

Effects-Based Targeting: The Future of Targeting for the Royal Australian Air Force

Chief of Air Force Fellowship Paper

Mat Butler



Air Power Development Centre
Canberra

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Abbreviations and Acronyms

AAP	Australian Air Publication
ADDP	Australian Defence Doctrine Publication
ADF	Australian Defence Force
AWPD	Air War Plans Division
BDA	Battle [or Bomb] Damage Assessment
C3	Command, Control and Communications
C3I	Command, Control, Communications and Information
C4ISREW	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance and Electronic Warfare
CEP	Circular Error Probable
EBO	Effects-Based Operations
FLIR	Forward Looking Infra-Red
GPS	Global Positioning System
ISR	Intelligence, Surveillance and Reconnaissance
JDAM	Joint Direct Attack Munition
kg	kilogram
km	kilometre
KTO	Kuwait Theatre of Operations
lb	pound
MEF	Marine Expeditionary Force
MUAV	Multi-mission Uninhabited Aerial Vehicle
NATO	North Atlantic Treaty Organisation
NBC	Nuclear, Biological and Chemical
NCW	Network Centric Warfare
OODA	Observe, Orient, Decide and Act

RAAF	Royal Australian Air Force
RAF	Royal Air Force
RFC	Royal Flying Corps
UAV	Uninhabited Aerial Vehicle
UN	United Nations
US	United States
USAAF	United States Army Air Forces
USAF	United States Air Force
WMD	Weapons of Mass Destruction

Introduction

*The ADF will be able to **strike** if this suits national strategy.¹*

On 8 February 2003, and as part of the Australian contribution to the US-led coalition against Iraq, the Royal Australian Air Force (RAAF) deployed 14 F/A-18 Hornet fighters of No 75 Squadron to the Middle East under the auspices of Operation *Bastille*. A little over a month later in mid-March, Operation *Falconer* commenced with the start of hostilities against Saddam Hussein's regime. No 75 Squadron conducted strike missions against fixed military targets, battlefield interdiction missions and close air support in direct support of ground forces. The last time RAAF aircraft had bombed ground targets in a war zone was 31 May 1971 during No 2 Squadron's deployment to Vietnam.



Phan Rang, South Vietnam, 31 May 1971 – The last bomb dropped by No 2 Squadron during the Vietnam War loaded on the wing of a Canberra bomber. On the side of the bomb the armourers have painted the words, ‘76,389th and last bomb compliments to “Charlie” from No 2 Squadron RAAF Uc Dai Loi. Uc Dai Loi here we come.’

(Photo: Australian War Memorial P02146.002)

¹ Department of Defence, Australian Defence Doctrine Publication–D.3—*Future Warfighting Concept*, Department of Defence, Canberra, 2003, p. 33.

No 75 Squadron performed well in the Middle East and completed a range of air-to-surface sorties, using precision guided munitions, against a wide array of military targets—including tanks, artillery and anti-aircraft systems. Its area of operations extended throughout southern and central Iraq, from Al Amarah to Baghdad and Tikrit. The objectives were to support the manoeuvre of coalition ground forces and to strike at strategic targets as the opportunity arose. One such example was the engagement of a fleeting, ‘time sensitive’ ground target by a RAAF Hornet flying a defensive counter air mission. Because the aircraft was in a multi-role configuration, it could be quickly re-tasked from an air-to-air to surface-to-air role.²

During Operation *Falconer*, Australian aircrews, ground crews and support staff worked hard and impressed their American counterparts with their versatility and professionalism. However, our experience in Operation *Falconer* highlighted targeting as an area that warranted further development.³ Whereas overall expertise displayed by the RAAF was quite high, our targeting methodology was neither well developed, nor well established. This was primarily due to a lack of operational bombing experience in the preceding 30 years. Analysis of the results of Australian bombing, conducted by Australian Defence Force (ADF) staff in conjunction with US headquarters, was little more than a hit or miss assessment. Conversely, in a high-tempo campaign, command decisions cannot always wait for an in-depth analysis of damage caused by bombs. A hit or miss indication may be all that is required before proceeding to the next phase of a campaign. It is our foreknowledge of adversary systems that enables such a flexible application of targeting doctrine, because in a fast moving battlespace, superior intelligence on adversary systems may allow the functional results of bombing to be quickly extrapolated. This is not to say that in-depth combat assessment is redundant, but circumstances may dictate that a commander does not have time to wait for it to be conducted before making a decision or proceeding forward with a plan. Moreover, doctrinal flexibility is only one aspect of the need to improve our capability to conduct aerial strike in the future. Operation *Falconer* revealed that the RAAF did not have a full appreciation of the cognitive effects produced by aerial strike on an adversary system. Combat assessment had a tendency to be biased towards the physical effects caused by bombs and fell short of assessing the cognitive

² Department of Defence, *Operation Falconer: Fact Sheets – F/A-18 Hornet*, Department of Defence, Canberra, www.defence.gov.au/opfalconer/factsheets/hornet.htm, accessed on 8 December 2005.

³ Department of Defence, *The War in Iraq: ADF Operations in the Middle East in 2003*, Department of Defence, Canberra, 2004, p. 28.

effects that RAAF strikes were causing on the Iraqi system as a whole. It was this experience and the ‘lessons learned’ that prompted this body of research.



Middle East Area of Operations, 21 March 2003 – An F/A-18 takes off for missions over Iraq as part of Operation *Falconer*.

(Photo: Department of Defence)

ADDP–D.3—*Future Warfighting Concept* presents ideas on how the ADF aspires to fight in the future. Concepts such as ‘Effects-Based Operations’ and ‘Network Centric Warfare’ promise to change fundamentally the way in which the ADF approaches conflict in the future. Within the scope of these broader concepts, ‘Effects-Based Targeting’ receives a brief mention as a sub-concept, but is not elaborated on in any great detail. ADF doctrine defines targeting as the process of selecting a target and matching the appropriate response to it, taking into account national and strategic objectives, capabilities, international law and operational requirements. A target can be identified as an area, complex, installation, force, capability, equipment, behaviour, or function. Moreover, effects-based targeting involves a process of analysing and selecting an adversary’s vulnerabilities, and matching assets to achieve desired effects. To an airman involved in targeting, these definitions immediately raise further questions. What type of analysis is needed to identify specific vulnerabilities? How do we determine which vulnerabilities to select? Does effects-based targeting require the identification of new or different types of vulnerabilities, as opposed to those identified through traditional ‘attrition’ targeting methods? What are the effects and can we achieve them through the application of force through air power? These types of questions formed the basis of this research, and future concepts and targeting effects are explained in further chapters.

The intent of *Effects-Based Targeting: The Future of Targeting* for the Royal Australian Air Force is not to rewrite ADF targeting doctrine for the Air Force. Little

emphasis is placed on the techniques, procedures and doctrine of targeting. More emphasis is placed on what elements and factors need to be examined in order to develop an effects-based targeting methodology. The aim is not to review doctrine, but to examine the effects-based targeting concept further. The bulk of this research has come from open, quotable sources, including published books, academic papers, ADF public documents, fact sheets and official statements to the media.

Exploration of effects-based targeting methodology involves both the arrangement of ideas (the theory behind the concepts), and its practical implementation (examples from air campaigns in the past). Effects-based targeting is more than a 'future' concept. It has been put to practical use since the beginnings of offensive air power. Examining the practical implementation of effects-based targeting therefore involves a great deal of research of the aerial campaigns of World War I, World War II, Korea, Vietnam, the Gulf War, Kosovo and, more recently, the War in Iraq. In this context, the purpose of historical research is not to create a record of achievements. Instead, the underlying rationale of historical research is to be 'revisionist' to an extent—to examine those campaigns in a new light and from the perspective of effects-based targeting. The examination of historical case studies often reveals how effects-based targeting concepts were conceived, how they were implemented, what objectives were sought, what were their successes and failures, and what information of value may be drawn from those experiences.

This paper is separated into three parts. Part One is an outline of the concept and terminology of effects-based targeting, and is divided into two chapters. Chapter One is concerned with the establishment of the effects-based targeting as a future warfighting concept. Chapter Two then examines the theory behind effects-based targeting, its terminology, and the factors involved in its application.

Chapter One is titled 'Emerging Technology, Global Security Environment and Future Warfare'. It identifies three major, concurrent influences that have allowed the concept of effects-based targeting to become more of a reality in the development of future capabilities. These influences are: advanced developments in technology and its application, the ever-changing global security environment in which Australia finds itself, and future warfighting concepts, such as effects-based operations and network centric warfare. As the future cannot be predicted with any certainty, the purpose of this chapter is not to provide a 100 per cent accurate prediction of the circumstances under which RAAF may have to implement effects-based targeting. Rather, the intent is to map out those directions we are currently taking and provide the necessary background information in order to provoke thought on how we intend to approach effects-based targeting in the future.

The theory and language behind effects-based targeting is outlined in Chapter Two – 'Fire for Effect'. This chapter also examines those operational parameters that

may influence effects-based targeting, such as how much force may be required, what scope our set of targets may encompass, and how timing may affect the outcome. It also outlines some of the internal and external influences on our targeting capability.

- Operationally, our targeting capability draws a great deal of influence from national strategy and what objectives we are trying to achieve. At the strategic and operational level, targeting requires constant interaction between the various strategic and operational factors to ensure that our operational objectives are in line with strategy and our strategy is determined within the limits of what our operational capabilities are able to achieve.
- A great deal of this book emphasises the need for comprehensive intelligence support to effects-based targeting. Good intelligence is a key influence on targeting capability because creating effects relies heavily on what information is available on an adversary system and to what extent that information is analysed. The underlying rationale behind effects-based operations is influencing an adversary's decision-making, which means that a comprehensive understanding of this process is required.
- Strategic targets were once considered to be primarily economic in nature; that is, those industries that supported war fighting capacity. However, other types of targets are capable of producing strategic effects. The final portion of this chapter urges us to look further afield than 'traditional' target types to produce system effects on an adversary.

Part Two is titled 'Beyond Theory: Effects-Based Targeting in the Real World' and is divided into six chapters. The rationale behind Part Two is to re-examine the air campaigns of history, either to glean effects-based perspectives or to uncover case-studies that are relevant to the current effects-based approaches. Real-world targeting experience can be invaluable in exploring what has worked and what has not worked in the past. The downside of most historical air campaigns is that they are predominantly US-centric and thus the 'lessons learned' may not be particularly relevant to a comparatively small air force such as the RAAF. Instead, the aim is to examine those targeting effects that are possible in a practical sense. It is not the intention here to list effects that can be achieved by air power, but to highlight those effects that it are possible for the Air Force to produce on an adversary given that they have the capability to do so. In particular, the purpose of historical case studies is to highlight cognitive or psychological effects of air power over physical attrition.

‘Beyond Theory: Effects-Based Targeting in the Real World’ examines a selection of major air campaigns from World War I through to the War in Iraq:

- The chapter on World War I establishes where effects-based theory was first developed, but technological limitations curtailed its implementation at the time. It also reveals that the fundamentals of air power’s operating methods have not changed significantly in the past 90 years, rather the levels of sophistication have changed remarkably. World War I featured air campaigns conducted at the strategic, operational and tactical level. It also featured targeting methods that are still employed, such as target planning, intelligence gathering, operational research and combat assessment.
- World War II was characterised by a massive strategic air campaign and thus it has received a lot of attention from historians. The targeting requirements of the strategic air campaign resulted in operational research being revived once more and its concepts were developed further. In an effort to steer away from the ‘traditional’ view of World War II strategic bombing—where the bombing effort is assessed in terms of the quantity of physical damage inflicted—the Allied strategic campaign is viewed from the perspective of qualitative system effects. This chapter examines the strategic, operational and tactical effects achieved through targeting and bombing; in particular, how offensive air power was an enabler that assisted in shaping the battlespace, and the cognitive or psychological effects of bombing.
- The study of the Korea and Vietnam air campaigns is subtitled ‘Interdiction on a Strategic Scale’. It examines the effectiveness of interdiction against an opponent whose system featured limited strategic targets. Interdiction sometimes offers the only effective means of air strike against agrarian-based armies with small supply requirements. These campaigns also reveal the ‘fear factor’ of offensive air power, as the psychological aspect of constantly being under the threat of air attack was often more effective than the actual physical destructive results achieved. Korea and Vietnam featured the use of RAAF capabilities in ‘niche roles’ as part of a larger Allied or coalition operation. In this context, the RAAF retained its independent character whilst conducting operations that were well suited to limitations in its capability.
- Operation *Desert Storm* can be considered a revolution in targeting doctrine mainly because in preceding air campaigns, the creation of ‘effects’ to influence adversary decision-making was secondary to what physical damage could be inflicted on the enemy. *Desert Storm* is

popularly regarded as a revolution in air warfare because of the highly visible media reports on the use of precision guided munitions. However, the revolution probably had more to do with Warden's less-publicised concentric-ring model that mapped the centres of gravity of an adversary. *Desert Storm* is often regarded as the epitome of success of air campaigns because its effectiveness resulted in a short ground war. It was the success of attacking a 'hybrid' of targets—the combination of strategic and operational level air strikes in conjunction with each other—that probably led to this success. *Desert Storm* highlights the effectiveness of air power in disrupting command and control at the strategic level, and enabling ground forces and shaping the battlespace at the operational level. Subsequent air campaigns since the Gulf War have followed the same principles but have found it difficult to emulate its success. This highlights the circumstantial nature of conflict—the success of an air strike is often dictated by those features that are unique to each conflict situation—in this case a largely conventional opponent, good weather and an open desert made it conducive to striking at targets from the air. From this we find that effects-based targeting should be adaptive to the unique circumstances of each conflict.

- From a number of angles, Operation *Allied Freedom*—the air campaign over Kosovo in 1999—resembles the 'perfect' effects-based operation. From an 'air power' angle, it involved the exclusive use of force from the air. From the 'just war' angle, it had the moral high ground—the noble cause of freeing the Kosovar people from Serbian oppression. From the 'effects' angle, its objectives were humanitarian based but pursued through the use of aerial strike. Moreover, aerial strike relied on attacking those targets that were likely to produce a coercive effect on the Serbian leader, Slobodan Milosevic. *Allied Force* also highlights the pitfalls of asymmetric warfare, where paramilitary ground forces avoided detection by NATO aircraft flying overhead—turning the conflict into a contest of means versus will. Those same paramilitaries used human shields to prevent NATO from targeting military facilities and equipment, and also manipulated the media to try and turn international opinion against the humanitarian operation. It highlights the fact that an asymmetric opponent can negate some of the effectiveness of air power, but also reveals that accurate target intelligence that is adaptive to a rapidly changing situation can restore the balance in air power's favour. *Allied Force* also highlights the fact that air strike is only effective to a point and that it is a single influence on an adversary system in a coercive operation.

- The air campaign of the 2003 War in Iraq is the focus of Chapter Eight. Compared to other campaigns, not much information has been publicly released about the strike missions flown in Iraq and so this chapter is quite short. At the strategic and operational level, many of the lessons learned from Operation *Desert Storm* were put to good use. There was no argument over whether to pursue an exclusively strategic or operational strike campaign—a ‘hybrid’ campaign was conducted from the outset. The concept of ‘parallel warfare’ was also fully implemented, whereby many target sets were struck at the same time in an effort to induce shock on the Iraqi system. The War in Iraq was also characterised by a rapid ground campaign in conjunction with the air campaign—US planners did not wait for the air campaign to finish before launching the ground invasion. The 2003 War in Iraq featured some distinct differences in the approach to targeting since *Allied Freedom*, and these are again a product of the unique circumstances of the conflict.

Part Three comprises one chapter only, ‘Implications for the Future’. It draws together all of the effects-based targeting theory and practical factors and prepares a road map for the future, ‘tailor-made’ for the RAAF perspective. The need for comprehensive intelligence support to effects-based targeting is emphasised, as is the need for high levels of expertise from personnel who support targeting. Adopting US models for targeting can be counterproductive, and so the national character of Australia and the size and capabilities of the RAAF are significant factors to be considered in determining future paths to take.

‘Implications for the Future’ is not a prescription of ‘what the RAAF must do’ in order to develop fully its effects-based targeting capabilities. Instead, it highlights ‘implications’—those factors and elements that will affect the future of targeting and how our thinking may have to change in order to introduce fully effects-based targeting as a concept. In essence, this body of research is about creating ‘effect’—the ideas presented within are intended to be a stimulus to which the reader responds. The desired outcome is that decision-making is influenced towards a deeper analysis of the effects-based targeting concept and the future of the application of force through air power.

Part 1

The Theory: Concepts and Terminology

Chapter One

Emerging Technology, Global Security Environment and Future Warfare

Modern technologies, both within the aerospace field and in the areas of communication and information processing, have altered the modalities through which air power is employed, as well the efficacy of various strategies for its use.¹

There are three readily identifiable ‘streams of influence’ that will directly affect RAAF targeting capability over the next decade. These are advanced technology, an uncertain global security environment and new models in the application of military force. An uncertain security environment will continually pose new challenges to target selection methodology and the application of force. What is regarded as a highly valued military target today may not hold the same currency tomorrow, as adversaries or the strategic situation change. The versatility of advanced technology and the functionality of new concepts offer a counterweight to these challenges. Technology and emergent concepts of operational warfighting can be combined to adapt to change and thereby offer a more efficient use of targeting capability.

Technology allows modern military forces to be smaller, more manoeuvrable and have greater firepower. The acquisition of new technology will enable the ADF to pursue more efficiently its objectives within an operational context. If the Air Force is called upon to target and apply force to an adversary, new technologies in surveillance and combat aircraft will have a direct impact on the outcome of targeting in the future. Thus it needs to be asked, how will these new acquisitions affect the targeting capability of ADF air power, and how will targeting capability have to change and adapt in the near future? These questions must be taken in context. The ADF cannot rely on technology alone for air power solutions to future warfighting.² Future targeting capability not only involves technology, but also

¹ Spencer Abbot, ‘Air Power Strategy and the Problem of Coercion’, in Stephen D. Wrage (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, p. 23.

² Department of Defence, Australian Defence Doctrine Publication–D.2—*FORCE 2020*, Department of Defence, Canberra, 2002, p. 11.

adequate personnel dedicated to the task, adopting modern operational concepts, robust organisation, realistic training and dynamic doctrinal changes.

Modern operations involving the use of force are conducted with a purpose. They have a defined 'end-state' and must meet the parameters of desired strategic outcomes. This in turn affects the application of force and how targeting methods are utilised. To 'set the scene' for the future of targeting in the RAAF, each of these 'streams of influence' needs to be explored and an assessment made as to how they can be applied or, in case of the security environment, an outline made of some expected challenges.

EMERGING TECHNOLOGY

The RAAF of 2020 will have a different 'look and feel' to the Air Force of today. Over the next two decades, the ADF as a whole is expected to undergo a process of change. This process will primarily involve the acquisition of new strategic lift, air combat and surveillance aircraft. The Air Force of 2020 will be required to be flexible and adaptable, rapidly deployable, able to easily interoperate with allies, capable of seamless joint operation and be at the 'sharp end' of technological change. In addition, the Defence Force as a whole will exploit emerging information technology to make their armed forces more 'network centric'.

There are two main sectors of the Air Force where new acquisitions will primarily affect targeting—surveillance and combat aircraft. Surveillance aircraft enhance the detection, recognition and acquisition of emerging targets in the modern battlespace. Some surveillance aircraft, such as the AP-3C armed with Harpoon missile and Mk 46 torpedo, are also capable of engaging surface and sub-surface targets. Combat aircraft, being predominantly or exclusively fighters, are capable of acquiring and engaging targets with increasingly sophisticated weaponry. As such, new acquisitions of both types of platforms, utilising the latest in technology, will fundamentally change the methods of targeting used by the Air Force in the future. This is because the Air Force will be better equipped to gather intelligence on targets and better equipped to prosecute them for precise effect.

Although the ADF plans to withdraw the F/A-18 Hornet from service in the 2012–2015 time frame, it is undergoing major changes to its capability. The most significant of these changes that will affect targeting in the short term, is the acquisition of a new forward looking infra-red (FLIR) pod. Under the AIR 5376 proposal, the Grumman LITENING AT/ISR pod is being installed on the F/A-18 Hornet as a replacement for the ageing NITE Hawk pod. The new pod will improve the detection, identification, precision targeting and combat assessment capability

of the F/A-18 when engaging ground targets.³ Such an advance in capability reflects the future trends of the application of force using air power in the modern battlespace. Since the experiences of the United States during Operation *Desert Storm* in 1991 and again during the Australian contribution to the War in Iraq (Operation *Falconer*) in 2003, aircrews are often obliged to fly at medium to high altitudes (usually upwards of 20 000 feet). This was to avoid exposing aircraft and aircrews to the risk of low-altitude anti-aircraft artillery, surface-to-air missiles and man-portable air defence systems that are difficult to detect.⁴ The addition of an advanced, high-resolution FLIR pod will allow Hornet aircrews to target and engage ground targets more effectively from higher altitudes, and thus bolster their stand-off capability and survivability in high-threat environments.

The ADF must retain a similar capability once the F/A-18 Hornet is retired in the 2012–2015 time frame. Australia will need an advanced, multi-role, combat aircraft to replace it. The F-35 Joint Strike Fighter is expected to fulfil the strike capability requirements formerly held by the F/A-18 and F-111.⁵ The Joint Strike Fighter represents a major improvement in network connectivity, joint warfighting and allied interoperability. It features enhanced situational awareness, stealth technology and ability to carry advanced precision guided munitions—all of which translate into greater targeting capability.⁶ The Joint Strike Fighter is expected to be able to penetrate air defence networks using its stealth technology, to acquire ground targets quickly via advanced electro-optical and infra-red sensors, and to engage them from greater stand-off ranges with internally carried small diameter bombs or other conventional precision-guided munitions. These abilities are essential in the modern battlespace, and allow smaller force packaging in order to conduct multiple strikes and employ a highly accurate, proportional use of force with small diameter bombs.

Surveillance aircraft or space surveillance platforms can contribute to the target development and combat assessment stages of the targeting cycle. Within target development, a surveillance platform may contribute to the gathering of pre-strike target information, or assist in acquiring transient targets as they emerge in the battlespace. Within combat assessment, surveillance platforms have the ability to contribute greatly to gathering information to make battle damage assessments and

³ Defence Materiel Organisation, *Defence Capability Plan 2004–2014*, Defence Materiel Organisation, Canberra, 2003, p. 24.

⁴ Stephen Budiansky, *Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Gulf War II*, Penguin Group, New York, 2004, p. 421.

⁵ Defence Materiel Organisation, *Defence Capability Plan 2004–2014*, p. 44.

⁶ Defence Materiel Organisation, *Project Overview: Project AIR 6000, New Air Combat Capability (Joint Strike Fighter)*, Defence Materiel Organisation, Canberra, p. 44.

restrike recommendations. Surveillance platforms currently within the Air Force inventory include the AP-3C Orion maritime patrol aircraft and the RF-111C. The RAAF has also acquired the Wedgetail Airborne Early Warning and Control aircraft. Although the Wedgetail is primarily a surveillance platform for the air-to-air environment, its multi-role radar is capable of detecting targets in a relatively clutter-free maritime environment.⁷ Moreover, the Wedgetail is an enabler for the targeting process—it can be utilised in the key role of ‘strike coordination’ which will allow ‘big picture’ support to strike aircraft near and over their target areas. This coordination increases effectiveness by allowing strike aircraft to concentrate on their targets in the knowledge that their backs are covered, and also allows greater weight of weapons on the target because their time over target is fully coordinated.

Surveillance platforms or capabilities that the ADF is considering acquiring include a replacement for the AP-3C (AIR 7000 Phase 2), a Multi-mission Uninhabited Aerial Vehicle (MUAV) (AIR 7000 Phase 1) and a Space Based Surveillance Capability (JP 2044). The AP-3C replacement will be a manned aircraft capable of conducting the maritime patrol role with improved sensors.⁸ The MUAV is intended to be a long endurance uninhabited platform capable of all-weather, wide-area surveillance using advanced electro-optical sensors, infra-red sensors and/or synthetic aperture radar.⁹ Intended to complement the capabilities of manned aircraft, MUAVs enhance the ability to provide a commander with near real-time information and have the potential to build a rapid and accurate target picture for targeting purposes. MUAVs are particularly useful for surveillance over wide areas with adverse terrain, be it urban, mountainous or jungle, without risking the safety of aircrews in a hostile environment.

The Global Hawk is a prime contender to fulfil the future MUAV requirement for the Defence Force and its capabilities are highlighted here as an example. Global Hawk is a long endurance platform, demonstrated by its flight of 7500 miles (12 000 km) nonstop across the Pacific Ocean to Australia on 22–23 April 2001, setting new world records for uninhabited aerial vehicle endurance in the process. Global Hawk can provide the joint battlefield commander with near real-time, high-resolution, intelligence, surveillance and reconnaissance imagery.¹⁰

⁷ Boeing Australia, *Project Air 5077 Wedgetail Airborne Early Warning and Control*, Boeing Australia, Brisbane; www.boeing.com.au/BAL/DIVNetworkEnabledSystems/aewc.html, accessed on 8 December 2005.

⁸ Defence Materiel Organisation, *Defence Capability Plan 2004–2014*, p. 49.

⁹ *ibid.*, p. 47.

¹⁰ US Air Force Fact Sheet, *Global Hawk*, Department of Defense, 1 October 2005; www.af.mil/factsheets/factsheet.asp?fsID=175, accessed 21 November 2005.

It can be integrated via satellite communications links to forward-deployed and rear-based headquarters and, if need be, to an imagery analyst on the ground with troops.¹¹ Its synthetic aperture radar and ground moving target indicator are able to produce high resolution, near photo-quality images of a target. This has the potential to give the Defence Force the capability to have an all-weather targeting platform. Combined with guidance provided by coordinates derived from a global positioning system, these new systems potentially enable the Air Force to deliver bombs through cloud and from high altitude, on targets pinpointed by the synthetic aperture radar.

The development of a Space Based Surveillance Capability (JP 2044) will not necessarily involve the acquisition of an Defence-owned satellite system. It is a proposal to update information technology, communications and training infrastructure to support a space-based surveillance capability.¹² This represents the ability to patch into existing satellite surveillance systems and to maintain situational awareness. Space-based surveillance platforms allow wide-area, pervasive surveillance without risk to aircrew. Satellite sensors are becoming more and more advanced, offering global coverage through electro-optical, infra-red, radar and multi-spectral imagery with increasingly fine resolution and the ability to track moving targets on the earth's surface. Improved space-based sensors offer Defence unprecedented intelligence, surveillance and reconnaissance (ISR) capabilities for targeteers in support of commanders and warfighters. Operating from the virtually untouchable 'high ground' of space, surveillance satellites can provide persistent global coverage, assure access into areas denied to other assets and enable worldwide situational awareness.

The final technological factor regards weaponry. Early generation Paveway laser-guided bombs have been held in Air Force inventory since 1985. During the Australian combat contribution to the 2003 War in Iraq—Operation *Falconer*—the Paveway series of bombs were the only weapons employed by the Air Force in the air-to-ground role.¹³ Subsequently, the Bomb Improvement Program (AIR 5409) and Follow-On Stand-Off Weapon (AIR 5418) acquisitions have been aimed at upgrading the Defence Force's air-delivered firepower with integration to emerging aircraft, sensor, and network technology. The future of Air Force targeting lies with precision munitions because they represent economy of

¹¹ Gordon Trowbridge, 'Battlefield Airmen Find Chance to Excel in Thick of Action', *C4ISR Journal*, 13 December 2004; www.isrjournal.com/story.php?F=552957, accessed 8 December 2005.

¹² Defence Materiel Organisation, *Defence Capability Plan 2004–2014*, p. 81.

¹³ Department of Defence, *The War in Iraq: ADF Operations in the Middle East in 2003*, Department of Defence, Canberra, 2004, p. 26.

effort and mitigation against collateral damage. Whereas ‘dumb’ bombs without guidance are still useful against tactical area targets, precision-guided munitions are key weapons for any air force that wishes to have a capability to produce precision effects. A precision weapon allows the use of force to become much more focused, controlled and channelled towards select targets, and thus is more likely to produce the desired effects.

Already underway, the Bomb Improvement Program, is upgrading the existing inventory of Air Force bombs so as to provide an all-weather, autonomous and accurate capability that can be delivered against a broad spectrum of targets.¹⁴ The program involves the addition of a GPS and inertial navigation system kit to a standard munition to enable it to be all-weather capable and highly accurate. Depending on the final configuration, such a kit also enhances the deliverable range of standard munitions—typically 15 nautical miles in standard configuration and up to 40 nautical miles for extended range versions.¹⁵

Follow-on stand-off weapons allow a target to be attacked outside the range of enemy air defences. The Lockheed Martin Joint Air-to-Surface Standoff Missile (JASSM), with a range of over 200 miles (320 km) was selected by the AIR 5418 project to fulfil this role. Despite the substantial military impact follow-on stand-off weapons make, their operation relies on complex and sophisticated targeting data. Hence, they rely on our capability to produce such data for the weapon to operate correctly. The gathering of target data for ‘weaponneering’ relies heavily on our auxiliary intelligence, reconnaissance and surveillance collection capability. Thus, a future air force must not only possess adequate capability to strike, but also the ISR resources to provide weapons and shooters with the relevant information to guarantee delivery accuracy.

Follow-on stand-off weapons heighten the need to develop sophisticated targeting data for precision guided weapons. Mission planning can take hours and, when multiplied by the number of weapons to be delivered, can have a significant impact on a commander’s battle rhythm and tempo of operations. Follow-on stand-off weapons require a vast improvement in the numbers and capabilities of sensors and in data-gathering assets, to reduce further the sensor-to-decision-maker-to-shooter time frame. In this respect, it can be argued that Air Force targeting capabilities are not lacking, but need to be developed further. By developing weaponneering expertise, the Air Force can employ more complex weapons with a higher degree of mastery. This will improve considerably the ability to bring weight of fire on a

¹⁴ Defence Materiel Organisation, *Defence Capability Plan 2004–2014*, p. 29.

¹⁵ Gregor Ferguson, ‘Industry awaits weapons RFTs’, in *Australian Defence Magazine*, Vol. 13, Issue 5, Canberra, May 2005.

target to achieve effects-based targeting, simply because force can be employed more effectively and efficiently.



A RAAF F/A-18 Hornet armed with a GBU-32 (1000 lb JDAM) and a GBU-11 (1000 lb laser-guided bomb), and with a Time/Space Position Information pod on the wing tip during Developmental Test and Evaluation at Woomera.

(Photo: Department of Defence)

Precision weapons thus require an increased level of information and intelligence analysis for their effective use. They can also be employed from increased ranges to a target, which means increased safety for aircrews. These increased weapon employment ranges translate into greater flexibility regarding decisions on the use of offensive air power, since targets normally considered to be beyond our capabilities can be struck with relative impunity. Furthermore, the high tempo of contemporary operations usually means that decisions on the use of precision weapons have to be made in a timely manner. The broader options available for the use of precision weapons, and the requirements for high levels of target intelligence and fast decision-making, pose a challenge for command and control mechanisms in maximising the effect of strike weapons. As more information is available and there is a greater emphasis on getting this information to the shooter as soon as possible, command and control networks should be improved accordingly.

EMERGING GLOBAL SECURITY ENVIRONMENT

A constantly changing global security environment poses significant challenges to the ADF. It faces levels of conflict other than conventional warfare. The ‘spectrum of operations’ that the ADF is likely to be called upon to respond to in the future—namely ‘peace’, ‘operations other than war’, and ‘war’—are likely to be broad and diffuse.¹⁶ Warfighting represents the core of preparation and training, and the purpose and justification for its existence. The skills imparted to personnel when training for high-end warfighting are transferable to other contingencies.¹⁷ These skills allow the ADF to remain flexible in its response to a wide range of possible contingencies. The core purpose of the ADF, of which air power plays a decisive part, remains defending Australia and its interests. Although a war for national survival is unlikely in the foreseeable future, the consequences of defeat in such a high level of conflict would be catastrophic for Australia. Therefore, the ADF remains prepared for a high level of warfare. Conversely, in the foreseeable future, operations other than war are much more likely to occur.¹⁸ High intensity conflict must be hedged against, but it is low intensity conflict that is much more probable. Therefore, the possibility that the ADF will have to contribute to limited interventions, coalition operations and local conflicts will require highly versatile and flexible offensive air power capabilities.

The future is likely to feature the emergence of new and more immediate threats to Australia, of which two major concerns are the proliferation of weapons of mass destruction (WMD) and international terrorism. Australia also recognises its vested interest in helping maintain regional security and stability. The potential threats of the future have placed an increased emphasis on readiness, mobility, interoperability, and enhancement of capabilities within the ADF.¹⁹ Notable examples of potential threats can be readily identified. Since 11 September 2001, the prominence of well-organised international terrorism has emerged. Likewise, the potential of North Korea as a possible flashpoint is recognised, especially with regard to their nuclear aspirations and unwillingness to agree with international conventions governing the proliferation of nuclear weapons.²⁰ Australia shares many interests with the United States, especially with regard to international

¹⁶ Department of Defence, ADDP–D.2—*FORCE 2020*, pp. 8–9. See also Department of Defence, Australian Defence Doctrine Publication–D.3—*Future Warfighting Concept*, Department of Defence, Canberra, 2003, pp. 23–24.

¹⁷ *ibid.*

¹⁸ Department of Defence, ADDP–D.2—*FORCE 2020*, p. 9.

¹⁹ Department of Defence, *Australia’s National Security: A Defence Update 2003*, Department of Defence, Canberra, 2003, p. 6.

²⁰ *ibid.*, p. 8.

terrorism and WMD. It is possible that these shared interests may create a requirement in the future for Australia to participate in a coalition with the United States, and other partners, that require high levels of interoperability. As such, RAAF targeting methods will have to integrate with US joint targeting plans.

Cold War era concepts of conventional strategic deterrence are rapidly becoming superseded by new paradigms. Many nations now regard strategic deterrence against terrorism as a higher priority. Deterrence relies on convincing a terrorist group that the cost of pursuing terrorism outweighs any benefit that they might receive. As a cognitive form of security, it still relies on a visible form of defence if hostile action is pursued. Deterrence against terrorism, therefore, involves developing capabilities that are effective *in combat* against terrorism. Targeting is one of these capabilities and it can be effective in shaping behaviour of terrorist groups if they know that they can be effectively attacked by offensive air power. Air strike has the potential to contribute both physical and psychological inputs that can combine to have a discouraging effect on a terror organisation.

Australia readily identifies itself as an ally in the US War on Terror and is not alone in this stance. The 'International Coalition Against Terror' is a collection of over 60 countries with a shared perception of threat from terrorism.²¹ 'Cooperative regimes' of coalition-minded nations are much more effective at combating terrorism and they necessarily demand 'a balanced application of both civil and military power to shape [the] behavior [sic]' of recalcitrant groups and states.²² Furthermore, cooperation requires a 'whole-of-government' or 'whole-of-nation' approach to security problems involving military, civilian, diplomatic and economic responses to potential security threats. Both ADF and RAAF air power are intrinsically integrated to this whole-of-government approach.²³ Offensive air power represents one tool at the Australian Government's disposal to solve security concerns. If called upon to prosecute the targets of an adversary, air power produces effects that are complementary to whole-of-government strategy and objectives. Likewise, air power is unlikely to be called upon to fulfil security objectives on its own. Political, diplomatic and economic effects have complemented aerial campaigns in the past.

The proliferation of WMD among rogue states and their potential use by terrorist groups signifies a powerful foreshadow to Australia's security. WMD are the ultimate

²¹ *ibid*, p. 13.

²² Edward A. Smith Jr, *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis, and War*, Department of Defense Command and Control Research Program, Washington DC, 2002, p. xiii.

²³ Department of Defence, *Australia's National Security: A Defence Update 2003*, p. 13.

asymmetric threat, whereby weaker states can defy international norms and terrorists have the potential to strike unilaterally.²⁴ Globally, the incidence of ‘asymmetric warfare’ is increasing. Asymmetric warfare is a function of capability versus will. Developed nations usually possess technologically sophisticated weaponry, high levels of training and a well-developed capability to fight conventional wars against a similarly equipped enemy. Extremist, interest-motivated groups usually lack the sophisticated weaponry, but characteristically have a disproportionately high willpower to carry out violence in the name of their cause. It is this willpower that offsets and partially neutralises conventional capability.

When such a disparity of military power exists, it is difficult to apply parity-based Cold War principles of deterrence. The strategies and tactics employed by potential adversaries, such as terrorists and rogue states, differ from the models developed by the Soviets prior to 1991. Until recent years, it was this conventional-style threat that developed militaries trained to respond against. Asymmetric adversaries of the future, therefore, are expected to employ strategies to affect the non-military vulnerabilities of developed nations—public opinion, government policy, national tolerance for casualties, concern for collateral damage, coalition and alliance relations, and economies of scale.²⁵ The Australian Government recognises the nature of such threats and the changes needed in the force structure of the ADF to combat them effectively. Hence, the ADF strives towards a capability where it can effectively respond if called upon to stop proliferation of WMD in rogue states, or to neutralise the activity of terrorist groups—whether alone or in support of an international coalition.²⁶

... our strategic circumstances have changed and this has implications for the types of conflict in which Australia might become involved, the types of operations the ADF might have to conduct, and the capabilities it might require.²⁷

Such contingencies highlight the need for flexibility and adaptability of air power to respond to expected threats.²⁸ The use of force represents a major portion of the ADF’s capability to defeat asymmetric threats. With this in mind, the ability to target an asymmetric opponent and strike at them from the air should be a capability that is developed in conjunction with other capabilities. Effects can be

²⁴ *ibid*, p. 15.

²⁵ Abbot, ‘Air Power Strategy and the Problem of Coercion’, pp. 27–28.

²⁶ Department of Defence, *Australia’s National Security: A Defence Update 2003*, pp. 16 and 23.

²⁷ *ibid*, p. 24.

²⁸ *ibid*, p. 9.

achieved by offensive air power that can shape adversary behaviour. Moreover, these desired effects can only really be achieved by well-developed targeting methods that take into account a unique adversary target system. As such, it is argued here that the development of effects-based targeting for offensive air power is a critical requirement for fighting an asymmetric opponent.

Development of RAAF effects-based targeting can be achieved by understanding its application and appreciating the contribution advanced technology makes to air power. The adoption of improved targeting procedures was identified as one of the 'lessons learned' from the Australian involvement in the War in Iraq in 2003.²⁹ Furthermore, the potentially asymmetric nature of future security challenges can be more effectively neutralised by the adoption of effects-based methodology by the ADF. The effects-based approach to conflict warrants further development, especially given the propensity of asymmetric warfare.

The more symmetric the means and will of the adversaries are, the more likely they are to be drawn into a fundamentally attrition-based conflict that continues until one or the other contestant's means and/or will are exhausted. The more asymmetric the means and will of the opponents are, the more likely they are to take a more effects-based approach (for example, centred on a damage infliction strategy in a protracted low-intensity conflict) of which terrorism must be considered a form.³⁰

The effects of an adversary mentioned above are primarily psychological and terror based, relying on public reactions of confusion, outrage and impotence in order to lower the will of a nation to take a stance against them. The utility of an effects-based approach is that it utilises the same methodology (not means) as an asymmetric adversary and seeks to undermine their own will and therefore presents a much greater range of responsive options to decision-makers when confronting asymmetric threats.

EMERGING CONCEPTS OF FUTURE WARFARE

'Effects-Based Operations' (EBO) and 'Network Centric Warfare' (NCW) are cornerstones of the way in which the ADF expects to fulfil its strategic objectives in the future. In a military sense, effects-based operations involve the application of military capability, not necessarily force, to realise a desired operational outcome

²⁹ Department of Defence, *The War in Iraq: ADF Operations in the Middle East in 2003*, p. 28.

³⁰ Smith, *Effects Based Operations*, p. 42.

according to national strategy and the commander's objectives. ADDP-D.3—*Future Warfighting Concept* expands on the meaning of effects-based operations:

EBO is defined as the application of military and non-military capabilities to realise specific and desired strategic and operational outcomes in peace, tension, conflict and post-conflict situations.³¹

The effects-based operations concept is not a recent development. The key to contemporary effects-based operations is that new capabilities permit new methods to be employed and a whole-of-government solution may be needed to reach what was once perceived as wholly military objectives.

Effects-based operations are not new. Good generals, admirals, and statesmen have focused on using military forces to shape the behavior [sic] of friends and foes for centuries. What is new is the potential application of network-centric thinking and capabilities to such operations.³²

Network centric warfare is achieved through the linking of different elements of the ADF to conduct warfare more effectively.

At its core, NCW seeks to provide the future force with the ability to generate tempo, precision and combat power through shared situational awareness, clear procedures, and the information connectivity needed to synchronise our actions to meet the commander's intent.³³

In a nutshell, network centric warfare is an enhancer of existing capabilities. Moreover, network centric warfare is 'the concept of linking all aspects of warfighting into a shared situation awareness and shared understanding of command intent so as to achieve a unity and synchronicity of effects that multiplies the power of military forces'.³⁴

The combination of effects-based operations and network centric warfare will influence the way the ADF thinks about conflict and its development of capability in the future.³⁵ There are three major influences. Firstly, the application of new technologies to existing forces, doctrine, tactics, concepts, training and organisational structures promises to enhance capability. Secondly, the adaptation

³¹ Department of Defence, ADDP-D.3—*Future Warfighting Concept*, p. 12.

³² Smith, *Effects Based Operations*, pp. 1–2.

³³ Department of Defence, ADDP-D.3—*Future Warfighting Concept*, p. 29.

³⁴ Smith, *Effects Based Operations*, p. 61.

³⁵ Department of Defence, ADDP-D.3—*Future Warfighting Concept*, p. 3.

of doctrine, tactics and improved organisation can optimise the impact of new and future technologies. Thirdly, the application of new technology and adoption of new concepts can improve the ADF's capability to conduct modern-style warfare.³⁶ All of these elements should have a significant impact on our thinking of targeting and the development of future targeting capabilities.

At this juncture, it is important to note that network centric warfare and effects-based operations are not substitutes for military force—they can serve to enhance the effectiveness and impact of military force in a given tactical, operational or strategic context.³⁷ The success of effects-based operations depends on results achieved, rather than the innovation of the means used. That is, if traditional application of force is the best means to achieve the effects sought, then it is counterproductive to think 'outside the square' in order to find a non-martial military solution. Conversely, adhering to 'conventional' modes of operation because they have worked in the past may also be inefficient.

In essence, effects-based operations are about eroding an adversary's will to fight, rather than destroying his means of fighting. In this vein, it can be argued that the primary purpose of effects-based operations is to avoid traditional attrition-based warfare that generates 'unavoidable' casualties in a trade-off for a solely quantitative advantage over an enemy.

... the focus on means that is typical of a symmetric conflict produces what is essentially an attrition-based approach to warfare centered [sic] on attacking physical targets, usually to meet military objectives and usually to produce quantifiable results. This does not mean that the result is a pure attrition approach in which the only thing that matters is the destruction of forces and capabilities. Such attacks certainly may have psychological impacts in the manner of effects-based operations. The distinction is that in attrition-based operations, these impacts are usually a by-product of the attack, rather than its purpose.³⁸

Modern military forces, in particular air forces, are increasingly highly technical, exponentially expensive and the tendency in their employment is to try and achieve more with less. The traditional and conventional approach to warfare is largely attrition-based and focused on the destruction of an opponent's physical capacity to wage war. Modern air forces can scarcely afford to suffer anything greater than a

³⁶ Smith, *Effects Based Operations*, p. 64.

³⁷ *ibid*, p. xxxi.

³⁸ *ibid*, p. 42.

low incidence of losses, in both personnel and materiel, and there are inherent lethal risks involved to aircrew in the pursuit of the physical destruction of an adversary.

When force is involved, the success of effects-based operations is not determined by physical destruction alone, but is a product of the interrelationship between physical destruction and psychological processes taking part in minds of targeted human actors, be they national leaders, military personnel or civilians.

EBO seeks to defeat an adversary's strategy and resolve instead of merely attriting his armed forces.³⁹

Note that actors may not be targeted directly in a *physical* sense, but through the process of targeting may be influenced in a *psychological* sense. Effects can be applied to influence actors either directly or indirectly, depending on how, when, where and why force is applied to a physical entity.

It can be seen that effects-based operations go beyond the allocation of targets and damage infliction, as military operations are becoming increasingly concerned with the focusing of actions and behaviour, that is, to input a stimulus into an adversary system in order to achieve a desired response. It is recognised by the ADF that effects-based operations are more than a new name for warfare:

From the military perspective, effects-based operations is [sic] more than just targeting and destroying an adversary's capacity to fight, but it also includes these aspects of warfare.⁴⁰

The principles of effects-based operations are applicable to conventional types of conflict as well as military operations short of combat. The emphasis in this work is to explore those kinetic applications of force, through offensive air power, that can contribute to an effects-based operation. It also recognises closely related fields that can enhance effects created by the use of force, such as electronic warfare or psychological/information operations.

