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Foreword

The Royal Air Force Strategic Plan, launched by the Chief of the Air Staff earlier this year, tasked the Director of Defence Studies (RAF) with, amongst other things, 'leading in the development of air power doctrine within the military and academic communities'. With air power increasingly taking centre stage in modern conflict, it is essential that our doctrine is up to date, relevant and understood by all our people; it is also vital that it is situated within the joint and multinational arena. Yet doctrine inevitably means different things to different people. In the first article, therefore, I have sought to explain the nature of doctrine and examine the methodology used in the UK to produce joint doctrine. I then look at the unique features of air power in contemporary warfare before suggesting a more radical critique of how the doctrinal process may be seen to work.

One doctrinal lesson that can be drawn from any conflict is that we ignore or under-resource Sustainability at our peril. In the second article, the last in a trilogy of pieces commemorating the 60th anniversary of the Battle of Britain, Air Commodore Peter Dye graphically illustrates the part played by logistics in the Battle of Britain and how it shaped the outcome. He contends that the Battle was essentially an attritional struggle that tested the logistic systems of the RAF and the *Luftwaffe* as much as it tested their aircrew, aircraft and tactics. Production, storage, repair and salvage may not be as glamorous in the public eye as the heroism shown by 'the Few', but they were just as important.

The third article has been contributed by the eminent aviation historian Dr Alfred Price. His subject is the Junkers Ju 87 *Stuka*, the legendary German dive-bomber famous for its gull-winged profile and screaming siren. The *Stuka* has come to epitomise the operational doctrine of *Blitzkrieg* employed so successfully by German forces early in the Second World War. Dr Price examines the aircraft's service record in detail: its stunning impact in Poland and France; its limitations exposed during the Battle of Britain; its success against shipping in the Mediterranean; its role on the Eastern Front and the countermeasures devised by the Red Army; and finally its reinvention as a tank-buster. As one of the few aircraft types in action from the first day of the War to the last, the *Stuka* has earned its place in history.

If the advocates of Information Warfare (IW) had their way, history is where weapons such as ships, tanks and aircraft would be consigned; to them, modern warfare has become a conflict of 'systems'. In the next article, Squadron Leader Andrew Coller discusses the developments in both the philosophy and technology of IW and one of its major components, Electronic Warfare (EW). He argues that control of the electromagnetic spectrum is essential for modern forces, and that the utility of conventional weapons is being challenged by new EW systems such as Directed Energy Weapons (DEWS). He concludes that, in order to exploit these new developments, the RAF must adopt a radically different approach to EW to produce an offensive doctrine of 'electronic fire'.

In the fifth article, Vincent Orange examines the relationship between General Eisenhower, the Supreme Commander for Operation *Overlord*, and Air Marshal Sir Arthur Tedder, his deputy and one of the RAF's foremost doctrinal thinkers. In the months leading up to D-Day, the question of how air power could best assist the invasion was in danger of becoming bogged down in the 'command jungle' that characterised the rivalries of the air commanders and their political masters in Whitehall and Washington. It was largely due to the close personal and professional relationship between Eisenhower and Tedder that the 'Transportation Plan' – a prolonged, systematic attack on the transport arteries serving the invasion area – was adopted, thereby ensuring the success of the invasion.

The sixth article is the second and final part of the *Argentine Gazette* translated from the original document by Flight Lieutenant Christopher Brooks. The *Argentine Gazette* was the news leaflet issued to all members of the occupying Argentine forces during the Falklands War. It contains an account of military events on the islands and news from home, and as such represents a unique primary source of material on the Falklands campaign from the enemy perspective. In order to situate the document in its historical context, it has been complemented by the editorial edition of material drawn from a number of authoritative historical works; this material has been prepared by Squadron Leader Alan Riches.

In the final article, Alan Riches looks at the contribution of the balloon to the history of air power. It is often forgotten that, until the advent of heavier-than-air platforms at the beginning of the 20th century, the humble balloon was the only means of generating air power. As such, the balloon has been used in a wide range of military roles. Some of these roles – observation, balloon barrages and weather forecasting – are well known, but attempts have also been made to use balloons for more offensive purposes, such as the little-known strategic attacks against the continental USA by the Japanese in 1944-45. The author also shows how, thanks to technological developments, balloons now offer a cost-effective alternative to traditional platforms in areas such as surveillance and air defence.

D Def S (RAF)

CONTRIBUTIONS TO
THE ROYAL AIR FORCE AIR POWER REVIEW

The Royal Air Force Air Power Review is published 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.

Quality contributions from both service and civilian authors are sought which will contribute to existing knowledge and understanding of the subject. Any topic relevant to the study of contemporary or historical air power 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. Lengthy articles may be published in instalments. Contributions from serving military personnel should be in accordance with DCI GEN 313 dated 26 November 1999.

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AIR POWER and JOINT DOCTRINE:

An RAF Perspective

By Group Captain Peter W Gray, Director of Defence Studies (RAF)

Doctrine inevitably means different things to different people. To some, the mere mention of the 'D – word' is an instant cure for insomnia. Yet for others, it represents the panacea for all matters of policy and practice. This may be the means of defence against predatory treasury officials, or the ultimate authority for settling disputes. For some writers, doctrine is shorthand for accepted military thinking – for example, the official British Army doctrinal thinking on the early use of tanks was that they were only 'effective in masses'.[1] To others, doctrine represents the fundamental principles of military thinking that provide the foundations for generations of junior officers who, as they progress through their service careers, use the central tenets to influence their actions at every level of warfare from the tactical to the rarefied arena of force development, procurement and strategic policy making.

Doctrine can in no way, however, be taken as unchanging gospel; as Professor Richard Overy has written, 'military doctrine is neither ideal nor universal; it is historically specific and in flux, and the best doctrine reflects that reality'.[2] We must therefore ensure that our doctrine is not 'inscribed in stone' and that it is subject to constant and critical interrogation.[3] During the Cold War, NATO forces had the relative luxury of basing their planning on two manifestations of the threat: the Warsaw Pact forces would come over the horizon with little or no warning requiring instant force generation or there would be a gradual period of tension resulting in escalation to a war footing. In the 1973 Chesney Memorial Gold Medal Lecture given in the Royal United Services Institute, Professor Michael Howard stated that:

> 'I am tempted to declare dogmatically that whatever doctrine the Armed Forces are working on now, they have it wrong. I am also tempted to declare that it does not matter that they have got it wrong. What does matter is their capacity to get it right quickly when the moment arrives.'[4]

Air power could not have won the Gulf War on its own; but the 100-hour offensive could only have been made as effective as it was because of the aerial offensive that preceded it

I would suggest that we no longer have this luxury. The multi-faceted nature of modern conflict, compared to the linear spectrum of an earlier age, is such that our doctrine needs to be up to date, relevant and understood by all of our people.

It is particularly important that we get our doctrine right in relation to air power. The end of the Cold War with its relatively bloodless victory has seen air power come of age, realising many of the aspirations of its early prophets. Air power could not have won the Gulf War on its own; but the 100-hour offensive could only have been made as effective as it was because of the aerial offensive that preceded it. Similarly, air power was the only means of coercing Milosevic and his cronies at the start of both Deliberate Force and Allied Force. If air power is going to be expected repeatedly to take centre stage in modern conflict, it is vital not only that we get our air power doctrine right, but also that it is situated and understood within the joint arena. Should this task not be difficult enough in its own right, we must not neglect the importance of ensuring, as far as is possible, that our doctrine is consistent across the members of existing and potential alliances. As stated at the outset, doctrine means different things to different people.

This paper will therefore look at the nature of doctrine before going on to examine the methodology used in the United Kingdom to produce Joint Doctrine. The paper will then look at the unique features of air power in contemporary warfare before suggesting a more radical critique of how the doctrinal process may be seen to work.

THE NATURE OF DOCTRINE

The North Atlantic Treaty Organisation (NATO) defines military doctrine as:

> ‘fundamental principles by which military forces guide their actions in support of objectives. It is authoritative, but requires judgement in application.’[5]

This straightforward definition is cited, with approval, in the extant edition of British Defence Doctrine.[6] This pamphlet-sized document is at the head of the hierarchy of doctrine documents used by the British military. 'Military' is taken to encompass all armed forces.[7] British Defence Doctrine (BDD) does not purport to be a set of rules that could be applied without thought; instead it suggests that doctrine is a 'framework for understanding the nature of armed conflict and the use of military force'. BDD goes on to explain the relationship between policy and doctrine:

> 'Doctrine is the body of thought which underpins the development of defence policy; it is informative, whereas policy is essentially prescriptive. Doctrine has its foundation in history and derives its authority from being the distillation of much hard-won experience. Therefore it is enduring, but it is not unchanging. Doctrine evolves in response to changes in the political or strategic background, in the light of experience, or as a result of new technology. In turn, it influences the way in which policy and plans are developed, forces are organised and trained, and equipment is procured'.[8]

The careful wording of this bulleted paragraph highlights the underlying tension between policy and doctrine. Beneath this is the fundamental dilemma facing the armed forces in the post cold war era. With the demise of the Warsaw Pact, the services of virtually all NATO nations had to deliver early 'peace dividends' followed by annual defence of their budgets.[9] But at the same time, violent clashes in different parts of the world have tempted politicians to involve the armed services in a wide range of activities far beyond their cold war posture. Governments, with their policy advisors in close echelon, need the flexibility to respond to crises where national interests[10] are at stake or where humanitarian considerations demand. That this action may arise from the so-called CNN factor rather than from strictly altruistic logic matters little.[11] Doctrine can only be 'informative' in such circumstances. There is no scope for the military to challenge the wishes and desires of the government of the day by asserting that their putative actions are doctrinally unsound. And, on the face of it in a parliamentary democracy, nor should there be. The taxpayer is entitled to value for money, and where national survival is not at stake, defence expenditure is seen by many as an unnecessary luxury. That said, none of the services should be expected to deploy with either minimal training, or arguably worse still, having been trained for totally the wrong contingency. Military strategic level doctrine therefore acts as the source for a common approach through 'training to consistent behaviour, mutual confidence and properly orchestrated collective action without constraining individual initiative'.[12] The final element of the paragraph highlights the desirability of the whole process being mutually reinforcing.

This theme was evident in the 1998 Strategic Defence Review[13] in which the foundations were laid for the formation of the Joint Defence Centre (this was later expanded to include Concepts of future warfare). In essence, the Centre would be responsible for the development of defence doctrine and was also to provide a joint framework for more specific single-Service doctrine.[14] An underlying assumption in the Defence Review was that the vast majority of future operations would be inherently joint and combined – a fact recognised in the first paragraph of AP 3000 British Air Power Doctrine.[15]

In Chapter 11 of AP 3000, the authorities obviously accept the place of single-Service doctrine in the hierarchy; the NATO definition is therefore accepted without qualification.[16] The introduction to this Chapter, however, starts with the definition of doctrine as being 'what is taught; a body of instruction'.[17] This is followed with the warning that 'doctrine' is a loaded term that had developed differently among nations; as one could describe a British way in war, so there was a British way in air power doctrine.[18] This makes it clear that the United Kingdom's air power thinking had been specifically thought through and was not merely an adaptation of United States Air Force doctrine. The principal author and editor of the document was the Director of Defence Studies (RAF) with considerable assistance from the Air Warfare Centre and selected staff from the Ministry of Defence[19]. The USAF equivalent is the College of Aerospace Doctrine, Research and Education (CADRE) located at Maxwell Air Force Base in Alabama; links between the two organisations are nevertheless close. Chapter 11 of AP 3000 goes on to stress that 'knowledge and understanding of doctrine, and its application, help individuals to think more clearly in the chaos, fog and friction of crisis, conflict and war'.

It is axiomatic that doctrine must not be allowed to become dogma, however enduring we hope its central tenets will become. Some principles have become enshrined in air power thinking since its inception; in particular, the concept that air power is essentially an offensive weapon has withstood the test of time. Other influences include national interpretations of history, available resources and the incorporation of lessons learned from conflict or wars;[20] these factors will inevitably add to the national identity accorded to the body of doctrine. Set against this is the sharing of experiences in the conflicts that are undertaken as part of coalition. The majority of those responsible for the authorship of AP 3000 have taken part in operations alongside, inter alia, the USAF[21] and have access to the various publications emanating from Maxwell AFB.[22]

AP 3000 also states that air power doctrine should provide the intellectual framework within which the exploitation of air power and air warfare in general can be discussed, analysed and understood. That said, the issues below strategic level work are left to publications further down the hierarchy such as the RAF Air Operations Manual.[23]

British Maritime Doctrine[24] (BR1806) maintains inter-Service consistency by quoting, with approval, the BDD definition of doctrine.[25] BR1806 goes on to quote Admiral Sir Jock Slater who, as First Sea Lord, wrote in his introduction to the first edition that maritime forces 'must be careful to avoid a dogmatic approach in thinking about the principles that govern maritime actions'; he goes on to say that 'we must retain our reputation for innovation and for responding to political changes and technical opportunities'.[26] The authors of BR1806 insist that doctrine must be flexible in allowing commanders to challenge 'received wisdom' when appropriate and that it must be subject to 'regular formal review to ensure that the accumulated wisdom being promulgated in the form of doctrine is as robust and relevant as possible'. Having warned against change for change's sake, BR1806 contrasts doctrine at the strategic level with thinking at the tactical; at the former, doctrine will change only very rarely, whereas in the tactical arena it will be driven by equipment, threat and the environment.[27] BR1806 also fixes the

relationship between national doctrine and that agreed by NATO allies in that the UK prefers to influence NATO thinking and only elects not to ratify relevant issues in exceptional circumstances.

Although a systematic review of the doctrine of the world's air forces is outside the scope of this paper, it is instructive to look briefly at the nature of doctrine as envisaged by key allies. The United States Air Force (USAF), almost inevitably, takes the evolution of air power doctrine one stage further by including 'space' within its framing of the definition:

> 'Air and Space doctrine is an accumulation of knowledge gained primarily from the study and analysis of experience, which may include actual combat or contingency operations as well as equipment tests or exercises.'[28]

More loosely speaking, doctrine reflects what has usually worked best. Air Force Doctrine Document 1 (AFDD 1) describes its high level doctrine as being 'basic doctrine' which is defined as 'the most fundamental and enduring beliefs that describe and guide the proper use of air and space forces in military action'.[29] Operational and tactical levels of doctrine fall below this level and are guided by it. AFDD 1 goes on in addition to acknowledge joint and multinational doctrine as existing at each of these levels. Military doctrine, according to the USAF view, describes 'how a given task *should* be done to accomplish military goals; strategy defines how it *will* be done to accomplish national political objectives'.[30] Because war is an instrument of policy, military commanders must therefore 'ensure that policy governs the employment of military power and be prepared to adapt operations accordingly'.[31]

Military doctrine, according to the USAF view, describes 'how a given task should *be done to accomplish military goals; strategy defines how it* will *be done to accomplish national political objectives*

From the Commonwealth perspective, the Canadian Forces neatly combine definitions from both sides of the Atlantic. They emphasise that military doctrine 'explains in broad terms how operations should be conducted so that operational objectives can be realised'.[32] Chapter 1 goes on to describe doctrine as that which is taught, prior to citing the formal NATO definition.[33]

In his Foreword to AAP 1000[34] the Chief of the Royal Australian Air Force describes the Air Power Manual as being the RAAF's strategic level doctrine – the expression of its 'fundamental beliefs and principles'. As an example of an enduring principle from which doctrine is derived, he states that the 'aircraft is an inherently offensive weapon'.[35] Equally, doctrine must recognize the importance of the air base, physical geography and pressures arising from social organization or technology. Beyond the Foreword, AAP 1000 suggests that doctrine is derived from three sources:

- The lessons of the history of war
- Theory – the outcome of strategic thought
- Demonstrated or desired technological developments.[36]

AAP 1000 specifically ascribes personal responsibility to all members of the RAAF for understanding air power – every individual is 'encouraged to learn more about air power – through reading and discussion and, if possible, writing'

AAP 1000 defines Basic Air Power Doctrine as being, inter alia, a set of endorsed principles for the guidance of commanders; the essence of current strategic thought; and an authoritative source from which both joint doctrine and procedures can be drawn. This is the fundamental philosophy for the employment of air power.[37] The manual also emphasises that basic military doctrine's 'prime purpose is to educate – to provide the foundation of professional mastery' (emphasis in the original).[38] AAP 1000 specifically ascribes personal responsibility to all members of the RAAF for understanding air power[39] – every individual is 'encouraged to learn more about air power – through reading and discussion and, if possible, writing. The practice of professional mastery, complemented by one's own set of key skills will enable unique insights to be drawn as to how air power could be delivered better… all individuals have an equal responsibility – regardless of rank, category, mustering, appointment or location – to do their very best.'[40]

JOINT DOCTRINE IN THE UNITED KINGDOM

Mention has already been made of the Joint Doctrine and Concepts Centre. Its Director General and his staff took formal responsibility for Joint Doctrine from the Chief of Joint Operations in the Permanent Joint Headquarters on 1 Oct 99. As part of the process, the single-Service Heads of Defence Studies were due to collocate in the JDCC to act, inter alia, as a conduit between their own services and the Centre on all strategic doctrinal matters. The premise upon which the JDCC is working is that all doctrine at the operational level and above is, by definition, joint and is therefore the responsibility of the Director General. The editor of the latest edition of BR 1806 makes it clear in his introduction that future editions of that work would be written and published by the JDCC. The same is true for Air Power Doctrine and British Military Doctrine. The JDCC is also responsible for tactical level doctrine that is inherently joint in nature. The rest remains the responsibility of the single-Service warfare centres, albeit with JDCC oversight and co-ordination.

British Defence Doctrine is in the process of being produced by the JDCC under the direction of VCDS and will be issued under Defence Council authority. Subsequent iterations of BMD, BR1806 and AP 3000 will be compiled in the same way albeit with single-Service Board approval. In a recent interview, the DG JDCC confirmed the pragmatic approach between single-Service concerns and joint oversight.[41] The recent editions of the last two documents stress the joint nature of warfare and rigorously avoid dogmatic debate over ownership of platforms.

AIR POWER AND JOINT DOCTRINE

At the outset of this section it is worth reiterating that the vast bulk of air power doctrine is consistent with wider military thinking on the joint and combined levels. Nowhere is this more evident than in the convergence of our views on manoeuvre warfare.[42] There will inevitably be areas of difference, however, and it is equally inevitable that I will spend more time discussing these than on topics of congruence.

A central tenet of British military training is that our officers and men (and women) are inculcated with their single-Service ethos long before we attempt to turn them into 'purple' beings. This ensures that the individual has a thorough grounding in his or her specialist field and will therefore in the future be able to contribute more effectively to their own Service and later in the joint arena. The obverse side of this particular coin is that they will bring their own baggage to the table whether this be differing interpretations of history or unhealthy doses of dogma. A fair example of the former could be the evacuation of Dunkirk in 1940. Many army officers and men still consider that the RAF had let them down over the beaches. This dogmatic assertion does not take into account the very real practical difficulties of co-ordinating close air support in such a fluid situation. Nor does it allow for the much more efficient use of air power in interdicting enemy supply routes and achieving vital air parity. The lack of radar cover over France and the sheer numbers involved prevented the RAF from establishing air superiority, but the evacuation would have been doomed had not the fighters kept the Luftwaffe at bay albeit unseen by the beleaguered soldiery. The reality was that all but ten of Fighter Command's Squadrons took part, flying over 2,700

The lack of radar cover over France and the sheer numbers involved prevented the RAF from establishing air superiority, but the evacuation would have been doomed had not the fighters kept the Luftwaffe at bay albeit unseen by the beleaguered soldiery

sorties; according to the Official History, the Luftwaffe were only able to interfere seriously with the evacuation on 2 out of the 9 days.[43] The dangers of dogma were apparent in 1940 in the debate over the use of bombers against German invasion barges and ports rather than against strategic targets in the homeland.[44]

To many soldiers, 'Command' implies direct responsibility for and control over those that have been put in his charge. To an airman, command of air power should be exercised at the highest level, but execution of the military tasks should be decentralised. Modern air power doctrine requires the allocation of all assets to the Joint Task Force Commander. It may well be that in a given situation, the vast majority of the air assets are allocated to the Land or Maritime Component Commanders rather than to the Air. This is centralised command and control.[45] Decentralised execution avoids over-prescriptive tasking and allows subordinate commanders the scope to interpret their commander's intentions, making the most of the assets available to them. What must be avoided is an unseemly spat over ownership of assets or, even worse, the dispersal of air assets into penny packets. As Tedder remarked after his experiences in the North African Desert campaign:

> 'Air Warfare cannot be separated into little packets; it knows no boundaries on land and sea other than those imposed by the radius of action of the aircraft; it is a unity and demands a unity of command.'[46]

This does not necessarily mean that only airmen can make the best use of air power or the Joint Force Commander must be 'light blue'. The circumstances of a particular conflict may make it more appropriate to have a soldier or a sailor as JFACC. What is important is that they understand air power doctrine and how to gain best advantage from the assets available. The welcome attendance of members of the other Services on the Air Warfare Centre JFACC course is testament both to openness and jointery at work.

The use of air power to achieve strategic effect has been dear to the hearts of air power theorists for over a century. A full analysis of their thinking is outside the scope of this paper,[47] but suffice it to say that the premise that air power may succeed in isolation from the efforts of sister Services is not conducive to the joint approach. No serious air power advocate would contend that prosecution of the enemy by air alone would guarantee success on every occasion. But all potential commanders of whatever cloth should be aware of the ability of air power to attack a target set, successful prosecution of which could have a genuinely strategic effect on the enemy.[48] The important aspect to be considered is that the commander's

Montgomery's assertion that loss of control of the air leads to a rapid loss of the war is as relevant today as it was in the Desert and in Normandy

staff must identify the enemy strategic centre of gravity from the enemy's perspective – not through western-centric eyes. This is, or should be, an inherently joint activity with benefits beyond the utilisation of air power.

If the use of air power for strategic effect is close to the hearts of air power advocates, the matter of control of the air should be coursing through the veins of every military planner. Montgomery's assertion that loss of control of the air leads to a rapid loss of the war is as relevant today as it was in the Desert and in Normandy. There may be a popular misconception in some circles that control of the air will be ceded in the face of overwhelming US fighter cover. The reality is that it has to be fought for, established and then maintained. This is the ultimate service that air power can provide to any commander short of instant success in winning the war outright.

The exploitation of information superiority is absolutely vital if manoeuvre warfare is to be conducted. Only by getting inside the enemy OODA-loop is it possible to avoid a costly descent into attritional warfare. This process must be joint and must make full use of all collection methods with shared analysis of the final product. Again, debate over ownership of assets is anathema to efficiency.

As intimated above in the discussion on Dunkirk, the use of air power in Direct and Indirect air operations must be fully understood by commanders at all levels. It is highly improbable that the Joint Commander will have a surfeit of air assets. The reality is that he will have to prioritise his tasking and his weapons expenditure. He will not be able to afford the luxury of, to paraphrase General Colin Powell, 'doing bridges and power stations because we do bridges and power stations'. Nor will we necessarily be able to engage in 'tank-plinking' to produce media friendly statistics or video footage. The commander must ensure that the targets chosen will have a vital and deleterious effect on the enemy. Again there is emphasis on the word 'effect'. That said, air power must always be sufficiently flexible and responsive to be able to support ground troops in their hour of critical need – provided the commander has weighed fully the costs and benefits against the risks (not least of blue-on-blue incidents, of which examples abound from Normandy to the Gulf). To do this efficiently, a thorough understanding of joint and single-Service doctrine is essential.

The risks to friendly forces, whether they are deployed or operating from home base, from special forces or terrorists is of sufficient importance that it cannot always be left to self-help. Peace dividends and

... less glamorous roles such as air-to-air refuelling, air transport, suppression of enemy air defences and combat SAR are as vital to mission success as precision weaponry

contractorisation have so depleted uniformed manpower levels that adequate self-protection may no longer be possible without considerable detriment to operational tempo.

The final area of Joint Force Employment comes into the category of 'last but by no means least'. After the Kosovo air operations, General John Jumper (Commander USAFE) wrote in the RAF Air Power Review a warning against learning generic lessons from such an idiosyncratic campaign.[49] One general lesson that is worth drawing from this conflict, however, is that we ignore or under-resource Combat Support Air Operations and Sustainability at our peril. The less glamorous roles such as air-to-air refuelling, air transport, suppression of enemy air defences and combat SAR are as vital to mission success as precision weaponry. It is vital in the formulation of joint doctrine, in considering single-Service doctrine and in establishing the extent and content of equipment capabilities that we are all aware of the needs of and requirements of our joint war-fighting partners. At the heart of this understanding is an awareness and appreciation of each other's doctrine. This can only be achieved through education – the most basic definition of doctrine – that which is taught.

EDUCATION AND PROCESS

The emphasis on the role of education in the formulation and dissemination of doctrine is important to the maintenance of dogma-free thinking. Likewise the reliance on personal responsibility is vital. Beyond requests for formal feedback,[50] or the invaluable discussion periods at the end of presentations, the process of maintaining an active debate on air power depends on enthusiastic participation from as broad a cross-section of the Kirk as is possible. At the formal end of the spectrum, air power doctrine is taught at each level of command and staff training within the RAF, and likewise in all other professional services. Syndicate exercises, war games and study periods are all used to encourage both the learning process and to stimulate debate.[51] Given that all of this training is conducted under the auspices of the Joint Services Command and Staff College, it should be inherently joint and consistent.

Debate is also encouraged by the publication of formal journals. For many years, the RAF published current thinking on air power topics as the leading article in its monthly magazine, *Air Clues*. In 1998, the RAF Magazine was terminated, and followed by a new magazine *Airclues* which focused on flight safety matters. A quarterly journal –*The RAF Air Power Review* – was instigated in place of the monthly article and rapidly achieved a worldwide readership.[52] Articles are selected from work produced on the staff college courses thereby extending the product of the debate in those places of learning far beyond their hallowed portals. Other works are submitted by leading academics, servicemen on the frontline, Service chiefs[53] or by air power thinkers from other overseas forces.

REAL DOCTRINE

Real doctrine can therefore be considered to exist at three levels. The formal level is where conceptual thinking and fundamental principles have been distilled and transformed into the written word. But this is not set in stone and must be subject to Overy's constant and critical interrogation. Even in the depths of the inter-war years, strategic bombing 'doctrine' did not totally stifle original thought. Work continued into thinking on Home Defence with concomitant work on fighter development – even though this was supposedly heretical. This second level of fluid, innovative and active thinking should then mature into the third level of doctrine – emerging doctrine that takes its place in the in-trays of those charged with re-writing the next editions of the formal documents. Joint establishments, in which the active exchange of ideas is encouraged, facilitate the abolition of single-Service shibboleths and the production of real joint doctrine without diluting the key attributes of each environment.

It is important in any discussion on doctrine to ensure that the relationship between doctrine and policy is defined clearly. There will inevitably be a policy baseline for defence such as that iterated in the Strategic Defence Review. There will also be strategic and/or policy guidance particular to a given conflict or set of circumstances. But policy does not drive doctrine. Even if a specific crisis highlights a lack of 'fundamental principles' to guide our actions, doctrine cannot be formulated in such circumstances. Rather, it is the product of regular and careful reflection by the advocates of a particular medium which is then enunciated within the joint and combined arena.

NOTES

1 John Terraine, *To Win a War, 1918 The Year of Victory*, Cassell, London, 2000, page 39.

2 Richard Overy, 'Doctrine Not Dogma; Lessons from the Past', *Royal Air Force Air Power Review*, Vol 3, No 1, Spring 2000, page 46.

3 Overy, ibid, page 44.

4 Michael Howard, 'Military Science in an Age of Peace', Chesney Memorial Gold Medal Lecture given on 3 Oct 73 and published in *JRUSI*,Vol 119, No 1, page 7.

5 AAP-6 NATO Glossary.

6 Joint Warfare Publication (JWP) 0-01, *British Defence Doctrine*, (hereinafter cited as BDD) HMSO, 1997, page 1.2. At the time of writing, this document was being re-written, but no change in definition was envisaged at the first working group (which the author attended).

7 BDD, ibid, page 1.2.

8 BDD, ibid, page 1.2.

9 Whole rain forests have been decimated on this subject. For a brief review of the challenges see 'Perspectives' *International Institute for Strategic Studies, Strategic Survey 1991 –1992*, Brassey's, London, 1992, pages 5 –14.

10 National interests have always been difficult to define. For a particularly thought provoking essay on the US view see Joseph S Nye Jnr, 'Redefining the National Interest', *Foreign Affairs*, Number 4, Volume 78, July/August 1999, pages 22 – 35. That this is based on the US national interest does not make it any the less pertinent as the relationship between the UK and the US is close enough for their concerns to be directly relevant.

11 See, for example, Michael Ignatieff's essay in Jonathan Moore (Ed), *Hard Choices: Moral Dilemmas in Humanitarian Intervention*, Lanham, Rowman and Littlefield, 1999.

12 BDD, ibid, page 1.3.

13 *The Strategic Defence Review*, Cm3999, London, 1998, Chapter 3. (Henceforth cited as 'SDR').

14 SDR Chapter 9, page 45. The Joint Doctrine and Concepts Centre came into being on 1 September 1999, albeit in an interim format.
Full status was expected by 1 April 2000.

15 See the Introduction to *AP 3000 British Air Power Doctrine*, Third Edition, HMSO, London, 1999. (Henceforth cited as AP 3000).

16 AP 3000, Chapter 11, page 3.11.1.

17 AP 3000, Chapter 11, page 3.11.1.

18 The British way in war is taken from Basil Liddell Hart, *The British Way in Warfare*, Penguin, London, 1942. This is relevant to the doctrinal debate in that Liddell Hart suggested that the British military had operated according to a series of assumptions and general ideas concerning the nature and conduct of war, rather than emphasising formal doctrine. See also Colin McInnes and John Stone, 'The British Army and Military Doctrine' in *Doctrine and Military Effectiveness – Proceedings of the Conference held at The Britannia Royal Naval College 16 – 17 January 1997*, edited by Michael Duffy, Theo Farrell and Geoffrey Sloan, University of Exeter.

19 The author assumed this post on the working day after the third edition of AP 3000 was launched. The acknowledgements in AP 3000 fully reflect the credit to those that contributed to the process.

20 AP 3000, Chapter 11, page 3.11.2.

21 In the biographical notes supplied to the Joint Services Command and Staff College, Department of War Studies, RMA Sandhurst, and Strategic & Combat Studies Institute Joint Seminar on 28 October 1998, Group Captain Stu Peach, (Director of Defence Studies (RAF)) stated that he had 'commanded squadron size deployments to 15 countries in three continents and completed three operational tours in the Middle East'. Some degree of cross-fertilisation of ideas is inevitable with such experience.

22 The majority of these are available on the Internet via http://www.usafdoctrine.maxwell.af.mil/library/Hierarchy.asp.

23 *The RAF Air Operations Manual*.

24 *British Maritime Doctrine, BR 1806*, Second Edition, HMSO, London 1999. (Henceforth cited as BR1806).

25 BR1806, ibid, page 5.

26 *British Maritime Doctrine BR1806*, First Edition, HMSO, London, 1995, Foreword; also cited in the second edition pages 5 & 6.

27 BR1806, Second Edition, page 6.

28 *Air Force Doctrine Document1*. Published by Order of the Secretary of the Air Force, September 1997, page 1. (Henceforth cited as AFDD 1).

29 AFDD 1, ibid, page 2.

30 AFDD 1, ibid, page 4; emphasis as in the original.

31 AFDD 1, ibid, page 4.

32 *Out of the Sun: Aerospace Doctrine for the Canadian Forces*, Craig Kelman, Winnipeg, para 101.1, page 1.

33 *Out of the Sun*, ibid, para 101.2.

34 *Royal Australian Air Force, The Air Power Manual, AAP 1000*, Third edition, Air Power Studies Centre, 1998, (henceforth cited as AAP 1000), page v.

35 AAP 1000, ibid, page v.

36 AAP 1000, ibid, page 2.

37 AAP 1000, ibid, para 1.13, page 4.

38 AAP 1000, ibid, para 1.5, page 2.

39 AAP 1000, ibid, paras1.19, 1.23 and 1.28.

40 AAP 1000, ibid, para 1.33.

41 Major General Tony Milton, 'My Job: Director General Joint Doctrine and Concepts', *JRUSI*, Vol 145, No 2, April 2000, page 17.

42 See Group Captain Peter W Gray, 'The Contribution of Air Power to Manoeuvre Warfare', *JRUSI*, Vol 145, No 3, Summer 2000, page 60 et seq.

43 Sir Maurice Dean, *The Royal Air Force and Two World Wars*, Cassell. London, 1979, page 134.

44 See Neil Young, 'The Role of Bomber Command during the Battle of Britain', *Imperial War Museum Review*, No 6, 1991, page 79.

45 For a full description of this see Wing Commander Tom McWilliams, 'Centralised Command and Control, Decentralised Execution; What does this mean?' *RAF Air Power Review*, Vol 1, No 2, Autumn 1998, page 87.

46 Cited in AP 3000, page 1.3.1.

47 The best and most recent summary is given by Philip S Meilinger in 'The Historiography of Airpower: Theory and Doctrine', *The Journal of Military History*', 64, April 2000, pages 467 – 502.

48 See Group Captain Peter W Gray, 'Air Operations for Strategic Effect – Theory and Practice in Kosovo', *RAF Air Power Review*, Vol 3, No 1, Spring 2000, pages 16 – 32.

49 General John Jumper, 'Kosovo Victory – a Commander's Perspective, *RAF Air Power Review*, Vol 2, No 4, Winter 1999, page 2.

50 AP 3000, introduction specifically requests such feedback from its readership.

51 Beyond the lectures described in the footnote to the introduction, the author also took part in syndicate and panel discussions on such topics as the role of air power in the air operations of the Kosovo campaign.

52 As Director of Defence Studies (RAF), the author is chairman of the Air Power Review Management Board responsible for the selection and publication of suitable articles.

53 See almost any copy of the *RAF Air Power Review* for examples; specifics include the speech from Air Chief Marshal Sir Richard Johns reprinted in Volume 3, No 1, Spring 2000 or that written by General John Jumper, Commander of the USAF in Europe in Volume 2 No 4, Winter 1999.

Welcome to NATO.
Royal Air Force Jaguar with Polish Air Force Sukhoi 22 on visit to UK.

Photo by SAC Steve Follows

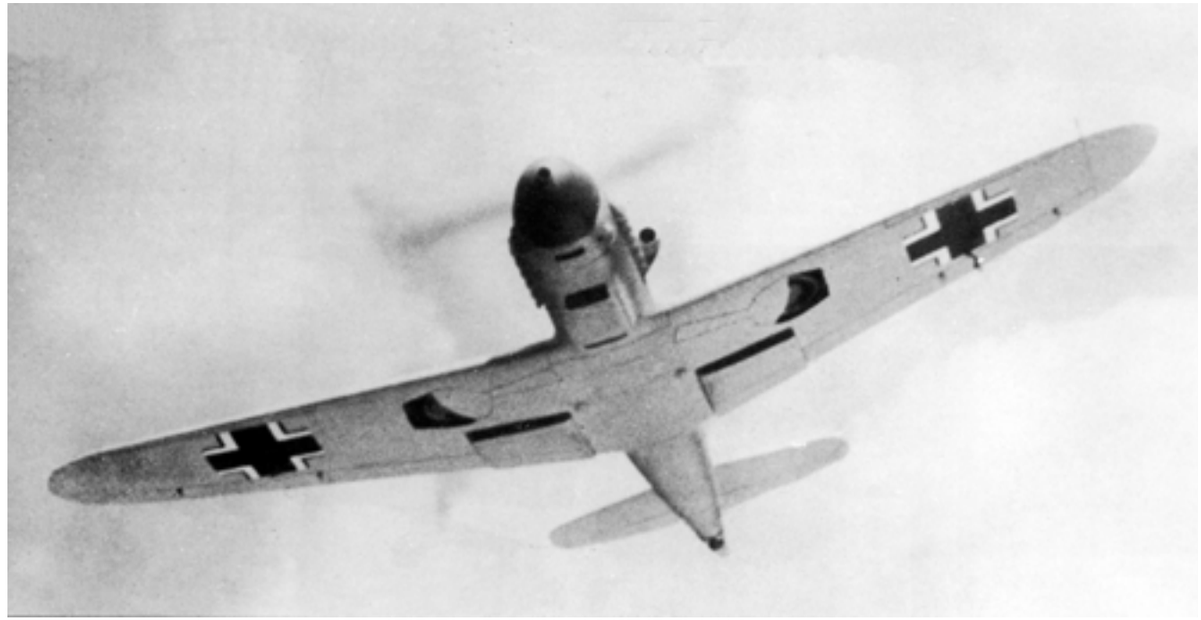
LOGISTICS and the BATTLE OF BRITAIN

It is arguable that the Battle of Britain was lost long before the Second World War started. Luftwaffe doctrine, so successful in establishing a powerful synergy between air and land operations, was deeply flawed in its understanding of the fundamentals of air power. The causes were various but the result was that inadequate provision was made for the industrial investment and resources necessary to sustain operations in the face of the high wastage rates that war would bring. By contrast, the Royal Air Force was well placed to defend Great Britain, notwithstanding its perceived doctrinal emphasis on strategic bombing. As Richard Overy has recently pointed out, the contest that the country faced after Dunkirk had been anticipated and prepared for in the 1930s.[1] The Air Ministry, planning the rapid expansion of the frontline, had clearly understood the lessons of the First World War and, in particular, the high cost – in human and materiel terms – of sustaining air operations.[2] By providing the proper economic and logistic basis for realizing these plans, the air staffs had also established the foundation for increasing Allied air superiority as the war progressed. This is not to say that their pre-war planning was without flaws. Indeed, at a tactical and operational level the Luftwaffe enjoyed self-evident advantages. However, by getting the fundamentals right and being prepared to learn from painful early reverses, the Royal Air Force placed itself in a significantly stronger position to fight the Battle of Britain than the Luftwaffe.

None of this is to deny the huge importance of technology, of tactics, of leadership and the courage of individual pilots in determining the final outcome. No doubt these issues will continue to dominate the debate on the conduct of the Battle of Britain for the foreseeable future – much as they have for the last 60 years. But the possibility of a Luftwaffe victory was effectively compromised by plans laid down in the pre-war period that provided Fighter Command with a quantitative advantage, and the means to sustain this advantage, denied to their opponents.

…single seat fighters would need to prevail if the Luftwaffe was to achieve air superiority over Southern England and, in so doing, defeat the Royal Air Force

This article seeks to clarify the part played by logistics in the Battle of Britain and how it shaped the outcome. For brevity, the analysis focuses primarily on the single seat fighters deployed by the respective air forces. It was in this arena that the Luftwaffe would need to prevail if it was to achieve air superiority over Southern England and, in so doing, defeat the Royal Air Force.



