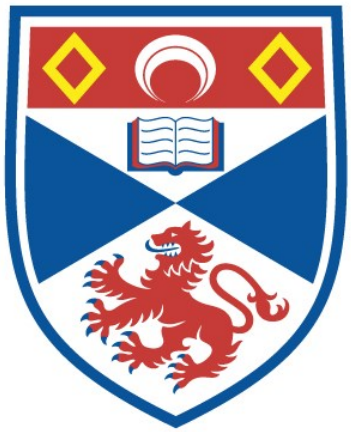
STRIKE, PARALYSE & CONTROL: THE DIRECTION OF MODERN STRATEGIC AIR POWER DEVELOPMENT & PRACTICE, 1989-2015

Matthew Paul Warren

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



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ABSTRACT

‘Strategic air power’ is an operating concept through which air power is arranged and directed to achieve objectives at the strategic level of warfare by exerting control over an adversary. At the end of the Cold War, utilising a new theory of strategic effect, the *Desert Storm* air campaign demonstrated its power and potential in practice. A question then emerges: how did the concept of strategic air power develop in the post-Cold War period and what factors accounted for its direction? Across five development phases from 1989-2015 this question was addressed from the experiences of six relevant states by determining the underlying process in action, common factors, and an explanatory model. It is based on comparative case study analyses of the United States, Russia, Britain, France, Israel and Australia and their development of strategic air power theories and capabilities, the influence of environmental and national factors, and practice.

This thesis finds that a common process of concept development became evident following *Desert Storm*. This process repeated itself throughout the research period. It also finds that eight common factors shaped the direction of strategic air power. In the early research period, air power transformed in response to a reconceived battlefield and new technology and was reframed as a tool for conventional strategic effect. After *Desert Storm* precision weapons’ unique role in enabling strategic attack was recognised and applied in successive air campaigns. Development cycles were compressed and sensor-to-shooter timescales improved, creating new options and expectations for strategic effect. Their limits were exposed by adaptive adversaries and complexity, leading to a divergence of agreement in the concept’s direction and a shift in its place in defence thinking. Combined with political and operational demands, by the end of the research period structural limits emerged on the strategic effects that could be delivered in practice.

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I was admitted as a research student at the University of St Andrews in August 2018.

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ACKNOWLEDGEMENTS

I have always been fascinated by aircraft, and as a child I watched with excitement and pleasure as American fighter jets, tankers and transports flew over our house on their approaches to the air force bases at Lakenheath and Mildenhall. I was very interested – probably far more interested than an 8-year-old should have been – in the Gulf War and Operation *Desert Storm* in 1991. It is here that the genesis for an academic path through International Relations and Strategic Studies and a career in the defence aerospace sector no doubt began. The culmination of that journey is this thesis, and I would like to express my thanks and appreciation to everyone who has helped and made it possible.

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CONTENTS

RESEARCH INTRODUCTION

Introduction

This thesis is focused on the study of air power as an instrument of the state during and in relation to war. Within this context, this thesis presents research on the development and practice of 'strategic air power', an operating concept through which a state's air power is arranged and directed to achieve objectives at the strategic level of warfare by exerting control over an adversary's behaviour and options. Using air power to achieve strategic objectives is not a new idea and has evolved in both theory and practice throughout the history of manned flight. Historically, the immaturity and limitations of platform and weapons technologies, and associated shortfalls in range, accuracy, intelligence and planning, has meant that the expected advantages and outcomes suggested by theory have not been delivered in practice. By the early-1980s, in the context of the Cold War and in the aftermath of the long, broadly unsuccessful air campaign in Vietnam, theorists and practitioners in both the United States and the Soviet Union recognised the potential for the technological revolutions in computing power, precision weapons and intelligence collection to address many of the historic limitations of strategic air power. For the first time, theory could be translated into practice and the creation of far-reaching effects from the air to achieve political objectives on the ground became credible. In 1991, the *Desert Storm* air campaign against Iraq demonstrated the capabilities and potential of modern strategic air power to strike rapidly and decisively against a well-armed state adversary. The historic evolution of air power generally, the use of strategic air power in the Second World War and the Cold War, and the post-Vietnam transformation of US air power is well documented. The direction of modern strategic air power – that which came after the Cold War – its direction after *Desert Storm*, and the concept beyond the experience of the United States is not. This thesis will address these shortfalls.

The research period starts in 1989 with the end of the Cold War. For over four decades the Cold War had shaped the historic concept of strategic air power. Its end marked the start of a new period in which air power would play a new, significant and far-reaching political and military role, drawing on developments from the late-Cold War. The research period ends in 2015, over 25 years and multiple conflicts, reforms and doctrines later. This endpoint balances a representative view of the post-Cold War era in which analysis of relatively recent developments in air power and its use in conflict is possible against being reliant upon current events. The thesis is made up of this introduction, five chapters and a conclusion. This introduction starts with a discussion of how modern strategic air power can be defined and then explores its key concepts and capabilities, reviews the relevant literature, presents the research question, and outlines the research methodology, approach and findings.

Defining Strategic Air Power

The concept of strategic air power is built upon its two constituent elements – air power itself and what is meant by 'strategic'. This section will discuss both elements, offer a resulting definition of modern strategic air power, highlight its unique intentions, and expand upon the essential elements on which the concept rests.

Air Power

In its most basic sense, air power can be considered to be 'the use, or denial of use, of the air or outer space for military purposes, by or to vehicles capable of sustained and controlled flight, beyond the area and range of the immediate surface conflict' (Lambert & Williamson 1996). Air vehicles may be manned or unmanned, operating distances can range from tens of miles to thousands, and no specific organisation or force is assumed to have authority over air power's use. Over the research period the definition of air power has increasingly included the cyber domain as well as air and space. This reflected the rise of both defensive and offensive computer network operations in modern conflict, the significance of computing and advances in computing power to modern platforms, weapons, sensors and systems, and the operational similarities between the three domains. Consequently, by 2015 the United States Air Force's (USAF) Basic Doctrine defined air power more simply and more broadly as 'the ability to project military power or influence through the control and exploitation of air, space, and cyberspace to achieve strategic, operational, or tactical objectives' (United States 2015, 25). This power and influence is possible because air power 'exploits the third dimension of the operational environment, the electromagnetic spectrum, and time, to leverage speed, range, flexibility, precision, tempo, and lethality to create effects from and within the air, space, and cyberspace domains' (United States 2015, 25). These attributes give air power several unique advantages over surface forces. These include rapidity of deployment and action, mobility and flexibility of engagement and employment, simultaneity of operations, and the ability to concentrate force at a specific place and time. Air power also has several disadvantages over surface forces, not least the fleeting and impermanent nature of its relative presence, its substantial development, procurement and sustainment costs, and its complexity. The use of air or outer space for military purposes can achieve or support a wide variety of tasks. These include *inter alia*: transportation of personnel and materiel; enabling activities including aerial refuelling, airborne early warning (AEW), command and control (C2), and intelligence, surveillance and reconnaissance (ISR); and a wide range of offensive actions including electronic warfare (EW), the provision of close air support (CAS) to surface forces, interdiction, maritime anti-surface and anti-submarine warfare, punitive strikes, conventional strategic attack, and nuclear deterrence and strike.

'Strategic' in the Context of Air Power

Historically, in the context of air power the term 'strategic' has manifested itself in three ways. First, through the range at which air operations have been undertaken; second, through the range at which air platforms can operate, particularly those capable of flying intercontinental distances; and third, through the destructive power of air-launched weapons, particularly nuclear weapons. However, these associations are not particularly helpful or instructive as to what 'strategic' means in the context of modern air power, in either theory or in practice. No aircraft is inherently strategic. It is not the platform, the weapon or the range that is strategic, but the objectives sought, the targets selected in that context, and the effects achieved. Strategic objectives are set at a national or coalition level, and 'strategic' air power is thus air power which is directed towards achieving these through its operational employment. For this to be successful, air power must have an effect on the adversary that contributes to the achievement of the strategic objectives set. This is achieved by leveraging the unique attributes of air power – rapidity, mobility, flexibility, simultaneity, and the concentration of force at a specific place and time – to deliberately and systematically disrupt, damage or destroy an adversary's political, economic and military capabilities to the point that the adversary is no longer able to fight effectively. In doing so, air power aims to create a degree of control over the adversary and produce the conditions for ending the military aspect of a conflict on terms favourable to the attacking state, at minimal risk, minimal cost in blood and treasure, and with a rapidity and directness not possible using surface forces alone.

Achieving strategic-level effects through air power is a complex, difficult and disputed practice. A clear linkage between what is being targeted and its relative importance to the adversary's political, economic and military power must be made, the exact timing of the effect considered in relation to other effects, and the cascade of direct and indirect effects on the adversary predicted. The aim is for air power to produce a lasting advantage against the adversary that exceeds the effort required to achieve it, and through which a state's strategic objectives are furthered and ultimately achieved. Challenges to realising this are numerous. They include the technical, logistical and cognitive efforts required to understand the adversary and identify targets that will produce the desired effects; the significant eco-system of platforms, weapons, capabilities, personnel, and C2 required to execute strategic operations; and the inherent difficulty in measuring the effects themselves, particularly indirect effects and those which do not manifest immediately. Consequently, the 'strategic' use of air power offers tremendous promise to the state that can develop and employ it but not without the commitment of tremendous efforts and resources. In short, in the context of air power, 'strategic' can be

considered to combine high-level political objectives with the application of force directed against the adversary in a way that produces a range of effects advantageous to the achievement of these objectives. It is rooted in the ends to which air power is focused, not the means.