The effects-based approach to warfighting has radical implications for the future of targeting. The combination of 'effects' and enhanced networking means greater emphasis is placed on the capability of the ADF to absorb battlespace information, analyse it, and disseminate intelligence. If done properly, the ADF has the potential to have greatly enhanced situational awareness. Further, accurate analysis of adversary target systems can produce solutions that maximise effect.

³⁹ Department of Defence, ADDP-D.2—*FORCE 2020*, p. 22.

⁴⁰ Department of Defence, ADDP-D.3—*Future Warfighting Concept*, p. 12.

... new information technologies are enabling us to know an adversary and his centres of gravity better than in the past.⁴¹

In the modern age, advanced technology and sophisticated target knowledge allow the precise application of military power to specific critical vulnerabilities, as opposed to brute force dispensed indiscriminately. With the ability to selectively target, combined with an in-depth knowledge of adversary target systems, the air force can look beyond fielded military forces, headquarters and bases as potential aim points. This is not to say that they are automatically null and void for the purposes of target selection; on the contrary, targets should be selected on the basis of greatest 'positive' impact on the will of an adversary.

In essence, although the warfare decisions that emerge from an effects-based thought process may still be denominated in terms of targets or forces and capabilities to be destroyed, the core of the approach is not the destruction of targets, but an action-reaction cycle in which success is defined by the behavior [sic] produced.⁴²

With this said, it must be noted that the use of force on the wrong target can have a 'negative' impact on the will or behaviour of an adversary. It is widely acknowledged that the targeting of British cities by the *Luftwaffe*, during the Blitz of 1940–41, served to fortify the resolve of the British people to resist subjugation by Nazi Germany.⁴³

It is argued, therefore, that targeting is at the heart of effects-based operations involving the use of force.

EBO means knowing what targets to select for maximum results in achievement of our national objectives.⁴⁴

This is the crux of effects-based operations. It is highly dependent upon national objectives, an over-arching strategy and what the commander is trying to achieve within policy guidelines. Effects-based operations are a function of quality over quantity, that is, the point at which an effect can be achieved that will successfully shape the battlespace according to the ADF's strategic purpose. As such, 'effects-based targeting' is a function of effects-based operations, which in itself is a

⁴¹ Department of Defence, ADDP-D.2—*FORCE 2020*, p. 22.

⁴² Smith, *Effects Based Operations*, p. 47.

⁴³ For example, see Budiansky, *Air Power*, pp. 242–243.

⁴⁴ Department of Defence, ADDP-D.2—*FORCE 2020*, p. 22.

capability of the ADF, which is a single component within the Australian whole-of-government approach.

Effects-based targeting is especially relevant to the application of offensive air power. In the future use of air power, the well-worn responses pertaining to the use of force in the past, must be avoided. That is, a display of precision strike may be technologically impressive, but it is of little use in shaping the disposition of an opponent unless the targets hold enough importance to an adversary, in order to have the desired positive effect.

ORGANISATIONAL DYNAMICS

The future of the ADF promises to be highly dynamic, as the combination of advanced technology and new warfighting models change our approach to warfighting. The ability to be flexible, adaptive and versatile is necessary to stay ahead of emerging security issues that pose new and, as yet, unmapped challenges. Air power, especially, may be tasked in roles that require greater flexibility in deliberate strike and the prosecution of ground targets. In order to meet a commander's objectives, the RAAF will be required to have the capability to change rapidly with the strategic environment, to adapt and to create its own opportunities.

An effects-based approach poses a challenge to the future use of air power. The key is to develop doctrine, organisations and strategies that 'optimize emerging technologies or that incorporate them into new concepts of warfare that better adapt our capabilities to the changing security environment'.⁴⁵ In doing so, the RAAF can better adapt its capabilities to meet future security requirements. Future events are unable to be predicted or foreseen with any accuracy, but preparedness for a broad spectrum of contingencies is probably the best option in order to meet security challenges with a degree of dynamism. Given the future security environment and development of technology in military applications, the function of effects-based targeting offers a flexible and dynamic solution to achieving objectives with the use of force. Therefore, the methodology of effects-based targeting deserves further investigation of its evolution as a warfighting concept from past experience and its potential for future application in the RAAF.

⁴⁵ Smith, *Effects Based Operations*, pp. 74–75.

Chapter Two

'Fire for Effect': Effects-Based Targeting

In times of conflict, the underlying rationale of effects-based operations is to threaten or administer some form of punishment, or offer some inducement. It is intended to be the stimulus that will motivate the recipient towards a particular course of action or behaviour. ADDP-D.3—*Future Warfighting Concept* calls the overall effect of this as creating a dilemma—whereby an adversary is faced with undesirable choices as a consequence of our action.¹ In essence, the conceptual objectives of effects-based targeting are to shape the environment and erode an opponent's will to continue with a fight. The challenge for effects-based targeting is in selecting the correct target set and matching it with an optimal amount of force, to produce the correct stimuli that will produce the reaction we seek in an adversary. For the RAAF, the use of weapons with a kinetic effect is the primary means to affect an adversary target system and is likely to remain so in the foreseeable future. This is not to say that more non-kinetic options will not be available in the future, but kinetic effects currently remain the basis of the decision to use air power in the application of force. A decision-maker may have no other choice than to destroy, degrade and erode the capabilities of an adversary, for it forecloses to them any courses of action that depended on their use, and thus limits the options they may pursue.²

Notice that the action involved may be the same in both cases: blowing something up. Only now we are considering what the impact of that target's destruction will have on the enemy will and psychology and not just on his physical capabilities. Logically, the more significant the action, the greater impact the stimulus will have on the enemy decisions and ultimate behavior [sic].³

Destruction and attrition are not the 'be-all and end-all' of aims in military conflict. It is arguably more important to consider the cognitive and psychological effects

¹ Department of Defence, Australian Defence Doctrine Publication-D.3—*Future Warfighting Concept*, Department of Defence, Canberra, 2003, p. 24.

² Edward A. Smith Jr, *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis, and War*, Department of Defense Command and Control Research Program, Washington DC, 2002, p. 113.

³ *ibid*, p. 117.

of striking at adversary target systems within the context of the end-state that is being pursued.

Effects can be defined as physical, functional or psychological outcomes, events or consequences that result from specific military or non-military actions at the tactical, operational or strategic level.⁴ Effect, as a target planning term, refers to the impact of a particular target's damage or destruction upon some larger operational or strategic dimension. In this context, there is a direct impact of physical damage and also that of a chain of successive events or indirect impacts that arise from the direct impact.⁵ Current nodal targeting efforts identify the potential nodes in this chain or cascade of subsequent indirect events and then exploit them. This is the basis of 'Target Systems Analysis' or 'Systems Thinking'. Systems Thinking means that targeting solutions can be assessed for their immediate impact as well as consequential effects that such an attack may produce. It requires a deeper understanding of adversary systems-infrastructure, their reasoning and perspectives.⁶ Non-kinetic effects, generated through means such as information and psychological warfare operations, can create similar outcomes, but are generally not as well developed as physical effects. Other types of non-kinetic means include military manoeuvre, economic sanctions and diplomatic pressure, and necessitate a whole-of-government approach to effects-based targeting.

The optimal outcome for effects-based targeting is the creation of synergistic effects that are holistic in nature. This means that for each strike against a node, each physical and psychological effect causes a chain reaction that has a combined effect that is greater than the individual effects added together. The holistic nature stems from the effect on an adversary system as a whole—the end-state is more important than viewing effects at the nodal and target-set level. The implication here is that a single physical attack on a selected adversary node can produce whole-of-system psychological or cognitive effects. The chain of events depicted in Figure 2–1 (below) is 'stove-piped', two-dimensional and rather abstract. By necessity, systems thinking should ultimately be thought of as a complex three-dimensional picture of an adversary system.

⁴ Department of Defence, ADDP–D.3—*Future Warfighting Concept*, p. 11.

⁵ Smith, *Effects Based Operations*, pp. 110–111.

⁶ Department of Defence, ADDP–D.3—*Future Warfighting Concept*, p. 12.

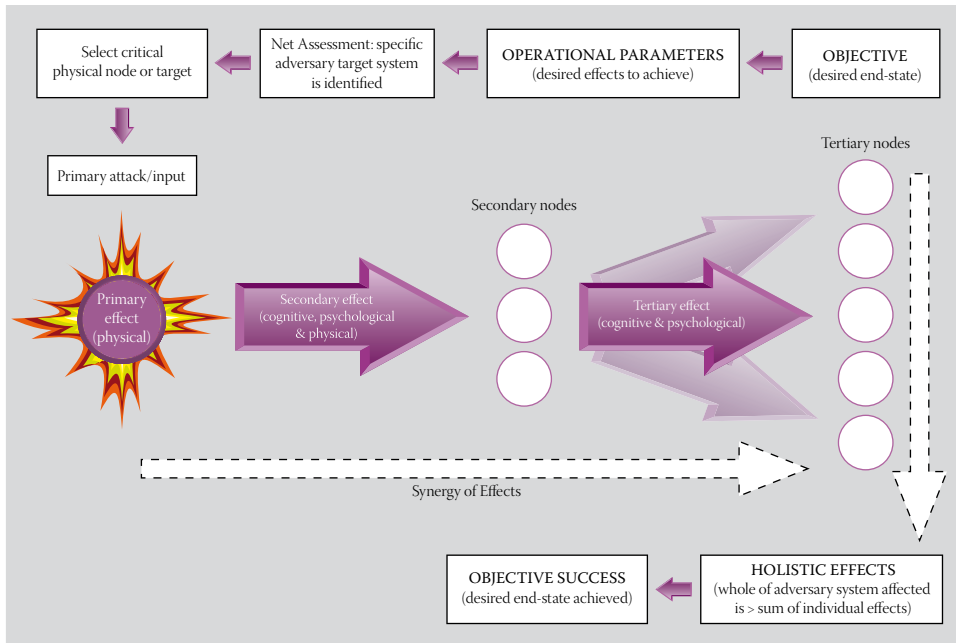


Figure 2-1: Chain of indirect impacts from nodal targeting

Targeting effects can be viewed on an x- and y-axis. The x-axis is the synergy of effects. Striking at a single node can create a chain of events that cascades beyond physical destruction and has cognitive knock-on effects. The difficulty is in identifying which node to strike to produce the desired results. The y-axis is the holistic view of effects. The prosecution of a target can permeate beyond visible barriers and affect an adversary system as a whole—thereby having an effect on overall system stability.

At this point, it is important to describe some more of the terminology for effects-based targeting. The intent is to establish terms that describe the effects sought in targeting specific nodes or aim points. Certain effects are highly attrition-centric and rely mostly on some sort of physical damage in order to achieve an outcome. Highly attrition-centric effects occupy the ‘high-level-warfare’ end of the spectrum and tend to be directed towards a clearly defined enemy. Any psychological effects from attrition-centric attacks are usually secondary and not the primary intention. Other effects are less attrition-centric and, although they still involve the use of force, the primary outcome sought is cognitive or psychological. They include warlike operations such as coercive diplomacy and peace enforcement. Less attrition-centric effects are largely derived from the lessons of conflict since the end of the Cold War, such as Operation *Desert Storm* and Operation *Allied Force*. Occupying the middle ground are traditional or conventional effects, which

correspond with a roughly equal mix of physical and psychological outcomes. Medium attrition-centric effects are ‘traditional’ or ‘conventional’ because they are methodologies on the use of force developed from the Cold War. An example of a conventional effect would be *deterrence*.

ACTION–EFFECT–REACTION CYCLE

Actions in the battlespace produce effects.⁷ An *action* is the exertion of force, real or implied; an input or influence; or stimulus; or manoeuvre; or demonstration of capability or intent. Targeting is mostly concerned with the exertion of force. An *effect* is a physical, functional or psychological outcome that results from an action.⁸ A *reaction* is a reciprocal action, in a manner corresponding to an imputed action or stimulus; or reflex—an unplanned or irrational reciprocal action. A *response* is a reciprocal behaviour, in a manner corresponding to an imputed action or stimulus, and has a tendency to be planned and/or rational. The key to the action-effect-reaction cycle is to force an adversary to make decisions and conduct reciprocal actions that are unplanned. The aim is to keep the initiative—to respond, not react—and make informed rational decisions.

Actor model

The way we view an ‘enemy’ needs to be updated. Warfare in the modern era has moved away from the traditional national ‘enemy’ threats that were characteristic of the Cold War and wars of national survival such as World War II. This is not to say that the traditional ‘enemy’ is no longer valid as a potential threat, but the need to recognise other forms is readily apparent given the rationale behind effects-based operations. Thus, we have an ‘Actor Model’ that acknowledges the existence of a variety of threats, be they an independent militaristic force, a terrorist organisation, or a nation-state. There are different types of target sets that air power can seek effects against, depending on the circumstances and therefore it is important to define the type of ‘enemy’ we face. Definitions such as ‘opponent’ or ‘adversary’ are useful descriptors of an ‘enemy’ that is not a high-end state-based threat. Such a distinction is necessary in an era of increased incidence of asymmetric warfare. It is important to break away from traditional ‘enemy’ models in effects-based targeting.

⁷ Australian Defence Force, *Effects Based Operations Discussion Paper*, Directorate of Future Warfighting Concepts, Canberra, 2003, p. 15.

⁸ *ibid*, p. 12.

Use of the term *enemy* implies an overtly hostile nation-state with intention, and the capability, of inflicting harm on friendly forces or interests. An enemy also implies a heightened level of conflict, such as regional war, general war or war of national survival. An *adversary* is a party that is acknowledged as being probably hostile to a friendly party and against which the use of force may be envisaged. An *opponent* or *adversary* has security interests that compete with our own and would hold a demonstrated willingness to escalate conflict continually if it suited their purpose. An opponent or adversary implies a low-to-medium level of conflict, such as a 'Cold War' situation, a terrorist threat, a coalition operation against a localised recalcitrant regime, or a limited intervention to restore order. For the purposes of this discussion, the terms 'adversary' and 'opponent' are interchangeable and more widely used than 'enemy'. While the possibility of a future enemy of Australia is recognised, the probability of involvement in a lesser conflict is much greater. Thus the term 'enemy' is used sparingly.

Adversaries, opponents and enemies are not the only actors that must be considered in effects-based targeting. Other actors that have an influence on the way we conduct targeting are *friends* and *neutrals*. A 'friendly' actor is usually another state that has strongly allied national security interests. Typical examples would be the United States of America, Great Britain, New Zealand and Canada, but could also include regional partners such as Indonesia, Malaysia, the Philippines and Singapore. It depends on the security environment and the circumstances surrounding it. A friend would have a direct, strong influence on our practise of effects-based targeting if they were a partner in a mutual coalition operation. Friendly nations usually have their own rules of engagement, their own interpretations of the law of armed conflict and their own desired end-states. A neutral actor is a third party that has an indirect degree of influence on the way we conduct effects-based targeting. A typical neutral actor may be a nation-state, the media or an organisation. Other states form their own opinions of our actions—often targeting has to be conducted with world opinion in mind. The media reports on what it perceives to be a 'story', which serves to shape world and domestic opinion. Organisations such as the Red Cross and *Médecins sans Frontières* are often involved in all forms of conflict, and also serve to shape opinion. The acknowledgment of neutrals helps to understand how the rest of the world and our own population perceive our targeting operations. Although the prosecution of a target may be within the boundaries of the law of armed conflict, it may not be well perceived by neutral actors.

The 'actor model' can be considered dynamic and movement within its scope is possible. Operations against an opponent may produce a positive outcome and the level of conflict becomes less acute. For example, diplomatic dialogue may diffuse a medium level conflict situation to produce a set of accords acceptable to

all parties. A former opponent may not be fully trusted, but is no longer considered to be a threat to security. Likewise, a former friend may become neutral, or a neutral may become an enemy according to the security environment. Large shifts are unlikely, but history has taught us that change is to be expected.

TARGETING EFFECTS

Targeting is an integral and vital element of air operations, and accurate, timely targeting information must be provided to deployed air forces through a dynamic and responsive system of deployed capabilities and connectivity to national intelligence and targeting resources.⁹

The first step in the effects-based target planning process is to determine the effects sought before actual target sets are selected. Effects are chosen to correspond with a commander's strategic objectives, a desired end-state and the type of adversary. The effects sought may be physical or psychological, or a combination of both. The basis of effects-based targeting is that targets should be carefully selected, to produce the desired effect on an opponent. The effects of prosecuting a target are not uniform across all strata of an adversary system.

Physical effects

Destruction

Destruction is the effect of destroying an opponent's physical capability to do something. 'Destruction' of a capability is the underlying principle of targeting. The physical effect of 'destruction' is not dependent on a psychological effect, but the reverse is not true—a psychological targeting effect is mostly dependent on some form of destruction. Therefore, 'destruction' may be successful regardless of whether it produces a psychological effect. Although it may not affect an adversary's will, it has an enduring validity because the physical elimination of an opposing force is definitive—it no longer poses a threat. Destruction is a means to an end and an enabler of psychological effects. It can change decisions, produce shock and chaos, and wear down resistance.¹⁰ The levels of damage required to achieve 'destruction' imply a short, large-scale air campaign against a wide matrix of targets, which is physically beyond the capabilities of all but very large air forces.

⁹ AAP 1000-D—*The Air Power Manual* (Commonwealth of Australia, 2007), 5th Edition, p. 121.

¹⁰ Smith, *Effects Based Operations*, pp. 257–258.

Physical attrition

Physical attrition is the effect of wearing down the capabilities of an adversary over a series of operations. 'Attrition' is similar to 'destruction', but takes into account the time scale required to produce a result and the possibility of an adversary adapting to changing circumstances. The outcome is more likely to be adversary weariness and unwillingness to continue, rather than sudden collapse.¹¹ Typical types of physical attrition include:

- *Degradation* – to inflict high levels of damage to enemy fielded forces, capabilities and/or supporting infrastructure, with the aim of achieving a direct influence on military operations.
- *Disruption* – to interfere with the continuity of enemy military operations. A typical target set for disruption includes command and control nodes.
- *Interdiction* – to damage or delay an enemy force before it can enter the battlespace and be effectively brought to bear. Interdiction type targets may be static or mobile and typically involve lines of communication. Target types include, but are not limited to, roads, railways, bridges and/or transport capability.
- *Neutralisation* – to damage a set of targets to an extent as to render a capability or node ineffective for a period of time, depending on how long it will take to replace or repair it.

Chaos

Chaos is an effect that is both physical and psychological in nature. It is intended to render an opponent unable to react coherently, or to control their forces. Adversary decision-makers are temporarily unable to command their forces and therefore less able to deploy capabilities.¹² Chaos is 'disruption' on a less forceful scale and needs to be carefully controlled, so as not to produce a negative effect on an opponent where their reaction is highly unpredictable. The intent is to interrupt temporarily the ability of an adversary to employ a capability. Chaos affects the intentions of an adversary, whether the capability has to do with government, national information infrastructure, military, economic activities or social framework—it is an action and reaction type effect.

¹¹ *ibid*, pp. 258–259.

¹² *ibid*, p. 260.

Psychological effects

Foreclosure

Foreclosure is an effect that curtails an opponent's options or hinders potential courses of action. It is achieved through the damage of a particular capability or rendering it unusable in a given situation. Foreclosure is temporary and may be active or passive. Active foreclosure involves the use of military force to block a course of action an opponent has initiated. Passive foreclosure brings to bear an array of capabilities to prevent a destabilising course of action. Success is dependent on the relative capability of an adversary and convincing them of the strength of friendly capabilities.¹³ Typical types of foreclosure include:

- *Containment* – to halt the military manoeuvre of an opponent and cause them to centre activity in a given geographical area. It requires a physical, friendly element either to block or manoeuvre, with a demonstrated willingness to resort to force if need be. The friendly element is a physical input and the demonstrated willingness is a psychological input, and both combine to have restrictive effect.
- *Deterrence* – to convince an opponent that the pursuit of particular course of action would result in an end-state for which the cost to the opponent would outweigh its benefits:

Deterrence can be defined as the utilization of implicit or explicit contingent threats to persuade an actor to refrain from a specific course of action based on the actor's calculation of its rational self-interest.¹⁴

Or to put it another way: 'Deterrence involves changing the enemy's expectations about what war will be like so they will choose not to attack'.¹⁵ It requires the presence of a visible, friendly element as a counterweight to opposing elements and a demonstrated willingness to resort to forceful action. In other words, 'to be successful, a deterrent threat must be credible and sufficient'.¹⁶ Both physical and psychological inputs combine to have a discouraging effect on an opponent.

¹³ *ibid*, pp. 261–262.

¹⁴ Spencer Abbot, 'Air Power Strategy and the Problem of Coercion', in Stephen D. Wrage (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, p. 25.

¹⁵ Dr Karl Mueller, 'The Essence of Coercive Air Power: A Primer for Military Strategists', in *Air Power Review*, Vol. 4, No. 3, Autumn, RAF Information Media Training and Technical Publications, London, 2001, p. 56.

¹⁶ Abbot, 'Air Power Strategy and the Problem of Coercion', p. 25.

- *Denial* – to prevent an opponent from using a designated capability and thus is intended to make an adversary's objectives unachievable:

Denial involves changing the enemy's behavior [sic] by making the undesired course of action appear pointless, either through actually reducing the enemy's ability to carry it out successfully, or by persuading the enemy that it lacks the ability to succeed.¹⁷

Again, it requires the presence of a physical, friendly element that can psychologically push the price of defiance for an opponent upwards, so that it is greater than compliance. The synergy of physical and psychological effects results in the negation of an opponent's ability to resist change in a given direction.

Shock

Shock is induced in order to create a situation where an adversary can neither interfere with friendly operations, nor effectively develop their own. Shock produces vulnerability within an adversary's belief system, which leads to a condition where they are unable to function in a way that fulfils their own objectives.¹⁸ Shock is an effect that centres on the sudden collapse of a foe's belief in their ability to produce an acceptable outcome in a given situation. It is induced by constant surprise through controlling the tempo of operations, or by orchestrating unexpected failures in an opponent's plans. Tempo can be defined as the rate of operations relative to that of the enemy.¹⁹ Shock forces an opponent to cede initiative to the initiator of actions. Furthermore, shock is harder to produce on an adversary with a highly trained military.²⁰

Shock is a product of 'getting inside the OODA loop'. The OODA loop is a concept that was developed in the late 1960s by (then) Major John R. Boyd and stands for Observe, Orient, Decide and Act. It was originally developed as a diagram to instruct new fighter pilots on how to direct their own energies to defeat enemy aircraft and survive aerial combat. Boyd argued that all engagements of opposing forces can be divided into four essential elements: observe and interpret the situation; become oriented to the condition and intensity of the situation; make a decision as to what response to make; and put that response into action.

¹⁷ Mueller, 'The Essence of Coercive Air Power', p. 47.

¹⁸ Department of Defence, ADDP-D.3—*Future Warfighting Concept*, p. 24.

¹⁹ Royal Australian Air Force, *The Air Power Manual*, p. 91.

²⁰ Smith, *Effects Based Operations*, p. 264.

The key is to obscure your intentions and make them unpredictable to your opponent while you simultaneously clarify his intentions. That is, operate at a faster tempo to generate rapidly changing conditions that inhibit your opponent from adapting or reacting to those changes and that suppress or destroy his awareness. Thus, a ‘hodge-podge’ of confusion and disorder occur to cause him to over- or under-react to conditions or activities that appear to be uncertain, ambiguous, or incomprehensible.²¹

Control is a typical type of shock, which is to direct or manage an adversary’s use of an area, or time, or tempo of operations. Typical types of control, as subsets of shock, are as follows:

- *Lock out* – to prevent a coherent response from an adversary, to cease effective military planning for a designated period of time, through the ‘swarming’ of attacks on an opponent’s capabilities and the pervasive nature of friendly capabilities.

In essence, we provide so many stimuli that adversaries can no longer act coherently, but would be constantly forced to recycle their decisionmaking. Repeated often enough, the stimuli applied to the enemy decisionmakers could result in an almost catatonic inability to act: a lock out.²²

A flexible target planning process and demonstration of an ability to change targets rapidly may convince an adversary that counter-plans are futile because they cannot ‘cover all bases’.

- *Overwhelming pace* – to create such a high tempo of operations that an adversary does not have sufficient time to recover before new strikes are made. Conversely, a slow tempo may be chosen, such that friendly forces have time to recover while another effect is chosen to tie an opponent’s forces down. The essential element is control of the pace of operations such that ownership of the initiative is maintained.

Psychological attrition

Psychological attrition is an effect that is the product of the gradual erosion of an opponent’s will.²³ The key to psychological attrition is in ‘engineering’ alternative paths for an adversary to follow. The opponent gradually becomes convinced that

²¹ Harry Hillaker, ‘Tribute to John R. Boyd’, in *Code One Magazine*, Lockheed Martin, Bethesda MD, July 1997.

²² Smith, *Effects Based Operations*, p. 133.

²³ *ibid*, p. 265.

the only satisfactory outcome that can be achieved is by following the alternative path. It is based on the growing belief of an opponent that their capabilities will be to no avail.²⁴ Psychological attrition relies on making the cost for specific types of adversary actions too high to be considered and guiding them towards a more acceptable outcome.

Typical types of psychological attrition are as follows:

- *Coercion* – to compel an adversary to adopt a particular course of action, which is contrary to their interests, through the threat of overwhelming force:

Coercion is an effort to cause an actor to undertake a given course of action by manipulating the actor's incentive structure and decision-making processes through either the threat or the use of force.²⁵

Coercion does not necessarily require a highly visible physical presence and the threat of the use of force can be applied against a select array of target sets that hold some psychological value to an adversary.

- *Deception* – to confuse an adversary by concealing or disguising intentions. An example of targeting deception was the decision to preserve the secrecy of Normandy as the intended Allied invasion area of Europe in World War II. In the lead-up before 5 June 1944, fighter-bombers struck at radar installations and the Seine River railway bridges in the vicinity of Calais—'to mislead the enemy, two targets outside the assault area were attacked for every one inside'.²⁶ Such a gambit had limited direct effect in disrupting command and control, or interdicting lines of communication in the actually intended battlespace, but the effect was to keep the German planners guessing as to where the actual invasion location would be.
- *Influence* – to sway or induce a desired response from an adversary. Influence is similar to coercion, but does not necessarily need a threat of the use of force, but may involve the demonstration of such a capability.

There is an interaction between threat-based deterrence and coercive strategies. Deterrence seeks to inhibit undesired actions and coercion attempts to compel desired actions. Deterrence and coercion require a very high level of control,

²⁴ *ibid.*

²⁵ Abbot, 'Air Power Strategy and the Problem of Coercion', p. 25.

²⁶ John Herington, *Australia in the War of 1939–1945 – Series Three – Air – Volume IV – Air Power Over Europe 1944–1945*, Australian War Memorial, Canberra, 1963, pp. 32–33.

substantial resources, extensive feedback mechanisms for evaluating effectiveness, and the ability to respond to the reactions of a targeted actor. As part of a coercion strategy, air power should have limited objectives and be flexible enough to be able to modify its methods ‘on the fly’.

Dr Karl Mueller outlines three requirements for coercion that are just as applicable to other types of psychological effects. They are *credibility*, *capability* and *communication*. Credibility refers to the fact that a threat of the use of force will only have a positive effect if the adversary believes that the threat will be carried out if compliance is not forthcoming. Capability refers to the ability to carry out a threat and if it is in doubt, a demonstration of capability may be called for. Communication refers to the fact that demands and threats must be properly conveyed in order to be effective, that is, what is expected of an adversary and what will happen if there is no compliance.²⁷

ADVERSARY SYSTEM

A system is an organisation that contains a number of separate elements that have both a relationship with each other and combine to have a common purpose. The reasoning behind creating cognitive effects on a system is that a change exerted on one element will have effects on other elements.²⁸ The ‘adversary system’ refers to the ‘environment’, ‘surroundings’, ‘circumstances’ and/or ‘region’ of the adversary. Understanding the adversary system requires study of the association of those organic elements that make up the environment as a whole. It is also concerned with the mechanisms and interrelationships that exist between these elements. ADDP–D.3—*Future Warfighting Concept* states that to create an effect that changes adversary decision-making (a dilemma) we must have a deep understanding of the adversary, their goals and capabilities.²⁹ The converse side of this is to pose dilemmas whilst retaining rational decision-making ourselves in time of conflict. Australia and the ADF have good internal mechanisms for remaining rational during times of conflict—we are a democracy with well-established checks and balances and the ADF has a robust command structure that values decentralised and intuitive command decisions.³⁰

²⁷ Mueller, ‘The Essence of Coercive Air Power’, pp. 49–50.

²⁸ Department of Defence, ADDP–D.3—*Future Warfighting Concept*, p. 31.

²⁹ *ibid.*, p. 27.

³⁰ *ibid.*, pp. 31–32.

The actions of an adversary are equally important to our own actions. Targeting for effect should be cognitive—guided by a formal theory of human decision-making that accounts for behavioural factors such as mindset, desperation, fatalism, perceptions and fears. Effects-based target planning should reflect ‘that human reasoning can be highly nonrational with conclusions other than those the same decisionmakers would reach if they were reminded of other objectives and values, or if they were shown alternative ways to make tradeoffs’.³¹ Targeting of an adversary should take into account up-to-date key issues and related variables, plausible reasoning patterns and the possible consequences of an adversary using different reasoning chains. It has already been established that targeting and the resort to striking an adversary’s target systems implies a heightened state of crisis or conflict. In these circumstances, adversary decision-making may not necessarily be rational or reasonable.

It is naturally difficult for humans to accept new information that is inconsistent with their current mindset—it is a feature of human thinking that could exaggerate perceptions of certainty and obstruct conflict-termination overtures.³² An example of such overtures could be targeting for an effect that makes the cost of continuing a conflict too high for an adversary. A narrow mindset may cause an opponent to misinterpret our intentions and continue a conflict despite the cost. This is a dangerous spiral that could eventually escalate a coercive, limited conflict into a war of national survival. Ultimately, peacetime attributes of decision-makers would not necessarily prevail under the stress and desperate circumstances of conflict. Furthermore, adversary military commanders, who see their job as accomplishing missions, or who might be operating with low situational awareness, might be unwilling to bend in their decisions, or step back a moment for breathing space.

All things considered, *historical and psychological evidence on decisionmaking is sobering rather than encouraging when one considers the stakes*. Avoiding crises is a sound policy.³³

In times of conflict, the natural language of discussion and decision may be impractical. Decision-makers cannot always maintain a high degree of rationality while sorting out what information is important enough to act upon. There are a number of factors that point towards an adversary having a propensity for negative

³¹ Paul K. Davis, *Studying First-Strike Stability with Knowledge-Based Models of Human Decisionmaking*, RAND/UCLA Center for the Study of Soviet International Behavior, Santa Monica CA, 1989, p. v.

³² *ibid*, p. viii.

³³ *ibid*, p. ix.

reactions to an effects-based approach.³⁴ The equation below (see Figure 2–2) serves to highlight these factors. Starting with the reactive temperament of an adversary that is generally not conducive to external influence, each plus sign signifies other cognitive factors that may be present which push an adversary away from rational reasoning and the intended course of action.

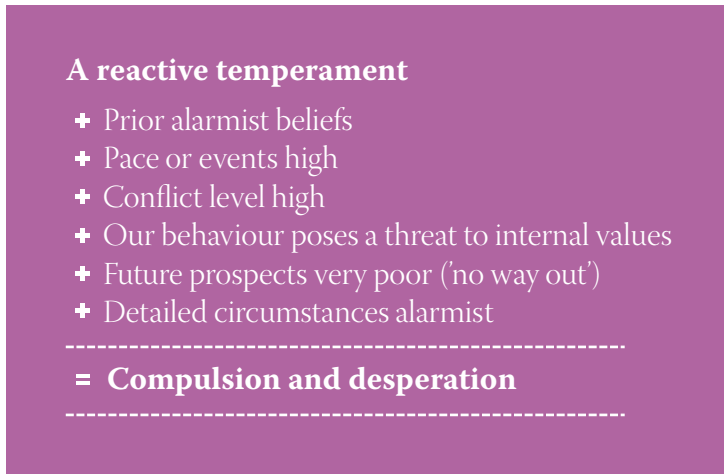


Figure 2–2: The compulsion and desperation equation

The equation shows that as more factors are added, the compulsion and desperation of an adversary grows. With this in mind, it is argued that it is not enough to produce cognitive effects on an adversary system without considering what directions their decision-making process may take.

If circumstances indicate an opponent is predisposed towards compulsion and desperation, some targeting effects, such as *shock* and *chaos*, may need to be controlled carefully, so as not to produce a negative effect on an opponent where their reaction is highly unpredictable or irrational. A decision is rational if it is reasonably consistent with objectives given the information available. Decisions may be irrational because of bad leadership, the overlooking of self-objectives, or through miscalculation. There are a number of variables that can be taken into account when targeting for effect, so as not to produce compulsive and desperate decisions in an adversary.³⁵

³⁴ *ibid.*, p. 19.

³⁵ *ibid.*, pp. 20–21.

- The adversary decision-maker—who or what makes the decisions? It may be an individual, a small cabinet of ministers or advisers, or a larger committee. They may have a history of good or bad decision-making.
- The context of the current situation and its origins may affect decision-making. The level of conflict, whether it is of high or low intensity, will have a direct effect. An adversary may have history of acting decisively and unilaterally, or they may be consensus driven and seek multilateral support before taking action. An opponent's military forces may be weak or strong, or there may be discontent within their ranks. There should be clarity of what is at stake with regard to our own national interests and an adversary's competing interests. National intentions should be communicated clearly and an opponent's intentions clearly understood. Account should also be taken of any alliances in play—our own and the opponent's.
- Given the overall context, prospects should be examined and a targeting strategy decided upon that will best fulfil national objectives.
- Given an overall targeting strategy, capabilities should be examined to ensure that an ability exists to strike at those targets to achieve decisive effects.
- Decisive effects depend on the value those targets hold to an opponent's military, political culture, society and economy.

Rational decision-making is ultimately a function of situational awareness. Better decisions will be made if accurate information is available. The flow of information to a decision-maker is a function of intelligence analysis. A commander cannot personally gather information, process it and analyse it, in addition to conducting a war. Thus, they rely on sufficient intelligence to feed and enhance situational awareness. Given this, it is argued that rational decision-making relies on accurate intelligence. Therein is the argument for improved intelligence support to effects-based targeting. Intelligence analysis of adversary systems can enhance the understanding of adversary decision-making and thus identify targets to produce desired effects that will influence adversary decision-making in the desired direction. Moreover, rational decision-making can be retained in times of heightened tension by situational awareness produced by good intelligence.

TARGETING PARAMETERS

There are many factors to be considered when selecting targets to produce certain effects. What is targeted depends on what the commander's objectives are and what reactions are expected from an adversary. How a target is prosecuted is considered within the scope of available capabilities and how striking it will produce an effect. There are some other important considerations.

Scale of targeting

Scale is an appreciation of the magnitude of force to be applied to a target. It is the sum of the amount of effort required and the size of the impact made. Scale is cumulative—multiple targets may be required to produce a single effect. The more targets that are planned to create effects, the greater the effort and impact that is required.

- The scale of the attack must be conducted according to limits of national rules of engagement, as well as the interpretations of the law of armed conflict, and it must be proportionate.
- The scale should be sufficient to produce the desired effect and subsequent reaction from an adversary.
- The scale must not convey weakness, but confidence in an ability to detect and select targets, and to strike them precisely.³⁶
- Neutrals must be considered—although an attack may be proportional and within the parameters of the law of armed conflict, it may be considered excessive by the international community and media.

The scale of the targeting effort required to produce an effect presents a difficult to determine quantitative variable to the decision-maker when attacking an adversary with air power. As such, *scale* is an integral part of the effects-based target planning 'equation'.

Scope of the target set

A target set can be defined in both a geographical and operational context. Geographic scope defines the physical boundaries (that is, the battlespace) within which an adversary is bound or is vulnerable. Operational scope defines the nature of the battlespace or environment, for example air, sea, land, space and/or electronic, where an adversary might be challenged. Geographic scope constrains where friendly forces can be brought to bear or where geography may pose a

³⁶ Smith, *Effects Based Operations*, p. 241.

challenge to the employment of friendly resources. Operational scope defines what operating environments may be contested by an enemy and be considered hostile. The greater number of warfare environments in which an adversary operates that can be subject to a credible challenge by friendly capabilities, the more stressing the threat of those friendly capabilities will be perceived by that adversary. Therefore, a coherent, complex and multidimensional capability to attack targets at will has the potential to overstretch an adversary's assets and command and control to render them inefficient.³⁷ In a targeting sense, the more potential targets of an enemy that can be prosecuted, over a wider variety of operational environments, the greater probability of producing a positive cognitive effect.

Timing of targeting

There are four main dimensions that govern timing in effects-based targeting—speed, agility, duration and synchronicity.³⁸ In a targeting context, speed represents the ability to establish a high tempo of operations by deliberately striking a set of targets within a short time frame. A high tempo may pose a dilemma for an adversary in that they cannot react fast enough or cover all bases, and the effect of this may induce shock, chaos, or a non-coherent response.

Agility is the ability to change from one type of activity to another in time to be effective.³⁹ In a joint targeting context, this may represent a series of aerial strike missions followed by manoeuvre of surface forces. In an aerial targeting context, it may represent the ability to switch the prosecution from one type of target set to another in rapid succession. Agility is also related to responsiveness in that a responsive force can rapidly adapt to changes in the battlespace and then deploy its agile force accordingly. The ability to respond rapidly to changes in battlespace and then prosecute different sets of targets with agility may produce effects that foreclose areas of action that were available to an adversary, or induce feelings of inadequacy.

Duration is an allocated period of time, within an operation, in which targets are prosecuted. It is usually somewhere between the preparation and 'mopping-up' stages. An allocated time frame infers that a set of objectives should be achieved from assailing a set of targets before a deadline is reached. A time scale allows the narrower definition of operational aims, end-states and outcomes desired from targeting. The duration also needs to be long enough to allow the desired effects to be achieved through targeting.

³⁷ *ibid*, pp. 242–244.

³⁸ *ibid*, p. 245.

³⁹ Department of Defence, ADDP–D.3—*Future Warfighting Concept*, p. 25.

Synchronicity is the ability to prosecute targets at the right time, in the right sequence, or in conjunction with other actions, to achieve the desired effect. It is similar to simultaneity—the creation of one or more dilemmas that prevent an adversary from reacting in time to be effective.⁴⁰ Effective synchronicity can make a problem too complex for an adversary to control.⁴¹ Information operations and surface forces manoeuvre are examples of actions that could be conducted in conjunction with aerial targeting to produce synchronicity.

INFLUENCES ON TARGETING CAPABILITY

Interaction with strategy

Strategic attack describes the application of air power to create specific strategic effects that degrade or destroy an adversary's will, warfighting capabilities or any other capacity that would adversely affect Australia's interests. The effects created by strategic attack must be well managed, as they have the potential to adversely change the conduct and outcomes of a campaign, which might detract from achieving the strategic goals of Government.⁴² Through necessity, strategic target planning is obliged to provide for 'a continuum of options'—whether ranging from a limited number of weapons at a narrowly defined list of targets, or the employment of a large number of weapons at a broad spectrum of targets.⁴³ This planning is underpinned by a strategic assessment to ensure the viability of planned targets—that effects sought in an air campaign are matched with objectives.

A strategic assessment is of a broad scope and is accomplished by planners and their support personnel. To ensure viability, the following criteria are used for target selection:

- The acceptability of effects generated if prosecuted.
- Technology barriers and intelligence shortfalls.
- The desired impact on an adversary's values and perception.
- The correct balance of diplomatic, political, economic and military aspects.
- The baseline forces required to match expected effects-outcomes.

⁴⁰ *ibid.*

⁴¹ Smith, *Effects Based Operations*, p. 247.

⁴² Royal Australian Air Force, *The Air Power Manual*, p. 145.

⁴³ Richard Lee Walker, *Strategic Target Planning: Bridging the Gap Between Theory and Practice*, National Defense University Press, Washington DC, 1983, p. 22.

- The alternatives which are available to retain planning flexibility.

Strategy designed in ignorance of real limitations is likely to fail.⁴⁴ Practical considerations not properly accounted for in planning could prevent a selective attack from meeting its desired effects. In turn, this failure could cause an unwanted response or preclude subsequent options.

Closing the gap between effects-theory and the practice of target selection is a responsibility shared by both the strategic planner and the operational planner. Strategic planners must make their objectives clear and operational planners must ensure that strategic planners are aware of limitations in capability to execute a target plan. Constructive communication and feedback between the two groups is essential (see Figure 2–3). The operational commander is more likely to be cognisant of the capabilities at his/her disposal when making an assessment of proposed attack options and target recommendations. An operational assessment involves the more detailed methodology of military planning. However, an operational assessment of target sets is not an in-depth 'system analysis' or 'net assessment', nor is it intended to produce a final attack solution. An operational assessment is simply to bind a target plan in terms of barriers and shortfalls that can be fed back to strategic planners. This is, in effect, defining the *scope* and *scale* of a targeting operation. If a problem is identified, a target-effect concept can be rejected or further action can be taken to remedy a shortfall.⁴⁵ Through the feedback cycle with the strategic level, operational target planning can be further refined until appropriate force is matched to specific targets to generate desired effects.

In the near future, national strategy may change and evolve to suit domestic opinion, changing events, and world and coalition opinions. In these circumstances, the speed at which strategy can adapt is more important than having a 'perfect' strategy. Walker suggests an improvement in the mechanics of implementing strategy, rather than in perfecting strategy itself.⁴⁶ Planners who are responsible for developing and refining strategy should be aware of the basic limitations in operational target planning. To obtain a degree of flexibility in effects-based targeting, strategic planners should consider the full spectrum of attack options that are available at the operational level. Likewise, operational target methodologies should be well developed within the boundaries of available capabilities and be capable of providing the necessary feedback for this to occur. The outcome is a target planning structure that balances sought after strategic objectives against the realities of operational capabilities.

⁴⁴ *ibid*, p. 31.

⁴⁵ *ibid*, p. 30.

⁴⁶ *ibid*, p. 25.

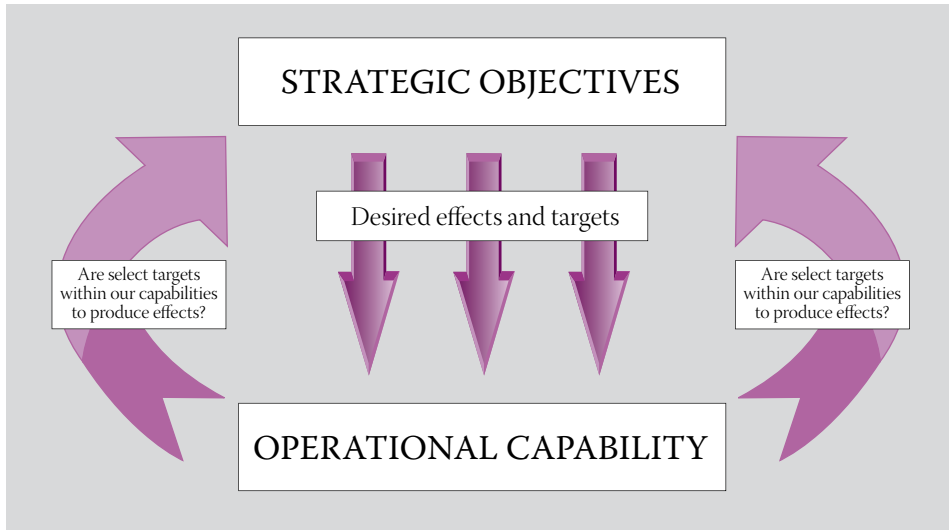


Figure 2–3: Interaction between strategic and operational target planning

Strategic target types

The type of targets that can be struck is ultimately a strategic policy issue. It involves attacking different target sets, be they military, political or economic, for the purposes of very specific requirements. These requirements will vary according to the strategic objectives and the outcomes sought for an operation. The majority of non-military targets, such as industry that supports warfighting capability, will tend to be strategic in nature and require more analysis to determine the likely effects of attacking them. Strategic target types may be economic, such as plant and stockpiles; political, such as leadership; or may have dual civil-military use, such as a national communications network. These targets are more in the cognitive effect spectrum of the effects-based approach than the physical effects spectrum. Although a non-military strategic target may be physically destroyed by a strategic strike, the ultimate goal is to erode an adversary's war-making capacity. The conventional view of strategic strike is that reached above and beyond the defended perimeter of a nation, in order to destroy the fundamental elements on which an adversary's warfighting capability relies.⁴⁷ The effects-based purpose of strategic strike is to terminate conflict quickly, on our own terms, by negating an adversary's ability and will to fight.⁴⁸

⁴⁷ Benjamin S. Lambeth and Kevin N. Lewis, *Economic Targeting in Modern Warfare*, RAND, Santa Monica CA, 1982, pp. 4–5.

