantage. The Eighth Army had "to get off its bloody wheels and put some shoe leather to the earth, to get into the hills and among the scrub and meet the enemy where he lived".[43] The new commander quickly abandoned any thoughts of an immediate return to the offensive and began to prepare his force to meet a Chinese offensive that he believed would come at the beginning of the new year. "The Chinese outnumbered us," he reasoned. "But our armor [sic] was far superior . . . and of course we had control of the air." He urged his commanders to use the ground and enemy tactics to their advantage. They should occupy suitable hill masses, so inviting enemy infiltration at night. "Then with our superior firepower and air support we could destroy the enemy by daylight," he planned.[44]

A new phase of the Chinese offensive commenced on 31 December 1950. Ridgway's policy was to yield a little further ground as his force withdrew to the south.[45] Pushed by advancing Chinese forces, the rear battalion of the Eighth Army crossed the Han River on the morning of 4 January. For the second time in six months, Seoul had been abandoned to the enemy. Achieving a clean break from the advancing Chinese,

the withdrawal continued for another 160 kilometres to the south-east where, on 5 January, a defensive line known as Line D was occupied. Ridgway had originally planned a further withdrawal to a Line E, some 50 kilometres to the south, but this was to be the limit for the new commander was determined to hold this position while inflicting heavy casualties on the Chinese.[46]

The plans to withdraw to Line E were not implemented. "There were supposed to be 174,000 Chinese in front of us at that time," Ridgway observed, "but where they were placed, in what state of mind, and even that they were there at all was something we could not determine." A vigorous forward patrolling program and constant aerial reconnaissance failed to reveal evidence of a substantial Chinese presence south of the Han River. Ridgway himself took to the air in a slow advanced trainer with Major General Pat Partridge, commander of the Fifth US Air Force, as his pilot. "We flew at times at tree-top level and frequently below the barren ridges," Ridgway recalled. "Hardly a moving creature did we spot, not a camp fire smoke, no wheel tracks, not even trampled snow to indicate the presence of a large number of troops." Accordingly, Ridgway decided that he would begin to advance northwards to seek out and close with the enemy.[47] While he made plans to begin his offensive in late January, General MacArthur's headquarters in Tokyo was making detailed preparations for the evacuation of Korea. President Truman had authorised MacArthur to take this action if he thought the safety of his command was threatened.[48]

In the third week of January, Ridgway ordered a limited probing offensive known as Operation *Wolfhound* in the Osan-Suwon area, just to the north of the western end of Line D. A large Chinese force was located and substantial casualties were inflicted on it, promoting a sense of confidence in the Eighth Army and encouraging Ridgway to proceed with planning for a major offensive.[49] As a deliberate strategy, Ridgway proposed to seek out the enemy and, rather than sustaining heavy losses to his own force by fighting for and holding ground, he would endeavour to inflict punishing casualties by extensive use of his available fire power. This strategy, which he announced on 20 January, meant that the use of tactical air power would play a key role in the forthcoming battle, calling for a high degree of air-ground cooperation.[50]

By this stage, United Nations Command air operations enjoyed better co-ordination, much of the confusion of the earlier months having been resolved. Furthermore, the Eighth Army had received its normal allocation of artillery. For example, in January the 27th British Commonwealth Brigade, which included the 3RAR, was augmented by the arrival of the 16th New Zealand Field Artillery Regiment. Such developments prepared the basis of a more rational application of the Army-Air Force close air support system in accordance with established doctrine. Ridgway planned to operate within this doctrinal framework.

Ridgway assured Major General Partridge that he would not support the calls General Almond had been making for radical changes to the close air support system. In return, Partridge examined the

On 15 March the Eighth Army regained Seoul for the final time in the war. Continuing the advance into April, Ridgway prepared his force for an expected Chinese offensive

Air Force aspects of the system and brought about improvements in communication procedures and equipment. The Air Force general also took steps to improve the training of TACPs and — to make FACs more efficient — Partridge increased the duration of their normal tour with land units from three to eight weeks. When Ridgway commissioned his own staff to examine the Eighth Army's participation in the air support system, similar reforms were implemented: improved communications and better training for Army personnel involved in the system. This was a distinct step forward from the early weeks of the war when it was reported that only two officers of the headquarters of the Eighth Army had ever read the service manual on joint army-air tactical operations. The reforms initiated by Partridge and Ridgway were timely, bringing improvements to joint operations.[51]

On 25 January, three of Ridgway's divisions advanced north on Operation *Thunderbolt*, encountering an enemy screening force comprised of two divisions of the Chinese 50th Army. Mosquito aircraft from the 6147th Tactical Air Control Squadron remained aloft over the advancing troops and, as they located enemy strong points, they informed the ground forces using infantry radios. These radios had been installed in the cockpits of these aircraft earlier in the month as one of the measures aimed at improving the close air support system. An airborne relay station had also been established enabling radio messages to be transmitted from the advancing troops to the tactical air control centre at Taegu. Air strikes were used to soften enemy resistance and to attack the enemy as they withdrew to the north. With the capture of Suwon airfield, air resupply of the advancing force began on 30 January.[52]

By the end of the month, the advance had reached a line approximately 20 kilometres to the north without encountering any major Chinese defensive position. As Operation *Thunderbolt* proceeded on the western flank, Ridgway ordered a second thrust, Operation *Round-up*, in the central sector and by 10 February the whole battle-line had moved forward by 30 to 60 kilometres. Moderate resistance was encountered on the western flank but north of Ichon the Chinese resistance increased.[53] The main body of the enemy had been attempting to rest and restore their forces after their recent offensive but they now realised that they needed to regain the initiative. Beginning on the night of 11 February, the Chinese 40th and 66th Armies and the North Korean V Corps launched a counter-attack along the Hoengsong-Wonju axis.[54]

It was a period of determined fighting and the Fifth Air Force's fighter bombers flew almost 400 close air support sorties each day, the heaviest effort of the war

US F-84s

The communists had to divert thousands of men to repair the continual damage to the railways and the roads. For example, the enemy eventually had a repair gang positioned at four-mile intervals throughout the rail system

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The attack by the communist forces did not take Ridgway by surprise. Aerial reconnaissance had detected large groups of the enemy making their way to their line of departure. Ridgway assigned priority air support to the elements of his force under immediate threat, which meant that some aircraft that had been supporting ground forces in the west now found themselves providing assistance in central Korea. As the communist force began its attack, Republic of Korea troops north of Hoengsong were in imminent danger. Close air support was a key element in enabling them to withdraw. In the daylight hours groups of up to 400 enemy were detected by tactical air support Mosquitoes which organised and controlled napalm and rocket attacks from the air.[55] While it is clear that enemy sustained many casualties, Hoengsong was taken by the communists on 13 February, forcing United Nations Command troops to fall back to Wonju.

As daylight broke on the morning after Hoengsong was taken, aerial observers detected two Chinese divisions moving south in columns along the Som River. It was clear that the communist force intended to encircle the United Nations Command troops at Wonju. Caught in the open without the protection of field trenches, this force took a relentless pounding from artillery and air strikes over a period of some hours. Further fighting continued that night and into the next day, but the enemy attack had been broken by the extensive punishment it suffered. It is estimated that the battle at Wonju cost the Chinese over 5,000 men, an unacceptable loss even for a profligate enemy and they shifted their efforts to Chipyong-ni.[56] Chipyong-ni was a village surrounded by mountains to the west of Hoengsong. The occupying force, the United States 23rd Infantry Regiment and a French battalion, were quickly surrounded and in immediate danger.

From the outset it was a grim struggle against superior numbers. The defensive position, being approximately one kilometre in diameter, was dependent on ammunition, fuel and rations resupply from the air as the enemy attacked in strength. Blood plasma and medicines were also flown into the position by helicopters and 52 casualties were evacuated. It was some of the bloodiest fighting of the whole campaign with the defenders grimly engaged in desperate combat with a force that was estimated to be more than three Chinese divisions: Ridgway would later claim that it was five divisions.[57]

For the three days that the position was under immediate threat, Mosquito tactical control aircraft were constantly aloft over the area when it was light. Air strikes were directed against the enemy in the surrounding hills with rocket and napalm attacks. The 5th United States Cavalry was dispatched from the south of Chipyong-ni in a bid to relieve the beleaguered position. At the same time, the 27th British Commonwealth Brigade was deployed to remove enemy forces from the main supply route from Iho-ri to Chipyong-ni. Broken in spirit by artillery and air bombardment and the fierce resistance of the defenders of Chipyong-ni, the communists abandoned attempts to take the position just as it was finally relieved by the 5th United States Cavalry Regiment. General Almond, commander of X Corps, subsequently acknowledged that close air support and resupply by air were critical in sustaining the force at Chipyong-ni over the period 14 to 16 February.[58]

The enemy forces were successful in an attack on a third front to the east at Chechon. Overall, however, their offensive collapsed due to the amount of punishment they had suffered in central and western Korea. The United Nations Command force had again assumed the upper hand by 21 February. Therefore, Ridgway launched Operation *Killer* which, by thrusting eastward, was designed to isolate enemy forces which had penetrated into South Korea. Throughout this operation close air support was used extensively. Major General Claude Ferenbaugh, commander of the 7th Division, reported that close air support given to his division was 'outstanding' and the 'excellent results' achieved by air strikes enabled the taking of objectives with minimum casualties.[59]

On 15 March, the Eighth Army regained Seoul for the final time in the war. Continuing the advance into April, Ridgway prepared his force for an expected Chinese offensive. By this stage Eighth Army had developed confidence and a higher degree of operational competence. The experienced

infantry commander had reversed the fortunes of a bewildered army, turning it into an efficient fighting organisation able to deal with a determined and aggressive enemy. Ridgway did this largely by reminding his field commanders of the basics of infantry tactics and by utilising the overwhelming firepower which he had at his disposal. A major element of this firepower was close air support, an asset which Ridgway had endeavoured to employ to his advantage from the outset.

Buoyed by its successes against the Chinese, Eighth Army was well prepared for and able to counter the Chinese offensive which commenced on 22 April and extended through to 22 May. The Eighth Army plan was to absorb the momentum of the Chinese attack by withdrawing through a number of defensive lines while inflicting heavy casualties on the enemy with artillery and air strikes.[60] It was a period of determined fighting and the Fifth Air Force's fighter bombers flew almost 400 close air support sorties each day, the heaviest effort of the war.[61] The Chinese and North Korean forces sustained serious casualties in this period, making them ponder whether it was worthwhile proceeding with another offensive. Indeed, there were few real gains to be made by either side. The communists agreed to truce talks in June 1951, thereby giving prominence to the political arena of negotiation. At this stage, military operations developed into a seesaw war of stalemate which continued until the armistice of July 1953.

Interdiction
In April 1951, FEAF's emphasis on air operations shifted from close air support to interdiction missions. Yet Ridgway, who had assumed the position of Commander-in-Chief of United Nations Command in April 1951, began to have serious doubts about its effectiveness. He noted that the enemy's defensive strength "obviously improved during the summer" of 1951, recording that:

"Despite our constant and consistently successful effort to knock out railroads and bridges, to demolish marshaling [sic] yards and deny the highways to enemy traffic, supplies continued to flow down from Manchuria."

It was evident that fire from Chinese artillery greatly increased while more and more anti-aircraft fire appeared, destroying 81 FEAF aircraft in the period of three months from April to June.[62] "Whatever may be said for the value of air power — and there is no question that without it many of our advances would not have been possible," he concluded after the war, "it simply could not keep the enemy from bringing in the armament he needed." In Ridgway's opinion, air power "could not isolate the battleground" in Korea.[63]

While there were doubts about the immediate benefits of air interdiction programmes, the Commander-in-Chief had another reason for maintaining such pressure on the communist forces. The enemy hoped for an early cease-fire to relieve their forces from air attack. But Ridgway reasoned that once an armistice had been granted, there would have been no incentive for the communists to negotiate on other issues. Therefore, he decided to maintain pressure by using the available air power to operate far and wide over North Korea conducting close support operations, maintaining air superiority and cutting supply lines.[64]

Operation *Strangle*, an air interdiction programme involving a major portion of FEAF's assets, commenced in April 1951. The area between the 39th parallel and the forward edge of the battle was divided into three north-south strips, one being allocated to each of the Fifth Air Force, the 1st Marine Air Wing and air units of the naval Task Force 77. But the concentrated interdiction programme was unsuccessful in preventing sufficient resupply to the communist forces to enable them to maintain a moderate rate of combat. As quickly as one route was cut, another was opened or repaired, while aircraft suffered the danger increasing anti-aircraft fire.[65]

Following the poor results achieved through Operation *Strangle*, FEAF staff officers examined the logistic system in North Korea. They determined that the 60 Chinese and North Korean divisions in the combat zone depended upon a daily supply of 2,400 tons. The most efficient means of carrying this quantity of supplies was on the North Korean railways. It was therefore determined that a comprehensive attempt would be made by FEAF to cripple the rail system by attacking its bridges.[66]

These interdiction operations continued at an intensive rate for four months, from August to December, but it was only in the first two months that it was evident that the communist supply system suffered any major dislocation. The enemy soon displayed an ability to recover quickly from damage to the railway by transferring the load to road convoys and by undertaking speedy repairs.

It also proved difficult to make complete cuts in the system without a large number of sorties. Making the task even more difficult, anti-craft protection for the rail system increased significantly. There were serious doubts whether it was worth the effort. While this program was in progress it was still necessary to conduct close air support operations, but this was done at a reduced rate, because air assets were limited. As a result, ground commanders complained — O'Neill believes with justification — that their forces were suffering increased casualties because of the emphasis on interdiction.

Yet no one could be sure whether the interdiction program was actually making it impossible for the communist forces to accumulate sufficient supplies and equipment to mount a damaging offensive. There were grounds to believe that, if interdiction stopped completely, then an offensive would follow.[67] Ridgway reported to the United States Joint Chiefs of Staff in January 1952 that although the communist logistic system had suffered as a result of the raids, the enemy was still able to conduct a defensive operation.[68]

In March 1952, Fifth Air Force launched a new form of interdiction known as Operation *Saturate*. The object was to inflict intensive damage to railways in select areas rather than to achieve simple cuts over a wide range of track. The reasoning behind these operations was the observation that the North Koreans found it more difficult to repair damage if it required heavy equipment to be brought forward. While this program met with some early success, the increased deployment of anti-aircraft artillery made it extremely costly. The whole of the railway interdiction program resulted in a loss rate that exceeded the replacement rate of fighter-bombers. By May 1952, there were only enough aircraft to

maintain six intensive cuts and the program was abandoned.[69]

In his account of the Korean war, Ridgway was adamant that interdiction 'could not isolate the battleground'. Clearly, such an objective would be uppermost in the mind of a ground force commander. Yet there can be no doubt that the interdiction program, which lasted for 10 months, did cause disruption to the communist system of supply. The communists had to divert thousands of men to repair the continual damage to the railways and the roads. For example, the enemy eventually had a repair gang positioned at four-mile intervals throughout the rail system. The repair of a single break took them two hours and intensive damage requiring special equipment took from four to seven days. These are the small gains that were made at a large cost, but it seems probable that the results would have been greater if the communists had not enjoyed the sanctuary of Manchuria.[70]

Conclusion

Air power was a vital component of the United Nations Command forces in Korea. At times its influence was decisive. This was particularly so in providing close air support in the defence of the Pusan perimeter where it inflicted heavy losses on the North Korean invaders. Breaking down the enemy's combat power and resolve, air power permitted a break-out of land forces. Yet the provision of close air support was subject to debate. The Marine-Navy system was impressive from the land force commander's perspective but it demanded a relatively large number of dedicated assets. This not only involved dedicated aircraft but also the provision of TACPs down to battalion level. This lavish scale of support was not feasible where large forces were concerned. Furthermore, concurrent air operations had to be executed. Most important was the necessity to maintain control of the air. Without this the war in Korea would have had a different outcome.

Ridgway demonstrated that the Korean war could be fought successfully through a conventional approach to battle which paid attention to the fundamentals of sound tactical operations while making good use of available fire support. Ridgway used the existing Army-Air Force system

of close air support but introduced efficient procedures and improved communications. This achieved positive results which permitted an advance by the Eighth Army. Where the Eighth Army and X Corps had been initially overwhelmed by the entry of the Chinese forces, Ridgway's approach turned the tables on the communists. He claimed that some stages of his advance would not have been possible without the application of air power. But he also believed that air power used in the interdiction role was unsuccessful. Yet it is going too far to say that it failed entirely.

There can be no doubt that the interdiction programs did complicate the resupply of the communists forces and did force the enemy to use large amounts of resources to keep his supply routes functional. In this light, it seems that the full impact of the interdiction program is not known.

Notes

[1] Richard P. Hallion, *The Naval Air War in Korea,* The Nautical & Aviation Publishing Company of America, Baltimore, 1986, p. 206.

[2] Allan R. Millett, 'Korea, 1950 - 1953', in B.F. Cooling (ed.), *Case Studies in the Development of Close Air Support,* Office of Air Force History, United States Air Force, Washington, DC, 1990, pp. 354-5.

[3] Hallion, *The Naval Air War in Korea,* p. 208.

[4] John Terraine, *The Right of the Line: The Royal Air Force in the European War 1939 - 1945,* Sceptre, 1988, p. 156.

[5] Hallion, *The Naval Air War in Korea,* p. 207.

[6] Robert F. Futrell, *The United States Air Force In Korea 1950 -1953,* Duell, Sloan and Pearce, New York, 1961, pp. 7-8.

[7] Eliot A. Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War,* The Free Press, New York, 1990, pp. 165-6.

[8] ibid., pp. 168, 172.

[9] Millett, 'Korea, 1950 - 1953', p. 345.

[10] Robert O'Neill, *Australia in the Korean War 1950 - 53,* Volume II: 'Combat Operations', The Australian War Memorial and the Australian Government Publishing Service, Canberra, 1985, p. 296.

[11] Robert F. Futrell, *The United States Air Force in Korea,* Revised Edition, Office of Air Force History, United States Air Force, Washington, DC, 1983, p. 84.

[12] Robert O'Neill, *Australia in the Korean War 1950 - 53,* Volume II: 'Combat Operations', The Australian War Memorial and the Australian Government Publishing Service, Canberra, 1985, p. 299.

[13] Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 43.

[14] O'Neill, *Australia in the Korean War 1950 - 1953,* p. 299.

[15] Robert F. Futrell, *The United States Air Force in Korea,* Revised Edition, Office of Air Force History, United States Air Force, Washington, DC, 1983, p. 55.

[16] O'Neill, *Australia in the Korean War 1950 - 1953,* p. 299.

[17] ibid., p. 298; and Alan Stephens, *Going Solo: The Royal Australian Air Force, 1946 - 1971,* Australian Government Publishing Service, Canberra, 1995, p. 217.

[18] ibid., pp. 305-6.

[19] Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 86.

[20] ibid., p. 55; and O'Neill, *Australia in the Korean War 1950 -1953,* p. 299.

[21] Hallion, *The Naval Air War in Korea,* p. 42-3.

[22] ibid., p. 42.

[23] Millett, 'Korea, 1950 - 1953', p. 351.

[24] Hallion, *The Naval Air War in Korea,* pp. 43-4.

[25] Millett, 'Korea, 1950 - 1953', pp. 351-2.

[26] Futrell, *The United States Air Force in Korea,* Revised Edition, p. 706.

[27] Millett, 'Korea, 1950 - 1953', p. 366-7.

[28] ibid., p. 367.

[29] Hallion, *The Naval Air War in Korea,* p. 52.

[30] ibid., pp. 52-3.

[31] ibid., pp. 61-4.

[32] Futrell, *The United States Air Force in Korea,* Revised Edition, p. 706.

[33] Millett, 'Korea, 1950 - 1953', p.354.

[34] Cohen and Gooch, *Military Misfortunes,* pp. 178-9.

[35] Millett, 'Korea, 1950 - 1953', p. 355; and Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 85.

[36] Cohen and Gooch, *Military Misfortunes,* p. 179.

[37] Millett, 'Korea, 1950 - 1953', p. 372.

[38] Cohen and Gooch, *Military Misfortunes,* pp. 176-9; and Figure 7-1, 'Matrix of Failure', p. 190-3.

[39] ibid., p. 179.

[40] Matthew B. Ridgway, *The Korean War,* Doubleday & Company, Inc., New York, 1967, p. 89.

[41] Robert O'Neill, *Australia in the Korean War 1950 - 53,* Volume II: 'Combat Operations', The Australian War Memorial and the Australian Government Publishing Service, Canberra, 1985, p. 91; and Ridgway, *The Korean War,* p. 78 & p. 83.

[42] Ridgway, *The Korean War,* p. 86.

[43] ibid., pp. 88-9.

[44] ibid., p. 90.

[45] O'Neill, 'Combat Operations', p. 92.

[46] ibid., p. 94.

[47] Ridgway, *The Korean War',* pp. 105-6.

[48] O'Neill, 'Combat Operations', p. 97.

[49] ibid., p. 98.

[50] Futrell, *The United States Air Force In Korea 1950 -1953,* p. 314.

[51] Millett, 'Korea, 1950 - 1953', pp. 376-7.

[52] ibid., pp. 316-7.

[53] O'Neill, 'Combat Operations', pp.103-6.

[54] Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 318.

[55] ibid., p. 318.

[56] *The History of the United Nations Forces in the Korean War,* Volume IV, pp. 472-3; and O'Neill, 'Combat Operations', p. 112.

[57] Ridgway, *The Korean War,* p. 107.

[58] Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 319; and *The History of the United Nations Forces in the Korean War,* The Ministry of National Defense, The Republic of Korea, 1975, Volume IV, pp. 467-76.