Strategic Air Power Defined

Placed in the context of its potential contribution to warfare, strategic air power is the pinnacle of what post-Cold War air power can achieve. Modern strategic air power can be defined as: '*the direction of air power towards the achievement of political objectives through simultaneous offensive actions against the critical elements of an adversary's system of power and control, with the intention of producing effects that disrupt, paralyse or destroy these critical elements sufficient to exert control over his behaviour*'. It is a deliberate, considered use of air power, based on extensive intelligence gathering and target selection, with constant assessment required of the effects produced and the adversary's reactions.

The definition of modern strategic air power contains four key elements and there are basic criteria that must be met for it to be viable and credible. The first element is political objectives. These are goals set by state leaders at the strategic level of warfare. They determine what is to be achieved through the use of armed force against an adversary. Political objectives provide the source for the operational level's subordinate military objectives which are used to achieve them, direction to the air campaign itself, and consequently flow down to the tactical level's array of specific missions and tasks. Thus, strategic air power can be considered to be primarily a tool of state rather than a capability of the state's air force, although the latter is where the bulk of the state's air power capabilities and expertise are found. The second element is the adversary's system of power and control and the critical elements within. These are the focus of offensive actions. The conceptualisation of the adversary as a system of systems is central to the application of strategic air power because it is the nature of systems that it seeks to exploit. It is understood that for any actor to have power – political, economic, military – they must develop a system through which that power can be created and expressed. By identifying, analysing and understanding these systems – and the system of systems that results – connections, dependencies and ultimately the 'critical elements' that are essential and disproportionately important to the adversary's ability to function can be known. In turn, these critical elements – also known as 'vital centres' or 'centres of gravity' – can be targeted by air power. The third element is effects. Effects are the results of actions. They are manifested immediately and as a direct result of action but also indirectly, over time, as a consequence of both direct action and the adversary's reactions. Through selective

targeting, in combination these effects may impact a specific system or the system as a whole, resulting in disruptive change, restrictions in operations or options, and/or create a level of control or influence over an adversary's actions and behaviour. The fourth element is control. The level and type of control intended is linked to what the effects ultimately aim to produce in order to achieve a state's political objectives. A useful categorisation of what is possible is offered by Killey (2006). In ascending order of scale and the effort and destruction required to achieve them, they are cost/benefit manipulation, system disruption, system paralysis, and system destruction. The desired end result of all of these ways of directing effects is the same: control over the adversary's behaviour, with the specific level of effect to be attained determined by the objectives being sought and any overarching restrictions on the use of force.

The viability and credibility of modern strategic air power rests upon two linked criteria that a state must fulfil: possession of the necessary capabilities and intention to use these capabilities operationally to create strategic effect. First, a state must possess a full spectrum of air power capabilities. These are the tangible, physical manifestation of strategic air power. They include airborne and space-based platforms, sensors, weapons, systems and enabling infrastructure, and the data and communications that pass between them in cyberspace. The spectrum of capabilities includes three core elements: intelligence collection and dissemination, strike aircraft and precision weapons, and platforms that enable these to operate effectively including aerial refuelling, AEW and C2. For the full spectrum of capabilities to be utilised, it is also essential that a state can establish control of the air above which operations will take place. This may be achieved through the destruction of an adversary's air defence system and air force, or through the employment of low-observable (stealth) strike aircraft. In the absence of air superiority, strategic air power is not a viable means of warfighting. Second, the state must intend to use air power to strike in order to change the adversary's behaviour through the exertion of control. This requires the attacking state to conceive of its adversary as a system rather than as a military force or a simple series of targets, understand what is critical to the system's functioning, and target these critical elements in order to either manipulate the adversary's cost/benefit calculations, create disruption, paralysis or destruction. This intent may be explicitly stated in doctrine or in campaign materials or it may be inferred from the direction of air power in conflict towards creating effects that further stated political objectives and resultant campaign objectives.

Review of the Literature

This review of the literature primarily covers published material that discusses modern strategic air power within the context of the broader literature on air power and conflict. Secondarily, it also covers material that explores the causes of military innovation and adaptability. The review's scope is secondary sources including those that debate and critique the concept, those which analyse and evaluate air power's use in practice, and those that examine the nature of military innovation and adaptation, and the broader politics of air power. The secondary literature on air power can be grouped into three distinct approaches. The first approach is the literature concerning the development of air power theory. This provides a historic view and the context for modern air power, touches upon the use of air power at the strategic level of warfare, and also captures the main debates in air power up to and including the research period. The second approach is the consideration of national experiences. These include a substantial body of work on the United States, reflecting its position as the state with the most significant, comprehensive and advanced air power, and work covering a wide range of states that operate relatively capable air forces, tracing their historic experiences, reforms and practice. The third approach contains cross-cutting analyses of air power in conflicts since the end of the Cold War. These were produced during or after conflicts and provide discrete analysis of air power's aims, contributions, successes, failures, and lessons for the future.

Beyond the literature on air power, a broad body of literature exists that tackles the concepts of military innovation and adaptation. Given the research topic and the broad timeframe that it is concerned with, issues of innovation and adaptation by national air forces and within the concept of strategic air power as a whole are of relevance and worthy of exploration. Within this literature, the debate over the definitions, causes, and consequences of military innovation and adaptation are discussed, theories are offered utilising a range of disciplines from International Relations to Management, and numerous case studies are used to highlight each authors' contentions. In this review, the three air power literature approaches as well as the military innovation and adaptation literature are briefly outlined, drawing out the major contributors, arguments, areas of agreement and disagreement, before concluding with a discussion of the limitations in the literature and consequential areas of research interest. This in turn informed the creation of the research question and the research methodology.

Air Power Theory

The first literary approach tackles the development of air power theory and its relationship to modern air power. This draws on the work of primary theorists, both historic and contemporary, considers the potential for air power to be used strategically, and extends to capturing the

major debates within the field which rest upon air power theory. Several works provide overviews of the development of theory, from its origins in the 1920s to the early-21st century. These include Gray's 'Air Warfare: History, Theory and Practice' (2015), and Meilinger's 'The Paths of Heaven' (1997), the latter of which features contributions from a range of military and academic writers to reflect on the contributions of key theorists and major influences in air power theory's development. This includes Fadok's consideration of the role of US theorists John Boyd and John Warden in the development of the idea of strategic paralysis and its place in modern strategic air power (Fadok 1997). Indeed, the centrality of the primary work of four US air power theorists to the development of modern air power theory, and consequently to the debates in the field, requires a brief overview for context.

In summary, John Warden's 'The Air Campaign: Planning for Combat' (1988) outlined how air power used at the operational level of warfare could have strategic effect through the targeting of the centres of gravity within the adversary's system. Later, Warden formally arranged these systems into five concentric rings of strategic priority (Warden 1995). By rapidly and simultaneously striking at the targets that make up the centres of gravity within each system, Warden suggested that it was possible to inflict 'strategic paralysis' on an adversary which would result in the complete breakdown of the adversary's ability to fight (Warden 1988, 1995). John Boyd wrote and lectured on competition, warfighting, strategy and systems, and the importance of adaptation (Fadok 1995, Osinga 2013). As with Warden, systems are of central importance to Boyd, which he characterised as being complex, adaptive and open but vulnerable to surprise, shock and disruption which ultimately leads to paralysis and collapse (Fadok 2010, Osinga 2013). The key to victory for Boyd is to operate in a manner which is 'more indistinct, more irregular, and quicker' than the adversary in order to shatter and paralyse their core decision-making cycle – the (in)famous observe-orientate-decide-act ('OODA') loop (Osinga 2013). Philip Meilinger's '10 Propositions Regarding Air Power' (1995) captured the essential strategic role, strengths and unique attributes of modern air power; and David Deptula's work on Effects-Based Operations (EBO) focused on the potential for disruptive effects to control an adversary (1995, 2001). All four theorists were USAF officers, emerged from the post-Vietnam period of reflection on US air power, and were contributors to its subsequent transformation. It is upon these theorists' work that much of the critical response and debate about modern strategic air power, direct and indirect, rests. The most comprehensive view of the development of strategic air power itself is offered by Colin Gray in his 2014 work, 'Airpower for Strategic Effect'. Gray offers a broad and deep analysis of the development of air power theory through the lens of strategic effect, from the early theorists through the world wars, and discusses the role of US strategic air power during the Cold War,

its post-Vietnam reforms, and its triumphs and challenges in the post-Cold War defence environment. This analysis draws out the importance of context, circumstance, expectation and national strategy in the use of strategic air power and the results that it delivers in practice. Beyond the experience of the United States, Gray does not incorporate the experience of other capable states, such as Britain, France or the Soviet Union / Russia, into the analysis and, crucially, the overarching thrust of 'Airpower for Strategic Effect' is the relative ease or difficultly in the *delivery* of strategic effect from the air through history rather than its evolution as a concept.

The more theory-focused literature in the field of air power extends to covering the debates that have characterised modern air power, and in which the question of strategic air power's effectiveness and relevance are considered. Three debates emerged in the post-Cold War literature, reflecting on the increased sophistication, capability and accuracy of modern air power and its promise to fulfil historic theoretical expectations. The first of these debates concerns whether air power is effective as a tool of coercion or as a tool of denial. Coercion is more closely associated with strategic effect than denial, as it attempts to change the behaviour of the adversary through attacks away from the battlefield and deployed forces; denial is better associated with 'tactical' air power in which the adversary's military and directly supporting functions are attacked in theatre to deny the adversary the ability to achieve their aims. The debate about air power's coercive potential was led by Pape's 1996 study 'Bombing to Win'. Pape used a number of historic case studies – primarily US strategic bombing operations in the Second World War and in Vietnam – to demonstrate that air power is only credible as a means of denial (Pape 1996). Pape argued that coercion means inflicting punishment on civilians and civilian targets in order to break their morale and force national surrender. In contrast, denial is aimed at military forces to prevent them achieving military objectives and thus force national leaders to concede. Broader efforts to disrupt or destroy strategic targets are seen to have no effect on fielded forces or on national leaders.