⁴⁸ Department of Defence, ADDP–D.3—*Future Warfighting Concept*, p. 33.

A lot of the emphasis of strategic targeting in the past has been placed on economic factors. During World War II, the Allies identified certain German industries that they considered to be essential to Germany's warfighting efforts. Of these industries, they identified key sectors on which other industries were reliant for their own operation. The Allies believed that by attacking these 'bottlenecks' they could collapse the German economy. The Allied idea of conducting systems analysis on the German economy was sound but was based on the analysis of flawed information and this will be explored in Chapter Four.⁴⁹ Moreover, the idea of attacking industry as a strategic target is more suited to a war of physical attrition and does not fit our concepts of contemporary operations. Ideally, effects-based operations should be concise and avoid falling into a lengthy spiral of physical attrition. More recent air campaigns, such as Operation *Desert Storm* and Operation *Allied Force* have highlighted adversary command, control and communications (C3) systems as strategic targets for producing cognitive effects such as *shock* or *coercion*. While effective as targets, experience also shows that adversaries are prone to making C3 systems hard to attack through hardening, concealment and dispersal or building backup systems.

It is evident that in attacking different target systems, each has its own advantages and disadvantages—depending on the situation and/or objectives. Detailed knowledge about the system interactions of an adversary is a prerequisite for identifying those strategic targets that will produce desired cognitive effects. Equally important to knowing *what* to target, is *how much* damage will be enough to ensure an effect is produced. It is also difficult to assess the positive and negative consequences of strategic strike, even given superior target intelligence. Potential negative consequences of strategic strike could be unintended civilian casualties, biased media reporting, international outcry or simply misjudging the cognitive system effect that was actually produced from the attack. Not only does strategic targeting rely on good intelligence, but it also relies on selecting targets according to given circumstances, objectives and a rather unique adversary system.

Weapons systems

New concepts in targeting should not outstrip our weapon systems capability. If the physical capabilities of our weapons systems are lacking, then target planning may need to be modified. That is, target plans may need to be revised if weapon systems are unable to meet targeting objectives without major design changes, or increased manufacturing outputs, or large purchases to increase their numbers. Good weapons system design is achieved through the optimal matching of aircraft

⁴⁹ See 'Chapter Four – World War II (1939–1945)'.

and munitions capabilities. Likewise, good weapon system design enhances the respective capability of effects-based targeting. Increased flexibility of targeting capability is obtained by deploying weapon systems that are designed to minimise limitations in their employment. However, the cost of tailoring an entire arsenal to maximise flexibility can be an unacceptable burden. Therefore, in the procurement of a strike capability, performance and budget are the two major competing factors. For a comparatively small air force, the paramount performance parameter is flexibility. That is, the ability to select multiple types of payloads, or to be multi-role; to perform rapid re-targeting functions in-flight; to enhance survivability through increased stand-off ranges and stealth; and to provide a high assurance of penetration of defences.

Under the current methodology of matching weapon systems to targets, effectiveness is primarily based on a target's susceptibility to blast damage. As the number of available weapons systems and viable target types (to produce a certain effect) diminish, more attention needs to be paid to alternative weapons effects in planning an attack. When the avoidance of collateral damage is involved, examination of other weapons effects becomes a necessity. As targeting objectives become more narrowly defined in terms of target system vulnerabilities, the effects desired and law of armed conflict considerations, there is a subsequent narrower scope for weapon systems to be employed effectively against targets. More intensive damage assessment calculations need to be undertaken to match actual outcome with expected outcome. Thus, a high level of weaponeering expertise is essential to effects-based targeting. It allows an understanding of the scope of the potential outcomes that is critical to judging the efficacy of an attack. Weaponeering enables the correct amount of force to be apportioned to a target in order to produce desired effects.

Target intelligence

New concepts in targeting should not exceed our ability to produce accurate target intelligence. The feasibility of targeting objectives needs to be assessed in terms of the available intelligence on adversary target systems. Due to the rapidly changing nature of the modern world, intelligence is only valuable if it can be exploited before it becomes outdated.⁵⁰ Accurate and up-to-date target intelligence is mandatory in a rapidly moving battlespace involving valuable air assets. The greater the detail in target intelligence, the more support can be given to meet narrow targeting objectives and the more flexible a commander's responses can be to changing situations. The selection of targets for specific effects can only be

⁵⁰ *ibid*, p. 139.

based on available intelligence. Furthermore, accurate target intelligence relies on the analysis provided by trained, professional personnel dedicated to the task of 'net assessment' or analysing target systems. Any shortfalls or gaps in target intelligence must be identified and remedied before actual targeting takes place.

As the targeting objectives become more sophisticated, more must be known about the interrelationship of the installations in the target set under attack. The required information would reveal not only how the set functions as a sub-system, but also whether a complete set had been identified.⁵¹

The identification of target functions and how they relate to the adversary system as a whole is crucial to effects-based operations.

In-depth intelligence analysis is required so that adversary systems can be selectively targeted for maximum effect. Effective intelligence not only contributes towards reaching objectives, but also contributes towards economy of effort:

Additionally, the target set ... should be closely examined to determine if unique damage criteria can be established. It may be consistent with the targeting objective simply to disrupt rather than destroy certain functions of the target set. With an understanding of the interrelationship of various installations, the targeting objective may be accomplished in a unique manner which could either reduce weapon requirements or enhance the damage provided by a fixed allocation of weapons.⁵²

As increased technology and flexibility in weapons systems is introduced, it translates directly into an increase in the intelligence analysis required. This increased analysis is represented by an exponential growth in the necessary calculations for a weapon to be delivered accurately on target, in addition to the analysis needed for effects to be predicted realistically. Furthermore, the intelligence analyst is a 'man-in-the-loop' with a qualitative function, which cannot yet be sacrificed for a computer program with a quantitative function. Analysts ensure quality control in targeting, make discrete, unique decisions based on military judgement and act as 'data filters' sorting out what is relevant or irrelevant to achieving operational objectives.

⁵¹ Walker, *Strategic Target Planning*, p. 28.

⁵² *ibid*, pp. 28–29.

CONCLUSIONS

Effects-based targeting is largely a function of proportionality. How much is enough firepower? What is not enough? What is too much? Targeting for effect, by definition, relies on the correct amount of force to be applied, in the right place, to achieve a given objective. That amount of force is largely ephemeral and dependent on the enemy target sets that can be struck. The proper answer is that no hard and fast effects-based solution exists. Targeting can be considered in terms of quality and quantity. The qualitative side of the equation can be expressed in the types of desired effects and what optimal end-state can be achieved. The quantitative side can be expressed in terms of scale, scope and available resources.

An underlying tenet of effects-based targeting is the avoidance of physical attrition. Cognitive effects on an opponent are the preferred accomplishment of targeting. However, given the limitations of current weapon systems, cognitive effects in targeting are only achievable through a modicum of physical damage. It is the reality of contemporary offensive air operations that, for the moment, the inducement of effects is closely tied to the infliction of physical damage. Current international trends in research and development indicate that it is possible that non-lethal and non-destructive weapon systems will be introduced at some time in the future—it just remains to be seen how far the RAAF will also follow this trend.

Another underlying tenet of targeting for effect is to think ‘outside the square’ and to consider all factors that affect target planning. The avoidance of mindset and the use of innovation and imagination are the keys to unlocking an effective target plan. Modern conflict is often comprised of more than the traditional ‘us’ versus ‘them’ scenarios. In addition to the adversary system, the boundaries of friendly actors and the actions of neutrals must be weighed against potential targeting decisions. As a whole, target planning is bound by our national objectives and what capabilities can be brought to bear. Higher pay-off and greater probability of achieving objectives can be achieved by being realistic with respect to targeting capabilities.

Part 2

Beyond Theory: Effects-Based Targeting in the Real World

In nearly any circumstance, it is necessary to examine the past in order to understand what direction to take in the future. Therefore, an examination of the successes and failures of targeting in the past is appropriate. Any historical ‘Australian experience’ in targeting is often poorly documented. Moreover, it would be foolhardy to conduct a narrow study of solely Australian experiences, given the greater number of resources available that are devoted to the experiences of our traditional allies—the United States and Britain. Yet the purpose of this research is to develop the future concepts of effects-based targeting for the RAAF. Some lessons are simply universal and can be applied regardless of their origin. Most lessons, however, lack relevance and can only be applied to their originating air force; for example, a large air force with near-limitless resources. As a comparatively small air force, the RAAF has often either integrated itself into a larger force or performed a ‘niche role’ for which it was well suited. In examining ‘effects-based targeting in the real world’ and the historical lessons of other air forces, critical assessment has to be made as to whether these lessons can be applied to the future roles of the RAAF.

Part Two is divided into six chapters that examine air force targeting methods used during World War I, World War II, the Korean and Vietnam Wars, Operation *Desert Storm*, Operation *Allied Force* in Kosovo, and the War in Iraq.

Of note overall is that targeting has become better defined as air power is employed in times of war and this has paved the way for future development of effects-based targeting theory.

Chapter Three

World War I (1914–1918)

Purely and simply, World War I was a war of attrition. The effective use of air power was still in the stages of conception and invention. Yet the beginnings of an effects-based targeting regime begin to emerge. Most of the targeting data that is available from this period is only available from the Allied side. The Germans either did not collate the data or any records were probably destroyed in fires caused by Allied incendiary bombing in World War II.

In addition to the direct attack of enemy troops, early air power was also used to *disrupt* enemy headquarters and *interdict* supplies on their way to the front. The cognitive effects sought in the World War I air campaigns are harder to identify, primarily because they were ill-defined at the time. As early as 1915 the effect of aerial bombing on enemy morale was recognised.¹ Later, in the final years of the war, some evidence suggests that the Allies sought to achieve *psychological attrition* of the German will to wage war, through aerial attacks on industrial and civil targets. However, whatever theories the Allies had about the efficacy of bombing seldom matched reality. The nature of early planners was to equate effort with the result—launching a long-range bombing mission was a large effort alone and it was hard to admit that effort may be wasted.² Often no distinction was made between dropping a bomb on (or near) a target and destroying a target.

INTERDICTION: FIRST ATTEMPTS AT OPERATIONAL TARGET PLANNING

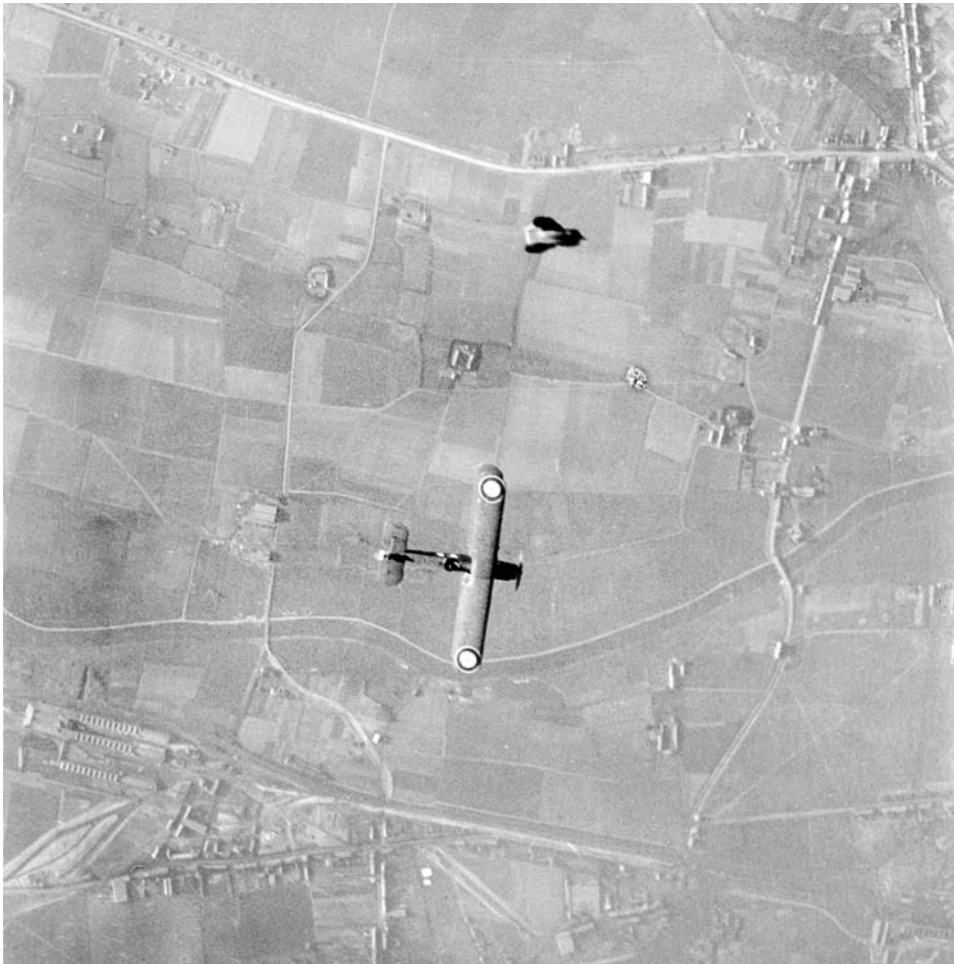
Until mid-1915, the results of bombing by the Royal Flying Corps (RFC) had been disappointing. In response, Royal Flying Corps Headquarters conducted an analysis of the results of bombing by all Allied flying units on the Western Front between 1 March and 20 June 1915. The report revealed that of 141 sorties to hinder enemy movement by bombing railway stations, only three had been successful.³ It was found that damage to railways was easily repaired and railway junctions

¹ Major Evelyn B. Gordon, 'Some Notes on Bombing Attacks (December 1915)', reprinted in H.A. Jones, *The War in the Air – Volume II*, Appendix VI, Clarendon Press, Oxford, 1922–1937, p. 463.

² Stephen Budiansky, *Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Gulf War II*, Penguin Group, New York, 2004, p. 103.

³ Jones, *The War in the Air – Volume II*, p. 118.

were increasingly well defended. It was determined that a change of targets may be needed to achieve greater effect. On 24 July 1915, Royal Flying Corps Headquarters ordered that tactical strikes, under the direction of Army commanders, would be limited to attacks on German headquarters, telephone exchanges and munition and poison gas factories within the Army area of operations. However, an order from General Headquarters pressed the need for sustained interdiction attacks on rail lines of communication and trains in motion beyond the German front lines. Specially designated squadrons were to be trained for this purpose.



Bombing a railway junction – A British Air Ministry photograph showing a De Havilland bomber in flight from above. Visible is the bomb dropped by the aircraft taking the photograph.

(Photo: Australian War Memorial H11965)

On 7 August 1915, a conference between representatives of the British and French air services convened to decide the future of Allied bombing policy. Attacks on rolling stock were considered better than rail infrastructure, because engines and flat-beds were more difficult and costly to replace or repair. This form of attack would only be effective if conducted on a large scale and in close cooperation with main operations. To achieve the large scale required, closer cooperation between the British and French air services would be necessary. The two services would also exchange target information, pilot training techniques and advances in bombsight technology. These changes would be put into effect for the upcoming Artois-Loos Offensive (25 September 1915).



An unidentified member of the Australian Flying Corps fixing 25 lb incendiary bombs to an RE8 aircraft

(Photo: Australian War Memorial E01176)

The first real bombsights were to be used at Loos and were developed by an RFC intelligence officer—Second Lieutenant R.B. Bourdillon. Originally ‘consisting

of a couple of nails and a few lengths of wire⁴ in early 1915, bombsights were developed further, such that by mid-1915, the Central Flying School bombsight was adopted by the Royal Flying Corps and Royal Naval Air Service (RNAS), and used until the end of 1916. Later developments in the Central Flying School bombsight did not achieve anything more than appalling accuracy. Bombs salvoed from a formation at 1500 feet had a Circular Error Probable (CEP) in the ground plane of 308 yards (282 metres) radius. Toggling bombs individually had a CEP of 425 yards (389 metres).⁵ Given the obvious technical limitations of bombsights, aircrews often developed their own methods of bomb aiming that involved lining up sections of the aircraft with the target. Errors in early bomb aiming were often compounded by poor navigation, erroneous target identification, flying by night, adverse weather and limitations of the aircraft.

The method of engaging targets of opportunity for the Loos offensive was worked out in June 1915. The corps front was divided into squares, much like modern interdiction ‘kill boxes’, and prearranged signals were determined. Targets had to be substantial; for example, a battalion, a battery on the move, or a long line of transport. Targeting methodology was predetermined in order to avoid haphazard tactical targeting and, therefore, preserve economy of effort. On 23 September 1915, the special bombing offensive was launched in prelude to the Loos battle. It was a comprehensive attack on enemy railheads that led to the forward battle area and it featured close coordination between the British and French air services. The aerial attack was conducted in squadron strength from low altitude of approximately 500 feet. Over the period of 23–28 September, five squadrons dropped nearly 5.5 tons of bombs.⁶ Despite mixed results, Loos represents the first use of offensive air power to interdict enemy lines of communication before the launch of a ground offensive. It also represents the first attempt at coordinating close air support for advancing troops by outlining the methodology for engaging targets of opportunity.

By the end of the war, the use of fighter/scouts as ‘trench-strafters’ played a pivotal role. At the Battle of Cambrai in November 1917, fighters fitted with bomb racks were used in an attempt to neutralise German direct-fire artillery as the major threat to British armour on the battlefield. The British fighters spotted and neutralised two batteries but failed to notice a third, which knocked out 65 tanks.

⁴ *ibid.*, p. 119.

⁵ George K. Williams, *Biplanes and Bombsights: British Bombing in World War I*, Air University Press, Maxwell Air Force Base, Alabama, 1999, p. 121.

⁶ Jones, *The War in the Air – Volume II*, p. 128.

But by the summer of 1918 the Allied system of aerial counter-antitank support, in the form of machine-gun fire and 20- or 25-pound bombs dropped from massed forces of small, fast airplanes like the Camel, the SE5, and the Bristol Fighter, was having a devastating effect on German resistance.⁷

The early use of offensive air power proved its utility through tactical close air support. The aircraft proved itself to be a pervasive artillery platform—capable of delivering a payload of bombs, from low level with reasonable accuracy, to create a temporary breach in the line or to allow a ground commander to manoeuvre forces.

Perhaps buoyed with the early success at Loos, the British air services continued their attacks on the areas behind the front lines for the remainder of 1915. The winter of 1915 featured a significant change in strike tactics, as squadrons were concentrated in force in order to attack a single objective. Attacks by small detachments on many objectives gave way to the mass bombing of a single target. In December 1915, the number of aircraft deployed on single raid was 14 and by March 1916, this had grown to 31.⁸ Formation flying was also introduced in January 1916, principally to reduce casualties and to provide squadrons with a degree of self-protection.

The ‘go-as-you-please’ methods have been abandoned definitely, both by the French and by ourselves, in favour of attacks carried out by swarms of aeroplanes. It is now an accepted principle that attacks on all important objectives should be carried out by as many aeroplanes as possible, all the aeroplanes flying together and reaching the objective together. This method is calculated to give A.A. guns the least possible chance of effect, and to render attack by hostile aircraft most difficult.⁹

INCREASED SCALE OF EFFORT AND WIDER TARGET SETS

In February 1916, Royal Flying Corps Headquarters outlined a new bombing policy. Targets were to be commensurate with effort—the further away they were from friendly lines, or the greater their scale of defences, the higher their strategic worth must be. The bombing of headquarters, munition depots, railway stations and bridges would be done in connection with, or in direct support of, ground

⁷ Budiansky, *Air Power*, p. 115.

⁸ Jones, *The War in the Air – Volume II*, p. 182.

⁹ Gordon, ‘Some Notes on Bombing Attacks (December 1915)’, p. 463.

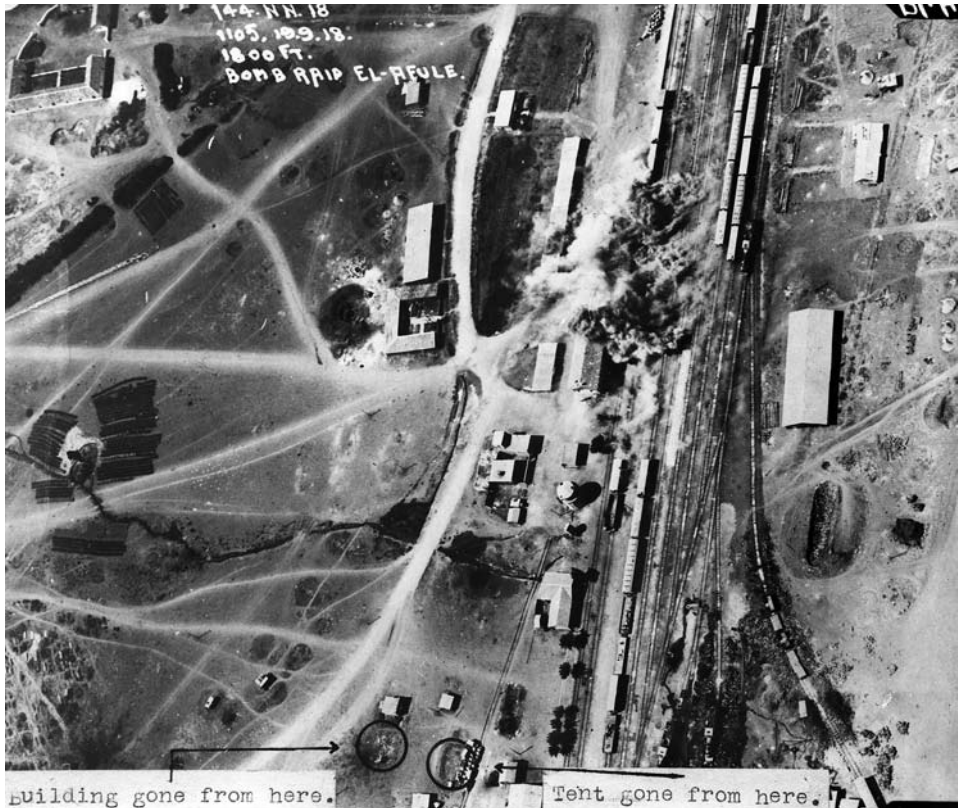
operations. Depots and headquarters were easily moved and rail lines easily fixed. Therefore, to get appreciable results, they were to be attacked in conjunction with a ground offensive, so that results could be measured in ground gained, not just to drop bombs for the sake of it. The scale of air operations was to be increased, to ensure a reasonable chance of success, because bombing on a small scale achieved negligible results. At the same time, General Trenchard secured permission for night bombing at a distance of five to six miles beyond enemy lines. Although this policy was limited by a lack of night flying experience in Royal Flying Corps pilots, it was a game of catch-up for the British, as the Germans were already conducting extensive night bombing operations. Orders were issued on 21 February 1916 for all Royal Flying Corps Brigades to undertake night bombing at every opportunity.

In preparation for the Somme offensive (first phase 1–18 July 1916), No 9 Wing was made responsible for strategic reconnaissance and interdiction of enemy lines of communication. Bombing was targeted at railways behind the German lines and opposite the British. The aim was to destroy rolling stock in cuttings, on bridges and at junctions. The plan sought to achieve near-constant coverage of British aircraft over German rail lines. To achieve this, bombing in formation was temporarily cancelled for rail attacks and pilots were allowed to operate in small groups, pairs or singly. It was to begin on the opening day of the infantry assault in order to catch the enemy on the move as they sought to reinforce their own lines. Targets of opportunity or secondary targets were troops, transports, dumps, billets and headquarters in the immediate battle area.

Despite the meticulous planning, aircraft and pilot losses were high at the beginning of the Somme offensive. Many bombers (BE2Cs) were flown without a gunner/observer, so that more bombs could be loaded. This adversely affected their self-protection ability. Reports of the effects of bombing were not commensurate with the losses sustained. As a result, Trenchard halted further low-altitude bombing attacks on railways by the BE2Cs, such that ‘bombing in formation, under escort, once again became the general rule’.¹⁰ Despite the setbacks, H.A. Jones considers the interdiction attacks conducted by the Royal Flying Corps during the Somme offensive to be successful. He claims that it disrupted enemy air operations through the bombing of German aerodromes and disrupted their lines of communication. Furthermore, the material damage that was inflicted influenced enemy ground operations and lowered their morale due to persistent air attack.¹¹

¹⁰ Jones, *The War in the Air – Volume II*, p. 222.

¹¹ *ibid*, pp. 251–252.



An annotated battle damage assessment of an enemy-held railway station, September 1918. The photograph was taken as the bombs dropped by No 1 Squadron AFC were bursting over the target. The raid took place in support of the British ground attack, launched in the morning.

(Photo: Australian War Memorial A00643)

In August 1916, Trenchard requested the Royal Naval Air Service bomb German facilities, in order to divert enemy aerial assets away from the Somme. Their primary targets were to be aerodromes and ammunition dumps. Soon after the initial raids, a wider program of bombing was agreed upon between Trenchard and the Royal Naval Air Service. Zeppelin bases in occupied Belgium and shipyards were added as targets. Zeppelin bases were attacked in an effort to curb raids on England, once the long summer days ended and winter allowed German night raids to recommence. Since the introduction of Sopwith 1½ Strutters and Short Bombers in spring 1916, it provided the Royal Naval Air Service with the capability to conduct longer-range bombing into Germany. They operated from Luxeuil in France, so as to be in range of as much of German industrial and munition centres as possible. However, the effectiveness of No 3 Wing was curtailed by the transfer

of their aircraft to other squadrons to make up shortfalls and also by poor weather. The small number of aircraft deployed therefore reduced their effectiveness. Likewise, the poor weather determined how many sorties could be flown. After the initial phases of the Somme offensive, the Royal Naval Air Service had enough machines to conduct effective strike operations. The first large raid was on 12 October 1916 against the Mauser factory at Oberndorf, involving more than 40 aircraft from the British and French air services.¹²

The French were the first to form a specialised bomber unit—the *Groupe de Bombardement No 1*—made up of three squadrons of Voisin pushers, with each aircraft capable of carrying 100 pounds of bombs.¹³ In late May 1915, the unit began striking the *Badische Anilin und Soda-Fabrik* (Baden Aniline and Soda Factory) in Mannheim, believed to be the source of chlorine gas used prior to German ground offensives. The first serious attempt at drafting a comprehensive target list was probably done by the French air services. Neville Jones defines strategic bombing of the World War I era as a ‘direct attack against the most important elements of an enemy’s war-making capacity, for example, his industries, communications, and the morale of his civilian population, as opposed to the units and equipment of his armed forces’.¹⁴ Given this, the French formation of a specialist unit and target plan probably represents the first implementation of strategic bombing.

When the Admiralty agreed with Trenchard to make the Royal Naval Air Service available to bomb German facilities, it placed the operational command of British naval squadrons in the hands of French planners. Therefore the French air staff used the Royal Naval Air Service to strike selected targets according to their predetermined bombing plan. This bombing plan proved itself to be practical and already included many targets the Navy had wanted to attack. The French target plan constituted a scheme for the strategic bombing of German military and industrial objectives and was the most comprehensive target list available to the British at the time. The French air staff drew up a list of critical targets in Germany and determined their relative importance. They then ascertained whether each objective lay within the range of their aircraft and whether it was vulnerable to aerial attack. Finally, they allocated an order of priority, based on the operational feasibility of striking it. Given the amount of force required to damage a target and the availability of aircraft, their payload and range to target, French planners selected the steel industries of the Saar as the only strategically feasible target

¹² *ibid.*, p. 453.

¹³ Budiansky, *Air Power*, p. 104.

¹⁴ Neville Jones, *The Origins of Strategic Bombing: A Study of the Development of British Air Strategic Thought and Practice up to 1918*, Kimber, London, 1973, p. 13.

area. They concluded that the steel industry of the Saar-Lorraine-Luxembourg area was the only vulnerable objective of importance that they could reasonably expect to affect through aerial strike.

The French considered material damage to be the only outcome of importance—damage to morale was not a consideration.¹⁵ Conversely, British air planners had a tendency towards a preoccupation with the effects of bombing on enemy morale, rather than material or physical results. For example, Trenchard, who was commander of the Independent Air Force from June 1918 and head of the Royal Flying Corps in France, was obsessed with the morale effects of bombing. This in turn affected target selection and the manner in which targets were attacked. The Royal Naval Air Service had already proved the utility of offensive air power through their early raids against Zeppelin bases. In April 1916, the Admiralty argued to the War Office that defensive patrols against Zeppelin raids were not adequate and some offensive action should be taken. They argued that the bombing of select targets would restrict attacks by German airships and affect the morale of German people. Therefore, the aim of the early British aerial offensive was twofold—to inflict both material and cognitive damage.

However, the Admiralty plan to damage enemy industrial centres and depress civilian morale never reached full fruition. The utility of long-range strikes was not universally acknowledged. The Army applied pressure on the War Office to supply aircraft for immediate tactical objectives, artillery observation and reconnaissance in direct support of ground operations. Subsequently, No 3 Wing Royal Naval Air Service was never deployed in enough strength to cause major damage. Although the Wing flew some missions in conjunction with the French, it was eventually disbanded in March 1917. The missions that were flown were not fully effective due to inadequate aircraft for the task, their small bomb load, bombing inaccuracy, poor weather and increasingly heavy German anti-aircraft artillery defences. This is not to say that all missions were unsuccessful. On 10 and 11 November 1916, a total of 23 bombers with fighter escort, with approximately 6000 pounds of bombs, struck the German Volklingen industrial complex. Subsequent reports after the war showed a loss of 1713 tonnes of steel production and infrastructure damage to the value of 42 171 marks.¹⁶ No British aircraft were lost despite being engaged by German interceptors.

The British and French differences of opinion on the efficacy of bombing on civilian morale produced some tension. The British, for example, were quick to

¹⁵ Williams, *Biplanes and Bombsights*, p. 4.

¹⁶ *ibid*, p. 9.

launch reprisals against German towns in payback for German Zeppelin attacks on British towns and U-boat attacks on hospital ships. The French also launched limited reprisals for the shelling of French towns, but were more realistic as to the effects they achieved. Both the British and French would drop leaflets explaining why the reprisals had gone ahead. The French, however, considered reprisals to be a secondary consideration compared to their overall plan of targeting the Saar industrial valley.

As the means and goals for British strategic bombing expanded, the emphasis on morale effect increased proportionately. The limited physical damage done by aerial bombing perhaps increased support for the importance of psychological effects over physical destruction. It is noteworthy that neither the French, nor later US air staff, attached significant importance to such an intangible factor and did not acknowledge civilian morale as an appropriate bombing target. For the British, psychological and material effects were important for air power advocates, to silence the War Office critics and aid in competing for scarce aircraft and crews. Morale and material claims combined to justify strategic bombing and rebut its detractors. British air staff claimed bombing and the threat of bombing in itself would impair German industrial productivity and their perceived effect on German morale only rationalised the lack of observable physical results.¹⁷

TIT FOR TAT: EARLY STRATEGIC BOMBING

British interest in strategic bombing was boosted when the Germans resumed daylight raids over London in June and July 1917 with Gotha bombers. Bowing to public pressure to ‘do something’, the British Government considered raids against the German nation as an act of reprisal. The British suffered 3000 casualties and 1.5 million pounds worth of property damage, inflicted by 120 tons of German bombs.¹⁸ The British public exerted pressure on the Government to target German towns, not military targets, in retaliation. Subsequently, on 15 October 1917 the War Cabinet decided to raise a new ‘Air Policy Committee’ to advise on aerial policy. It decided to target German towns where munitions factories existed. On 17 October, the first sortie was launched by No 55 Wing against the Burbach iron works in Saarbrücken. The War Cabinet had actually developed an aerial policy that was instrumental in directing targeting. Whereas Trenchard favoured tactical bombing in support of ground offensives, public pressure for reprisals resulted in a renewal of resources dedicated solely to strategic bombing.

¹⁷ *ibid*, pp. 24–28.

¹⁸ *ibid*, p. 36.

At the end of 1917, the War Cabinet raised a new committee—the Air Ministry. Targeting was, therefore, directed by a synthesis of political and military positions that decided aerial strategy. Two major factors influenced decision-making—the need for continual pressure on the enemy through offensive operations and the targeting of German morale. It is notable at this stage that Trenchard also had a change of heart. Never a believer in the efficacy of strategic bombing, and preferring instead direct aerial support to ground offensives, he nevertheless realised that to ensure continued allocation of resources to air power he would have to support the ‘psychological effect’ of strategic bombing. Trenchard considered that the effect on German morale was the only significant result of strategic bombing, especially given the limited physical effects of bombs. Conversely, French planners still considered physical destruction as their sole criterion and continued to prosecute accessible and vulnerable targets. The British were aware of the French strategy, but identified with a more ambitious goal of enemy morale erosion.¹⁹

However, the direction of the Air Policy Committee was vague. It identified over 100 German towns as possible targets but gave little direction on which to select according to importance.

By formulating grandiose schemes, contingent upon large quantities of suitable machines and crews, the Air Policy Committee quite overlooked the needs of their existing small bombing force. No one ever thought it necessary to determine, in order of priority, the targets to be bombed.²⁰

Meanwhile, the French had substantially developed their targeting planning. The French had conducted long-range strategic bombing since late 1915 and regularly changed their goals and procedures. Furthermore, the British were fully and continually aware of French bombing policy since the first days of Allied cooperation in 1915. Thus, the French could have offered the British some valuable insight into their fledgling program.

THE FRENCH ARE FIRST WITH STRATEGIC TARGET PLANNING

In October 1917, the French developed their ‘Plan of Bombardment Operations During Winter of 1917–1918’ and forwarded it to the British War Office. The French target plan was based on two principles. The first was that it was preferable to break down a German industry at the source, rather than attempt to destroy

¹⁹ *ibid.*, pp. 52–54.

²⁰ *ibid.*, p. 55.

the many factories and workshops where the materials were used. The second considered operational factors, such as prevailing weather, range to target and number of aircraft, to determine whether it was feasible to prosecute a particular target or group of targets. The French believed that operational factors were the most important consideration in allocating an order of priority to targets. The plan itself was a list of objectives, classified in decreasing importance, according to their production of strictly war material. Chemical works and explosive plants had highest priority, followed by iron foundries and munition works, respectively. Industries were in turn grouped geographically and target priorities further sorted and defined according to their range from French airfields. Under this system, a less-critical industry may receive greater priority if it was closer than a more critical industry, because it was within their capability to strike it. Following this methodology, the French placed the German industry in the Saar-Lorraine-Luxembourg region at the head of their list of targets.

All of the Saar-Lorraine-Luxembourg targets lay within 100 kilometres of the main French airfield at Nancy and could, therefore, be subjected to frequent and systematic bombing. Overall, the French plan was workable and impressive, with the region containing the richest deposits of iron ore in Europe and approximately 50 per cent of Germany's total output of steel. Like Britain, Germany's output of munitions barely met demand at the front and any disruption to supply could provide the Allies with a distinct advantage on the ground. Moreover, blast furnaces were conspicuous targets by both day and night, and were chosen by the French as the principle target for the joint offensive.²¹ The French also set themselves achievable operational goals and set out to 'blockade' German industry by bombing rail choke points instead of futilely trying to annihilate it through sheer force.²² This is perhaps the first case of achieving an effect through indirect targeting—a knock-on, or cascading effect achieved by attacking a vulnerable node. Most missions were directed towards the 'blockading' of strategic industry, with other easily identifiable facilities, such as industry or rail junctions, designated as secondary targets or targets of opportunity. Aircraft were assigned tasks according to their range and performance. Long-range bombers would be assigned the iron and steel works of the Ruhr or Saar Valley, whereas fighters would be assigned enemy aerodromes or railway stations. As a result, French aircraft were tasked according to their capabilities, with operationally feasible aims.

²¹ Jones, *The Origins of Strategic Bombing*, pp. 108–109.

²² Williams, *Biplanes and Bombsights*, p. 56. See also Jones, *The Origins of Strategic Bombing*, p. 150.

The British did not fully embrace the French plan to target strategic rail choke points and perhaps were more concerned with the psychological effects of reprisal. The primary mission of British strategic bombing was long-range attacks on German commercial centres as reprisals for enemy Zeppelin raids on English towns and cities. Whereas the French endeavoured to enforce a limited aerial blockade of select German industry, the British were committed to a more ambitious but less clear-cut goal. The French were sceptical of the value of reprisals for they diminished the effect of offensive strategic air attacks and had little, if any, effect on the enemy on the front lines. In addition, reprisals could engender more reprisals from the Germans and the air war could easily degenerate into indiscriminate retaliatory bombing of civilian population centres. Differences in perception between the French and British prevented them from pursuing a unitary bombing strategy as they had done in 1916–1917.

Since 1915, the French had continually updated their target information. In January 1918, they updated their plans according to changes in German rail traffic patterns. They documented lists of alternate targets available to missions if the weather deteriorated. Although the French strategic plan remained the same, their targeting process evolved with the action around them. Conversely, the British persisted on reaching targets within Germany, despite prevailing weather conditions, with no short-range alternatives. Consequently, approximately one-third of British missions were aborted due to bad weather in the winter of 1917–1918.²³ When the British did select short-range targets they were often not on the French target list and had no perceptible scheme of priorities. On these occasions, the British preferred to act autonomously rather than cooperate with the French air service.

The French placed greater emphasis on the role of intelligence analysis in determining targets. They kept abreast of changes to traffic on the German rail network and traced out two identifiable rail traffic systems—both economic and military-strategic. Through this, the French determined that the economic system was more vulnerable and narrowed their target list to four main targets that could be prosecuted to blockade effectively the German iron industry—Bettembourg, Thionville, Pétange and Athus. By narrowing their target set, the French could achieve objectives with the limited capabilities at their disposal. In the foundries themselves, the French determined which were operable and non-operable, as some smelters had been stripped and moved further east into Germany out of range of Allied bombers. As further testimony to the effect of French bombing, some of

²³ Williams, *Biplanes and Bombsights*, pp. 62–63.

the non-operable German smelters were lit up at night to give the impression they were still active and to act as decoys.²⁴

The French had developed bombing policy early, in 1916, and adhered to it with periodic modification. It was a good plan and the British could have shared intelligence from it, or contributed to it. However, after joint Allied raids were suspended in March 1917, British and French bombing was never again to enjoy the same level of cooperation. When the British reacted to the Gotha raids in July 1917 with retaliatory strategic bombing, they had their own politically driven agenda that did not easily fit into the French strategy. Their attitude denied the British an opportunity to yield more benefit from a closer relationship with the French. Evidence suggests that the separate bombing programs of British and French could have been mutually complementary if better coordinated.²⁵ There was, however, limited cooperation due to operational restrictions.

The [British] raids were not based on any bombing programme, and this was hardly surprising, since the majority of targets it was desired to attack were not at the time operationally feasible. As a result, the choice of targets during the winter of 1917-1918 was for the most part left to the French whose bombing plan concentrated on objectives which were at short range from the Nancy base.²⁶

The British were to suffer additional problems other than poor target planning. Rushed pilot training and poor manufacture of bombs contributed to delivery inaccuracy, in addition to poor appreciation of what constituted a good military target as opposed to an attractive one at the time. Some pilots tended to deviate from assigned targets and select their own over the target area. The bulk of the problem lay with poorly trained pilots and observers who were often rushed into service to replace casualties and had little appreciation of strategic objectives. Likewise, the Air Ministry and War Office hardly clarified the objectives of their strategic bombing campaign either. No firm priorities or target lists were defined and formulated despite the French example. The War Office tended to view strategic bombing as a self-fulfilling prophecy and momentum within the organisation tended to regard it as successful, if only with regard to the psychological effects on enemy morale. Results of bombing were selectively interpreted, with little independent evidence to back up the claims of bomb damage made by pilots and observers. With public pressure following the Gotha

²⁴ *ibid.*, pp. 64–65.

²⁵ *ibid.*, pp. 65–66.

²⁶ Jones, *The Origins of Strategic Bombing*, p. 150.

raids, the tendency was towards reporting optimistic results despite the reality. 'Hours flown, sorties launched, and bombs dropped were accepted as proof of worthwhile results'.²⁷ This created an inflated expectation of the potential for strategic bombing. Inflated results, for public approval, were widely published in the newspapers of the time. An objective evaluation of strategic bombing was becoming increasingly difficult.

MAJOR LORD TIVERTON: THE FATHER OF BRITISH TARGET PLANNING

There were, however, a number of people on the British side who appreciated the need for detailed target planning. For instance, Major Lord Tiverton was a technical member of the British Aviation Mission to Paris in 1917. He was knowledgeable in mathematics and science and worked as an armament training officer in the Air Department of the Admiralty. Tiverton investigated ballistics and its application to bomb-aiming accuracy. Furthermore, he qualified as a pilot at age 36 and carried out practical work in fitting the Sopwith 1½ Strutter with a suitable bombsight.²⁸ In September 1917, Tiverton submitted a paper to the Air Board that was the first to deal with the deficiencies in British target planning. He drew up a list of possible objectives and divided them into geographic groups. After establishing the main targets within each region, Tiverton considered which British or French bases were within range. He also considered which bases featured a high frequency of favourable weather conditions for flying operations. Tiverton allowed for short-range tactical sorties if weather ruled out long-range strikes. In addition, he emphasised accurate navigation and target recognition training:

Experience has shown that it is quite easy for five squadrons to set out to bomb a particular target and for only one of those five ever to reach the objective, while the other four, in the honest belief that they had done so, have bombed four different villages which bore little if any resemblance to the one they desired to attack.²⁹

In early November 1917, Tiverton submitted another report to the Air Board. It was devoted to the selection of targets and employed a method of scientific analysis that was 'used to make an assessment of the vulnerability of nearly a hundred German factories manufacturing war materials'.³⁰

²⁷ Williams, *Biplanes and Bombsights*, p. 124.

²⁸ *ibid*, p. 136.

²⁹ Jones, *The Origins of Strategic Bombing*, p. 146.

³⁰ *ibid*, p. 154.

For each individual target, the area occupied by the factory was calculated and an assessment (based on the nature of the manufacturing activities) was made of the area occupied by buildings and plant vulnerable to bomb attack. Making an allowance for mean bombing errors considerably more than twice the mean errors for practice-bombing in England, Lord Tiverton calculated, among other things, the probable number of bombs to fall within the factory area and the probable number of bombs that would cause effective damage.³¹

Tiverton concluded that his statistics pointed to a need for attacks on a large scale if worthwhile damage was to be achieved. Large factories were easy to hit but difficult to destroy and small factories were easier to destroy but difficult to hit. He believed in the need for a massive bombing campaign, with the firm intention of completely destroying selected targets and not merely causing damage, which could be easily repaired.

In sharp contrast to Trenchard, he concluded that it was necessary to ‘obliterate’ factories, not merely scare the workers; even the rough estimates he produced showed that this would be an effort of monumental proportions, far greater than anyone had anticipated.³²

Targets should be carefully selected so that bombing produced the greatest disruptive effect on the enemy war effort. It is also interesting to note Tiverton’s observations of German explosive manufacturing factories. They were constructed in such a way that any accidental explosion would be confined to that part of the factory—which would subsequently mitigate the effects of bombing. He therefore argued that it would be better to attack the chemical works where inert primary ingredients were formulated.³³

In early 1918, Tiverton was head of FO3a Section at the Air Ministry’s Directorate of Flying Operations, and was responsible for technical direction and training in relation to strategic bombing. As such, he was responsible for the collection of target data and the development of the British strategic bombing force. Tiverton was the first advocate of a scientific approach to targeting.

His most impressive application of this method was in his calculations of the probable number of bombs required to destroy various kinds of targets. When Lord Tiverton left the Air Ministry at the end of the First World War

³¹ *ibid.*, p. 155.

³² Budiansky, *Air Power*, p. 109.

³³ Jones, *The Origins of Strategic Bombing*, pp. 156–157.

his work was forgotten, and the methods which he had evolved were not applied to the solution of bombing problems until the initial failure of the bombing offensive during the Second World War.³⁴

The Department of the Chief of the Air Staff had established two staff groups to support strategic bombing. The first was FO3 Branch, Strategic Bombing and Independent Force Operations, within the Directorate of Flying Operations. Tiverton was the planning officer and Air Ministry expert on target selection and technical matters. FO3 was responsible for operations of the Independent Air Force and for the policy of selection of bombing targets. The second staff group was the Bomb Raids and Targets Section, a subcomponent of the AI1 Branch - Receipt and Distribution of Intelligence. The AI1 Branch was within the Directorate of Air Intelligence.³⁵ As such, the AI1 Branch was one of seven branches of the Directorate of Air Intelligence and was responsible for compilation of all information regarding targets in the British area of operations, including the location of enemy anti-aircraft defences, the records of bomb raids and the location of prisoner of war camps in districts within scope of Allied bomb raids. It consisted of just five intelligence officers.³⁶

TO WHAT EFFECT TARGETING POLICY?