[59] Futrell, *The United States Air Force In Korea 1950 - 1953,* p. 320.

[60] O'Neill, 'Combat Operations', p. 348.

[61] Millett, 'Korea, 1950 - 1953', p. 379.

[62] O'Neill, 'Combat Operations', p. 350.

[63] Ridgway, *The Korean War,* p. 186.

[64] O'Neill, 'Combat Operations', pp. 350-1.

[65] ibid., p. 350.

[66] ibid., p. 353.

[67] ibid., pp. 353-5.

[68] ibid., p. 375.

[69] ibid., p.376.

[70] ibid., pp 377-8.

To Stop Them On The Beaches

Luftwaffe Operations against the Allied Landings in Italy

By Professor James S Corum

In May 1943 it was not yet clear to the Nazi High Command that the war had turned irrevocably against the Axis. German forces had suffered a disaster at Stalingrad, but hoped to recover the situation on the Eastern Front with a grand offensive in the Summer. In Tunisia the Axis had taken another severe defeat. After winning a few operational victories early in the campaign the German/Italian forces had been overwhelmed by Allied ground and air power. Over Germany, cities were taking a beating from the increasing RAF night raids, but German air defenses were

formidable and it looked as if Germany could win the aerial attrition battle. Although the strategic situation in the Mediterranean looked bleak, with Italy clearly the next target of Allied forces, the Wehrmacht High Command was feverishly working on plans to reinforce Italy in the hope that the expected Allied landings could be thrown back into the sea or at least endure heavy losses so any Allied advance would turn into a stalemate. Whatever the Allied course of action in the Mediterranean, the Luftwaffe was expected to have a major role in repelling any landing attempts.

The German and Italian air forces left behind hundreds of wrecked and damaged aircraft on Tunisian airfields — many of the planes in good condition

This article will examine the Luftwaffe plans, tactics and operations against the Allied amphibious operations at Sicily, Salerno and Anzio between July 1943 and February 1944. The air war in the Mediterranean in 1943-44 was a sideshow for both the Luftwaffe and the Allied air forces, overshadowed by the great air battles on the Eastern Front and over the skies of Germany. As such, the Luftwaffe and the Allied air operations over Italy have received scant attention from airpower historians. Yet it was nonetheless a very important campaign and one the Luftwaffe fought with considerable effort and ingenuity.

German strategic situation in May 1943
The early part of the campaign for Tunisia gave the Luftwaffe a false impression of its true capabilities. From December 1942 to February 1943 the Luftwaffe generally held air superiority over the battlefront. The German and Italian air forces operated from good, all-weather airfields close to the front while the British and Americans had few airfields within effective range of Tunisia and were forced to build new airstrips at the end of a long logistical pipeline and with far too few engineers. During the Winter of 1942-43 the USAAF and RAF forward airfields were often deep in mud and short of parts and supplies. At the same time, the Americans had trouble coordinating their air operations with the British and developing an effective doctrine for supporting the ground war.

However, by the Spring of 1943 the Allied problems with coordination of air forces, supplying forward airfields and building adequate airstrips had been largely sorted out. The Americans and British were soon able to use their superiority in numbers to drive the Luftwaffe from the skies, interdict Axis ships and aircraft traveling to and from Tunisia and render the Axis airfields largely inoperable. Just before the end of the collapse, the Germans and Italians, having taken heavy losses in the air, pulled their battered formations out of Tunisia to Sicily and the Italian mainland. The German and Italian air forces left behind hundreds of wrecked and damaged aircraft on Tunisian airfields — many of the planes in good condition but unflyable due to a lack of spare parts

Macchi MC 202

The only really useful units of the Regia Aeronautica were the fighter units that had recently been reequipped with the Macchi 202s and 205s

that never arrived because of the Allied interdiction of Axis supply lines.

The disaster in Tunisia woke up the German High Command to the crisis in the Mediterranean theater. As the situation in Tunisia deteriorated, the German High Command assessed the Italian armed forces as being in such poor shape that they were basically incapable of offering serious resistance to an Allied attack on Italy. The fighting worth of the Italian Army was low due to lack of equipment, obsolete equipment, poor training,

Light bomber and attack (fighter-bomber and Stuka) units were based in Sicily, southern Italy

poor morale and weak officer leadership. The Italian Air Force was rated as largely ineffective. While there was a large number of planes on hand, all but a few of the fighters were capable of taking on Allied aircraft on an equal basis. The Italian bomber force of several hundred planes was regarded as so hopelessly obsolete that it was rated as having no value for the defense of Italy. The Italian aircraft industry and air force logistics system, never very capable in the first place, were close to a breakdown. Air force operational rates were about 30-40% of aircraft due to a lack of parts and especially a lack of spare engines. The only really useful units of the Regia Aeronautica were the fighter units that had recently been reequipped with the Macchi 202s and 205s. In those two fast, maneuverable and well-armed aircraft the Italians had planes that were roughly equal to the Allied P-40s and Spitfires. The only Italian force that was rated as fairly modern and effective was the Italian navy. Even then, the Germans wondered whether the Italian fleet could ever stand up to the Royal Navy in open battle.[1]

On 2 March 1943 the Italian High Command, the Commando Supremo, sent Hitler a long message outlining Italy's precarious strategic situation and demanding large quantities of modern equipment from the Germans. The next day, after conferring with his staff about the crisis on the southern front,

Hitler replied to Mussolini and, to reassure his ally, promised large quantities of German matériel and assistance to include tanks and artillery for the Italian Army and re-equipping the Italian bomber fleet with German Ju 88 medium bombers. A large number of flak guns and radar units were also promised and the German equipment was to flow immediately.[2] In the meantime, German army and air reinforcements were ordered to Italy.

The Luftwaffe prepares to meet the Allies
The crisis in the Mediterranean pushed the German High Command to reorganize the command structure of the army and Luftwaffe in Italy. Through the North African campaign Luftwaffe Field Marshal Albert Kesselring, with the title of 'Commander in Chief-South', had worn two hats as commander of German army units as well as commander of Luftflotte 2 (Air Fleet 2). In June 1943 Luftwaffe Field Marshal Wolfram von Richthofen was pulled from the Russian front, where he commanded Luftflotte 4 in southern Russia, to take over Luftflotte 2 in Italy. Kesselring still maintained the title of Commander in Chief-South but his authority now extended only to

Hitler . . . promised large quantities of German matériel and assistance to include tanks and artillery for the Italian Army and re-equipping the Italian bomber fleet with German Ju 88 medium bombers

Junkers Ju 88

The Italian Air Force paper strength of 1,042 aircraft translated into an operational strength of 164 relatively modern aircraft that could take on the Allies in less than suicidal conditions

German army units and some Luftwaffe flak units placed under army command. As was typical in the Nazi command system, there was no true theater commander or joint staff. Luftflotte 2 was under Berlin's direct authority and reported directly to the Luftwaffe High Command. In any case, Kesselring and von Richthofen were expected to coordinate their commands and plans for the defense of Italy.

The selection of von Richthofen as Luftwaffe commander shows how seriously the High Command viewed the threat in the Mediterranean. The temperamental and rather humorless von Richthofen was not an easy general to work for. However, he had the well-deserved reputation as the best tactical air commander in the Luftwaffe. Not only was von Richthofen a gifted tactician, he was ruthless and aggressive and was known for accomplishing a lot with limited resources. A great part of his success as a commander was in his understanding of aviation technology. He had earned a PhD in engineering during the Reichswehr era and had served as a leader in the Luftwaffe's Technical Branch developing new weapons and equipment before he was sent to serve in the Condor Legion in 1936. He could be expected to make the best use of the new anti-ship torpedoes and radio-guided bombs that the Luftwaffe was deploying to the Mediterranean.

Along with von Richthofen other first rate Luftwaffe senior commanders were sent to the theater. Col Dietrich Pelz was pulled out of his post as Inspector of Luftwaffe bombers and Stukas and sent to command the German bomber force in Italy. Pelz had won recognition as an outstanding bomber commander and tactician early in the war and was charged to develop effective bomber tactics against the expected allied invasion forces.

The next year he would become the Luftwaffe's youngest major general at 32.

The available Luftwaffe forces for the defense of Italy were commanded by Luftflotte 2, headquartered at Frascati, a small town near Rome, which also contained Kesselring's headquarters. Luftflotte 2 had two major elements, Fliegerkorps II, whose headquarters was in Sicily at Tavromina

Airfield. However, before July a more secure headquarters had also been prepared near Naples.[3] Also assigned to support Fliegerkorps II was Air Training Division 2, based in the south of France. Fliegerkorps II's main force consisted of a fighter command based at Tapani Airfield in Sicily, with fighters and fighter-bombers at Vibo Valentia and Monte Corvine airfields. Light bomber and attack (fighter-bomber and Stuka) units were based in Sicily, southern Italy and there were several groups of aircraft in Sardinia.

Air Training Division 2 was headquarters for bomber units that been badly mauled on other fronts and had been sent to a restful sector to be rebuilt, reequipped and retrained. It also contained Bomber Wing 100 (KG 100), which was being equipped and trained to employ the new radio-controlled bombs, the first true PGMs. In addition to these flying commands, the Luftwaffe's representative to the Italian Air Force staff (Superaeria) General Ritter von Pohl, had a staff to conduct liaison with the Italians and also commanded the Luftwaffe's ground forces and flak units in Italy.[4]

In total, in early July 1943 the Luftwaffe had an official strength of 667 combat aircraft available for the defense of Italy: six Ju 88 bomber groups, each with 40 aircraft, 1-2 weak He 111 torpedo bomber groups, three fast bomber groups (1 group Me 210s and two groups Me 110s), several attack (Schlachtflugzeuge) groups in the process of transitioning from the Ju 87 Stuka to the FW 190 fighter-bomber, four groups of Me 109 day fighters and one group of Ju 88 night fighters. For reconnaissance, Luftflotte 2 had one group of Ju 88 long range reconnaissance planes, one group of He 111 bombers equipped with radar to track shipping and one squadron of Me 109s equipped with camera and drop tanks for extra range.[5] Official numbers are, of course, often misleading. Most of the units were well under strength. For example, the Me 210 fast bomber group had only 18 aircraft, and of these, only 12 were operable. In most categories of combat plane, the Luftwaffe units were at two-thirds strength or less. Thus, in early July there were only 443 Luftwaffe operational combat aircraft in Italy and southern France.[6] The Luftwaffe estimated that it

Von Richthofen placed a good deal of hope in the small fast bomber and fighter-bomber force (Me 210s, 110s and FW 190s)

Messerschmitt Me-110

and the combat units of the Regia Aeronautica were outnumbered by a factor of approximately five to one in the air — a fairly accurate assessment.

The Italian Air Force (Regia Aeronautica) was in far worse shape than the Luftwaffe. Of the massive German assistance promised to the Regia Aeronautica in March 1943, by July only 40 Ju 88s had arrived to equip an Italian bomber group, and this unit was not yet operational. The Italian bomber force of 400 aircraft was so obsolete that it was written out of German planning. Italian aircraft production and maintenance remained in poor shape and was, in fact, getting worse by the day. The Italian fighter arm had a strength of 530 planes, but of these only the Macchi 200s, 202s, 205s and Re 2001s were considered modern enough to take on any Allied planes. Of these latter craft, only 130 were operational. To repel any Allied landing, the SM 79 and SM 84 torpedo bombers would be essential, but the Regia Aeronautica had only 22 of these operational. In the final reckoning before the Allies landed, the Italian Air Force paper strength of 1,042 aircraft translated into an operational strength of 164 relatively modern aircraft that could take on the Allies in less than suicidal conditions.[7]

Von Richthofen arrived on 12 June 1943 to take over a battered and demoralized force. On his way to Italy, von Richthofen had been personally briefed by Goering in his vast Karinhall estate. Goering was convinced that the Luftwaffe's failure in North Africa had been due to poor leadership and lack of will. As he had done in the Battle of Britain, Goering blamed his pilots' lack of courage and aggressiveness for the failure against the Allies. Goering even drew up an order stating that any Luftwaffe pilot — up to wing commander — who showed any lack of aggressiveness would be demoted to private and sent to fight as a soldier on the Russian Front.[8] Von Richthofen made his own assessment when he got to Italy. Von Richthofen, who had been continuously at war as a senior Luftwaffe commander since 1939 (and for 18 months in Spain before that) and had more than enough experience to intelligently review the Luftwaffe's condition without Goering's advice. His private assessment of the Luftwaffe's capabilities versus the vast Allied resources led to some pessimistic conclusions. Von Richthofen realized that if the British and Americans got ashore in force, neither the Italian army or the small number of German ground units had any hope to defeat them.

The only way to defend Sicily or Sardinia was to catch the invasion fleet at sea, or at the moment of landing, and to sink enough transports and supply ships to cause an Allied logistics breakdown. He remarked, "We can put every effort into attacking enemy shipping . . . If we are successful in disrupting the supply over the beaches we can make his ground units ineffective and vulnerable to counterattack by our forces".[9] The Luftwaffe's Intelligence estimated that the Allies had 1 1/2 million tons of cargo shipping in the Mediterranean to support landing operations. If the Luftwaffe and Regia Aeronautica could sink or disable 100,000 tons per day, any allied assault would soon be crippled. As von Richthofen noted, "We can't

The Allies "would do the Germans a favor" if they only attacked at one location as the Luftwaffe and Regia Aeronautica only had enough airplanes to make a good fight on one front

predict a success with this strategy . . . but it's the only strategy that offers a possibility of success".[10]

From May to July the Luftwaffe experienced an ever-increasing number of air raids against their airfields in Sicily, Southern Italy and Sardinia. Even the Luftwaffe bomber bases in southern France were attacked. The Allied advantage lay in the American four engine B-17 and B-24 bombers that had the range and payload to pound any Axis airfield in the theater, including those in Northern Italy and Southern France. The large British and American twin-engine bomber force had the range and payload to hit targets in Sicily, southern Italy and Sardinia. Through the month of June, the

AAF/RAF bombers ranged all across Italy, attacking rail centers, shipping, and Italian munitions factories. The Luftwaffe's air bases came in for special attention. Von Richthofen pulled most of his bombers out of Sicily for well-defended fields in the Foggia area in southern Italy. Some fighters were pulled out of Sicily and based at airfields around Naples, Foggia and Calabria although some fighters and the attack units remained.

There are conflicting accounts of the Luftwaffe's relations with the Regia Aeronautica before the Sicily battle. Some Luftwaffe officers describe the Italians as being very cooperative and loyal Allies at this point in the war. Other Luftwaffe officers complained that the Italians were deliberately

SICILY, 1943

ALLIED PLAN FOR THE INVASION OF SICILY, 10 JULY 1943 AND AXIS DISPOSITIONS

dragging their feet and inhibiting full cooperation with the Germans. The lack of Italian engineers supporting the Luftwaffe delayed the process of rebuilding, repairing and enlarging the airfields that the Germans urgently needed if they were to stage their units south and mount an air defense of Sicily.[11] I tend to support the former view of the Italians as loyal allies of the Germans in mid- 1943. Whatever the relations between the German and Italian army had been, and they were often marred by distrust and acrimony, the Regia Aeronautica had a reputation of always doing its best to support the Luftwaffe in North Africa. In the case of the slow pace of airfield building and repair, I suspect that the Italian regime's routine incompetence is a better explanation than any bad faith.

The defense plan
From May to June the Luftwaffe feverishly tried to set up an effective air defense system for Sicily, southern Italy and Sardinia. As part of Hitler's aid package, 100 German flak batteries arrived in northern Italy to defend the heartland of Italy's war industry. Normally, most of the flak crews were Italian soldiers with Germans manning the radars and gun control systems. Additional Luftwaffe flak reinforcements went to southern Italy and Sicily along with German ground troops and the 5th Flak Division was deployed to southern Italy. As Tunisia was falling, the Germans emplaced a long-range Freya radar in Western Sicily and another in Sardinia. Numerous short-range radars were deployed to cover German bases.[12] One of the most severe German problems was a shortage of trained technical specialists. In Tunisia the Luftwaffe had lost its most experienced fighter operations (radar) controllers and such men were hard to replace.[13]

In spite of Goering's admonition to simply fight harder, the new commander had a few weeks to make his own assessment and draw up his own plan. Von Richthofen and Pelz worked hard to develop some anti-shipping tactics against the expected Allied invasion that would inflict maximum damage on the Anglo-American fleet with minimal German casualties. Given the massive Allied superiority in fighters, the Luftwaffe's best chance would be to attack at night or at dawn or dusk. Pelz directed that the bombers were to fly carefully planned courses out to sea and then drop to 50 meters altitude and change course to confuse

Allied radar. As planes approached the target they were to climb to 2,500 meters and attack the target in a 30-50 degree dive. The group commander would drop illumination flares and would use colored flares to mark the target for his bombers.[14] Due to the fuel shortage, each mission would be carefully calculated with the most experienced pilots and navigators carrying a larger bombload and less fuel and the inexperienced crews a smaller bombload and more fuel.[15]

Ideally, German/Italian reconnaissance would find the Allied invasion convoys well out to sea and give the air units plenty of warning to hit the enemy hard and early. Pelz hoped that the Allied shipping could be hit with large, coordinated attacks of 50-80 planes at once. The highly trained German bomber force of 1940 might have been able to carry out such complex plans, but after Russia and North Africa, the Luftwaffe bomber force was a shadow of its former self. Despite a desperate shortage of trained bomber aircrew, Pelz hoped to quickly retrain his units to carry out anti-ship strikes.

Attacking ships is quite an art, and one the Germans had done little to master. A specialized Luftwaffe anti-shipping force had been virtually ignored before the war. From 1939-1942 the Ju 87 Stuka was the most capable airplane for attacking ships. But the Stuka had little chance to survive in combat against the Western Allies in 1943. In 1942 the Luftwaffe had finally created a small force of He 111 torpedo bombers, which did well against Allied convoys to Northern Russia that summer. In the Mediterranean the Luftwaffe had set up a torpedo bomber school at Grosetto and in the Spring of 1943 and was in the process of training and equipping two bomber groups for the mission when a massive Allied raid devastated the base. Von Richthofen withdrew the small torpedo plane force to relative safety in Southern France.[16]

Von Richthofen placed a good deal of hope in the small fast bomber and fighter-bomber force (Me 210s, 110s and FW 190s). They were expected to roar in at full speed at 50 meters altitude in order to evade allied radar. At about a kilometer from the target they would climb slightly and skip their bomb into the enemy while also strafing him.[17] The greatest problem in using these light attack planes was their limited range with heavy bombloads,

A force of 24-36 Ju 88 roared in over the US fleet. A direct hit was made on the SS Robert Rowan, an ammunition ship, and it began to burn. The crew was removed with no casualties and the Robert Rowan blew up at 1700 in one of the most dramatic moments of the campaign

especially the FW 190. Some attack units would have to be held in central or southern Italy and stage into Sardinia or Sicily if these islands were attacked. The closer a German airfield was to Allied bases in North Africa, the more intense the Allied bomber attacks and the heavier the daily attrition. Luftflotte 2 would have to pick just the right moment to stage the aircraft forward to the vulnerable Sicilian or Sardinian bases.

The intelligence picture:
anticipating the Allied assault
German Intelligence left Kesselring and von Richthofen largely in the dark about Allied plans and forces. German signals intelligence was usually a very good source of intelligence on the Allies, but after Tunisia fell, the Allies maintained a pretty thorough radio silence in the Mediterranean and this source died up. The Luftwaffe's only long-range reconnaissance asset capable of monitoring Allied shipping and port activity was a squadron of Ju 88 reconnaissance planes. Try as they might, it

was hard to get past the Allied fighter cover to photograph the main North African ports where Allied invasion forces were assembling. A few aerial reconnaissance reports came in during May-June, but there was nothing like a comprehensive coverage of Allied port and naval activity.[18] A handful of Italian and German flying boats and seaplanes patrolled the open sea to try to spot Allied convoys and shipping, but dared not get too close to the well-patrolled North African coast.

From all sources of intelligence, including agent reports, Wehrmacht intelligence in Italy estimated that the Allied powers had 50-55 divisions of ground troops in the Mediterranean, including the US Army, British Army and Free French Forces. German Intelligence even reported that the Americans had a force of three paratroop divisions based near Oran and being readied for the invasion of Italy. Of this vast Allied force, which included the former Vichy French forces in North Africa, the Germans estimated that 25 divisions were fully

Even in an all-out campaign against Allied shipping, the Luftwaffe and Regia Aeronautica were not able to accomplish much. The Allied loss of 12 ships to Axis air attacks did not hinder the landing of over 100,000 troops nor their vehicles and supplies on the shores of Sicily

equipped and trained and available for the coming campaign. Moreover, of this force, the Germans estimated that the Allies had the shipping and landing craft to land 120,000 men and 4,000 thousand tanks and vehicles in one lift.[19] The German estimates were almost double the true Allied strength figures. The Allies would use most of their ready combat forces in the theater, 12 divisions, in the Sicilian operation and the Allies, at peak strength in 1944, would never have more than 20 divisions in Italy. As for airborne divisions, the Americans had only one, the 82nd Airborne, in the theater. However, the estimate on Allied shipping was not far from the mark. The British and Americans had the capability to land a force of 100,000 men on Axis shores.

