

AIR POWER REVIEW

Volume 12 Number 3 Autumn 2009

'The Future of British Air and Space Power:
A Personal Perspective'

Air Chief Marshal Sir Stephen Dalton

"Air Power and the Environment:
The Ecological Implications of Modern
Air Warfare"

Doctor Joel Hayward

'Executive Fuller!' - The Royal Air Force
and the Channel Dash

Group Captain Alistair Byford

Air Power and the Contemporary Army

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Air/Land Integration in the 100 Days:
The Case of Third Army

Jonathan Boff

'Building a Good Instrument': Assessing the
likely characteristics of Future conflicts and
their implications for the air component

Wing Commander Helen Miller

Viewpoints

Group Captain Ian Shields

Squadron Leader Dave Stubbs

Book Reviews

Wing Commander Clive Blount

Bob Gordon

Historic Book Review

Air Commodore Neville Parton

Centre for Air Power Studies

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Foreword

This edition of *Air Power Review* begins with an article by the Chief of the Air Staff, in which, early in his tenure, he gives his personal perspective on the strategic challenges that face the Royal Air Force, both now and in the future. The article provides a précis of the current strategic environment, characterised by uncertainty, fiscal pressure and the compelling need to achieve success in Afghanistan. It goes on to examine briefly the role that air and space power plays in the security of the United Kingdom and comments on the recently published Air Publication 3000 Edition 4, which, under one cover, captures in a clear and digestible fashion the main themes and messages of British Air and Space doctrine. The article concludes by offering the Chief of the Air Staff's ten propositions about the future of British air and space power.

The theme of future challenges is taken up by Dr Joel Hayward, the Dean of the Royal Air Force College, in his thought provoking article on the ecological aspects of modern warfare. He argues for the inclusion of environmental issues at an early stage of planning, to sit alongside the more traditional considerations of proportionality and discrimination - and for post-war remediation to feature in campaign plans. The article points out the size of the air

component's carbon footprint and notes that the firepower available to it has the potential to devastate the infrastructure essential to sustaining population centres and to create environmental disasters by damaging storage and production facilities. Whilst not proposing the banning of certain munitions types or the exclusion of environmentally sensitive targets, it makes a strong case for the environmental impact of operations to be considered very carefully at the outset.

Group Captain Al Byford offers a historical perspective on the employment of air power in an article entitled 'Executive Fuller! – The Royal Air Force and the Channel Dash', a fascinating example of a relatively small action which resonated strongly across all the levels of warfare, from the tactical to the grand strategic. The article provides an analysis of the Royal Air Force's participation and considers the key points of failure. It demonstrates how even seemingly insignificant events can involve complexity of the highest order in terms of planning, integration and execution, and the way in which the public reaction to the event created a political impact that shook Churchill's government to its foundations. The parallels with current operations are easy to draw, particularly with the capability of modern communications

technology and the voracious appetite of the twenty-four hour news culture we now inhabit.

The complexity of operations and the challenge of effective component integration is an enduring theme and Group Captain Chris Luck has produced a contemporary examination of the difficulties of delivering timely, appropriate and strategically relevant joint effect. He picks up on some of the themes explored by the Chief of the Air Staff in his leading article, highlighting strategic uncertainty, fiscal stringency and a shared misunderstanding of some of the key aspects of delivering a coherent strategic campaign in a complex operating environment - particularly a collective failure to grasp the fundamentals of air power. The article ponders the truism that air power needs to be, and is, fundamentally flexible, agile and able to respond to rapid changes, should the political need dictate. Luck goes into some detail in exploring what it really means to deliver air power to the contemporary army in order to maximise the strengths of both in delivering joint effect in pursuance of a political aim.

Continuing with the theme of air/land integration, but this time in an historical setting, Jonathan Boff's article on the cooperation between the Royal Air Force and

the Army during the Hundred Days campaign of August – November 1918 in the British Third Army sector seems to reinforce the notion that understanding the delivery of air power is far from simple. He argues that by focussing too much on the battle of Amiens, the Royal Air Force's true contribution to victory has been distorted. The article recognises that although air power was in its infancy, the Royal Air Force was already demonstrating the ability to innovate and effectively manage new technology and the evolving requirement to offer an integrated, all-arms effect.

Moving from the past to the future, the article by Wing Commander Helen Miller attempts to capture the nature and causes of future conflict. It recognises that predicting the future is folly, but argues that to ignore the rapidity of change is equally foolish. Consequently, she seeks to establish a context of technological innovation, globalization and uncertainty to outline the possible causes of future conflict. The article speculates that irregular warfare is not a passing phase and explains the role that air power may play in this complex and most difficult operating environment. It concludes that the air component will continue to have pivotal relevance and will also need to continue to evolve in order to meet new and

emerging threats.

This edition of *APR* includes two viewpoints, both of which are thought provoking and topical. Group Captain Ian Shields examines in detail what is meant by the agility of air power and indeed, what is understood by agility itself. He contends that it is neither fully understood nor adequately articulated as a concept. He concludes, however, that it remains at the core of air power and efforts to better understand the nuances of this concept will pay dividends in the broader understanding of air power in the round. Squadron Leader Dave Stubbs tackles the subject of defence risk in his viewpoint, suggesting that against a backdrop of increased fiscal pressure and growing strategic uncertainty, defence is carrying risk in a number of areas, but that that risk is poorly defined and acknowledged. He contends that service rivalries and an understandable but inappropriate focus on current operations prevent a clear and balanced analysis of the greatest areas of risk, and the development of plans to resolve or mitigate them.

The two book reviews in this edition are followed by the latest in the series of historic book reviews by Air Commodore Neville Parton, who considers Mark Clodfelter's *The Limits of Air Power: The American Bombing of North Vietnam*. As he points out, this is a something of a departure in the series, as the author is still living and the subject matter is much written about and familiar to many. Parton concludes that Clodfelter fully deserves the status he enjoys as one of the leading analysts of the air campaign in the Vietnam

War. Although his book does not agree with conventional wisdom and is likely to be unpopular in some quarters as a result, Parton assesses it as being rewarding and instructive in equal measure and argues that it represents 'an air power classic'.

Finally, it would be remiss not to include prior notice of some forthcoming air power events. The Royal Air Force Air Power Conference 2010 - 'Meeting the Challenge: Optimizing the Air & Space contribution to national security' will take place at the Victoria Plaza Hotel on 16 and 17 June 2010. The Royal Air Force Centre for Air Power Studies and King's College London Conference, entitled 'Twenty Years in Iraq: Royal Air Force Operations in the Gulf since 1990' will take place at the Defence Academy, Shrivenham on the 29 and 30 September 2010. Articles on any air and space power-related themes are now welcome for the spring 2010 edition of *APR*, and potential contributors may also wish to be aware that as 2010 marks the twentieth anniversary of the RAF's deployment to Iraq, the summer edition is planned to be devoted to an analysis of the two decades of continuous air operations conducted in and over that state. As there must be few serving personnel who have not been affected by operations in Iraq, there should be no shortage of contributions and viewpoints, which should be submitted in accordance with the guidance set out at the RAF Centre for Air Power Studies (RAF CAPS) website,

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The Defence Studies Department of King's College London and the Royal Air Force Centre for Air Power Studies invites applications from air power academics and specialists, military historians, experts on the Gulf Wars, and RAF and other veterans of these conflicts to share new analyses of the RAF's contribution to operations in Iraq across the broad spectrum of conflict, including the 1991 and 2003 Gulf Wars, the policing of the no-fly zones between 1991 and 2003, and the counter-insurgency phase from 2003-2009.

The conference intends to bring together scholars and practitioners, including those with operational experience, with an interest in the RAF's participation in the various phases of the Iraq deployment in order to explore the following themes:

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Notes on Contributors

Air Chief Marshal Sir Stephen Dalton joined the RAF in 1976 and undertook a number of flying appointments, including 3 tours on the Jaguar, both in Germany and the UK, before completing the Advanced Staff Course, after which he trained to fly the Tornado GR1A and went on to command No 13 Squadron. He commanded Royal Air Force Coltishall and the RAF's Jaguar Force for 2 years from September 1997 and on promotion to Air Commodore he was appointed as Director of the Eurofighter (Typhoon) Programme in the Ministry of Defence. Further appointments in the Ministry of Defence included Director General Typhoon. In May 2007, he became Deputy Commander in Chief Personnel and Air Member for Personnel, based at HQ Air Command, RAF High Wycombe and was appointed Chief of the Air Staff on 31 July 2009.

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Doctor Joel Hayward is Dean of the Royal Air Force College. He is also Head of Air Power Studies at King's College London and a Director of the Royal Air Force Centre for Air Power Studies. He has written extensively on air power and related defence topics - including well-received books, chapters and articles. His latest book is the edited collection, *Air Power, Insurgency and the "War on Terror"* (2009). He teaches and lectures widely throughout Europe and beyond. He is also the lead academic for King's new MA, Air Power in the Modern World, the UK's only specialist degree programme in air power studies.

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Group Captain Alistair Byford is the RAF's Director of Defence Studies. A Tornado strike, attack and reconnaissance pilot, he has flown over 4000 hours in an operational career that began with the first Gulf War and has included twelve operational detachments, command of No. 31 Squadron and, most recently, No. 904 Expeditionary Air Wing in Afghanistan. He has taken post-graduate degrees in International Relations at Cambridge as an RAF Tedder Fellow, and in War Studies at Kings College, London. He is the author of the current edition of *AP3000 - British Air and Space Doctrine*.

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Group Captain Chris Luck is a contingency planner at the UK Permanent Joint Headquarters. A Support Helicopter pilot, he has flown nearly 5000 hours of which 4200 have been on the Puma HC1. He was the flight commander of 33 Squadron Puma Conversion Unit from 1996-1998 and more recently commanded 33 Squadron from September 2007 to June 2009. Operational

experience has included tours in Northern Ireland, Operation GRANBY, Bosnia and Operation TELIC, including exchange tours with the Kuwait and United States Air Forces. A graduate of the USAF Air Command and Staff College, he was also privileged to graduate as the first non-American from the USAF School of Advanced Air and Space Studies in 2007. He wrote this article at the beginning of 2009 whilst detached to command a joint air and aviation unit in Iraq. He is an RAF Portal Fellow studying for a PhD in Strategic Studies.

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Jonathan Boff was educated at Merton College, Oxford, before spending some twenty years working in finance in London, Tokyo and Singapore. He returned to full time study in 2006 and holds a Masters degree in History of Warfare from the Department of War Studies, King's College London, where he is currently completing a PhD on the application of combined arms tactics by, and general combat effectiveness of, British Third Army on the Western Front during the Hundred Days campaign of August - November 1918.

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Wing Commander Helen Miller is a serving Air Traffic Controller in the Royal Air Force. Commissioned in 1991, she has carried out several air traffic control appointments within the UK, as well as a number of broadening appointments: Aide-de-Camp to the Commander-in-Chief Strike Command, a Strategic Planner and Personal Staff Officer to the Chief of Staff Strategy Policy and Plans at Headquarters Air Command. A recent graduate of the Advanced Command and Staff Course at the Joint Services Command and Staff College, she is currently the Staff Officer in charge of Royal Air Force Media Operations based at Headquarters Air Command, Royal Air Force High Wycombe.

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‘The Future of British Air and Space Power: A Personal Perspective’



by Air Chief Marshal Sir Stephen Dalton
KCB ADC BSc FRAeS FCMI RAF

We are shackled by the past and never has the future been more difficult to divine. What we must do is to quite ruthlessly discard ideas, traditions and methods which have not stood the test... each of the fighting services must go for speed, mobility and economy, and develop the whole time with an eye on the other two members of the team in co-operation, not in competition.

Marshal of the RAF the Lord Tedder, Lee Knowles Lecture, 1947

Introduction

Lord Tedder's prescription for a 'united, efficient and economical armed force',¹ set within a context of fiscal stringency and strategic uncertainty, seems as relevant today as it was when he was speaking in 1947. In 2010, the United Kingdom will arguably reach a crossroads, where the defence green paper and the security review that is likely to follow a general election will force us to define our national level of ambition and determine our notion of Britain's place in the world. Inevitably, this will have significant implications for the size, shape and structure of our armed forces. Given this background, I feel it is important to provide a perspective on what this challenging strategic environment means for British air and space power, and set out my vision of the role that the Royal Air Force should play in the future security of the UK.

The Strategic Environment

Defence is currently facing two compelling strategic drivers: the first is the impact of ongoing operations in Afghanistan; the second is the pressure on government spending resulting from the global economic downturn.

Afghanistan, quite rightly, remains our main effort and the RAF's overriding priority. This is a war that we cannot afford to lose: for reasons of own national security, because of the potential knock-on effect on Pakistan and the concomitant effect on the diaspora in the UK; because of the consequences for our relationship with our most important ally, the USA; and, not least, because of the implications for the future of NATO. More broadly, I am also conscious of the impact of current operations on the credibility and reputation of the armed forces and indeed, on the popular perception of the utility of military force as a lever of national power. One of the deeper and more troubling legacies of our recent operational experience is that although at one level, public support for the military is very strong - witness the homecoming parades and the continuing media focus on Wootton Bassett - this may mask a lack of genuine understanding and there could now be an underlying belief that military action is too expensive - politically, financially, and in human terms - to be contemplated as a serious future policy option. The public reaction to the casualties, suffered during Operation *Panther's Claw* in the summer illustrate the point.

But this perception, if it does exist, is misguided. In some circumstances, military force will be the only tool of national power that is appropriate. Consequently, those of us involved in defence must engage the public more proactively, to help build a deeper understanding of the military and to explain the rationale for and legitimacy of the use of force. We in the RAF must also play our part by

continuing to adapt so that we can fulfil our mission: to project relevant and superior military air and space power to, if necessary, fight and win to protect the UK's vital interests. 2009 is the 200th anniversary of Charles Darwin's birth; a timely reminder of his famous assertion that:

It is not the strongest of the species that survive, nor the most intelligent, but the most adaptable.

We must adapt if we are to continue to provide a relevant and useful defence capability to policy-makers and here, the innate characteristics of air and space power are a real strength. Air power's reach, flexibility and ubiquity mean that if - and this is an absolutely critical prerequisite - if we can secure control of the air, we have the freedom to offer viable alternatives to the commitment of major land forces with the heavy cost that this invariably entails. We should not forget, for example, that the air policing of no-fly zones over Iraq by the USAF and RAF neutered Saddam Hussein's regime as a regional threat for eleven years, without the loss of a single coalition life, and at the combined cost of \$1 billion a year. In contrast, the USA has suffered well over 4,000 service deaths since the start of major land operations in Iraq in 2003, and the financial cost has averaged \$12.5 billion every month.²

Even where a significant presence is required on the ground as part of a joint campaign, air power is able to act as a force multiplier to dramatically reduce exposure. Ideally, the 'boots on the ground' required in a counter-insurgency operation will eventually be provided by indigenous forces after suitable training, as these are sensitive to local conditions and

often more culturally acceptable than coalition land forces that can be easily portrayed as an alien, invading army. Air and space power can then be used in a more discrete manner, providing the higher-end technological capabilities, such as Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) capabilities that are difficult for local security forces to acquire and develop.

The second strategic driver is, of course, the economy. Defence will have to compete with other government departments in what George Osborne has described as an 'age of austerity'³ and while I would not wish to second-guess the outcome of any future spending review, most analysts predict that whole government spending will have to fall in real terms by about 11% in the six years to 2016/17.⁴ Whatever political choices are made in the future about governmental priorities, it is clear that defence will need to take account of the consequences of a fiscal squeeze and as a result, some very difficult decisions will have to be made about our future force structure and capabilities.

Consequently, I welcome the impending defence green paper - and the likelihood of a subsequent defence and security white paper - as an opportunity to engage in a national debate about the role that the UK sees itself playing in the world, so that we can understand both the contribution defence will be expected to make, and learn what resources the nation is prepared to commit to fund this vision. Only then can we make sensible decisions about capabilities and future force structure. This means that, inter alia, we will

have to decide what military tasks are non-discretionary - for example, I would suggest that it would never be publicly acceptable to cede primary responsibility for the air defence of the UK to an ally or alliance - but also, what spread of other military capabilities are required over and above this threshold, to buy the level of influence we determine that we need internationally, particularly within coalitions and alliances.

Any white paper following the general election next year is likely to review security in the round, rather than concentrating on defence alone. Consequently, we must be much more forward-leaning in understanding and developing our capability to provide what Joseph Nye has termed 'smart power', rather than just 'hard power'.⁵ I would contend that air power has always provided much wider influence beyond coercion based on the delivery of kinetic effect, but we have never been particularly good at articulating our ability to contribute 'soft power' capabilities, because of our traditional emphasis on the harder edge of the air power domain. However, we must give serious consideration to the ways in which we can contribute to the security of the UK more broadly, especially within the context of the recently published second edition of the National Security Strategy.⁶ I have already mentioned the air defence of the UK, and this remains an essential task: the London Olympics in 2012 will throw this particular requirement into sharp focus. But I believe there are many other ways in which the RAF can play a more significant role in the wider security of the nation, notwithstanding the cultural, legal

and constitutional constraints that will have to be overcome.

A Language and Lexicon of Air Power for the Twenty-First Century

Understanding and articulating the vital contribution that air and space power can make across the whole of the defence and security sector is therefore important, especially at this particular moment in our history. But this is challenging, when the RAF has been primarily operating in support of land-based, counter-insurgency campaigns for the last six years. While air power has been absolutely essential - in fact, none of these operations could ever have been contemplated without it - because of the understandable focus on operations on the ground, the critical contribution of the air component is in danger of being overlooked. The lay observer may be able to understand intuitively what a soldier is doing, when he or she sees media imagery of a foot patrol moving through a village in Afghanistan. But because it is largely invisible and therefore intangible, they will almost certainly not realise or understand those soldiers' total reliance on air and space power, from the Chinook that inserted him into the zone, through the persistent ISTAR he is receiving from a constellation of air and space assets, to his assurance of on-call, heavy firepower support from combat air elements 'over the horizon'.

As airmen, we have not always helped ourselves. We are fascinated by technology, and this makes it easy for us to get caught up in the jargon and acronyms that are part and parcel of our profession. This has

sometimes made it difficult for us to understand each other properly, let alone explain air power's utility to soldiers, sailors, politicians and other decision-makers. Consequently, all of our major doctrinal publications have now been reviewed to provide the basis for a simpler and more coherent conception of air and space power centred on just four, vital roles.⁷ These make sense and are easy to explain and understand; it means we will all be equipped to give air power a much clearer and more credible voice in the ongoing defence and security debate.

The Four Air and Space Power Roles

The fundamental roles are: Control of the Air and Space, Air Mobility, Intelligence and Situational Awareness and Attack. Together, they explain how air and space can be used 'to project power to influence the behaviour of people or the course of events'.⁸ The key here is to understand how the air power roles can be used holistically to create influence - and invariably, as part of a joint campaign within an inter-agency, comprehensive approach to crisis resolution.

Control of the Air and Space remains the most important role of any air force. The RAF was established as the world's first independent air force ninety-one years ago to maintain the integrity of the UK's airspace, and this remains our most important responsibility today. Equally, when we deploy on expeditionary operations, Control of the Air is critical, because it guarantees freedom of manoeuvre for the entire joint force, while denying it to our adversaries. We only need to recall

the images of *Sir Galahad* burning at Bluff Cove during the Falkland Conflicts in 1982 to understand the consequences of a failure to secure control of the air on expeditionary operations. Our adversaries will always contest our freedom to use the air, even if - like the Taleban - they do not possess an air force. Instead, they will use small arms fire and rocket propelled grenades against slow-moving aircraft and helicopters, booby traps and mortar attacks on our airfields, or even propaganda about civilian casualties to attempt to deny our freedom to use air power - our own asymmetric advantage - as we choose. There is a danger that it is generally perceived that the current level of Control of the Air that we enjoy can be assumed. This is a mistake; Control of the Air will always be contested, and we will always have to fight to maintain it, and sometimes in unexpected ways and in unexpected arenas, such as within the information domain.

The second air power role is **Air Mobility and Lift**. This has been critical in recent operations in Iraq and Afghanistan. Without strategic air lift - enabled, of course, by Control of the Air - it would have been impossible to deploy and sustain our forces in theatre in the first place. And on a day-to-day basis, tactical lift, provided by support helicopters and Hercules transports, means that we can still move our forces around freely, even when movement on the ground is difficult, either because of the terrain or the threat of road-side or suicide bombs. Air lift is a real force-multiplier, because it means we can operate effectively with far smaller ground forces than would

otherwise be the case, especially as air power also provides the heavy firepower that would have to be generated by artillery and other land-based systems. Finally, in the context of counter-insurgency operations, air lift operations can be as important, in terms of influencing the overall course of the campaign, as more 'traditional' uses of air power. Flying a regional governor to a *Loya Jurga*, or moving an Afghan Army *Kandak* back to its home province for leave, are good examples of the unglamorous, but absolutely essential, contributions that air power is making towards establishing proper governance in Afghanistan.

The third air power role is **Intelligence and Situational Awareness**. Military action has traditionally been explained as four functions: Find, Fix, Strike and Exploit. In the Cold War, 'Find' was relatively easy, as it was difficult to conceal an entire Soviet Shock Army. The problem was to 'Fix' and then 'Strike' it, when it was protected by a sophisticated, Integrated Air Defence System (IADS). So we invested heavily in Control of the Air and precision strike capabilities to do just that. As a result, modern western air forces now have the ability to attack targets very precisely, whatever the weather. In recent, conventional 'force-on-force' conflicts, such as the wars against Iraq in 1991 and 2003, air power has become the prime tool of military force, with the land component effectively fixing the enemy to be struck and destroyed in detail from the air. This primacy has been acknowledged across defence; the decision to restructure the British Army into lighter, more uniform brigades, breaking up

traditional mechanized and armoured formations, was taken on the basis of the assurance of air support - and this assumption, the cheque that air and space power is expected to be able to cash, should be acknowledged and taken into account in future discussions about force structure.⁹

The overwhelming advantage conferred by modern air power has obviously driven the asymmetric approaches adopted by insurgents in current operations. The problem is now very different: although we can 'Strike' very effectively, the challenge is to 'Find' exactly where we need to apply force, when our enemies are elusive and fleeting, and often operate in a boundless and borderless battlespace 'amongst the people'. If commanders are to formulate sound military plans in this environment, they need to build their awareness through access to the most comprehensive, all-source, intelligence picture possible. Consequently, the RAF has invested heavily in the 'Find' function over the last decade, procuring a wide spectrum of collection capabilities. At one end of the scale, we have acquired a 'non-traditional' ISTAR capability by fitting high-resolution targeting pods to combat air elements, such as the Harrier, Tornado and Typhoon, which can be employed to produce 'pattern of life' full motion video, data-linked in real time to forces on the ground. And at the other, we have invested in specialist systems, such as the Reaper Uninhabited Air System (UAS) and ASTOR wide-search stand off radar, which are both currently being used to huge effect in Afghanistan.

The challenge is to use these impressive collection capabilities

to their full potential by directing them, analysing the data gathered and disseminating the intelligence produced as effectively as possible, and this is the focus of our current efforts. Our ISA capability can only be fully exploited if we use a developing Networked Enabled Capability (NEC) to build a truly comprehensive intelligence picture, fusing data from all sources. For example, in Afghanistan, wide area search assets, such as ASTOR, are routinely used to cue fast jets with high-resolution, but narrow field of view, sensors on to points of interest for tactical exploitation; the analogy is searchlight to flashlight to spotlight.

Attack - precise, proportionate and discriminate - is the final air power role. Attack may be non-kinetic as well as kinetic, and an opponent's will or understanding may be attacked as effectively as his physical capabilities. For example, on many occasions in Afghanistan, the frightening and disorientating effects of a 'show of force' - a low and extremely noisy fly-past by fast jets - have been hugely effective in dispersing a mob or buying time for own forces to act, especially in those circumstances when it would be inappropriate, or counter-productive to use heavy weapons, because of the danger of civilian casualties or collateral damage. Attack remains one of air power's most important roles and our demonstrable capability to hold an adversary at continuous risk is an important aspect of deterrence and coercion; it provides a key component of the UK's 'hard power' capabilities, which are necessary to underpin the 'soft power' tools that form part of a whole-government approach to crisis resolution.

The Pre-eminence of Information and the Growing Importance of Space

All current trend forecasts emphasize the increasingly fragmented and disparate nature of conflicts and crises. In the coming years, the UK will need to deal with a multiplicity of sub-state threats and actors, but may also have to confront traditional states with similar high-technology capabilities to ourselves, either directly or through proxies in 'ungoverned spaces'.¹⁰ Our adversaries in this future battlespace - both state and non-state - will therefore be highly agile, and are likely to have access to sophisticated capabilities. In this sort of environment, 'time is a weapon', and we need to respond by leveraging air power's potential to exploit the fourth dimension so that we can operate within our opponents' decision cycle. This is critical, as opportunities are likely to be fleeting, and we must be ready to take advantage of them as they arise. Future success will therefore depend on effective decision making, based on accurate and timely information, underpinned by the agility delivered through flexible and adaptive capabilities. In particular, space and cyber-space will become increasingly important to all military operations, and I would contend that the RAF's core values as an institution make us particularly well-suited to lead defence in the exploitation of these domains.

The provision of accurate and timely information has always been critical to the effectiveness of all military activities, and the importance of the information domain will only increase as societies become more networked.

The exponential growth in the availability of information means that we must understand how to deliver and protect our national interests - which may depend as much on perceptions as on hard realities - in the cyber domain. This means that we must grow a cadre of people who understand and can manage the modern networked environment, and are comfortable with the concept of treating information as a capability in itself. Here, our organizational culture is a real strength: the RAF is steeped in a history of information management and network operation, and this is a domain that we find intuitive. Fighter Command's air defence system during the Battle of Britain was a classic example of early NEC, where information from radar and observers was collected, processed, fused and disseminated to provide battle-winning decision-superiority to Park and Dowding, the two primary RAF operational commanders. This tradition of networking, driven by the particular requirement of air operations for timely information, has continued to the present day, forming the basis, for example, of the strategy that is being developed to create the best possible intelligence picture to counter the proliferation of Improvised Explosive Devices in Afghanistan.¹¹

Consequently, one of the greatest challenges presented by NEC for the RAF is not the concept of enabling networks itself, or even the interconnected application of air power, as we have been operating in this manner for many years, but rather improving our ability to fully integrate and synchronize our capabilities, at speed, with the other services, government departments

and coalition members that we will encounter within the comprehensive approach. Additionally, as we enhance our own network capabilities, so we increase our susceptibility to computer network attack¹² and computer network exploitation;¹³ indeed, in a world where information is pre-eminent, it could also quickly become our critical vulnerability. Set against a backdrop of a dynamic and proliferating threat,¹⁴ an effective computer network defence¹⁵ capability is therefore essential. This means identifying and addressing risks as early as possible in the capability development process, while developing tactics, techniques and procedures to provide resilience where networks are contested or compromised.

Space is similarly vital to both our military operations and wider society. All nine sectors of the UK's critical national infrastructure¹⁶ depend to a greater or lesser extent on space and networked operations, and there is a growing awareness across government of what a 'bad space day' might look like, in terms of both military effectiveness and the economic viability of the UK as a functioning state. Up to 90% of all military capabilities depend on space, from surveillance to navigation and targeting and, most fundamentally, the accurate position and timing functions which are vital to nearly all of our activities.¹⁷ Inevitably, we will have to continue to rely on alliances and partnerships for access to space, leveraged through influence and specialist knowledge - the US's freedom of orbit is particularly important in this respect - but prudence dictates that we cast the net

as widely as possible to guarantee the access we require, and also remain open to the technological developments that may offer the means for us to acquire an affordable indigenous space capability - nanotechnologies enabling small satellites are one example. What is certain is that despite treaty constraints, space will become an increasingly contested domain, and we must develop a concept of operations to deal with this. The US's Operationally Responsive Space Initiative provides one potential model for how flexible space capabilities may be delivered in short timescales in such an environment.¹⁸

The Future of British Air and Space Power

I have provided a personal perspective of the current strategic environment and its consequences, and outlined what I consider to be the key issues pertaining to the four air and space roles. I have also indicated why space and cyber will play an increasingly significant part not only in UK military operations, but also in the essential infrastructure of national life. I suggest that this all demonstrates that air and space power is more essential to defence than it ever has been before, either as the prime agent of force in conventional warfare, or as the key enabler in counter-insurgency operations; and that it will have a growing part to play across the wider security sector, especially in the space and cyber domains. But how can we develop our capabilities and continue to provide superior and relevant military capability in an atmosphere of real fiscal stringency? The answer lies in our vision of 'an agile,

adaptable and capable twenty-first century Royal Air Force' - but I would like to unpick this strap-line to tease out what it really means in practice, before offering my thoughts on our path into the future.

It is clear that we need to balance our force structure so that we can deliver relevant capabilities across all four air power roles; and in the space and cyber domains too. Accomplishing this will not be easy, because of the variety, unpredictability and uncertainty of the threats we will face in the future. This is where agility and adaptability - in our equipment and in our people - will be vital. We must continue to seek out innovative solutions if we are to deliver affordable capability, and the novel partnership arrangements we have developed with industry to sustain our aircraft fleets, and on projects such as the future tanker and strategic aircraft programme, indicate how substantial savings can be made - although the implementation of these structures has required real commitment to overcome the sometimes painful adjustments required of our people and for our processes. However, I am absolutely determined that the traditional excellence of our flight safety regime is not compromised by the adoption of any of these initiatives; the twin pillars of airworthiness and flight safety lie at the core of the RAF's operational effectiveness and they must be given the attention they deserve, above all other considerations.

One of the RAF's enduring institutional strengths is its readiness and capacity to embrace emerging technologies and, in the relatively

near-term, technical solutions are in prospect that may offer ways for us to square the circle between capability and cost. For example, the development of simulated and synthetic training technologies will enable us to enhance the quality of the learning experience while, as a by-product, driving down the cost - not least the environmental impact - of flying training. More fundamentally, the emergence of directed energy weapons may mark a revolutionary step-change in air power capabilities, potentially offering a low collateral alternative to the employment of more traditional and very expensive capabilities, such as low observable or stealthy platforms, as a means of, for example, securing control of the air by taking down a sophisticated IADS in conjunction with cyber-attack.

Consideration of a balanced force is not, therefore, just a question of numbers of platforms and the proportion of fast jets to helicopters or transport aircraft. Instead, it is the overall balance of capabilities. The key areas we need to take a judgement on include the balance between manned and unmanned systems; capability versus mass; directed energy weapons in relation to low observable or cyber capabilities; high technology versus low technology; and Intelligence and Situational Awareness against Attack, the traditional 'Find-Strike' debate I described earlier. In all probability, none of these issues are 'either-or' choices. For example, UAS will contribute significantly to our future capability; they offer a very attractive and cost-effective option for 'dull, dirty and dangerous' tasks at minimal risk to their operators, and with impressive persistence.

However, within the bounds of near-term technology, manned aircraft retain significant advantages in terms of speed, payload, flexibility, discrimination and situational awareness over UAS and their remote operators. Additionally, the legal and ethical implications of UAS operation in civilian controlled airspace, and the role and status of their operators, are all important concerns that are yet to be fully resolved. Nevertheless, as the subject matter experts, the RAF needs to lead in addressing these issues to ensure the coherence of the UK's UAS capability on a pan-defence basis.

Adaptability can help to resolve force-balance dilemmas and genuine multi-role capabilities - particularly in terms of manned and unmanned Combat ISTAR - mitigate some of the problems. For example, over the last two decades the Tornado has been used in everything from full-blown combat in the Gulf (twice) and the Balkans, through low-intensity air policing over Iraq to its current role as a Combat-ISTAR counter-insurgency platform in Afghanistan. Consequently, I am determined to continue to promote and enhance adaptability by focusing our thinking on the provision of capability in the round, rather than continuing with the more platform-centred approach of the past. This encourages a much more holistic conception of air power and permits us, for example, to see the F35 Lightning as primarily an ISTAR asset, but with hugely effective built-in Attack and Control of the Air capabilities. However, there are limits to the effects that multi-role adaptability can deliver, and we must be wary of putting all of our investment into a small number of highly

capable platforms; this is where the 'capability versus mass' argument comes into play. There is a danger, if we are not rigorous enough in our analysis or try to hedge our bets too far, that we will field a 'middle-weight' force structure, which is too sophisticated to fight low technology insurgencies in a cost-effective manner, but equally, is unable to be completely effective against the high technology equipment that future state adversaries - or their sub-state proxies - are likely to deploy.

So what will the RAF of the future look like? It is impossible - and would be inappropriate - to offer detail of a mooted force structure in advance of a strategic security and defence review, but the direction of travel is clear. I am convinced that the RAF needs to capitalise on air power's ability to acquire and process intelligence, and to strike with proportion and precision. We need to be able to both 'Find' and 'Strike', by continuing to develop a force with Combat ISTAR at its heart - this will be our core future competency. If as a nation, we continue to aspire to contribute to expeditionary operations, then there will be a continuing need to invest in favour of air lift and mobility assets, both fixed and rotary wing. And finally and inevitably, the unmanned element of our capability will continue to grow in importance, notwithstanding the caveats regarding their employment and the necessity for a sensible capability-mix.

In terms of people, the requirement for agility is clear, and this will increasingly demand strategic and operational thinking, in addition to the tactical proficiency that we have

excelled at in the past. We need to institutionalise air power education, and nurture leaders who can deal with the complexity and ambiguity of the contemporary operating environment. This demands education, not just training, and will have to be delivered on a through-career basis, from initial air power schooling through to scholarships and exposure to post-graduate learning opportunities. It will be difficult to find the resources to support this adequately, and it will also be difficult to promote a cultural mindset that properly values education in mainstream career terms. However, this is a necessary change and I am determined to make it happen; initiatives such as the Review of Officer and Aircrew Development and the CAS Fellowship scheme have been important steps in the right direction, but we need to go much further in developing the intellectual capital that is essential to guarantee our future institutional success.