The Air Policy Committee released an employment plan for their newly formed Independent Air Force in January 1918. However, its operational policy was not clearly formulated. The only targets mentioned were industrial towns along the Rhine, which were to be attacked whenever possible. Short-range alternatives, when weather was foul, were the steel industries at Briey and Saarbrücken.³⁷ The chief factor for selection of targets was the small size of the Independent Air Force—one wing. Both psychological and material aims were considered, with erosion of morale being the highest goal. The Air Policy Committee's 'thinking on the question of bombing policy had not progressed beyond a statement of the general method of attack to be employed against large German cities'.³⁸ Due to the influence of Trenchard, emphasis was placed on the ground offensive, with no particular target plan applied to other types of bombing operations. Furthermore,

³⁴ *ibid*, p. 143.

³⁵ Williams, *Biplanes and Bombsights*, pp. 147–148.

³⁶ *ibid*, p. 150.

³⁷ *ibid*, p. 54.

³⁸ Jones, *The Origins of Strategic Bombing*, p. 162.

Trenchard 'did not regard the destruction of the enemy's vital war industries as the principle aim of the bombing offensive'.³⁹ In his view, the best way to cause morale and material damage was to direct heavy and sustained attacks against large industrial centres, irrespective of whether the targets in these centres formed part of a particular industry or group of industries. Bombing policy did not mention attacking enemy industry, merely referring to German war industry as one of several desirable target types.

This was perhaps the first statement of the doctrine which was to dominate strategic thought in the Royal Air Force from the early post-war period until the middle of the Second World War.⁴⁰

Moreover, at the end of the war:

This doctrine was the work of Trenchard and represented the peace-time counterpart of his wartime offensive policy. The air defence of Britain was vested in a home-based force of bombers which, in the event of an attack upon his country, would be launched against the populous centres of the enemy.⁴¹

Despite the statistical evidence and intelligence reports that contradicted its efficacy, strategic bombing became an end in itself—mostly to damage German civilian morale.

It seemed to offer a method of attack by which every bomb dropped could be made to count, thus creating an exaggerated notion of the destructive effect of air bombing, it also led to an unwarranted complacency regarding operational standards, and this in turn obscured the need ... to improve the methods of navigation, target location, and bomb-aiming.⁴²

After becoming Chief of the Air Staff, Major General Frederick Sykes initiated the 'Strategic Council' to oversee the details of the bombing plan. Its aim was to clarify policy and achieve the best utilisation of aerial resources and its inaugural session was on 22 April 1918.

The Strategic Council represented the first definite organizational attempt to translate policy into achievable goals.⁴³

³⁹ *ibid.*, p. 163.

⁴⁰ *ibid.*

⁴¹ *ibid.*

⁴² *ibid.*

⁴³ Williams, *Biplanes and Bombsights*, p. 153.

The Air Council would lay down policy, such as, ‘the bombing of key German industry’. In turn, the Strategic Council would decide the number of bombs necessary, the force necessary to achieve the desired amount of hits and the order of targets with respect to the availability of aircraft. The Strategic Council filled the gaps between sweeping directives and particular objectives. It held that the proper object of bombing should be the selective destruction of key German war industries. Tiverton was requested to submit a paper to the Strategic Council on 24 April 1918. Outlined in his report, his first priority was the compilation of data concerning various aspects of bombing. Otherwise, it was not possible to estimate the size of force required or to devise tactics. He identified the areas of knowledge required as: bombing errors and accuracy of bombsights; the type of aircraft that was most suitable as a bomber; and the best type of bomb to affect the types of targets the force was up against. No real data existed for the effects of bombs on specific types of targets.⁴⁴

Tiverton concluded that further targeting research was necessary. He conducted experiments on buildings to determine what types of bombs caused the most damage, in what patterns and the explosive yield necessary to demolish them. Tiverton also sought to construct full-scale outlines of German industry targets, to be laid out on Salisbury Plain, to aid pilots in their target recognition.⁴⁵ In another paper to the Chief of the Air Staff dated 22 May 1918, he pointed out that, although papers dealing with bombing policy had been written, no definite bombing plan for 1918 had been produced. Tiverton considered such a plan to be a high priority—to target as many German industries as possible before the winter of 1918–1919 curtailed activities. In the same paper, he reiterated the errors associated with bombing accuracy and the need for a comparison between different types of targets, to assess their vulnerability to existing ordnance. Accurate calculations were needed for the number of bombs, tactics, training time, bombsights and choice of targets—a complex equation needing all the time available to solve.⁴⁶

In June 1918, Tiverton wrote ‘Notes on Targets’, which summarised offensive targets as well as industrial ‘bottlenecks’ of German war-making industry. The ‘bottlenecks’ were select chemical works, steel industries, machine shops, magneto works and accumulator factories that would have a high impact on German war-making capability if prosecuted. He identified three main industrial areas near the western frontier of Germany, which contained 80 per cent of the industries necessary for the manufacture of explosives, which were within striking distance of British Handley

⁴⁴ Jones, *The Origins of Strategic Bombing*, pp. 175–176.

⁴⁵ Budiansky, *Air Power*, p. 109.

⁴⁶ Jones, *The Origins of Strategic Bombing*, pp. 180–181.

Page bombers operating from English and French airfields.⁴⁷ Trenchard largely ignored Tiverton's findings. This can perhaps be attributed, in part, to the small force that Trenchard had at his disposal, whereby it was recognised that the effectiveness of bombing at the time was rather poor and the morale effect was perceived to be more easily obtainable. Tiverton, however, made allowances for the small size of the Independent Air Force. His target planning was based on a small force attacking a limited set of chemical and munitions works, within a viable range.

The planning of Independent Air Force operations throughout 1918 remained ad hoc. Low priority was given to a coherent strategic targeting policy. In May 1918, Brigadier C.L.N. Newall, commander of the Royal Flying Corps 8th Brigade, wrote 'Scientific and Continuous Attack of Vital Industries', which outlined Independent Air Force target priorities. The targets Newall listed included German iron ore and coal mines, steel blast furnaces, chemical production, explosive production and miscellaneous categories such as railway material, rolling stock, aircraft on the ground, automotive engineering, submarine parts, magnetos and leather industries. Given the limitations of range due to technology, all targets were located up to 125 miles behind German front lines.⁴⁸ His report also highlighted the effect bombing had on enemy morale, believing it to be greater than the destructive effect (which was true, but only due to poor target prosecution). Although Trenchard later modified the priorities on this list, he ultimately selected targets on the basis of their psychological effect on morale, not material destruction. Trenchard ordered target priorities as chemical works, iron and steel works, railways, aircraft engine works and airfields. He also intended to use his strategic force to bomb tactical targets in support of ground offensives, such as enemy airfields and railways. Incidentally, nearly 85 per cent of bombs dropped on targets in September 1918 were against airfields and railways.⁴⁹ Trenchard operated the Independent Air Force in defiance of the original War Office directions. In opposition to Tiverton's advice on targeting specific facilities, Trenchard's orders entailed wide target areas, such as the 'central portion of the city'.⁵⁰

In October 1918, Tiverton wrote 'The Possibilities of Long Distance Bombing from the Present Date until September 1919'. Realising the limited resources of aircraft available to the Independent Air Force, he advocated a less ambitious bombing program, with chemical and steel industries as primary objectives but scaled down to a manageable level. Tiverton argued for the utilisation of a wide

⁴⁷ *ibid.*, p. 181.

⁴⁸ Williams, *Biplanes and Bombsights*, pp. 174–175.

⁴⁹ *ibid.*, p. 179.

⁵⁰ *ibid.*

range of technical expertise to assist in targeting by considering commercial, political and technical aspects. He regarded the briefing of aircrews to be of critical importance so that they would be familiar with their targets, to mitigate wasted effort or the dropping of bombs indiscriminately. Tiverton also calculated the amount of ordnance needed to destroy each target and a time frame in which it could be accomplished. Despite the intelligence support at his disposal, Trenchard continued to prosecute his own target list. Trenchard himself wrote:

My Intelligence Department provided me with the most thorough information on all targets such as gun factories, aeroplane factories, engine factories, poison-gas factories, etc., each target having a complete detailed and illustrated plan, and maps were prepared of every target that was within reach.⁵¹

When the US Air Intelligence Branch of the American Expeditionary Force asked Trenchard's headquarters for targeting information on German industries in October 1918, the request was forwarded to the Air Ministry. This was because the majority of Independent Air Force targets were railways and airfields, and were not strategic-industrial in nature. The attraction of railways and airfields to Trenchard was that they were at short range, easily identifiable and not as well defended as many other targets. Combined with inexperienced aircrews, these targets were the only ones that Trenchard could expect to attack at a sustained rate without sustaining unacceptable losses.

PROS AND CONS OF EARLY STRATEGIC BOMBING

Trenchard's target selection—primarily railway sidings and aerodromes—showed little imagination, nor proper use of a stand-alone air component conducting a strategic bombing campaign. Trenchard's choices represent more tactical targets for short-term, readily identifiable gain, rather than long-term impact on German war effort. It is arguable that Trenchard lost sight of the purpose of strategic bombing, but his blinkered approach is perhaps mitigated by his attempt at being realistic given the dearth of resources at his disposal. In general, the British chose the wrong targets, used the wrong bombs, and their pilots lacked the proper training—all of which amounted to wasted effort. This was recognised by Trenchard:

⁵¹ Hugh Trenchard, 'Trenchard's Final Dispatch', reprinted in C. Gordon Burge, *The Annals of 100 Squadron*, Bivouac Books, London, 1975, p. 157.

Thus the Independent Force comes to an end. A more gigantic waste of effort and personnel there has never been in any war.⁵²

The Independent Air Force had continued to bomb towns instead of the targets recommended by their own strategic planners and intelligence officers. As such, it failed to meet the objectives for which it was created.



Haubourdin, France, 17 October 1918 – Aerial photograph of smoke billowing from hangars set on fire during bombardment by aircraft of No 80 Wing, RAF. Note the DH-9 aircraft flying over the airfield.

(Photo: Australian War Memorial P02163.003)

The early means of conducting combat assessment and reports on the psychological effect of aerial attack were often fragmentary and contradictory. The indicators needed to evaluate the aerial campaign's effectiveness were largely unavailable to Allied target planners. Without the required capabilities, such as post-strike photography and access to enemy industrial records, the Directorate of Air Intelligence relied on available feedback, such as aircrew observations, captured letters, agent reports and German news reports. A lack of multi-source,

⁵² H.M. Hyde, *British Air Policy Between the Wars 1918–1939*, Heinemann, London, 1976, p. 44.

complementary data often deceived planners into believing in a heightened efficacy of the bombing when, in fact, this was not the case. ‘Ground truth’ missions were conducted by British and American survey teams after the Armistice and they confirmed the general ineffectiveness of strategic bombing. The survey teams investigated material damage inflicted, the effect of bombing on morale, the organisation of anti-aircraft defences and the overall effectiveness of Allied bombing strategy. Their results showed a low correlation between wartime claims and postwar findings. In particular, the claims of physical damage by aircrews tended to be overestimated.⁵³ Aircrew reports would be forwarded through the Air Ministry to the War Office and would be further embellished by Ministry officials who had a stake in proving the efficacy of air power.

Although many mid-war Anglo-French air raids were accurate (depending upon visibility), the small number of aircraft involved, the load-out capacity of early bombers and the sprawling nature of targeted facilities all limited the damage inflicted. Furthermore, surrounding structures often protected the critical elements of facilities. Target planners did not emphasise accuracy against select elements of facilities, often believing that bombs anywhere within the target area would cause sufficient damage to ensure a good result. ‘Ground truth’ reports revealed that this was not the case. The actual damage inflicted was invariably less devastating than reconnaissance photographs had led them to believe, especially with regard to near misses. On many occasions, the wrong target was bombed. The effectiveness of strategic bombing in World War I was initially based on assumptions and this ‘mythos’ was perpetuated during the war, buoyed by optimism and, in the British case, the need for reprisal. Despite some singularly notable successes attributable to ‘luck’, strategic bombing during World War I achieved unremarkable results. In monetary terms, the damage to German industry was almost negligible compared to their total wartime expenditure.⁵⁴

Furthermore, the Allied survey teams did not substantiate the psychological effects of bombing. German plant managers and civil officials maintained that air raids had a minor impact upon civilian morale and productivity. Civilians tended to be more concerned with whether the government would compensate them for damage to their homes. As with the British, factory workers were initially alarmed by raids over their homeland in 1917, but quickly built up mental defences and a collective moral courage. The principle morale effect was positive press reports of British raids in British newspapers—the population felt they were getting their pound of flesh from Germany, even if this was not exactly the case. The

⁵³ Williams, *Biplanes and Bombsights*, pp. 19–21.

⁵⁴ *ibid*, pp. 246–247.

US Air Service concluded that the lack of a predetermined methodology—a plan calculated to destroy critical German industries through successive raids—was the biggest downfall of strategic bombing during the war.⁵⁵

The problem with the over-inflated claims of the effects of strategic bombing to morale was that it affected Allied air power doctrine. Advocates of air power came to believe their own philosophy and outsiders came to believe in it also. The survival of independent air forces was at risk after 1918, as all branches of the armed services became increasingly competitive for a shrinking pool of funds. They had to justify their own existence and emphasise the importance of their own unique role. Air power theorists such as Douhet argued that bombers would play a decisive role in any future conflict, but more emphasis was increasingly placed on morale effects rather than material destruction. Trenchard himself acknowledged that to achieve appreciable material effects through bombing, greater numbers of bombers must be used, with highly trained pilots and a vast support staff.

CONTEMPORARY RELEVANCE

The targeting experience of World War I should not be dismissed as ‘happening too long ago’ and having no relevance to modern air power. Common themes underlie these experiences that are applicable to contemporary effects-based targeting. They include the need:

- for an aerial offensive to have a coherent strategic objective;
- to have strategy translated into a target plan that will produce certain effects to meet the given objectives;
- for comprehensive target intelligence and weaponeering data;
- for adequately trained and briefed air crews so that they can recognise targets; and
- to have a realistic process of assessing the results of bombing operations—not just the battle damage assessment of bombs dropped, but an operational assessment of methods that are successful and areas that can be improved.

This list is by no means exhaustive. They are all factors that were realised and developed during the dawn of offensive air power and they still endure to the present day.

⁵⁵ Maurer Maurer (ed.), *The U.S. Air Service in World War I – Volume IV: Postwar Review*, Albert F. Simpson Historical Research Center, Maxwell Air Force Base, Alabama, 1978, pp. 501–502.

Chapter Four

World War II (1939–1945)

From 1939–1945 the RAAF garnered very little experience at target planning. There were a number of reasons for this. Firstly, Australian air power doctrine closely resembled that of Britain and, in some instances, it was the same—there was no reason to develop stand-alone targeting doctrine. Secondly, offensive air operations of the RAAF were seldom entirely independent—they were often conducted as a part of a broader Allied strategy or operation. Australian airmen in Europe were either assimilated into British squadrons or operated in one of a handful of Australian squadrons that flew from Britain. The Middle East was similar, but with perhaps more Australian airmen serving in RAAF fighter squadrons. In the South-West Pacific theatre, the operations of both Australian and US squadrons were directed by the Allied Air Force Headquarters. Although RAAF squadrons conducted many successful interdiction attacks against enemy shipping and airfields, sophisticated target planning was hardly needed. At the time, there was no *need* for such a faculty within the Australian military and, therefore, a wholly independent, capability-based targeting doctrine was not developed until decades later. Perhaps more importantly, World War II highlighted the ability of the RAAF to fulfil niche roles in coalition operations and help bridge gaps in the select capabilities of an ally.

World War II was a cataclysmic conflict that defined targeting doctrine for the Western Allies. Strategic bombing, as an adjunct to the war of attrition, was conducted on a massive scale. Interdiction was found to be able to shape the operational battlespace. Tactical close air support could deliver enough firepower to have an immediate effect on the outcome of a battle.

Twenty years prior to 1939, nations of the European community were deeply affected by the horrendous casualties caused by large-scale industrial warfare. Military thinking and doctrine tended to reflect this mindset. Although conflict of any type might be unavoidable, the trend was to invent means of waging war without resorting to irreverent destruction of life. Therefore, the rationale behind targeting an enemy with air power was to inflict a knockout blow and thus end a war quickly. The key to this was to identify those facilities of an enemy that were vulnerable to air attack and, through their destruction, set in motion a chain of events that would bring about a cessation of hostilities. However, the more realistic advocates of offensive air power viewed the looming war in Europe as

one of capability attrition—whoever could sustain capabilities, while degrading their opponent's capability to wage war, would prevail.



Britain, 1945 – A Handley Page Halifax B Mark III aircraft of No 192 Squadron RAF, showing nose art consisting of a kangaroo, a 1000 lb bomb headed for the Reich and the name ‘Matthews & Co. Express Delivery Service’. This aircraft, piloted by RAAF skipper James Matthews had flown 55 operations denoted by the small kangaroos painted on the side.

(Photo: Australian War Memorial P01523.017)

Despite the rhetoric, World War II was not over quickly and more soldiers, sailors, airmen, auxiliaries and civilians died than in World War I. A distinguishing factor of World War II was the sharp rise in the incidence of civilian casualties. It was a ‘total war’ and a conflict of national survival whereby all and any means were considered to defeat an opponent. This included targeting and attacking civilian populations from the air. The essential reality is that no technological alternative really existed at the time that could have avoided such civilian casualties. Further, politically and morally, it was seen as a means to an end. The purpose here is not to exonerate, nor to persecute, it is to examine the doctrine. A doctrine developed from the memory of history, moulded by circumstance and limited only by technical disposal. As it was 20 years earlier, World War II was another war of attrition but fought on more advanced and grander scale. Furthermore, targeting methods, operational techniques and concept experimentation became more acutely defined

as air power became more technologically capable and its application became more flexible. Thus, modern targeting doctrine was born.

THE INTER-WAR YEARS: AIR CORPS TACTICAL SCHOOL

The first example of targeting doctrine emerged in the 1930s from the US Army Air Corps Tactical School (ACTS) which asserted that, through the aerial bombardment of strategic targets, offensive air power was capable of undermining the capacity of an enemy to wage war. Such a stance was derived directly from advocates of the psychological effects of bombing on morale, such as Trenchard and Douhet. However, Air Corps Tactical School instructors believed that precision attacks on key industries, rather than indiscriminate attacks on civilian centres, were the best method of undermining capacity. At the time, technological capability drove offensive air power doctrine and how this capability could be translated into decisive effect. Therefore, the United States mistakenly believed that decisive effect was made possible by their new technology—the Norden bombsight. The Air Corps Tactical School developed the idea that modern industrial economies were highly interdependent and highly vulnerable to disruption of key ‘bottlenecks’ or ‘choke points’—also known as the ‘industrial web’ theory. The key to targeting, therefore, was the identification of these weak links within an adversary’s economic infrastructure. It was believed that those weak links could then be precision-targeted using the Norden bombsight and heavy bombers.

Precision capability is a perfect match for the ‘industrial web’ theory, because it does not require large-scale destruction to achieve results. By striking only crucial industries or services that supported the enemy’s war effort, disruption would ‘spread like a shock wave’ through the enemy society far wider than the physical destruction that could be inflicted.¹ The ‘industrial web’ theory implied that the ultimate purpose was to curtail an enemy’s war-making capacity and this would, in turn, affect their will to continue hostilities. Although the theory offered a more humane methodology than direct attacks on a civilian population, it was severely hampered by the precision that was achievable at the time. Advanced technology and sophisticated target knowledge offer a more agreeable substitute than brute force, because they represent the precise application of military force to specific vulnerabilities. The problem lay not with the overall objective, but with the shortfalls in technology. Bombing in the 1930s and 1940s was not as accurate as hoped. The Air Corps Tactical School conducted carefully controlled studies

¹ Stephen Budiansky, *Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Gulf War II*, Penguin Group, New York, 2004, p. 178.

on bombing accuracy and munitions effectiveness against selected targets. For instance, before 1941, the US Army Air Corps² dropped over 200 000 bombs during training exercises. At low altitude, from 5000 to 8000 feet, accuracy was sometimes within 100 feet using the Norden bombsight. But 200 to 400 feet was the norm, especially from above 10 000 feet.³ All the data obtained was under ideal conditions—with clear skies, clearly marked targets and no air defences. Operational experience during the war would later reveal that targeting theory had developed further than technological reality.

ALLIED STRATEGIC BOMBING

The Allied strategic bombing offensive was arguably a fully independent air operation, divorced from what was happening with ground or naval forces, with some hardline advocates thinking it could win the war on its own. For Britain during the earlier years of World War II, strategic bombing represented a means of challenging the status quo of the Axis powers, without having to sustain a large land army on the European continent. The popular view of strategic bombing was that it would erode the German will to wage war. Some senior US planners, commanders and strategists also held this view. However, this was not the entire basis of strategic bombing and evidence suggests that many more factors should also be considered. Strategic bombing should always be regarded in terms of joint warfighting—how it affects the concurrent operations of other services, what effect it has on enemy warfighting capability and how it affects the ‘big picture’. The defeat of the Axis powers by the Allies in 1945 was a joint and collaborative effort in every sense.

Effective air power in World War II was dependent on technological and economic factors. Air power, then and now, needs to stay abreast of technological advances, have a firm research and development base, and adequate financial and resource backing in order to sustain operations and replace losses. The strategic bombing offensive of World War II, in terms of planning, matériel and personnel, was an undertaking of monolithic proportions. Faced with the costs involved, the Soviets rejected strategic bombing in favour of a tactical air force. Likewise, the Germans largely abandoned strategic bombing once the requisite scale of effort became apparent after the Battle of Britain. Only Britain and the United States pursued strategic bombing and dedicated a large amount of resources to it. For Britain, as an island power, it was one of their only means of projecting military power onto

² The US Army Air Corps became the US Army Air Forces (USAAF) in June 1941.

³ Budiansky, *Air Power*, p. 179.

the continent. For the US, it was for similar reasons but they also possessed the industrial might to do it. There are mixed views as to whether strategic bombing was successful. However, it must be considered in the overall context and in conjunction with other Allied objectives.

The positive purpose of a bombing offensive was essentially complementary to the general strategic aim of defeating the enemy power ... Bombing was a component part of a wider strategy, complementary to land invasion and to the exercise of tactical air power.⁴

A handful of British and US senior air staff believed in the principles of strategic bombing from the outset. Although it was a subject still under debate, its supporters in senior military and political circles allowed the concept to proceed. Since the end of World War I, both the Royal Air Force (RAF) and United States Army Air Corps had continued the development of heavy bombers, albeit at a much reduced level of support. Thus, they already possessed the means and the will to conduct strategic bombing. The support for bombing in leadership circles gave strategic bombing its operational impetus.

A common theme that underscores the strategic bombing campaign is the need for accurate intelligence. It is a theme that persists today. Accurate target intelligence is perhaps even more important in contemporary conflicts given the use of precision weapons and the greater awareness of law of armed conflict issues.

Intelligence was a crucial part of the bombing campaigns. It was necessary not only to predict the most suitable targets and priorities, but for the equally important task of surveying bomb damage and overall results.⁵

Before World War II, Britain realised that a war with Germany was a distinct probability and so, in June 1936, the RAF established the Air Targets Sub-Committee to coordinate intelligence from various departments on the German economy and possible targets within it. However, the amount of effort dedicated to target development was small. Target intelligence gathering, such as photographic reconnaissance, was carried out from 1938 but only on a very limited basis. It was not until war broke out in September 1939 that intelligence staffs were expanded and enough effort and resources assigned to get appreciable results. Intelligence on German industry was gathered through the Ministry of Economic Warfare and its analysis was generally overly simplistic. Simplistic intelligence analysis and

⁴ R.J. Overy, *The Air War 1939–45*, Europa Publications, London, 1980, p. 106.

⁵ *ibid*, p. 110.

a weak appreciation for the realistic effects of strategic bombing produced initial flaws in target planning that would not be rectified until the closing stages of the war.

Two separate, but complimentary dichotomies regarding strategic bombing emerged early in the war. The first was centred on a split between air power advocates who either saw strategic bombing as a complementary force to concurrent operations or those who perceived it to be a 'war winner' on its own. The 'war winners' can arguably be excused because of the myths that had been perpetuated around strategic bombing since World War I. The second dichotomy was centred on the physical effect versus cognitive effect schools of thought. Some, primarily the US, believed that the rationale behind strategic bombing was to achieve physical destruction of enemy war industries. Others, primarily the British, believed that strategic bombing was best utilised in an effort to undermine morale and bring about a collapse in enemy support for the war. Initially, most strategic planners believed in the material effects of bombing.

By destroying its key areas the armed forces of the enemy would be so weakened as to leave only token resistance to an advance by ground troops; or it might lead in certain cases to the enemy government giving up the struggle altogether. Both the British and United States air forces favoured attacks against crucial economic and military targets.⁶

On the other hand, there were those who believed that the whole purpose of strategic bombing was to create a psychological effect that would wear away civilian morale and therefore usurp the support base of a warring nation. The psychological argument can be derived from:

... Trenchard's often repeated assertion that the moral [sic] effect of bombing was twenty times greater than the material, a fact that could not be verified quantitatively but which nevertheless attracted the more enthusiastic bombing theorists to morale as potentially decisive target.⁷

⁶ *ibid.*, p. 13.

⁷ *ibid.*



Lincolnshire, Britain, 27 February 1943 – Marshal of the Royal Air Force Viscount Hugh Trenchard inspecting airmen. Trenchard reinforced the British belief in the ‘morale’ effects of strategic bombing.

(Photo: Imperial War Museum CH 8705)

Psychological effect first – British area bombing

In 1940 Bomber Command sought to target civilian morale as a tangible resource that could undermine the German war effort.

In order to justify such attacks the Air Staff presented industrial workers as a factor of production which had to be rendered ineffective like transport or fuel.⁸

This is not to say that enemy morale was Britain’s sole target. It was believed that the combination of physical destruction and psychological erosion would have a more decisive effect.

⁸ *ibid*, p. 106.

The objective of strategic bombing, whether of a more limited character or not, was to undermine morale in the enemy territory on one hand and to destroy vital economic targets on the other.⁹

The initial ineffectiveness of British strategic bombing can be traced to two factors. The first was that the extent of physical destruction that strategic bombing would inflict had been overestimated. The second was due to the intangible nature of psychological effects.

Morale was a difficult target to define. Its definition for operational purposes depended on a highly subjective assessment of the political or moral character of an enemy state.¹⁰

By the time the shortfalls in strategic bombing were realised, the Allies were committed to their bombing plan and it took a long time before the gap between strategic intention and operational reality was closed to a significant degree.

Operational reality dictated that strategic bombing required more bombs and bombers than previously considered to achieve desired effects. By mid-1941, the RAF had already attempted attacks on German strategic targets, such as oil production, armament industries and lines of communication. The results of their attempts to strike specific targets precisely were unsatisfactory. It was difficult to find and hit targets during daylight, let alone night-time.

Only 22 percent of bomber crews who claimed to have hit their assigned target got so much as within five miles of it. In the more heavily defended and haze-bound areas of the Ruhr, the figure fell to 7 percent.¹¹

Losses to bomber crews were also high. Intelligence and photographic interpretation of the damage inflicted by bomber sorties supported these figures, but the evidence was generally not accepted as reliable. Some British planners realised that strategic bombing needed improvement, although they still adhered to achieving psychological effects by bombing the civil population. Their adherence to that methodology signalled a shift in policy towards area bombing. Strategy was, therefore, determined by tactics, instead of the other way around. The technological limitations on what accuracy was achievable meant that bombers could only scatter their bombs over large areas and this could only mean that

⁹ *ibid.*, p. 13.

¹⁰ *ibid.*

¹¹ Budiansky, *Air Power*, p. 282.

whole cities, or selected portions thereof, were targetable. On the other hand, until the Allied landings in France during Operation *Overlord* in June 1944, strategic bombing was the only effective method the Allies had of striking directly against Germany. Inaccurate area bombing, therefore, represented the only option available.

Ad hoc and hastily assembled target intelligence led to the belief that early bombing was accurate and objectives were being met. When the British increased their photographic reconnaissance in 1941, post-operational assessments revealed that bombing was not accurate and objectives were not being met. Subsequently, an inquiry into the effectiveness of bombing was raised. In August 1941, Mr D.M. Butt, a member of the War Cabinet secretariat, submitted his findings on Bomber Command's ability to hit targets accurately. The report contradicted the claims of mission accuracy by British aircrew. The investigation had delved into 600 photographs of 100 raids on 28 cities. It was found that on average, one-fifth of bombers dropped their bombs within five miles of a target. Over heavily defended targets in zones such as the Ruhr, this figure dropped to one-tenth of the bombers.¹² Not all of this can be attributed to bombsights, as poor navigation was equally to blame.

In February 1942, Air Chief Marshal Sir Arthur Harris was appointed to lead Bomber Command. 'Bomber' Harris championed the idea of 'flattening' German cities to demoralise their workers. Subsequently, the British War Cabinet directed that the primary objective of the air offensive would be focused on directly attacking the morale of the enemy civil population, in particular that of industrial workers. A secondary consideration would be the targeting of key oil and rubber industries, and power plants. 'Bomber' Harris enforced these orders, believing:

the only way bombers could destroy *anything* was to destroy *everything*. Cities were *the* target—not factories, not morale, but the physical cities themselves. No modern society could last long with its metropolitan centers reduced to ashes.¹³

Perhaps his attitude can be justified to some extent because of the technical means available to conduct an air offensive, which meant that area bombing was the only method available to RAF. However, the fixation with area bombing created a spiralling decline in the need for accurate target intelligence.

¹² Stuart Halsey Ross, *Strategic Bombing by the United States in World War II: The Myths and the Facts*, McFarland & Company, Jefferson NC, 2003, p. 62. See also Overy, *The Air War 1939–45*, p. 110.

¹³ Budiansky, *Air Power*, p. 286.

The growing evidence that bombing was too inaccurate for precise bombing of selected targets pushed the RAF towards area bombing for which a minimum of intelligence was required. For area bombing Harris simply needed a long list of German cities and the industries located in them. Bomber Command remained more impervious to intelligence suggestions than other commands for the rest of the war, arguing that it had already been proved that area bombing at night was the only effective bombing policy.¹⁴

The only target development that was conducted was to increase the effectiveness of area bombing itself. In March 1942, Lord Cherwell, the British Cabinet's chief scientific adviser, devised a scheme to create an impact on the German civil population. He estimated that, in the average life expectancy of a bomber and aircrew, it would 'de-house' (that is, make homeless) approximately 6000 German people. He estimated that by mid-1943, Bomber Command could make one-third of the German population homeless.¹⁵ While it is not surprising that the British developed their area bombing doctrine to be more efficient, it is chilling to examine how Cherwell coolly applied scientific target analysis against German civilians to gain the maximum demoralising psychological effect.

To make matters worse, the psychological effect of the aerial offensive was difficult to quantify accurately. Scientific target intelligence could be dismissed by Harris, who did not have to produce quantifiable evidence as to the effectiveness of Bomber Command's methods. However, despite the claims of Bomber Command that entire German industrial centres had been destroyed by area bombing, the Ministry of Economic Warfare found that German war production actually began to increase in 1943. Again, this was more a function of technological limitations rather than poor doctrine.

In fact the whole argument between those who favoured strategic bombing and those who favoured the dispersion of bombing among the other combined strategic objectives rested on the fact that the available technology placed severe limits on what bombing could and could not do.¹⁶

Bomber characteristics such as range, payload and self-protection are perhaps less important than considerations such as accuracy that can be achieved through bombsight technology and accurate navigation. Regardless of the end result sought, area bombing still had a marginal effect on the quantity of German economic

¹⁴ Overy, *The Air War 1939–45*, p. 110.

¹⁵ Ross, *Strategic Bombing by the United States in World War II*, p. 62.

¹⁶ Overy, *The Air War 1939–45*, p. 112.

output. Furthermore, the United States disagreed with Britain on the employment of air power. The Americans were confident in their precision bombing capability and of its place in current doctrine. Due to high losses, the RAF had already concluded that daylight bombing was foolhardy—impossible in practice and pointless in theory.



RAF High Wycombe Headquarters, Britain, 27 February 1944 – Air Chief Marshal Sir Arthur Harris (centre), Commander-in-Chief Bomber Command, studies aerial reconnaissance photographs. Air Chief Marshal Harris championed the idea of targeting the civil population of the enemy in order to undermine their war effort.

(Photo: Imperial War Museum HU 44269)

Physical effect first – US precision bombing

United States target planners believed otherwise. Until the air war against Japan was in full swing in 1945, the US believed that attacks on key economic systems would have a secondary effect on morale without resorting to bombing population centres. In 1939, Britain had already regarded oil production, transportation and aircraft industry as crucial targets, but had adopted indiscriminate bombing of industrial targets, largely due to technological limitations. US planning was more elaborate and based on attacking sensitive sections of the enemy economy that

were already overstretched by war effort, such as the electrical power system, rail transport, oil production and petrol supplies. In 1942–43, US planners added to their target lists aluminium production and synthetic rubber plants, as well as submarine bases because of the threat U-boats posed to Atlantic sea lanes. US air commanders regarded the neutralisation of the Luftwaffe as their chief priority—being essential to achieve air superiority before other objectives could be fully realised.

Despite the British experience, the United States advocated precision targeting. As early as 1940:

Immediately work was begun on military-economic intelligence in order to offer firm support for the air force doctrines on bombing and the attacks on 'vital centres'.¹⁷

Convinced that, in all probability, the US would become involved in the war in Europe, operational planners drew up a list of German targets in August 1941. US economic analysts mistakenly believed that the Germany resources were stretched to their maximum capacity, so that the prosecution of a select handful of critical targets would collapse their economy. Electrical power was chosen as a target because of easy access to its technical specifications. The same can be said for oil production refineries. The US economic specialists used data from American industries in order to arrive at an analysis that could be applied to German industry. Estimates of the manpower and equipment required were based on this flawed analysis of the strengths and weaknesses of the German economic system. The final report was Air War Plans Division–Plan 1 (AWPD-1) – 'Munitions Requirements of the Army Air Forces for the Defeat of Our Potential Enemies'. In this report 'the planners listed 124 targets whose destruction would finish off Germany: 50 electric power stations, 15 bridges, 15 marshalling yards, 17 inland waterway facilities, 27 oil plants'.¹⁸

Accounting for bombing accuracy during the high stress of a wartime environment, the economists determined that 6860 bombers would be required to achieve German economic collapse within six months. It was not until mid-1943 that the US had 600 B-17 bombers operating from England—less than 10 per cent of the projected total.¹⁹ Although it was an ambitious document, much of its analysis was

¹⁷ *ibid.*, p. 111.

¹⁸ Budiansky, *Air Power*, p. 287.

¹⁹ *ibid.*

hastily assembled and flawed, based on scant knowledge of the German economy, air defences, and their ability to disperse facilities and repair damage.

The first US strategic bombing attack in Europe was conducted by the Eighth Air Force on 17 August 1942. Early results were not impressive.

The 8th Air Force daylight bombers sometimes hit the wrong cities, even the wrong countries; often bombed the countryside; and typically missed their intended targets by hundreds and thousands of yards.

There were ample reasons for this lack of precision. Hitting a target smaller than a football field from five miles up with a plain 'iron bomb' was then—as it has remained over 50 years later—a daunting challenge.²⁰

In September 1942, AWPD-42 was formulated as a review of AWPD-1. The new document recognised the need to expand US effort against targets in Germany. It identified seven major target systems, comprising 117 separate targets.²¹ Target sets included aircraft manufacturing, submarine yards, transportation, electrical power stations, oil production, aluminium production and rubber production. The efficiency of strategic bombing was still overestimated with regard to the rate of effort needed to make a realistic effect the German war effort. The findings of the report were still based on flawed analysis and a mistaken belief in the accuracy of precision bombing. Perhaps in response to poor analysis and unimpressive operational results, General 'Hap' Arnold, the US Chief of Army Air Forces, established the Committee of Operations Analysts in December 1942. The committee was born out of a need for detailed target analysis and was intended to streamline the process of target selection and act as an independent body in target development. Initially, it produced a list of 19 priority target systems but the committee's analytical methods were mostly incomplete. Target selection was still based on scanty intelligence, poor appreciation of results that could be achieved and little appreciation of operational realities.

A case in point is the Schweinfurt mission that was flown on 14 October 1943. Sixteen bomber groups, without escorting fighters, flew 500 miles from England to Schweinfurt in Germany, to attack ball bearing plants. Sixty out of the 229 B-17s that flew the mission were shot down and 138 damaged, with 599 aircrew posted as killed or missing. One-tenth of their bombs fell within 500 feet of intended targets, with 63 direct hits. Of the targets, three ball bearing plants lost 10 per cent

²⁰ Ross, *Strategic Bombing by the United States in World War II*, p. 8.

²¹ *ibid.*, pp. 51–52.

of their machines damaged or destroyed.²² Schweinfurt represents the highest attrition rate of US strategic forces in return for little appreciable gain.



USAAF Boeing B-17F formation over Schweinfurt, Germany on 17 August 1943. The raid on Schweinfurt on 14 October 1943 represents the highest attrition rate of US strategic forces in return for little appreciable gain.

(Photo courtesy of USAF)

Ball bearing plants were a poor target selection in any case because Germany possessed ample reserves of them and they had materials that could be substituted for their use in the manufacturing process. The actual damage inflicted was minor and could be quickly repaired. For the rate of effort required and losses sustained, a better target could have been selected that had greater impact on German war industry. The Committee of Operations Analysts had initially identified ball bearings as an indispensable component in the manufacture of tanks, machinery and aircraft. German ball bearing manufacture was also highly concentrated, with 50 per cent of

²² *ibid*, p. 54.

production coming from a plant in Schweinfurt. Despite massive raids in August and October 1943, the damage to ball bearing plants was less than expected. Ball bearing production was only briefly curtailed and the Germans began redesigning critical components of their equipment. In tanks, aircraft and weaponry, German engineers reduced the consumption of ball bearings by up to 60 per cent.²³

By the end of 1943 when it finally became clear to U.S. mission planners in Washington and England that American heavy bombers were incapable of hitting so-called ‘precision’ targets, there was a purposeful shift to area bombing of German cities as practiced [sic] by the Royal Air Force.²⁴

The distinction between British ‘area bombing’ and US ‘precision bombing’ is marginal. Technological limitations and anti-aircraft defences meant that, in reality, British aircrew could only hit an area target at night. Likewise, US aircrews found they could not achieve the precision they sought—meaning that their bombs would invariably be spread over a wide pattern regardless.

Interoperability and ‘Coalition’ operations

A meeting between the Allied leaders changed the face of targeting in World War II. In January 1943, Roosevelt and Churchill (sans Stalin) held a conference at Casablanca to decide their future strategy in Europe. Both leaders agreed to common strategic objectives regarding the aerial offensive. The underlying rationale was to achieve the progressive destruction of German military, economic and industrial systems, combined with the undermining of morale of the German people to a point where their capacity for armed resistance would be fatally weakened. Despite US reservations, the leaders agreed that no attempt would be made to spare residential areas from bombing attacks. Subsequently, the priorities of certain targets types were updated. To help maintain open sea lanes for convoys in the Atlantic, submarine construction yards topped the list of priorities, followed by German aircraft industry, transportation, oil refineries and storage, and ‘other’ industrial plant deemed vital to the enemy’s war industry.

Yet targeting objectives were not the only subject under discussion. The Allied leaders decided on a strategic objective that would define how the war was conducted. When Roosevelt announced at Casablanca that the Western Allies would only accept an Axis unconditional surrender, it created a passive effect that had a knock-on impact to targeting. Germany was subsequently compelled to ‘fight to the last man’ to prop up the Nazi regime, because Hitler was unable

²³ Budiansky, *Air Power*, p. 323.

²⁴ Ross, *Strategic Bombing by the United States in World War II*, pp. 8–9.

to seek concessions with the Allies and also refused to surrender.²⁵ However, the decision to ‘knock Germany out first’ was made at the same conference. Thus it necessitated the need for a land invasion of Europe to end the war. It is arguable whether Roosevelt’s statement prolonged World War II or not. The writing was already on the wall before Roosevelt’s statement—his words simply put the conflict into perspective. The most notable result of the conference was that strategic bombing and targeting became a combined *Allied* effort, no longer delineated into two separate camps. Although the RAF and United States Army Air Forces (USAAF) had markedly different doctrines, they managed to share target information and work to a common target plan.

The selection of German aircraft industry as a high priority target can be attributed to the US desire to achieve air superiority from the outset of the air war. The British flew their raids at night and largely left the question of air superiority to the Americans who flew in the daytime. By targeting aircraft factories the aerial offensive would contribute towards the Allies achieving air superiority in Europe. This was done by attempting to destroy the Luftwaffe on the ground at its source—in the aircraft manufacturing factories. It proved to be elusive as a strategic bombing objective. From January to April 1944, US strategic air forces attacked every aircraft factory in Germany that could be identified. Despite this effort, German aircraft production managed to reach an all-time peak later in the year. As the British had done during the Blitz, the Germans responded by dispersing aircraft factories, so that the destruction of a singular major facility would not completely halt production. The US raids only served to disrupt aircraft factories for a short period of time and simply delayed a few production deadlines. Similar to its Allied counterparts, the German economy featured a degree of flexibility and redundancy. Like all societies, they also possessed the sagacity to improvise and adapt to the changing fortunes of war. Quite simply, US strategic target planners had underestimated the German capacity for war production—‘what had looked on paper like a choke point was at best a minor pressure point’.²⁶

Although oil production was slated as a high priority target in 1943, by June 1944 it became the Allies’ chief target priority. Before 1944, the problem with striking at oil facilities was that they lay deep within Germany and their occupied territories to the east. They were simply beyond the range of Allied bombers. This situation changed as Allied ground forces advanced further into Italy and forward air bases could be established. There are a number of factors that make oil installations an inviting target. Refinery fields are large, more easily identifiable from the air and

²⁵ *ibid.*, pp. 66–67.

²⁶ Budiansky, *Air Power*, p. 327.

placing bombs within the facility perimeter is easier to achieve. Likewise, they are fixed facilities that cannot readily be moved or dispersed to other areas. The last factor is that the end product—fuel—is of critical importance to mobility in modern warfare. Of the total effort, in terms of tons of bombs that Allied strategic bombers in Europe delivered, only 12 per cent were dropped on oil targets.²⁷ The USAAF dropped 123 586 tons of bombs on oil targets, of which only 4326 tons hit anything significant.²⁸ The small success rate however had a serious impact on German oil production. By late 1944, reliable Allied intelligence reports indicated that, due to bombing, German oil production had dropped by 50 per cent and reserve stocks would only last until mid-1945.²⁹ Postwar figures show that average domestic oil production fell from 666 000 tons per month at the beginning of 1944, to 260 000 tons in December 1944, and 80 000 tons in March 1945.³⁰

Targeting oil had decisive secondary physical effects by curtailing the operations of German aircraft in the air defence role and limiting the manoeuvre of mechanised ground forces. After the war, Albert Speer, the Reich's Minister for Armaments and War Production, admitted to his captors that Germany's capacity for war was severely diminished when the Allies switched their targeting efforts to oil facilities. Most of the attention paid to targeting oil was after June 1944, in the final 11 months of the war in Europe. Some evidence suggests that, in all probability, the war in Europe could have ended sooner if oil could have been targeted from the start. However, it should be noted that such a statement is, in reality, playing 'devil's advocate'. The Western Allies still needed to land troops on continental Europe in order to bring about an effective end to the war. With this in mind, strategic bombing should always be considered within the context of broader joint operations.

Despite the success of attacking oil production, Allied bombing had an unquantifiable effect on civilian morale and did not prevent German workers from working in the factories. Factory workers in the cities learned to cope and improvise, and essential services were restored as quickly as possible after bombing raids. The German war industry was buffered by excess capacity. Contrary to the early estimates of US target planners, the German economy was not 'stretched too thin' at the start of the war—only 49 per cent of GDP was invested into war production in 1941. In 1943, Germany had twice as many machine tools per worker as did England and 90 per cent of industry continued to operate on a single shift throughout the war. Despite the strategic bombing of his homeland, Albert Speer

²⁷ *ibid.*, p. 329.

²⁸ Ross, *Strategic Bombing by the United States in World War II*, p. 72.

²⁹ Budiansky, *Air Power*, p. 328.