From the scanty information available, von Richthofen believed that there were two obvious targets for an Allied invasion, Sicily and Sardinia. Of these Sicily was the most probable site for an attack as it lay within fighter range of the British airfields on Malta. In the case of Sardinia, while it was out of range of the single-engine fighters, it was within easy range of Allied light and medium bombers and the British had carriers in the Mediterranean that could provide fighter cover. As an obvious target, Sardinia was reinforced by Italian and German ground forces and a strong German and Italian air contingent was sent there. If the Allies took Sicily, they could easily base aircraft there and assault southern Italy. If the Allies took Sardinia, its airfields could cover Allied landings in central Italy. As far as von Richthofen

was concerned, the worst possible scenario was a simultaneous Allied attack on both islands. German and Italian ground and air strength was simply too thin to make an effective fight for both locations. Per Luftflotte 2's assessment, the Allies "would do the Germans a favor" if they only attacked at one location as the Luftwaffe and Regia Aeronautica only had enough airplanes to make a good fight on one front.[20]

The Allies telegraphed their intention to move on Sicily when they seized the island of Pantelleria south of Sicily in early June. Pantelleria was a large, well-garrisoned island with a major airdrome and a radar station. The Allied air forces subjected the island to a massive two-week bombardment that broke the morale of the Italian defenders and the garrison surrendered just as the first boats of the amphibious landing force touched shore. Pantelleria was vital to any Allied action against Sicily because its radar provided early warning of Allied raids and its airfield, within fighter range of Sicily, was urgently needed for land-based aviation. The Germans rightly figured that the British and Americans would not make such a great effort to seize Pantelleria if Sicily were not the primary target. After Pantelleria the AAF and RAF bombers began ranging all over Sicily and southern Italy, striking logistics centers, rail centers and, most importantly, German and Italian airfields. Von Richthofen noted that, "the competition between us and the Allies is to see if we can repair our airfields as fast as the Allies could bomb them".[21] By 20 June, von Richthofen noted that the German

airfields in Sicily had been so heavily damaged that the Luftwaffe's attack units "couldn't get off the ground in less than 45 minutes".[22] As the air attacks on airfields across southern Italy increased in early July, the Germans and Italians placed their forces in Sicily and Sardinia in the highest state of alert.

Battle for Sicily

Early on the morning of 9 July an Italian reconnaissance plane spotted an allied invasion convoy south of Pantelleria. At 1630 the same day another Italian plane spotted five convoys steering north from Malta. The Italian and German forces on Sicily were all alerted. Within an hour a German reconnaissance plane reported a convoy 33 miles northwest of Malta. Until dark the Axis reconnaissance units shadowed the Allied convoy movements and before 2000 hours the Italian Air Staff ordered their torpedo bombers based in Sardinia to attack.[23] The Axis forces were about to face the largest amphibious operation in history (to that time). The time and place of the attack was expected and the Luftwaffe had used the time since Tunisia to prepare air attack plans and tactics.

On the morning of 10 July the Allies began landing six divisions at eight landing points along a 100-mile stretch of the southern Sicilian coast. With an invasion fleet of 1,365 warships, transports and supply ships as well as 1,225 smaller landing craft it was, as one might say today, a "target rich environment" for the Luftwaffe and Regia Aeronautica.[24] The Luftwaffe and Italian Air Force began hitting Allied armada before dawn.[25] At 0510 the US minesweeper *Sentinal* was sunk by a direct hit from a Stuka with 10 killed and missing and 51 wounded. At the Licata landing site there were several air attacks but no US ships were hit.[26] At the Gela landing site just before 5 AM a Stuka made a direct hit on the destroyer USS *Maddox* that sank immediately with heavy loss of life. Italian and German bombers flying from Sardinia attacked the Gela beachhead in the afternoon and inflicted minor damage to the destroyer USS *Murphy*. A Luftwaffe fighter-bomber sank LST 313 while a high-level bomber attack that night came nowhere close to hitting any ships.[27]

In the British landing sector near Catania the British invasion fleet came under heavy attack, mainly from the Luftwaffe bombers based in southern Italy. On D-Day four Liberty ships and a Dutch auxiliary were hit by bombs and two were sunk. That night two British hospital ships, the *Dorsetshire* and *Talamba* were bombed and *Talamba* subsequently sank.[28]

During the first two days of the landing the German and Italian aircraft met little opposition from Allied fighters. Even though the RAF and AAF had based several fighter groups on Malta and Pantelleria, amounting to several hundred planes, the fighters were flying at extreme range and had less than an hour to patrol over the beachheads. With eight landings and over 100 miles of coast to cover the AAF and RAF could keep no more than a few planes patrolling over each sector, even with a maximum effort. The German and Italian planes, which had orders to avoid combat with Allied fighters, found it easy to slip in to attack the Allied ships. The American 307th Fighter Squadron that covered landing reported the German tactics of the first part of the invasion as "2-5 Me 109s or Fw 190s trying to sneak in and dive bomb the ships".[29] The US unit claimed only two German aircraft in the campaign for the island.[30] The main resistance to the Axis air attacks was the shipboard anti-aircraft fire, which managed to bring down several Axis aircraft during the first day. During the first two days of the campaign the Germans and Italians lost at least 27 aircraft attacking Allied ships — losses under the 5-10% rate that von Richthofen deemed acceptable attrition.[31]

On 11 July the German and Italian air forces attacked Allied shipping throughout the whole landing area. In the American sector, ships logs reported several large and well-coordinated attacks by German bombers. At 1540 hours a force of 24-36 Ju 88 roared in over the US fleet. A direct hit was made on the SS *Robert Rowan*, an ammunition ship, and it began to burn. The crew was removed with no casualties and the *Robert Rowan* blew up at 1700 in one of the most dramatic moments of the campaign.[32] The ammunition ship sent a column of smoke thousands of feet into the sky as debris and unexploded shells rained down over several square miles. The event was captured on film (a US cameraman at Gela was taking a photo of the beachhead just as the *Robert Rowan* exploded).

That night the Italian and Luftwaffe bombers attacked for more than an hour using parachute flares for illumination and the destroyer USS *Tilman* was slightly damaged by a near miss. In the British sector, the destroyer HMS *Eskimo* was badly damaged by a German bomb.[33]

After the first days of the invasion the Axis attacks tapered off as the Allied air forces rapidly put several captured airfields near Catania into operation and immediately shifted fighter units to

The Germans had deployed a revolutionary new weapon to the theater . . . The new weapon was the precision-guided munition

The HS 293 would actually glide towards the target with the bombardier steering with a joystick and radio guidance for the control surfaces. Once a target was clearly sighted, the bombardier would ignite a rocket engine that would propel the bomb and its 700-pound warhead into some unfortunate ship at almost 500 miles per hour

The first days of the Allied landing at Sicily was last time the Axis air forces were able to have a fairly free hand in the air due to the thin Allied air cover. It was the last opportunity for the Germans to use their most lethal anti-ship weapon, the now-obsolete Ju 87 Stukas, in daylight operations. However, even in an all-out campaign against Allied shipping, the Luftwaffe and Regia Aeronautica were not able to accomplish much. The Allied loss of 12 ships to Axis air attacks did not hinder the landing of over 100,000 troops nor their vehicles and supplies on the shores of Sicily.[35] The massive Allied air campaign against Axis airfields in June had cost the Germans and Italians over 200 destroyed aircraft and over 100 damaged.[36] The systematic Allied air superiority campaign against Axis airfields played the primary role in minimizing Axis airpower over Sicily.

The air battle over Sicily was also the last gasp of the rapidly expiring Italian Air Force. As the Germans expected, the Italian bomber force proved worthless and Italian bomber raids sank no ships and caused minimal damage. The Italian torpedo bombers did somewhat better, sinking one ship and damaging the British carrier HMS *Indomitable* on 16 July, forcing the ship to steam to Gibraltar for repairs. The Italians indeed did their best as loyal German allies. The Regia Aeronautica coordinated operations with the Germans and pressed their attacks aggressively. But the Italians didn't have much to fight with. The Italian 4th Fighter Wing that flew in the Sicilian campaign had a strength of 133 Mc 205 and Mc 202 fighters on the books but only 49 operational planes. Italian air operations

Sicily. Once RAF and AAF fighters were based in Sicily they quickly won air superiority over the whole island and made it far too dangerous for the Luftwaffe or Regia Aeronautica to operate in daylight. In the meantime, before the Allied air units were established ashore, the Luftwaffe kept up the attacks. On 13 July the Liberty ship *Timothy Pickering* was sunk and on the 17th the Liberty ship *William Coleman* was badly damaged as well as the HMS *Queen Emma*.[34]

SOUTHERN ITALY, 1944
ALLIED INVASION OF ITALY AND
OPERATIONS TO 25 SEPTEMBER 1943
PLANNED GERMAN DELAYING POSITIONS

included escorting the Luftwaffe's Stukas to the target and from 11-14 July the Italian fighters tangled with the AAF's P-38s and the RAF's Spitfires over the invasion beaches.[37] After a few days, however, the Italian Air Force was literally fought out, suffering from attrition and constant attacks on their airfields. By mid-July 1943 the Regia Aeronautica disappeared from the war as a cohesive force.

The lack of accurate intelligence remained a problem for the German commander and staffs. The reports on Allied losses sent to von Richthofen by the air units were wildly inaccurate. Apparently every near hit was counted as a sinking. With many of the attacks at night, air units simply estimated the damage inflicted on the Allied fleet. On 10 July, von Richthofen estimated that 100,000 tons of shipping had been sunk as well as a "large number of landing boats".[38] On 11 July Luftwaffe units reported five to six large ships sunk along with many landing boats. By the end of the second

day of the operation the Axis estimated that they had sunk or disabled 350,000 tons of Allied shipping.[39] On 12 July another 100,000 tons of shipping was reported as sunk or heavily damaged.[40] Although von Richthofen believed his strategy of attrition against the Allied shipping was working, reality in the form of growing Allied air superiority affected the German campaign plans. At dawn on the 13th a strike by the Ju 88 force suffered a heavy loss when six were shot down. At the same time, a group of Me 110s shipped in from Germany to replace combat losses was destroyed on the ground by an Allied air attack. By the 14th, von Richthofen, still receiving reports of heavy Allied shipping losses, forbade any more large air attacks. Luftwaffe units were ordered to try to slip by Allied air and anti-aircraft cover in small groups to attack the invasion fleet.[41] By 15th, five days after the landing, Kesselring and von Richthofen realized that the invasion was not going to be defeated and Luftflotte 2 started to evacuate Luftwaffe personnel, equipment and aircraft in Sicily.[42]

The thing the Allies had most feared came to pass as Dorniers carrying Fritz X bombs arrived over the fleet

The Luftwaffe continued small attacks through July and August and reported another few hundred thousand tons of Allied shipping lost. However, from mid-July on, the Luftwaffe's priority was to rebuild its force and prepare for the next stage of the war, the expected Allied invasion of southern Italy. In contrast to the massive Allied losses claimed by the Luftwaffe (over 500,000 tons), in the month of July, in fact, the Allies lost only 14 merchant ships (80,000 tons) in the Mediterranean along with two warships (USS *Sentinel* and USS *Maddox*).[43]
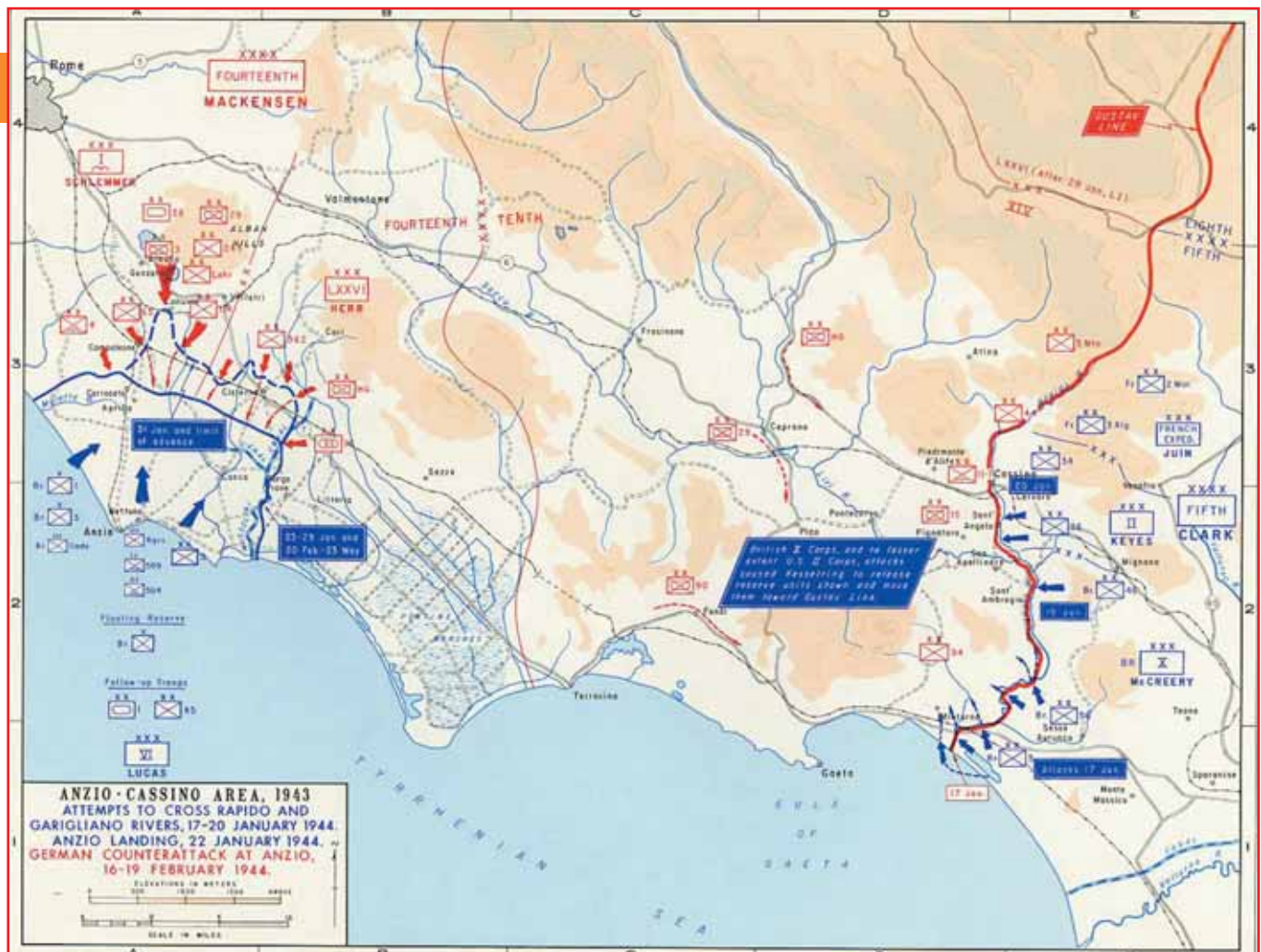
Salerno

The Sicily Campaign ended on 17 August 1943 when the Allies marched into Messina. On that day Kesselring was busy rushing reinforcements to southern Italy and von Richthofen was working frantically to rebuild the units that had been badly battered in Sicily. The Allied failure to follow up the victory in Sicily with an immediate jump across the straits to the Italian mainland was viewed as a godsend by the German commanders. Montgomery, with characteristic caution, waited more than two weeks to land the 8th Army in Calabria on 3 September and the Germans used the time to prepare strong defenses. The Bay of Salerno, with the great port of Naples, was the most obvious target for an Allied landing on the Italian coast although the Germans were still concerned about the possibility of an Allied landing on Sardinia and had to maintain a strong air detachment there. At this time Luftflotte 2 had seven bomber groups based in the Foggia area and another two at the southern Italian base at Viterbo. Three bomber groups (I KG 26, III KG 26 and III KG 100) were stationed in southern France, ready to stage south to support Luftwaffe operations against an Allied landing. Although the unit strength of each bomber group was supposed to be 40 aircraft, some of the groups, especially KG 26 and KG 100, had taken heavy losses in Sicily and the heavy attacks on the Foggia and Viterbo airfields continually cost the Germans aircraft destroyed on the ground. In early September 1943 most of the bomber groups were at half strength or less, giving the Luftwaffe fewer than 200 bombers for the whole theater. As the Allies prepared to attack Salerno, the Luftwaffe prepared to withdraw its bombers to airfields in the far north of Italy, in Piedmont, Bergamo and Piacenza, in order to make them less vulnerable to

Allied attack.[44] The fighter, light bomber and fighter-bomber units were dispersed to airfields in Calabria and Apuleia within range of any probable Allied landing sites. After the losses in Sicily, the fighters and attack units were also weak, operating at half strength or less.

For the Luftwaffe, Salerno would be a tougher air campaign than Sicily as the British and Americans had captured and repaired numerous airfields in Sicily and, although flying at long range, were in a better position to keep a strong air cap over the beachhead than in the first days of the Sicily landing. The Luftwaffe would need new tactics and weapons to have a chance of inflicting major damage upon the Allied fleet. Indeed, the Germans had deployed a revolutionary new weapon to the theater that gave them the hope of turning back the expected Allied invasion of southern Italy. The new weapon was the precision-guided munition, a bomb that could be dropped at high altitude, steered in flight by a bombardier with radio control and could hit a precise target, such as an Allied ship, with devastating effect. In tests the new bombs had proven to be ten times more accurate than any conventional bombs dropped at high altitude. The campaign at Salerno would be the first major test of the precision bomb in warfare.

The Luftwaffe had, in fact, developed two different models of precision bombs. The first was the Fritz X, a 3,000 lb armor-piercing bomb designed with a large tail with controllable surfaces. The Fritz X would be dropped at approximately 22,000 feet in a trajectory that would bring it close to the target. A flare in the bomb's tail gave the position to the bombardier, who then used a simple joystick to manipulate the radio-controlled tail surfaces to steer the bomb to the target. Because it was an armor-piercing bomb, the Fritz X was intended for use against Allied warships. The second bomb was the Henschel Hs 293 and resembled a powered glider more than a conventional bomb. The Hs 293 could be dropped from high or medium altitudes and the bombardier was able to track it by a flare in the tail, as with the Fritz X. The HS 293 would actually glide towards the target with the bombardier steering with a joystick and radio guidance for the control surfaces. Once a target was clearly sighted, the bombardier would ignite a rocket engine that would propel the bomb and its

ANZIO - CASSINO AREA, 1943
ATTEMPTS TO CROSS RAPIDO AND
GARIGLIANO RIVERS, 17-20 JANUARY 1944.
ANZIO LANDING, 22 JANUARY 1944.
GERMAN COUNTERATTACK AT ANZIO,
16-19 FEBRUARY 1944.

700-pound warhead into some unfortunate ship at almost 500 miles per hour. The latter bomb was intended primarily to destroy soft-skinned merchant vessels and transports.

In September 1943 two bomber groups of Bomber Wing 100 (KG 100), each with twenty planes, had been trained and equipped to drop the Fritz X and Hs 293. Both groups employed Dornier Do 217 bombers and KG 100 had long been considered to be an elite bomber unit and used consistently by the Luftwaffe to employ new equipment and techniques. In 1940 KG 100 had been the premier unit in the Luftwaffe for long-range navigation and bombing and had been the first air force unit to be designated as a 'pathfinder' force for other bombers. Because of the more complex nature of the radio-guided bombs, the aircrew of KG 100 were a carefully selected and trained group. In dropping the Fritz X, for example, the pilot had to pull up and fly as slowly as possible after dropping the bomb in order to allow the bombardier to acquire the bomb and the target. Moreover, the

pilot had to fly straight and release the bomb within a five-degree cone. Employing such a weapon required precise flying far above the standard coming out of the German pilot schools in 1943. The Hs 293 was considerably easier to employ, without the same requirements for staying on a direct course.[45]

On 8-9 September 1943 it must have seemed to the Wehrmacht in Italy as if everything was happening at once. In the late afternoon of 8 September a German reconnaissance plane spotted a vast Allied convoy north of Malta heading east for Salerno. A landing at Salerno was expected within 12 hours and the German forces were alerted.[46] On the same day, the Italian surrender, which had been secretly negotiated and signed the week before, was announced. At the same time that they had to prepare to repel an Allied invasion, the German forces also had to immediately seize control of all Italy and disarm the Italian armed forces. However, the Germans had also been quietly planning for this eventuality since the Spring and had its forces

All the Luftwaffe forces in Italy were ordered into the Anzio battle. In von Richthofen's words, "We couldn't have done more"

in position of execute 'Operation Axis', the plan to secure Italy for the German Reich. The selection of the code name for the operation suggests that Field Marshal Kesselring had a humorous streak in his nature.

Of course, things can always get worse, and they did. That night the USAAF launched a big raid of 120 heavy bombers on the German army and Luftwaffe headquarters at Frascati. The outside buildings were all leveled and Kesselring almost killed in the raid. Of the 1,000 personnel at the army and Luftwaffe headquarters about 80 were killed with many more wounded. The German theater headquarters communications were shut down. However, the Germans were fairly lucky that day. Most of the headquarters was located underground in deep tunnels and caves and remained unscathed by the attack. In a remarkable show of competence, the Luftwaffe's signal engineers restored full communications in only six hours.[47] On the morning of the 9th, von Richthofen was able to put his portion of Operation Axis into effect.

The first mission of the German bomber force was to see that the Italian navy did not end up in Allied hands. A large part of the Italian fleet had sailed for Allied ports in North Africa during the night and was spotted off the coast of Corsica. Aircraft of KG 100 attacked their allies of a day before and made two direct hits with Fritz X bombs on the Battleship *Roma*, the pride of the Italian fleet. Two near misses added to the damage. The Roma sunk almost immediately, taking almost all the officers and crew with her. It was a pretty impressive debut for the PGM in use against a major warship.[48] Several smaller Italian ships were sunk or damaged by German air attacks on the 9th as the Italian fleet raced to safe Allied havens.[49]

A force of 55,000 American and British ground troops supported by 586 Allied warships, transports and landing ships fought their way ashore in the Bay of Salerno at dawn on 9 September.[50] With the bombers busy attacking the Italian fleet, the first Luftwaffe attacks were made by Fliegerkorps II's Me 109 fighters and the Fw 190 fighter-bombers of the attack groups. The Me 109s employed a new weapon in the form of 21cm rocket launchers mounted on the wings.