Others presented an alternative view in which air power's failures were not attributed to attempts to coerce but to wider factors. Clodfelter's 1989 work 'The Limits of Airpower' which examined the air campaign in the Vietnam War, argued that air power's failures were a result of politicised planning and targeting, and a deep misunderstanding of the adversary (Clodfelter 1989). Clodfelter suggested that when the air campaign against the North Vietnamese was depoliticised and focused on limited objectives it was broadly effective as a tool of coercion. Further, the narrowness of Pape's definition of coercion as simply the infliction of punishment on an adversary was seen to be problematic. The work of Byman, Waxman & Larson (2000)

on ‘Air Power as a Coercive Instrument’ provides a much richer definition. It considers the balance of compellence and deterrence and the need to model costs, benefits, probabilities and perceptions. Notably, Byman *et al.* (2000) explicitly critique Pape’s own critique of coercive air power for only selecting cases in which adversaries’ vital interests were at stake and who would be highly unlikely to surrender under any circumstances. Thus, the debate over the coercive potential of air power – and ultimately air power’s independent potential – remained situation-dependent and contested.

Through the 2000s, two other debates were reflected in the air power theory literature. These concerned the increasing focus on EBO and its effectiveness, and the utility of modern air power to defeat non-state actors. These debates responded to the theories and approaches advocated by the work of Deptula and Boyd, whose ideas were increasingly incorporated into the air power doctrine of the United States and its allies, and which were being tested in practice. Much was written about the potential of EBO to maximise the efficiency of air power through disruption of the adversary’s systems and by extension, exert control, including work by Batschelet (2002) and Pendall (2004). However, in both the United States and in Israel the concept was criticised for its complexity, abstraction and deviation from established methods of warfighting. The limits of EBO as a concept and the failure of a perceived EBO-led strategy against Hezbollah by the Israeli Air Force in 2006 was criticised from within US military academic circles, by Vego (2006) and Matthews (2008) for example, and these critiques were influential in the idea’s decline in joint doctrine in the United States. During the same period, the necessity for air power to address non-state actors in a much-changed operational environment led to criticism of its effectiveness and utility. Van Creveld’s (2011) summary of this in ‘The Rise and Fall of Air Power’, whilst speculative in part, points to the root causes being the adversaries’ variability, non-trinitarian character, and hidden, fleeting nature due to their relative weaknesses. Air power is ill-suited to conflict with such actors argued Van Creveld, illustrating this with historic and contemporary examples from the United States and Britain. Others agreed, including Hooker Jr. (2016) who argued that not only had US air power largely failed in Afghanistan and Iraq but that the USAF’s continued focus on complex capabilities is used to justify its development spending, procurements and its independent identity – drawing on Organisational Theory and the work of, *inter alia*, Posen (1986). Related literature that examines the role of air power in national politics is also notable in this area of discussion, including Sherry’s (1987) ‘The Rise of American Air Power: The Creation of Armageddon’, which traces the origins and enduring appeal of strategic bombing to politicians, and work by Renner (2004) on the utility of air power in the post-9/11 strategic environment as a tool to translate technology and precision into political control – and the tensions and

problems that would arise from such. Conversely, others such as Downs (2005) and Meilinger (2017) saw fewer problems and argued that environmental change was a challenge to be adapted to through an emphasis on modern air power's potential for precise effects and rapid reaction. As with the coercion-denial debate, the effectiveness of EBO and the utility of air power against non-state actors remains contested, but in all three cases the influence of these debates on the direction of air power generally, and strategic air power specifically, is both intriguing and unanswered.

National Experiences

The second approach is found in the literature that provides the historical and contextual perspectives for the direction and emphasis of national air power. It naturally covers a broad range of states, with those with the most advanced air power covered in the most detail. The United States is a significant focus, followed by Britain, France, and other European states. The literature also covers Russia, Israel and Turkey, a number of Asian military powers including China, India, Japan and Singapore, as well as Australia, Canada and Brazil. In general terms, the national experiences literature provides a consistent approach to these states through descriptions of their historic air power capabilities from founding to present-day, analysis of their use of air power in conflict where appropriate, and inter-state relationships that influenced procurement choices or the use of air power alongside coalition partners. This approach reveals several areas of general importance to the development of national air power.

The general literature on modern US air power can be divided into two. First, the post-Vietnam transformation of the USAF, with works by Lambeth (2000) and Olsen (2007) amongst others tracing the rationale, reforms and outcomes of this period. These works complement Clodfelter's analysis of air power's failures during the Vietnam War, which provides the context for the reforms that followed. Second, there is a substantive body of work that explores and analyses the operational use of US air power in the post-Cold War period. This includes work by Davis (1996), Hallion (1998) and Putney (2004) on the Gulf War, Lambeth on Kosovo, Afghanistan and Iraq (2001, 2005, 2013), Grant on Iraq and the Global War on Terror more broadly (2003, 2004), and Mueller on Libya (2015). These works provide detailed analysis and context for the use of US air power, situating it within history, outlining its operational contributions, and linking it to national security policy and the direction of US warfighting. Common to all is a rich level of detail, gathered from extensive interviews with active and retired military officers who participated in the conflict being examined, and sometimes access to unpublished and classified documents which shed additional light on decision making,

mission details, and analysis of performance and effects. Beyond the United States, the literature features a number of instances where a general approach to national air power is taken, in which the experiences of each state are presented as chapters or sections of a broader work on air power. This approach can be seen in volumes on contemporary global air power by Wragg (2003) and Olsen (2011), and on European air power by Olsen (2014). These works provide the history, context, operations, equipment and challenges for air power in states ranging from Britain and France to China and India, with each national experience authored by an expert and treated as a separate, standalone analysis. A deep analysis of European air power in the post-Cold War era is provided by Anrig (2015) in which the experiences and direction of air power in a range of states with relatively advanced capabilities is examined. In Anrig's work, as in the more general literature, reactions to developments in US air power are noted. The consequence of this is to curtail analysis of a state's own reasoning for developing its air power capabilities as it has, and assume that development has either followed the United States or reacted to it from a position of opposition.

Within the international literature three main analytical themes are revealed: the importance of geography to air power's development; the role of a state's political and military history; and the experience and lessons learned from using air power in conflict. Geography is seen as consistently important due to the unique challenges it imposes and which air power is well-placed to mitigate. For example, Ball (1991) notes that Australia's air power is linked to the defence of the air/sea gap to the north of the country due to its ability to rapidly respond despite the distances involved. Air power can also be used to create strategic depth, as is the case for small states like Israel, ensuring that fighting takes place over the territory of the adversary (Brun 2011). A second theme is the political and military context in which air power develops, often associated with historic tasks which become embedded in national defence thinking or politicised views. Examples include French air power's clear division between tactical national air defence and strategic nuclear deterrence (Anrig 2011, de Durand 2014), Germany's air power development in the context of NATO and national defence, combined with its post-war aversion to expeditionary operations (Mey 2014), and Russia's historic political direction of how air power should be utilised in support of the favoured massed ground forces (Kainikara 2011). The third theme is the experience and lessons learned from using air power in conflict. Here, the literature highlights areas of success or failure in relation to existing structures, doctrine or previous reforms and reflects on these in the context of subsequent developments in national air power.

The approach taken by the literature on national experiences reveals three limitations. The first is a lack of critical analysis. There is little evaluation of whether each state made logical, deliberate decisions in their development of air power, particularly when following developments in the United States and the growing emphasis on strategic air power, in light of their own national contexts. Instead, the literature broadly tells an interesting, and at times detailed, narrative of how each state's air power changed over time. It does not explain why. The second limitation is the siloed nature of the analysis. Each state is considered in near-isolation, with only coalition operations and the predominating influence of the United States on many of the other states noted. The parallels between Russian and Israeli air power theories, for example, or the similarities and differences between the development of air power between two major European powers are not really explored. This is the case in the edited works on European air power by Olsen and Anrig, with only the introduction and concluding chapters beginning to integrate the differing experiences of different states. The third limitation is that national analyses focus on air power in its broadest sense. There is little specific analysis of a state's specific strategic capabilities or its place and role in the development of their modern air power. Such a lack of specificity in analysis is not unexpected given that it is one of a number of capabilities that constitute air power and that many of even the most advanced air power states lack the means or intention to utilise air power in this way.

Air Power in Conflict

A large body of secondary literature covers analysis and assessment of air power in practice. This is sometimes written during a conflict but more often in the months and years that follow. This literature is divided between two approaches: first, general analysis of a conflict which included the use of air power; and second, specific analysis of air power in a particular conflict, often with a focus on when it was used for strategic effect. The general approach taken in the post-conflict analysis literature is to examine the contextual factors that led a state to use its air power, to provide details of its employment such as platforms and weapons used, and to evaluate its effectiveness through quantitative analysis of targets damaged or destroyed and the measurable effect that this had. Some of the literature also discusses qualitative factors including intentions, personal reflections and lessons learned.

The first approach concerns the broad analysis of a specific conflict. The primary thrust of such analysis covers the breadth of political, diplomatic and military plans and actions throughout the conflict, and their results. Analysis of the role of air power and its use for strategic effect is part of a broader assessment of the employment of force by the state. Examples include Felgenhauer (2000) and Kramer (2005) who approach their analyses of

Russia's wars in Chechnya in this way, and Matthews' (2008) analysis of Israel's performance in the 2006 Lebanon War. This approach situates strategic air power in the broader context of a conflict's political and military objectives and permits an assessment of its relative effectiveness in relation to these. However, by definition this general approach to conflict only provides a limited view of air power as one of several areas of analysis, and strategic air power as a subset of this. Linkage to the state's use of air power in other conflicts is absent or confined to immediate cases – Russian use in the second Chechen War, for instance, is compared to the first (Felgenhauer 2000, Kramer 2005). Consequently, the literature on general conflict analysis is a useful starting point but cannot provide substantive detail or analysis.