³⁰ Ross, *Strategic Bombing by the United States in World War II*, p. 72.

had tripled arms production by 1944. Few factories remained in city centres—they were dispersed to smaller towns and regional areas. British experts later estimated that the overall loss in German war production, attributable to urban area attacks in 1944–45, amounted to less than one per cent.³¹ Throughout the targeting of German industry, morale was presented as a ‘complementary target’. British doctrine of directly attacking the German population shifted marginally towards US doctrine as the Allied target plan was prosecuted. Although the Allies deemed it necessary to break German morale before launching a continental invasion, it was considered to be a by-product of physical attrition; that is, breaking morale was a secondary psychological effect that was not pursued directly.

Qualitative effects

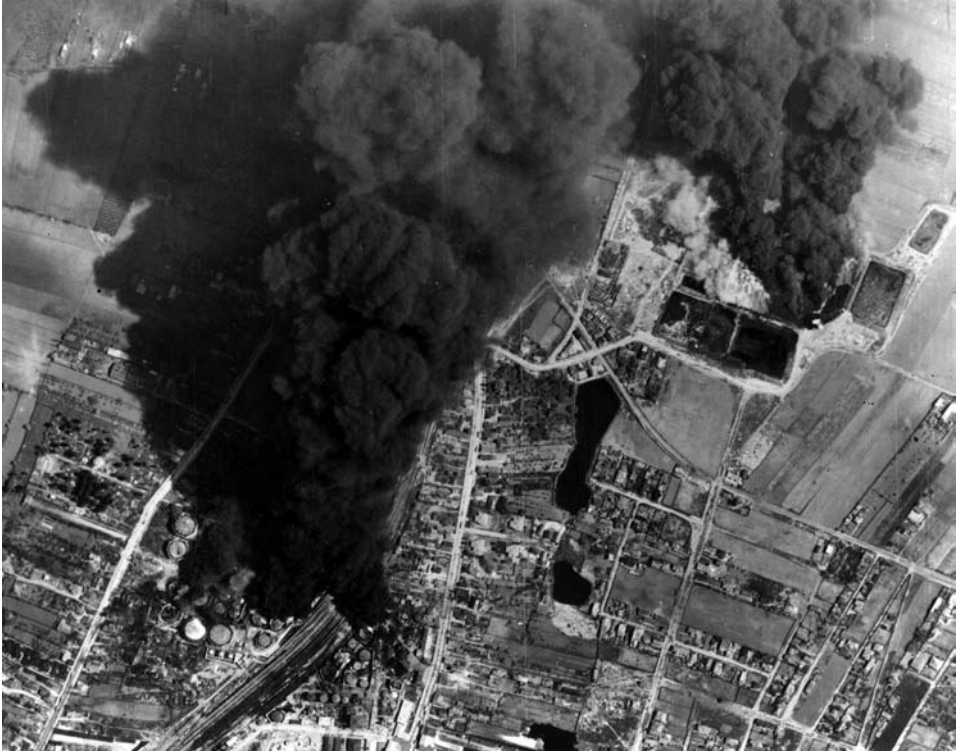
Often the qualitative effects of the Allied aerial offensive are overlooked. It is overly simplistic to quote raw production figures of German industry in 1944 and claim that strategic bombing was unsuccessful. Examples of qualitative effects that affected Germany were a decline in manufacturing quality, attrition of trained pilots and a psychological depression of the civilian population. The problem in assessing qualitative effects lies with a lack of data that makes it difficult to gauge these effects with a reasonable degree of accuracy. The other caveat applicable to qualitative effects is that they are complementary to concurrent operations. In isolation, they are virtually worthless and should only be considered in the light of overall strategy.

After June 1944, it was clear that any end to the war would be the consequence of Army operations assisted by the bomber, rather than the other way around. Strategy was dependent on air power to help pave the way for land operations on the European continent. A major problem in the perception of air power was that its effects were often viewed in isolation of overarching objectives. The same can be said of air power today.

Despite the controversy surrounding the claims of the bombing strategists and the purposes of bombing the offensive was successful within the terms of the overall strategy agreed between the Allies. Those terms had always confined bombing to a primarily tactical role pursued by what others described as ‘strategic’ methods. More could not be achieved because more was not necessary to the fulfilment of the main objective. Nor was more asked for. The Luftwaffe was fatally weakened; German transportation was successfully interdicted; the submarine and V-weapons successfully combated from the air; the German economy increasingly eroded in the year-long conquest of mainland Europe ... Those who favoured a maximum strategy for bombing were confounded through technical shortcomings,

³¹ Budiansky, *Air Power*, p. 318.

operational difficulties and the demands of the services as a whole. It was the rhetorical threat of bombing that created the illusion in the early years of war that bombing promised more than it could fulfil.³²



Campina, Romania, 6 May 1944 – A vertical aerial reconnaissance photograph taken over the oil refinery and marshalling yards, following an early morning attack by the RAF. Targeting oil (a strategic resource) had a considerable effect on the enemy's ability to conduct operations.

(Photo: Imperial War Museum C 4346)

Contemporary advocates of a 'maximum strategy' for air power are still confounded by modern technical shortfalls, operational difficulties and service demands. It is often due to a poor realisation of what offensive air power actually promises, rather than air power itself promising too much.

³² Overy, *The Air War 1939–45*, p. 118.

From the point of view of general strategic intention bombing achieved all that was expected of it. Only those who expected bombing to win the war on its own were frustrated by events.³³

A similar situation was played out over 50 years later in Kosovo as planners with overly-high expectations viewed the effects of bombing in isolation and disregarded the complementary nature of air power.³⁴

In terms of physical attrition, Allied strategic bombing achieved mixed results. Little direct impact was made on German industry until oil production was singled out as a priority target in the final 11 months of the war. Despite these results, the postwar US Strategic Bombing Survey seemed to validate the use of offensive air power. At the time, the Strategic Bombing Survey was perceived as an objective study that had a reinforcing influence on US doctrine regarding the future use of strategic bombing. The fundamental flaw in the survey is that it upheld the myth that US bombing was a 'precision' capability, specifically aimed at German industry. This is in contrast to British area bombing that was, initially, aimed at morale. In reality, poor accuracy and operational limitations meant that little distinguished each from the other. In other words, US 'precision' bombing was, in reality, area bombing aimed at industry, which also caused a high proportion of civilian casualties.

Interviews with Albert Speer after the war indicate that Allied bombing did have a direct psychological effect on German morale.³⁵ It is difficult to determine exactly to what extent. The Strategic Bombing Survey measure of effectiveness was benchmarked against industrial and economic targets, and morale was not considered as a 'target set'. Therefore, psychological effects were not pursued to any great extent in postwar reports. Some authors, however, have collected some anecdotal evidence from the era that suggests German civilian morale was reeling from the onslaught of near-constant aerial attack. Antony Beevor's accounts of life in Berlin in 1944–1945 provide some invaluable insights into the psyche of a nation under aerial siege. Stress-induced psychological mindsets are evident:

Berliners, gaunt from short rations and stress, had little to celebrate at Christmas in 1944. Much of the capital of the Reich had been reduced to rubble by

³³ *ibid*, p.119.

³⁴ 'Chapter Seven – Operation *Allied Force*: Kosovo (24 March – 10 June 1999)' covers this in more detail.

³⁵ Gian P. Gentile, *How Effective is Strategic Bombing?: Lessons Learned from World War II to Kosovo*, New York University Press, New York, 2001, pp. 59–60.

bombing raids. The Berlin talent for black jokes had turned to gallows humour. The quip of that festive season was, 'Be practical: give a coffin'.³⁶

The bombing also caused disruption of daily routines and imparted a sense of depression:

Air raids were so frequent, with the British by night and the Americans by day, that Berliners felt that they spent more time in cellars and air-raid shelters than in their own beds. The lack of sleep contributed to the strange mixture of suppressed hysteria and fatalism.³⁷

Unlike the British experience under the Blitz, the Germans displayed no consensus of opinion, nor a united front:

General Günther Blumentritt, like most of those in authority, was convinced that the bombing raids on Germany produced a real '*Volksgenossenschaft*' or 'patriotic comradeship'. This may well have been true in 1942 and 1943, but by late 1944 the effect tended to polarize opinion between the hardliners and the war-weary.³⁸

It would probably be a close representation to say that in the closing months of 1944, German city-dwellers were at the end of their tolerance for aerial bombardment. Again, this is not to imply that the German population would suddenly snap and cause the regime to capitulate. The Nazi regime had already displayed that it would fight to the finish. Rather, aerial bombardment contributed to the undermining of German 'universal' morale. Many civilians no longer supported the war, nor believed in the propaganda, nor believed that Germany had a chance of winning the conflict. Swathes of '*Volkssturm*' militia groups no longer heeded their call-up orders. Many soldiers in the front line deserted or simply surrendered at first opportunity. Although Germany was strongly defended on land (particularly in the East), the capacity for fanaticism was significantly degraded as people reconsidered the futility of resisting.

It is interesting to note that the early US AWPB-1 report was not aimed at 'how to destroy select enemy industries', but rather 'how to best affect enemy war production'.³⁹ Right from the outset, US target planners never really intended to decimate German industry. This distinction should be made so that strategic bombing

³⁶ Antony Beevor, *Berlin: The Downfall 1945*, Penguin, Camberwell, 2002, p. 1.

³⁷ *ibid*, p. 2.

³⁸ *ibid*, p. 4.

³⁹ Gentile, *How Effective is Strategic Bombing?*, p. 68.

effort is put in proper perspective. US strategic bombing was effective in reducing German war capacity when certain targets were bombed. At this juncture, Speer's 'tripling of wartime production' in 1944 should be put in context of the overall strategic situation. The bulk of this war matériel was produced to offset the Soviet's superiority in numbers on the Eastern Front. Much of the quality of German arms manufacture was significantly reduced. Tank armour, for example, was thick but the metallurgical properties were poor, as the critical metals to manufacture strong alloys were in short supply. Their tanks frequently broke down as the mechanical components needed for high-maintenance engines were increasingly scarce. As the Soviets built larger tanks to match the Tigers and Panthers, German gunners found they were frequently unable to penetrate the Russian armour due to a shortage of tungsten to make armour-piercing rounds. Many of these types of factors can be attributed to the secondary effects of Allied bombing in some way.

The German experience in the Battle of Britain in 1940 created a perception that sustained strategic bombing of Germany could not be carried out. The defeat of German bombers at the hands of a determined British air defence created the impression that the bomber would not always get through. Later, during the initial stages of the Allied strategic bombing campaign, the Germans subsequently miscalculated that the British were carrying out a morale-breaking exercise, which was not surprising given most early sorties failed to hit a military target. Behind the eight ball from the outset, air defence was therefore a constant game of catch-up for Germany. The German people gradually lost faith in the ability of the Nazi regime to protect them from aerial bombardment. Given the need to retaliate in kind, there is some evidence that Germany sought to mount a counter-strategic bombing campaign on Britain in 1942, but lacked the resources to do so at such a late stage in the war. By the end of 1943, the Germans realised that they would never be able to retaliate against Britain to the same extent.

In the end no significant attack could be mounted through a shortage of trained pilots and the necessary aircraft and the considerable improvement of the British night defences.⁴⁰

Yet the German desire to attack the British in a similar way remained. Thus, they increased development and use of the 'V' series of missiles, or 'terror weapons', in 1944. These missiles, with a rudimentary guidance system, flew from forward launching pads in Europe to drop on British cities. The point here is that strategic bombing had such an effect on the German psyche that they felt compelled to react with any means that seemed feasible at the time.

⁴⁰ Overy, *The Air War 1939–45*, p. 120.

Until 1944, the physical destructive effect of strategic bombing on the German economy was less than expected. Between 1943 and 1944, Allied bomb tonnage dropped on Europe increased from 226 513 to 1 188 577 tons.⁴¹ The precision of aerial attacks also increased significantly. However, in general terms, Allied destruction of German industry was mitigated by dispersion of facilities and an ability to repair damage quickly. Strategic bombing disrupted, interrupted and impaired smooth production, but it did not destroy enough capital stock, such as plant and heavy machinery, to bring it to a standstill. In more real terms, the offensive air campaign caused significant manpower to be diverted towards anti-aircraft home defences. In 1944, approximately two million soldiers and civilians were manning guns, piloting aircraft or filling in craters.⁴²

Given the mixed results of strategic bombing, perhaps the most pertinent question that should be asked is ‘What if it had not occurred?’ An absence of an Allied bombing campaign would have resulted in a markedly different strategic landscape. The removal of an aerial threat would have freed-up those German resources that were dedicated to home defence and repair work. Furthermore, it would have resulted in less physical damage to infrastructure and industry. This would have allowed Albert Speer the freedom to plan, build and operate the German war economy without any major interruption.

The important consequence of the bombing was not that it failed to stem the increase in arms production, but that it prevented the increase from being very considerably greater than it was. Bombing placed a ceiling on German war production which was well below what Germany, with skilful and more urgent management of its resources, was capable of producing after 1943.⁴³

Like their air defences, Germany was compelled to play catch-up and continually modify their means of production in reaction to the changing strategic situation. That strategic situation was being influenced by the Allies—‘bombing increasingly dictated to the German authorities how the economy was to be organized’.⁴⁴ The underlying factor was that, as the Allied offensive air campaign progressed, it helped to wrest away the strategic initiative from the German planners and deposited it with the Allies.

⁴¹ *ibid*, p. 121.

⁴² *ibid*, p. 122.

⁴³ *ibid*, p. 123.

⁴⁴ *ibid*.

The bottom line

The strategic bombing offensive was a function of a wider war of attrition. Ironically, however, its doctrine was founded in the principles of avoiding a protracted and bloody war. The same can be said of contemporary and future conflict—the aim is to avoid lengthy battles of attrition, to reduce casualties and to reach an acceptable end-state as soon as possible. This is the challenge to effects-based target planners who select strategic targets—choosing those facilities that fulfil the conditions above. It is arguable whether strategic bombing could have shortened World War II with earlier selection of critical targets such as oil production, as the outcome was still dependent on a land invasion. Similarly, effects-based target prosecution in the future will certainly be tied to a broader operational objective or strategy.

INTERDICTION AND CLOSE AIR SUPPORT

Strategic bombing on the scale of World War II is unlikely to be repeated. While tonnages of bombs dropped in subsequent conflicts have increased, the widespread devastation is hard to equal. Furthermore, ‘battlefield air interdiction’ and ‘kill box interdiction’ are becoming increasingly more prevalent as contemporary roles for offensive air power. On the surface, these roles seem to be highly centred towards achieving physical effects on an adversary. Yet this is not always the case. Some examples of close air support and interdiction from World War II indicate that operational and tactical level targeting can also achieve cognitive effects. Thus, interdiction and close air support have a distinct role in effects-based operations.

The intricacies of interdiction and close air support in World War II have not received as much attention as strategic bombing. This is probably due to two major reasons. The first is the moral issue of strategic bombing—due to the civilian casualties it caused, strategic bombing carries a stigma that somehow needs to be explained. The second is the ongoing debate of target selection and strategic bombing—that is, which targets can produce the desired effects. *Interdiction* is important as a physical effect. It is the application of attrition at the operational level to cut an enemy’s lines of communication, hamper supply and deny reinforcement. Interdiction can serve to restrict an opponent’s ability to manoeuvre so that he can be contained. World War II featured two types of interdiction attacks—the first was a planned and deliberate attack against fixed targets and the second was ‘armed reconnaissance’ against targets of opportunity along the enemy’s lines of communication. These types of attacks roughly correspond to their modern equivalents of ‘battlefield air interdiction’ and ‘kill box interdiction’, respectively. Typical target types for World War II interdiction attacks were supply dumps, forward airfields, lines of communication and bridges

leading to and from the forward battle area, concentrations of troops in transit and armour in reserve. Likewise, close air support is equally important. It is a function of air superiority and the ability to provide tactical support to land forces engaged in battle. Before the age of precision-guided, ground attack weapons, close air support was largely psychological in nature—it provided friendly ground troops with a degree of security and imparted a degree of insecurity upon the enemy. This psychological impact can be derived from the nature of air power. Massive amounts of firepower can be delivered, over a short period of time and from a vulnerable direction—above. Given this, the psychological nature of close air support is still relevant in the modern battlefield.

Interdiction: Physical attrition to achieve operational objectives

A good example of planned interdiction from World War II can be found in the pre D-Day invasion aerial attacks. As fighter engines and airframes improved during the war, the Allies realised that certain types of fighters were more suited to a ground attack role. World War II fighter-bombers had certain advantages over heavy and medium bombers—they were faster, more manoeuvrable and able to achieve greater accuracy at low altitudes. They were limited only by their small payload. Pre-invasion air operations were primarily focused on neutralising the German ability to mobilise a quick counterattack against an Allied beachhead. Planners, therefore, targeted the French rail system, with the idea of cutting off supply closer to the source, rather than having to strafe or bomb it on the battlefield. The target plan entailed striking 80 rail centres, not near Normandy where the landings would take place, but further away in northern France and Belgium. The intended targets were repair shops, rather than attacking rail lines and switching yards that resulted in localised and easily repairable damage. The actual effect, however, was not the one desired. The Germans shunted all civilian traffic from the railways in order to keep military-supply trains running. They also possessed a surplus of rail stock to maintain their essential needs.

In response, in May 1944, the Allies decided to switch targets to rail bridges across the Seine River. Fighter-bombers proved to very effective at cutting bridges with accurately delivered bombs at low altitude. Train engines and rolling stock were also attacked. By 6 June 1944, 475 train engines were out of action and every bridge across the Seine south of Paris had been dropped.⁴⁵ ‘Strategic’ interdiction had failed, but a more focused operational level interdiction campaign, to isolate a section of the intended theatre of battle, had succeeded. It should be noted that the

⁴⁵ Budiansky, *Air Power*, p. 302.

strike accuracy of fighter-bombers was in direct proportion to the defensive fire of enemy anti-aircraft artillery batteries.

With no flak, P-47s could put half of their bombs within 180 feet of their target and required 30 bombs to score one hit. With medium flak, accuracy dropped to 300 feet, requiring 84 bombs per hit; with heavy flak, it was 420 feet and 164 bombs.⁴⁶

Thus, it still took a lot of effort to demolish a single bridge. More importantly, the 1944 interdiction attacks reached a high water mark in the use of offensive air power. It showed that an operational objective could be achieved through secondary effects—attacking the bridges instead of the trains directly. It also revealed that, compared to bombers, dedicated ground attack fighter aircraft had the capability to strike with enough precision to achieve decisive, small-scale effects.

Yet precision bombing, and the technical means to achieve it, was finally developed during the war to such a degree that it was possible to carry out remarkable operations in the interdiction of crucial communications in the preparations and support for 'Overlord'.⁴⁷

The increased accuracy of low-level attacks did not mean that fighter-bombers were effective at interdiction against all types of targets, nor in all types of circumstances. Ground attack aircraft were found to be much more successful in an interdiction role against thin-skinned vehicles and supply columns. The destructive effects of interdiction attacks were also overrated. It was found that interdiction strikes, in general, did not destroy large numbers of German vehicles on roads.

As with close air support, neutralisation was often more important than destruction. Armed reconnaissance rendered all German movement in and around the battle area potentially vulnerable to air attack.⁴⁸

⁴⁶ *ibid.*, p. 305.

⁴⁷ Overy, *The Air War 1939–45*, p. 115.

⁴⁸ Ian Gooderson, *Air Power at the Battlefield: Allied Close Air Support in Europe 1943–45*, Frank Cass Publishers, London, 1998, p. 212.



Gael Airfield (near St Malo), France, 21 March 1944 – Low-level daylight attack by De Havilland Mosquitos of No 21 Squadron RAF. The aircraft flying away has its bomb doors still open as its 500-lb bombs explode on the hangars. Prior to the Normandy landings on 6 June 1944, the battlespace was thoroughly ‘prepared’ by attacking tactical targets that could influence the outcome of the battle.

(Photo: Imperial War Museum C 4239)

Interdiction challenged German freedom of movement along roads, such that most large-scale movement was conducted at night-time and with large gaps between groups to ensure adequate dispersion.

Yet, in operational terms, night movement was a very poor substitute for total mobility, particularly in summer with few hours of darkness.⁴⁹

We can see that interdiction was, in June 1944, effective in creating an operational theatre that was conducive to Allied operations; that is, an amphibious invasion. As the war in North-West Europe progressed, interdiction attacks were aimed more at German resupply and reinforcement efforts. Both were successful, but not solely in terms of the rates of attrition they achieved. Interdiction’s greatest contribution was to *shape* the battlefield, to make a German counterattack difficult and to create a *delay* effect. With regard to the modern battlespace, a delay effect is particularly pertinent and has relevance to contemporary time-critical, high tempo operations.

⁴⁹ *ibid*, p. 214.

Close air support: More psychological than physical

In 1946, the British Army's Military Operational Research Unit (MORU) initiated a Battle Study to determine the effectiveness of close air support. During the war, Operational Research Section (ORS) teams had studied battlefields shortly after operations. They examined destroyed and damaged vehicles and equipment, gun positions and strong points, and recorded the number of shell, bomb and rocket impacts in the area and around positions, with a view to determining what had been destroyed from the air. Of particular interest were the claims of tank 'kills' by Allied aircrew that flew close air support missions against German armour. The ORS survey teams also conducted interviews with captured enemy troops, and friendly troops who had, at times, witnessed close air support missions from the ground. Also of interest were accidental aerial attacks on friendly troops, which provided a more easily obtainable, first-hand report of the effectiveness of close air support. The first indication of the psychological effect of close air support came from a fratricide report of the First Canadian Army:

The Army report of late 1944 on air support observed that the moral[e] effect of such attacks on friendly troops was great and tended to be out of proportion to the damage and casualties inflicted.⁵⁰

The RAF had recognised early, in France in May 1940, that the physical effects of air strikes were not in proportion to the risks involved, particularly when attacking tactical targets that were protected by anti-aircraft artillery defences. Yet the demand for aerial support from ground forces remained and so the principles of close air support were developed further. Significant resources were invested in communications and in training pilots, forward air controllers and liaison officers. The United States, in particular, first used light observation aircraft in Italy in 1943 to direct fighter-bombers onto close support targets. Known as 'Horsefly' sorties, fighter pilots flew the observation aircraft and became the first airborne forward air controllers.⁵¹ The underlying idea with Horsefly was to make close air support as efficient as possible. Although very little priority and thought was given to close air support in 1943, over the next two years, through operational trial and error, it had become a workable system.

In fact, systemised and organised close air support was born from US operational experience following the Operation *Torch* invasion of North Africa in November 1942. Formal doctrine was introduced in May 1943 when the US War Department

⁵⁰ *ibid.* p. 33.

⁵¹ *ibid.* p. 43.

published the Field Manual *Command and Employment of Air Power*. The document enforced the primary principles of air power—to secure air superiority and to provide support to ground forces through interdiction. Almost as an afterthought, close air support was awarded third priority and was to be employed as a ‘last resort’. At first, close air support doctrine progressed slowly, mostly through personal contacts and a demand for it from ‘enlightened’ ground commanders. Inter-Service exchanges ensured that both air and ground liaison officers proved to be invaluable as they built personal connections between the Army and Air Force. Subsequently, the willingness of aircrew to prosecute ground targets increased as goodwill and mutual understanding improved. However, greater understanding of each other’s roles was also needed at the command level.

Ground-force commanders often failed to appreciate that air support, to be effective, had to be an integral part of an operation rather than simply appended to it. The 1944 investigation of air support in North-West Europe drew attention to the fact that some air personnel felt that the maximum effectiveness of air support was often not obtained because of the commander’s failure to call in G-3 air until after a plan had already been adopted, rather than during the planning stage itself.⁵²

Then, as now, effective close air support largely depended on air force integration into the planning stages of land operations. The fact that close air support developed at all was due to the fact that some less-senior Allied commanders were determined to make air support work at the operational level through cooperation with ground commanders. Another contributing factor was the Allied achievement of air superiority over the Luftwaffe, in operational areas, from 1943–45.

Like strategic bombing, the efficacy of close air support was determined by accuracy. The unguided bombs and air-to-ground rockets of 1943–45 were highly inaccurate and barely adequate for use against precision targets. Their accuracy is recorded in a battery of experiments conducted by the British Army and RAF Operational Research Section. In a series of tests conducted at Armament Practice camps in 1945 in the United Kingdom, peacetime, low stress firing of rockets showed that for a 50 per cent chance of a hit, 140 rockets from 18 Typhoon sorties would be required against a single Panther tank. The average Typhoon pilot firing all eight rockets had a four per cent chance of hitting the same tank in a single pass. Actual wartime results were similar. Surveys of close air support attacks against German field positions in a single operation found that of 11 bombs, only five, or 45 per cent were within 150 yards (137 metres) of the intended target. For 1944–45,

⁵² *ibid*, p. 52.

average CEP of a fighter-delivered bomb was found to be 130 yards (119 metres) against point targets.⁵³ Strafing with machine guns or cannons proved to be much more accurate than bombs or rockets but lacked stopping power against armour or penetration against fortified positions. A post-battle survey by XIX Tactical Air Command in 1945 showed that ground attack aircraft had only knocked out six armoured vehicles out of the 90 claimed by aircrew.⁵⁴

In terms of effectiveness, close air support was found to be most useful in a set of limited circumstances. Due to the inaccuracy of munitions, these circumstances were when a psychological effect could be achieved. The following are examples of the effectiveness of close air support in specific situations and are by no means exhaustive, nor definitive.

Armoured column cover

A niche capability for close air support is to act as a dedicated air strike capability for armoured columns. For instance, a detachment of the United States 3rd Armored Division enjoyed effective close air support on its advance to the heights near Brécy, on 31 July 1944. The task force commander, Colonel Doan, requested a P-47 strike as his force approached a defended railway embankment. The strike package went in and the ground forces advanced in the aftermath:

As the US tanks crossed the embankment unopposed their crews saw several unmanned German anti-tank guns. The morale effect of air attack coupled with the shock of an immediate follow-up had induced their crews to remain under cover, though they subsequently returned to man their guns against the following US infantry.⁵⁵

Such a dedicated capability required considerable air effort and allocation of resources. However, Army opinion was that the effort was worth the dividends and it was a major factor that enabled US armour to break through German defences. The utility of armoured column cover is that it enhances the manoeuvre capability of ground commanders and provides them with more flexible options with regard to moving through tactically important terrain.

Queuing

Queuing was a British system whereby flights of ground attack aircraft would proceed to an area of battlespace likely to require air support. On arrival, the flights would communicate with the local forward control post that was manned

⁵³ *ibid.*, pp. 75–77.

⁵⁴ Steven J. Zaloga, *Lorraine 1944: Patton vs Manteuffel*, Osprey Publishing, Oxford, 2000, p. 29.

⁵⁵ Gooderson, *Air Power at the Battlefront*, p. 86.

by both Army and RAF personnel. The forward post would then provide a close air support flight with a target as a request from ground forces emerged, giving a short target brief and an indication with coloured smoke artillery rounds if necessary. This method was dubbed 'CABRANK', because the queued flights resembled a line of taxis waiting for business. Using this procedure, it was possible for targets to be attacked within 10 minutes of the original request for support.⁵⁶ The queuing system was particularly successful during the XXX Corps advance to relieve the British 1st Airborne Division at Arnhem in September 1944. In particular, the road approach of the 2nd Irish Guards (Tanks) was halted by dug-in and concealed German anti-tank guns that had good cover against artillery fire. Queued close air support was on call and proceeded to neutralise the anti-tank positions.

The Typhoon attacks quickly and utterly demoralised the German troops. The Irish Guards War Diary recorded that effect of the rockets was almost instantaneous, and that German troops came running from the trenches 'trembling with fright' in order to surrender.⁵⁷

In this instance, close air support proved to be more effective than supporting artillery fire, not in terms of casualties caused, but in the way it affected enemy morale. As the Guards' advance continued, so did the aerial attacks in support, which produced hundreds of demoralised prisoners for a minimum of British casualties. Furthermore:

This demoralisation was achieved, in some cases, without rockets or cannon being fired, as the Typhoons stayed with the Guards even though they had expended their rockets and cannon ammunition, making dummy attacks on the German positions that proved equally effective in subduing them.⁵⁸

The tactical success of close air support had operational repercussions on the German force. British ground attack aircraft continued to attack headquarters elements and road traffic—effectively interdicting lines of communication. Faced with the additional pressure of the tank advance, the local German commander withdrew to positions further in the rear. Such an example serves to highlight that in highly mobile and fluid operations, close air support can provide a direct level of firepower that can be more effective than artillery.

⁵⁶ *ibid*, p. 87.

⁵⁷ *ibid*, p. 89.

⁵⁸ *ibid*, p. 90.



France, 18 August 1944 – A rocket fired from a Hawker Typhoon of No 181 Squadron RAF is shown heading towards German motor transport trying to escape through the Argentan-Falaise gap on a road near Livarot, Normandy. This type of photograph would have become increasingly rarer as the enemy restricted their road movements to night-time in order to mitigate the effects of Allied air superiority.

(Photo: Imperial War Museum C 4571)

Other types of operations

There are a number of alternative situations where close air support has proven to provide effective firepower. The first of these is airborne operations, whose execution is entirely dependent upon air power. After airborne troops are landed they depend on close air support to supplement their own organic fire support. The second is the product of an encirclement of the enemy. Close air support directed against an encircled position was found to be very effective in World War II, especially where defences needed to be neutralised and artillery could only produce limited results. The third is to halt an enemy armoured spearhead. Given that it was difficult to destroy tanks from the air in World War II, close air support still proved to be effective in stopping an armoured advance. It was not always necessary for ground attack aircraft to achieve tank 'kills'. Rather, it was the acuteness of firepower that could be concentrated on an armoured thrust that would often inflict enough disruption

and demoralisation to cause tank crews to abandon their vehicles. Again, it is the psychological effect that is greater than the physical—the fear that is instilled causes the enemy to seek what is perceived as a greater degree of protection. The fourth niche role is simply when artillery is out of range and no other type of fire support is available, or when other types of fire support are proved to be ineffective. Artillery is sometimes hampered by rough terrain or poor supply and close air support is, therefore, the only other option available. The same reasoning can be applied to the utility of close air support overall. At times, warfare requires the experimentation of trial and error, whereby close air support *may* provide an effective solution when all other types of fire support have failed to achieve a decisive result.

Then, as now, effective close air support relied upon a capable and extensive communications network. Such a network was essential for the rapid accumulation, processing and dissemination of data and instructions so that rapidly emerging targets could be prosecuted. This is a feature that is especially relevant to the emerging concept of network centric warfare on the modern battlefield. Close air support also relied upon flexible and versatile fighter aircraft to act as aerial artillery platforms. This feature is applicable to today's multi-role aircraft, which may be configured and tasked to conduct an air patrol *and* ground attack mission in the same sortie. An aircraft's configuration needs to be flexible enough to deliver adequate firepower for the close air support task at hand. Without a high degree of firepower, delivered with a reasonable amount of accuracy, close air support is unable to produce adequate effects to meet the objectives of the commander on the ground. The final cornerstone is entirely dependent upon the land forces. The disruption, demoralisation and shock produced by close air support counts for nothing, unless there is a substantial land-based force that is capable of 'following through' on the ground. Close air support in World War II rarely produced totally destructive effects. Therefore, it relied on a land force to manoeuvre quickly and exploit any effect close air support produced.

CONTEMPORARY RELEVANCE

In assessing the offensive aerial operations of World War II, the purpose is not to be critical of achievements, but to garner practical lessons that are applicable to contemporary warfare. For example, by examining the rationale behind British area bombing, the purpose is not to denigrate Allied airmen and target planners as war criminals. Nor is the purpose to view their effort as wasted. The effectiveness of Allied strategic bombing represented the best effects that could be achieved at the time and within the limits of available technology. Also, World War II was a global-scale conflict and for many nations it was a war of national survival. Thus,

a situation existed where nations were compelled to escalate the level of violence towards total war that encompassed civilians as targets. Herein are two major lessons that can be learned from the World War II targeting methods.

The first lesson is the need to acknowledge the humanitarian side of targeting. Modern law of armed conflict compels military decision-makers to make rational targeting decisions that take military necessity, proportionality and humanity into account. In the contemporary conflict or fight of the future, directly targeting civilians is not only evil, it is a waste of resources. ‘De-housing’ factory workers does not weaken support for a totalitarian regime. It creates a humanitarian disaster. Morale is better attacked by destroying those symbols of state that perpetuate a regime—be they individual leaders, internal paramilitary forces, or the facilities that barrack them. The reality is that the technology exists today to attack these targets with a degree of precision that did not exist during World War II.

Secondly, from the start, target analysis in World War II was derived from faulty or flawed intelligence. Early operational research teams did not have an adequate appreciation of individual targets, target systems, nor operational realities. This situation gives rise to a fundamental question. Given the same conflict, but with better target knowledge and precision weapons, could air power have helped secure a ‘win’ earlier? The answer is ‘unlikely’, or ‘not to any great degree’. World War II was conducted on a huge scale between industrial nations with a rough parity in capabilities. Strategic strikes with precision weapons would still have had to penetrate a sophisticated air defence system. There would have been no way to achieve a quick and decisive ‘knockout blow’ and attrition would still have been the underlying basis of the conflict. But what of the target sets? Precision weapons would have enabled cognitive effects to be achieved by targeting symbols of national power. Better target intelligence would have probably identified oil production as a critical factor a lot earlier. Yes, they are factors that would have more rapidly undermined the Nazi regime, but the fact remains that these effects would have been superficial without a land-based operation to seize ground and liberate countries. The objective of Allied strategic bombing in World War II was to create a strategic environment that was conducive to a land invasion of North-West Europe and the unconditional surrender of Germany. Air power is a shaper and enabler, but is not a war winner by itself—a fact that is equally relevant today, as it was then.

Chapter Five

Interdiction on a Strategic Scale

THE KOREAN WAR (1950–1953)

The Korean War was fought with World War II-era technology and doctrine, yet the whole scope of operations was different in that it was a limited conflict against a non-industrial opponent. It was an action under the auspices of the United Nations (UN), comprised of mostly Western nations and South Korea (Republic of Korea – ROK), against the forces of North Korea (Democratic People’s Republic of Korea – DPRK) and China. The Korean aerial campaign was led by the United States Air Force (USAF), who formulated the target plan and made the most significant contribution to ground attack sorties. The United Kingdom and Australia also made a significant air power contribution and, thus, the air campaign is referred to herein as an ‘Allied’ effort. United States doctrine, in air power terms, was centred on traditional forms of offensive air power and based on the ability of strategic bombers carrying atomic weapons to penetrate Soviet airspace. Thus, doctrinal emphasis was placed on targeting the strategic facilities of an industrial nation.

The emphasis of air planners was in making war fit a weapon – nuclear air power – rather than making the weapon fit a war.¹

Although nuclear weapons were not used in Korea, US air doctrine was geared towards their use. It is arguable that US nuclear deterrence strategy had an effect on the geographic scope of the Korean War—it started and remained a limited conflict and did not escalate beyond the Korean peninsula.

The very nature of the Korean conflict placed a renewed emphasis on targeting at an operational and tactical level. Although the concepts of interdiction and close air support had been fully developed in World War II, little importance had been placed on operational and tactical targeting since 1945. The Korean War, however, reinforced the need for air forces to be flexible and, in the case of the USAF, to retain conventional forms of air power. Despite the power of the air force that the US could bring to the table, the Korean War was still a UN operation that lacked a centralised joint

¹ Stephen Budiansky, *Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Gulf War II*, Penguin Group, New York, 2004, p. 371.

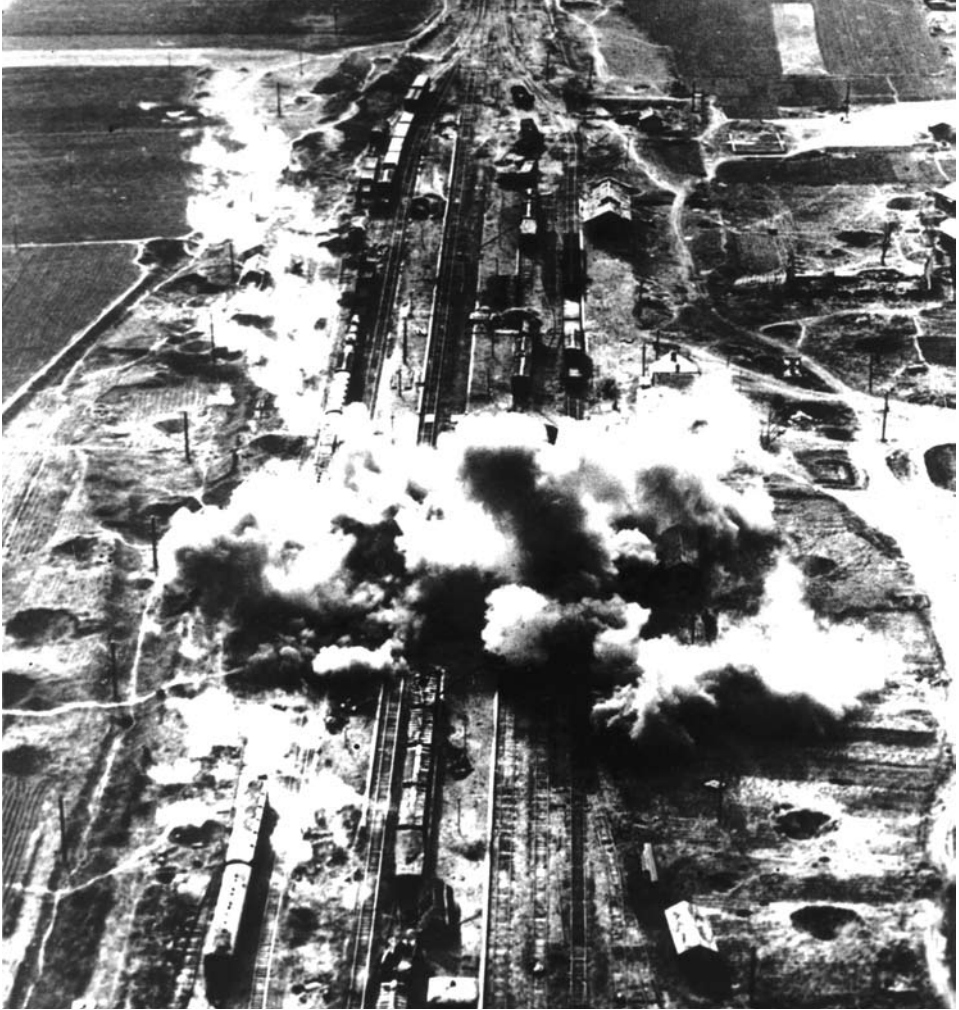
headquarters to coordinate the use of air power to strike ground targets. Partly because of this, offensive air power did not reach its full potential during the conflict. Air power was effective but failed to secure a decisive result. Its failure went beyond intrinsic weaknesses in the USAF in doctrine, equipment and preparations for conventional war. Air power's failings can be attributed more to shortfalls in the Allied capability to wage limited war against a non-industrial opponent.

The US Joint Chiefs of Staff outlined three broad strategic aims for the Korean War. They were to repel the North Korean attack, to bring about a timely end to the fighting, and to do so without starting another world conflict. It was believed that air power could foreshorten the war by attacking strategic targets. Allied strategic strikes were directed at curtailing North Korea's ability to wage war and, therefore, driving them to the bargaining table or compelling them to sue for peace. The primary strategic targets were dams, industrial centres and hydro-electric plants. It was reasoned that striking at dams would disrupt irrigation and, therefore, the ability to supply troops with food. Damaging industrial centres would disrupt supply of ammunition and manufacture of heavy weapons and artillery. Likewise, disruption of the electricity supplies would hinder North Korean industry that supported the war effort. The Korean War highlighted that fighting a limited war against a non-industrial opponent required different aircraft and weapons, planning, concepts of operations and training from that involved in Strategic Air Command's nuclear strike plan against the Soviet heartland. Limited war required high mobility and flexibility, since static targets were few and dynamic targets formed the majority of target types. The 'traditional' strategic doctrine of striking directly at 'sources of national power' as opposed to enemy military forces was not applicable in the Korean conflict.²

To avoid spreading the conflict wider than the Korean peninsular, US leadership prohibited air strikes on Chinese territory, which was the main source of supplies to North Korea. Given these limitations, Allied target planners were denied their traditional strategic target sets. As a result, they often made poor target choices or lacked the means to identify and strike the correct targets. This state of affairs was compounded by a lack of accurate analysis of aerial reconnaissance photographs and under-utilisation of the capabilities that were available. The emphasis on strategic strike meant effective fighter-bombers were initially in short supply in the Korean theatre of operations. The workhorse of the strategic fleet—the B-29 heavy bomber—was marginally effective at night and was unable to attack targets with a reasonable degree of precision. A combination of the limitations of World War II bombsight technology and the small scale of North Korean industry neutralised the strategic heavy bomber as a potent force. In addition, the strategic squadrons practised deficient tactics that were

² *ibid*, pp. 374–375.

unable to penetrate North Korean air defences. The B-29s would operate at very high altitudes to avoid flak, which diminished the ability of aircrews to hit small targets. To compound their problems, large numbers of Chinese MiG-15 interceptors would often be airborne and would 'bounce' strategic bombing formations.³



Aerial photograph of bombs dropped across a railway marshalling yard in North Korea by B-26 Invader light bombers of the US Fifth Air Force, 19 June 1951. Interdiction of lines of communication was mitigated by an abundance of North Korean manpower and their minimal supply needs.

(Photo: Imperial War Museum HU 61478)

³ *ibid*, p. 371.

The application of strategic offensive air power had promised an early end to the war. However, the bombing of strategic targets made virtually no difference to North Korea’s ability to maintain military effort. The Communist forces were mainly infantry-based, not highly mechanised nor highly technical—they did not require a sophisticated industrial complex to support their operations in the field. The light industrial base of North Korea meant that they relied chiefly on imports of heavy military weapons. These were imported through common borders with China and the Soviet Union, which Allied air power could not touch for fear of expanding the conflict. Like all conflicts, the expectation placed on air power and the promises its leadership made, were too high for what it could actually achieve. A realistic assessment of capabilities, both friendly and enemy, was needed at the start to realise the full potential of the aerial campaign. More success stemmed from the operational (interdiction) and tactical (close air support) levels of offensive air power.

The Allied air forces conducted a massive aerial interdiction campaign but it had limited success. Basically, it failed to fulfil its promise of foreshortening the conflict by eroding the ability of the Communist forces to wage war. Allied target selection and prosecution, including that of the RAAF, was derived from US intelligence and strategic target plans. Target planners failed to realise how a small logistics chain supported a large Asian army. Figure 5–1 provides a comparison of the daily requirements needed to keep a full-strength US infantry division, a Chinese division, and a North Korean division in action:⁴

Formation	Standard complement of troops	Tons of matériel needed daily
US division	15 000	500
Chinese division	10 000	60
North Korean division	11 000	70

Figure 5-1: Comparison of daily requirements of different nationalities

The logistic needs of a US division were over seven times greater than their nearest Communist counterpart. Moreover, the Communist logistics chain relied on a vast low-tech network of human labour, oxcarts, wagons and pack animals. Although Allied interdiction attacks were successful in dropping bridges and cutting railways,

⁴ B.C. Mossman, *The Effectiveness of Air Interdiction During the Korean War*, Historical Manuscripts Collection File 2-37 AD.H, Office of the Chief of Military History, Department of the Army, Washington DC, March 1966, p. 2.

the damage was either quickly repaired or the enemy used adaptive methods to overcome shortfalls. For example, cuts in railways were often repaired within two to six hours and tunnels and caves were used to establish forward caches of food and supplies close to the front lines.⁵

Given the reliance of North Korea on Chinese and Soviet aid, and the inability of the Allies to target the source, the interdiction air campaign was crucial. Once supplies were within Korea and flowing south to Communist troops they were vulnerable to air attack. The major target types for interdiction missions were the enemy supply system and transportation structure. Although the damage claimed by aircrews was in excess of the actual damage inflicted, an enormous amount of destruction was still meted out on bridges, railways, roads, rolling stock and road transport. The initial success of interdiction attacks ironically created a high expectation that air power would enjoy continued success throughout war. North Korea, however, adapted to the aerial threat. Significant amounts of supplies and large troop concentrations restricted their forward movement to the hours of darkness. Increased camouflage, dispersal and deception were utilised to hinder Allied targeting efforts. It was a case of diminishing returns, whereby the enemy learned and adapted new behaviour to avoid forms of attack. Thus, the Communist forces reduced their vulnerability to interdiction. Furthermore, the North Koreans actually increased their efforts despite interdiction:

In July 1951 the Chinese and North Korean forces were firing about 8000 artillery and mortar rounds a month; in May 1952 after 10 months of transport interdiction they fired over 100,000 rounds. Not only that, but their capacity to mount and sustain an offensive actually increased.⁶

The scale of North Korea's involvement was bound to increase as the war escalated. It would probably be more useful to examine the figures for artillery usage if interdiction was *not* conducted, but of course this is speculative and the figures are not available. It is argued here that, although the interdiction campaign did not meet what was expected of it, it nevertheless made a positive contribution to Allied operations.