The Fw 190s carried 500 kg bombs (1,100 lb). With fairly strong Allied fighter cover, with additional air cover provided by five British carriers, the only effective tactic for the Germans was to slip in at high speed, fire the rockets and drop the bombs at the first likely targets and run away at high speed. As in Sicily, the damage reported by the Luftwaffe was wildly exaggerated. While von Richthofen was told that two Allied cruisers had been sunk and 150,000 tons of Allied shipping had been taken out of action, in reality the Luftwaffe's fighter-bombers had only crippled one LST and sunk another.[51] Some small landing craft were sunk or badly damaged as well, the 21 cm rockets actually proving to be an effective weapon against small vessels.

In any case, 9 September 1943 was perhaps the busiest day for the Luftwaffe in Italy as it survived Allied air attacks, seized control of all the Italian Air Force installations and flak units, bombed the fleeing Italian navy and attacked the Allied landing. Despite the events of the Salerno landing, von Richthofen's personal diary hardly mentioned the Allied attack while containing a detailed account of all the measures that had to be taken to secure the German lines of communication in Italy. It's a testament to the Luftwaffe's competence and von Richthofen's capable leadership that so many simultaneous crises could be handled. .

It would be three days before Luftflotte two bombers were ready to conduct major strikes against the Allied beachheads. In the meantime, General Fink's Fliegerkorps II fighters and fighter-bombers made a series of low level hit and run raids, which mostly damaged Allied light craft. Most of the German bombers were relegated to night raids on the Allied fleet because there were too few fighters to escort them in daylight attacks. The three battered Luftwaffe fighter groups still in southern Italy could only mass enough planes to escort the Do 217s of KG 100 on daylight raids. One of the Luftwaffe's most effective anti-shipping forces, the small group of torpedo bombers, could not be used in daylight due to the paucity of escort.[52]

On the 11th the thing the Allies had most feared came to pass as Dorniers carrying Fritz X bombs arrived over the fleet. The cruiser USS *Savannah* was badly damaged by a glide bomb. Two days

later the cruiser USS *Philadelphia* had a narrow escape as it maneuvered frantically to avoid two guided bombs. The cruiser HMS *Uganda* was not so lucky. It was hit by a guided bomb and crippled on the 13th and attacked again while it was being towed away on the 14th.[53] On the 13th the British hospital ship *Newfoundland* took a direct hit and sank. On the 14th the merchant ship SS *Bushrod Washington* was hit by a guided bomb, probably a Hs 293, and sunk. The next day KG 100 Dorniers struck the *SS James Marshall* with a guided bomb. The ship was wrecked but later salvaged. On the 16th, a week after the landing, KG 100 got their biggest prize of the campaign. The battleship HMS *Warspite*, which provided vital gunfire support for the Allied units engaged in desperate fighting ashore, was hit by two guided bombs and damaged further by two near misses. The *Warspite* was towed to Malta, repaired and eventually returned to service, but would be out of action for several months.[54]

It was basically a pretty auspicious beginning for the PGM in warfare. The small Luftwaffe force equipped with the new weapons had, in a week, disabled a battleship, two cruisers and had sunk or wrecked three other vessels. It still was not enough to seriously hinder the Allied landing and buildup. The Luftwaffe, however, had a different picture. The Germans believed that dozens of Allied warships and merchant vessels had been sunk or disabled at Salerno (400,000 tons by the 18th) when the reality was far different. In the month of September 1943 the Allies lost 52,000 tons of merchant shipping in the Mediterranean.[55] Still, by mid September it was clear that the Allies were successfully ashore and would continue to advance up the Italian peninsula.

The combat losses to the Luftwaffe during the Salerno battle were reported as low. Still, there was a steady attrition from combat and Allied attacks on German airfields and by mid-September the Luftwaffe bomber force was described simply as being 'fought out'.[56] Since the southern Italian bases were in the path of the Allied ground advance, they were evacuated on 20 September and the bomber units sent to northern Italy. The fighters and attack groups who had borne the brunt of the battle at Salerno were pulled out for the relative safety of Central Italy. The Luftwaffe needed time to

reorganize, retrain and rebuilt its units after Sicily and Salerno. Von Richthofen, who was being treated for tuberculosis, started five weeks of convalescent leave in a northern Italian sanitarium. Kesselring, who didn't like von Richthofen but still valued his competence, told Berlin to keep von Richthofen in the theater despite health problems because he needed the Luftwaffe commander to rebuild his force for the battles expected in the Spring.

The Luftwaffe reorganizes
Of course, Hitler's promise of massive reinforcements to von Richthofen made in the Summer proved false. After the failure to stop the British and American landings at Salerno, the Luftwaffe in Italy was radically reorganized and reduced to a fraction of its former strength. The situation in Italy was at least stable and the demands of the other fronts and defense of Germany were too pressing for Berlin to ignore. The Luftwaffe's command setup was also reduced and reorganized. Fliegerkorps II under General Bulowius was detached and sent to France. Luftflotte 2's bomber command was eliminated. KG 1 was sent to Germany to be reequipped with the He 177. One bomber group (II KG 77) was sent to Germany to be trained as a torpedo unit and another group (II/LG 1) was sent to Greece but was available to support operations in Italy. Only three Ju 88 bomber groups with about 100 planes were retained in Italy (I and II KG 76 were stationed at Aviano) and the other bomber groups were sent to France to take part in the planned bomber offensive against England. Sardinia was evacuated with its air detachment brought to northern Italy. Three fighter groups (I JG 53, I JG 77, I JG 4) a fighter-bomber wing of two groups (I SG 4, II SG 4) and some reconnaissance squadrons were retained in the theater and stationed in northern and central Italy.[57] By late Fall 1943 the Luftflotte 2 had fewer than 300 operational combat planes available for operations in Italy.

However, even this reduced force was still capable of inflicting serious damage on the Allies. During November 1943 the Germans noted the weakness of the Allied air defenses at the port of Bari in southern Italy, one of the Allies' most important supply bases. Using reconnaissance planes flying from the Albanian Luftwaffe command as well as from Luftflotte 2, Bari and its shipping was kept

under careful observation for two weeks.[58] In a raid meticulously planned by von Richthofen and his staff, a force of 105 Ju 88s, virtually every bomber in the Italian theater, attacked Bari harbour the night of 2-3 December. The Luftwaffe's tactics were superb. Most bombers first flew out to sea and dropped to low altitude to avoid Allied radar observation. Pathfinder bombers dropped 'windows' (aluminum foil strips) to jam the Allied air defense radars while the bombers systematically worked the port over by the light of parachute flares. The small port was crammed with shipping and the Ju 88s were lucky enough to hit an ammunition ship and a tanker. The ammunition ship blew up and rained explosives on the other vessels as the fire from the tanker's burning oil spread. In a short time 16 Allied merchant vessels were destroyed and eight others damaged. The port facilities were heavily damaged and knocked out of operation for three weeks. Naval historian Samuel Morison described it as "the most destructive air attack since Pearl Harbor".[59] Yet the Bari raid was not to be repeated, Allied anti-aircraft and night fighter defenses at the major ports, such as Naples, were simply too strong for the Luftwaffe's small bomber force.

Anzio
The Luftwaffe settled into a routine of small night harassment raids against Allied logistics during the Winter of 1943-44. By January 1944 things were so quiet that Field Marshal von Richthofen took a trip to the Po Valley to hunt ducks with some of his staff. While von Richthofen was reducing the bird population of northern Italy an Allied invasion fleet of 370 ships and landing craft made the 150 mile jump from Naples to Anzio on 22 January 1944 and landed a corps of 50,000 American and British troops on the coast near Rome with virtually no opposition. In contrast to Sicily and Salerno, the landing came as a complete surprise to the Germans. The Luftwaffe's air reconnaissance force was, by this time, unable to provide more than the sketchiest picture of Allied shipping movements and convoys. However, the Germans had noted Anzio as a possible landing site and had enough reserves near Rome to throw against the invaders and slow the Allied advance.

Bad weather over northern Italy prevented von Richthofen from flying immediately south to direct operations against the landing from his headquarters near Rome.[60] Many German aircraft in Northern Italy were grounded by bad weather for the first days of the battle and the Luftwaffe's premier anti-shipping force, the guided bomb groups of KG 100, were dispersed around small airfields in southern France to evade the Allied bomber campaign against the larger German airfields. It took days to assemble the units and stage them south to airfields in Italy closer to the action. The Luftwaffe's fighter and attack groups in Italy had been badly weakened by constant attacks on their airfields in the three days before the Anzio landing and needed time to sort themselves out and move to airfields close to the landing site. When he arrived at his headquarters late on the evening of the 22nd, von Richthofen gave the orders to deploy available air units to oppose the landing as well as ordering 40 Luftwaffe flak batteries to the front lines to engage the Allied ground troops. Virtually all the Luftwaffe forces in Italy were ordered into the Anzio battle. In von Richthofen's words, "We couldn't have done more".[61]

In the meantime, Luftflotte 2's only response to the Anzio landing on the 22nd were a few fighters stationed near Rome that evaded the Allied air cover and strafed the beach. Some fighter-bombers also attacked the shipping. For the next two days, poor weather hindered the Luftwaffe's deployment of forces to meet the Allied landing.[62] On the night of the 23rd the Luftwaffe drew its first blood when a destroyer HMS *Janus* was hit by a German air-dropped torpedo and sunk and the destroyer HMS *Jervis* was damaged by a bomb.[63] The first large attacks came on the 24th. Fifteen fighter-bombers of Schlachtgeschwader 4 attacked the Allied fleet in the afternoon while another 43 aircraft attacked at dusk and 53 bombers attacked at night. A 500 kg bomb from a fighter-bomber hit the destroyer USS *Plunkett* and caused heavy damage and casualties. That night the hospital ship *St. David* took a hit from a guided bomb and sank. The destroyer USS *Mayo* hit a mine and was badly damaged.[64] Through the campaign, the German bombers also dropped mines in the shipping lanes at night and between January and April 1944 more than 600 mines were dropped by the Luftwaffe near Anzio.[65]

As the fighting intensified von Richthofen was often at the front to observe the air attacks of his

unit from an observation post overlooking the bay. General Ritter von Pohl, commander of all the flak units in Italy was appointed as the 'close battle commander' of Luftflotte 2 with the responsibility of commanding all the flak and air units in the Anzio sector.[66] Within a few days, the German air campaign assumed a pattern. Groups of 30-50 fighters and fighter-bombers would attack the shipping and beachhead once or twice a day while the bombers, especially the KG 100 units with the guided bombs, would attack at night. The German bombers normally employed 'Window' against the Allied air defenses, which proved effective in jamming the Allied air defense radars. The Allied commanders noted that Anzio saw the toughest German air opposition in the whole Mediterranean campaign. A dusk raid of FW 190s on the 26th damaged a LST, 7 light craft, two merchant ships and a tug.[67] On the night of 29 January KG 100 had its best night of the campaign when its guided bombs sank the cruiser HMS *Spartan* and the Liberty Ship SS *Samuel Huntington*.[68] One factor that made the German night attacks so effective was the Luftwaffe's large radar installation at Cape Circe that overlooked the Anzio beachhead. Despite many attempts by the Allies to destroy the site, the radar kept operating throughout the campaign and gave the Luftwaffe a clear picture of the Allied air activity over the sector.

Any air attack can be terrifying, but it is especially tough on sailors because there is no place to hide on a ship. The sailors that faced the nightly Ju 88 raids with conventional bombs took them fairly calmly. While the conventional bombers made a lot of noise, they rarely hit anything. This was not so in the case of the attacks with the Fritz X and Hs 293. Because the tail flare in the bombs and the rocket engine of the Hs 293 were highly visible at night, anyone under attack could see the bomb heading straight for the target. This leant a surreal quality to the raids by KG 100 on the Allied fleets at Anzio and Salerno. An American Army sergeant at Anzio watched the attack that sank the cruiser HMS *Spartan* (probably a Hs 293) and described the "bright red spot (the flare) that seemed to hang in the sky for several seconds . . . when the target was located it came down like a comet in a wide sweeping arc". The explosion was described as 'tremendous'.[69] After the initial landing supplies were brought in by LSTs and Liberty Ships that unloaded as quickly as possible and sailed away. Such ships might be unlucky enough to experience one such attack. However, the sailors

A 25% hit rate for bombs does not seem much by modern standards but it represented a quantum leap in the capability of airpower in 1943-1944

A DO 217 carrying the Hs 293 guided bomb

manning warships like the HMS *Spartan* that stayed on station to provide gunfire support to the troops onshore had to suffer through several such attacks. If the PGMs of 1943-44 were not as accurate as their modern descendents but, like the Kamikazes in the Pacific, they certainly had a demoralizing effect on their targets. The German campaign against the beachhead reached a crescendo in mid February when Kesselring mounted a major ground offensive to try to destroy the Allied beachhead. Massed Luftwaffe fighter-bombers provided close air support for the German panzer units advancing on the Allies and bombers struck Allied depots and logistics. The Germans flew more than 150 sorties on 16, 17 and 19 February in a desperate attempt to break the Allied defense.[70] The all-out effort failed. The AAF and RAF were able to fly hundreds of sorties against the German attackers as well as against the Luftwaffe. Between 16 and 19 February the Allies claimed 26 German aircraft shot down at Anzio.[71] By 22 February it was clear to Kesselring that his forces were not going to overrun the Allied beachhead at Anzio. At the same time, the Luftwaffe was clearly exhausted by its effort and steady attrition. Night bomber attacks continued with a Liberty Ship and LCT hit by guided bombs and sunk on 15 February and the destroyer HMS *Inglefield* sunk by a guided bomb on 25 February with heavy loss.[72] However, after this time the Luftwaffe effort petered out and assumed the nature of minor harassment raids.

By mid-Spring 1944 Berlin understood that there was little the Luftwaffe could do in the Italian theater and all the bombers were withdrawn from the theater to reinforce the expected battle in France. By June Luftflotte 2 was left with a force of less than 200 combat aircraft on paper, with about 100 fighter planes and fighter-bombers operational. That month the Luftflotte was officially abolished and the Luftwaffe force in Italy downgraded to the status of a special command 'The German Air Force in Italy's. For the rest of the war, the major Luftwaffe opposition to the Allies in Italy would be its flak brigades. Von Richthofen, a field marshal, remained in command of a force more suitable for a major general. Perhaps it was Hitler and Goering's way of punishing von Richthofen for the failure to hold the Allies in Italy. In any case, relegating a brilliant commander and tactician like von

Richthofen to a minor command on what had become a backwater front when there were major air battles to come over Germany and on the Western front is typical of the petty manner in which the Third Reich treated its top soldiers in the last two years of the war.

Conclusion

The Luftwaffe's campaign in Italy in 1943-1944 is a snapshot of a force in rapid decline. Given the enormous Allied air superiority over the Germans, its surprising that Luftflotte 2 did as well as it did. Von Richthofen and gifted subordinates such as General von Pohl, General Bulowius, and Colonel Pelz developed some fairly effective tactics against the Allied invasion fleets and inflicted moderate damage on the Allies against great odds. Frankly, it is hard to see how the Luftwaffe could have done better given its strategic situation and the force disparity.

The British-American commanders wisely chose the most effective strategy for dealing with the Luftwaffe threat to the invasion fleets at Sicily, Salerno and Anzio. The German airfields throughout the Italian theater were attacked so constantly and effectively (with a lot of help from Ultra intelligence) that the battered Luftwaffe combat units were never able to recover from their losses. Attrition was constant. No sooner would replacement aircraft arrive from Germany, sometimes in batches of 30 or more, than they would be blown to bits in an Allied bomber raid. The German records are full of such stories. Moreover, the heavy Allied attacks on the forward German airfields forced the Luftwaffe to pull their units away from the front and to fly at extreme range for much of the campaign. The sound Allied air strategy forced the Luftwaffe to fight inefficiently.

Attrition of aircraft was especially heavy in the Italian theater.[73] In addition, pilot attrition had become a crisis for the Luftwaffe by the time of Sicily. Although careful tactics kept pilot losses fairly low in Italy, the well-trained aircrew of the early war years could not be easily replaced. To make tactics effective one also needs good pilots. Yet, by 1943, the failure of the Luftwaffe to adequately expand its flight schools early in the war was evident in the state of pilot proficiency. In 1942 pilot attrition forced the Luftwaffe to drastically reduce the time and flight hours for new pilots. By 1943 new bomber and reconnaissance pilots were arriving at the front

with scarcely more than 100 hours total flight time. This meant that the operational commanders in the Mediterranean couldn't simply give their squadron commanders mission orders. Flights had to be carefully planned to ensure that inexperienced pilots were allocated more fuel and were shepherded by more experienced pilots. Luftwaffe pilots were generally less capable in night operations, although the Allied air superiority forced the Luftwaffe to operate largely at night.

An example of the failure of the Luftwaffe's Training Command to meet the needs of the war is seen in the two groups of KG 100 that specialized in dropping the Fritz X and Hs 293 guided bombs. Both were cranky weapons to use. As with any new and complex weapon there were a lot of bugs in the system and the aircrew needed a lot of extra training to use the guided bombs effectively. Moreover, only very competent pilots and aircrew could be expected to accurately drop the bombs and hit the targets. Because of the deficiencies in the Luftwaffe training system and the acute shortage of experienced bomber crews by 1943, there were never more than 40 airplane crews that were fully qualified to employ the guided bombs. That alone was a godsend for the Allied forces that had to face the German attacks. The bombs weren't that hard to produce nor were there any shortage of Do 217 bombers. The whole programme was limited by personnel shortages.

Another issue that limited the effectiveness of the Luftwaffe's precision bomb attacks was the failure to provide enough battle-experienced pilots and commanders to KG 100. While the pilots and bombardiers of the precision bomber groups were the top graduates of the Luftwaffe training programme, only a few of the squadron and flight leaders in KG 100 had considerable battle experience. Even a well-trained pilot or flight leader can become unnerved and confused in his first experience in combat. Several of the attacks made by KG 100 at Salerno and Anzio went off course and executed poor attack runs due to the inexperience of the flight and aircraft commanders. Another problem for KG 100 was the Allied flak. Due to the German use of 'window' against the Allied radars, Allied defensive fire tended to be unguided barrage fire — spectacular to view but not especially dangerous. If the Luftwaffe had

assigned some more 'Old Hares' (combat-experienced bomber pilots) to KG 100 the attacks against the Allied shipping would likely have been pressed much more aggressively through the relatively ineffective Allied night air defenses. Instead, more than a fifth of all the Fritz and Henschel bombs dropped in combat were dropped in emergency release mode as the bombers broke off combat. Many other bombs were dropped in such a haphazard fashion that the crew was unable to track the fall of the bomb.[74]

Although many pundits and historians touted the First Gulf War as 'the first precision war' few remember that modern precision bombing was born in the Italian campaign. The Fritz X and Hs 293 were true PGMs and mark the beginning of a revolution in aerial warfare that culminated in the air campaigns of 1991 and 2003. Before the Luftwaffe's radio-controlled bombs the only precision weapon of an air force was the dive-bomber, and dive-bombers were highly vulnerable to enemy fighters and light anti-aircraft. Moreover, dive bombers couldn't operate effectively at night and none of the World War II dive bombers could carry the large ship-busting 3,000 lb Fritz X. In contrast, the Luftwaffe's radio-controlled bombs were true standoff weapons, designed to be released at high altitude, outside the range of light anti-aircraft, and sometimes miles from the target. The survivability of the PGM carrying aircraft was notably increased. In addition, the Fritz X and Hs 293 could be used effectively at night. Of the 500 guided bombs dropped by KG 100 in 1943 and 1944 28% malfunctioned, usually due to electronic or guidance problems. Twenty percent of the bombs were dropped in emergency release, sometimes when the aircrew fear Allied night fighters. However, of the over 300 bombs dropped in combat, about a quarter of them either hit the target directly or landed close enough to inflict damage. Indeed, the damage inflicted by a few guided bomb raids on the Allied fleet in the Italian theater was pretty impressive. In opposing the Allied landings in Italy the Luftwaffe's two small guided bomb units sank or disabled two battleships, sank one cruiser and disabled two, sank or crippled two destroyers and sank a further seven merchant ships and transports and damaged at least 17 more. A 25% hit rate for bombs does not seem much by modern standards but it

represented a quantum leap in the capability of airpower in 1943-1944.[75]

Notes

[1] General Paul Deichmann, ed. *Die deutsche Luftwaffe in Italien*, Monograph, April 1956. In the USAF HRA Doc. K113.310-8 1943-1945 Kapitel 1 pp. 18-22

[2] ibid p. 25

[3] Deichmann Part II p. 3

[4] Deichmann Part II p. 3

[5] Deichmann Part II p. 5

[6] Deichmann Part II p. 5

[7] Deichmann Part II p. 7

[8] ibid p. 36

[9] Von Richthofen Diary 12 July 1943. Copy of the Diary from the Von Richthofen family.

[10] ibid

[11] In his diary von Richthofen expresses continual distrust of the Italian High Command and its intentions. General Paul Deichmann, in his monograph on the Italian campaign, often describes the Italians as doing their best.

[12] Deichmann pp. 37-40

[13] Deichmann pp. 40-41

[14] Deichmann p. 53

[15] ibid.