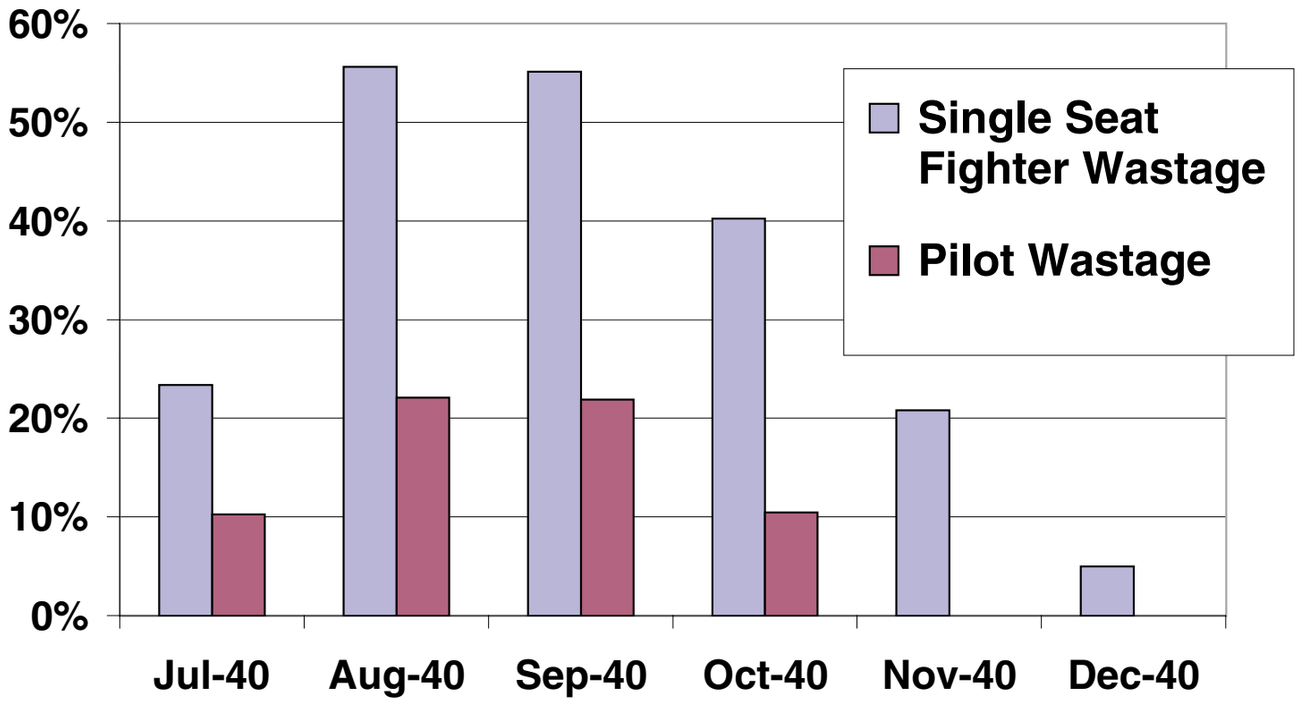
WASTAGE

As the prospect of war grew ever stronger, the Royal Air Force turned to the First World War for some indication of what to prepare for. While it was recognised that technology had moved on considerably since 1918, it was expected that the problems to be overcome in prosecuting a modern war would be familiar, albeit more acute. In a paper delivered to the Royal United Services Institute in 1934, the difficulties facing a technical service preparing for the next war were explored in some detail, particularly the question of how to make good wastage.[3] Chairing the meeting was Sir Robert Brooke-Popham, who had been largely responsible for the development of the highly efficient logistic system that supported the Royal Flying Corps and the Royal Air Force on the Western Front.[4] In a review of the key issues, it was stated that the average life of an aircraft in war was 2 months, a view shared by Sir Robert, who referred to the 45% monthly attrition suffered by the Royal Air Force between March and October 1918.[5] Wastage could only be made good from 3 sources: manufacture; reserves; and repair. As matters stood, it was unlikely that either industry or the Service depots could satisfy the demand. Accordingly, for the Royal Air Force to prosecute the next war it would need a greatly expanded peacetime establishment, high production rates, larger repair depots, additional skilled technical personnel, an emphasis on quantity over quality (in the sense of balancing production against continuous progress), long preparation and careful planning.

Such public pronouncements were matched by the Air Staff's own calculations in Memorandum No 50 (Secret Document 78), first issued in 1933, that provided data for the calculation of consumption and wastage in war.[6] The monthly wastage rate for single seat fighters engaged in Home Defence was assessed to be 100% and that for single seat pilots 30%. Thus, it was

anticipated that a fighter force of 50 squadrons would suffer wastage of 1,000 aircraft a month when engaged on active operations. Assuming that the depots could repair 50% of these machines,[7] industry would need to produce 500 new aircraft a month just to maintain frontline strength. In order to cope with peaks in attrition, and the inevitable delay in mobilizing industrial production, reserves equal to at least 6 weeks' wastage would also be required (some 1,500 aircraft). Finally, approximately 300 new fighter pilots would be needed each month, although it was recognised that dilution would be a major factor in determining whether operational effectiveness could be sustained.[8] Interestingly, given the received wisdom that pre-war Royal Air Force planners were only interested in strategic bombing, it was further stated that "*Home Defence was the most important commitment that the Service had to prepare for*".[9]

Figure 1 : Fighter Command Monthly Wastage July - December 1940



In the event, these calculations would not prove to be grossly unrealistic, as **Figure 1** indicates.[10] More importantly, in recognising the attritional nature of any future war,[11] the Air Staff had laid the foundations of an expansion plan that would provide the Royal Air Force with the resources to defeat the Luftwaffe both in terms of availability and sustainability. This is not to say that the Luftwaffe had failed to recognise the importance of wastage. Plans prepared in 1938 envisaged a monthly attrition of 50% in bombers and fighters, but the necessary resources and organizational arrangements to make good such losses were not put in place prior to the outbreak of war. Richard Overy has previously commented that pre-war air theory had largely avoided the difficult question of the appropriate level of supply to sustain air power, noting that "*This was not a question of sheer numbers alone, but also of aircraft quality, and of repair and maintenance as well*".[12] As we will see, it would be difficult to accuse the Royal Air Force staffs of this failing, whatever their faults in other areas of pre-war planning.

“Battle of Britain 1940 – Repairs underway by squadron engineering personnel to a Hurricane.” – One of the subsequent lessons drawn by Fighter Command was that the semi-autonomous maintenance system, introduced during the pre-war expansion of the RAF, was not that well matched, in size and flexibility, to the mobility demanded of the flying squadrons.

REARMAMENT

Between 1934 and 1938 there were 8 separate expansion schemes designed to close the air gap with Germany. They were, as John Terraine has observed “*All, in the strictest sense, failures*”, nevertheless adding that they “*did provide Britain with an air force which was fit (just) to go to war in 1939 and fit (by a narrow margin) to win a decisive victory in 1940*”.[13] Understandably, for the purposes of deterrence, there was a strong element of show compared to substance in all of these schemes, however, they did ultimately provide for a considerably expanded and modern frontline with significant reserves and the necessary industrial capacity, including shadow factories, to sustain operations. For Fighter Command, the intention had been to provide 50 squadrons of Hurricanes and Spitfires by March 1942, the number deemed necessary to defend against a possible attack by 2,000 German bombers. In the event, this would be achieved (just) by July 1940.

Unfortunately, none of the expansion schemes had tackled the question of repair and overhaul. In fact, the air staffs were divided on the advisability of building up a large-scale repair and maintenance organization in preparation for war. There was little prospect of any significant investment while Sir Edward Ellington remained Chief of the Air Staff (CAS). He had famously expressed his own views with the statement that "*There will be no repair in war*".[14] When Sir Cyril Newall replaced him in September 1937, the Air Member for Supply and Organisation, Air Vice-Marshal Welsh, was moved to comment that "*we had been building up a frontline Air Force, which was nothing but a facade. We had nothing by way of reserves or organisation behind the frontline with which to maintain it*".[15] To meet these needs, it was agreed to construct 3 large Service depots (Sealand, St Athan and Henlow) and 3 civilian-manned depots under Service control (Stoke, Abbotsinch and Burtonwood). The former would undertake 25% of the repair arisings, the civilian-manned depots the remainder. This presaged a huge expansion in the repair, supply and storage organization as the war progressed. But, while this would ultimately comprise a network of over 300 maintenance units at home and overseas, the outbreak of war arrived before any of the large general repair depots could be completed.

"Battle of Britain 1940 – A Spitfire is serviced and rearmed by squadron engineering personnel." – At this stage of the war, maintenance was carried out on a semi-autonomous basis, but by 1942 a more efficient, and more mobile centralized system had been introduced.

PRODUCTION

The expansion of the British aircraft industry in support of re-armament was an immense achievement in which huge obstacles had to be overcome. Perhaps the most significant development in pre-war planning was the introduction in 1938 of the War Potential programme that sought to give Britain the capability of producing 2,000 aircraft a month by the end of 1941. As Sebastian Ritchie has pointed out, this provided the basis for planning aircraft production in much greater depth and for developing a comprehensive state production organisation.[16] Although an output of 2,000 aircraft a month would not be achieved until the end of 1942, actual production soon exceeded planned targets. By comparison, German aircraft production languished in the early part of the war. Thus, while Britain produced 4,283 Hurricanes and Spitfires in 1940 against a planned total of 3,602, Germany produced 1,870 Bf 109s against a planned total of 2,412.[17] Incredibly, Germany did not mobilize its aircraft industry on the outbreak of war neither did it seek to expand the Luftwaffe's repair capability to make good this deficiency. In September 1940, when attrition was at its highest, Britain produced 467 Hurricanes and Spitfires while Germany only produced 218 Bf 109s.[18] As we will see, the relative performance of the British and German aircraft industries was critical to both the size and sustainability of the frontline.

Single Seat Fighter Production[19]

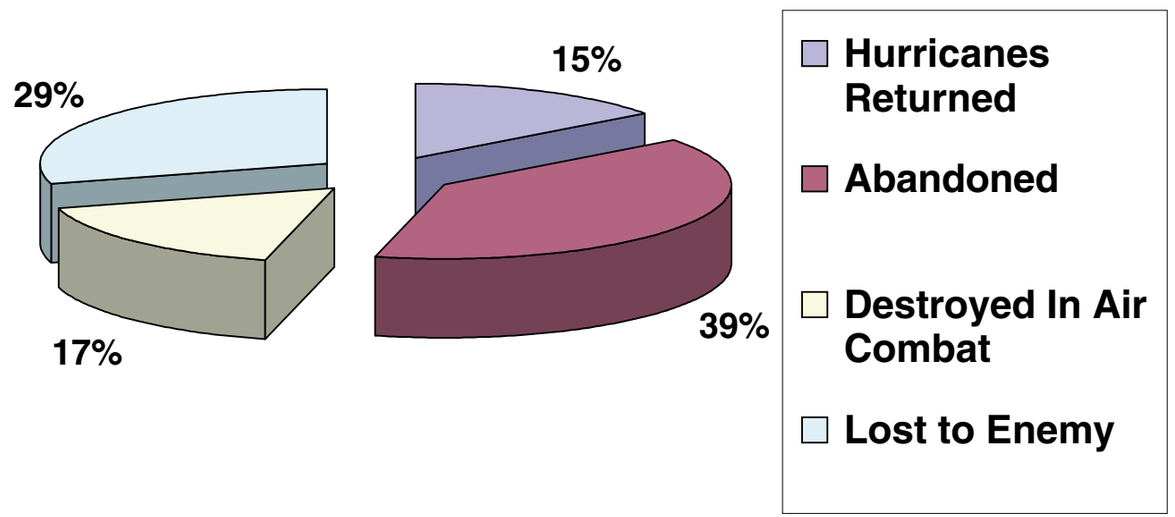
	Germany	Great Britain
1939	1,541	1,324
1940	1,870	4,283
1941	2,852	7,064
1942	4,542	9,849
1943	9,626	10,727

THE BATTLE OF FRANCE

Just how high actual operational wastage would prove was demonstrated in the Battle of France. Of the total of 452 Hurricanes sent to France (equivalent to some 2 months' production) only 66 returned **(Figure 2)**. No fewer than 178 of those lost had been abandoned or destroyed through lack of repairs.[20] Only a relatively small number were lost in air combat.

These losses could be ill afforded. They were also, to some extent, avoidable. The arrangements for the maintenance of the Royal Air Force units deployed in France were unsatisfactory in many respects. In 1934 it had been decided by Sir Edward Ellington to make deployed squadrons self-sufficient in the event of war rather than to establish a supporting organisation of mobile air parks and depots (based on First World War experience) as had been originally proposed. The course of the war would demonstrate the soundness of the latter scheme; indeed, it would form the basis of the highly effective support arrangements for the Tactical Air Forces.[21] In the meantime, those squadrons deployed to France found themselves desperately short of reserves, vehicles, spares, and repair and salvage capabilities. Wastage rates were also higher than they had prepared for. As a result, in-theatre repair amounted initially to a mere 2 Hurricanes a week and had risen to only 8 a week by June (and this after considerable effort). Almost no engine repairs had been completed owing to a shortage of tools.[22]

Figure 2 : Hurricane Wastage During The Battle of France



No fewer than 178 of those lost had been abandoned or destroyed through lack of repairs

Such experiences were not unique to the Royal Air Force. Anecdotal evidence indicates that the Luftwaffe suffered no less seriously from high operational attrition. Feldwebel Eric Bartel, who served as a Jagdgeschwader mechanic for much of the war, recalled that after just 17 days action his staffel of 12 Bf 109E's from JG 77 had been reduced to just 5 or 6 machines – including spares – but mainly through mechanical failures and "*normal wear and tear*" rather than enemy action.[23]

THE ROYAL AIR FORCE MAINTENANCE ORGANIZATION

With the expansion of the Royal Air Force from 1936 onwards came the need to change the policy on aircraft servicing. Prior to this period, each flight within a squadron was a self-contained unit for repair and maintenance, up to 'write-offs'. This was altered to a 3-flight arrangement under which 2 flights undertook day-to-day maintenance and the third flight all major inspections and repair. This system remained in force during the first year of the war but experience in the Battle of Britain exposed significant weaknesses. As the tempo of operations increased so squadrons were moved at more frequent intervals. The result was that squadrons became increasingly detached from their support staff; in some cases they found themselves distributed across 3 different stations. In December 1940 it was decided to transfer the bulk of the squadron's servicing personnel to a station maintenance unit, so significantly increasing the mobility of the Fighter Command squadrons.[24] These arrangements, with some refinements, would remain in place until the end of the war.

Repair was a more difficult issue to resolve. It became rapidly apparent, even before the outbreak of war, that the Royal Air Force would not have the capacity to meet anticipated arisings. As a result it was agreed in October 1939 that a Civilian Repair Organization (CRO), based around the 'fringe firms',[25] would be set up under Lord Nuffield who would also control the Service repair organisation; including the Service-manned depots. At the time, this was a difficult decision taken in the face of some understandable hostility. The CRO came into being in January 1940, yet by the end of the year it had repaired a total of 4,955 airframes, about 33% of the total airframe output going to the Metropolitan Air Force. By 1941, the total was slightly over 50%.[26] Similar arrangements, organized around the original equipment manufacturer, were put in place for engine and propeller repair.

Prior to the expansion scheme such reserves as existed were stored on the stations where they were to be used. The significant increase in the size of the reserve demanded dedicated storage facilities. It was planned to establish 24 Aircraft Storage Units (ASUs) equipped to store 400 aircraft each and located at existing airfields (but as far away from continental Europe as practicable). On the outbreak of war, the Royal Air Force had some 2,200 aircraft in storage at 12 ASUs. Early in 1940 it was decided that large hangars storing considerable numbers of aircraft presented too high a risk and, accordingly, aircraft were dispersed more widely to reduce the maximum holdings in each ASU from 400 to 200 aircraft.[27] ASUs not only provided a strategic reserve of aircraft but also formed an important buffer between the factory and the frontline to cope with inevitable surges in wastage and also to complete modification and installation work prior to final delivery. For example, in

August 1940, No 19 Maintenance Unit at St Athan issued 58 Hurricanes and received 55, leaving 23 in stock out of a total of 237 stored aircraft of 19 different types. By the last quarter of 1939 total ASU holdings had risen to 3,600 aircraft and had grown to over 5,000 by the end of 1940.

THE LUFTWAFFE REPAIR ORGANIZATION

Much of June and July 1940 was used by the Luftwaffe to make good the significant losses it had suffered[28] and, in particular, to put in place the logistic arrangements needed to support operations from their new airfields across northern France. The repair organisation was less easy to improvise. Day to day maintenance was the responsibility of mechanics attached to each staffel.[29] When in the field, major repairs and overhauls (such as routine replacement of the Bf 109's Daimler-Benz 601 engine after just 100hrs flying time) fell to the workshop section attached to the Group Headquarters Company. Work that was expected to take longer than 2 days was transferred where possible to regional workshops based at major airfields, established to undertake major repairs or modifications. At this stage of the war, however, these workshops were all located in Germany and thus many damaged aircraft had to be transported considerable distances by road and rail just to be repaired. There was no equivalent of the CRO, although there had been a violent debate early in 1938 between Udet (Head of Supply and Research) and Milch (Goring's deputy and State Secretary for the Air Force) about the provision of more extensive repair capabilities to support the Luftwaffe. The latter's view – that campaigns would be short and aircraft could be repaired and salvaged at home after victory was achieved – prevailed against Udet's proposals for significant investment in spares, tools and repair facilities.[30] It is tempting to compare this outcome with the decision reached by Royal Air Force staffs on the very same issue at much the same time.

Much of June and July 1940 was used by the Luftwaffe to make good the significant losses it had suffered

Field maintenance on a BF 109E of JG 26 based at Caffiers, near Calais. The DB 601 engine required replacement every 100 flying hours

In quality and general professionalism it would be hard to fault the Luftwaffe maintenance organisation – it was certainly a match for the Royal Air Force. However, it was not organized for an attritional war and had made little provision for timely repair and salvage. It is also arguable that it was less flexible and found it more difficult to respond to changing circumstances. For example, as the war progressed, it became increasingly evident that maintenance personnel were finding it difficult to keep up with their parent units, much as Fighter Command would discover in 1940. Nevertheless, it would not be until late 1944 that the Luftwaffe introduced independent maintenance companies subordinate to the airfield rather than a particular flying formation to resolve this particular problem.[31]

THE BATTLE

Over the course of June and July 1940, it became obvious that Britain was not about to sue for peace. The Germans recognised that the destruction of the Royal Air Force had now become essential to the achievement of their strategic aims. On 1 August 1940, Hitler issued his Fundamental Directive No 17 for the "Conduct of the Air and Sea War Against England". The Luftwaffe was to use all means to overpower the Royal Air Force in the shortest time possible. Attacks were to be directed primarily at flying units, their ground installations and their supply organization as well as the aircraft industry in order to "*establish the necessary conditions for the final conquest of England*".[32] To achieve this aim, the Luftwaffe could muster 3,358 aircraft, as follows:

Luftwaffe Order of Battle – 10 August 1940 [33]

	Establishment	Strength	Serviceability
Bombers	1569	1481	998
Dive-Bombers	348	327	261
Single Engine Fighters	1011	934	805
Twin Engine Fighters	301	289	224
Reconnaissance	246	195	151
Ground Attack	40	39	31
Coastal	94	93	80
Total	**3,609**	**3,358**	**2,550**

Other sources give slightly different figures but most agree that the Luftwaffe deployed an effective strength of a little over 900 Bf 109 fighters out of an establishment of some 1,000 aircraft. This comprised the bulk of their single seat fighter force – approximately 150 aircraft remained in other theatres, including Germany, to defend against possible Bomber Command attacks.[34] By comparison, Fighter Command could field 52 squadrons of Hurricanes and Spitfires – some 1,100 aircraft in total. Thus, in terms of single seat fighters, the opposing air forces were fairly evenly matched, albeit that Fighter Command was outnumbered more than 3:1 in overall terms.

Fighter Command Order of Battle – 11 August 1940[35]

	Establishment	Strength	Serviceability
Hurricanes	723	721	656
Spitfires	366	374	334
Total	**1,089**	**1,095**	**990**

…in terms of single seat fighters, the opposing air forces were fairly evenly matched, albeit that Fighter Command was outnumbered more than 3:1 in overall terms

Of course, these figures only provide an opening balance. Not unexpectedly, the strength of the respective air forces altered over the course of the summer and autumn as attrition took its toll. However, when we look at the overall picture, **Figure 3**, it is evident that Fighter Command steadily fielded more single seat fighters as the Battle progressed. In fact, as the Royal Air Force grew stronger so the Luftwaffe grew weaker.[36]

Figure 3 : Single Seat Fighter Strength July - December 1940

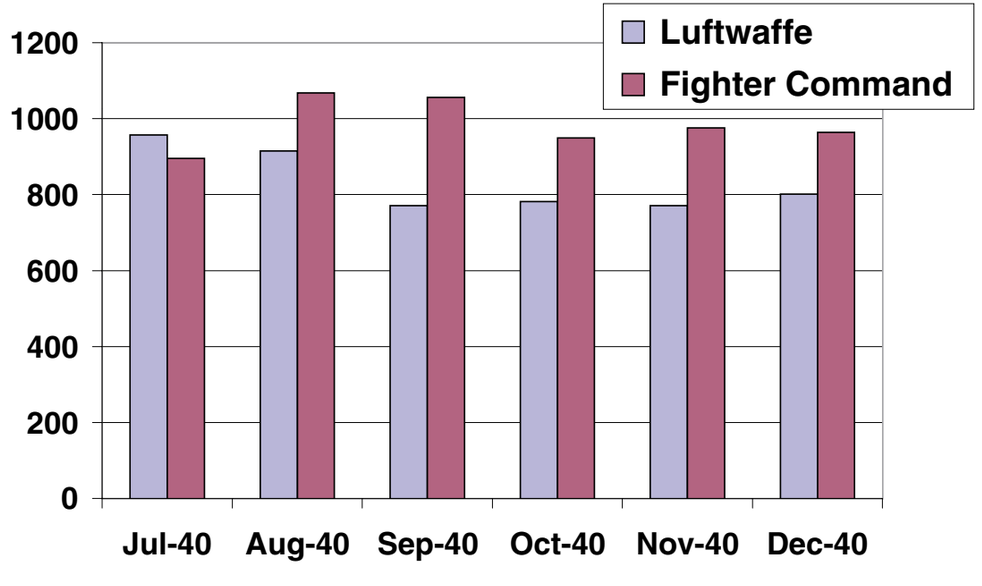
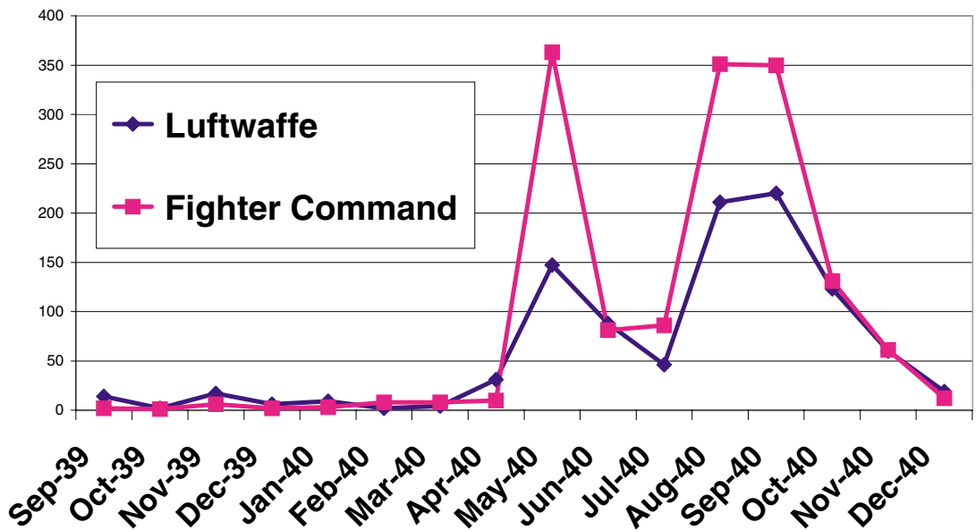


Figure 4 : Single Seat Fighters - Operational Losses 1939 - 1940



What makes this all the more surprising is that Fighter Command's operational losses were significantly higher than those suffered by the Luftwaffe's fighter force. This was equally true for the Battle of France as it was for the Battle of Britain **(Figure 4)**. Thus, for the 4 months, July-October 1940, Fighter Command lost over 900 Hurricanes and Spitfires destroyed on operations[37] compared to 600 Bf 109s recorded by the Luftwaffe Quartermaster returns.[38]

Of course, operational losses do not tell the whole picture since they exclude accidents and other wastage. Determining the actual attrition (total destroyed and damaged) in single seat fighters during the Battle is not entirely straightforward. Definitions vary between the air forces and some interpretation is required. **Figure 5** indicates the total attrition in fighters over the period July to December 1940.[39] At the height of the Battle, Fighter Command's total wastage in Hurricanes and Spitfires was over 180% of its operational losses, compared to 140% for the Luftwaffe's Bf 109s. Given Fighter Command's greater combat losses it is hardly surprising to find this

Figure 5 : Single Seat Fighter Attrition July - December 1940

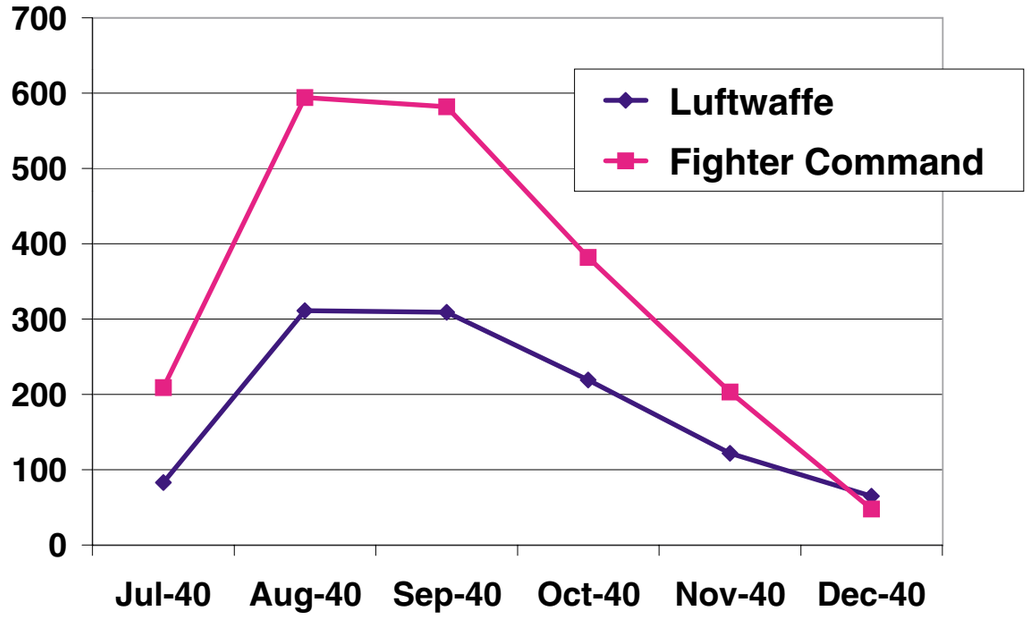
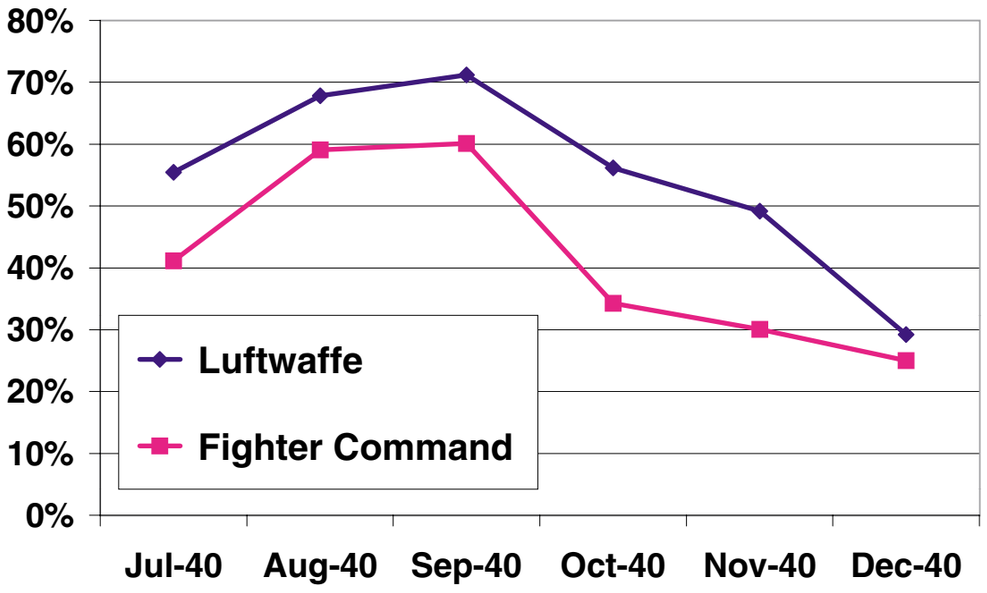


Figure 6 : Single Seat Fighter Operational Losses Against Overall Wastage

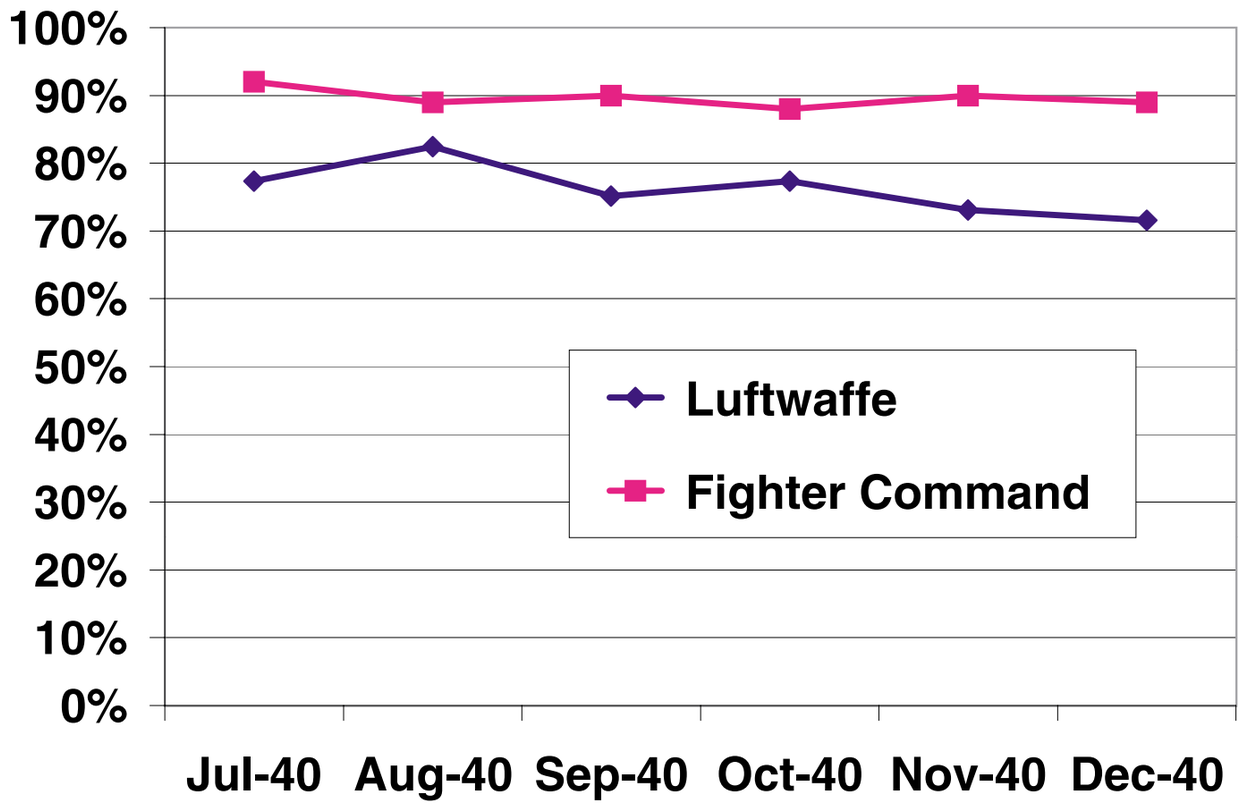


matched by a higher overall attrition. However, the Luftwaffe's figures seem lower than might be expected, even allowing for the fact that damaged Bf 109s were less likely to make it back to their home airfields. When one compares operational losses, as a proportion of the overall wastage recorded, this disparity becomes clearer **(Figure 6)**. While distance and the hazards of a Channel crossing could explain some of the difference, it seems likely that the attrition suffered by the Luftwaffe was actually higher (perhaps by as much as 20-25%) than the Quartermaster returns would indicate.

It could be argued that a better test of relative strength is serviceability. The comparative rates for Fighter Command and the Luftwaffe are shown at **Figure 7**. The Fighter Command data has been extracted from an analysis produced in 1945 on production and wastage during the Battle of Britain.[40] The levels appear to be higher than those quoted in other sources, notably Dempster and Wood.[41] Another source states that Fighter Command serviceability rose from 70% on the outbreak of war, to 80% by November 1939, but, having fallen to 76% in July 1940 had recovered to 80% by September where it stayed for the remainder of the year.[42] All in all, it seems safe to conclude that serviceability remained fairly constant in Fighter Command throughout the Battle, at somewhere between 80 and 90%.[43]

The Luftwaffe figures, drawn from the Quartermaster returns, indicate that the serviceability of the single engine fighter force fell from a little over 80% at the start of the Battle to close to 70% by the autumn. These are also somewhat higher than other sources might indicate. Indeed, Richard Overy has suggested that the number of serviceable Bf 109s could have fallen as low as 40% of total strength in October 1940.[44] If, as discussed previously, operational wastage was actually higher than recorded, then availability may well have fallen to these levels. What is not in doubt is that Fighter Command, unlike the Luftwaffe, was largely able to sustain the serviceability of its fighter force.

Figure 7: Serviceability Rates July - December 1940

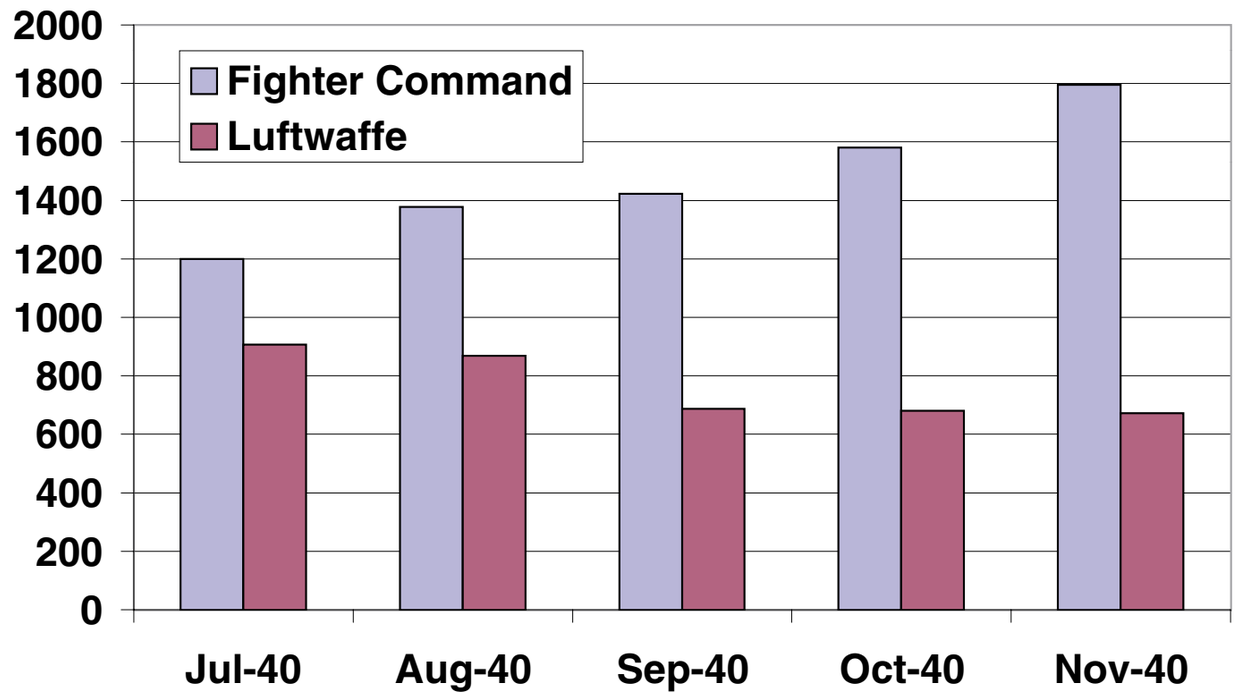


OPERATIONAL IMPLICATIONS

The operational implication for the Luftwaffe in the steady decline in the number of serviceable Bf 109s was significant, if not crucial. Experience rapidly demonstrated that only the Bf 109 could provide adequate protection to the bomber formations. In general, attacks on mainland targets required a 2:1 fighter: bomber ratio and sometimes as high as 3:1. With only 600-700 Bf 109s available daily for offensive operations, the attacking force was limited to no more than 250-300 bombers out of a total strength of 1,800.[45] Quite simply, the number of Bf 109s available for escort duties determined the Luftwaffe's day offensive capability.

Although great emphasis has been placed in the past on the shortage of pilots faced by Fighter Command, the Luftwaffe suffered even more from the impact of wastage. Fighter Command's pilot casualties reached a little over 20% in August and September, but with some 260 pilots (albeit inexperienced) being produced each month from the Operational Training Units, the situation was unlikely to become desperate. In fact, as **Figure 8** indicates, Fighter Command started with a distinct advantage in pilot numbers that only increased as the Battle progressed.[46] Robin Higham argues that Fighter Command's effective strength was lower, at between 900 and 950 operational pilots.[47] But, even on this basis, Fighter Command was able to field 250 more single seat pilots than the Luftwaffe in September 1940. The cause was the Luftwaffe's systematic neglect of training; a chronic weakness that only worsened as the war progressed.