The purpose of large-scale interdiction was not only to shape the battlefield for ground forces in an operational sense, but also to make the conflict too expensive for the Communist forces to continue. An examination of the supply figures shown above reveals a flaw with this 'make-it-too-expensive' reasoning. Given that the supply needs of a North Korean division were one-seventh of a US division,

⁵ Budiansky, *Air Power*, p. 370.

⁶ Jeffrey Grey, "'Definite Limitations': The Air War in Korea 1950–1953", in Alan Stephens (ed.), *The War in the Air 1914–1994*, Air Power Studies Centre, Canberra, 1994, p. 149.

the problem was that the cost to the Communists was so inexpensive in the first place. The other flaw lay with the human cost. The pool of manpower available to the Communist forces was greater than that available to the Allies and South Korea. It was also *cheaper*. Some unattributed sources indicate that about half of the estimated 900 000 casualties suffered by China in the conflict were due to hypothermia. Such a figure is not unrealistic. Moreover, this statistic shows that the Chinese may have neglected to supply adequate winter clothing to their forces in order to keep the logistic chain light. It indicates that the Communists were not so much concerned with the quality of forces they were fielding—more the sheer *mass* of troops they could throw at Allied forces.

Air interdiction certainly made an impact, but did not diminish the Communist's ability to wage war in a strategic sense. Deep strikes into North Korea did not do as much damage as expected, nor were they as accurate as aircrews reported. An 'Air Pressure' strategy was intended to put pressure on the Communists during the negotiations at Panmunjom. It is unknown whether they had a significant impact on the North Korean bargaining position. The most notable effect was observed when air interdiction was used to shape the immediate battlefield for ground operations. Furthermore, prisoner of war reports indicate that the psychological effect of interdiction attacks on Communist forces was greater than physical destruction.⁷ Figure 5–2 indicates which weapon system had the most psychological effect on enemy troops and highlights the fear that offensive air power induced:⁸

Type of Weapon System	Percent of Responses
Air Attack	82.0
Artillery	7.0
Tanks	2.6
Infantry	1.6
Not Answered	6.8

Figure 5-2: Communist POW reports of weapon systems feared most

⁷ *ibid*, p. 150.

⁸ Kilchoon Kim and E.A. Johnson, 'Evaluation of Leaflets on Early North Korean Prisoners of War', Technical Memorandum ORO-T-4 (EUSAK), Johns Hopkins University, Baltimore MD, February 1951, p. 7, reproduced in Colonel Michael E. Haas, *Apollo's Warriors: US Air Force Special Operations During the Cold War*, Air University Press, Maxwell Air Force Base, Alabama, 1997, p. 49.

All too often, the effectiveness of offensive aerial campaigns is measured in terms of attrition effects achieved and the cognitive or qualitative effects are overlooked. Large-scale interdiction disrupted Communist command and control, it lowered morale, diminished combat effectiveness and restricted large-scale manoeuvre to night-time. The sheer mass of the Communist war machine was difficult to wear down in a physical sense. Thus, it was more realistic to erode the quality of those troops once they found themselves engaged with Allied forces.

Australian contribution

The RAAF and Fleet Air Arm of the Royal Australian Navy played a significant role in interdiction attacks on the Korean peninsula. The RAAF initially deployed No 77 Squadron, equipped with the P-51 Mustang. With the growth of the jet age, the Mustang was found to be no match for the Chinese MiG-15 fighter and not suitable for air superiority missions. Therefore, No 77 Squadron was relegated to the less glamorous ground attack role. However, the Mustang was vulnerable to ground fire and pilot casualties rapidly mounted. In response to the need for a jet fighter and to overcome the vulnerability of the Mustang, the Australian Government acquired the Meteor.

Although it was a jet fighter, the Meteor was a bomber-interceptor and unsuitable for air superiority missions. Thus, the Australian squadron was once again relegated to ground attack missions. It was fortunate that the Meteor was well suited for this role. Reports indicate that the Meteor was ‘a robust and well-trying aircraft from a flying point of view and has shown itself in Korea to be a good gun and rocket firing platform’.⁹ Once again, the RAAF found it could still make a significant contribution within the context of a larger *Allied Force*. In this case, it was the limitations of the Meteor in air-to-air combat that highlighted its capability in the ground attack role. Denied the chance to produce an ‘ace’ from the Korean conflict, the RAAF nevertheless made a contribution where it could and created a substantial impact on Communist ground forces.

⁹ Minute, RAF Deputy Chief of the Air Staff to Secretary of State, 26 September 1951, as quoted in Grey, “‘Definite Limitations’: The Air War in Korea 1950–1953”, p. 156.



Gloster Meteor Mk 8 aircraft of No 77 Squadron prepare to take off on their first operational strike over Korea

(Photo: Australian War Memorial P03119.023)

THE VIETNAM WAR (1962–1975)

The main influence on US air power doctrine in the 1960s continued to be nuclear deterrence. As such, the USAF was unprepared for a counter-revolutionary war in South-East Asia. It seems the lessons on the use of air power in limited war against a non-industrial nation, learned by the US in Korea, were not assimilated before the war in Vietnam. The Vietnam War was fought between South Vietnam (Republic of Vietnam – RVN) and North Vietnam (Democratic Republic of Vietnam – DRV). The majority of assistance to South Vietnam came from the US and assorted allies—Australia, New Zealand and the Republic of Korea—who contributed both troops and matériel. North Vietnam relied on logistic support from China and the Soviet Union. North Vietnam was a poor nation, its industrial sector was small and its economic output unremarkable:

When the Joint Chiefs drew up their initial target list, intelligence analysts could find only eight industrial installations in the whole country worth listing.¹⁰

The target planners subsequently argued that industry, therefore, was all the more vital to North Vietnam. This was not the case – it had a subsistence economy, whereby the majority of people lived without the use of electricity and cars. In 1964, US planners identified 94 targets that could be destroyed in a 16-day aerial shock campaign. Their thinking was based along the lines of targeting the Soviet Union—strike deep into enemy territory, at industry and transport, to curtail their war-making capacity and disrupt logistics to the battlefield. US targeting doctrine was inflexible and lacked dynamism—it was based on the President and his immediate staff making decisions for nuclear strikes on enemy territory. As such, it allowed political interference in its execution to the point of micro-management.

An aerial shock campaign was not conducted. Operation *Rolling Thunder* was an incremental campaign, that delivered 643 000 tons of bombs on North Vietnam and remains the longest sustained bombing campaign in history. It is argued here that the sheer magnitude of the US air campaign in Vietnam was probably a product of overconfident belief in technology and firepower, and not enough in-depth ‘systems thinking’ that was tailored towards a realistic analysis of North Vietnamese strategic vulnerabilities. The problem firmly lay with ill-defined strategic objectives and the attempted application of conventional targeting doctrine to an unconventional war. The offensive air campaign ‘was in any case a perfect reflection of the desire to force the chaotic jungle fight against a shadowy enemy into a conventional form that the United States military thought it could master’.¹¹ US planners believed that conventional means could be used to force North Vietnam to surrender primarily through the weight of bombing and level of general destruction. Although this in itself was flawed logic, such an approach was also constrained by two additional factors—the desire to limit escalation and contain the conflict within South-East Asia, and to reserve the threat of more aerial attacks in the future if North Vietnam would not cooperate.

By the time Operation *Rolling Thunder* was temporarily halted in 1968 for political reasons, the target list had been expanded to 242 targets, of which nearly all had been destroyed.¹² The majority of these were static interdiction targets—designated to cause disruption of logistics. Until 1968–1969, the Vietnam War

¹⁰ Budiansky, *Air Power*, p. 382.

¹¹ *ibid.*, p. 378.

¹² *ibid.*, p. 381.

was conducted primarily at a grassroots level. The majority of guerrillas operating in South Vietnam—the Viet Cong—were locally recruited and supplied. In mid-1967, it was estimated that their import requirements were quite small—estimated at nearly 18 tons per day for the whole guerrilla movement.¹³ This reveals that, given small supply objectives from the outset, a sheer mass of supplies moving south would eventually meet their recipients because not enough could be damaged along the way. Any surplus that did get through could be stockpiled for further use in hidden caches.

Attacking static logistic infrastructure was not more effective either:

A Pentagon analysis in February 1967 calculated that a completely ‘unrestricted’ air campaign, even backed by the mining of Haiphong harbour, would reduce the North’s import capacity to 7,200 tons a day, which was still about 200 times what it needed to keep the war going.

Just like their Korean comrades had done over 10 years previously, the North Vietnamese overcame the loss of bridges, railways and fuel storage depots by employing vast armies of human labour. Furthermore, as in previous conflicts, they were an ‘intelligent enemy’ and adapted to meet circumstances:

By 1968 an estimated 60 percent of all oil-storage facilities had been wiped out; the North Vietnamese responded by filling thousands upon thousands of fifty-five-gallon drums with fuel and dispersing them along roadways, in villages, rice paddies, everywhere.¹⁴

Similarly, attempts to cut the primary supply line to South Vietnam—the Ho Chi Minh Trail—grossly overestimated the guerrilla’s reliance on matériel and underestimated their ability to improvise and adapt.

To conceal their movements, the North Vietnamese constantly established new routes and adopted improved techniques to camouflage their movements. What started as a single line of supply evolved into a multitude of tracks, trails and roads that led from North Vietnam into South Vietnam:

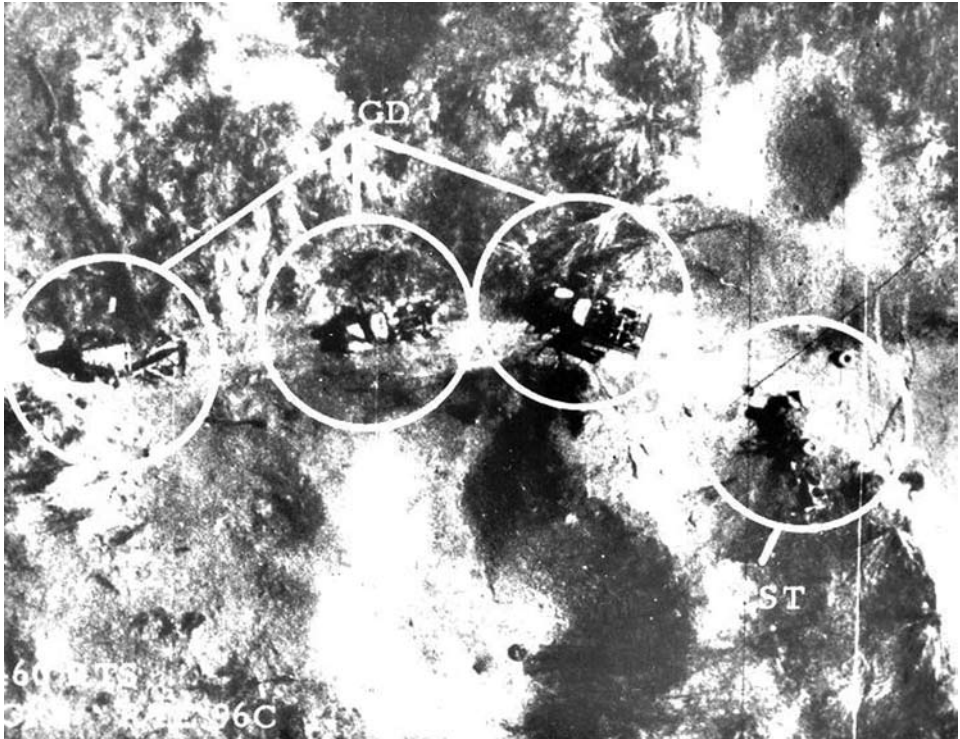
At the peak of the interdiction campaign, hundreds of fighter-bombers and dozens of B-52s were carrying out strikes each day, destroying tens of thousands of trucks and wiping out as much as 90 percent of all the supplies the North attempted to move south. The truth ... was that it didn’t

¹³ *ibid.*, p. 383.

¹⁴ *ibid.*, p. 382.

matter. Supplies never fell below what American analysts calculated to be the Communist forces' minimum requirements.¹⁵

Although the USAF increased their scale of interdiction effort, it could never meet the scope of expansion and adaptation of their enemy. Combined with the small amounts needed to keep a guerrilla army supplied, it ensured that the required minimums would invariably reach their intended destination.



Ho Chi Minh Trail, Vietnam, 12 June 1970 – An overhead reconnaissance photograph with annotations showing four North Vietnamese trucks destroyed by an air strike. The Ho Chi Minh Trail was not a single road, but a collection of paths and roads that proved impossible to interdict effectively.

(Photo courtesy of USAF)

North Vietnam was never going to be subdued through the conventional application of air power. This was both in the sense of selecting traditional target types and in the methods of application. Operation *Rolling Thunder* was perceived as a way of

¹⁵ *ibid*, p. 384.

exerting influence on the North Vietnamese regime to cease its military activities in South Vietnam. Contrary to contemporary media reports of ‘surgical strikes’, air power was, and remains, a rather blunt instrument to deliver a message. It created a plethora of negative effects, the main one being that the air campaign fed negative public opinion in the US homeland. The average individual saw the damage to Vietnamese civilians on television, and those who opposed the war gained strength from an ever-increasing pool of disgruntled citizens. Psychologically, it was a war that the United States could not win. As such, North Vietnam probably got more political benefit from the air campaign than did the US.

It was not until the *Linebacker* operations in 1972 that many target restrictions were lifted and the USAF was given the necessary freedom to prosecute targets that may have produced the desired effects. At this stage the United States was exercising its exit strategy—conducting their ‘Vietnamization’ program in order to release full responsibility for the war to South Vietnam. By bombing the primary logistic centres of gravity—mainly the Haiphong port facilities and rail links with China—the US hoped to place enough pressure on the North Vietnamese Government to bring about a truce so that American forces could be withdrawn. This was also at the stage of the conflict where the guerrilla forces were on the sideline and regular North Vietnamese Army (NVA) units were fighting a quasi-conventional war in the south. The evolving nature of the war meant that the North Vietnamese Army relied much more heavily on conventional lines of supply than their guerrilla counterparts. The *Linebacker* operations were perhaps the only instance in which the aerial bombing campaign produced a noticeable positive effect for the US. The Vietnam War emphasised the need for creative thinking and fresh methodologies in the employment of offensive air power.

Here was a case where an outdated doctrine, rigidly applied, proved unresponsive to the demands of a conflict demanding a more creative approach. Vietnam was a reminder that war frequently produces situations which defy rules that quantify or expectations which seem straightforward.¹⁶

Therein lies the crux of effects-based targeting and the non-industrial nation. Chasing a quantifiable result—that is, attrition—in these circumstances is self-defeating. It is a ‘numbers game’ that cannot be won because it produces no worthwhile results that can meet achievable objectives. Expectations must be realistic. It is better to set reasonable and achievable objectives first, within the

¹⁶ C.D. Coulthard-Clark, ‘The Air War in Vietnam: Re-evaluating Failure’, in Alan Stephens (ed.), *The War in the Air 1914–1994*, Air Power Studies Centre, Canberra, 1994, p. 176.

scope of capabilities, and then produce methods to meet them. At least then, there is a milestone at which ‘success’ can be declared.

RAAF contribution

The Australian Government decided in late 1966 to support operations in Vietnam with the Canberra bomber. The first offensive missions were flown by No 2 Squadron on 23 April 1967 and continued on a daily basis until 31 May 1971. The squadron provided eight out of its normal complement of 12 bombers, each of which carried up to 6000 pounds (2722 kg) of bombs. Initially, the Canberra was considered to be too old and slow for missions against well-defended targets over North Vietnam. Its methods of delivery were also dated—employing straight and level bombing techniques. While they were originally deployed in support of Australian ground forces, they could also provide support to other allied units or interdict enemy movements or concentrations. No 2 Squadron was deployed under the operational command of the US Seventh Air Force at Phan Rang air base, and the US perceived the role of the Canberra bombers as general support to all allied formations, not just Australian units as was initially agreed.

Under the arrangement agreed to by the Australian Government, the RAAF squadron came under American operational control—meaning that selection of targets to be hit by RAAF bombers rested with Seventh Air Force ... By mutual agreement it was decided that in each 24-hour period the eight RAAF sorties would be against up to sixteen preselected targets, which might be anywhere within the republic’s four Corps Tactical Zones.¹⁷

Until September 1967, the operations of the Canberra bombers were conducted at night-time, normally from high level, under the guidance of radar sites that covered the entire area of South Vietnam. A ground-based radar controller would indicate by radio when the Canberra crew should release their ordnance. Called ‘Combat Sky Spot’ missions, they enabled a 24-hour, all-weather attack capability to be provided. Accuracy, however, was not in the region of precision strike, although ‘employing this technique still enabled bombs to be dropped on targets with an average error of only 270 feet (82 metres)’.¹⁸

Although the bombing invariably had an effect, such accuracy was not good enough to cause sufficient damage to typical targets such as supply dumps, base camps, bunker complexes, fortifications and assembly areas. USAF fighter-

¹⁷ Chris Coulthard-Clark, *The RAAF in Vietnam: Australian Air Involvement in the Vietnam War 1962–1975*, Allen and Unwin, St Leonards, 1995, pp. 186–187.

¹⁸ *ibid.*, p. 187.

bombers employing dive deliveries during daylight were achieving considerably greater accuracy.

No 2 Squadron operated predominantly at night, over all tactical zones, for the first four months of its time in Vietnam. In the first 10 weeks squadron crews delivered 1200 tonnes of bombs against more than 900 targets and were involved in numerous operations.¹⁹ Despite praise from US Headquarters for their professionalism, there was little meaningful feedback on the effectiveness of their combat operations. Battle Damage Assessment (BDA) was difficult to conduct because of concurrent operations. It was normal for the squadron's target areas to be subjected to heavy artillery fire and attention from other ground attack aircraft. By the time the Army could move in and glean 'ground truth' from the area, it was impossible to determine with any degree of accuracy who had caused what damage.

Due to this state of affairs, No 2 Squadron sought to be assigned to daylight ground attack sorties. Initially, two Canberra bombers were dedicated to daylight missions until all-daylight missions were flown by the end of November 1969. As a result, accuracy greatly improved—an average CEP of 38 metres—and aircraft flew at lower altitudes in direct support of ground forces.²⁰ Typical missions were now close air support and interdiction of supply routes. The focus of the squadron became less on the BDA body count and more on customer-focused delivery.

Yet while BDA statistics were freely quoted in monthly reports from the unit, this was never accepted as the sole or most important yardstick. Within the unit, greater emphasis was given to the ability to place bombs where they were called for, rather than on more debatable claims of damage caused.²¹

Although 'customer' is a strange term to use for a military agency, its use here refers to the initiator of a request for aerial support—whether it is forces in the field or a headquarters assigning an interdiction target. It signals a move away from measuring success in terms of attrition effects, because they are an inaccurate measure of true effectiveness. It was difficult to quantify the exact casualties caused or matériel damaged from aerial attacks due to difficulties in forming an accurate combat assessment picture. Instead, the measure of success for No 2 Squadron became the quality of their work—how accurately they could deliver according to the wishes of those whom they were supporting. In this case, it possibly signals a

¹⁹ *ibid.*, p. 188.

²⁰ *ibid.*, p. 199.

²¹ *ibid.*, p. 196.

realisation of effects-based targeting at the tactical level. This is further reinforced by the squadron realising that to achieve an effective hit against fortified positions, a bomb would have to be delivered within 20 metres of the intended target. This was the benchmark which aircrews sought to achieve for all bombs dropped.²² The objective was not to achieve a certain amount of enemy casualties per sortie, but to set a high professional standard.



Vietnam, 26 August 1969 – An aerial photograph showing the damage resulting from a mission flown by a RAAF Canberra bomber—a line of craters following the line of a river. Canberra aircraft were especially effective in delivering a stick of bombs against linear targets, with the spacing between the bombs being variable to achieve the desired coverage of the target area.

(Photo: Australian War Memorial P01963.001)

In Vietnam, the RAAF once again fulfilled a niche role within a broader allied coalition. RAAF involvement in bombing in Vietnam was limited by the small size of the contribution that could be afforded and the capabilities of the Canberra bomber. This was realised by RAAF leadership:

²² *ibid*, p. 195.

Also, when I arrived I found that the targeting and mission responsibility for those [Canberra] aircraft was totally in the hands of a USAF operations room run by a lieutenant colonel. Our Canberras were listed on the mission board as B-57s, when in fact in some critical aspects they were quite different.²³

The dialogue above highlights a couple of factors relevant to targeting. First, the RAAF was compelled to operate within the target planning system of the USAF. This emphasises the requirement that the RAAF must often integrate its capabilities to comply with bi-national or multinational air operations. The second factor concerns limitations in RAAF capability. In the example above, the B-57 was the closest aircraft type to the Canberra that the US possessed. Yet their attack profiles were considerably different. The B-57 delivered US ordnance in a dive. The Canberra delivered British-type ordnance in a straight and level flight pattern. The Canberra, therefore, was better utilised against linear targets, whereas the B-57 was designed to attack point targets. Furthermore, the B-57 possessed an electronic warfare suite that conveyed a degree of protection against surface-to-air missiles. The Australian Canberra was not fitted with these protection measures. On the surface, it appeared that the Canberra was less capable than the B-57 in prosecuting targets, yet the RAAF managed to fulfil a niche role, which it performed with very high degrees of accuracy. There was no other aircraft with the same 'straight and level' operating profile in all of South Vietnam and this is what the RAAF used to its advantage.

²³ Air Commodore C.H. Spurgeon, in 'Discussion' in Coulthard-Clark, 'The Air War in Vietnam: Re-evaluating Failure', pp. 176–177.

Chapter Six

Operation *Desert Storm*: the Air Component of the First Gulf War for the Liberation of Kuwait (1990–1991)

Saddam Hussein's Iraq invaded Kuwait on 2 August 1990. After more than five months of diplomatic negotiations and economic sanctions failed to resolve the situation, Operation *Desert Storm* commenced on the night of 16–17 January 1991. Operation *Desert Storm* was the offensive air component of the US-led, United Nations mandated, Coalition mission to liberate Kuwait. It was expected to meet its objectives within days but ended up lasting for six weeks. When the ground component, Operation *Desert Sabre*, was launched on 24 February 1991, it was concluded in about 100 hours.¹ The success of the ground campaign can be partly attributed to the training and technology of the ground forces involved and, also, to the accomplishments of the air campaign. The USAF coordinated the air war and American aircraft flew most ground attack missions. Of the 47 030 ground attack sorties flown during the operation, 90 per cent were flown by US aircraft. Other Coalition partners flew the remaining 10 per cent—(in order of contribution) Saudi Arabia, Britain, Kuwait, France, Italy, Bahrain, United Arab Emirates, Canada and Qatar.² Given the dominance of US target planning with relation to the Gulf War, and the introduction of new approaches to achieving strategic effect, the emphasis of this chapter will be on USAF doctrine and how this can be interpreted into generic terms of effects-based targeting.

Since the end of the Vietnam War, USAF doctrine was grounded in the belief that air bombardment could make its own exclusive contribution to meeting a theatre commander's objectives and not just as a supporting arm. Doctrine was also fairly conventional—air superiority was to be seized first and then air power would be used to strike at an enemy to force submission, or to attack those elements that were valuable to a regime. Tactical missions in support of ground forces, such

¹ A truce was declared on 28 February 1991.

² Eliot A. Cohen (director), *Gulf War Air Power Survey – Volume V – A Statistical Compendium and Chronology*, US Department of the Air Force, Washington DC, 1993, pp. 232–233. Data taken from 'Table 64: Total Sorties by U.S. Service/Allied Country by Mission Type'. These statistics should be regarded carefully as 'Mission Types' are not explained in any great detail and, therefore, should be taken as an indication only. Furthermore, raw sortie rates are not an indication of success or failure, nor of effects achieved.

as ‘Combat Air Support’³ and ‘Battlefield Air Interdiction’ (BAI), received less emphasis. Thus, the focus of USAF bombing doctrine was towards strategic and operational static targets.

Soon after the Iraqi invasion of Kuwait, the theatre commander, General Norman Schwarzkopf, called on the Air Staff in Washington to assemble targets quickly for retaliatory air strikes against Baghdad. The selection of targets was to be based on dislocating leadership and anything with value to the Hussein regime. USAF Colonel John Warden, of a Pentagon organisation known as ‘Checkmate’, was subsequently tasked with preparing a sketch air targeting plan. Warden advanced his ‘Five Rings Model’—five concentric rings representing centres of gravity for strategic planning, from which targets were derived to meet objectives. The centre ring was enemy leadership. Second was key production facilities, such as oil and electricity. Third was infrastructure, such as roads, railways and lines of control. Fourth was population and fifth were fielded military forces. A problem with the Five Rings Model was that it contained flaws in identifying the real centres of gravity of the Hussein regime.

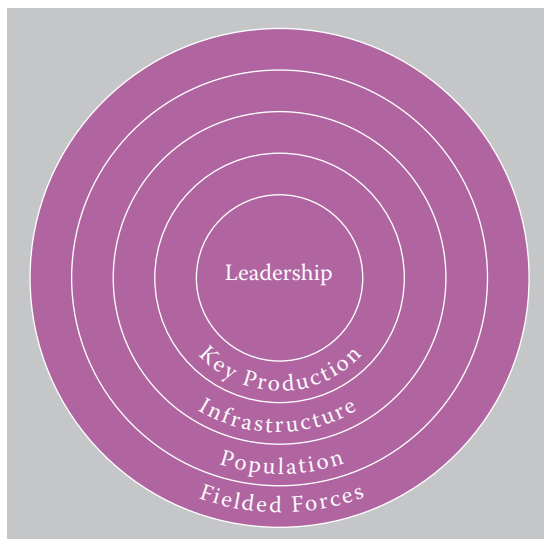


Figure 6–1: Warden’s ‘Five Rings Model’

³ For all intents and purposes, ‘Combat Air Support’ is the same as ‘Close Air Support’.

A ... criticism of the Checkmate plan is that its focus on the Iraqi leadership was unexecutable in the event the Coalition air forces were unable to find and hit that leadership. Moreover, there is now evidence that the real center [sic] of gravity may have been the Republican Guards—and they were not targeted in the Checkmate-developed plan.⁴

Another problem was that the model was a prototype, it was a sketch plan that was never intended as the firm basis for strategic aerial target planning, but was interpreted by air staff as being the basis for the air campaign. On the positive side, the model represents a high degree of innovative thinking. It represents an injection of ‘systems thinking’ for the practise of effects-based targeting and encourages exploration of targeting solutions beyond established and conventional norms.

Based on Warden’s model, the air staff developed a Concept of Operations (CONOPS) named *Instant Thunder*. It was a plan diametrically opposed to the concept of the Vietnam-era Operation *Rolling Thunder*. Unlike the Vietnam War air operation, the plan was not a signal of US *intent*, but a massive and rapid attack against identified Iraqi centres of gravity. It was a fast *shock* campaign based on six days of aerial strikes against 84 high-value targets.⁵ The list of target types included leadership (command, control, communications and information – C3I), key production facilities (electricity and oil), infrastructure (bridges, rail and ports) and fielded forces (air defences). There were no attacks on ground forces in the initial plan. When the theatre air commander, Lieutenant General Charles Horner, saw *Instant Thunder* he labelled it as being too simplistic, too doctrinally stilted and not in touch with strategic realities.⁶ However, it was a sketch and not a bad place to start target planning in more detail.

The distinctive feature of the Instant Thunder plan was that it ... went right to the heart of the Iraqi ability to conduct war. In a sense, it was a gamble that one could defeat the enemy by a successful attack on his head and nervous system (assuming one knew where they were) and leave the arms and legs until later.⁷

The initial sketch needed to go beyond being a plan for the USAF. It needed to widen its scope, to reflect an accurate appreciation of the situation and to enable the

⁴ James A. Winnefeld, Preston Niblack and Dana J. Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, RAND, Santa Monica CA, 1994, pp. 66–67

⁵ John Andreas Olsen, *Strategic Air Power in Desert Storm*, Frank Cass Publishers, London, 2003, p. 64.

⁶ Winnefeld, Niblack and Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, p. 68.

⁷ *ibid*, p. 70.

capabilities of the joint Services. As such, General Horner had it modified to suit operational conditions. Plans were made to attack many targets simultaneously for the shock effect. Desired effects included disrupting Republican Guard formations, isolating and incapacitating Hussein's regime, destroying potential weapons of mass destruction (WMD) sites and neutralising Iraq's offensive military capability. Particular emphasis was placed on denying the Iraqis the ability to interfere with Operation *Desert Shield*—the build-up of friendly ground forces—by preventing any Iraqi intention to conduct a concerted spoiling attack across the border in Saudi Arabia. Another factor was shaping the battlefield—the purpose of air power was to neutralise Iraqi Army formations in Kuwait so as to facilitate their removal through land combat.

The target list was widened from 84 to over 300 facilities before the air campaign started.⁸ Despite Warden's input, the target planning process was still fairly conservative. Once strategic objectives were passed down the chain of command from the President and his staff, air planners would compile vulnerable Iraqi centres of gravity. Analysts would then map out target systems and identify what effects could be achieved by striking them. From here, a concept of operations would be formulated whereby *achievable effects* would be matched to *desired objectives*. A master attack plan would be generated as the final step of target development. From an effects-based point of view, it is argued here that their methodology was flawed. Given the national-strategic objectives, it would be more logical to identify desired strategic effects before centres of gravity. The reasoning is that the targeting concept of operations should match *desired effects* to fulfil *achievable objectives*. Thus, centres of gravity are compiled from objective-driven, desired effects. The Gulf War target planning was based on centres of gravity-driven achievable effects, to try and fulfil objectives. The sequence of target planning should be: receive objectives, identify effects that can fulfil these, and then compile centres of gravity and target systems that can achieve the desired effects.

As it stood, the US President first identified four national-strategic objectives for their involvement in the Gulf War. Planners then translated this into five air campaign objectives. The five campaign objectives were then linked to 12 target systems and a four-phase targeting concept. Figure 6-2 outlines the five air campaign objectives and centres of gravity:

⁸ *ibid*, p. 73.

1. ISOLATE AND INCAPACITATE THE HUSSEIN REGIME:
 - Leadership and command facilities
 - Electrical supply to military facilities
 - Telecommunications and C3 systems
2. GAIN AND MAINTAIN AIR SUPERIORITY:
 - Integrated air defences, radar, surface-to-air missiles and control centres
 - Aircraft and airfields
3. DESTROY IRAQI NBC OR WMD CAPABILITY:
 - Known research, production and storage facilities
4. ELIMINATE IRAQ'S OFFENSIVE MILITARY CAPABILITY:
 - Military production and storage sites
 - Scud missile and launchers, production and storage facilities
 - Oil refining and distribution facilities
 - Naval ports and facilities
5. RENDER IRAQ'S ARMY IN KUWAIT INEFFECTIVE:
 - Lines of communication connecting means of support
 - Ground units in the Kuwait Theatre of Operations (KTO)

Figure 6–2: *Desert Storm* air objectives and centres of gravity⁹

Perhaps the most outstanding feature of the use of air power in the Gulf War was the decision to create a shock effect by attacking a multitude of targets simultaneously and in parallel. The USAF compiled the target sets and prosecuted them with a combination of ‘traditional’ and ‘emergent’ methods. The traditional method was first to obtain air superiority, then open holes in the radar network, roll back ground-based air defences, open corridors to targets, attack them sequentially to achieve high damage expectancies and leave many important targets untouched until further strike packages could be applied. By using emergent methods, the initial USAF strategic strikes were conducted in parallel. This involved spreading their attacks across a broad spectrum of targets, to *shock* the entire system and exploit the delayed reactions of their opponent.

⁹ Taken from Winnefeld, Niblack and Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, pp. 74–76.

Attacks on an enemy's strategic centre, one capability at a time, provide that enemy with the opportunity to repair the first target while the second or third is being attacked. This form of 'series' attacks was argued against, for the air campaign in the Gulf. The Gulf War, through the use of stealth and precision, witnessed 'parallel' warfare, in which the whole breadth of strategic targets was attacked and the entire strategic base crippled in the first few days.¹⁰

The key to parallel air warfare was stealth technology, in particular the F-117 aircraft, as it held a surprise value and could penetrate air defences without destroying them first.

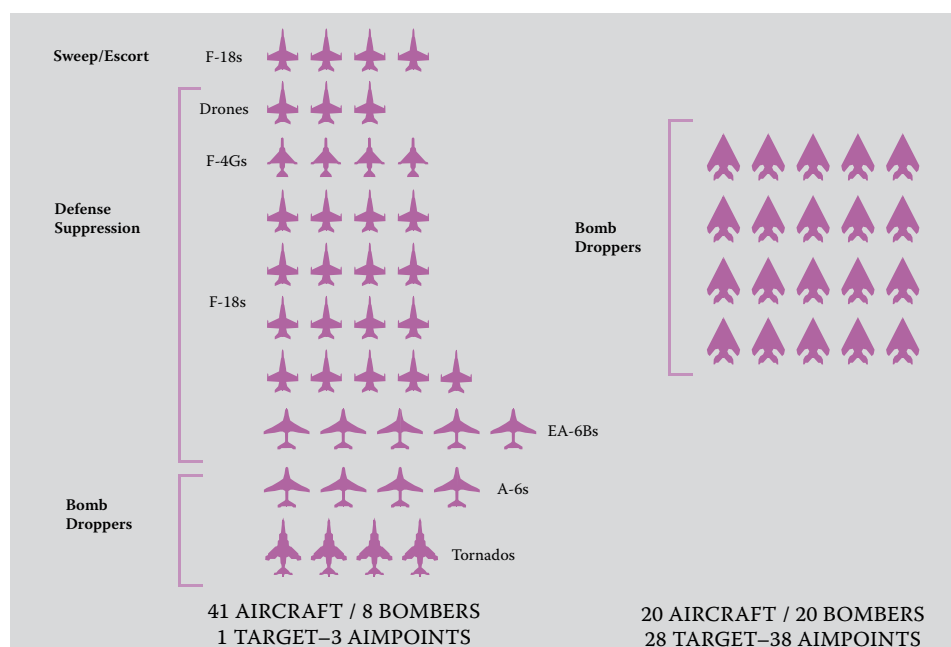


Figure 6-3: Stealth warfare¹¹

The diagram represents the comparative size of strike packages in the initial stages of *Desert Storm*. On the left is non-stealth: 41 aircraft are required to hit one target. On the right is stealth: 20 aircraft that do not require extra protective assets can prosecute 28 separate targets.

¹⁰ Gary Waters, *Gulf Lesson One – The Value of Air Power: Doctrinal Lessons for Australia*, Air Power Studies Centre, Canberra, 1992, p. 171.

¹¹ Adapted from US Air Combat Command Briefing to media, 'Effects Based Operations', presented by Colonel Gary L. Crowder, Director for Strategy, Concepts and Doctrine, Air Combat Command, Washington DC, 19 March 2003; see Department of Defense News Transcript, www.defenselink.mil/transcripts/2003/t03202003_t0319effects.html.

Low observability allowed for direct strikes at the heart of the Iraqi air defense [sic] system at the very outset of the war. In the past, air forces fought through elaborate defenses and accepted losses on their way to the target or rolled those defenses back. In the Gulf War, the Coalition could strike Iraqi air defenses immediately, and they never recovered from these initial, stunning blows.¹²

A combination of stealth and accuracy fulfilled the requirement for parallel warfare. Furthermore, it was not so much new technology that created a new capability, but the way in which it was applied that created the shock effect. Non-stealth aircraft were equally important in their traditional assigned roles, in that once air defences were blinded, they were free to strike other targets without a high ground-based air defence threat. However, small strike packages of stealth fighter-bombers with precision weapons could now achieve what previously took up to 10 times more aircraft.

After modification, the target plan still involved prosecuting key nodes with the intention of neutralising whole Iraqi systems. Initially constrained by the number of strike aircraft available, the US believed that they would be unable to use swarms of aircraft to attack each and every target system in the country. Reality proved otherwise. As aerial assets committed to the theatre dramatically increased, and support was made available from Coalition partners, by week four of *Desert Storm* the aircraft had bombed everything feasible they could detect and were starved of fresh targets. By attacking centres of gravity it was thought that the ability of Hussein's regime to control their military, and therefore wage a war, would be diminished. The rapid build-up of air power assets enabled initial target plans to be broadened. The initial results were gratifying in a 'classic' sense and, from a strategic point of view, the air campaign had achieved 'success' in its first few days. Oil refineries and production were shut down early, forcing Iraq's military to rely on prewar stockpiles of fuel. Iraq's electrical power grid was also severely disrupted but that had an inadvertent effect of disrupting the water supply and sewerage facilities of the civil populace. In a military sense, however, the severing of electricity supply and attacks on communication nodes combined to have a disruptive effect on the regime leadership's ability to spread propaganda to citizens and communicate with fielded forces.

¹² Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*, Naval Institute Press, Annapolis MD, 1995, p. 190. Previously published as Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report*, US Department of the Air Force, Washington DC, 1993.

The civilian telephone system was knocked out, which overloaded the military communications system.

Even if the Coalition strategy had been detected, the relentless aerial bombardment had flattened Iraq's electrical and telephone system and left intact little other communications through which a regrouping of forces might have been managed. Ignorance, misjudgement and high technology had left Iraqi forces pinned under the sand and in the path of an oncoming juggernaut.¹³

Attacks on bridges not only interdicted lines of communication, but also downed the fibre optic communication cables that were carried on them. The Iraq military communications network was heavily redundant and dispersed. As such, it required repeated follow-up attacks and was never entirely knocked out. However, it was severely disrupted, which obliged the regime leadership to use less secure means of communication, such as radio, which was subject to signals intelligence collection. Continued attacks on communication facilities kept networks under pressure and prevented major repairs.

The centralised nature of the totalitarian regime meant that little, if any, initiative was apportioned to front-line commanders.

Democracies tend to fight autocracies or totalitarian regimes, not other democracies; hence the value of attacking the C3I systems has more utility than many in Australia may believe. Clausewitz argued that an enemy's field forces represented the prime centre of gravity, once a nation was at war. While this may have been true once, when civil and military functions were concentrated in the one leader who would actually be in the field with the forces, it is not so today. Today, air power allows a nation to reach over the fielded forces of another and behind them to attack the inner strategic rings of C3I ...¹⁴

Disrupting communications from the central leadership to forward deployed forces had the effect of isolating field commanders and significantly reducing their situational awareness, their ability to receive orders and, therefore, their combat effectiveness. The reduced combat effectiveness was particularly important in preparation for the ground combat phase of the campaign—Operation *Desert Sabre*.

¹³ Alan D. Campen, 'Communications Support to Intelligence', in Alan D. Campen (ed.), *The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War*, AFCEA International Press, Fairfax VA, 1992, p. 51.

¹⁴ Waters, *Gulf Lesson One – The Value of Air Power*, p. 170.

While air power alone did not win the war in the Persian Gulf, the relentless air strikes against command and communications left Iraq blind, befuddled, isolated and no match for the team of land, air, and sea forces that took but 100 hours to envelope and disable what had been the world's fourth largest military force.¹⁵



Iraq, 18 April 1991 – A view of the remains of a satellite station demolished during Operation *Desert Storm*. Regime communications were high on the list of target priorities during *Desert Storm*.

(Photo courtesy US Department of Defense)

Interdiction tends to have first-order physical effects and second-order physical or psychological effects on an enemy's forces and, thus, contributes to shaping the battlefield, whereas strategic strike of command, control and communication nodes in this case featured third-order, almost wholly, psychological effects. These effects did not exert their influence in isolation to one another and were cumulative in nature. Like the concepts of parallel warfare, the combined effects of strategic strike against command, control and communications, and interdiction of lines of communication, served to induce *chaos* into the adversary's military system.

¹⁵ Campen, 'Communications Support to Intelligence', p. 23.

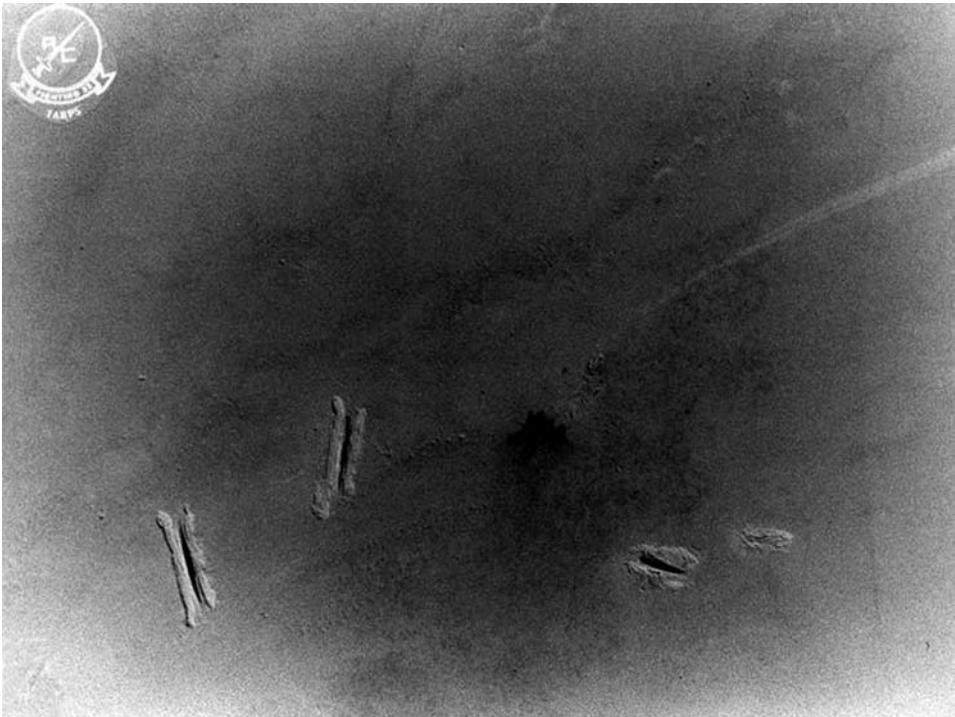
Of particular importance during the Gulf War air campaign was the interdiction of lines of communication. The incidence of interdiction attacks increased dramatically after week four—when targeting of strategic facilities was on the decline. A heavy effort was directed against bridges, railways, fuel depots and supply depots in a drive to reduce Iraq's ability to sustain fielded forces, particularly those in the Kuwait theatre of operations. Air attacks against rear supply areas were only moderately effective because of their dispersed nature; however, attacks against lines of communication and traffic severely disrupted supply to forward Iraq ground forces. As mentioned earlier, this had significant first and second-order effects such as *degradation* and *disruption*. About halfway through the air campaign, it was estimated that supplies reaching Iraq forces in Kuwait were below the level needed to sustain offensive combat operations.¹⁶

Iraq's offensive Scud missile capability and nuclear, biological and chemical (NBC) weapon capacity were interlinked. Three factors emerged early in the campaign that made Scud missile launchers, production and storage areas a high priority target. First, the Scud was a strategic weapon with political ramifications—it demonstrated Iraq's ability to strike at targets beyond its own borders. Second, it was feared that Iraq might arm its Scuds with NBC warheads, turning them into a weapon of mass destruction. With a weapon of mass destruction, Iraq could severely disrupt Coalition forces and escalate the war to an unprecedented level. The third factor was realised on 17 January 1991 when Iraq launched a conventionally armed Scud at Israel. Although physical damage was slight, the psychological impacts were much more significant. The Hussein regime had proved that Iraq was capable of striking Tel Aviv—a target that enemies of Israel had once thought of as untouchable. Whereas regional governments had publicly condemned Iraq's actions over the invasion of Kuwait, a great deal of private support was generated amongst those enemies of Israel who applauded Hussein's Scud attack on what was perceived as a 'common enemy'. In an attempt to keep Israel out of the conflict and thus escalating it into a full-blown regional war, the United States sought to neutralise the WMD threat by targeting both the means of delivery—the Scud launchers—and the propensity for a worst case scenario—the nuclear, biological and chemical capacity.

Air strikes against Iraq's Scud missile launchers, production and storage areas were less effective than anticipated. The launchers were highly mobile, elusive and well hidden during the day. Their supporting elements were also well camouflaged and concealed. It was also discovered after the war that attacks against Iraq's nuclear, biological and chemical capacity were less effective than expected. These facilities

¹⁶ Winnefeld, Niblack and Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, p. 131.

also were well hidden, dispersed and camouflaged. As a result, most facilities escaped detection and were not discovered until United Nations inspectors sought them out after the conflict. Despite the best aerial efforts of the USAF, a more effective result came from diplomatic quarters, which perhaps emphasises the whole-of-government approach. Placated by Russian diplomacy, US assurances and a supply of Patriot missiles, Israel displayed restraint and did not enter into the conflict. Without a regional ‘common enemy’, Hussein was denied the opportunity to garner enough support for his cause to shape the situation in his favour.