[16] Deichmann part II p. 13

[17] Deichmann Part II p. 26

[18] See Bundesarchiv/Militaerarchiv BA/MA Doc RL/2/II/305 'Lageberichte Luftflotte II' for the surviving reconnaissance reports of April-June 1943. The Germans only occasionally got reconnaissance planes over the major Allied ports in North Africa such as Algiers, Oran, Bizerte, Bone tried to observe major Allied ports with

[19] Deichmann, see Chapter 2 pp. 1-3 and Part III pp. 45-47

[20] Von Richthofen Diary, Entry of 9 July 43

[21] ibid

[22] Von Richthofen Diary entry of 20 June 1943

[23] Samuel Eliot Morison, *History of United States Naval Operations in World War II: Sicily, Salerno, Anzio, January 1943-June 1944*, New York: Little Brown and Co., 1954 p. 69

[24] www.naval-history.net/WW2194306.htm World War 2- 1943, Sicily, Salerno, Italy p. 4

[25] Morison p. 85

[26] ibid p. 88

[27] ibid pp. 107-108

[28] ibid p. 164

[29] USAF HRA Doc SQ FI 307-HI, *307th Fighter Squadron Outline History* to 31 Dec 1943

[30] ibid

[31] Brigadier General C.J. Molony, *The Mediterranean and Middle East* Vol. V, London HMSO 1973 p. 66

[32] Morison p 120

[33] ibid p. 158

[34] ibid pp 164-165

[35] Richard G. Davis, *Carl A. Spaatz and the Air War in Europe,* Washington; Center for Air Force History, 1993, p. 241. The Allied planners had expected to lose as many as 300 ships to air attack.

[36] .Molony p. 48

[37] Antonio Duma, *Quelli Del Cavallino Rampante: Storia Del 4 Stormo Caccia,* Rome: Edizioni Dell'Ateneo, 1980 pp. 347-349

[38] Von Richthofen diary 10 July 43

[39] ibid entry of 11 July

[40] ibid entry of 12 July.

[41] Ibid entries of 13 and 14 July.

[42] Ibid entry of 15 July 43

[43] See WWW. Naval-history and David Brown, *Warship Losses of World War II*, Annapolis: Naval Institute Press, 1990 pp. 87-88

[44] Deichmann, Part III pp. 71-72

[45] Deichmann part II p. 46 On the difficulties in using the Fritz X and Hs 293 see A.I. 2 G Report 1813 "German difficulties in Guiding the Remote-Controlled Glider Bomb", Oct. 1945 in USAF HRA Doc. 170.2278B

[46] Deichmann part III p. 80

[47] Deichmann Part III p. 85

[48] The Luftwaffe employed a few Fritz X and Henschel PGMs against Allied merchant shipping in the Bay of Biscay on 25 August and in the Mediterranean on 29 August. The first use of the weapons against armored warships was on 9 September. See William Green, *Warplanes of the Third Reich*, New York; Galahad Books, 1970, p. 154.

[49] Morison p 244, see also Deichmann Part III p. 86

[50] WWW. Naval-history, Salerno p. 11

[51] Von Richthofen Diary 9 Sept. 43

[52] Deichmann Part III p. 83

[53] Morison pp. 290-292.

[54] Morison pp. 296-300

[55] WWW. Naval-history, Salerno, p. 11

[56] Deichmann Part III pp 88-89

[57] Deichmann Part III p. 89-93

[58] See BA/MA Doc RL/2/II 304, Intelligence Reports Luftflotte 2 November-December 1943 and BA/MA/2/II/369 Luftflotte 2 Lageberichte Nov-Dec 1943

[59] Morison p. 319, 322

[60] Von Richthofen Diary, 22 January 1944

[61] ibid

[62] ibid

[63] Morison p. 344

[64] ibid pp. 345-346

[65] Deichmann Part IV p. 110

[66] ibid p. 105

[67] Morison p. 349

[68] ibid p. 355

[69] History of the 3rd AAA Air Support Control Squadron. P. 3 in USAF HRA Doc SQ-A-Sup-Cont-3-HI, Feb 1944-Feb 1946.

[70] USAF HRA Doc 650.430-3, HQ 12th AF, A-2 Section, *Enemy Air Activity Over Anzio Beachhead,* Jan- April 1944.

[71] ibid

[72] Morison pp. 363-364

[73] Attrition in the Mediterranean was far worse than on the Eastern Front. With a fighter force of 296 planes in the Med in September-December 1943, the Luftwaffe lost almost 400 planes. In Russia, during the same period, the Luftwaffe had almost 500 fighters, but lost fewer airplanes. Most of the attrition, About 70%, was due to aircraft lost on the ground to Allied raids. At each stage of the Allied advance, the Luftwaffe abandoned dozens of aircraft, sometimes only slightly damaged, on airfields in Sicily, Southern Italy and Sardinia. The weak Luftwaffe forward maintenance structure could not cope with the number of aircraft repairs required.

[74] Interview with Herr Ulf Balke, historian at the Bundesarchiv/Militärarchiv Freiburg, 14 May, 2003. Herr Balke's father served in KG100 and he is writing a book on that unit.

[75] In 1945 KG 100 did a careful study of its experience in using the guided bombs. See translation of Air Force Research Station Karlshagen, "Considerations on the Employment of New Technical Special Weapons" 18 Feb 1945 in USAF HRA Doc. 170.2278B

The technology, newly available to the RAF in the form of the Tornado Infra-Red Reconnaissance System (TIRRS) on the Tornado GR1a, meant that night imaging missions could be flown

An image of an aircraft taken at night, using the TIRRS system

The paper begins with an analysis of recent conflict from the ISR perspective, taking the last decade as a recent and relevant time period, examining the Gulf War (1991), Bosnia (1995) and Kosovo (1999) as convenient episodes at approximately five-year intervals. The analysis will attempt to show the changes and improvements in ISR capability and draw out what is feasible and what is not, leading to the position we are today. It will also show what the ISR challenges are for conflict today, how conflict is changing and the consequences for the role and employment of ISR capability.

Having identified what remains challenging, the major discussion will propose potential solutions for maximising the employment of our ISR assets in order to bring significant additional benefit to bear on the battlefield. The editorial constraints and the classification restrictions for this paper preclude in-depth or technical analysis. The discussion will focus on the principal considerations. The paper is constrained in its focus on 'air ISR' capability as it cannot hope to cover all three Services' ISR capabilities, although there is certainly applicability across the joint and combined arena. Any broader

examination would require more detailed research: work is already being undertaken, particularly in the Applied Research Program (ARP). It is hoped that this paper will complement, rather than duplicate, such work.

The Gulf War

This was the first major conflict after the end of the Cold War and inevitably attracted close scrutiny. Many lessons emerged from this unexpected and largely unenvisaged conflict, certainly unlike any expected NATO/Warsaw pact confrontation in Central Europe. Gen Adams, the USAF Deputy Chief of Staff for Plans and Operations at the time, said: "Reconnaissance needs attention. It's a continuing effort to assess how well we're doing every day. Many of our systems are configured for a Soviet-type scenario, and they are not as capable as they might be".[1] Analysis in the Australian Defence Forces Journal added comment on a number of weaknesses including the lack of timely Battle Damage Assessment (BDA).[2] Such detailed target imagery analysis is essential to ensuring that effort is not wasted on unnecessary re-attacks, and that any re-attacks which do prove necessary are

targeted appropriately.[3] Lack of trained BDA analysts was a problem but the operational training of existing analysts also needed improving.[4] Despite such criticism, intelligence and BDA functions did work quite well, but the unexpected pace of the conflict demanded better capabilities. Most aircraft were not fitted with sensor video so that immediate reporting of impact results could provide an element of additional post-strike BDA without recourse to scarce ISR assets.[5]

Reconnaissance System (TIRRS) on the Tornado GR1a, meant that night imaging missions could be flown, albeit at low level only. However, only a few of these aircraft were available to the coalition. As cloud increased, reconnaissance assets were forced to operate at increasingly lower altitudes throughout the war as sensors were not capable of imaging through weather. Furthermore, no tactical assets were available to carry out reconnaissance at night at medium level.[9]

"The ability to maintain the initiative was tied to the ability to undertake reconnaissance and surveillance" . . . The French Mirage F1CR was the only tactical platform with even a limited capability

Reconnaissance assets were scarce. Even more importantly, the ability to manage all of the information collected by them was inadequate.[6] Intelligence gathering assets needed to be better managed to avoid expensive and unnecessary duplication of effort to achieve the right and timely coverage of the appropriate targets.[7]

To match the rapid pace of the war, real time transmission of reconnaissance information was required. So too was high-quality imagery which was capable of being provided at night and in poor weather.[8] The technology, newly available to the RAF in the form of the Tornado Infra-Red

Coalition warfare demands trust, yet intelligence sharing across the Coalition was lacking at tactical, operational and strategic levels. Sharing intelligence demands effective dissemination but this was poor due to an inadequate communications structure. Where sharing did occur, the lack of effective output was exacerbated by an inability to fuse intelligence from cockpit video, tactical reconnaissance aircraft and satellites.[10] Improved abilities to be able to process information quickly, together with improved dissemination capabilities were deemed essential.[11] The employment of smart weapons was seen as highly desirable but such weapons relied on

The Predator offered the ability to conduct ISTAR operations in real time. It was equipped with UHF and Ku-band SATCOM data links so its operators could conduct a degree of immediate analysis and provide near real-time intelligence to the commander

accurate and timely target intelligence, especially of mobile targets, such as the infamous Scuds.[12]

This issue is continued by Gen Norman Schwarzkopf: "The lack of timely reconnaissance imagery is one of the shortfalls of Op Desert Storm".[13] The ability to control air assets and re-target in real-time in order to keep abreast of the fluid battlefield, proved essential: "The ability to maintain the initiative was tied to the ability to undertake reconnaissance and surveillance".[14] J-STARS (deployed as a prototype) did provide some capability to detect critical Iraqi war fighting capability in real or near real time.[15] Another report also adds comment on almost a total lack of data link systems for real time reporting. The French Mirage F1CR was the only tactical platform with even a limited capability.

The lack of intelligence system interoperability, across both strategic and tactical systems was a problem, as it prevented information from being collated more efficiently and then disseminated to commanders.[16] Col Mann relates the lack of timely intelligence to flaws in the "observe, orient, decide, act" (OODA) loop cycle.[17] He relates various C4ISR

activities and processes to each component of the OODA loop and makes the noteworthy point that the OODA cycle is exactly that, a cycle, and therefore only as strong as the weakest link in the cycle. In Desert Storm's case, poor levels of observation lead to weak orientation and, while the Allied OODA loop was quicker and superior to the Iraqi's, it was not nearly as short and quick as Allied commanders would have wished.[18]

The presence of the media also posed problems, in particular the need to balance the release of potentially revealing intelligence with the desire to keep popular support strong through timely and accurate reporting. Management of the media and managing the media's requirements for imagery was also a lesson learned.[19]

Most Gulf War material is consistent in its key themes: the scarcity of assets; the importance of real-time information; an unexpected emphasis on night, all-weather activity; precision-guided munitions and their requirement for precise target locations; the criticality of command, control and decision-making (DM); intelligence dissemination, including to the media and interoperability.In

Bosnia, nearly five years later, had the Gulf lessons been learned, had progress been made, or did the nature of war change, bringing with it new requirements?

Bosnia

The Bosnian theatre of operations was very different to that of the Gulf War. From the relatively flat, Arabian desert environment with relatively clear skies, to the hilly, forested terrain of Bosnia under often low-lying European cloud cover. Bosnian terrain was much less conducive to ISTAR operations and the poorer weather had an equally degrading effect. The ground situation was significantly more challenging given the lack of a clear 'front line' to delineate friendly and enemy forces on the ground and where belligerents were mixed with non-combatants. This made it difficult to discriminate between forces.[20] The Allied forces found themselves having to cope with a shift from traditional targeting and offensive work to a peacekeeping and crisis management role that was more difficult and complex.[21] The target sets could not have been more different to the Gulf as Saddam's large, unconcealed armoured formations had given way to elusive, mobile Serb artillery and infantry units.

Bosnia did provide a testing ground for some new ISR capabilities. The US Predator UAV flew its first operational missions, and it was J-STARS first operational use with the USAF and its first use in the peacekeeping role.[22] The Predator deployed with a high-resolution (1 ft) Synthetic Aperture radar (SAR) sensor allowing it to conduct area imaging from above the weather. It could then fly to lower altitudes to gather more detail from its usual electro-optical/IR sensor.[23] An important factor was that the Predator offered the ability to conduct ISTAR operations in real time. It was equipped with UHF and Ku-band SATCOM data links so its operators could conduct a degree of immediate analysis and provide near real-time intelligence to the commander. The data links also allowed timely BDA to be undertaken, thus enabling and enhancing re-strike decision-making.

However, despite such advances as Predator and SAR, conventional NATO aircraft largely flew the 20,000-plus reconnaissance sorties accomplished during the conflict and there was much that still

could not be achieved. Weather was still a significant problem. In one critical 10-day period, low clouds virtually wiped out all chances of imagery mission success and it was this weather factor that instigated the initial requirement to deploy the J-STARS.[24] With the advent of better weather, sensors were still hampered by the hilly terrain profile, and the thick vegetation that masked military targets.[25] The safety of friendly forces was jeopardised, as vital road and rail routes could not be kept under observation to ensure safety of movement.[26] Fast-jet ISR capability limitations could not be overcome by the use of UAVs either, as bad weather and high winds hampered Predator operations.[27]

The challenge of timely dissemination of imagery had still not been resolved since the Gulf War. Thousands of images were being processed daily, largely still from wet film, as most systems had not yet been upgraded to digital technology. The problem then, was how to get it to the decision makers and end-users. Generally, verbal reports were first transmitted through the intelligence system to the NATO CAOC at Vicenza and Southern Command HQ in Naples. This might then be followed by a video feed of the still image and finally, hard copy image transmission of specific targets.[28] RAF personnel describe how the transmission of a 4 x 3 in image on an A4 sheet took up to one hour via the NATO LOCE system and also how imagery hard-copy prints were hand-couriered to the user from the UK. The task-to-imagery-available cycle was taking in excess of 48 hrs.[29] Training was also still deficient. Imagery analysts were simply 'picture reporting' and unable to offer much in the way of an actual intelligence assessment or, for BDA, a re-attack recommendation based on damage assessed.[30]

Prior to post-strike BDA imaging however, pre-attack reconnaissance had to be conducted, either to search for and find targets or indeed to confirm known targets just prior to a strike. In his RUSI address, Sweetman describes many of the problems, commenting that the risks of hurting or killing civilians, the very people NATO was there to protect, had a huge importance and meant that stringent Rule of Engagement (RoE) were put in place. This drove an attendant to accurately locate and positively identify the target prior to attack.[31]

The reconnaissance of chosen areas to provide the location of previously known and unknown targets is the biggest and highest priority task for ISTAR assets now and in the future

On one occasion, Swedish troops came under mortar attack near Tuzla and requested air support. However, when the RN Sea Harriers dispatched to assist the troops under fire arrived, they could not locate the mortar threat and therefore could not drop any ordnance.[32]

Precision-guided munitions (PGM) were used in significantly greater numbers than in the Gulf War. Some reports suggest over 600 were used during Op Deliberate Force.[33] Their use had a significant knock-on effect for intelligence requirements, as USAF General Ken Israel remarked: "You cannot have precision-guided munitions unless you have precision guided reconnaissance".[34] Many believe that the reconnaissance of chosen areas to provide the location of previously known and unknown targets is the biggest and highest priority task for ISTAR assets now and in the future.[35]

Saratoga's F-14 Sqn was processing as many as 3,500 images daily and more during surge operations

Linked closely to the pre-attack reconnaissance requirement, is the growing political imperative of proving what has actually been attacked. Accurate and timely BDA imagery offers to analysts not only essential imagery of the mission results, but also to commanders at all levels the means to show exactly what was attacked and the damage caused. With media deployment now inevitable in any likely conflict zone, images of damage, which may or may not be as a result of Allied weapons, can be seen on TV screens worldwide in almost real time. Media deployed on the enemy's ground are open to influence by the opponent's regime and Allied forces must be able to quash any disingenuous claims.[36] Demands to provide such imagery for public consumption can come from all levels of command and from many and varied locations. The ability to provide the required imagery will therefore be dependent both on the communication links for dissemination and an appropriate imagery format to facilitate ease of viewing. Own force BDA needs will be subject to the same two requirements in order to provide rapid weapon effectiveness assessment and to inform re-tasking decisions. BDA and media requirements reinforce the need for responsive reconnaissance assets at the tactical/operational level that are able to gather and provide timely imagery.

The importance of BDA also drives an attendant ISR requirement at the very beginning of the targeting process. Prior to hostilities, aircrew consequently flew intensive reconnaissance missions over an area of interest, both to familiarise themselves with pre-planned targets and so that

the very latest imagery was available in order to assess whether targets were in accordance with the NATO targeting mandates, in particular to assess the risk of collateral damage.[37] The demand to provide imagery throughout the targeting cycle is driving even greater use of ISR assets. For example,

The US forces deployed Predator and Hunter UAVs (the latter with the CIA) providing a significantly enhanced ISR capability

Hunter UAV

with just four TARPS systems, *Saratoga's* F-14 Sqn was processing as many as 3,500 images daily and more during surge operations!

Since the Gulf War, modern, digital reconnaissance systems, fully integrated with the host aircraft avionics system have emerged. They offer accurate target positional data that can be rapidly downloaded into intelligence systems and is thus almost immediately available to the front line users and the C2 chain.[38] However, when such a digital reconnaissance system can store somewhere in the region of 12,000 images per mission, it is also clear that disseminating such a mass of imagery quickly is going to be extremely challenging! Bandwidth availability, particularly for imagery, which is so much more 'data hungry' than text and many other data types, is crucial to the successful flow of imagery to the end user. Imagery transmission certainly seems likely to be the largest single restriction in the reconnaissance cycle.

Kosovo

Nearly another five years later, the Kosovo conflict showed a further number of key differences,

underlining the way in which the conduct of conflict is changing. The British experience emphasised "the extent to which our operations are joint".[39] The air operation involved assets from all three Services, aircraft and missiles from the RN, aerial surveillance assets from the Army and of course RAF air assets. Kosovo was significant in other new approaches with key differences to the Bosnia conflict just a few years before. One author wrote: "Commanders and warfighters found new capabilities that allowed them to take full advantage of precision-guided munitions, flexible surveillance and reconnaissance assets, and real-time situational awareness".[40] Kosovo marked the first real employment of UAVs in strength, although not in such great numbers with British forces. The US forces deployed Predator and Hunter UAVs (the latter with the CIA) providing a significantly enhanced ISR capability; their ability to loiter over hostile terrain providing 'stop and stare' and real time surveillance imagery. Perhaps the greatest change though was the high level of political interest and involvement in both air and (later) ground operations.[41] Such was this political interest that targeting was both more closely scrutinised and more tightly controlled than ever before. The North Atlantic Council set out targeting guidelines, then NATO Military Authorities selected target sets and then individual Allies finally cleared those targets assigned to them.[42] Such complex targeting processes demands

significant, timely transmission of targeting data throughout the levels of command, flowing both nationally and internationally.

Many of the lessons learned from the Kosovo conflict are reported in the MOD's *Kosovo: Lessons* document. The first lesson is that: "an improved Intelligence, Surveillance and Reconnaissance capability is of great importance to all three Services . . . an improved capability would be of benefit across the board".[43] Imagery intelligence (IMINT) from a variety of sources played an important role in informing decision-makers (and the public) of key developments and in the selection and clearance of targets. This last point is crucial given the view that: "Accuracy in attack, and taking all feasible precautions with a view to avoiding, and in any case minimising, collateral damage, are important both politically and legally".[44] Such political and legal oversight was exercised to an unprecedented degree during the Kosovo campaign.

Politicians were also concerned about the need to ensure that the civil populace was kept up to date, to: "Cut through Milosevic's propaganda . . . to let people know the truth, and to let an informed public decide what was right".[45] Satisfying the media appetite for timely information and news stories was a major challenge: "In many ways, getting our messages across in the broadcast and written media was as crucial as the military campaign".[46] With such an importance attached to the media war, the ability to provide the right news, at the right time must be increasingly important to the military.

Winning such an information war is not easy. As digitisation of the battle space continues, systems increasingly provide data in a digital format. The proliferation of data formats also increases, so interoperability typically decreases. The requirement to win the information war places a great dependence on passing the data around the battlespace efficiently, so a huge premium is placed on bandwidth and connectivity.[47] The MOD clearly experienced such problems and consequently carried out a comprehensive intelligence review: "improving secure Information and Communication Technology (ICT) at both strategic and operational levels to enable the

passage of intelligence and targeting information across and between these levels, is a major concern".[48] Whether it is to win the media campaign or to reap the benefits of digitisation, passing data efficiently and in a usable manner is of the utmost importance; this demands interoperability.