Figure 8 : Single Seat Pilot Strengths July - November 1940



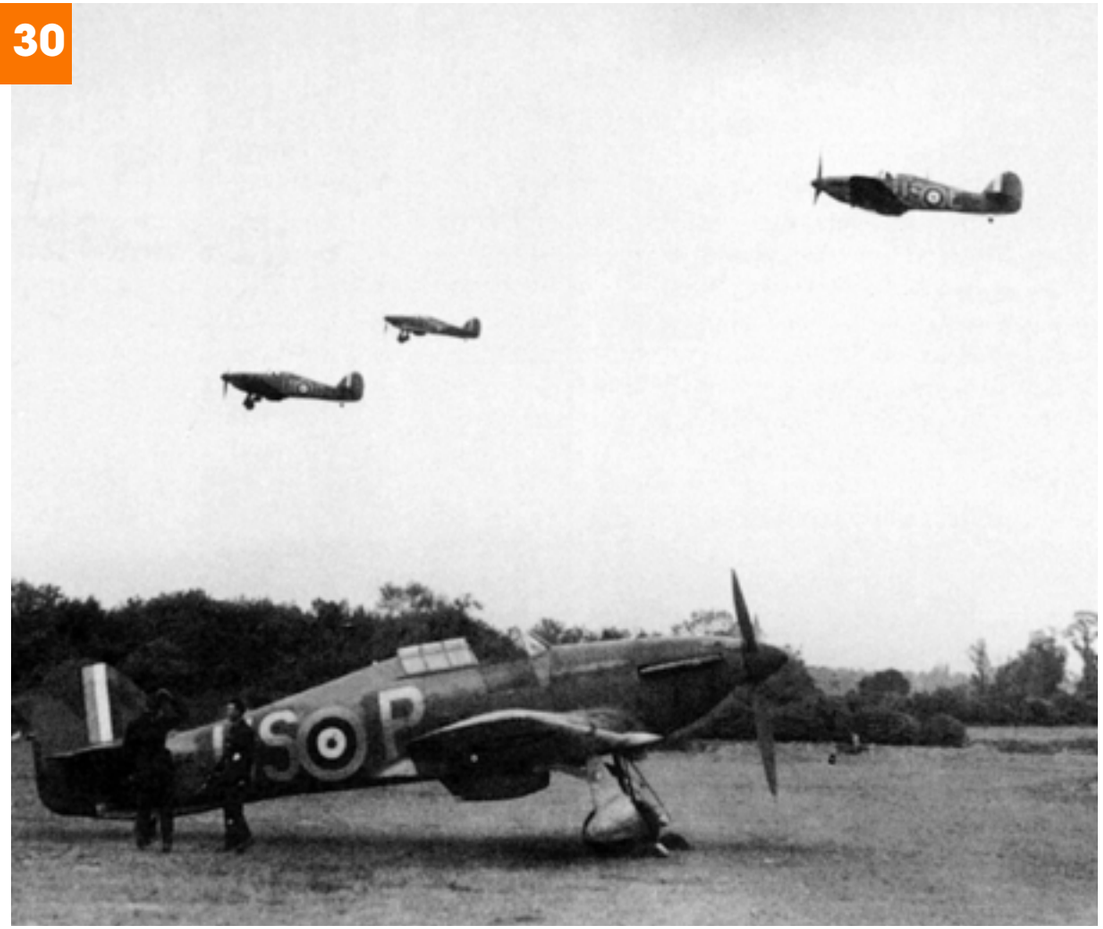
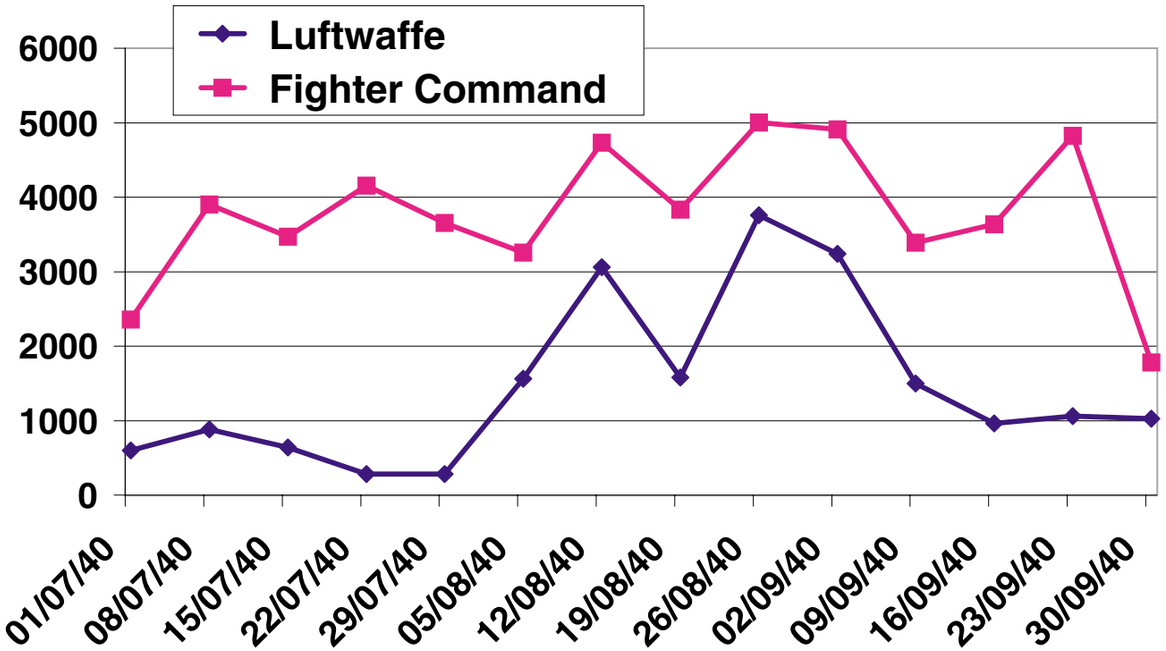


Figure 9 : Comparative Weekly Fighter Sorties



…at the peak of the Battle, Fighter Command's Spitfires and Hurricanes flew 1,000 sorties per week more than the Luftwaffe's Bf 109s

In operational terms, Fighter Command significantly outperformed the Luftwaffe. A comparison of day fighter sorties between the respective air forces indicates **(Figure 9)** that it was able to generate up to as many as 4 times the weekly sortie rate as the Luftwaffe. Even at the peak of the Battle, Fighter Command's Spitfires and Hurricanes flew 1,000 sorties per week more than the Luftwaffe's Bf 109s.[48]

Fighter Command clearly possessed an increasing advantage in single seat fighters as the Battle continued, notwithstanding higher aircraft and pilot attrition. How then, was this achieved?

PRODUCTION BALANCE

The simple answer is that losses were never greater than production. Deliveries to the operational squadrons actually exceeded wastage throughout the Battle (**Figure 10**). This disguises, however, the crucial role played by the CRO.[49] While the sustained efforts of the aircraft industry were vital to maintaining the frontline, repair provided 40% of the total output received by the operational squadrons,

Figure 10 : Fighter Command - Aircraft Issued July - December 1940

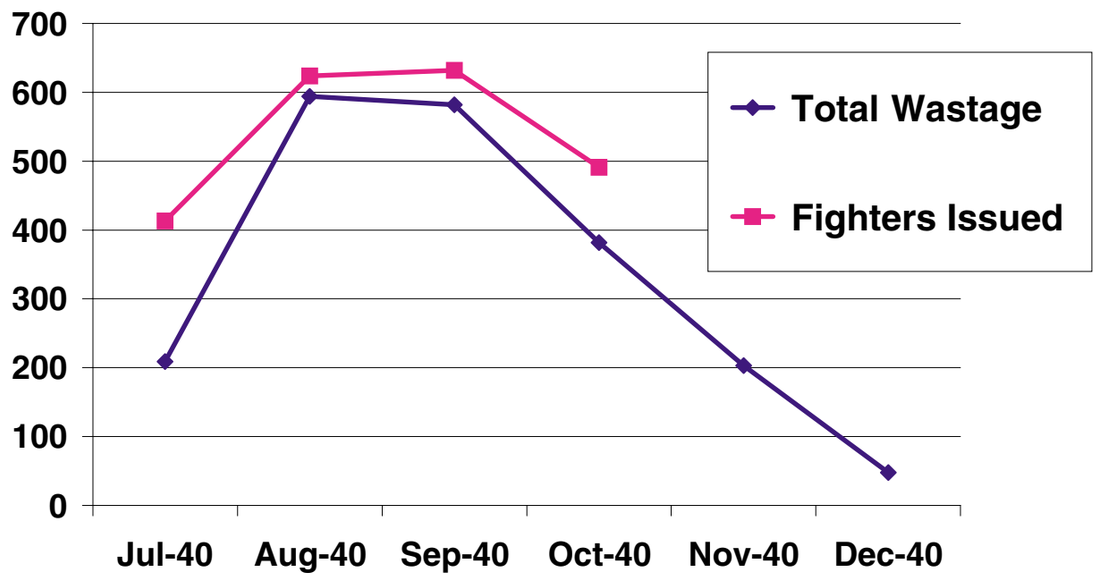
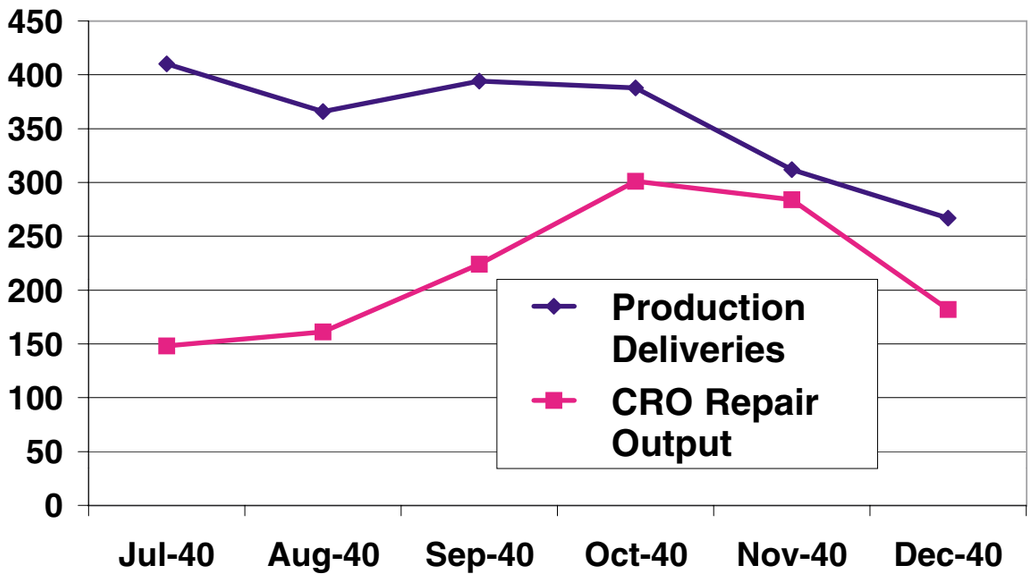


Figure 11 : Hurricane & Spitfire Production vs Repair July - December 1940



as **Figure 11** illustrates. At the height of the Battle, the CRO was achieving repair turn round times of under 6 weeks for Hurricanes and Spitfires, employing a combination of depot, fly-in and on-site repair. The Luftwaffe had no capability on this scale. In fact, until as late as 1942, repair output was no more than 25% of production.[50] Germany had entered the war with reserves of 900 aircraft, equivalent to 25% of front line strength, compared to reserves of 2,200 aircraft, some 115% of front line strength, held by the Royal Air Force.

Accordingly, the Luftwaffe's relatively modest reserves were rapidly dissipated through operational attrition. Fighter Command's reserves did shrink after July 1940, but they never totally disappeared and by the end of the year had returned to their previous levels (**Figure 12**).

Perhaps the most telling comparison is the monthly balance between wastage and production (including repair). Fighter Command and the Luftwaffe both experienced a negative balance in single seat fighters during August. Against a total wastage of 594 Hurricanes and Spitfires, new production and repair could only provide 527 aircraft, the difference being found from the immediate reserve stocks.[51] In turn,

Figure 12 : Fighter Command Reserves July - December 1940

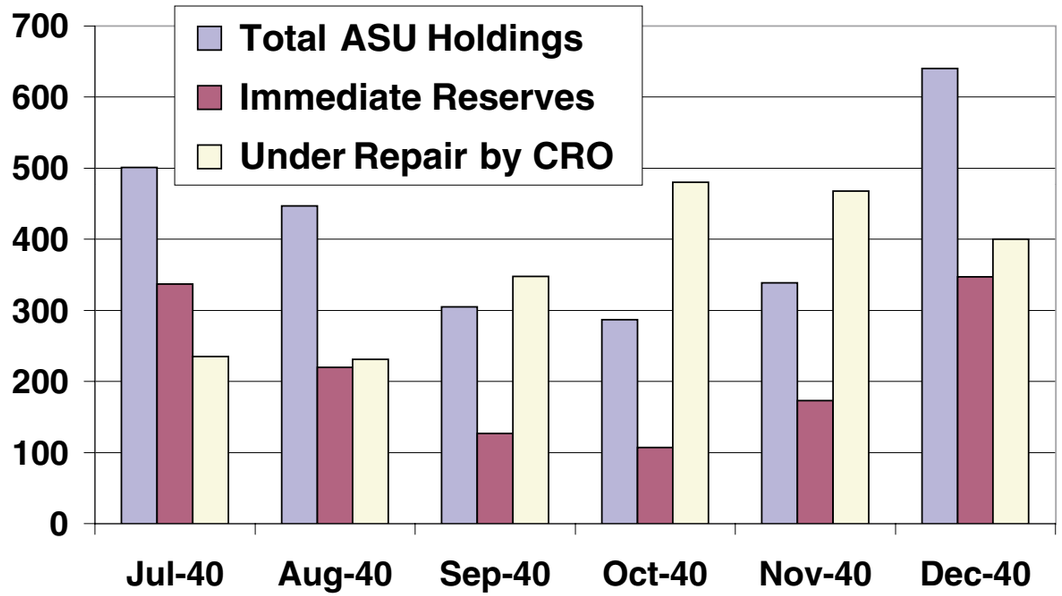
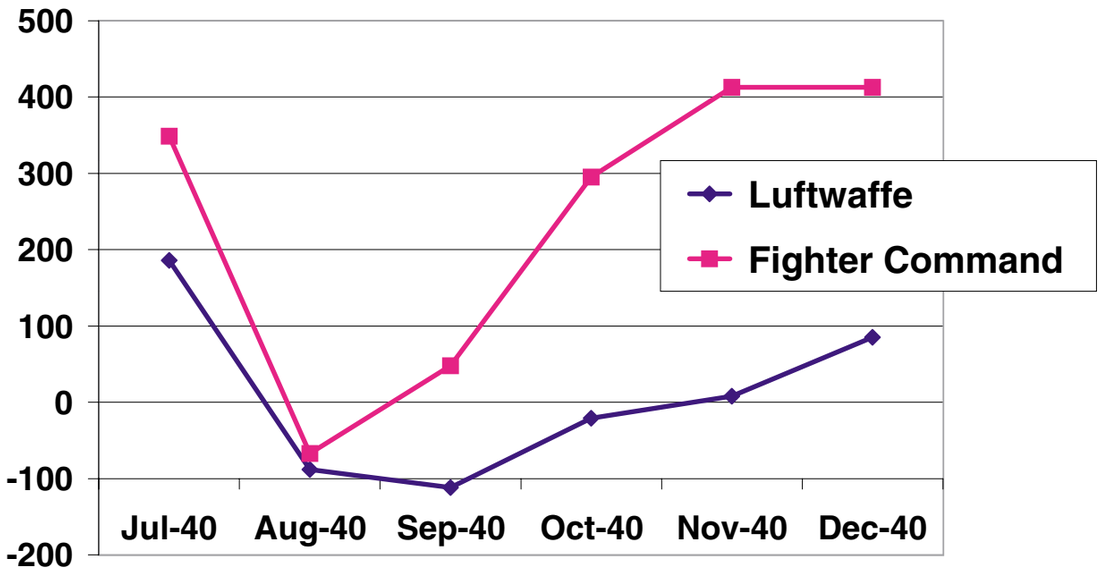


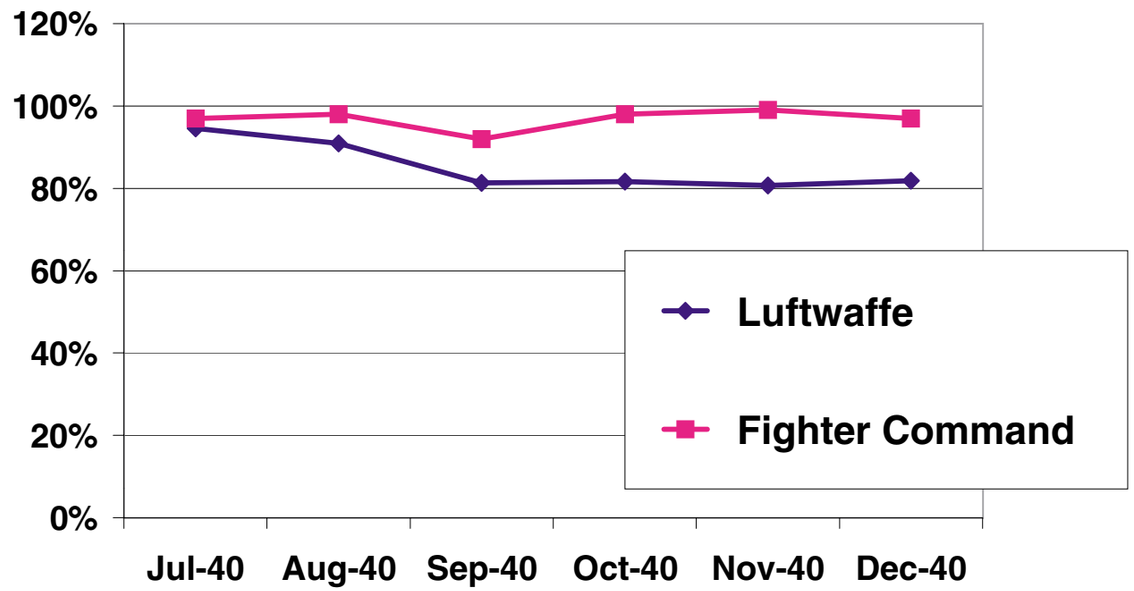
Figure 13 : Single Seat Fighter Production Balance July - December 1940



the Luftwaffe lost over 300 Bf 109s against new production of only 173 aircraft. Repair and reserves made good some of this shortfall but such sources were nowhere near the scale of those available to Fighter Command.[52] More importantly, while Fighter Command quickly recovered to a positive balance of some 50 aircraft a month by September, it took the Luftwaffe a further 2 months to reach this position (**Figure 13**). In October, after 3 months of steady attrition, Fighter Command's frontline stood at some 98% of its established strength, slightly higher than when the Battle opened. By comparison, the Luftwaffe fighter force had

fallen from 95% to 82% of established strength (**Figure 14**). Reserves aside, the fundamental reason for this outcome was that Britain was out-producing Germany in single seat fighters by a ratio of 2:1 and, including repair, by closer to 3:1.

Figure 14 : Comparative Fighter Strengths Against Establishment



LOGISTICS AS A TARGET

If the Royal Air Force's logistic system was the foundation of its operational strength; it raises the question as to why the Luftwaffe did not attack such an important target more vigorously? The answer would seem to lie partly in faulty intelligence that significantly underestimated the strength of Fighter Command and partly in the flawed thinking that had shaped the Luftwaffe's own logistic arrangements. It might also be added that the rapid destruction of the Polish, Norwegian, Dutch, Belgian and French Air Forces had provided little indication that the Royal Air Force would prove any more difficult to overcome. Thus, while attacks were made on Fighter Command's airfields, and some of the depot and storage units, they were never pressed home with the urgency, discrimination and weight that their significance warranted. Continued attacks on the Supermarine's Southampton factories did eventually stop production of the Spitfire Mk 1, but this was not part of a coordinated plan and had no marked effect on the delivery of new or repaired aircraft to Fighter Command. To be fair, the dispersed nature of such facilities made success problematical. It was the view of some in the Luftwaffe that such attacks would not succeed. "*We have no chance of destroying the English fighters on the ground. We must force their last reserves of Spitfires and Hurricanes into combat in the air*".[53] Failure to understand the complexity and strength of the Royal Air Force's logistic system, and overly optimistic combat claims, led directly to the fateful decision in early September to cease attacks against Fighter Command's airfields and concentrate instead on London – in the mistaken belief that only a few enemy fighters were now left to prevent the Luftwaffe's final victory.

SUMMARY

The Battle of Britain was essentially an attritional struggle that tested the logistic systems of the opposing air forces as much as it tested individual pilots, technologies and tactics. It was a trial of strength, a relentless and grinding contest far removed from the popular image of 'the few' pitted against 'the many'. Production, storage, repair and salvage may not have been as glamorous in the public eye as the undoubted heroism shown by Fighter Command's pilots, but they were just as important.

Fighter Command's overall logistic position through 1940 is illustrated at **Figure 15**. Although total wastage in Hurricanes and Spitfires approached 3,000, deliveries to the squadrons were in excess of 3,500. The front line strength of Fighter

Figure 15 : Fighter Command Strength, Production & Losses 1940

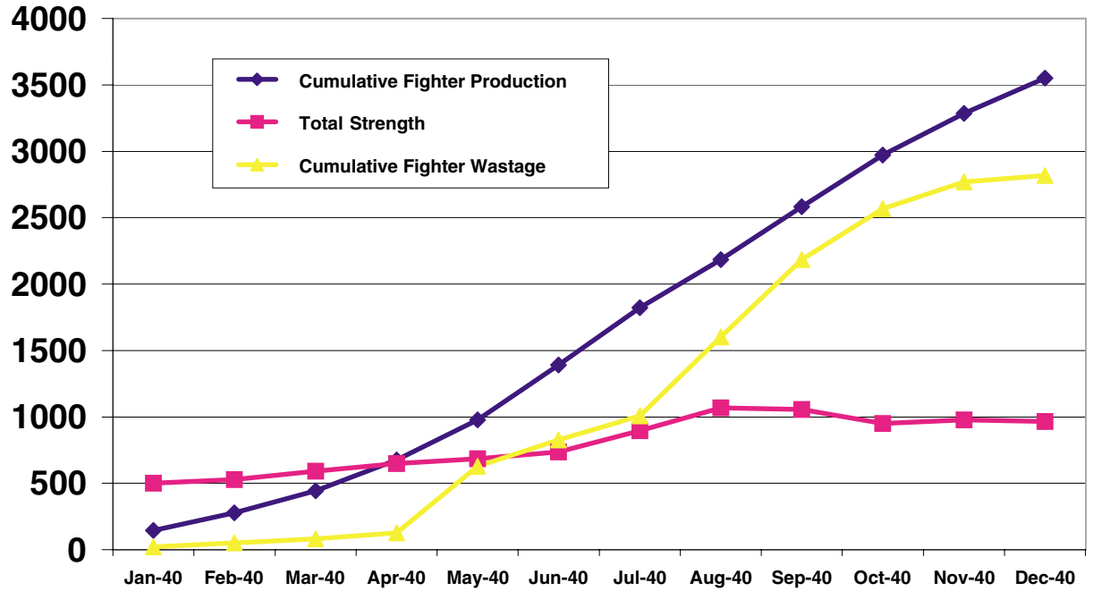
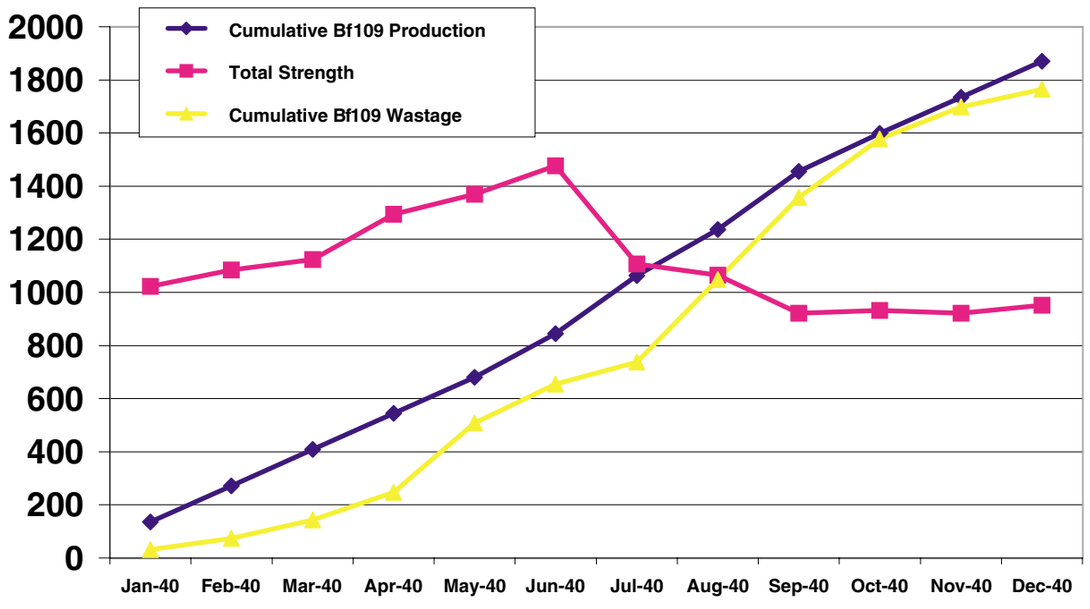


Figure 16 : Luftwaffe Strength, Production & Losses 1940



Command was able, therefore, to grow from some 500 Hurricanes and Spitfires in January 1940 to over 1,000 by August. Even so, without a comprehensive repair and salvage organization, attrition (in excess of 50% of front line strength per month) would have rapidly weakened the operational squadrons. That such a decline did not occur was owed to the pre-war Air Staffs, who not only understood the attritional nature of air power, but also put in place the necessary resources and support arrangements to enable Fighter Command to fight effectively when war came. Their achievements are all the more commendable given the Luftwaffe's failure to grasp these principles (**Figure 16**). Over the course of 1940, the Luftwaffe's single seat fighter

strength fell slightly while the once considerable numerical superiority over Fighter Command was rapidly lost. With production, wastage and strength in close balance, it is clear that the Luftwaffe enjoyed few reserves and little repair capability. In turn, this left no ability to cope with surges in attrition, leading to an inevitable decline in operational capability. The Luftwaffe's half-hearted attacks against the aircraft industry, storage units and Fighter Command airfields reflected not only a weakness in intelligence but also the shortcomings in their own approach to the logistics of an attritional war.[54]

The Battle of Britain was a contest that the Luftwaffe had neither prepared for nor envisaged. Created as a strategic instrument, the Luftwaffe had become a superb tactical weapon. However, the expectation of a 'short war' meant that there were neither the industrial resources nor the necessary logistic arrangements in place to sustain operations in the face of a determined enemy. These shortcomings were never properly redressed and, coupled with the huge resources available to the Allied air forces, would ultimately seal the Luftwaffe's fate.

That said, too much can perhaps be made of the Luftwaffe's doctrinal weakness and flawed decision making. It was the creation of a strategic air defence force, in the form of Fighter Command, with the necessary equipment, organization and resources – underpinned by a comprehensive and highly effective logistic system – which defeated the Luftwaffe. Fighter Command's victory was founded on the vision, determination and hard work of the pre-war planning staffs. As Dempster and Wood concluded, in their authoritative study of the Battle of Britain, "*the outcome was the combination of the preparation, good judgement and error, made in the preceding seven years*".[55]

NOTES

1 Dr Richard Overy, *The Battle*, page 9, London, 2000.

2 Air Commodore Brooke-Popham expanded on these issues in a lecture on the Air Force in the Great War presented to the RUSI on 3 December 1919. One of the significant conclusions was that "…*it was of the highest significance that spare machines and spare parts of every sort shall be instantly available. This means large base depots and an efficient channel of supply between depots and squadrons, and on the sound working of this supply system the efficiency of the Royal Air Force in any theatre of war very largely depends*."

3 Wing Commander GW Williamson, *Some Problems of a Technical Service*, Lecture delivered on 21 March 1934. RUSI Journal No 516, pages 780-800.

4 A full description of the Royal Flying Corp's logistic system in France can be found in Air Power Review, Vol 1 No 2, pages 42-58.

5 Wastage grew steadily through the war. The average number of aircraft dispatched to France to maintain the frontline (additional to any new squadrons) was 33% in 1914, 26% in 1915, 37% in 1916 , 47% in 1917 and 52% in 1918 (PRO AIR1/676/21/13/1880). Interestingly, of the 6,500 aircraft struck off charge in France between March and October 1918, 6% were time-expired, 36% were due to enemy action, 24% arose from pilot error and 29% from forced landings as a result of engine failure.

6 Air Staff Memorandum No 50, PRO AIR 10/1522.

7 This was the planning figure used in France in 1918, however, the actual achievement was probably closer to 25%.

8 It was recognised that such figures were only approximate in nature, being based to some extent on conjecture. When setting targets for the 1918 flying training programme, the 'life' of a single seat fighter pilot on the Western Front was estimated, for planning purposes only, to be just 10 weeks (PRO AIR 1/683/21/13/2234).

9 The traditional views on the development of Britain's air defence, prior to the establishment of Fighter Command, have been recently challenged by John Ferris, *Fighter Defence Before Fighter Command*, The Journal of Military History, pages 845-885, October 1999. He properly identifies the influence of the First World War and argues powerfully that without Bomber Command there could have been no Fighter Command. His article is highly recommended reading.

10 The aircraft wastage data is drawn from PRO AIR 20/1835 that provides gross weekly wastage in Spitfires and Hurricanes experienced by the operational squadrons. Pilot wastage has been calculated from the pilot strengths for Fighter Command provided by Richard Overy, op. cit., page 162, and the gross monthly casualties to be found in Appendix 34 of the AHB Narrative. If wastage is calculated on the basis of the squadrons' actual pilot strength, the rate is closer to 42%.

11 These wastage figures were to some extent drawn from British and American plans. German experience in the First World War indicated that a monthly attrition of some 30% might be expected. In 1938 it was calculated that a front line of 2,307 would demand a monthly production of some 1,800 aircraft. On the outbreak of war, the Luftwaffe's front line strength was in excess of 3,600 but monthly production was less than 700 aircraft. Edward Homze, *Arming The Luftwaffe*, pages 182-183, Nebraska, 1976.

12 Dr Richard Overy, *The Air War 1939-45*, page 45, London,1980

13 John Terraine, *The Right of the Line*, pages 24-36, London, 1985.

14 PRO AVIA 46/168, The Repair and Maintenance of Aircraft 1939-1945.

15 Official History, *Maintenance*, page 5, AHB, 1954.

16 Dr Sebastian Ritchie, *Industry and Air Power*, page 5, London, 1996.

17 Dr Richard Overy, *The Battle*, page 54, London, 2000.

18 Dr Richard Overy, *The Air War*, page 33, London, 1980.

19 This data is drawn from M.M Postan, British War Production, pages 484-485 and the BBSU Report on the German Aircraft Industry, Appendix B.

20 Norman Franks, *Fighter Command Losses 1919-1941*, pages 18-28, Midland Publishing, 1997.

21 Official History, op cit, page 54.

22 PRO AIR 16/1023, Report on Operations of British Air Forces France.

23 Christian G Sturm, *The Black Men*, pages 44-55, Air Combat, 1986.

24 Official History, op cit, pages 179-182.

25 The 'fringe firms' were companies with some experience of the aircraft industry and a degree of familiarity with the problems of aircraft production and repair that were able to provide additional production capacity – initially for airframe modification work. By June 1939, 5 companies (Rollason's, Airwork, Brooklands Aviation, Scottish Aviation Prestwick and General Aircraft) had joined the scheme.

26 AVIA 46/168.

27 PRO AVIA 46/149, The Storage and Distribution of Aircraft.

28 The Luftwaffe lost 288 Bf 109s to operational causes over the months of April and May 1940.

29 Each fighter staffel comprised some 90 ground personnel.

30 Control Commission for Germany, *The Supply Organisation of the German Air Force*, pages 71-74, June 1946. According to Milch, "*The movement of squadrons must not be hampered by administrative work. Officers will not be dependent on engineers – such a situation would prejudice the whole morale of the Luftwaffe*".

31 Ibid, pages 229-231.

32 Dr Hans Boog, *The Luftwaffe and The Battle of Britain*, The Battle Re-Thought, RAFHS, 1990. Hugh Trevor-Roper, *Hitler's War Directives*, London, 1964.

33 AHB/VII/39, Appendix A, page 7. This total does not include the 190 aircraft of Luftflotte 5 based in Norway.

34 Bomber Command had commenced strategic attacks on Germany from the night of 14/15 May 1940.

35 PRO AIR 20/2307.

36 The figures for Fighter Command are somewhat higher than those quoted in other sources but have been taken directly from PRO AIR 20/2307. Nevertheless, it is the trend that is important rather than precise strength levels.

37 Norman Franks, op cit.

38 AHB VII/83.

39 The Luftwaffe data represents total wastage (destroyed and damaged for the entire fighter force on operational and training sorties). The Fighter Command data is from PRO AIR 20/307 and records gross wastage on the operational squadrons. The wastage rates for November and December 1940 have been estimated from the known operational losses.

40 PRO AIR 20/1835.

41 Dempster and Wood, *The Narrow Margin*, London, 1961.

42 Official History, op cit, pages 185-186.

43 An analysis undertaken by the Fighter Command Research Branch in 1949 (PRO AIR 16/1047) indicates that the average number of serviceable aircraft per squadron across 11 and 13 Groups was in excess of 15 for the period July to October 1940.

44 Dr Richard Overy, op cit, page 33, London, 1980.

45 Hooton, *Eagle In Flames*, page 21, London, 1999.

46 Data drawn from the AHB Narrative and Richard Overy, op cit.

47 Dr Robin Higham, *The Royal Air Force in the Battle of Britain*, Centre for Air Force History, 1994.

48 Taken from Hooton, op cit, pages 14-15. The Luftwaffe figures have been abated by 20% since Bf 110 and fighter-bomber sorties have been included in Hooton's total.

49 This is described in some detail by Dempster and Wood, op cit, pages 103-105 and in PRP AVIA 46/168.

50 Wing Commander Asher Lee, *The German Air Force*, pages 234-235, London, 1946. Repair turn round times are not known but prior to the war periods in excess of 3 months were average. Edward Homze, op cit, page 156.

51 This largely explains why ASU reserves fell so rapidly, notwithstanding the overall positive production position – an apparent anomaly identified by Robin Higham, op cit, page 135.

52 Only 400 repaired Bf 109s were accepted by the Luftwaffe in 1940, equivalent to just 21% of new production. Harold Faber, Ed, *Luftwaffe*, page 203, Sidgwick and Jackson, 1979.

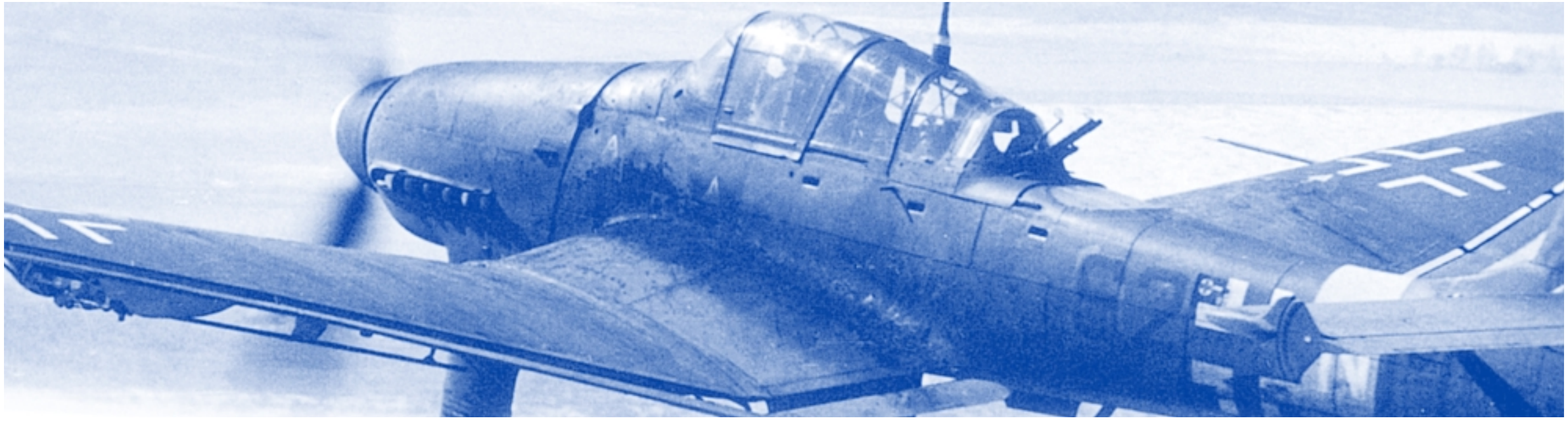
53 Kesselring, Commander Luftflotte 2.

54 Between 15 August and 25 September 1940, the Luftwaffe destroyed or badly damaged on the ground just 44 Hurricanes and Spitfires.

55 Dempster and Wood, op cit.

Artist impression of C-17 in Royal Air Force livery. Four are due to enter RAF service during 2001.

The RISE AND DEMISE of the STUKA



With its angular outline and screaming siren, on our TV screens the steep-diving Junkers Ju 87 *Stuka* has come to epitomise the fast-moving hard-hitting “Blitzkrieg” tactics employed so successfully by German forces early in World War II. With a front-line strength that never exceeded 350 aircraft, during that period the *Stuka* units had an impact on military operations that went far beyond their modest numbers. This article examines the ingredients of this aircraft's success, and the countermeasures that brought an end to its run of successes.

Until the advent of guided weapons, the steep diving attack was the most accurate method for delivering bombs on a defended target. As the well-informed readers of this journal are fully aware, a small load of high explosive delivered accurately will have a far greater military effect than many times that weight of explosives delivered inaccurately. For the first two years of the Second World War, usually operating under conditions of air supremacy, the *Stuka* units were the only force on either side that could deliver accurate bombing attacks on pin-point targets. Therein lay the basis of the Junkers 87’s formidable reputation.

*…*Stuka *units were the only force on either side that could deliver accurate bombing attacks on pin-point targets. Therein lay the basis of the Junkers 87’s formidable reputation*

The Junkers 87 had been designed without compromise as a steep-diving bomber and everything else was subordinated to that requirement

The word *Stuka* is a contraction of the German word *Sturzkampfflugzeug*, “dive-bomber”. Strictly speaking that term refers to all aircraft capable of performing the role and not merely to a particular type. Yet by common usage over many years, “Junkers 87” and *Stuka* have become synonymous and they will be treated as such in this account.

The Junkers 87 had been designed without compromise as a steep-diving bomber and everything else was subordinated to that requirement. The B variant, the main production version up to 1941, carried a bomb load of only 500 kg (1,100 pounds). Usually this was made up of one 250 kg weapon mounted under the fuselage and four 50 kg bombs under the wings; alternatively it could carry a single 500 kg bomb under the fuselage. The forward-firing armament comprised two 7.9 mm machine guns. The two-man crew comprised a pilot and a wireless operator/rear gunner with a 7.9 mm machine gun on a flexible mounting.