1 February 1991, Iraq – An overhead view of an Iraqi Scud missile site during Operation *Desert Storm*.

The blackened earth at centre marks the spot from which a missile was fired. The photograph was taken from an F-14A Tomcat aircraft using a tactical reconnaissance pod. This photograph serves to highlight the difficulty in targeting Scuds: they were highly mobile platforms that were also difficult to track and detect. Once their missile was fired and by the time an aircraft responded, they had long since departed back to their hiding places.

(Photo courtesy US Department of Defense)

Within the Kuwait theatre of operations, air power is attributed with neutralising the Iraqi forces' will and ability to fight. This led to a rapid and low casualty ground campaign. Operational planners determined that a 50 per cent attrition of ground force capabilities would be required, before *Desert Sabre* could commence.¹⁷ Iraqi capabilities were not measured solely by what equipment they still possessed in their order of battle. Intelligence gathered on resupply rates, troop readiness, morale and prisoner of war or deserter rates, helped to build a picture of the opposing ground forces. Degradation of command and control, disruption of logistics and collapse of morale had as much influence on determining when to launch *Desert Sabre* as the numbers of enemy tanks destroyed. A good proportion of the air campaign was concerned with the overall aim of shaping the battlespace such that the victory conditions for friendly ground forces were made more conducive. Another factor during the build-up phase to the ground campaign—Operation *Desert Shield*—was the prevention of Iraq making a major spoiling attack into Saudi Arabia. Therefore, an effect of battlefield interdiction strikes was to *foreclose* this option to Hussein before it could be exercised. The success of theatre-level tactical strike 'can in large measure be attributed to its sheer *mass* and *relentlessness*'.¹⁸

Such a statement begs the question of whether the RAAF could achieve similar effects if it were to conduct an independent air operation. The USAF is a large air force and the RAAF is small by comparison. Thus, depending on the scale of operations to be conducted, the RAAF would be hard-pressed to create the same sort of aerial presence. *Relentlessness* also implies a high *tempo* of operations that would be difficult to achieve. To create a similar effect, the RAAF would be required to optimise its capabilities. *Mass* may be synthesised using parallel warfare techniques such as a Joint Strike Fighter (stealth capability) with small diameter bombs, which would permit a greater number of targets to be prosecuted per sortie. Likewise, high *tempo* can be achieved through high mission turnaround rates and robust organisational traits. An example of a robust organisational trait would be well-developed targeting techniques and procedures, so that time is not squandered developing them 'on the fly'.

The constant presence of Coalition aircraft overhead had a profound psychological impact on Iraqi ground forces. Later phases of the air campaign featured considerable effort directed at the destruction of the Republican Guard and regular

¹⁷ *ibid*, p. 148. See also Keaney and Cohen, *Gulf War Air Power Survey: Summary Report*, p. 49; recently republished as Keaney and Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*.

¹⁸ Winnefeld, Niblack and Johnson, *A League of Airmen: U.S. Air Power in the Gulf War*, pp. 158–159 (emphasis added).

Iraqi troops in the Kuwait theatre of operations. The desired effect was to shape the battlefield, but the objective of a 50 per cent attrition of deployed Iraqi forces was over-ambitious and not achieved before the ground offensive was launched. This is not to say that battlefield interdiction was not effective:

From the perspective of the Iraqi troops in the KTO, the ‘air campaign’s psychological damage exceeded [its] physical damage’:

- It was ubiquitous—there were always aircraft overhead;
- It was intense—bombing went on around the clock, day in and day out;
- It was accurate; and
- It was impossible to defend against.¹⁹

It is arguable that in the age of precision air warfare, the same theme is emerging about tactical theatre strike that had emerged from World War II and Korea: the psychological effect on ground forces is greater than the physical effect. As intelligence analysts sorted information prior to *Desert Sabre*, they found that enemy prisoners of war and deserters expressed little regard for the Hussein regime. After interviews with them, analysts concluded that most remaining forces in the Kuwait theatre would probably offer minimal or no resistance to a Coalition ground campaign. Their analysis proved to be correct—Iraqi troops began deserting before the ground campaign began and often surrendered quickly once it started. Over 85 000 Iraqi prisoners were captured during *Desert Sabre*.²⁰ Such a result suggests that the battlefield interdiction phases of the air campaign had their greatest effect on enemy morale. Iraqi ground forces felt helpless as they had no way of effectively fighting back against aircraft that destroyed their equipment, hampered their movement and cut their lines of supply.

Although tactical air power was successful in shaping the battlefield, it was difficult to assess its efficacy at the time *Desert Storm* was taking place. The methodology for determining damage levels to ground forces was similar to techniques employed during World War I. Combat assessment reports relied heavily on aircrew observations and video of a weapon’s impact that was taken from on board the same strike aircraft that delivered the weapon. Moreover, the majority of aircraft were not fitted with the necessary equipment to record video of the weapon system’s impact. Objective, third-party reports of mission results were uncommon. Combat assessment is more than a hit or miss determination

¹⁹ *ibid*, p. 159.

²⁰ *ibid*.

and restrike recommendation. A commander needs to know whether air power is meeting its overall objectives.



Persian Gulf, 9 February 1991 – An intelligence specialist aboard the aircraft carrier USS *John F. Kennedy* (CV-67) evaluates aerial photographs to assess battle damage inflicted on Iraqi forces during Operation *Desert Storm*. Although useful, sometimes too much emphasis is placed on the value of imagery intelligence alone in assessing the effects of aerial strike.

(Photo courtesy US Department of Defense)

Combat assessment was performed during the Gulf War almost as an afterthought. The resources dedicated to it did not match its scope, training was minimal and no central agency was responsible for its production. Multiple source information (for example, signals intelligence and human intelligence) was often lacking and great reliance was placed on space-based imagery—a process that took time and was beholden to satellite orbits. There was a lack of third-party, timely, tactical, post-strike target intelligence that led to a reliance on weapon system video alone. Overall, combat assessment was too conservative and process driven, with pedantic adherence to established procedures that did not take into account the nature of modern, fluid battle. There was a reluctance to make a ‘functional’ damage call on a target system over physical damage that was easily visible.

The more meaningful but elusive measures of effectiveness are the functional damage wrought on the enemy, in terms of the campaign objectives—that is, not simply the number of targets destroyed in a given category, but the effect of the destruction on the enemy's ability to wage war.²¹

This suggests that more meaningful effects-based objectives should be set for air power at the start of campaign and not just '50 per cent attrition'. Furthermore, a functional basis for combat assessment can be applied to operational and strategic objectives.

To begin to evaluate the role and performance of air power in more functional terms, numerous analysts and commentators have used the broad distinction between strategic and battlefield preparation phases of the air campaign; that is, between on the one hand the campaign against the major sources of Saddam Hussein's power ... and on the other the effort devoted to weakening and destroying his army in Kuwait preparatory to the ground offensive.²²

Care should be taken here—in a totalitarian regime, the armed forces are a major source of power. History has shown us that damaging civil infrastructure, in the hope that civilians will rise against a totalitarian regime, is fruitless. Hence, the effects-based approach is still valid through the direct targeting of fielded forces. As a first-order effect, it physically damages or destroys the adversary's ability to wage war and, as a second-order effect, it erodes the military-political power base of a totalitarian regime. This is not to dismiss the need for a functional damage assessment of tactical level strikes. Functional damage should be considered above raw figures and requires secondary or tertiary analysis of strike success with regard to objectives. Thus, care should be taken when arbitrarily dividing effects into strategic, operational or tactical theatres. A *holistic* approach to effects is optimal—strategic strike may have a direct effect on reaching objectives; operational strikes or interdiction may help shape the battlespace, making the environment conducive to joint warfighting; and tactical strikes may erode the military power base. All influences on an adversary regime are considered such that the whole of effects contribute towards objectives and do not work in isolation of one another.

As a smaller air force, it seems impossible that the RAAF would be able to mount an operation on the same scale as *Desert Storm*. This is not to say that the RAAF could not learn from the US experience and adopt similar methodologies in order

²¹ *ibid*, p. 156.

²² *ibid*, pp. 156–157.

to draw greater effect from the practice of targeting and striking at an opponent from the air. Given the larger size and more advanced technology of the USAF, the Gulf War experiences of those personnel involved with targeting possibly strike a more resonant note with the RAAF outlook. In other words, by examining the human dimension behind the USAF targeting experience, we can reveal ‘lessons’ that are more pertinent. Despite the footage of ‘smart bombs’ destroying targets, which were popular in the media at the time, *Desert Storm* was largely successful because of highly skilled personnel, rather than advanced technology. Officers and airmen would often ‘jury-rig’ substitutes when capabilities were found wanting.

It was ... bright and innovative people, rather than in-place full-up systems, that saved the day and provided the Coalition the command and control, logistics, and mobility edge that would decide the conflict.²³

The human aspect of targeting capability is often foreshadowed by the technological bias of contemporary military trends. Targeting, in particular, suffers because of technical advances that have been made with the introduction of precision guided munitions. Targeting is often dominated by talk of joint direct attack munitions, joint strike fighters, uninhabited aerial vehicles, streaming data and real-time satellite links. Such bias is foolish because it neglects the linchpin of capability—the human in the loop. Given the right tools, sufficient motivation and in-depth training, the expertise of military personnel can contribute more to capability when it counts—in high stress situations—than blindly following the latest advances in technology. This is a lesson for the RAAF that is worth learning.

²³ *ibid*, p. 261.

Chapter Seven

Operation *Allied Force*: Kosovo (24 March – 10 June 1999)

Air power is an unusually seductive form of military strength because, like modern courtship, it appears to offer the pleasures of gratification without the burdens of commitment.¹

On 24 March 1999, the North Atlantic Treaty Organisation (NATO) launched Operation *Allied Force* as a means to compel Slobodan Milosevic to cease ‘ethnic cleansing’ in Kosovo and to pull Serbian forces out of the disputed province. *Allied Force* was initially expected to last a week but endured for 78 days. It concluded on 10 June 1999, when Milosevic agreed to NATO’s terms. *Allied Force* marked a departure for NATO away from their traditional military focus of deterrence against Cold War–era Soviet aggression. The purpose of *Allied Force* was as a *coercive* operation and, as such, it proves to be a sufficient case study on the use of effects-based targeting from an air power perspective.

Operation *Allied Force* was officially supported by all 19 NATO members, of which 13 nations contributed military aircraft. The United States made the most significant contribution, with 700 of the 1055 aircraft deployed to the operation and it flew most of the sorties. Of the other members, Germany and Italy flew suppression of enemy air defence missions, and France and Britain flew ground attack interdiction. Of the 38 004 sorties flown, 10 484 were strike missions.² A major factor in determining which NATO members contributed to the strike campaign was their ability to minimise civilian casualties. Those members who possessed aircraft that featured all-weather, night flying and precision weapon delivery capabilities were able to contribute to strikes on ground targets.³

Although *Allied Force* was originally intended to curb the efforts of the Serbians to expel Kosovars from Kosovo into Albania, it ended up being an attempt by

¹ Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*, Naval Institute Press, Annapolis MD, 1995, p. 213.

² Group Captain Peter W. Gray, ‘Air Operations for Strategic Effect’, in *Air Power Review*, Vol. 3, No. 1, Spring, RAF Information Media Training and Technical Publications, London, 2000, p. 27.

³ RAND Research Brief RB-72, *Operation Allied Force: Lessons for Future Coalition Operations*, RAND, Santa Monica CA, 2001.

NATO to destabilise the Milosevic regime. Air power was touted as a capability to bring about change in Kosovo because of its speed of application—a readily available tool to appear to be doing something—and because of NATO’s initial unwillingness to commit ground forces. It is safe to conclude confidently that air power alone did not succeed in coercing Milosevic to relent from his program in Kosovo. There is a fundamental flaw in the thinking that air power alone can bring about a decisive result. Since the Gulf War, air power had come to be perceived as a ‘silver bullet’—a sure-fire, low risk, high-performance instrument to be used with little cost, yet to great effect. Operation *Desert Storm* was successful because of rather unique conditions, such as a clear and open desert environment that favoured unambiguous target detection, and it was a symmetric type of conflict that left Iraq unevenly matched.⁴ These conditions made for easy use of air power and were unlikely to be repeated.

The use of force to coerce an opponent is always difficult and coercion carried out from the air alone is nearly impossible. The 1991 success of *Desert Storm* had raised the expectations of strategy planners in 1999 to overly high, unrealistic and perfectionist levels.⁵ It is argued here, however, that the use of air power in *Allied Force* needs to be viewed from a whole-of-government approach. Surely, the planners of NATO governments realised that air power, up until this point, had not achieved success in isolation of other factors? Such factors include, but are not exclusive to, the use of diplomacy, economic sanctions and ground forces.

The ‘armchair generals’ and some academics on the one hand suggested that only an overwhelming ground force could secure the province of Kosovo. Others (arguably the more enlightened) kept faith in the efficacy of air power, but without necessarily advocating its utility in isolation.⁶

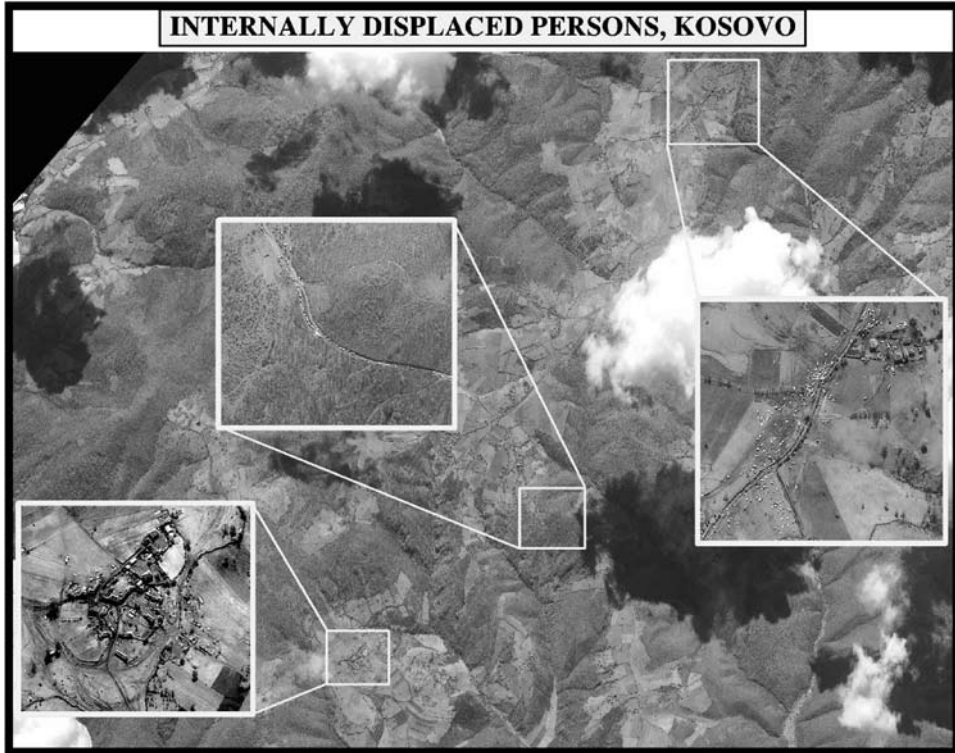
If *Allied Force* is viewed as a method for NATO to display resolve and obtain more time, so that consensus could be reached on the deployment of ground forces, then it appears to have been at least partially successful. Another factor for the ‘buy more time’ argument was revealed early in the NATO planning stages. A 1998 estimate of the size of a land force, necessary for a NATO intervention to defeat the Serbian army, was put at nearly two corps of ground troops. Subsequent analysis found that the cost in monetary terms and potential casualties would be

⁴ Scott A. Cooper, ‘Air Power and the Coercive Use of Force’, in Stephen D. Wrage (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, pp. 5–6.

⁵ Wrage, *Immaculate Warfare*, p. 2.

⁶ Gray, ‘Air Operations for Strategic Effect’, p. 17.

too high.⁷ Thus, air power allowed an immediate operational commitment until other options could be pursued. This is the underlying theme of effects-based targeting—that effects are not produced in isolation of one another and air power is but one tool at a commander’s disposal.



Kosovo, Serbia, 1999 – A US satellite image indicates areas of Kosovar refugees or ‘internally displaced persons’ subject to Serbian ‘ethnic cleansing’. This mounting humanitarian crisis formed the basis for NATO intervention in March 1999.

(Photo courtesy US Department of Defense)

⁷ Anthony H. Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, Praeger Publishers, Westport CT, 2001, p. 20.

NATO clearly communicated a number of points for Serbian compliance. Milosevic had to:

- ensure a verifiable stop to all military action and the immediate ending of violence and repression;
- ensure the withdrawal from Kosovo of the military, police and paramilitary forces;
- agree to the stationing in Kosovo of an international military presence;
- agree to the unconditional and safe return of all refugees and displaced persons and unhindered access to them by humanitarian aid organisations;
- provide credible assurance of his [Milosevic] willingness to work on the basis of the Rambouillet Accords in the establishment of a political framework agreement for Kosovo in conformity with international law and the Charter of the United Nations.⁸

Although its strategic objectives were clear, *Allied Force* relied on an ad hoc operational targeting plan. This, in itself, is surprising, since NATO target planning began nearly a year in advance. In 1998, planners had foreseen two types of aerial response to the Kosovo crisis. The first was a short, intense attack on Serbian targets in response to a specific Serb action, and the second was a short campaign involving air superiority, attacking Serb fielded forces in Kosovo and high value military targets in Serbia.⁹ Furthermore, ‘as early as May 1998, well in advance of the activation warnings, planning staffs at all levels had initiated work to identify the classes, types, and specific characteristics of targets that would need to be attacked to meet the specific goals of these two alternatives’.¹⁰ Despite the high level of preparation and well-meaning intent of *Allied Force*, it lacked a clearly defined targeting philosophy from the start—a concept of operations that would elaborate on how force was to be applied and clear parameters on how the air campaign could change direction if needed.¹¹

⁸ NATO Press Release M-NAC-1(99)51, *The Situation In and Around Kosovo*, 12 April 1999, www.nato.int/docu/pr/pr99e.htm, accessed 21 November 2005.

⁹ Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, p. 19.

¹⁰ US Department of Defense, *Report to Congress: Kosovo/Operation Allied Force After-Action Report*, Department of Defense, Washington DC, 31 January 2000, p. 21.

¹¹ Scott A. Cooper, ‘The Politics of Air Strikes’, in Stephen D. Wrage (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, pp. 72–73.

Predicting the success of air power as a coercive instrument is difficult. Air strikes tend to have unplanned secondary and ancillary effects that feed negative media reports. Thus the ‘moral high ground’—the original reasons for the use of military force in an intervention—may be easily lost to changing public opinion. The very nature of offensive air power means that exact results are difficult to predict. Moreover, there is difficulty in discerning the exact effects of an air campaign on the decision-making process of adversaries. All of these factors are stacked against the use of air power, in solitude, to produce coercive effects. The expectation that air power in isolation would produce the desired results in *Allied Force* was overambitious and proved that capabilities could not match expectations.

The crew of an aircraft can be expected to bomb a fixed target for which they have a satellite image, even with significant cloud cover. Technology allows aviators to determine which part of a building to hit for maximum impact and even what damage can be expected on the surrounding structures, all while avoiding air defenses [sic] as simple as a man with a shoulder-fired missile or as complex as a fiber-optically [sic] linked, multitiered radar operations sector. To be expected to stop lightly armed military police from killing unarmed civilians, however, mismatches the *mission* and the *means*.¹²

The emphasis on a mismatch of mission and means is important. The quote above provides a good indication of the highly technological capabilities of modern air power to prosecute targets accurately but, conversely, it is not so easy to produce the desired effects. Despite this, realistic mission parameters or objectives sought from air power should be articulated from the outset, otherwise capability is negated through poor strategy.

As the major contributor to the air campaign, the USAF dominated the application of targeting doctrine. In other words, NATO partners largely prosecuted targets according to USAF methodologies. Due to the application of a traditional targeting template, many of the targets prosecuted were mismatched with desired effects. That is, the analysis of Serbian target systems followed a ‘standard’ script. It was expected that certain effects could be achieved by prosecuting the standard set of targets that normally produced these effects. After the initial strikes of the air campaign, it was apparent that Milosevic’s regime would not be coerced and NATO members agreed to intensify their air attacks against a broader spectrum of targets.

During the fourth week of the campaign, targeting efforts began to focus not just on the fielded forces in Kosovo but also on Milosevic’s political

¹² Cooper, ‘Air Power and the Coercive Use of Force’, p. 8 (emphasis added).

machine, the media, the security forces, and the economic system, with such approved targets as national oil refineries, railway lines, road and rail bridges over the Danube, military communications sites, and factories capable of producing weapons and spare parts. By the end of the sixth week of the campaign, the bombing of infrastructure targets had cut Yugoslavia's economic capability by half and had left more than 100,000 civilians out of jobs. Finally, during the final two weeks of the campaign, Serbia's electrical power-generating capacity was struck.¹³

Escalation of the air campaign took place despite the obstacles. An initial lack of available air assets in the theatre of operations limited the scope of *Allied Force*. There was reluctance amongst several NATO members to escalate the use of force to coerce Milosevic. The multinational nature of NATO meant that the process of determining procedures, authorities and targeting concepts was convoluted and slowed the tempo of operations. Likewise, US planners themselves were divided over the most appropriate targeting strategy and, thus, the target approval process was often frustrated through lack of consensus. 'In fact, the disagreement within the military over strategy may have hampered the effectiveness of the air campaign more than any other factor'.¹⁴

Like the Gulf War, the disagreement centred on which choice of targets—whether striking fielded forces or strategic targets valuable to Milosevic—would have greatest effect in securing objectives. At the start of the air campaign, targeting policy was somewhat ad hoc and the majority of effort was directed at military targets, such as fielded forces.

A focus on the fielded forces in Kosovo also lent itself to an ill-advised dependence on quantifying the campaign. The raucous debate over the number of Serb military targets destroyed by allied aircraft detracted from overall aims of mission and undermined the concept of coercive strategy.¹⁵

The rationale behind the targeting strategy developed to such a degree that certain strategic targets were seen to be a critical vulnerability of the Serbian regime and, if they were destroyed, central leadership would be isolated from their power base—the military. Moreover, the military itself could be neutralised if it was disconnected from its source of command and control. Thus, as the air

¹³ Cooper, 'The Politics of Air Strikes', p. 80.

¹⁴ *ibid.*

¹⁵ Cooper, 'Air Power and the Coercive Use of Force', p. 15.

war developed, more strategic targets were added, such as Milosevic himself, his immediate underlings and state security apparatus.

The use of air power to achieve leadership decapitation in the past had proved to be ineffective, as it is usually too difficult to locate and target a leader accurately, and Milosevic proved to be no exception.¹⁶ The targeting of leadership offers the ‘silver bullet’ of quick capitulation but runs the risk of high civilian casualties because strikes against individuals and their means of communication are usually in highly urbanised areas. Therefore, there is a risk of disproportionate use of force—where the negative effects are greater than the positive—and the ‘moral high ground’ is lost. Coercion carries the wider risk of undermining the larger good that is being pursued in an effects-based operation. It may create an image of our military forces being willing to bomb, but not to fight:

... how can a democracy or an alliance of democracies exercise overwhelming power outside their borders without corrupting their self-declared normative basis for intervention? In a democracy, choices regarding national policy and military strategy are inherently normative—they are reflective of society’s values. To craft a strategic policy consistent with those values, policy makers must consider the sum total of all effects, primary and ancillary, of any use of threat-based diplomacy or actual force.¹⁷

On the flip side, Serbian fielded forces in Kosovo were difficult to acquire and strike from the air. This was further exacerbated by a lack of troops on the ground to provide target indications. Effective battlefield interdiction of mobile targets relies on timely and accurate networked intelligence so that the gap between sensor and shooter is minimised. Adverse weather, terrain, camouflage, concealment and the friction and fog of war often hindered such intelligence. The pros and cons of both strategic and interdiction target systems meant that one could not be prosecuted in isolation of the other. Therefore, a dual approach was implemented, comprised of night-time attacks on pre-planned targets and daytime interdiction within kill boxes.

¹⁶ In particular, Operation *Desert Storm*’s attempt to destabilise Iraq’s regime of Saddam Hussein.

¹⁷ Spencer Abbot, ‘Air Power Strategy and the Problem of Coercion’, in Stephen D. Wragge (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, p. 38.



Belgrade, Serbia, 1999 – A post-strike battle damage assessment photograph of the Belgrade Milicija Depot Area 2 in Serbia. NATO air strikes targeted Serbian forces in an attempt to curb their attacks against Kosovar civilians. While strikes against static militia depots were accurate, they were mostly ineffective because their garrisons were in the field.

(Photo courtesy US Department of Defense)

A problem with *Allied Force* was that it was perceived as being a punitive air campaign. The failure to apply overwhelming force from the outset, led many commentators to believe that it was incapable of meeting its stated objectives. There is merit in this line of thought. History has proven that punitive strikes are political in nature and air power is seen as a relevant tool to make this political statement. The British public backlash after the German Gotha raids on Britain in 1917 are a prime example of this, where the British desire for revenge served domestic political interests, but failed to have a marked strategic effect. Other examples are the Operation *El Dorado Canyon* raids on Libya in 1986, the cruise missile attacks on Iraqi Intelligence Service facilities and weapons of mass destruction (WMD) sites during Operation *Southern Watch* in 1993, and the Operation *Desert Fox* air strikes against Iraq in 1998. Such operations satisfy domestic public pressure ‘to do something’ but result in little change to strategic realities. However, in the

case of Kosovo, care must be taken with judging the correct use of force with regard to strategic objectives. Initially, 'the strikes began under the assumption that, using limited numbers of cruise missiles and air strikes, could rapidly force Serbia to concede in a short campaign of no more than 12 days'.¹⁸ However, the proposition of heavier strikes, that is 'going downtown' from day one, warrants careful attention because it hardly represents the proportional use of force under the circumstances. The overarching objective was to coerce Milosevic to accept those accords for the future of Kosovo that had already been tabled through diplomatic negotiation at Rambouillet in February 1999. The Kosovo crisis hardly resembled a full-blown shooting war of national survival for its NATO members. It was only later, after Milosevic did not concede, that 'NATO was forced to rush into massive escalation, and was forced to take a completely new approach to the conflict by mid-April'.¹⁹ Such a decision was reached after much deliberation and a consensus amongst NATO members. Although air power was capable of delivering much more destruction, its use was still in accordance with its place within the wider operational effects-based approach.

Operation *Allied Force* was rather unique in that its primary targeting focus was on the leadership of the Serbian regime. Such is the nature of a coercive air campaign. Under a coercive effects-based targeting strategy, the decision-making process of the targeted actor becomes the major factor. As a threat-based strategy, it must incorporate an understanding of the interests and incentives of the targeted leadership structure, plus knowledge of their processes by which decisions are made. To be effective, it must incorporate a considerable degree of sensitivity towards psychological, cultural and political variables. An in-depth grasp of target intelligence is essential and it should go beyond physical characteristics such as accurate aim points.

Modern technologies for determining target sets, finding and mapping targets for air strikes, and then evaluating the success of the strikes in a timely fashion have substantially improved the ability of military leaders and policy makers to integrate the use of air power with given strategic objectives. Any effort to target decision-making processes with air power, however, requires a fundamental understanding of not only the characteristics of the targeted actor, but of the structure and dynamics of organizations more generally, so that predictions can be made regarding the behaviour of organizations subjected to the stress of a coercive air campaign.²⁰

¹⁸ Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, p. 21.

¹⁹ *ibid.*

²⁰ Abbot, 'Air Power Strategy and the Problem of Coercion', p. 33.

The prediction of cognitive outcomes, related to the prosecution of an adversary target system, allows probable positive effects to be weighed against possible negative effects. The aim is to produce effects that do not have a negative impact on wider strategies or concurrent operations.

A cursory examination of air campaigns of the past, such as Vietnam and Iraq, reveals that the nature and characteristics of adversary systems targeted for coercion have widely differed or been rather unique. Take Warden's concentric rings model for instance. Such a generic targeting model does not automatically fit as a template for *all* target plans. From the United States' perspective:

... the understanding and use of a conceptual model is not a satisfactory substitute for specific knowledge of the state or organization that the United States seeks to influence and is only useful if a thorough knowledge of the targeted system is applied to the theoretical model.²¹

Following the success of the Gulf War, many US planners believed that they had a winning game plan that could be applied to *Allied Force* with the same results. Although *Allied Force* was a mixed success from an effects-based targeting point of view, there are some aspects of the target analysis that deserve more attention for future improvement.

Coercion, as one function of effects-based targeting, is concerned with the leadership structures of an adversary. All regimes have a leadership structure to provide direction and to respond to internal and external influences. Moreover, leadership structures consume resources to fulfil their role and rely on certain national facilities to perform their function. A leadership structure is held together by an infrastructure that binds resources and facilities. Non-democratic regimes will tend to rely on military forces to protect their regime from internal and external threats, and to project their power. The aim of a coercive effects-based targeting strategy is to erode leadership infrastructure, or pillars of support, such that it does not function to an adversary's advantage. Thus, a perception of not being in control can lead to a regime being manipulated according to friendly interests. Therefore, coercion relies on understanding an adversary leadership as a target system, which in turn relies on in-depth intelligence and analysis.

... efforts to map out the structure of an organization or system are an essential precursor to any attempt to exert influence on that system.²²

²¹ *ibid.*, p. 35.

²² *ibid.*, p. 34.

Such intelligence on leadership target systems is extremely difficult to gather ‘on the fly’ or from a standing start. In-depth intelligence understanding requires an understanding of cultural, economic and political factors in addition to the military forces of an opponent. Coercion is dependent on an opponent’s leadership structure being completely mapped out and its individual components identified. Therefore, if a component is attacked, *expected* effects can then be matched to it. Once components and expected effects are matched, *desired* effects can be isolated according to operational objectives. Thus, a coercive target plan may start to formulate. Friendly capabilities are then employed against *vulnerabilities* of the opponent leadership system. Air power is one such capability of an array that is available to operational planners. In this context, vulnerabilities are not necessarily those leadership-structure components that are exposed or easiest to strike. They are the components that are most likely to produce *desired* effects. As such, they can be identified as ‘centres of gravity’ of an adversary’s national leadership, but note that not all leadership ‘centres of gravity’ will necessarily produce desired effects.

As an effect, coercion can be broken down into four sub-components. They are *punishment*, *denial*, *escalation of risk*, and *decapitation*.²³ Punishment is a strategy focused on the direct use of air power against select targets of an adversary in order to lower civilian morale and possibly create an uprising against a non-democratic regime. Such a strategy originates from the World War II strategic bombing school of thought, where it was believed that targeting regime symbols would erode the enemy population’s will to fight. It is a strategy that contains pitfalls. For instance, historical use of punishment has been found to be ineffective in creating an uprising against non-democratic governments (including the Allied air campaign in World War II, the Gulf War and Kosovo) because of their institutionalised suppression of civilian populations.

The less accountable the leadership of the target state, ... the less likely they are to bow to public opinion. Furthermore, measuring ‘public morale’ is hardly a scientific art in any country let alone one that is subject to police control, censorship and propaganda.²⁴

The methodologies employed in the Gulf War have also come under criticism for targeting civil infrastructure and causing unnecessary suffering. The key is to prosecute clearly defined regime targets, so that symbols of office and power are toppled in the eyes of the citizenry. Although *Allied Force* was initially criticised

²³ *ibid.*, pp. 30–31.

²⁴ Gray, ‘Air Operations for Strategic Effect’, p. 21.

because public support for the Milosevic regime did not seem to crumble, it was later found that targeting of regime symbols was rather effective. It took time, but many Serbians were eventually disenchanted with Serbian leadership.²⁵

Denial is an effect concerned with the use of air power to attack opposing capabilities, thereby reducing an adversary's capacity to pursue a particular course of action. For instance, adversary forces may be eroded to the point where they cannot fulfil their objectives and, thus, friendly forces can operate without suffering unacceptable losses. Such a strategy was employed in the Gulf War and Kosovo. It enabled the build up of coalition forces during Operation *Desert Shield* in that they were not under threat of a counterattack by Iraqi forces and subsequently led to the rapid success of Operation *Desert Sabre*. In *Allied Force*, aerial denial bought time for NATO to deploy ground forces. The degradation of their military ability, coupled with the threat of a NATO ground intervention, was a factor that led the Serbs to the conclusion that their presence in Kosovo was unsupportable. Examining denial as a sub-component of coercion lends greater weight to the argument that *Allied Force* was successful from a whole-of-government point of view.

Escalation of risk is a strategy that involves a gradual escalation in the use of force in order to manipulate the level of risk faced by an opponent, thus attempting to leverage an opponent's fear of future costs in order to coerce action in the present. The threat that more damage can be inflicted by friendly forces if the situation warrants it, is to act as a motivating force to compel an adversary to comply. Like punishment, an escalation of risk strategy brings forth numerous law of armed conflict concerns and is thus a two-edged sword.

We choose our target to make the enemy move, and we set our level of force to extort a compliant response, but once we make our move, we must wait for the enemy's response, and it is never possible to say with confidence what that response will be. Once force is committed, if the adversary's behavior [sic] does not change, our only options are escalation or admission of failure.²⁶

This was displayed in *Allied Force* after initial NATO strikes against leadership targets. The targeting options of planners subsequently dwindled as Milosevic continued to defy NATO. In a bid to avoid an admission that NATO strikes were ineffective, it was decided to escalate their efforts and, thus, increase the risk to

²⁵ Stephen T. Hosmer, RAND Research Brief RB-71, *Why Milosevic Decided to Settle the Conflict Over Kosovo When He Did*, RAND, Santa Monica CA, 2001.

²⁶ Cooper, 'Air Power and the Coercive Use of Force', p. 9.

Milosevic. Therefore, NATO began to attack dual-use civil infrastructure targets. Although procedures were followed to minimise the risk of death to civilians before the strikes went in, NATO came under strong criticism for the perceived increase in suffering of the Serbian and Kosovar people, whose living conditions were markedly degraded. On the other hand, the risk of escalation strategy enjoyed limited success in that it displayed NATO resolve.

Decapitation is an effect achieved by applying air power against key leadership, and command and control targets, thereby achieving ‘paralysis’ of a regime’s decision-making capacity, without resort to the large-scale efforts of more traditional punishment or denial strategies. Decapitation highlights the need for an understanding of the nature of an adversary regime and good intelligence to identify centres of gravity that will, if attacked, inhibit their decision-making process. The aim of decapitation is not to assassinate enemy leadership, but to paralyse the normal function of an adversary regime. It is particularly effective when a spectrum of leadership targets are attacked in parallel—creating the impression that there is ‘no place to hide’ for an adversary. It also damages all regime control mechanisms such that power cannot be exercised through a single apparatus. Thus, decapitation seeks to disconnect leaders from their sources of power and leadership, such as control over the population, essential industries and military command. Ideally, holistic effects are sought over the depth and breadth of an adversary system such that a leader feels they are no longer in control and the military feel they are no longer being led. The cognitive outcome would be that a regime’s leadership would be more inclined to accept external shaping, or compel them to pause before selecting future actions because of the consequences.

During the later stages of the air campaign, NATO ground forces were deployed to neighbouring Macedonia. By the end of May, speculation in the media asserted that a NATO land operation may be forthcoming in Kosovo. Whether such speculation was the result of a NATO information campaign or not, it signalled to Milosevic the extent of NATO’s resolve and cohesion. It not only seemed that NATO was willing to commit forces other than air power, but the Serbs also realised that outside support was dwindling and international opinion was going against them.²⁷ *Allied Force* concluded on 10 June 1999 when Milosevic acceded to NATO’s terms. There have been a number of reasons put forward for Milosevic’s compliance, the most popular being as follows:

²⁷ Gray, ‘Air Operations for Strategic Effect’, p. 28.

- Russia withdrew its diplomatic support, which signalled that Serbia was at its lowest ebb in the eyes of the international community.
- The limited success of US air strikes in attacking military infrastructure and fielded forces – Milosevic's power base was gradually being eroded.
- The threat of a NATO land-based intervention.

All of these factors served to compel Milosevic to cross a certain coercive threshold, at the point of which he realised his operations in Kosovo could no longer be sustained in the long term.

A RAND Corporation study has produced a deeper analysis based on war crime tribunal interviews that were conducted with Milosevic. Early in the conflict, Milosevic would not comply with NATO's terms because he would lose authority in the face of domestic public opinion. He had promised Serbian hegemony in the province of Kosovo. In addition, Milosevic believed that the mounting refugee crisis in Kosovo and international concern for collateral damage would pressure NATO to reconsider their strategy of aerial attack. Furthermore, Milosevic believed that Russia would continue to provide unwavering diplomatic support to Serbia in defiance of NATO. All of these characteristics of the Serbian regime's belief system took a while to test and dismantle, and this perhaps accounts for the air campaign lasting for 78 days, which was longer than expected. By early June, Milosevic realised that further delay to test the resolve of NATO would prove unsound. Such a tactic had increasingly placed him in an unwinnable situation and unpopular predicament. By this time, the popular mood within Serbia began to change from patriotic defiance against NATO to increasing war weariness and a desire for the bombing to end. The change in public mood was such that Milosevic was virtually compelled to make concessions that might have cost him his power before the air attacks began.²⁸

The evidence suggests that the principal reason Milosevic accepted NATO's terms was his fear of the bombing that would continue if he refused. Serbian leadership lost its nerve and believed that NATO was willing to escalate the aerial campaign further. The peace terms for Kosovo were now fully endorsed by Russia and such an outlet provided Milosevic with a face-saving means of ending his defiance. The Serbians were convinced that NATO was prepared to broaden their target plan to inflict more damage on their entire national infrastructure, such as remaining bridges, electric power facilities, telephone systems, and factories. Coupled with the mounting reports of NATO's willingness to start a ground-based intervention, it was enough to compel Serbia to comply. The RAND report

²⁸ Hosmer, *Why Milosevic Decided to Settle the Conflict Over Kosovo When He Did*.

indicates that the cumulative impact of NATO air power played a crucial role in influencing Milosevic's decision to agree to terms, first, by creating a political climate conducive to concessions and then by making such a settlement imperative through the threat of future unconstrained bombing.²⁹

The RAND report identified two key areas for improvement in any potential coercive air campaign of the future. It is notable that whilst these 'key lessons' were drawn up for NATO, they are equally applicable to the RAAF given the probable evolution of asymmetric warfare in the future. The two key areas were as follows:

- Improve capabilities to locate, identify, and rapidly strike enemy mobile targets.³⁰
- Preserve the option to attack dual-use targets.³¹

Improve capabilities to locate, identify, and rapidly strike enemy mobile targets. Interdiction of military targets on the ground proved to be difficult due to adverse weather and forest-covered mountainous terrain. In addition, the Serbs managed to avoid much of NATO's attrition efforts against their ground forces through dispersal, extensive use of concealment, civilian shielding and hardening of facilities. Control over the Serbian military forces represented one of Milosevic's 'pillars of support'. Although not be destroyed completely, there is perhaps an argument that they were at best partially neutralised. Like interdiction campaigns of the past, an enemy adopting dispersion and camouflage techniques to avoid detection and destruction are usually compelled to restrict their movements and operate within certain windows of opportunity. As such, Milosevic found it difficult to exercise the full capabilities of those military forces at his disposal, or mass them for a large operation. In effect, Serbian ground forces were universally *suppressed* to a moderate degree. In a world of increased asymmetric warfare, such tactics are likely to become more popular as totalitarian regimes avoid conventional conflict and resort to insurgencies. Therein lies the argument for better operational targeting capabilities, for target detection, acquisition and prosecution, so as to achieve greater suppression or neutralisation. Persistent surveillance is able to identify targets as they emerge in the battlespace. Advanced sensors on board a networked aircraft can then acquire a target more easily and differentiate it from non-military objects and civilians. Extremely accurate low-yield munitions also offer greater mitigation against civilian casualties and are a more proportional use

²⁹ *ibid.*

³⁰ *ibid.*

³¹ *ibid.*

of force. The RAAF could do well to develop its capabilities in these areas in the long term.

Preserve the option to attack dual-use targets. In the Kosovo conflict, it was the threat of escalation of aerial attacks against dual-use infrastructure targets that generated the decisive pressure for war termination. In possible future coercive operations, such attacks may be the most effective and, in some instances, the only feasible way to compel opposition decision-makers to react in certain ways or accept peace terms. The key is to keep it as a planning option whilst being fully aware of the potential humanitarian impact. If an adversary knows that certain facilities are immune to aerial attack due to friendly doctrine or rules of engagement, they can serve as military shields or endure as regime symbols. As such they have the potential to negate positive effects. On the other hand, by attacking such targets, negative effects may be generated because of a breach of the laws of armed conflict. It is a delicate situation that calls for moral substance behind targeting concepts that is more than bluff. Again, such an avenue of approach is still reliant on the typical factors of coercion—a communication of intent, a demonstrated willingness or resolve to carry it out, and the capability to do so.

A common thread runs through the ‘key lessons’ that are discussed above, and that is ‘capability’. Often, capability is perceived as the material assets alone—the uninhabited aerial vehicle, the advanced fighter, or the precision munition. All of these rely on being able to keep abreast of the latest technological developments, but acquisition alone is not enough. Targeting capability also relies on such elements as highly trained personnel, evolved doctrine, proven methodologies and adequate resources. By following the ‘full capability’ path, the RAAF has the potential to engage effectively in a broader spectrum of warfighting, if required, in the future.

Although it was a US-dominated campaign, *Allied Force* still offers some valuable insights for the RAAF as far as target planning is concerned. This is due to the participation of other NATO members according to their means. For example the RAF, as a medium sized air force, contributed 28 ground attack-capable aircraft that flew 1 008 strike sorties.³² As a smaller operator in a larger US-led coalition, the RAF experience perhaps provides a ‘role model’ for potential RAAF coalition operations in the future and this concept shall be explored in Chapter Nine.³³ From a purely air power point of view, many of the ‘lessons’ NATO derived from

³² UK Ministry of Defence, *Kosovo: An Account of the Crisis*, www.kosovo.mod.uk/account/stats.htm, accessed on 21 November 2005.

³³ For an expansion on this subject, see ‘Chapter Nine – Implications for the Future’.

Allied Force were directly related to increasing operational capability. Those very 'lessons' coincide with the current directions being taken by the RAAF while it develops a competitive force structure for the future, comprising:

- improved intelligence gathering and analysis;
- improved target acquisition and use of uninhabited aerial vehicles;
- improved battle management and interoperability through network centric warfare;
- improved all-weather capability;
- improved long-range aerial munition attack capability;
- improved precision guided munitions; and
- development of a beyond-visual-range air combat, stealth and penetration capability.



Gioia del Colle Air Base, Italy, 1999 – A British Harrier GR7, armed for the dual role of air superiority and ground attack, takes off for a mission over Serbia. Despite being a NATO air campaign influenced by a multitude of different national interests, *Allied Force* was ultimately successful in meeting its objectives.

(Photo courtesy UK Ministry of Defence)

As noted earlier in Chapter Two, many, if not all, of these improvements or developments will affect the Air Force's targeting capability in some way.

Allied Force is a rather unique air campaign that highlights an evolving rationale behind the use of offensive air power. As such, it presents a set of circumstances where targets were selected to accomplish fairly clear objectives related to the *coercion* of the Serbian regime. Parallel attacks on leadership, command and control, and fielded forces were undertaken as part of the NATO strategy to achieve coercive objectives. The outcomes of *Allied Force* encourage a deeper exploration of coercive logic, or what adversary capabilities to target so as to shape the strategic situation in favour of friendly strategies and objectives. A good portion of the air campaign was aimed not only at enabling friendly strategies, but also disabling those of an opponent. In this set of circumstances, *denial* constituted a substantial portion of *Allied Force*. NATO planners assessed how Milosevic intended to accomplish his military and political objectives, and based part of their targeting strategy on denying this through the prosecution of the dynamics of the Serbian leadership structure. Although the same sort of denial strategy was employed during Vietnam, it proved to be more effective against centralised, industrial, conventional and mechanised forces, rather than decentralised, non-industrial guerrilla forces.