The political and legal implications of targeting, particularly to reduce collateral damage and minimise civilian casualties, are significant. It is this, and the drive to 'find and strike' rapidly, before a fleeting target disappears, that are the key issues. "Attacks against tactical targets in Kosovo proved to be a significant challenge to the Alliance, given the difficulties in locating and positively identifying targets".[49] The Yugoslav's ability to conceal forces and employ deception techniques caused such difficulties. Should such a target present itself, it seems highly likely that it would be under cover of darkness or poor weather and probably only fleetingly.[50] The ability to find and engage a target in such difficult conditions is vitally important and the MOD has identified the need to do it much better, from the entire sensor, C2 and weapon engagement points of view.[51]

BDA during the Kosovo campaign was certainly as essential as during the Bosnian campaign. The importance attached to the political imperative to keep the public and the media well informed, to be able to nullify Milosevic's information campaign, dictated the growing requirement for post-strike imagery. The images that commanders need for media publication are also the images required for BDA, so such post-strike imagery has become 'dual-use' in nature. After the campaign, Allies conducted comprehensive reviews of their BDA processes. The MOD noted that "sufficient background information should be compiled to enable the accurate assessment of the impact of operations and of an adversary's remaining capability".[52] A significant amount of the 'background information' referred to will come from reconnaissance missions flown before an offensive starts i.e. pre-strike imagery. This places greater demands on in-theatre ISR missions in the build-up phase and also requires more effective and widespread dissemination of *strategic* level imagery to the targeting and BDA cells at all levels. Co-ordinating weapon strikes on targets with

"We are constrained by ISTAR assets and availability and by the bandwidth available . . . Quite simply, we cannot be all-seeing all the time — we simply do not have the resources"

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imaging TOTs will offer timely BDA and maximise use of assets. Such timely BDA ensures rapid dissemination of imagery to cater for political and media requirements can be carried out.

The growing importance of ISR, has led to increased demand, placing severe stress on bandwidth availability that actually limited the deployment of some of the alliance's most useful assets'.[53] During Kosovo, the US bought significant commercial satellite bandwidth and still needed more. Gen Clark (then SACEUR) commented: ". . . the information environment was characterised by multiple imagery . . . "This imagery, however, 'eats up' megabits of information with each use. Often it must be routed simultaneously to several headquarters for study and review".[54] Clark added that, trying to operate a high-precision campaign needs robust information to plan effectively, control the strikes and then decide where to go back into. Clark notes that UAVs were limited in their employment (numbers) simply because the bandwidth required for their operation was not available. However, bandwidth is not only the key to effective employment of assets, it is also vital in ensuring that the product is flowed down to those who really need it, particularly in the lower echelons. It seems increasingly that, while we are certainly not asset rich, we are already in the position of not being able to disseminate what we are collecting to those who really need it. Improving dissemination emphasises the criticality of interoperability because: "Command, control, communications, computers and intelligence are the backbone of the alliance, and they have to be the first elements of interoperability".[55] If dissemination was already poor, then the added dimension of a ground offensive would only have emphasised the Kosovo campaign's interoperability and connectivity problems.

Summary of ISR effectiveness to date
Analysis of the past decade has analysed ISR capability in three major conflicts, showing both what was and was not possible and the progress that has been made. It illustrates the changing manner in which the ISR capability battle is being fought, how the ISR product is being used and shows the key issues, the challenges that remain. CDS recently summed up the UK's present capability ". . . we are constrained by ISTAR assets

and availability and by the bandwidth available . . . Quite simply, we cannot be all-seeing all the time — we simply do not have the resources".[56]

As more ISR data become available (with ever more capable sensor systems), more end-users demand that product. Such end-users will inevitably have differing degrees of connectivity, variable bandwidth capacity or availability and deficiencies in data format reading and exploiting capabilities. The very same connectivity also impacts the command and control aspects of ISR and our ability to use such capability effectively. Increasingly, air power is demanded to deliver rapid effect in the battle space, yet the very connectivity we have seen to be so lacking in ISR product dissemination is likely to be the same connectivity bearing the C2 aspects needed to employ offensive air power to maximum effect. If these rapid effect operations are demanded, then how can we ensure that timely, efficient command, control and DM, whether carried out on or off the battle-field, is in place to deliver the desired effect in a highly time sensitive manner?

Time taken to either procure more systems or develop new technologies will neither bring immediate benefit nor maximise use of current systems. The shortfalls in overall ISR capability seen in recent conflicts and placed in the context of the changing way in which we are using the ISR product, show two key areas on which we can focus: firstly, ISR product dissemination, and secondly, employment of the sensor system on the battle-field so that the desired *offensive* effect can be brought to bear.

Product dissemination
"Traditionally, the UK MoD has bought stand-alone, stovepiped systems, especially when it comes to intelligence-gathering equipment. The sensor reports back to a specific ground station and even though the information may be useful to another user, there's usually no way of ensuring it gets to him".[57]

Product dissemination can be viewed as a comprised of two components: the product itself and its ease of use once it has been distributed; and the means of distribution. In the latter case, the means of distributing an ISR product is dependent upon point-to-point or networked connectivity and

Two principal Allies are not interoperable at the primary imagery level

A Tornado GR4A carrying the RAPTOR ISR system (AHB/RAF)

the data rate or capacity available. The reported deficiencies in dissemination capability will not be solved either quickly or easily. Only significant investment will provide an efficient and capable system architecture. The ISR product and its ease of use might be considered much more easily however, in that it should be relatively easy to ensure data can be used much more readily once it has been distributed. Ensuring the data also places the least burden on the distribution system should be an important consideration too. The key is data formatting. IMINT can be formatted so that data is distributed in a bandwidth efficient manner and to ensure that the data is in a format that can easily be opened and used by every user. Joint warfare is increasingly likely, so improving interoperability brings greater benefits. Anything that can be done to improve product usability and ease of distribution will have significant dividends.[58]

Examination of one key UK ISR system will demonstrate this issue. The RAF's new RAPTOR ISR system, fitted to the Tornado GR4 and recently operational in the Gulf, formats data coming off the sensor into a 'primary imagery format', PIF. RAPTOR's PIF is *not* bespoke, and conforms to NATO's ratified PIF standard, called STANAG 7023. RAPTOR's 7023 sensor data is taken into the Data Link Ground Station (DLGS), via digital tape from the recce pod or off the high-bandwidth Common Data Link (CDL), to be viewed and exploited. After an image analyst has analysed the *information* and turned it into *intelligence*, this imagery product becomes a 'secondary' image file

and is saved in the NATO standard format for secondary imagery called STANAG 4545 (NATO Secondary Imagery Format, NSIF). NSIF is aligned with the US National Imagery Transfer Format, NITF 2.1, which is mandated for use on US military systems.[59]

Although such data standards exist and therefore interoperability should be assured, in practice the first interoperability hurdle has already arisen. Coalition partners are using the secondary imagery standard as their primary imagery format, so their ground stations cannot take RAPTOR's imagery data until after the primary imagery has been exploited and processed into secondary imagery. In this example, Allies at the theatre level are not interoperable at the primary imagery level. Another hurdle must also be overcome. While STANAG 4545 has been widely incorporated into commercially available but quite specialised imagery exploitation software, neither format has become available on standard home/office user COTS software. Even if the data file could be sent to an end-user, is unlikely that the information could be opened and viewed. To do so, the RAPTOR NSIF image file would need to be converted, re-saved and then disseminated in a more commonly used format, for example a JPEG file. Alternatively, all prospective end-users would need to have an imagery exploitation software package pre-loaded on their IT systems.

The former solution — conversion of the image into a more common standard prior to

Increasingly capable ISR collection systems such as RAPTOR will be creating nothing more than a data stockpile and little in the way of intelligence that is of real use to commanders, politicians and decision makers

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dissemination — will undoubtedly incur a time and workload penalty. However, if the imagery was converted and saved in the commonly used JPEG format, then this format offers an additional advantage by offering variable data compression. If the data is compressed to 1/4 of its original size for example, then the bandwidth or transmission time required for dissemination would be greatly reduced. In the bandwidth 'starved' operational environment, it seems likely that the time and workload penalty of saving exploited images in a compressed JPEG file format is more than compensated for by being able to distribute the image files more efficiently and readily open, and view them once at the end-user point.

While we have only been able to look at one case here, the importance that imagery formats have in influencing interoperability, distribution requirements and the usability of an ISR product should be clear. Unless commanders and equipment capability managers alike drive the need to procure ISR systems that produce data in a usable, interoperable and easily distributed format suited exactly to all end-user requirements for that imagery, then increasingly capable ISR collection systems such as RAPTOR will be creating nothing more than a data stockpile and little in the way of *intelligence* that is of real use to commanders, politicians and decision makers. There must be a clearer understanding of the benefits that interoperable format standards can bring to operations and therefore increased emphasis on the need to ensure system and data interoperability between Allies by military and political commanders at the highest levels.

Delivering effect
"In broad terms, the principal purposes of our forces . . . are to find and strike the enemy. The focusing of intelligence collection and targeting effort, particularly against fleeting targets, demands the full panoply of an integrated capability to reduce the links between sensors and effectors, to shorten and reduce decision loops".
(Maj Gen R Fulton, CM (IS), MoD)

The second challenge is delivering effect on the battlefield, especially against difficult targets. To find and strike the enemy effectively, the key issues outlined by Maj Gen Fulton must be overcome: reducing links between sensors and shooters and

shortening and reducing DM loops. The find and strike process begins with a sensor system finding the target, then the application of C2 to exercise the DM process and, having decided to engage the target, the strike is carried out with a platform and weapon of choice. This process has been called C4KISR, or, put in an element process order, ISR (find and fix the target), C4 (C2 and decision-making) and 'K' for kill. Examination of the process elements may reveal where ISR improvements may improve the whole 'find-and-strike' process.

The first element — ISR — is dedicated to finding the target. In the 'difficult target' situation, fixed, static, relatively easy targets are not the issue but the mobile and semi-mobile targets which offer limited time and space for the whole find and strike process. The start of the process may be cueing from another ISR asset, a SIGINT platform for example, or soon, ASTOR with its Ground Moving Target Indicator (GMTI) radar. Whether cued, or simply tasked to reconnoitre a given area or location, an ISR asset e.g. RAPTOR will image the area attempting to find a target. Once imaging is complete, the RAPTOR operator now has three options: to review the imagery in-cockpit, to data link it to the DLGS for an imagery analyst to review, or to do nothing and return to the operating location with the imagery recorded on tape.

The latter option, because of the transit time required, is unlikely to meet the timeliness being sought within sensor to shooter operations. The first two options may. If the Tornado navigator reviews the imaged target area, finding and identifying a target, then a target image and its geographical co-ordinates will be available. The target image/location must then be acted upon and to do so it must enter the next step in the process, the C2 element. The target image must be dispatched to the next man in the loop, the DM. In the simplest of cases however, the DM might be the same aircrew who has just found the target. In this case, the ISR and DM actors are one, and the target data need not be sent anywhere. However, this can only be the case if the sensor actor has been *enabled* as the decision-maker. To be enabled, sufficient authority needs to be delegated down to him/her in order to enable a positive engagement decision to be made. In this simple case of sensor-to-shooter (S2S), not only has the need to distribute the target

It is no longer acceptable to bomb the wrong target, to kill innocent civilians or to damage non-military propert

party or other actors in the process, i.e. the shooter who will carry out the kill element of the ISRC4K process. The principle that emerges is that the lower down the command chain the DM authority can be pushed, the simpler the necessary C4 connectivity can be. Fewer links are required and the dependency on the C2 connectivity in the S2S loop can be significantly reduced. In addition, if the DM is being taken on-board the sensing platform, then there is also likely to be a considerable reduction in the time taken from initial 'sensing' to final 'delivery of effect'. It is exactly this timeliness that is so vital for effective engagement of a so-called 'difficult' target. The driver thus appears to be managing the delegated engagement authority and, as a command issue, rests firmly in the DM or C4I element of the process.

"Legality is topical today . . . I would simply note that it is a key issue and will remain so. It will become increasingly important . . ."[60]

The increasing need to conduct conflict in a legal manner is being driven from the highest political levels. Commanders and politicians alike are concerned about the risks of collateral damage and injury to non-combatants. It is no longer acceptable to bomb the wrong target, to kill innocent civilians or to damage non-military property. Such concerns dictate the very careful management of the RoE and at what level of command the authority to engage a target can be given.

Collateral damage assessment (CDA) is broken down into Tier levels of risk. It is highly unlikely that any commander would be satisfied that the target meets his delegated RoE unless he has seen a current image of the target and can carry out a CDA and CCA assessment. This issue will drive a requirement to get the target image off-board the ISR platform and to the DM. So, as the RoE that permit target engagement either become

more restrictive or are not delegated down to the 'shooter', the complexity of the S2S loop grows. This requires more sensor to effector links.

In the previous example, with RAPTOR acting as the ISR collector, the target image would need to be data-linked to the DLGS so that the target image could be processed, exploited and then re-packaged and transmitted to the commander empowered to make an engagement decision. The DM may well be the JTFC as he "is responsible for every single bomb that hits the deck".[62] The decision may rest with him, but there are also occasions when the decision may need to be made even higher up the command chain perhaps by CJO at PJHQ, or at the very highest, political, level. With each step up the chain of command, the complexity of the S2S loop increases, the time-cycle also inevitably increases, and with both, an increasing likelihood that the target will no longer be present to allow engagement, if and when the approval to do so is finally given. Furthermore, if the target is approved, then the approved-target image must flow back down the C2 chain to a shooter of choice. Additional S2S loop complexity is the result as the image/decision must get to the platform chosen to deliver the effect on the target. *Which* data format and *what* connectivity will ensure that will happen are additional considerations.

What can be derived from this is that the S2S loop complexity is largely driven by the level of command to which the target engagement authority is delegated. The higher the level of command at which the decision is taken, the longer and more complex the DM chain becomes: a greater number of 'actors' with attendant considerations of data format, bandwidth and connectivity all come into play. Above all, timeliness — so critical in engaging a 'fleeting' target — will decrease with growing complexity, causing an overall reduction in the likelihood of the S2S operation being successful. Nonetheless, once the

target is approved the 'effect' element can then be carried out.

Strike! But with what and how?
Minimising collateral damage and reducing the risk of civilian casualties are of the highest political and legal concern, yet this may clash with the military need to destroy targets and enemy military force. Weapons that can be delivered so that the required effect can be ensured but also, in delivering it precisely, that the risk of collateral damage and civilian casualties is minimised are necessary. The PGM is therefore increasingly the weapon of choice on the battlefield.

In the UK's inventory, the standard PGM is the Paveway II laser-guided bomb (LGB). This is a standard 1000 lb bomb fitted with a laser guidance package and a weapon which can be carried by all of the RAF's offensive attack aircraft. During the Kosovo campaign, poor weather often constrained the employment of such weapons because the laser required to guide the bomb to the target could not see through weather. As a result, the MoD upgraded LGBs with GPS guidance kits so that these weapons can now be employed in all weather (GPS LGBs are called Enhanced Paveways).

The employment of the weapon in either the GPS or laser-guided mode has a dependency on the target data required by the person/platform delivering it, which will be a significant consideration within the ISRC4K loop. The delivery of the bomb in the non-laser GPS mode, permitting

delivery in poor weather conditions, is totally dependent upon accurate target co-ordinates. The greater the inaccuracy of the co-ordinates, the greater the inaccuracy of the weapon. So, if the weapon can be delivered to an accuracy of 10 m, which is not unreasonable, then it follows that the target co-ordinates programmed into the weapon must also be provided — ideally — to 10 m accuracy.[63] These co-ordinates are sourced from the sensor element of the S2S loop, so the weapon accuracy requirement in turn drives the degree of accuracy with which target locations need to be obtained from the sensor's image of the target. In the laser-guided, man-in-the-loop mode the case is very different.

In a laser mode, typically guided using an on-board TIALD pod, then the target co-ordinates need to be known to a much lower order of accuracy. This is because the operator of the laser designator must acquire the target through the optics of the pod and only if and when he has done so will the LGB be released. The operator will acquire the target by knowing what the target looks like, and its approximate co-ordinates, so that the field of view of the guidance optics can be brought to bear on that area with sufficient accuracy to allow target acquisition and confirmation. The requirement to bring the optical field of view into the approximate target area is much less demanding in terms of target location accuracy, with perhaps 500-1000 m rather than the 10 m accuracy being quite sufficient. However, the vital requirement for this type of delivery is for the laser

In the UK's inventory, the standard PGM is the Paveway II laser-guided bomb (LGB)

A Paveway II LGB under the wing of a Harrier GR7 aircraft

operator to know what the target looks like, so he or she needs to have an image of it. Therefore, if an LGB is going to be employed then the requirement on the sensor portion of the S2S loop is to provide an image for the shooter's use and not merely target co-ordinates.

Employment of an LGB not only requires an image to be provided to the DM in the C4 process, i.e. from the sensor system into and up the command chain, but also to get the approved target image back down the command chain and finally to the shooter to deliver the desired effect. Needing to do so has an attendant impact on connectivity, bandwidth and data formatting considerations and once again, the complexity, timeliness and overall effectiveness of the S2S loop.

E-3 AWAC

A voice-data message will be relatively easy to get to the shooter platform (typically via an E-3 AWAC aircraft) but ensuring a target data file can get to the platform is not nearly so simple

If an approved target image needs to be sent back to the cockpit, then it might be possible if the aircraft was fitted with an imagery-compatible Improved Data Modem (IDM). The IDM would allow a ground agency to take the target image, ensure it was in an appropriate data format to allow efficient transmission to the aircraft (format issues again!) and then transmit it to the platform via radio. The RAF Jaguar is now fitted with an imagery capable IDM and therefore such a capability could be employed relatively easily. Operational scenarios where Tornado/RAPTOR sensor and Jaguar shooter combinations are tasked to conduct S2S operations on the battlefield could thus be employed to great effect.

The analysis so far shows that there are two principal cases of PGM employment: either man-in-the-loop laser guidance or GPS-guided delivery with no man-in-the-loop (post weapon release). The decision or ability to employ either of the two-weapon employment methods drives the sensor product requirement at the very beginning of the S2S cycle. In the first case, the man-in-the-loop is reliant upon the image of the target in order to be able to work from the image to his view of the real world as seen through the guidance equipment optics, to find and acquire the target and then laser mark it for the weapon. His requirement for the target image (and only approximate target co-ordinates) drives the need for the sensor and the intermediate command chain to provide an image file.

In the GPS-guidance mode however, the operator need not receive an image of the target. The weapon delivery is totally dependent on the accuracy of the target location co-ordinates. In this mode, the operator will need to receive a data file or voice message. Therefore, the requirement on the S2S chain is to provide and distribute data and not imagery. If it is assumed that the sensor system produced an image on which the target was found, thus beginning the S2S loop, then at some point this image can be translated into the simpler requirements of a data message. Once the DM has seen, assessed and approved the target on the image, the image is largely redundant as only the target co-ordinate data now needs to be sent to the shooter. In this case, the imagery format considerations are greatly simplified, the bandwidth requirement reduces and timeliness

should improve. A voice-data message will be relatively easy to get to the shooter platform (typically via an E-3 AWAC aircraft) but ensuring a target data file can get to the platform is not nearly so simple.

In most of the UK's current front-line aircraft fleet, ground target data files are not routinely transferred to or from an aircraft; however, the recent integration of the IDM into the Jaguar was carried out to provide exactly such a capability. The Jaguar IDM fit was born from the requirement to receive target data from a ground Forward Air Controller (FAC). The FAC can be equipped with a radio linked to a computer equipped with an IDM card. In this manner, the FAC can enter target co-ordinates into a task message, which can then be sent via the IDM and radio to the aircraft. This method could also be used to send S2S target data messages from a suitable point in the C2 chain once engagement had been authorised. This does mean that the C2 node needs to have such equipment but this should certainly be possible. Such a solution provides for the case where the engagement decision must be taken off-board the sensor platform. However, in the case where the decision can be taken on-board then the target data must be sent from the sensor/DM platform to the shooter.

Target data could be sent from the sensor platform via a simple voice message but doing so is susceptible to the normal vagaries of air-to-air voice communications and success is reliant on the shooter crew receiving the target co-ordinates completely and accurately, noting them down and then entering them into the weapon computer with no mistakes or inaccuracies. This process is neither ideal nor efficient, so, if the sensor platform could send a data message to the shooter, and that data message could be accepted, read and entered directly into the weapon aiming computer, then this would offer far less likelihood of error and a much higher probability of success. This process is exactly the functionality that the Jaguar IDM has in order to carry out IDM-based FAC operations. The S2S requirement is for the sensor platform to be capable of sending such a target data message. If the sensor system is Tornado with RAPTOR, this would entail integration of IDM into Tornado so that a targeting message could be sent to a shooter. If this integration was carried out, then it might

also be possible to send a RAPTOR target image through the IDM, which might offer sufficient flexibility for both man-in-the-loop and GPS-guidance shooter operations.

It has been shown that is possible to get the vital target data message to the shooter, whether directly from the sensor platform or from the C2/DM chain once an engagement decision has been taken by the empowered commander. In both cases, IDM is potentially capable of carrying this out; it simply needs to be at a suitable point in the C2 chain, or to permit direct data transmission to a shooter, also in the sensor platform. If fitted in the sensor platform, IDM should also permit imagery transmission from sensor to shooter platforms.[64]

Earlier discussion showed how the GPS weapon is dependent on the accuracy of the target co-ordinates for success and in the S2S scenario, that these co-ordinates will be extrapolated from the sensor image of the target. Accordingly, the sensor system must be able to provide coordinates to the level of accuracy required for the weapon as if not, then an imagery-based, man-in-the-loop, laser-guided weapon operation may be the only type of attack that can be carried out.

Geo-coordinate data of a location viewed on imagery has only quite recently become available.[65] At one time, inaccurate platform location data was all that was available, but often today even the sensor system has its own GPS fitted, RAPTOR once again being such an example. A complex reconnaissance management system fed with such accurate positional data and linked to an inertial sensor system, allows the sensor to be pointed and scanned very accurately. Imagery embedded with accurate co-ordinate data can then be obtained, whether viewed in the cockpit or in the ground station. Two particular factors affect the accuracy of the geo-coordinate data embedded within the imagery file. Firstly, a problem arises from the fact that the accurate positional data is GPS based, which does provide accurate location, but only in the two-dimensional plane; it is relatively inaccurate in the 3rd, vertical plane.[66] Secondly, the location data is determined by algorithms in the reconnaissance management system that assume a flat earth: there is no allowance made for the real world or terrain profiling.