Conclusion

The current strategic environment is extremely challenging. The impact of ongoing operations combined with the bleak economic climate has arguably put defence in the eye of 'a perfect storm'. Yet I remain very optimistic about the future of air and space power - and the service that I am proud and privileged to lead. The RAF's role in current operations is self-evidently vital, while in the future, we are best-placed to lead defence in the increasingly important domains of space and cyber. We must remain alert to the opportunities offered by potentially game-changing technologies, but while we will have to exploit the new and the novel,

we must ensure that we do not fall in thrall to them; there will be no silver bullets. We will continue to field a balanced force, but Combat ISTAR will be established as our core capability and unmanned systems will increase as a proportion of our battle order; this in turn means we will need to determine how to support and sustain this capability, and decide whether we need to establish a specialisation, with its own career structure, to operate it. Finally, our ultimate operational success as a fighting service will continue to depend - as it has done throughout the last ninety-one years - on our agility as an air force, based above all else on the quality and the education of the high calibre men and women who are proud to serve, and ready to meet the future military needs of the UK.

Ten Propositions Regarding British Air and Space Power

In the past, theorists and practitioners have advanced different notions and propositions regarding air power. In closing, I thought it might be useful if I summarised my thinking by offering ten of my own propositions about the future of British air and space power:

- **Air and space power is all about creating influence.** *Air and Space Power provides influence in support of the national interest: this is achieved through a holistic range of effects, including the kinetic and non-kinetic. The inherent flexibility of air power means that it will be a key component in the UK's arsenal of 'smart power' capabilities.*
- **Control of the Air and Space remains the paramount air and space role.** *Control of the Air and Space remains the RAF's first duty in both homeland defence and on expeditionary operations; it will continue to be contested whenever we engage in combat, but in different and unexpected ways to the past, including through information operations, cyber attack and, in the future, by the use of directed energy weapons.*
- **Air and space power is about the provision of capability, not the generation of platforms.** *Air and space power's role is to deliver capability; in the past we have too often focused on platforms. We need to take a more adaptive approach to creating desired effects through integrating and synchronising a range of capabilities and activities.*
- **Time is a weapon: air and space power offers the means to dominate it.** *The contemporary battlespace is complex, congested, and cluttered and opportunities will be fleeting. The inherent characteristics of air power, and its ready access to the information domain, offer the best prospect of creating decisive effect in this sort of environment.*
- **Combat ISTAR will lie at the heart of the RAF's future capability.** *A developing Combat ISTAR capability reduces the requirement for networking and increases resilience while underpinning flexibility and adaptability, thus mitigating force balancing issues. It will be the baseline capability and core competency of our combat air elements.*
- **Unmanned Air Systems are here to stay.** *UAS are an integral part of*

the UK's air power capability.

As the subject matter experts, the RAF needs to lead in coordinating, developing, supporting and sustaining a coherent and viable UK UAS capability.

- **Space and Cyber are joint domains, but the air component is best-placed to lead in coordinating the defence effort in these arenas.** *The RAF has the tradition, expertise and people with the capability to lead defence in these two important domains.*
- **Technology and air and space power are synergistically related.** *Emerging technology will be vital in enabling the delivery of affordable and relevant air and space power in the future, but we must not rely on technology as a substitute for ideas.*
- **Agility and adaptability are the key to the delivery of capable, relevant and affordable air and space power in a complex and uncertain world.** *The successful employment of British air and space power in the twenty-first century depends, above all else on the agility of the RAF's people; this demands education, not just training, and we must get serious about investing in it and valuing it as institution.*

- **Network Enabled Capability is critical to unlocking air and space power's potential.** *As the information domain becomes increasingly important, NEC will be critical in fusing and integrating capabilities to unlock the true potential of air and space power.*



Chief of the Air Staff

Notes

- ¹ Marshal of the RAF the Lord Tedder¹, *Air Power in War*, London: Hodder and Stoughton, 1947, p. 28.
- ² Joseph Stiglitz and Linda Bilmes, *Three Trillion Dollar War*, New York: Allen Lane, 2008.
- ³ 'Tories Cut to the Chase as Osborne Heralds an Age of Austerity', *The Times*, 7 October 2009.
- ⁴ Malcolm Chalmers, 'Preparing for the Lean Years', *RUSI Future Defence Review Working Paper Number 1*, July 2009, p. 1.
- ⁵ Joseph Nye, <http://csis.org/program/smart-power-initiative>, last accessed 22 October 2009.
- ⁶ *Security for the Next Generation, 2009*, available at http://www.cabinetoffice.gov.uk/reports/national_security.aspx, last accessed 22 October 2009.
- ⁷ Notably AP3000 'British Air and Space Power Doctrine' Edition 4, 2009, available at <http://www.airpowerstudies.co.uk/ap3000.htm>, and *The Future Air and Space Operational Concept Edition 2*, 2009, available at http://www.mod.uk/NR/rdonlyres/8373350E-6958-4928-A409-E9C24F2226FF/0/20090901FASOC_2009UDCDCIMAPPS.pdf.
- ⁸ AP3000, p. 3.
- ⁹ General Sir Richard Dannatt, speech transcript, 'The Land Environment – Moving Towards 2018', *RUSI Future Land Warfare Conference*, 12 June 2008.
- ¹⁰ *HLOC Framework*, page iv, para 6.
- ¹¹ Air Cmd "Strategy for NEC in the Air Environment" dated Dec 08.
- ¹² Software-base attacks against CIS intended to modify, disrupt, deny, degrade or destroy information or functionality (D/DTIO/PCS/03/01/08/01 dated 26 Jan 06 (Policy for CNA in support of Military Ops.
- ¹³ Operations to produce intelligence from CIS. (GCHQ Paper - The UK Framework for Computer Network Operations dated 16 Mar 06).
- ¹⁴ CDS Directive 06/08 - the number of detected deliberate attacks on MoD networks has increased over a 2 yr. period.
- ¹⁵ Actions taken within an overall Information Assurance framework to deter, protect, detect, react to and recover from a CNA or CNE on MoD CIS.
- ¹⁶ See: www.cpni.gov.uk.
- ¹⁷ *FASOC 2009*, p.1-2.
- ¹⁸ *Ibid*, C-1.
- ¹⁹ See for example, Philip Meilinger, *10 Propositions Regarding Air Power*, Maxwell: Air University, 1995.

“Air Power and the Environment: The Ecological Implications of Modern Air Warfare”

By Dr Joel Hayward¹

Ecologists, activists, lobbyists and of course politicians are already turning their attention to ecological aspects of modern warfare. As a consequence, governments and their armed forces will have to pay more attention to the serious ecological ramifications of conflict. Air forces face the greatest challenges. During both peace and war they have far greater carbon footprints than armies and navies. They use potentially more devastating ordnance. Their targets traditionally include objects in or near population centres and the aquifers, waterways, soils and food sources that sustain them. And air forces cause far worse damage to environmentally significant production, storage and distribution infrastructure (much of it based on petroleum, oil, lubricants or chemicals). This article does not recommend the blanket exclusion of any potential target sets from planning processes. Rather, it argues that, when we utilise our existing warrior code, the Just War ethical framework, we must now slightly expand our time-honoured moral and legal constructs of proportionality and discrimination to include environmental issues. That is, the article argues for the inclusion of ecological protection in military planning and for it to be weighed expertly, along with the likely need for post-war remediation activities, among the factors that will ultimately determine the justifiability of military actions.

Introduction

Twenty years ago the Norwegian Prime Minister, Gro Harlem Brundtland, stated: "We are living in an historic transitional period in which awareness of the conflict between human activities and environmental constraints is literally exploding."² We have come a long way in the subsequent two decades. Environmental responsibility now lies at the forefront of our western world perspective and is constantly growing in importance. Ecological activism, which used to be a fringe movement, has now become mainstream. In 2007 Al Gore and the Intergovernmental Panel on Climate Change won the Nobel Peace Prize (and an Oscar!) for their efforts to raise environmental awareness. Greenpeace, which uses "non-violent, creative confrontation to expose global environmental problems," alone has no fewer than 220,000 members in the United Kingdom and 2.8 million worldwide. Ecologists, environmentalists, activists, lobbyists and of course strategists are already turning their attention to ecological aspects of modern warfare, including land mines, cluster ordnance, erosion and soil damage, air pollution, deforestation, nuclear testing and proliferation, oil spillage and fires, depleted uranium contamination, the disposal of ordnance, and so forth. It seems likely that such concerns will also become increasingly mainstream. As a consequence, governments and their armed forces will be paying more attention to the serious ecological ramifications of conflict. Some already are. The *Global Strategic Trends* paper published by the Ministry of Defence's Development, Concepts

and Doctrine Centre (DCDC) illustrates the importance now being placed on these matters by some British strategists.³

Balancing strategic and operational needs with both military and environmental ethics is certainly not impossible, and responsible armed forces are already beginning to think about how best to balance what superficially seem to be (but actually are not) competing imperatives. Air forces face the greatest challenges. During both peace and war they have far greater carbon footprints than armies and navies. They use potentially more devastating ordnance. Their targets traditionally include objects in or near population centres and the aquifers, waterways, soils and food sources that sustain them. And air forces cause far worse damage to environmentally significant production, storage and distribution infrastructure, much of which is based on petroleum, oil, lubricants or chemicals.

My philosophical framework should be easy to understand. Although I recognise intrinsic worth in the natural environment - meaning it has a value in its own right regardless of what humans gain from it - I am primarily concerned with its instrumental value. That is, I argue from an anthropocentric vantage point that we should safeguard the environment and its myriad complex ecosystems because humans are part of those ecosystems and their security, health and happiness depend entirely upon them. I see no conflict or inconsistencies between environmental ethics and the ethics of war. Western warriors increasingly understand that the environment is

in many ways the collective property of all humanity, including future generations, and that its responsible stewardship is critical regardless of the good and bad governments and regimes that might exist at any given time within man-made boundaries. In this respect the environment is highly akin to the “cultural property” that the 1954 Hague Convention for the Protection of Cultural Property makes illegal to damage or destroy deliberately.⁴ The physical environment’s significance is actually inestimably greater than the “property of great importance to the cultural heritage of every people” - including unique architecture, archaeological sites and other objects of artistic, historical or cultural importance - that the Convention considers inherently valuable and morally inappropriate as targets of military action.

Moreover, the West’s ethical framework for understanding armed conflict, Just War, forms a sizeable chunk of the western warrior code. Within this code warfare is a regrettable activity directed against the culpable, undertaken only when a better state of peace is the likely outcome and if the good accomplished outweighs the harm done. Deeply embedded within Just War are concepts of proportionality and discrimination. In terms of *jus in bello* (the criteria for fighting wars “cleanly”), proportionality means that military forces must not undertake any actions in which the incidental harm would be excessive in relation to the likely military benefit. Throughout my own career of teaching military officers I have ordinarily summarised this concept by encouraging them never to use more force or to cause more damage

than is necessary to guarantee the attainment of just military goals. Similarly, discrimination means that military forces may only wage war on combatants and military objects, and must act purposely and painstakingly to ensure that civilians suffer no more harm than military necessity demands. It is thus eminently logical that, as western warriors are framing their use of force in terms of minimising suffering while doing good, all the while protecting the innocent, including those on the other side, they should understand the importance of minimising harm to the very environment and habitat that sustain the innocent. It is equally reasonable that, as the purpose of military activity is a better state of peace, it would be incongruous to inflict damage upon the innocents within the opposing state, and possibly within neighbouring states, that lasts well beyond the end of conflict and complicates the restoration of harmony.

Lastly, I strongly disagree with those ecologists who assert that we need to take an absolutist stance against all military activities that result in any ecological harm. Our Just War criteria are adequate as a guide for military planners and practitioners. Both proportionality and discrimination involve careful calculations that render some regrettable harm acceptable when balanced against the greater good being achieved. I accept this line of reasoning and argue, not for absolutist prohibitions, but for the inclusion of ecological protection in all military planning and for it to be weighed expertly, along with the likely need for post-war remediation activities, among the factors that will ultimately determine the justifiability

of military actions.

This article draws on the Kosovo Conflict as its central case analysis so as to give readers something recent upon which to reflect that does not involve the emotionally charged War on Terror. (Equally powerful examples of environmental harm caused by air power and other forms of military force can also be found during that so-called war.) The article is not intended as the last word on the subject of the real and potential ecological ramifications of modern air power, but merely as a first word. It aims to demonstrate some complexities within the closely intertwined relationship between defence and security priorities, international humanitarian law, the West's Just War framework and environmental ethics. It offers several observations and asks a set of questions in the hope that readers will feel prompted to seek their own answers. It is my belief that air forces should engage these issues proactively, addressing them on their own terms with judgement and at a realistic tempo before public pressure and special interest groups might compel defence ministries to make sweeping changes, some of them possibly rushed and unhelpful.

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Since ancient times armies have often consciously used the natural environment as a weapon against opponents. They have poisoned wells, salted fields, burned crops and done other ecologically harmful things. In 1945, for example, German officers who feared an Allied attack intentionally flooded 20,000 hectares of agricultural land in the Netherlands, leaving it unusable

for crops until the Dutch finally reclaimed the land four months later after a massive rehabilitation program. I began thinking about the ecological implications of modern air warfare when, as an undergraduate, I studied the environmental damage caused by the RAF bombing of the Möhne and Edersee dams in May 1943 and the USAF atomic bombing of Hiroshima and Nagasaki in August 1945. I was surprised most of all to learn the full extent of the American defoliation programme during the Vietnam War, which represented a watershed in the relationship between warfare and the environment. Between 1962 and 1971 US aircraft sprayed 3,640 km² of South Vietnam's croplands, deep vegetation and jungles with 55,000 metric tonnes of herbicides and defoliants in order to destroy the plant-based ecosystem for the purpose of disrupting agricultural food production and destroying plant cover for the Viet Cong.⁵ Its effects were dreadful for Vietnam's ecosystems and, most infamously, for human health.

My thinking about the relationship between warfare and the environment began to focus in March 1999, when NATO air power began wrecking Yugoslavian (especially Serbian) infrastructure in a well-intended but poorly conceived attempt to coerce Slobodan Milošević's government into protecting and granting more freedom to the beleaguered Albanian ethnic majority of Kosovo and Metohija. I felt disappointed that, even in our era of effects-based operations and precision strike capabilities, NATO chose to wreck almost all major oil refineries, petrochemical installations and fertiliser works, as well as their

tankage areas. NATO thereby spilled harmful oil and toxic chemicals into the soil, aquifers and waterways - including into the Danube River, the crucial economic artery of several uninvolved nations - and created carcinogenic, mutagenic, toxic and perilous airborne pollution. These acts were widely publicised and highly controversial. Like many concerned observers, I wondered why, in a war fought for humanitarian purposes, with a highly commendable, almost obsessive desire to ensure the totally accurate placement of ordnance so as to minimise immediate civilian deaths, NATO nonetheless seemed reckless with Yugoslavia's natural environment.

I began researching this particular article in July 2006 after feeling equal disquiet when Israeli Air Force air strikes created a dreadful six-mile wide and 100-mile long oil slick along the Lebanese coast by striking an oil storage depot at the Jiyeh power plant, about nineteen miles south of Beirut, flooding 15,000 tonnes of oil into the Mediterranean and causing the worst-ever oil spill in that sea. A further 25,000 tons burned for 27 days, reportedly "spewing a toxic cloud into the air and causing a rain of toxic oil downwind."⁶

Targeting oil infrastructure from the air is not new. During the Second World War, for instance, both Allied and Axis air forces considered oil production, refinement, storage and transportation facilities and systems as integral to their enemies' viability and survivability. Even the Luftwaffe, designed and utilised primarily for battlefield interdiction and attack, bombed Caucasian oilfields in 1942 in an angry attempt to punish the

Soviet Union.⁷ During the last three months of the Pacific War, the USAAF conducted a weighty campaign aimed at destroying Japan's oil infrastructure.⁸ The greatest counter-oil campaigns occurred during 1943 and 1944, when the USAAF struck the Romanian oilfields and refineries that supplied a large portion of Germany's oil and both the RAF and the USAAF wrecked synthetic fuel plants across Germany.⁹

The targeting of oil sharply divided senior Allied air commanders, but only because some of them passionately argued against its purported strategic effectiveness and not because anyone felt gravely worried about the natural environment.¹⁰ Occurring decades before scientists began expounding concerns about "acid rain," "sustainability," "carbon emissions" and the "greenhouse effect," and during a war in which neither side worried much about the suffering of enemy populations, these great campaigns caused levels of local environmental harm that were not analysed in any of the major post-war bombing surveys and which would be unacceptable in any of today's limited wars.¹¹

I would not dream of casting stones at our valiant forebears. It would be wrong to impose the widespread ecological values of today onto previous generations. Moreover, we cannot attribute responsibility for large-scale oil pollution during the Second World War solely to air forces. For example, navies, equally unaware of the long-term harm likely to occur, targeted and sank not only fuel-laden warships, but also each other's merchant ships, including

oil tankers. Indeed, the combined gross registered tonnage of the oil tankers sunk was 1,235,097 with a total oil-carrying capacity of as much as 17,171,183 barrels or 2,592,380 tonnes.¹² That is the equivalent of one *Exxon Valdez*-size spill occurring every month of World War II.

Petroleum, oil and lubricants (often simplified as "POL") infrastructure remained a primary target set for air power planners throughout the Cold War and following decades, and featured prominently, for example, in the USAF's and USN's Rolling Thunder and Linebacker bombing campaigns against North Vietnam.¹³ In 1988 the most celebrated air power thinker of recent times, John Warden III, maintained that the "petroleum chain ... still remains a potentially key target simply because a modern military machine cannot function without fuel."¹⁴ Indeed, Warden argued that, along with electricity, oil was a major centre of gravity (one of his five "rings") and that carefully focused attacks on the oil chain would denude the enemy of energy. Warden's ideas influenced the Gulf War of 1991, during which Coalition air forces wrecked Iraqi oil storage and distribution installations - but not all long-term export infrastructure - as part of a campaign aimed at paralysing Saddam Hussein's state and forces.¹⁵ (The Iraqis created far more devastating environmental harm when they detonated more than 700 Kuwaiti oil wells, igniting over 600 of them, and discharged more than six million barrels of crude oil directly into the Persian Gulf. Happily for air power advocates I must note that precision air strikes by USAF F-111Fs against pumping stations and manifolds actually stemmed that

horrific flow.¹⁶)

Warden and other air strategists of his generation did not analyse (and to be fair probably gave no thought to) the key problem with destroying or damaging oil infrastructure, as opposed to merely disrupting distribution. They ignored the fact that liquid hydrocarbons and the chemicals utilised in refinement are potentially extremely damaging to ecosystems. The explosive or incendiary force of ordnance either burns the petroleum upwards, creating potentially deadly air pollution, which may cause dreadful health problems in the short-term (but thankfully seldom causes lingering harm after the pollution dissipates), or spills it into the ground, with the potential for long-lasting and calamitous contamination of soils, aquifers and waterways. As the Commentary on the 1977 Additional Protocols to the Geneva Conventions states: "As regards the destruction and setting alight of refineries and petroleum storage facilities, it is hardly necessary to stress the grave danger that may ensue for the civilian population".¹⁷

NATO's 1999 attacks on Yugoslavian refineries and petrochemical and fertiliser installations at Pančevo, Novi Sad and elsewhere created such demonstrable environmental pollution - with the wreckage, spills, fires and billowing clouds being captured on the handycams of local inhabitants as well as more expertly by journalists - that when the Serbian government accused NATO of creating an environmental catastrophe it was not a lone voice. Even the relevant watchdog agencies within the United Nations and other

reputable and non-partisan intrastate bodies expressed strong concerns about the attacks. Neither they nor western media could brush aside the Serbian governmental allegations (which exaggeratedly described the violence as “ecocide”) as merely unverifiable and unwarranted anti-NATO propaganda.¹⁸ With many scores of thousands of Serbians evacuating towns and villages to flee from clouds of toxic chemicals, with slicks in the Danube and with some smoke plumes moving eastwards over Romania, Bulgaria, Moldova, Ukraine and the Black Sea¹⁹, it was impossible to deny that, even if only in the short term, the attacks had an adverse and widely concerning environmental impact.²⁰

NATO argued emphatically that the one hundred or so industrial facilities it bombed throughout Serbia were “dual-usage” installations and thus legitimate targets according to sections of the 1977 Additional Protocol I to the 1949 Geneva Convention. For example, NATO described the Pančevo refinery and works, the largest petrochemical complex in the Balkans²¹, as a “strategic target” that “provided oil and other elements to support the Yugoslav Army. By cutting off these supplies [NATO] denied crucial material to the Serbian forces fighting in Kosovo.”²² Although civilian facilities are ordinarily strictly off limits, Article 52(2) does indeed permit attacks on those facilities “which by their very nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralisation, in the circumstances ruling at the time, offers a definite military advantage.”

The moral “double-effect” principle embedded within *jus in bello* also permits the targeting of dual-usage infrastructure and makes allowance for incidental civilian deaths if those deaths are *unavoidable*. Yet it permits this targeting only if it is *solely* intended to affect the capability of the opponent’s armed forces. If NATO’s intention was also to demoralise the Serbian population in order to generate additional pressure for the Milošević regime to capitulate, then the double-effect principle no longer provides justification for these actions.

Unfortunately, this seems to have been the case. Even if one chooses to argue that oil refineries were providing fuel for military operations as well as for civilian consumption, and were thus reasonable “dual-usage” targets, it is harder to make an equally strong case for pharmaceutical factories, car factories and even fertilizer plants.²⁴ The view that NATO wanted to put pressure on Milošević by squeezing and scaring his people by wrecking things around and amongst them gains support from the US military’s own reported admission to Human Rights Watch that NATO destroyed some targets that were not legitimately “dual-usage” and did so because they were “symbolic” and “psychologically lucrative.”²⁵ Human Rights Watch found that such actions were “done more for psychological harassment of the civilian population than for direct military effect.” This conclusion is reinforced by an ironic source: the NATO Joint Air Component Commander, Lieutenant General Michael C. Short. “If you wake up in the morning,” he told the *Globe and Mail* on 26 May 1999, “and you

have no power to your house and no gas to your stove and the bridge you take to work is down and will be lying in the Danube for the next 20 years, I think you begin to ask, 'Hey, Slobodan, what's this all about?'²⁶ How much more of this do we have to withstand?" Perhaps with a boast, he later said that he had wanted the Serbian leadership "to wake up to a city that was smoking".²⁷ He even admitted that he had warned Serbian air force commanders: "The speed and the violence and the lethality and the destruction that is going to occur is beyond anything that you can imagine. ... If you force me to go to war against you, Belgrade will never look that way again - never in your lifetime, or your children's lifetime. Belgrade and your country will be destroyed if you force me to go to war."²⁸

Even ignoring this unusual ethical position, NATO failed to explain convincingly why its remarkably precise and thus potentially highly discriminate air force needed to destroy the storage tankage, thus burning or spilling staggering quantities of liquid hydrocarbons and chemicals, rather than less harmfully targeting the adjacent but separate refinery installations, or, far better still, precisely hitting the more discrete river-port, road and rail-related nodes in order to stop the oil and chemicals' loading, transportation and distribution.²⁹ NATO did publicly explain on 3 May 1999 that it had damaged Serbia's main electricity stations and thus robbed the Serbian population of seventy percent of its electricity. Spokesman Jamie Shea even publicly stated that Milosević would thus know that NATO "has its fingers on the light switch ... we

can turn the power off whenever we need to and whenever we want to".³⁰ Yet NATO's information campaign included no real effort to explain why it was setting ablaze and flooding oil and chemicals in refineries and storage facilities and not, instead, merely "switching off" those installations by accurately targeting their internal and external sources of electricity. Aircraft did target and destroy local transformers at the sites, interrupting their functionality, so it is less clear why NATO still chose to inflict such heavy and dangerous damage to the oil and chemical tanks and plants. Further, NATO did not explain why, after a European Union total oil embargo of Yugoslavia came into effect on 30 April 1999³¹ - "the tap is being turned off all across Europe," NATO's chief spokesman claimed on 30 April³² - it continued to burn and spill huge quantities of oil and chemicals right up until the conflict's last days.

During the war NATO responded to accusations of grave environmental harm in a very strange fashion. Aware that the world rightly felt horror at the expulsion and panicked flight of 850,000 Kosovars, NATO exaggerated the physical harm being done to their abandoned dwellings by the Serbian Army and by Serb paramilitaries. It maintained at one point that there were then "200 burning villages, town and cities" across Kosovo.³³ After presenting exaggeration as fact, it then relativised the environmental harm being committed by both NATO and the ethnic cleansers:

[we] see a lot of smoke, the smoke is coming from all of these burning villages in Kosovo and if you're talking about environmental damage, I think the

*“scorched earth” policy applied to Kosovo, the destruction of livestock, the destruction of rivers and roads and communication routes, the destruction of the agriculture, the slaughtering of a large percentage of the cattle and the livestock, is going to be much more significant in the long term and incidentally require a lot more money to fix than the repair of some oil refineries.*³⁴

This *tu quoque* defence (“you can’t criticise us for our wrongdoing because you’re doing it too!”) was disingenuous at best and dishonest at worst. Some Serbian regular army units and paramilitary groups did atrocious, murderous things in Kosovo, but they did not apply a “scorched earth” policy to the province, let alone cause or threaten a long-term environmental catastrophe involving the destruction of permanent natural features and resources. And the complaints levelled against NATO related to the imperilment of human life and widespread and potential enduring damage to fragile ecosystems, not to the cost of repairing oil refineries.

NATO’s inadequate explanations and attempts at justifications did little to assuage concerns all over the world about *jus in bello* proportionality and thus the operation’s justice. Even worse, NATO’s actions and media ops failings resulted in accusations - and even formal charges presented at the International Court of Justice - of wilful and criminal contravention of Articles 35(3) and 55(1) of Additional Protocol I’s explicit prohibition, regardless of the military objective, of “widespread, long-term and severe damage to the natural environment”. Unlike other provisions of the same Protocol, once this threshold is met,

no exception can be made for “military necessity”.³⁵

Convincing critics that the level of wreckage remained proportionate was always going to be far more difficult for NATO than justifying the inclusion of the installations in its target sets. People believe what they see. And in 1999 they saw colossal destruction. I use the word “colossal” here with no desire for hyperbole. It may surprise some readers to learn that in total, NATO burned far more oil and dangerous chemicals into the air or spilled far more into the Serbian soils, aquifers and waterways in its 1999 air war than the 10.8 million gallons (257,000 barrels or 38,800 tonnes) of crude oil that the *Exxon Valdez* had spilled following its highly controversial grounding off the Alaskan coast in 1989.³⁶

At Pančevo alone, NATO air attacks caused the release of 80,000 tonnes of oil and oil products, most of which burned wildly from ruptured tanks, poisoning the air only twelve miles from Belgrade’s 1.5-million inhabitants with deadly substances including sulphur dioxide, nitrogen dioxide, carbon monoxide, polyaromatic hydrocarbons (PAHs) and lead. The Pančevo raids also spilled over 2,000 tonnes of toxic dichloroethane (EDC) into soils and groundwater, burned around 250 tonnes of vinyl chloride monomer (VCM, which would have produced toxic dioxins and hydrochloric acid), flooded around 250 tonnes of liquid ammonia and eight tonnes of metallic mercury, some of which entered a canal leading straight into the Danube. Desperately weighing the lesser and greater of two evils, the site managers themselves released

the liquid ammonia, knowing that a direct hit on stored ammonia had the potential to kill large numbers of people.³⁹ Another 73,000 tonnes of crude oil and oil products burned or seeped into the groundwater in the northern city of Novi Sad.⁴⁰ Elsewhere throughout Serbia (and Kosovo itself), heavy metals, sulfur dioxide, ammonia, and other caustics escaped from burning industrial facilities into the air, soil, ground waters and rivers, causing large-scale evacuations and leaving many experts convinced that the impact of the toxic releases would reach - as they did - far beyond Yugoslavia's borders.⁴¹

I am not for a moment suggesting that the long-term ecological consequences of the destruction at Pančevo and other sites exceeded those of the infamous *Exxon Valdez* spillage. The latter occurred in a highly fragile ecosystem in an area along the Alaskan coast so remote that clean-up proved tragically slow, difficult and incomplete. Little of the spilled oil could be burned, which, even though producing airborne toxins, would have reduced the destruction of flora and fauna caused by the concentrated surface "slick". This evaporated and decomposed far more slowly in the low temperatures than it would have under similar circumstances in more temperate climates.⁴²

One cannot deny, on the other hand, that the environmental contamination at and around NATO's Serbian industrial targets was, at least in the short-term, so obviously severe that it greatly reduced NATO's ability to gain positive press from the fact that, in terms of minimising civilian deaths caused *directly* by bombing, it was

extremely successful.⁴³ Moreover, it alienated many influential observers, including former Soviet President Mikhail Gorbachev and others who had agreed with NATO's aims of ending ethnic violence, and caused highly unhelpful domestic controversy in NATO nations.⁴⁴

Serbia employed a clever media strategy to draw the world's attention to the level of its environmental suffering, aware that, with no objective scientific teams being in-country and able to verify or challenge its claims during the conflict, NATO would have few options for countering its information (or *misinformation*) strategy.⁴⁵ This is something important for military planners nowadays to ponder. If their campaigns or missions cause even what *appears* to be large-scale ecological damage, their political leaders will find it difficult to mount a credible defence against charges of catastrophic harm. Garnering and maintaining popular support for wars of choice that involve no direct threats to sovereignty or key interests is not easy even within apparently reasonable contexts, but in this era of widespread public concern for the environment, politicians will find it easier to maintain support for their actions if they do not seem to be doing harm while claiming to be doing good.

In response to continued reports of widespread environmental harm, the Regional Environmental Centre for Central and Eastern Europe, assisted by a variety of specialist contracted experts, undertook the very first objective study.⁴⁶ It reported that, while thankfully there was "no evidence of a large-scale ecological

catastrophe, ... the environment in the whole territory of Yugoslavia was affected as a result of the military conflict". It also found that pollution was "very severe in the vicinity of targeted industrial complexes ... and many valuable ecosystems were disturbed."⁴⁷ It considered it too early to offer evidence-based opinions about the long-term effects, but warned that the environmental damage that had occurred or might in the future included threats to ecosystems (especially river systems) and human health caused by exposure to toxic or carcinogenic substances.

Likewise, at almost the same time, the very concerned United Nations Environment Programme took the unprecedented step of hastily forming a Balkans Task Force to assess the environmental consequences of NATO's air campaign. This was the first time that the UN had ever integrated environmental issues as a central part of a post-conflict humanitarian effort. Led by former Finnish environment minister Pekka Haavisto, the Task Force visited the wrecked refineries and industrial complexes in the weeks immediately after the cessation of violence and released its findings four months later. It detected four major ecological "hot spots" of grave concern that needed urgent attention (Pančevo, Kragujevac, Novi Sad and Bor), but added that permanent degradation of soils and waterways seemed unlikely. The UN team recognised that some of the environmental pollution apparently predated the NATO strikes while some of it resulted from it. The Task Force nonetheless added that urgent attention would be needed irrespective of the cause, "if

further damage to human health and the environment is to be avoided."⁴⁸

The Task Force's report was not accepted by all scientists and interested bodies. Many considered it a "political" report supporting a pre-determined conclusion and relying on hasty and imperfect research and an inadequate methodology.⁴⁹ Better studies, the critics asserted, contradicted the Task Force's findings. They pointed to a parallel short-term study by the World Wide Fund for Nature, which highlighted the broader trans-boundary and ecosystem implications of the discharged toxic chemicals and offered the less positive summation that "toxic contamination in Yugoslavia is spreading".⁵⁰ The politically neutral Swiss-based FOCUS team of humanitarians and scientists that spent several months in 1999 assessing post-war damage throughout Serbia also offered this sombre assessment: "Destruction of many potentially dangerous objects on FRY territory caused the threat of ecological catastrophe."⁵¹ Likewise, focusing especially on Novi Sad, two Belgrade scientists identified "catastrophic pollution".⁵² They reported that, although airborne pollution was "extreme but short-lived," the pollution of the soil and surface and groundwater was long-term. "The pollution in these zones," they asserted, "especially in the Danube river basin, is a hazard for the further degradation of the environment, and a risk for the human health."⁵³ Similarly, and perhaps most notably, the US-based Institute of Energy and Environmental Research (IEER) expressed serious concerns in its 2002

assessment.⁵⁴ Particularly at Pančevo, chemical releases occurred “which pose potentially long-term threats to the local population and local environment.”⁵⁵ The IEER noted that, while it was impossible to be precise or to predict future circumstances with certainty because of a lack of available pre-war baselines, persistent toxins, carcinogens and other pollutants entering the ecosystems looked likely to have long-term negative consequences, including for human health. The IEER was very careful to apportion responsibility fairly and even criticised Serbia for its pre-war record of industrial pollution at some sites. It nonetheless reserved its strongest criticism for NATO for its inclusion of some of the petrochemical infrastructural targets and the excessive level of their physical destruction, reporting that “persuasive evidence indicates that humanitarian law may have been violated in the NATO bombing campaign, notably with respect to the bombing of Pančevo.”⁵⁶ The IEER went so far as to recommend:

The entire issue of bombing civilian facilities to accomplish military objectives needs to become the subject of a rigorous public inquiry. Such an inquiry should include consideration of immediate and/or environmental and health damage that could be inflicted on the country or in neighboring countries sharing ecosystems with the countries at war.

Given that NATO undoubtedly intended Operation Allied Force as a positive humanitarian intervention - with the ending of ethnic violence being the primary objective - even on balance such environmental degradation and explicit criticisms

of it can only be considered ultimately counter-productive. It weakens moral positions. Ethicist Alex J. Bellamy argues that humanitarian interventions place additional burdens of justice upon political leaders and military commanders than many other expressions of warfare. He notes that planners must pay particular attention to the selection of targets involving civilian objects and that, “in humanitarian interventions, failure to exhibit due care casts serious doubt on the legitimacy of the operation as a whole.”⁵⁸

Just as any physician is morally obliged to cause no harm while seeking to remedy a patient’s malady, or at least to minimise all possible harm created by the treatment, responsible government institutions need to balance their security priorities and moral considerations with other influential factors, which nowadays includes environmental ethical considerations. It is not beyond reason to foresee a near future in which ecologists will sit alongside lawyers in campaign planning staffs and air targeting cells to offer advice or direction on the potential harm likely to be caused in specific missions. Their expertise in helping air planners to minimise harm to the very people they are trying to support should be welcomed, not feared. The moral shift away from old-fashioned concepts of collective responsibility, in which populations are punished or permitted to suffer harm because of the actions of their governments, as well as the strengthening of international legal protections of civilians, greatly increases the onus upon air planners to minimise every

form of so-called collateral damage.