A more focused analysis is provided by the literature on air power in conflict. Here, a state's strategic intent, campaign plan and the role of strategic air power in achieving these are explored, as are the air power contributions of different national or coalition forces. This approach is a common one and draws on both qualitative and quantitative methods. Examples include work by Fostic (1994), Davis (1996) and Hallion (1998) on the United States in the Gulf War, Stephens (2002) and McPhedran (2013) on Australian operations in Afghanistan and Iraq, Grant on US air power in Iraq (2003), Lambeth on the use of US and NATO air power in a number of conflicts including Kosovo (2001), Afghanistan (2005) and Iraq (2013), Lambeth on Indian air power in Kargil (2012), Mueller (2015) on US, British and French air power in the Libyan Civil War, and Boeke & Schuurman (2015) on French air power in Mali. A notable exception to this methodology is Gentile (2001) who produced a comparison of post-conflict analyses, with a focus on the 1945 US Strategic Bombing Survey and the 1993 Gulf War Air Power Survey, in the context of the NATO air campaign in Kosovo. The literature reviewed often provides a retrospective view of a conflict, shaped by outcomes that may not have been apparent at the time but which have been revealed years later. It is naturally restricted to assessing only those states that used their air power in conflict, resulting in some states with relatively advanced air power capabilities by the early-21st century – China, Japan, Singapore and Brazil for instance – not featuring. There is also an element of 'myth busting' contained in some of the work, for instance Lambeth's study of the Kargil conflict in which the Air Force's strategic contribution is examined and reassessed (Lambeth 2012). Relatively-recent analysis of Russian air power in Syria has been used to consider whether a conceptual evolution has taken place in Russian strategy (Shield 2018), examined the link between strategic air power and national strategic principles (Adamsky 2018) and as a comparison with previous Russian operations (Lavrov 2018).

The secondary literature on post-conflict analysis covers every conflict in the post-Cold War period in which air power was used and provides rich details on the manner of its use, instances of strategic intent, the supporting capabilities required, and a critique on its relative success. There is a tendency for this literature to examine the topic in isolation – many analyses focus on a specific conflict, a few on specific actors within a conflict – rather than offering a more holistic, contextualised or comparative study. Where there is analysis of multiple conflicts, a historic view is taken which addresses lessons learned, similarities and differences. There is a lack of analysis comparing the use of strategic air power in conflicts that took place concurrently as a way of evaluating different states' approaches or what each learned from the other in the aftermath. Finally, instances where directs links between practice and the continued evolution of the concept itself is discussed are generally lacking for the post-Cold War period.

Military Innovation & Adaptation

Beyond the core literature on strategic air power and the contextual debates in air power more broadly, a second area of interest to the research topic can be found in the literature on military innovation and adaptation. This literature considers topics that are considerably broader than air power. Although there are some air power-specific examples, particularly in the innovation literature, the primary focus is upon the military as an institution and its relationship with the civilians that oversee and direct it. Indeed, the core debate in the innovation literature is whether civilian or military organisations drive innovation, and it provides perspectives on the formation of doctrine over long time periods and outside of conflict. The adaptation literature is, overall, slightly narrower in its focus. It is concerned with exploring how militaries adapt when doctrine fails in conflict, an issue that occurs with a frequency that necessitates studying the resulting adaptation (or lack thereof) by militaries to better prepare for future wars – and future adaptation.

The literature on military innovation can be divided into two – the core debate between Posen (1986) and Rosen (1994) and the subsequent expansion of the field of study to consider other drivers of innovation, often linked to systemic factors. Posen's landmark 'The Sources of Military Doctrine' (1986) argued that doctrine is the product of military organisations that are incentivised to focus on the offense in order to reduce uncertainty and assert control. In peacetime, organisational theory – which explains why organisations operate at they do, internally – governs doctrine formulation through a set of primarily negative factors including mitigation of uncertainty, conservatism, vested interests, and the disconnections that emerge between military and civilian leaders. These factors drive behaviours including

standardisation, the seeking of a competitive edge, and efforts to increase the size, wealth and autonomy of the organisation. In times of conflict, Posen argues that balance of power theory prevails but that this still tends towards the production of offensive doctrines – favouring preventative warfare or the necessity to shift the fighting to the enemy's territory for example. In both cases, the result is to suppress incentives to change or innovate, for fear of disrupting or undermining vested interests. Posen thus determines that the primary drivers of innovation cannot come from within the military but instead emerge from outside – either from organisational failure / defeat in conflict or from civilian intervention, and that these are often linked (Posen 1986, 57). An alternative view was suggested by Rosen in his 1994 work 'Winning the Next War: Innovation and the Modern Military', in which he argues that simple doctrine change is in itself not innovation, and that 'a change in one of the primary combat arms of a service in the way that it fights or alternatively, as the creation of a new combat arm' is required (Rosen 1994, 6). Building on this assertion, Rosen argues that innovation is linked to a change in the concept of operation that wins a campaign and that it consequently originates within the military itself not from civilian control or imminent defeat. In peacetime military innovation is based upon 'how military communities evaluate the future character of war' and in wartime it 'is related to the development of new measures of strategic effectiveness… and an organization [sic] able to implement the innovation within the relatively short time of the war's duration' (Rosen 1994, 52). Rosen uses the United States' strategic bombing campaign in the Second World War as a case study, noting that the key innovation was its targeting methodology, and specifically the development of target analysis based on the work of the Army's Air Service School, as well highlighting the significant challenges and shortfalls that still emerged (Rosen 1994, 148-182).

The divergent views of Posen and Rosen on military innovation and the development of doctrine created amble space for other academics to add alternative explanations and drivers. For example, Goldman & Andres's (1999) work suggested that military innovation is driven by national systemic effects, centred on neorealism, power transitions theory, offensive-defensive balancing, or organisational theory, depending upon the mix of economic, political, cultural, and environmental factors affecting a state. Zisk (2001) accepts Posen's general arguments but considers them to be too limited, adding to them military systemic effects. In Zisk's analysis, three additional variables are important: officers' reflections on changes in the enemy – which creates the need to innovate; the formation of different communities of experts from within the officer corps which may seek to conserve the status quo or to innovate; and the nature of civilian intervention, which varies and is more flexible than Posen allows. The contrasting structural dynamics of the collective, collaborative Soviet General Staff system is

used to illustrate this against the United States' competitive Joint Chiefs system. A further view is offered by Adamsky's 'The Culture of Military Innovation' (2010), which argues that different strategic cultures account for varying approaches to transformation. Using the examples of the Soviet, US and Israeli approaches to theorising and realising the military-technical revolution / revolution in military affairs characterised by precision weapons, C4I and ISTAR, Adamsky argues that differences between the three states can be accounted for by an ideational approach linking security with strategic culture (2010, 11-12). This potentially offers a better explanation of innovation that a purely neorealist, competition and power-maximising theorisation.

The literature on military adaption distinguishes itself from that on innovation by clearly demarking the former as a function of wartime, and the latter as a function of peacetime, each a product of the context and pressures found under those conditions (Murray 2011, 2). The adaptation literature focuses on lessons learned during conflict and how the armed forces, military branches, and individual units are able to identify and react to change across different organisational levels. Murray's 'Military Adaptation in War' (2011) and Finkel's 'On Flexibility' (2011) both start from the same assumption that doctrine is usually wrong in practice and that militaries are usually poorly prepared for the next war due to factors beyond their control and an underlying set of assumptions about the future battlefield contained in force planning. Murray argues that adaptation is difficult due to the nature of the military itself, built upon discipline, doctrine, organisation, and top-down control but that the twin pressures of technology and society have driven adaptation. Crucially, it is those militaries that have formed an organisational culture in peacetime 'that encourage the upward flow of ideas and perceptions as well as direction from above' and which are open to change that will adapt to the actual conditions that they face in war – and that the opposite is true of militaries that do not (Murray 2011, 309). Finkel considers the question of how armies have managed to cope with surprises on the battlefield, and reaches some similar conclusions to Murray based on the experiences of the IDF. This includes the necessity of conceptual and doctrinal flexibility derived from encouraging lower ranks to challenge official doctrine to provide more options, avoid dogma, and challenge the 'cult of the offensive', as well as having a broad-based organisation, command cognitive flexibility to allow learning and creativity on the battlefield, and the rapid circulation of lessons (Finkel 2011). Beyond this, the work of Farrell, Osinga & Russell (2013) on adaptability of different national forces in Afghanistan during the 2000s considers bottom-up adaptation and the preference for militaries to first exploit existing methods and techniques before exploring alternatives. Later work by Farrell (2022) has considered the broader issue of organisational convergence in Allied forces in the context of

adaptability. This includes insights into why organisations converge – due to competitive natural selection of ideas or the influence of norms on institutions – the direction of military learning, and the process of emulation that results from socialisation amongst allies (Farrell 2022). Finally, Barno & Bensahel (2020) offer a critique of Posen, Rosen, and Farrell's *et al's* top-down approaches to innovation, and outline an alternative bottom-up approach built around doctrine, technology and leadership. For Barno & Bensahel, adaptation is about changes in environmental demands and the necessity for organisations to keep pace with that change, whatever it is and however fast necessary (2020, 9).

