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CONTRIBUTIONS TO THE ROYAL AIR FORCE AIR POWER REVIEW

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

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

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

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FOREWORD

This Spring edition of *Air Power Review* opens with a article from Wg Cdr D A Stamp entitled *Does the United Kingdom Require a Strategic Deterrent Capability Post-2030, or Is There a Better Strategy?* The paper examines the utility of the strategic deterrent in a geopolitical environment far removed from the Cold War of the 1950s. Using an effects based analysis, the author argues in favour of a transformational shift in national security policy. Firstly, he examines the effects, in military and political terms, of the current force of Trident missile submarines and strategy of 'minimum deterrence'. Secondly, he analyses the United Kingdom's future security requirements, finding interesting parallels between the perceived enemy bomber threat in the 1930s and the possible threat of ballistic missile attacks from rogue states in the years ahead. Finally, he offers a proposed solution to meet our future security requirements, one based on active defence rather than continued reliance on deterrence. Readers may or may not agree with the author's line of argument and conclusions; however, given that the future of our strategic deterrent is likely to become a heated source of debate in the very near future, it is certainly a timely piece.

Much has been written about Operation CHASTISE since 617 Sqn launched its famous raid against the Möhne and Eder dams on 17 May 1943. Wg Cdr M Gilligan joins the debate with his thoughtful paper *Does the Dambusters Raid Deserve its Growing Reputation as Operationally Daring but Strategically Futile?* Again using an effects based approach, the author demonstrates

that the raid was not, as one commentator has stated, 'a conjuring trick virtually devoid of military significance'. Applying modern campaign planning principles as a benchmark of his analysis, the author argues that it is important not just to look at the economic effects of the raid, but also its broader military, diplomatic and psychological impact. Taking each of these areas in turn, he points out that, had the same level of industrial disruption been effected by more 'conventional' bombing raids on the Ruhr, the loss in aircraft and aircrew terms would have been massively greater. He adds that, following the raid, the Germans were forced to divert valuable military resources to the dams' reconstruction and defence. On the diplomatic front, the raid greatly impressed the Americans and, perhaps more significantly, encouraged the hard-pressed Soviet Union to believe that its Western allies were, after all, committed to taking the fight to heart of Germany. Finally, in psychological terms, the raid provided a major fillip to British national morale in a critical period of the conflict.

In his paper *Playing the Killing Fields without Killing: To What Extent Should the RAF Incorporate the Use of Non-Lethal Technologies?* Wg Cdr N J Hay examines the practical, ethical and legal issues surrounding the employment of non-lethal technologies from the air. To open this debate, he stresses the key point that desired effects can often be achieved without kinetic destruction. He follows this with a useful analysis of individual non-lethal systems, ranging from kinetic energy and directed energy weapons, through to incapacitating agents or even

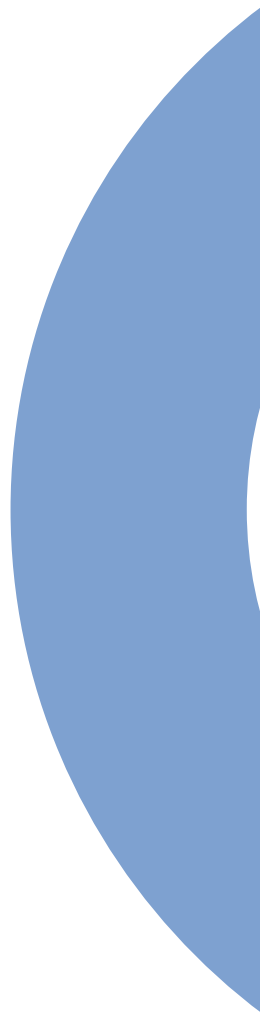
'stink' bombs. The author rightly points out that non-lethal weapons are nothing new, as tear gas was widely used in World War 1. In the modern context, particularly in the urban environment, non-lethal weapons can potentially limit collateral damage and civilian casualties, thereby making post-conflict reconstruction efforts less costly and time-consuming. On the negative side, however, the use of these weapons could be viewed as escalatory in some scenarios; furthermore, their perceived less-harmful nature might tempt some users to intervene, without appropriate reflection, in potentially dangerous crisis situations. The high human cost of using incapacitants to end the Moscow Theatre siege of 2002 is held up as a useful case study of the inherent risks of using non-lethal agents. As a result of his examination of the non-lethal technologies presently available, the author concludes that direct energy weapons, such as lasers, offer the greatest potential for airborne use, although he remains realistic about the resource implications involved in creating non-lethal weapon systems for the RAF's current and future aircraft platforms.

Wg Cdr S W Wray, in his paper *Perspectives on the Revolution in Military Affairs and Network Centric Warfare: Challenges for the UK Network Enabled Capability Programme*, looks at the introduction of NCW and NEC and the challenges this will represent in the post Cold War security environment. By examining the role of information dominance in both recent and earlier conflicts, the author argues that NCW may be the product of an evolutionary rather than revolutionary

process. Using historical examples, he points out that innovations in warfare seldom provide the user with a long-lasting advantage over its adversary, since the proliferation of technology often allows the latter to develop appropriate counter systems. Turning to the question of future security threats, he states that NCW would be potentially very useful in a variety of smaller scale military operations as well as 'force on force' encounters. He adds that NCW offers advantages against asymmetric threats, but warns that it could also provide terrorists, within a 'cyberwar' scenario, with a valuable and vulnerable target. Other potential problems highlighted are the impact of force reductions imposed by the need to fund new technology programmes, the danger of information overload and the ever-thorny question of interoperability. The author rounds off his argument by examining the impact, on the UK's planned NEC roll-out, of all the key issues raised — plenty of food for thought as the Service takes off into the information age.

One last point: regular readers of *Air Power Review* will have noticed that the date for publication has changed. This reflects the fact that from now on, it will appear on a twice-yearly basis, as opposed to quarterly. We will ensure that we maintain or enhance the quality of our articles, but also want to engage our readers in the key air power debates of the day. A letters page will therefore be featured in future editions — so if you do wish to comment on any of our articles — or other pertinent matters regarding air power, please do write in.

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Contents

- 01** Does the United Kingdom require a strategic deterrent capability post-2030, or is there a better strategy?
Wg Cdr D A Stamp
- 27** Does the Dambusters Raid deserve its growing reputation as operationally daring but strategically futile?
Wg Cdr M Gilligan
- 49** Playing the killing fields without killing: To what extent should the RAF incorporate the use of non-lethal technologies?
Wg Cdr N J Hay
- 73** Perspectives on the revolution in military affairs and Network Centric Warfare: challenges for the UK network enabled capability programme
Wg Cdr S W Wray
- 96** Book reviews

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Does the United Kingdom require a Strategic Deterrent Capability Post-2030,

or is there a better strategy?

By Wg Cdr D A Stamp

Britain's strategic deterrent capability is due to be decommissioned in approximately 2030, and the requirement for a replacement system needs to be considered. Demonstrating that Britain's strategic deterrent offers few positive effects in today's international environment, this paper considers the merits of a defence-based security strategy exploiting missile defence systems. Analysis is conducted utilizing contemporary and historical evidence combined with the theory of 'strategic drift', highlighting the influence of post-Cold War mentalities and underlying British culture. This paper contends that a deterrent-based replacement would not afford Britain the level of strategic security, status and technological advantages that a defence-based strategy would.

*'What ought we to do? Which way shall we turn to save our lives and the future of the world? I find it poignant to look at youth in all its activity and ardour and wonder what would lie before them if God wearied of mankind.'*¹
(Winston Churchill)

The United Kingdom (UK) has remained committed to nuclear weapons as a source of security and influence ever since its first atomic test in 1952. This test highlighted that Britain was prepared to go to astonishing lengths in its quest for what was perceived to be both a highly influential military weapon and a substantial enhancement to national status.² The current UK strategic deterrent was designed with a political and strategic utility very different from that extant

today or anticipated tomorrow.³ The geopolitical situation has changed dramatically since the Cold War, and the UK's nuclear capability now exists in an international system that has undergone considerable political, technological and moral changes.⁴ Although no major arguments are being advanced in favour of altering Britain's current nuclear posture, will the UK require a strategic deterrent capability when the existing system comes to the end of its service life in approximately 2030?

The aim of this paper is to provide an effects-based analysis of the British strategic deterrent, using open source material, to provide evidence as to the UK's long-term requirements for strategic national security. It will also aspire to offer a solution that could fulfil these requirements. In this context, the term 'effects' will be used to describe the military and political results, or consequences, experienced by the UK as a direct result of the ownership of a nuclear arsenal. The paper will contend that a strategic deterrent strategy will not provide the UK with the optimum level of security required to meet the challenges and threats envisaged in 2030. It will go on to contend that a transformational shift in national security strategy will be needed if Britain hopes to meet the demands of the future international environment. In conducting this evaluation the paper will firstly outline the UK's current strategic deterrent system before defining what effects this weapon system affords Britain today; this will be achieved by assessing both contemporary and historical evidence regarding security and status benefits. The second part of the paper will then analyse the UK's future strategic security requirements and strategies, utilizing the strategic management concept of 'Strategic Drift', before offering a possible solution to meet Britain's security needs in the 21st Century. The paper will highlight the requirement for the UK to re-evaluate its security priorities without allowing Cold War era mentalities and strategic culture, pertaining to reliance upon deterrence, to overshadow its decision making process. For the purpose of clarity, this paper will focus on the UK's nuclear deterrent, to provide a dispassionate view of any benefits that are, or could be, derived from it as a weapon system. No attempt will be made to analyse the

relevance, ethics or utility of nuclear weapons as a whole. Furthermore, the paper will limit its scope to future national security systems; arguments regarding early disposal of the current strategic deterrent system will not be addressed.

Effects afforded by UK nuclear weapons in today's international environment

To enable an accurate assessment of the effects that Britain's nuclear deterrent provides, an outline of the current weapon system must be established for use as a baseline. Presently, the UK strategic and sub-strategic nuclear deterrents comprise just one weapon system. This consists of a four-boat Vanguard-class ballistic missile submarine force, with each boat carrying 16 United States (US) built Trident II D5 missiles. Each of these missiles carries three independently targeted warheads, developed and produced autonomously by the UK. This system is generally regarded to be modern and highly sophisticated. The combination of the UK's geographic position and a submarine-based launch vehicle provides the UK with an efficient and, debatably, invulnerable nuclear deterrent force.⁵ Allowing for maintenance schedules and time to transit to patrol areas, four boats afford the UK the ability to have one boat on patrol at all times.

This capability is underpinned by a strategy of 'minimum deterrence', which constitutes current British nuclear strategy. This strategy encapsulates the belief that Britain's nuclear arsenal is the minimum required to deter an opponent, by having the capability to inflict a degree of destruction that would outweigh any potential benefits he could hope to make from his aggression.⁶ Britain's nuclear arsenal and offensive capability are at the lowest levels they have ever been. All other British nuclear weapons have been withdrawn from service and the UK's estimated number of warheads only represents approximately one per cent of the total number in the world. Moreover, Britain has made considerable reductions to the country's weapons alert status since 1994. The UK no longer has its warheads targeted at specific locations in Russia and the notice-to-fire times have increased significantly.⁷ But will a policy of minimum deterrence remain relevant to the UK as the 21st century unfolds?

A fundamental prerequisite in determining any future UK strategic deterrent requirement is an assessment of the effects the current nuclear capability offers the UK in today's dynamic international environment. The complex and interwoven elements that combine to define what nuclear weapons provide for the UK in the 21st century are difficult to assess clearly as they are

subject to considerable conjecture and subjectivity. Nevertheless, what is of enduring relevance is the perception that nuclear weapons provide the UK a degree of national security, and status on the world stage. To determine how these factors contribute to the overall effect that nuclear weapons afford Britain, these elements will be analysed against the post-Cold War international system.

The UK strategic and sub-strategic nuclear deterrents comprise just one weapon system. This consists of a four-boat Vanguard-class ballistic missile submarine force, with each boat carrying 16 United States built Trident II D5 missiles



UK Vanguard class is the only submarine that carries Trident missiles in the UK Navy
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National security effects and UK nuclear weapons

Most political leaders believe that the maintenance of national security is their primary duty to those that they represent, and Britain is no exception. In today's international security environment, characterised predominantly by uncertainty, the new threats faced by the UK will require a far broader approach to security. Julian Lindley-

French believes that 'uncertainty is almost certain to continue progressively, revolutionizing the assumptions that drive security policy'.⁸ Security has been defined in many different contexts ranging from territorial, cultural and religious to economic. This is encapsulated by Barry Buzan's definition of security as 'the pursuit of freedom from threat and the ability of states and societies to maintain their independent identity and their

British nuclear policy today no longer has specific threats against which it is targeted. 'The forces intended to generate nuclear deterrence for Britain today are for the notice of whomever they may concern'



Britain's nuclear deterrent — a Vanguard class ballistic missile submarine, stern view
 (© Crown Copyright, image from www.defenceimages.mod.uk)

functional integrity against the forces of change that they see as hostile'.⁹ It is this definition that will be used when considering the concept of Britain's strategic security.

Within the writings of most advocates of maintaining a UK strategic nuclear deterrent, four main security elements can be distilled that underpin what they believe the future roles of nuclear weapons will be. These potential roles can be summarized as undertaking the following functions: deterring other states who have, or are developing, nuclear arsenals; bolster conventional war prevention; deterring the possession, or use, of chemical and biological weapons; and to provide a 'low-key' element of insurance in support of general world order.¹⁰ To examine what security effects nuclear weapons provide for the UK, these roles will be analysed to ascertain their relevance in the post-Cold War international environment.

The first of these nuclear roles, that of deterring other states who have or are developing nuclear arsenals, is difficult to argue for the UK. The issue of deterrence has always been highly subjective, fundamentally requiring the group that the deterrence is aimed at to evaluate the effectiveness of the strategy.¹¹ The required influence or effect can only be achieved with the cooperation of the intended deteree. By virtue of there being human beings within the decision making loop 'whether or not a nuclear arsenal deters is a matter for decision by the recipients of would-be deterrent menaces, not by the owners of the putative deterrent'.¹² British nuclear policy today no longer has specific threats against which it is targeted. 'The forces intended to generate nuclear deterrence for Britain today are for the notice of whomever they may concern'.¹³ Having no specified target for its deterrent, and hence no established deterrent relationship, would suggest that Britain's deterrent strategy is fatally flawed. Colin Gray believes that deterrence can never be considered to be reliable, as it is intrinsically difficult to deter those who are 'truly desperate, those who are over-confident and that are fatalistically resigned to submit to 'History's Command' or the will of Allah'.¹⁴ This analysis is somewhat general in nature. To get a detailed reflection of how effective Britain's

nuclear weapons are at deterring other states who have or are developing nuclear arsenals, examination must be conducted of the UK's nuclear relationship with each potential threat that is perceived to fall within the 'whomever they concern' category.

Of the eight states known to possess nuclear weapons it is unlikely, due to Britain's alliances, history, cultural and economic ties, that the UK's nuclear weapons are meant to deter either France or the US. This position is unlikely to change in the foreseeable future.¹⁵ This only leaves Russia, China, India, Pakistan, Israel and emerging nuclear states such as North Korea or Iran.¹⁶

The demise of the Soviet Union has modified the way that the UK perceives the threat from Russia. Despite the possession of a huge nuclear arsenal, it is no longer considered to threaten an invasion of Europe, and has also become intrinsically linked to the West through a number of political organizations including the Organization for Security and Cooperation in Europe and the NATO/Russian Founding Act on Mutual Relations, Cooperation and Security.¹⁷ Moreover, the substantial reforms that the country has undergone over a relatively short period has left the Russian military in crisis and disarray, with any plans to restructure its conventional forces severely hampered by a lack of political reform, a parochial opposition to restructuring, inadequate education standards within the officer corps and widespread deterioration of military facilities.¹⁸ Christopher Donnelley observes that the implications of this decline require the West, "having long thought of Russia as a problem because of its strength, to deal with a Russia that becomes a problem because of its weakness".¹⁹ As such, the only real threat to Western interests currently posed by post-Cold War Russia emanates from the uncertainty of the political situation, not from a premeditated aggressive political doctrine. It is possible that further disintegration of the Russian Ministry of Defence could undermine the power balance in Eurasia or, in extremity, foster the conditions conducive to civil war.²⁰ Either scenario has the potential to seriously harm UK economic and diplomatic interests throughout the world and

would threaten European stability. In this way, Russia poses only an indirect, unintended threat to British national security and, consequently, deterrence by means of the threat generated by the UK's nuclear arsenal is ineffective. Conversely, even if Russia were to return to a hostile mode, and utilize nuclear weapons to threaten or blackmail, it is difficult to believe that the UK's minimal nuclear arsenal could be the influence that would promote world order; only the nuclear strength of America would, realistically, be able to achieve this.²¹

The relationships between India-Pakistan, Israel-Arabs and China-US/Russia represent a significant threat to global security. Given the mainly bilateral, and geopolitically determined, nature of these relationships they present no direct threat to the UK's national security. Moreover, considering that the UK has no specified nuclear relationship with these states, it is unlikely that Britain's relatively small nuclear arsenal imposes any restraining influence upon the sporadic bouts of brinkmanship between the parties.

This only leaves the deterrent effectiveness of the UK's nuclear arsenal towards emerging nuclear states for consideration. Many states such as Argentina and South Africa have abandoned their quest for nuclear status following substantial diplomatic pressure from the international community. States such as North Korea and Iran are believed to be actively pursuing nuclear weapons. These so called 'rogue states', which are known to have facilitated anti-western terrorist groups, are also developing ballistic missiles which could be utilized to target the UK with weapons of mass destruction (WMD). This is likely to become a substantial threat to UK national security. With no established deterrent relationship, and vastly differing perceptions of tolerable attrition and rational behaviour, the UK's nuclear arsenal could hope to offer little reassurance against these increasing threats. Malcolm Rifkind expanded upon this fact in 1993. It is difficult to be confident that an intended deterrent would work in the way intended, in the absence of an established deterrent relationship. Would the threat be understood in the deterrent way in which it was intended; and might it have some unpredictable and perhaps counter-

productive consequence?²²

Deterrence theorists often describe a further limiting factor to the UK's deterrent strategy as self-deterrence. This phenomenon can best be explained by the notion that retaliatory threats can lack credibility if they are deemed to be disproportionate in nature or give rise to fear of escalation, leading to all out nuclear exchange. As Donald Whitmore observes, the 'threat of nuclear retaliation can have a hollow ring if it is believed [that] actual retaliation would be self-deterred by fears for national survival'.²³ Some strategic planners have contemplated the use of very low-yield nuclear weapons to overcome this self-deterrence feature of Britain's existing nuclear weapons. This is generally viewed with much scepticism outside of the US. In opposing this notion, Malcolm Rifkind stated that 'the implications of a new war-fighting role for nuclear weapons would be seriously damaging to our approach to maintaining stability in the European context, quite apart from the impact it would have on our efforts to encourage non-proliferation'.²⁴ It can be seen, therefore, that the practical value of Britain's nuclear arsenal in deterring nuclear attack from an established, or emerging, nuclear aggressor is highly questionable.

The second role envisaged for the UK's nuclear weapons is to prevent conventional war. Michael Quinlan believes that the reality of war has changed radically due to the influence of nuclear weapons, leading to the recognition that the concept of winners and losers between the major nuclear powers is inconceivable. Therefore, the idea of total war as a trial of military strength to gain advantage over an adversary is completely irrational between states that possess nuclear arsenals.²⁵ Effectively, this argument maintains that 'a trial of strength between effectively infinite forces is nonsensical';²⁶ the notion that total warfare has become *ruductio ad absurdum*. This argument is difficult to assess objectively, due to the very nature of the deterrent concept, as describe earlier. To ascertain whether the UK's nuclear weapons protect Britain from the risk of all-out conventional war, it is necessary to assess how well deterrence worked in this way in the past, and then ascertain

whether changes in the international environment will alter this deterrence factor in the future. Examples within this arena will be derived by evaluating Cold War interactions and then, by way of balance, analysis of the India-Pakistan dispute and the effectiveness of British nuclear weapons at averting conventional war.

During the Cold War the historical evidence concerning the effectiveness of nuclear deterrence in preventing a major East-West conflict is far from clear. It is 'not even certain that the Leadership of the Soviet Union had any real intention of attacking Western Europe in the first place'.²⁷ Most Western suspicions originate from a speech made by Stalin, on the eve of elections to the Supreme Soviet in 1946, when he claimed that capitalism made war inevitable; to Stalin's audience this was merely repeating familiar communist rhetoric. The West perceived it as an overt threat. George Kennan's subsequent assessment of Soviet intentions, now known as 'The Long Telegram', amplified the fears initiated by Stalin's speech and enhanced US apprehension towards the Soviet Union for several decades.²⁸ If there was a *real* threat of a European invasion, the resolve that the US and Western European countries showed in order to defeat the Soviet Union blockade of Berlin in 1948-1949 would have played a major part in demonstrating the determination of the West to resist any form of aggression. This, combined with the commitment of the US to base large numbers of its troops in Germany, and the strong political cohesion of the North Atlantic Treaty Organization (NATO), is more likely to have been the influential factors that deterred Soviet invasion attempts.²⁹

Further examples — beyond the Cold War — of how nuclear relationships have deterred conventional warfare include the Indian-Pakistan dispute over Kashmir. On the surface, this case does seem to be an example of how the ownership of nuclear arsenals has prevented conventional war. Although India and Pakistan have fought three wars since they won independence from Britain in August 1947, since they were declared as being nuclear weapon states in 1998, full-scale conventional war over Kashmir has not occurred.³⁰ Prevention of a full-scale war between

the adversaries in 1999, following the build up of tensions in the region, was probably due more to diplomatic and economic pressure exerted from the world community than any deterrent effect afforded by their nuclear arsenals. Other historical examples provide evidence as to the ineffectiveness of Britain's own nuclear arsenal in deterring conventional wars since 1945. The UK's nuclear capability failed to prevent the Suez crisis in 1956, did not deter the Argentinean invasion of the Falkland Islands in 1982, nor did it prevent Saddam Hussein's invasion of Kuwait in 1990. These examples demonstrate that nuclear weapons do not play a significant role in deterring conventional war. A more compelling theory is that world opinion, expressed through diplomacy and underpinned by economic leverage, is the major contributor in reducing the incidents of confrontation today.³¹ This conclusion is supported by several theories regarding the utility of force in the modern world.

Edward Luttwak suggests that modern society is too sensitive to loss of life and that competitive trade is gradually taking the place of warfare.³² Similarly, Francis Fukuyama believes that the gradual spread of democracy will replace the cruel world with consumerism and liberal culture, preventing the majority of conventional war between developed states.³³ Michael Doyle observes that, within the liberal states of the world, 'conventions of mutual respect have formed a cooperative foundation for relations among liberal democracies of a remarkably effective kind'.³⁴ This theory does not suggest that the 'political realism' school of thought, that advocates that 'war is an inevitable outcome of human insecurity and the desperate quest for the power it generates',³⁵ is no longer valid. Instead, it highlights that the 'political bond of liberal rights and interests have proven a remarkably firm foundation for mutual non-aggression'.³⁶ There is little evidence that categorically supports the claim that Britain's strategic nuclear deterrent can play a role in preventing all-out conventional war for the UK today or in the future.

The third role that the UK's nuclear forces are said to fulfil is that of deterring the possession or use

of biological and chemical weapons by states. The deterrence provided by the UK's nuclear arsenal is argued to protect the UK as well as providing a nuclear umbrella over British forces fighting 'wars of choice' around the world. This role of retaliating with nuclear weapons for an attack by biological and chemical weapons was first envisaged as a way of preventing the Soviets from mounting a surprise attack against NATO during the Cold War. Today a similar argument is made, advocating that nuclear weapons deter the use of chemical and biological weapons by rogue states.³⁷ It would certainly be reassuring to believe that the UK's nuclear weapons did offer a degree of protection in this way; however, there are several reasons why these arguments are not valid. Firstly, in 1995, Britain (along with the US, China, Russia and France) reiterated the Carter Administration's pledge against nuclear strikes against non-nuclear countries who were party to the Non-Proliferation Treaty (NPT).³⁸ Although, there are some loopholes within this pledge, the possession or use of chemical or biological weapons against the UK does not nullify this undertaking. This then rather limits the deterrent value that the UK's nuclear weapons have in countering a chemical or biological attack by a rogue state to only a handful of countries around in the world. Moreover, the very nature of these weapons, especially in the case of biological agents, makes verification of their origins extremely difficult to confirm with the degree of certainty required to justify nuclear retribution.³⁹ This was only too evident during the uncertainties surrounding Iraq's alleged possession of chemical weapons during the prelude to hostilities in 2003. As such, the UK's nuclear arsenal would seem to offer little in the way of deterrence, or security, from the threat of chemical or biological attack by rogue states.

In addition to a direct attack against the UK, it is feasible that a chemical or biological attack could occur against British forces whilst engaged in expeditionary operations; the so-called 'wars of choice' around the world. The UK's nuclear weapons are often cited as a means of deterring adversaries from the use of chemical and biological weapons whilst British troops are engaged in such operations. Given the UK Government's



A Trident ballistic missile takes to the skies
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The International Court of Justice gave an advisory opinion on 8 July 1996, stating that the only time the threat or use of nuclear weapons may be considered lawful is 'in extreme circumstances of self-defence, in which the very survival of a State would be at stake'

commitment to the Carter Administration's pledge, this would only be feasible if the 'war of choice' was against one of the few states not party to the NPT. Moreover, it is difficult to imagine that the UK, considering public and international opinion, would choose to engage a state in conflict (acting as a 'force for good') and then resort to killing large numbers of the civilian population if the ruling faction resorted to the use of chemical or biological weapons. The international community would probably view this action to be as morally reprehensible as the introduction of chemical or biological weapons in the first place.⁴⁰ Some commentators argue that Saddam Hussein was deterred from the use of chemical weapons, during the American led invasion of Iraq in 2003, due to the threat of nuclear retaliation from the allied forces. There are two more likely factors that explain his apparent restraint: either Iraq lacked the capability to launch such an attack or Hussein considered the protection by the Allies against chemical weapons to be vastly greater than that of his own forces, risking greater impact on his own troops from the introduction of such weapons.

The final role cited for the retention of the UK's nuclear weapons is that they 'serve as a low-key element of insurance, not directed against specific adversaries, in support of world order'.⁴¹ Although, on the face of it, this argument sounds reasonable, it is difficult to see how successful the threat of UK nuclear weapons would be in defusing tension around the world or in reducing the threat posed by international terrorism. Considering the role of reducing world tensions, if two states went to war it is highly unlikely that Britain's nuclear weapons could be employed legally to bring tensions to a peaceful conclusion.⁴² The International Court of Justice gave an advisory opinion on 8 July 1996, stating that the only time the threat or use of nuclear weapons *may* be considered lawful is 'in an extreme circumstance of self-defence, in which the very survival of a State would be at stake'.⁴³ Considering this, it is difficult to envisage the UK receiving international support, or a United Nations (UN) resolution, endorsing the threat of nuclear intervention, even if it was to promote world order, as such an act would clearly be outside the bounds of international law. This role is

further complicated as the UK's submarine based deterrent has inherent difficulties in deploying overtly to facilitate the British Government's resolution. Moreover, 'the majority of future conflicts are likely to be internal ones, where the use of nuclear weapons is almost literally inconceivable'.⁴⁴ This rationale is even more apparent in the case of deterring international terrorism.