I disagree with some ethicists and lawyers who argue that, because of the likely release of “dangerous forces,” attacks on oil and petrochemical installations should be prohibited in the same ways that dams, dykes and nuclear generators are prohibited under the provisions of Article 56 of Additional Protocol I. Because meticulously planned and very precise attacks on oil targets need not cause “severe losses among the civilian population,” as defined by Article 56, I cannot accept the position that air planners must *never* target oil or petrochemical installations. When balancing competing priorities, particularly when a patient’s life is threatened, even the most compassionate of physicians may judge it necessary to dispense a treatment - chemotherapy, for example - that will kill peripheral healthy cells even as it targets the source of the threat to life. Of course, no doctor would prescribe these terrible treatments unless the patient’s illness was grave. Likewise, continuing with this analogy, the implementation of any significant environmentally risky or destructive measures should only be contemplated in military contexts involving tremendous need such as tipping-point moments in struggles of national survival. Ethicist Michael Walzer argues that during such “supreme emergencies,” a fear exists beyond the ordinary fearfulness of war, caused by dangers beyond the ordinary dangers of war (he means the imminence of defeat and enslavement⁵⁹), and that such fear and danger may well require extreme measures that override ethical norms and even contravene law.⁶⁰

NATO made a reasonable case in 1999 that the world community should not tolerate Serbian maltreatment of Kosovars. It represented a grave affront to the West’s core values. Yet the scale of ethnic violence, while sufficiently distressing to merit efforts to end it, did not constitute enough of a grievance - let alone anything close to a “supreme emergency” - in order to warrant the scale of violence of the armed intervention by NATO that inadvertently posed serious health risks to both Serbian and Kosovar civilian populations and caused much short-term and at least some long-term harm to the Balkans environment and its ecosystems.

Even without the gravity of the disputed issues of legality and morality, NATO’s destruction of Yugoslavian oil infrastructure did not even accord with sound military strategising. Planners who target an enemy’s cardinal energy systems must know that, with the exception of electricity which can be quickly interrupted, it will take a relatively long time for the desired effects of a counter-oil campaign to kick in. Destroying petrochemical installations and refineries and storage facilities will inevitably reduce the enemy’s ability to operate its armed forces effectively, but it will not do so swiftly, much less immediately, especially if the armed forces are (as Yugoslavia’s were) adaptable, lying low and not engaged in significant fuel-consuming movements or manoeuvres. Destroying enough oil infrastructure to paralyse armed forces will necessitate a massive and focused attack, or a lengthy and constant series of attacks. Even after seventy-eight days of increasingly powerful attacks, NATO had only

destroyed around forty percent of Serbia's military fuel stocks.⁶¹ Whilst a counter-oil strategy might superficially seem eminently sensible for campaigns predicted to be protracted - and my view is that any such campaigns should be undertaken only with tremendous care, proportionality, precision and thought for the future - it is not an especially useful *modus operandi* for brief coercive strikes, particularly those with humanitarian goals.

We should not forget that the NATO planners intended Operation Allied Force to be a short and sharp *coercive* mission along the lines of Operation Desert Fox in December 1998. Indeed, Kenneth Bacon, the Pentagon's regular spokesman, announced on the eve of the first strikes on Serbia: "we have plans for a swift and severe air campaign."⁶² Likewise, Secretary of State Madeleine Albright herself stated on 24 March 1999: "I don't see this as a long-term operation. I think it is achievable within a relatively short period of time."⁶³ The fact that Operation Allied Force lasted seventy-eight days cannot disguise the fact that it was intended to coerce Milošević into changing his mind on the violence in Kosovo within two or three days. As Tom DeLay, the United States House Majority Whip, commented one-third of the way through the campaign, "the Secretary of State, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff told us that this was no big deal, that we were going to bomb for a couple of days, 48 hours, and then stop bombing, and Milošević would come to the table".⁶⁴ Permanent destruction of oil refinement and storage facilities and other chemical works was thus at odds with the

original rationale of the mission, and makes little sense unless one attributes to NATO air planners a recognition some time in April - as I do - that their coercive strategy had failed and that the campaign had changed from coercion to denial and then to punishment.⁶⁵

Moreover, astute and politically smart strategists and planners might want to reflect on the likelihood that in today's ecologically aware world, massive or sustained attacks on petrochemical installations - especially on their tank farms, which will cause sizeable poisonous spills and huge toxic fires - will generate politically destabilising arguments about proportionality, and thus the operation's justice. Refuting any public allegations over proportionality is not something a military wants to find itself having to do. It will have few objective and easily understandable criteria upon which to build a defence. The Just War concept of proportionality pertaining to non-combatants is complex and not helpfully defined in international humanitarian law. The legal explanation of proportionality is codified in Articles 51.5(b) and 57.2(a)(iii) of Additional Protocol I, which states that it is prohibited for the military to engage in any action "which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated."⁶⁶ A breach nowadays constitutes a war crime under the Statute of the International Criminal Court.⁶⁷ Unhelpful ambiguity exists on how anyone can objectively determine when an attack crosses the threshold and becomes

“excessive” (it is a comparative concept, not a measurable absolute concept) and how anyone can compare and evaluate such dissimilar values as civilian harm and military gain. Yet the consensus view and the *jus in bello* norm is, that when they wage war on combatants and military objects, military forces must act painstakingly, deliberately and carefully to ensure that civilians must suffer no more harm than military necessity demands. Suggesting that the drafters of Additional Protocol I also meant ensuring that the quality and habitability of the environment is not degraded would be hyperbolic. The environmental movement was far less motivated, powerful and ubiquitous in 1977 than it is now. Yet it is not unreasonable to foresee that (as I believe and recommend) a strengthening of both ethical and legal definitions will come to include these concepts.⁶⁸

Tightening legislation is necessary. Opponents of any attacks that purportedly cause environmental harm and who desire to see prosecutions made against the perpetrators are currently not helped by the ambiguity of the wording in Additional Protocol I which prohibits “widespread, long-term and severe damage to the natural environment,” regardless of the military objective.⁶⁹ The problem with this prohibition, of course, is that currently it is almost impossible to measure the threshold in specific and objective terms. Moreover, the adjectives “widespread, long-term and severe” are joined by the conjunction “and,” which means that it is a cumulative triple standard that needs to be fulfilled. In other words, even an attack on a petrochemical plant that caused

widespread and horrific ecological harm might fail to meet this standard unless critics could demonstrate that its effects could also be measured in years, if not decades.⁷⁰

Some critics of environmental degradation caused by air attacks have attempted to reduce this time-scale by drawing upon the 1977 Convention on the Prohibition of Military or Any Other Hostile Use of the Environmental Modification Techniques (ENMOD), written as a consequence of widespread criticism of the disastrous US defoliation programme in Vietnam. The ENMOD came into force in 1978 and was ratified by the US in 1980.⁷¹ The ENMOD bans “military or any other hostile use of environmental modification techniques having *widespread, long lasting or severe* effects as a means of destruction, damage or injury to any other State Party” (emphasis added).⁷² The Conference of the Committee on Disarmament defined these terms for the purpose of the ENMOD treaty in an Understanding Regarding the Convention:

- a) ‘widespread’: encompassing an area on the scale of several hundred square kilometers;
- b) ‘long-lasting’: lasting for a period of months, or approximately a season;
- c) ‘severe’: involving serious or significant disruption or harm to human life, natural and economic resources or other assets.

Interestingly, the three criteria mentioned in the ENMOD are joined by the conjunction “or,” rather than the “and” of Additional

Protocol I, meaning that it may not be necessary to fulfil a cumulative standard. Moreover, the Committee on Disarmament's explanation that "long-lasting" might mean "a period of months, or approximately a season," seems to suggest a more readily defined and reasonable threshold that would make prosecutions for environmental harm during wartime more likely. Indeed, if these criteria were applied to NATO's targeting selection process, the worst of the aforementioned attacks on petrochemical installations in Serbia, especially the destruction of Pančevo, might have been prohibited. Aaron Schwabach, an American law professor who has written extensively on the NATO campaign, concluded that it seemed "likely" that the damage at Pančevo would meet "at least one of these requirements."⁷⁴ Unfortunately for critics of NATO's war, the ENMOD's prohibitions do not automatically include all attacks leading to environmental harm, but only those activities undertaken in order deliberately to manipulate the environment's natural processes (by changing weather patterns or widespread defoliation, for example). Even more unhelpfully for those who seek to minimise environmental harm during wartime, the Committee on Disarmament's definition was not intended as a definition of Additional Protocol I (in addition to the ENMOD) and it is not even formally incorporated into the terms of the ENMOD. In other words, the definition actually serves to confuse matters, not to clarify them.

Given this lack of clarity over time-scales, making a compelling legal case that a state had committed

excessive harm to the environment is always going to be highly problematic immediately after the cessation of any hostilities, at least without new laws or a strengthening of existing laws. Compounding this problem is the fact that demonstrable, as opposed to merely threatened or even likely, human health problems (unusual cancers, for example) or damage to ecosystems may take years to appear and, within contexts in which little baseline public health and environmental information exists, may never be easy to measure, let alone place within an objective and provable analysis of causation. The emotions surrounding warfare, with inevitable finger-pointing from both sides, also make this type of analysis particularly problematic.

This was precisely the problem that Yugoslavia and various NGOs faced when they tried to bring a case against NATO before the International Criminal Tribunal for the Former Yugoslavia. To the dismay of many international legal experts and human rights groups, who accused her of accepting unbalanced evidence in favour of NATO⁷⁵, Carla Del Ponte, the ICTY Prosecutor, informed the United Nations Security Council on 2 June 2000 that she had decided not to open a criminal investigation into any aspects of NATO's 1999 air campaign.⁷⁶ She specified that although NATO undoubtedly made mistakes, she felt "satisfied that there was no deliberate targeting of civilians or unlawful military targets by NATO during the campaign". More importantly for the purposes of this article, whilst accepting a finding that NATO had caused "some" damage to the environment, Del

Ponte rejected assertions that the Tribunal should prosecute NATO for causing excessive ecological harm. The main problem was not that the US and France had never ratified the Additional Protocols of 1977 (This was of course true. The US has still not ratified them and France only did in November 2001). Rather, Del Ponte accepted a review committee's finding that the "imprecise" phrasing in Additional Protocol I meant that it was extremely difficult to determine when any attacks during any wars had caused environmental harm exceeding the Protocol's threshold, especially as "long-term" would (despite the ENMOD-related advice) need to be "measured in years rather than months." The committee noted that, whilst it had "led to criticisms by ecologists," the vagueness of the standard meant that, "on the basis of information currently in its possession, the environmental damage caused during the NATO bombing campaign does not meet the Additional Protocol I threshold."⁷⁷ The issue of intent also created a problem:

The requisite mens rea [measure of intent] on the part of a commander would be actual or constructive knowledge as to the grave environmental effects of a military attack; a standard which would be difficult to establish for the purposes of prosecution and which may provide an insufficient basis to prosecute military commanders inflicting environmental harm in the (mistaken) belief that such conduct was warranted by military necessity.⁷⁸

The current vagueness of international humanitarian law is also a problem for critics of air forces that use ordnance that the public consider

extremely ecologically harmful, such as white phosphorus bombs, cluster munitions and depleted uranium (DU) rounds. All three of these ordnance types have undeniably effective military roles when used only against enemy combatants. Yet for different reasons each one causes such highly controversial unintended secondary effects that many people consider *any* use to be reckless. Most environmentalists condemn them all as environmentally harmful. I also tend not to like their usage, especially in close proximity to civilians, but that is mainly because I recognise that the use of any contentious weapons will create destabilising controversy and add to unwanted propaganda battles. Moreover, I am not convinced that an adequate scientific consensus exists to allow me to argue with certainty, for example, that even the 30,000 DU shells fired at 112 locations in and around Kosovo by USAF A-10s caused (or will cause) serious and long-term environmental harm and that DU-contaminated areas should be treated with anything more than the "precautionary approach" recommended by the UN's environmental watchdog organisation.⁷⁹ Science may in time demonstrably undermine the UN's position, and I am mindful that the defoliation of Vietnam by Agent Orange and other defoliants has caused severe human health and environmental harm despite early US beliefs that no long-term harm to humans would occur.⁸⁰

Cluster bombs are different from white phosphorus and depleted uranium shells in that they produce no secondary toxins that can cause chemical actions on life processes that might kill or harm humans,

animals or other living things. Yet they have a worse and more clearly proven influence on the natural environment. Cluster bombs' primary harm comes when widely spread and highly volatile unexploded submunitions cause the death and maiming of innocent people after - sometimes *long* after - the cessation of hostilities. 98 percent of the 11,044 recorded and verified casualties of cluster munitions in recent wars have been civilians.⁸¹ In terms of the environment, cluster munitions have a very deleterious effect. Hundreds of thousands of fearful farmers in modern warzones avoid tilling submunition-contaminated fields, irrigating contaminated groves or orchards and raising livestock on contaminated grasslands. This has a seriously negative impact on local economies and on ecosystems. Cluster munitions also cause health and hygiene problems by creating malnutrition and denying safe access to water. In these ways they cause foreseen but unintended harm similar to, although individually far more lethal than, anti-personnel land mines. During NATO's war on Serbia, USAF and RAF (and a small number of Dutch) aircraft dropped a confirmed minimum of 1,254 cluster bombs in Kosovo (531 by the RAF which mainly targeted fielded forces and their weapons⁸²). They scattered no fewer than 234,123 submunitions.⁸³ With a failure rate calculated at 7.8 percent, this means that NATO left 18,261 unexploded submunitions in or on the ground in Kosovo, none of them having self-destruct fuses. Thankfully, nearly all have now been located and cleared⁸⁴, although 2,500 remain in Serbia proper⁸⁵ and Kosovo's litter of USAF and RAF

cluster submunitions has caused 152 post-war civilian casualties.⁸⁶

Within the first year after the war's end, elements within the British Government were unhappy with the RAF's heavy use of cluster munitions. On 23 May 2000, a Report of the Foreign Affairs Select Committee of the House of Commons concluded: "We recommend that the UK Government consider carefully the experience of the use of cluster bombs in the Kosovo campaign to determine in future conflicts whether they are weapons which pose so great a risk to civilians that they fall foul of the 1977 Protocol and should not be used in areas where civilians live."⁸⁷ Likewise, on 23 October 2000, a Report of the Defence Select Committee of the House of Commons concluded that "our major contribution to the bombing campaign was in the form of unguided cluster bombs - a contribution of limited military value and questionable legitimacy."⁸⁸ It is therefore unfortunate that the RAF used them again (although nowhere as prolifically as the British Army) in Iraq in 2003, alongside the USAF, which had also used them in Afghanistan in and after 2001. Israel's air force, but especially its army, likewise used staggering quantities of cluster munitions in its 2006 campaign against Hezbollah insurgents and terrorists, leaving one million unexploded submunitions across southern Lebanon.⁸⁹ The unintended death and maiming rates of civilians in all three campaigns have been high and regretted and have seemed to undo some of the good that the various air forces and armies were trying hard to achieve.

A widespread western consensus

has quickly emerged that cluster munitions violate the *jus in bello* principles of proportionality and discrimination so grievously that they must be classed as weapons *mala in se*, which means “bad in themselves,” irrespective of any legal prohibitions. The logic framing this consensus is consistent with both international humanitarian law and Just War principles. It argues that, because military forces nowadays can reasonably determine from objective analyses of recent conflicts that almost all cluster bomb victims will be civilians who will suffer death, maiming and environmental harm for many years after their initial use for military purposes, their harm cannot reasonably be balanced against any good achieved.

Modern wars have included many things *mala in se*, such as rape, torture, ethnic cleansing, chemical and biological weapons. Cluster munitions are the most recent addition to this category. In February 2007, forty-six national representatives met in Oslo to endorse a call by Norwegian Foreign Minister Jonas Gahr Støre to conclude a new legally binding instrument that will prohibit the production, stockpiling, transfer and use of cluster munitions and to provide adequate resources to assist survivors and clear contaminated areas. Subsequent International Oslo Process meetings occurred in Peru (May 2007), Austria (December 2007), New Zealand (February 2008), and Ireland (May 2008). 107 countries adopted the treaty text in Dublin and opened a signature process in Oslo on 3 December 2008. The Convention will enter into force six months after thirty states have submitted their Instruments of Ratification to the

Secretary General of the United Nations. Four states have now done so. The United States has neither signed nor ratified the Convention, although in March 2009 President Obama took a highly commendable first step by permanently banning the US sale of all cluster munitions except those (which is a tiny amount) that leave behind less than one percent of their submunitions as duds.⁹⁰ The United Kingdom has gone even further. It responded to the emerging *mala in se* consensus on cluster munitions responsibly and decisively by banning them in three stages; first on 20 March 2007 by withdrawing all of the RAF’s 3,650 RBL755 “dumb” cluster bombs and their 536,550 submunitions as well as the British Army’s 43,200 multiple-launch M26 rockets and their 27,820,800 submunitions; second in May 2008 by withdrawing the remaining Army cluster munitions which had (inadequate) self-destruct fuses; and third in December 2008 by signing the Convention outlawing all cluster ordnance.⁹¹

Even if we accept a *jus in bello* argument that, in any particular conflict a belligerent may foresee but not intentionally cause some environmental harm, we should also accept the *jus post bellum* argument that, after the end of hostilities and the restoration of what we hope will be a better state of peace, the restoration of the quality of life of the effected innocents should occur as fully as swiftly as possible. As the UN explains, this is not only a moral obligation, it is practical part of peacemaking and it nowadays extends to the human habitat and even beyond. “Environmental conditions - from the air that people

breathe and the water they drink, to the ecosystems that support forestry, farming and fishing - have a crucial influence on the success of efforts to rebuild shattered communities and livelihoods. Only by ensuring environmental security can the wider goals of post-conflict reconstruction and human development be sustained."⁹² In the case of the Kosovo Conflict the infrastructural damage was substantial and the environment harm severe in places. Swift remediation was crucial.

The United Nations Environment Programme (UNEP) took the unprecedented step of assuming responsibility for post-war remediation, concluding that "it was evident that, not only had people been through untold pain and suffering, but that the environment had suffered as well."⁹³ It therefore immediately undertook to create a strategy to unite concerned nations in a programme to clean up the worst pollution and contamination in order to minimise long-term risks to Serbs, Kosovars and others. Its own 1999 Task Force, which had identified the four heavily polluted "hot spots" around Pančevo, Kragujevac, Novi Sad and Bor, served as the basis of its feasibility study to define the exact scientific and financial requirements for urgent clean-up projects at those and maybe other locations. In March 2000, clean-up measures for the four worst hot spots featured prominently as priority projects at the funding conference organized under the auspices of the Stability Pact for South-Eastern Europe. By the late summer of 2000, following positive initial responses from many governments, and pledges from several European countries to support

additional activities, the UNEP commenced a major environmental clean-up project at conflict-caused contamination sites in Serbia (including Kosovo). Over the next four years the UNEP mitigation and remediation project helped to secure fresh drinking water, remediated contaminated soil and groundwater, removed and treated scores of tonnes of extremely hazardous chemicals and waste, rehabilitated wastewater treatment capacities, installed environmental monitoring stations and strengthened national and local environmental management capacities.

Donor countries had pledged a total of twenty million dollars, but several reneged altogether or reduced their contributions. The UNEP had to make do with twelve million dollars and could not do everything it had wanted.⁹⁴ Its efforts nonetheless made a highly positive difference. After four years of intense industrial site, soil, and groundwater remediation work at the worst sites, the UNEP announced in May 2004 that, while the clean-up programmes had only addressed the most urgent issues, they had made such substantial progress with them that the ecological "hot spots" no longer warranted that label and that the programmes could be turned over to the Serbian government.⁹⁵ There was, and still is, much work left to Serbia to do before anyone can reasonably conclude that all environmental damage has been entirely negated.

It has now been ten years since NATO air power destroyed Serbian refineries and petrochemical installations and five since the UNEP ended its partial environmental clean-up campaign.

Yet Serbia is still deeply troubled by NATO's ostensible disregard of ecological responsibility. Unusually higher cancer rates, for instance, are still attributed to the effects of NATO's bombing campaign and even to its use of depleted uranium.⁹⁶ Establishing the verity of such claims is beyond my professional expertise, and might not even be possible for an oncologist or a public health expert, because of a lack of both baseline evidence and objective thorough studies and because of Serbia's continuing poor record of industrial pollution.⁹⁷

Conclusions

This study has demonstrated that modern air power has unequalled capacity for destructiveness within the human habitat and interrelated ecosystems of an opponent's state. Traditional target sets *still* include a lot of industrial plants and infrastructure that contain highly toxic and carcinogenic chemicals which can, if discharged through attacks, cause severe damage to the natural environment and its flora and fauna, not to mention human health. Any such environmental harm nowadays has far greater potential for causing destabilising controversy within the environmentally aware public than ever hitherto. Existing international humanitarian law is not yet adequate to discourage protagonists during the heat of war from attacking some things that perhaps should only be targeted under unique circumstances, with extraordinary care and after weighing potential wider implications. Existing conventions should be strengthened or new laws created. Yet the *jus in bello* concepts of proportionality and

discrimination embedded within our Just War code already *are* - or would be if more widely understood - an eminently reasonable basis for constraining the injudicious use of force against objects that have the potential for environmental harm. Western warriors already conceptualise their use of violence in terms of minimising suffering while doing good, all the while protecting the innocent, including the opponent's. It is a short and easy step of logic that they should understand the importance of minimising harm to the habitat of the innocent. It is equally logical that, as the purpose of armed violence should always be a better state of peace, warriors will want to avoid inflicting damage upon the innocents within the opposing state, and possibly within the wider region, that might last well beyond the end of conflict and therefore complicate the restoration of lasting peace. One of the lessons we should learn from the Kosovo Conflict - indeed, from Afghanistan, Iraq and Lebanon as well - is that most military commanders and planners are not adequately familiar with the key environmental sciences and are therefore not best placed to foresee all *unwanted* consequence as they plan operations and missions in order to achieve wanted effects. The inclusion of ecologists alongside lawyers in campaign planning staffs and air targeting cells to offer advice or direction on the potential harm likely to be caused in specific missions will at least partially strengthen the way that environmental factors can be "brought in from the cold". Their expertise in helping planners to minimise harm to the very people they are trying to support should be

welcomed, not considered intrusive.

Notes

¹ Dr Joel Hayward is Dean of the Royal Air Force College. He is also Head of Air Power Studies at King's College London and a Director of the Royal Air Force Centre for Air Power Studies. He has written extensively on air power and teaches and lectures widely throughout Europe.

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⁴⁰ *Ibid.*, p. 47.

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⁴³ According to the *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia*, NATO's campaign killed 495 civilians and wounded a further 820 (§ V (53)).

⁴⁴ For an example of Gorbachev's concerns, see his article, "Poison in the Air: The Environmental Cost of the Kosovo Conflict must be Exposed," *Guardian*, 18 June 1999. A trawl of

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⁴⁵ Andrew J. Bacevich and Eliot A. Cohen, eds., *War Over Kosovo: Politics and Strategy in a Global Age* (New York: Columbia University Press, 2001), p. 15.

⁴⁶ *Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict: Preliminary Findings*, op. cit.

⁴⁷ *Ibid.*, Executive Summary (no p. no.).

⁴⁸ *The Kosovo Conflict: Consequences for the Environment and Human Settlements*, pp. 9, 11.

⁴⁹ See Claude Morgan, "Collateral Damage of the Environmental Kind". In her 2000 paper, "Ecological and Health Consequences of the NATO Bombings of Pancevo and other Petrochemical and Chemical Industrial Complexes," now available on various internet sites, the late Dr Janet M. Eaton, a Canadian biologist and activist, typified these critics: The Task Force, "although composed of many expert scientists from around the world, was very limited in duration, lacked breadth and scope, failed to have within its mandate assessment of the impact on human health and lacked the cooperation of NATO authorities to either locate or assess the impact of depleted uranium weapons in spite of widespread concern and warnings about the ecological and health implications."

⁵⁰ World Wide Fund for Nature's

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⁵⁴ Gopal and Deller, *Precision Bombing, Widespread Harm*, op. cit.

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⁵⁶ *Ibid.*, p. 86.

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⁵⁸ Alex J. Bellamy, *Just Wars: From Cicero to Iraq* (Cambridge: Polity, 2006), p. 213.

⁵⁹ See Brian Orend, "Is there a Supreme Emergency Exemption?" in Mark Evans, ed., *Just War Theory: A Reappraisal* (Edinburgh University Press, 2005), pp. 134-153.

⁶⁰ Michael Walzer, *Just and Unjust Wars: A Moral Argument with Historical Illustrations* (1977. Basic Books ed. 2000), pp. 251-262.

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⁶² See my own, "NATO's War in the Balkans," op. cit., p. 2.

⁶³ *Ibid.*

⁶⁴ *Ibid.*, p. 3. See also Ivo H. Daalder and Michael E. O'Hanlan, *Winning Ugly: NATO's War to Save Kosovo* (Washington DC: The Brookings Institution, 2000), pp. 91-93, 209. Dag Henriksen, *NATO's Gamble: Combining Diplomacy and Airpower in the Kosovo Crisis 1998-1999* (Annapolis: Naval

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⁶⁶ Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), Article 51 (5)(b) and Article 57 (2)(b).

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⁷⁰ *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia* (§ I (15)). Austin and Bruch, *Environmental Consequences of War*, p. 652.

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‘Executive Fuller!’ - The Royal Air Force and the Channel Dash

By Gp Capt Alistair Byford

In February 1942, the *Wehrmacht* executed a well-planned and highly effective joint air-sea operation to transfer a powerful battle squadron from Brest to Wilhelmshaven in what became known as the ‘Channel Dash’. Although this was a relatively minor action, it resonated strongly across the levels of warfare: for the Germans, it was a tactical success, but ultimately a strategic failure, while for the British, it was a minor tactical embarrassment that was inflated by the context of other events into a direct threat to the survival of Churchill’s government at the grand strategic level. This paper provides an analysis of the RAF’s participation in the Channel Dash and identifies the key points of failure: these include structure, in terms of the poor organisation of the system of command, and agency, particularly in the characters of the most important personalities involved. Other important themes emerge: at a time of intense focus on air-land integration, the Channel Dash illustrates that empathy and understanding is also required to make air-maritime operations work, while the need to balance operational security against the requirement for absolute clarity of communication in high-tempo military actions is also prominent.



*The Channel Dash.*¹

'Their pilots fought bravely, tenaciously and untiringly, but they were sent into action with insufficient planning, without a clear concept of attack, without a centre of gravity and without systematic tactics'.

Adolf Galland²

Introduction

In February 1942, the German *Wehrmacht* mounted an audacious air-sea operation to transfer a powerful *Kriegsmarine* battle-squadron through the English Channel from Brest, on France's Atlantic coast, to the apparent safety of Wilhelmshaven in Germany. The break-out of the battlecruisers *Scharnhorst* and *Gneisenau* and the heavy cruiser *Prinz Eugen* was given the codename *Cerberus* by the Germans;³ to the British, it became known as the 'Channel Dash', a public relations disaster that was hugely

damaging to the reputation of both the government and the armed forces. Despite clear intelligence that a major operation was imminent, the German ships remained undetected for fourteen hours after leaving harbour and were subsequently able to brush off a series of gallant, but ineffectual, British attacks with dismissive ease. *The Times* characterized this as the greatest national humiliation since the Dutch burned the fleet at Chatham in 1667;⁴ certainly, it was the first time a hostile naval force of any significance had entered the Channel since the Spanish Armada. However, like many *Wehrmacht* operations, *Cerberus* was a tactical success but a strategic failure, as the battlecruisers were a far greater threat to the Atlantic supply-lines at Brest than at Wilhelmshaven, where the concentration of all of the *Kriegsmarine's* capital units at one location also made the task

of containment and eventual destruction far easier for the Royal Air Force (RAF) and Royal Navy (RN). Nevertheless, Britain's failure to act decisively in waters that it considered its own was a huge embarrassment; in conjunction with the fall of Singapore just two days later, the Channel Dash arguably marked the nadir of Britain's military fortunes in the Second War, calling into question the competence of Churchill's administration and providing a striking example of how tactical actions may have strategic, and even grand-strategic implications.

The Channel Dash has considerable contemporary relevance. First, it is a timely reminder during a period of intense focus on air-land integration that air-sea cooperation also cannot be taken for granted; it demonstrates that *ad hoc* coordination is rarely successful and effective results will only be achieved through empathy and understanding developed over time. It also raises important issues of command and control, the effective coordination of operations within a joint framework and, particularly, the balance between operational security and the clarity of communication required to enable mission command and effective decentralized execution in fast-moving, high-tempo operations.

Strategic Direction - Hitler's Decision

On 23 March 1941, the *Scharnhorst* and *Gneisenau* docked at Brest at the conclusion of Operation *Berlin*, a three-month cruise during which the two battlecruisers had sailed 17,800 miles and sunk or captured twenty-two merchantmen, illustrating in stark terms the threat that these powerful

vessels posed to the Atlantic convoys. They were joined on 1 June 1941 by *Prinz Eugen*, which had escaped to Brest after her consort, the battleship *Bismarck*, was sunk on 27 May. A comprehensive range of active and passive anti-aircraft measures were implemented at the port to protect the ships from bombing, including sophisticated camouflage and concealment techniques, an intense concentration of anti-aircraft guns and a highly effective smoke-screen system.⁵ Nevertheless, the RAF mounted repeated raids over the next nine months, dropping 3,413 tons of bombs and inflicting significant damage on all three ships, albeit at the cost of 127 aircraft. *Prinz Eugen* received a direct hit which killed sixty of her crew, while the *Scharnhorst* and *Gneisenau* were put out of commission for four months and six months respectively, the latter as a result of an extremely gallant torpedo attack executed by a Coastal Command Beaufort, the pilot, Flight Lieutenant Kenneth Campbell, being awarded a posthumous Victoria Cross.

The constant raids persuaded the German high command that it would only be a matter of time before the RAF was able to sink the vessels, especially as Hermann Goering, the head of the *Luftwaffe*, refused to sanction any increase in fighter cover. Although he cited the *Luftwaffe's* commitments on the newly opened Eastern Front in mitigation, he was probably motivated by his fierce inter-service rivalry with *Gross-Admiral Raeder*, the *Kriegsmarine* commander. Meanwhile, Hitler was fixated on the illusory threat of a British invasion of Norway, so the danger posed by the RAF's bombing raids only added

to his growing conviction that the battlecruisers must be brought back to Germany as soon as they were seaworthy, so that they could be defended more easily and would be available for redeployment into Scandinavian waters if necessary. Consequently, Hitler ordered the ships to evacuate Brest at a conference at his Rastenberg Headquarters on 12 January, comparing the battle squadron to 'a patient with cancer who is doomed unless he submits to an operation'.⁶

Once Hitler had made this decision, two courses of action were available. The *Kriegsmarine* preferred to route the squadron out into the Atlantic to take the Denmark Strait passage, well to the north of Great Britain, but there was also the option to use the short - but apparently much more dangerous - direct route through the English Channel. Hitler chose the bold alternative with little hesitation. Although this was partly because he was concerned that the Brest squadron might not be capable of an extended Atlantic passage after being bottled-up in harbour for a protracted period of time, his decision was largely based on intuition. Drawing on previous experience, Hitler believed that if the British high command was taken by surprise, it would lack the agility to act decisively in response to a rapidly changing situation;⁷ he felt that if he seized the initiative he could operate within his opponent's decision cycle, and events were to prove that he was absolutely right.⁸ Naval Command West, under Admiral Alfred Saalwächter, was directed to plan the operation; execution would fall to Vice-Admiral Otto Ciliax, flying his flag on *Scharnhorst*.



British commanders: Air Vice-Marshal 'Jack' Baldwin, acting Commander-in-Chief Bomber Command (left), Air Vice-Marshal Trafford Leigh-Mallory, Air Officer Commanding-in-Chief No.11 Group, Fighter Command (centre) and Vice-Admiral Bertram Ramsey, Flag Officer Dover (right).⁹

Operational Planning - the British Approach

British contingency planning to prevent a break-out began as soon as the ships' arrival at Brest was confirmed by photographic reconnaissance on 28 March 1941. It was quickly apparent that responsibility for enforcing a blockade would fall mainly to the RAF, because of the RN's pressing commitments elsewhere. Capital ship cover had to be maintained at Scapa Flow, in case of a raid by German heavy units (primarily the battleship *Bismarck*) into the Atlantic via the North Sea; and battleship escorts were also needed to protect the 'WS' convoys sailing to the Middle East with reinforcements for the 8th Army, as these were vulnerable to the Brest squadron as they routed through the Bay of Biscay. The sinking of the *Bismarck* did not materially affect the operational calculus, because her sister-ship, the *Tirpitz*, was about to be commissioned at Wilhelmshaven, so the RN was still faced with geographically separate threats from capital ships to both the north and west. This meant that it had to split its heavy units to cover both eventualities and only light surface forces - the destroyers and Motor Torpedo Boats

(MTBs) commanded by the Flag Officer Dover, Vice-Admiral Sir Bertram Ramsey – would be available to contest a German force in the Channel. As Ramsey's command was likely to be totally overmatched by the German squadron and its attendant flotillas of escorting destroyers and E-boats,¹⁰ a coordinated joint operation maximising the use of air power represented the only realistic means of destroying or crippling any of the German ships.

The recent loss of 'Force Z' (the battleship *Prince of Wales* and battlecruiser *Repulse*) to Japanese air attack off the coast of Malaya had reinforced the Admiralty's opinion that it could not risk battleships in the Channel in the teeth of German air power; conversely, it also heightened expectations about what the RAF might achieve against German capital units, although the circumstances were very different. Whereas the Japanese had employed a specialist wing (the 'Genzan' air group) trained and equipped in anti-shiping techniques to attack ships with weak anti-aircraft defences in conditions of total air superiority and excellent weather, the RAF would have to attack with whatever aircraft and crews could be made available, in poor winter weather, against modern ships that were much better armed and would be heavily defended by a thick screen of highly capable fighter aircraft. However, the transparent weakness of Ramsey's naval forces meant that air power was still the most potentially lethal form of attack available, so the Air Staff took the planning lead for the operation to stop the *Scharnhorst* and *Gneisenau*. This was given the codename *Fuller*: activation would be implemented by

the order '*Executive Fuller*'.¹¹

The production of a properly integrated air plan proved to be problematic, however, because no RAF officer was given overall responsibility for the operation and the three commands involved – Bomber, Fighter and Coastal – 'were virtually autonomous within their own spheres',¹² a legacy of the decision that had been made in 1936 to structure the RAF into single-role commands. This had proved to be a useful means of organizing pre-war expansion and enabled Fighter Command to provide an effective air defence of Great Britain (notably in the Battle of Britain) and Bomber Command to conduct its own strategic offensive - but these campaigns were both a linked series of isolated, single-role operations. There were continual difficulties whenever the commands were required to act together in any joint endeavour requiring a broad spectrum of air power capabilities. In contrast to the RAF system of mono-functional commands, the *Luftwaffe* was divided into multi-role *Luftflotte* or air fleets, which meant that properly integrating a coordinated air effort was far less challenging: the *Luftwaffe's* contribution to Operation *Cerberus*, for example, was provided by *Generalfeldmarschal* Hugo Sperrle's *Luftflotte 3*, which included all of the necessary air assets as integral elements of its own order of battle, including bombers, single and twin-engined fighters, and reconnaissance, 'sea-service' and electronic warfare aircraft.