It is evident that the body of literature on military innovation and adaptation is continuing to broaden and deepen, and that it is contested amongst academics. There is debate across a wide range of areas, from the circumstances under which innovation and adaptation occur, which organisations play the pivotal role, how external and systemic effects impact decision-making and development, and the importance of bottom-up analysis particularly during wartime. Collectively, the literature provides a number of interesting lenses through which to view and examine change over time, which is of great relevance to the research topic. Nonetheless, there are several shortcomings in the literature which must be highlighted. These include a predominant focus on high-level institutional decision-making rather than those of the branches of the military. Although understandable, this leads to a top-down perspective on innovation. The bottom-up analysis suggested by Barno & Bensahel (2020) and provided by Farrell (2022) fills this gap to an extent but is focused on the unit level, and as such feeds into a predominant focus on adaptation 'on the ground' in national Armies. Air power is not wholly overlooked – the Second World War, 1973 War, and Gulf War all feature in the literature – but there is clearly more to be considered from this perspective.

The military innovation and adaptation literature has relevance to strategic air power in three areas. First, over the research period a great deal of change took place in how states utilised and understood air power, resulting in new operating concepts, doctrines, and organisational reforms. What was driving these changes – and resistance to change in some cases – may be explained in reference to the literature on military innovation. Second, the military innovation literature offers a perspective on the context and relative successes of the United States' and the Soviet Union's theorisation of strategic air power, and the adaptation literature may offer additional insights into how different states' air forces incorporated the concept in practice. Third, Farrell's consideration of evolutionary convergence and related ideas on emulation, provide lenses through which to view and explain the concept's direction and national experiences over the research period.

Conclusions

From the review of the secondary literature on and concerning strategic air power there are seven main conclusions that can be drawn. First, that the influence and importance of the United States to the post-Second World War development of air power theory is emphasised by the literature, and that the work of modern US air power theorists is of seminal importance to understanding modern strategic air power. However, there is also potential to explore the influence and experiences beyond the United States, particularly in states with advanced capabilities. Second, that the three debates within air power theory, which collectively consider the effectiveness of air power in conflict, remain contested and difficult to resolve but also that their influence on the direction of air power's development is deserving of further inquiry. Third, that the roles of geography, political and military history, and the experience of conflict, have played important and continuing roles in how states have developed and utilised air power more broadly. These will be essential themes to explore in the research. Fourth, that the literature takes a siloed approach to the analysis of air power resulting in a lack of comparative analysis between states, between conflicts and through time. There are some limited examples, but comparative analysis is not a common approach and there are no holistic views. Fifth, underlying much of the analysis and critical responses is a preconception of strategic air power being a static concept, largely unchanged since the earliest air power theorists. Historic examples of strategic bombing are assumed to be largely the same as modern examples, albeit with the latter employing more sophisticated weapons. There is little discussion in the literature on changes to theory, concept and employment, and yet ample evidence in theory and practice of dynamism. Sixth, the literature on military innovation and its relationship with doctrine, and military adaptability from lessons learned in combat offers several competing and complementary explanations and lenses through which to consider concept change over the research period. Finally, as noted in this literature, there is room to explore the role of civilian, military, and structural factors on innovation and adaptation of air power specifically.

Research Question

Having briefly considered the context in which modern strategic air power emerged, defined the concept, explored the underlying elements and capabilities required for it to be viable and credible, and discussed the approaches taken in the academic literature, it is now appropriate to state and explore the research question being addressed.

This research addresses the question:

'*How did the concept of strategic air power develop and evolve in the post-Cold War period and what factors accounted for its direction?*'

There are two clear parts to the question. The first part is the 'how', which seeks to capture developments in the concept from 1989 until the end of the research period through the diverse experiences and approaches of relevant states. The second part of the research question is the 'what', which addresses the reasons for the concept's direction of development. This includes considering the relative influences of different factors – environmental, political, military, technical, theoretical, and practice – as well as common elements of the concept across the relevant states. In addition to these two parts, a third, overarching part emerges: why the concept developed in the direction that it did?

Research in Context

The research question is predicated on two arguments: that the post-Cold War understanding of the concept is generally lacking, particularly post-*Desert Storm*, and that any examination of strategic air power must consider a broader range of states than just the United States. Thus, answering the research question adds to the field of study in several ways. First, this research provides a detailed account of the direction of the most sophisticated, complex use of air power through the various conflicts that have employed it since the end of the Cold War. In doing so it reveals the influences and events that were factors in both the development of national strategic air power capabilities, theory and doctrine, and by extension in the development of the modern concept itself. Second, the research tackles the modern concept as a whole, drawing upon the experiences of a diverse range of states rather than simply the dominant experience of US air power in the post-Cold War period. In doing so it challenges the idea that US strategic air power and modern strategic air power are one and the same. As a number of states besides the United States developed theory, doctrine and capabilities in this area and applied them in practice, the contention is that the modern concept can only be understood through a wider, comparative examination. More broadly, the research question engages with the debates in modern air power, incorporating and reflecting them in the development of national air power doctrines, capabilities, and practice, which in turn provides these debates with additional context. Overall, the research is positioned at the intersection of the literature on modern air power theory, national experiences, and strategic effect, drawing on each but offering new insight into strategic air power's development in the post-Cold War period at both a state- and concept-level.

Research Methodology

The research employed an inductive approach to assess the importance of different factors, reveal common factors, and to identify a process and propose a model that answers the research question. The chosen methodology to do this was comparative multiple-case studies of states determined to be of relevance during the research period. This methodology was selected as the most appropriate for three reasons. First, the collective experience of the relevant states was required in order to understand the concept's overall direction of development; a single case study would only provide a partial answer. Second, over the research period air power was used in multiple conflicts by multiple states, at different times, utilising different approaches and with different outcomes; this variety of experience needed to be captured, analysed and evaluated. Third, determining the factors that account for the direction of the concept's development required areas of common experience and response and areas of difference and divergence to be identified; these could only be revealed through comparative multiple-case studies.

Case Study Selection

In order to build the case studies, the states of most relevance to the research question were determined. A three-phase process to do this was designed and followed, based on assessments of national air power capabilities over the research period. The sources used were the International Institute for Strategic Studies' (IISS) Military Balance 1989-1990, 1995-1996, 2010 and 2015, Jane's Air Forces of the World (Wragg 2003) and Jane's World Air Forces 2011 (Peacock & Von Rosenbach 2011). The first phase focused on general capabilities. An initial filter established which states had an active fixed-wing air capability during the research period, and once filtered, the relative sophistication of that capability, including platforms, weapons and deployability, in comparison to the benchmark contemporary air force, the USAF. Twenty states made it through the initial filter. The second phase focused on assessing those twenty states against the two linked criteria for viable and credible strategic air power: possession of the full spectrum of capabilities and the intent to use them for strategic effect. This assessment used the IISS and Jane's sources outlined as well as available national defence and air force doctrines and any examples of practice. The result was that thirteen states were selected for the final phase of assessment. The third and final phase focused on three further criteria: whether the states had used their air power capabilities in practice during the research period, whether use was a one-off or whether there were examples throughout the period, and whether any use was 'strategic' as defined. Several states, including China, Singapore and South Korea, did not use their air power in practice; for several more, including Turkey, Norway, Italy and Canada, their use of air power in practice

was limited in its scope and/or infrequent. Consequently, six states were determined to meet the criteria for inclusion in the research. These were Australia, France, Great Britain, Israel, Russia and the United States.

Method, Sources & Approach

The research followed the historiographic approach, qualitatively analysing primary texts and documents for their meaning in relation to the concept and its development by the case study states. These were supplemented where appropriate and necessary by secondary sources. From these texts and documents, a synthesised, contextualised and critical view of events, approaches, outcomes and consequences was constructed for each case study state. This analysis was conducted from multiple perspectives, taking into account the roles of the geographic and geopolitical environment, national political and military context, air power theory, operational capabilities, and use in practice for each state. Each case study analysis was subsequently reviewed and discussed. This body of analysis formed the foundation of the subsequent comparative analysis between states presented in this thesis. The historiographic approach was appropriate to answer the research question because the question seeks to explain an historic, real-world phenomenon – the development of modern strategic air power – and to do so by looking at the events, capabilities, experiences and records of those states most intimately involved.

Central to the method of analysis was the selection of sources from which data for analysis were obtained. These sources can be divided between primary and secondary. The primary sources used can be further divided between official state documents and the writing and testimony of military officials, theorists and policymakers. Official state documents communicate each state's contemporary thinking on its national defence, the role of air power within that, the capabilities, organisation and operational details of its air power generally and strategic air power specifically, and its intent, employment and assessments on its use in practice. A wide variety of documents were identified as containing these data. They include national security strategies, national military doctrines, joint doctrines, air force doctrines, defence white papers, legislative records and budgets, campaign materials, official statements by political leaders and military officers, and post-conflict analyses created by the state. The writing and testimonies of military officials, theorists and policymakers were also primary sources for analysis because they capture contemporary views or analysis of the concept in theory or practice, and in the context of their respective state. Sources included books, journal articles, published speeches, lectures and appearances at conferences, and statements and interviews in the national or defence press. The research also utilised a variety of secondary

sources. These comprised relevant reports and analysis of air power capabilities and their use in conflicts throughout the research period published by think-tanks, news outlets, and the defence industry press, as well as critical analysis by scholars in academic journals. These secondary sources served as an important source of non-state data that could provide contemporary context, reflection, debate, and an element of verification to official state sources.