The fixed spatted undercarriage gave the Ju 87 a decidedly out-dated look, and in horizontal flight its maximum speed was only 206 kts.[1] Yet for its intended role the drag from that fixed undercarriage was an asset for, combined with that from the dive brakes extended under the wings, it made for a stable aiming platform

once the aircraft was established in its 80-degree attack dive.[2] In the dive the speed built up until the machine reached its terminal velocity of around 300 kts. A less draggy aircraft would reach a higher terminal velocity in the dive, forcing the pilot to release the bombs and begin the pull-out much higher, at the expense of bombing accuracy.

Junkers Ju 87B

THE ATTACK DIVE

The description that follows covers a typical dive-bombing attack by Ju 87s. On the way to the target these aircraft typically flew at altitudes around 3,000 metres (about 10,000 feet). The basic tactical unit was the three-plane "Vic" and, depending on the size and importance of the target, a *Staffel* (up to 9 aircraft) or *Gruppe* (up to 30 aircraft) flew with Vics in line astern with intervals of about 300 metres between each.[3]

For an accurate attack it was important that the aircraft was heading into wind during its dive. As he neared the target the formation leader kept an eye open for smoke plumes rising from the ground to determine the wind direction, and aligned his attack run accordingly. Immediately before commencing his dive each Ju 87 pilot re-trimmed his aircraft for the dive and set the briefed bomb release altitude (above sea level) on the plane's contacting altimeter.

Inset into the cockpit floor, between the pilot's legs, was a window through which he could observe the ground beneath the aircraft. As the target slid into position, a series of parallel lines etched in the perspex assisted him to judge when to

commence the dive. Immediately before commencing the dive, the pilot operated a lever to rotate the dive brakes to the maximum-drag position. That produced a severe nose-up trim change, and an elevator trim tab lowered automatically to compensate for it.[4]

After the formation leader commenced his dive, the rest of the aircraft in the formation followed in turn. Against targets of small horizontal extent, for example bridges or individual buildings, the Ju 87s usually approached in echelon formation, peeled into the dive and attacked in line astern. Against larger or better-defended targets, for example harbours or marshalling yards, the dive-bombers would usually bunt into their dives in three-aircraft Vics and attack together to split the defensive fire.

Once the Ju 87 was established in its 80-degree dive the pilot would position the target under his reflector sight and hold it there. The attack dive lasted about 15 seconds, allowing plenty of time align the sight on the target. The accuracy of the attack depended on maintaining a constant dive angle, and to assist in this a protractor was etched into the perspex on the side of the cockpit canopy so that the pilot could read off his angle during the dive.[5]

When the aircraft reached a point 600 metres (about 2,000 feet) above the bomb release altitude previously set on the contacting altimeter, a warning horn sounded in the cockpit. When the aircraft reached the previously-set bomb release altitude, typically 700 metres (2,300 feet) above the ground, the warning horn ceased. The pilot pressed the button on his stick to release the bombs. As the fuselage-mounted bomb fell clear, a crutch mechanism pushed it away from the fuselage and safely clear of the propeller disc.[6]

It will be remembered that when the dive brakes were placed in the high-drag position, before commencing the dive, a trim tab fitted to the elevators had lowered automatically to compensate for the resultant nose-up pitching moment. The operation of releasing the bombs activated a powerful spring, which returned that trim tab sharply to the neutral position. The nose of the aircraft now pitched up at 6 G, to pull the aircraft firmly but smoothly out of the dive. The plane bottomed out of the dive at about 300 metres (about 1,000 ft) above the target, to give a margin of safety from splinters from the exploding bombs and enemy small-arms fire.[7]

As the nose of the aircraft rose above the horizon the pilot returned the dive brakes in the low-drag position, opened the throttle, re-trimmed the aircraft and turned on to the pre-briefed escape heading.

On completion of their training, German dive-bomber pilots were expected to put half of their bombs within a circle 25 metres (27 yards) in radius centred on the target.

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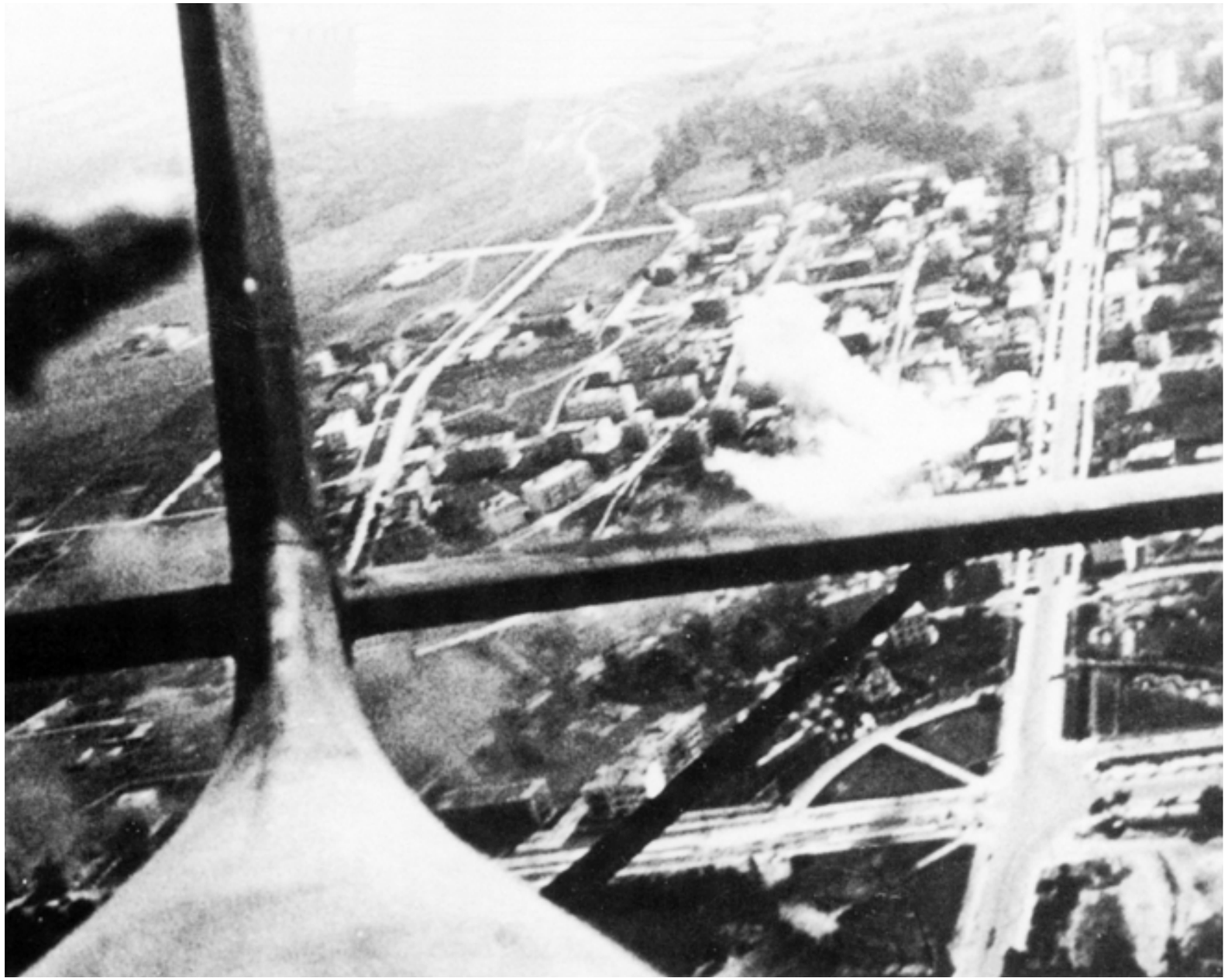

IN ACTION IN POLAND

During the invasion of Poland in September 1939, the Ju 87 established a formidable reputation in combat. As part of its establishment each Ju 87 *Gruppe* possessed three twin-engined Dornier 17 reconnaissance aircraft (later replaced by converted Messerschmitt 110 twin-engined fighters). These machines took the pre-strike photographs, led dive bomber formations to their targets, and took post-strike photographs for bomb damage assessment.[8]

In Poland the dive-bombers delivered pin-point attacks on bridges, rail targets and troop concentrations well behind from the front line – what we would now term Air Interdiction missions. They also attacked airfields, though with less success. During the period of tension preceding the invasion, the Polish Air Force re-deployed most of its combat flying units to well-camouflaged field landing grounds. As a result few front-line aircraft were lost during the initial onslaught. Yet although the main body of the Polish Air Force survived, it was too small and its equipment too outdated to pose any serious threat to German air operations. The Polish forces were also poorly equipped with anti-aircraft guns for the protection of targets and, operating with little hindrance, the Ju 87s struck with great accuracy and effect.

…operating with little hindrance, the Ju 87s struck with great accuracy and effect

Despite numerous assertions to the contrary, only a small proportion of Ju 87 missions were Close Air Support operations against enemy ground forces in contact with friendly troops. To carry out the accurate steep-diving attack a *Stuka* pilot needed to discern his target from at least 5,000 feet, and camouflaged troop positions in the battle area were difficult to see from such an altitude.

The dive-bomber was a new and effective weapon and, above all, it was predominantly a *German* weapon. In those circumstances the German propaganda machine can hardly be blamed for playing the aircraft for all it was worth. Among friends and foes alike, the legend of the invincibility of the *Stuka* was established.

BLITZKRIEG IN THE WEST

On 10 May 1940 German forces launched their all-out Blitzkrieg campaign in the West, and from the first the Stuka units were heavily committed. One of these was *Trägergruppe 186 (Träger* = aircraft carrier; the unit was earmarked to operate from the aircraft carrier *Graf Zeppelin* when the warship was completed). With an establishment of about 35 dive bombers and 40 crews, the unit's combat record was typical for a dive-bomber *Gruppe* at this time. TGr 186 went into action on almost every day that the weather allowed, with crews flying as many as four missions per day. It flew about 1,500 sorties, in the course of which it lost 15 crews. The overall loss rate was about 1 per cent, but the cumulative loss during the six weeks of hard fighting mounted to 40 per cent of the aircrew.[9] At that stage of the war the war losses in crews and aircraft were replaced almost immediately from the replacement units, but it was an uncomfortable pointer to the problems that would arise during a lengthy campaign.

At the beginning of World War II, the latest heavy AA guns and prediction systems could make life hazardous for bomber crews making horizontal attacks at altitudes below 10,000 feet. Firing time-fused high explosive shells, these weapons forced horizontal bombers to attack from altitudes of 15,000 feet and above. That greatly reduced the accuracy of their bombing. Against planes attacking in the dive, however, the predicted fire from heavy AAA was ineffective. The rate of closure of range was too rapid for time-fused shells to cope (radar proximity fused shells did not become available until 1944). Nor were dive bombers particularly vulnerable to ground fire as they pulled out of their dives. They bottomed out of the dive at about 1,000 feet, which made them difficult targets for infantry automatic weapons even if their crews were brave enough to ignore the bombs exploding around them.

REVERSE DURING THE BATTLE OF BRITAIN

The Battle of Britain opened in July 1940, and the large-scale bombardment of targets on the mainland of England began on 12 August. That day dive bombers attacked the radar stations at Pevensey, Rye, Dover, Dunkirk (in Kent) and Ventnor. The radars proved difficult targets, however. They were small objectives and their vital parts were protected by blast walls. Moreover, although the openwork metal towers supporting the aerial arrays appeared fragile, they presented only a small vulnerable area to blast pressure or bomb splinters. It required a direct hit on the base of a tower to knock one down, and this was rarely achieved. All the radar stations suffered damage, but following hasty repairs all except one were back in operation on the following day.

The largest co-ordinated attack ever mounted by *Stukas* took place on 18 August 1940. One hundred and nine Ju 87s drawn from four *Gruppen*, escorted by more than a hundred and fifty Messerschmitt Bf 109 fighters, set out to attack the airfields at Gosport, Ford and Thorney Island and the radar station at Poling.

British radar observed the approaching attack force in good time, and sixty-eight Spitfires and Hurricanes scrambled to meet it. As the formations crossed the coast, the escort of Messerschmitts split into two. One half remained with the dive-bombers at altitude, while the other descended to 3,000 feet to be in position to protect the Ju 87s when they pulled out of the dives.

At that moment, when the high level escort was at its weakest, eighteen Hurricanes of Nos 43 and 601 Squadrons hit the *Gruppe* about to dive on Thorney Island. At least four dive bombers were shot down before they began their dives. Once the Ju 87s were in the dive, however, they were almost invulnerable to fighter attack. Flight Lieutenant Frank Carey of No 43 Squadron, who led the Hurricane attack that day, told this writer:

> “In the dive they were very difficult to hit, because in a fighter one's speed built up so rapidly that one went screaming past it. But he couldn't dive for ever…” [10]

As the dive-bombers had pulled out of their dives, their tactic was to leave the target in a loose gaggle flying at cruising speed. If one of their number came under fighter attack, the pilot opened his throttle and accelerated past the dive bombers in front. If the fighter followed, its pilot came under fire from the forward-firing guns of the Ju 87s behind him.[11] In the past that tactic had been effective in forcing fighters to break off the chase, but now several British squadrons were piling into the fight. The 25-mile strip of coastline between Bognor and Gosport became a turmoil of over three hundred aircraft twisting and turning to bring guns to bear, or to avoid guns being brought to bear.

This *Stuka* of STG 77 failed to pull out of its dive after it was hit by an RAF fighter during the action on 18 August 1940. The aircraft crashed at West Broyle, near Chichester.

The *Gruppe* attacking Thorney Island was hit particularly hard: of the 28 *Stukas* taking part ten were shot down, one returned damaged beyond repair and four returned with serious damage. The *Gruppe* commander was among those killed. The other three *Gruppen* lost six aircraft shot down and two damaged between them.[12] Considered as a whole, the raiding force lost 21 per cent of its aircraft destroyed or damaged. That was too great a loss to be accepted as a matter of course.

Although the *Stukas* had taken heavy losses, they had hit their targets with great precision. Scarcely a single bomb landed outside the immediate area surrounding each target. Ford airfield was put out of action for several weeks, those at Thorney

The *Stukas* usually delivered their attacks with great precision. This German reconnaissance photo shows fires burning at the airfield at Ford, after the attack on 18 August.

Although the Stukas had taken heavy losses, they had hit their targets with great precision. Ford airfield was put out of action for several weeks

Island and Gosport continued in use though at reduced efficiency. Twenty-one RAF and Fleet Air Arm aircraft were wrecked on the ground. The radar station at Poling suffered severe damage, though following repairs it was back in operation after a few days.

The action on 18 August 1940 was the first real setback suffered by the *Stukas*, and it served to highlight a weakness that would be demonstrated again and again as the war progressed: the aircraft was a fine offensive weapon, but only if it could operate without hindrance from enemy fighters. If air superiority had not been secured, the dive-bomber units risked heavy losses. The *Stukas* had a vitally important roles to play in the planned invasion of southern England, and it was important that the units be conserved for the main battle. Accordingly, the Ju 87 units were pulled out of the Battle of Britain and played no further significant part in it.

IN ACTION OVER THE MEDITERRANEAN

The *Stukas* next saw major action over the Mediterranean, after 150 of these aircraft were deployed to Sicily to support the Italian bombardment of Malta and the convoys taking supplies there. In attacks on ships manoeuvring in open water, dive-bombing was far more effective than horizontal bombing. A dive-bomber pilot could follow the ship during its evasive turn, re-aligning his sight to aim at a point in the sea immediately in front of the vessel. The short time-of-flight of the bombs after release was too short for any subsequent change of helm to take effect.

On 10 January 1941 the Ju 87 revealed its devastating effectiveness against capital ships, during an attack on a Royal Navy battle group comprising the new aircraft carrier *Illustrious*, two battleships and eight destroyers escorting a convoy carrying supplies to Malta and Greece. The striking force comprised 43 Ju 87s drawn from two *Gruppen*. At the time the German aircraft

In attacks on ships manoeuvring in open water, dive-bombing was far more effective than horizontal bombing

were first detected on radar, the four defending Fulmar fighters were at low altitude having driven off an attack by Italian torpedo bombers. The carrier immediately launched four more fighters, but it was too late for any of them to climb into position to engage the raiders before the attack opened.

The Ju 87s concentrated their attack on *Illustrious*. Admiral Cunningham, the Royal Navy force commander, later wrote:

> "One was too interested in this new form of dive-bombing attack to be frightened, and there was no doubt we were watching complete experts. Formed roughly in a large circle over the fleet they peeled off one by one when reaching the attacking position. We could not but admire the skill and precision of it all. The attacks were pressed home to point blank range, and as they pulled out of their dives, some of them were seen to fly along the flight deck of *Illustrious* below the level of the funnel."[13]

From start to finish the action took less than seven minutes. By the end of it the Royal Navy's newest aircraft carrier had suffered seven direct hits from 1,100 pound bombs and was in a dire condition. With several fires blazing out of control below decks she could no longer operate her aircraft. The rudders jammed, the vessel headed for Malta steered by using differential revolutions on her main engines.[14]

A follow-up attack that afternoon by fifteen Ju 87s caused a direct hit near the after-lift and two near-misses close to the stern. That evening, with the fires inside her hull still burning out of control, the carrier limped into Valetta harbour. Eighty-three of her crew had been killed and more than a hundred wounded. [15]

While *Illustrious* underwent temporary repairs in Valetta she was subjected to further attacks by dive bombers. Yet another direct hit near the after lift added to the damage to that part of the ship. Near-misses caused damage to machinery in the boiler room. Despite these intrusions, essential repairs were completed in a remarkably short time. After dark on 23 January, still unable to operate her aircraft but unobserved by the enemy, the carrier limped out from Malta and made a dash for Alexandria. More than a year would elapse before she was again ready to go into action.

AGAINST THE SOVIET UNION

Operation Barbarossa, the invasion of the USSR, opened on 21 June 1941. Beforehand, eight Ju 87 *Gruppen* with a total of 324 aircraft had concentrated at forward airfields. The Luftwaffe supported the Blitzkrieg onslaught in its now established fashion, and when the weather allowed the dive-bomber units maintained average daily sortie rates of about 75 per cent of their strength in aircraft. This effort was maintained day in, day out for more than four months.[16]

As always when attacking targets in front of advancing friendly forces, there was the risk that the dive-bombers would hit the very troops they were trying to support. Hauptmann (Flight Lieutenant) Otto Schmidt, who flew Ju 87s with Dive Bomber *Geschwader* 77, recalled:

> "The contact between the forward troops and our airfields was often poor, and with a rapidly changing situation on the ground it sometimes happened that we hit our own troops by accident. Map reading and finding targets was often difficult, especially when we were being engaged by flak. If we attacked our own troops they would fire light signals and we would break away. Often the communications were so bad that we did not learn the correct colours of the day before we took off, so we had to break off our attack when we saw light signals. But strangely I cannot remember any instance where the enemy attempted to deceive us by firing false signals."[17]

The high sortie rates brought problems, however. During each of the first hundred days of the campaign in the east the Luftwaffe lost an average of 16 planes of all types destroyed and 10 damaged. That represented only about 0.3 per cent of the sorties flown, a low rate of attrition in percentage terms. Yet the cumulative effect of the losses incurred during this period of intensive air operations, 2,600 aircraft destroyed or damaged, was to prove disastrous.

The reserve of trained crews that had sustained the Luftwaffe since the beginning of the war was quickly exhausted and the trickle of replacements from the operational training units was insufficient to make good those being lost. As a result, at the end of the period many units were operating at well below their establishment of both aircraft and crews.[18] Only the arrival of the autumn rains, then the winter snows, brought a degree of relief from the hectic pace of operations. That winter, one by one, the dive-bomber *Gruppen* withdrew to Germany to rest and refit.

BLITZKRIEG RESUMED

The main German thrust in the late spring of 1942 was to take place on the southern front, to seize the Crimean peninsular and the important naval base at Sebastopol. From there the thrust was to continue east to capture Stalingrad and the valuable oilfields in the Caucasus area to the south east.

During each of the first hundred days of the campaign in the east the Luftwaffe lost an average of 16 planes of all types destroyed and 10 damaged

The assault on Sebastopol opened on 2 June, and it was the only occasion during World War II when the siege of a major fortress went to the final reduction. The Luftwaffe quickly established air superiority over the battle area, then the dive-bomber units moved to forward airstrips within ten minutes flying time of Sebastopol. On occasions aircraft and crews flew as many as eight sorties in a day, as they supported infantrymen and army engineers methodically eliminating key strong points in the path of the German advance. Here, against the easily discernible fortress installations, the *Stukas* operated in the Close Air Support role. Otto Schmid recalled:

> "During the operations against Sevastopol there was little flak and no fighter opposition. For us the most difficult thing was when the infantry wanted us to drop each bomb individually, to keep the enemy troops' heads down and send up great clouds of chalk so they could work their way forwards. From out point of view, however, that meant carrying out five separate diving attacks per sortie, which over several sorties per day placed a lot of strain on the body."[19]

Despite stubborn resistance, the outnumbered and outgunned Soviet troops were squeezed into progressively smaller pockets. Resistance in the fortress finally ended on 3 July.

During 1942 life became more hazardous for the dive bomber crews. On each of the battle fronts the enemy fighter opposition became more effective. Most dangerous of all, however, was the large scale deployment of the fast-firing medium calibre anti-aircraft gun. Typical weapons in this class were the 40 mm Bofors gun used by British and Allied forces and the 37 mm M 1939 used by the Soviets; the former fired 2-pound shells at a rate of about 120 per minute, the latter fired 1.6 pound shells at a rate of about 150 per minute. Effective up to 10,000 feet, these weapons fired an impact-fused shell sufficiently powerful to destroy a Ju 87 with a single hit. When viewed from a gun position near the target, an aircraft engaged in a steep-diving attack appeared to hang almost stationary in space. That gave the gunners a zero-deflection shot, and if those manning the Bofors or M 1939 knew their business the effect was often lethal for the attacking aircraft. Otto Schmidt again:

> "At first things were easy in Russia, we had few losses either to flak or fighters. But gradually the Russians gained more experience in dealing with our diving attacks. They learned to stand their ground and fire back at us, instead of running for cover as others had done before. And when that happened, losses began to mount. A further strain was caused by the knowledge that if one was shot down on the enemy side of the lines the chances of survival were minimal. During the early stages of the war the Russians took hardly any prisoners."[20]

The heyday of the *Stuka* was fast drawing to a close. The number of high-value targets lacking effective gun defences dwindled to the point where the highly accurate steep-diving attack had become almost a thing of the past. Increasingly, the Ju 87s were used in shallow dive or low altitude attacks which were less risky but also less accurate. At the same time losses in experienced crews mounted, further reducing the effectiveness of these *Gruppen*.

During 1943 the *Stuka* units started to re-equip with the fighter-bomber version of the Focke Wulf 190 fighter.[21] By the summer of 1944 the Ju 87 had almost passed out of service in its original, daylight, dive bombing role. The rugged and dependable plane now began serving in limited numbers in other specialised roles.

JU 87 TANK BUSTER

In spring of 1943 the Ju 87 took on the role of tank-buster. The G version had the dive brakes, bomb shackles and other systems related to the earlier role removed. In their place it carried a modified 37 mm AA cannon under each wing outboard of the wheel fairing. Each weapon was fitted with a six-round clip of armour-piercing rounds, and both guns fired a single shot with each press of the firing button.[22] The 37 mm weapon was not powerful enough to pierce the front armour of the heavier Soviet tanks, but it was effective against their thinner armour over the engine compartment and rear.

The Ju 87G was at its most effective against tanks that had broken through the German defensive line and outrun their flak protection. On the Eastern Front this happened with disconcerting frequency during the final two years of the war. For brave and skilful crews there were frequent opportunities to engage enemy tanks under optimum conditions. The leading exponent of this role was the legendary Major Hans-Ulrich Rudel, a courageous pilot and an outstanding shot. After the war he wrote:

> "We have always to try to hit the tank in one of its most vulnerable places. The front is always the strongest part of every tank; therefore every tank invariably tries as far as possible to offer its front to the enemy. Its sides are less strongly protected. But the best target for us is the stern. It is there that the engine is housed, and the necessity for cooling this power centre permits of only a thin armour plating. In order to further assist the cooling this plating is perforated with large holes. This is a good spot to aim at because where the engine is there is always petrol. When its engine is running the tank is easily recognizable from the air by the blue fumes of the exhaust."[23]

The Ju 87G was at its most effective against tanks that had broken through the German defensive line and outrun their flak protection

Having lined up on his prey, Rudel's usual method was to attack in a shallow descent, closing to within 300 yards before opening fire. He would then press his attack to short range before pulling up to pass close over his victim.

By the end of the war Hans Rudel had been credited with the destruction of 519 Soviet tanks.[24] That claim is impressive, but it needs to be taken with a grain of salt. For most of that time the German army was on the defensive, so very few of those claims were validated by ground examination. Without such evidence, it is unwise to take the claim at its face value.

NIGHT HARASSMENT OPERATIONS

In the final year of the war the Ju 87 took on one further role, that of night harassment raider. Night after night these aircraft flew nuisance raids over the enemy rear areas, where they bombed and strafed any enemy movements they detected on the ground.[25] These operations incurred few losses and exerted pressure on the enemy, but they were never going to secure decisive results. Their greatest effect was that by forcing enemy vehicles to drive at night without lights, leading to a steady toll of deaths and injuries in accidents.

Production of the Ju 87 finally ended in September 1944, after some 5,700 examples had been built.[26] In April 1945, less than a month before the end of the war, the Luftwaffe Order of Battle included sixty-five Ju 87s serving with ground attack and tank busting units, while a further sixty served with the night attack units.[27] Despite its obsolescence, the type continued to fly operational missions until the surrender.

THE STUKA IN RETROSPECT

The Ju 87 was in action from the first day of World War II until the last. It served on every major battlefront. In its heyday the crank-winged dive-bomber was the terror of Germany's enemies, but by the mid-war period the Allies had taken its measure. As the gun defences became more effective, the Ju 87's accurate steep-diving attack became progressively more risky for its crews. Yet although the plane had been designed without compromise as a dive-bomber, it proved sufficiently flexible to perform as a tank-buster and a night ground attack aircraft.

The six years of World War II saw greater technological advances in military aviation than in any comparable period before or since. One can count on the fingers of one hand the number of aircraft types in front-line service at the start of the conflict that were still flying combat missions at the end of the war. Circumstances dictated that the Junkers 87 should be numbered in that exclusive band. Moreover, as the first true precision attack aircraft to go into action, the *Stuka* has secured its place in history.

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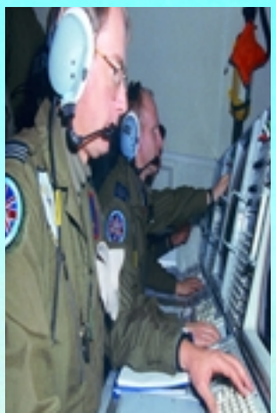
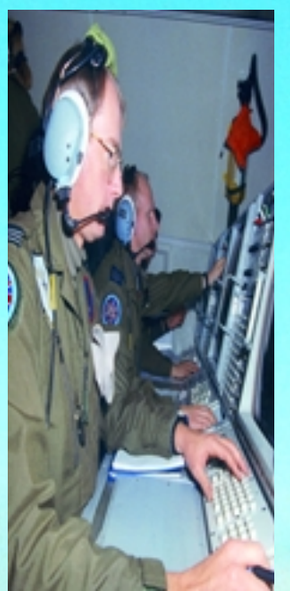
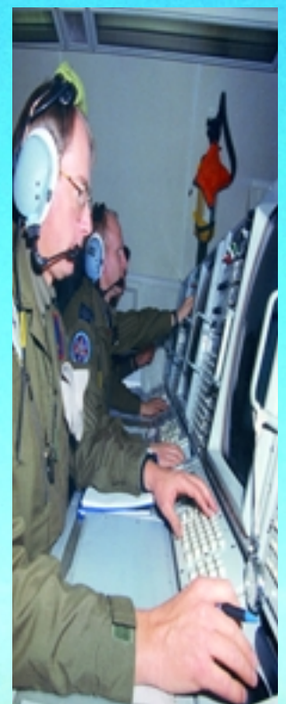
Electronic Fire







By Squadron Leader A J Coller

"War between mass armies weighed down with baroque equipment they cannot use properly has become an established third world sport. The advanced world, too vulnerable to survive a war of attrition or mass destruction, must learn to conduct its affairs by the rapier – by the threat or use of small specialised forces exploiting high tempo and strategic surprise."[1]

Advocates of Information Warfare (IW) talk of a new Revolution in Military Affairs (RMA) that will make current modes of operating and weapons obsolete. In America Andrew Marshall, head of Net Assessment, criticises spending on so-called 'sunset systems,'[2] such as aircraft carriers, tanks and even F-22s'. Modern warfare has become a conflict of 'systems.' Digital networks allow the rapid interchange of data between individual points, around nets, between nets, across the world almost instantaneously and in great volume. In this dynamic systemic environment the effectiveness of violence has been blunted, not because killing the enemy has become any less of a necessity, but because an iron bomb will not easily damage or kill the system or network that guides and directs the energy of a military force. In order to win, and win quickly, pure physical destruction of the enemy is unrealistic and unnecessary. New weapons and new ways of utilising existing weapons are required under new concepts of operations in order to deliver the requisite shock and paralysis to enemy systems to achieve military and political aims.

A REVOLUTION IN MILITARY AFFAIRS?

The Americans are convinced that the RMA is here and are embracing their chosen path to the future, but are they in a 'race of one,' driving forward an unrealistic agenda where the threat is technology itself? The 'information age' has been driven by U.S. industry and research, "*The computer really represents the first genuinely American expression of civilization. More than the auto or television, the computer redefines both thought and daily life. It also will redefine war.*"[3]

More than the auto or television, the computer redefines both thought and daily life. It also will redefine war

Many writers who see the Gulf War as an example of the RMA are often accused of presenting a stereotyped view or of falling for the media image. For Russian observers of the war, it seemed to confirm the early 1980's Soviet prediction of the 'military-technical revolution,' advances in computers, sensors and weapon systems that were expected to inflict damage comparable to that of a nuclear weapon.[4] This was perceived to offer a qualitative transformation in conventional war that would introduce the 'reconnaissance-strike complexes.' What you see in real time you can destroy almost as rapidly, "…operations will no longer be conducted cyclically, with intensive operations followed by lulls. Rather, they will be conducted continuously, making it important to kill an enemy immediately after he is detected."[5] The use of hand held global positioning systems, AWACS, JSTARS, JTIDS, precision guided munitions (PGMs), computerised air tasking orders, all seemed to herald the new dawn. However, whilst many of the components of such a reconnaissance-strike complex were present, there was little integration.

The combat potential of PGMs was first revealed in Vietnam when, on 13 May 1972, 14 bombers dropped both laser-guided and dumb bombs on the bridge at Tanh Hoa finally destroying it after the failure of 871 sorties, the loss of 11 aircraft and the use of 2,000 tons of conventional bombs.[6] During the last decades of the Cold War the USAF began to put faith in such accuracy to counter the Soviet threat. Desert Storm appeared to confirm the power of these weapons, especially when the RAF changed its tactics and adopted the wide scale use of laser guided munitions. Yet a number of reports since the war have played down the significance of PGMs.[7]

The conflict did realise the potential of air power that its pundits had been predicting for so long, even if not in the way that its prophets such as Trenchard or Douhet would have foreseen: as President George Bush said, "Gulf lesson one is the value of air power."[8] But even as air power has come of age, technology has made an even greater impact on the traditional ideas of what is required for victory in the air. 'Stealth' technology was seen as being

…as important as the F-117 was in attacking high-value strategic targets it could neither replace the ordinary bombers nor pave the way for all aircraft in hostile air space

instrumental both in opening the conflict and in neutralising Iraqi air defence systems. Yet as important as the F-117 was[9] in attacking high-value strategic targets it could neither replace the ordinary bombers nor pave the way for all aircraft in hostile air space, "The overwhelming electronic combat achievement laid the basis for all subsequent Coalition military success. Stand-off, barrage and escort jamming of Iraqi radar and fighter control communications blinded and paralysed Iraq's air defence system."[10] The use of AH-64 Apache helicopters to blast a forward air defence radar installation showed both the variety of aircraft types involved in the opening attack and the novel tactical solutions adopted.

The Allies' air and EW campaign turned Iraq's intimidating numbers and hardware into little more than a defenceless and ineffective rabble. In the first hours of the air war, the Iraqi air defences were systematically disrupted. From a front-line strength of around 700 aircraft, the Iraqi air force was to lose only 33 in the air whilst nearly 140 perished in hardened aircraft shelters and more than 120 were eventually flown to Iran.[11] Even so, Coalition planes would not fly missions without SEAD support from US Navy EA-6B Prowlers or USAF EF-111.[12] Such strike support aircraft, and other intelligence-gathering and reconnaissance aircraft, flew more than 50,000 sorties during this short but intensive campaign, such was their crucial importance to the Allies.

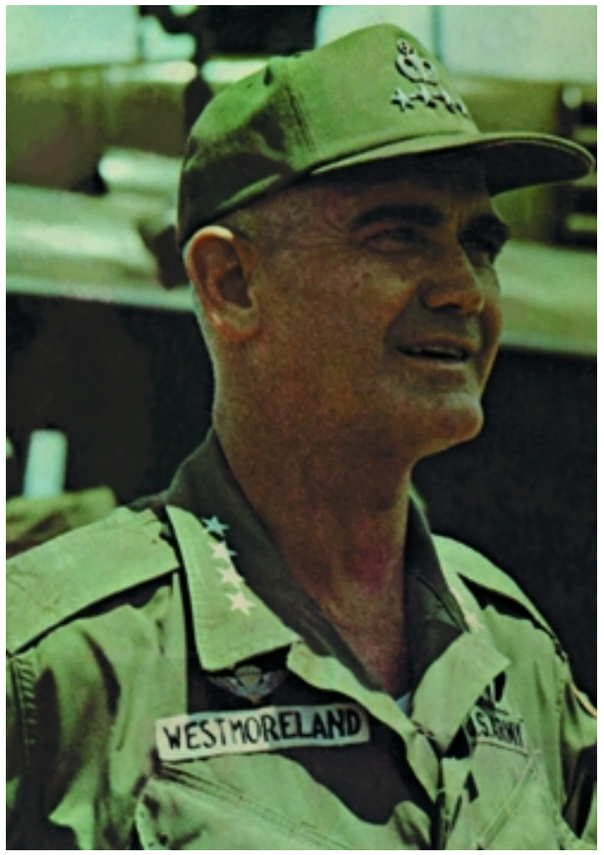
Major General (Retd) Vorobev[13] believed that the eventual land victory had become a certainty as a result of the envelopment of the Iraqis both in the air and in the ether (electromagnetic). He saw the air war in terms of an '*operational electronic-fire battle*' which combined a range of massed, prolonged air and naval, missile and electronic strikes to paralyse and dislocate the Iraqi systems. This symbolism of 'electronic-fire' accords well with the Soviet military's vision of Radioelectronic Combat or Struggle (REB (radioelektronnaya bor'ba)). This aggressive doctrine emphasised the annihilation of enemy command and control systems and structures in order to gain control of the electronic spectrum. While NATO stresses the timely jamming of certain critical radios or radars, the Soviets were more direct. It has been estimated that a goal of the Soviet REB doctrine was to destroy or disrupt at least 50 percent of the enemy's command, control, and weapons systems communications, either by jamming or by destructive fires.[14] They had come to recognise in the early 1970s that in order to off-set NATO's technological superiority they needed to be aggressive in disrupting and denying the electromagnetic spectrum which would allow this superiority to be realised.

It has been estimated that a goal of the Soviet REB doctrine was to destroy or disrupt at least 50 percent of the enemy's command, control, and weapons systems communications, either by jamming or by destructive fires

The Gulf conflict went well for the Coalition for a number of reasons but some were more important than others. The six months of uninterrupted preparation prior to the outbreak of hostilities was a very real advantage; the desert was also an ideal battle space for what was a set piece action, controlled and directed from the centre. The technological one-sidedness meant the question was not who would win but what the price of that victory would be. In the final analysis, numbers aside, the Iraqi armed forces represented a minor power that faced the world's only superpower, and her allies, in a contest where the Allies avoided Iraqi strengths and played to their own.

The Gulf War seems to have reaffirmed the appeal of the technological solution to war but it would be dangerous to ignore the lessons of Somalia or Vietnam. The destruction of the Than Hoa bridge was a success for PGMs; however, its destruction did not prevent NVA supplies getting across the river using prepared fords and under surface bridge platforms.[15] Bosnia and Kosovo have revealed the continuing improvements in the accuracy of PGMs and also their limitations. On balance the conflict saw the application of techniques and weapon systems that had long been available or in development over an extended period of time. But the war did starkly reveal the gulf between the West and even large and apparently well armed Third World armies. If the war was not an RMA then it contained all the elements that will bring about such a revolution in the future.

MILITARY TRENDS



As early as 1969 General William C. Westmoreland was predicting the evolution of an 'automated battlefield'.[16] In this vision of war there would be no need for large forces to fix the opposition physically as the enemy would be tracked and targeted almost instantaneously through use of data links, computer assisted intelligence evaluation and automated fire-control. Vietnam saw the first attempts at realising this approach with the use of ground and air sensors designed to find the Vietcong and then allow their rapid destruction with artillery or air strikes. Westmoreland believed that the sensors were already available for the automated battlefield, but he thought integration was the problem that should be solved in ten years; integration remains a problem both today and for the foreseeable future.

The Westmoreland vision reflects the American dream of a technology driven war with the 'automated battlefield' a centralised quasi-automatic control of war itself. As the pace of war and the destructive power, or accuracy, of weapons increase we become more reliant on machines and there is less room for men. With the increasing employment of machines coupled with the extensive use of modelling there is an inevitable move towards seeing war as capable of being controlled. Man has always sought to impose order on chaos, as much as he has produced that very chaos. During the Second World War modelling was done using real data and it did help in a number of areas.[17] Since then the modelling of possible scenarios has been based on less and less real data and more conjecture or simulation.

The Westmoreland vision reflects the American dream of a technology driven war with the 'automated battlefield' a centralised quasi-automatic control of war itself

Whilst it is natural to seek order from chaos, it is dangerous to believe that war can be ordered. This approach remains susceptible to the same criticisms Clausewitz made of those who sought to reduce war to a set of rules in the nineteenth century. Replacing the war-fighter with more technology will not reduce the dynamics of chaos in conflict and may well increase them. The danger for commanders ensconced in their headquarters viewing neat presentations of maps, units and other information is that computers 'appear' to present an ordered and understandable picture out of a mass of contradictory and fast moving data. That picture is only one version of many possibilities and reflects compromise and limitations in any number of areas, such as programming, available information, the filtering of lower formations and staff officers, etc.

In recent times the battefield has expanded with the capabilities of weapons but the actual battlespace has been reduced. Targets are chosen as much for political or media reasons as for military and the Services must accept a growing political interference down to quite low-levels of detail.[18] The future contains many uncertainties and problems for which a military solution does not exist, such as population growth, immigration, drugs, famine,[19] but this will not prevent the military being fielded to augment political measures.