British air planning was also hindered by excessive secrecy. Only a very few senior officers in each command were

allowed to know what *Fuller* meant and this had a profound affect on the RAF's speed of response when the operation was activated, as these men could not always be located quickly enough to issue the appropriate orders and brief what was required. The result was that many of the aircrew involved had no knowledge of their mission, even after being ordered into the air.¹³ With only sketchy information available, British air operations were characterized by misunderstandings and a piecemeal application of the air effort, as the true significance of events was unclear to most of the participants.

It was expected that the main onus for stopping the German ships would fall to Coastal Command, as Bomber Command was neither trained nor equipped to attack moving targets at sea. Coastal Command possessed three squadrons of relatively modern and capable Beaufort torpedo-bombers specialized exactly for this task;¹⁴ it was anticipated that these would execute a concentrated attack to saturate the defences, protected by a heavy fighter escort. In the event, a failure to coordinate the movement of the squadrons, poor weather (there was widespread snowfall in February 1942) and a logistics catastrophe - one squadron arrived without some of its torpedoes - meant that the planned, three-squadron attack degenerated into 'a series of uncoordinated raids by aircraft in ones and twos, spread over three hours in steadily worsening weather conditions'.¹⁵ Coastal Command's other role was to provide a dusk to dawn reconnaissance screen to provide early warning of any German movements, centred on three patrol lines in the central and western Channel: 'Stopper', 'Line

SE' and 'Habo'. Hudson aircraft equipped with Air-to-Surface Vessel (ASV) radar were nominated for this task. As these would be vulnerable to German fighters when operating close to enemy territory in daylight, Fighter Command was allocated the visual maritime reconnaissance mission in what were known as 'Jim Crow' patrols, but these were not expected to be significant, as it was thought that the Germans were unlikely to risk a passage of the Channel in daylight. This preconception was reinforced by an otherwise highly prescient intelligence appreciation submitted by the Admiralty on 3 February, which accurately predicted that a German operation was imminent and that the selected route would be up the Channel - but in the hours of darkness.

In the event of a break-out, Bomber Command had been directed by the Air Ministry to attack the ships 'to the maximum practical effect'. As a result of the Admiralty's intelligence appreciation, 300 bombers were allocated to Operation *Fuller* on 4 February, to be held at two hours' notice. This represented the core of Bomber Command's available frontline force, meaning that major raids on Germany had to be suspended. Bomber Command was in a very difficult position during this period, as it was still struggling to establish itself as a viable force capable of inflicting real damage on the enemy heartland. Losses had been very heavy in return for indifferent results and the Air Officer Commanding-in-Chief (AOC-in-C), Sir Richard Peirse, had been replaced after ordering a particularly disastrous raid in very poor weather on the night of 7/8 November 1941.¹⁶

The acting AOC-in-C, Air Vice-Marshall 'Jack' Baldwin, was therefore eager to underscore the command's worth while acting as its caretaker, pending the arrival in post of the new chief, Air Marshal Sir Arthur 'Bomber' Harris. Baldwin felt that this was much more likely to be achieved by continuing with raids on area targets in Germany rather than through a putative attack on a heavily defended naval battle-squadron manoeuvring at speed, where the chances of achieving any sort of success were slim. At his instigation, the Air Ministry approached the Admiralty on 8 February to suggest that the bomber force allocated to *Fuller* should be released. The Admiralty's response was robust: it was convinced that a German breakout was imminent and reaffirmed its opinion that the destruction of the *Scharnhorst* and *Gneisenau* would be far more significant, in terms of the overall course of the war, than a few extra bombing raids on Germany. This assessment was passed back to Bomber Command by the Air Ministry, but Baldwin decided unilaterally to withdraw 200 aircraft from the *Fuller* commitment and put the remaining 100 bombers (of No.5 Group) back to normal (four hours) stand-by. Moreover, he did not inform the Air Ministry, the RN, or the other RAF commands of this decision. The result was that although Bomber Command would eventually mount a significant effort against the German ships, the first aircraft could not be made ready until three hours after the *Executive Fuller* order was received towards noon, so the attacks had to be prosecuted after the weather had deteriorated and dusk was falling. Had the bombers been able to attack

even an hour earlier, some may well have found the *Scharnhorst* when she was stationary and vulnerable following a mine-strike at 14.31 hours.

Fighter Command's main contribution to *Fuller* would be the responsibility of No.11 Group, led by Air-Vice Marshal Trafford Leigh-Mallory. Its role, apart from providing the 'Jim Crow' patrols, was to provide fighter cover for all other air and naval operations.¹⁷ A direct telephone link was established between No. 11 Group's headquarters at Uxbridge and the naval command at Dover Castle to facilitate cooperation, but events were to prove that inter-service and even inter-command integration was poor, although this was more a function of organization and culture rather than the mechanics of the communications set-up. Fighter Command was also faced with a qualitative challenge: the 'F' model of the *Luftwaffe's* Messerschmitt Bf 109 was at least comparable with its best fighter, the Spitfire Mark V, while the Focke Wulf Fw 190 was superior in all respects. Both German types had a clear advantage over the Hurricanes and twin-engined Whirlwinds that were also fielded by Fighter Command.



*The German operational commanders: Vice-Admiral Otto Ciliax (right), was the German naval commander. He was not a popular officer, unlike the flamboyant air commander, 'Dolfo' Galland, General der Jagdflieger (left). In November 1942, Galland would become the youngest general in the Wehrmacht at the age of 30.*¹⁸

The Effectiveness of German Joint Planning

The plan for Operation *Cerberus* demonstrated that the *Wehrmacht* was still capable of operational excellence, despite the shortcomings in Germany's strategic direction of the war effort. The most important decision was to leave Brest in darkness and risk running the Channel in daylight, the planners calculating – quite correctly – that achieving surprise in the departure phase was more important than the risks involved later, on the basis that the *Luftwaffe* would be able to beat off any subsequent daylight air and surface attacks. Essentially, the plan was to seize the initiative at the outset and set a tempo that the British could not match.

This put much of the responsibility for success onto the shoulders of the designated air commander, *Oberst* Adolf Galland, the flamboyant fighter ace and youthful *General der Jagdflieger*. He admitted to Hitler that he would need 'complete surprise and a little luck into the bargain' to see the operation through, but he was also determined to make his own luck.¹⁹ Despite the high-level antipathy and in-fighting between the two Service chiefs, Goering and Raeder, Galland was determined to foster the closest possible level of understanding with his naval counterparts at the operational level and in the event, 'coordination worked without friction'.²⁰ His air plan was codenamed *Donnerkeil* ('Thunderbolt') and was executed from headquarters at Caen and Le Touquet in France and Schipol in the Netherlands, with control being transferred from one to the other as the ships passed *en*

route. This was a maximum effort for the *Luftwaffe*; twelve aircraft from the Fighter Training School at Paris were even included in the total of 250 day and thirty night fighters put at Galland's disposal. He planned to provide constant cover over the fleet by cycling squadrons through the task. A standing air patrol would employ a minimum of sixteen fighters at any one time, increasing to up to thirty-two fighters during the periods of squadron relief, which amounted to ten minutes in every half hour. Additionally, on-call reserve squadrons were available at four bases along the route, in case the scale of British air attack threatened to overwhelm the defences. After dusk, standing cover would be limited to two night fighters at any one time, to ensure deconfliction and effective radar control.

Galland provided crystal-clear direction to his pilots, who would all be expected to fly at least four sorties on the day of the operation. Success would not be measured by numbers of enemy aircraft shot down, but solely in terms of the level of protection provided for the warships. Consequently, RAF aircraft leaving the target area were to be avoided, but attacking aircraft were to be engaged at all costs – if necessary, through ramming.²¹ Galland delegated one of his senior subordinates, *Oberst* Hans Ibel, to sail with the squadron as the *Jafü*, or on-scene fighter controller, and the *Luftwaffe's* own short-wave radio equipment was installed on all of the ships to guarantee seamless air-sea communication. In contrast to the ambiguous British command structure, Galland was empowered by the authority of a 'Führer Order' to take control of all air assets

participating in *Donnerkeil*, including the bomber force, which was retained at readiness throughout the operation to counter any prospective movement south by British naval units. Finally, to ensure that the complex choreography required would work in practice, 450 sorties were flown between 22 January and 10 February in an elaborate mission rehearsal exercise known - somewhat optimistically - as 'The Beginning of Spring'.²²

Other elements of the German plan displayed the same meticulous attention to detail. British coastal radar would have to be jammed if tactical surprise was to be retained, but a sudden increase in jamming would, in itself, alert the British. Consequently, General Martini, the *Luftwaffe's* Director of Communications, carefully raised the level of jamming over a two-week period, subtly increasing the duration and intensity to desensitize the British operators over time. This was highly effective: the heavy jamming from the *Luftwaffe's* coastal stations, supplemented by two specialist Heinkel He 111 electronic warfare aircraft, was successful in masking the movement of the German ships on the day of operation, while British watch officers who expressed suspicion at the higher than usual level of electronic noise were branded as 'scaremongers'.²³

No detail was too small to be overlooked: additional light *flak* guns manned by *Luftwaffe* gunners were placed on the decks of the ships in extemporized mountings to increase the volume of anti-aircraft fire, and a mine-sweeping schedule was arranged at night and conducted in

sections, so that no pattern or swept route was readily apparent. Finally, as the Germans were fully aware that the British ran French intelligence agents in Brest, an elaborate deception operation was mounted to indicate that the squadron would break-out west for a destination in the South Atlantic; rumours were spread around town to that effect, tropical helmets were ostentatiously brought on board and French dockers were tasked to load oil barrels clearly marked 'for use in the tropics only'.²⁴

Tactical Actions - The Break-out

Following a two-hour delay imposed by another RAF raid, Operation *Cerberus* commenced when the German fleet slipped its moorings at 21.15 hours on the night of 11 February. Galland had acknowledged the role of luck in military operations regardless of the thoroughness of planning, and the Germans squadron immediately experienced a huge and unpredictable slice of good fortune when a mixture of bad management and unreliable equipment allowed it to pass through all three Coastal Command patrol lines without being detected. 'Stopper' was unmanned for three hours when its Hudson had to return to its base at RAF St. Eval in Cornwall after being damaged by a German night-fighter. A spare aircraft was available, but its ASV was unserviceable - later found to be a result of a blown fuse - and the second replacement Hudson failed to start, this time because of a damp sparking plug. The crew eventually managed to find a serviceable aircraft and arrived on station at 22.38 hours, but by this time the German squadron had already passed the patrol line. The Hudson at 'Line SE'

also had a problem with its ASV. After ninety minutes, the crew broke radio silence to report the fault and was ordered to back to base, but no replacement cover was provided. Finally, the station commander at RAF Thorney Island, near Portsmouth, ordered the Hudson covering 'Habo' to recover early, as he was concerned that mist on the airfield might turn to fog and make landing difficult. The Hudson duly left its station at 06.15 hours, just as the German squadron was approaching the point where it would have come within the 30-mile range of the aircraft's ASV.



A Lockheed Hudson maritime patrol aircraft of Coastal Command pictured in a contemporary edition of 'Flight Magazine'.

What was as damaging as Coastal Command's inability to detect the warships was its subsequent failure to inform Flag Officer Dover - and the other RAF commands - of the extent to which its patrol coverage had been compromised. Consequently, all of the commanders assumed that the German squadron was still in harbour and the forces allocated to *Fuller* were stood down to normal readiness. At this stage, the German squadron had already been at sea for over ten hours and had steamed some 300 miles.

The first real indication of something unusual was when RAF radar-operators noticed the high level of German air activity over the Channel, even though the effective German electronic noise-jamming was still masking the 'blips' generated by the ships themselves. Additional Spitfires were dispatched to supplement the standing 'Jim Crow' patrol and these finally spotted the German squadron at 10.42 hours. However, due to the secrecy pervading *Fuller*, the pilots were under strict orders not to break radio silence, although the fighter leader was Group Captain Victor Beamish, who in his previous appointment as Senior Air Staff Officer at No. 11 Group had signed off the *Fuller* directive, which included a proviso that permitted radio-telephony ('R-T') to be used 'in an emergency'.²⁵ Nonetheless, a sighting report was not raised until after the Spitfires had landed and, as Fighter Command had not been expected to be the first agency to locate the German fleet, further valuable time was lost while it was determined who needed to be notified. Eventually, '*Executive Fuller*' was declared after the report reached the Admiralty at 11.25 hours, some fourteen hours after the ships had left harbour.

The initial British response was a series of piecemeal and uncoordinated attacks mounted by whatever force elements came to readiness first. The long-range guns of the Army's coastal artillery were immediately available and the South Foreland battery was equipped with the new, 'K-type' radar, which was able to burn through the jamming and track the German fleet as it passed Cap Gris Nez. However, the maximum visibility was only five

miles, so although radar-predicted full salvo firing began at 12.19 hours, the fall of shot could not be verified visually, markedly reducing accuracy. By now, the German ships had worked up to 30 knots and quickly moved out of range, suffering no damage from the thirty-three rounds fired. Next, five MTBs of the Dover and Ramsgate flotillas attacked, but it was obvious that they would be unable to break through the strong screen of destroyers and E-boats protecting the three big ships without additional support, and they were reduced to launching hopeful torpedo shots at extreme range: unsurprisingly, all of these missed.

In a rare act of British initiative, Wing Commander Constable-Roberts, Flag Officer Dover's air liaison officer, had ordered the six obsolete Swordfish biplane torpedo bombers of the Fleet Air Arm's No. 825 Naval Air Squadron, based at RAF Manston in Kent, to be armed and brought to immediate readiness after hearing the first reports of unusual activity from the coastal radar stations. These old aircraft were not expected to survive a daylight raid on the German squadron; they were only ever intended to be used to drop flares in support of a night MTB attack, on the assumption that the Germans would run the Channel in darkness. Nevertheless, because the other forces earmarked for *Fuller* had been stood down at dawn, there were no other options available for an immediate response. Ramsey was fully aware of the vulnerability of the Swordfish and, after some soul-searching, made an agonized telephone call to the First Sea Lord, Sir Dudley Pound, to request his advice. Pound replied that 'the navy would attack the enemy

whenever and wherever he be found', and Ramsey reluctantly ordered the attack to go ahead.²⁶

Although No.11 Group had promised three squadrons of Spitfires as a fighter escort and another two squadrons in a flak-suppression role, poor communication between Flag Officer Dover and Headquarters No.11 Group meant that only the ten Spitfires of No. 72 Squadron, commanded by Squadron Leader Brian Kingcombe, arrived at the rendezvous overhead Manston. Like most other RAF units, No.72 Squadron had not been briefed about the mission and Kingcombe had no inkling of the scale of opposition that would be encountered. As the German ships were already passing abeam Ramsgate, the Swordfish could not afford to wait for the rest of the escort and had to press on, but they were intercepted by German fighters with twelve miles still to run. Although Kingcombe's Spitfires quickly engaged the Bf 109s and Fw 190s, the six Swordfish were all hacked out of the sky by either the fighters or the barrage of anti-aircraft fire, as they attacked at low level and a speed of just eighty knots. No damage was inflicted on the warships, and only five of the eighteen aircrew involved survived to be rescued by the withdrawing MTBs. The mission lasted less than twenty minutes from the time of take-off until the last Swordfish crashed into the sea. Ramsay wrote: 'In my opinion, the gallant sortie of these six aircraft constitutes one of the finest exhibitions of self-sacrifice and devotion to duty the war had ever witnessed'. Even the austere Ciliax was moved to acknowledge 'the mothball attack of a handful

of ancient planes, piloted by men whose bravery surpasses any other action by either side that day'.²⁷ The commanding officer, Lieutenant Commander Eugene Esmonde, was awarded a posthumous Victoria Cross. Ironically, he had visited Buckingham Palace the day before the Channel Dash to receive the Distinguished Service Order for the leading role he had played in crippling the *Bismarck* eight months previously.



The Fairey Swordfish was too vulnerable to be effective in daylight operations.

The final throw of the dice for British naval forces was represented by six elderly destroyers of the Harwich flotilla, led by Captain Mark Pizey in HMS *Campbell*. This force had been stood down in the morning and was consequently off station practising gunnery in the North Sea when it received the 'Executive Fuller' transmission. Pizey realised that he was unlikely to be able to intercept the German squadron in time, but he managed to get into a position to deliver a torpedo attack by steaming south at full speed across two unswept minefields: unfortunately, all of the salvos missed, while counter-fire from *Gneisenau* and *Prinz Eugen* severely damaged *Worcester*, although the destroyer eventually limped back to port. In a good illustration

of the way that the fog and friction of war affected both sides in the grey winter light and poor weather, two RAF Wellingtons bombed and near-missed another of the destroyers, *Walpole*, but were driven off by the Messerschmitt Bf 109s of *Jagdgeschwader 2* before they could do serious damage. *Walpole* prudently withheld her fire as the German fighters then provided a close (and disconcerting) escort for the British ship, in the mistaken assumption that it was a *Kriegsmarine Zerstörer*, until they reached the limit of their endurance and peeled off to return to France.²⁸ Meanwhile, the German destroyer *Hermann Schoemann* was firing frantically at a *Luftwaffe* Dornier Do 217, which repeatedly bombed her and then raked her with machine-gun fire.²⁹ Captain Wright of *Mackay* reported that 'the mixture of aircraft in our vicinity was extraordinary... some aircraft thought we were friendly; some of our own thought we were hostile. We, on our part, opened fire on aircraft later recognised as friendly'. He added, with characteristic understatement: 'The aircraft on both sides must have found the situation rather confusing'.³⁰

The three Beaufort squadrons of Coastal Command had been expected to pose the greatest threat to the German squadron. No. 217 Squadron was first into the fight, but could only muster four serviceable aircraft to fly to Manston to meet its fighter escort. Their leader, Squadron Leader Carson, had not been briefed before departing Thorney Island and did not know what his target was, or even what the codeword *Fuller* meant. Headquarters No. 16 Group, Coastal Command, intended to pass

the details to him in morse over wireless-telephony ('W/T') when the Beauforts reached Manston, but was not aware that No.217's Beauforts had been converted to R/T. After circling the airfield for some time in puzzled silence, Carson landed and made his way to Manston's operations room to ask the station commander if he knew what his mission was. After getting airborne again, he failed to make radio contact with the other three Beauforts, which were still patiently waiting in the overhead; nevertheless, they followed as he set course towards the battle squadron's last reported position. The four aircraft finally found the German ships at 15.40 hours and began their attacks, joined eventually by three more Beauforts that had been made ready at Thorney Island in the interim. These had also been kept in ignorance about *Fuller* and been forced to land at Manston to be briefed. By now, the visibility was extremely poor and no hits were scored: one aircraft was shot down by the fighter screen. Most of the other Beauforts were badly shot-up by the German ships' defences, but all managed to make it back to Manston, including Pilot Officer Etheridge, whose aircraft suffered further severe damage from the Ramsgate anti-aircraft batteries, which 'appeared to be shooting at everything coming up the Channel'.³¹

No. 42 Squadron's preparations had also been chaotic. Its move south from Leuchars had been delayed by poor weather and only nine of its fourteen aircraft were armed. Consequently, the other five aircraft were ordered to land at North Coates, a Coastal Command airfield, to be loaded with torpedoes, but the heavy snowfall on the East Coast meant

they had to divert to Coltishall, a fighter station. In theory, a specialist Mobile Torpedo Unit was available to transport their weapons from North Coates to Coltishall, but what was subsequently christened the 'Immobile Unit' took so long to bring to readiness and deploy that this plan had to be abandoned, and only the original nine aircraft could be used.³² These rendezvoused at Manston with eleven Hudsons of No. 407 Squadron, Royal Canadian Air Force, and twenty Spitfires to act as fighter escort, but neither of the bomber formations had been briefed about *Fuller* and a farcical situation developed, as each squadron attempted to follow the other in the hope that they would be led to a suitable target. Eventually, the Beaufort's leader, Squadron Leader Cliff, lost patience and set course for the Channel to see what he could find.

Five Hudsons continued to hold at Manston until they ran short of fuel and returned to RAF Bircham Newton in Norfolk, but the other six followed Cliff. However, they soon lost contact with the Beauforts in heavy rain, but picked up some blips on their ASVs and dived through low cloud to attack some German *Zerstörers* and E-boats, losing two of their number to the heavy *flak* barrage.³³ Meanwhile, Cliff was taken aback to stumble across a powerful battle-fleet and its escorting fighter umbrella, steaming east at thirty knots: he later telephoned No.16 Group to complain – not unreasonably in the circumstances – that 'I was expecting a coastal convoy. Why was I not told about the bloody great battleships'?³⁴ In the ensuing confusion, three crews mistook the retreating Harwich destroyer flotilla

for elements of the German squadron and attacked the British ships, but fortunately, all missed, as did the four aircraft that correctly identified and launched their torpedoes against the German vessels.

It was a similar story for No. 86 Squadron, the last Beaufort squadron to go into action following a staged deployment from its home base at St. Eval. The leader waited for the promised fighter support until dusk was beginning to fall, when he decided he would have to complete the mission without an escort. Two of the Beauforts either flew into the sea or were shot down by German fighters on the way to the target, and none of the survivors was able to find the German squadron in the worsening weather.

Because of its initial lack of readiness, RAF Bomber Command's response was slow, and further delays were caused by the requirement to re-arm the aircraft that were available. The 100 bombers retained by Baldwin at readiness for *Fuller* had been loaded with 500-lb semi-armour piercing (SAP) bombs, the only weapons likely to inflict fatal damage on heavily armoured warships. However, these bombs had to be dropped from a minimum of 7,000 feet in order to fuze properly and by noon, the cloud-base was already less than 1000 feet. Therefore, the decision was made to load aircraft with general purpose (GP) bombs as they were brought to readiness, as these weapons could be dropped at low-level. This meant that the German ships were unlikely to be sunk if they were hit, but significant blast damage might still be caused to their superstructures. This decision was partially countermanded when

it was realised that the 100 aircraft already armed with SAP could not be de-bombed, rearmed with GP and still take-off in time to catch the German squadron before nightfall. Accordingly, these were dispatched with their original weapon-loads in the hope – which was not to be fulfilled - that they might find a break in the clouds.

Two hundred and forty-two bombers eventually took off in three waves. Ninety-two Wellingtons, sixty-four Hampdens, thirty-seven Blenheims, fifteen Manchesters, thirteen Halifaxes, eleven Stirlings and ten Bostons were employed in what was the largest daylight bombing operation of the war to date,³⁵ but only thirty-nine of the bombers were able to find the German ships in low cloud, rain and gathering darkness: actual conditions were reported as ten-tenths cloud cover at six hundred feet with visibility less than 1,400 yards in drizzle and rain.³⁶ In these circumstances, the heavy, four-engined, Halifaxes and Stirlings were simply too unwieldy to manoeuvre into a position to attack and only the medium and light bombers claimed to have bombed the warships. The experience of No. 241 Squadron, based at RAF Stradishall, was typical. It was preparing for a night raid on Germany when it received the declaration '*Executive Fuller*'. Twelve of its Wellingtons took off at 14.45 hours, but formation keeping proved impossible as the cloud base dropped to less than 500 feet, and the squadron quickly split into individual elements. Only one aircraft claimed to have seen the German ships and the Wellington flown by the squadron's commanding officer, Wing Commander Macfadden, failed to return. The Operational

Log Book (Form 540) commented laconically that 'the squadron had a very unsuccessful day and lost the Commanding Officer'.³⁷

Bomber Command lost fourteen other aircraft, predominantly to the *Luftwaffe's* fighter umbrella, as the poor weather also hampered the anti-aircraft gunners on the ships, who found it difficult to track attacking aircraft as they emerged through the mist and rain. Another bomber crashed while attempting to land back at its base. Unfortunately, but not surprisingly, only minor splinter damage was caused by these gallant but uncoordinated attacks, although the fighting was so intense that the sailors had to cool the ships' flak guns by pouring buckets of water over them and at least one gun-barrel burst.³⁸ Ciliax acknowledged the gallantry of the Bomber Command crews in his post-action report: 'From about 12.45 until 6.30 p.m. massed and individual attacks from aircraft of all types. Impressions: Dogged aggressive spirit, very plucky flying'.³⁹

Fighter Command flew 398 sorties during the operation. Although - with the benefit of hindsight - the poor coordination of fighter escorts appears culpable, the context has to be taken into account; arrangements were inevitably *ad hoc*, given the secrecy and lack of available information available, and the short planning time following the late declaration of 'Executive Fuller'. Commendably, most of the leaders of the fighter escorts acted on their own initiative if they failed to make contact with their designated attacking force, making their own way to the scene of action to try and disrupt or disturb the German fighter screen.

Undoubtedly, the losses to bomber aircraft conducting piecemeal attacks over several hours would have been far higher if the fighters had not flown to the 'sound of the guns'. Post-war analysis indicates that Fighter Command shot down sixteen German aircraft for the loss of seventeen of its own aircraft, a commendable effort given the technical superiority generally enjoyed by the German fighter force, although in line with Galland's directive, the *Luftwaffe's* priority targets were the RAF's bombers rather than its fighters. Twenty-one Spitfire squadrons were employed and these generally held their own, losing just five aircraft between them, but the four Hurricane squadrons lost five aircraft and No. 137 Squadron was particularly roughly handled, losing four of the eight Whirlwind long-range fighters that it committed to battle. These losses were a simple reflection of the relative capabilities of the aircraft involved; in air combat, even ostensibly small qualitative advantages invariably have a disproportionate affect on the outcome.

Just as it appeared that the German ships would escape entirely unscathed, they ran into a series of minefields that had been laid by the Hampdens and Manchesters of Bomber Command's No. 5 Group. Ninety-eight mines had been dropped between 3 and 9 February in anticipation of a German break-out, and a further thirteen were laid in the path of the battle-squadron on 12 February itself.⁴⁰ *Scharnhorst* hit two mines off Flushing and was forced to stop for repairs; in accordance with the *Cerberus* directive, the rest of the ships pressed on without her, but

she was eventually able to get under way again and managed to make harbour the following morning, albeit with serious damage. *Gneisenau* also struck one of the air-dropped mines at Terschelling and was forced to stop for half an hour for repairs, but her damage was much lighter. The mine-strikes caused concern and confusion within the German force and Ciliax was forced to transfer his flag twice, in anticipation that one or both of the battlecruisers might have to be left to their fate, much to the derision of the respective ships' companies – he was a highly unpopular commander. However, the German squadron was shrouded in the darkness of the long winter night and remained undetected by the British while it was potentially vulnerable to attack. By 09.00 hours on 13 February, all three big ships had berthed safely in Wilhelmshaven, allowing Ciliax to signal Admiral Saalwächter: 'It is my duty to inform you that Operation *Cerberus* has been successfully completed'.

The Reckoning

Despite the intensity of the fighting, casualties on both sides – while not insignificant - were relatively minor in the context of an existential war of national survival. The British lost a total of forty-two fighters and bombers, shooting down sixteen *Luftwaffe* aircraft in return: eleven of the German pilots were killed. No British ships were lost, although HMS *Worcester* was severely damaged and twenty-seven of her crew were killed by enemy shell-fire. On the German side, in addition to the mine damage to the capital ships, the torpedo boats *T13* and *Jaguar* received light damage from bomb splinters and

machine-gun fire, suffering one killed and two wounded; another sailor on *Prinz Eugen* was also killed by bomb splinters.

Paradoxically, the very success of the Channel Dash resulted in the *Scharnhorst*, *Gneisenau* and *Prinz Eugen* being neutralized as an immediate threat to Britain's supply lines, the German Naval Staff itself characterizing the outcome as a 'tactical victory, but a strategic defeat'.⁴¹ The ships were no longer a menace to the Atlantic convoys at Wilhelmshaven, instead being earmarked for employment in Hitler's 'zone of destiny' in Norway, while on the night of 26/27 March - a month after *Cerberus* - the St. Nazaire raid was successful in blocking off the last French port capable of handling the *Kriegsmarine's* capital ships, effectively removing any lingering threat to the Atlantic. Moreover, the German ports did not provide the expected safe haven from British attack and all three ships were crippled or destroyed in the aftermath of the Channel Dash: *Scharnhorst* was in dock for six months due to the mine-damage and was then caught by the Home Fleet and sunk off the North Cape when she did sail; *Gneisenau* received a direct hit during an RAF bombing attack on the night 26/27 February, just a fortnight after the Channel Dash, killing 116 of her crew and causing so much damage that she was never returned to service, instead being filled with concrete and used as a static fort; and *Prinz Eugen* had her stern blown off by a British submarine three days later, taking no further effective part in the war, but surviving as a hulk to be sunk in a post-war nuclear test in the Pacific.

Therefore, in strictly strategic and material terms, the outcome of Operation *Cerberus* was highly advantageous to Britain; but contemporaneous perceptions were very different. Whereas all Germany rejoiced and the operation was celebrated by the propaganda machine as an unprecedented triumph, in Great Britain, the sense of national shame was profound, and this had inevitable political consequences. Churchill was taken aback by the scale of popular anger; it seemed that by this stage of the war, while the British public was inured to a seemingly unbroken run of defeats on land, it was not prepared to accept humiliation in a domain that it considered to be its birthright. An editorial in *The Times* asserted that: 'Vice-Admiral Ciliax has succeeded where the Duke of Medina Sidonia failed. Nothing more mortifying to the pride of our sea power has happened since the seventeenth century',⁴² while the *News Chronicle* characterized the operation as a story of 'individual courage and steadfast devotion to duty', but 'not one that reflects much credit on those primarily responsible'.⁴³

The government came under blistering attack in the Commons from all sides of the House, where the Channel Dash was described as a 'major blunder'⁴⁴ and, unusually, the Admiralty and Air Staff were openly criticised in Parliament. Churchill was forced to convene a formal commission of enquiry, but ironically, the furore about Operation *Fuller* was politically beneficial in the sense that its reverberations masked the impact of the fall of Singapore two days later, on 15 February 1942. This was a disaster of an entirely different order

of magnitude, with 150,000 British and Commonwealth troops surrendering to a much smaller Japanese force in the largest capitulation in British military history. In his history of World War 2, Churchill noted that by comparison, the Channel Dash was 'an episode of minor importance as I judged it', but acknowledged it as 'arousing even greater wrath and distress among the public' and he accepted that 'it is certainly not strange that public confidence in the Administration and its conduct of the war should have quavered'.⁴⁵ The damage to the reputation of the armed forces in an alliance context was also significant. Churchill conducted an elaborate correspondence with President Roosevelt to convince him that the Channel Dash did not represent another strategic defeat and was duly grateful for the President's assurance that he would couch a radio address to the American nation in emollient terms.⁴⁶

The Post-Mortem

The Board of Inquiry was convened under Mr Justice Bucknill on 16 February 1942 and delivered its findings in early March,⁴⁷ these were not published due to security considerations, but the Deputy Prime Minister, Clement Atlee, made a statement to the House on 18 March, explaining that 'the general findings do not reveal that there were any serious deficiencies in either foresight, co-operation or organisation between the Services concerned and their respective Commands'.⁴⁸ Unsurprisingly, this was greeted with widespread scepticism and, at a secret session of the House of Commons on April 23, Churchill was forced to give more

details in an attempt to suppress further dissent. He acknowledged that he had been 'impressed by the shock which the passage of these two ships through the Channel gave to the loyal masses of the British nation'⁴⁹ and won over the House by using the details of the Admiralty's intelligence appreciation to argue that the German operation had not come as a surprise, asserting that the British forces were as well-prepared as they could have been, but there were simply not enough of them, because of commitments elsewhere. Most of the torpedo-bombers were required in the Mediterranean, the majority of destroyers had to be used for convoy escort duties in the Atlantic and the few capital ships available, after the requirements of the Mediterranean and the Far East had been met, could not be employed in the Channel because of the danger of air attack.⁵⁰ While Churchill's statement won the debate and his administration survived to fight another day, he was certainly disingenuous in suggesting that the actions of the limited forces that were available were as well-led and well-organised as they could have been.

An Inevitable Failure?

Given the scarcity of the resources committed to *Fuller*, it is highly unlikely that the operation could ever have succeeded without a mixture of extraordinary good fortune and the closest possible inter-service and inter-command cooperation. Unhappily, a chain of bad luck, poor decision-making and incompetence delayed the detection of the break-out, and this ensured that the British reaction was uncoordinated and reactive,

with weak force elements being committed to battle as they became available; the piecemeal attacks that ensued were easily countered by the powerful, concentrated and well-integrated German force. It has even been argued that British planners tacitly accepted Operation *Cerberus* as a *fait accompli*, as they acknowledged that insufficient forces were available to prevent a break-out, but also knew that this would not represent an entirely undesirable strategic outcome.⁵¹ If this really was an acknowledged but unspoken belief held by Air Staff and Admiralty planners, then it was - at best - politically naïve, and represented a complete misreading of the likely public reaction.