There is now intense national and international attention paid to the risks posed by terrorism, both conventional and that utilizing WMD.⁴⁵ The possibility that a terrorist group may acquire the materials and knowledge to build nuclear, chemical or biological weapons, construct a dirty bomb or attack a commercial/military nuclear facility — in order to trigger a nuclear meltdown — is of particular concern. There is little evidence to suggest that the UK's nuclear weapons help to suppress the ever-increasing threat posed by international terrorism. The attacks against the US on 11 September 2001 demonstrate the inability of even America's nuclear strength to deter terrorist attacks.⁴⁶ This was highlighted by the Under-Secretary of State for Arms Control and International Security Affairs, John Bolton when he said: 'these horrible events demonstrated the validity of our concern, that there [are] people in the world who [don't] adhere to classic notions of deterrence and whose value systems and respect for human life [don't] match Western standards'.⁴⁷ As a growing number of international terrorist groups are not anchored to states or geographical regions, it is eminently difficult to find a justifiable target that could be engaged in retaliation and thus form the basis for a deterrence relationship. Some commentators have suggested that low-yield nuclear weapons could re-introduce this deterrence factor, especially if utilized in sparsely populated areas like the Afghanistan desert.⁴⁸ It is hard to see how nuclear weapons could achieve any practical effect in combating an internationally dispersed terrorist network such as Al-Qaeda. As such, the UK's nuclear arsenal would seem to offer little in the way of deterrence effect against global terrorist groups.

The arguments throughout this section demonstrate that the UK's nuclear arsenal now

contributes little in the way of security and this is a position that is unlikely to alter markedly in the foreseeable future. Within the current international framework the UK's strategic nuclear deterrent affords Britain little, if any, benefits in combating or deterring the threats posed by established or emerging nuclear arsenals or WMD; neither does it offer security against the instability to British interests caused by conventional warfare worldwide or the ever increasing threat from terrorism. In terms of creating a credible force structure and effective security, the UK's nuclear arsenal is an 'investment of very dubious value'.⁴⁹

Political effects provided by UK nuclear weapons

In addition to the security benefits that the UK's nuclear arsenal is perceived to maintain, some commentators believe these weapons to be of value in preserving Britain's status, maintaining a role for the UK on the world stage despite the decline of the British Empire. Hugh Beach and Nadine Gurr wrote on the subject of British nuclear disarmament that 'by far the most powerful and insidious political reaction would derive from considerations not of security, but of status'.⁵⁰ Given Britain's overt commitment to the NPT, it is unlikely that a UK Government would ever openly admit that one reason for its retention of a nuclear arsenal was to maintain influence and status in the international system. This would be somewhat hypocritical given that Article VI of the NPT enshrines the principle that all states should work towards complete nuclear disarmament.⁵¹ To examine whether this ambiguous purpose for the UK's nuclear capability remains valid and defensible, analysis must address two distinct areas: the perceived, as well as the actual, benefits for Britain's position and role in the world. To do so requires an evaluation of Britain's nuclear history, to identify the political motives that have shaped current nuclear strategy, whilst also determining the ways in which Britain's nuclear posture has actually benefited UK interests on the world stage.

From the advent of the nuclear revolution in military affairs it is evident that the British Government never seriously considered a scenario in which it would not develop a military nuclear

capability. 'Successive British Governments simply assumed that modern great powers, among which they counted Britain, must be nuclear powers'.⁵² Authors such as Margaret Gowing characterise the UK's decision to develop and maintain a nuclear force, not as a carefully thought out process but as a reaction, underpinned by perceptions of global power.⁵³ Andrew Pierre takes this argument further, judging that Britain's major objective for developing nuclear weapons was to secure political influence over the US, whilst adjusting its gradual decline in responsibilities on the world stage.⁵⁴ More recent works by Ian Clarke and Nicholas Wheeler, based upon access to newly released archive material from the late 1980s, suggest that strategic calculations did play a role in British nuclear policy, although they do not deny the importance of political influence and prestige.⁵⁵ But why was Britain so attracted to nuclear weapons to provide its security following the Second World War and do these reasons have any enduring relevance when considering the UK's nuclear deterrent today?

Most commentators agree that the original incentive for UK atomic weapon development originated during the Second World War from the belief that Nazi Germany was working on its own atomic device. This was highlighted in a report compiled by the MAUD Committee that was first to recognise the potentially decisive influence that an atomic weapon could have in warfare.⁵⁶ Post-war development of an independent UK nuclear capability was overshadowed by concerns that the US could return to a policy of isolationism. That possibility, combined with the fact that America had terminated the lend-lease and atomic collaboration agreements, heightened Britain's feelings of vulnerability within the world environment.⁵⁷ The UK was, to a degree, compelled to implement a national counter to the perceived threat posed by the Soviet Union.⁵⁸

As such, deterring the threat from the Soviet Union became the overtly pronounced purpose of the UK's nuclear development programme. There is much evidence to support the claim that a more significant factor was the desire to maintain political influence and status benefits that

Britain's nuclear collaboration relationship with the US was re-instigated following the UK's successful atomic test and the 'special relationship' that proved to be most beneficial to the UK throughout the period of the Cold War



An early nuclear test by Britain off the coast of Australia

were perceived to accompany atomic capability.⁵⁹ Churchill argued that the UK had to possess the most up-to-date nuclear weapons to maintain influence as a 'great' world power.⁶⁰ According to Patrick Garrity, nuclear weapons also provided a method of distinguishing between second-tier states that possess them, and third-tier non-nuclear states.⁶¹ Robert O'Neill takes this sentiment further, believing that 'nuclear-weapon states have more clout in the international system just because they have nuclear weapons'.⁶² This then, is the basis for the perceived status that nuclear weapons bestow upon a nation. Whilst British policymakers generally believed that it was nuclear possession that determined and maintained major power status in international politics, there is much evidence to refute this theory. McGeorge Bundy argues that the decay of Britain's diplomatic and political power, especially within Africa and the Middle East, was not slowed by the possession of nuclear weapons. He also observes that, since the UK achieved nuclear status, these weapons have provided Britain with no additional political influence within international decision-making organizations.⁶³ This is most apparent when considering that Britain's acquisition of nuclear weapons did not achieve a status in line with that of the super-powers, nor did it break down bipolarity during the Cold War. Even with nuclear weapons, the UK was unable to develop a security strategy that was fully independent and had to accept that it must 'adapt within the bipolar competition that existed between the US and the Soviet Union'.⁶⁴ Although Britain's nuclear capability had a significant part to play within NATO's overall deterrent against the Soviet Union, it can be argued that the UK's political influence within NATO was primarily due to Britain's economic and political attributes. The same is true of Britain's status within the UN. Some commentators promote the argument that the UK's permanent status within the UN Security Council was due to, and has been maintained by, its possession of a nuclear arsenal. The UK's position within the UN was secured much earlier than their nuclear acquisition and it is unlikely that this seat would have been lost if the UK had chosen not to acquire nuclear weapons.⁶⁵ Today it is inconceivable that the UN would

promote the rationale that permanent status on the Security Council was dependent upon the possession of nuclear weapons. If the international community saw this to be the case, the UN would be considered to be actively encouraging and rewarding proliferation. It is more realistic that the UK's political, diplomatic and economic influence, through its policy of being a force for good within the world has sustained its position within the UN. It is evident that the possession of nuclear weapons is not the reason for Britain retaining its influential position within the UN. The UN Charter states that any amendments to the constitution of the Security Council must have the concurrence of all the permanent members, and Britain is unlikely to vote itself off the Council.⁶⁶ Notwithstanding the issue of perceived and actual status, three additional political reasons are cited to explain Britain's decision to develop and maintain a nuclear capability.

Firstly, one of the fundamental political motivations for developing the UK nuclear force was the recognition of its importance in influencing American policy and in later years, the need for influence within Europe.⁶⁷ "British security was recognised as being dependent upon the stability of the Soviet-American nuclear balance, and it was believed in Whitehall that Britain's most valuable contribution lay in the influence it could bring to bear in Washington".⁶⁸ There is strong evidence to suggest that this stance achieved some of the desired results; Britain's nuclear collaboration relationship with the US was re-instigated following the UK's successful atomic test and the 'special relationship' that proved to be most beneficial to the UK throughout the period of the Cold War.⁶⁹

Although the desire to influence American policy has been evident throughout most of Britain's nuclear history, it is difficult to substantiate claims that Britain's nuclear capability affords it the same degree of influence in today's international environment. Since the collapse of the Soviet Union, the UK's distinctive role within the Soviet-American nuclear balance has gone. This, combined with the increased reliance that Britain has upon American technology to maintain its

nuclear force and the comparatively small size of the UK's nuclear arsenal, reduces substantially any influence that Britain's nuclear weapons have on American policy. Ironically, recent influence over America has been accomplished most effectively through the UK's conventional forces, in the form of support to the 'War on Terrorism' in both Afghanistan and Iraq. This overt support, given despite much worldwide and domestic disapproval, highlights the UK Government's conviction that Britain remains reliant upon America for enhanced security in the new international environment. This is not surprising: since 1959, Britain's defence posture has been built upon UK/US interdependence.⁷⁰ Today that interdependence is more aligned towards diplomatic support, the provision of conventional forces and intelligence cooperation. The UK's 1998 Strategic Defence Review acknowledged that Britain would be unlikely to conduct any substantial operation without being part of an alliance of some kind; most likely led by the US.⁷¹ As such, a key UK security requirement for the future will be the continuing need to influence American policy. The nuclear relationship that Britain maintains with America no longer achieves this aspiration. The demise of the Cold War, combined with Britain's reliance on Trident as the sole delivery vehicle for its nuclear weapon has established a UK/US nuclear relationship that is now more characterised by American independence and UK dependence.

The second politically induced reason for the development of UK nuclear weapons was economic in nature. Towards the end of the 1950s Britain was facing substantial economic difficulties and had to establish a means of reducing its conventional forces substantially whilst maintaining a credible defence organization. In Richard Crossman's view the nuclear weapon was developed 'as a substitute for the fighting soldier'.⁷² The process of substituting nuclear weapons for conventional capabilities began when Britain was unable to meet rearmament goals during the Korean War, and became most apparent in the 1957 White Paper.⁷³ This reform made drastic cuts to conventional force strengths and placed a greater dependence upon nuclear weapons. As

Britain's colonial responsibilities diminished, this was believed to be a cheaper way of providing the force required to deter a Russian invasion of Western Europe without the need for vast numbers of uniformed personnel. Therefore, Britain's Cold War defence against a Soviet invasion of Europe was predicated upon a mixture of conventional forces supplemented by a nuclear arsenal.

Nuclear weapons certainly allowed the British Government to maintain public confidence in national security whilst projecting a plausible rationale to substantially reduce the size of its standing forces; security at an affordable price. Although there is no evidence to suggest that this reason was the major factor in the decision to acquire nuclear weapons, it was certainly a consideration. The notion of nuclear weapons providing the UK with cheaper and more affordable security is not credible in today's international environment. The need to maintain large numbers of standing conventional forces capable of defeating or deterring an invasion of the kind envisaged during the Cold War has substantially diminished. Consequently, the UK's nuclear weapons no longer fulfil the role of substituting for a shortfall in conventional forces. Moreover, the UK's armed forces are currently in the process of reconfiguring in an attempt to become a smaller, more flexible and highly mobile expeditionary organization. These forces will be configured to conduct operations to defuse potential international problems before they reach UK shores. These 'wars of choice', conducted beyond the European theatre, where national survival is not at stake, would make the threat or use of nuclear weapons unacceptable to world opinion, as outlined earlier. Therefore, it is evident that nuclear weapons cannot be seen as a substitute for conventional forces in this new role, and the role that conventional forces played during the Cold War has now all but disappeared.

The final political reason cited for Britain's decision to develop and maintain nuclear weapons is that of remaining at the forefront of science and technology. The UK suffered greatly in this area: in a forlorn attempt to maintain a lead role

Britain's security in the coming years is likely to focus less on maintaining high-level nuclear relationships and more on meeting challenges such as the threat of ballistic missile strikes instigated by rogue states; particularly since these could carry a variety of chemical and biological warheads



An Iranian Scud missile and launcher

in scientific and technological fields, Britain attempted to compete with the US and Soviet Union, and suffered a heavy financial burden as a result. The demise of the UK's Blue Streak ballistic missile programme, was a defining event that clearly verified that the aspiration to remain at the forefront of technology and science was not financially possible for the UK.⁷⁴ Although retaining an ambition to be in the vanguard of science and technology, despite a continued reduction in economic strength following the end of the Second World War, the continued development of nuclear weapons would seem to be of little benefit to the UK in this respect today. Given that nuclear technology has extremely limited applications beyond the national weapons arena, and that Britain already has a well-established civilian nuclear industry, further development within this field would seem to offer the UK few advantages. By virtue of the economic resources that are required to procure and maintain nuclear weapons, they may limit British research work aimed at exploiting technologies applicable to the revolution of military affairs.

It is evident that the development and maintenance of the UK's nuclear capability has been influenced as much by political, economic and scientific considerations as it has been by strategic security analysis.⁷⁵ It is clear that the UK's nuclear arsenal has been maintained since its introduction for reasons of perceived status as well as for security, but the degree of influence in each arena has varied in relation to the prevailing geopolitical environment. The extent to which the UK's status and influence have been enhanced by nuclear weapons is disputable, as any assessment of this kind is highly subjective in nature. It is evident that in today's post-Cold War international environment, the military instruments that held supreme during the previous era are of less significance to a nation's status today. The changing nature of international power implies that nuclear weapons are decreasing in value as a way of influencing the international environment. As international relations become more focused on economic and technological competition, most commentators believe that military intervention will be focused primarily on regional ethnic

conflicts that have little, if any, scope for the use of nuclear weapons.⁷⁶

Future UK strategic security: requirements, strategies and ballistic missile defence

The UK is now facing a substantial challenge. Within the present and projected post-Cold War international system, Britain must quickly determine its national strategic security requirements and decide upon the most suitable policies and weapon systems to fulfil them. This new international system is less well defined than the bipolarity that it replaces, and offers increased challenges for those who endeavour to manage it. Commentators such as Robert Paterson believe that, although the precise nature of the new system is not yet clear, what is evident is the certainty that it will be more dynamic than what went before and will, by necessity, incorporate complex interdependent relationships between states.⁷⁷ As such, the UK will doubtless maintain its high degree of interdependence and influence within alliances such as the European Union and NATO. As analysed earlier, the ability to have some form of influence over the US, as the world's only superpower, will remain a vital component of Britain's national security strategy. The benefits of this will be most apparent in the areas of information exchange regarding terrorist threats and technology advancements as well as in enhancing Britain's status on the world stage. Of relevance for the UK at a national level is Nye's argument suggesting that 'the sources of power are never static and continue to change in today's world'.⁷⁸ The significance of this for Britain is identified by Paul's notion that 'nuclear weapons are instruments for conducting high-level conflicts without resorting to actual war, and therefore, their utility as a power resource changes when the dimensions of conflict change'.⁷⁹ Consequently, Britain's security in the coming years is likely to focus less on maintaining high-level nuclear relationships and more on meeting challenges such as the threat of ballistic missiles strikes instigated by rogue states, particularly since these could carry a variety of chemical and biological warheads. The UK's security strategy will also have to cope with the threat from terrorism, especially from groups with access to WMD.⁸⁰ The solution to

these security requirements cannot simply focus upon a choice of weapon system. The scope of the analysis should not be limited to whether or not the UK requires replacement nuclear weapons after Trident; the whole UK strategy for national security must be evaluated and procurement decisions tailored to the results.

The danger that threatens to undermine sound analysis within the procurement process is the misguided perceptions of the policies and current benefits that envelop nuclear weapon issues in the UK. The secrecy and confusion, characteristic of successive British governments' nuclear strategy as it has evolved over the decades, is the main culprit in this regard.⁸¹ It is undeniable that nuclear weapons revolutionized warfare and fulfilled a vital role during the Cold War. Such mentalities and strategies cannot be relied upon now that the Cold War is over.

UK security strategies

Since the advent of the nuclear age, UK strategic security policy has evolved incrementally to meet gradual changes in the international system, albeit based on an overarching 'deterrence' policy. Gerry Johnson's view that most strategies have a tendency to take on a degree of momentum reflects this. His theory, known as 'strategic drift', was devised to help analyse strategic management in business. It can be harnessed to provide useful analysis of Britain's security strategies. Johnson argues that, once an organization has adopted a particular strategy, it tends to mature incrementally utilizing the initial strategy as a baseline, resisting any major change in direction.⁸² Scot Robertson identifies this within the military, observing that military strategy has roots that span many decades.⁸³ As most global change happens gradually, incremental change appears to be a highly effective way of adapting in a measured and considered way. It is evident that British nuclear policy has developed in line with this thesis, adapting to developments within the geopolitical environment with small changes in policy. The policy of 'mutually assured destruction' evolved into one of 'flexible response' in 1968, when the changing international environment required a strategy

that had 'multiple options' available should a crisis arise. The concept of 'minimum deterrence', that underpins Britain's current nuclear strategy, subsequently replaced 'flexible response'. The strategic drift theory recognizes that a system of incremental change has inherent pitfalls. These become apparent if the environmental change is so great that no amount of incremental change is able to adapt fast enough to meet the new challenges presented. 'If such incremental strategic change lags behind environmental change then the organization will get out of line with its environment'.⁸⁴ If this occurs the only way that the organization can meet and adapt to the dynamics of the new environment is by instituting a fundamental strategic change. It is apparent that this has happened within British strategic security strategies. It has been shown that the strategy of deterrence, by threat of retaliation, is no longer appropriate in the prevailing international environment. The demise of the Soviet Union ought to have made it easier to develop the step-change in strategy required to replace deterrence. Yet legacy weapon arsenals, and the intellectual mind-set of the Cold War era, persist in obstructing change. As a result, the UK currently has a nuclear strategy that is unable to meet the challenges that have developed since the end of the Cold War; transformational change now needs to be planned to create strategy to meet Britain's security requirements. Realistically, this cannot be achieved until Trident reaches the end of its service life and new, tailor-made equipment can be procured.

To determine this strategy requirement, lessons can be drawn from the debates over the UK's national security policies in the 1930s. This period of history contains striking parallels to the security situation confronting contemporary British policy makers seeking to address the threat posed by rogue states armed with ballistic missiles. Scot Robertson commented that the fear instigated by the advent of the bomber aircraft, enhanced by the belief that Britain was vulnerable, 'had a profound impact on the British people'.⁸⁵ There is evidence of such sentiments growing today: the UK Parliament passed new terrorism legislation on 11 March 2005, constraining civil liberties in order to achieve a

greater level of perceived security. If the current threat of terrorist attacks incites such a response, a ballistic missile attack by a rogue state against the UK could evoke similar national fears as those experienced during the 1930s. As such the political debates of the 1930s, regarding the relative merits of defence, deterrence and international diplomatic regulations, are extremely pertinent today.⁸⁶

The fear of attack prevalent during the 1930s was based on the assumption that there was no way of preventing a bomber from reaching its target, giving it the ability to strike against any civilian population with no means of defending against it — similar to the threat posed by a ballistic missile today. In the 1930s, the initial UK response to this threat was an attempt to abolish the bomber and outlaw bombing by international agreement. This has uncomfortable parallels with the NPT, utilized today to attempt to reduce and contain the spread of WMD capabilities. As early as 1936 it was apparent in the UK that, once invented, the bomber could not simply be disinvented.⁸⁷ As such, a strategy of deterrence was developed, based upon Lord Trenchard's own theories of strategic bombing. This deterrence, by threat of retaliation, was widely believed to be the only feasible way of countering the bomber threat. Tami Biddle believes that the Royal Air Force may have been biased towards the concept of strategic bombing and may have pressed this strategy with a view to enhancing the merits of an independent air force. She maintains that 'Britain made a mistake in fixating an exaggerated faith on the offensive, and elevating it — to an extensive degree — over the power of the defence'.⁸⁸ Notwithstanding this, it is evident that strategic bombing has had a major influence on British security strategies, evolving into the UK nuclear deterrence policy that pertains today. As such, it would seem to be deep rooted within the British security psyche.

Hans and Michael Rühle distil three lessons from the 1930s that are pertinent to future UK security strategies. The first is that diplomacy and international treaties will not always guarantee security when dealing with dictators or radical terrorist groups. Chamberlain's failure to sustain

peace forced him to admit that military weakness also equated to diplomatic fragility. The second lesson is the notion that the evolutionary nature of science will guarantee that a counter for even seemingly insurmountable security threats will be found, given sufficient time. The fact that radar and sophisticated fighter aircraft eventually countered the threat posed by the bomber is just such an example.⁸⁹ There are comparisons in this regard with current nuclear policy debates. The culture that evolved during the Cold War and persists today, maintains that no ballistic missile defence system will ever be able to defeat the evolutionary sophistication of ballistic missile systems. There are signs that anti-missile technology is now showing signs of being able achieve success against today's threats. Colin Gray believes it is an error to argue that 'defence does not work in the nuclear era'.⁹⁰ He highlights the fact that in the second nuclear age, defence systems will only be required to defeat the less sophisticated missile threats presented by rogue states and not the multiple warhead defence scenarios envisaged in the 1970s and 1980s.⁹¹ With the end of the Cold War 'both the strategic theoretical and the military-technical-tactical referents for this subject have been transformed'.⁹² This leads on to Hans and Michael Rühle's third lesson from the security debates of the 1930s: that of the relative merits of offensive and defensive security strategies. The 1930s show that, although there will be periods of history where offensive strategies represent the only method available for national security, this does not establish that offence is a permanently superior security approach to defence.⁹³ Theorists such as Clausewitz and Sun Tzu both saw defence as the stronger form of war, with Sun Tzu observing 'invincibility lies in the defence'.⁹⁴ Today, more than 24 countries are developing nuclear, biological and chemical capabilities, as well as the means of delivering them via missiles.⁹⁵ This makes the need for an effective defence to replace the UK's questionable deterrence strategy increasingly urgent. It is contended that the most effective such defensive system would be a Ballistic Missile Defence system.

A ballistic missile defence system and the UK

Many countries, from the US to Taiwan, have already been prompted to develop or buy tactical

Israel, whose defence spending in 1999 was less than a quarter of that of the UK, made the first successful test interception of a ballistic missile using their anti-ballistic missile 'Arrow Weapon System' on 29 July 2004



Israel's anti-ballistic missile 'Arrow Weapon System'

or ballistic missile defence systems to provide a defensive element to their national security policies.⁹⁶ Israel, whose defence spending in 1999 was less than a quarter of that of the UK,⁹⁷ made the first successful test interception of a ballistic missile using their anti-ballistic missile 'Arrow Weapon System' on 29 July 2004.⁹⁸ India is also making progress in the field of missile defence, generating a capability through a combination of off-the-shelf purchases and the development of an indigenous system.⁹⁹ Both Israel and India, by virtue of their countries' geopolitical situations, and mindful of the proliferation of tactical ballistic missiles in the Middle East and Asia, have already accepted the need for greater reliance on a defensive element to their security strategies. Whether these moves towards a greater emphasis upon missile defence have been motivated by their proximity to a greater number of potential threats, or by the fact that their security planners are free from the burden of Cold War legacies, is not evident. What is apparent is that the UK has only a limited period of time before the technology required to produce long-range missile systems is freely available around the world. At this time the UK will no longer be shielded by its relatively secure geographic location. Britain will then be as vulnerable to missile attack as Israel or India is today.

A defensive security strategy, centred on a UK ballistic missile defence system, would also fulfil other key security requirements determined earlier. The US is heavily committed to missile defence, investing much time and money into developing the technology. If Britain were to establish a leading role within America's development project it would allow continued British influence over the



The radar station at RAF Fylingdales (RAF Fylingdales)

US's defence policies and strengthen the 'special relationship' between the UK and America. This would also establish a leading role for Britain within the European Union and NATO in the arena of missile defence, increasing the interdependence and enhancing the influence it has within these alliances. These measures would maintain or even enhance the UK's national security, but would also help to maintain its status within the international system and help to keep Britain at the forefront of technological development. Britain has already taken the first steps towards this goal. On 5 February 2003, the then Secretary of State for Defence, Geoff Hoon, announced that the British Government had accepted the US request to upgrade the early warning radar located at Royal Air Force Fylingdales, in North Yorkshire, for use in ballistic missile defence.¹⁰⁰

Conclusion

This paper has highlighted the way in which

On 5 February 2003, the Secretary of State for Defence, Geoff Hoon, announced that the British Government had accepted the US request to upgrade the early warning radar located at RAF Fylingdales, in North Yorkshire, for use in ballistic missile defence

political and military deliberations regarding the UK's nuclear arsenal have tended to progress under their own technical momentum. This evolutionary process has been underpinned over the decades by the strategic imperatives of the Cold War, political decline coincident with Britain's withdrawal from its colonies and a deeply embedded culture of deterrence-based policies emanating from the strategic bombing theories established in the 1930s. As such, nuclear weapons have played a central role in the formulation and development of defence policies within the UK since 1945 and, even today, exert an influence that is disproportionate to their utility for Britain. The dramatic changes initiated by the end of the Cold War have dictated that Britain's basis for security, power and influence is now markedly different. The UK Government is now faced with formulating a national security strategy to counter the contemporary threats and challenges that have emerged within the new international order. It is increasingly evident that nuclear weapons offer the UK little in addressing these new challenges. Nuclear deterrence, a strategy that evolved to meet specific challenges exclusive to the Cold War era, looks increasingly inappropriate for the types of military conflict and threats that Britain is likely to face in the future. Today many states are actively developing WMD and the means to deliver them over substantial ranges. It is unlikely that all of these diverse state actors will permanently act rationally, which is a fundamental requirement of all deterrence-based security strategies. As such, the ever-increasing threat posed by ballistic missiles is likely to be of particular concern to the UK in the future, comparable to the threat that the bomber posed to Britain in the 1930s. In those days many put their faith into diplomacy, arms control and, eventually, deterrence to protect the UK from attack. These measures failed to prevent mass attacks against the civilian population. In this context, would it not be reassuring to know, in an international system that is no longer characterised by the stability of a bipolar environment, that Britain could defend against the emerging menace of the new century?

This paper concludes that a strategic deterrent

capability, to replace Trident in 2030, will be of little utility to the UK. Following the end of the Cold War, there is evidence to support the need for a fundamental change in British strategic security strategies to align the UK with the international environment in which it now resides. This change process needs to be transformational in nature; radically different from the incremental security changes that Britain has experienced throughout most of the 20th century. The UK needs to revert from the predominantly deterrence-based strategies that have dominated UK defence policies since the 1930s, to a defensive strategy designed to counter the increasing threat that Britain faces from ballistic missiles. Currently the most practicable means of implementing a defensive capability would be via a missile defence system. This would provide Britain with a strategic security strategy that had the utility to not only address the envisaged future threats to the UK, but also to maintain a substantial degree of influence within both America and Europe. It is not envisaged that this step will be an easy one for Britain to take; it will require a substantial change in British military culture. The consequences of inaction for the UK are severe. If the change process is not transformational the UK will find itself unable to meet the challenges of the post-Cold War international system in the second quarter of the 21st century. Britain must look forward towards the future when making decisions regarding strategic security, dispelling Cold War mentalities that presently threaten to undermine the UK's future security. Those who build the present in the image of the past will miss out altogether on the challenges of the future.¹⁰¹

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Does the Dambusters Raid deserve its growing reputation as operationally daring but strategically futile?

By Wg Cdr M Gilligan

Operation CHASTISE, the breaching of the Möhne and Eder dams in May 1943, represents the most celebrated operation in Royal Air Force history. However, its operational glory has been overshadowed by a growing historical consensus that it failed to achieve the strategic objective of bringing Germany's armaments industry to a standstill. This paper questions the perceived strategic reputation of Operation CHASTISE. Using campaign planning methodology, it establishes alternative strategic objectives and considers whether intended effects were realised. It then establishes the operation's enduring benefits, before concluding that the 'Dambuster Raid' was a strategic success rather than an abject failure.