Chapter Eight

Operation *Iraqi Freedom* / *Telic* / *Falconer* (20 March – 14 April 2003)

Despite their relatively low public profile, air-power operations appear to have been the key to the rapid degradation of Iraqi defences, and hence to the relative ease with which coalition ground troops took over the country.¹

The War in Iraq in 2003 can be provided three names. The United States called it Operation *Iraqi Freedom*, for Britain it was Operation *Telic* and the Australian involvement was named Operation *Falconer*. For the purposes of this book it is referred to as *Iraqi Freedom* because, as such, it is an all-encompassing name that includes all coalition involvement in general. The strategic aim of the military campaign was derived from United Nations Security Council Resolution 1441—the elimination of weapons of mass destruction (WMD) in Iraqi territory. An ‘unofficial’ aim was also the removal of Saddam Hussein’s Ba’athist regime.²

The operational objectives of the military campaign were not overly complicated. The first objective was to achieve sustained military control over the entire territory of Iraq in order to enable a comprehensive search for WMD. To achieve this it was necessary to *deny* Iraqi forces the ability to operate effectively. Thus, air power was one capability used to ensure Iraq’s military capability was neutralised through surrender, coercion or destruction. Air strikes against command and control nodes were conducted in order to undermine the coherence of the Iraqi military and thus affect their capacity to oppose coalition operations. The second objective was to eliminate the political control of the Ba’athist regime over Iraq. This was to be achieved by either attacking leaders directly or other leadership targets to isolate the regime from their means of control. Because of their economic potential for the future of Iraq, the third objective was to protect Iraqi oil fields from sabotage by insurgents.

¹ Philip Wilkinson and Tim Garden, ‘Military Concepts and Planning’, in Paul Cornish (ed.), *The Conflict in Iraq, 2003*, Palgrave Macmillan, Basingstoke, 2004, p. 117.

² Michael Codner, ‘An Initial Assessment of the Combat Phase’ in Jonathan Eyal (ed.), *War in Iraq: Combat and Consequence*, Whitehall Paper 59, The Royal United Services Institute for Defence and Security Studies, London, 2003, p. 8.



7 April 2003 – A RAAF F/A-18 Hornet refuels from a USAF KC-135 tanker over international waters south of Basra, Iraq. The Hornet above is configured for both the air superiority and ground attack roles.

(Photo: WO2 Al Green, Department of Defence)

From these objectives, a concept of operations was formed. The underlying elements were flexibility, overwhelming force and resolve. Flexibility was needed because of uncertainty over what direction the campaign would take. A ‘scripted’ approach may have foreclosed options to coalition planners and a flexible plan allowed commanders to respond to events as the situation developed. Overwhelming force was intended to maximise the psychological impact of coalition operations through the display of tremendous military power and the careful selection of targets. Primary targets were symbols of government power and Ba’athist control. Other targets included command and control nodes to isolate the regime and destabilise coherence over Iraqi military forces. Dubbed ‘shock and awe’ in the media, the opening shots of the air campaign were intended to ensure an early collapse of political and military control, or compel the acquiescence of Hussein’s regime with coalition terms. This was achieved by very large strikes against centres of government and other targets over a short space of time. Resolve was displayed by linking air strikes with concurrent and rapid ground manoeuvre. Thus, there could be no doubt of the coalition’s intention to seize and control territory and undertake a process of liberation.

The intention of air campaigns in recent history has been to shape the strategic environment to make it conducive to ground operations. This usually involves an

initial phase that is exclusively the domain of air power. Although the intention of air power was the same, Operation *Iraqi Freedom* was characterised by an initial rapid ground advance enabled by concurrent use of air power. In less than four weeks, major combat operations were over and nation rebuilding began. From the outset, planning was conducted at a joint level and air operations were an integral part of the entire manoeuvre plan of coalition ground forces.

The joint concept of operations required rapid establishment of air superiority in turn enabling large-scale, simultaneous precision attacks against the Iraqi regime infrastructure, military centres and communications systems. At the same time, a rapid advance on the ground from both the north and the south towards Baghdad would take advantage of the aerial disruption to the centre of power.³

The traditional doctrine of launching strategic strikes and interdicting centres of gravity before a land campaign could be launched was rejected in favour of a compressed air campaign of just four days.

However, it should be noted that there was a major mitigating factor in the success of the coalition's joint manoeuvre plan. The United States had been attacking the Iraqi air defence network since the end of the 1991 Gulf War in the enforcement of a southern Iraq no-fly zone. Furthermore, since 2002 'whenever the Iraqis fired on coalition aircraft, American and British planes would reply by striking targets on a carefully planned list of some 350 fiber-optic [sic] relay stations and other critical communications nodes in the air-defense [sic] system'.⁴ In effect, the coalition had already achieved air superiority and had been shaping the situation in Iraq since 2002. A radically new joint manoeuvre doctrine was not the only factor in the departure from an initial air phase, since constant, but low-level conflict, air operations against Iraq had already been in motion for over a decade beforehand.

Regardless of the preceding suppression of Iraqi air defences, the coalition still needed to create a strategic environment conducive to ground operations and having a propensity towards regime change. Thus, the opening air war, albeit compressed, was extremely focused on achieving specific effects. It was directed at 59 leadership targets, 112 communications targets and 104 facilities housing the Ba'ath party and internal security services. 'The strategy was to disconnect the regime leadership from its military commanders, and those commanders from their fighting units.'⁵ It was

³ Wilkinson and Garden, 'Military Concepts and Planning', p. 110.

⁴ Stephen Budiansky, *Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Gulf War II*, Penguin Group, New York, 2004, p. 436.

⁵ Wilkinson and Garden, 'Military Concepts and Planning', p. 116.

intended to achieve more than influencing adversary decision-making; it was also setting the conditions for regime change. As opposed to *Desert Storm*, the aim was to spare economic infrastructure while decapitating the leadership, thus weakening their control of the military and of the civilian population.⁶ It was realised from the experience of *Desert Storm* that attacks against civilian or dual-use infrastructure could be counterproductive. There are three major reasons for this—an aversion to civilian casualties, concerns over longer-term humanitarian problems, and to keep administrative infrastructure in place to assist in postwar rebuilding. In essence, regime change was not to be facilitated through a civilian uprising—it would be achieved through coercion or physical removal.

When the air campaign opened on the night of 20–21 March, the initial attacks were carried out on the basis of intelligence that supposedly pinpointed the whereabouts of Saddam Hussein. Subsequent attacks on the night of 21–22 March were part of the ‘shock and awe’ plan. Although initial attacks imposed a high degree of fear and vulnerability on the civilian population of Baghdad, initial fears were mitigated when it was realised that the coalition were deliberately attacking government facilities with a high degree of accuracy.⁷ Nightly attacks against government targets continued throughout the war with the principle purpose of neutralising political and military command and control. Highly symbolic targets, such as palaces, were frequently chosen to demonstrate that the coalition’s fight was with the regime, not the Iraqi people.

Coercion was the fundamental effects cornerstone of the strategic air war in Iraq. The aim being to bend the will of the Iraqi regime towards coalition interests. It was a high risk strategy because human behaviour tends to be less predictable than the effects of physical destruction.⁸ The desired outcome was to achieve a near bloodless ground war through exercising the right coercive levers on the Iraqi regime. It not only required an in-depth knowledge of adversary systems, but also a good appreciation of friendly capabilities and the strategic environment. However, adequate knowledge of adversary systems is hard to achieve because of difficulties in identifying and understanding relevant groups with common behavioural characteristics in an adversary population. Whereas one part of population needed to be coerced, the other needed to be persuaded and calmed.

⁶ At this juncture, it is important to reiterate the intention of *decapitation*. The effect is to dislocate and cut off the leadership from its sources of power—not assassination. Although select leaders were targeted during *Iraqi Freedom*, this should not be the effect sought as experience has proven that it is difficult to kill leaders with air power.

⁷ Codner, ‘An Initial Assessment of the Combat Phase’, p. 14.

⁸ *ibid*, p. 18.



Iraq, 2003 – Satellite image indicating post-strike damage to an Iraqi Intelligence Service Headquarters. RAAF Hornets prosecuted similar regime targets in conjunction with USAF and RAF aircraft. Targets such as the one above were struck in an effort to decapitate the Ba’ath regime from control over the Iraqi civil population.

(Photo courtesy UK Ministry of Defence)

The groups being targeted in the ‘shock and awe’ campaign were not the immediate inner circle of the regime who had nothing to gain by compliance. Rather, they were: the outer circle who might be persuaded to overthrow their colleagues, commit regicide or surrender; the wider Ba’athist civilian leadership who might surrender or comply; the military-strategic leadership, where it can be distinguished from the former, who might overthrow, surrender, acquiesce or comply; the military-operational and tactical leadership and troops who might welcome the invaders, surrender or desert; potential guerrillas who might disperse; civil functionaries and police who might surrender or disperse; and ordinary people who might welcome the invaders, comply or acquiesce. And after every ‘might’ in this list there is a ‘might not’.⁹

⁹ *ibid*, pp. 18–19.

This highlights the complexity of the effects-based approach to operations and the difficulty in achieving desired effects through air power. To be truly effective, offensive air power needs to be an integral part of a wider joint plan or whole-of-government approach. One aspect of the 'shock and awe' campaign was that it was closely tied with information warfare operations. Carefully controlled public statements to the media and distribution of leaflets were aimed at convincing Iraqi political and military leadership that they would be destroyed if they resisted the coalition's intentions.¹⁰

The high tempo of operations and rapid ground manoeuvre meant that the focus of the air campaign quickly switched from strategic to operational and tactical targets. Although attacks against strategic targets continued throughout war, the emphasis of aerial attack was against those Iraqi units that did stand and fight. Even as coalition ground units paused for resupply in sandstorms, aircraft did not relent on attacks against tactical ground targets. Infra-red and radar target acquisition allowed coalition aircraft to strike at Iraqi fielded forces even in adverse weather.

In late March, while sandstorms prevented the rapid progress northwards of US forces and hampered normal close air support missions, Iraqi defensive positions could nevertheless be attacked repeatedly with a range of munitions.¹¹

Furthermore, a case study detailed:

It was during this period [26–27 March 2003] that the Republican Guard attempted a series of counter-moves, under the cover of sandstorms, against the 7th Cavalry Regiment and other units of the US 5th Corps, and the 1 MEF as they advanced north towards Baghdad. Two columns, each of up to 1000 vehicles, including T-72 tanks, counter-attacked at Najaf and at al-Kut ... Presumably, the decision to counter-attack was taken under the mistaken assumption that the sandstorms and bad weather would mask movement from coalition surveillance and counter-strikes.¹²

In reacting to coalition ground manoeuvre, and in leaving their defences and moving under cover of sandstorms, the Iraqi Republican Guard had made themselves more vulnerable to air attack. Some commentators assert that this is perhaps the first case of ground forces enabling air attack, instead of the other

¹⁰ Budiansky, *Air Power*, p. 437.

¹¹ Wilkinson and Garden, 'Military Concepts and Planning', p. 116.

¹² Philip Wilkinson and Tim Garden, 'Campaign Analysis: Ground and Air Forces', in Paul Cornish (ed.), *The Conflict in Iraq, 2003*, Palgrave Macmillan, Basingstoke, 2004, p. 127.

way around. Either way, it was a groundbreaking use of offensive air power due to advanced technology. In this case, tactical targeting of emerging targets was made possible by advances in intelligence, surveillance and reconnaissance (ISR) technology. Excellent battlespace awareness was generated by integrated ISR information from space, air, ground and other electronic sources. This information was then rapidly provided to air forces, who were on call to destroy any threat. Light and highly mobile coalition ground forces were used to lure Iraqi forces into an open fight where they could be attacked from the air. Meanwhile, strategic and interdiction air attacks continued as required.

The high tempo of operations also meant that there ‘would be not time to sit back and assess effects before the tanks rolled’.¹³ A concurrent ground manoeuvre strategy, therefore, requires a high degree of confidence in air force targeting capability—to produce desired effects without waiting to see if they have been actually achieved. In this context, waiting for in-depth assessment of initial air strikes is not a high priority. The tempo of operations was so rapid that coalition commanders were compelled to be forward looking. In a highly compressed initial air campaign, commanders literally have to trust the ‘expected effects from air strikes’ that are already mapped out in planning stages. Limits to ISR resources mean that if a commander were to wait for a re-attack recommendation, or wait for effects to be visible, then the battle may have already ‘moved on’ to a subsequent phase. Thus, there is a need for the flexible application of dynamic doctrine and not to be beholden to established procedures. Another element of a high tempo of operations is the use of lighter, more agile ground forces. The traditional doctrine of friendly forces attacking an adversary with a 3:1 ratio was refuted in *Iraqi Freedom*—instead Iraqi forces outnumbered the coalition by 3:1. Offensive air power thus enabled a multidimensional and manoeuvrist approach instead of one that was heavy and cautious.

In the case of *Iraqi Freedom*, it was not just an initial air campaign that induced ‘shock’ in the adversary system or shaped the battlespace prior to a ground-based operation. Each Service ‘shaped’ for each other. Examples above show that the manoeuvre of coalition ground elements at times flushed out or forced countermoves from Iraqi forces, which could then be targeted from the air. This resulted in massive neutralisation of armoured Republican Guard divisions. Likewise, the high tempo of joint strike and manoeuvre combined to have a paralysing effect on Iraqi command and control networks—through overwhelming pace, confusion and disruption. The counterattacks of 26–27 March 2003 were the last evidence

¹³ Budiansky, *Air Power*, p. 436.

of any central direction of Iraqi conventional forces until the end of the war was declared by President Bush in the beginning of May.¹⁴



Western Iraq, 2003 – Australian Special Forces soldiers observe the aftermath of an air strike against an Iraqi MiG-25 aircraft as they conduct security tasks. The rapid nature of manoeuvre warfare meant that ground forces were often in a better position to provide timely intelligence for BDA, rather than waiting for traditional ISR assets such as overhead imagery.

(Photo: Department of Defence)

Operation *Iraqi Freedom* emphasised a number of factors for the use of offensive air power in an effects-based operation:

- **The need for dominant situational awareness.** ISR allows us to see first and understand first. From a targeting point of view, it allows us to shoot at the right target first. Surveillance allows detection of targets as they emerge in the battlespace and superior intelligence decides which of these is important. Likewise, good intelligence is crucial to understanding adversary systems and decision-making processes. The development

¹⁴ Wilkinson and Garden, 'Campaign Analysis: Ground and Air Forces', p. 128.

of ISR capability in the future is important to retain effective targeting decisions.

- **The need for an agile and adaptive force.** *Iraqi Freedom* was not a scripted campaign that followed a rigid timeline or set of phases. The plan was flexible to allow for changing circumstances. Air power is required to have the same flexibility, whether it is to sustain a high tempo, rapidly change attacks from one target type to another, or be in so many places at once so as to overwhelm adversary ability to cope with attacks.
- **The need for dynamic and flexible doctrine.** Targeting doctrine should be seen as a ‘living’ document. That is, it is adaptable to whatever circumstances eventuate. Targeting doctrine should not be seen as a set of rigid procedures to be followed. Rather, it is a set of flexible guidelines for the conduct of targeting. High tempo operations mean that a targeting ‘script’ cannot necessarily be followed. Waiting for the post-strike assessment of effects is one such area. This may require a heavy reliance on good intelligence in order to predict effects from a target plan. Although effects of initial strikes will be eventually collated, the need for rapid decision-making means that commanders cannot always wait for them before advancing to subsequent phases of a plan.

All of these elements require not only the application of new technology in developing targeting capability, but they also rely on the ability of our thinking, about the application of targeting methodologies and doctrine, to be adaptive to a rapidly changing operational environment.

Part 3

A Road Map for the Future

Chapter Nine

Implications for the Future

The general absence of new operational concepts for the use of air power in this war suggests that if a revolutionary change in the conduct of war is under way, the harder parts of its implementation may still lie in the future.¹

The scope of this book is specifically concerned with effects-based targeting and the move away from physical attrition effects towards cognitive effects that influence adversary decision-making. In its course, a number of dominant factors that affect targeting have emerged:

- **Targeting requires superior intelligence support.** The creation of effects relies on knowledge of adversary systems. The influencing of adversary decision-making depends on an understanding of their thinking, their mindset and their psychology.
- **Targeting methodology needs to be adaptive to changing circumstances.** It is essential to look further than traditional target types when fighting an asymmetric opponent. Moreover, a target plan should not be rigid, as a lack of flexibility means that we may prosecute targets that are not conducive to meeting effects-based objectives. A clear concept of operations for targeting needs to be tailor-made for each operation. It should not only establish how force is to be applied and what effects are expected, but also how a plan may change direction if needed and how a risk strategy for the escalation of force may be implemented to display resolve.
- **Target strategies and planning should be cognisant of the comparatively small size of the RAAF.** Any targeting strategy or plan needs to recognise what effects the RAAF is capable of producing in a practical sense.
- **Effects-based targeting relies on the application of new technologies.** While new technologies should be exploited as they become available, the effective use of these new technologies relies on appropriate personnel

¹ Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report*, US Department of the Air Force, Washington DC, 1993, p. 247.

resources and excellent training. The personnel involved in effects-based targeting need to display a high degree of expertise, an ability to embrace progressive methodologies and an ability to make intuitive, objective-based decisions.

- **Offensive air power is capable of producing effects at all levels of conflict—tactical, operational and strategic.** Air power can create effects that are holistic in nature. A strike at the tactical level can ultimately affect outcomes at the strategic level. The effects of air strike are not produced in isolation, they are part of a wider joint strategy or whole-of-government plan. In its contribution to effects-based operations of the future, two challenges are posed for the RAAF—how will it create opportunities for itself and how will it integrate itself as part of a broader team?

EFFECTS-BASED TARGETING IS ONLY AS EFFECTIVE AS OUR UNDERSTANDING OF AN ADVERSARY

Just because targets can be hit with great precision, it does not mean that anything can be achieved thereby, unless the targets are selected with equal precision in the fluid turmoil of war, in accordance with a valid theory of victory.²

A weapon system—an aircraft and bomb flown by a pilot—is only a single aspect of target prosecution and represents the ‘tip of the spear’. The effectiveness of broader factors, namely our command, control, communications, computers, intelligence, surveillance, reconnaissance and electronic warfare (C4ISREW) capability, ultimately decides how effective of our targeting is. *Command* and *control* provide responsiveness to changing circumstances and ensure that the objectives of a target plan are being met. Good *communications* are the core of network centric capabilities and provide links between separate entities and agencies in the targeting process. Thus, they ensure that the correct targets are struck and changing target information is shared. *Computers* allow large target databases to be stored accurately and their automated processing power means that target changes can be rapidly incorporated and shared across as broad a system as possible. Good *intelligence* builds an accurate target picture. *Surveillance* and *reconnaissance* allow targets to be detected and contribute to situational awareness.

² Edward N. Luttwak, Foreword in John Andreas Olsen, *Strategic Air power in Desert Storm*, Frank Cass Publishers, London, 2003, p. xvi.

Electronic warfare is increasingly important in masking our own target intentions, protecting friendly forces and debilitating adversary defences.

Of these, good intelligence is the key to effects-based targeting. For instance, we assign a strike package which successfully hits a target and causes damage. Such a scenario immediately poses a number of questions. Was it the best target system to strike to achieve desired effects? Did we strike the optimum target component that was particularly vulnerable to air attack struck by the attack? What are the immediate effects of striking this target? What are the expected secondary and tertiary knock-on effects? Will there be effects that have negative impact on our objectives? What are the humanitarian concerns with striking this target? Could a better target have been chosen to produce desired effects? Without an adequate intelligence picture and in-depth analysis, these types of questions cannot be answered and striking at targets is simply attrition. Moreover, such an approach to targeting will invariably contribute little towards the achievement of our military objectives.

History has shown that the effects produced from attacking given centres of gravity are not uniform for different adversaries. If attacking target ‘type X’ of ‘adversary Y’ produces desired effects, then attacking a similar target ‘type X’ of ‘adversary Z’ will not necessarily produce the same effects. There are a number of examples of this from aerial campaigns in the past. For example, targeting German oil production in World War II was more effective than targeting Iraqi oil production in *Desert Storm*. Conversely, targeting Iraqi command, control and communications was more effective in *Desert Storm* than in World War II. It should be noted that the contemporary targeting of command, control and communications (C3) nodes is a lot more effective than it was 50 years ago. This is a product of the application of new technology and new targeting methodologies. New ISR technology and precision guided munitions mean that targets can be more readily identified and then prosecuted to achieve exact effects. New targeting methodologies, such as Warden’s Five Rings theory, have revised the way adversary systems are perceived. Whereas it was once almost impossible to attack C3 targets effectively with air power, they are now viable targets. Thus, the potential to influence directly the decision-making mechanisms of an adversary regime are greatly improved.

However, no generic targeting blueprint exists that determines if ‘target X’ is attacked, then ‘effect Y’ is the result. This is especially relevant to attacking C3 and leadership targets. The aim of an attack may be to influence adversary decision-making, but the effects of such attacks are highly ephemeral and difficult to quantify. This places greater emphasis on the gathering of high quality target intelligence. Any given opponent will have a unique national system that is comprised of components and linkages that are not replicated in another opponent.

These unique characteristics mean that a generic cause-effect template will not identify an adversary's centres of gravity. These need to be determined by analysis of adversary systems on a case-by-case basis, so as to produce unique targeting solutions that can be applied to produce desired effects, meet objectives and achieve an optimum end-state.

The current mechanism for targeting is based on industrial age utility; that is, attacking adversary infrastructure in order to deny their warfighting capability. The future will require that we employ targeting methods that attack those facilities that have a high cognitive value to an adversary and, therefore, deprive regime leaders of the capacity to fulfil their plans or meet their needs. The negative side to utility targeting is that a given capability may not hold high value in the eyes of the adversary leadership. Likewise, history has also shown that opponents tend to be intelligent and adaptive to the changing circumstances of a conflict. Adversaries may, therefore, find substitutes to targeted capabilities, hatch alternative plans or simply make their systems harder to hit from the air.

Warden's Five Rings model represents the embodiment of utility targeting theory. It is a standardised targeting template that describes a system of entities. This allows the targeting of those entities that support an adversary system. Moreover, Warden's model still acknowledges the leadership entity as the central ring. As such, the primary objective of targeting an adversary system is to shape their decision-making, to raise the price of certain courses of action, and to influence their decisions in a given direction. While Warden's model is still useful, it is ageing rapidly. The concept of 'value targeting' recognises that adversary organisations are human; therefore, targeting should match human motivations and behaviour. The idea is to target those human values that are relevant to regime leaders and their organisation as a whole. Value targeting establishes a hierarchy of needs, from basic necessities, such as food and shelter, to complex human desires, such as wealth, self-realisation and fulfilment. As the leadership hierarchy of a regime ascends, it equates to higher access to a hierarchy of needs. For example, the poor may have food and shelter only, whereas leaders have security and wealth.³ Warden's central ring can thus be broken out into leadership needs—physiological (food, water and shelter), safety and security (perceptions of wellbeing) belonging and social activity (family, tribe, friends and allies), esteem and status (sense of importance), and self-realisation (ego, wealth).

³ Lieutenant Colonel Peter W.W. Wijninga and Richard Szafranski, 'Beyond Utility Targeting: Toward Axiological Air Operations', in *Aerospace Power Journal*, Winter 2000, Vol. XIV, No. 4, Maxwell Air Force Base, Alabama, 2000, pp. 49–51.

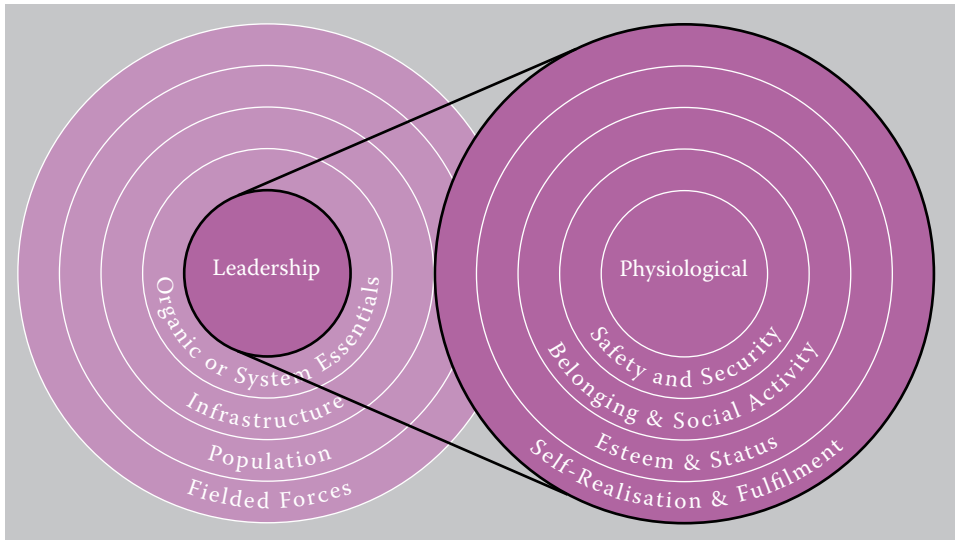


Figure 9-1: The inner ring – Value targeting⁴

Destroying an adversary's warfighting means can be effective, but it may not always be successful in affecting their psychological mindset or decision-making ability. Targeting the core values of leadership allows a dual approach to effects-based targeting, by attacking both the means and eroding the will of an opponent. Whereas Warden's outer rings equate to pushing the cost of war too high, the inner ring equates to increasing the risk a regime's leadership must face because of adverse consequences. In essence, value targeting has the potential to make warfare too-closely personal for the adversary leadership as they actually stand to lose something they value.

Those physical elements of an adversary's leadership core that are vulnerable to attack are usually highly protected and firmly established in urban areas. Thus, offensive air power, because of its reach and agility, will often be the most effective way of attacking the leadership core. The Air Force will also require the necessary intelligence support to conduct effective strikes. Value targeting places a great deal of emphasis on a wide variety of systems knowledge of an adversary. Figure 9-2 highlights a number of core leadership values that can be attacked through air power and some of the effects that can be hoped to be achieved.

⁴ Adapted from Wijninga and Szafranski, 'Beyond Utility Targeting', pp. 51–52.

Value	Target	Outcome
Security	Command centres and residences	Deny feeling of wellbeing (no place to hide)
Control	Command centres and regime facilities (whilst creating urgent, surprise problems that are complex and multidimensional)	Create dilemmas, overload decision-making, induce loss of self-esteem and ability to cope
Social Relations	Family, tribe, friends, allies	Isolation, loneliness or deny associations
Regime Dominance	Successors or allies	Deny feeling of group safety or continuation of regime

Figure 9–2: Leadership core values, targets and outcomes⁵

The table serves to highlight the broad range of subject areas that may be required to build comprehensive systems knowledge on an adversary. These may often be found outside of the normal Air Force intelligence specialties; for example subject matter experts in the culture or region, psychology of the adversary, financial systems, information warfare, communications and political systems. Many of these experts will need to be found outside of the Air Force, requiring personal networks and cooperation with other agencies. Furthermore, RAAF intelligence personnel may need to modify the way they conduct analysis. ‘... today “intelligence” is dominated by “counting” and not by “measuring effects”’.⁶ It is a question of avoiding a quantitative mindset when it comes to developing systems knowledge of an opponent. Value targeting requires value-added analysis—an appreciation for qualitative intelligence over quantitative intelligence.

Each adversary system is both unique and complex. It requires a great deal of effort and analysis to identify potential targets and desired effects correctly. This is especially pertinent to the RAAF. Given its limited capabilities and mass, a scattergun approach to targeting will not produce desired effects. As a small air force the RAAF does not possess the capability to attack a broad spectrum of targets, over a short time frame, to achieve a high degree of surprise and shock across the length and breadth of an opponent’s infrastructure. The onus, therefore, is on the RAAF to fight more intelligently, to identify, select and prosecute those targets that fall within its capabilities. Although RAAF targeting capabilities are likely to be expanded significantly in the foreseeable future, we cannot afford to go beyond given

⁵ Adapted from Wijninga and Szafranski, ‘Beyond Utility Targeting’, p. 58.

⁶ Wijninga and Szafranski, ‘Beyond Utility Targeting’, p. 54.

parameters in resources and, thus, must be realistic in our approach. The bottom line is that targeting for destructive effect alone does not represent an economy of effort. Thus, effects-based targeting offers a solution that realises limitations in capability and utilises the most effective apportionment of force.

EFFECTS-BASED TARGETING FOR ALL SITUATIONS

As has been stated in this paper, the RAAF contribution of 14 F/A-18 aircraft to Iraq in 2003 broke a gap of over 30 years in Australian bombing operations. Operation *Falconer* perhaps signals a trend of what can be expected in future deployments. Operation *Falconer* was characterised by:

- A modest contribution—a single squadron of 14 aircraft.
- The squadron was required to operate within the boundaries of coalition operational planning and an allied target list was compiled in accordance with US doctrine. However, it should also be noted that the portion of the target list for which Australia was responsible, was re-validated by RAAF intelligence and legal personnel in order to be aligned with Australian national objectives. Specifically, it was modified to meet high Australian rules of engagement and to reduce the risk of collateral damage.
- Aircraft involved were required to be flexible and flew multi-role missions in both defensive counter air and strike configurations.
- When required, the F/A-18s struck ground targets, whether deliberate strike, interdiction or close air support.

Such a set of circumstances could perhaps signal a trend for future RAAF operations, that is, operating within a coalition and flexible use of combat air power. While the future cannot be predicted with any amount of certainty, there are two areas that indicate future scenarios for which the RAAF should be prepared.

National character and Australian involvement in future operations. Australia has signalled its intention to be a partner in the US-led coalition in the war on terrorism. Australia has also signalled its intention to be a regional leader through pro-active engagement with our neighbours. If the US was to commence a new operation against a terrorist or despotic regime in the near future, Australia could be *reasonably* expected to respond with a force commitment. If such a commitment were to include combat air power, the RAAF could likewise reasonably be expected to strike at surface targets according to a US-conceived target plan. A similar situation would apply to a regional coalition. If a significant security threat was posed to Australia, it is reasonable to assume that a military response could be utilised. Moreover, it is reasonable to assume that Australia could form a coalition

with neighbouring nations who share a common interest in curtailing a threat to stability. In such a situation, Australia could find itself as a coalition leader or equal partner. If the level of threat were high enough, combat air power could be used to strike at an enemy, in order to reshape the strategic situation, to cease hostilities or compel negotiation. As such, the ADF would need to compile its own list of targets, formulate a target plan and prosecute them in conjunction with an ally and with a given set of national objectives in mind.

Spectrum of operations. The underlying rationale of the ADF is the defence of Australia. Yet different security challenges mean that the ADF is constantly called upon to mount operations outside its 'traditional role'. While being prepared to wage a conventional war, it may be called upon to perform peacekeeping, peace enforcement, anti-terrorism or intervention type operations. Current trends indicate that the ADF may be tasked increasingly to deal with asymmetric security threats—most likely extremist regimes with limited means but a high degree of will to carry out attacks. Such asymmetric threats demand new ways of looking at target systems, where conventional cause-effect linkages will need to be rethought and re-mapped. There are a number of features of asymmetric warfare that affect targeting:

- An adversary may use civilian populations and facilities as shields, or to create sanctuaries against advanced capabilities such as precision strike.
- Adversaries may exploit 'collateral damage' to stage-manage a 'humanitarian crisis' and to create public outcry in the international community. Although collateral damage may be real, incidents in the past have indicated that adversaries have 'enhanced' existing damage or fabricated it entirely. Exploitation of public perceptions enhances an adversary's ability to use civilians and civilian facilities as sanctuaries or shields. Often this has a direct impact on what targets can be selected and how they can be attacked.
- Adversary operations may be conducted in ways that minimise the concentration of their forces wherever possible. Adversary forces will often have a low detection signature and will be dispersed amongst the civil population. Such a strategy is designed to maximise the shielding effect of civilians.
- Potential future adversaries learn from their own and other's experiences when dealing with Western-style militaries. Overt military operations create risk of detection and Western/UN intervention. Moreover, air campaigns of the past have shown adversaries those targets that are likely to be prosecuted if they are attacked by a Western coalition. This leads to greater camouflage, concealment, dispersion and protection.

- An adversary may use refugee populations and their movements as a shield or to conceal the manoeuvre of their military forces. This may prevent the use of aerial interdiction to disrupt the mobility of an adversary.⁷

Overall, the political character of asymmetric warfare is reinforced in that it will continue to challenge the assumption of targeting doctrine. The assumption is that military force can invariably be concentrated against readily identifiable centres of gravity and will result in the physical destruction of an opponent. Conflicts in recent history have demonstrated that adversaries have intelligence and memory—they will constantly adapt to our targeting methods and capabilities such that they will not face us head-on and will instead try to fight a battle on their own terms. As seen above, many of these terms can negate the utility of aerial attack and, if strike is to continue to be a future capability of the RAAF, targeting may need to take on a fresh perspective.

AN EFFECTS-BASED TARGETING MODEL: CLOSING THE GAP BETWEEN THEORY AND PRACTICE

For the US, the situation is markedly different; by virtue of the size of their investment, industrial base and population, the gap between the theoretical possibilities which air power offers and their capabilities is small.⁸

For Australia, the divergence between targeting theory and practical capability is quite significant. Operations of the future must accede to constraints of our limited resources, which will in turn influence the way the RAAF conducts effects-based targeting. In comparative terms, the USAF is a large organisation with advanced capabilities that are generally outside the scope of RAAF operations. US air campaigns have been large in scale, utilised the latest technology and have had much greater personnel resources than the RAAF could hope to match. The USAF is in a much better position to experiment with new concepts of effects-based targeting and to apply the lessons learnt. Even if the RAAF was to be deployed as a partner within a US-led coalition, the our targeting concept of operations should reflect our own strategic objectives and national character. So what can be learned

⁷ Anthony H. Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo*, Praeger Publishers, Westport CT, 2001, p. 241.

⁸ Group Captain John Thomas, 'The Future of Air Power?', in *Air Power Review*, Vol. 3, No. 1, Spring, RAF Information Media Training and Technical Publications, London, 2000, pp. 73–74.

from the US experience, with respect to effects-based targeting? The key is to pick and choose those methods that enable RAAF capabilities.

As such, US effects-based targeting methods are helpful from a conceptual point of view, but are difficult for the RAAF to try and emulate in practice. Differences in size, operational scope, technology and national character mean that Australia and the US approach the use of force from very different standpoints.⁹ They hold different perceptions on what constitutes minimum or overwhelming force. Tolerance to casualties is another factor. They also have differences in interpretations of international law, what is acceptable political risk and what are national interests, when assessing any given situation.

Given that USAF targeting methods are not necessarily transferable, there is an argument for an independent, objective-driven, effects-based targeting methodology that is developed towards RAAF capabilities. Such an argument requires relevant factors to be considered. What effects can be achieved through the application of RAAF air power? How can they be applied within the context of joint, coalition, and/or whole-of-government operations? Can RAAF effects-based targeting methods be tailored towards a given adversary or threat? These factors can be addressed through the establishment of mature effects-based targeting methods. Mature methodology implies good appreciation of capabilities, in-depth link (cause-effect) analysis of adversary systems, established processes, robust organisation of targeting agencies, functional feedback loops and open communication for the sharing of information. If the USAF represents a role model that is beyond our means, who else is there? It is argued here that the RAF may provide a better model from which to learn.

There are a number of elements to support this claim:

- The RAF has developed its targeting methodology through experience. They have participated in a broad spectrum of contemporary operations involving independent targeting and the application of force. Those operations include Operation *Desert Storm* (1991), Operation *Deliberate Force* (1995), Operation *Allied Force* (1999) and Operation *Iraqi Freedom/Telic/Falconer* (2003).
- The RAF possesses established targeting methods that are mature, independent and joint-focused.
- The RAF serves the United Kingdom, which is a democratic nation with similar political apparatus and processes to Australia.

⁹ *ibid*, p. 79.

- The RAF conducts coalition operations with a focus on multinational interoperability, but without sacrificing their distinct national character, national interests or interpretations of international laws and conventions.
- The RAF also acknowledges the gap between capabilities of the United States and the United Kingdom.¹⁰
- The RAF has similar organisational and personnel structures to the RAAF.

As a potential role model, the RAF does not offer a seamless transition for the RAAF from ‘targeting for attrition’ to ‘targeting for effect’. However, the RAF probably offers a ‘best fit’ of effects-based methods that are more closely aligned with Australian capabilities. There are a couple of factors that militate against the adoption of the RAF as a direct role model. Its geo-strategic interests are distant from Australia and more closely aligned with Europe, and its equipment has different specifications to Australian equipment that is largely procured from US sources. Yet, these last factors are outweighed by the positive influences. Britain is a traditional Australian ally and both mechanisms and points of contact are already in place that can facilitate exchange of information on effects-based targeting methods.

EFFECTS-BASED TARGETING IS ONLY AS EFFECTIVE AS THE PEOPLE INVOLVED

Each advance in the application of technology requires a shift in the thinking and maturity of the institution.¹¹

The conventional view of military capability is usually in terms of weapons systems and force structure. Personnel are invariably referred to in terms of numbers, size, composition of units and the way they are employed. Such a view of the military does not adequately capture major elements of personnel capability and their interrelationships.¹² This is especially relevant to personnel structures involved

¹⁰ Thomas, ‘The Future of Air Power?’, p. 74.

¹¹ Nicholas Jans, *The Real C-Cubed: Culture, Careers and Climate and How They Affect Military Capability*, Canberra Papers on Strategy and Defence No. 143, Strategic and Defence Studies Centre, Australian National University, Canberra, 2002, p. 36.

¹² *ibid*, p. 8.

in targeting. It is argued here that to conduct effects-based targeting properly, a higher degree of expertise is required from the people involved.

Advances in military technology have an impact on the way targeting is conducted. In particular, technological advances, such as computerised stealth fighters, information systems and ‘smart’ weapons, have a considerable impact on command and control and the ability to bring greater firepower to bear on a target. In other words, they create a demand for increased networking of the air force as a whole. However, increased networking does not automatically equate to an increase in capability. The advantages conveyed through network centric warfare are only as effective as the expertise displayed by those who operate it. The ADF as a whole is an organisation that needs to develop its targeting expertise in tandem with developments in technology.

As the ADF develops networks that are best suited for the dissemination of targeting information, thus creating a holistic situational awareness for a commander, it means a move away from vertically-integrated control-centred hierarchies and towards coordination-centred networks operating independently.¹³ Increased situational awareness calls for greater targeting expertise within each sub-loop, so that a correct decision is made with regard to prosecuting a target—producing effects that match objectives. Thus, targeting promises to become more decentralised at the operational level. As networking increases, it is envisaged that the sensor-to-shooter loop will be flattened, resulting in reduced time between targeting decisions and a reduced need to ‘push’ emerging targets up the chain of command to be validated. ‘Objective awareness’ in sub-commanders must match situational awareness, because a solitary centralised commander risks information overload otherwise. This also fits with reducing the time of the sensor-to-shooter loop. That is, there is still a demand for a human in the loop, making decisions on the best target for greatest effect and apportionment of force. An officer in command of a sub-loop may be required to make effects-based targeting decisions with the overall objectives and a higher commander’s intent in mind.

Yet fighting ‘smarter’ is not the only personnel link to capability. There is also a link between staffing resources and military capabilities. While there is a demand for greater expertise, there is also a demand for more personnel to be involved with targeting. A target plan may be comprised of many targets of vastly different categories which require individual analysis for probable effects that can be generated if subjected to air strike. Each target needs to be assessed for law of armed conflict concerns and the best weapon system determined that matches

¹³ *ibid*, p. 37.

the level of force required. Surveillance and reconnaissance platforms, such as multi-mission uninhabited aerial vehicles and satellites may provide timely target updates, but that data still needs to be collated, analysed and disseminated by a team of human operators. Air tasking orders and strike packages need to be generated in accordance with target data. There are vast numbers of skill sets required to collect target data, conduct cause-effect link analysis and decide on the most appropriate use of force. In high tempo operations, staffing levels increase as target cycles need to be conducted in rolling shifts. Acquiring an adequate number of personnel who are trained and qualified to conduct targeting operations is important when addressing the issue of 'ideal' effects-based targeting methods vis-a-vis the best practice that can be achieved under the circumstances. Efficient effects-based targeting demands a greater number of personnel with a high degree of expertise. To conduct operations with less than adequate skills will result in less than optimum effects. By fostering the future growth of targeting personnel, the RAAF can hope to enhance its effects-based targeting capability.

EFFECTS-BASED TARGETING IS ONLY AS EFFECTIVE AS 'THE TEAM'

Air power will often be the best mechanism to display the iron fist of resolve, without removing the velvet glove of diplomacy.¹⁴

We engage neutrals. We entice allies. We attack tanks. The success or failure of each of these activities, to the degree that they are congruent with the larger theory of conflict or conflict termination employed, conditions or determines our judgement as to whether, at the end of the day, we have won or lost.¹⁵

The Air Force derives its versatility for a wide range of operations through an intelligent combination of platforms, C2 systems, robust logistic support, training and professional personnel.¹⁶ As new technologies are introduced and capabilities are developed further, the demand on personnel is set to become steeper.

Perhaps the greatest barriers to other countries deploying precision warfare capabilities lie in the very high levels of skill and coordination required

¹⁴ Thomas, 'The Future of Air Power?', p. 80.

¹⁵ Wijninga and Szafranski, 'Beyond Utility Targeting', p. 47.

¹⁶ Royal Australian Air Force, *The Air Power Manual*, p. 87.

of the pilots, flight crews, intelligence officers, and all the other personnel involved in planning and carrying out air missions.¹⁷

This argument can be taken further, as highly developed targeting methods require broader skill sets. Effects-based targeting is not solely the domain of aircrews and intelligence offices. Armament officers have an input into the best types of weapons to employ. Logistics officers must match demand for such weapons with an adequate supply chain. Air traffic controllers are often required to deconflict different air force strike packages or ensure artillery is not falling as aircraft are operating. Legal officers are required to keep a constant eye on law of armed conflict concerns. The airman technician on the flight line makes all of this possible by attaching the weapons and keeping the aircraft serviceable. In this context, effects-based targeting relies on the success of a ‘Whole-of-RAAF Team’.

Air power is not a substitute for surface operations, nor is it a war winner by itself. However, some desired effects, such as disrupting an adversary through neutralising a command bunker deep within his territory, cannot be achieved by surface forces. This is where air power can achieve unique effects. It performs a unique role within a joint warfighting environment. The employment of air strike is for the ultimate purpose of shaping the battlespace and influencing the outcome of future events. Air power is transitory and can be utilised in a given point of space for a limited amount of time. Thus, offensive air power should be seen as a lever—an enabler of friendly capabilities and a disabler of adversary capabilities. Obviously, air power cannot produce effects that will satisfy all military objectives within a given campaign, but nor is the opposite true—surface forces cannot achieve them all either.¹⁸ In the context of targeting, air power is beholden to the operational commander’s intent—effects are not produced through air power for the sake of producing effects alone. In this context, effects that the RAAF can produce are complementary to a ‘Whole-of-ADF Team’.

Air power has some unique characteristics. In particular, it offers a degree of commitment, which can be increased or decreased more easily than other forces. It also can avoid the complexity and practical difficulties of committing surface forces in a hostile environment. The effects-based approach means air power can be employed in a given set of circumstances and be more effective at de-escalating a crisis situation.¹⁹ AAP 1000-D—*The Air Power Manual* also

¹⁷ Stephen D. Wrage (ed.), *Immaculate Warfare: Participants Reflect on the Air Campaigns over Kosovo, Afghanistan, and Iraq*, Praeger Publishers, Westport CT, 2003, p. 106.

¹⁸ Thomas A. Keaney and Eliot A. Cohen, *Revolution in Warfare? Air Power in the Persian Gulf*, Naval Institute Press, Annapolis MD, 1995, p. 223.

¹⁹ Thomas, ‘The Future of Air Power?’, p. 79–80.

highlights the *versatility* of air power. Combat aircraft can be switched between widely separated and diverse targets and they can achieve a wide range of effects. It is the inherent versatility of air power that gives the Australian Government and military commanders a broad range of options in effects-based operations.²⁰ As discussed before, air power represents one tool at the Australian Government's disposal when considering a military response to a security problem. The RAAF may be tasked to strike at targets to produce effects that complement effects produced by other government agencies, whether they be political, diplomatic, economic, cultural or social. Producing effects through air strike is a complicated process and, as such, any effects that air power can produce are part of a greater government plan. In this context, Air Force targeting is part of the 'Whole-of-Government Team'.

In essence, the purpose of this work has been to stimulate the reader into thinking about the future of targeting in the RAAF, as advanced capabilities and operational requirements may necessitate an ADF approach that does not require physical destruction of an enemy. There is no hard and fast answer or generic solution to the implementation of effects-based targeting. The challenge that effects-based targeting poses to the RAAF is not necessary organisational—it is personal. Future security solutions may require innovative thinking, initiative and an ability to adapt to rapidly changing circumstances. Under these conditions, a 'traditional' targeting solution that seeks to 'destroy the enemy' rapidly becomes a thing of the past.

²⁰ Royal Australian Air Force, *The Air Power Manual*, pp. 86-87.

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