Although the inadequacy of the available forces was largely a consequence of strategic realities, the incoherence between the RAF and the RN, and between the RAF commands, was far less excusable. This was partially structural, because of the organisation of the system of command, but was also a result of agency, in terms of the personalities involved. The initial point of failure was the lack of an overall authority responsible for the execution of *Fuller*; as the Bucknill Report noted, this compromised any realistic prospect of the achievement of unity of purpose. This was compounded by the lack of trust and communication between commands. The demarcation of responsibilities between Coastal Command and the RN had been an enduring source of friction and, although a Joint Headquarters had been established as early in April 1941, ultimately delivering a high level of integration, the lack of effective cooperation during *Fuller* indicates

that even sensible organisations and processes will be inadequate if the will to make them work properly is absent, and it is very apparent that the power of personality was critical. While Ramsey was an outstanding naval leader, he was extremely sceptical about the support that he could expect from the RAF. In 1940 he had commanded Operation *Dynamo*, the Dunkirk evacuation, where he had been disappointed with the RAF's contribution. Although this assessment was incorrect and unfair,⁵² it meant that he was predisposed to doubt the RAF's commitment to maritime operations and he was highly critical of the air force in the aftermath of *Fuller*. He was especially bitter about the role of Leigh-Mallory and No.11 Group, particularly because of the failure to provide the full escort promised for the Swordfish attack.⁵³ The character of the AOC-in-C Coastal Command, Air Marshal Sir Philip Joubert de la Ferte, was also unhelpful, as he was unable to maintain the generally harmonious relationship with the RN that his predecessor, Air Marshal Sir Frederick Bowhill, had established. Ironically, the release of the full details of the Bucknill Report in 1946 was used as ammunition in a further, post-war, inter-service battle for control of land-based maritime air assets.

However, the most toxic relationships existed not between the RAF and the RN, but between the different RAF commands and commanders. Joubert and Leigh-Mallory were both 'career officers of the old-fashioned type'⁵⁴ and the tripartite participation of elements of Bomber, Coastal and Fighter Commands without the nomination of one as

primus inter pares was disastrous. Each essentially represented the personal fiefdom of its commander and there was a marked reluctance to pool their resources for a common purpose. In the wake of *Fuller* - and the criticisms implicit in the Bucknill Report - Joubert proposed that Coastal Command should take the lead in maritime operations involving units from the other commands. However logical the suggestion, it was rejected out of hand by Leigh-Mallory, who perceived it as empire-building. The No. 11 Group AOC-in-C - described by a senior subordinate as 'a pompous, ambitious fuddy-duddy'⁵⁵ - had already demonstrated during the Battle of Britain, as AOC-in-C No.12 Group, that he was hardly a team player. Now, he insisted on perpetuating the inadequate, three-pronged approach to joint operations that had been found so wanting during *Fuller*. The Air Staff was not inclined to impose a solution, and it was not until Joubert and Leigh-Mallory were replaced that a satisfactory inter-command arrangement was brokered, enabling later operations to be more successfully coordinated. The misplaced secrecy that so hindered air operations was also entirely symptomatic of the organisational preference to centralise control - at all costs and at the highest level - that so pervaded the highest echelons of RAF command at this stage of war.

Although Bomber Command had been the most reluctant participant in Operation *Fuller*, ultimately it made the greatest contribution to the favourable strategic situation that was finally achieved. It was the incessant bombing attacks - mounted from the date of the *Scharnhorst* and

Gneisenau's arrival in March 1941 to the very eve of their departure – that made Brest untenable for the German ships and precipitated the decision to withdraw them to Wilhelmshaven, thus simplifying Britain's strategic dilemma by corralling the entire German fleet at a single location; and it was Bomber Command's indirect air mining operations that inflicted the only significant damage on the German ships, negating them as a threat in the immediate aftermath of the operation.

In the final analysis, the ultimate failure of *Fuller* is attributable to the British high command's lack of agility. As foreseen by the Germans, after the initial shock, the British were simply unable to regain their balance and take the initiative. The last word may be left to Ciliax, whose summary of the operation is apt:

*The British were surprised, which led ... to desultory and precipitate actions by their forces. During a period spanning one and a half hours after the first attack, no English aircraft succeeded in reaching the Squadron due to our excellent fighter cover.*⁵⁶

Notes

- ¹ A painting by Robert Taylor.
² Adolf Galland, *The First and the Last*, 3rd edn., (London: Methuen, 1973), 167.
³ Appropriately enough, as in Greek mythology, Cerberus was the three-headed dog that guarded the gate to Hades.
⁴ John Deane Potter, *Fiasco: the break-out of the German Battleships*, (London: Heinemann, 1970), 200.
⁵ Martin Middlebrook and Chris Everitt, *The Bomber Command War Diaries: An Operational Reference Book* (London: Penguin, 1985), 235.

⁶ Stephen Roskill, *The War at Sea, 1939-45*, 3 vols., (London: HMSO, 1954), Vol.1., 150.

⁷ Galland, *First*, 144.

⁸ Boyd characterises the decision-cycle as the 'OODA loop', with the steps running from 'Observe', through 'Orient' and 'Decide' to 'Act'. Robert Coram, *Boyd: The Fighter Pilot who Changed the Art of War* (New York: Little Brown and Company), 25.

⁹ Photographs courtesy of the RAF and RN websites, <http://www.raf.mod.uk> and <http://www.royalnavy.mod.uk>.

¹⁰ The British acronym for 'Enemy Boats', the German fast attack craft also and more correctly known as S-boats, for the German *Schnellbooten*.

¹¹ AIR 14/823 Operation 'Fuller' 1941 Apr. 1942 Oct. IIH/241/3/733 BC/S22200/22.

¹² Peter Kemp, *Escape of the Scharnhorst and Gneisenau*, (London: Ian Allan, 1975), 26.

¹³ *Ibid.*

¹⁴ Owen Thetford, *Aircraft of the Royal Air Force since 1918*, 4th ed. (London: Putnam, 1968), 87.

¹⁵ Kemp, *Escape*, 26.

¹⁶ Middlebrook, *Bomber Command*, 238.

¹⁷ AIR 16/403 Operation 'Fuller' 1941 Apr.-1942 Apr AHB Reference and Fighter Command File Reference: IIH/240/4/149 FC/S24043.

¹⁸ Photographs courtesy of <http://www.marine.de>.

¹⁹ Galland, *First*, 144.

²⁰ *ibid*, 146.

²¹ *ibid*, 150.

²² *ibid*, 146.

²³ Kemp, *Escape*, 35.

²⁴ Terence Robertson, *Channel Dash: The Drama of Twenty-four Hours of War* (Quality Book Club: London, 1958), 60.

²⁵ Kemp, *Escape*, 60.

²⁶ *The Channel Dash Association*, <http://www.channeldash.orgswordfish17>.

- html, accessed 18 Aug 09.
- ²⁷ Potter, *Fiasco*, 189.
- ²⁸ Robertson, *Channel Dash*, 147.
- ²⁹ Potter, *Fiasco*, 116.
- ³⁰ Robertson, *Channel Dash*, 147.
- ³¹ *ibid*, 141.
- ³² Robertson, *Channel Dash*,
- ³³ Potter, 139.
- ³⁴ *ibid*, 192.
- ³⁵ Middlebrook, *Bomber Command*, 235.
- ³⁶ Kemp, *Escape*, 71.
- ³⁷ Potter, *Fiasco*, 143.
- ³⁸ *ibid*, 168.
- ³⁹ *ibid*, 146.
- ⁴⁰ Roskill, *War at Sea*, 150.
- ⁴¹ *Ibid*, 159.
- ⁴² *Ibid*.
- ⁴³ Robertson, *Channel Dash*, 191.
- ⁴⁴ *Ibid*, 170.
- ⁴⁵ Winston Churchill, *The Second World War, Vol. 4, The Hinge of Fate* (Chartwell Edn., London: The Educational Book Company, 1951), 63.
- ⁴⁶ Churchill, *Hinge of Fate*, 90.
- ⁴⁷ ADM 116/4528 Escape of German battle cruisers GNEISENAU and SCHARNHORST and heavy cruiser PRINZ EUGEN up the Channel: Operation 'Fuller' and Board of Enquiry. 1941-1942.
- ⁴⁸ Robertson, *Channel Dash*.
- ⁴⁹ Churchill, *Hinge of Fate*, 90.
- ⁵⁰ *Ibid*, 91.
- ⁵¹ Robertson, *Channel Dash*, 190.
- ⁵² Roskill, *War at Sea*, 67.
- ⁵³ Robertson, *Channel Dash*, 188.
- ⁵⁴ Potter, *Fiasco*, 192.
- ⁵⁵ *Ibid*.
- ⁵⁶ *Ibid*, 146.

Air Power and the Contemporary Army

By Gp Capt Chris Luck

The search for political meaning and value in operational and tactical excellence is enduring. Contemporary strategic uncertainty and financial austerity elevates the need for coherent joint thought. 'Indisputable' single-Service views and preferences allied to a sub-optimal grasp of the meaning and purpose of 'power' and 'strategy' exacerbate the difficulty in delivering timely, politically relevant, strategic effect. Today's wars demand innovation in the joint appreciation and application of force; agility, adaptability, rapidity of response, precision and scaleable lethality as well as reach are fundamental qualities at all levels. Air power is today as essential an enabler and multiplier of land power as vice versa (as is sea power). With war unknowable in detail in advance, the trick is to be as structurally and doctrinally right as possible but also poised for rapid change should political need dictate. However, the Services' aspirations for geographical excellence are fundamental in giving scope to political options. This article seeks to debate what it means to deliver 'air power' to the contemporary army in order to wage warfare to achieve policy objectives: it examines inherent tensions; what air power is; what can be expected of it and how it is best delivered.

We must develop new joint and service operational concepts that are consistent with the enduring uncertainty and complexity of war. Rather than being 'capabilities-based', these concepts ought to be based on real and emerging threats and connected to scenarios that direct military force toward the achievement of policy goals and objectives.

H.R. McMaster

Introduction

War is the final auditor of military preparedness and therefore relevance; theory, doctrine, and practice interact in a complex fashion to either validate or excoriate the military establishment. History points to a default to fighting the last war; institutional preferences look forward to a 'proper' martial test, but contemporary wars driven by context tend to upset all. History also tells us that 'tactical and operational excellence is quite meaningless save with respect to their political and strategic contextual significance'.¹ Today's wars demand innovation in the joint application of force. Agility, adaptability, rapidity of response, precision, scaleable lethality, and reach are all fundamental qualities. Air power has evolved to meet these requirements and act as a powerful force multiplier. At the risk of single-service heresy, this is not about 'supported' or 'supporting' arguments, but about effect. However for reasons best summed up by Bernard Brodie, 'the officer who is really objective about his own service as compared with the sister services is not going to rise to high enough estate to make that objectivity of much service to the nation'.² Fortunately, today's war fighters are

not so inhibited and are willing to contribute to the joint debate.

This think-piece does not attempt to provide a theory for air power and land power application. It is aimed at analysing what air power is and how it is applied, while reminding the reader that all wars are contextual and contingent, and that all geographically separated military arms have relevance that is equally contextual and contingent. It does not rake over the sterile ground of which service is supported, supporting, or has legitimate claims for independence – that would be waging yesterday's battles, and according to Colin Gray:

It is foolish to debate whether the RN or the RAF exists primarily to support the Army, or vice versa. In common with war, warfare, peace and crisis, military power is a unity....The five geographically specialised forms of military power (land, sea, air, space, cyber), all support each other, at least they should do so.³

This paper also aims to expose current limitations on joint thinking, describe air power's effect, and establish a way forward for air power's relationship with the contemporary army.

Aspirations for the execution of truly joint action remain plagued by single-service parochialisms, often magnified by officially endorsed myths and deliberate misinterpretations.⁴ This is 'just a fact of life and indeed of institutional loyalty and occupational culture'⁵ and has had a negative impact on collegiate effort.⁶ All too often, the fault lines lie at the senior levels of the services and government, as 'every player in the grandly complex policy-and-strategy-making

process has his own interests... [that] paint strategically unique pictures of reality for their players'.⁷ In the U.S., Carl Builder captures this institutional preference when he states that 'despite the logical wrappings of defense planning, there is considerable evidence that the qualities of U.S. military forces are determined more by cultural and institutional preferences for certain kinds of military forces than by the "threat".'⁸ Organisations, weapons and systems therefore tend to reflect military institutions, not context and contingency, whereas at the tactical level, the gritty realities of combat and its dire consequences prove to be an effective lubricant for smooth enough interaction and joint effort. This needs to be championed from the top down. Much of the malaise can be laid squarely at the door of two realities: limited finance and a poor appreciation of strategy.

The defence budget is too small to meet the complete spectrum of war-fighting and collides with the services' institutional preferences at a time when 'the severest test of government is whether, in times of war, it can integrate a viable grand strategy with available resources, manpower, and the nature and vulnerability of both the enemy and its own vital resources.'⁹ Defence spending as a proportion of GDP 'has been on a downward trend since the mid 1950s', leading to doctrinaire and dogmatic positioning for reasons of institutional survival. This can only lead to the death of strategy.¹⁰ Max Hastings is not alone when he declares that 'it should be unacceptable to continue making policy on the hoof, lurching from one budgetary crisis to another'.¹¹

But theory and practice are often worlds apart. Recent acrimonious Department of Defense spending debates highlight similar issues for the U.S.. Secretary Gates is struggling to fix a budget that supports the strategic priorities of the president rather than 'simply fattening defense contractors or satisfying institutional choices'.¹²

Consequently, strategy is required to tie the means to the ends. Strategy is the 'creative act of choosing a means, an end, a way to relate a means to an end, or any combination of those three. In the absence of some choice about means, ends, or their relationship, there is no strategy'.¹³ But having no strategy is not the same as there being no strategic effect – the actions we do or do not take will still have negative, positive, or neutral effects. To make strategy purposeful, the strategist must take the means available and attempt to construct the bridge between ends and means. Strategy takes on historical proportions if the span cannot reach, despite attempts to innovate; ends or means must change, or strategy will fail. In a sense, strategy is a necessity borne of means poverty, and can only function within a coherent overall theory of war and warfare because concentrating on one aspect, whether geographical or elemental, is to risk the 'tacticisation' of strategy. Contemporary operations are invariably reactive to the context and contingency that arises at any given time. Strategy is likewise contextual and contingent and iterative, not dogmatic. Service doctrine, synthesised from theory and past experience, is the jumping off point for developing strategy. The hope is that it is good enough and adaptive

enough to stand the shock of any novelty that may arise. If not, then doctrine becomes dogma, and the historical record shows it will result in failure as the last war is fought.

The ability to create effective strategy is, however, damaged by the ability of the British to invert 'policy for strategy to deliver' with 'strategy to deliver policy'.¹⁴ Strategy should never become the end. Muddled definitional thinking is at fault, as is the lack of precision with definitional language. A woeful lack of a common understanding of the noun 'strategy' (and its adjective 'strategic') exists, to the point that the noun 'has acquired a universality which has robbed it of meaning, and left it only with banalities'.¹⁵ Government and military literature, and attempts at real-world application, is replete with such 'banalities' and the shaping function that strategy could have bestowed to the actions in pursuit of policy is lost.¹⁶ To labour the point, policy is not strategy and strategy cannot exist without policy or the means to achieve it. Likewise, platforms, munitions or targets are not inherently strategic; the consequences (or effects) of their use, or not, are strategic. To reiterate a well-worn Clausewitzian notion, strategy, the bridging function, aims for a 'sufficiency of military success to enable achievement of whatever it is that policy identifies as the war's political object'.¹⁷ But wars and warfare have a nasty, protean nature. Services which truly 'understand the nature of war expect to have to adapt in real-time to circumstances that could not have been forecast with precision long in advance'.¹⁸ Such adaptation must include air-land jointery.

Montgomery was not the first or the last to applaud the benefit of truly joint air-land integration, but a discussion on air power and the contemporary Army is timely as 'integration across Air/Land seams is a priority'.¹⁹ The reason is obvious: blood and treasure is at stake and there is insufficient of both. The national consensus regarding the nation's war in Afghanistan is volatile and apt to evaporate if progress is not made. Every penny of a perceived miserly defence allocation has to be spent wisely if the maximum effect is to be wrung-out to produce a positive strategic performance. If this is not done - and seen to be done - then accusations, such as Simon Jenkins' that 'brass hats protect their precious toys and politicians lack the guts to bang their heads together', will give sustenance to the belief of incompetence in political and military leadership.²⁰ The stark reality is that 'the ends must be matched to the means in the short term [as] to do otherwise is to risk frittering away resources on very long odds when there are more critical things to achieve. Conversely, the means must be matched to the ends in the long term when there is time to think and plan'.²¹ This is all to the good if the ends or means can be adjusted. If not, innovation in the synergistic use of force is required to produce capability for strategy to use in the joint fight.

If we are to make progress in jointery, then the arcane argument of who is supporting or supported must be discarded. The distinction has little strategic merit if the characterisation of strategy is one of instrumentality. However, the environments within which conflict takes place are different in nature,

with distinctive characteristics that 'make the application of military force in each of the environments a specialised process'.²² If the title of this essay is altered to 'Land Power and the Contemporary Air Force,' or even 'Contemporary Air Power and Land Power', then the true question crystallises: what is the appropriate force structure and balance, between geographical dimensions, to wage warfare to achieve policy objectives in today's resource constrained environment? So what can be expected of air power in the contemporary fight? To answer the question, we must first define what air power is.

Power is by dictionary definition the 'possibility of imposing one's will upon the behaviour of other persons'. Hannah Arendt adds the equally persuasive thought that power 'is never the property of an individual; it belongs to a group and remains in existence only so long as the group keeps together'.²³ This is not to be confused with strength, which is inherent in an object or person. Power is about having the choice to act favourably through organisational unity; disunity reduces choices to act and diminishes power.²⁴ For example, an enemy fighting 'amongst the people' will constrain the military options of a first-world nation, as public opinion abhors collateral loss – power is diminished, despite strength remaining. Military forces are instruments, the means to impose our will, an expression of power. The sub-domains of military power must seek unity in purpose and performance to provide political masters with organisationally coherent choices – not to achieve parity or precedence as an end. Military power, threatened

or used, is aimed at the 'possibility of imposing one's will', and 'should be intended to increase options, not eliminate them'.²⁵ The military instruments available to achieve this are land, sea, air, space, and cyber power. The order of precedence is one of historical precedence rather than a hierarchy of utility - it is the context that determines the utility, and therefore the strategic relevance of any of the services. Therefore 'service doctrine that is not in harmony with government policy is likely...to fail; government policy made in isolation of service capabilities tends to do the same'.²⁶ In practice, individual service contributions 'will not be equal and will vary dependent on the context of the operation'.²⁷ Air power therefore represents the ability to achieve organisationally coherent and politically useful effect through the medium of the air.²⁸ It is not a service, or a platform, or a weapon.²⁹

As discussed, to be relevant and useful, power must be contextually and contingently orientated. However, context and contingency is often omitted in planning, sometimes to the extent that an enemy may even fail to appear in the calculus. Context can be divided into seven categories: political, social-cultural, economic, technological, military-strategic, geographical, and historical. Each category interacts to produce an overall environment that is complex. Mix this with the enemy's own contextual soup and the demands on strategists become obvious. The inter-war years for Great Britain were a classic example of interplay of context that led to initial strategic failure with the onset of war with Germany.³⁰ The context for current warfare is more of counter-insurgency

and state-building that 'require population security, security-sector reform, reconstruction and economic development, building governmental capacity, and establishing the rule of law'.³¹ Aggravating factors, such as ungoverned space, increasing climate degradation and overpopulation add to the complexity of possible futures. What is certain is that the traditional defence of the national boundary against quantifiable enemies is the least likely option. This context requires forces that can react with little warning time. In the likely event of inadequate preparatory time, forces-in-being will have to be deployed with current doctrine and equipment. Only judicious selection of structures and equipments that give robust performance and capability adaptation in producing the desired effects will mitigate the challenges - but they will not eliminate them.

With foreseen and unforeseen threats likely to be at some range from the national boundary, rapid power projection will be an absolute theatre entry standard for any vanguard force. This is likely to be kinetic air, but closely followed by air lifted ground troops. The challenge will be in balancing the force components between rapidity of entry, and the weight and efficacy of the deployed capability. Air power is - and will remain - vital to any such rapid vanguard capability. It will therefore need to have inherent qualities of persistence and endurance, as well as the ability for significant heavy lift. Situational awareness to support UK defence missions prior and during actions will continue to demand significant information flows. The aim must be to retain an asymmetric

information edge over adversaries. This will increasingly require more persistence of observational capabilities. Space and developing high-altitude platforms will continue to provide the capability and potential (including the technical leveraging of the electromagnetic spectrum and increasing bandwidth) needed to maintain the informational and surveillance edge required. But freedom to leverage the overhead flank is not free.

Control of the Air is essential for the success of the joint battle. That this requirement has all but faded into the planning background is evidence of both the current asymmetric advantage enjoyed by the UK (albeit enhanced by the US) and the complacency with which it is viewed. The sheer technological dependency, complexity, and limited shelf life of air platforms and their capabilities means that control of the air can be rapidly and asymmetrically (i.e. not necessarily contested in the air alone) lost. Indeed some have gone as far as to declare that 'air power as a combat power projection element is the repository of technology-driven capabilities more than any other military force projection capability'.³² As such, even apparently ineffective adversaries can rapidly constrain the advantage provided by air power. Technology and the expertise to leverage such technology cannot be replaced by any sheer will to overcome the odds stacked against a force. The challenge will be to ensure that the fragility of the air advantage, bequeathed by control of the air, is assured through constant investment in the technology and supporting infrastructure that defines air power. On the plus side,

this superiority has 'resulted in the uninhibited development of other air power competencies that have become invaluable contributions to the success of joint campaigns'.³³

Air power enables ground forces to be more effective while mitigating the worst dangers they may face by allowing them to move faster, lighter, to maintain awareness, and employ accurate firepower against the enemy. If fully integrated, ground forces can devote fewer resources to specific missions while maintaining acceptable levels of risk. Air power finds, fixes, and finishes massed forces, which deprives any adversary of the ability to mass. This corraling effect needs careful integration with land power if the full potential to asymmetrically affect the enemy is to be realised. Air power also fields other vital non-kinetic positive effects. Intelligence, surveillance, and reconnaissance missions are today's meta-enablers. A characteristic of today's operations is an insatiable demand for intelligence, with the above-ground perspective critical to leveraging operational success. Other missions such as airlifting troops; evacuating the wounded; and providing fire support for engaged ground forces have tended to be taken for granted or undervalued outside aviation communities, but now this view is rapidly changing - all are considered vital.³⁴ The war in Afghanistan clearly demonstrates the effectiveness and innovative effect of air power in support of Special Forces (SF); a precursor to the lighter army's modus operandi.

This 'new' way of carrying the fight to the enemy at the tactical level, epitomised by the image of the SF

soldier on horseback in 2001, exploits the third dimension to produce an innovative and lethal combination for the joint application of force to produce tremendous and innovative strategic effect. From pattern of life, to over-watch, to strike, air and aviation is fundamental to today's counterinsurgency fight. As the contemporary army morphs more towards the image of SF agility, air power's enabling effect will be entrenched to generate a truly synergistic, Siamese twin-like dependency. The key to harnessing the plethora of effects that modern air power can bring to the joint fight is at first an acceptance that 'the reality is that land, maritime and air forces will combine in all future operations'. Narrowly perceived areas of responsibility, through geographically demarked channels, constrain perceptions and invariably reduce synergistic effect to the detriment of military strategy.

The classic example of synergistic effect between air and land power, where precedence depended on the shaping required, was that between General MacArthur, USA, and General Kenney, USAAF, in the Far East during World War Two.³⁵ The conflict was studded with exceptional innovation of air power use in leveraging military combat effect. In the West, Montgomery, when commanding the Eighth Army in Africa in pursuit of Rommel, stated 'that Army plus air...has to be so knitted that the two together form one entity', and his chief airman added to the communitarian message by stating that 'there has been as much air co-operation by the army as army co-operation by the air, and the natural result is that we have now

passed beyond that stage into a unit or team which automatically helps the other'.³⁶ The message has not been altogether lost, as the Future Land Operational Concept captures the sentiment in the statement that:

*Land forces will continue to depend on the integration of air and aviation capabilities...to deliver potent operational effect. It is likely that Land forces will place an increasing importance on such platforms [air and aviation capabilities], particularly in stability operations where threat levels and force dispersion necessitates Land forces reliance on air and aviation assets to provide precision strike capability.*³⁷

In short, air power provides control of the air; rapid mobility and lift; intelligence and situational awareness; and attack.³⁸ Air power effects can reduce the weight of today's army by providing overwhelming scale of fires. It can increase an army's mobility, agility, rapidity, and potential to deliver disorientating novelty against an enemy. Air power's reach, rapidity, and flexibility are qualities to be harnessed and leveraged in the joint fight; in fact the 'scalability in weight of effort that can be used to achieve Effects gives air power exceptional flexibility'.³⁹ The context and the contingency should determine the application mix of forces, not an industrial concept limited by geographical channelling.

However, air power is about decision on land: 'all military power is land power'.⁴⁰ We wage war from the air and the sea in order to produce a political effect on land. Air power is an enabler of land and sea power, but any combination and attribution

is equally true; hence arguments that the Royal Navy won the Battle of Britain, rather than the RAF, have a germ of truth, but suffer identical parochialism. What is true is that air power is inherently joint, as its broadest definition is inherently synonymous with *all* military power.⁴¹ But, 'at all levels of conflict and in all ways, air power is an element no military force dares ignore. For intelligence, logistics, and tactical support, it is an imperative no modern force can do without'.⁴² Simply put, air power is a vital force multiplier: it makes forces much more effective.⁴³ The RAF simply must provide it in sufficient quantity and quality for today's army, to meet the demands of today's fight.⁴⁴

The RAF's stated number one strategic priority is clear: to 'support current operations'.⁴⁵ However harsh criticisms are levied on its efforts, such as on legacy platforms continuing to 'embarrass and humiliate' air force commanders as Typhoons and Tornados fail to take their place in the thin blue line, due to inappropriate or inadequate equipments for the current fight.⁴⁶ As stated above, institutional preference and inertia of all the services, limited resources, and unclear governmental policy and understanding of strategy hinder change. This - coupled with the rapid technological pace of change invalidating equipments and doctrine - means that the RAF is hard pressed to maintain balance in its military-strategic policy. The reality that today's synergistic support to the army requires ISR and lift as priorities, with no lessening of investment in the reach, speed, and scalability of air power lethal effects,

leaves resource shortfalls that strategy cannot bridge. The mantra that 'we have too many fast jets, insufficient transport aircraft and helicopter lift' does not account for the need to guarantee the asymmetric advantage accrued to the army by dominance of the air, without which the contemporary army would struggle to achieve its effects at reasonable cost in blood.⁴⁷ A glance at a typical air and aviation package in support of a mission in Afghanistan today would show that all elements are needed.

The argument that the 'overhead' of having an independent air force is an unnecessary excess is fallacious. The airman's perspective is essential if the detail of the air environment is to be properly understood and leveraged. The Smuts' review of 1917, which led to the formation of the RAF, first and foremost identified the need for a specialist air staff and force in order to coordinate, develop, and effectively and efficiently employ the air instrument to deliver strategic effect - i.e., to deliver policy goals.⁴⁸ Nothing has changed and air force air power has continued to deliver exponentially to the point that no contemporary army would choose to wage war without it. Today's army air-power shopping basket includes: guaranteed control of the air; rapid heavy lift; battlespace mobility; 24-hour, unblinking ISR; and scalable, precise, and persistent lethal fires. All of these need to be delivered at global distances, at speed, and at short notice. In addition, the army requires an embedded air perspective from air specialists, at all HQ levels, who understand strategy and air force capability - this function is vital.

The broad basket approach is utopian

in today's financial climate, but no less necessary. Army and air force - and not forgetting navy - senior leadership need to bridge the gulf between ends and means. Capability development requires the unique perspective that each geographical service provides, but military effect requires a joint mindset at the highest levels that accepts that parity of budget, size, or programmes does not lead to maximising that military effect. Non-linear synergy ($2+2=5$) only comes from a mutual belief that military power flows from political utility, and acceptance that individual services' relevance will necessarily ebb and flow with context. But only so much can be squeezed out of a pint pot. Ultimately, policy that refuses to be informed by the strategy bridging function is no policy at all, and is likely to fail, despite best efforts. The education of government policy-makers is a greater challenge.

Air power is today as essential an enabler and multiplier of land power as vice versa. Doctrinaire and dogmatic arguments that artificially divide the two confuse military effect required for achieving policy goals with environmental expertise as an end in itself. The aim should be to integrate and synchronise from the outset. Insufficient air power, both kinetic and non-kinetic, exists to meet demand, although the current greater need is for more ISR, lift and mobility, and fires. There is no discounting the need to control the air, at least at a time and space of our choosing. Strategy must never become the end, but strategy cannot alone overcome unreasonable policy demands or insufficient means. Today's army requires a quality and quantity of air power as never before to compensate

for the need for greater speed, range, lift, attack, less organic heavy fires, and critical ISR dependency, to meet the unpredictability of future threats. The RAF is the expert of choice to provide the synergistic effect required, but it will need to leverage some resources away from traditional, institutionally preferred, platforms. However, air and aviation assets will remain a limited resource and therefore a rationed one. The contemporary army will need to better understand and integrate air power in its holistic approach to war fighting if 'all military power' is indeed 'land power.'

Notes

¹ Colin S. Gray, *Recognising and Understanding Revolutionary Change in Warfare: The Sovereignty of Context*, Carlisle, PA: Strategic Studies Institute, US Army War College, February 2006, 13.

² Bernard Brodie, *War and Politics*, New York: Macmillan, 1973, 483.

³ Colin S. Gray, "Britain's National Security: Compulsion and Discretion." *RUSI Journal* December 2008 Vol. 153 No. 6 pp 12-18, 16.

⁴ See *Creating the Myth of Air Control* in James S. Corum and Wray R. Johnson's *Airpower in Small Wars: Fighting Insurgents and terrorists*, University Press of Kansas, 2003, 62-66, and Tami Davis Biddle's *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914-1945*, Princeton, NJ: Princeton University Press, 2002.

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⁶ The recent exchanges in the papers as to the viability and purpose of the RAF is evidence, although the logic is often flawed – one particular

argument for foreclosure of the RAF was based on its size in numbers of personnel, conveniently forgetting that the RN is smaller.

⁷ Colin S. Gray, *Understanding Airpower: Bonfire of the Fallacies*, Strategic Studies Quarterly, Winter 2008, pp43-82, 46.

⁸ Carl H. Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, Baltimore and London: The Johns Hopkins University Press, 1989, pp6-7.

⁹ Robin Higham and Stephen J. Harris, eds., *Why Air Forces Fail: The Anatomy of Defeat*, Lexington, KY: University Press of Kentucky, 2006, 3.

¹⁰ Malcolm Chalmers, "A Force for Influence? Making British Defence Effective", *RUSI Journal* December 2008 Vol. 153 No. 6 pp 20-27, 26.

¹¹ Max Hastings, "Sleep Walking Towards the Precipice: The Crisis in British Defence Policy." *RUSI Journal* December 2008 Vol. 153 No. 6 pp 32-35, 32.

¹² *The Stars and Stripes*, Mideast edition, 5 April 2009; "DOD Shuffles Funding" 2.

¹³ Builder, *Masks of War*, 50.

¹⁴ Hew Strachan, *The Lost Meaning of Strategy*, *Survival* vol. 7 no. 3 Autumn 2005 pp 33-54, 33-34, 37.

¹⁵ Strachan, *Meaning of Strategy*, 34.

¹⁶ Strachan, *Meaning of Strategy*, 46.

¹⁷ Gray, *Defining Victory*, 12.

¹⁸ Gray, *Defining Victory*, 21.

¹⁹ "Future Land Operational Concept," Swindon: Developments, Concepts and Doctrine Centre, October 2008, Pt1-4.

²⁰ See Simon Jenkins' 'Lovely new aircraft carrier, sir, but we're fighting in the desert', *The Sunday Times* (of London), February 24, 2008.

²¹ Robin Higham and Stephen J. Harris, eds., *Why Air Forces Fail: The*

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- ²² Sanu Kainikara, *A Fresh Look at Air Power Doctrine*, Tuggeranong ACT: Air Power Development Centre, 2008, 18.
- ²³ Hannah Arendt, *On Violence*, San Diego, New York, London, Harcourt Brace & Company, 1970, 22
- ²⁴ Everett Carl Dolman, *Pure Strategy: Power and Principle in the Space and Information Age*, London & New York: Frank Cass, 2005, 42.
- ²⁵ Dolman, *Pure Strategy*, 9.
- ²⁶ Robin Higham and Stephen J. Harris, eds., *Why Air Forces Fail: The Anatomy of Defeat*, Lexington, KY: University Press of Kentucky, 2006, 348.
- ²⁷ Kainikara, *A Fresh Look*, 47.
- ²⁸ The official definition of air power is "the ability to project power from the air in order to influence the behaviour of people or the course of events" (Joint Doctrine Note 2/08, *Integrated Air-Land Operations in Contemporary Warfare*, dated August 2008, The Development, Concepts, and Doctrine Centre, Ministry of Defence, Shrivenham, 2-1).
- ²⁹ Gray, *Fallacies*, 55.
- ³⁰ Correlli Barnett, *The Collapse of British Power*, Stroud: Alan Sutton Publishing Ltd, 1993, xi.
- ³¹ HR McMaster – Learning from Contemporary Conflicts to Prepare for Future War, p1
- ³² Kainikara, *A Fresh Look*, 42.
- ³³ Kainikara, *A Fresh Look*, 54.
- ³⁴ Alan J. Vick, Adam Grissom, William Rosenau, Beth Grill, Karl P. Mueller, *Air Power in the New Counterinsurgency Era*, Santa Monica, CA: RAND Corporation, 2006, 111.
- ³⁵ See The Genius of George Kenney by Herman S. Wolk in *Air Force Magazine* April 2002 and *Airpower in the Pacific; A Case Study in Innovation* by Thomas E. Griffith, JR in *Joint Force Quarterly* Autumn 2000.
- ³⁶ Guedalla, *Middle East*, 207-209.
- ³⁷ *Future Land Operational Concept*, pt2-11.
- ³⁸ Air Cdre Paul Colley, Soldiers are from Mars and Airmen are from Venus: Does Airpower do what it says on the tin?, *Air Power Review*, Vol. 9, No. 2, Summer 2008, 102-118, 107. For air power roles see also Joint Doctrine Note 2/08, 2-1.
- ³⁹ *Future Air and Space Operational Concept*, No1 AIDU, RAF Northolt: Directorate of Air Staff, 19.
- ⁴⁰ Gray, *Fallacies*, 59.
- ⁴¹ Jeremy Stocker, "There is no such thing as Air Power," *Air Power Review*, Vol. 8, No. 1, Spring 2005, pp10-20, 16.
- ⁴² James L. Stokesbury, *A Short History of Air Power*, London: Hale, 1986, 290.
- ⁴³ Corum and Johnson, *Airpower in Small Wars*, 435.
- ⁴⁴ 'Today's fight' is defined in this context as being for the next 10-20 years. This of course leaves us hostage to strategic shock if the context changes unexpectedly. The better, but unaffordable, solution is always to have balanced and as broad as possible effects capabilities.
- ⁴⁵ *RAF Strategy – Strategic Priorities*, <http://www.raf.mod.uk/role/strategic.cfm>
- ⁴⁶ Thomas Harding, Defence Correspondent, *The Daily Telegraph*, Monday, February 23, 2009, 'Tornados' Afghan mission delayed by concrete farce.' P14.
- ⁴⁷ Hastings, *Sleep Walking*, 34.
- ⁴⁸ See Christopher J. Luck, "The Smuts Report: Interpreting and Misinterpreting the Promise of Airpower," Maxwell AFB, Alabama: The School of Advanced Air and Space Studies, April 2007.