For the immediate future, the Western trend is toward smaller, professional and more lethal forces equipped with more accurate weapons integrated into advanced C4I systems.[20] Thermal and infra-red night vision and targeting systems will allow forces to operate at both a higher tempo and around the clock. The American domination of space, and her other intelligence and surveillance assets, will provide an 'overwatch' of the battlefield. John Blaker[21] shares Andrew Marshall's view of 'sunset' systems and believes the Pentagon is trying to preserve a force "...designed twenty years ago, for an era that ended nearly a decade ago." In his view the 'big ticket platforms, such as the F-22, draw the lion share of the defence budget and the attention. Blaker would prefer to focus on what platforms carry and the IT that allows the real integration of weapons into a true 'system of systems'. For both Blaker and Marshall, the RMA is all about the interaction of precision, target identification, computers, integration and communications.

The American domination of space, and her other intelligence and surveillance assets, will provide an 'overwatch' of the battlefield

INFORMATION WARFARE

With the advent of the 'Information Age' many of the world's armed forces now rely on the commercial market to provide the majority of their communications bearers and to provide intelligence; from watching CNN to buying satellite imagery. Computers have also allowed other technologies to be developed that have allowed the expansion of the physical battlespace as the potential for military operations can now move beyond traditional boundaries to include virtual economic, financial, psychological, and political targets. The battleground is no longer to be defined by purely geographical boundaries; it extends into 'cyberspace.' Information Warfare is a much-used term of the 90's, but its meaning and impact remains misunderstood.

THE AMERICAN MILITARY CONCEPT OF INFORMATION WARFARE

For the Americans, IW is not something that can be easily defined.[22] Its scope is potentially so broad that it can encompass almost any military action and can, therefore, become almost meaningless as a specific idea. IW, "...is a broad concept that integrates many elements of modern warfare and in fact transcends military applications."[23] The DoD officially defines it as:

> *"Actions taken to achieve information superiority by affecting adversary information, information-based processes, information systems, and computer-based networks while defending one's own information, information-based processes, information systems, and computer-based networks."*[24]

Military IW operations include EW, Psychological Operations, intelligence, etc. Almost any and every action can aid IW operations and objectives from bombing troop positions to using computer viruses to cripple an air defence control system. Traditional weapons platforms equipped with complex computer systems and sensors both demand information (such as JTIDS) and supply it. New technology is blurring once diverse and defining missions. Taken to its logical conclusion, IW is not simply about gaining a better understanding of the enemy and denying him the same, rather it is, "…about influencing human beings and the decisions they make."[25]

American IW is a philosophy rather than a strategy and one that has two sides. First there is the promise of the reduction of the 'fog of war' and the effects of 'friction'. With their control of extensive space and air based sensor and information gathering platforms it becomes almost impossible for the enemy to hide any large force from sight, and with almost real-time data flows it could be possible to launch precision weapons against any detected enemy concentration. Possession of almost unlimited information would allow US forces to dominate any potential battlespace and IW would, therefore, relegate traditional forms of warfare to mere supporting elements of the greater struggle.[26] Conversely, the loss of this information dominance could negate even the strongest military force. The U.S. is most vulnerable to a loss of its information dominance via strikes against the computer networks on which it relies.

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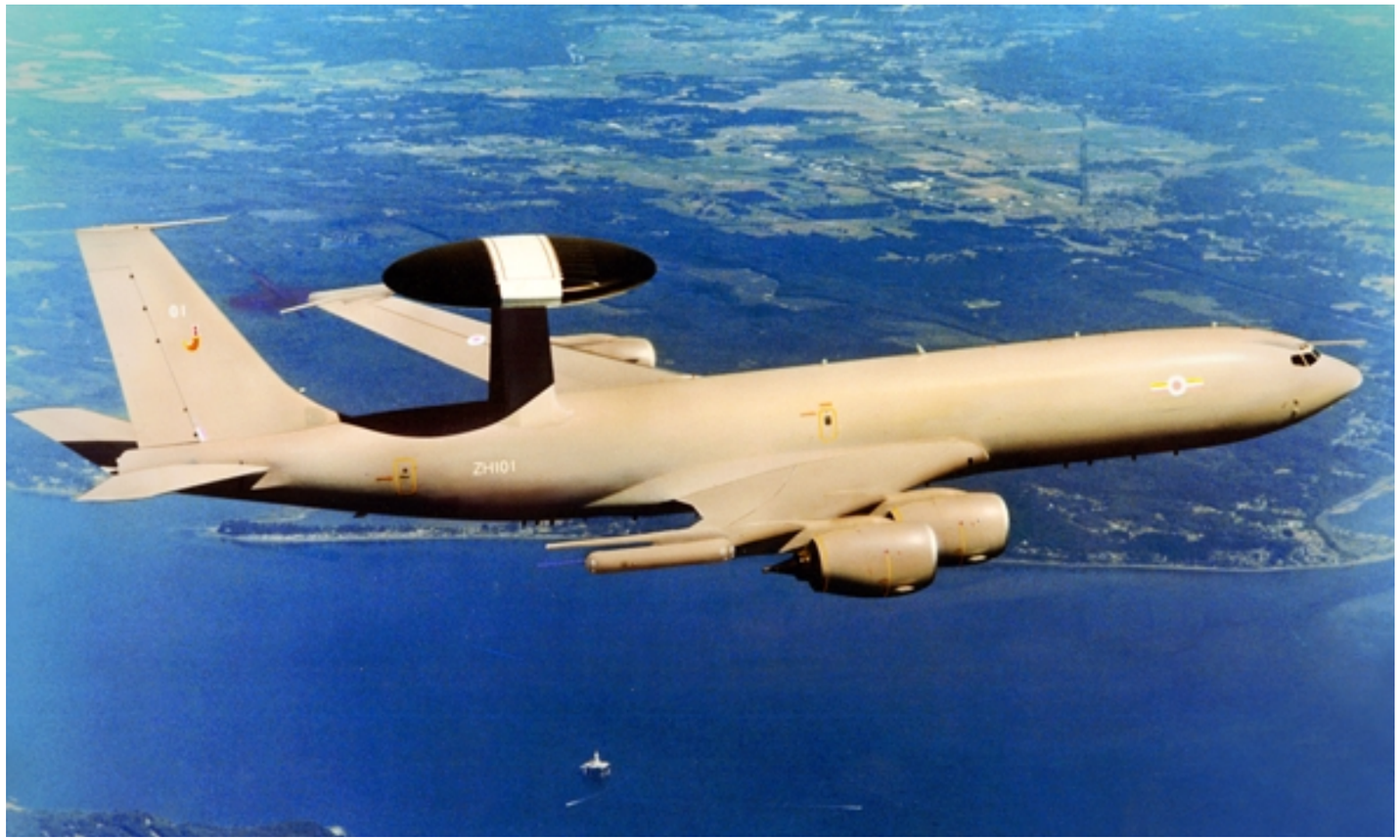
The American military see IW as being both shaping and paralysing. The former is in its ability to deceive the enemy into acting on or believing false information; the latter when information is used to overload, or is denied to, C4I systems. It is the exploitation of information and information systems to achieve a hitherto unforeseen dominance of the battlespace, both physical and cyber, whilst creating and exploiting the new capabilities and vulnerabilities which accompany this profound revolution. For America, their definition of military IW is C2W.[27] They recognise that digitising the battlespace is not IW. There is a big difference between information-in-war and information, or its denial, used as a weapon.

Admiral William Owens has given the U.S. military a vision of a 'system of systems'[28] which will eventually provide her forces with 'dominant battlespace knowledge' that, when combined with precision stand-off weapons, will allow her to control any given battlespace. In order to achieve this 'system of systems' America needs a 'WarNet'[29] a super C4I data integration[30] of all the various military computers and sensor platforms to provide near real-time situation awareness and reaction. The dream is to own the dimension of time and to be able to control or dominate a situation totally. The power and attraction, therefore, of information dominance is the ability to get inside your enemy's decision cycle; time rather than mere information becomes the new 'centre of gravity.'[31] For IW the primary targets are the C4I nodes, satellites, EW systems and AWACS, not the tank or other weapon platforms which have dominated warfare during much of the twentieth century. This is not to say such platforms have no importance, only that their individual destruction contributes little to the reduction of the enemy 'system'. IW is moving away from the war of attrition towards the incapacitation of the functioning military and political entity.



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ALTERNATIVE APPROACHES TO INFORMATION WARFARE

For the American military definition of IW, information is a target even though information is not an entity, but the information systems can also be a target and they do have a physical existence; the two are differentiated. Information systems can include computers, books, photographs and even human beings. But for the non-U.S. military, IW is perceived as being the threat to computer systems and their data, its loss, copying, corruption or destruction.

Whilst the U.S. military believes there may be a role for new elements, such as viruses, 'herf-guns', hackers, and Trojan horses and does perceive a need to defend its computers against these threats, for many these elements represent the main basis of IW. Cyberspace is regarded as a virtual realm in which little or no law exists to protect the innocent and each firm or government must ensure that its firewalls, passwords and back-up procedures and systems are in place to keep out the unwanted hacker or limit the damage of the unhappy employee or the malicious virus.

The British Defence Doctrine defines IW as:

> *"…actions to attack or defend any of the information-based activities supporting either operational or business processes."*[32]

This definition lacks the broad based philosophy of the American vision. Britain has to date treated the concept of IW with a healthy degree of scepticism,[33] and the MOD has only a limited defensive policy with little concept of the possible threat. Only recently has there been any official recognition that the MOD's reliance on civilian infrastructure and even its own IT systems may be susceptible to a hostile IW attack. At present the MOD has no separate offensive IW policy although it does consider that it is included by C2W.

LIMITATIONS OF INFORMATION WARFARE

Information attacks are not necessarily easy to carry out, especially on a networked system. Dan Kuehl, who is a firm advocate of the potential of IW, is also one of the first to admit that attacks designed to bring down complete systems are not only unlikely to occur but are also beyond most, if not all, countries' abilities. For him IW must be focused to achieve limited aims in association with other weapons in order to achieve the political or military objectives. IW is not seen as a 'silver-bullet', nor is its use expected to be easy.[34] Martin Lubicki has pointed out that IW is extremely difficult to conduct without precise and reliable knowledge of the other side's technical architecture. He draws attention to just how complex this task is becoming as ever more small networked systems are proliferating.

IW operations could view information as the focus or primary target whose destruction or manipulation is seen as the key to success. This approach is dangerous because it transforms information into an entity and a target that can be identified and

"War is an act of force," the very essence of war is fighting and everything else is there either as a prelude, a support or to exploit its outcome

somehow fixed. The proliferation of computers helps to give the impression that information is a centre of gravity, that information is moving from a means to an end. For many in the commercial world information is the be all and end all of IW. Within the military there are many advocates of IW/IO who see information in much the same way, but war is about more than information. "War is an act of force,"[35] the very essence of war is fighting and everything else is there either as a prelude, a support or to exploit its outcome. As with non-lethal weapons, there is an attraction in allotting them a capability for which they either weren't designed or aims for which they were not intended. "The latest batch of cyberwar and information theories are particularly sexy – and dangerously limited."[36] Information is something which is an intangible, you cannot touch it, you cannot be sure it is correct and you cannot be sure what your opponent knows. In the very near future the sheer abundance of commercial satellites and data available on the Internet will make the denial of information to hostile organisations or countries almost impossible.[37] As Lawrence Feedman has noted, with the multiplicity of information channels it becomes almost impossible to stop: "There are few information choke points, no command of info-power easily obtained, no 'centre of gravity' to be targeted."[38]

Instead of information dominance lifting the friction and fog of war we may find that it is supplemented by an 'Electronic fog-of-war.' All concepts of military IW/IO suffer from the problem of obtaining accurate and timely battle damage assessment (BDA). How can cyberwar effects be accurately and timely applied or their effects predicted? Even where successful, for how long will such effects last? It is difficult to ensure that a virus will bring down a system at the right time; too early and back up systems will be activated, too late and the attack has failed. Even with the 'system of systems' the challenge of accurately collecting and analysing information remains formidable. Obtaining the correct data does not guarantee that the commander will receive it, after software and human filtering, or that the right conclusions will be drawn from it. Information fusion and filtering all carry risks, as does the danger of greater centralised control stifling lower echelon initiative or allowing greater political interference. Information dominance presents many individual and organisational challenges for the military staff of the future.

Then there is the simple problem of acting on the data received. During the Gulf War, SCUD hunting had the highest priority, yet reaction time from detection to aircraft on target was about fifty minutes. It took 20 minutes

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to erect a launcher and only 6 minutes to be on the move again. No kills of mobile launchers were ever confirmed.[39] The Allies lacked the ability to truly watch and react instantaneously. The problem with complete information becomes the speed of analysis and reaction. Even today, intelligence only minutes old may become worthless.

The techniques of cyberwar remain in their infancy and are not widely available within military communities, even in America.[40] IW/IO may not contribute as much in OOTW as some hope; its deterrence value may not be great where visual capability is often the most important factor. IW/IO operations will also be subject to spoofing, deception and other counter-measures. IW offensive and defensive moves will be rapid. By the very nature of digital communications and instructions, this rapidity will be too fast for human cognition if it is to be effectively countered; therefore, a greater level of computer directed automatic defence and counter moves will be required. Another step towards the automated battlefield.

A NEW IMPERATIVE

"It was always clear that the next war would be won by the side which best used the electromagnetic spectrum. In that environment the advantage enjoyed by the power(s) with superior technology over a slightly inferior adversary has probably increased."[41] Today, and even more so in the future, commanders will need to shape the electromagnetic battlefield just as they have shaped the physical one. C2W has the potential to disorganise the enemy, prevent him massing troops or directing effective fire. However, it doesn't go far enough. Russia, in adopting REB, has recognised *"…the increased importance of systems, have focused more attention on the interaction of combat systems instead of on simple force (the old correlation of forces) ratios... According to this logic, warfare is viewed as the interaction among the military systems of the sides in confrontation."*[42]

"The real purpose of heavy weapons is not to destroy enemy soldiers but to destroy enemy weapons. The rationale for this is, if our weapons can shatter the enemy's tanks, artillery, and other guns, then the enemy soldiers will be defenseless, and either be killed or wounded, or forced to surrender or flee."[43] EW can achieve this, temporarily, through jamming. Offensive targeting of electronic transmitters, using anti-radiation missiles or even conventional munitions, can also achieve this aim. Modern weapons are complex inter-linked systems, and quickly become worthless or vulnerable targets without their electronic systems. Spending money on combat platforms gives the public something to show for their money, but without comprehensive EW systems they may truly be 'sunset' weapons. EW, *"…is now so integral to effective war-making that it is difficult to isolate and analyze it as a separate entity."*[44]

In tomorrow's conflicts the side whose systems fail will lose the ability to control not only his own forces but also the ability to shape or influence the battle. In the future we may be able to move away from an emphasis on physical destruction to collapsing the enemy from the inside. Warden's post-Clausewitzian viewpoint recognised that air power could strike, simultaneously against an enemy's entire range of tactical or strategic targets, his five-ring model.[45] Targets should be identified

that can cause the collapse or paralysis of the system and the quickest way is to attack such targets simultaneously across all five rings; 'parallel attack' to cause rapid and real system shock. "Parallel war brings so many parts of the enemy system under near-simultaneous attack that the system simply cannot react to defend or to repair itself. It is like the death of a thousand cuts; any individual cut is unlikely to be serious." That such attacks can be possible despite ever fewer aircraft is due to the availability of accurate weapons which make economy of force possible. However, identifying targets or the centre of gravity requires good intelligence and planning, commodities that may not always be available. Even in the Gulf much of the targeting of Iraqi forces took place before a centre of gravity was identified and was often influenced by political rather than military concerns.[47]

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As operations speed up traditional command lines are too slow and unresponsive, more devolved command is required, and time becomes ever more important. IT compresses this duration and any degradation in the speed of the process or a return to relying on human links would be a fatal consequence for a modern force in a general war confronting similar conventional forces. The lethality, speed[48] and scope of war have increased, and continue to increase. The difference between the quick and the dead is very small: disrupt the enemy's system and integration collapses. Control of the electromagnetic spectrum is essential if small Western technology-reliant forces are to operate successfully in the future; any disruption could produce a disproportionate effect on the efficiency of such forces. Offensively, it should also be possible to combine the flexibility of air power with the weakness of modern industrial societies and other military forces' reliance on a single technology: the 'chip'. IW, in its broadest sense, seeks to maximise advantages of the information age whilst denying/de-grading it to the enemy. Speed of

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change, speed of response, economies of effort, are today dependent on the exploitation of the chip. Whole 'system of systems' do not need to be completely destroyed but their components and how they interact must be understood if suitable system shock is to be induced. By system shock we must include not only component destruction, loss or denial but also personal shock, confidence in the system (and its information) loss. The human operator and user remains central to any debate in modern warfare, as the American debate on IW/IO recognises and seeks to exploit.

DIRECTED ENERGY WEAPONS (DEWS)

Offensive EW, or electronic fire, requires suitable weapons; existing ARMs are relatively limited in their target set and are reactive in nature. Conventional weapons can be used to hit communication nodes and other electromagnetic targets. DEWs would not replace such weapons; they would complement them. Their scope is enormous as transistors form the core of virtually every modern electrical system from communications to ignition systems. Such transistors are vulnerable to heat and high energy, whether that is radiation or voltage. The Russians believe that REB has become a new combat category and their literature talks of "electronic fire;"[49] DEWs would make the fire real. Dominant firepower leads to domination of the battlefield but traditional concepts of firepower are changing.[50] DEWs could be used to disrupt the entire range of an enemy's system by attacking any and all aspects of the adversary's electrical or digital systems including communications, GPS, targeting systems, radars, fuses, engines, even watches.

There are three general classes of DEWs: lasers, radio frequency (RF) including high-power microwaves (HPM), and energy particle beams. DEWs may be some years away from introduction into service, but they are already available in trial form.[51] The USAF have been testing HPM generators on CMs for some years now, although they have experienced some problems with the range and focus of emissions.[52] The potential power of such weapons has led to some commentators seeing them as destructive as nuclear weapons against electronic equipment: an alternative to the neutron bomb without the nuclear.[53] DEWs also represent a greater threat than conventional weapons due to a number of factors including the higher probability of hit compared with conventional missiles or bullets (an RF weapon is an area weapon); as a result it requires less accuracy and has an instantaneous time of flight. Initially, DEWs are likely to be relatively crude and consist of single emission types mounted

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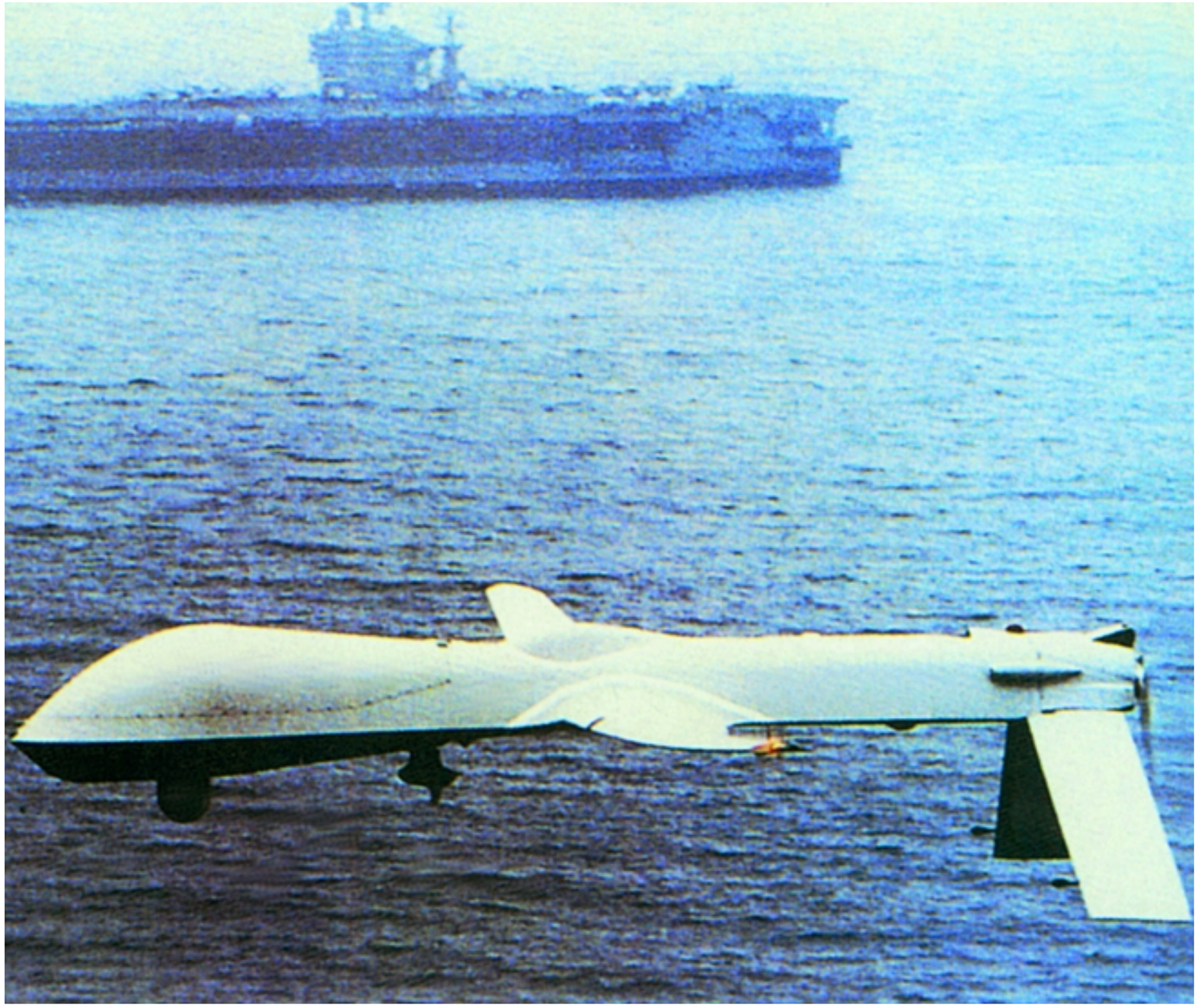

Initially, DEWs are likely to be relatively crude and consist of single emission types mounted in CMs, bomb cases or UAVs

in CMs, bomb cases or UAVs.[54] But large aircraft carrying sufficiently powerful generators for a directed HPM beam weapon could enter the tactical as well as strategic arena by being amongst the first to carry reusable DEWs.

Today, electronics are vulnerable to microwaves which can enter systems through either front or back door paths at frequencies that may be either in-band or out-of-band. As components continue to be miniaturised they become more susceptible to HPM; therefore the most modern electronic systems are also the most vulnerable. Protection is possible, but it is difficult to implement and maintain against an unknown range of potential threats. The cost of protecting in-service equipment would be very expensive and may prove impossible to achieve.[55] Simple economics, use of COTS[56] equipment, and normal budgetary pressures will largely negate attempts to design protection for all possible combinations of microwave frequency, bandwidth, pulse width, peak power, and so on. Effective protection for the diverse and widespread electronic systems in use today, against an equally unpredictable threat, is not really a practical option.

Defence suppression is becoming ever more problematic as the increasing sophistication and density of some of the potential threats are making such systems as ALARM and HARM less effective

Defence suppression is becoming ever more problematic as the increasing sophistication and density of some of the potential threats are making such systems as ALARM and HARM less effective. The ability to operate aggressively and successfully in the electromagnetic environment can reduce the reliance on other technologies. If you have other ways to defeat air defences then the need for 'stealth' aircraft is much reduced and simply adopting limited stealth measures, and appropriate tactics, will still allow success in operations. "In the case of RF weapons, if the location of air defense radars and/or C3I systems can be localized (order of kilometers), the potential exists to suppress those sites using an RF weapon to destroy air defense radars/C3I systems electronics."[57] Nor does it matter if the equipment is switched off at the time of the attack.

DEWs have the potential to significantly alter the scope of the future air battle. Indeed, offensive EW can blur the distinction between strategic, operational and tactical still further as DEWs can threaten missile systems as easily as a power grid or banking system. Areas of a nation, from the front-line to the heart of government, would be susceptible to 'electronic fire.' Targets and effects will still be localised and will depend on aircraft, weapons, objectives and time available, but with the

dependence of society on a single vulnerable technology, shock would be assured. Although talking about the use of reserves Col Warden makes a point that is equally valid to the likely effects of DEWs, "...the mental shock to the enemy may be more important than the physical effect..."[58] People are not the direct target of 'electronic fire' but their inability to utilise modern weapons systems will negate their ability to effectively react to or defeat their opponents' weaponry.

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A NEW APPROACH TO THE FUTURE

EW and IW are about superiority and denial: the former of the electromagnetic spectrum and the latter of information. Conventional weapons cannot achieve the same effects in either the same time frame or with such few assets. A radically different approach to EW to produce an offensive doctrine of 'electronic fire' can exploit a new philosophy, one that changes traditional views on operations and targeting strategy. It is about how to meet the challenge of the 'information age' and exploit its technology, using a weapon that seeks to rupture, shock and paralyse the enemy's systems by denying them the freedom to operate in the electromagnetic spectrum whilst assuring our own exploitation of this medium.

An aggressive EW doctrine utilising DEWs would find them a flexible tool, a media friendly weapon. They allow damage without great physical destruction or loss of life. As Third World countries continue to buy advanced weapons it is necessary to accept that whilst few really have the ability or the money to maintain extensive C4I systems, sensors and EW systems, they do represent a threat to our ability to operate freely. The psychological effects of losing systems to DEWs and the jamming of others would be a serious blow to such forces and their politicians. Control of the electromagnetic spectrum cannot assure victory against a less advanced opponent but it can deny them the ability to utilise more advanced weaponry.

Although not discussed, DEWs also have a defensive function disrupting, by whatever means, the target-tracking capabilities of autonomous or semi-autonomous weapons. An optical seeker may not be fooled by IR flares or towed decoys, but if its computer guidance system is scrambled it will probably fail. An anti-aircraft system based on DEWs will also knock an aircraft out of the sky as easily as a missile if it flies into its zone of effectiveness. However, the down side to such weapons is the chance of fratricide against your own systems.

An optical seeker may not be fooled by IR flares or towed decoys, but if its computer guidance system is scrambled it will probably fail

Conventional weapons can strike, albeit less effectively, at electromagnetic spectrum targets. There is jamming, both stand-off and platform defence, but counter measures cannot easily defeat multi sensor types and C4I systems with fallback facilities nor jam resistant communications. DEWs do not need to remain up-to-date with frequency changes or ECCM techniques; they will simply destroy the electronic components. Danial Deudeney, an American expert in Information technology, has suggested that "Advances in IT – sensors, communications and data processing – have created a rudimentary planetary nervous system, fragments of a planetary cybernetic."[59] The life blood of such a cybernetic remains the electromagnetic spectrum. IW attacks part of its functions, the brain and sensors, but offensive EW or electronic fire could be the nerve-agent that paralyses and slows the system down leaving it vulnerable to attack.

Electronic fire is not necessarily the right or, indeed, the only choice for the future but control of the electromagnetic spectrum is essential for modern forces and it is a weakness the RAF has recognised. It is an area which is also the bedrock underlying the information age and its technology. So while there are other choices that can reasonably be made or argued for, an enhanced and expanded EW doctrine represents a promising possibility for the RAF. The interplay between doctrine and technology is complex; it is not a straightforward matter of establishing operational requirements, it should also involve experimentation and innovation. The promise of the new digital driven RMA is the ability to conduct operations, albeit adhering to traditional military rules, in a completely new way. The integration of not only weapon systems but also support areas, of all land, sea and air forces, into a single, operational system will require new organisations and flexibility. Above all, the ability to dominate the electromagnetic spectrum will confirm the necessary skills and capabilities needed to operate in the twenty-first century and provide the foundation for building upon new technology and concepts as they become available.

"The common thread throughout...is the emphasis on the need to examine the manner and extent to which information technologies alter our basic assumptions about the nature and conduct of war."[60]

NOTES

1 Simpkin R., *Race to the Swift,* p. 180.

2 Ascribed to Marshall by Dr Libicki, at National Defense University (NDU), 28 May 1998.

3 Friedman, George & Meredith, *The Future of War: Power, Technology & American World Dominance in the 21st Century.*

4 Fitzgerald Mary C., 'The Soviet Image of Future War: Through the Prism of the Gulf War', pp. 4, 66-67. Maj Gen(Reserve) I. N. Vorob'ev, Doctor of Military Science, 'Lessons of the War in the Persian Gulf', saw the Gulf as an RMA in the same vein as the Franco-Prussian War, the latter exhibited the changes in small arms, open-order infantry tactics, railway and telegraph. The former showed the face of twentieth century warfare.

5 Thomas T. L., *Dialectic Versus Empirical Thinking: Ten Key Elements of the Russian Understanding of Information Operations,* p. 14.

6 Werrell K. P., 'Did USAF Technology Fail in Vietnam?', pp. 87-99.

7 The US General Accounting Office , *Operation Desert Storm: Evaluation of the Air campaign,* suggests that the DOD, and several contractors, over-emphasised the contributions of stealth and laser-guided bombs as factors in the success of the air campaign and have given very little credit to less publicised systems. Keaney T. A. & Cohen E. A., *Gulf War Air Power Survey Summary Report,* accept that the PGM success came as a surprise to the Americans, as much as the Iraqis, and that they did have limitations. It was their combination with stealth that made them so effective initially and then the absence of any real Iraqi threat to Coalition aircraft that allowed their unrestricted use. PGMs were not revolutionary, as they had been used extensively in Vietnam during the Linebacker operations; rather it was the quantitative increase in their use that was new.

8 Nalty B. C. (Ed), *Winged Shield, Winged Sword: A History of the United States Air Force,* Vol. II 1950-1997, p. 565.

9 Keaney T. A. & Cohen E. A., *Gulf War Air Power Survey Summary Report*, the F-117s flew only 2% of the total attack sorties, yet hit nearly 40% of the strategic targets.

10 Mason T. – *Air Power A Centennial Appraisal.*

11 Cohen E.A., 'The Mystique of U.S. Air Power'.

12 Watson B. W. (Ed), *Military Lessons of the Gulf War.*

13 Vorob'ev .I. N., Maj Gen(Reserve), Doctor of Military Science, `Lessons of the War in the Persian Gulf'.

14 See Munro N., *Electronic Combat and Modern Warfare: The Quick and the Dead* and Chizum D. G., *Soviet Radioelectronic Combat.*

15 Werrell K. P., 'Did USAF Technology Fail in Vietnam?', pp. 87-99.

16 Cliffe T. , 'Military Technology and the European Balance', pp. 1-58.

17 Ibid. Mathematical modelling techniques helped to achieve an increase in the kill rate of U-boats by a factor of 3 as the modelling allowed the isolation of significant variables, i.e., large convoys were better than smaller convoys, identification of optimum search patterns and fuse settings.

18 Gray C. H., *Postmodern War: The New Politics of Conflict*, has highlighted this paradox of capability restricted by the political decision rather than by actual ability.

19 Barnaby F., *The Automated Battlefield.* The population of the industrialised countries is approximately 1,200 million and is likely to remain around this level; that of developing countries may reach 10 billion by 2030. Environmental threats, global warming and the widening poverty gap between rich and poor will all impose strains in future relationships that may fracture into armed conflict.

20 Starr B., 'USA's rapid targeting reaches new heights', pp. 22-23. The Rapid Targeting System (RTS) architecture aims to transmit real time imaging data to aircraft; brings the 'reconnaissance-strike complex' closer to realisation. "The aim is to provide real-time information into the cockpit of F/A-18 Hornet and F-15 Strike Eagle aircraft for attacking mobile targets such as 'Scud' launchers within five to 10 minutes..."

21 Blaker J. R., 'The American RMA Force: An Alternative to the QDR', p. 21-30.

22 *Air Force Basic Doctrine,* talks about Information Operations (IO) which are defined as, "Those actions taken to affect adversary information and information systems while defending one's own information and information systems." IW is referred to but it is IO on which the doctrine concentrates. Libicki M. C., *What Is Information Warfare?*, "...information warfare may better be considered a mosaic of forms, rather than one particular form."

23 Harley J. A. Lt Cdr USN, 'Information, Technology, and the Center of Gravity', p. 68.

24 *Joint Publication* 1-02, Department of Defense. The USAF, *Air Force Basic Doctrine*, includes a copy of this definition plus an additional definition for clarity, "The capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same".

25 Stein G. J., 'Information Warfare', p 124.

26 Chairman of the Joint Chiefs of Staff, National Military Strategy (February 1995),p.15, "winning the information war" is a priority.

27 Campen A. D. (ed), *Cyberwar: Security, Strategy, and Conflict in the Information Age*, the Joint Chiefs of Staff have said that C2W is the military component of IW (JCS Memorandum of Policy (MOP) 30),it has 5 elements deception, operational security(OPSEC), EW, Psychological Ops and physical destruction.

28 Owens William A., 'The Emerging System of Systems', p 15-19.

29 Thomas Timothy L., 'The Threat of Info Operations: A Russian Perspective' in Pfaltzgraff Robert L., Jr & Shultz Richard H., Jr (eds), *War in the Information Age.*

30 Evers S., 'Data fusion holds the key to US 2025 vision', p.27. 10 person team paid to 'free-think' possibilities for the future of war have identified data fusion as one of the most pressing of requirements.

31 John R. Boyd's Observation, Orientation, Decision, Action (OODA) loop has become a popular American model for describing the decision making loop: he uses it to describe the interaction with the environment and sensory data. U.S. forces want to have a smaller OODA loop than their potential opponents. Boyd's work is much quoted by current American military writers, especially on IW, but his work remains unpublished.

32 *British Defence Doctrine,* (JWP) 0-01, p. 4.10.

33 European armed forces have traditionally been less dependent on technological solutions in war and are, therefore, less technologically focused than America.

34 Interview with Dr Dan Kuehl at NDU, 28-29 May 1998.

35 von Clausewitz C., *On War*, p. 77.

36 Gray C. H., *Postmodern War: The New Politics of Conflict*, p. 23.

37 A U.S. Army wargame revealed this dilemma when players were attempting to deny or subvert intelligence sources on which a future enemy was relying and utilising, reported by Seffers G. I., 'Army War Game Reveals Power of Commercial Data', p 44.

38 Freedman L., 'Information warfare: will battle ever be joined?', p. 98.

39 Shukman D., *The Sorcerer's Challenge: Fears and Hopes for the Weapons of the Next Millennium*.

40 Fulghum D. A., 'Cyberwar Plans Trigger Intelligence Controversy', pp. 52-54. Intelligence agencies are restricting the USAF's ability to hack into enemy systems. The secrecy that surrounds such techniques mean that they are currently unavailable to commanders in the field; similarly, during the Gulf, they were either not revealed or offered too late to make any difference. The military reportedly remain lacking even a working knowledge of true capabilities thus restricting their ability to conduct realistic desk-top exercises.

41 Bellamy C., *Expert Witness: A Defence Correspondent's Gulf War 1990-91*, p. 176.

42 Thomas T. L., *Dialectic Versus Empirical Thinking: Ten Key Elements of the Russian Understanding of Information Operations*.

43 Alexander B., *The Future of Warfare*, p. 65.

44 Watson B. W. (Ed), *Military Lessons of the Gulf War*, p. 163.

45 Warden III, Col J., 'The Enemy as a System', pp. 364-374.

46 Warden III, John A., 'Air Theory for the Twenty-first Century', from Magyar K. P.(Ed), *Challenge and Response: Anticipating US Military Security Concerns*.

47 De La Billiere, General Sir Peter., *Storm Command: A Personal Account of the Gulf War*, “By the third day of the war we were putting forty per cent of all our air sorties into our effort to destroy the (SCUD) launchers…”.

48 At a pre-war conference, German Air-force General Erhard Milch said, “The real secret is speed – speed of attack through speed of communication.” Keegan J., *A History of Warfare*.

49 Kipp J. W., ‘Confronting the RMA in Russia’, pp. 49-55.

50 Shukman D., *The Sorcerer's Challenge: Fears and Hopes for the Weapons of the Next Millennium*. He suggests that an electromagnetic weapon weighing 10-40 pounds could give off 100 megawatts in a single flash effective to out to 4 kilometres, more than enough to ‘fry’ most transistors. Another example of a possible DEW is an isotropic radiator – a 'light bomb', which would be capable of producing an incredibly powerful flash that could temporarily blind all optical devices.

51 Starr B., *Russian bomb-disarming device triggers concerns*, p.4. Russia has developed “...a compact high-current electron accelerator that could potentially stop car engines and destroy the electronic arming and firing circuits of bombs.” Called the RADAN, it is smaller than an attaché case, weighs about 8kg and has a directional antenna and a 12V rechargeable battery. Dr Ira Merrit, of the advanced technology directorate at the US Army Missile Defense and Space Technology Center. Congressional Joint Economic Committee (JEC). US scientists have long been monitoring Russian, French and Swedish programmes. “France's Gramat Research Centre ‘has dedicated significant assets to study the effects of electromagnetic energy on electronics’” according to Dr Merrit's statements.

52 Fulghum D. A., ‘New Weapons Slowed By Secrecy Clampdown’, pp.54-56. The USAF also contend that future improvements may allow the YAL-1A airborne laser (ABL) to be used in the SEAD role by disabling electronic equipment in air defence sites.

53 DoD, *Critical Technologies Plan*. “High power microwave weapon offers a revolutionary means of defeating enemy weapons in mass. It may also provide means of severely interrupting enemy communications….without resort to the nuclear arsenal.”

54 Fulghum D.A., ‘Computer Warfare Offense Takes Wing’, pp. 56-58. UAVs and stand-off missiles are being developed as EW platforms. “Teledyne Ryan Aeronautical is preparing some of its Model 350 (BQM-145) fleet of high-speed, swept-wing, medium-range UAVs for installation of a directed energy weapon - perhaps a laser or HPM device – for an unnamed customer.”

55 Baker Dr. William L., ‘Air Force High-Power Microwave Technology Program’, pp.13-17.

56 R. P. O`Neill, ‘Integrating Offensive and Defensive Information Warfare’ in Pfaltzgraff Robert L., Jr & Shultz Richard H., Jr(eds), *War in the Information Age*. Civil sector advances are now out-pacing military development in all but the most specialised of fields: “Market realities yield a policy encouraging purchase of commercial off-the-shelf (COTS) equipment for military procurement”.

57 Marquet Dr. Louis C., Assistant Deputy Under Secretary for Advanced Development, OUSD/A&T, ‘Aircraft Survivability and Directed Energy Weapons’.