Data were collected from the desk through a wide range of online resources. Prior to collection a significant effort was undertaken to identify the types of document available and the frequency of publication in order to ensure gaps in collection and subsequent analysis were minimised. This was an iterative process, with emergent gaps identified in the case study phase and filled as appropriate prior to writing-up. Official state documents were collected directly from national online repositories of information including national legislatures, government ministries and departments, national air forces, and intelligence agencies, either directly or through general national archives. Official state documents were also obtained from subscription-based archives including those of Chatham House, FirstSearch's Government Publications Office catalogue, and the Digital National Security Archives, and from third-party websites hosting archived materials such as historic doctrines and white papers. Some documents from the early research period, particularly air force doctrines, were not located in digital format but hard-copy publications were acquired. Identifying and locating the writing and testimonies of military officials, theorists and policymakers entailed a detailed compilation of the personnel involved in the creation of strategic air power theory, air power doctrine, campaign strategy, and post-conflict analysis during the research period. Searches of journal databases, think-tanks, the online archives of reputable news outlets, and the defence press were undertaken to identify sources that reported on and analysed air power capabilities and their use in conflicts throughout the research period. These yielded a large number of articles and extensive reports that contextualised, described and analysed the use of air power in practice.

Limitations & Ethics

The research has several limits imposed by the chosen methodology, the sources utilised and the method of collection. First, the research is concerned with relatively recent events in a field in which national security is paramount. This imposed limits on the availability of official state documents due to documents known to exist continuing to be classified at the time of writing, and the redaction of parts of some declassified official state documents used in the research. The availability of documents, particularly in relation to details on state air power capabilities

and their use in practice, would likely provide additional data and insights into the research topic. These limits of availability and security were a feature of data collection for all six case study states, with Israel's 50-year period of classification on official documents related to conflict of particular note. Consequently, this emphasised the importance of those Israeli documents that are in the public domain and the writings and testimonies of retired military officers and policymakers who have reflected on their experiences in books and journals. The national security limitation also raised an ethical consideration in regard to accessing and using classified material. No information of a classified or non-public domain nature was sought, referenced or utilised during data collection, case study analyses or write-up of this thesis. All documents accessed are in the public domain, either by virtue of being unclassified, having been declassified and released, or constituting unclassified elements of classified documents referenced in secondary sources.

The second limit is the reliance on the identified sources of data being comprehensive, based on the researcher's efforts to identify, catalogue and locate all materials of relevance. This limit emerges from the classified nature of some material – and the resultant known-unknowns and unknown-unknowns – language barriers, and the breadth and depth of the material sought. Consequently, it is possible that some gaps exist both in identification and collection. These may offer additional information and perspectives to the analysis undertaken, although given the numerous sources successfully located it is unlikely that significantly different conclusions would result. The third limit is language, and specifically the publication of official state documents and other relevant material in languages besides English. For the United States, Britain and Australia, this was not an issue; for France, a few key documents were published in English as well as French (including national white papers) and the French originals were generally used, along with translated French-language sources for legislative documents, campaign materials and the writings and testimonies of military officers. Israeli- and Russian-language publications imposed greater limits due to non-Latin script and the researcher's unfamiliarity with Hebrew and Russian. Consequently, Israeli and Russian sources were confined to those published or translated into English, with a small number of Russian-language documents identified in English-language material collected and translated.

The fourth limit is the reliance on published materials, which whilst extensive, could have been supplemented through the conduct of interviews with senior military officers and policymakers from the case study states. These may have provided additional details and inside accounts which cannot be found in the sources used. However, the researcher determined that interviews would not be pursued as a method of data collection for reasons of balance

between states in which key personnel could be identified and those where they could not, the associated issue of access (particularly to Russian military officers), the potential cost of conducting multiple interviews for each of the six states, and the logistics of doing so during the coronavirus pandemic.

Structure & Findings

The research is presented over five chapters. These chapters are ordered chronologically, and their period of coverage is determined by distinct phases in strategic air power's development between 1989 and 2015.

The first chapter contextualises strategic air power at the start of the research period through a brief overview of the concept through history. This covers the concept's theoretical inception through to the early-Cold War, followed by a more detailed analysis of developments from 1973 to 1991. It shows that the concept of strategic air power was strongly shaped by nuclear deterrence and strike where it existed at all, and that despite innovative thinking about the potential of conventional strategic air power amongst both the Soviet General Staff and officers in the USAF, only the latter was able to translate theory into capability. It finds that this was due to USAF officers recognising the potential for air power to act at depth to affect the frontline of the battlefield by utilising new technologies to counter the contemporary Soviet threat, and then reframing the tools of deterrence and tactical support as tools for creating conventional strategic effect.

The second chapter assesses the implications of Operation *Desert Storm* across the case study states. It shows that there were a range of different interpretations of what this demonstration of strategic air power meant for each state's own air power capability and that it was instrumental in driving the air power reforms of the early-1990s. It finds that the role of precision weapons in future warfighting was the common lesson taken by all of the case study states and that this triggered new investments, doctrines, and organisational changes. In addition, resulting from the disruption to thinking in this period, a three-part development process is identified which shows how the case study states established, tested, and evaluated their understanding of strategic air power based on practice or their perception of events or others' practice.

In chapter three, the 'era of intervention' that encompassed strategic air power's use in five conflicts over nine years is assessed. It shows how the post-*Desert Storm* reforms to national air power were put into practice, demonstrating significant progress in capabilities and

strategic effect by several states, and that the scale and tempo of air power's use in this period drove progress in areas including intelligence collection, precision firepower, interoperability, and targeting. It finds that there was a compression of the air power development cycle and that the primary output of this was a revolutionary improvement in sensor-to-shooter timescales. This in turn created new options for targeting and control, and with them, greater complexity and the risk of politicisation.

In the fourth chapter, the limits of strategic air power are assessed through the challenges, implications, and reactions of the case study states to counterterror, counterinsurgency, and limited operations from 2003-2011. It shows that the concept, and its prevailing understanding, was stretched and shaped by different strategies, doctrines, and users, resulting in shortfalls, failures, and added complexity. It finds that this period marked the end of two decades of air power's general convergence towards a more 'strategic' focus and that a divergence of agreement in the concept's future direction emerged in light of its increasingly tactically-focused adaptation to address non-state adversaries. It also finds that Israel and Russia, who fought brief conflicts in which their air power 'failed fast', were able to re-evaluate and adapt their understanding of strategic air power quicker than the Allies.

The fifth chapter assesses strategic air power at the end of the research period, a time characterised by divergent approaches to its use in practice. It shows that contemporary operations normalised persistent, reactive counter-personnel and counter-force strike as a primary means of employing air power for both the Allies and Israel, leveraging the capabilities of strategic air power for essentially tactical means. If finds that this in turn limited what air power could be called on to do, underpinned by structural constraints imposed by granular political control, rules of engagement, and coalition warfare. It also finds that although Russian air power was not subject to the same constraints, it was also structurally limited to a strategy of destruction due to the limits of organisational reform, shortfalls in its C2, ISR and strike capabilities, and the weakness of the supporting defence industrial base.

The research concludes by presenting its findings in three parts. First, strategic air power's evolution is accounted for through the experiences of the case study states. This includes operational practice, the relationship between the concept and national air power doctrine, and the role of organisational dynamics – military officers, rivalries, and convergence. Second, strategic air power's development is accounted for by a repeating process through which the case study states understood, tested, and evaluated the concept. The development process's emergence, influence and impact are discussed and traced over the research period. Third,

the direction of strategic air power is accounted for by taking the factors identified as common to the experience of all case study states and creating a concept-level model. This model shows why strategic air power developed in the direction that it did after the Cold War and serves as the basis for a proposed final theory of historic cyclical development.

CHAPTER 1 The Foundations of Modern Strategic Air Power: The Shadow of History & the End of the Cold War (1973-1991)

Modern strategic air power is the product of decades of theorising, debate, development, practice, controversy, success and failure. A brief overview of the concept's history is the focus of the first part of this chapter, providing the context for developments in the late-Cold War from 1973 and the start of the research period in 1989. This overview starts with the concept's theoretical foundations in the 1920s, in which the underlying ideas of the unique strategic contribution to warfighting that air power could make were debated, before considering the influence and consequences of widespread practice during the Second World War. The post-war and early-Cold War period then saw the role of nuclear weapons transform strategic air power into a tool of deterrence, and the long, ineffective US air campaign over Indochina severely damage its conventional credibility. In the second part of this chapter, the aftermath of the Vietnam War and developments in the late-Cold War are examined. These provide the fundamental basis and context for each of the case study states' respective air power structures, rationales and understanding of strategic air power immediately prior to the research period. Examining, understanding and evaluating the relative positions of US, Soviet, British, French, Israeli and Australian air power at this time provides both a baseline from which to trace subsequent developments and an insight into how each state interpretated geopolitical events that influenced defence reforms and the direction of national air power. This reveals that the underlying structure of each state's respective air power capabilities was shaped by their view of and reaction to their defence environment in the late-Cold War period. Consequently, through the lenses of deterrence and national defence, innovation and stability, the approach taken by each state to the post-Cold War development of strategic air power can be understood and the initial factors that influenced it determined.