The Dambusters Raid, by the Lancaster aircraft of 617 Squadron, is arguably the most famous

and celebrated single operation conducted in the history of the Royal Air Force (RAF). In the early hours of 17 May 1943, the great western German dams at Möhne and Eder were breached by Barnes Wallis's bouncing bombs during Operation CHASTISE, in what was described by Webster and Frankland as 'the most precise bombing attack ever delivered and a feat of arms which has never been excelled'.¹ However, their further contention that 'the effects of this brilliant achievement upon the German war machine were not, in themselves, of fundamental importance nor even seriously damaging'² has been echoed by the majority of commentators since. The overwhelming historical view of the dams raid is that it was operationally skilful and daring, but failed to achieve its strategic intent. One author goes as far as describing the raid as 'a conjuring trick, virtually devoid of military significance'.³

This paper questions the validity of such a dismissive conclusion. It is possible that the relative success of the dams raid claimed at the time may well have been skewed by the lack of quantifiable evidence to determine its true effectiveness. Equally, those subsequent claims of its lack of effectiveness could potentially have been distorted by a dispassionately narrow interpretation of the limited evidence of effect, some years after the conclusion of World War II (WWII). In order to determine the degree of success of the mission, it is vital to establish its strategic objectives, and to compare the expected outcome with the results achieved. In general, this paper will examine the planning and results of the Operation through a modern effects-based lens, and to consider its impact beyond the narrow economic effects upon which its level of success has primarily been gauged. As a precursor, the paper will briefly describe the background and operational conduct of the mission. It will then look at the overall strategic context of the time and apply some modern campaign planning principles to establish the potential strategic objectives, before looking in greater depth at how these objectives were furthered in terms of economic, military, diplomatic and psychological lines of activity. It will attempt to use both quantifiable and qualitative historical evidence to determine whether the effects sought by Operation CHASTISE were achieved, whether any unplanned effects were realised and whether the results achieved could have been done so more cost-effectively by alternative means. It will also look at the enduring effect of the raid on the application of air power thereafter, before concluding, contrary to conventional wisdom and literature available on the subject, that the dams raid was extremely successful and had far-reaching strategic effects.

Background

Operation CHASTISE was conceived in order to destroy the great dams of the Ruhr in western Germany, against a strategic backdrop as described later in this paper. Before and during the early years of WWII, the dams had been considered as important, but overly demanding targets, because of their massive construction, the inadequate

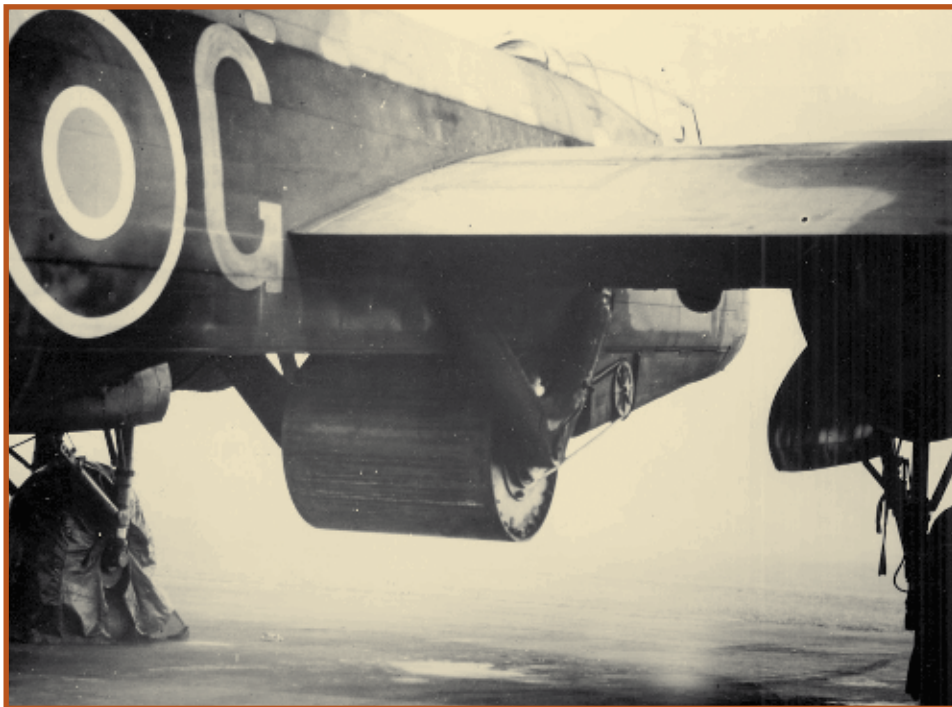
explosive capacity of available weaponry and the inaccuracies of contemporary airborne armament delivery: the destruction of the dams required a precise and significant explosion below the surface of the water on the upstream face of the dam. Eventually, during 1942, Barnes Wallis, a brilliant engineer at Vickers-Armstrong Aviation, devised an ingenious solution. Having had a previous proposal for a huge bomber aircraft and a 10,000lb 'earthquake' bomb rejected on the basis of impracticality, Wallis formulated the concept of the bouncing bomb; in reality, the munition was a revolving depth charge.⁴ Wallis's bomb was designed to be released at low level, skip across the surface of the water, strike the dam wall and slide down the face of the dam until exploding at the optimum depth. Codenamed Upkeep, the cylindrical weapon was to be spun up to 500 rpm on the aircraft and released 425 yards from the dam, at an altitude of approximately 60 feet and a speed of 210 knots: the release conditions were extremely demanding.

From being given the go-ahead on 26 February 1943, the project was completed in a mere 80 days.⁵ The weapon was turned from design to reality through a number of iterations, the aircraft were extensively modified, and system integration and safe release trials were conducted. That it succeeded in such short timescales was a remarkable feat of project management; an engineering exploit of similar scale on the software-intensive aircraft of today is incomprehensible. From 15 March, 617 Squadron, under the command of Wing Commander Guy Gibson and constituting experienced crews from within Bomber Command, was formed, before completing six weeks of intensive low-level training.

On the night of 16 May 1943, the first of three waves of 617 Squadron Lancasters took off from RAF Scampton in Lincolnshire and headed for the Möhne, Eder, Sorpe, Ennepe, Lister, and Diemel dams of the Ruhr. The aircraft flew at low level over the North Sea, before descending to below 150 feet whilst over continental Europe; at higher altitude, the bright moonlight (essential to see the dams) would have made the bombers extremely

vulnerable to night-fighters.⁶ Gibson led the first nine aircraft to attack the Möhne and Eder dams. The second formation of five aircraft headed for the Sorpe, and a further five aircraft were held in reserve to bomb as directed, subject to the relative success of the preceding waves. Of Gibson's group, two of the first five bombs dropped struck accurately, creating a massive breach through which 116 million cubic metres of water cascaded into the Ruhr valley in just 12 hours. Gibson led the remaining weapon-carrying aircraft to the Eder; the fourth bomb dropped there caused similar devastation, with 154.4 million cubic metres escaping.⁷ Of the second formation, only one aircraft reached the Sorpe and, whilst its bomb was successfully dropped, the dam remained intact. Of the third wave, three aircraft were directed to the Sorpe, and the others to subsidiary targets. Of those attacking the Sorpe, one never made it, one released a bomb in thickening mist, and the third could not see the target; again, the dam stood. On the ground, approximately 1,294 people were killed by the floodwater, of whom 493

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An Upkeep in position under modified Lancaster ED932 'AJ-G'



Wing Commander Guy Gibson escorting HM King George VI during a visit to RAF Scampton on 27 May 1943

The gallantry, skill and danger of the operation were reflected in the award of decorations to 34 members of the Squadron. Most notably, Guy Gibson was awarded a Victoria Cross for his bravery and leadership

were Ukrainian prisoners of war. In modern wars of choice, the prospect of such civilian casualties and the questionable legality of the action would almost certainly preclude the targeting of a dam. However, Operation CHASTISE occurred in a war of survival, where 1,300 was a comparatively humane death toll for a raid in the Battle of the Ruhr.

The gallantry, skill and danger of the operation were reflected in the award of decorations to 34 members of the Squadron. Most notably, Guy Gibson was awarded a Victoria Cross for his bravery and leadership. However, the raid cost 617 Squadron heavily. Of the 19 aircraft that departed only 11 returned. Fifty-three of the 133 airmen involved were killed, with a further three taken prisoner.

Strategic assessment

Throughout history, successful military leaders have applied strategy to the defeat of their enemy. This premise is equally applicable to the conduct of WWII. Political and military planners would have considered the characteristic capability from which Germany derived its freedom of action, physical strength or will to fight: the enemy's strategic centre of gravity.⁸ Equally, it would have been as important to consider one's own strengths and weaknesses. Further assessment, albeit in different terms than those used today, would have determined the critical capabilities, critical requirements and, importantly, critical vulnerabilities of both friendly and enemy centres of gravity in order to establish how to gain military advantage. A critical capability is defined as an inherent capability that enables the functioning of a centre of gravity, a critical requirement would be an essential condition, resource or means to enable the centre of gravity or critical capability to be effective, and a critical vulnerability is a weakness through which the centre of gravity can be attacked or neutralised.⁹ Specific objectives can then be set to achieve the effects necessary to exploit the weakness. From these objectives, coordinated actions across economic, military, diplomatic and psychological lines of activity, would seek to generate the effects considered necessary to lead to the eventual defeat of the

enemy's strategic centre of gravity. However, the rigour of the modern campaign planning process was not in widespread use at the time; by applying this process in hindsight, it is possible to estimate the strategic imperatives of the day, and from these, to evaluate whether the results of Operation CHASTISE met, exceeded or failed to achieve the effects sought in pursuit of defeating the enemy. In January 1943, during the Casablanca Conference, the Allies publicly demanded the 'unconditional surrender' of Germany, Italy, and Japan.¹⁰ Accordingly, in order to terminate the conflict on favourable terms, Britain's strategic end-state of the campaign within the European theatre of war can retrospectively be considered as the unconditional surrender of Germany. However, the political leadership of the Nazi regime had long since cast their ideological die, and their collective political demise would almost certainly lead to their individual post-war ruin or execution; there was no feasible prospect of their voluntary surrender. Hence, in order to bring about the strategic end-state, it was vital to bring about the complete involuntary downfall of the German political leadership.

From the foregoing, the strategic enemy centre of gravity must be considered to have been the ruling echelons of the Nazi Party. Yet, bringing about their demise would be no mean feat. After all, they controlled all of the internal levers of power. They held sway over a population that had been heavily influenced by years of dogmatic and passionate rhetoric, and they brutally suppressed any opposition to their control. Of vital importance, the Nazi leadership provided the strategic and operational direction to a patriotically committed military who were thoroughly trained, battle-hardened, well-equipped, in unchallenged command over most of the Continent, and with a healthy level of morale borne out of many successes and few defeats. Also, their economy and industrial capacity were buoyant and had significant slack.

From a British perspective, the ability to prosecute a successful campaign was dependent upon the continuing cohesion of alliances with the US and the Soviet Union. Without the assistance of their

Allies, Britain would have lacked the economic resource and combat power to mount a realistic land-based offensive into Europe. Arguably, without the prospect of powerful intervention, the maintenance of morale amongst the British population and armed forces would have become impossibly demanding over a prolonged period. In hindsight, the friendly strategic centre of gravity can be assessed as the cohesion of the Tripartite Alliance.

Having identified possible strategic centres of gravity, the value of Operation CHASTISE in affecting them should be established in terms of economic, military, diplomatic and psychological lines of activity. This requires further analysis of the desired effects sought by the raid towards achieving those decisive acts considered collectively necessary to bring about the demise of the enemy's leadership and the bolstering of Alliance cohesion. Having estimated those effects sought, it is then important to determine to what degree they were achieved in effects-based operations (EBO) terms, where EBO have been defined as those 'operations conceived and planned in a systems framework that consider the full range of direct, indirect and cascading effects, which may, with differing degrees of probability, be achieved by the application of military, diplomatic, psychological and economic instruments'.¹¹ During WWII, airmen sought to apply principles equivalent to EBO at the strategic level of war; if a strong military was reliant upon a strong economy, then, by destroying the economy through strategic bombardment, the effect of preventing the enemy's capacity to wage war could be achieved.¹² It was relatively easy to determine the effect sought by military action, but a lack of suitable analytical, cognitive or intelligence tools hampered its effective measurement.¹³ Even with the benefit of hindsight, a definitive measure of the effectiveness of operation CHASTISE is impossible.

Economic strategy

A pre-war Allied paper on Broad Strategic Policy recognised that in the first phase of war, the only effective offensive strategy available to the Allies was to apply economic pressure on

Germany. Such pressure was applicable in two forms: the prevention of the external supply of articles essential to the German war effort, and the destruction of economic life within Germany.¹⁴ However, the vast scale of the German economic infrastructure demanded precise nodal analysis to determine those economic targets of most significant strategic importance; it was the role, within the UK, of the Ministry of Economic Warfare (MEW) to conduct that analysis. Their role was hindered by a lack of reliable information, resulting in a significant amount of intelligent guesswork and application of analogies.¹⁵ Soon after the outbreak of war, the MEW had identified 'grave financial weakness' among the chief defects of the German economy,¹⁶ but Germany had not mobilized its economy for war to anywhere near the degree assumed.¹⁷ Unfortunately, expectations of a German economic collapse failed to materialise. Ironically, Germany received much of its supply of scarce materials from the Soviets¹⁸ and from the Far East by means of the trans-Siberian railway.¹⁹ By June 1941 it was apparent that, with Germany controlling most of the European continent, economic war alone would not defeat Germany. Nonetheless, continued blockade and the increasing strategic bombardment of the economic infrastructure would continue to focus on denying those resources in short supply. The latter task was to be the concern of Bomber Command.²⁰

In the context of spring 1943, the German ruling elite maintained its considerable grip on power almost exclusively through the strength of its military; the defeat of the military would strip away the Nazi's protection and lead to their capitulation. The German military as a force were highly effective but entirely dependent upon the German industrial base for the re-supply of armament and equipment. The armament industry was equally dependent upon adequate power supplies, which in turn were wholly reliant upon natural energy sources and a plentiful supply of water. Economically, the German industrial base was a critical capability that required power, and that power supply was critically vulnerable to a loss of water.

From as early as 1937, the MEW and Air Staff had generated military plans for use in the event

of general war against Nazi Germany; of these, Western Air Plan 5 (WA5) identified 45 industrial plants in the Ruhr as vital to the German war machine. The destruction of the Möhne and Sorpe dams was thought to be capable of demolishing these plants,²¹ but weapon accuracy and payload limitations of the time precluded their effective targeting. Nonetheless, the Air Ministry maintained effort in seeking the means to attack the dams successfully. Besides denying vital water supplies to industry, the dams' destruction had the potential to cause enormous flood damage to the hydroelectricity generating stations, railways, bridges, pumping stations and industrial chemical plants of the low-lying Ruhr valley.²² The advent of a suitable weapon in early 1943 made an attack against the dams feasible.

Military historians have largely considered the results of the dams raid in economic terms. Moreover, they have compared the results with the most optimistic pre-war expectations of effect that the destruction of the dams, and the Möhne in particular, would bring: in essence, the belief that the entire industrial capacity of the Ruhr would be completely paralysed, and that a consequential knockout blow would be delivered to the German war machine.²³ By March 1943, however, the economic benefits of attacking the dams had come under critical examination and were broadly considered to be overstated. Scientific Advisers to the Minister of Production concluded that the breaching of the Möhne would be sufficient to cause a 'disaster of the first magnitude', a 'substantial loss of electricity' and have 'serious repercussions on morale'.²⁴ They further concluded that a successful attack on the Eder would have insignificant economic importance. The MEW largely supported an attack on the Möhne as justifiable in physical and morale terms, even if the industrial effects were unlikely to be significant. However, they stressed that the simultaneous destruction of the Sorpe dam would be worth much more than twice the destruction of one [of the dams].²⁵ Importantly, in April 1943, the Chief of the Air Staff, Air Chief Marshal Sir Charles Portal, became aware that the potential effects of an attack on the Möhne dam had been overestimated, but he determined that the operation remained meaningful.²⁶

Notwithstanding an awareness of the importance of maximising effect through a simultaneous attack on both the Sorpe and Möhne dams, the differing types of construction limited the prospects of achieving such an objective. The Möhne was a gravity dam of masonry construction with a vertical wall on the water side, whilst the Sorpe was an earth dam with sloping earth walls on either side of a central concrete core. It was known that Wallis's weapon was optimised for the former, and unlikely to breach the latter. Despite a specific change in attack strategy for delivery of the weapon against the Sorpe, expectations were tempered by the belief that the weapon was likely to be non-effective against the Sorpe, and that the totality of effect predicted by the MEW was unlikely to be realised. Thus, the economic effects sought by Operation CHASTISE were to disrupt industrial water supplies and to destroy some of the means of production; the former was expected to be more serious than the latter.²⁷ At the time of the Raid, the planners harboured no false expectations of bringing the German war machine to its knees. The Operation Order for the mission reflected a suitable degree of realism: 'Destruction of target X [Möhne] alone would bring about a serious shortage of water for drinking purposes and industrial supplies. This shortage might not be immediately apparent but would certainly take effect in the course of a few months. The additional destruction of one or more of the five major dams in the Ruhr area would greatly increase the effect and hasten the resulting shortage. Target Z [Sorpe] is next in importance. A substantial amount of damage would be done, and considerable local flooding would be caused immediately consequent on the breach of Target X. In fact it might well cause havoc in the Ruhr valley. There would be a large loss of electrical capacity in the Ruhr partly caused by destruction of hydro-electric plants, but also due to loss of cooling water for the large thermal plants.'²⁸

It has become the established academic view that the dams raid failed to achieve its economic objectives, as the water production for the Ruhr's industry was recovered to its pre-raid levels by 27 June 1943.²⁹ Whilst the expected shortages of water for industrial purposes did not materialise

to the degree expected, the effect was achieved in part. Cooper contends that 'The Möhne attack caused flooding of pumping stations, which in turn caused a shortage of water. Post-war German records show that production in the Dortmund area was reduced by between 10 and 15% and was not fully recovered for 6 months'.³⁰ Also, the Index for German Armament Production shows a reduction of about 8% in the rate of growth during June 1943;³¹ whilst this must be attributed to the totality of the bomber offensive, Operation CHASTISE was at least partially responsible. The unexpected speed with which the Germans garnered resources and set about reconstructing the dams is also partially responsible for the restriction of the duration of the effect; rapid and unmolested repairs to the dams were completed shortly before the arrival of the autumn and winter rains, meaning that the shortages would not continue into the following year as had been hoped. This was due to the requisitioning by Albert Speer, Germany's Head of War Production, of replacement machinery from around the Reich: the reduced effect in the Ruhr must have had a negative, although indeterminable, effect elsewhere. Speer was surprised that the British did not press home their advantage during the rebuilding phase when the work was most vulnerable.³² There are three possible reasons for this. Firstly, the Germans had increased their defences around the dams considerably and would have been more alert to further attacks. Further attacks would probably have met with greater attrition than the already excessive losses of the first operation: as Air Chief Marshal Sir Arthur Harris, Commander-in-Chief of RAF Bomber Command, remarked, 'Any action deserving of a Victoria Cross is, by its nature, unfit to be repeated as an operation of war'.³³ Secondly, it is possible that the strategic effect sought had been achieved outwith the economic line of activity, rendering a further attack as nugatory. Finally, British expectations were that the dams could not be repaired in time for the autumn and winter rains, and that the expected economic impact would take effect in the longer term.

Whilst ensuing industrial water shortages did not meet expectations, the devastation caused by the

torrents certainly did. The industrial destruction caused by the breaching of the dams was significant, affecting some one hundred and twenty-five factories. Of these, eleven were destroyed, a further forty-one severely damaged and seventy-three others suffering varying degrees of lesser damage.³⁴ Post-war translations of German documents detail that six power plants, a steel works, two weirs and nine water-works were destroyed or severely damaged; these 18 assets were considered by the Germans to be works of great economic importance.³⁵ Based on these latter achievements alone, the dams raid achieved the equivalent of 40% of the requirements of WA5. In addition, the raid accounted for the destruction of two armaments factories and damage to a further ten.³⁶

WA5 had envisaged the destruction of the 45 specified plants by utilising 3,000 conventional bombing sorties over a two-week period, with an anticipated loss of 176 bombers (equating to 5.9% per sortie);³⁷ these figures were based on pre-war predictions of weapon accuracy and aircraft attrition rates. As a cumulative total up to June 1943, 10,466 aircraft were lost during 308,919 sorties of the wider strategic offensive,³⁸ equating to an average aircraft loss rate of approximately 3.4%. Also, night-bombing weapon error was initially assumed to be about 1,000 yards,³⁹ but the 1941 Butt Report suggested that, in the Ruhr, only one-tenth of aircraft came within five miles of its aiming point.⁴⁰ Also, during 1943, the relative density of bombs dropping within a square mile around the aiming point stood at 33.4 tons per thousand tons of explosives dropped.⁴¹ In other words, only 3.3% of weapons released landed within a half a mile of the target; of these, only a tiny proportion would have struck the point targets that WA5 had prescribed. The US Department of Defense have reported that, with American B-17 bombers, to achieve a high probability of destruction of a point target would have required 1,500 aircraft and 9,000 bombs.⁴² The Lancaster ultimately had a weapon-carrying capacity of 18,000lb, approximately three times the load of the B-17.⁴³ By extrapolation and assuming similar accuracy, for a Lancaster to strike a point target of factory proportions would have required some 500 sorties; that equates to 9,000 sorties to



Dr Joseph Goebbels

From a German perspective, Dr Joseph Goebbels, Hitler's Propaganda Minister, recorded in his diary that 'The attacks of British bombers on the dams in our valleys were very successful'

achieve parity with the effects of the dams raid. At an attrition rate of 3.4%, approximately 305 aircraft and 2,100 airmen would have been lost as compared to the 8 aircraft and 53 airmen lost on Operation CHASTISE. Therefore, in cost-benefit terms, the raid provided an exceptional return on investment in destroying 18 high-value industrial assets.

Operation CHASTISE's economic success is magnified further when considered from an effects-based perspective. Post-war data suggests that when conventional bombs struck their targets, they did not necessarily achieve the destruction sought; detonating on the factory roofs, they appeared externally to have caused significant damage, but only 5% disabled the machinery within.⁴⁴ The damage caused to the factories in the path of the raid is undeniable. Even those not destroyed suffered the debilitating mechanical and electrical effects of flooding and silting. Therefore, although 9,000 conventional bombing sorties may have struck as many economically significant targets as the dams raid, they would have had a twentieth of the effect of Operation CHASTISE by comparison.

From a German perspective, Dr Joseph Goebbels, Hitler's Propaganda Minister, recorded in his diary that 'The attacks of British bombers on the dams in our valleys were very successful. Damage to production was more than normal'.⁴⁵ Speer concurred, 'A mere 19 bombers of the RAF tried to strike at our whole armaments industry by destroying the hydroelectric dams of the Ruhr. Industry was brought to a standstill and the water supply of the population imperilled'.⁴⁶ He further recorded that, 'The British came close to a success which would have been greater than anything they have achieved hitherto with a commitment of thousands of bombers'.⁴⁷ Speer was referring to the bomb damage at the Sorpe, which was: 'slightly higher than the water level. Just a few inches lower – and a small brook would have been transformed into a raging river which would have swept away the stone and earthen dam. But they made a single mistake which puzzles me to this day: they divided their forces and that same night destroyed the Eder Valley dam, although it had

nothing whatsoever to do with the supply of water to the Ruhr.'⁴⁸

Speer's comments confirmed the MEW conclusion of the impact of breaching both the Sorpe and the Möhne simultaneously. The division of forces that Speer referred to was achieved more by catastrophe than by design; of the eight aircraft of the second and third waves directed to the Sorpe, only three survived as far as the dam, and only two managed to drop their payload. Whilst the weapon had not been expected to damage a construction such as the Sorpe, the first dropped bomb had landed on the crown of the dam and cratered it. The raid came surprisingly close to causing more significant economic damage than was realistically anticipated. Hastings shares Speer's sentiment that the attack on the Eder demonstrated 'profoundly flawed reasoning' and that the 'target was attacked because it was destructible, not because it was vital'.⁴⁹ In effects-based terms, this stance may be valid from an economic perspective alone, but if the overriding strategic objective was diplomatically, militarily or psychologically driven, then physical damage was what was sought. If so, then the Eder offered a more realistic pre-mission prospect of achieving the effect, because the weapon was optimised for such a construction.

Military strategy

Notwithstanding the respective capacities of the protagonists in Western Europe to re-arm, the critical capability from a German military perspective that supported the enemy's strategic centre of gravity was their possession of European territory. From an Allied viewpoint, gaining a foothold in France or elsewhere, even with a numerically stronger invasion force, had the potential to be very costly in terms of life and resource, such that the resulting military balance could feasibly swing back towards Germany. Therefore, a critical requirement of the campaign was the combat effectiveness and the combat strength of Germany's fielded forces in France. It was therefore essential to create an environment of retrenchment by drawing Germany's military resources back to defend their home nation and also to reduce their fighting capacity by

disrupting their logistics chain. The enemy's critical vulnerability in both respects was its homeland, and in particular its industrial targets. A concentration of the combined strategic air power of RAF Bomber Command and the United States' 8th Army Air Force (AAF) could deliver the effect such that sufficient diminution of the enemy's extended defensive posture could be achieved. Strategic bombing offered the only means of projecting power into Germany at that point in the war.

However, the Allies needed a well-defined common purpose for a combined air offensive, that could also meet the disparate doctrines of the two bomber forces;⁵⁰ for good reasons the Americans favoured daylight precision-bombing attacks, whilst the RAF preferred area bombing at night. The Casablanca Directive of January 1943 gave an agreed general aim that satisfied both camps: 'Your primary object will be the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened.'⁵¹ Therefore, through the subsequent destruction of the economic industrial infrastructure, the military strategic objectives of shaping the battle space for an impending invasion would be achieved in part. Within the spirit of the Casablanca Directive, the effects sought by Operation CHASTISE were to impede industrial activity through denial of essential industrial water supplies, and to flood as much industrial infrastructure as possible.

In Churchill's speech to Congress on 19 May 1943, he specified that, 'our air offensive is forcing Germany to withdraw an ever larger proportion of its war-making capacity from the fighting fronts in order to provide protection against air attacks'.⁵² This statement provides explicit evidence that retrenchment of the enemy was a specific strategic goal of the bomber offensive, of which CHASTISE was a part. Speer noted that 'in 1943, I estimated that the air war was costing us, in terms of production for the Eastern Front, the equivalent of more than 10,000 heavy guns and approximately 6,000 medium-heavy and heavy tanks. Defence against air attacks requires the production of

thousands of anti-aircraft guns, the stockpiling of tremendous quantities of ammunition all over the country, and holding in readiness hundreds of thousands of soldiers, who in addition had to stay in position by their guns, often totally inactive, for months at a time'.⁵³ Although only part of the wider bombing campaign, Operation CHASTISE was responsible for absorbing a disproportionately high ratio of German assets. The ensuing protection of the dams was to distract an entire division's worth of military assets for the following two years, including considerable quantities of searchlights, flak guns, smoke canisters and balloons.

The effect was not limited to military assets. As many as 27,000 workers would be reassigned to the reconstruction of the dams and in recovering the damage to the surrounding areas; in addition to the industrial infrastructure, there was extensive destruction of railway lines and embankments, bridges and roads, domestic dwellings, and agricultural wherewithal.⁵⁴ Many of the workers came from the Todt Organisation and the building of the Atlantic Wall;⁵⁵ this diversion of resource had the military advantage of ensuring that a future Allied invasion would face a reduced level of enemy fortification.