58 Warden III J. A., *The Air Campaign: Planning for Combat*.

59 Barnaby F., *The Automated Battlefield*, p. 38.

60 Pfaltzgraff Robert L., Jr & Shultz Richard H., Jr (eds), *War in the Information Age*.

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Cutting through the Political Jungle:

Eisenhower and Tedder

as allies and friends, 1942-1945

By Dr Vincent Orange, University of Canterbury, New Zealand

In July 1938, Air Marshal Sir Wilfrid Freeman, head of research and development in the Air Ministry, had Arthur Tedder appointed to a position in that ministry specially created for him: Director-General of Research and Development. During the next 28 critical months, until December 1940, he and Freeman worked with managing directors, chief designers and senior trade union officials of aircraft companies and their suppliers to provide Britain with weapons capable of resisting the Luftwaffe and, one day perhaps, doing some damage to Germany.

Their task was complicated by a revolution during the 1930s in the design, construction, equipment and production of aircraft. A further complication came in May 1940 when the entire aviation business was detached from the Air Ministry and made part of a new Ministry of Aircraft Production under the control of Lord Beaverbrook, a close friend of Britain's new Prime Minister, Winston Churchill. Beaverbrook, a newspaper magnate entirely ignorant of aviation, supposed that improvisation gave better results than organisation; set unrealistic targets as opposed to making rational plans; and preferred exhortation to argument, threats to persuasion.

Consequently, Tedder became desperate to escape and Freeman, who had himself returned to the Air Ministry as Vice-Chief of the Air Staff, supported a request in November 1940 from Arthur Longmore, head of Middle East Command in Cairo, for Tedder to be appointed his Deputy. Six months later, in May 1941, Longmore was fired and Tedder took his place.

Long before he arrived in Cairo, Tedder clearly understood, as a result of his daily work as Director-General of Research and Development, that neither Britain's aircraft industry nor her merchant fleet could supply him with sufficient weapons to overcome Axis power on land, at sea or in the air. American aircraft were essential and therefore good relations with Americans were essential. American ships, tanks, trucks and soldiers would become equally essential, once the 'Allies' moved onto the offensive in the Mediterranean and still more so if the war were ever to be carried into the Nazi heartland.

These humiliating facts did not please Tedder – why should they? – but his claim to greatness (and I believe that he *was* a great commander, both in war and peace) lies precisely in his readiness to accept them. Better still, to accept them wholeheartedly, with a cheerful face, not with a resigned sigh, and thereafter take advantage of the goodwill thus generated (Americans being a notoriously generous people). Many of Tedder's countrymen, in and out of uniform, refused either to accept American superiority in material or manpower, or did so grudgingly. Worse still, they assigned to themselves a compensating *moral* superiority; casting themselves as British Greeks to American Romans in a play that has always bombed on this side of the Atlantic.

But from December 1940, when Tedder became an operational commander in Egypt (and no longer a constantly-harried ministry official in Britain, to his delighted surprise and relief) until the day he died, Tedder remained acutely aware that the actual relations between the United States and Britain were those of master and man, although both sides might like to pretend – and even to persuade themselves – that they really were equal partners, if not loving blood brothers.

Success in the Desert War, achieved by November 1942, commended Tedder to an American general, Dwight David Eisenhower, newly-arrived in North-West Africa as Supreme Allied Commander, and to Carl Andrew Spaatz, head of American air forces there. By then, Tedder had earned one vital asset to offset Britain's shortage of material and manpower. That was *experience*. In general, experience of the amazing efforts a nation geared for total war could make in overcoming deficiencies of every kind. And in particular, experience of the practical management of air forces, in daylight and darkness, to compete for air superiority, to assist land or sea forces, and to bomb enemy bases and lines of communication.

By November 1942, before he met Eisenhower or Spaatz, Tedder also had a great deal of experience in dealing with Americans. Firstly, in the days before Pearl Harbor, many 'observers' passed through the Middle East and they sometimes offered advice on military operations (based on theory rather than practice) that caused him to swallow hard before replying; but swallow he did and then answered blandly with a warm smile.

Secondly, some diplomats in Cairo sent exaggerated reports about British problems to Washington in what Tedder called 'misdirected enthusiasm'. They were anxious to galvanise the American government into helping the British more urgently, but he was unable to restrain their enthusiasm (which he thought might prove counter-productive) because their reports were supposed to be secret. The Americans had yet to learn that secrets in Cairo became public knowledge in at most 24 hours.

Thirdly, of all the Americans with whom Tedder had dealings, before or after Pearl Harbor, those with representatives of Pan American Airways – which might be described in those days as a particularly aggressive, tightly-focused company – proved to be the trickiest. On this front, fortunately, he found loyal allies in the American military and, after a long and bitter fight, they triumphed and Pan Am was 'militarised' for the duration. Incidentally, this is one aspect of the Desert War which, as yet, has received very little attention.

And fourthly, American airmen came under Tedder's indirect command when General Lewis H. Brereton formed the 'Middle East Air Force' on 28 June 1942. With his usual sensitivity when Anglo-American relations were concerned, Tedder emphasised Brereton's independence and invited his co-operation. They got on famously because at that time they had much to offer each other. For example, American pilots were highly trained, but lacked operational expertise and there were not many of them; their aircraft provided a vital reinforcement, but they had as yet very few supporting ground crews. 'The Americans work in very well with our squadrons', reported Tedder to Portal (head of the RAF) on 22 October. 'They are learning from us, and we are learning from them – I was glad to hear this from both sides.' A few days later, he received the ultimate American accolade: an appearance on the cover of *Time* magazine, 9 November 1942, described as 'Tedder of North Africa' and, less respectfully, in the cover story as 'a pale, thin gremlin.'

'The Americans work in very well with our squadrons', reported Tedder to Portal (head of the RAF)...

During 1943, Eisenhower, Tedder and Spaatz formed a triumvirate which did much to balance increasingly tense relations with Bernard Montgomery, an exceptional but single-minded British field commander. Montgomery became increasingly reluctant to discuss hopes and fears with fellow-commanders, preferring instead to declare his own intentions. As head of Mediterranean Air Command (from February 1943), Tedder recast Anglo-American air power into an effective shape, ending early setbacks in Tunisia and helping to bring about a complete victory there in May, followed by the conquest of Sicily in August and the invasion of Italy in September.

Americans respected Tedder for his achievements and liked him for his straightforward, unpompous manner. At this moment, the thought may be crossing your mind: 'Well yes, Tedder's biographer *would* say that. No doubt he has a whole bunch of pro-Tedder quotes in his files, but do they represent what Americans really thought of him?' To answer that question, I learned that many officers returning to the United States from duty in North Africa were interviewed in the Pentagon. No question of buttering up allies arises because neither they nor the press knew about these interviews and so their opinions have double value for me.

Three examples. Firstly, Major Frederick S. Wildman reported that everyone at Casablanca in January 1943 had been impressed by Tedder's 'warmth, his simplicity and, above all, his direct objective thinking and plain common sense. He hasn't any style or artificial dignity and could as easily be a fine character out of New England or Texas as out of Great Britain.'[1] Secondly, Lieutenant-Colonel C. V. Whitney – who worked with Tedder for nine months – emphasised his 'versatility, open-mindedness to suggestions, and his courage.' The courage Whitney had in mind was not, as you might suppose, in fighting against Germans and Italians, but 'in

Tedder recast Anglo-American air power into an effective shape, ending early setbacks in Tunisia and helping to bring about a complete victory there in May

his stands and arguments with (British or American) Army commanders.'[2] And thirdly, General Elmer E. Adler regarded Tedder as 'a quiet type of man, especially well liked by all of his subordinates… He demonstrated beyond peradventure of doubt that even though the RAF is an independent organization it can support a Ground Army in battle.'[3]

The strength of Tedder's commitment to Anglo-American public harmony (translated into an exalted ideal by Eisenhower) was never more clearly illustrated than in Tedder's instantaneous reaction against 'Mary' Coningham, his own greatly-admired field commander, when Coningham quarrelled with General Patton early in April 1943. Neither at the time, nor in his memoirs published in 1966, did Tedder recognise that in this quarrel Coningham was defending his *American* subordinates, 12th Air Support Command, against extravagant criticism. But Eisenhower, like Tedder, over-reacted badly. Spaatz and Kuter, who knew Patton, reacted calmly and Tedder was quite mistaken in supposing that his intervention on Patton's side converted that remarkable man into 'a friend of ours' who would thereafter become a loyal team-mate.

Tedder had been fortunate, as Roderic Owen (his first biographer) wrote, to find in Eisenhower 'a man of goodwill with a similar ability to cut through dense political jungles on the trail of a similar, simple idea.'[4] General Laurence S. Kuter, himself a very shrewd operator, thought Tedder was 'a politician of Eisenhower's stature. That's why they got along so well.'[5]

There was also the fact that Tedder's wife had been killed in January 1943 in an aircraft accident at Heliopolis airfield, near Cairo, while returning from a visit to RAF hospitals. His eldest son was also dead: a pilot, killed over Cherbourg in August 1940. These and other personal tragedies played a part in bringing Britons and Americans together. Late in February 1943, General Marshall became seriously concerned about the strength of anti-British sentiment in the Army and among American civilians. In a letter to his Public Relations chief he drew attention to the losses suffered by British commanders at all levels and required him to make these widely known.[6]

In April 1943, Tedder met Marie de Seton Black, younger daughter of a Scottish colonel, Sir Bruce Seton, and his wife Elma, who had been a pillar of British society in India. Marie (or rather 'Toppy' as she was always known) was then just 36 (Tedder was nearly 53). She was currently arranging a divorce and working for the Americans in Algiers as a welfare/liaison adviser. They fell as joyfully in love as any of us would hope to and Eisenhower – now 'Ike' – became their friend. They had drinks and meals together, with Kay Summersby (Ike's British-born driver) sometimes making a foursome with them. 'Ike just ragged the lives out of us', wrote Toppy to her mother in June, 'and I must say we both adored it for it meant a lot of laughing!' 'He is a dear, honest-to-God, straight, good man and a very good friend of ours.'

Toppy was the inspiration behind the Malcolm Clubs, founded for airmen in Algiers in July to honour the memory of a most gallant pilot: Wing Commander Hugh Malcolm. His was the only Victoria Cross awarded to an airman in the entire North African campaign. These clubs became Toppy's pride and joy and Tedder shared her enthusiasm wholeheartedly. Eisenhower also approved of her concern for welfare work and both men were able to relax in her cheerful company.

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One September evening in Tunis they all played 'silly games', wrote Toppy, 'and I wondered just what people would say if they could see two such great men trying to float needles on water, bouncing teaspoons into glasses!!' Ike was 'best man, bridesmaid and witness' at their wedding in the British Consulate, Tunis, on 26 October 1943. The night before, Ike and Kay Summersby had called at Tedder's caravan for drinks. Both men 'behaved shockingly and acted like a couple of small boys, kept on asking *what* they had to do' next day. In May 1946 the Tedders had a son, Richard. Eisenhower agreed to be his godfather and kept in regular touch with Richard, at birthdays and Christmas, for the rest of his life. The friendship formed during these middle months of 1943 would make professional relations between Eisenhower and Tedder easier for the rest of the war.

Like Eisenhower, Tedder had acquired management skills and dealt efficiently both with correspondence and with visitors to his office. He could argue cogently, on paper or across a table; he could keep his temper in public no matter how provoked; he had the rare gift of brevity (in speech or writing); and greater than these admirable qualities, he knew when to keep his mouth shut. He often persuaded stubborn, strong-minded men to agree with him, or to let him have his way, or at least not to break with him: men who were as awkward to deal with as officers in the three services, journalists, politicians and government officials.

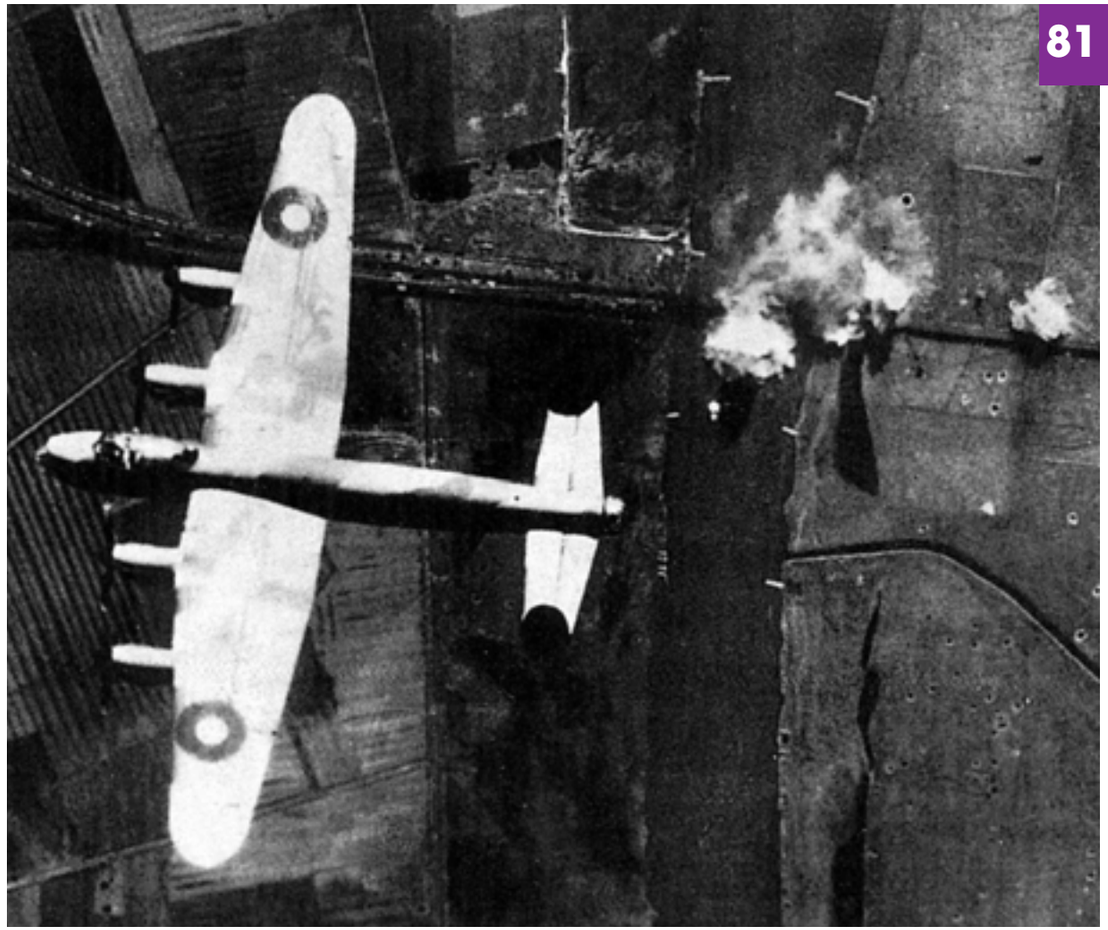
Eisenhower and Tedder were remarkably similar in their methods. 'I don't remember ever hearing a directive from Tedder', recalled Pete Quesada, a famous American airman, in 1950. 'Even when persuading you, he seldom worked on the actual point. He tried to influence people's minds and have *them* think straight rather than order their actions.'[7] Larry Kuter agreed. 'His manner of operating, said Kuter in 1950, 'was one of getting conflicting interests together and staying very much in the background. I remember meeting in the presence of Tedder and decisions forming which were more in the nature of a resolution of difficulties by mutual agreement in his presence.'[8]

Adroit operators usually get their way, but both Eisenhower and Tedder were accused of taking too long about it, of being indecisive, of keeping options open, in a vain attempt to pacify every interested party, long after they should have been closed. Carl Spaatz made a perceptive criticism of Tedder while being interviewed by Dr Bruce Hopper, historian of the US Strategic Air Force, in June 1945: 'he would never put himself in a position where he had responsibility – but always authority.'[9] Perhaps the same criticism could be made of Eisenhower.

In December 1943, Tedder was appointed Eisenhower's Deputy for Operation 'Overlord', launched in June 1944 to liberate Occupied Europe and assist the Soviet Union to overthrow Hitler. Both before and after D-Day, there are many occasions when their methods angered opponents and exasperated friends. No issue generated more heat than the Transportation Plan and I would therefore like to use it as an example of Eisenhower and Tedder working together.

The question arose of how air power – specifically four-engined 'strategic' bombers – could best assist 'Overlord'. The British bomber commander, Arthur Harris, preferred to continue his destruction of German cities, hoping to win the war before the invasion could begin. Spaatz, who had left the Mediterranean Theatre with Eisenhower and Tedder to become the American bomber commander, wanted to employ his forces against Germany's aircraft and oil industries and the fighters defending them. Like Harris, Spaatz hoped that bombing would win the war without the need of a costly assault on defended beaches.

Tedder, supported by Eisenhower, successfully urged a prolonged, systematic attack on the numerous railways, roads, bridges, rivers and canals serving the invasion area, all the way from Normandy into Western Germany. It would be easy, he argued, for the Germans to move in reinforcements quickly – especially of heavy weapons such as tanks and artillery, together with ammunition, fuel, food and water – if they had the use of good communications. Therefore, if the Allies were not to be swept back into the sea shortly after D-Day, the German build-up must be delayed and disorganised. This 'isolation of the battlefield' impressed Eisenhower, who understood at once that it would greatly help Allied soldiers to secure a Normandy bridgehead and, equally vital, build up strength to enlarge it more quickly than the Germans could build up strength to eliminate it.



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The military arguments were complicated by Prime Minister Churchill, who claimed to fear the political consequences if friendly civilians in France and Belgium suffered serious casualties. Churchill, who had a low opinion of Tedder, tried to win over Eisenhower. Finding no response, he appealed over Eisenhower's head to President Roosevelt. The President supported the field commanders, bluntly and promptly. By prior warning and careful targeting, Tedder hoped to reduce the civilian toll to a minimum.

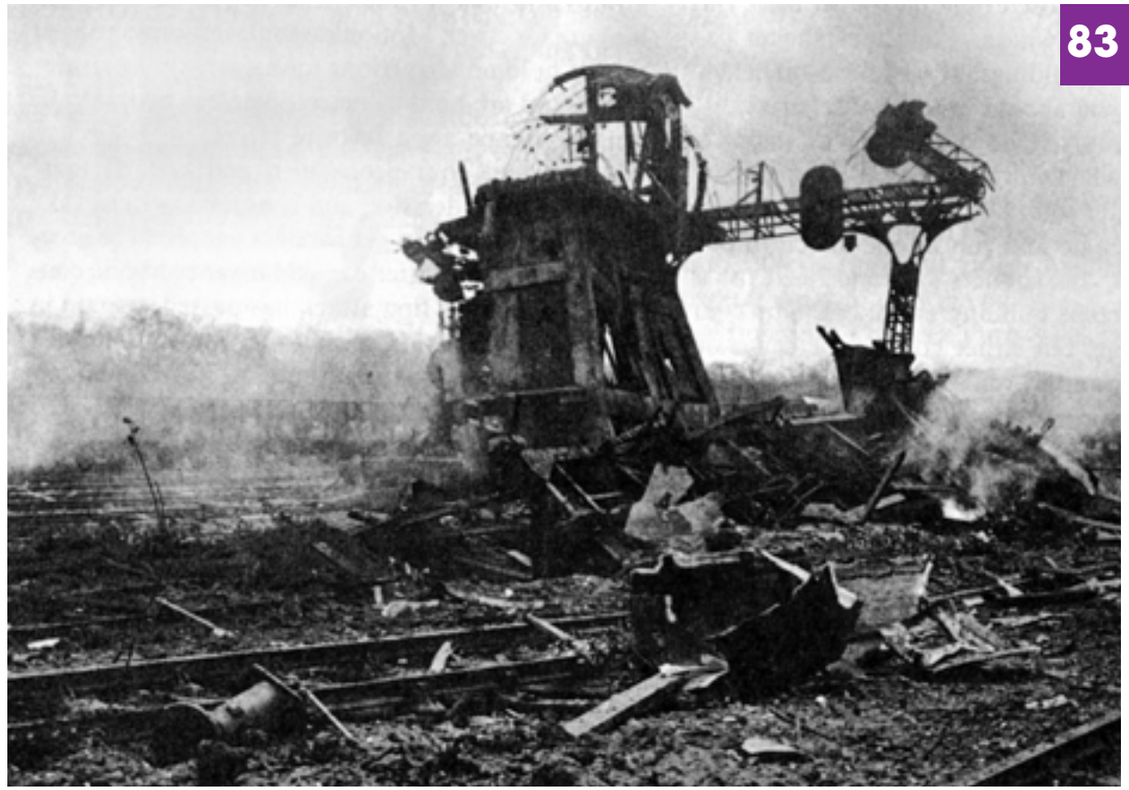
The cruel fact remained, however, that even if his plan had been cancelled, *any* direct attempt to liberate western Europe from German rule must result in unbearable grief for many families as well as massive destruction to everything they loved or needed: their homes, shops, churches, public buildings, cultivated fields, animals, pastures, woodlands and streams. On the other hand, numerous civilians showed themselves ready to risk death, torture or deportation in order to help the plan: occasionally by direct attack upon railway lines or centres, more often by quiet sabotage, and most often by working slowly and poorly.[10] In fact, fewer than 5,000 civilians were killed. A grievous toll, but far below the worst estimates and many fewer than would be killed by ground fighting after D-Day.

In advocating transport targets, Tedder was influenced by his knowledge of the success achieved by Allied bombers against such targets in Sicily and southern Italy and by the advice of British railway executives. The task of preparing a detailed Transportation Plan was assigned to Solly Zuckerman, Tedder's chief scientific adviser. They considered it the most effective means not only of safeguarding the Normandy landings, but also of helping soldiers to win the war, if the commanders of the strategic bombers would co-operate fully.

Spaatz and Harris, having accepted that an invasion *was* necessary, intended to support it with their heavy bombers only immediately before and after D-Day, but Tedder argued that to paralyse the enemy transport system would require maximum concentration for several weeks, at the expense of other targets: in Spaatz's case, the Luftwaffe (on the ground or in the air) and synthetic oil plants; in Harris's case, large urban areas.

At a meeting on 10 March 1944, Tedder agreed that the Luftwaffe should remain 'an absolute first priority', but was unconvinced by the oil plan. The targets, he told Portal, 'are in difficult areas (six of them in the Ruhr, where we have been assured that the Americans could not do precision bombing on railway targets because of flak and smoke, and the most important ones in the areas south and south-west of Berlin, where penetration is most difficult.' The arguments for and against transport or oil targets were nicely balanced, but Tedder prevailed because at a decisive meeting on 25 March Spaatz was unable to assure Eisenhower that his oil plan would give more direct help than the transport plan to troops going ashore on and after D-Day. The Combined Chiefs of Staff directed that control of the heavy bombers be handed over to Eisenhower and he assigned that task to Tedder.

Unfortunately, the debate upset many in 8th Air Force staff circles and they did little to implement the transportation plan. Most of the work, in fact, was done by the RAF's Bomber Command. But Tedder found it prudent not to press Spaatz. He knew that Spaatz thought the invasion might fail. As Alfred Mierzejewski wrote, Spaatz 'wanted to evade responsibility for that failure and hoped to wreck the German war economy himself through the use of air power alone and so win the war and the bombing debate and strengthen the Army Air Force's claim to organizational independence.'[11] Eisenhower also found it prudent not to press Spaatz. He respected Spaatz's judgment even more than he did Tedder's. After the breakout, Eisenhower was willing to give Spaatz his head. To restrain him would expose Eisenhower to the charge of favouring British commanders ahead of American commanders: a charge already being aired by some American soldiers (and newspapers) with regard to the intensely-unpopular British general, Bernard Montgomery.



After the breakout, the Transportation Plan came to envisage the war-shortening advantage of paralysing Germany's industrial, commercial and agricultural life by inhibiting all movement. Raw materials are useless unless they can be moved to factories and the products of these factories must be moved elsewhere, given the dispersion increasingly forced upon German industry from 1942 onwards by Allied bombing raids. Only then can they be assembled, either into weapons or into something almost equally vital. Similarly, harvested crops are of little value unless they can be moved from where they are grown to where they are eaten. And synthetic oil, essential to Germany's military operations, cannot be produced without coal, which must be carried from where it is mined or stored to a refinery.

German military strength, depended upon coal. Upon coal which could only be transported efficiently by railway networks. Upon railways networks which depended upon large, fixed and therefore vulnerable marshalling yards…

The inspiration for this plan did not come from *intelligence* sources, not even from Ultra intercepts, but from *information*, most of it not even classified. It was based, quite simply, on general knowledge supplemented by discussion with transport experts. In intelligent (including intelligence) circles, both military and civilian, it was no secret that Germany lacked natural oil and

therefore needed Romanian imports and synthetic oil plants. In such circles, who did not know that Germany industry, and consequently German military strength, depended upon coal? Upon coal which could only be transported efficiently by railway networks? Upon railways networks which depended upon large, fixed and therefore vulnerable marshalling yards, including the repair and servicing facilities found therein?[12]

Nevertheless, both parts of the Transportation Plan – firstly to isolate the battlefield and secondly to paralyse the German economy – were bitterly opposed by intelligence agencies, British and American.[13] A dedicated Kremlin Watcher, trained in the good old Cold War days, might – just might – truly understand the complex compromise and savage rivalries which bound together the air commanders and their alleged masters in Whitehall and Washington.[14] The British Ministry of Economic Warfare, the American Enemy Objectives Unit, the planning and intelligence staffs of the British and American bomber commands, the Directorate of Bomber Operations in the Air Ministry and the Combined Strategic Targets Committee all took full advantage of this command jungle. They became more than advisers, presenting a balanced summary of facts and offering opinions based upon those facts. They saw themselves as equal (if not directing) partners in decision-making, advocating particular policies.

Walt Rostow, personally involved in the transport-oil controversy (of which he composed a persuasive analysis) explained that decisions were reached in an 'arena of power, vested interest, and personality where forces quite different from straightforward intellectual argument were at work.'[15]

Tedder, whom Zuckerman called 'the politically sensitive airman',[16] was as much at home in that arena as Eisenhower. Both men recognised, early in 1944, that centralised employment under a single director of the massive air power available to the Allies was politically impossible. A coherent organisation, acceptable to all the principal interests, service and civilian, could not be created. There were too many conflicting ambitions, energetically and cunningly pursued. Also, everyone in a high position was tired, worried and at times overwhelmed by numerous, urgent demands.

On 20 May 1945, Spaatz told Bruce Hopper that he would have served under Tedder as air commander for the Overlord campaign as willingly as he had in the Mediterranean campaign, but it was not to be. Fortunately, said Spaatz, Eisenhower, Tedder and he kept in such close touch 'that nothing could possibly go wrong, except in our own persons… It worked well enough to win the war, yes, but if one of the three had been struck by heart failure it might have worked so poorly as to lose the war… In other words, it was a lousy organisation.'[17] Eisenhower and Tedder knew that, and therefore relied on each other, on Spaatz and other enlightened individuals to make it work.

'I consider him one of the outstanding men I have met in this war', wrote Eisenhower of Tedder to Portal on 14 May 1945. 'He is selfless, keen of mind and absolutely loyal. His grasp of complicated problems, his strategic sense, and his intimate knowledge of all matters affecting the air arm, have been of inestimable value to me, and in my opinion, to his country and to the Allied cause. I have never been separated from him officially since early February 1943 and during all that period I have

counted myself extremely fortunate to have by my side a senior officer of such outstanding moral courage and extraordinary comprehension of all major problems with which I have had to deal.'[18]

NOTES

1 Pentagon interview, 5 April 1943: Bolling microfilm A.1274.
2 Pentagon interview, 6 April 1943; also in reel A.6008.
3 Pentagon interview, 25 March 1943: Bolling microfilm, A.1748.
4 Roderic Owen, *Tedder* (Collins, London, 1952) p. 180.
5 Interview with Kuter, September/October 1974, Bolling AFB, K239.0512-810, p. 284.
6 Forrest C. Pogue, *George C. Marshall: Organizer of Victory* (Viking Press, New York, 1973) p. 129.
7 Owen, p. 207.
8 Owen, p. 216.
9 Spaatz Papers, Library of Congress, Box 136.
10 M. R. D. Foot, *SOE: The Special Operations Executive, 1940-1946* (BBC Publications, London, 1984) p. 225.
11 Alfred C. Mierzejewski, *Wheels Must Roll For Victory: Allied Air Power and the German War Economy, 1944-45* (D.Phil dissertation, University of North Carolina at Chapel Hill, 1985) p. 96.
12 Alfred C. Mierzejewski, *The Collapse of the German War Economy, 1944-1945* (University of North Carolina Press, Chapel Hill and London, 1988).
13 W. W. Rostow, *Pre-Invasion Bombing Strategy: General Eisenhower's Decision of March 25, 1944* (University of Texas Press, Austin, 1981).
14 Richard G. Davis, 'RAF-AAF Higher Command Structures and Relationships, 1942-45' in *Air Power History*, vol. 38 (Summer 1991) pp. 20-28 offers a valuable guide through this morass. See also Carlo d'Este, *Decision in Normandy: The Unwritten Story of Montgomery and the Allied Campaign* (Collins, London, 1983) chapter 13.
15 Rostow, p. 43.
16 Lord Zuckerman, *Six Men Out of the Ordinary* (Peter Owen Publishers, London, 1992) p. 65.
17 Spaatz Papers, Library of Congress, Washington DC, Box 136.
18 Eisenhower Papers, Eisenhower Library, Abilene, Kansas. 1916-52, Portal, Box 93.

The

Argentine Gazette

Part Two

LAS MALVINAS SON Y SERAN ARGENTINAS

Port Stanley, 25th May 1982 **Year 1 Number 6**

On National Day: “Long Live the Motherland”

1. The ARGENTINE GAZETTE was the news leaflet issued to all members of the occupying forces during the Falklands Conflict. It was the means by which the Commander of the occupying forces, Brigadier General Mario Menendez, sought to inform his forces of events on the Islands. The GAZETTE was also the means of imparting news from home. Whilst the reader may disagree strongly with the depiction of some events, the style and content of that depiction is deemed to be of interest in its own right.

2. This work is not intended to be an accurate depiction of those tragic events of 1982. Rather, I have attempted to follow as closely as possible the tone, style and literal meaning of the source text.
At no time have I allowed personal opinion to shape the translation. Where cultural references have been made which might have no significance to the reader, I have attempted to render the closest possible equivalent. For the sake of brevity, those terms for which there is no translation have been denoted in brackets [ ].

3. In any kind of translation the ultimate goal must be one not of attempting to render a literal translation of the source text, lest the result be gibberish. Rather, an attempt should be made to reduce to an absolute minimum the ‘equivalence loss’ inherent with the work, ie the degree to which the target text fails to accurately represent the effects and features of the source text. This approach results in the translation of some common phrases appearing to bear no relation to their original form, due to the context in which they had been used.

4. I would like to express my most sincere thanks to Mr John Smith, Curator (Retd) of the Falkland Islands Museum, for the opportunity to undertake this work, and to Elvio and Anya Cofre for the friendship and hospitality they showed me throughout my stay on the Islands. I hope that this work proves to be an interesting addition to the exhibits in the Falkland Islands Museum.

Additional remarks by the Editor, Squadron Leader Alan Riches

Following the surrender of the Argentine forces in June 1982, Mr John Smith, until recently the curator of the Stanley Museum, collected together a full set of the Argentine Gazette; as far as he is aware, this is the only complete set in existence. This translation of the Gazette was undertaken by Christopher Brooks in his spare time during his tour as Engineering Officer of 78 Squadron in the Falkland Islands between April and October 1999. It is a remarkable piece of work and provides both important primary source material for historians of the Falklands Conflict and an interesting insight into the Argentines' perception of events. Other than a little editorial 'tidying up', I have deleted nothing from Christopher Brooks' translation. I have, however, added throughout the text my own commentary on the Argentine version of events which is based on information contained in two books about the Conflict published in the 1980s: "Falklands – The Air War" published by the British Aviation Research Group; and "Air War South Atlantic" by Jeffrey Ethell and Alfred Price. In order to distinguish them from Christopher Brooks' original translation, my comments are in italics.

Editorial.

This week will be the first May week celebrated in these recovered Islands. The memory of the heroic revolution of 1810 has acquired a special dimension for 2 reasons: firstly, because amongst the wars of liberation it was the only one in which a defeat was not suffered. When General San Martín crossed the Andes in 1817 to liberate half the Continent, he was carrying the determination of the only free and independent people at that time in Latin America. Secondly, because those events could be repeating themselves today, albeit in another form. Argentina is undertaking the difficult task of the final recovery of the remains of colonialism in her territory. Argentina's heroic stand has acquired for her the natural leadership of American nations which, understanding her heroic deed, accept her position. Furthermore, they applaud her energy in confronting one of the 'modern monsters' and support her in unmasking Britain's enormous arrogance in keeping hold of certain stolen lands. Argentina has raised the shout for freedom and total independence. We hope that the strengthening of the fraternal bond between Americans will also be the strengthening of ties between brothers in the Country. For history, we know who were the men of history in Buenos Aires in 1810. That same history will judge those men who are in the Falkland Islands, in this May of 1982.

Military Events between 22nd and 24th May 1982

22nd May 1982

0900 hrs: A coastguard vessel of the Argentine Naval Prefecture (PNA) was attacked by 2 Sea Harriers, and shot down one of them with machine-gun fire. During the action, the vessel was damaged and had to run aground. The crewman who controlled the machine gun that shot down the enemy aircraft died during the action; 2 seamen were wounded. *This attack on the "Rio Iguazu" was carried out by 2 Sea Harriers of 800 Sqn. The vessel was run aground and abandoned. Both Sea Harriers returned safely.*

Throughout the day, the Enemy continued to land men and materiel in the area of San Carlos and was harassed by 2 sections of the 25th Infantry Regiment. It is estimated that the Enemy has landed 3,000 men.

During the afternoon our aircraft attacked the Enemy in the area of San Carlos. *Bad weather prevented Argentine air operations until late afternoon when a pair of Skyhawks mounted an unsuccessful attack on the Task Force.*

23rd May 1982

Naval Aviation and Air Force aircraft attacked the Enemy in the area of San Carlos Water, seriously damaging a frigate and a troop transport. *During these attacks, the frigate Antelope was hit by 2 bombs which failed to explode. Later, however, one of the bombs exploded while an Army bomb disposal expert was working to make it safe; following several secondary explosions, the ship sank. The Argentines lost 2 aircraft.*

Two of our Puma and one of our Augusta helicopters were shot down by enemy aircraft and a frigate in the area of San Carlos Water. All of our crewmen were rescued by a fourth helicopter which, despite the enemy fire, returned to look for them. *Sea Harriers of 800 and 801 Sqns destroyed 3 Pumas and one Augusta 109 near Shag Cove inlet.*

The freighter 'Monsunen' was attacked by 2 enemy helicopters to the south of East Falkland, was damaged and managed to run aground. The crew was rescued without injury. *This attack was carried out by a Lynx from Brilliant.*

24th May 1982

1000 hrs: Enemy Sea Harrier aircraft attacked Port Stanley, bombing the Airport. *This attack was carried out by 2 Sea Harriers of 800 Sqn and 4 Harriers of 1 Sqn.*

1300 hrs: Naval Aviation and Air Force aircraft attacked the Enemy in the area of San Carlos Water, seriously damaging a Type 42 frigate and a troop transport (identified as

the transatlantic liner ‘Canberra’). *During these attacks, the landing ships Sir Galahad, Sir Lancelot and Sir Bedivere sustained minor damage. The Canberra was not hit. The Argentines lost 4 aircraft.*

1400 hrs: The 2 sections of the 25th Infantry Regiment located at San Carlos, the site of the enemy landing, returned to our own lines after having attacked and harassed the Enemy for 3 days.

A statement by the Military Governor of the Falkland Islands, South Georgia and South Sandwich Islands:

> Sailors, airmen and soldiers; on this 25th May 1982, as one the same day 172 years ago, we find ourselves fighting to build a proud and sovereign nation. Like our ancestors we have left our families, our homes, our villages and cities to fight and defend our beloved land. To my men on this 25th May, on which Argentina finds itself at war for a true and just cause; I exhort you with all my strength to gain an honourable victory, praying to the Almighty for his protection of everyone on this day. Long Live the Motherland!

A Maritime Temple Called Malvinas

We re-affirm our faith in God and the Holy Mother. Today, the Falkland Islands are a battlefield and a great temple to the Land of the Armies. The oration of the Prayer of Santo Rosario is permanent; it is a powerful weapon against the enemies of God and his Church. To pray to Santo Rosario is to shout ‘Long Live the Motherland!’ and to renew, daily, the dedication of one’s life as a Christian and as an Argentine. Argentina is, and will be, what each one of us wants it to be. But, we know that the calling and the destiny of Argentina is to be great, the champion of the West and of Christian culture which, for a long time due to the duplicity and the lies of the Anglo-Saxons of Europe and America, is split. Argentina is a Christian country, and the Christian will never be true without Mary. From another viewpoint, but with the same consequences, the Falklands could be the contemporary Lepanto.

Sport

Results of the Qualifying Matches for the Quarter-Finals of the National Football Championships

Unión	1	Quilmes	1	Estud	3	S Martín (Tuc)	1
Indep Riv (Mza)	0	Perro	1	Talleres	1	Rácing (Cba)	1

For History

The May Week of 1810 was the culmination of a series of occurrences which led to this great event. The English Invasions of 1806 and 1807 showed the strength of the Country when faced with an enemy against the Motherland and her faith. On the other hand, Spain has been invaded by the French of Napoleon and the native people here found themselves confronted by the

natives from there. The incompatibility of Spain-Europe versus Spain-America was demonstrated. Events came to a head in May. Fernando VII was simply a prisoner of France and did not govern. The natives, noting the lack of authority of the rulers of Buenos Aires, rose against the Imperial Power. It was a very turbulent week. The opinions voiced in the town councils brought about a very dangerous situation. The Viceroy could do nothing other than resign and allow a council of powerful city-dwellers to assume power. Argentina immediately found herself confronted by France, which had invaded the Mother Country, and with a Spanish-Europe that did not want to relinquish power to the native Americans. History says that, on that successful 25th May, it rained torrentially. The weather was bad and, perhaps in the minds of many, a bad omen for the journey they had embarked upon. But, “the people want to know their purpose in life” has signified since then the beginning of a permanent freedom in Hispanic-America.