The Rise and Fall of Strategic Air Power: A Brief History (1920-1972)

The concept of strategic air power is not new. The inherent strategic potential of air power was recognised after the First World War by the earliest air power theorists. All noted, to varying degrees, the potential for air power to strike at depth, to cause the disintegration of command and control, and to realise effects beyond the immediate battle. In the 1920s and 30s a variety of theorists proposed similar ideas about strategic effect through countervalue, simultaneous targeting from the air. In the landmark 'Command of the Air', written in 1921, Italian General Guilio Douhet emphasised the necessity of an independent air force, focused on offensive operations aimed at 'inflict(ing) the greatest damage in the shortest possible time' (Douhet & Ferrari 1998, 51). Air power should be focused against the adversary's 'vital centers [sic]', broadly encapsulating the adversary's cities that contain 'rail centers [sic], port facilities, supply

bases (and) factories' and which would be all but impossible to defend comprehensively (Douhet & Ferrari 1998, 54). According to Douhet, in targeting cities and infrastructure over the adversary's forces it would be possible to break the morale of the population, create panic and consequently influence the outcome of the war (Douhet & Ferrari 1998, 58). In the Soviet Union, a group of Army theorists including Triandafillov, Tukhachevsky and Isserson, emerged during the 1920s and considered how new technologies, including air power, could be used to achieve the Soviet theory of the Deep Operation (Triandafillov & Kipp 1994, Isserson & Menning 2013). Deep Operation (also known as Deep Battle) theory focuses on conducting multiple simultaneous operations against an adversary at depth in order to cause the collapse of the system on which his ability to fight depends. In the United States, the Army's Air Service School was founded in 1920 to create air power doctrine and teach strategy and tactics (Boyne 2003). The direction of the School was influenced by the advocacy and work of Mitchell, including his Douhet-influenced 1925 'Winged Defence: Development and Possibilities of Modern Air Power' and the work of Sherman who published 'Air Warfare' at the School in 1926. Sherman broke with Douhet and Mitchell in laying the ground for the idea of industrial targeting, an idea that would be developed in the following decade (Sherman 2002, 195-200, Biddle 2019). Lord Trenchard provided much of Britain's early thinking on and practice of using air power for strategic effect through colonial policing in the 1920s and a series of papers in the late-1930s. Trenchard outlined the importance of air power and its unique contribution to the ongoing war with Germany, including in his paper 'The Effect of the Rise of Air Power on War' in which he noted the essential need to establish air superiority, the offensive advantage of air power, and the strategic necessity of paralysing German war production (Dyndal 2007). These theoretical foundations were then tested, refined and expanded upon during the Second World War.

During the Second World War strategic bombing was employed by all major actors, from the Japanese against Chinese cities in September 1937 to the atomic bombings of Japan by the United States in August 1945. As detailed in the 1945 and 1946 United States Strategic Bombing Survey Summary Reports, there were two broad applications for strategic bombing. The first was the use of massed strikes to target population centres in order to cause destruction and terror; the aim being to break the will of the people to fight and to abandon their political leaders, drawing on Douhet's ideas. As a consequence of the scale of bombing, the deliberate targeting of cities, and the inaccuracy of munitions, enormous destruction to urban areas was caused resulting in high casualties and the loss of critical infrastructure for the post-war period (United States 1987, 6, 36, 86, 89). Area bombing of urban centres did not result in civilian uprisings against political leaders or to national surrender. The

combination of aircraft capabilities, their weapons, defensive capabilities including the advent of radar, the effect of poor weather on missions, and the miscalculation about what civilian populations were willing to endure, all contributed to the failure of this application of strategic bombing (United States 1987, 37-39). The second use of air power was to bomb infrastructure including transportation, war production, and energy generation and storage; the aim being to destroy the adversary's capacity to make war. This use built upon work undertaken in the United States. In parallel with the development of viable bomber aircraft, the Industrial Web Theory was developed in the 1930s from Sherman's earlier work (West 1999, Biddle 2019). The Industrial Web Theory was predicated on the idea that modern adversaries were reliant upon their economies to maintain warfighting capabilities, that each element of the economy was vital to the functioning of the whole, and that by destroying these elements the adversary's ability to fight and the morale of his population would be weakened (West 1999). It did not advocate the direct bombing of civilian populations to achieve this. Based on this theory Air War Planning Document 1 was written, forming the basis on which US air power would be created, deployed and utilised (United States, War Department 1941, Boyne 2003). The Casablanca Directive in January 1943 directed that strategic air power be applied to the 'destruction and dislocation of the German military, industrial, and economic system and the undermining of the morale of the German people to the point where their capacity for armed resistance is fatally weakened' (United States 1987, 14). From this, priority targets were identified and operations against war materiel factories, aircraft production, submarine bases, oil, steel, rail, waterways and electric grids followed. The successful impact that the destruction of these targets had on German war production affirmed the potential of strategic air power when directed by clear objectives linked to specific targets identified as critical to the adversary's ability to operate (United States 1987, 37, 39).

During the early-Cold War, the development of strategic air power was influenced by two requirements: the need for air power to form the core component of nuclear deterrence and carry out nuclear strikes; and by the potential for longer-range bombers with more powerful munitions to continue the conventional strategic bombing approaches of the Second World War. The development of nuclear weapons in the 1940s and 1950s by the United States, the Soviet Union, Britain and France shaped thinking on future warfare, what strategic air power meant and the role it would play. For these states, conflict in Europe was framed by the expectation that nuclear weapons would either be used immediately or that conventional fighting would escalate to nuclear warfighting. In this context, air power's roles were divided between tactical missions to support surface forces and defend national airspace and strategic missions to support nuclear deterrence, and, in the event of its failure, nuclear strike. The

United States organised its air power along these lines, through Tactical Air Command and Strategic Air Command, as, in broad terms, did the Soviet Union with its arrangement of Frontal Aviation and Strategic Aviation. France and Britain also mirrored this model. The development of ballistic missiles capable of carrying nuclear warheads, fired from silos positioned deep in a state's interior or from undetectable nuclear submarines, coupled with investment in more capable air defence systems, shifted the central role of strategic air power in the nuclear mission to a lesser role by the 1960s of a flexible but vulnerable delivery method (Paterson 1997, Freedman 2003, Jones 2017).

In parallel to nuclear developments, in both the Korean War and the Vietnam War the United States used conventional strategic bombing in an attempt to set conditions on the ground to its advantage. This included attacks on urban centres, infrastructure, firebombing in Korea, and the use of defoliants in Vietnam. The main air campaign during the Vietnam War, Operation *Rolling Thunder*, was based on the idea of 'strategic persuasion' – setting the conditions for negotiations through 'applying a measured amount of strategic air power in order to persuade North Vietnamese leaders to cease their aggressive actions' (McConnell 1965, 8). Strategic persuasion required a gradual increase in strikes that aimed to balance risk and reward. Targets were selected by political leaders in Washington with little military input and no in-theatre control; significant restrictions were put in place including not targeting North Vietnam for fear of escalation and Chinese or Soviet intervention (Clodfelter 2015). *Rolling Thunder* lasted for 3½ years and failed to achieve the political objectives set. Four years after *Rolling Thunder* ended, operations *Linebacker* and *Linebacker II*, both in 1972, saw the concentrated use of air power using novel precision weapons to target key enabling infrastructure through large-scale, simultaneous strikes, in order to achieve limited political and military objectives. *Linebacker* demonstrated the first use of precision weapons in conflict, able to strike targets with far greater accuracy and efficiency than unguided bombs and missiles, which in turn reduced the risk to the attacking force and signalled air power's potential to create strategic effects.

Air Power at the End of the Cold War: Structures, Rationales & Challenges (1973-1991)

The brief history of strategic air power's rise and fall provides context for its later development, demonstrating its deep roots, its potential, and its challenges in practice. In the period from the early-1970s to the end of the Cold War in 1991 the foundations of the modern concept were laid. It is here that the underlying structures and rationales for the organisation, focus and application of national air power can be found, and it is upon these foundations that the different positions of each of the case study states can be understood. The second half of this

chapter presents, analyses and links those prevailing structures and rationales from the 1970s and 1980s to the position of national air power at the end of the Cold War, in the period 1989-1991. It also discusses the challenges each state faced in thinking about air power and developing strategic air power in light of environmental changes, national preconceptions and contemporary practice. The differing positions that emerge in this period between the United States, the Soviet Union / Russia, Britain, France, Israel and Australia offer an insight into how each state would interpret change and how it would develop its air power for strategic effect during the 1990s.

Two broad approaches to the organisation, focus and doctrine of the case study states' air power, and their views of strategic air power, at the end of the Cold War can be discerned. The first approach is deterrence. This was concerned with the primacy of air power's role in delivering nuclear weapons and driven by the circumstances and geopolitical environment of the late-Cold War. The United States, Soviet Union / Russia, Britain and France structured their air power for deterrence. This structure comprised three elements. First, a predominant focus on 'strategic' forces that would deliver high-yield nuclear weapons over medium-long range and which formed the primary element of air power's contribution to national deterrence policy; second, a clear delineation between those forces and a tactical air force armed with both conventional and low-yield nuclear weapons that was tasked with national or area air defence and with supporting offensive or defensive ground operations through CAS and battlefield interdiction; and third, a lack of operational independence for tactical air power and its general subordination to surface forces and the ground war. The second approach is defence. This was concerned with air power's conventional capabilities to control national airspace, interdict enemy forces and support ground forces, and driven by more parochial concerns over immediate regional threats to the state, distinct from the politics of the Cold War. This was the approach of Israel and Australia. Both states were notably geographically and politically peripheral to the Cold War's primary theatres in Europe and East Asia. Air power was directed towards territorial defence and thwarting potential aggression through the maintenance of a qualitative military and technological edge over regional adversaries. These two approaches to organising, theorising and utilising air power provide the context for each state's subsequent approach to the development of its air power in the post-Cold War period and the reforms that they embarked upon. Analysis of those states focused on deterrence also accounts for their different levels of innovation and reveals the long-term consequences of this for the development of modern strategic air power.