It is probable that one military effect achieved was not sought in advance. The raid may have had significant repercussions for the Luftwaffe and their future capabilities. Sweetman stated that, 'Before and during the attack on the Möhne, night-fighter training continued from the airfield at Werl. The Luftwaffe neither reacted nor despatched aircraft to intercept the bombers even though Gibson's crews remained in the Möhne area for over half an hour'.⁵⁶ In the aftermath of the attack, Speer's report to Hitler made 'a deep impression on the Führer'.⁵⁷ In his diary, Goebbels confirmed that, in relation to the dams raid, 'The Führer is exceedingly impatient and angry about the lack of preparedness on the part of our Luftwaffe'.⁵⁸ Hitler's reaction to the failure of the Luftwaffe to repel the attacks can only have served to galvanise his growing disaffection for the effectiveness of his fighter force. Having already dictated on 8 May 1943 that all new aircraft should be capable of carrying bombs, Hitler became increasingly

oblivious to counter-arguments in favour of the development of the jet-engined Messerschmitt Me-262 as a fighter aircraft alone, despite the enormous advantage it would have given to the Luftwaffe.⁵⁹ The subsequent delay to the development of the Me-262 represents a tangible, if unquantifiable, reprieve for Allied air superiority.

Diplomatic strategy

In the gloom of unfolding events at Stalingrad in late 1942, German diplomatic attempts were being made to achieve peace between Germany and the Soviet Union that would enable the withdrawal of German forces from the east and thus allow a greater concentration of forces against the Allies in the west.⁶⁰ The Soviets, having suffered 11 million casualties by the end of 1942 in hindering German advances,⁶¹ may have been inclined towards a cease-fire. Stalin's Order of the Day of 23 February 1942 reinforced the potential for such a course of action; the order implied disappointment at the lack of offensive action in western Europe, and that Soviet war aims were to regain lost territories rather than to achieve total victory over Germany.⁶² Soviet suspicions over Allied commitment were exacerbated by the continued failure throughout 1942 of the Allies to open a 'promised' second front in the west, despite Soviet pleas to do so, and the lack of success or cancellations of Arctic re-supply convoys from Britain to the Soviet Union. At a meeting in Moscow in August 1942, Churchill had placated Stalin's ire at a lack of offensive action and the delay of invasion until 1943, with the promise of intensified air attacks on German industry.⁶³ However, as the year had progressed, there had been further prevarication over the practicality of a grand invasion in 1943 following the decision to conduct an offensive in North-West Africa. Eventual confirmation of a delay until 1944 was specified at the Casablanca Conference in January 1943. These events only served to increase the tension in relations with Stalin. Naturally, Churchill feared that the Soviets' commitment to the war against Germany would wane if they were to regain lost territories whilst noting no particular backlash from the west.⁶⁴

Alliance cohesion across the Atlantic was a further cause for mild consternation. Historical

tensions had existed since the American War of Independence and from British support for the Confederacy during the American Civil War. However, the greatest frictions came from the influence of the large Irish-American community in Democratic politics and their hostility towards British rule over Ireland, and an American distaste for the imperial nature of the British. The British, for their part, held grudges over American lack of support of the peace settlement from 1919 and over the American tariff system.⁶⁵

Prior to the Casablanca Conference, Anglo-American relations were at a low ebb. There was significant feeling in British circles that the Americans were more interested in settling accounts with the Japanese than with the belligerents in Europe;⁶⁶ this view is supported by correspondence from the Chief of Staff to the British Joint Staff Mission in Washington who wrote to Portal in late 1942, stating, 'We must re-emphasize the swing-over taking place in the highest quarters [of the US administration] towards Pacific strategy which still does not appear to be fully appreciated in the United Kingdom . . . Not only has it [the idea] gained currency, but we daily see its practical effect in the diversion of resources to the Pacific Theatre'.⁶⁷ From a UK perspective, a diminution of American support to the European theatre had extremely serious implications both in terms of prolonging the war and in the associated negative effect on morale at home that an excessively extended conflict could create. There was a perceived need to convince the Americans to focus on Germany as the main enemy.⁶⁸ Although the divisions on where US war efforts should be concentrated were abated during the Casablanca Conference, they resurfaced shortly afterwards. By the Trident Conference of May 1943, soundly-based British reluctance to commit to Operation Roundup (a joint aspiration for an Allied invasion into Northern France) any earlier than May 1944, had resulted in intensified American threats of transferring their major war effort to the Pacific: this had resulted in deadlock.⁶⁹ UK belief that the Americans were committing too wholeheartedly to a cross-Channel invasion at the expense of other opportunities were balanced by an American view that the British were seeking



A modified Lancaster of No 617 Squadron prior to Operation CHASTISE

Operation CHASTISE, if successful, offered the opportunity through a singular spectacular strike to provide confidence that the bomber offensive was turning the course of the war in the west, and by extrapolation, would indicate that Germany's ultimate defeat was inescapable

to divert resources to further their imperial aims rather than promoting the main aim of defeating German-held Europe.⁷⁰

Diplomatically, a critical capability in supporting the cohesion of the Tripartite Alliance was the combat strength and economic resource to mount effective offensives on two fronts. To achieve this, a critical requirement was the commitment of the Soviets not only to regain their pre-war territories, but also to continue offensive action against the retreating German forces in the East. Stalin needed to be compelled to stay in the war from a political standpoint. To do this required demonstration of the inevitability of the ultimate defeat of Germany, either with or without Soviet assistance. If German defeat was inevitable, then the Soviet Union would want to be involved in the post-war shaping of Continental Europe's frontiers, in order to satisfy her longer-term ambitions to expand communism westwards.⁷¹ An equally critical requirement was a

commitment from the Americans to focus sufficient military strength in Europe. Britain's capacity to demonstrate a credible counter-offensive capability represented a critical vulnerability.

The diplomatic strategic effect necessary to protect the friendly strategic centre of gravity was a compelling demonstration of the British capacity to strike at the heart of Germany; the air war against Germany offered, at the time, Britain's only means of doing so. Strategic bombing was therefore essential in keeping the Soviets in the war; this view is reinforced by Lord Cherwell, Churchill's personal scientific advisor, in a letter to the Prime Minister in March 1943, where he stated, 'But it will surely be held in Russia as well as here that the bomber offensive must have more immediate effect on the course of the war in 1943'.⁷² Operation CHASTISE, if successful, offered the opportunity through a singular spectacular strike to provide confidence that the bomber offensive

was turning the course of the war in the west, and by extrapolation, would indicate that Germany's ultimate defeat was inescapable. That Churchill had written to Stalin only a month before the Operation promising an increase in the scale of bombing, only serves to emphasise the strategic importance of the Raid.⁷³ A significant British demonstration of force would also strengthen the US' perception of Britain's commitment to the aim of defeating Germany rather than protecting its wider imperial interests, and therefore augment support for a greater balance of resources towards the European theatre.

The raid occurred at a strategically fortuitous moment, if there was no political influence in its timing or objectives. Churchill was able to make great capital out of it during his visit to the Trident Conference, particularly in his speech to both Houses of Congress on 19 May 1943, the day after the breaking of the story in the media. Having pledged full British support to the United States in the defeat of Japan and stressed that the intensified Allied air bombardment of Germany was paving the way for Hitler's downfall,⁷⁴ Churchill continued:

'The Condition to which the great centres of German war industry, and particularly the Ruhr, are being reduced is one of unparalleled devastation. You have just read of the destruction of the great dams which feed the canals and provide the power to the enemy's munition works. That was a gallant operation, costing eight out of the nineteen Lancasters employed, but will play a very far-reaching part in reducing the German munition output. Wherever their centres exist or are developed, they will be destroyed.'⁷⁵

Notwithstanding its timing, the Raid impressed both of Britain's Allies. The Joint Chiefs of Staff acknowledged a dramatic British success and it helped in gaining the acceptance of the Combined Bomber Offensive plan.⁷⁶ The Soviets were equally impressed and sought information on the operation as they were 'possibly contemplating something similar'.⁷⁷ Importantly, it demonstrated to her Allies that Britain could, using air power, strike at the heart of the enemy territory. As

Speer noted, 'The real importance of the air war consisted in the fact that it opened a second front long before the invasion of Europe. That front was the skies over Germany . . . The unpredictability of the attacks made this front gigantic; every square metre of the territory we controlled was a kind of front line.'⁷⁸

To determine whether Operation CHASTISE had a pre-determined diplomatic objective requires analysis of the decision-making process that determined its viability. When the Upkeep proposal was first put to Harris, in mid-February 1943, he described it as 'tripe of the wildest description. There are so many ifs and buts that there is not the smallest chance of its working'.⁷⁹ Harris further railed at the prospect of diverting Lancaster assets for modification, when the weapon itself existed at that stage 'only within the imagination of those who conceived it'.⁸⁰ Harris's misgivings about the idea were encapsulated in his statement that 'we have made attempt after attempt to pull successful low attacks with heavy bombers. They have been, almost without exception, costly failures'.⁸¹ Conversely, the First Sea Lord, Admiral Sir Dudley Pound had described the smaller, naval version of the weapon (codenamed Highball) as 'the most promising secret weapon yet produced'.⁸² Within two days of his earlier rant, Harris met Wallis and considered his proposals, but without commitment. The following day, Wallis was advised to stop all ideas of attacking the dams, and subsequently offered his resignation. Yet, by 26 February, Wallis had been given the go-ahead for the Upkeep programme, having had authorisation to proceed with Highball four days earlier. It is unlikely that Harris had changed his viewpoint, given his contention in April 1943 that 'As I always thought, the weapon is bamy'.⁸³ Therefore, higher authority must have overruled him. Cooper contends that the Upkeep papers were sent to Sir Winston Churchill by Sydney Barratt, assistant to Sir Thomas Merton, the Scientific Advisor to the Ministry of Aircraft Production, to whom Wallis had spoken following his 'resignation', and that the Prime Minister subsequently gave the order for the raid to be prepared.⁸⁴ An alternative assertion is that Portal, having been a keen advocate of

attacking the Möhne dam since his time in Harris's role three years earlier, personally sanctioned the modification of three Lancasters for further trials.⁸⁵

Regardless of its ultimate sponsor, Operation CHASTISE would proceed. The motive behind the decision is important, though. As noted earlier, Portal was aware of the limited economic impact that the Raid was likely to have. Also, Churchill was fully informed of the operation before the event, and expected much from it;⁸⁶ any intervention by Churchill in the decision to proceed would suggest, arguably, a diplomatic motive.

A further argument in support of a diplomatic objective lies in the development of Highball, designed for attack against capital ships. For maximum effect and for optimum operational security, Highball and Upkeep should have been launched together.⁸⁷ Unfortunately, Highball trials stalled and the optimum opportunity to use Upkeep approached; failure to meet temporal target validity constraints, imposed by water levels in the dams and moonlit conditions, would mean an almost certain postponement by almost 12 months to the attack on the dams. Conversely, proceeding with Upkeep would undoubtedly prejudice the future utility of Highball. The Vice-Chief of the Naval Staff, following the specific direction of the First Sea Lord, refused to agree to the decoupling of the weapons' programmes. His RAF counterpart, Air Chief Marshal Sir Douglas Evill, sent a summary of the situation to the Chiefs of Staff at the Trident Conference. The immediate response from Washington was to proceed with Upkeep. Some commentators have credited Churchill with having authorised the operation, but without corroboration.⁸⁸ Nevertheless, given the predisposition of the First Sea Lord to oppose such a move, it is reasonable to conclude that a swift response from the Joint Chiefs might only have been possible through higher-level mediation, particularly if Churchill was already familiar with the programme, appreciated its strategic potential and sought an outcome in advance of his speech to Congress.

Psychological strategy

In February of 1943, when the critical decisions

were being made on whether Upkeep development should proceed, Britain was in need of a major fillip to morale. Britain had survived through the Battle of Britain, the Blitz, the Battle of the Atlantic, the bombardment of Malta and the loss of Crete. Avoiding defeat does not in itself provide hope of ultimate victory, and morale under such circumstances is difficult to maintain. Whilst the Germans had been defeated at Stalingrad, and the tide had turned in the North Africa campaign following El Alamein in November 1942, the British had not yet registered a conclusive victory against Germany. Against the strategic backdrop of sustaining Alliance cohesion and in accordance with Clausewitz's 'Remarkable Trinity', maintaining the strong support of the people was a critical capability in both withstanding and responding to the enemy. Maintaining high morale among the population was therefore a critical requirement, and a perceived lack of tangible military success represented a critical vulnerability: hope had to be fostered both at home and abroad that the British were fighting back, and achieving success. Moreover, the impact on morale is a balancing act; that which strengthens friendly morale must surely erode the morale of the opposition.

The raid was intended to demonstrate the capacity to retaliate. However, Operation CHASTISE would fail to optimise its psychological benefits unless it exploited some aspects of indirect air power. In this case, the non-lethal air power activity constituted reconnaissance and psychological operations; the latter would be achieved through the product of the former allied to the widespread use of the media.⁸⁹ The Air Ministry was aware of the advantages of the reporting of operations, even if security implications limited much of the potential propaganda benefits. They had set up a Public Relations Department in advance of Operation CHASTISE.⁹⁰ Harris himself sought to exploit propaganda opportunities and had arranged for free access within Bomber Command to the BBC's correspondent, Richard Dimbleby.⁹¹ Also, although Harris rarely visited his operational units, such was the potential significance of Operation CHASTISE that he broke with his tradition to be present at 5 Group Headquarters during the event,

and at RAF Scampton for the mission debrief. Within an hour of the last Lancaster aircraft's return to its home base, a reconnaissance Spitfire was airborne from RAF Benson en route to the scene of devastation. The speed with which its hitherto classified reconnaissance photographs were released to the worldwide media was exceptional, and denoted a watershed in the publication of such material.⁹² That such haste was sanctioned, only serves to endorse the view that the British leadership was aware of and sought to exploit the psychological impact that such powerful and immediate images of the destruction would have, both at home and abroad. The management of the mass media continued for some time after the event, with Gibson encouraged both to write a book, published posthumously in 1946 and entitled *Enemy Coast Ahead*, and to run for parliament (before withdrawing his candidacy).⁹³

There is no denying that Operation CHASTISE had a hugely positive effect on British morale, and, following victory in Africa, further confirmed the British capacity to strike back effectively at Germany. It was also heralded in the United States, where *The New York Times* reflected the general sentiment, 'The RAF has secured another triumph. With unexampled daring, skill and ingenuity it has . . . delivered the most devastating single blow dealt from the air'.⁹⁴ Naturally, by bolstering Allied morale, there was equal intent to deflate the morale of the enemy. Notwithstanding the worldwide media coverage, the British employed a leaflet drop into occupied Europe to spread news of the operation.⁹⁵ Although suppressed in Germany, news of the scale of civilian deaths spread around the Reich by word of mouth 'like wildfire', creating an air of terror until official casualty figures were published. The attack on the dams proved that the RAF was now able to reach out and strike in as precise a way as had not previously been thought possible;⁹⁶ this had the additional psychological undertone that the British were capable of technically overcoming any constraints that German defences could present, and that no target was invulnerable. Whilst a reduction in enemy morale was less likely to bring about the downfall of a totalitarian

regime than a more susceptible functioning democracy, it was nevertheless a contributory factor, even if measures of effectiveness were all but impossible. The US Strategic Bombing Survey highlighted the significant resistance of the Germans to air attack, 'Their morale, their belief in ultimate victory or satisfactory compromise, and their confidence in their leaders declined, but they continued to work efficiently as long as the physical means of production remained. The power of a police state over its people cannot be underestimated'.⁹⁷ Despite this, the raid appeared to impact morale. By destroying 3,500 hectares of arable land and killing 6800 cattle and pigs,⁹⁸ the subsequent reduction in rations had a very serious psychological effect.⁹⁹ Hans Rumpf emphasised a 'lasting effect' on morale,¹⁰⁰ whilst Douglas Bader recalled, 'I well remember the destruction of the Möhne and Eder dams when I was in a prison camp. It had an enormous effect on Germans and the opposite effect, of course, on the prisoners-of-war'.¹⁰¹ Within two weeks of the Raid, Goebbels had recorded in his diary that, 'An interesting transformation is taking place among the German people . . . the defeatists, especially the intellectuals are outdoing each other with pessimistic utterances'.¹⁰² Upon interrogation following the Raid, his captors informed Flight Sergeant Fraser, a captured 617 Squadron aircrew, that the mission had 'accomplished as much as 100 normal air raids'.¹⁰³ Psychologically, these quotes combine to imply degradation in the general morale of the German people. However, this effect may have been short-lived or the sentiments may be unrepresentative.

Enduring effects

Many of the early air power theorists such as Douhet, Mitchell and Trenchard hypothesized that the hardship created by conventional area bombing would erode the morale of the people, defeat their will to resist and turn them against their regime. By 1943, the British experience of the Blitz and the Malta campaign should have given a graphic representation of the doctrinal folly of such thinking. In the immediate aftermath of the dams raid, questions were raised in the House of Commons on the reprehensible nature of indiscriminately bombing civilian centres.¹⁰⁴ Whilst



A Harrier GR7 armed with Paveway II laser-guided bombs (AHB RAF)

Loss of life has become the Achilles heel of modern coalition forces; equipment complexity has continued to escalate in an attempt to minimise this

Bomber Command continued to concentrate on area bombing with the aim of striking industrial centres within urban areas, this is more likely to have been through technical limits to greater precision than in a specific attempt to shatter morale. If so, then any reduction in morale will have been a by-product of the bombing offensive rather than its stimulus, as can be inferred from the Casablanca Directive.

Whilst the raid illustrated the benefits of low-level precision bombing, it also demonstrated that aircraft vulnerability would lead to unsustainable attrition rates. By reverting to

higher altitude, attrition reduced at the expense of targeting accuracy. Harris, who had previously demonstrated a renowned distaste for corps d'elite, demonstrated prescience by resolving to keep 617 Squadron for the conduct of specialist projects thereafter. An attempt to combine the target-marking expertise of the Pathfinder Force (originally set up in August 1942) with the bombing accuracy of 617 Squadron proved largely ineffective against point targets, but led to the development by 617 Squadron of its own highly successful marking technique;¹⁰⁵ by dropping incendiaries from an extremely low-level lead aircraft onto the target, the remainder of the

squadron could bomb accurately from medium altitude using stabilised automatic bomb-sights. This technique minimised the requirement for low-level flying and was to prove extremely profitable throughout the remainder of WWII, by reducing the requirement to revisit targets. Similar effects could be achieved with a reduction in aircrew losses, or greater effect achieved for similar loss rates. Immediately following WWII, emerging British air doctrine would lead to investment in technology to further reduce risk to aircrew lives.¹⁰⁶ Loss of life has become the Achilles heel of modern coalition forces; equipment complexity has continued to escalate in an attempt to minimise this.

One undeniable success of Operation CHASTISE was the ingenuity and correct functioning of the weapon. Harris had a history of dismissing those 'panacea-mongers' who regularly presented him with preposterous solutions to some of his problems, but in the instant afterglow of the Möhne breach, he remarked to Wallis, 'you could sell me a pink elephant now'.¹⁰⁷ The credibility that Wallis subsequently enjoyed was to influence Bomber Command's future development of weapons. He would later be sponsored to develop the 12,000lb 'Tallboy' bomb that would be used to great effect by 9 and 617 Squadrons to sink the Tirpitz in November 1944, and the 22,000lb 'Grand Slam' bomb used successfully in the destruction of the Bielefeld Viaduct in March 1945, again by 617 Squadron.¹⁰⁸

Harris, a shrewd propagandist, would exploit the publicity of the operation in cultivating support for the strategic air offensive.¹⁰⁹ Operation CHASTISE enhanced Bomber Command's credibility, both in the eyes of Britain's military allies and within British political circles. In the Pointblank plan, approved by the Combined Chiefs of Staff on 14 May 1943, the 8th AAF implied that the RAF could not hit precision targets;¹¹⁰ the imminent success of the mission proved just how precisely Bomber Command could strike, and suitably impressed American counterparts. The raid also offered Bomber Command political kudos, and the platform from which Harris would garner additional resources and commitment for future bomber offensives; this would heavily influence

the future conduct of the war.

Finally, due to the extraordinarily complex nature of the operation, a need for airborne control of the mission had been identified during the work-up phase that had necessitated the fitting of radios similar to those in fighter aircraft.¹¹¹ Gibson was able to direct other aircraft whilst in the air and to relay information back to 5 Group Headquarters to enable appropriate tasking of the mobile reserve. Webster and Frankland described this 'Master Bomber' technique as 'the real significance of the dams raid'.¹¹² Gibson's direct influence on the operation extended to a degree of manipulation of the Operation Order and to autonomy in the tireless composition and training of his squadron.¹¹³ In effect, the dams raid initiated the concept of mission command within Bomber Command.

In the Official History, Howard described Operation CHASTISE as 'a spectacular feat of skill and courage, but one whose effect on the German war effort was, unfortunately, slight'.¹¹⁴ Many recent commentators have considered the Dambusters Raid in solely economic terms, based on imprecise expectations of the raid's economic intent. Their conclusions, that predominantly discredit its strategic effectiveness, are fundamentally misleading. By retrospectively applying campaign planning methodology, a range of economic, military, diplomatic and psychological strategic objectives begin to emerge for the operation.

Economically, the raid largely achieved its strategic objectives. Industrial water supplies were undoubtedly disrupted, despite a tempering of the required effect by the remarkable and unexpected speed of the dams' reconstruction. The partial destruction of the means of production was a significant success. Eighteen industrial works of great economic importance were destroyed at a fortieth of the cost, in aircrew and aircraft terms, of an equivalent conventional bombing campaign, and with 20 times the destructive effect. Although much scholarly capital has been made of the failure to breach the Sorpe dam in conjunction with the Möhne, and thus maximise the economic benefit, the reality is that the weapon was neither optimised

for nor expected to achieve this desirable effect.

Militarily, the raid satisfied wider strategic objectives of reducing the potential combat strength and effectiveness of German forces that would oppose an allied invasion. At least a division's worth of manpower and assets would be absorbed in the defence of the dams for the remainder of the war.

Portal's correspondence to Churchill before and immediately after the operation indicated that the Prime Minister was anxious to discover the outcome of the raid as a matter of priority.¹¹⁵ Churchill, an astute political opportunist, must have been aware of the strategic diplomatic benefits of breaching of the great German dams. Arguably, the timing of the raid was calculated to occur during the Trident Conference and immediately before Churchill's speech to Congress; this argument is supported by the rapid decision of the Joint Chiefs of Staff to give the operation the go-ahead, despite the implications for the Highball programme and the prior Naval resistance to decoupling it from the Upkeep programme. Also, the authorisation of a pre-determined plan to release previously sensitive reconnaissance photography to the worldwide media only serves to support the premise of high-level intervention. However, insufficient conclusive evidence supports this speculative theory. A less controversial conclusion would be that the timing of the raid was fortuitous, driven by moonlit conditions and water levels in the dams. Regardless of whether it was sought, the diplomatic effect of reassuring the Tripartite Allies of British offensive capability and thus strengthening the cohesion of the Alliance was achieved. Equally, the psychological effect sought in boosting British morale was also undeniably achieved, and there was an unquantifiable but tangible impact on the declining morale of the Germans.

Not only did Operation CHASTISE meet its stated and inferred objectives in each of its economic, military, diplomatic and psychological lines of activity, but it also provided the foundation for further developments in weaponry, bombing

precision, and command and control, whilst enhancing political and military commitment for the ensuing strategic air offensive.

Operation CHASTISE achieved considerably more than it has been given credit for, particularly by latter-day historians. The Dambusters Raid was a legendary feat and a remarkable strategic success; its undoubted accomplishments do not deserve to be belittled unjustly.

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Tomahawk missiles carrying carbon fibres were launched at Iraq for the purpose of disabling electrical powerplants



Playing The 'Killing Fields' Without Killing

To what extent should the RAF incorporate the use of Non-Lethal technologies?

By Wg Cdr N J Hay

Non-lethal technologies have the potential to reduce conflict fatalities and the post-conflict reconstruction costs arising from the detonation of conventional, air-delivered weapons. Therefore, "should the RAF embrace non-lethal technology, enabling it to play the 'killing fields' without killing?" This paper examines the viability of employing non-lethal technologies from the air. It discusses typical non-lethal technologies and the arguments for and against their development. It will show that legal constraints and the limitations of standoff associated with air-vehicles restrict their utility. However, from the RAF's perspective, directed energy technology appears to have the greatest potential for employment. Despite technological immaturity and financial constraints affecting its immediate employment, this paper concludes that directed energy technology is worth pursuing, should the MoD be willing to finance its acquisition.

"I have killed in my lifetime. There are rules to justify the carnage. But the fact remains, you've killed a man. It's not a nice sight. If there is another answer, an alternative, why wouldn't you use it?"¹

Many commentators viewed the conflict phase of Operation IRAQI FREEDOM (OIF) as an effective example of effects-based operations (EBO) and the UK MoD's ethos continues to shift from an equipment-based defence policy towards an 'effects' and capability-based approach. However, despite Service Chiefs' rhetoric and emphasis on the need to embrace an effects-based ideology, the House of Commons Defence Committee (HCDC) publicly criticised the MoD's acquisition of the full range of capabilities required to execute EBO. The HCDC stated that 'the MoD has only "begun to develop" capabilities to provide a range of options other than having to resort to traditional attritional warfare methods [and they were] disappointed at the apparent lack of progress in developing

capabilities to provide non-kinetic options'.² As 'the ultimate application of EBO might involve only the discrete or limited use of destructive force', particular areas of the Committee's concern included a failure to enhance information warfare capabilities and the need to embrace non-lethal technologies for use across the spectrum of conflict.³

The Commander-in-Chief Strike Command's (C-in-C HQSTC) vision is to deliver '*precise campaign effects, at range, in time*'.⁴ HQSTC's current offensive weapons inventory lacks a non-lethal element, despite this element's potential for providing an effect without causing kinetic destruction. Consequently, the aim of this paper is to examine whether an inventory of air-deliverable, non-lethal weapons (NLW) is a viable proposition and to assess the validity of the Committee's criticisms when viewed through an 'air lens'. This paper will concentrate on the viability of NLW employment from current and future offensive fixed-wing aircraft, including UAV /UCAVs;⁵ it will not cover information warfare or the use of NLWs from rotary platforms. Finally, in accordance with NATO policy, this paper will assume that NLWs would be deployed in tandem with lethal alternatives, creating a complementary force package.⁶

Definition of NLWs

The UK defines NLWs as 'weapons explicitly designed and employed to incapacitate personnel or material while minimising fatalities and undesired damage to the property and environment'.⁷ NATO expands this definition by stating NLWs should have 'a low probability of fatality or permanent injury'⁸ and the US Department of Defence (DoD) adds that 'NLWs employ means other than gross physical destruction to prevent the target from functioning . . . are intended to have relatively reversible effects on personnel or material [and] they affect objects in subjective ways within their area of influence'.⁹

The lead department for the development of US non-lethal policy is the Joint Non-Lethal Weapons Directorate (JNLWD). They class a 'non-lethal chemical weapon as one that incapacitates 98% of the target population while causing fewer than

0.5% fatalities'.¹⁰ Similar figures apply across the spectra of NLWs and while it is accepted that NLWs are not *intended* to kill, the aforementioned definitions accept that a minimal number of fatalities is acceptable during their employment. However, it is the expectation of fatalities that creates academic concerns with the term 'non-lethal'. Critics describe the term 'non-lethal' as a 'euphemism and an oxymoron'¹¹ as the term raises public expectation in the capability of these technologies. Although other terms have been considered appropriate,¹² the term non-lethal 'represents the intent of the user which is neither to kill nor harm permanently'.¹³ Therefore, should NLWs be developed apace, the public must be informed that NLWs are not the 'silver bullet' and there is a distinct likelihood that deaths will occur from their use. These semantics could pose the French a problem as they define NLWs as 'an instrument or means of attack or defence whose direct effects do not lead to death'¹⁴; should fatalities occur following French NLW employment, they could be viewed as totally unacceptable in the eyes of a critical French public.