Air/Land Integration in the 100 Days: The Case of Third Army

By Jonathan Boff

This essay examines RAF-Army co-operation during the Hundred Days campaign of August - November 1918 in the sector of British Third Army. It argues that, by focussing over much on the Battle of Amiens (8-11 August 1918), some historians have tended to suggest that the RAF's contribution to victory lay primarily as a ground attack force. This role was significant, but in fact, as the campaign continued, a range of external constraints hindered the ability of aircraft directly to impact ground operations. However, with military aviation still at a highly experimental stage of development, new missions and methods were continually evolving. The RAF managed change well and played a wide range of roles in the campaign above and beyond direct close battlefield support. Air-land integration had many dimensions, and German records suggest that the importance of the RAF lay less in any one specific mission than in the contribution it made to an apparently unstoppable British combined arms machine.

Introduction

The summer 2008 edition of this journal published an excellent essay by Dr David Jordan which, having neatly summarised the development of the Royal Air Force (RAF) during the First World War, focussed primarily on its direct provision of close ground support, particularly to General Sir Henry Rawlinson's Fourth Army. Dr Jordan argued that, despite some command and control problems, 'the Hundred Days marked the point at which the BEF was able to carry out effective Air/Land operations' and that 'the BEF and the RAF had developed an extremely high degree of cooperation that added considerably to the potency of the BEF as the war drew to a close'.¹

Fourth Army is probably the best-known of the five British armies which took part in the 'advance to victory' of autumn 1918. The Battle of Amiens, in particular, dominates the historiography of the Hundred Days. J.C. Slessor's influential book 'Air Power and Armies', for example, has much to say about Amiens, but pays little attention to the application of air power thereafter.² This article concentrates primarily on the RAF's work with Third Army, Rawlinson's neighbour to the north, during the Hundred Days. It broadly reinforces Dr Jordan's conclusions but also casts a slightly different light on RAF - Army cooperation during this period. Specifically, it first points out that as the campaign unfolded a range of constraints increasingly inhibited the RAF's ability directly to impact ground operations. Secondly, it develops Dr Jordan's point that air power in 1918 remained 'at its earliest

stage of development'. The conduct of air operations remained highly dynamic and was characterised by ongoing experimentation. Different formations employed a variety of methods of close support provision. The RAF was also continually expanding and refining its repertoire of roles on the First World War battlefield. Thirdly, it explores German perceptions of the impact of British air operations. These suggest that the RAF's contribution to victory can be seen less in specifics, such as the tonnage of bombs dropped in close air support, than in the larger part the RAF played in the overall British combined arms effort. In other words, it lay in Air/Land integration interpreted in the broadest sense.

Commanded by General Sir Julian Byng, descendant of both the ill-starred admiral and a Waterloo brigade commander, Third Army advanced some 60 miles between 21 August and 11 November. It launched major set-piece attacks on 21 and 23 August, followed by days of scrappy fighting around Bapaume until the Germans retreated to the Hindenburg Line on 3 September. On 27 September Third Army, as part of Marshal Foch's carefully coordinated offensive all along the Western Front, assaulted the Hindenburg Line. Again, several days of confused combat ensued before the Germans fell back to the Beaurevoir Line southwest of Cambrai. This line was breached by another deliberate assault on 8 October, compelling the Germans to withdraw behind the River Selle. By now, logistics were proving troublesome and preparations for the next push took time. The British

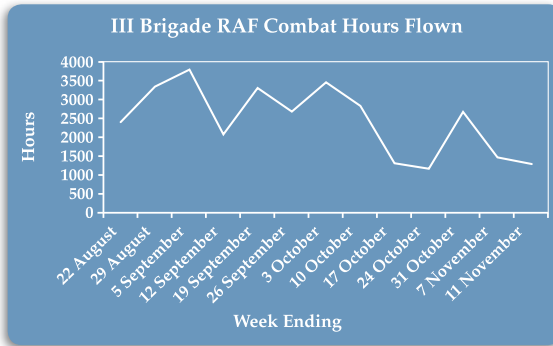
carried out an audacious crossing of the Selle on 20 October, followed by another large-scale planned attack three days later, in the face of which the Germans again recoiled. The last enemy defensive position, running north-south through the western edge of Le Quesnoy, was broken on 4 November and Third Army pursued the Germans eastward, liberating Maubeuge on 10 November. When the Armistice took effect, cavalry had penetrated a few miles inside Belgium.

Throughout the campaign, Third Army enjoyed the support of III Brigade RAF under Brigadier-General Charles Longcroft, later first commandant of the RAF College at Cranwell. In August 1918 III Brigade was made up of a balloon wing and of two aeroplane wings with 197 aircraft in all. Twelfth (Corps) Wing, under Lieutenant Colonel A.B. Burdett, was equipped with 61 R.E.8 two-seaters in three squadrons: numbers 12, 15 and 59. Number 13 Squadron joined during the Hundred Days. Each squadron was attached to an army corps for liaison and artillery spotting work. Thirteenth (Army) Wing, led by Lieutenant Colonel (later Air Marshal) P.H.L. Playfair, mustered 136 aircraft, of which the Sopwith Camel, Sopwith Dolphin and S.E.5a machines of numbers 3, 56, 60 and 87 Squadrons were responsible for air superiority and close air support. Number 57 Squadron's D.H.4s were used for bombing by day, the F.E.2bs of number 102 Squadron for bombing by night, while number 11 Squadron flew reconnaissance in Bristol Fighters. In the course of the campaign, Playfair was replaced by Lieutenant Colonel A.J.L. Scott, and numbers 201 and 210 Squadrons

joined. A reorganization transferred some squadrons into a newly formed Ninetieth Wing under Lieutenant Colonel G.W.P. Dawes. Other units were attached from time to time as required, most notably including the American 17 and 148 Squadrons.

Three external constraints worked hindered air operations in the Hundred Days. The first was weather. Early morning fog was a particular problem. For example, aircraft due to support Third Army's first major attack of the campaign, scheduled for 04.55 hours on 21 August, were unable to take off before 10.00.³ This prevented planned dawn attacks on enemy aerodromes as well as delaying direct air support to ground troops. Number 73 Squadron had been specially tasked with targeting enemy anti-tank guns to help the attacking armour, but by the time it was over the battlefield, most tank operations had already finished. Over the days that followed, cloud prevented day bombing from altitude on several occasions, although close ground support missions could sometimes be flown. Number 3 Squadron spent at least 203 hours on ground attack between 21 and 30 August, despite two days completely lost to poor weather.⁴ As the autumn closed in, this problem inevitably grew. Although only two days in September were complete washouts, flying was impossible on ten in October and every day in November except the first and fourth of the month.⁵ The chart on the opposite page top shows how air support fell as autumn advanced.⁶

A good example of the impact weather could have on operations is given by the counter-battery



artillery effort. Perhaps the most complex of the new techniques of war developed between 1914 and 1918, it incorporated a range of brand new technologies which included sound-ranging, flash-spotting and, of course, the aeroplane, used both to identify hostile gun positions and to spot for friendly artillery engaging them. In the run-up to the 21 August offensive, the British identified 86 German artillery emplacements in the sector opposite VI Corps alone; 70% of the heavy artillery effort was devoted to their neutralization.⁷ On the day of the attack, number 11 Squadron called in destructive shoots on four hostile batteries and neutralising fire on seven others. Three other targets were engaged for effect, and the positions of another 34 batteries reported. Another good example is the work of Lieutenants Griffin and Knox (number 15 Squadron) who ranged 48 rounds onto 'hostile battery XW.9', causing three large explosions and one fire. Balloons also helped direct fire onto two German batteries, and located another eleven.⁸ Similarly, for the 27 September attack the RAF helped identify 70 counter-battery targets for VI Corps.⁹ Inclement weather, however, rendered counter-battery flying almost impossible in the week ending

24 October, and VI Corps artillery could engage only eleven targets in support of the 23 October attack.¹⁰

The second major constraint was opposition from the German air service. At Amiens on 8 August about half all British fighters available had been allocated to ground

attack. The violence of the German fighter response, however, took the RAF by surprise and contributed to the outright loss of 45 aircraft, with another 52 written off. *Generalleutnant* Ernst von Hoeppner, commander of the German air service, considered 8 August his most successful day of the war.¹¹ The rate of wastage of low flying British aircraft on that one day was 23 per cent.¹² Clearly more fighter cover was required, and never again was such a high proportion of air assets tasked with ground support. In Third Army on 21 August three squadrons of fighters, from an available fourteen, were deployed in this role; this was reduced to just one for the Hindenburg Line attack on 27 September and for the last major assault on 4 November. Thus, where Amiens had seen a concentration of some twelve fighters per mile of front on ground attack, this figure fell to four on 21 August and thereafter to a little over one.

The German air threat remained potent until the end of the war. 30 October, indeed, saw 'the most intense day of air fighting which the war had provided', accounting for 67 German and 41 British machines.¹³ Four factors underpinned this threat. First, the Fokker D.VII, fitted with a 185 horse power BMW engine,

remained superior to any British fighter.¹⁴ Secondly, experienced aces like Ernst Udet were still at work: he recorded his 60th kill on 23 August.¹⁵ Thirdly, although morale was rapidly deteriorating in the German army, there is no evidence of this problem affecting the air service.¹⁶ The fourth and most important factor, however, was that throughout the campaign the Germans managed to offset strategic numerical inferiority with an impressive display of operational flexibility, rapidly shifting fighters to where they were most needed. Thus, for example, one fighter wing based near Laon flew 150 kilometres to Cambrai one morning in September, spent the day supporting a German counter-attack there, returned home in the evening, and was in action again over Laon the next day.¹⁷

Given the vulnerability of First World War aircraft to even small-arms fire, it would be unsurprising if RAF fighter pilots preferred air-to-air, rather than air-to-ground, missions. It should also be remembered, however, that air superiority operations still had a direct and positive impact on the ground fighting. Obviously they enabled other, more offensive, RAF work, including ground attack, but they also severely restricted effective German defence. German indirect artillery relied heavily on balloons for observation, and a high priority every morning was to drive those balloons down. Number 3 Squadron was given special responsibility for this on 27 September, for instance.¹⁸ Further, by denying hostile aeroplanes the freedom to roam over British lines, the RAF prevented reconnaissance of movements behind the British front which might give warning of an attack. On 26 September, as

Third Army made final preparations for the next day's assault on the Hindenburg Line, for example, *IV Reservekorps* warned that its aircraft were finding it impossible to gain any view of the British rear areas as a result of particularly strong British defensive patrols. Three days later, the same unit complained that between 30 and 50 British machines had blocked all attempts to head west at every altitude, destroyed two German aeroplanes and two balloons, and prevented any warning of that morning's attack.¹⁹

The third constraint on RAF influence lay in the area of tank cooperation. The destruction of anti-tank guns was, as Dr Jordan pointed out, a high priority, to which number 73 Squadron was permanently dedicated from 21 August on, while number 8 Squadron carried out liaison duties with the tanks. However, where in August almost all tanks had been concentrated to attack with one army, when the offensive widened in September all five British armies wanted to employ them simultaneously and they became more dispersed. The specialist squadrons could not be everywhere and neither number 8 nor number 73 Squadron fought in the Third Army sector after 24 August. Less experienced squadrons had to try to fill the gap. At the same time as demand for tanks increased, their supply fell due to heavy losses. By 20 October 55% of the tanks and 44% of tank crews which had begun the campaign in August had become casualties.²⁰ So, where Third Army had the use of 156 tanks on 21 August, it commanded just eleven on 4 November. As the importance of tanks declined, so too did that of the

RAF in the tank support function.

These three factors combined significantly to reduce the impact of the RAF as the campaign wore on. We can also see, however, quite how well integrated the RAF already was into the entire British combined arms machine. Only when the aviation element was operating at full power were the other arms able to do the same. This becomes even clearer if we consider some of the other functions carried out by the RAF during the Hundred Days.

The first and most important of these was as what Martin van Creveld has termed the 'directed telescope' of command, allowing senior generals to gather intelligence direct from the front, bypassing the established chain of command.²¹ This took two main forms. First, aircraft carried out reconnaissance, both photographic and real-time, to determine enemy dispositions and movements. III Brigade took 12,405 photographs during the campaign.²² Aircraft warned of impending German counter-attacks and called in artillery shoots to break them up, as they did for 63rd Division at Anneux on 27 September.²³ Similarly, if aeroplanes spotted an enemy withdrawal, British units could be directed to follow up. Third Army orders on 3 September were: 'from aeroplane reports the enemy appears to have withdrawn opposite the fronts of V Corps, IV Corps and VI Corps. Corps will pursue the enemy....'²⁴ Secondly, and no less importantly, the RAF told commanders the location and status of friendly forces through 'contact patrols'. Number 13 Squadron, for example, flew five of these patrols for XVII Corps at set intervals throughout

27 September. The infantry were to watch out for these patrols and signal their position by flare, panel, or reflective disc.²⁵ Aircraft had a marked speed advantage over other forms of communication while an attack was underway. It might take hours to extend telephone and telegraph networks to advancing troops. Runners got lost or became casualties. Even in fair weather, a pigeon took 55 minutes on average to make its way home. Wirelesses were in short supply and cumbersome, were rarely deployed forward of brigade headquarters, and were a new medium to which all were still becoming accustomed. Poor signals discipline resulted in wireless messages taking an average 40 minutes to get through. News brought by contact patrols, on the other hand, was generally only 24 minutes out of date.²⁶ As operations became more fluid and communications consequently ever harder, the utility of these grew. Indeed, by 2 October, corps squadrons were being ordered, before they went searching for German artillery, to locate *British* gun positions.²⁷

Secondly, in the course of August Third Army received a flight of Bristol Fighters, specially equipped with wireless and tasked with long range observation. Their job was to spot for the heavy artillery firing on targets, such as communication nodes, over 10,000 yards behind the line. This fire had previously, of necessity, been unobserved.²⁸

A third, more experimental, role was the air supply of infantry. In late August, corps squadrons dropped between 30,000 and 60,000 rounds of

small arms ammunition each day.²⁹ The true impact of this air supply is hard to quantify. Infantrymen generally carried 120 rounds per man into action, so 60,000 would only restock 500 men, or about a battalion. On the other hand, a small amount of ammunition at a critical time can prove decisive, and air supply offered speedy delivery. For instance, two infantry companies, surrounded near Miraumont on 24 August, managed to hold out until relieved after number 15 Squadron dropped them boxes of ammunition and a (equally welcome?) message of encouragement from the corps commander.³⁰

Experimentation continued also in relatively well-established functions of the RAF. One example was air-to-air tactics. The Germans were sending up patrols of 20-40 aircraft at irregular intervals during the day. The smaller, more or less continuous, British patrols were thus finding themselves either in a sky empty of potential targets, or in danger of being overwhelmed. On 22 September, therefore, Brigadier-General Longcroft ordered a change. Offensive patrols were thenceforth to be conducted at least two squadrons strong, generally with S.E.5s or Dolphins above and Camels below. Within each squadron, different flights were also to operate at different altitudes.³¹ The result was a *Luftsperr* ('aerial barricade') which the Germans, as we have already seen, found so frustrating.

The second area to see ongoing experimentation was air-to-ground support. This is best seen in the close support effort for the offensives launched by three different armies, supported by their RAF brigades,

against the Hindenburg Line in late September. All three adopted different approaches. I Brigade (First Army) allocated five squadrons to ground support and specified targets for their first patrol. Thereafter, all five squadrons landed at Le Hameau aerodrome. A single specially detailed officer (Major B.E. Smythies) here commanded them, allotting targets and priorities on the basis of information received from First Army's Central Information Bureau.³² V Brigade (Fourth Army), as Dr Jordan explained, used a similar system.³³ The approach of III Brigade (Third Army) was more *laissez-faire*. Only number 201 Squadron was dedicated to ground attack and, instead of having specified objectives for its first patrol, it was left to find its own targets of opportunity. Number 201 Squadron then landed at an advanced landing ground and came under direct control of the Thirteenth Wing commander, who allocated subsequent targets. At the same time, however, another three squadrons carrying out offensive patrols were free to attack any ground target which took their fancy.³⁴ It is impossible now to quantify how far this less coherent effort undermined coordination of fires both within the RAF and between aircraft and artillery, but it does seem reasonable to conclude that no single doctrine applied across all the British armies. We should not underestimate the extent to which the RAF was grappling not only with new and rapidly evolving technology, but also with an extremely dynamic battlefield environment. Every British innovation met a German response which forced further change, and *vice versa*. In this atmosphere of continual experiment,

it is not surprising that different units, facing different challenges, sometimes evolved different approaches.

In the course of the Hundred Days III Brigade RAF flew nearly 32,000 hours of combat missions, fired millions of machine-gun rounds and dropped over 19,000 25-pound, and 1,700 112-pound, bombs. It claimed 352 German aircraft and twelve balloons destroyed.³⁵ This impressive output demonstrates the effort made by the RAF during the campaign, as do the high casualty rates. Number 57 Squadron, for example, had over 100 per cent battle casualties in August, September and October, losing 24 pilots and 30 observers.³⁶ To judge the success of this effort, however, we need to examine it from the German perspective. In the absence of hard data on casualties directly caused, let alone on the extent to which enemy tactical and operational mobility was impaired by RAF interdiction, this therefore needs to be somewhat impressionistic.

First, there is some evidence that the Germans found British fliers 'even more annoying and enterprising' than French airmen. *Generalleutnant* Curt von Morgen moved from a sector opposite the French to command *XIV Reservekorps* facing Third Army in late August. He noted that, where the French bombed only by night, the RAF strafed and bombed marching troops and locations also by day. The British flew even on cloudy days! In dog-fighting also, he considered the British 'bolder and more skilled' than the French.³⁷

We have already noted the defensive success achieved by Longcroft's new strong patrols in late September, and the problems this caused for German

intelligence-gathering and artillery spotting. The air superiority thus gained, however, could also be turned to more offensive uses. First of these was ground attack. Offensive patrols which found themselves unopposed by German aircraft were free to turn their attention to enemy ground troops. *IV Reservekorps* complained on 26 September that it had insufficient fighters to prevent British ground attack, and on 3 October that its infantry and artillery were being strafed and bombed by groups of up to 40 British fighter-bombers. This was not a new problem for the Germans.³⁸ As early as 21 August, *Generalkommando 54* noted that 'enemy air activity was extraordinarily heavy, great numbers of low-flying aeroplanes continuously strafed our defensive positions and attacked our troops and balloons with machine-guns and bombs'.³⁹

Secondly, RAF interdiction operated in three zones. While fighter-bombers swept roads immediately behind the front, the bombing squadrons of III Brigade concentrated on villages, roads and bridges slightly further back and bombers from IX Brigade (Brigadier-General R.E.T. Hogg, under the direct command of RAF HQ) attacked railway stations deep behind the lines. Thus, during the night of 26/27 September, III Brigade dropped one and three quarter tons of bombs on villages four to five miles behind the line while IX Brigade attacked Busigny station, twenty miles back. This bombing, generally carried out from 12,000 feet or higher, was inevitably inaccurate: Major-General J.M. Salmond, commander of the RAF in France, admitted that 'an error of 1,000 yards is not at all excessive' even in daylight.⁴⁰ Nonetheless, judging

by the German records, the combined effect of RAF interdiction was at least a serious irritant to the Germans.

Both *Heeresgruppe Boehn* and *Armeeoberkommando 2* complained of strong enemy attacks on their reinforcement and supply columns on 29 September, for example.⁴¹ Even units moving in the dark were not immune. *Infanterie-Regiment Nr. 66* lost men and horses, and one battery of a field artillery regiment all its limbers, to night attacks.⁴²

There is evidence that the bombing of railway stations and junctions caused problems, too. As early as 9 September, blockages on the railways were delaying ammunition trains.⁴³ More dramatically, RAF bombs on 1 October set fire to an ammunition train at Aulnoye, a particularly important junction through which all traffic west of the Ardennes flowed.⁴⁴

Important as all the direct physical effects of RAF operations seem to have been, however, the moral effects were perhaps even greater. First, the RAF had a direct impact on German morale. The pace of operations was such that the ever-weaker German infantry divisions had only rare chances to rest and integrate replacements. The RAF, by raiding German rear areas, was able to maintain pressure even on units out of the line. So, for instance, *1 Garde-Reserve-Regiment* claimed to have had only three days of rest between 5 August and 11 November, and that it had been under enemy air attack even then.⁴⁵ It is not surprising that on 1 November *Armeeoberkommando 2* reported the regiment's parent division 'not mission-capable', the lowest of four possible ratings.⁴⁶

Secondly, air operations had a more

general effect on morale. On the whole, the German army explained its defeat in 1918 in one of two ways. One was that the German army itself was never conquered, but was betrayed by a collapse of home front morale whipped up by Bolsheviks and pacifists. This 'stab-in-the-back' myth, first popularised by Ludendorff but later notoriously exploited by the Nazis, deserves little serious consideration here.⁴⁷ The other explanation was that the army was simply overwhelmed by the material superiority of Germany's enemies.⁴⁸ That the Germans were outnumbered and outgunned affected not only their physical capacity to resist, but also their moral ability to do so. As the German official history explained, 'everyone recognized that on one side enemy strength in men and *matériel* was growing, while on the other our own was declining. As hope of victory declined, the will to fight also began to flag'.⁴⁹ The inability of the German air service to disrupt the large numbers of British aeroplanes overhead not only exposed the defending infantry to more accurate artillery fire but was also demoralizing in its own right.⁵⁰ The RAF played an important role in continually reinforcing the German sense of material inferiority, and so hopelessness, which contributed to the collapse of resistance.

This essay has argued that, important as the ground attack role was, the RAF in fact played a wide range of parts during the Hundred Days in the face of a variety of serious challenges. As those challenges evolved, so too did the conduct of air operations. Experimentation and change remained key features of the RAF experience to the end of the war,

as did ever closer integration into every part of the British combined arms machine. Some historians have suggested that the key to British victory was the discovery and application of a set combined arms 'formula for success'.⁵¹ Nowhere is this less true than in the case of air/land integration, which had to respond to ever-changing situations on the ground and in the sky, all while grappling with new technology. Only if we see the Royal Air Force of 1918 both in the context of this highly dynamic environment, and as an integral part of the combined arms effort, can we see its achievements in full perspective.

Notes

¹ David Jordan, 'The Royal Air Force and Air/Land Integration in the 100 Days', Air Power Review Volume 11, Number 2, pp. 12-29: pp. 27, 28.

² J.C. Slessor, *Air Power and Armies* (London: Oxford University Press, 1936).

³ The 24 hour clock has been used here for consistency's sake, although the British army did not adopt it until 1 October 1918. All dates here are 1918, unless otherwise specified. German units are italicized.

⁴ Number 3 Squadron War Diary, The National Archives, Kew (TNA) AIR 1/166/15/142/19.

⁵ *Ibid.*

⁶ III Brigade Weekly Summaries of Work, 28 December 1917 - 11 November 1918, TNA AIR 1/1518/204/58/65.

⁷ Counter Battery Map, 21 August, VI Corps General Staff War Diary, TNA WO 95/774; VI Corps Artillery Narrative, 21 August - 11 November, VI Corps General Staff War Diary, TNA WO 95/775.

⁸ III Brigade Weekly Summaries of Work, 28 December 1917 - 11 November 1918, TNA AIR 1/1518/204/58/65.

⁹ Counter Battery VI Corps Operation Order No. 5, 25 September, 2nd Division General Staff War Diary, TNA WO 95/1302.

¹⁰ Weekly Report on Operations, week ending 24 October, IV Corps General Staff War Diary, TNA WO 95/718; Counter Battery VI Corps Operation Order No. 3, 22 October, VI Corps Commander Heavy Artillery War Diary, TNA WO 95/789.

¹¹ Ernst von Hoepfner, *Deutschlands Krieg in der Luft: Ein Rückblick auf die Entwicklung und die Leistungen unserer Heeres-Luftstreitkräfte im Weltkrieg* (Leipzig: K.F. Koehler, 1921), p. 174.

¹² H.A. Jones, *The War in the Air: Being the Story of the Part Played in the Great War by the Royal Air Force 1914-1918* Volume VI (Oxford: Clarendon Press), pp. 445-446.

¹³ *Ibid.*, p. 544.

¹⁴ *Ibid.*, p. 445.

¹⁵ *Armeeoberkommando 2*, evening report 23 August, *Heeresgruppe Boehn* War Diary, Bundesarchiv-Militärarchiv, Freiburg (BA-MA) PH 5 I/47.

¹⁶ For the interesting debate about exactly how and when German army morale crumbled, see Alexander Watson, *Enduring the Great War: Combat, Morale and Collapse in the German and British Armies, 1914-1918* (Cambridge: Cambridge University Press, 2008), chapter 6.

¹⁷ Hoepfner, *Deutschlands Krieg in der Luft*, pp. 172-173.

¹⁸ Special Operation Order No. 12, 24 September, Thirteenth Wing Operation Orders, TNA AIR 1/1808/204/161/4.

¹⁹ Situation Report Ia Nr 356, 26

September, and Summary of Intelligence on 29 September, Ic, dated 30 September; entry for 29 September: all in *IV. Reservekorps Generalkommando War Diary*, BA-MA PH 6/II/23.

²⁰ G.S. 59/4, 29 October, Report by Major-General H.J. Elles, Liddell Hart Centre for Military Archives, King's College London (LHCMA) Fuller I/7/17.

²¹ Martin Van Creveld, *Command in War* (Cambridge: Harvard University Press, 1985), p. 75.

²² III Brigade Weekly Summaries of Work, 28 December 1917 - 11 November 1918, TNA AIR 1/1518/204/58/65.

²³ Narrative of Operations, 27 September - 2 October, 63rd Division General Staff War Diary, TNA WO 95/3097.

²⁴ Telegram G.B. 114, 10.08 hours 3 September, Third Army Operations, TNA WO 158/227.

²⁵ The Western Front - Air Operations May - November 1918, TNA AIR 1/677/21/13/1887, p.250.

²⁶ Narrative of Operations, 21-25 August, 1st Tank Brigade HQ War Diary, TNA WO 95/99.

²⁷ Third Army Artillery Instructions No. 44, G.O. 59, 2 October, Third Army Operations, TNA WO 158/228.

²⁸ The Western Front - Air Operations May - November 1918, TNA AIR 1/677/21/13/1887, p. 76.

²⁹ *Ibid.*, p. 195.

³⁰ History of Number 15 Squadron, TNA AIR 1/166/15/153/1.

³¹ Jones, *The War in the Air*, pp. 506-507.

³² This system had first been used on 26 August. The Western Front - Air Operations May - November 1918, TNA AIR 1/677/21/13/1887, pp. 252, 198.

³³ Jordan, 'The Royal Air Force and Air/Land Integration', pp. 24-25; Jones, *The War in the Air*, pp. 524-526.

³⁴ Special Operation Order No. 12, 24 September, Thirteenth Wing Operation Orders, TNA AIR 1/1808/204/161/4.

³⁵ III Brigade Weekly Summaries of Work 28 December 1917 - 11 November 1918, TNA AIR 1/1518/204/58/65.

³⁶ Number 57 Squadron Miscellaneous Returns, TNA AIR 1/1500/204/39/15.

³⁷ Morgen, Curt von, *Meiner Truppen Heldenkämpfe* (Berlin: Ernst Siegfried Mittler und Sohn, 1920), p. 154.

³⁸ Situation Reports Ia Nr 356, 26 September, and. Ia Nr 432, 3 October, *IV. Reservekorps Generalkommando War Diary*, BA-MA PH 6/II/23.

³⁹ *Generalkommando 54 War Diary*, BA-MA PH 6V/68.

⁴⁰ Memorandum on Bombing Operations, June 1918, reproduced in Jones, *The War in the Air*, Appendices Volume, p. 112.

⁴¹ *Heeresgruppe Boehn War Diary*, BA-MA PH 5 I/47; *Armeeoberkommando 2 War Diary*, BA-MA PH 5 II/124.

⁴² Lademann, Ulrich, *Das 3. Magdeburgische Infanterie-Regiment Nr. 66* (Berlin: Gerhard Stalling, 1922), p. 85; Geyer, *Feldartillerie-Regiment Nr. 225* (Oldenburg: Gerhard Stalling, 1923), p. 211.

⁴³ *Heeresgruppe Boehn War Diary*, BA-MA PH 5 I/47.

⁴⁴ *Armeeoberkommando 2 War Diary*, BA-MA PH 5 II/124.

⁴⁵ Brederlow, Tido von, *Geschichte des 1. Garde-Reserve-Regiments* (Oldenburg: Gerhard Stalling, 1929), p. 336.

⁴⁶ Report Ia 6/XI, 1 November: *Untersuchungsausschuss der Deutschen Verfassunggebenden*

Nationalversammlung und des Deutschen Reichstages 1919-1926, 'Die Ursachen des Deutschen Zusammenbruchs im Jahre 1918', Volume VI (Berlin: Deutsche Verlagsgesellschaft für Politik und Geschichte, 1928), p. 336.

⁴⁷ See Wilhelm Deist, 'The Military Collapse of the German Empire: The Reality Behind the Stab-in-the-Back Myth', *War in History* Volume 3, Number 2 (April 1996), pp. 186-207.

⁴⁸ See, for example, Morgen, *Meiner Truppen Heldenkämpfe*, pp. 147-148.

⁴⁹ German Army Military History Research Section, *Der Weltkrieg 1914 bis 1918: Die Militärische Operationen zu Lande Band 14: Die Kriegführung an der Westfront im Jahre 1918* (Berlin: Ernst Siegfried Mittler und Sohn, 1944), p. 759.

⁵⁰ Viereck, Helmut, *Das Heiderregiment Königlich Preussisches 2. Hannoversches Infanterie-Regiment Nr. 77 im Weltkriege 1914 – 1918* (Celle: August Pohl, 1934), p. 610; Brandis, Cordt von, *Die vom Douaumont: Das Ruppiner Regiment 24 im Weltkrieg* (Berlin: Tradition Wilhelm Kolk, 1930), p. 461.

⁵¹ Robin Prior and Trevor Wilson, *Command on the Western Front: The Military Career of Sir Henry Rawlinson 1914-18* (Oxford: Blackwell, 1992), p. 289.

‘Building a Good Instrument’: Assessing the likely characteristics of Future conflicts and their implications for the air component

By Wg Cdr Helen Miller

Trying to predict the nature of future warfare is fraught with difficulty. The recent emergence of non-traditional adversaries, an exponential change in technologies, increasing globalisation, economic interdependence and the economic downturn have all served to cloud the picture. This paper outlines the possible causes and several projected models of future conflict and discusses its probable characteristics, before exploring the utility of the air component in the most likely future scenario - irregular conflict.

The paper concludes that, given the likely characteristics of future conflict, the air component will remain important, seeing an evolution of the way it is currently utilised. This will mean a requirement to fight across the spectrum of warfare, utilising air power’s strengths and characteristics and developing mastery of the intellectual dimension in order to facilitate cultural understanding of potential opponents and to enhance the ability of air component personnel to think in terms of the strategic level of conflict which their actions at the tactical and operational levels may influence.

'A man who wants to make a good instrument must first have a precise understanding of what the instrument is to be used for; and he who intends to build a good instrument of war must first ask himself what the next war will be like'

General Giulio Douhet, 1928.

Introduction

Trying to predict what will constitute future warfare is fraught with difficulties. The recent past has seen the emergence of non-traditional adversaries, an exponential change in technologies, increasing globalisation, economic interdependence and the inevitable economic downturn all serving to cloud the picture. Given the likely characteristics of future conflict, there will continue to be a role for the air component, and this role is likely to be an evolution of the way it is currently utilised, not least because platforms procured today could be in service for the next 30 years. That there will be conflict in the future, is almost certain, for, as Gray suggests, humankind has yet to demonstrate that, '...(it) is in the process of curing itself of the habit of war.'¹

This paper outlines the possible causes, and exploring several projected models of future conflict, discusses the probable characteristics of future conflict, before exploring the most likely utility of the air component in the most likely future scenario – irregular conflict - towards the end. Here, relevant factors such as training and education for airmen and procurement issues for air platforms will be covered. This paper only looks out to the 2030 timeframe, as advances in technology

and the rapidly evolving global environment militate against longer-term predictions. The focus will be on both the UK and US Air Forces, although where it is relevant, other nations' uses of their air component will also be discussed. The US Air Force (USAF) has brigaded 'Air', 'Space' and 'Cyberspace' together as stated in their mission statement, '...to deliver sovereign options for the defense of the United States of America and its global interests - to fly and fight in Air, Space, and Cyberspace.'² However, that is not true of all air forces, or indeed air components, and so this paper only considers both space and cyberspace when it is relevant to the discussion of the air component generally.

As Colin Gray observes, 'It is more than 100 years since Wilbur and Orville Wright achieved the first sustained heavier-than-air flight, and those years have been liberal in providing a host of opportunities for airpower to demonstrate its contemporary prowess.'³ Air Commodore Paul Colley notes that, '...the wider utility of air power in irregular warfare is less obviously clear.'⁴ Nevertheless, the air component is a force-multiplier, and in the future is likely to remain so providing the intellectual dimension is there to support it.