Poem: The Falkland Islands, by Jose Pedroni

Her wings are flecked with small islands
She is our Beauty of the Sea
The Motherland gazes at Her from the shore
With an enduring pain

Her wings are full of moonlight
A vigilant sea lion is her guardian
The Motherland gazes at Her
The Motherland next to the Sea

She is an angel that does not sleep
She has the chest of a dove above the freezing wave
A fallen dove is her equal
The water lifts between her wings

It wants to but cannot fly
The penguin watches over Her
The seagull carries Her
Letters of freedom

Her eyes are upon her cold plains
She is desolate from waiting
Like a raped woman her name has been taken away
She has been thrown to the Sea

She has been given another names so that She will forget
One that She cannot pronounce
The wind is hers, the horizon is hers
Only, She wants more

She knows that her man will return one day
With the flag and the song
She is captive and silent
She is the first, She neither asks for nor gives

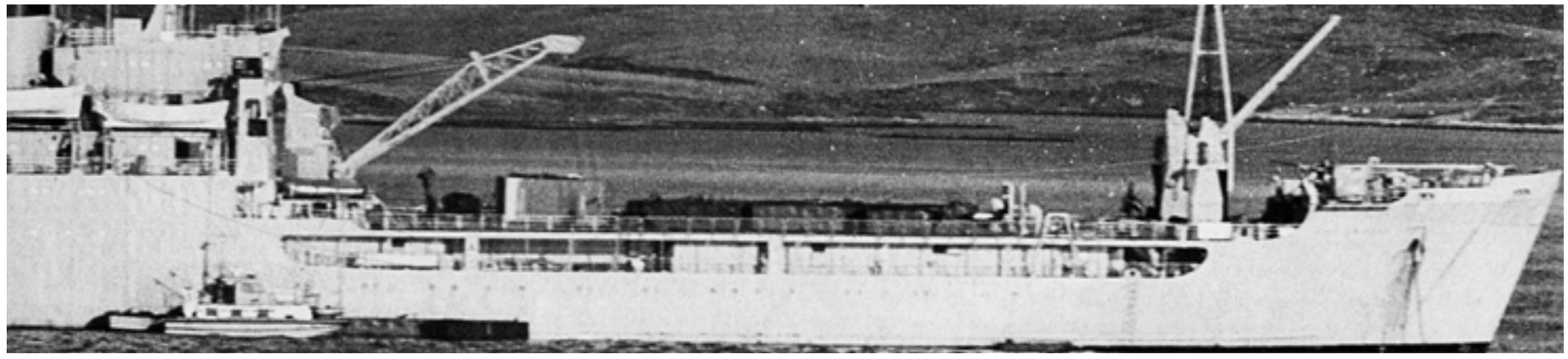
Her message of love is the migrating dove
The falling snow is her sundial
Since the Mother’s ships do not anchor amongst her wings
She is called Solitude

WAR ROLE OF COMBAT TEAM 'GUILMES' (COMPANY 'C' 25th INFANTRY REGIMENT) SENT TO THE COMMANDER OF THE 3RD INFANTRY BRIGADE UPON FINISHING HARASSING OPERATIONS AGAINST THE ENEMY LANDED IN THE AREA OF SAN CARLOS

(This report probably refers to the events of 21 May, the first day of the British amphibious landings at San Carlos Water. The 2 "Sea Lynx" helicopters reported destroyed were in fact Gazelles of the Royal Marines.)

1. At 0230 hrs naval fire was heard from the 'AGUILA' command post (of Combat Team GUILMES) in the area of Height 234.
2. AGUILA proceeded to call GATO (commander of the heavy weapons on Height 234), who did not respond to any of the communiqués until 0600 hrs.
3. The naval barrage was intermittent, and in an unidentified area, for the next 180 minutes.
4. AGUILA was waiting for a messenger from GATO, since they were unable to make contact by radio.
5. At 0630 hrs, AGUILA placed observers, with optical devices, on the heights above Port San Carlos.
6. At 0810 hrs (first light), an observer made out a large white ship at the entrance to San Carlos Water (it was not a warship).
7. At 0815 hrs, AGUILA deployed to the heights and, with the aid of optical devices, observed at least 3 frigates behind the white ship.
8. At 0820 hrs, AGUILA verified that a barge larger than the landing craft left the white ship for San Carlos settlement; various helicopters were flying above the ships.
9. At 0822 hrs, it was possible to make out landing craft heading in all directions.
10. At 0830 hrs, the AGUILA observers reported that English Infantry were advancing in file to the West.
11. At 0831, AGUILA reported to its command that it was beginning to defend its site.
12. AGUILA ordered its troops to deploy to the heights east of the Port, to avoid the encirclement that the English Infantry were attempting.

13. At about 0840 hrs, tens of English Infantry fell upon Port San Carlos and, at the same instant, a Sea King helicopter arrived from the east to complete the encirclement.
14. The order was given to open fire against the enemy machine which, badly damaged, decided not to descend over the Port and escaped the area.
15. The English Infantry opened fire without reaching the positions occupied by AGUILA.
16. One minute later a Sea Lynx helicopter approached the positions occupied by AGUILA, in order to open fire with its rockets. All weapons concentrated upon the Sea Lynx and it crashed into the sea off Port San Carlos. The machine sank immediately; one body was left floating and another clung to a buoy; a launch rushed to its help.
17. With the Sea Lynx having marked its positions, the infantry opened fire with mortars against AGUILA.
18. AGUILA ordered another change of position further to the East, in order to elude the mortar fire.
19. A Sea Lynx helicopter appeared above the new position, opened fire with its machine guns and attempted to bring its rockets to bear. Once again, concentrated fore was ordered and the machine fell to the ground in flames. The Sea Lynx crashed 10m from AGUILA's position, which was able to observe that the 3 crew had been killed.
20. The English again opened fire with mortars, without being able to locate AGUILA's exact position.
21. AGUILA ordered another change of position, and 3 minutes later the Enemy sent another Sea Lynx, apparently to direct the naval gunfire.
22. Concentrated fire was again ordered and the pilot managed to retreat, with his aircraft seriously damaged and trailing smoke.
23. Mortar fire and naval gunfire were directed against AGUILA'S positions but fell 500m away, the Enemy being unable to locate us.
24. Throughout the 20-25 minutes of combat with the helicopters, approximately 200 English Infantry were to be found in Port San Carlos; approximately double that number were in launches and heading directly towards San Carlos settlement.
25. Apart from the Command Platoon and the Logistics Company, AGUILA counted upon only a section of marksmen.
26. AGUILA ordered the occupation of a new position.
27. At approximately 0930 hrs, from that position, our aircraft was observed carrying out a heavy attack against the English Fleet.
28. At that same moment, the ships halted the naval bombardment against AGUILA's positions in order to deal with the air attack.



29. At no time did the English Infantry attempt to approach AGUILA's positions; their rifle fire was ineffective and their mortars fired many rounds without hitting the target.
30. AGUILA'S troops waited for up to 3 hrs for the retreat of GATO from Height 234.
31. AGUILA did not suffer a single casualty during the action; only the heavy personal equipment was left in the Port, plus an 'Instalaza' rocket launcher hit by machine-gun fire from the helicopter. The weapon was left unusable, having been damaged during the attack in which the English helicopter was shot down.
32. The damage inflicted upon the Enemy was as follows: 2 Marines dead, 2 Sea Lynx helicopters shot down (of the 2 crews only one man survived) and one Sea Lynx put out of action.
33. The troops comprising AGUILA boarded their transport towards CAPANGA, leaving behind only their field equipment. The complement of AGUILA is as follows: 2 officers, 9 NCOs and 31 soldiers.
34. Contact has still not been made with GATO. The complement of GATO is as follows: 1 officer, 4 NCOs and 15 soldiers.
35. Throughout the action, AGUILA noted that the Enemy used a Sea King helicopter to carry out night-time, low-level reconnaissance. Those missions were purely defensive since, upon coming under fire from AGUILA, they accelerated and left the area without carrying out a single action.
36. During the combat at San Carlos, the population ridiculed the Argentine soldiers, shouted insults and made rude gestures. When the helicopters were shot down, they went quickly to the aid of the crews. This proves that the population is hostile through fear, but that with a little strength they change quickly. The population was pointing our location out to the English.
37. Throughout the action it was noted that the Enemy was slow to take aim and that his fire was weak. This applied especially to the helicopter crews, which gave the infantry time to shoot them down without difficulty.

CARLOS DANIEL ESTEBAN
First Lieutenant
J Ca 'C'/RI 25

RESULTS OF OPERATIONS UP TO 25TH MAY 1982

(Actual British losses in action up to and including 25 May (not including accidental losses) are given in brackets after the Argentine figures.)

1. Enemy Losses

a. Helicopters Destroyed

Sea Lynx	3 *(2 Gazelles)*
Sea King	2
Unidentified	7
Total	12

Very Important: Three helicopters were shot down by fire from FAL rifles.

b. Sea Harrier Aircraft Shot Down 14 (3 Sea Harriers; one Harrier GR3)

c. Warships

(1) **Sunk**

Type 42 Destroyers	2 *(2 – Sheffield and Coventry)*
Type 22 Frigates	1 *(2 – Ardent and Antelope)*
Frigates	2

(2) **Seriously Damaged**

Type 42 Destroyers	2 *(2 – Glasgow and Antrim)*
Leander Class Frigates	1
Aircraft Carrier Hermes	1
Frigates	4 *(1 – Argonaut)*

d. Transport Ships

(1) **Sunk**

Trans-Atlantic Liner Canberra	
Troop Transport	1
Harrier Container Transport	1 *(1 – Atlantic Conveyor)*

(2) **Damaged**

Landing Craft Personnel (LCP)	3

e. Total Number of Ships Out-of-Action 19 *(8)*

Note: The casualties listed above refer only to confirmed reports and not to estimates or unconfirmed reports.

Port Stanley, 30th May 1982 **Year 1 Number 8**

Second Part of an Editorial.

Circumstances demand that our notes be brief; the least we can do is accept this as our wishes cannot be met. In the first edition of THE ARGENTINE GAZETTE we expressed only the ruling thought: that the editorial should be short. Today we add, again briefly, another part.

In the second place, the business of the Press is to shape opinion. How difficult this objective is here in the Falklands at this moment! The GAZETTE will be individually distributed to all members of the Armed Forces. Our purpose is to give them something: information, and afterwards shape a view. However, a view of what? We should ask ourselves whether the Falkland Islands are Argentina's. Given that, why are we here? That is the belief, consequently, it is not possible for form a view that one already has, and has existed for many generations.

What is necessary in its own right is to make military personnel aware that these historical events which are now unfolding have become key points in history, since they mark a clear and precise division in the history of Western Christianity. The future of our Motherland, and that of America, depends upon the resolution with which we confront the problems defining the 20th Century.

Beluga

This projectile of Israeli origin is an anti-personnel weapon ejected from a conventional bomb rack carried by an aircraft; in this case by a Sea Harrier aircraft. All bombs of this type dispense 68 'Beluga' projectiles within an area of approximately 30-50 m in diameter.

The projectile is detonated, it appears, by 2 different means. Firstly, by percussion: the impact with the ground activates the detonator and produces the burst. It has been proven that many projectiles have not detonated due to the soft ground characteristic of this area. Secondly, by an electrical system. In the upper part of its body there is a small turbine which generates electricity and produces the burst. This system is known in the Air Force as 'electrical initiation'.

The projectile possesses in its upper body a safety device that is ejected upon hitting the ground, in order that an unexploded projectile cannot be handled. If the warhead (similar to a hollow charge, bronze in colour and conical in shape) is found detached, it can be collected without risk and subsequently used for explosive.

In the event that the hollow charge is found together with the turbine and some sharp spokes, it should not be touched since there would be a risk of explosion.

Chaplain's Mass

At 0930 hrs on 28th May 1982, in the Catholic Church of Port Stanley, 5 chaplains celebrated a prayer mass according to the liturgy "In Time of War".

Platelet

In a sack of mail sent to the Air Force arrived a plaque bearing the following inscription: "Lord, font of all reason and justice! Give protection to our Argentina. Give faith and courage to the soldiers. Distance our country from the maliciousness of the Enemy". May your holy angels keep us at peace and may your blessing always be upon us.

Sport

Come on Argentina! After having won 1-0 against Benfica of Portugal, with a goal from Kempes, the Argentina Select Football Team travelled to Spain, where in June they will defend their title in the next Football World Cup.

Army Day

The forthcoming anniversary of the Argentine Army, 172 years after its founding, finds it passionately engaged, together with its sister services of the Navy and Air Force, in the enterprise of maintaining the recovery of our Falklands.

Letters from 5 Argentines to a Soldier

Lomas De Zamora, 30-4-82

To The Argentine Soldier:

Hello! I do not know you but it is as if I have been watching you. I want to know that your countenance, your bravery and daring are formed in the smile of every happy child; in every flower which, thanks to you, can blossom; in each morning and each evening; in our colours which join us; in the gentle countenance of an old woman and in the warm look of a young mother.

I write to you and could be your mother, a girlfriend, your sister or, perhaps, only someone who feels that there is a bond; a find bond of silver which unites us, sacred and inflexible, which crosses time and distance, honest and without condition. Nothing can dampen or break that bond. I tell you that this link is called 'Motherland'. It is also our twin colours of sky blue and white; it is our independence and our land, ours. It is also those who cry out from the strength of those heroes who, the same as you, give everything to fight for them.

I ask that you forgive such excesses of frankness. I know, or imagine, what strength there must be in your heart to have gone to war. But I also guess that in your breasts beats a tender heart, full of childhood memories. I ask you to trust in God and in this land, that today he asks you to give unto your last breath. For you and your children, I ask that you defend this, your land, which is also mine. I swear on my life that here, although far from you, I hare not only your fears but also your convictions, and know that He will be able to set you along the right path.

You will be Triumphant in Heaven and on Earth!

Stella-Gladys-Mary-Teresa-Silvia

Military Events Between 27th and 29th May 1982

(This report refers to the famous attack on Darwin and Goose Green by 2 Para.)

27th May 1982

2300 hrs: Enemy warships bombarded positions around Port Stanley, producing neither damage nor casualties. The Enemy was beaten off by fire from heavy artillery.

2400 hrs: The Enemy harassed, with naval gunfire, positions around Fox Bay and Port Howard; light casualties resulted.

28th May 1982

0400 hrs: The Enemy directed naval gunfire against Port Howard and Darwin.

0500 hrs: Three warships fired upon Darwin.

0530 hrs: The Enemy began to advance upon Darwin by land.

0800 hrs: The Enemy attacked Darwin by land.

0930 hrs: Two Pucará aircraft attacked the enemy soldiers in action against Darwin, causing heavy casualties. *No casualties were sustained.*

1000 hrs: The troops stationed at Darwin beat off the Enemy, forcing him to retreat, reorganise and re-form.

1100 hrs: Aermacchi aircraft of Naval Aviation attacked the Enemy at Darwin.

1300 hrs: Aircraft based on the Continent attacked enemy ships in San Carlos Water, seriously damaging one warship. *No such attack.*

1600 hrs: Pucará and Aermacchi aircraft carried out attacks against enemy troops, during which Pucará aircraft shot down 3 enemy helicopters. In these actions 2 Pucará and 1 Aermacchi were lost. *Two Royal Marine Scout helicopters were attacked by Pucaras; one was shot down, killing the pilot, the other escaped. The Argentine aircraft were brought down by Blowpipe missiles and/or small arms fire.*

1700 hrs: The troops based at Darwin organised Goose Green as a support area, concentrating their artillery.

1700 hrs: Helicopters of the Army and Air Force transported an infantry company to Darwin, in order to reinforce the position. All aircraft returned safely.

1800-2100 hrs: The actions at Goose Green (Darwin) continued, involving the reinforcement company.

29th May 1982

0200 hrs: Canberra aircraft of the FAA bombed Port San Carlos from high altitude.

1000 hrs: Military action at Darwin ceased after the garrison exhausted stocks of ammunition for its small arms and artillery, plus all supplies. Radio contact was lost.

0900/1100/1300 hrs: Port Stanley Airport was shelled, without damage.

Port Stanley, 1st June 1982 **Year 1 Number 9 (Special Edition)**

To My Men

The hour of the final battle has arrived. All our efforts, the hours of waiting, the cold, the exhaustion and the vigils, have come to an end. The adversary is preparing to attack Port Stanley with the audacious and impudent intention of conquering the capital of the Falkland Islands.

Each man should understand clearly his duty. The Enemy will be defeated by the action taken by each man at his fighting position. If each man with his rifle, his mortar, his machine gun or cannon, fights with the strength and heroism which has always characterised us, success would be assured.

The gaze of the Argentines is upon us. Our parents, wives, girlfriends and children; all our families confide totally in us. It is our duty at this final hour to not let them down.

We have taken on a sacred responsibility, before our fallen comrades, to convert their personal sacrifice into a glorious page in the history of Argentina. We cannot allow their heroism to have been in vain.

We should not just defeat the Enemy, but do so in such a crushing manner that they will never again have the insolent idea of invading our land. To Arms! To the Fight!

Mario Benjamin Menendez
Brigadier General
Military Governor

Military Events Between 30th and 31st May 1982

30 May 1982

1000 hrs: One of our Puma helicopters was shot down by an enemy air defence missile, killing 6 men from the National Police patrol. *No record of this incident.*

1100 hrs: An enemy Sea Harrier aircraft was shot down at Monte Wall. *A Harrier GR3 of 1 Sqn, flown by Sqn Ldr Jerry Pook, was shot down by small arms fire. Pook ejected and was rescued from the sea.*

1430 hrs: Two Super Etendard aircraft of the Navy, and four A4-C aircraft of the Air Force, attacked the English fleet and scored a direct hit on the aircraft carrier Invincible with an Exocet missile. Following this, the A4-Cs attacked the ship with 250 kg bombs and scored a direct hit on the flight deck. The ship was seen burning on the high sea. During the action, two A4-Cs were shot down by the Enemy. *No British ship suffered damage on this day, although the frigate Avenger claimed to have destroyed an Exocet missile with her 4.5 inch gun and the destroyer Exeter shot down 2 Skyhawks with Sea Dart missiles.*

31 May 1982

0100 hrs: Heavy artillery opened fire against 2 enemy frigates found close to Port Stanley; the Enemy withdrew.

0500 hrs: Aircraft carried out high-altitude bombing raids against enemy positions at Darwin and Port San Carlos.

0545 hrs: Two enemy aircraft bombed Port Stanley. *In fact this was "Black Buck 5", an anti-radar Vulcan mission armed with 2 Shrike missiles.*

1100 hrs: An enemy aircraft was shot down by Air Defence artillery located in Port Stanley. *No such loss.*

Port Stanley, 3rd June 1982 **Year 1 Number 10**

Editorial. Good examples are always very significant in all aspects of Life. But when these examples have a sheen of heroism, they reach the peak of Man's endeavour in his attitude to Life. Luís, an infantryman from the Class of '62, was in a shelter with a companion during the early hours of the morning when his company came under fire from both sea and land. Once the bombardment had ceased, Luís proposed leaving the shelter; he received the categorical answer: no! Seconds later a bomb exploded close by. His companion was wounded in the arm and stomach. He told Luís, who then left his shelter in search for help, that his wounds were hurting. He didn't find it as it was far away, and it would not be prudent to have gone too far from the shelter. Upon returning, Luís did not find his comrade; he had left the shelter behind Luís but, after a few metres, had fallen into a crater. Luís heard his name being called; his friend was calling him to lie down as the bombardment had begun again. At that moment, another shell exploded close by. This time, Luís was wounded by a splinter in his right leg. Despite all of this, when the bombardment appeared to be shifting to another area, Luís grabbed hold of his friend's jacket and dragged him from the crater. Luís dragged his companion across country and, shortly afterwards, came across a captain and a private. As they were unable to reach medical aid, they were later sent two stretchers by means of which they were able to leave the site. Luís is in hospital recovering from his wounds, hoping that God will help his companion, who has undergone surgery.

Perhaps because of its brevity, this narrative appears to be unemotive since it is neither lively nor literary. However, the endurance of those infantrymen serves as a model example of the nobility of our soldiers when faced with death.

Military Events

1st June 1982

1100 hrs: A Harrier aircraft was shot down by fire from Air Defence units based in Port Stanley.

1430 hrs: An enemy Harrier aircraft was destroyed in Port Stanley by an Air Defence Roland missile. The English pilot ejected, descended by parachute and, despite a search, was not found.

One Sea Harrier of 801 Sqn was destroyed by a Roland missile on this day. The pilot, Flt Lt Ian Mortimer, ejected and was rescued from the sea.

1600 hrs: A Hercules KC-130 of the FAA was shot down by the Enemy in the vicinity of West Falkland. *This aircraft was shot down by a Sea Harrier of 801 Sqn flown by Lt Cdr Ward.*

3rd June 1982

0630 hrs: An enemy missile destroyed a Sky Guard fire-control radar for twin-barrelled 35 mm cannon. In the action died a lieutenant, a sergeant major and 2 privates of the 601st Auxiliary Air Defence Group. *This was "Black Buck 6", another anti-radar Vulcan mission armed with 4 Shrike missiles. On the return trip, the tip of the Vulcan's refuelling probe broke off during air-to-air refuelling and the crew were forced to divert to the nearest available airfield, which was at Rio de Janeiro in Brazil. The Vulcan was impounded by the Brazilian authorities and eventually released on 10 June.*

1500 hrs: Heavy-calibre artillery based in Port Stanley carried out counter-battery fire, silencing an enemy artillery position.

Greeting from the Military Curate

In a greeting sent by the Military Curate, Monsignor José Miguel Mëdina, to the chaplains in the Falkland Islands. "I would like to finish this brief and brotherly greeting by asking that you pass on my best wishes to the young soldiers, their chiefs, officers and NCOs, wishing them well and telling them that they are in my thoughts and my affections, that they are in my prayer and I am ready to go where you are if the Country requires it. You have the blessing of the Lord, through the Virgin Mary and the ministry of José Miguel Medina.

Greeting from the Camping Movement of the Argentine Federal Police

We pray that this brotherly greeting, sent to the chaplains in the Falkland Islands, reaches the fighting troops who, with such bravery and gallantry, are defending our land with such courageous spirits as those which today unite and motivate 28 million Argentines.

Sport

The Argentine Football Team is today to be found in the city of Alicante, Spain, where on the 13th June they will begin to play in the World Cup, with the aim of defending the title won in Buenos Aires in 1978. The players who have travelled are: Ardiles, Valey, Barbas, Bertoni, Calderón, Díaz, Fillol, Gallego, Galván, Hernández, Kempes, Maradona, Olarticoechea, Olguín, Passarella, Pumpido, Santamaría, Tarantini, Trossero, Valdano, Valencia y Van Tuyne. The Technical Director is Menotti.

Now, Yes, I Am a First-Class Citizen and not a Second- or Third-Class Kelper

Derek William Rozee, 22 years old, became on 28th May the first Argentine citizen born in the Falkland Islands. He received his citizenship papers from the hands of the Chief of Federal Police, at a ceremony in the city of Buenos Aires. At the end of the Ceremony, Rozee expressed his satisfaction at feeling more an Argentine citizen than a second – or third - class kelper "as we are categorised in England." The new citizen was runner-up in the World Sheep-Shearing Championships, and will represent Argentina at the World Championships scheduled for next August in Great Britain.

Visit of the Pope to England and Argentina

On the 28th May His Holiness Pope John Paul II began his visit to England. The visit comes after 450 years of separation between the Catholic and Anglican Churches, and is due to finish on 2nd June. During his visit to that country, The Pope made a plea for Christian unity, visited Queen Elizabeth II and led several prayers for peace in the Falkland Islands.

The Pope will visit Argentina over 2 days: he will arrive in Buenos Aires on 11th June, and will return to Rome on the afternoon of the 12th. He comes to pray for peace, will celebrate a mass in Luján before the sanctuary of the Virgin, Patron of Argentina, and another at the foot of the Spanish Monument in Palermo.

The Exocet is Built in England

The Exocet rocket, built by France and used by Argentina for the destruction of British ships, has been acquired in 4 different versions by at least 36 countries. By an irony of history, 17% of the Exocet is build under licence in Great Britain. This missile is guided from launch by internal navigation devices until its autonomous radar detects the target in the final seconds of flight. The missile can be launched up to 48km from the target.

Port Stanley, 7th June 1982 **Year 1 Number 11**

JOURNALISTS' DAY

Editorial

It is assumed that everyone who reads THE ARGENTINE GAZETTE is asking the same questions:

What is really happening with the Enemy?
When will the aforementioned attack come?
Why should we maintain a steady and boring routine?
Well perhaps we have a few ideas that will help you understand.

Regarding the Enemy

He has learned that our soldiers neither yield easily nor have they lost their faith
Their massive bombardments have not yielded the results hoped for
The limited confrontations so far have gone against them
The weather has affected them
The routine is beginning to worry them and cause a loss of faith in their forces.

Regarding our own Troops

We have sufficient ammunition for an indefinite period
We have sufficient supplies for an indefinite period
We have unlimited faith
Does the Enemy not understand that he is in the wrong place, that he has picked the wrong adversary and that he is without sincere and honest motives?

Military Events Between 3rd and 8th June 1982

3rd June 1982

2200 hrs: Our patrols clashed with light enemy forces, which suffered 3 dead, including the commander. Meanwhile, our forces lost contact after incurring 3 casualties.

2300 hrs: It has come to our attention that our troops held prisoner at Darwin have had their clothing and equipment swapped, with the apparent purpose of clothing enemy soldiers in order to infiltrate them through our lines.

2330 hrs: News from Brazil stated that a Vulcan bomber of the English Air Force was obliged to descend upon flying over its territory, and is being held at the airport in Rio de Janeiro due to the fact it was carrying bombs and rockets for employment against the Falkland Islands. *The aircraft concerned was Vulcan XM597, which was forced to divert to Rio de Janeiro after the tip of its refuelling probe broke off during air-to-air refuelling. The Vulcan was returning from "Black Buck 6", an anti-radar mission against Port Stanley. It was impounded by the Brazilian authorities and eventually released on 10 June.*

4th June 1982

On 3 occasions our aircraft bombed the area of Mount Kent, without being able to determine the results.

5th/6th June 1982

2345 hrs: A confrontation took place between our patrols and those of the Enemy, during which 2 of our troops were killed and a further 2 wounded. Enemy casualties are unknown, but materiel was captured at the site that had been hurriedly abandoned.

7th June 1982

0230 hrs: A confrontation took place between one of our patrols and enemy troops, lightly wounding one of our soldiers. The Enemy abandoned equipment during their flight.

8th June 1982

An attack was carried out against enemy ships and ground targets using A4-B and Dagger aircraft. One ship was sunk, 2 others damaged and the aircraft returned to base without further event. *During these attacks, the frigate Plymouth was hit by four 1000lb bombs; although none exploded, the ship was seriously damaged. Later, the landing ships Sir Galahad and Sir Tristram were severely damaged off Fitzroy. Altogether, 51 men were killed and 46 injured (mostly Welsh Guards) – the worst single loss inflicted on British forces during the conflict. The Argentines lost 3 Skyhawks.*

Note: During the compilation of these events it emerged as a characteristic of the Enemy that he would seek to preserve his physical well-being when faced with decisive action on our part.

The Visit of the Holy Father to Argentina

The Holy Father will come to Argentina. It will be a paternal gesture equal to that of his visit to England. We regret his visit at this time. We would have liked a more propitious time: one of peace. The Supreme Pontiff will meet an Argentina united in a desire for sovereignty, involved in a war that, because war has not been declared, has been labelled a conflict. He will meet an under-developed, Catholic country confronted by two, practically, Protestant world superpowers. It is under military blockade by England, aided by the United States, and both politically and economically by the European nations. Some of those nations are Latin in origin and, with their stance have finished a nation weak from colonialism and unleashed the fury of the powerful who have torn her clothing to pieces, crying out to Heaven. In the Falkland's Conflict, Argentina has given a shout for America, audacious and bold, with its whole. It is a testament of a human truth confronted by a colonialist and slavist lie. Could our Holy

Father impose his Catholic moral strength when faced with the protestant treachery? That moral strength will be able to show, as is characteristic of the Church, that the gravest political and moral errors are based upon religious ones. That is what we are hoping for from this visit of the Holy Father to Argentina.

The Beginning of Journalism in Argentina

In 1801 appeared in Buenos Aires the 'Telégrafo Mercantil, Rural, Político, Económico e Historiográfico del Río de la Plata". It was founded and edited by Colonel D Francisco Antonio Cabello y Mesa, and was produced at the Los Niños Expósitos printworks.

In 1810, on 7th June, the first May Council founded the "Gazeta de Buenos Aires", a publication edited by the Council Secretary D Mariano Moreno.

In 1982, on 7th May, the "GAZETA ARGENTINA" was founded in the recovered Falkland Islands, and published its first edition the following day, 8th May.

Greeting to the Argentine Gazette

Professors, students, graduates and staff of the Argentine Journalism School, express their pride in, and give their most sincere congratulations upon the historic founding of the first Argentine newspaper in the Falklands. We wish our distinguished colleagues and graduates every professional success.

Carlos Abregu, Principal

Greeting from the Governor of the Islands to the Journalists

On this day, the Governor of the Falkland Islands received in his office the journalists detached to Port Stanley, and greeted them on Journalists' Day.

ENCOTEL Argentina

Two Days after the recovery of the Falkland Islands by Argentina, members of ENCOTEL arrived on these shores to find the (Dependencial) that opened for business on 6th April. Appointed as Director, and given responsibility for the postal area, was D Everto Hugo Caballero, who stated: "The volume of correspondence, both postal and telegram, between the Falkland Islands and the Continent is equal to that of a city of 700,000 to 800,000 inhabitants.

To our Colleagues

On Journalists' Day we wish to greet the representatives of the written press and television present on the Islands, those who boast of a high level of patriotism and professional responsibility; they accompany us in this glorious enterprise. We express our gratitude to: "Russian" Kansansev and the cameraman Lamela (ATC), "Equeco" Rotondo (Channel 9), "Uruguayan" Meir Silva (Bai Press) and for all the staff at TELAM, "Pete" Garcia Malot, "John the Interviewer" Perez Andrado, "Electric Hair" Ferre and "Radio Ears" Gonzalez.

Cultural Supplement

Hand-to-Hand (Mano a Mano)

Mocking you from my trench
Today I challenge you and what you have been
In your unhappy United Kingdom
Only a poor woman
Your presence here in the Georgias
Puts warmth into my people
We ask you to leave
But you went and boasted of your power
And because of your empty head
You could not understand us

You play the game of plundering
When you are poor
With a patch over one eye
You turn to piracy
Today you do nothing but lie
Iran already holds out against you
Your people are in rebellion
The colonies resist you
And you, poor, simple woman
You try to frighten us!

'Maggie' forgive us now
If the Argentine boys
Punish you
And you never again repress
If the missiles chase you away
If we disable your fleet
Do not protest an injustice
And this advise we give to you
We order you to turn about
And never return

Today your (maté) is full
Of wretched delusions
Your friends gather around you
Dirty Yankees in NATO
The intrigue amongst tycoons
With your crazy temptations
Where triumph
Buccaneer's claims
It has entered deep inside you
This text as would a prayer

No-one should thank you
We have been left hand-to-hand
The alligators salute you
Who ruin your vermuth
The smoke with which you arrived
We believe has humbled you
And if someone sends away your frigates
You would have failed
In the story of the gullible
Which you have, you are in trouble

And tomorrow when you are
A destroyed piece of old furniture
And you have no hope
Of being in the driving seat
If you need some money
If you are left with an inferiority complex
Remember the friend
Who gave you this advice
If the "Colony" has come to an end
Ask for the Yankee lotion

By: Juan Durazno (on operations)

BALLOONS

What have they ever done for us?

The contribution of the balloon to the history of air power

By Squadron Leader Alan Riches, SO2 Defence Studies (RAF)

One of the more enjoyable aspects of my job in Defence Studies (RAF) is giving lectures on air power to University Air Squadron students. I often start by asking them the following question: when was a manned aircraft first used for a military purpose? A simple enough question; however, although there are often a number of ‘spotters’ in the audience, no one has yet given me the correct answer. In fact, it is widely accepted that the first military use of a manned aircraft occurred on 26 June 1794, when the French used a balloon to observe Austrian troop movements at the Battle of Fleurus. I use this question to make two points: firstly, that air power is not just a twentieth century phenomenon – its history goes back over two hundred years; and secondly, that for the first half of its history, air power could only be generated by means of the humble balloon.

Given that balloons have played such a seminal part in the history of air power, it is perhaps surprising that so little has been written about their use. What may also be surprising is the wide range of military uses to which the balloon has been put. British Air Power Doctrine (AP 3000 3rd Edition), which was published last year, identifies seven core capabilities of air power and outlines the roles that are derived from them. For those who are not familiar with this publication, the seven core capabilities are: Information Exploitation; Control of the Air; Strategic Effect; Indirect and Direct Air Operations; Combat Support Air Operations; Force Protection; and Sustainability. The purpose of this article is to show that a role for balloons has been found, or at least envisaged, in respect of all seven core capabilities.

It is important to stress at the outset that I shall only be considering the use of balloons – not airships, dirigibles, blimps or zeppelins. The addition of a source of power – other than the wind – makes for an entirely different kind of platform, one which is beyond the scope of this article.

INFORMATION EXPLOITATION

"Reconnaissance, or observation, can never be superseded; knowledge comes before power; and the air is first of all a place to see from."

Sir Walter Raleigh

Reconnaissance is as old as war itself. Five centuries before the birth of Christ the Chinese strategist Sun Tzu instructed his captains to "know your enemy and know yourself and you can fight a hundred battles without disaster". More recently, the Duke of Wellington ascribed much of his success to his care in studying what was happening "upon the other side of the hill". The best military commanders have always been those who realised that the more they knew of their opponent's positions, the greater was their opportunity for engaging him at a time and place most calculated to ensure his defeat. Air power platforms and systems play a vital role in gathering data and information, and the timely exploitation of information is thus a key core capability of air power.

Until the end of the eighteenth century, however, reconnaissance was restricted to that which could be seen from the top of a hill or from the back of a horse. The development of the flying machine changed all this. The first manned flight, by the Marquis d'Arlandes and Jean-Francois Philatre de Rozier in a Montgolfier hot air balloon on 21 November 1783, seemed to offer a new dimension to the art of warfare. Typically, perhaps, the military establishment in Britain regarded ballooning as an amusing new sport rather than as a means of gaining advantage in warfare. The French, however, took a different view and, in the war against Austria and Prussia which followed the Revolution in 1789, they developed a mobile apparatus for producing hydrogen on the battlefield. In April 1794 the world's first military aviation unit, La Premiere Compagnie d'Aerostiers Militaires, was formed near Paris, and in June its first balloon, *L'Entreprenant*, was deployed to Meubeuge, Belgium, for use by the French Republican Army against the Austrians. The first operational ascent was made on 26 June when a certain Captain Coutelle carried out a series of observations of Austrian forces manoeuvring on the battlefield at Fleurus. Coutelle was airborne for a total of ten hours and was accompanied later in the day by the French commander, General Jourdan. Messages were transmitted to the ground by means of semaphore, luminous balls hung on the basket or written information slid in sandbags down the mooring cable. The observations made a decisive contribution to the French victory.[1]

This ascent led to a classic military response to the air weapon. The Austrian troops panicked at the sight of the balloon – a typical reaction when soldiers first come up against a 'secret' weapon. Not long afterwards came the next almost inevitable

step – the disbandment of the balloon company by Napoleon in 1799. The reason given was that the balloons' speed of deployment did not comply with his concept of fast moving operations, although there is also a suggestion that he disapproved of the glamorous reputation that soon became attached to the French aeronauts – the 'brylcreem boys' of the Republican Army. History can only reflect on what would have happened at the Battle of Waterloo in 1815 had Napoleon possessed a balloon which could have peered over the Mont St Jean Ridge and seen Wellington's troop dispositions.

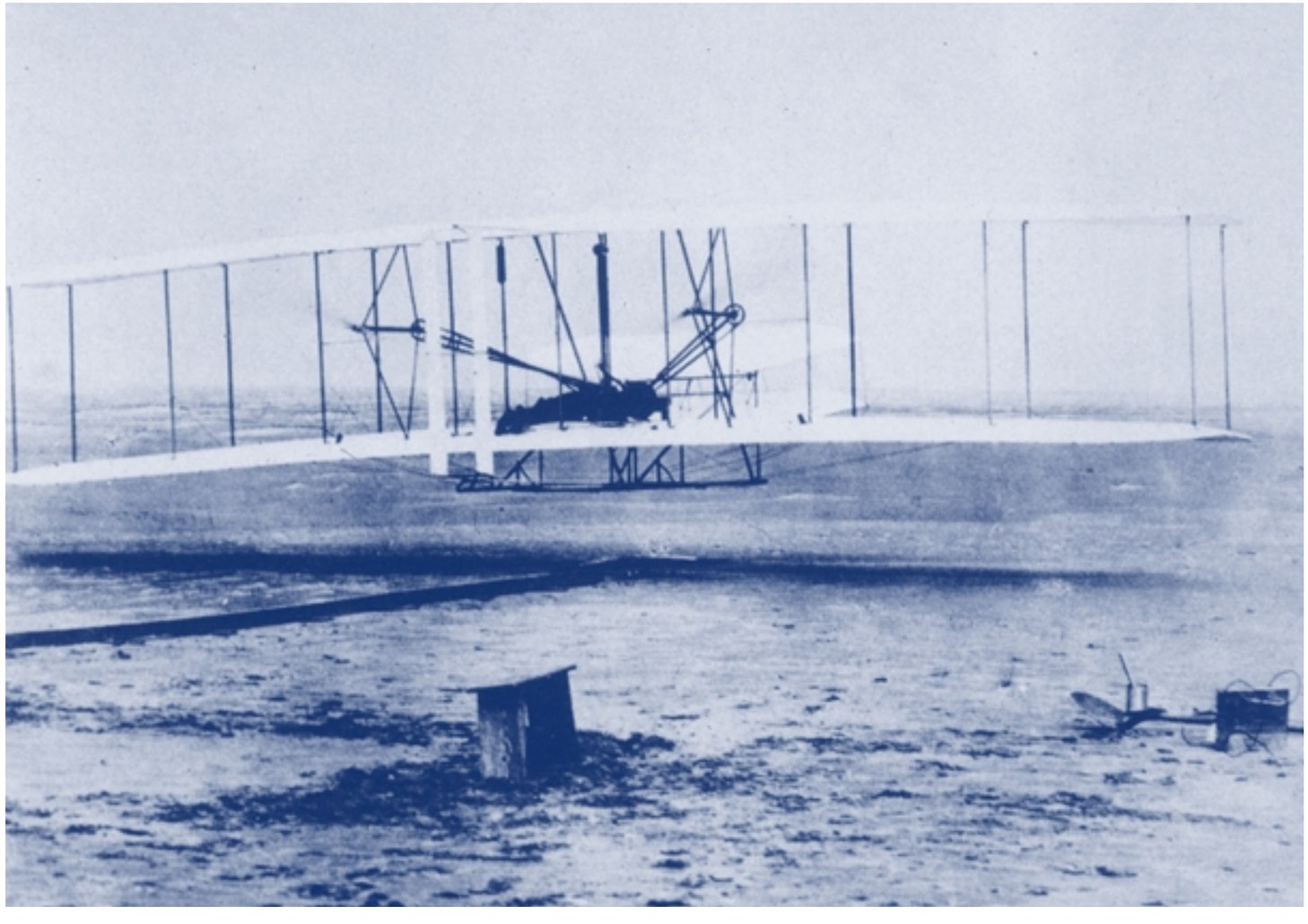
With the peace in Europe which followed the defeat of the French at Waterloo, the military development of observation balloons stalled. It was not until the 1860s, when significant progress was made in the fields of photography and telegraphy, that interest was renewed.