Non-lethal capabilities

There is a broad misconception that NLWs are a recent phenomenon. Although NATO and US Policy did not formally recognize non-lethal weaponry until the 1990s, NLWs have existed for nearly a century. 'Tear gases were first synthesized in 1848 [and] were used in both lethal and non-lethal forms during World War I.'¹⁵ The US released defoliants during the Vietnam War in order to increase the vulnerability of an enemy who used the jungle canopy for cover and concealment. Although they were not intended to cause fatalities directly, defoliants had a detrimental effect on the environment, contrary to current definitions. Additionally, US aircraft released 58kg cluster bombs as delivery vehicles for CS.¹⁶ In 1991, carbon fibres were released from US cruise missiles in order to shutdown Iraqi electrical power plants. Generator outputs were halted and no damage was caused to the sites.¹⁷

Kinetic Energy (KE)

KE NLWs include rubber / plastic bullets, baton rounds, water cannons and dual-use lethal / non-



F-35 Joint Strike Fighter

US aspirations include an integral or podded version of a laser for use on the F-35

lethal guns that can fire 'beanbags'. The dual-use lethal/non-lethal guns are currently fielded in Afghanistan while water cannons and rubber bullets have been used in Northern Ireland and Korea.¹⁸

Barriers and Entanglements

Barrier and entanglement technologies are intended to stop entry to installations or immobilise moving or stationary vehicles. Typical examples are the 'Stingers' used by US police forces and a Boat Trap Entanglement System (BTES). During testing, a BTES canister was 'dropped from a helicopter in front of a vessel. [Subsequently], an X-shaped net [was] deployed and propelled into the path of a target vessel.'¹⁹

Electro-Shock

Electro-shock technology utilises an electrical discharge to immobilise either a person or vehicle. A number of police forces operate the anti-personnel 'Taser' and Sky-Marshals in the US,

Middle East and Europe are alleged to possess this technology as a means of ensuring greater safety in defending against potential hijackers.²⁰

Acoustic

The aim of acoustic weaponry is to project high-intensity sound in order to repel or disable personnel at a distance or to drive personnel out of a facility. The Long Range Acoustic Device (LRAD) has been acquired by the US Marines for use in Iraq and there are claims it was used in Afghanistan to draw terrorists from caves.²¹

Directed Energy (DE)

DE technology directs electro-magnetic energy in order to produce its effect. This classification will be further sub-divided into three classifications:

1. *High Power Microwave (HPM)*. HPM technology has the ability to disrupt electronic circuits, enabling it to 'stop vehicles by . . . [disabling] their onboard computers'.²² A recent article indicates

the feasibility of fitting HPM devices on Storm Shadow, cruise missiles and UAVs.²³ In an anti-personnel Mode, HPM technology is used to heat a victim's body to about 55°C. The USMC are developing a vehicle-borne prototype with future intentions of installing it on aircraft to operate in an 'area-clearing' Mode.²⁴

2. *Non-Nuclear Electro-Magnetic Pulse (EMP)*. EMP technology is also capable of targeting electronics. It was tested with mixed results at the Los Alamos National Laboratory in 1993 when its potential for disabling electronics was demonstrated by '[the disabling of] privately owned automobiles [located] 300 metres from the test site.'²⁵

3. *Laser*. Lasers can be utilised in either an anti-personnel or anti-material Mode. A Mobile Tactical High Energy Laser demonstrated an impressive anti-material capability by shooting down an artillery shell in flight²⁶ and Boeing are developing an Airborne Tactical Laser (ATL) for scheduled employment on a C130 in 2006/07. Initially designed to counter Intermediate-Range Ballistic Missiles, the ATL has the potential to stop a vehicle or disable targets akin to radio towers or antennae — it is not designed to destroy buildings.²⁷ US aspirations include an integral or podded version for use on the F-35.²⁸

Riot Control Agents (RCA) and Malodorants

RCAs are irritants deployed with the intent of defusing crowd hostility; their effects are designed to disappear within a short time.²⁹ Malodorants are affectionately known as 'skunk bombs' and have been used in the US to prevent the occupation of vacant buildings. However, UK research into malodorants has halted due to a lack of technological advances in this field.³⁰ The main criticism of RCA employment is a lack of standoff from the target area — air assets could prove a key player in resolving this problem.

Biochemical Incapacitating Agents

Typical anti-material biochemical capabilities include microbes that increase the viscosity of fuel or chemicals that act as supercaustics, supercorrosives or embrittlement agents. These agents are designed to render either equipment

or fuel ineffective in a combat situation.³¹ In anti-personnel roles, biochemicals could be used as calumative or sleep agents. Incapacitating chemicals were used during the Moscow theatre siege in 2002 and this incident will be covered later. Finally, sticky foams are 'polymers that can be used to immobilise [a person], yet allow them to breathe'; the USMC deployed this technology to Somalia although it remained unused.³²

Combined Technologies

A typical example of a combined technology is sticky foam laced with an RCA or 'electrical projectiles that use a capacitor to store an electrical charge within a bullet that is released when it hits the target person'. The former is currently available while the latter, a combination of kinetic and electrical capabilities, is under development.³³

Summary

Barriers and entanglements are optimised against relatively slow target sets and would be ideally suited for deployment from rotary platforms vice the generally faster, fixed-wing platforms. As electro-shock capabilities require use in extremely close proximity to the target, it is unrealistic to expect this technology to be deployed from any airborne platform. However, recent US research implies that RAF 27mm projectiles could be adapted to deploy biochemical agents or RCAs in an airburst Mode³⁴ and this will be discussed in greater detail, alongside KE, DE and acoustic technologies.

The NLW debate

Trusedell remarked that 'NLWs would seem to have more particular utility in special operations — especially where there is concern about civilian lives — rather than the main battlefield. Particularly when ensuring non-lethality is the key factor (eg protection of food convoys to refugees), where forces are involved in operations where they personally are not directly threatened (eg hostage-taking situations), where the public is already wary of involvement in a particular conflict (eg Bosnia), these weapons must play an important role.'³⁵ This view is typical of commentators who support the development of NLWs based on the premise that Western military involvement



Images of the Highway of Death led to a public perception of unnecessary human suffering and calls for a ceasefire . . . and adversely affected coalition targeting plans and the eventual attainment of US objectives

will generally be in Operations Other Than War. However, since Trusedell's article, UK forces have 'intervened' in Kosovo, Iraq and Afghanistan where non-lethal technologies would have proved useful in providing the effects required of a medium or high-intensity conflict. DE technologies could have enabled UK forces to disable mobile forces or neutralise command and control (C2) facilities and surface-to-air missile (SAM) radars. RCAs, biochemical agents and acoustic technology could have been used to disrupt or disable enemy land forces thus enabling Allied forces to take vital ground. Therefore, the relevance of NLWs is not restricted to OOTW but includes the 'main battlefield'.

Combatting the 'CNN Effect'

The 'CNN Effect' is the result of an 'unwritten expectation that military operations conducted by democracies . . . will involve as little bloodshed as possible'.³⁶ Consequently, any media images highlighting civilian deaths could impact adversely on the continuation of a campaign plan. In 1991, the bombing of a dual-use bunker and air-raid shelter in Baghdad resulted in 200-300 civilian deaths. The resultant media coverage forced extensive coalition PR efforts across the political-military spectra in order to protect coalition cohesion. Coalition targeting plans were also affected, as the impetus moved away from leadership and other targets in Baghdad. Eventually, images of the 'Highway of Death'



A Harrier GR7 of No 20(R) Squadron armed with Maverick air-to-surface missiles (AHB RAF)

The RAF's offensive inventory consists solely of kinetic weapons and these tend to offer the choice of doing nothing or killing

led to a public perception of unnecessary human suffering and calls for a ceasefire. The domino effect of public discourse ran from the shelter bombing to the 'Highway of Death' and adversely affected coalition targeting plans and the eventual attainment of US objectives.³⁷ Had DE NLWs existed in 1991, the coalition would have been able to dislocate the Iraqi C2 network with a concomitant reduction in civilian casualties, thus countering or delaying the 'CNN Effect'.

During recent conflicts, opponents have used urban areas for cover, concealment and movement. The increased use of the urban environment is down to two major factors. Firstly, compared to 1990 figures, the world's urban population is expected to triple by 2025, potentially making it difficult to bypass sprawling urban areas in

manoeuvre warfare. Secondly, enemies will continue to lure coalition forces into urban areas in order to reduce the effectiveness of the coalition's technological superiority. This occurred in Somalia when 'warlords sought to fight US forces in the alleys . . . where combat was reduced to rifle against rifle.'³⁸ OIF highlighted Krulak's '3-block war' where warfighting, peacekeeping and humanitarian assistance operations occurred in adjacent neighbourhoods and equipment was also placed in urban areas for 'sanctuary' purposes. During OIF, a satellite antenna was positioned in a car park to the rear of a Western media facility and used to broadcast Iraqi propaganda. Following much consternation and conscious of the proximity of Western journalists, coalition commanders elected to destroy the antenna with a Maverick

missile that contained a small, explosive warhead. Fortunately, there were no casualties. Had the commanders possessed a non-lethal alternative, for example DE technology, they would have undoubtedly taken this option.³⁹ These examples highlight the potential of non-lethal technology in reducing the strategic impact of kinetic weapon use in areas of collateral concern.

'Filling the gap'

Alexander writes that 'assuming . . . no utopian intervention will take place in the foreseeable future, humans will continue to engage in conflict, just as they have in the past and are today'.⁴⁰ As a consequence of the Strategic Defence Review and New Chapter, the UK could be involved in protecting its national interest and acting as a 'force for good' over an indefinite period. While EBO requires inter-governmental assistance in resolving conflicts, military intervention is often seen as the 'necessary evil' once the diplomatic, information and economic lines of activity are perceived to have failed. Currently, the RAF's offensive inventory consists solely of kinetic weapons and these tend to offer the choice of doing nothing or killing.⁴¹ Therefore, NLWs offer an alternative to conventional weaponry and could reduce the probability of enemy armed forces' and civilian deaths, thereby reducing the probability of conflict escalation. Recent events in Iraq have shown the value of 'air presence' in defusing volatile situations, as hostile crowds have dispersed and insurgents have halted attacks following the arrival of 'fast-air'. Should these 'shows of force' have failed, conventional firepower was the sole remaining option and could have resulted in civilian deaths with associated, far-reaching, political ramifications.

NLWs could be used to demonstrate intent to a belligerent, thereby providing airmen and politicians with a 'sort of halfway house in the decision-making process'.⁴² The use of non-lethal technology to attack a strategic target would demonstrate intent for military involvement, with a reduced probability of civilian deaths. Once the intent, willingness and capability to engage in conflict had been demonstrated, the

belligerent would be left with two choices — do nothing and face further punishment from NLWs and/or lethal means or refrain from the activity that preceded the need for military intervention. Although Saddam Hussein appears to have had no intention of surrendering in 2003, the option of launching a cruise missile, armed with a DE warhead, against his strategic targets would have enabled the coalition to partially dislocate Saddam from his forces giving him time to reconsider his enemy's real intent. Conversely, critics 'feel the use [of NLWs] reflects a lack of political resolve and weakens the effectiveness of the military by not producing the physical effects necessary to punish an aggressor [and that NLWs] encourage politicians to micromanage military commanders and places the lives of military personnel at risk'.⁴³ Assuming that NLWs can deliver the desired effect, an aggressor should not have to be subjected to kinetic effects and the potential loss of life in order to feel 'punished'. The loss of an enemy's ability to communicate intent to his forces, or the use of incapacitating agents to fix enemy forces thereby increasing their vulnerability for subsequent attack, could be viewed as sufficient 'punishment' in certain scenarios. Moreover, air assets — UAVs and missiles in particular — offer commanders the opportunity to deliver effect at range without placing a large number of forces at risk. It could also be argued that politicians are already able to micromanage military commanders as a consequence of recent improvements in standoff capability and precision weaponry. During 1991, political consternation arising from Tornado losses during low-altitude operations resulted in their elevation to medium altitude for the remainder of the conflict.⁴⁴ This is a prime example of political micromanagement, as medium-altitude operations were in direct opposition to RAF tactics and doctrine and the aircraft were subsequently less effective. However, extensive US Suppression of Enemy Air Defence support reduced the risk to aircraft operations at medium-altitude and the acquisition of Precision Guided Munitions (PGMs) and laser designation pods quickly reversed the initial decline in RAF effectiveness. Therefore, it is likely that NLWs will simply form another part of the politicization process



RAF Tornado GR1s armed with Paveway laser-guided bombs departing from Muharraq, Bahrain, during Operation GRANBY, 1991 (AHB RAF)

During 1991, political consternation arising from Tornado losses during low-altitude operations resulted in their elevation to medium altitude for the remainder of the conflict

and military commanders must ensure their personnel are not placed at increased risk simply because NLWs are contained in the inventory.

Critics of NLWs also argue their use would increase the probability of conflict escalation. The use of RCAs to quell a peaceful demonstration following a misinterpretation of the crowd's intent would undoubtedly antagonise the target population and create further problems for occupying forces. A compounding argument is that 'in interventions which begin with an intent to employ only NLWs, forces may quickly face the necessity of employing lethal weapons where no

actual intervention would have occurred if it were understood that lethal systems would be used.'⁴⁵ However, as stated previously, this paper assumes that NLWs would be deployed in tandem with a lethal alternative, thereby demonstrating intent to deploy lethal means should they be required.

Another area of concern is the temptation for pre-emptive use of a NLW prior to the attainment of international consensus for military action. The US Council of Foreign Relations (CFR) discussed this eventuality by '[suggesting] that weapons targeting electrical systems might be a solution to the clear need for means short of invasion and



A Tornado GR4 armed with Storm Shadow missiles. Storm Shadow could be modified to carry HPM/EMP technology

It is imperative that the temptation to continually use a non-lethal capability for destroying enemy infrastructure be guarded against and that pre-emptive non-lethal options should be given the same considerations as those required for the employment of kinetic effect

destruction [in order] to discourage state tolerance or support terrorist activities'.⁴⁶ The use of a Storm Shadow fitted with HPM/EMP technology is the type of device that could pose this temptation, although the legality of an 'electronic invasion' could well be challenged in the international forum. It is also imperative that the temptation to continually use a non-lethal capability for destroying enemy infrastructure be guarded against and that pre-emptive non-lethal options should be given the same considerations as those required for the employment of kinetic effect. However, despite the aforementioned counter arguments, 'most conflicts pose a

fear of escalation [and] the use of NLWs in the early stages of a conflict *may* reduce the risk of escalation, [thereby giving] diplomacy a chance to work'.⁴⁷

Credibility on the world stage

An increasing amount of military action results from Western calls for interventions in humanitarian crises. However, 'when lethal force instead of non-lethal force is used by those who have come in the name of 'humanity', the complexion of the situation changes'.⁴⁸ If an intervening force's attempts to quell unrest by employing NLWs were to prove unsuccessful, an escalation into the kinetic realm

in order to save friendly forces and civilian lives *should* have more justification in the international arena. Conversely, critics 'feel the development of non-lethal technology will trigger unwanted and unintended involvement in parts of the world experiencing turmoil.'⁴⁹

Reduced post-conflict reconstruction costs

The astronomical cost of rebuilding a nation following the extensive use of kinetic force is evident in Iraq.⁵⁰ Following the use of carbon-fibres against Iraqi power stations, 'the Iraqis restored commercial power considerably faster than had been anticipated'.⁵¹ This could have been a result of inadequate pre-conflict analysis or the fact that the cessation of electrical distribution by non-lethal means aided in reducing the reconstruction effort, as components had not been completely obliterated and structures permanently weakened by kinetic effect.⁵² Critics expand this argument further by stating that NLWs had lethal consequences, as public services were drastically affected by the loss of power, resulting in increased health hazards and a lack of potable water.⁵³ However, these critics fail to comprehend that the desired effect was the cessation of electrical distribution and this could have been achieved by lethal or non-lethal means. Had conventional means of attack been employed, the potential for civilian deaths and physical damage at the time of weapon impact would have been greater and the security of the infrastructure would have been placed in greater jeopardy. Therefore, this criticism should relate to the coalition's targeting policy rather than the inadequacy of NLWs. Finally, while this example highlights the potential benefit of reduced reconstruction costs resulting from NLW employment, an extremely relevant lesson is the need for planners to identify potential second and third order effects when targeting NLWs: this is an essential facet of EBO.

Targeting biochemical weapon facilities

In 1994, the US Defence Secretary issued a memorandum detailing a need for HPM weapons in order to "disable or destroy weapons or weapon development/production processes, including suspected weapons of mass destruction."⁵⁴ Concerns at this time included a suspected, buried

and hardened chemical weapon research facility that was deemed impenetrable to all means of attack vice a nuclear strike. Furthermore, the potential destruction of illegal Iraqi biochemical production facilities was perceived as difficult to achieve with conventional weapons, as the release and dispersion of biochemical agents following kinetic attack would be difficult to control. Therefore, the benefits of developing DE weapons in order to halt the production of biological and chemical weapons is an obvious benefit, particularly if one considers the devastating effects of the nuclear option. However, some critics believe that NLWs should not be developed at all despite their applicability in countering the 'greatest evil', that of WMD, and this leads to the specific criticisms of NLWs.

Criticism of specific non-lethal technologies KE weapons

During tests on KE rounds, it was claimed that '56% of rounds could not reliably hit a [50cm diameter] circular target . . . from 23 metres away' and that 'ricochets from hard objects posed substantial hazards to friendly bystanders at near range'.⁵⁵ An associated problem with inaccuracy is an increased risk of fatalities and deaths have resulted from KE employment.⁵⁶ The increased muzzle velocities of aircraft cannons, combined with a reduction in accuracy caused by the standoff inherent with a strafing delivery of KE projectiles, would render this technology more lethal and potentially less discriminate. Therefore, KE technology will be discounted from further discussion.

Acoustic

Acoustic weapons operate by inducing pain in a victim. 'When [a victim is] subjected to [acoustic attack], possible changes can occur in the pulse and in breathing . . . followed by extreme nausea and . . . disorientation . . . Medical evidence suggests that infrasound at certain frequencies can cause long-term damage on internal organs at short range, with perhaps uncontrollable effects, such as epileptic seizure, and bowel spasms'.⁵⁷ This causes potential human rights issues as innocent victims may be subject to 'cruel and inhumane treatment' contrary to Article 5 of the Declaration



A Tornado GR4 of No 617 Squadron; the muzzle of the 27mm Mauser cannon carried by this aircraft can be seen ahead of the squadron badge (AHB RAF)

Despite the potential for adapting strafing rounds for delivering RCAs, the only fixed wing asset forecast as capable of firing a cannon is the GR4

of Human Rights, particularly if operated in 'towns where there are crowds and buildings, the sick and elderly, as well as children, [as they] are likely to be in the weapon's range'^{58 59} However, the greatest restriction to the airborne employment of acoustic technology is the requirement for minimal standoff from a target to ensure the appropriate weapons effects.⁶⁰ If a UAV were utilized to deliver acoustic effect, its proximity to potential targets would cause it to become a 'sitting duck' to small arms fire. Missiles could be employed to deliver this effect although the damage mechanism must be constantly placed on the target for a prolonged period in order to force personnel to move: this is probably an unlikely use of missile technology. Finally, as the accuracy and efficiency of this technology would be further reduced by atmospheric conditions, land forces would be more appropriate in directing acoustic effect, particularly

in an urban environment. Therefore, acoustic technology is discounted for the remainder of the paper.

DE weapons

A US serviceman who was exposed to HPM effects during testing remarked that "the skin gets extremely hot and people can't stand the pain, so they have to move".⁶¹ HPM therefore requires the victim to select an exit route and if unable to move, the victim would suffer extreme pain and possibly agonising death. Dr Robert Becker, a specialist in electromagnetic effects, claims that other side effects of HPM include retinal bleeding, disorientation, temporary paralysis and loss of memory.⁶² Consequently, there are concerns that HPM technology infringes human rights, although the USAF claims that 'in many cases, [an HPM] effect can be generated covertly with no collateral

structural or human damage'.⁶³ This raises the question of 'discrimination' in HPM employment, although the ability to accurately direct the energy is still under development.

A distinct advantage of DE weapons is their characteristic for employment at range from a target, although atmospheric, obscurants and smoke can reduce their effectiveness.⁶⁴ HPMs have been employed at ranges in excess of one kilometre⁶⁵ and airborne lasers are often used at ranges in excess of 10 kilometres for designation purposes. It is predicted that future airborne lasers would have the potential to attack an aircraft-type target at ranges of 30-155 miles.⁶⁶ Research on the effective range of EMP technologies has failed to uncover recent assessments but it is assumed to be similar to HPM technology. Therefore, based on potential advances in energy direction techniques and the benefits associated with standoff from a target area, DE weapons show significant potential for airborne employment.

RCAs and malodorants

It is likely that trained enemy forces would be equipped with respirators, thus countering the effects of RCAs and potentially, malodorants. Consequently, the utility of RCAs lies at the peacekeeping end of the conflict spectrum, although 'the effect of CS on a civilian in a poor state of health [could] be terminal, even under strict clinical conditions'.⁶⁷ Once employed in open areas, RCAs have the potential to drift downwind, affecting the local populace; this occurred in Tucson 'after tear gas used in a training exercise [on a USAF base] was blown over a local shopping plaza triggering numerous calls to the emergency services'.⁶⁸ These detrimental effects worsen if RCAs are concentrated in buildings, forming potentially lethal doses. Consequently, RCAs should be targeted against personnel in open areas, reducing the potential for harmful concentrations.

During weapon employment, airmen would be required to consider the meteorological effects on agent dispersion in order to reduce the risk of fatalities among bystanders. This would be difficult to assess from height and should there be a zero-tolerance of fatalities, it would be unwise

to employ RCAs from the air. Additionally, despite the potential for adapting strafing rounds for delivering RCAs, the only fixed-wing asset forecast as capable of firing a cannon is the GR4.⁶⁹ It is unlikely that financial resources would be expended on equipping a single aircraft type with such a capability, as pressure could be placed on the GR4 as the platform of choice for deployments on peacekeeping missions, placing a potentially unacceptable burden on the Tornado Force. Although RCAs could be delivered by adapting current bomb bodies or by designing new, smaller munitions, another problem is the ability of an airman to assess when to deliver the effect. Co-located land forces are currently the only means of assessing a crowd's mood and intent, and the elapsed time between identifying a crowd's 'trip-point' and resultant chaos could be very short. Even in an era of Network Enabled Capability, the timeliness of air-deliverable RCA could not be guaranteed. Consequently, it would be wiser to properly equip land forces rather than expending resources on equipping aircraft with this capability.

Biochemical incapacitating agents

Gurr argues that the employment of 'sticky foam' could result in a 'risk of asphyxiation or suffocation if . . . ingested [and that] victims [would also be placed] in a vulnerable position'.⁷⁰ The standoff capability inherent with airborne platforms would reduce the accuracy and affect the dispersion of 'sticky foam' and it is unlikely that forecast delivery platforms would be able to generate the quantity of foam typically required for a task. A major concern with biochemical incapacitating agents arises from the increased vulnerability of an incapacitated enemy following NLW employment. The Geneva Protocols state that a person is '*hors de combat*' if '[he is] incapacitated by wounds or sickness, and therefore is incapable of defending himself' and 'should not be made the object of an attack'.⁷¹ NLWs are unlikely to cause any external wounds and the ability of a lethally armed attacking force to identify an enemy's inability to defend himself or surrender as a result of NLW-induced 'sickness', would be markedly reduced during the 'fog of war'.⁷² This combination of non-lethal and lethal effect on the battlefield rightly concerns the critics of NLWs although

the ability of this technology to *incapacitate* a terrorist makes these agents attractive in an era of asymmetric warfare and insurgency. Therefore, incapacitating agents will be carried forward with DE weapons for further discussion, commencing with the legal issues detailed in the Laws of Armed Conflict.

The legal issue

The main counters to the development of biochemical incapacitants are the Chemical and Biological Weapons Conventions (C/BWC), whereas the development of DE technologies faces greater opposition from the Geneva Protocols.

Additional Protocol I to the Geneva Convention details the regulations for the methods and means of warfare. Articles 35 and 36 state that weapons are not to cause 'superfluous injury or unnecessary suffering . . . cause widespread, long term and severe damage to the natural environment . . . [Additionally], signatories 'of the convention [are obliged] to determine whether [the employment of a new weapon] would, in some or all circumstances, be prohibited by [the standing] protocol or by any other rule of international law applicable to the High Contracting Party.'⁷³

Article 48 subsequently highlights the requirement to discriminate between the civilian population and combatants during targeting⁷⁴ whereas the Martens Clause states that weapons 'that are abhorrent to the public conscience may be prohibited' based on the principles of international law, humanity and public conscience.⁷⁵ In the UK, the Joint Doctrine and Concepts Centre (JDCC) performs this legal analysis, assesses the likelihood of future changes in the law and their effect on the future utility of a weapon.⁷⁶ In completing this task, it is imperative that NLWs are not viewed as different to traditional weaponry and the scrutiny they undergo during research and development (R&D) should be rigorous enough to ensure the aforementioned legal principles are considered in addition to potential medical and technical issues.⁷⁷

Unnecessary suffering relates to the physical harm caused by the weapon and its enduring psychological effects. The International Committee

of the Red Cross (ICRC) attempted to quantify superfluous injury and unnecessary suffering (SIrUS) and recommended consideration of the following four criteria in assessing a weapon as unsuitable:

1. [Causing] specific disease . . . abnormal physiological state . . . permanent disability and disfigurement
2. [Causing a] provable mortality of more than 25%, or hospital mortality of more than 5%
3. [Causing] Grade-3 (very large) wounds
4. [Causing of] effects that are not treatable by conventional methods of surgery.⁷⁸

The SIrUS criteria were based on conventional weapons effects but have an element of 'applicability' to NLW design. Coupland argues that one of the major obstacles in furthering the acceptability of NLWs would be the difficulty in treating a victim whose symptoms were unrecognisable.⁷⁹ HPM technology is claimed to 'disorientate people . . . [and have] a permanent detrimental effect on [their] internal organs'⁸⁰ whereas the purpose of an incapacitating agent is to alter the psychological state of an individual, creating little observable physical evidence to infer a cause of injury. In order to further 'guide the acquisition of information [with] the task of quantifying human suffering and pain',⁸¹ the JNLWD has set up a human-effects-advisory-panel (HEAP). However, this is a national institution and it is imperative that its work is used in producing a clear mandate, issued by a globally accepted body, concerning the subjective rather than objective amount of disability or incapacitation that is acceptable in warfare. Currently, the SIrUS does not cater for the development of the wide range of NLW capabilities, despite their potential for reducing suffering in Modern warfare.

User intent could also be considered in assessing the legality of a technology and it could be argued that this criterion is already recognised in the use of lasers. Lasers with a primary purpose of blinding, fall foul under the first and fourth SIrUS

criteria and are also prohibited under international law. However, incidental or collateral blinding as a result of their use in guiding PGMs or attacking optical systems is not prohibited.⁸² Lasers are being designed to possess a rheostatic capability, enabling their use at low powers in order to dazzle personnel and their use at higher powers in an anti-material role. Consequently, laser systems will possess sufficient power to blind and indeed kill personnel and the 'proof of purpose' of the equipment will lie with the weapon designer and airman in ensuring the weapon will not be used to blind instead of destroying a victim or object, thereby demonstrating its use for legal means. International lawyers could find this distinction difficult to justify and it is conceivable that high-powered lasers could be incorporated into an extension of the existing conventions prohibiting the total use of lasers in an anti-personnel Mode, while still permitting their use against material — the outstanding issue would then be the requirement to discriminate and act proportionately. This issue could also apply to EMP or HPM techniques, once their true capabilities and potential side effects are realised.