The UK's Defence Concepts and Doctrine Centre (DCDC) suggests that the greatest risk of large-scale conflict will come from those areas where there is a history of recurring conflict, where there is demonstrable economic hardship, demographic and environmental stresses and where there is enduring inequality.⁵ Challenges such as climate

change, transnational terrorism, pandemic diseases, inequality and globalisation, particularly with regard to the economy, are likely to have global effect. For DCDC, the areas of change over which conflict may occur in the future are set out within four key themes: population and resources; identity and interest; governance and order; and knowledge and information.⁶ First, population growth, resource competition, urbanisation and changing demographics are all loosely related, and may lead to tensions, either singly, or in combination. Clearly, if global population levels grow, then it is not unreasonable to assume that resources such as water and energy will also be at a premium, and competition for them will increase. The trend towards societies in the developed world having an increasingly ageing population, where health care and lifestyle have had a positive effect for increased life-expectancy, present funding challenges in those nations which may impact upon defence expenditure. Here, funds that could be used on defence budgets may have to be diverted to health and social care as the result of pressure from voters, with possible adverse effects on overall levels of defence spending.

In other areas of the world, where societal conditions militate against long life, and where inequalities (both real and perceived) can lead to bloody and brutal conflicts, there exists a 'youth bulge', where the majority of the population is less than 25 years of age. This bulge may cause conflict, given the potential lack of gainful employment, and sufficient social infrastructure for these people to live their lives. Furthermore, perceived

historical slights and tensions between different groups in society may be exacerbated and become sources of confrontation, as has been seen in areas as diverse as Africa and the Balkans in recent years.

Second, migration, which is likely to increase, '...in response to environmental pressures, deprivation and the perception of economic opportunities offered in towns and cities, as well as in wealthier regions and countries', is a likely source of tension and potential confrontation.⁷ Such migration is likely to lead to increased urbanisation, whereby populations congregate in cities for reasons of employment or forced migration, and this will have particular implications for the military should a conflict erupt, a point explored later in this paper. Forced migration caused by failed or failing states also has military connotations, not least through the mixing of combatants with non-combatants and all that this means for the use of force.

International organised crime is forecast to expand with emerging markets, increased profitability and volume.⁸ The implications for the air component derive from the ability of criminals to gain ever more sophisticated means to protect their trade. In Colombia, for example, drug production and trafficking is protected by the Revolutionary Armed Forces of Colombia, which operate freely within a huge demilitarised zone that was set up in 1998 in the South of the country.⁹ If this type of sophisticated illicit activity with significant military capability increases, counter strategies will need to be developed across all components. The ability for an

opponent engaging in this type of activity to deny the air component control of the air is a real threat, and one that would require the capabilities to provide traditional air surveillance and the suppression or destruction of the enemy's air defences, even if these are limited to man-portable systems.

One of the most militarily significant factors for the future is likely to be the demand for new energy sources. There may be a need for a well-funded research programme by governments to seek alternative fuels for their military capabilities. The demand for dwindling stocks of hydrocarbons is also likely to continue to cause conflict in the future, such as that caused by Iraq's invasion of Kuwait in 1990 for, (amongst other reasons) control of disputed oilfields spanning the common border. Will climate change also drive the air component to invest in technologies that move away from hydrocarbons in favour of biofuels or other forms of energy? The USAF, for example is certifying its fleet to use biofuels in order to reduce its reliance on traditional supplies.¹⁰

It is clear that a great many factors could influence the characteristics of future conflict, but it is unsurprising that there is no consensus of what the most significant characteristics will be. It is clear that key decision-makers would be imprudent to ignore the possibility of participation in conflict across the spectrum of warfare - from high to low intensity, from major peer competitor, in nuclear or conventional war, to irregular warfare. For the air component, this range of possibilities means that its constituent forces will need to be

chameleon-like in order to adapt to their circumstances reflexively.

Some theorists argue that the likelihood of future major interstate wars is slim for the next 30 years or so. For Rupert Smith there is no doubt: 'It is now time to recognize that a paradigm shift in war has undoubtedly occurred...the old paradigm was that of interstate industrial war. The new one is the paradigm of war amongst the people...'¹¹

Lind, Schmitt and Wilson contend that future war will not be a trinity between the Government, the Army and the People, but like in the past, wars will be fought between groups, not states.¹² They argue that, 'the nation state is losing its monopoly on war, and its hold on its citizens' loyalty, in a growing portion of the world...when it loses the ability (or perceived ability) to do that, it will lose the loyalty of the people... (they) will transfer to whatever organizations can protect them' and suggest that this is particularly true in parts of the world such as the Middle-East, Asia and Africa, where the nation state has rarely had the same degree of loyalty from its population as has been seen in the western world.¹³ This presents many complications for armed forces, particularly those engaged in intervention operations, and is particularly challenging for the air component which may be called upon to achieve a number of desired effects through exploitation of its perceived utility in the domains of deterrence and coercion without being able to target clearly defined centres of political or military significance with the facility that it

has in previous conflicts, such as that in Kosovo in 1999.

The DCDC suggests that, in the 2007-2036 timeframe:

*Major interstate wars will be unlikely, because of the increasing economic interdependence of states in a globalized economy and the need to confront the symptoms of a challenging range of transnational problems, which will enhance the requirement for cooperative governance and action.*¹⁴

However, even since the publication of that statement in 2006, there have been indications that state on state and intra-state warfare can not be easily disregarded as a possibility. The recent Russian invasion of Georgia in 2008 is a case in point. Russian tactics that combined conventional force with cyberwarfare to disable Georgian command and control underscored the range of threats.¹⁵ Flexibility of attitude by all components will be vital to addressing these emergent challenges. Gray predicts that while irregular conflict 'may well be the dominant mode in belligerency for some years to come' interstate war, with the possibility of conflict between major powers, 'will enjoy a healthy future.'¹⁶ It must be asked whether increasing state interdependence through the globalized economy may not transpire as readily or as rapidly as predicted given the current world economic climate. It may be that states will wish to isolate themselves from the international market in order to try and protect themselves from the downward spiral.¹⁷ If the global economic downturn is viewed as a 'strategic shock' (an unexpected event that has strategic implications that

breaks the prevailing paradigm), this could in and of itself be a catalyst for future conflict.

There is every sign that conflicts and crises in the future, will be complex and sometimes unpredictable, with the methods employed by belligerents becoming increasingly irregular.¹⁸ The IISS also recognises that potential opponents of the United States have:

*...taken note of US conventional superiority and acted to dislocate it. Non-state actors... developed 'asymmetric' approaches that allowed them to side-step US military power - either by rendering it functionally irrelevant, or by operating in environments where the US cannot bring its conventional superiority to bear.*¹⁹

Frank Hoffman argues that, "Irregular warfare" is inspired by the ideologies that spawned Islamist terrorism and Osama bin Laden...' and 'Irregular warfare is a natural reaction to globalization and America's overwhelming military superiority.'²⁰ There are a number of theories that use a similar construct and describing future conflicts in which opponents will use a multitude of approaches simultaneously with which to undermine an enemy - conventional war, cyber-warfare against financial or military targets, terrorism, the employment of biological agents and media-manipulation.²¹

To counter some of these threats, Hoffman suggests that America's military posture when deployed should be 'less direct and appear less intrusive', where 'maximum influence should be sought from a minimum footprint'.²² This may have implications for America's allies in

general, and for the air component in particular. In some scenarios, the air component's footprint can be quite sizeable, given the need for aircraft refuelling, flight maintenance and cargo-loading, which may militate against the reduction of the size of the footprint of American and coalition forces. Conversely, air power's inherent reach could also be used to minimize in-Theatre basing as evidenced by the USAF's successful use of Diego Garcia to undertake air missions in Afghanistan.²³

In the Pentagon's 2006 Quadrennial Defense Review, the shift in terms of future conflict has been recognised. The report states that, 'In the post-September 11 world, irregular warfare has emerged as the dominant form of warfare confronting the United States.'²⁴ The characteristics of irregular future warfare have been projected in varying ways by authors such as T X Hammes, as well as Hoffman and Smith, and it is useful to analyse their thinking in order to consider how the air component might have to adapt to meet the concomitant challenges.

Hammes introduces the concept of 'fourth-generation war' (4GW), as: 'an evolved form of insurgency...[that] uses all available networks – political, economic, social, and military – to convince the enemy's decision makers that their strategic goals are either unachievable or too costly for the perceived benefit.'²⁵

In Iraq, for example, the insurgents believed that if the Coalition could raise the standard of living for ordinary Iraqis, this would lead to its gaining popular support. Consequently, insurgents attacked economic or social targets in a bid

to disrupt Coalition efforts in this field and to remove the prospect of popular support arising from the resulting improvements in infrastructure and the concomitant increase in living standards.²⁶ This approach to conflict is very difficult for western armed forces, with a focus on more conventional war-fighting operations, to counter, hence Hammes' description of 4GW as, 'America's 'Achilles Heel'.²⁷

The motivation for fighting a larger and more powerful opponent in this fashion is highlighted by Hammes who observes: 'Our opponents know 4GW is the only kind of war America has ever lost – and done so three times: in Vietnam, Lebanon and Somalia.'²⁸ It appears that the enemies of the US are studying its tactics and using its past failures to good effect. Hammes suggests that 'the consistent defeat of major powers by much weaker fourth-generation opponents makes it essential we understand this new form of warfare and adapt accordingly.'²⁹ This suggests that a new mindset may be required at all levels, and this thread of military education will be developed below.

Another key characteristic of 4GW is enemy use of the media to bombard the public with images of the battlefield, in real time to raise the profile of their struggle.³⁰ This aspect has been seen with particular clarity in recent years, with the exploitation of the media evolving from Saddam Hussein's rather crude attempts at media manipulation during the 1991 Gulf War to the much more effective harnessing of an array of media technologies by insurgents in both Iraq and Afghanistan in a bid to

make western societies question the legitimacy of their involvement in the conflicts in those countries.

The final key characteristic of 4GW is that these conflicts tend to last for decades as can be seen in the Vietnamese, Afghan/Soviet and Palestinian conflicts. Hammes is convinced that opponents in 4GW can be beaten, though, but to achieve success requires, 'coherent, patient action that encompasses all agencies of the government and the private sector.'³¹ Even with the effective integration of all these agencies, the likely duration of this model of conflict presents serious challenges for western nations, particularly in maintaining sufficient public support for continued involvement.

Developing the ideas of 4GW further, Hoffman argues that, 'future contingencies will be more likely to present unique combinational or hybrid threats that are specifically designed to target US vulnerabilities' and that, 'we can expect to face competitors who will employ all forms of war and tactics, perhaps simultaneously.'³² In essence, a hybrid threat combines conventional tactics with irregular ones, the use of terrorist acts and criminal activities, and this combination seeks to destabilise the opponent and undermine the legitimacy of the host state.³³ Hoffman argues that hybrid warfare complicates future defence planning, though he does not believe that it replaces planning for conventional warfare.³⁴ The US Secretary of State for Defence, Robert Gates observed:

Other nations may be unwilling to challenge the United States fighter to fighter, ship to ship, tank to tank. But

*they are developing the disruptive means to blunt the impact of US power, narrow the United States' military options, and deny the US military freedom of movement and action.'*³⁵

Hybrid means of conflict will surely be highly attractive to future opponents. Hoffman is convinced that these means will develop rapidly, that opponents will build on their successes, and adapt to use high tech means to improve their killing methods. To add to the complexity, hybrid attacks will capitalise on Western vulnerabilities, such as casualty aversion and the enduring pursuit of no or low collateral damage. By drawing the fight into urban and littoral areas, an opponent will seek to exploit these weaknesses in the Western approach, drawing out the conflict, driving up costs and sapping national will.³⁷

Hoffman predicts that future opponents will seek innovative ways with which to fight - using technology to seek advantages in unanticipated ways, but fundamentally, an opponent who will 'accept no rules (on the battlefield)'.³⁸ Other experts agree. Michael Evans notes that we may see a future where '...symmetric and asymmetric wars merge and in which Microsoft coexists with machetes and stealth technology is met by suicide bombers.'³⁹ Hoffman predicts future adversaries will be found 'blending high-tech capabilities, like anti-satellite weapons, with terrorism and cyber-warfare directed against financial targets.'⁴⁰ Whilst this paper cannot cover the entire spectrum of cyber-warfare, it is relevant to note that it is conceivable, even highly likely, that an adversary would seek to exploit

what Shaud refers to as our 'reliance on cyberspace (which) has turned a technological advantage into a vulnerability...'⁴¹ It was precisely this vulnerability that Russia sought to exploit in its 2008 war with Georgia.⁴²

Smith takes a different tack. He argues that 'wars amongst the people' are literally that. He says, '...it is the reality in which the people in the streets and houses and fields - all the people, anywhere - are the battlefield.' For Smith, the military must be prepared to engage anywhere, and civilians are the 'objective to be won'.⁴³ For the air component serious difficulties arise when opponents use the urban environment to shield themselves. Air platforms, may find it extremely difficult to maintain reference upon fleeting targets - particularly fast jets, given their speed, operating height and turning circles - even with the most capable of sensor pods.⁴⁴

Smith concurs with Hammes and Hoffman that these types of conflicts tend to be long and drawn out, not because of a lack of willingness from the military to fight for a decisive (and quick victory), but because the guerrilla, terrorist or insurgent, will only fight at the time of his choosing.⁴⁵ Smith also argues that the fight must be won by 'capturing the will of the people', by adapting and adapting again as a reaction to the enemy, who is living amongst the people. The whole basis for success in such a campaign is an understanding that a military solution is not the answer - it just sets the conditions to allow other agencies to sustain the outcome.⁴⁶ Traditional air power paradigms that foresee victory achieved through bombing opponents into submission

must therefore be reconsidered.

The characteristics of future warfare will affect the way that each component prepares itself to fight. Before the events of 9/11, and the subsequent 'War on Terror' was launched, the preceding years had seen Western warfare waged from a distance - greater reliance on air and maritime strike, rather than the use of ground forces.⁴⁷ The problem with this kind of approach, one informed by the idea of a 'Revolution in Military Affairs', is that this was founded on emerging technologies, and the need for pervasive surveillance and information dominance, all of which were based on the assumption of traditional target sets.⁴⁸

In terms of shaping the armed forces for future conflict, a balance of capabilities will be required - not only between the different components, but between the armed forces and the other government departments which contribute to nation building and stabilisation through a form of cooperative approach (formalised as the Comprehensive Approach in the UK). Secretary of State for Defence, Gates recently underlined this need for balance by saying, 'To truly achieve victory as Clausewitz defined it - to attain a political objective - the United States needs a military whose ability to kick down the door is matched by its ability to clean up the mess and even rebuild the house afterward.'⁴⁹

The IISS suggests that there will be a need for smaller, more agile military teams which are, 'deliberately optimised for operations in complex, urbanised, populated areas marked by pervasive media presence and

globalised communications.⁵⁰ There will almost certainly be a counter-evolution by irregular opponents, and the ability for regular forces to continue to adapt will remain paramount. The air component will therefore have to be ready to apply effects or set decisive conditions across the spectrum of warfare from conventional state on state, or high-end war right down to conflict prevention and defence diplomacy. As high-end war fighting is comparatively well-understood within the air component, only the area of irregular conflict and the challenges it presents for air will be explored in detail below.

General T Michael Moseley, the former USAF Chief of Staff, asserts that, 'No modern war has been won without air superiority. No future war will be won without air, space and cyberspace superiority.'⁵¹ Colley makes clear that air power has a key role in irregular campaigns, and distils its utility down to 4 key areas, which are useful for this discussion: Control of the Air; Rapid Mobility and Lift; Intelligence and Situational Awareness; and Coercion.⁵² For many control of the air is paramount in any kind of conflict, a fact long since recognised by ground commanders. General Montgomery famously said, 'If we lose the war in the air, we lose the war, and we lose it very quickly.'⁵³

The same is true in an irregular conflict, where the lower airspace will often be besieged with small arms fire and man-portable air defence weapons, leaving rotary assets and slow fixed wing aircraft vulnerable to attack.⁵⁴ To some extent this threat can be countered with force-protection (at operating

bases) and by employing suitable tactics and countermeasures to mitigate the threats. Of the Summer 2006 conflict between the Israeli Defence Force (IDF) and Hezbollah, Hoffman comments that, 'Hezbollah even managed to launch a few armed UAVs that required the IDF to adapt in order to detect them.'⁵⁵ The implications of this are plain to see. Not only does the ground commander have to deal with the complexities of the hybrid threat, but the air commander does too. Colley goes further and says that this conflict represented strategic failure for Israel because there was failure to deliver anticipated air power for either strategic or operational success, due to the inability of the air component to find, track and engage fleeting targets amongst the wider population.⁵⁶ This again serves to underline that there is a clear implication for the air component in urban conflicts with respect to aerial targeting and surveillance.

Moseley agrees, saying, 'Airpower's unprecedented lethality and effectiveness deters opponents from massing on the battlefield, driving them to adopt distributed and dispersed operations.'⁵⁷ Of course, this actually makes things more challenging for the air component and perversely leads to criticism over the general utility of air power in these operations. However, it is clear that all components will need to find new strategies to counter the tactics of new adversaries.

When considering air for rapid mobility and lift, the ability of the air component to support light and Special Forces with air lift (and battlefield evacuation) is likely

to continue to be paramount to a successful prosecution of any irregular campaign.⁵⁸ The UK's air component is successfully supporting land forces in Afghanistan and Iraq in current operations in this manner, although many of the platforms and trained crews are heavily over-tasked. Any future decision maker should invest in the types of air capabilities that enable these light and Special (Ground) Forces to be inserted, carry out decisive missions to secure ground, or to sustain them through precision air drops of vital supplies.⁵⁹ For intelligence gathering and gaining situational awareness, the air component is highly effective in irregular campaigns and this trend should continue for future conflicts. The ability to both identify and detect individual objects or people by using the latest air and space technology will continue to be in high demand with ever increasing exploitation of technology to deliver and enable commanders to gain the information edge on any opponent.⁶⁰

The air component has traditionally played the coercion role well, albeit with some difficulties (such as during the Kosovo campaign in 1999)⁶¹ and the ability to provide a show of force, or to use precision attack will continue to be relevant for any future irregular conflicts. Of course, it will be easy for an opponent using hybrid means to use these strengths against us, particularly where precision air strikes are necessarily used in an urban environment. Images of an imprecise strike, such as those used against the IDF by Hezbollah in the Summer of 2006 can seriously undermine an air campaign. Colley states that, 'air weapons have undoubted utility for

irregular warfare,' but he also warns, 'planners and operators should not underestimate the potential for unintended psychological effects on the population...'⁶² He acknowledges however, that the presence of air can have a psychologically lifting effect on its own ground forces.⁶³

Turning to other areas, Gray identifies an obvious issue for the air component, although one that could easily be overlooked, in that, 'combat aircraft...are...expected to remain in service - barring attrition through combat and accident - for thirty or forty years or even longer.'⁶⁴ The same is clearly true for other types of air-platform - helicopters, air transport and UAVs. The implications of this are clear - it will not be possible to rapidly acquire new capabilities at very short notice and the air component, certainly for the UK, will have to fight in the air with what it already possesses. Upgrades and modernisation refits can extend the life of today's platforms still further (the Canberra aircraft was a prime example flying for over 50 years with multiple upgrades to its capabilities) and these will be key to unlocking potential for dealing with emergent threats and adversaries.

For future air component procurement, Gates stated that, 'Given that resources are not unlimited, the dynamic of exchanging numbers for capability is perhaps reaching a point of diminishing returns. A given ship or aircraft, no matter how capable or well-equipped, can only be in one place at one time.'⁶⁵ The air component, like the others, will continue to be constrained by the realities of the defence budget. Perhaps the solution,

as Gates contends, is that whilst you can use high end equipment for low end warfare, '...the time has come to consider whether the specialized, often relatively low-tech equipment well suited for stability and counterinsurgency missions is also needed.'⁶⁶ Others with recent operational experience in Afghanistan agree with this sentiment.⁶⁷ Perhaps therefore, rather than concentrating solely on the equipment, the key to unlocking airpower's potential will be by looking at the other (UK) Defence Lines of Development.⁶⁸

First, looking at training and education, Moseley argues that his airmen must be educated for key joint leadership positions, in skills such as potential opponent's culture, language and defence studies, in order to be, '...capable of fully integrating and leveraging our distinctive (airpower) capabilities in joint and coalition arenas.'⁶⁹ It is not just the military who are turning to education and training. Gray says that, 'Capable enemies who have studied the US style in warfare would be hugely motivated to reduce the American airpower advantage. Such a reduction might be achieved not only by air defense but also by contesting the uses of space or cyberspace'.⁷⁰ The only tangible counter to this is by educating military personnel across all components, and not just at the tactical level. Air Commodore Subramaniam, Indian Air Force, warns that his nation's airmen have their training too skewed towards the tactical level, and suggests that, '... in the furtherance of India's strategic objectives...training and thinking (is needed) to fight strategically.'⁷¹ Doctrine too needs to catch up. General Sir John Kiszely suggests

that military doctrine needs to be flexible and agile enough to adapt to changing circumstances, but he also warns that, '...the nature of complex insurgencies is that they are amoeba-like...dynamic...agile...insurgents, being thinking enemies, study our doctrine.'⁷² On the organisational side, air components will need to stay agile and use existing platforms in new and innovative ways whilst training alongside the other components to maximise chances of success, whatever the type of conflict.

To conclude, predictions of the likely characteristics of future conflict are, at best, difficult. Whilst state on state conflicts cannot be ruled out, they are not as likely to be the main area for conflict in the foreseeable future. The general consensus appears to be that future opponents will adopt irregular or hybrid campaigns, designed to seek out vulnerabilities. These are likely to be based on a combination of factors that will seek to undermine national will, by using techniques such as skilful information campaigns, terrorism, and prolonged conflicts, that are both costly in terms of funding and in the lives of the military. For the air component, this means a requirement to fight across the spectrum of warfare, whilst utilising airpower's strengths and characteristics to prosecute successful air campaigns in irregular conflicts. To do this, more low-end platforms may be necessary, especially those capable of being a force-multiplier, such as battlefield helicopters, but the overall message for the air component is clear - the need to master the intellectual dimension - and educate the airmen to be able to think strategically and to develop cultural understanding of potential

opponents.⁷³ The temptation for air components to do what they have always done in the past - see a new threat as a catalyst to buy new equipment to solve that problem should be avoided, not least to counter the rising costs of defence technologies, and the commensurate reduction in overall platforms. Kiszely's advice is that armed forces not only need to recognise that they should be adaptable, but that they must 'institutionalise' this adaptability to be successful in post-modern warfare.⁷⁴

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Viewpoint

Air Power and Agility

By Gp Capt Ian Shields¹

An agile, adaptable and capable Air Force, that person for person, is second to none, and that makes a decisive air power contribution in support of the UK Defence Mission.

The Royal Air Force Vision
Quoted in AP 3000, 4th Edition, p.5.

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

Sir Winston Churchill
Quoted in AP 3000, 4th Edition, p. 13.

Introduction

What is air power? In a previous article² I have argued that we have not yet produced a true air power strategist, but perhaps more fundamentally than that, what do we understand by the term “air power”? As Churchill says in his oft-used quote above, it is the most difficult to measure or define precisely, while this lack of clarity of understanding can in part be explained by the sort of people Churchill claims we, air power practitioners and proponents, are: more inclined to pragmatism than philosophy - and, I would add, inherently technically minded (for it

is only through technology that we can fly). Professor Colin Gray wrote in 2005 that “... we still do not have a satisfactory theory of air power”³, quoting in turn David MacIsaac:

“Air power, the generic term widely adapted to identify this phenomenon (the use of aircraft in war), has nonetheless yet to find a clearly defined or unchallenged place in the history of military or strategic theory. There has been no lack of theorists, but they have had only limited influence in a field where the effects of technology and the deeds of practitioners have from - the beginning played greater roles than ideas”⁴.

Go back a decade or so and we all chanted the mantra that *flexibility is the key to air power* which, indirectly, goes some way to explaining how air power is employed, and therefore hints at what air power *is*. This statement does not, however, go far enough, and it is noticeable that we now regard flexibility as a sub-set of agility. Indeed, in the present RAF Vision we see the idea of flexibility being taken one step further forward with the idea that it is, and therefore Air Forces are, inherently *agile*. By exploring what makes Air power, as opposed to Maritime or Land power, unique not only do we get closer to answering the philosophical question of what air power is, but also - and

arguably more importantly as it is more practical - how we can best exploit its very uniqueness.

Accepting, then, that agility as at, or very close to, the core uniqueness of air power, what do we understand by agility? The new edition of AP 3000 identifies agility as one of the six fundamental strengths of air power⁵, before going on to assert that agility itself comprises five strands: responsiveness, flexibility, resilience, adaptability and acuity⁶. This article will build on the (necessarily) short reference to agility in AP 3000 by exploring further the notion of agility and how it relates to air power in order to contribute to the wider debate on the meaning of air power. To do so, it will first look briefly at the notion of agility before considering how each of the individual aspects of agility identified in AP 3000 relate to air power. It will then discuss how agility can be used as way of balancing strengths and weaknesses before concluding.

Air Power and the Five Strands of Agility

Agility, taken as an entire concept, is a little like time: we all know what it is but find it difficult to define. It is important to recognise that agility is primarily a state of mind and an approach to problem solving: it is this aspect of agility on which we should concentrate rather than on the physical attributes of aircraft and other air-breathing platforms possessing agility, necessary though such an attribute might be. But to develop an attitude of mind that is not only itself inherently agile, but can in turn produce agile solutions to problems, requires both training

and a broader, widening educative approach that is somewhat counter-intuitive to the military mind. How, though, do the five strands of agility relate to air power?⁷

Responsiveness. Air power is, inherently, highly responsive. Aircraft are, compared with ships or regiments, relatively easy to maintain at very high readiness which offers a degree of agility not available to our Maritime or Land colleagues. Moreover, with their speed, aircraft can transit much quicker, delivering or threaten to deliver air power rapidly. This high responsiveness of air power can make it attractive for politicians, especially as it also represents a limited political commitment, especially when offering a reduced ground footprint. Furthermore, aircraft on task can respond rapidly to developing situations on the ground (or on the surface of the sea): one only has to think of the close air support requests from troops in contact in Afghanistan to recognise the responsiveness of Air power. However, speed itself should always be seen in the context of a specific situation, not as an absolute virtue. Speed does offer commanders at all levels the ability to bring influence to bear quickly, be that reassuring presence, humanitarian relief or attack; all at long range and in time. This makes air power useful for initial crisis management. But, in recognising air power's intrinsic strengths we must also have the confidence to accept its limitations: it is never a panacea and has two significant limitations. First, when moving materiel to a crisis zone, air power has limited lift compared with surface means. Airlift exploits speed

and reach, but trades off mass; this allows pragmatic policy options⁸. The second limitation is impermanence, although this is being addressed to a degree by unmanned aircraft, and can be offset by air refuelling. Moreover, technological advances suggest that impermanence, often regarded as the Achilles' heel of air power, may be significantly reduced within the next 20 years⁹.

Flexibility. Flexibility allows for people, units and platforms to switch roles without major re-training or re-configuration when faced by the unexpected or by changes in anticipated activity. In addition, it assists in mitigating system failure or the results of enemy action, in providing a measure of redundancy. Aircraft are reasonably flexible, although they are invariably configured towards one broad role. However, at the design stage more and more flexibility is being introduced - it is worth recalling that the original name for the Tornado was the Multi-Role Combat Aircraft. Moreover, the JCA is likely to be an excellent ISTAR platform, because its suite of sensors will relay their information without the pilot even being aware of what it is doing. Meanwhile, the Reaper Unmanned Air Vehicle demonstrates where this flexibility, aided by technology, may be leading with the old stovepipes of surveillance and attack increasingly being broken down. There is, though a down-side to advancing technology, and that is unit cost: as platforms become fewer and more expensive, albeit more able, flexibility becomes more difficult. The effect of mass will be considered further under the next heading, resilience. However, we must generate, through training,

flexible thinking in our people for we must be alive to the loss of flexibility that technology and cost between them suggest. Fortunately, it is not just platforms that are flexible, air-minded people, for the very reasons Churchill spelt out in the quote at the beginning of this article, are flexible. Mankind is at ease operating in a two-dimensional world, be that the surface of the land or of the sea, but adding the third dimension of height requires a different perspective on the world, one that, combined with the speed at which we are accustomed to operate and therefore our different perception of time, the fourth dimension, requires a more flexible approach.

Resilience. Air platforms are, by their nature, fragile. They must be light enough to defy gravity and from the earliest days of aviation we have sought lighter and stronger structures. Air platform fragility, both of the ground and in the air, can be partly addressed by height, speed, defensive aids and stealth (in harmony, not isolation) but with unit costs rising and platform numbers declining, attrition directly impacts resilience. Indeed, in terms of resilience here lies the conundrum: we can make platforms more resilient by making them more survivable thanks to technology, but that makes them more expensive, and fewer in number (witness the recent US decision on F-22 numbers¹⁰). That in turn makes the loss of any single platform more significant and, with replacement for both the platform (limited capacity to manufacture and long build times due to the technological challenges) and, for manned aircraft, the operator (aircrew training is now measured in years), decreases resilience. Mass, of course,

has a resilience all of its own, and the time may be drawing close when we need to have a debate over whether we should have large numbers of low-technology platforms (perhaps unmanned) or a very few high technology aircraft?^{11,12} . However, with our traditional love-affair of technology it is more likely that we will continue the trend towards more complex solutions and have to accept ever fewer platforms - even Unmanned Air Systems such as Predator are increasing rapidly in unit cost as we demand ever more of them. The greatest need for increased resilience, though, is mental. In particular, we have become accustomed to very low casualty rates and the loss of just a single platform, as alluded to above, may have strategic impact. Indeed, we are at a historically low point for losses from peace-time flying training accidents and have experienced mercifully few losses on recent operations. We should be alive to this trend, and not only guard against any assumption that we will never again face large-scale losses, but ensure that our political masters are aware of the impact that even relatively small losses of scarce and precious resources could have.

Adaptability. Allied to flexibility and resilience is the need to be adaptable in the face of the unexpected. Unlike flexibility, where our modern platforms can be re-rolled by design, technology counts against adaptability: it is becoming less common that we can *rapidly* adapt our sophisticated aircraft to new roles. Instead, the adaptability that we need to generate and retain is mental: we need to have the ability to recognise when our opponent has gained the

initiative, and have the ability to respond; a key requirement for all military practitioners. Air power practitioners have, traditionally, been good at adapting, but the constraints of fighting limited wars (with their emphasis on legal/ethical considerations) and the constraints of airspace control mechanisms (the Air Tasking Order has, perforce, driven air power employment) have offered limited opportunities for the full gamut of the flexibility of air power to be exploited. Future trends, such as increasingly centralised control (particularly political) and the advent of the Virtual Knowledge Bases (with networked data solutions offering algorithm-derived solutions that inadvertently constrain thinking: the solution being driven by the writer of the algorithm writer and tempting the commander to use that rather his own intuition¹³ is likely to exacerbate this tendency. Education is again the key, and both Commanders and the practitioners of air power must remain alive to its inherent adaptability and guard against those trends that risk reducing this fundamental strength.

Acuity. Acuity, the sharpness and acuteness of understanding¹⁴, are implicit in the best employment of air power. However, this requires a deep understanding of air power at all levels; such understanding can only come about through exposure to air-minded proponents, education and deep thinking. The development of the required depth of understanding must be gained, it is not an inherent ability. Of the five strands of agility this is the most difficult to articulate and therefore reduce to a balance-sheet style argument: it requires investment in

a conceptual rather than a physical field, the results of which are more difficult easily to identify. And yet it is also the most important for only by developing air power practitioners, proponents and commanders with the required insights into its agility will we exploit air power's tremendous potential into action.

Agility - Balancing Strengths and Weaknesses

While agility is an inherent property and strength of air power, we must recognise and accept that agile Air power alone will never be a panacea. The future operating environment is arguably more uncertain than ever, and we have witnessed in both Iraq and Afghanistan the rapid adaptability of our adversaries to UK concepts, doctrine and capability. Air power is on the one hand inherently agile; however, on the other we must constantly assess not just any campaign but the wider piece to ensure that we are aware of developments and can respond: this requires agility but also will allow us to retain our agile advantage.

Air power must be able to attack critical target sets to unhinge an adversary's will or ability to resist. Opportunities will exist in future to achieve physical and coercive effects that are out of proportion to the modest effort required for attacks; the advent of novel weapon technology will only assist in this endeavour. However, identifying these effects will require a depth of analysis that may not be possible in the time available: we will, for example, rarely fully appreciate how an adversary makes policy decisions, or how an economy, society or individual and collective

psychology of enemy leaders and citizens works. Trying to understand an adversary is the right approach¹⁵, but trying scientifically to model behaviour and the effects of air power applied against key nodes would be folly; the effects based approach can only be taken so far¹⁶. Good air power strategies are agile, where the best assessment is made in the time available, where people are willing to learn and where strategy is adjusted based on the observed effects and events. The ability to sense and respond to what unfolds is crucial: this is how air power can adapt, and how its strategists can learn, gain deeper insights into their adversaries and retain the initiative. It is all a question of balance: failing to inflict the damage called for by the initial strategy, or abandoning a sound strategy before it has time to work, are problems that an astute strategist considers. Selecting and maintaining the aim will always be apposite, but as allegiances shift and centres of gravity change, so too must end states, and the means adopted to achieve them. This, then, is agility, and with broad education, constant re-assessment and an innate knowledge of both the strengths and weaknesses of air power, air power practitioners and proponents can exploit this inherent agility to considerable effect.

Conclusion

Air power is still, I contend, neither fully understood nor adequately articulated as a concept. But by considering what makes Air, as opposed to Maritime or Land, power unique we can get closer to an understanding of its inherent nature, and by doing so enable us to be better placed to exploit its

strengths and avoid its weaknesses. Air power remains a young capability and this youthfulness allows we, its practitioners, to be open-minded. We are inherently technical in our outlook, and this willingness both to embrace new ideas and exploit new technology are themselves symptomatic of the inherent agility of air power. We must always acknowledge air power's weaknesses and limitations, particularly its impermanence and fragility, but by making full use of its strengths we can ensure that we deliver the maximum capability and achieve the greatest effect. Agility is at the core of air power, and by better understanding the five strands of agility (responsiveness, flexibility, resilience, adaptability and acuity) we increase our knowledge and understanding of this most difficult of military capabilities to define - but the capability that simultaneously offers the greatest potential.

Notes

¹ Group Captain Shields is Assistant Head Air and Space at the Development, Concepts and Doctrine Centre (DCDC). This article, which has its origins in early drafts for the (now published) Future Air and Space Operating Concept 2009, are, however, his own views and do not represent either MOD or DCDEC policy.