Balloons were used extensively during the American Civil War. In October 1861 the first Union Army Balloon Corps was formed under the command of Thaddeus Lowe with a complement of 50 men. By early 1862 the Corps had seven balloons. A converted coal barge was used to transport and tow the balloons during operations along the Potomac River – arguably the world's first aircraft carrier. The Balloon Corps proved its worth time and again, especially in directing artillery fire by aerial telegraph. In response, the Confederate forces operated their own balloon in the spring of 1862. It was manufactured from silk dresses donated by Southern ladies, but because the only gas supply was in Richmond, Virginia, it had to be inflated there and then towed to the front by train. The Union Army Balloon Corps, on the other hand, had portable hydrogen-making equipment.[2]

Impressed by the success of the balloons used in the American Civil War and the Franco-Prussian War (see below), the British War Office asked the Royal Engineers to look into the practicability of using balloons with the Army. The Army Balloon Equipment Store was established at Woolwich in 1878 under the command of Captain James Templar, an experienced aeronaut, who thus became the first British air commander. The first British Army balloon, named *Pioneer*, was constructed in 1879, and officers and men of the Royal Engineers were trained in aerial reconnaissance, photography and signalling. In 1884 a balloon unit travelled to Bechuanaland as part of an expedition sent to repel Boer incursions, with useful results. Another unit was sent to the Sudan the following year, after the fall of Khartoum and the death of General Gordon. In 1892 the Royal Engineers Balloon Depot was given a permanent base at Aldershot and a school of ballooning founded there.[3]

In December 1899, at the start of the Boer War, a Royal Engineers balloon detachment carried out observations during the Battle of Magersfontein. The balloon could have been used for aerial reconnaissance of the enemy trenches before the battle started, but the British commander, Lieutenant General Lord Methuen, neglected to issue the necessary orders, with the result that his forces were committed to action with no real knowledge of the Boer trench systems. The British suffered heavy casualties, which would certainly have been heavier still if balloon observation had not detected enemy movements during the battle itself. The activities of the balloon detachment persuaded some senior British officers that aerial reconnaissance was a valuable asset, although most remained convinced that scouting by cavalry remained the best method.[4]

Meanwhile, following the outbreak of war between the United States and Spain in 1898 over Cuba, a US Balloon Company was sent to the Caribbean island in support of an American expeditionary force. On 1 July 1898, some 8,000 American troops were struggling along a congested jungle path towards Spanish positions on San Juan Hill. Travelling with the troops, though a hundred feet or so above them, was a balloon from which one Lieutenant Colonel Darby attempted to make observations of the enemy positions. The jungle was so thick, however, that all Darby could see below him was a blanket of green foliage. The Spanish could not see the American troops either, but they knew exactly where they were because Darby's balloon was directly over the top of them, acting as a marker. As a result, a heavy barrage of fire rained down on the Americans, causing heavy casualties. Later that day the balloon, with a carnival aeronaut named William Ivy aboard, was badly holed by enemy fire and dropped into the water. Ivy survived and lived until 1955, with the dubious distinction of having become the first pilot in history to be shot down in war.[5]



A hundred years after their debut at Fleurus, balloons had made a useful but hardly decisive contribution to warfare. They were awkward to deploy, they lacked mobility and they were difficult to control in strong winds. Despite these shortcomings, however, they were the only aerial observation platform available. Then, on 17 December 1903, an event occurred which heralded the eventual eclipse of the use of balloons and their cousins, airships, as observation platforms. This was the first powered flight of the aeroplane *Flyer*, designed by the Wright brothers, at Kitty Hawk beach in North Carolina. Although at first this invention

…on 17 December 1903, an event occurred which heralded the eventual eclipse of the use of balloons and their cousins, airships, as observation platforms

received little encouragement from the military in America or Britain, a French syndicate purchased the patent and took the lead in aeronautical progress. By the time the First World War began in 1914, aeroplane technology had developed to such an extent that heavier-than-air machines were already on the inventory of all the major combatants.

Nevertheless, the balloon was to play an important part in the First World War. The

By the time the First World War began in 1914, aeroplane technology had developed to such an extent that heavier-than-air machines were already on the inventory of all the major combatants

problem of control was solved by the German invention of the sausage-shaped *Drachen* or kite-balloon, which had tail fins to keep it pointed into wind; moreover, the static nature of trench warfare meant that the balloon's lack of mobility was rarely exposed. Thus *Drachen*-style kite-balloons were used extensively by both sides throughout the war and proved very useful for observation and artillery spotting.[6] Ultimately, however, the inherent characteristics of the aeroplane – height, speed, reach and flexibility – appeared to condemn the balloon as an observation platform to the pages of history.

It is therefore all the more surprising that, at the end of the 20th century, balloons are enjoying something of a renaissance as high-technology surveillance communications platforms. In the USA, a chain of radar-equipped aerostats (the American term for a tethered, non-rigid, payload-carrying balloon) plays an important role in the country's anti-drug campaign. US experience of surveillance aerostats has shown the technology to be both technically and cost effective. In a senatorial hearing in 1993, the US Customs Service put on record detailed data on the operation of what has become known as the Tethered Aerostat Radar System (TARS) which forms a key part of the USA's anti-drug National Air Interdiction Strategy. The network comprises fifteen operational sites which provide continuous coverage of the USA's southern border from Puerto Rico to the Pacific Coast. The 71m aerostats, manufactured by TCOM LP and equipped with Westinghouse radars, are designed to detect a $2m^2$ radar cross-section target within a 280km radius. On-station costs per hour are $300-500, compared with $3,500 for a fixed-wing airborne early warning aircraft such as the Lockheed P-3 Orion.[7] So successful has the experiment with surveillance balloons been that other agencies are now showing an interest in developing their own capability.

CONTROL OF THE AIR

"Anyone who has to fight, even with the most modern weapons, against an enemy in complete control of the air, fights like a savage against modern European troops."

Field Marshal Rommel

One of the primary considerations of any commander is to shape the battlespace so that friendly operations can proceed at the place and time of his choosing without prohibitive interference from an opponent. A second important consideration is to ensure that friendly military forces are safe from attack. One of the core capabilities of air power is, therefore, to achieve and maintain the degree of control of the air required to ensure the success of the operation. Friendly control of the air aims to restrict an opponent's ability to use air power against friendly forces.

Following the Montgolfier brothers' successful experiments with hot air balloons in 1783, the air power theorists of the period were soon painting lurid pictures of balloon-borne fleets sailing like galleons in the sky, armed with 200 guns apiece and engaged in death grapples as part of an invasion from the sky. In 1810 a Prussian officer, Julius von Voss, wrote, apropos balloons, that they had the task of observing the enemy from afar, but "…the enemy, eager to conceal his intentions, did not hesitate to send up his own light craft in order to drive back the enemy balloons; and so in the heavens above skirmishes developed between advanced patrols…".[8] A century later, von Voss's prediction was realised over the trenches of France, but by aeroplanes rather than balloons. Dependent on the prevailing wind for their direction and speed, balloons' lack of basic manoeuvrability would limit them to a passive but nevertheless important role in the struggle for control of the air.

The concept of using balloons for air defence (or Defensive Counter-Air Operations in the modern idiom) originated in Britain before the First World War. "The general idea was to build a stockade of nets in the skies and thus enmesh hostile aircraft on their way to the defended area".[9] During the last years of the First World War, the British employed the barrage balloon in response to attacks by German Gotha bombers on London. The London Balloon Defence in 1918 consisted of seven 'aprons' formed by a chain of balloons linked by cross

During the last years of the First World War, the British employed the barrage balloon in response to attacks by German Gotha bombers on London

cables carrying weighted wire streamers. The aprons were regarded as an essential element of the air defence system and were designed to force enemy bombers to use a restricted height band which could be effectively covered by fighters and anti-aircraft guns.[10] A German prisoner said that the aprons were "sufficient to keep all machines at their maximum height".[11] The Germans had developed similar ideas and by 1917 had formed balloon barrage detachments to protect industrial targets. In January 1918, a British FE2b was caught in a German net and the pilot emphasised the "fearful mess which the balloon cable had made of his machine".[12]

During the Blitz, 102 German aircraft struck balloon cables, resulting in 66 crashes or forced landings

The threat of another war rekindled interest in balloons in 1936, when a second balloon barrage was designed. The Air Staff laid plans for a ring of balloons around London, without the connecting apron, spaced at about ten balloons to the mile and requiring 450 balloons. This plan was quickly changed when it was realised that a ring of balloons merely forced an attacker high to cross the ring, after which he could come down to bombing height once more. Instead, 'field siting', an irregular pattern all over the area, was adopted.[13] RAF Balloon Command was formed in November 1938 and by September 1939 a barrage of 444 balloons was flying over London. During the Blitz, 102 German aircraft struck balloon cables, resulting in 66 crashes or forced landings.[14]

"An outstanding example of the disconcerting effect balloons have upon attacking aircraft was observed at one British cathedral city in the spring of 1942. The target, already twice attacked, was provided with a defensive balloon barrage against the probability of a third visit. The enemy returned, but by far the greater proportion of his bombs were discharged well outside the city boundary".[15]

The Germans learned the hard way that balloons could enhance low-level defences

Both fixed and mobile barrages were widely used during the Second World War to deny the enemy use of low-level airspace from where accurate bombing was possible. At its maximum strength, Balloon Command consisted of 52 operational squadrons, equipped with almost 2,500 balloons and manned by 33,000 personnel.[16] Besides cities, balloons protected ports and fleet anchorages, and balloons mounted in boats defended estuaries against mine-laying aircraft. Four thousand balloon personnel even took part in the invasion of Normandy, crossing the channel to protect beach heads, artificial harbours and ammunition dumps.[17]

The Germans learned the hard way that balloons could enhance low-level defences. Only after the Ruhr dams had been breached did they erect an aerial barrage to prevent repetition of the raid by 617 Squadron. Since its success depended upon low-level weapon release, the raid could not have been accomplished had a balloon barrage been earlier incorporated into the dams' defences.

The increased service ceiling of bombers coupled with the improvement in weapon aiming techniques from high level and at night diminished the importance of balloon barrages during the latter part of the war. The hazard to friendly aircraft posed by balloons and cables up to 20,000 feet was also not inconsiderable. Barrage balloons did, however, go out with a bang. To help combat the threat created by the use of V1 flying bombs in 1944, the 'largest balloon curtain in history'[18] formed the last layer of Britain's defences, and was credited with 278 kills. Nonetheless, Balloon Command was eventually disbanded in February 1945. Though used in small numbers by US forces in Korea, balloons have not figured significantly in air defence planning since 1944.

STRATEGIC EFFECT

“ Air power has become predominant, both as a deterrent to war and, in the eventuality of war, as the devastating force to destroy an enemy’s potential and fatally undermine his will to wage war.”

General Omar Bradley

The concept of ‘centres of gravity’, first espoused by Clausewitz as a way of describing how to compel an opponent in conflict to bend to your will, has stood the test of time. In Clausewitz’s day, the enemy’s army was considered to be his centre of gravity; in modern times, an opponent’s centre of gravity may take many forms. Air operations for strategic effect are intended to destroy or disrupt the defined strategic centre of gravity of an opponent and thus undermine his ability, will and means to continue fighting.

When the Marquis d’Arlandes and Jean-Francois Philatre de Rozier made their historic ascent in a Montgolfier hot air balloon in November 1783, one of the onlookers that day was the US envoy Benjamin Franklin. Alive to the sense of a new age dawning, Franklin wrote of the flight: “The invention of the balloon appears to be a discovering of great importance and may possibly give a new turn to human affairs. Convincing sovereigns of the folly of wars may perhaps be one effect of it, since it will be impractical for the most potent of them to guard his dominions. Five thousand balloons capable of raising two men each could not cost more than five ships of the line; and where is the prince who could afford to cover his country with troops for its defense that 10,000 men descending from the clouds might not in many places do an infinite mischief before a force could be brought to repel them?”[19]
Franklin’s concern about the irresistible nature of the new way of war predates by 150 years Stanley Baldwin’s famous assertion in 1931 that “The bomber will always get through”. His idea acquired credibility when a hydrogen balloon crossed the English Channel for the first time in January 1785. Thus, when England and France once more went to war in 1793, it was tempting for propagandists and alarmists to inspire the dread of airborne invasion at a time when the Royal Navy prevented any such happening by sea. The Mongolfier brothers themselves had a strategic purpose in mind for their balloon: nothing less than the capture of the British garrison at Gibraltar. They planned to build a whole fleet of balloons and lift

The invention of the balloon appears to be a discovering of great importance and may possibly give a new turn to human affairs

thousands of French soldiers to the top of the Rock. Fortunately for a large number of unnamed French soldiers, the Montgolfiers were prevailed upon to move more slowly.[20]

It was thus the potential strategic effect of balloons that first caught the theorists' imagination, and although balloons actually began their military career in observation work, their strategic possibilities were not forgotten. Ironically, it was the Austrians, who had panicked at the sight of the new aerial phenomenon at the Battle of Fleurus in 1794, who were the first to put the concept into practice. During the siege of Venice in March 1849, the Austrians conceived a plan which, they hoped, would force the Venetians to surrender without the need to storm the city: they would bomb the civilian population. Two hundred small, unmanned hot-air balloons were constructed, each fitted with a 30lb bomb which would be released by a time fuse. The idea was simple: the balloons would be floated over the city to release their deadly cargo on the unsuspecting Venetians, whose will to continue fighting would thus be broken. When at last the wind was favourable and the attack launched, it produced reactions among both the victims and the attackers which were to be seen again during the strategic bombing campaigns of the twentieth century. Though at first alarmed, the citizens of Venice rapidly assumed a disdain for the new method, particularly since no casualties resulted. The Austrians, on the other hand, made exaggerated claims of the damage and casualties they had inflicted and the effect on their opponents' morale they felt must have ensued. Nonetheless, the experiment was not repeated.[21]

…balloons would be floated over the city to release their deadly cargo on the unsuspecting Venetians, whose will to continue fighting would thus be broken

Almost one hundred years later, on 18 April 1942, sixteen B-25 bombers from the aircraft carrier USS *Hornet*, led by General James H Doolittle, bombed Tokyo in retaliation for the attack on Pearl Harbour four months previously. The raid did little physical damage, but the Japanese Imperial High Command were shocked at the violation of their homeland. Reprisal raids were demanded, but there were no suitable airfields within striking distance of the continental United States and precious aircraft carriers could not be risked. Enter the balloon! Japanese balloon technology was the most advanced in the world, and Japanese scientists knew that intercontinental, free-flight balloons were possible. By making use of the prevailing wind currents, they could send death-dealing balloons to US shores within a matter of days.

Two years later, at a cost of nine million yen (about two million pre-war US dollars), the Japanese had perfected a weapon that could travel over 6,000 miles to American shores, drop a payload of incendiary and anti-personnel bombs and, with a small explosive device, self-destruct. On 3 November 1944, the first balloon rose slowly and silently from its launching site on Honshu's eastern seaboard. More than 9,000 bomb-carrying balloons would follow.

When the first balloons began drifting over US shores, there was confusion and panic. It was soon established that the source of the balloons was Japan and, as more and more balloons reached the United States and Canada, their detection and interception became a top priority. Of vital concern was the payload the balloons carried. The destructive explosive power was small, but the incendiary threat was incalculable. With huge forests all along the West Coast and extending inland, a massive incendiary raid during the dry season could envelop the entire area in a gigantic, uncontrolled holocaust. From this alone, the loss of lives and property would be enormous.

Under great pressure, the US military was forced to establish a defence against the balloons. The *Sunset* project, initiated in early 1945, aimed to track the balloons by radar and shoot them down. Scores of interceptor aircraft of the US Fourth Air Force, including P-38 Lightnings and P-61 Black Widows, and literally thousands of military personnel were tied up in balloon defence. Thus did the balloons achieve a strategic effect, although not the one for which they had been conceived.

The Japanese balloons did cause some damage. Not only were six people in Oregon killed by the balloon explosives, but in a strange twist of fate, one of the balloons landed on transmission lines leading to the Hanford Engineering works in Washington where a portion of the top-secret *Manhattan* atomic energy project – soon to bring vast destruction to their own shores – was taking place. A power failure did occur, but safety controls triggered and electric current immediately resumed.[22]

JOINT FORCE EMPLOYMENT – INDIRECT AND DIRECT AIR OPERATIONS

"The greatest lesson of this war has been the extent to which air, land and sea operations can and must be co-ordinated by joint planning and unified command."

General 'Hap' Arnold, 1946

The inherent characteristics of air power – height, speed, reach and flexibility – give commanders a range of options to exploit it in joint operations. Indirect air operations are intended to destroy, disrupt, neutralise or delay the military potential of opposing forces before they can be brought to bear effectively against friendly forces – so-called 'shaping the battlespace'. Direct air operations are conducted against hostile targets that are in direct contact with friendly forces on the battlefield itself.

The same inherent lack of basic speed and manoeuvrability that would prevent balloons from being used in offensive counter-air operations would also effectively disqualify them from being employed *directly* in anti-surface force operations, although the idea

has been put forward on at least one occasion. During the war between the United States and Mexico in 1846 (which arose out of a dispute over the ownership of New Mexico), a Pennsylvania balloonist named John Wise suggested using a balloon to drop "a thousand percussion bombshells" on the fort of San Juan de Ulloa at Veracruz, whose gun batteries were holding up the advance on Mexico City of American forces under General Winfield Scott. Typically, the idea was ignored by the War Department, and the fort was eventually taken only after a bloody land assault.[23]

Nonetheless, balloons can certainly be used *indirectly* in anti-surface force operations. Their observation and artillery spotting roles have already been covered, and recent advances in balloon and cable technology have opened up more exciting possibilities. In 1995, as part of the Pentagon's attempt to create a limited, operational counter-battery capability to destroy heavy weapons in the event of an attack by North Korea, senior US military officials in South Korea began examining the use of moving target indicators combined with synthetic aperture radars on board tethered balloons to monitor North Korea's mobile artillery and missiles.[24] The balloons' cables could be used to carry secure data links that would allow controllers to guide the flight of cruise missiles from a ground station or ship. Indeed, the accuracy of a whole range of precision guided munitions could be increased during the final minutes of flight by allowing a person to take over terminal guidance of the weapon.

JOINT FORCE EMPLOYMENT – COMBAT SUPPORT AIR OPERATIONS

"Supply and transport stand or fall together; history depends on both."

Winston Churchill

Combat support air operations cover the full spectrum of air power roles and emphasise the utility of air power around the spectrum of conflict. Essentially, combat support enables forces on land, sea and air to undertake their combat roles; combat support air operations include air transport, air-to-air refuelling, air surveillance and reconnaissance, combat search and rescue, electronic warfare and the suppression of enemy air defences.

During the Franco-Prussian War of 1870-71, the French used balloons in the air transport role. Sixty-six balloon flights were made out of Paris, under siege by Prussian forces, to unoccupied territory. The balloons carried a total of 110 passengers, more than 2½ million letters and carrier pigeons to fly back to Paris bearing microfilm messages. The early flights from Paris were made by skilled aeronauts, but later missions were undertaken by French Navy personnel, specially trained for the task. In response, the German firm of Krupp produced the world's first anti-aircraft guns. Five balloons and their occupants were captured by the enemy; of the others, two were lost in the Atlantic and one ended up in Narvik in northern Norway after a flight of 1,400 miles.[25]

While the balloon flights out of Paris – the first airlift in history – had been something of an epic, it was clear that the venture would have been a greater success if the aeronauts had been able to steer their craft. Some bizarre suggestions were put

forward, the best of which was for a quartet of eagles to be harnessed to the balloons.[26] Ultimately, however, the Parisian experience gave impetus to the idea of building a dirigible balloon – an airship.

JOINT FORCE EMPLOYMENT – FORCE PROTECTION

"It is easier and more effective to destroy the enemy's aerial power by destroying his nests and eggs on the ground than to hunt his flying birds in the air."

General Giulio Douhet

Air power depends upon a number of component elements – platforms, weapons, bases, logistics, command and control assets – the degradation of which may reduce its effective application. Force protection means preventing an enemy from attacking vital air assets, or minimising the effects of any attack, to enable air operations to continue.

During the Cold War, the greatest threat to NATO's air power was a massive Warsaw Pact attack on the Alliance's airfields. Since the Warsaw Pact lacked large numbers of stand-off weapons, its aircraft would have had to overfly the target to deliver their bombs and, to increase their chances of survival in the face of the SAMs, rapid-fire AAA and fighters of NATO's air defence system, they would have had to make their attacks at low level. Although the British, American and German experiences with barrage balloons in the Second World War showed that balloons could be very useful in countering the low-level threat, their utility was ignored by NATO. Yet even today, for nations threatened by adversaries not equipped with precision, stand-off weapons, balloons would enhance the effectiveness of existing airfield defences at relatively low cost.

Balloons placed across valleys or along the dead side of high ground would prevent enemy aircraft from using terrain-masking to conceal their approach to a target and thus render them more vulnerable to early radar detection. Balloons deployed nearer to airfields would add to the attacking pilot's problems in reaching a position from which accurate weapon delivery were possible. Most importantly, well planned balloon barrages would force attacking pilots either to manoeuvre around or more probably pull up to avoid flying through balloons and cables. At higher level there is a much greater probability of successful GBAD engagement. Moreover, the increased time available to acquire and track targets would permit better co-ordination of missile launches against individual targets during mass attacks, thereby avoiding wasteful multiple engagements of single targets.[27]

The utility of balloons in force protection does not end with aerial barrages. The concept of balloon- (or aerostat-) mounted radars, discussed earlier in this article in connection with US anti-drug surveillance, has also been applied to defence against low-flying aircraft. Both Saudi Arabia and Israel have an aerostat-based low-altitude surveillance system (LASS) integrated into their air defence network which is used to detect low-flying aircraft at ranges up to 300km. In Kuwait, an aerostat LASS was in service for six days before the 1990 Iraqi invasion, during which it was destroyed. Nevertheless, this limited experience of

operating an aerostat system was enough to convince the Kuwaitis of its effectiveness; indeed, the system is reported to have given the first in-country indication of the invasion and may well have been instrumental in helping the Emir to escape. As a result of the Kuwaiti experience, the United Arab Emirates has also purchased an aerostat LASS.[28]

In the USA, research is also ongoing into the possibility of using balloons as a counter-stealth tool. Stealth aircraft and cruise missiles are built primarily to elude ground-based radar, so engine inlets, cockpits and other hard-to-disguise parts of aircraft are shielded from the ground but often not from an airborne sensor. Moreover, a radar looking down at fixed ground clutter can locate a moving empty spot produced by a non radar-reflective object. With improvements in balloon technology over the last decade, it ought to be possible to place an aerostat at 65,000 feet, above the most violent weather, for at least 30 days at a time. The aerostat, shorn of tail structures required for low-altitude operations and carrying a large aperture radar, would cost $10-20 million with its mooring system and ground support vehicles. But the real benefit would be in its operating costs: compared with $2,700 per hour for a Grumman E-2 Hawkeye or $8,300 for a Boeing E-3 AWACS, the balloon system would cost only $500 per hour.[29] How ironic it would be if the solution to the problem posed by stealth, the newest air power technology, should be solved by the balloon, the oldest.

SUSTAINABILITY

Sustainability is defined as the ability of a force to maintain the necessary level of combat power for the duration required to achieve its objectives. It is the function that ensures or denies the capability of air power to operate. It influences the tempo, duration and intensity of an operation. In its broadest sense, it encompasses all activities necessary for the employment of air power other than its execution.

The most important element of sustainability is personnel – the provision of trained, available manpower in sufficient numbers to man the force and to replace losses. In 1941, impressed with the part played by German paratroops in the capture of Crete, Winston Churchill called for large numbers of British soldiers to be trained in the art of parachuting. Owing to a shortage of suitable aircraft, it fell to the balloon to provide the necessary airborne platform. Parachute training with balloons began at Tatton Park near Manchester the same year. It soon became apparent that balloons are ideal for ab initio parachute training as they allow the trainee to undertake his first descent in controlled conditions; there is no slipstream, and the trainee is able to parachute as a singleton, allowing the instructor to talk him safely down to the ground. After the Second World War, the balloon remained, with the C130, the main platform for parachute training. During the Gulf War, when most of the C130s were employed elsewhere, the balloon was the only facility available for Airborne troops to remain current.[30]

Another key element of sustainability is equipment, in particular the provision of weapons that are fit for the task. Balloons have played an important role in the research and development of British weapons. In the 1960s and 70s, balloons were used in support of the Bloodhound trials and the Atomic Weapons Research Establishment tests in Australia and on Christmas Island.

More recently, they have been used for testing the Low-Level Parachute and the British Army's Starstreak hyper-velocity anti-aircraft missile.[31] Balloons were also used extensively by the United States and Soviet military for the research and development of new weapons during the Cold War.

Last but not least, it should not be forgotten what a key part the weather has always played in the tempo, duration and intensity of air operations. As recently as 1999, NATO air operations over Kosovo in the early days of Operation Allied Force were severely hampered by bad weather. Accurate forecasting of weather conditions is an essential part of operational planning, and even in the age of the satellite, the weather balloon remains an important forecasting tool.

Before the development of powered aircraft – airships and, ultimately, aeroplanes – balloons were the only aerial platform available to military commanders. It is therefore not surprising that experiments in employing balloons in a range of air power roles were carried out. The limitations of free-flying balloons quickly became apparent. Dependent on the prevailing wind for their direction and speed, balloons' lack of basic manoeuvrability soon rendered them unsuitable for active air power roles – offensive counter-air operations, strategic attack, anti-surface force operations and most combat support air operations – and accelerated the development of powered platforms. Tethered balloons, on the other hand, proved useful for aerial reconnaissance, artillery spotting, defensive counter-air operations and parachute training and continued to do so long after the advent of heavier-than-air machines.

Indeed, balloons are enjoying something of an air power renaissance at the dawn of the 21st century. Benefiting from developments in balloon and cable technology, and equipped with radar and secure data links, aerostats offer a cost-effective alternative to fixed-wing platforms in areas such as surveillance, airborne early warning, target acquisition, weapon guidance and force protection against both low flying and stealth aircraft. The wheel has come full circle, and the early pioneers – Captain Coutelle, Thaddeus Lowe, the unfortunate William Ivy et al – would be pleased at the way things have turned out.

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BOOK REVIEW BY GROUP CAPTAIN PETER W GRAY DIRECTOR OF DEFENCE STUDIES (RAF)

ALANBROOKE BY DAVID FRASER

Published by Harper Collins
Paperback edition 1997
ISBN 0 00 638863 9

On Monday 18th of October 1999 Viscount Alanbrooke, son of Field Marshal the Viscount Alanbrooke KG GCB OM GCVO DSO, opened the Joint Doctrine and Concepts Centre named after his father. The citation that accompanies the portrait of the Field Marshal points out that he succeeded Dill as Chief of the Imperial General Staff in December 1941. It goes on to state that 'In this appointment he embodied the concept of operating in both the joint and international environment and was responsible for turning Churchill's political strategic decisions into military strategy throughout the remainder of the war'. As David Fraser makes abundantly clear in this eminently readable biography, this is only part of the story. It was in fact Alanbrooke's role as Chairman of the Chiefs of Staff Committee that made him so suitable a contender for the Centre, rather than his position as professional head of his own Service. Alanbrooke admirably fulfilled the role of 'first among equals', working closely with his fellow Chiefs, Pound (later Cunningham) and Portal. When the three Chiefs were given the Freedom of the City of London after the war they symbolically rode through the City in the same car demonstrating with conviction their existence as a 'Trinity'.

Fraser, a soldier of some distinction, does not attempt to portray Alanbrooke as an early paragon or disciple of 'jointness'. In the fascinating review of Alanbrooke's experiences in the trenches as an artillery officer, the role of air power is acknowledged, not surprisingly, in its support functions. In later discussions Alanbrooke comes over very much as the professional soldier. On the premise that an enemy can be defeated by naval blockade (which had been a significant factor in reducing German will in 1918), by strategic bombardment or in the field of battle he has little sympathy with the Navy and none at all with disciples of Douhet and Trenchard.

The statue to Alanbrooke that is situated outside the Ministry of Defence in London includes the epithet 'Master of Strategy'. Fraser makes it clear that Alanbrooke was not an innovative strategic level thinker. His strength was in consistently applying military reality to the thinking of others – Churchill in particular. Alanbrooke's grasp of detail was impressive and his delivery of information rapid – often to the discomfiture of the interlocutor (especially the Americans).

This book is well written and easy to read. It does not purport to be an essay in 'jointness', nor does it attempt to portray its subject as a 'purple officer'. It is however evident that the nation was fortunate to have someone of Alanbrooke's ability both as the senior soldier and as primus inter pares.

BOOK REVIEW BY GROUP CAPTAIN PETER W GRAY DIRECTOR OF DEFENCE STUDIES (RAF)

WILFRID FREEMAN: THE GENIUS BEHIND ALLIED SURVIVAL AND AIR SUPREMACY 1939 – 1945

ANTHONY FURZE
Spellmount, Staplehurst, 1999
ISBN I-86227-079-I

Biographies of senior wartime leaders are always welcome additions to the bookshelf. Those that cover a relatively new figure or replace out-of-date works are particularly welcome. This book covers the life of Air Chief Marshal Sir Wilfred Freeman, thereby filling a significant gap in air power historiography. Some other valuable 'lives' are imminent with Air Commodore Henry Probert due to publish his life of 'Bomber' Harris in the not too distant future. Dr Vincent Orange is also nearing completion of his work on Tedder. Both of these works are of well-known figures and are eagerly awaited. We are overdue up-to-date biographies on Trenchard and Dowding. But was Freeman in the same category? In fact who was he?

Inevitably, the well-chosen sub-title to the book gives an instant answer to these questions. Possibly more pertinent would be to ask why the lacuna if he was so important. The simple explanation of the gap is the lack of personal papers that so frequently make the biographer's task relatively easy. It is evident from the author's notes that several well-known historians shunned the task for this reason alone. Furze, however, gives full and generous credit to colleagues who had collated material on Freeman, but were unable to transpose this into a full manuscript. As Freeman was not an operational commander, he certainly attracted little attention.

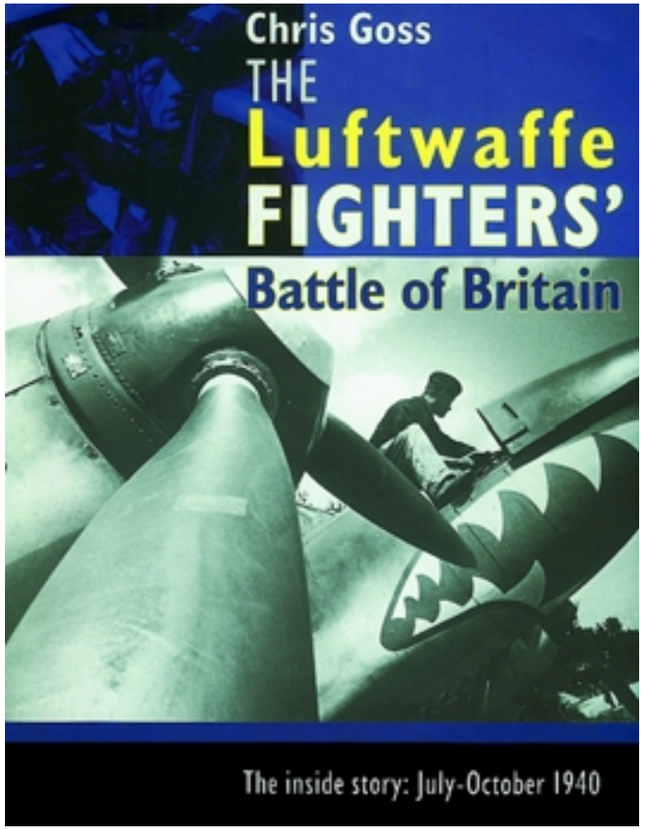
Freeman was Air Member for Research and Development and then Air Member for Development and Production between April 1936 and May 1940. He subsequently served as VCAS to Portal, who ironically had been one of his students at Staff College. Freeman's lack of preferment for the post was ascribed to his having been divorced! His support to Portal was vital as was his influence over high-level decision-making in the Air Ministry. He was a contender for the position of Deputy Supreme Allied Commander (filled by Tedder), but discounted himself on the self-effacing grounds that he lacked recent operational experience. Freeman returned to the Ministry of Aircraft Production, 'in civvies,' as its Chief Executive in October 1942 with the task of remedying what Churchill called 'the state of chaos – a muddle and a scandal'.

This track record alone highlights Freeman's contribution to his Service. Furze enumerates in considerable detail Freeman's other contributions. These include his fervent support for the Mosquito – in the face of considerable hostility from successive Cs-in-C Bomber Command to whom the concept of an unarmed bomber was preposterous. Freeman kept the project alive with orders for photo-reconnaissance aircraft. He was an early supporter of Whittle's jet research and later became an astute manipulator of jet engine production. Freeman, according to Furze, forced Harris into accepting the concept of the Pathfinder force and was instrumental in the decision to award Malta the George Cross. As with many biographies, there is often a tendency to ascribe all positive actions to the subject of the book in hand – and vice-versa. The reality in the case of the Pathfinder Force was that Portal forced Harris into line – admittedly after Freeman's intervention.

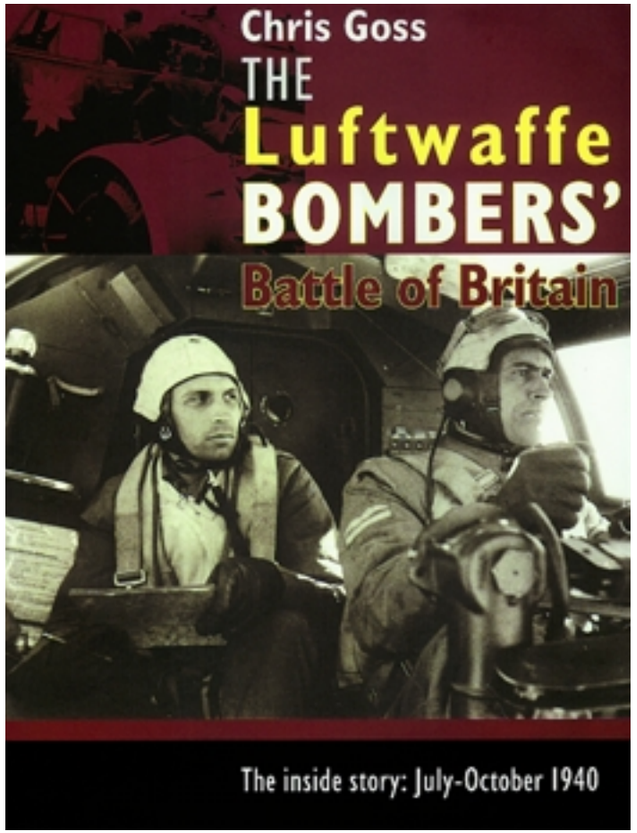
Perhaps Freeman's greatest contribution, and the one most valued by the crews who flew the aircraft that he ordered, was his never-ending struggle to ensure that political demands for numbers were not to the detriment of quality.

THE LUFTWAFFE FIGHTERS' BATTLE OF BRITAIN

Chris Goss



The story of how the outnumbered RAF fought and defeated the superior *Luftwaffe* in the Battle of Britain will always be a source of fascination. However, accounts of Summer 1940 have tended to centre on the British defenders, both in the air and on the ground, whilst the story of the losing German side has remained largely untold. *The Luftwaffe Fighters' Battle of Britain* and its accompanying volume, *The Luftwaffe Bombers' Battle of Britain*, are the result of some twenty years of research which will give the reader a new insight into the experiences of the German fighter and bomber crews. In 1939 the *Luftwaffe* was opposed to an RAF which was disorganised: inferior both in technology and in number. These books will explain how those same German aircrews felt just months later to be flying against a tenacious enemy with nothing to lose.



Written by a best-selling aviation author and historian, *the Luftwaffe Fighters' Battle of Britain* and its companion volume will form a major two-part series on the Battle of Britain from the attacker's viewpoint.

Details: Crécy Publishing Ltd, £19.95
ISBN: 0-947554-81-5

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Sunday 3rd December 2000 at 11 am	Advent Carol Service
Thursday 7th December 2000 at 6.30 pm	Carol Service: The Wishbone Trust
Sunday 10th December 2000 at 11 am	Choral Eucharist
Sunday 10th December 2000 at 3 pm (admission by ticket only)	RAF Benevolent Fund Carol Service
Monday 11th December 2000 at 6 pm	Carol Service: The Savage Club
Thursday 14th December 2000 at 12.15 pm	Carol Service: Exxon Mobil
Friday 15th December 2000 at 5 pm	Carol Service: Lawrence Graham Trust
Sunday 11th December 2000 at 11 am	Carol Service: St Christopher's Fellowship
Thursday 21st December 2000 at 12 noon	Carol Service: Shell
Thursday 21st December 2000 at 6 pm	Carol Service: Taylor Joynson Garrett
Sunday 24th December 2000 at 11 am	Choral Matins
Sunday 24th December 2000 at 11.30 pm Christmas Eve	Midnight Choral Eucharist
Monday 25th December 2000 at 11 am Christmas Day	Choral Eucharist
Sunday 31st December 2000	Choral Eucharist

The Royal International Air Tattoo

Tattoo 2001 returns to RAF Cottesmore

Europe's biggest airshow, The Royal International Air Tattoo (RIAT), will be held at RAF Cottesmore, Rutland on Saturday and Sunday 28/29 July 2001. The Royal Air Force has endorsed the decision, which will see the front-line Joint Force Harrier base playing host to the event for the second year running. Runway resurfacing work at RIAT's traditional home, RAF Fairford in Gloucestershire, is not due for completion until late spring 2002.

Group Captain David Walker, Station Commander at RAF Cottesmore, says "Following the success of RIAT in July this year, I am delighted that this prestigious military airshow is returning to the Station in 2001. We look forward greatly to once again working as a team with the RIAT organisation, the Emergency Services, County and Parish Councils and the many other agencies that come together to stage a spectacular weekend of aviation." In conjunction with Leicestershire Constabulary the organisers expect to limit any hold-ups on surrounding roads, repeating the success of the traffic plan put in place for RIAT 2000.

RIAT 2001 will celebrate its 30th birthday, looking back three decades to the first Tattoo at North Weald in 1971, and will also pay tribute to Women in Aviation. On 29 August 1911 Mrs Hilda Hewlett became Britain's first aviatrix, a feat that will be commemorated by women pilots, flight and ground crews at the Tattoo. The operational theme for participating aircrew from around the world is Training 2001, giving prominence to hi-tech training as the driving force behind modern air power.

RIAT Director, Paul Bowen, says "RAF Cottesmore is an excellent venue and 2001 will be a classic Tattoo, featuring all-time stars from the Lancaster bomber that first flew 60 years ago to 21st century Stealth technology."