The use of an incapacitating agent during the Moscow Theatre Siege of 2002 created serious concerns about the utility of incapacitating agents for military purposes. ICRC research estimates that injuries caused by a Kalashnikov result in a 20% probability of mortality while the use of the agent in Moscow resulted in a 17% mortality rate.⁸³ Detractors of NLWs assessed 'this level of mortality [to] be expected, and that genuinely non-lethal chemical weapons [were] beyond the reach of current science.'⁸⁴ It is unlikely the agent had undergone sufficient assessment prior to its employment, but the Russian authorities were no doubt concerned about the potential loss of life should they employ traditional measures in an attempt to free the hostages. The Russian conundrum was the need to use a minimum dose of agent in order to achieve the necessary effect on the terrorists, mindful of the potentially detrimental effect on the hostages who varied from the young-and-weak to the old-and-sick.⁸⁵

The Geneva Convention does not detail an

acceptable amount of environmental damage. However, the 1977 Environmental Modification Convention (EMC) prohibits weapons and techniques from having 'widespread (several hundred square kilometres), long-lasting (months) or severe (serious or significant disruption or harm to human life, natural and economic resources or other assets) environmental effects as the means of destruction.'⁸⁶ The use of caustics, corrosives, coagulants or liquid-metal-embrittlements could cause localised damage to the environment but it is unlikely they would cause effects of the magnitudes restricted under the EMC due to the limited payload expected of present and future capabilities. Conversely, the legality of sticky foam has been challenged under the auspices of the Montreal Protocol on Substances that Deplete the Ozone Layer⁸⁷ and biological agents could cause significant disruption to human life if spread by a national or natural water supply. However, the BWC and CWC place more significant restraints on the use of biochemical means in warfare.

The 1972 BWC outlaws lethal and non-lethal variants whereas the 1993 CWC prohibits the use of all chemical agents as a 'method of warfare' while permitting the use of RCAs for law enforcement and domestic riot control purposes.⁸⁸ The deployment of RCAs to Iraq for coalition peacekeeping and riot control situations has caused consternation among some commentators, as the coalition is employing RCAs outside of national boundaries. However, they are performing the domestic duty of maintaining law and order in Iraq and the German government intends to utilise this interpretation of the convention by equipping their forces in Kosovo with RCAs.⁸⁹ The US also appears to be planning a breach of the CWC in seeking to purchase riot control grenades for 'controlling counterinsurgencies and other tactical missions . . . outside [of] the law enforcement exception permitted by the CWC.'⁹⁰ This raises the dilemma of either enforcing treaties or amending them in order to utilise the technological advances and potential reductions in fatalities associated with NLW employment.

The CWC and BWC both permit research into

biochemical technologies for peaceful purposes. Therefore, an increased realisation of the potential utility of biochemical agents in the military environment should occur as technology matures. Perhaps unsurprisingly, the US is a vocal advocate of treaty amendments and Human Rights Legislation strengthens their case, as states have a responsibility to employ less grievous methods if they exist in order to preserve human life. The 1990 UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials endorsed this requirement by stating that *'governments . . . should develop a range of means as broad as possible . . . including the development of non-lethal incapacitating weapons . . . with a view to increasingly restraining the application of means capable of causing death or injury to persons.'*⁹¹ As a consequence of the misalignment of the various international treaties, it appears ironic that a state is forced to justify potentially saving lives with NLWs in order to forge treaty amendments when current international law places less restriction on the taking of lives by lethal means.⁹²

There is also a continued ethical and moral abhorrence of biological and chemical weapons and the UK government advocated the invasion of Iraq based on the perceived threat of these weapons: this appears to strengthen the case for the status quo. The ICRC criticises calls for treaty amendments and voiced their opinion in 2003:

*'In the history of warfare there has been a line in the sand drawn which is an attempt to keep out of the battlefield anything that involves toxicity on humans . . . The danger of the advances in technology that we're seeing now is that it might tempt us to step over that line.'*⁹³

The ICRC believes that all advances in technology eventually result in their detrimental use against humans and other commentators voice fears that their proliferation could lead to greater repression of individuals by a 'nanny' state.⁹⁴ A further critique is that diversification of biochemical technologies will result in an increased probability of their use by rogue states and terrorists, adversely affecting global security. Duncan,

however, scoffed at the prospect of a non-lethal arms race by stating that:

*'A non-lethal arms race would probably not be initiated by rogue nations who oppose the US since their desire would be to develop weapon systems to kill US citizens and to destroy US property rather than preserve life and refrain from property destruction.'*⁹⁵

Although this statement majors on the perceived US aversion to casualties that was highlighted during the Vietnam conflict, recent kidnappings and media coverage highlight the potential of NLWs in enabling the capture, rather than the killing of US troops. Furthermore, international terrorism is an increasing threat to global security and al-Qaida, in particular, has extensive financial resources and support from a number of rogue states. Imagine the US public's response to the capture of an armed convoy, the members of which had been incapacitated by a biochemical agent and were then paraded on the world's media.

Although international law does not remain constant, the impetus for amendments follow 'once a practice has obtained a degree of regularity and is accompanied by a belief among nations that it is obligatory'.⁹⁶ The opportunity to highlight the capabilities of incapacitating agents exists in the sphere of civil peace enforcement and riot control, although treaty amendments would be required to facilitate the further development of this class of technology. Although optimists are confident that further development will make these agents more predictable and hence more useable, skepticism concerning their actual capabilities was evident post the Moscow incident and the prospect of biochemical proliferation poses a real threat to global stability; these are strong arguments in countering the calls for treaty amendments. Although Human Rights Conventions call for restraint in causing death or injury in conflict and the HEAP is a positive move towards a realistic assessment of SirUS, the worldwide distaste for chemical and biological weapons further supports the need to maintain the status quo for the foreseeable future. This argument was further compounded in Mar 2003, when the UK Defence Secretary stressed that the UK would adhere

strictly to the CWC.⁹⁷ This substantially reduces the prospects of increased resources for R&D of biochemical incapacitants. As demonstrated, the military employment of biochemical agents is a legal quagmire that is unlikely to be resolved in favour of NLWs and this technology will be discounted for the remainder of the paper. Consequently, DE technology is the sole remaining option for further discussion.

The legal imperatives during targeting are the need to discriminate and act proportionately. Critics of NLWs argue that the seduction of non-lethality may result in a widening of rules of engagement (ROEs) with a reduced emphasis on discrimination between civilians and combatants, particularly in areas of urban terrain. Proportionality requires 'that . . . military action [should] not cause collateral damage or incidental injury which is excessive in light of the expected military advantage'.⁹⁸ Therefore, DE weapons designers must ensure they can focus the damage mechanism in order to reduce the probability of damage to neighbouring civilians, equipment or property.⁹⁹ The Iraq Wars demonstrated an increase in precision that lowered the political acceptability of incidental injury and collateral damage and it should be expected that DE NLW employment would reduce this threshold even further. Imagine the public outcry should an EMP/HPM device cause a failure of life-saving equipment in a nearby hospital or the disruption of a nearby hub of an international banking system. Consequently, the current UK collateral damage matrix, used to assess the likelihood of civilian casualties resulting from kinetic weapon effects at the time of weapon impact,¹⁰⁰ would be inappropriate for NLWs. Each potential target would need to be analysed in greater depth, placing a greater strain on the intelligence community and potentially slowing down the time-sensitive-targeting process. Rather than the relatively simple question: *"how close is the neighbouring building and how many personnel live/work there?"* the questions must include: *"how close is the building, who lives/works there, what electrical systems are resident and what would be the consequence should these systems be affected?"* Advocates of EBO should be asking these questions as a matter of course, but DE weapons should not be added to

the RAF inventory of weapons before their true capabilities and limitations are fully understood. If deployed prior to reaching full maturity, DE weapons could face the prospect of being classed as 'dirty' weapons, similar to the chemical weapons of World War I.

There are concerns that DE technologies would only be permitted for use in an anti-material role and that discrimination and proportionality would dictate the scope of their employment. Also, DE technologies would be adversely affected by atmospheric conditions and this would require the maintenance of a lethal alternative should the weather in potential theatres of operation preclude their employment. However, as the focusing of laser energy is forecast to improve markedly,¹⁰¹ lasers possess the greatest potential for operations across the broad spectrum of conflict whereas EMP/HPM technologies would probably have greater utility in medium or high-intensity conflicts. Duncan stressed that the Laws of Armed Conflict were 'permissive in nature'¹⁰² and there are currently few restrictions to developing this technology, particularly in comparison to other non-lethal technologies. Moreover, DE technology has the potential to satisfy the UK's Human Rights obligations of reducing the number of deaths in a variety of scenarios and is recommended for incorporation into HQSTC's inventory of offensive capabilities.

Further consideration relating to the development and employment of NLWs

The HCDC observed that 'it remains . . . more an art than a science to judge what kinetic or non-kinetic activity will produce a particular effect'.¹⁰³ Once employed, NLWs will also pose difficulties with the measurement of their effectiveness (MOE). The traditional means of Combat Assessment¹⁰⁴ will have less utility and the MOE will require an extensive use of Electronic and Measurement-and-Signals Intelligence (ELINT & MASINT) platforms. For example, should a DE weapon destroy an enemy C2 system, an increase in mobile telephone usage from the area may indicate system degradation. Constant assessment would be required to confirm the enduring effectiveness of an initial attack and

coalition support would be required to ensure the availability of the full complement of assets required to achieve this task.¹⁰⁵ Fortunately, UK Defence Policy foresees coalition operations as the future *modus operandi* for UK forces although, should coalition support be unavailable, a lack of an autonomous UK capability could lead forces to revisit targets with repeated non-lethal or even lethal strikes, thereby reducing the operational effectiveness of a deployed force. If possible, the UK should look to expand their MOE capabilities in order to avoid an over-reliance on coalition partners, although this will come at significant cost.

However, Duncan argues that 'commanders will employ only those weapons they feel comfortable using. For most commanders, the comfort level for lethal weapons systems is much higher than the comfort level for NLWs.'¹⁰⁶ This observation related to the use of RCAs and incapacitating agents, but also applies equally to DE weapons. It is unlikely that realistic training could demonstrate DE effects at first-hand and the education of commanders on the capability of NLWs would be the only solution. This would involve the removal of the cloak of secrecy that envelops new NLWs and potentially reduces the advantage that would come with surprise should these weapons be employed against an adversary. However, General Zinni used this situation to his advantage in Somalia by publicising the potential use of NLWs: this 'psychological ploy intimidated potential Somali adversaries and gave the US military a positive public image at home and abroad'.¹⁰⁷ Truesdell correctly prophesised that 'training for the use of NLWs . . . is moving into uncharted territory that must be defined as planners proceed with the programme development. Ideally, routine training for the use of NLWs should be based on doctrine and be fully integrated into combined arms training.'¹⁰⁸ The JDCC should be responsible for producing doctrine that enables the effective employment of NLWs and once the doctrine is understood, front-line commands should be responsible for continuing the education process. If the education process is not carried through from the concept to the employment phases, the hurdle of advancing on a 'dazed' vice smouldering

enemy would not be overcome and NLWs could become an expensive 'white elephant' during all-arms combat.

Operational planners must not be exposed to 'situations where a soldier who uses lethal force when he has had immediate access to NLWs becomes liable to answer in court'.¹⁰⁹ Each situation will require complementary capabilities and it is imperative that politicians do not restrict commanders by insisting NLWs are employed against every target. Assuming targeteers comply with international law, commanders must be given the freedom of choice and furthermore, it is essential in-theatre ROEs reflect this option.

The UK must be prepared to defend its own assets against potential NLW counterattack. Consequently, potential countermeasures must be identified during NLW development. Equipment hardening is likely to be prohibitively expensive as the UK continues to engage in expeditionary operations.¹¹⁰ Consequently, UK assets will be vulnerable to the proliferation of these technologies although potential adversaries are also likely to face difficulties in financing and developing these technologies. Open sources have identified potential countermeasures against millimetre-wave technologies¹¹¹ and further advances in countering DE technologies may offset the advantages proffered by these weapons. However, another advantage of continued NLW development is the knowledge of likely effects and the ability to recognise when under DE attack by an adversary. NATO policy discusses the necessity for robustness in combating potential countermeasures but supports continued R&D of non-lethal capabilities if they offer the opportunity of gaining a distinct military advantage.¹¹² Saddam Hussein employed smoke and GPS-jammers in order to defeat the laser designation of PGMs and GPS-guided weapons respectively, but he was unable to protect all his valuable assets and counter the coalition's technological edge and military advantage. However, the cost of maintaining this technological edge increases the pressure on decreasing defence budgets and the future role of NLWs is one that policy must dictate.

Current policy

The US and NATO produced coherent policies for NLWs in 1996 and 1999 respectively. Comparatively, UK doctrine incorporated an unspecific and superficial approach to NLWs prior to 2001 and there was no direct mention of non-lethal technology in 'British Defence' or 'Air Power Doctrine,' despite its applicability in executing the Manoeuvrist Approach. However, recent publications, including the 'UK Joint Vision', the 'Joint High Level Operational Concept' and the draft version of the 'Future Air and Space Operational Concept' refer to the utility of NLWs across the spectrum of conflict.¹¹³ Despite this emphasis, there is still no dedicated NLW policy and there are no formal staff requirements in place for air-deliverable NLWs. This situation gives the impression that the UK has no desire to advance in this field, particularly from an air perspective. However, the major factor affecting NLW development is the level of funding required for R&D and the UK's ability to progress in this field is dwarfed by US resources and intent.

The US has increased funding for NLW research from \$25 million in 2003 to \$44 million in 2004-2005. Moreover, it is proposed that the USAF alone will receive \$15.5 million for research into HPM technology in 2005, implying that the technology is worth significant investment. Furthermore, the CFR has called for an increased funding of NLW development to the sum of \$300 million in 2005, although this remains an unlikely proposition.¹¹⁴ While the US can afford to invest in a number of disparate NLW programmes, the UK would struggle to compete, as its R&D budget is approximately 10% of its US counterpart.¹¹⁵ Consequently, despite the UK's desire to research numerous capabilities, the financial resources are inadequate and the UK may need to identify niche capabilities for further work. From an air perspective, this paper recommends the development of DE capabilities for use primarily during medium or high-intensity operations, although DE technology is unlikely to have a dual use, civilian-military capability, further increasing the burden on the MoD's declining budget. However, the UK should participate in combined programmes in order to exploit

emerging DE capabilities, notably with the US, as it is likely they lead the field in developing these technologies. The ATL is an ideal opportunity for collaborative development at reduced financial risk, as US aspirations for this technology include its integration onto the US version of JCA.

Additionally, HPM/EMP weapons appear to be beyond the concept stage and could enable the RAF to deliver strategic effect with a reduced number of adversarial fatalities.

Conclusion

The broadcasting of images depicting the death and destruction caused by conventional weaponry is oft considered publicly and politically unacceptable and there are calls for an increased use of non-lethal technology in order to reduce bloodshed and reduce the financial burden of post-conflict reconstruction. A semantic debate will continue to ensue about the term 'non-lethal' as these weapons have and will continue to cause fatalities for the foreseeable future, be it as a consequence of the initial delivery of the effect or as a second or third-order effect. However, NLWs have utility across the spectrum of conflict and have the potential to deliver an appropriate effect with a reduced probability of fatalities.

While a number of non-lethal capabilities have utility from a land perspective, the majority do not appear to be suited to aerial delivery, particularly in an era of reduced spending when there is a constant requirement to justify the benefits of new weapons in offering the 'tactical edge'. A major problem with the aerial delivery of NLWs is a lack of accuracy, primarily due to the standoff inherent with the air environment. Furthermore, land forces are the most applicable means of employing RCAs, even in an era of NEC when aircraft tasking and reaction times should be markedly reduced.

The legal debate presents a dichotomy of interests. While Human Rights Conventions clamour for reduced fatalities, the BWC and CWC prohibit the use of biochemical agents in conflict. Despite calls for treaty amendments to facilitate further biochemical development, potentially saving more lives, the UK's policy is one of strict compliance and there remains a global

distaste of the use of biochemical technologies in warfare. DE technologies face scrutiny over the causing of unnecessary suffering and the principle of discrimination. The temptation to use this technology either indiscriminately or pre-emptively would be a major concern and must be resisted. Additionally, DE technology places increased demands on the intelligence community, particularly during the targeting and combat assessment phases of NLW employment. However, the merits of DE technology outweigh the negative aspects and despite relatively slow progress in its development over the past decade, it appears to pose the only viable alternative to conventional air-deliverable capabilities, albeit with potential restrictions on its use arising from atmospheric effects to possible constraints on its use in an anti-personnel role. Therefore, in considering the claims of the HCDC through an 'air lens', technological immaturity combined with a lack of resources probably explains the MoD's apparent lack of progress in developing NLWs.

In order to realise the true potential of air-deliverable DE technology, future UK funding priorities, collaborative ventures, doctrine and action must reflect both the intent of the HCDC and the MoD's emergent policy on NLWs. However, it is likely the UK will continue to be hampered by a lack of financial resources, particularly in comparison to the US and potential restrictions on the use of DE technology highlight the need to maintain precision-guided, lethal alternatives. Therefore, can the MoD *afford* to embrace the advantages of DE technology while there is a simultaneous requirement to maintain elements of lethality? In making this decision, perhaps MoD policy should attempt to reflect the true cost of human life.

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Perspectives on the Revolution in Military Affairs and Network Centric Warfare:

Challenges for the UK network enabled capability programme

By Wg Cdr S W Wray

Network Enabled Capability (NEC) has its roots in the concept of Network Centric Warfare (NCW) that is a central theme of the ongoing Revolution in Military Affairs (RMA) debate. This paper will argue that the UK is right to pursue NEC for the Armed Forces, although there is a need for careful management and leadership as it is a multi-faceted and challenging programme that carries high risk. In doing, so it will broaden the scope of the analysis beyond the

UK perspective and argue that the RMA is more evolutionary by nature and that the advantages of NCW are likely to be transitory. It will show that, in the complex and fluid post-Cold War security environment, military force has greater utility and will be used on a broad spectrum of military tasks in which NCW has varying degrees of effectiveness. It will expose some of the pitfalls of relying on technology and consider the wider challenges to the NCW concept. It will



Northrop Grumman B-2 Spirit

The increasing use of advanced information systems and the proliferation of information technology, indicate that information may be achieving a more direct and decisive role in warfare

then address the findings with specific reference to the UK NEC programme, highlighting the key issues that must be addressed if it is to be successful.

The late 20th century and early years of the 21st century are widely considered to be the beginning of a new epoch in human history. It is commonly accepted as being the beginning of the information age and commentators are speculating upon the impact that this will have on societies and economies.¹ In the military arena similar debates are taking place amidst arguments that we are on the cusp of a Revolution in Military Affairs (RMA) brought about by the information era. Cebrowski argues that, 'this is the most important RMA in the last 200 years and that it is a natural progression

in military evolution with its organizing principle antecedent in modern economies'. He argues that, 'Information Technology has undergone a fundamental shift from platform-centric to network-centric computing and as dominant business competitors have made the shift to network-centric operations and translated information superiority into competitive advantage, so must the military'. 'Just as in the business world, network-centric operations allow a detailed understanding of the competitive space allowing a shift from attrition style warfare to much faster war fighting characterised by speed of command and synchronisation.'² Much of this theory appears to be supported by experience in conflicts in Iraq, Kosovo and Afghanistan where superior information technology, sensors,

precision-guided munitions and stealth technology have all contributed towards decisive military victories. RMA theorists suggest that, 'the increasing use of advanced information systems and the proliferation of information technology, indicate that information may be achieving a more direct and decisive role in warfare'.³ One key RMA concept is that of Network Centric Warfare (NCW).⁴ This term contrasts with 'platform centric warfare' where emphasis is placed upon numbers of weapon platforms such as tanks, ships and aircraft and focuses not on individual assets but on the interconnected whole.⁵ The principal perceived benefit is that it enables smaller more mobile forces to act with disproportionate effect as shared awareness among them improves situational awareness allowing the generation of overwhelming tempo and manoeuvre.⁶ 'Combat power is concentrated using netted sensors and information, coupled with agile forces, precision munitions and combined command and control connectivity to spin decision loops so fast that the enemy is paralysed.'⁷

The US is committed to pursuing a bold NCW programme and most of the militaries in the West, particularly those that are potential coalition partners, are considering what NCW means for them. The UK announced its intent to pursue the benefits of NCW in the Strategic Defence Review-New Chapter and since then has evolved the thinking to create the concept of Network Enabled Capability (NEC). This embraces the concepts of NCW, yet is less ambitious than the US programme. Nevertheless, the perceived benefits of both programmes are synonymous and thus much of the analysis centred on US thinking is applicable to NEC. UK NEC is planned to have initial interconnection in 2007 leading to maturity in 2025-2030. It is still early days and many challenges remain, the principal one being affordability.⁸ Since the end of The Cold War, the Defence Budget has been under pressure to reduce expenditure and the potential for NEC to deliver military effect with fewer platforms is therefore seductive to both the military and politicians alike.

Proponents of NCW argue that we must embrace the concept ahead of any potential adversaries

given the widespread access to advanced technology. Indeed, US General H Shelton remarked, '*The proliferation of advanced technology is so extensive that many of our adversaries in the next century will have capabilities they could only dream about in this one*'.⁹ These arguments seem compelling. However, there are sceptics in equal number who offer equally convincing thoughts. Some question the validity of the RMA and the assumptions of the advantage offered by NCW.¹⁰ The Force reductions associated with the introduction of NCW systems alarms others who argue the continuing need for ships to enforce embargoes, soldiers to enforce peace and aircraft to patrol no fly zones.¹¹ 'For some the concept is nothing more than a military mirage where defence convinces itself falsely that technology will change everything.'¹²

This paper will evaluate whether the UK is right to pursue NEC, particularly as it is likely to place considerable pressure on the Equipment Programme requiring significant reductions in platform numbers to fund its introduction. NEC thinking has its roots in the RMA and, in doing so, it will broaden the analysis to consider the wider origins and assumptions of the RMA and evaluate whether this is truly revolutionary or evolutionary, drawing on historical examples to support the argument. It will then examine the factors affecting the post-Cold War security environment and consider the utility of military force in the contemporary world before evaluating the effectiveness of NCW enabled forces in carrying out the types of military tasks that are likely in the future. Finally, it will outline some of the risks of reliance on technology including potential strategic and political considerations. It will then draw these threads together with a specific focus on the UK NEC programme highlighting the key challenges that must be addressed if this programme is to be successful.

The revolution in military affairs

The recognition of a RMA is fundamental to accepting fully the benefits that the proponents of NCW have declared. Many of the arguments that surround its validity remain unanswered: despite this, many western military and political leaders,

led by the US, have already accepted that NCW will revolutionise conflict in the future. Under the pressures of shrinking defence budgets in the post-Cold War era, they are already planning force reductions whilst offsetting the increased operational risk against the perceived benefits of NCW. The US is fully committed to NCW and in May 2001, President Bush called for *'a future force that is defined less by size and more by mobility, swiftness and one that relies more heavily on stealth, precision weaponry and information technologies'*.¹³ The UK has accepted a similar vision laying out a view where 'combat power is not measured in terms of numbers of platforms and people but in an ability to measure effect with a robust network at the core, linking key capabilities and force multipliers'.¹⁴ The reductions in platform numbers may yet be premature whilst the RMA debate remains inconclusive. 'Revolution' is a heavily loaded word that may be misused by those attempting to influence policymakers.¹⁵ This section will outline what constitutes a RMA, disclose the origins of the current RMA debate and examine whether it constitutes a revolution or merely an evolution. It will draw upon historical examples to illustrate the importance of this distinction and the implications for the future of NCW.

Many contending definitions of a RMA have been made: that offered by the Office of the US Secretary of Defense is clear, stating: *'a RMA is a major change in the nature of warfare brought about by innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organisational concepts, fundamentally alters the character and conduct of military operations'*.¹⁶ It is recognised that RMAs comprise four main elements: technological change, system development, operational innovation and organisational adaptation.¹⁷ Their nature is such that warfare is transformed in profound ways and, throughout history there have been a number of such revolutions. Gunpowder produced an early military revolution transforming both land and naval warfare and, during the 19th Century, industrialisation transformed warfare through railways, the telegraph, steam engines, rifled guns and ironclad ships. More recently,

mechanization led to the development of Blitzkrieg, carrier aviation, amphibious warfare, and strategic bombing.¹⁸ These changes were rooted in technology, but are dependant upon new operational concepts, doctrine and organisation to realise their benefits.

Origins and evolution of the current RMA debate

The current term, RMA has evolved from an earlier one, used by Soviet military theorists who used the term Military Technical Revolution (MTR). They identified 2 periods of fundamental military change in the 20th Century: one driven by the emergence of aircraft, motor vehicles and chemical warfare in World War 1 and the 2nd driven by the development of nuclear weapons. In the early 1980s, they argued that advances in microelectronics, precision guidance and automated control systems would bring about the next MTR.¹⁹ The success of coalition forces in Operation Desert Storm convinced many of the validity of this view where the use of an impressive array of high technology weapons allowed a US-led coalition to defeat the world's 4th largest army in a remarkably short period of time.²⁰ The use of precision weapons captured the attention of the world's media and shaped mass perceptions of the war as being characterised by advanced technology enabling a decisive victory.

The orthodox view of the victory focuses on the coalition strengths and, especially its superior technology. It suggests that surveillance, air defence suppression, stealth and precision guidance systems gave coalition aircraft total command of the sky and the ability to find and destroy Iraqi ground forces at will. This in turn enabled the Coalition to destroy the Iraqi's equipment and morale in a six-week air campaign without exposing itself to a potentially costly land battle. Similar arguments are applied to the use of technology in the ground war where advanced systems such as thermal sights and more advanced tanks allowed the Coalition to strike with virtual impunity. Others argue that the Coalition's manoeuvre warfare concepts, enabled by advanced navigation and communications technology, allowed them to outflank the static Iraqi defenders.



An F/A-18 Hornet armed with GBU-12 Paveway II laser-guided bombs

Future war will be characterised by precision attack and the struggle for information supremacy will replace the breakthrough battle as the decisive action

Critics of these views have argued that Iraqi shortcomings and not coalition strengths were the main reason for the defeat. In particular, they argue that an unmotivated, dispirited Iraqi army simply did not fight back. Poorly led and with low morale and inadequate training they were little match for the well equipped, professional Coalition forces.²¹ Each of these views has validity, but it was in the information domain that the most revealing observations can be made. The war saw a comprehensive use of information and its denial to the enemy. Information was at the hub of all Coalition activity and the destruction of Iraqi

command, control and communication networks led to their inability to employ their forces effectively.²² The initial air attacks destroyed much of Iraq's ability to defend itself and early targeting of radar sites and command and control centres aimed to deprive them of useful information from the outset. With their information networks paralysed, Iraqi forward units found themselves dislocated from their leaders and at the mercy of Coalition forces. In contrast the coalition made use of advanced communication systems, airborne surveillance and satellites to gather detailed information for their commanders.²³

Operation Desert Storm was understandably dubbed the first information war. Despite this, the reasons for the ease and decisiveness of the Coalition victory have been the subject of much debate and are probably attributable to a combination of factors alluded to above. The overall impression of the part that technology played is perhaps misleading. For example, more 'dumb' than 'smart' bombs were used and the effectiveness of the Patriot air defence missile was overstated. Despite the wide range of surveillance systems available, targets were not always found or destroyed and collateral damage not always avoided. In practice, the fusion of sensors and communications data, which is the essence of NCW, was far from complete and in many cases improvised, leaving important deficiencies. Notwithstanding this, it was evident that the concept of information warfare could be developed and taken further and so the RMA debate was born.²⁴ The broad assumptions of those who support the case for a RMA are that future war will be characterised by precision attack and the struggle for information supremacy will replace the breakthrough battle as the decisive action.²⁵

Information revolution or evolution?