² APR Volume 11 No 1 Spring 2008, pp. 1 - 5.

³ Colin S Gray, *Another Bloody Century: Future Warfare* (London: Weidenfeld and Nicholson, 2005), p. 319.

⁴ David MacIsaac, 'Voices From The Central Blue: The Air Power Theorists', in Peter Paret, ed., *Makers of Modern Strategy: From Machiavelli to the Nuclear Age* (Princeton, New Jersey,

1986), p. 624.

⁵ AP 3000 4th Edition, p.17.

⁶ The current edition of *The High Level Operational Concept* lists the same five strands of agility, albeit in a slightly different order (responsiveness, resilience, flexibility, acuity, adaptability). See *The High Level Operational Conceptual Commentary* pp. 1-7 - 1-8.

⁷ This is not to say that Maritime or Land Power are not also agile - and it should be remembered that an enemy will also be agile, as we are witnessing today in Afghanistan. But where Airpower has the edge in agility over Maritime or Land Power is that, due to the flexible and responsive nature of air platforms, its *employment* is inherently agile - at least when employed imaginatively.

⁸ Another issue often quoted as a major drawback of air power concerns Access, Basing and Overflight (ABO) acting as a significant limitation of air Transport. However, the reality has been that employment of UK air power has invariably been consistent with the legal and moral justification held by the states neighbouring the zone of crisis and Host Nation Support (HNS) has rarely proven to be a issue.

⁹ See the recently published *Future Air and Space Operating Concept 2009* for more detail.

¹⁰ The F-22 is widely acknowledged as the most advanced fighter aircraft in the world, but at a reported unit cost of \$US143 *each* - or about 2/3 of the cost of a cheap naval Frigate. A combination of unit cost and changing requirements have limited the US buy. See: <http://online.wsj.com/article/SB123490303268502611.html>.

¹¹ One RAND study has predicted that by 2054 the *entire* US Defence Budget

would be able to buy just one aircraft, such is the cost growth of technology. See the Future Air & Space Operating Concept 2009 (FA&SOC 2009), p. 1-4 for a longer explanation of the impact of technology inflation on air and space platforms.

¹² There, is however, nothing new in this debate: when undertaking the then Weapons Employment Course in the mid 1980s (at the height of the cruise missile deployment to Greenham Common and Molesworth)

I recall a British Aerospace representative arguing that we could replace all our Harriers, Jaguars and Tornados in Germany with shipping containers full of cruise missiles.

The suggestion was that these missiles, conventionally rather than nuclear armed, would swamp the Warsaw Pack air defence network and enough missiles would get through, with no loss of scarce aircrew lives, to achieve the same effects that the manned aircraft fleets could. A somewhat tongue-in-cheek argument, as any increase in resilience would be more than offset by the decrease in flexibility, not to mention a concern that the missiles could be interpreted as being nuclear-armed, thereby triggering Armageddon. Nevertheless, as a concept worthy of note.

¹³ For more detail see FA&SOC 2009, especially paragraphs 226 - 237.

¹⁴ Concise Oxford Dictionary.

¹⁵ "Know the enemy, know yourself; your victory will never be endangered.

Know the ground, know the weather; your victory will be total". Sun Tzu, *The Art of war*, Chapter 10.

¹⁶ The Israeli offensive against Hezbollah in Southern Lebanon

in 2006 is testament to the dangers of taking an effects based approach too far.

Viewpoint

Is Defence Carrying Too Much 'RISK'?

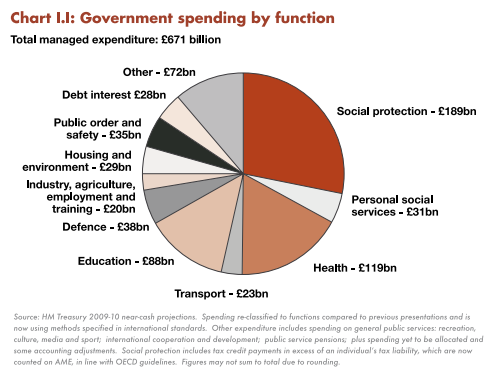
By Sqn Ldr Dave Stubbs

The words "We sleep soundly in our beds because rough men stand ready in the night to visit violence on those who would do us harm" are often attributed to George Orwell. The quotation succinctly explains, and cleverly justifies, the role of the military in society. Nevertheless, as Service personnel we are often reminded that the military is but one element of the government machine, competing for funding against all the other departments of state, all of which have greater electoral relevance to the population than the military, particularly in times of peace. In a democracy, when not under the threat of imminent attack, Health and Education spending will, so we are told, always trump military spending.

Military spending has always been under scrutiny so reports, like the one produced by the Institute for Public Policy Research (IPPR) on 30 June, which suggested that '£24 billion of future planned defence spending ought to be re-thought as part of a full Strategic Review of Security', are routine think pieces. The IPPR recognised that the debate should be focussed on how to get the best value for money from what we spend on security but gives scant recognition to the increases in spending on Health, Education and Social Protection over the last

10 years when compared with the reductions in defence spending as a proportion of national income, over the same period. Over the last 20 years the defence budget has declined significantly in relation to gross national product, from 4% to 2.6%¹; a cut of 35% in real terms, yet involvement in war fighting has increased and few commitments have been removed. This level of productivity increase in the civilian world would be remarkable. In relation to other government departments today's military is very efficient. The resource debate should really be about rebalancing spending priorities, rather than simply cutting the military budget further.

Many still maintain that the defence budget, as a proportion



of government spending, is very large and that by cutting it further,

resources could be effectively reallocated elsewhere. The chart above shows this view to be wide of the mark; salami slices of the defence budget can not yield significant resources for use elsewhere. Furthermore, the efficiency of other departments is questionable. If, as the IPPR suggests the world is much changed from what it was 20 years ago, with increasing globalization and power diffusion; more fragile and unstable states than strong and stable ones; neo-jihad ideology activity challenges and a more profligate nuclear age then why should the defence budget be under such pressure? Perhaps it is because defence is seen as an easy, politically acceptable, target. In an economic environment where tax revenues are insufficient to support spending and vast sums are being borrowed to support the banking system, health, education and other government priorities how much money should the military get to protect society, and play its part in supporting government directed national military objectives? More explicitly, where should the military be concentrating its resources?

Whilst Defence Reviews² have enabled military planners to match promised resources to tasked output, the amount of cash allocated to support the government's own defined objectives and tasks doesn't always materialize and funding gaps have led all 3 Services to manage 'risks'. Effectively this means that some of the activity required by government tasking can be measured, understood and prioritized in such a way that the activities that are perceived to have the lowest risk get less or, in the worst case,

none of the money needed. Risk management can be defined as the process of analyzing exposure to risk and determining how to best handle such exposure. Dr Alan Billings³ this year questioned how the management boards of financial companies overcame their risk management fears to take stupendous and ultimately disastrous risks; he asked "Could it be that the very mechanisms that businesses put in place to identify and evaluate, and so guard against risk, did the opposite?". He went on to ask "There is a human tendency to think that because we can understand something we have brought it within our control. There is nothing like a sophisticated set of figures and tables in a risk register to create the illusion that a risk is fully understood, and simply by being understood, less of a risk". When different teams and boards are responsible for project, programme and operational management elements of risk there is an increased danger that the understanding of the risks may be missed, or simply misunderstood.



Fig 1. Type 45 Destroyer

An example of risk management being affected by funding constraints was the decision, taken to reduce

number of Type 45 Destroyers from the 12 they initially expected to replace 12 Type 42's, down to 8 vessels at 'risk' to secure the government articulated Defence Review requirement for aircraft carriers.

Aircraft carriers require a significant amount of defending, before their offensive capability can be brought to bear. Later funding requirements, with a different Defence Secretary in post, have reduced the number of Type 45's procured to 6. Agreeing to 50% of the original requirement used to protect 90% of our maritime trade and having fewer vessels to protect the aircraft carriers requires



Fig 2. Nimrod R1

the acceptance of considerable risk. Whilst the need for aircraft carriers has come under scrutiny the demise of other capabilities has attracted less attention. For the RAF the indefinite delay to Project HELIX, the replacement for the Nimrod R1, could well lead to the loss of this vital strategic/tactical manned surveillance capability; the current aircraft is due to be taken out of service in 2011!

The Reaper UAS will only continue as an urgent operational requirement;

presumably it will now disappear when our forces withdraw from Op HERRICK. Although we know that communications underpin everything our opponents do the Soothsayer communications intelligence programme, which could have played a crucial role in Op HERRICK, will now be axed. Also, the cancellation of Project EAGLE, the upgrading of the E-3D mission system, will reduce its ability to interchange and interoperate with its USAF equivalent in contingency and war fighting operations. With reduced numbers of E-3s and crews funded, its capability could simply wither away. ISTAR was seen as one of the 6 RAF priorities only a few years ago!

There are differences in the way military and civilian equipment is procured. The production and delivery of military 'effect' requires the development of relatively small numbers of capable equipment, suitable people and training. Perhaps most importantly it takes time; it is rarely a quick or instantaneous process and as a consequence once a capability has gone it becomes extremely expensive to regain. Air platforms, touted as being capable of performing swing/multi-roles can become very expensive indeed. For instance the JSF/F35's ability to undertake Intelligence functions, perform surveillance, targeting, close air support, and air defence duties concurrently, across a range of war fighting activities and locations, ranging from counter insurgency to medium scale warfare is not yet fully proven. If, or when, it is sufficiently proven the numbers required will become the focus of attention. Defining how many aircraft are needed to provide all

of the capabilities that are required necessitates mathematical modelling, which should take account of capability enhancements anticipated; this process is relatively easy to undertake.



Fig 3. JSF/F35

However, as time progresses and costs rise, the carefully worked out figures, defining how many aircraft are needed, are likely to be revisited to incorporate a degree of 'risk'. Pressures on government spending often result in 'Savings rounds' which, with the enduring perception that there is fat in the military budget, cause the numbers game to be revisited again and again. Each time a layer of risk is added the ability of the aircraft to perform one or more of the roles it was originally envisaged to perform could be seriously challenged. Reducing the numbers of a defined operational requirement due to lack of resources diminishes operational capability, concurrency or readiness at a stroke.

Perhaps it is time to recognise that risk carried in isolation can be managed but with all 3 Services

carrying risk, at various organizational levels, against a significant portion of their operational activity there is a danger that some of the risks being taken will be realised. By continuing to convince itself that it can manage the multitude of risks across the given Defence tasks, programmes and projects the military may be setting itself up for failure. The military outlook is naturally positive; it has a 'can do' attitude and few are willing to say that government defence objectives cannot be satisfied for the money available and feel duty bound to accept the risk that some things will not happen. However, as the number and scale of the risks increase the likelihood that some of them may be realized increases. Many of those responsible for accepting risks in the past will have moved to other appointments or have left the Services; they are unlikely to be held retrospectively accountable for the risks they were happy to accept in their time. Indeed, it may go some way to explain why General Sir David Richards' recent keynote speech to the Royal United Services Institute (RUSI)⁴, warned that if the Forces continued to try "to do a bit of everything" then they would risk "failure across the board". Defence arguments centre on whether to continue to maintain a balanced force, with sufficient agility to flex from counter insurgency operations to medium and large-scale war fighting, or to intelligently focus our priorities on likely activity, funding them properly.

The problem for the observers who would like to rack and stack military capabilities against their perception of what is likely to happen is that their views are often wide of the

mark; wars and conflicts are not easily predictable. Who anticipated the Falklands conflict, or that our forces would be spending years in Iraq and Afghanistan? After the actions of Russia against Georgia do we need to re-focus defence to be sufficiently prepared for a conventional war in continental Europe? Indeed, many preconceptions of what, and how, defence needs to change often appear to override subsequent analysis. The IPPR recommendations implicitly suggest a defence budget reduction could be achieved if commitments were reduced, specialisation increased, integration with European defence increased and if defence equipment requirements were reviewed but, ultimately, their own analysis could lead to the view that defence spending should remain fairly constant or that more, rather than less, resource is needed. In particular the effects of climate change are likely to result in an increasing level of media driven, politically determined engagement from stable governments in disaster relief operations, around the world, under the UN concept of 'responsibility to protect'⁵, with the geo-political aim of securing our nations trade.

So, if it is not possible to squeeze any greater efficiency from the military, and the defence budget is insufficient to pay for the tasks the government demands what should happen? Ultimately the government may order another Defence Review, to quantify what it wants to do within the budget it will authorise, though this is unlikely to happen before the next general election. A Defence Review is likely to uncover is a Pandora's Box of risk, so big that actual

military capability, when set against articulated tasks is finally exposed. In this context the IPPR report may help drive a change in policy. In the interim General Richards told RUSI "Our Armed Forces will try with inadequate resources to be all things in all conflicts and perhaps fail to succeed properly in any. The risk is such that it's too serious any longer to be accepted".



Fig 4.
General Sir
David Richards

He added that "I am not suggesting for one moment that the UK should get rid of all its more traditional military capabilities. Far from it..... We need to possess a deterrent-scale, traditional war fighting capability; one that reflects our stated policy of only going to war as part of the NATO alliance or, within a smaller regional context, with an overwhelmingly powerful USA." The IPPR thinks that the government should conduct a review of the UK's defence requirements as part of a wider Strategic Review of Security: wider than just defence, focusing on specializing on certain capabilities and reducing commitment to the full spectrum of war fighting capability. If the next Chief of the General Staff believes that the risks of being able to support all current military tasks, within the current Defence Budget are too great, either the budget must grow or a significant degree of rationalization is needed. Until a review of some sort takes place it would be prudent for the 3 Services to work together in identifying where the risks are too great, rather than

conducting in-fighting over a funding pot everyone knows is too small, based on the tasks the military are required to undertake and what is happening in the world right now.

Notes

¹ Martin Innes, Sunday Times 28 Jun 09 http://www.timesonline.co.uk/tol/comment/columnists/guest_contributors/article6591202.ece?openComment=true.

² Most recently the 1998 Strategic Defence Review, and its 'New Chapter' edition of 2004.

³ BBC Radio 4 Thought for the Day, 31 March 2009.

⁴ General Sir David Richards speech, 25 June 09. <http://www.rusi.org/events/ref:E496B737B57852/info:public/infoID:E4A4253226F582/>

⁵ Resolution 60/1, para 139, World Summit, 2005.

Book Review

Torpedo Leader

By Wg Cdr Patrick Gibbs DSO, DFC

Reviewed by Wg Cdr Clive Blount

Torpedo Leader is a first person account of flying the Beaufort in the anti-shipping torpedo bomber role in 1941-2. Gibbs wrote this book whilst WWII was still in process and its immediacy and freshness - without the benefit of any 'post match analysis' - is stunning.

Gibbs was a regular officer who spent the early stages of WWII as a Flight Commander on a Coastal Command Beaufort squadron. He spent most of winter of 1940/41 in hospital following a flying training accident, which probably saved him from the fate of so many of his colleagues, leaving the squadron in Autumn 1941 as one of very few pilots to survive a tour of Torpedo Bomber operations. Attacks in those early days were conducted in small formations, with low level searches of the enemy coastline carried out in an attempt to locate shipping for attack. To hit a moving ship with a torpedo is no easy task, particularly as the Beaufort was not fitted with any form of weapon sight; so these attacks were largely ineffective despite the high losses sustained by the Beaufort crews. It was this futility that urged Gibbs to develop tactics and techniques to conduct squadron, and multi-squadron attacks later in his career. After a period as a staff officer in the Cairo HQ, Gibbs then talked his way back to operational

flying, first in the Western Desert and then on to Malta. It is the desperate battle for Malta's survival that forms the backdrop of the bulk of the book. The role of the air defence forces, not least the legendary Gladiators 'Faith' Hope' and 'Charity', and the story of the courageous convoy of Operation PEDESTAL in the protection and re-supply of Malta, is well known. Gibbs describes a much less familiar area of operation that, nonetheless, was vital in supporting the campaign in North Africa and drastically reducing the re-supply of Rommel's *Afrika Korps*.

Not only technically fascinating, with detailed discussions of tactics and techniques and an exciting first hand account of many anti-shipping attacks, this book is intensely personal and draws the reader in to Gibbs' fears, crises of confidence and determination to hit hard at the enemy. The leadership dilemmas of commanding a squadron in a high intensity battle are described and one can follow Gibbs personal torment in vivid detail. Gibbs is searingly honest about his fears and motivations; this adds a human dimension and grabs the reader's empathy like few similar memoirs. We are also introduced to the many supporting roles required to enable the Beaufort's success. The initial lack of intelligence on enemy shipping, and the poor use of that intelligence which was available,

is highlighted by Gibbs, as is the logistics support required for his campaigns. Gibbs describes his shock realisation of the effort it took to get sufficient Torpedoes to Malta - usually carried in the bomb bay of Wellingtons which themselves suffered not inconsiderable losses - a factor he had not considered as he developed his mass attack tactics. From an air operations perspective Gibbs describes in detail the evolution of co-ordinated attacks by large numbers of Beauforts and subsequently the addition of other ac to provide fighter escort and dive-bombing attacks to much increase the effectiveness of the anti-shipping effort.

Whilst an exciting book for the lay reader, I would say that *Torpedo Leader* is a fascinating and thought-provoking read for the professional airman. I found myself alongside Gibbs tackling his many problems and found the experience most rewarding. I would say that it will have great resonance among those conducting today's operations. The anti-shipping battle in the Mediterranean was a largely unsung role in a largely unsung campaign, although without these operations the allied successes in North Africa would have been considerably less likely. The Torpedo Bombers' successes were largely anonymous - no one knew whose Torpedo hit the target and did the damage - and there was no tally of kills, or of bombing missions to measure success - few crews flew more than six operational flights from Malta. It was a grittily determined effort to hit the enemy hard that drove the crews forward. Gibbs' book goes along way to redress the balance of recognition in this key campaign

and is a fitting tribute to the Torpedo Bomber crews.

Book Review

The Science of Bombing: Operational Research in RAF Bomber Command

Reviewed by Mr Bob Gordon

Colonel Randall T Wakelam (RMC 1975) is Director of Research and Symposia at Canadian Forces College in Toronto. He is also an assistant professor of Defence Studies with the Royal Military College. *The Science of Bombing*, his first book, reflects this combination of academia and the military. Thoroughly researched, drawing on previously unexamined files, it is concise, tightly argued and well-organized.

The research question at the core of this text is the relationship between the Operational Research Section (ORS) of Bomber Command - staffed primarily by civilian scientists commonly referred to as 'Boffins' - and the actual performance of the flight crews and effectiveness of the bombing campaign against occupied Europe and Germany.

Interestingly, Wakelam confesses to an initial bias against the value of operational research. Describing himself as "someone who has had a career of some three decades in the air force including over three thousand flying hours, experience in command and staff appointments, and over a decade providing education programs for mid-level staff officers and senior commanders.... my opinion of the worth of operational research was

not high."

Demonstration of the effectiveness of operational research requires, according to Wakelam, establishment of a feedback loop linking performance and research, "a sort of a continuum which started with a problem and led to the adoption of an ORS developed solution. Schematically, he outlines this feedback loop as a five-link chain:

1. *Problem defined by Commander or key staff.*
2. *Problem passed to ORS.*
3. *ORS develop research plan and conduct research.*
4. *ORS submit conclusions and recommendations.*
5. *Commander or key staff accept and implement solution.*

The key aspect of this inquiry is the identification of problems by the Air Staff, their analysis by the ORS, and the implementation of ORS generated recommendations and solutions by the Air Staff.

Organizationally, *The Science of Bombing*, commences with an assessment of the status of Bomber Command's operations in the summer of 1941, prior to the establishment of the ORS. Lord Cherwell (Frederick Linemann), chief scientific advisor to the Cabinet, directed David M Butt, a civil servant

in the War Cabinet Secretariat, to assess 650 target photos taken between June 2 and July 25, 1941 and compare the results with the aircrews' after-action reports. The resulting report was first circulated on 18 August 1941. It asserted that the bomber offensive was shockingly ineffective. Two-thirds of the crews reported having attacked the target: Hitting the target being defined as within a five mile radius of the aiming point. The Butt report concluded that under a full moon and in excellent weather conditions only two in five of the crews hit the target, "but in thick haze the ratio dropped to one in fifteen" of aircrews that reported hitting the target. In other words, in excellent conditions 26% of the attackers came within five miles of the target and in poor conditions that dropped to less than 5%. Butt concluded that only a miniscule fraction of the bombs being dropped, were hitting the target.

Many senior officers rejected the report outright. However, Sir Charles Portal, Chief of the Air Staff was not one of them and on September 11 he minuted Churchill recommending the establishment of an operational research section at Bomber Command. By the end of the month there were seven scientists under Dr Basil G Dickins in Bomber Command's ORS. Interestingly, Wakelam notes that Bomber Command, despite the obvious problems, possessed an organizational culture that facilitated solving these problems using operational research. As the newest branch of the military it was least tradition bound. It was founded on a scientific (aerodynamics) basis. Finally, the application of radar to air

defence had already introduced the RAF, specifically, Fighter Command, to operational research.

The ORS had an immediate impact on Bomber Command although the results can only be described as mixed. Initially, it focused on improving the concentration in time and space of the bomber stream. Its efforts were greeted with success when the Shaker technique was introduced. The Shaker technique had the initial aircraft drop flares to illuminate the target, succeeded by aircraft dropping incendiaries. Then 'followers' dropping heavy explosives bombed on the fires burning. Concentration improved immediately. However, the accuracy of the leading waves did not and frequently analysis of raids revealed that a concentration of bombs had been achieved, but the target had been misidentified with the result that raids were often densely concentrated but off target. In essence, Bomber Command became very good at missing the target.

Realization of this problem, ironically revealed by further operational research, led to increased attention to navigation and target identification, and, eventually, the development of the pathfinder force (PFF). The progress of Bomber Command's improving efficacy and the development of operational research within the command was not a story of uninterrupted progress as the previous example plainly demonstrates. It was, rather one of "of trial and error in defining work and assigning resources." On the whole, however, it was a story of overall improvement. The application of Gee, Oboe H2S and a host of other technical improvements was

greatly facilitated by operational research. The body of *The Science of Bombing* details this process and clearly demonstrates the existence and functionality of the feedback loop that Wakelam set out to assess. Operational research had a profound and positive effect on the performance of Bomber Command during the last four years of the war.

In the course of this analysis Wakelam offers an interesting, revisionist perspective on Sir Arthur Harris. Many historians have portrayed Harris as an automaton or worse. A man equally unconcerned about the casualties among his aircrews and the deaths of German civilians. Wakelam offers a more balanced view of a man open to technological and tactical innovation. A man stoically accepting Kitchener's dictum, 'We must wage war as we must; not as we would like.'

There remains one significant criticism of this volume. Admittedly, Wakelam pored over records largely neglected and offers detailed analysis of the documents produced by the ORS of Bomber Command. However, on the other hand, he demonstrates an excessive reliance on one secondary source: A source that, inevitably, is prone to a bias particularly favourable to the ORS. I refer to "Operational Research in Bomber Command", a document produced by the ORS under the signature of the Section head, Dr Basil R Dickins.

Chapter 4, "Sorting Out Process and Producing Results": September 1941-February 1942" serves to illustrate this over-reliance on a single source. Twenty-one of the first thirty footnotes in this chapter are from "Operational Research

in Bomber Command". The first half of this chapter is little more than a précis of the document ORS produced assessing its own performance. In Chapter 3, "Boffins at Bomber Command: September 1941" 25% of the footnotes reference this same document. One cannot avoid wondering about the objectivity of a document produced by an agency evaluating its own performance. However, this shortcoming is trumped by the original research in primary sources that figures highly throughout. The result is a volume that provides a valuable contribution to the history of Bomber Command and is essential reading for anyone wishing to understand the contribution that operational research can make to combat effectiveness.

Historic Book Review

The Limits of Air Power: The American Bombing of North Vietnam

Reviewed by Air Cdre Neville Parton

Now we reach an interesting point in our series of historic book reviews, as we have arrived at the point where we start to consider books written by individuals who are still living - and where the publications are more widely known. Not that this negates in any way the value of continuing with the series - but it does mean that the interpretation can always be challenged by the author - something which has not been likely with any of the previous reviews! However, the overall aim of the series remains the same - to provide a degree of background regarding the author, an overview of the book itself, and then to consider the subsequent impact of the publication.

Mark Clodfelter, better known throughout his service career (and subsequently) as 'Clod', joined the United States Air Force in 1973, as a cadet at the USAF Academy (USAF), Colorado Springs.¹ His father, Walter A Clodfelter Jr, had served in the United States Army Air Force (USAAF) towards the end of the Second World War, in the Pacific campaign, and his stories of watching the B29s rolling off the runway on their way to Japan clearly sparked an interest in the young Clodfelter. His Class at the Academy was marked by a number of 'firsts': the first not to have to attend chapel on Sundays, the

first to enter Colorado Springs after the Vietnam War had ended, and the first to see female entrants (in 1976). Although he majored in history at the Academy, he was commissioned into the ground radar branch, and spent his early career at ground radar units in both the United States and South Korea. It was during the latter tour that his interest in the Vietnam conflict, and particularly the USAF's involvement, was sparked by Clodfelter's commanding officer, who had participated in three Linebacker II missions.²

The study of history obviously continued to hold a fascination for Clodfelter, as the remainder of his career would be spent in the educational sphere, including teaching back at USAFA in the History Department, as well as at the School of Advanced Airpower Studies (SAAS) Maxwell Air Force Base (AFB), and as the Air Force ROTC Professor of Aerospace Studies at the University of North Carolina. Indeed, his PhD was undertaken at the University of North Carolina, and it was on this work that his 1989 book *The Limits of Air Power* was based. Since 1997 Clodfelter has been on the staff of the National War College in Washington D.C., where he is now a Professor of Military History, and continues to write on a broad range of defence-related subjects. From a more

parochial perspective, Clodfelter is also a member of the Academic Advisory Panel for the Royal Air Force Centre for Air Power Studies (RAFCAPS), and a 2006 reprint of his book was included in the 2008 Chief of the Air Staff's Reading List.³ And it is to *The Limits of Air Power* that we must now turn.

Clodfelter is an avowed Clausewitzian, and *The Limits of Air Power* seeks, quite simply, to address the issue of the USAF's air war in Vietnam against the test of the contribution that the campaign made to achievement of the nation's overall war aims. Particular attention is paid throughout to both the positive and negative aims sought through the application of air power, because of Clodfelter's belief in their importance in terms of Clausewitzian theory – in particular Clausewitz's observations that “a preponderantly negative policy will ... retard the decision.”⁴ In this usage, negative goals related to objectives that could only be achieved by *limiting* the use of air power – for instance President Johnson's desire to avoid bringing Russia or China directly into the war. Positive aims on the other hand related to an end-state that could only be brought about by *applying* air power, such as President Nixon's aim of forcing the North Vietnamese government in Hanoi to accept his ceasefire proposals by directly affecting its will to resist.

The book consists of seven chapters, which, after considering the growth of American air power theory from World War Two to Korea, then examine the American air campaign in Vietnam on a chronological basis. Meticulously researched throughout, and based on a mixture of archival

research and interviews with many of the key decision makers, it manages to be both readable and yet hugely comprehensive. The origins of the American approach to the offensive use of air power against North Vietnam, which led to the instigation of the ROLLING THUNDER air campaign in February 1965, are explored in some detail, together with the rationale that led to the campaign being run on such a protracted basis – and with such a high level of political involvement in the detailed planning of the missions. Consideration is then switched to the latter four years of the conflict, detailing President Nixon's initial approach to the use of air power, before moving to the critical period in 1972 which resulted in the LINEBACKER operations. A short epilogue pulls the threads together with a commendably clear set of conclusions.

Considerable attention is paid to the restraints that were imposed upon the air commanders, particularly by President Lyndon Baines Johnson, who sought by ‘... restricting weaponry, targets and sortie rates... to fashion an air campaign that would hurt North Vietnam without provoking external observers.’⁵ The need to examine this area was related to a deep-seated belief within the USAF that the war could have been won if air power had not been subject to those political constraints imposed on it, perhaps encapsulated best in General Curtis Le May's quote that the war could have been won “In any two-week period you want to mention”.⁶ This is based upon an understanding that during the ROLLING THUNDER period of operations, which lasted from 1965 to 1968 and saw 643,000 tons of bombs

dropped, the fundamental lessons of air power learnt during the Second World War, and subsequently in Korea, were being ignored. However, even whilst ROLLING THUNDER was in progress, its effects - and prospects for success - became suspect, with a civilian study concluding that "North Vietnam has basically a subsistence agricultural economy that presents a difficult and unrewarding target system for air attack."⁷

Further attention was paid to the political aspects of the conflict. By 1972 the strategic situation had changed markedly, with the President, Richard Nixon, having quite clearly indicated during the first three years of his presidency that his goal was to achieve 'peace with honour', which in Nixon's mind meant a withdrawal of American forces in such a manner that it did not simply abandon the South Vietnamese to their fate. However, Nixon also worked hard on the political front to isolate North Vietnam from its political supporters - Russia and China, and success on this front was key to what would come later. The massive invasion of South Vietnam by North Vietnamese forces in early 1972 forced Nixon to reconsider how he was to achieve his aims, and the ultimate result was the LINEBACKER operations.

The key point here, brought out most distinctly by Clodfelter, is that many of the targets struck on LINEBACKER were the same as those that had been attacked during earlier campaigns - where he differs from previous observers is in his analysis and deductions as to why the operations were successful in 1972 where they had not been

earlier. Earlier consideration, which had become 'received wisdom', was that it was the degree of political interference which led to the failure of ROLLING THUNDER, as it meant that air power was not applied in the correct manner - overpowering and sudden. However, this ignored the very different political aims behind the two operations: in the mid-1960s the American aim was to assist South Vietnam in winning the war against the North, which at that stage was largely guerrilla in nature. At this point air power was largely ineffective, as it could not prevent the meagre amount of supplies required for such a campaign from reaching the Vietcong forces in the South. In 1972, the aim was to coerce the North Vietnamese into accepting a ceasefire to allow the Americans to withdraw their forces from South Vietnam. Following the longer-term impact of the Tet Offensive in 1968, which resulted in a conventional campaign in the Easter Offensive of 1972, North Vietnamese military success now made considerable logistical demands, which when combined with significant technological advances in terms of precision guided munitions (PGMs) meant that air power operating in the interdiction role could now be effective.

Equally as important, the isolation of North Vietnam from Russian and Chinese support - in a physical as well as a moral sense, and to the point where the Communist Party newspaper in North Vietnam described the actions of the Communist superpowers as 'throwing a lifebuoy to a drowning pirate' - enabled air power to be used effectively against all targets in the North of the country. In other words,

the 'negative' limitations had been removed because of a change in the political climate and this, together with the change in the nature of the conflict, enabled air power to live up to its promise.

A significant number of lessons are identified in the book's epilogue, with the most fundamental being that unless there is a clear understanding of the political end state that is required, and this is matched with an understanding of what air power can realistically achieve against that aim, then success is unlikely. A further plainly identified point is the need to comprehend the true nature of the conflict in which you are engaged, and here the marked differences between the situation in Vietnam between the ROLLING THUNDER years of 1965 to 1968, and the LINEBACKER operations of 1972 are made evident. Clodfelter began his manuscript by observing that:

In the final analysis, the supreme test of bombing's efficacy is its contribution to a nation's war aims. Clausewitz's definition of war as "a continuation of political activity by other means" provides the only true measure for evaluating air power's effectiveness.⁸

and concluded by pointing out that in relation to LINEBACKER II:

As long as Hanoi waged an unrestrained conventional war, Linebacker threatened much more than the North's ability to win; it also threatened the North's ability to defend itself.⁹

In between those two statements, a continuous linking of political ends and military means support Clodfelter's basic contentions,

and lead to a conclusion which subsequent history has proven to be remarkably apposite:

Bombing doctrine remains geared to a fast-paced conventional war, and the conviction that such doctrine is appropriate for any kind of conflict permeates the service. Until air commanders and civilian officials alike realize that air power is unlikely to provide either "cheapness" or "victory" in a guerrilla war - and that success in such a conflict may well equate to stalemate - the prospect of an aerial Verdun will endure.

So what justifies placing *The Limits of Air Power* in our series of historic book reviews? Perhaps the most straightforward answer is quite simply that it is almost impossible to find a publication or journal article produced on the subject of the air war in Vietnam since 1990 that does not begin with Clodfelter's analysis. But it was also a polarising piece of work, which threw the USAF's beliefs regarding the conflict into sharp relief. It made clear the fact that the Vietnam campaign could not simply be regarded as a continuum, and thereby provided a compelling and coherent explanation as to why the LINEBACKER operations produced results whilst those of ROLLING THUNDER did not, which went beyond the conventional wisdom that simply pointed to 'political interference' in the conduct of the campaign.

Equally, an understanding of Vietnam is important in terms of the role that it has played within the American military psyche ever since 1973. In many ways the Gulf War of 1990-91, at least from a USAF perspective, provided an opportunity to lay some

particular ghosts from that conflict to rest. This was especially evident in the air campaign, where even the name originally chosen (Operation INSTANT THUNDER) consciously referenced the Vietnam War - where as we have seen Operation ROLLING THUNDER had been so unsuccessful.

This is a book which repays careful study, and rewards the reader on a number of levels. It provides an object lesson in how to deconstruct and analyse a problem area to gain a better understanding of the relevant facts, and then to synthesise those facts in order to produce a new understanding. But it also shows tremendous moral courage; the courage to commit to producing a piece of work which is likely to be extremely unpopular - in this case with the very Service in which the writer was serving. It is, quite simply, an air power classic.

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Notes

¹ A short history of USAFA can be found at <http://www.usafa.af.mil/information/factsheets/factsheet.asp?id=9409>.

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³ Reference

⁴ Mark Clodfelter, *The Limits of Air*

Power: The American Bombing of North Vietnam (New York: The Free Press, 1989), p. xi.

⁵ *Ibid.*, p. 118.

⁶ *Ibid.*, p. 206.

⁷ The Jason Summer Study of 1966 was based on the analysis of a number of scientists who had been briefed on the war by members of the government, and had a considerable impact on members of the administration; from that point on Secretary of Defense McNamara would never again recommend intensifying the air war. *Ibid.*, p. 99.

⁸ *Ibid.*, p. xi.

⁹ *Ibid.*, p. 206.



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