These two problems can induce quite significant geo-coordinate errors. Any sensor-system height error is approximately replicated in positional error on the ground, thus (if the sensor is looking about the 45 degree depression angle) a 1,000 ft height error in the sensor system will translate to a 1,000 ft positional error in ground location data and even more at shallower depression angles (which would be more typical for medium stand-off ranges). Therefore, any improvement that can be made to the system height accuracy will also benefit the geo-coordinate data accuracy of the imagery.

Kosovo is reported as the first truly joint conflict, an information revolution with significant employment of PGMs, flexible surveillance and reconnaissance and real-time situational awareness

The second factor, the flat earth problem, means that if the imaging is carried out over a portion of the earth's surface which consists of relatively flat terrain, such as the Arabian desert, then the geo-coordinate accuracy should be quite good as the real world will more closely resemble the flat earth software model. However, if the imaging is carried out over the hills of Kosovo, then an image of a target located in such terrain will be quite inaccurate as the location data on the imagery will still be based upon flat earth even though the target is situated well above it on the actual terrain present. Any reduction in this inaccuracy would require representation of the earth's surface within the reconnaissance management system so that points on the image could be correlated with the real world terrain elevation beneath and an accurate geo-coordinate position for the target would be derived.

Such a terrain profile is already widely available in a dataset called Digital Terrain Elevation Data (DTED): this is a grid system of area squares covering the earth's surface with a post at each gridline intersection that reflects the terrain elevation at that point.[67] This grid of posts and their elevations is held in the DTED loaded into the aircraft. If such data could be embodied into the sensor system, then a significant improvement to the target geo-coordinate accuracy might be achieved. Modification work would be required to the sensor system and this would involve some cost outlay, but it should be a relatively simple upgrade and certainly more cost effective than procuring a whole new sensor system.

Overall, improving the height accuracy of the sensor system would reap some benefit in imagery target location accuracy. If DTED could also be incorporated into the sensor system, then a further and probably more significant improvement of the imagery target location accuracy should be achievable.[68]

Conclusion

The aim of this paper was to demonstrate how ISR effectiveness could be maximised. Capable ISR systems are already in service, so making better use of what we already have would bring benefits free from procurement expense and time delays. The paper reviews the past decade of conflict, drawing out what was possible, what remains challenging and the implications borne out of the changing nature of conflict and its impact on ISR capability.

The Gulf conflict showed an overall lack of ISR capability. Very few assets offered night, all-weather or stand-off imaging, being largely still configured for the Cold War. The rapid pace of the conflict demanded faster intelligence, but the lack of data links and effective communications meant information demand outstripped supply. A poor communications structure also hindered the intelligence sharing so vital in a coalition conflict. BDA was poor, partially because analysts were not trained to analyse weapons effects nor to make re-strike recommendations, but particularly because ISR assets were not managed effectively to ensure imaging was closely co-ordinated with strikes. This also hampered the media campaign, as unexpected demands were placed on the military to provide pre- and post-strike imagery.

In Bosnia, the environment, terrain and force disposition were all very different to the Gulf. A much wider range of targets were tasked for ISR coverage. Although imaging was often severely

hampered by the environment, new capabilities such as J-STARS and Predator SAR could provide night, all-weather imaging and real-time transmission via data links. In more conventional areas, dissemination had still not been solved, with the task-to-imagery cycle still taking as long as 48 hrs. Commanders needed to show those targets attacked and the damage caused but poor BDA tasking hindered this requirement. Such coverage was increasingly important given the political drive to ensure minimum collateral damage and civilian casualties and to quash false enemy claims. Showing post-strike imagery also demanded pre-strike imagery for comparison, but it was the increasing use of PGMs that was really driving the demand for immediate pre-strike imagery, particularly against mobile or semi-mobile targets. Such targets demanded imagery offering accurate target locations which could be downloaded rapidly into the intelligence system. New digital ISR systems offered such possibilities but were also placing increasing and significant demands on communications bandwidth.

Kosovo is reported as the first truly joint conflict, an information revolution with significant employment of PGMs, flexible surveillance and reconnaissance and real-time situational awareness. The campaign was also characterised by unprecedented high-level political interest with much tighter control of targeting. Such political, and legal, oversight drove the need for significant pre-strike target imaging so that collateral damage and civilian casualty risk could be assessed before authority to strike was given. Timely post-strike imagery was then required, both for military BDA and also because winning the media campaign was vital. The key issue was the desire to find and strike difficult fleeting targets rapidly before they disappeared. The ability to find and engage such a demanding target was seen as vitally important, requiring effective sensor-to-shooter operations. Overall, the growing importance of ISR and the increasing digitisation of ISR systems placed an increasing burden on communications and reduced interoperability.

The shortfalls seen in these recent conflicts, placed in the context of the changing way in which the ISR product is being used, showed two key areas in which to focus: ISR product dissemination and

sensor system employment to bring desired offensive effect to bear. Product dissemination comprises two components: the product itself and its means of dissemination. The latter — the communications architecture — will require time and significant financial investment to improve, ensuring the product can be fully used by those that need it should be more easily solved. The key is IMINT interoperability through appropriate data formatting. If every user, especially in an increasingly joint environment, can access the data and use it, then this element of ISR effectiveness can be maximised.

Standardised IMINT data formats do exist but do not necessarily ensure interoperability as nations interpret and mandate standards in differing ways. As a result, two key allies may not be interoperable at all. Correct implementation of standards should offer interoperability but do not necessarily offer usability. Bespoke software is likely to be required to open and exploit such data and few users are likely to have such IMINT exploitation software on their computer systems. If imagery products were converted into a format such as the common JPEG, then notwithstanding the likely time penalty in doing so, all end-users could exploit the file. Such a format also offers data compression, the significant benefit of which is that less burden is placed on the communications architecture. In this way, maximising ISR effectiveness can be seen as mandating data formats which offer maximum ease of use, both for the military and for the media while minimising the communications bandwidth burden. Delivering effect, especially against difficult targets is the second significant challenge. To find and strike effectively demands reduced links and timeliness across the sensor-to-shooter process. Firstly, ISR assets search for targets in tasked areas, perhaps cued by other assets. With a target found, an image of the target and co-ordinates are available but still on-board the ISR platform. This data must be acted upon and sent off-board to the next actor, the DM. In the simplest case though, this is not so, the 'sensor actor' can also be the DM and may have sufficient delegated authority to allow engagement. If not though, the data must be passed to the DM who, given today's legal imperatives, will need to assess the target for collateral damage and civilian casualty risk in accordance with prescribed criteria. An approved

target then needs to be sent from the DM to the shooter. The level of command where the target engagement authority rests therefore partly dictates the complexity of the S2S process.

Risk of collateral damage and civilian casualties is also driving the preference for PGMs. The UK's PGMs are either laser or GPS guided: the latter is totally dependent on accurate target co-ordinates. These are derived from the original sensor image. Such accuracy is not required in the laser mode as the operator guides the weapon, but he/she must identify the target to do so and therefore needs a target image. Weapon choice, laser or GPS-guided, dictates whether a target image or target co-ordinates are needed, which in turn, drives the link complexity, and thus timeliness and overall effectiveness. The RAF Jaguar is now fitted with the IDM, offering the potential for receipt of either target data or an image. Equivalent equipment in the C2/DM chain or integrated onto the sensor platform would enable such an operation.

For the GPS weapon, imagery data accuracy is vital. Two particular factors reduce such accuracy, inaccuracy in sensor platform altitude and earth surface modelling. At medium altitudes, the sensor system is deriving altitude from GPS yet this is inherently inaccurate in height. The sensor's management system will model the earth's surface as flat whereas in reality the target sits above it on real terrain; both factors lead to inaccuracies in image target location co-ordinates. The former factor is less significant but the latter may be. Integration of DTED into the sensor software would permit significantly more accurate target co-ordinate derivation.

In summary, maximising ISR effectiveness could firstly be achieved by adopting suitable data standards allowing both ease of use and minimal communication system burden, and secondly, by focussing on the interplay between shooter weapon data requirements, delegation of DM and sensor-to-DM-to-shooter links. If these two aspects are understood and actively managed, then maximising ISR effectiveness will ultimately maximise delivery of effect in the battle space.

The RAF Jaguar is now fitted with the IDM, offering the potential for receipt of either target data or an image

Notes

[1] Sweetman (1991), p.329

[2] Waters (1993), pp.37-50

[3] Ibid. p.41

[4] Ibid. p.42

[5] Id.

[6] Id.

[7] Waters (1993), p.46

[8] Ibid. p.42

[9] Id.

[10] Id.

[11] Id.

[12] Ibid. p.49

[13] Wanstall (1991), p.833

[14] Waters (1993), p.42

[15] Ibid. p.44

[16] Id.

[17] Mann (1994), p.4

[18] Ibid. p.7

[19] Waters (1993), p.48

[20] Covault (1996), pp.44-46

[21] Id

[22] Id. Also Fulghum (1996), p.24

[23] Id.

[24] Covault (1994), pp.27-28

[25] Lum (1995), p.57

[26] Fulghum (1996), p.41

[27] Ibid. p.25

[28] Covault (1994), p.28

[29] Bailey interview

[30] Id.

[31] Sweetman (1994), p.34-36

[32] Covault (1994), p.27

[33] Lum (1995), p.54

[34] Id. p.54

[35] Id.

[36] Sweetman (1994), p.36

[37] Covault (1994), p.27

[38] Fulghum (1996), p.40

[39] MOD Kosovo: Lessons, Chap 6

[40] Ackerman (1999), p.49

[41] MOD Kosovo: Lessons, Chap 6, p.4

[42] Ibid. Chap 7, p.1

[43] Ibid. Chap 6, p.8

[44] Ibid. Chap 7, p.2

[45] Ibid. Chap 6, p.5

[46] Id.

[47] Ackerman (1999), p.49

[48] MOD Kosovo: Lessons, Chap 6, p.7

[49] MOD Kosovo: Lessons, Chap 7, p.2

[50] Ibid. p.6, e.g. on only 21 out of the 78 days of the campaign was the weather judged to be favourable for air operations.

[51] Ibid. p.8

[52] MOD Kosovo: Lessons, Chap 7, p.4

[53] Ackerman (1999), p.49

[54] Ibid. p.50

[55] Ibid. p.51

[56] Boyce (2002), p.3

f[57] Cook, N et al JDW, Sep 11, 2002

[58] Ibid. pp.67-69

[59] DSTL advice.

[60] Fulton (2002), p.69

[61] Targeting advice from JFHQ J3 Tgts

[62] JFHQ J3 Tgts

[63] Simplification: there will be additional flexibility as a result of the weapon's lethal damage radius e.g. if the lethal damage radius of the weapon is 100 m then co-ordinates with a 100 m accuracy, less the inherent inaccuracy of the weapon (10m in this example) should still result in achievement of the desired effect; many other factors come into play too.

[64] Goodrich technical advice.

[65] From tactical, not strategic imagery.

[66] http://www.nima.mil/publications/specs/printed/89020B/89020B.pdf: vertical accuracy for 'P'-code GPS is 27.7m, 156m for C/A code.

[67] www.nima.mil

[68] Goodrich technical advice.

The SE5a was the most famous of all the Royal Aircraft Factory's designs of the First World War and saw widespread service with the RFC and RAF

NCO Pilots in the RFC/RAF 1912-18

By Wing Commander 'Jeff' Jefford

Have you ever asked yourself why we take it for granted that all RAF pilots (and, what we used to call, navigators) are commissioned? Since relatively few aircrew are actually required to *command* anything, it is self-evident that it cannot have much to do with the disciplinary requirements of the military hierarchy. The short answer is that we do it as a response to market forces, primarily the need to recruit and retain high grade personnel. Until pay was specifically 'decoupled' from rank by the

innovative approach adopted in 2003, this link had always been regarded as being immutable. As a result, it has followed (at least since 1950) that all pilots had to be officers in order to permit the system to pay them something approximating to 'the rate for the job' that was a far cry from what the Air Council of 1946 had in mind.

In the immediate aftermath of WWI it had been decreed that all pilots would be officers (and, conversely, that the vast majority of officers would

It is quite clear that by 1913 the RFC can have had no serious intention of using its non-commissioned pilots operationally

be pilots), some of them Cranwellian careerists, the rest serving on short service commissions. The all-officer policy did not survive for long, however, and as early as 1921 the Service began to train a handful of airmen pilots who were automatically upgraded to sergeant on gaining their flying badges. By 1929, 20% of all RAF pilots were NCOs and by 1938 this had risen to 32%. Entry into the RAF *per se* ceased on the outbreak of war to be replaced by recruiting into the RAFVR and thereafter all prospective aviators were trained as airmen. Commissioning policy permitted up to 33% of wartime pilots to graduate as officers (although the actual figure was usually less than this) with subsequent commissioning in the field permitting the total to rise as high as 50%, the other 50% being NCOs or warrant officers.

Cpl Frank Ridd, the RFC's first non-commissioned pilot, had one of the legendary two-digit Service Numbers (26). Having been awarded RAeC Certificate No 227 on 4 June 1912, he was a flight sergeant with No 3 Sqn when war was declared but subsequently became a PoW

The end of the war was seen to provide an ideal opportunity to 'right a personnel applecart' that had been seriously upset by the pragmatic demands of WWII. Bear in mind that the 50% officer/NCO breakdown applied to navigators as well as to pilots, and that there were similar arrangements (although the proportions differed) applicable to all of the other aircrew trades: none of which had even existed before 1939. The Air Council's early post-war vision of an ideal peacetime flying branch was one which would be run by a small officer corps manned initially by wartime veterans who would gradually be replaced by Cranwell graduates (all of them pilots) with the numbers being topped up as required by commissioning from the ranks. All other aircrew (the vast majority, including most pilots) were going to have non-commissioned status. This scheme was actually implemented, but it proved to be so unpopular, and such a disincentive to recruiting, that it had to be abandoned in 1950 in favour of the now familiar 100% officer policy.

It is plain from this brief survey of the last 80 years or so that the status to be afforded to pilots, and to all other aircrew categories, is a question that has caused a lot of heart-searching in the past. Indeed its origins can be traced back to the earliest days of the RFC, provision for non-commissioned pilots having been made from the outset. At the time of its conception in 1912 the new Corps was expected to have an eventual strength of seven squadrons, each of which was to have had 12 aeroplanes and 26 pilots, half of them officers, half not.[1] The first non-commissioned pilot, Cpl Frank Ridd, gained his Royal Aero Club (RAeC) Certificate on 4 June 1912. Others were to follow but their numbers never actually kept pace with those of officers so that by the time that war was declared officer pilots already outnumbered those without commissions by almost five to one.[2]

Furthermore, in the light of experience, the RFC had refined its requirements by mid-1913 so that it now employed what were known as First and Second Class pilots, the qualification standards being published in September.[3] In practice, some non-commissioned personnel progressed no further than becoming Second Class pilots. In essence, this meant that they had passed the tests associated with the RAeC Certificate and had demonstrated

Sgt Thomas Mottershead originally enlisted as an air mechanic in August 1914. He began flying training in May 1916, gaining his Second Class Certificate a month later and his First Class Certificate on 9 June. In July he was sent to France to fly FE2bs with, first, No 25 and then with No 20 Sqn. He was eventually shot down on 7 January 1917 in an action that earned him a VC, the only one gained by a non-commissioned aviator in WW I. Sadly the award was announced posthumously. The ribbon worn in the photograph is that of a DCM gazetted on 14 November 1916

formations nor an ability to identify warships. Beyond an ability to map-read and use a compass, they were also not required to be familiar with aerial reconnaissance procedures and techniques. Whatever its initial intentions may have been, therefore, it is quite clear that by 1913 the RFC can have had no serious intention of using its non-commissioned pilots operationally.

That this was already *de facto* policy when war was declared is reflected in a contemporary typewritten minute in which the Director General of Military Aeronautics notes that, having been enlisted as 2nd Class Air Mechanics, "certain civilian pilots" were to be immediately given their three stripes, "the intention being to use them as NCO pilots with the Reserve Aeroplane Squadrons".[4] He subsequently added, in manuscript, "or, if found fit, with the Expeditionary Force" but this was clearly an afterthought. None of these men appears to have found their way to France and, although there were inevitably a few exceptions to the rule, this policy remained essentially unchanged throughout the war. Until 1917 there was no prohibition on the training of non-commissioned pilots but the majority of those who did manage to qualify were assigned to second-line units where they served as, for instance, ferry pilots at Aircraft Parks or staff pilots at the School of Aerial Gunnery.

an awareness of only some of the technical aspects of aviation. First Class pilots had to have passed examinations in a much broader range of topics at the CFS, in addition to having accumulated an adequate number of flying hours.

Even so there were marked distinctions within the First Class classification. Officers had to pass in all eight subjects examined at Upavon, whereas non-commissioned pilots were not tested on the theory of flight or on meteorology. Neither were they required to demonstrate knowledge of troop

A return of all officers and aircrew serving with the British Expeditionary Force (BEF) in September 1915 noted only two NCOs, both of them with No 3 Sqn.[5] A similar headcount made in February 1916, but reflecting all officers and aircrew serving with the RFC, shows that just over 30 non-commissioned personnel were carried on the strength of UK-based units as pilots, most of them still undergoing training, but there were still only three NCO pilots flying with operational units in France: one each with Nos 1, 3 and 5 Sqns.[6] Despite the considerable expansion of the corps over the next two years,

I knew what time I was going up but I didn't even know what job I was on until the observer came out . . . He did all the reporting – what he'd found, what he'd seen, what he'd photographed. I went to the sergeants mess and I had no further contact

Sgt Ernest Albert Cook was typical of the handful of NCO pilots who flew on operations. When he joined No 45 Sqn in France on 1 April 1917 he had a total of 34 hrs and 55 min flying time in his log book of which only 65 minutes had been on the Sopwith 1 Strutters that he was to fly in combat. He had two dual rides with a Flight Commander followed by two solo trips, damaging his aircraft on both occasions. Thereafter he got the hang of it and went on to become a sound squadron pilot until he was shot down and killed on 5 June

although more NCOs were trained, they continued to represent only a tiny proportion of the total number of pilots available.[7]

In mid-1916 it was ruled that all holders of Second Class Certificates would have to qualify to First Class standard within six months or become uncertificated.[8] Several more concessions were soon granted. For example, a retrospective clause which had been a feature of the new regulation was removed so that pilots already holding Second Class Certificates needed to re-qualify only at that level, the obligation to upgrade being confined to newly qualified pilots. Similarly, the six-month limit was waived for any Second Class pilots already serving with an Expeditionary Force. Perhaps as an added incentive, however, at much the same time it was also announced that corporals and air mechanics qualifying as First Class pilots would be automatically promoted to sergeant.[9] Nevertheless, the thin end of a wedge could be

discerned here and the evident reservations over the utility of the two-tier system would eventually lead to questions being asked about the real value of having *any* non-commissioned pilots. In this general context the Bailhache Committee[10] noted in November 1916 that: "Every pilot must now be an officer. There are a few exceptions".[11] What the writer had presumably been trying to convey via these two mutually contradictory statements is that despite the RFC's overwhelming preference for officers, a handful of NCO pilots was still being trained, in addition to the relatively small numbers that were already on strength.

The employment of sergeant pilots on operations peaked during 1917. There were for instance, a total of 27 of them on the strength of the squadrons serving with the BEF in March,[12] 24 in May[13] and 28 in August.[14] All of these NCOs were overborne against each unit's current establishment which by then provided for a total of 21 pilots per squadron, *all* of whom were to be commissioned: one Squadron Commander and two 'spare' Flying Officers with the headquarters, and a Flight Commander and five Flying Officers for each of three flights. By August 1917 there were 47 squadrons in France, reflecting an overall requirement for 987 officer pilots. There were actually 970 on strength, which, allowing for the 28 sergeants, represented a ratio of officers to NCOs of the order of 35:1.[15]

Since there was no official establishment for sergeant pilots, it would seem likely that the primary function of the handful serving in France may have been to provide a cushion to ensure that a squadron would remain fully operational if there were any delay in providing replacement officers. This is not to say that NCO pilots were used only as makeweights and those squadrons which had sergeants on strength certainly made full of use of them. It is worth noting, however, that very few NCO pilots were carried on the books of single-seat fighter squadrons until the summer of 1918. Of 32 NCOs at the front in the late summer of 1917, for instance, one was flying Pups and three Nieuports; all of the others were driving two-seaters.[16]

Long before this however, the RFC's practice of employing officer pilots — almost exclusively — had become policy. In June 1917 the War Office

The prospect of half-a-dozen sergeants turning up to fly Sopwith Camels prompted the immediate establishment of a mess for their exclusive use. Very odd

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Having enlisted in the REs in 1910, James McCudden transferred to the RFC in 1913 to become an engine fitter. He went to France with No 3 Sqn on the outbreak of war and soon began to fly as an observer, being formally recognised as such on 1 January 1916. He returned to the UK soon afterwards to train as a pilot, gaining his wings at the end of May. The photograph dates from this period, at which time McCudden was a sergeant. Commissioned while flying DH 2s with No 29 Sqn, he later flew SE5as with Nos 56 and 60 Sqns. When he died, in a flying accident on 9 July 1918, he was Major J T B McCudden VC DSO MC MM CdeG and the accredited victor of 57 aerial combats. His brother, William, had also qualified as a pilot, only the fourth RFC NCO to do so, as early as August 1912. He too was killed in a flying accident, on 1 May 1915

announced with immediate effect: "the training of non-commissioned officers and air mechanics as pilots will be discontinued". Special cases, should there be any, would still be entertained but, in general, all successful applicants for flying training were now to be posted initially to a Cadet Wing for eventual commissioning. This regulation was not to be applied retrospectively, but any serving NCO pilot

could apply to become an officer; if recommended, he was to be directly commissioned in the field without having to go through the cadet stage.[17]

It is not known to what extent it influenced the decision to cease training NCOs, but one of the problems associated with sergeant pilots was that some of the more Edwardian- (even Victorian-) minded among the officers will have found it difficult to work with them on anything like equal terms, which did little to foster the close working relationship that was so essential in the air. No 6 Sqn's Sgt G Eddington described it thus:[18]

"I knew what time I was going up but I didn't even know what job I was on until the observer came out — always an officer in my case. I said, 'Good morning, Sir' and we got on with our job. When we came down he got out and went to make his report. He did all the reporting — what he'd found, what he'd seen, what he'd photographed. I went to the sergeants mess and I had no further contact."