Information has always been a critical factor in war. Clausewitz said, *'imperfect knowledge of the situation . . . can bring military action to a standstill'* and viewed information as, *'a factor more vital than any other'*.²⁶ The dominant argument in the RMA debate is that 'information dominance' will alter the nature of future wars. Many analysts argue that information is synonymous with the RMA as it is technology that provides the means to exploit it.²⁷ Indeed, this assertion is central to the concept of NCW; information is the enabler that allows the commander to exploit tempo, manoeuvre and to break the enemy decision cycle. The computer provides the ability to collate, analyse and distribute data in huge volumes and at high speed to multiple recipients simultaneously. Moreover, multiple sources of data can be fused, manipulated and displayed faster than ever before and therefore it would appear that the value of information to the war fighter has been magnified to a new level.²⁸ However, closer consideration would seem to dilute this view, as military commanders have

always understood the value of information. Field Marshal Slim noted its importance in the Burma Campaign where he attributed the Japanese early success to their possession of sound information compared to his almost total lack of useful information on their strength, movements or intentions.²⁹ Sun Tzu identified deception and the need to deny the enemy information as a key facet of warfare and numerous other historical examples illustrate its importance. The use of smoke screens to conceal movement on medieval battlefields and elaborate deception operations during World War 2 illustrates both the enduring nature and importance of information dominance. Therefore, we must conclude that the value of information remains a constant, but it is the utility of modern technology in managing it that is magnified in importance.

Access to advanced information technology is not the right of wealthy nations with technologically advanced militaries. In the information age, in contrast with the historical norm, civilian markets and not military ones often drive state-of-the-art technology. The newest weapons increasingly employ commercial off-the-shelf technology and secure communications, access to global positioning and high-resolution earth observation satellites and advanced computing technology are widely available.³⁰ This ease of access makes it almost inconceivable that adversaries of NCW-enabled militaries will not seek to develop similar capabilities or effective countermeasures. Admittedly, the cost of technology may preclude many actors from gaining access to the most advanced systems. However, many argue that rogue enemies will be able to develop readily available information technology in to a range of innovative responses in what Barnett terms, *'The Radio Shack scenario'*.³¹ NCW proponents flirt with the deniable assumption that an enemy will lack the ingenuity to disrupt a network and to validate the claims of delivery of revolutionary advantage they have assumed a predictable enemy.³² The danger of underestimating the enemy is as perilous as overestimating our own ability. Sun Tzu said, *'Know your enemy and know yourself; in a hundred battles you will never be defeated'*.³³ These words seem particularly relevant when considering



Blitzkrieg in action: German armoured vehicles advancing (AHB RAF)

Co-ordination of firepower from armour, infantry, artillery and air, coupled with concentration, surprise, speed and continuity were its strengths

the grand assumptions of NCW that have yet to be tested.

Advanced information technology will provide a framework for NCW and if integrated with changes to doctrine and operational concepts it could deliver significant military advantage. However, the accessibility of technology makes it highly likely that competitors will also seek to utilize this to their own advantage. Revolution has been described as the logical progression of an existing system or framework, while revolution connotes a fundamental break with precedent.³⁴ The enduring importance of information to the military commander and the likely widespread development of technology-based military capability suggests that the move in to the information age is perhaps more evolutionary than revolutionary.

Warnings from history

Robert F Baumann notes that, *'Thinking deeply*

about the future requires careful reflection on the past' noting that, *'by its very nature, war exhibits much continuity amid change'*.³⁵ This is certainly true if we consider historical perspectives on the likely impact of NCW. History is filled with examples where technological breakthroughs have had a profound impact on warfare, such as the introduction of gunpowder, the combination of gun and sail, and the advent of the machine gun to name a few. In all these cases, new technologies provided a basis for advantageous shifts in doctrine, organisation and strategy enabling the innovator to avoid exhausting attritional battles and to pursue a form of decisive warfare.³⁶ These changes share one common feature in that none has delivered an advantage that has been enduring. The spread of technology and/or the development of countermeasures has ultimately eroded the advantage of the innovator and history offers two examples that indicate that we should expect the advantages offered by NCW to be short lived: The German Blitzkrieg and the Royal Air

Force defensive network made famous during the Battle of Britain.

Blitzkrieg

Blitzkrieg or 'Lightning War' overwhelmed the armies of Europe in 1939 and 1940. It is often interpreted as a RMA in its own right, but its life and effectiveness were short-lived as the Soviet Army eventually exploited its weaknesses at the Battle of Kursk in 1943. It had its origins in 1918 when, in the dying days of The Great War, the trench stalemate had been disrupted by the introduction of the tank and by the influence of ground support air operations. Following The War, Lt Col Heinz Guderian studied armoured warfare and, as a General in 1938, he was the architect of the Panzer Divisions. Guderian had specialised as a signals officer between 1914 and 1917 and it was at his insistence, that every tank was fitted with a radio and armoured command vehicles provided for divisional commanders. The Panzer concept was purely offensive and relied on armoured units driving a wedge through defences and bypassing centres of resistance as they moved toward their objective. The commander controlled the battle from just behind the main thrust and units could respond immediately to orders given over the radio network.³⁷ Armour, however, was only one aspect of Blitzkrieg and co-ordination of firepower from armour, infantry, artillery and air, coupled with concentration, surprise, speed and continuity were its strengths.³⁸ These principles remain relevant today and are enshrined in the manoeuvrist theory demonstrating how the original concept has evolved. Nevertheless, Blitzkrieg relied on tanks that could not move without the complex support of other arms. The Red Army eventually evolved their own tactics to defeat the overstretched German tank formations with the highly effective and plentiful T34.³⁹ Blitzkrieg was enabled by technology through the advent of mechanized warfare, radio communication and integration of air power. The doctrinal innovation of Guderian gave the Germans a significant advantage in 1939, but the Soviet success indicates how tactics can be devised to defeat the strengths of the innovator once the critical weaknesses are understood.

Battle of Britain

The Battle of Britain campaign made the Spitfire and Hurricane fighters of the Royal Air Force into legends, but the keystone of the British defence was the complex machinery of detection and command and control that ran the battle. This was known as the 'Dowding System' after its chief architect Air Chief Marshal Sir Hugh Dowding. In 1936 he was charged with the task of building an air defence force capable of stopping daylight bomber raids and created a system utilising radar and other visual reporting methods that is widely recognised as the world's first integrated air defence system.⁴⁰

Dowding's system began with early warning detection of incoming raids by radar stations lined along the coast. They would also be tracked visually from a network of ground stations that picked up aircraft that penetrated the radars. Reports were passed to Fighter Command Headquarters where the information would be plotted allowing controllers to co-ordinate a response. This simple yet ingenious system allowed the RAF to concentrate their fighters where they were needed achieving high rates of interception. The Germans had also been developing radar since 1934 and had achieved considerable sophistication by 1939, but had failed to realise its significance and potential.⁴¹

The Dowding System integrated emerging technology into an innovative command and control structure and fighter doctrine that maximised the combat effectiveness of the limited RAF fighter assets and thus, it had all the key components of a RMA. However, radar technology was already available to the enemy and, once they had recognised its potential they were able to develop their own integrated air defence system. By the time of the Allied Combined Bombing Offensive against Germany in 1943, they had developed a complex system involving radar, reporting stations and anti-aircraft artillery. Today integrated air defence relies on more advanced technology, but the essential elements of detection and command and control remain at their core indicating how the proliferation of technology can erode the advantages of the innovator.



McDonnell Douglas F-4J Phantoms of US Navy Squadron VF-194, flying from the USS Coral Sea, intercept a Tupolev Tu-95RT 'Bear D' over the Pacific, March 1977

During the Cold War, international security was dominated by the militarized confrontation between the West and the East where the bi-polar rivalry was intense, the danger of war was real, and the military dominated the security agenda

As we enter the information age, it is clear that advanced information technology will transform our ability to exploit information. Its value has

been understood throughout history and it is, therefore, inevitable that enemies will utilise readily available technology to develop NCW

capabilities or effective countermeasures. This indicates an evolutionary change in the nature of warfare where the advantages of the innovator are likely to be eroded as indicated by contemporary historical examples.

Future security threats and the utility of NCW

This paper has postulated that the information age will herald an evolution rather than a RMA and that the advantages offered by NCW will be eroded. The impact of the technology is as real as it is irreversible and information systems and complex weaponry are a reality for the future. Force reductions and re-structuring of the remaining elements is the immediate impact for militaries that embrace NCW and, although the concept is to lessen the advantages of size, there is considerable operational risk as the key proponents agree that it will take years of careful leadership to make NCW work.⁴² This is an important point as the post-Cold War era has brought a new range of security threats that have heralded a period of unparalleled uncertainty. Moreover, the role of Western militaries has been expanded beyond conventional war fighting to include a range of tasks classified as Operations Other Than War (OOTW).⁴³ In critically assessing the wisdom of acting on the assumptions of the RMA, it is important to consider the potential threats to security in the future and the suitability of NCW enabled forces to address these.

Post-Cold War security environment

The end of the Cold War had a profound impact on the international system and consequently, the concept of security underwent dramatic changes. During The Cold War, international security was dominated by the militarized confrontation between the West and the East where the bi-polar rivalry was intense, the danger of war was real, and the military dominated the security agenda. There now exists a multi-polar world in which there is neither a major ideological divide nor a dominating power rivalry. The US is the sole remaining superpower and in this new international environment, military and political security is no longer a predominant concern. Instead, economic, societal and environmental security assume greater prominence for many

countries in the world. If the security issues during The Cold War were primarily related to bi-polar ideological and military rivalry between the East and the West, then the security concerns after the Cold War are more rooted in the economic disparity between the wealthy and poorer nations.⁴⁴

The effects of globalization and the continuing influences of decolonization make the complexity of the new security environment worse where the increasing blurring of borders and the diffusion of political and economic power is eroding the position of the nation state as the principal foundation of international order.⁴⁵ The net effect is to change the character of the participants in the international arena and, although nation states remain the primary actors, international organizations such as the United Nations, the European Community and non-governmental organizations such as, Médecins Sans Frontières, play increasingly important roles. In addition, trans-national actors such as, the media, multinational corporations, terrorist groups, drug cartels and countless others, are able to exercise considerable influence on international relations.⁴⁶

This new world order is characterized by multi-actor, multi-dimensional, multi-regional security agendas that are more complex, more fluid and more uncertain. In the short term, large scale inter-state conflict appears unlikely as the spread of liberal democracy increases interdependency and makes it in the interests of neither protagonist. The principal threats arise from failing states where ethnic tensions, economic insecurity and mass migration promote intra-state conflict. Western powers are likely to intervene in so-called, 'wars of choice' in what Hirst terms, '*cosmopolitan law enforcement*'.⁴⁷ In the longer term, the geo-strategic balance of power may be disrupted, perhaps by the emergence of China as a great economic and military power, or through a resurgent Russia acting alone or in an alliance. Tensions are likely as nations compete for scarce resources such as oil, food and water. The effect of global warming and environmental changes may have a prolific effect on nations leading to greater instability in international order. Finally, the proliferation of

weapons of mass destruction (WMD) will promote regional and global tensions that could also alter the balance of power.⁴⁸ The threats are plentiful and diverse and will continue to challenge military planners in the future. Military operations seem more complex in this fluid environment and the tasks more diverse. In addition, military forces will have to interact with a wider range of agencies and may find themselves working alongside coalition partners or non-governmental agencies.

Utility of military force in the new era

At the end of The Cold War, many hoped that military force would have diminishing relevance to international security. That hope now seems to have been misplaced, war is being threatened or waged in various regions and the remaining super-power is showing greater propensity to use military force. The removal of the constraints that the Cold War enforced appears to have led to an increase in the utility of military power.

It is difficult to imagine a nation that could become a peer competitor to the advanced Western militaries, particularly a US led coalition. However incredible this may seem, a strategic view of the potential rise in the military strength of China or India, for example, would not exclude the possibility



A Sukhoi Su-30K Flanker of No 24 Squadron, Indian Air Force, landing at Gwailor during Exercise Cope India 2004

The current international system rests on an order dominated by the USA. The loss of the inherent military tensions of The Cold War has already seen examples of the increased utility of force through focused Western intervention in the former Yugoslavia and by Russian Forces in Chechnya. In The Cold War, the risks of the spread of conflict were so high that they made such actions unlikely. The events of 11 September 2001 added a further dimension to contemporary conflict and the subsequent 'War on Terrorism' has heralded a new type of warfare where the traditional views of victory and defeat are being challenged. Despite this, US policy towards these issues has military force as a central element of its strategy and her willingness to use military force, as witnessed in Afghanistan and Iraq, leaves little doubt as to the importance of force as an instrument of policy. Therefore, the persistence and utility of conventional military power in the international system seems assured, at least for the near future.

NCW in the new security environment

The complex post-Cold War security environment presents a number of challenges for military planners characterized by the increased spectrum of military tasks, the increased utility of military force and the uncertainty and instability in the international system. How well does NCW fit the various forms of conflict likely to be faced in the near future? The available material concentrates on high-intensity, high-tempo war fighting which is understandable as many of the relevant technologies had their origins in the Cold War period. Moreover, the importance of Operation Desert Storm to the RMA debate has ensured that high-intensity operations remain a central focus for discussion. Notwithstanding this, concentrating on this form of warfare at the exclusion of all others is a mistake as, in the post-Cold War era, high-intensity warfare is not the only form likely to be encountered and certainly not the most likely. The broad spectrum of military operations will see high-intensity combat at one end of the spectrum with routine military presence at the other.⁴⁹ Even if Western powers face a diminished threat of major conflict with another state they would be wrong to ignore this as it could take at least 30 years for NCW to reach its full potential.⁵⁰ During this time,

the geo-strategic situation could have altered markedly given the range of potential longer-term threats to international security. Nevertheless, in the shorter-term, collective intervention under international legitimacy or humanitarian operations represent the most likely use of military force.⁵¹ It would, however, be misleading to characterize such operations as low intensity or non-combat in nature. They could involve belligerents with formidable conventional forces and, even the most modest of operations, could involve short periods of high-intensity fighting.⁵² Accepting that there is the potential for a broad spectrum of operations, it is necessary to consider the utility of NCW enabled forces in meeting the various tasks that might be faced.⁵³

NCW theorists concentrate much of their attention on war fighting operations that are characterised by, 'force on force' combat with opposing forces where the immediate objectives sought are largely military.⁵⁴ In such an action, the potential impact of NCW is well documented. The ability of sensors to identify and target enemy forces for destruction using highly accurate weapons whilst long-range weapons strike a vast array of strategic targets simultaneously could be devastating to an enemy. The impact could easily shock and dislocate his forces rendering them incapable of effective resistance allowing a brief and decisive campaign.⁵⁵ However, Barnett is disparaging of such a vision doubting that NCW will meet an enemy worthy of its technical prowess. In support of this view he highlights that the US spends more on information technology than all but a couple of powers spend on their entire military budget.⁵⁶ It is difficult to imagine a nation that could become a peer competitor to the advanced Western militaries, particularly a US-led coalition. Nevertheless, however incredible this may seem, a strategic view of the potential rise in the military strength of China or India, for example, would not exclude the possibility. History provides many examples of potential competitors rapidly elevating themselves to peer competitor status and Japan and Germany prior to World War II offer just such an example.⁵⁷ Regardless of the emergence of a peer competitor, the advantages that NCW allows in a, 'force on force' encounter is likely to be relevant to a broad

range of operations. Many OOTW could involve short high-intensity clashes; the recent US counter-insurgency operation in Falujah during the post conflict phase of Operation Iraqi Freedom is a good example. However, the advantage that NCW could offer in combat is potentially eroded by the sociological complexity of modern warfare. Self-imposed restrictions of a political, moral or legal nature complicated by public intolerance of casualties (both friendly and enemy) and the intense media coverage of modern conflict could potentially force restraint on operations that would negate some of the benefits that NCW offers.⁵⁸ A fight against an enemy who possessed even a modest NCW capability of his own could erode the advantage yet further but notwithstanding these points, modern information technology is here to stay and the conflict environment is changing. The information age will not bypass warfare and there is the opportunity to gain a war fighting advantage. To ignore this may pass the advantage to others who choose to take the initiative and, having argued that the impact of information technology is evolutionary rather than revolutionary, it seems essential that the initiative is not lost. Thus in the context of high-intensity war, there seems little alternative but to embrace the concept of NCW.

OOTW include most military activity other than, 'force on force' encounters. Such operations are unlikely to require the defeat of enemy forces but rather some objective that does not necessarily require the use of violence. Activities may include relatively benign operations such as deterrence, power projection, peace enforcement, humanitarian relief or the evacuation of non-combatants from crisis zones. In the emerging broader security context, they might also include operations against criminal organizations or terrorist groups and opponents could include paramilitary or guerrilla forces.⁵⁹ Any of these could involve an element of combat in line with Krulak's concept of what he termed, 'The 3-block war'.⁶⁰ In any case, they are likely to be more challenges involving coalitions with broader political involvement and restrictive rules of engagement. Furthermore, casualty tolerance is likely to be a more prominent concern and the

international media will undoubtedly be present. Recent examples of the type of operations that can be expected include the UN intervention in Bosnia and the US/UN involvement in Somalia. Assistance to the Kurds in Northern Iraq and interventions in Sierra Leone and East Timor are further examples that illustrate both the diversity and potential frequency of such operations. Their nature is such, that the core war fighting capabilities that NCW enables, are less effective. However, even modest advances in sensor technology and the ability to collect, analyze and disseminate intelligence will improve situational awareness and be of importance in these demanding scenarios.⁶¹ Barnett argues that, 'a correctly structured NCW enabled force would, in the non-combat environment, be able to establish an information umbrella to boost the transparency of everyone's actions'.⁶²

Clearly, many common support activities such as logistics and force protection would benefit from aspects of NCW and the importance of these should not be overlooked.⁶³ The most significant weakness of NCW with respect to non-combat operations is the reduction in force sizes required to pay for it. Non-combat operations require troops to be present on the ground to establish a degree of direct contact between intervening forces and the local population and the concept that NCW could eliminate such a need is fanciful.⁶⁴ Experience in operations in Kosovo, Bosnia and the post-conflict phase of Operation Iraqi Freedom bears out this view. Without the presence of significant numbers of troops there would be a very real danger of winning the war, but losing the peace.⁶⁵ The value of NCW in OOTW is therefore less clear. The principal advantages of NCW are best suited to combat although improved situational awareness and support operations also has much to offer in a non-combat environment. The rub is that the payoff for enabling NCW is force reductions. Presence is an essential element of non-combat operations and there will continue to be a need for, 'boots on the ground' in what are likely to be the most demanding and frequent of future operations.

The attacks on New York and Washington

in September 2001 were a startling instance of asymmetric warfare and since then it has become a prominent concern of policymakers. It is frequently spoken of as a new and emerging threat, but in reality it is nothing new as the term simply means fighting an enemy by using forces, tactics or strategies that are dissimilar to his.⁶⁶ Asymmetric attacks are relevant to the entire spectrum of the security environment and could be employed by states, non-state actors, terrorist groups or individuals. Western states present tempting targets for asymmetric attacks due to the openness of their societies, sensitivity to casualties and dependency on complex social and economic infrastructure. Furthermore, the effects of globalization, modern communications, ease of travel, proliferation of weapons technology (including WMD) and the presence of global news networks have all increased the potential impact of asymmetric actors.⁶⁷ The disparity between the conventional military capabilities of the major Western powers and potential enemies dictates that asymmetric attacks are likely. Paradoxically, any additional military advantages that are offered by the introduction of NCW could increase the attraction of an asymmetric response from enemies who cannot threaten directly the superior forces.⁶⁸ This conundrum, however, need not be considered as the important question is what strengths and weaknesses NCW will have in the face of such threats.

The inherent flexibility, situational awareness and responsiveness of NCW-enabled military forces will, in some respects, decrease their susceptibility to asymmetric attacks as rigid and inflexible organizations present greater opportunity for an enemy to act asymmetrically. Moreover, having considered the advantages that NCW offers in non-combat operations, it is intuitive that similar advantages will be applicable to asymmetric threats. We have already seen the success that conventional forces can have in combating irregular, non-linear forces in the US intervention against the Taliban in Afghanistan. Information and access to it will always be an important aspect of any military action and NCW could offer advantages against asymmetric threats at all levels of conflict. It is important, however, to consider the

vulnerability that NCW could introduce. Modern military forces are already highly dependent on information networks for command, control and logistic support. Operations are dependent on uninterrupted availability of a complex system of networks and they will become more so as NCW evolves.⁶⁹ The concept of '*Cyberwar*' introduces a significant threat to this reliance and a significant opportunity to the asymmetric enemy. Cyberwar involves disrupting if not destroying information and communication systems to alter the balance of information knowledge in one's favour especially if the balance of forces is not.⁷⁰ It does not necessarily require the presence of high technology, is not dependent on kinetic effect and may involve electronically blinding, jamming deceiving, overloading and intruding into adversaries' systems.⁷¹ The spectrum of potential adversaries' is expanded markedly when considering that the entry level to such activity may require nothing more than a computer. As NCW theory and the supporting technology evolves it is difficult to envisage what shape such threats might take but the vulnerabilities were revealed when a teenager using a personal computer hacked his way in to the US military computer network gaining access to information on the dispute with North Korea over its nuclear programme.⁷² To simply assert that such threats will be negated by enhanced security measures is to assume the ascendancy of technology and ignore the ingenuity of man.

In an age where the security environment is uncertain and where there is increased utility of military force, advances in information technology will continue to offer enhancements to weapons and other military systems. It therefore seems essential to embrace the opportunities offered by NCW to maintain the military advantage and to retain the initiative ahead of potential competitors. NCW may offer greatly improved effectiveness in high-intensity combat and an element of this can be expected, to some extent, across the entire spectrum of military tasks. Moreover, greater situational awareness and improvements to common activities, such as logistic support, suggest that NCW could have a positive effect in all types of operation. Notwithstanding this, there is a need to retain awareness of its limitations.

Numbers are important and there will remain a need for boots on the ground in all operations. Moreover, in an era where asymmetric attacks seem increasingly likely, we must remain alive to the vulnerability that NCW systems may inadvertently expose.

The technology trap

The Western militaries, led by the US, have historically sought technical solutions to security threats and have devoted costly resources to an expanding range of opportunities and now find themselves less able to afford to develop and procure the most complex modern weapons. This is what Garden termed, *'The Technology Trap'*. 'It has as its bait the neat solution, just like the cheese in a mousetrap'.⁷³ The costs of NCW enablement will be made affordable through reductions in platform numbers and this will be offset against NCW's effect as a force multiplier. With these benefits not yet fully clear, such a move carries a significant risk. Furthermore, technology alone cannot deliver the full benefits of NCW and major changes to force structures and military culture are required. In addition, NCW could impact significantly the interoperability of forces from different nations and have important implications for the alliance politics of the future. We must guard against technology as a means to itself rather than a means to an end and be aware of the potential pitfalls of over-reliance on technology. There are many of these that impact both the military and political sphere and this section will highlight a few of the most significant.

The integration of advanced information technology into military networks is central to the NCW concept, although we must take a cautious view of the, 'cheese in the mousetrap'. If the assumptions of NCW proponents are correct, it will allow smaller, more agile forces to act with disproportionate effect. The US is leading the way but as John Arquilla noted, *'American military power is so far beyond its nearest competitors today that it seems senseless to pursue the latest technological advances'*.⁷⁴ This is countered by the argument that the fact that no adversary currently threatens the military advantage should not slow preparation for new competition, as the comfort drawn from

the size of forces, will be misplaced in an era of NCW as the whole idea is to lessen the advantages of size.⁷⁵ This counter argument assumes that a potential adversary will seek to develop NCW concepts and has some credibility as China is widely reported to be devoting considerable resources to the development of offensive information warfare capabilities to complement its improving conventional forces.⁷⁶ The question must be whether this is self-generated or in response to US intent. To pursue an answer to this would be wasteful of time and thought. Technology has, and will, continue to impact military thinking and in the information age it is implicit that advanced information technology will be embraced in some way. It could be argued that the concept of NCW is a pro-active visionary response to this inevitability. Even if NCW delivers the benefits it predicts, we must guard against the seduction of technology and consider the wider potential follies.

In the NCW environment, smaller forces will be deployed that will rely on the power of the network for their combat effectiveness. As a result, each platform or node becomes a high value asset and the loss of a single one could markedly degrade the effectiveness of a force. This highlights an obvious vulnerability and, in wars of choice, even modest losses of critical assets could have important strategic implications as the military options may be reduced to escalation or withdrawal.⁷⁷ Furthermore, in a NCW environment, the odds of technological failure are all the greater, particularly as opponents are likely to actively seek to confuse and disrupt the strength of the network.⁷⁸ Thus, there is a need to provide redundancy and strength in depth and not to expose obvious operational centres of gravity at the heart of the network. As deployed forces become lighter and rely more on non-organic fire support and taut logistics chains, the greater the risks in the failure of the network resulting in what Benbow called, *'a computerised Arnhem-style bridge too far or a digital Dien Bien Phu'*.⁷⁹ Finally, deterrence through the presence of armed forces is an important military task that is likely to retain a key role in OOTW. A reduction in platform numbers and force structures may have a counterproductive deterrent effect, as

smaller lightly armed forces could be less able to intimidate a target audience in the traditional way.⁸⁰ These examples graphically illustrate the dangers of the seduction of technology and the need to consider new vulnerabilities and any broader unintended secondary effects of its introduction.

Advanced information technology is at the heart of NCW, yet its introduction will not in itself realise its advantages. Future military success is not assured by the procurement of high technology platforms and military structures must be effectively organised to maximise the benefits.⁸¹ NCW has the potential to flood the battlespace with information; however, the commander does not necessarily want more information, he wants better information delivered where and when he needs it.⁸² NCW could become too technically complex and information could overwhelm the commander if the system is not constructed and organised properly.⁸³ Poorly managed information could lose wars and thus changes in military doctrine, training and operational and organisational concepts will be fundamental to the introduction of NCW systems.⁸⁴ It is true to say that this fact is recognised both in the US and the UK, but work in these areas is in its early stages. Despite this, NCW is in common military parlance and the term is liberally banded around. Without a proper understanding that NCW is as much about doctrinal innovation and changes to military culture as well as technology, the term could mean anything or nothing and this lack of clarity must be eliminated at the outset of any NCW programme. It seems counterintuitive that without a clear view of what these changes might be, the procurement of future systems is underway under the NCW banner. Unless the broader soft issues are understood and addressed, the introduction of costly and complex equipment may yet be another, 'technology-led military chimera'.⁸⁵

The alliance implications of NCW are a problematic topic since it is influenced from matters that are purely technical to issues at the broadest political level. Alliance politics is a constantly evolving and complex subject that is inevitably subject to a large degree of speculation.⁸⁶

For this reason consideration here will be restricted to the issues associated with NCW interoperability. There is no doubt that the US is largely setting the agenda for NCW. They are, however, sympathetic to their allies concerns over interoperability and in their, 'Joint Vision 2020' document they state:

'Since our allies will have varying levels of technology, a tailored approach to interoperability that accommodates a wide range of needs and capabilities is necessary'.⁸⁷

Notwithstanding this statement, maintaining parity with the US is likely to be prohibitively expensive for most nations and it is likely that many will have to find some form of compromise. Suggestions have included the development of national forces into smaller niche capabilities able to carry out specialist roles alongside the US. This solution appears attractive but requires a high degree of co-operation and understanding at the grand strategic and political level if such a move was to be practical. Another solution might involve a concept of two-tier forces where an upper tier of relatively small, high technology forces maintains interoperability with US forces whilst the second-tier of less advanced units is held back for less demanding operations.⁸⁸ This strategy also appears appealing, offering a skilful trade between affordability and the ability to remain fully engaged with the US on the military political stage. However, neither would seem suitable to any nation that wishes to retain an indigenous mix of balanced forces and the ability to act independently in a security operation. Freedman introduces the notion that *'The most important allies of the US will aim to stay abreast of technologies to gain access to US policy making in times of crisis and war'.⁸⁹* This is certainly true and the desire to remain engaged with NATO, whilst also developing the Common European Security and Defence Policy framework will present many European nations with a dilemma. The UK may be more inclined to align herself with the US if there were diverging trans-Atlantic capabilities, although it is less clear what stance other European nations might take. Until a clearer picture of such programmes starts to emerge it is not possible to assess the alliance tensions that may be introduced by the prohibitive costs of NCW technology. Interoperability must be addressed at a political, as well as military level, for all nations who aspire to work in the alliances

of the future.³⁰ Alarmingly, little work seems to have been focused in this area to date.

Policy makers appear to have already been seduced by NCW technology. This section has sought to expose some of the dangers in relying on this as the panacea. It has highlighted a few potential strategic, cultural and political implications of the pursuance of NCW to illustrate this. These have not been analysed in depth and are by no means comprehensive. However, it is clear that nations who aspire to develop NCW capabilities must not address it as a purely technical initiative but rather a major programme with impact on a wide range of activities and across government.

Implications for the UK NEC programme

The UK has made clear its commitment to pursue NEC for the Armed Forces. This aspiration will continue to be challenged by affordability in an environment that is unlikely to see a decrease on the pressure on defence expenditure. Whilst it is less ambitious than the NCW programme favoured by the US, NEC shares its origins as a facet of the so-called RMA. History shows us that military technological advantages have tended to be transitory and given the likely gestation period of the NEC programme, we could see the advantages it offers eroded significantly by the time it reaches maturity. Thus, the reduction in platform numbers and force sizes required to fund the current aspirations could expose operational risks in the future in the light of the evolving capabilities of potential adversaries. The short-term challenge will be more acute as significant reductions are already planned in the early stages of NEC development and the additional risks that this exposes must be acknowledged and managed appropriately.

We have seen an increase in the deployment of UK forces, particularly on OOTW, since the end of The Cold War. This is not unexpected given the increase in the utility of armed force and the challenges and threats posed in the more complex and fluid international security environment. The trend can reasonably be expected to represent the norm for the foreseeable future although,

in the longer term, changes in the geo-strategic balance of power and new security threats may change this. Although NCW and thus NEC's principal strengths lie in high-intensity combat, we can expect its introduction to benefit the full spectrum of military tasks. Nevertheless, the force reductions planned in advance of its delivery will place additional pressure on some elements of the Armed Forces that are already over-stretched. Without some reduction in current commitments, it is difficult to see how activity levels can be sustained and this will present a continual challenge prior to NEC reaching maturity. Moreover, fiscal pressures will mean that the UK will be forced to procure relatively small numbers of advanced platforms and systems. Therefore, even in the mature stages of NEC, UK forces may be vulnerable to disruption of their network and thus even limited attacks by conventional or asymmetric means could achieve a considerable effect severely limiting their combat effectiveness. The net effect of reduced force sizes and limited platform numbers could therefore create a number of critical weaknesses exposing obvious centres of gravity to adversaries.

NEC offers an attractive technologically based solution to the challenge of re-structuring the UK forces in the post-Cold War era and, although Western militaries have tended to favour such a strategy, there is risk in pursuing this route. Technology cannot provide an answer in itself and major doctrinal and cultural changes will be required to realise the benefits of NEC. At present UK doctrinal thinking appears to lag behind technology by some margin, although the term NEC is already in common use. Unless there is a clear vision for the development of NEC across the Forces, there is a real danger of the technological tail wagging the dog. Merely increasing the volume of information available is not the goal, but effective information management to meet a commander's needs is. This requires a clear understanding of the changes required to optimise command structures, develop networked operational concepts and training regimes to support them as well as ensuring maximum interoperability between force elements, and the ability to exploit information through

coherent hardware and software configuration management. These, 'soft' issues may prove more challenging than those that are purely technical and, therefore, priority should be given to their development in advance of the procurement of equipment under the NEC banner. To do otherwise is counterintuitive and risks a strategy driven entirely by available technology that fails to maximise the potential offered by NCW concepts. The UK military must guard against the temptation to be seduced by technology and recognise that the development of NEC is a major multi-faceted change programme and that the most important lines of development may not be technical. Interoperability, in both technical and doctrinal terms, with the US and European countries will impact on Alliance politics and will be a further challenge that could prove particularly difficult for the UK given its schizophrenic approach to US and European relationships. This issue highlights that the development of NEC should not just be a military lead activity as it has wider implications that require careful management across Government Departments. Moreover, we have argued that NCW delivers less obvious advantage in non-combat operations and in some traditional military tasks such as deterrence and power projection, smaller network-enabled forces may be less able to achieve the effects desired from a political perspective. These and other less obvious potential disadvantages must be considered throughout the development of the NEC programme and it is clear, therefore, that there is a need for high-level, cross-government involvement in the planning process and that this must be engaged from the outset.

Regardless of these issues, NEC is an essential aspiration for UK Forces and having argued the case for a technological evolution, it must be embraced if the UK is to maintain credible Armed Forces in the 21st century. Moreover, in order to remain a European ally of choice for the US there is little option but to follow their lead. However, realism must come in to play and affordability is the critical factor; the NEC vision is, without funding, a mirage. The success of the programme will depend on strong military and governmental commitment from the outset. The network will

only be as strong as its weakest link and therefore, despite budgetary pressures, an integrated equipment programme must be developed and protected if NEC's full potential is to be realised and, more importantly, if potentially critical weaknesses through capability gaps are to be avoided.

The NEC programme presents both opportunity and risk. The Vice-Chief of the Defence Staff has stated that '*NEC is at the heart of our transformation to defend against the principal security threats of the future*'.⁹¹ The recently published JSP 777 outlines a structure for NEC project governance and recognises that it is a long-term programme subject to incremental development over time with broad stakeholder involvement. If it is to be successful, it must address fully the issues that have been highlighted here and there must be a clear understanding of the risks and opportunities at the highest level of government. If viewed purely as a military technological enhancement programme, there is a real risk that limited funding and ambiguous strategic guidance could derail the initiative and the UK could find itself with sub-optimal forces and subsequently marginalised by its key alliance partners.

Conclusion

NCW offers the potential for smaller more agile forces to act with disproportionate effect and is a key tenet of the ongoing RMA debate. History shows us that the military advantages gained through technological advances have tended to be eroded by the proliferation of technology or development of tactical countermeasures and we should expect the advantages of NCW to be transitory. The post-Cold War security environment is increasingly uncertain with a broad range of threats and we have seen an increase in the utility of military power where forces are engaged in a wide spectrum of military tasks. NCW has its principal strengths in high intensity combat, but improved situational awareness will benefit the full range of military tasks and, having argued that this is an evolutionary change, NCW should be introduced to retain the initiative. We must remain aware of its limitations including the

need for adequate forces to conduct certain types of OOTW and of the vulnerability of networks to asymmetric attack.

Western militaries have tended to favour technological solutions to problems, but there is a need to guard against the seduction of technology as reliance upon it as a panacea introduces risks. The vulnerability of critical platforms and nodes may provide opportunities to aggressors as their loss could degrade significantly the overall combat effectiveness of deployed forces. Moreover, smaller force structures may have less deterrent effect reducing their value in some types of operation and there is a need to recognize the potential strategic implications of these secondary effects of NCW enablement. Interoperability and its effect on alliance politics is a key issue that appears to have received little attention to date. This is a complex matter requiring high-level political involvement and has implications for NATO and the emerging CESDP.

The UK is right to pursue its own NEC programme to maintain credible forces in the modern environment. It is, however, a challenging programme with both risk and opportunity that requires high-level cross-government support in order to address the wider strategic issues. The dominant concern will be affordability and force reductions, as an offset to cost, will be a key area of risk requiring careful management. The NEC initiative must not be viewed as a technology enhancement project but as a major multi-faceted change programme requiring political and military leadership. If the programme fails the UK could fail to optimise its Forces and be marginalized among the key Western allies.

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Joint Service Publication 777 Edn 1 – Network Enabled Capability

Notes

¹ Lonsdale (2004) p 1.

² Cebrowski & Gartska (1998) p 1-5.

³ Lonsdale (2004) p 2.

⁴ In this context, NCW is taken to mean a type of warfare characterised by network-enabled operations and not the defence programme of the same name favoured by the US DoD.

⁵ Benbow (2004) p 82.

⁶ Burridge (2004) p27.

⁷ Lescher (1999) p 58.

⁸ Unattributable discussion 25 Oct 2004.

⁹ Lescher (1999) p 58

¹⁰ McColl (2004) p 52

¹¹ McColl (2004) p 55

¹² ibid p 52

¹³ Mahnken (2001) p 1.

¹⁴ Strategic Defence Review - A New Chapter (2002).

¹⁵ Andrews (2002) p 1.

¹⁶ Schneider & Grinter (1998) p 56.

¹⁷ Krepinevich (1994) p 30.

¹⁸ Schneider & Grinter (1998) pp 65-66.

¹⁹ Galdi (1995) p 4.

²⁰ Arquilla & Ronfeldt (1997) p 80.

²¹ Biddle (1996) pp 3-4.

²² Schneider & Grinter (1998) P188.

²³ Freedman (1998) p 30.

²⁴ Freedman (1998) pp 31-32.

²⁵ Biddle (1996) p 1.

²⁶ Arquilla & Ronfeldt (1997) p 142.

²⁷ Benbow (2004) p 104.

²⁸ Schneider & Grinter (1998) p171.

²⁹ Lonsdale (2004) p2.

³⁰ Lescher (1999) p 59.

³¹ Barnett (1999) p 37.

³² Thomas (2004) p 9.

³³ Shibling (1993) p 106.

³⁴ Arquilla & Ronfeldt (1997) p 80.

³⁵ Baumann (1997) p 1.

³⁶ Arquilla & Ronfeldt (1997) p 24.

³⁷ Perret (1983) pp 55-75.

³⁸ Hallion (1989) p 145.

³⁹ Glantz & House (1999) pp251-254.

⁴⁰ Probert & Cox (1990) p 3.

⁴¹ Terraine (1985) pp 173-179.

⁴² Lescher (1999) p 63.

⁴³ Taken to mean the broader spectrum of military tasks including peace support, peace enforcement and humanitarian aid etc.

⁴⁴ Buzan (1991) pp 431-451.

⁴⁵ Benbow (2004) p77.

⁴⁶ Arquilla & Rondfelt p 87.

⁴⁷ Hirst (2001) p 87.

⁴⁸ Hirst (2001) pp 79-109.

⁴⁹ Benbow (2004) pp 132-133.

⁵⁰ Hirst (2001) p 90.

⁵¹ Ibid p 96.

⁵² Benbow (2004) p 135.

⁵³ Ibid pp 136-137.

⁵⁴ Benbow (2004) p 137.

⁵⁵ Ibid p 138.

⁵⁶ Barnett (1999) p 36.

⁵⁷ Schneider & Grinter (1998) p 71.

⁵⁸ Benbow (2004) p 152.

⁵⁹ Benbow (2004) pp 143-144.

⁶⁰ Krulak (1999) pp 1-7.

⁶¹ Benbow (2004) pp 143-151.

⁶² Barnett (1999) p 37.

⁶³ Benbow (2004) pp 147-153.

⁶⁴ Benbow (2004) p150.

⁶⁵ McColl (2004) p 53.

⁶⁶ Benbow (2004) pp 154-155.

⁶⁷ Ibid p 161.

⁶⁸ Benbow (2004) p 168.

⁶⁹ Podlesny (1999) p 51.

⁷⁰ Arquilla & Rondfelt (2004) p 30.

⁷¹ Id.

⁷² Schneider & Grinter (1998) p 192.

⁷³ Garden (1989) p 6.

⁷⁴ Arquilla (1998) p 42.

⁷⁵ Lescher (1999) p 62.

⁷⁶ Benbow (2004) p 161.

⁷⁷ Barnett (1999) p 38.

⁷⁸ Benbow (2004) p 92.

⁷⁹ id

⁸⁰ Arquilla & Rondfelt (2004) p 51.

⁸¹ Ibid p 62.

⁸² McColl (2004) p 54.

⁸³ Lescher (1999) p 60.

⁸⁴ McColl (2004) p 54.

⁸⁵ Ibid p 55.

⁸⁶ Benbow (2004) p 172.

⁸⁷ Benbow (2004) p 189.

⁸⁸ Ibid p 190.

⁸⁹ Freedman (1998) p 72.

⁹⁰ The constraints of this essay do not allow further analysis of this complex subject. However, 'Mind the Gap' addresses the subject in detail and offers potential strategies to address what is

a key strategic issue.

⁹¹ Foreword to JSP 377.

Book Reviews

Shot Down and in the Drink

RAF and Commonwealth aircrews saved from the sea 1939-1945

By Air Commodore Graham Pitchfork

Shot Down and in the Drink follows on from Graham Pitchfork's previous work 'Shot Down and on the Run', which had a justifiably glowing review in this journal at the time of its publication. Whilst the basic approach is the same, using a number of individual cases to illustrate the broader aspects of a particular subject area, obviously in this case the focus is on their survival and rescue of the large number of allied airmen who ended up in the sea during World War 2. Although many readers will be aware of the fact that a number of aircrew inevitably ended up ditching, the fact that losses in the sea of trained aircrew during 1941 averaged 200 a month is a clear indicator as to why an efficient search and rescue service was desperately needed.

The book comprises 16 chapters, split into four parts, covering the air sea rescue organisation itself, and then going on to look at specific cases in Northwest Europe, the Mediterranean and West Africa, and India and the Far East. The first part looks at the development of the air sea rescue organisation. Although this had existed in a nascent form in the First World War, providing support to aircraft engaged in anti-submarine operations, it was basic in nature as most aircraft carrying out such duties tended to operate close to shipping lanes where help was generally not far away. Unfortunately the procedures that had been worked out rapidly fell into disuse during the early 1920s.

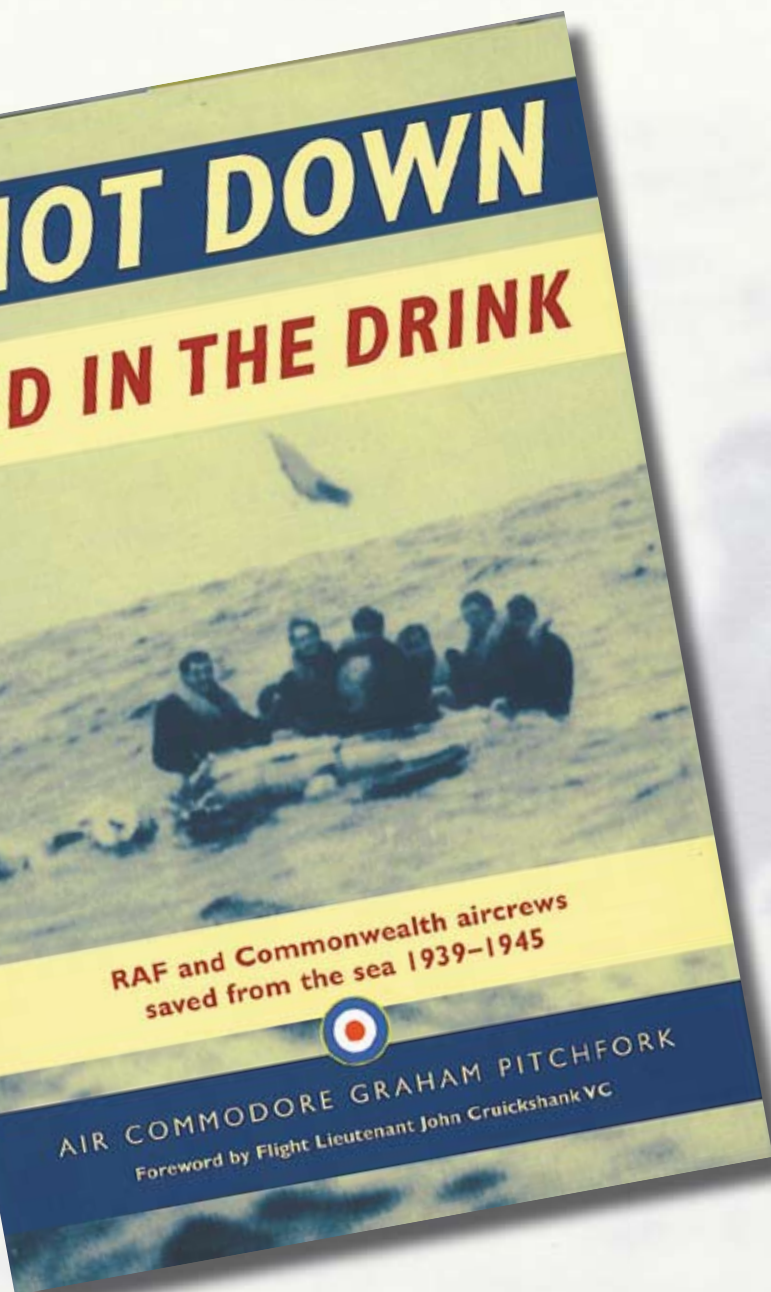
The introduction of much longer-range aircraft in the 1930s, however, together with the growing realisation that operations in Europe would involve long sea transits, resulted in a significant

amount of work being carried out from 1935 onwards to improve the chances of survival for aircrew at sea. Indeed the chance of surviving after landing in the sea at the start of the war only ran at about 20%, but that swiftly changed as the importance of rescuing such individuals became important not just in morale terms, but also in regard of the ability to make the most of a scarce resource. These efforts would eventually produce an organisation that supported the D-Day landings in Normandy, and following airborne operations, in an outstanding manner. The setting up of the organisation, the changes in aircrew training, and development of survival equipment and location aids are all covered in detail.

The rest of the book mostly consists of illustrative cases, showing the range of rescues (and in at least one case, escape) that allied aircrew were involved in. These range from the American airman flying with the RCAF who spent 14 days adrift in a dinghy in the North Sea, through to the Beaufort crew who hijacked the Italian floatplane that had picked them up near the Greek coast and managed to make their way back to Malta. However, it is not just a story of the aircrew, but also of those who manned the boats and search aircraft, and here also heroism abounded — as in the case of the high speed launch captain who in 1942 rescued a Stirling crew in daylight who were adrift in a minefield just eight miles from the Belgian coast.

Perhaps the high point of the air sea rescue service came during Operation Market Garden in 1944, when the tracks of the rescue tugs across the North Sea were so numerous, and so accurate in their positioning, that the tug aircraft only had to follow





them to make landfall. In the event a number of aircraft and gliders did end up making forced landings, but the launches were with them so quickly that, as is noted, 'the survivors hardly got their feet wet'.

Finally, a brief explanation of the origin of the 'Goldfish Club' is provided, membership of which was awarded to those who owed their lives to the manufacturers of air sea rescue equipment such as life rafts and jackets.

As with all of Graham Pitchfork's work, this bears the hallmarks of meticulous research combined with great storytelling, resulting in a read that is both entertaining and informative. It is a book that brings a human element to an important but often overlooked part of the RAF's operations during the Second World War, and with remarkable tales of heroism throughout it makes for inspiring reading.

It is eminently suitable for either reading straight through or simply as a book to dip into every now and then, as all of the stories are fascinating reads in their own right.

By Air Commodore Graham Pitchfork

Publisher: The National Archives, Kew

ISBN 1 903365 87 2

Price £19.99 (276 pages, hardcover)

Reviewed by Gp Capt Neville Parton

Book Reviews

Anti-Submarine Warfare in World War 1

By John J Abbatiello

Publisher: Routledge, London

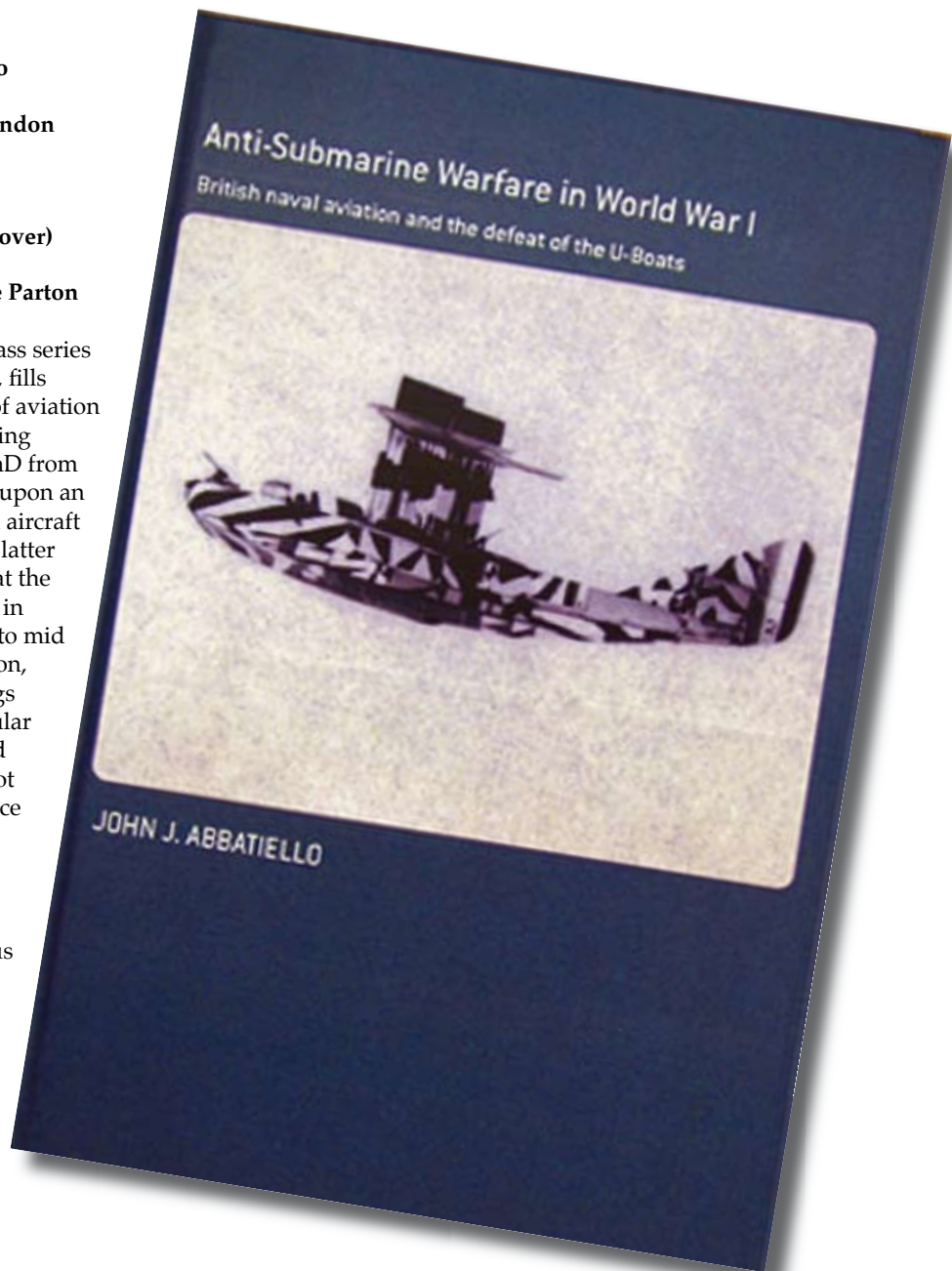
ISBN 0-415-76383-5

Price £70 (240 pages, hardcover)

Reviewed by Gp Capt Neville Parton

This book, one of the Frank Cass series on Naval Policy and History, fills a unique gap in the history of aviation and naval forces. Written by a serving officer in the USAF who holds a PhD from King's College London, it is based upon an in-depth study of the use of British aircraft against German submarines in the latter part of the First World War. Being at the intersection of Air Force and Navy in Britain during the 1920s and early to mid 1930s was not a comfortable position, and much in contemporary writings revealed as much about the particular prejudices of the author(s) as it did about the subject. Abbatiello has not only gone back to the original source material for much previous work, but also introduces a new element in the form of a detailed analysis of the German submarine service's experience of British air power, thus providing a far fuller picture.

The book begins by providing a brief overview of the development of British naval aviation up to the end of World War I, before going on to examine the technology



involved in both the aircraft and the U-boats in Chapter 1. Not surprisingly it is the aviation aspects that are examined in most detail, with coverage of not only the technological advances in specific fields and their relationship to the efficacy of air power against the submarine, but also of the breadth of platforms used in the role – ranging from sea planes and flying boats through the various classes of lighter than air craft to towed kite balloons. The growing importance of wireless, both for communications and direction finding, is well brought out, and the use of hydrophones by both flying boats and airships as a means of detecting submerged U-boats is a fascinating element of the story. The problems of training and production are then considered in Chapter 2, and although nothing particularly new emerges in terms of the problems of producing the numbers of aircraft, aircrew and especially engines that were needed, the difficulties that resulted in terms of relationships between the War Office and Admiralty initially, and Admiralty and Air Ministry later on, are well laid out.

Chapter 3 is where the main effort of the work begins, by beginning to examine the actual operations undertaken, in this case, in terms of attacking the enemy at home — the bombing of the Flanders U-boat bases. Although the RNAS without doubt first introduced the concept of what would now be understood as ‘strategic’ or ‘independent’ bombing to the British military establishment, a combination of weaknesses in technology, doctrine and command meant that a sustained campaign against this particular target set was never effectively carried out. The author concludes that, particularly towards the end of the war, a sustained campaign *could* have impacted on the ability of the U-boats to operate from these forward-bases, but that in fact the activities that were carried out had a negligible impact. The next chapter looks at the use of air assets in patrolling Home Waters, and assesses the efficacy of this particular approach. Whilst previous studies had suggested that this method had not been particularly successful in terms of submarines sunk or engaged considered against the resources employed, a convincing case is made that the increasing use of air patrols, utilising both aircraft and airships, significantly reduced the effectiveness of many submarine patrols by forcing

them to submerge. The impact of a coherent intelligence system, together with systematic search patterns (such as the ‘Spider Web’ system developed by Felixstowe) certainly presaged the Second World War combination that was to prove so devastating in containing and then defeating the later U-boat menace. Chapter 5 looks at the role of air in the convoy escort system, from which it is clear that the combination of convoy tactics with air support proved extremely effective in reducing the threat posed by the German submarines. However, equally interesting is the examination of the different approaches taken by different commands to both patrolling and convoy escorting throughout the war, which reveals a far from coherent approach, albeit some of the differences come down to particular local circumstances.

The overall effectiveness of all air activity against the U-boats is considered in Chapters 6 and 7, comparing and contrasting the official British and German assessments. It is not possible within the scope of a brief book review to adequately represent the complex arguments made within these chapters, but a brief synthesis would be that on both sides the situation was not as black and white as has been made out in many previous accounts of this particular conflict. Whilst the limitations inherent in aircraft and airships of the time made them far less effective than their Second World War counterparts, they certainly played a significant part in defeating the German U-boat menace, and along with innovations such as the convoy system, minefields, hydrophones and in particular wireless communications, contributed to the development of a successful ‘system’ of anti-submarine warfare.

This is without doubt a book that should be read by anyone with an interest in early naval aviation, or submarine warfare, or both. It provides a refreshing perspective upon this interface of technologies, which as the author cogently points out, took naval operations from two dimensions into three, with both height and depth becoming important in naval tactics for the first time. It is also a fascinating read, and, due to the significant amount of detail contained within its pages, repays careful study.

Notes