Sergeants never represented much more than 3% of the available pilots in France and, despite the continued expansion of the RFC, the universal commissioning policy meant that their numbers actually began to decline from the autumn of 1917. 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.[19]

For a time, it looked as if things were about to change again. Within a few weeks of the RFC's announcing that it did not intend to employ any more NCO pilots it had been obliged to reconsider this decision. There were two reasons. First, aviation was not the only field in which high grade manpower was required. The terrible casualty rate in the trenches meant that capable and competent young men with leadership qualities were urgently needed by other branches, particularly the infantry, and it was being argued in some of the corridors of the War Office, that the RFC's 100% officer pilot policy could be sustained only at the expense of the rest of the Army.

The second reason was the July 1917 decision to double the size of the RFC. While it might have

Sgt William Robinson Clarke was the first (possibly the only) black West Indian to serve as a pilot in the RFC. Born in 1895 he came to the UK from Jamaica to enlist in the RFC as an air mechanic. After service in France as a driver with a kite balloon unit, he was accepted for pilot training and eventually flew RE8s with No 4 Sqn. On 28 July 1917 he was wounded, and rendered unconscious, in combat with five German fighters. His observer, 2/Lt F P Blencowe, managed to gain control of the aircraft and pull off a forced landing, in which he too was injured, on the right side of the lines

been realistic to expect to be able to find enough soldiers with the potential to permit the 'old' RFC to operate on an all-officer basis, it was doubtful whether this ideal could be realised with the newly projected 200-squadron force. The staffs foresaw a recruiting crisis and, although it would involve a reversal of policy, reinstating NCO pilots, this time in comparatively large numbers, would provide an obvious solution to the problem.

Before implementing such a sweeping change in policy it would clearly be necessary to ascertain whether it would be acceptable to front-line commanders and in August the War Office submitted an outline proposal to the CinC BEF and sought his opinion on it.[20] Initial calculations indicated that, considering only the 44 squadrons currently serving with the BEF, it might be possible to replace as many as 290 of the commissioned

pilots with sergeants. Such a substitution would also save 143 batmen although this might have had to be partially offset by the provision of a number of cooks and waiters to cater for the increased numbers of NCOs.

Having first consulted with Trenchard, Field Marshal Haig eventually agreed to the introduction of significant numbers of NCO pilots with the proviso that the measure should be tried "purely as an experiment, subject to a further recommendation at some future date as to its permanent adoption". The CinC went on to indicate that he was prepared to accept one complete flight of NCO pilots in each of the recently enlarged 24-aircraft corps reconnaissance squadrons and up to 50% of all pilots in day bomber squadrons. He was less enthusiastic about NCOs flying fighters but, on a trial basis, he was prepared to have one flight of sergeants in one two-seater squadron and one flight in each of six single-seater squadrons. For night bombing duties, however, Haig considered that all pilots "must be officers". He imposed two other conditions. First, that the influx of NCOs was to be provided in a single group, not piecemeal, and, secondly, that separate messing facilities for sergeant pilots were to be provided on units associated with the trial.[21]

With hindsight, the second of Haig's conditions is curious — more for what it implied than for what it actually said. After all, every unit already had appropriate messing facilities for NCOs, although this did not necessarily always provide an appropriate environment. George Eddington again:[22]

"I couldn't make friends. I had nothing in common – I didn't have access to the officers mess; I didn't know what they thought. In the sergeants mess they were all fitters and riggers — I wasn't in their world any more than they were in mine."

Nevertheless, well over 200 non-commissioned back-seaters were already serving in France at the beginning of 1918 and no one had ever thought it necessary to make any special domestic arrangements for *them*. Yet the prospect of half-a-dozen sergeants turning up to fly Sopwith Camels prompted the immediate establishment of a mess for their exclusive use. Very odd.

If a man is of the right type and good enough to be a fighting pilot in a fighting unit, he should be commissioned

Sgt Ernest Elton originally enlisted as an air mechanic in 1915. Eventually accepted for pilot training, he joined No 22 Sqn early in 1918 and promptly proceeded to account for 10 enemy aircraft in 32 days while his various observers shot down another six. This performance made Elton the top-scoring NCO pilot in the RFC/RAF and earned him the DCM and MM but, a little surprisingly, he was not commissioned and was on his way back to France as a flight sergeant with No 39 Sqn when the war ended

London signalled its acceptance of the CinC's constraints in November, but in view of the critical importance of short range tactical reconnaissance and artillery spotting in the eyes of the army-oriented RFC, the option of using sergeants for corps work was not taken up.[23] In effect therefore, it had been agreed that the number of NCO day bomber pilots could be increased as required up to a maximum of 50% of establishment and that the use of a proportion of sergeants in selected fighter squadrons would be tried on an experimental basis. In practice, although a few sergeants did fly with bomber squadrons they never represented anything like half the overall strength and the aim of the trial began to focus increasingly on the single-seat fighter pilots.

Since there had been an embargo on the training of airmen pilots since the previous summer, this constraint had clearly had to be lifted, and although the programme must already have been under way by then, a formal announcement was made in February 1918 to the effect that training could be reinstated in batches of up to 10 per month, although, in view of the manpower situation 'no skilled mechanics' could be accepted.[24]

Early administrative difficulties were experienced in the training of NCO pilots and the plan soon began to slip. In January 1918 London notified GHQ BEF that the single-seat pilots were not now expected to become available until 15 March and that it would be the end of April before any two-seater pilots would be ready.[25]

By then, however, the trial had been more clearly defined and it had been decided to concentrate solely on the single-seaters. The project now embraced 24 pilots who had been trained on SE5a aircraft and 12 trained on Camels; they were all now due to reach France on 25 March. In anticipation of their arrival HQ RFC issued instructions that Nos 1, 24, 41, 43, 60 and 70 Sqns were to prepare the necessary accommodation (two Nissen huts per unit) and arrangements were made to provide the additional domestic staff (one cook and one steward per unit).[26] This directive was promptly short-circuited by receipt of a letter from the Directorate of Training announcing that "the training of NCOs on other than 2-seater machines has not proved to be an unqualified success and there is no doubt that they have proved slow in taking to Scouts".[27] The upshot was that the trial was postponed indefinitely. It had not been abandoned, however, and the training staffs persevered throughout the summer.

In the event it would be September before the trial commenced. By then it had evidently been decided not to concentrate on single-seaters and only two such units (Nos 84 and 203 Sqns) were nominated to participate in the experiment. The other units involved flew two-seaters in the fighter reconnaissance role (Nos 11 and 48 Sqns) and as day bombers (Nos 103 and 206 Sqns).

In preparation for the arrival of the pilots involved in the trial, the orders concerning the provision of

separate accommodation were reissued and, since two-seater units were now included, the instructions noted that any NCO observers on strength were also to be accommodated in the messes being provided for sergeant pilots. No mention was made of the NCO observers flying with other squadrons.[28]

The new arrivals were initially to be held supernumerary to the nominal strength of each unit, being progressively absorbed against the establishment as replacements for officers who were lost or posted. As intended, most of the initial influx of sergeants did arrive in groups but these were supplemented by a gentle trickle of additional pilots to offset wastage. As a result, most units were exposed to more NCOs than the nominal six required by the trial. Apart from stipulating that these men were not to be transferred to other squadrons, HQ RAF deliberately did not lay down any policy as to how they should be employed. It was specifically left to the discretion of Brigade Commanders to decide whether to integrate them into their existing squadron organisations, or to concentrate them within all-NCO flights commanded by an officer.[29]

Although details are incomplete, 32 of at least 44 pilots who participated in the trial have been identified and, of these, we know the dates of seven of their RAeC Certificates, the earliest of which was issued in May 1918.[30] While this does not exclude the possibility that some of the trainees who were reported to have been making slow progress back in February/March may still have been involved, it seems more likely that the eventual participants were a much later batch who would have had the advantage of being instructed in accordance with Smith-Barry's philosophy while passing through a far better structured sequence and in the process, and just as importantly, accumulating at least twice as many flying hours as their less fortunate predecessors.

Had the serious shortage of pilots anticipated in 1917 actually materialised there can be little doubt that the delays experienced in mounting the trial would not have been tolerated and that many sergeant pilots would have been sent to France, regardless of their capabilities. In practice, the manpower problem had been solved, largely by the

Dominions. An initial trickle of mostly South African and Australian cadets, arriving in the UK to be trained as pilots during 1917, had become a flood by mid-1918 and by that time substantial numbers of pilots were also beginning to graduate from the flying schools that had been set up in Canada by the RFC. When the output of the considerably expanded facilities in Egypt was added to the total, it seems possible that the number of officer pilots being turned out by the RAF's global training organisation might even have begun to exceed its requirements by the summer of 1918, much as it was to do again in 1944.

Against this background, little real urgency appears to have been attached to the NCO trial. Now that the original dynamic underpinning it, had evaporated, the main reason for sustaining the enterprise was probably scientific curiosity. The suspense date for reports on the experience gained from the trial was 10 November 1918 and at least five of those submitted have survived.[31]

There was almost universal agreement that the separate messes had been a serious mistake. It was considered essential that all pilots should share the same domestic facilities, partly because that was where flying was constantly discussed, allowing newcomers to soak up the experience of the older hands and partly because it was where *ésprit de corps* was consolidated. In view of the 'class' problems, of course, this more or less implied that all pilots needed to have similar social status. Unsurprisingly, none of the reports advocated that they should all be sergeants.

Opinions as to the overall capabilities of the sergeants involved in the trial varied considerably. For instance, Lt-Col T A E Cairnes, OC 22nd Wg, had considered that all of No 84 Sqn's NCOs had been good pilots and Brig-Gen C A H Longcroft, GOC III Bde, seems to have been equally content with those flying with No 11 Sqn who had "proved themselves to be quite as good as the average officer pilot". Brig-Gen E R Ludlow-Hewitt, GOC X Bde, was rather less enthusiastic about the experience of No 103 Sqn whose NCOs had been "thoroughly satisfactory when working in formations led by experienced Officers" but lacking in "initiative and enterprise when flying alone on Reconnaissance or Photography".

On the other hand, although No 206 Sqn's style of operation will have been very similar to No 103 Sqn's, its CO, Maj C T Maclaren, had considerable reservations about the performance of his sergeants, even on bombing raids since "they do not keep good formation and when attacked are inclined to split up rather than packing together". While acknowledging that two of his sergeants had been satisfactory, in general he was of the opinion that "there is a marked difference between the NCO pilot and the Flying Officer, particularly with regard to reconnaissance and photographic work". Maclaren had tried his men with both commissioned and non-commissioned back-seaters and had concluded that the two-NCOs combination did not "possess the necessary intelligence and initiative for the carrying out of their work successfully" and he had no doubt that "the absence of the spirit of the officer in command of the machine is largely felt". While the provision of a commissioned observer did improve matters, such mixed crews still tended to perform indifferently, because "there is not the complete understanding of two Officers". This was clearly an oblique reference to the sort of problems that were almost bound to arise as a result of the 'class' distinctions that were embedded within contemporary British society and it confirmed the testimony offered by Sgt Eddington from the other side of the social divide.

The most damning report came from OC 48 Sqn, Maj K R Park, who had received a total of nine sergeant pilots. He had had four of them posted home for further training and had recommended that a fifth be consigned to the trenches! Of the remainder, he considered only three to have been satisfactory. Park's assessment led him to draw a very interesting conclusion. He was of the opinion that his three good NCOs had been the equal of officer pilots and he recommended that if a man is "of the right type and good enough to be a fighting pilot in a fighting unit, he should be commissioned". Much the same view had been reflected by both Cairnes and Maclaren. The latter, noting that his two satisfactory NCOs had both been educated at Public Schools, failed to "understand how they came out as NCOs as their flying is beyond reproach".

With little else to go on, the RFC's preference for commissioned pilots had always been based largely on instinct. The feedback from the formal attempt to assess the capabilities of NCO pilots had provided positive, if unscientific, evidence that the corps had been right to trust its judgement. While their assessments will have been almost entirely subjective, three very experienced unit commanders had independently drawn the same conclusion, that a good pilot needed to possess much the same personal qualities as those traditionally associated with a commission. This tended to confirm the long-standing assumption that the terms pilot and officer were, in many respects, synonymous. The same was actually true of contemporary back-seaters, apart, perhaps, from those whose duties were confined solely to gunnery in those day bomber squadrons that usually operated in formation.

Two further points should perhaps be made. First, while the trial had focused on a specific group of NCOs, others had still been reaching France via the usual channels, as they always had done, albeit in ever-decreasing numbers.[32] When the fighting stopped in November 1918 only 35s of the 1,879 pilots on the strength of front-line units stationed in France, and operating under the control of HQ RAF, were NCOs:[33] less than 2% of the total. If the sergeants flying with units associated with the NCO trial are discounted, however, there were only two, or about 0.1%.

Secondly, the Armistice had been signed just four days before the last report on the NCO trial had been rendered. Since further intakes into training ceased almost immediately and the staffs soon became preoccupied with the problems associated with demobilisation, it seems unlikely that the, now largely irrelevant, reports will have attracted much attention. Nevertheless, anyone who did read them (and who was also able to read *between* the lines) might have been able to predict that the close correlation between commissions and, at least some, aircrew trades that had been highlighted by the trial might well present a difficulty in the future. The problem was that if a peacetime air force were to commission almost anyone who flew, most of them would actually have no one to command. This would make their being officers a little pointless and thus undermine the whole ethos of the commission. On the other hand, if it did not offer commissions on a fairly generous scale, it might not

be able to attract sufficient volunteers of the necessary calibre. This peculiarly 'air force' problem was to crop up again and again over the rest of the century, and despite several attempts it could be argued that it has never really been satisfactorily solved.

Which takes me back to my original question.

Acknowledgements: The photograph of Elton is reproduced courtesy of Cross & Cockade International and those of Ridd and Clarke courtesy of the Royal Aero Club Collection.

Notes: Documents identified as AIR and WO are held by the National Archives (*née* the Public Record Office) at Kew.

[1]   AIR1/119/15/40/62. Memorandum on Naval and Military Aviation presented to both Houses of Parliament on 12 April 1912.
[2]   Brett, R Dallas, *History of British Aviation 1908-1914*, (Surbiton, 1988 – reprint of 1933 original) lists the recipients of all 863 RAeC Certificates awarded prior to the outbreak of war. Of these, 305 had been issued to military, and 101 to naval, officers. By comparison only 47 non-commissioned army personnel and 39 naval petty officers had qualified as pilots.
[3]   WO123/55. A pamphlet, entitled *Tests For First And Second Class Pilots Certificates For Officers And Men*, was published with Army Orders for September 1913.
[4]   AIR1/122/15/40/131. Minute by Sir David Henderson dated 5 August 1914. The seven men involved were sworn in at Farnborough on the 9th.
[5]   AIR1/2148/209/3/191. Nominal roll of officers and non-commissioned aircrew serving with the BEF as at 15 September 1915. The two NCOs listed were Sgts F Courtney (2891) and W Watts (1831).
[6]   AIR1/1290/204/11/70. Nominal roll of officers and non-commissioned aircrew serving with the RFC, dated February 1916. The three NCOs concerned were F/Sgt T Carlisle (351), Sgt T Bayetto (4808) and Sgt J Noakes (4469) respectively.
[7]   Comprehensive records of the numbers of officer and NCO pilots trained during WWI do not appear to have survived but sufficient documentary evidence exists to provide a reasonable impression of the balance between them. On qualifying for their flying badges the CFS issued all commissioned pilots with an RFC Graduation Certificate, NCO pilots receiving a very similar document called a Flying Certificate; each series was numbered independently. It is known, for instance, that Sgt E A Cook's Flying Certificate No 175 was dated 7 April 1917 while 2/Lt H D Arkell's Graduation Certificate No 5,321 was issued on 26 June. While the dates of these documents differ by several weeks, they are close enough to show that officer pilots outnumbered NCOs by more than 30 to one, this ratio remaining more or less constant throughout much of the war.
[8]   AIR2/9/87/7956. Directorate of Air Organisation (DAO) letter 87/7956(AO1a) dated 25 June 1916. Subsequent correspondence amending the rules as initially published is on the same file.
[9]   AIR1/405/15/231/46. DAO letter 87/RFC/12(AO1a) dated 3 August 1916.

[10]   In the summer of 1916 a Committee on the Administration and Command of the RFC was appointed, under the chairmanship of Mr Justice Bailhache, to investigate a variety of serious criticisms raised in the Press and the House of Commons by a group of activists with Mr Noel Pemberton-Billing MP acting as their chief spokesman. Taking evidence from May, the Committee's final report, which substantially exonerated the corps and its commanders, was dated 17 November.
[11]   AIR2/9/87/7661. From the unpublished Appendix A to the Final Report.
[12]   AIR1/1297/204/11/139. Nominal rolls of officers and non-commissioned aircrew serving with the RFC overseas, dated January-April 1917.
[13]   AIR1/1297/204/11/140. Nominal roll of officers and non-commissioned aircrew serving with the RFC overseas, dated June 1917.
[14]   AIR1/1301/204/11/158. Nominal roll of officers and non-commissioned aircrew serving with the RFC overseas, dated August 1917.
[15]   *Ibid.*
[16]   AIR1/1036/204/5/1455. An enclosure on this file indicates that there were 32 NCO pilots flying with squadrons and a further seven held in reserve at Nos 1 and 2 Air Depots; unfortunately, this list is undated but there is ample circumstantial evidence to indicate that it was compiled *circa* late August or early eptember 1917.
[17]   AIR1/391/15/231/32. DAO letter 87/RFC/564 (O.2) dated 7 June 1917.
[18]   Eddington's personal recollections are in the Sound Archives of the Imperial War Museum. The extract reproduced here is taken from Steel, Nigel and Hart, Peter, *Tumult in the Clouds*, (London, 1997).
[19]   AIR1/1214/204/5/2630. Nominal roll of officers and non-commissioned aircrew serving with the RFC overseas, dated January 1918.
[20]   AIR1/520/16/12/1. War Office letter 79/9962 dated 18 August 1917.
[21]   AIR1/1078/204/5/1678. GHQ letter OB/1826/E/1 dated 6 September 1917.
[22]   See Note 18.
[23]   AIR1/1078/204/5/1678. War Office telegram 45677 dated 14 November 1917.
[24]   AIR1/399/15/231/40. DAO letter 79/9962 (O.2) dated 15 February 1918.
[25]   AIR1/398/15/231/39. DAO letter 79/9962 (O2) dated 8 January 1918.
[26]   AIR1/1078/204/5/1678. HQ RFC letter CRFC 2022/1G dated 6 March 1918.
[27]   *Ibid.* Brig-Gen H D Briggs informed HQ RFC of the problems being experienced in training NCO pilots on single-seaters in Air Ministry letter 79/9962 dated 5 March 1918.
[28]   *Ibid.* HQ RAF letter 2567(A) dated 30 August 1918.
[29]   *Ibid.*
[30]   In 1910 the Royal Aero Club had been recognised as the British licensing authority for all pilots and the completion of the elementary phase of military flying training was marked by qualifying for one's 'ticket'. By August 1916 the demands of the, still very basic, RAeC test no longer reflected the level of skill required of a military aviator. The Club's certificate had therefore become virtually irrelevant and it was agreed that the RNAS and RFC would thenceforth endorse the abilities of their pilots on their own cognisance. Until then most (but not all) RFC pilots had

been registered with the RAeC, thereafter registration became merely an option that was not always taken up. This would explain why only seven of the 32 pilots known to have flown in the NCO trial appear to have been recognised by (i.e. taken the trouble to register with) the RAeC.

[31] AIR1/1036/204/5/1455. Reports to HQ RAF, submitted either directly or via Brigade HQs, representing the views of Nos 11, 48, 84, 103 and 206 Sqns are on file.

[32] For example: Sgt J Matthews and FSgt J Helingoe had arrived in France with No 148 Sqn in April 1918 as had Sgt H N Lee of No 88 Sqn; Sgt H H Wilson joined No 99 Sqn in June and at the end of August, Sgts H W Tozer and A Haigh reached France with No 110 Sqn; Sgt A O Hall was posted to No 70 Sqn on 5 September 1918 and, just as hostilities were ceasing, the redoubtable FSgt Ernest Elton was on his way back to France with No 39 Sqn. This list is not presented as being exclusive; there will probably have been (a few) others.

[33] AIR1/1163/204/5/2532. HQ RAF return of numbers of aircrew by unit. Although undated, the assignment of squadrons to wings and brigades fixes the date as being no earlier than 1 November and no later than the 9th.

Notices/Reunions

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