Deterrence & Innovation: United States & Soviet Union / Russia

The air power capabilities fielded by the United States at the end of the Cold War were unique. Capabilities included long-range conventional strike, precision weapons, stealth aircraft, and networked command, control, communications and intelligence (C3I), all bound by a new theoretical framework to direct operations. These capabilities were the culmination of over a decade of reflection, reform, technological progress, and focus on increasing the utility and efficiency of air power. The result was a conventional air power capability that could be used for strategic effect. This capability developed during the late-1970s and throughout the 1980s within the USAF's *Tactical* Air Command (TAC). As detailed in work by Clodfelter (1989), Hallion (1998), Lambeth (2000) and Olsen (2007), development was driven by a reaction to lessons drawn from the Vietnam War. The broad failure of strategic bombing during *Rolling Thunder*, gradually applied, focused on interdiction of supply against a largely self-sufficient force, and politically misdirected, contrasted with the perception of tactical air power's success in the CAS role in South Vietnam and the success of strategic air power during the *Linebacker* operations with their limited objectives, use of precision weapons, pre-planned targets, simultaneity, and localised, depoliticised command (Clodfelter 1989, Lambeth 2000). These divergent interpretations set the course for US air power in the aftermath of the conflict, with the USAF's Strategic Air Command (SAC) returning to its familiar focus on nuclear deterrence contrasting with TAC's openness to new developments (Clodfelter 1989, Hamilton 1993). In the context of the continued Soviet nuclear threat and the potential invasion of Europe, SAC's role was to hold at risk Soviet military forces and infrastructure with a combination of land-based ballistic missiles and air-launched nuclear bombs and missiles. This returned US air power's primary focus to an enemy who was known, reasonably well understood and who aligned with the guidance provided by contemporary doctrine (Hamilton 1993, Mowbray 1995). Deterring a broadly unchanging adversary over the next two decades, SAC's development was essentially an iterative process: the operating range of bombers was extended through new aerial refuelling platforms, the mainstay B-52 bomber upgraded, and the supersonic B-1B and stealth B-2 bombers developed and fielded. The underlying mission of nuclear deterrence and strike against the Soviet enemy was refined but did not fundamentally alter. In contrast, TAC saw a more significant evolution of its role and its dynamic development over the same period had a far-reaching impact on the direction of US air power.

By the mid-1970s the focus for TAC had returned to its pre-Vietnam mission of providing battlefield CAS to the US Army in Europe. This contributed to deterrence in theatre and, in the event of failure, provided a defence against invading Soviet forces. In combination with this role and in reflecting on the lessons and successes of Vietnam, TAC's role began to develop

in close association with the Army. Development occurred in four phases. First, a new and specific tactical air power doctrine was created in 1978 and TAC began development of the A-10 for CAS in alignment with the Army's 1975 'forward defense [sic]' doctrine (Hamilton 1993, Mowbray 1995). Second, the growing threat of SAMs and specifically Soviet-built Integrated Air Defence Systems (IADS) threatened the establishment of air superiority and the ability of air power to provide CAS, as demonstrated by Egypt and Syria in the 1973 War with Israel (Hallion 2011). Third, the transformation of Army doctrine in the early-1980s, culminating in a reconceptualised battlefield under the AirLand Battle doctrine, changed the focus of TAC's air power from frontline CAS to interdiction of enemy forces at distance (Futrell 1989, Hamilton 1993, Hallion 1998). Fourth, the shift in thinking within both the Army and the USAF to the operational level of war by the mid-1980s as a result of the complexity of the modern battlefield permitted a more sophisticated and efficient utilisation of, as well as more control over, deployed forces (Hamilton 1993). In parallel to this, the consequences of the shift in senior personnel within the USAF was being felt. The USAF's SAC-origin leaders who flew in the Second World War and commanded in Korea and Vietnam were superseded by TAC officers, often pilots, who had different views and approaches to how air power should be used (Hallion 2011). The new leadership responded to and shaped the new warfighting environment through the introduction of a high-low mix of new combat aircraft, specifically the F-15C/E and F-16 to replace the century-series fighter-bombers and interceptors, the development of precision and stand-off weapons, the pursuit of technological enhancements such as stealth, a move to joint training and the integration of disparate air power elements, and new aggressor exercises (Lambeth 2000, Olsen 2007, Hallion 2011).

Many of these developments rested upon the ongoing advances in computing power, miniaturisation and precision. These were felt across the armed forces but arguably had an outsized and virtuous impact on the development of TAC's approach to air power specifically. This was due to its evolving mission – from frontline CAS to deep battlefield interdiction – and the benefits that technological advances brought to its ability to deliver this. New aerial refuelling options, including the KC-10 and upgrades to the KC-135, extended the range of TAC's new multirole strike aircraft which themselves were more capable than their predecessors, armed with a mix of unguided and precision weapons, protected by new electronic countermeasures, and enabled by new airborne C2 and intelligence platforms such as the E-3 *Sentry* and E-8 JSTARS (Hamilton 1993). Early demonstrations of some elements of TAC's increased capabilities included Operations *El Dorado Canyon* in 1986, which included the defeat of enemy air defences and simultaneous strikes on a range of military and political targets in Libya, and *Just Cause* in 1989, which included first use of stealth aircraft

(F-117As) in combat and effects-based targeting to distract and disorientate Panamanian forces. The increased complexity of TAC's air power capabilities reinforced the shift to operational-level warfighting and thinking for a more complex battlefield. This in turn provided the context and driver for the theoretical work of Boyd on competition, warfighting, strategy, systems and adaptation, and Warden's seminal work on the operational use of air power for strategic effect.

Consequently, by the late-1980s the TAC element of US air power was radically different from the TAC of fifteen years previous. Its dynamic development into a far more sophisticated force, capable of operations at distance, creating effects on the battlefield and beyond with precision weapons, and guided by a clear framework through which to plan operations, was at the vanguard of US air power capabilities and thinking. In contrast, SAC's role whilst essential to national defence remained narrowly-focused, its development iterative, and its relative importance and role diminishing. The ascendency and utility of TAC within US air power, its contribution to addressing the contemporary threat environment, and the role of air power in the United States' broader defence commitments were captured in Secretary of the Air Force Donald Rice's 1990 White Paper 'The Air Force and U.S. National Security: Global Reach – Global Power' (United States 1990). This reflected on the 1990 National Security Strategy, the growing appreciation of the coming post-Cold War defence environment in which a well-armed medium power hostile to US interests was considered the main threat, and the role of air power within this environment. The White Paper set out the purpose, direction and future of the USAF as the provider of combat air power during wartime through theatre operations and power projection, its control of the high ground of space and C3I, and deterrence through nuclear weapons (United States 1990, 5). A focus of the paper was on the use of conventional air power, drawing on the significant strides made by TAC and which included the use of tactical aviation to create strategic effects, the positive impact of aerial interdiction for the surface battle, and the options made available to policymakers through conventionally-armed long-range bombers (United States 1990, 7-9). The distinction between tactical and strategic air power was absent from the 1990 White Paper, and as Hamilton (1993) noted, laid the groundwork for the 'indivisible airpower [sic]' of the 1990s and the coming reform of the USAF which would merge TAC and SAC.

Thus, US air power by 1991 had successfully innovated in the aftermath of the Vietnam war. The sources of innovation were diverse. They encompassed the ideas of Posen (1986) by drawing from the failures of air power in conflict seen in *Rolling Thunder*, Rosen (1994) and Zisk's (2001) emphasis on the role of military officers, expert communities, and views on the

future character of warfare, exemplified by the role of the TAC officers' influence on aircraft design, procurement, tactics, training, and the creation of an operational-level framework through which to plan future air campaigns, and followed the expectations of organisational theory by mitigating the uncertainty and complexity of the evolving battlefield that the Army faced in Europe through the revolution in computing and precision. Crucially, the USAF was also able to transform organisationally to these innovations and challenges, particularly through the development of TAC, shifting focus and resources into conventional capabilities and developing the means by which air power could be both a credible tool of deterrence and a capable instrument of warfighting. In doing so, by 1991 the United States had created an air power capability with increased utility, the ability to conduct a broader range of missions and tasks, to deliver coordinated and far-reaching impacts on the battlefield, and – potentially – be used to create strategic effects that could achieve national political objectives. It would be able to test these capabilities in the Gulf War.

The parallel development of late-Soviet air power shares several similarities with the development of US air power. These include innovative theoretical leaps about the future of warfare, the potential effects and utility of conventional air power, and an operational-level focus. However, for historic, political, economic and environmental reasons the Soviet Union would not achieve the same strategic air power capability as the United States by 1991. The transition from Soviet air power to Russian air power did not formally occur until the founding of the *Voyenno-Vozdushnye Sily Rossii* [Russian Air Force – VVS] in May 1992. The legacy of Soviet air power is consequently the significant underlying factor in the subsequent development of Russian air power and its origins are closely aligned with the history, geography and political-military culture of the Soviet Union. Soviet air power was a product of a politicised view of warfighting, linked to geography, geopolitics, and technology. The Soviet Union's vast geographic territory, largely inherited by Russia in 1991, is a consistent and foundational element in the state's conception of defence rooted in historic conflicts fought on Soviet territory and which emphasised the importance of mass and the benefits of depth. These factors were emphasised by the prevailing communist doctrine that focused on manpower over technology and which gave primacy to the ground forces (Heyman 1978). The existential threat to Soviet territory from NATO's nuclear forces was met through a combined focus on its own nuclear weapons for deterrence, under the command of the Rocket Forces and the Navy, and massed ground forces supported by air power for defensive operations. These operations primarily concerned interventions in satellite states and those that bordered the Soviet Union. The exception to this was the invasion of Afghanistan, which was a much

larger and longer operation, but it still emphasised the use of ground forces supported by tactical, and predominantly rotary, air power (Westermann 1999, Kainikara 2005).

The consequences of history, political doctrine, technology and defence needs resulted in a fragmented air power capability. Responsibilities, equipment, and systems were split between internally- and externally-facing ministries. It also divided air power between the VVS's frontal aviation (FA) supporting the ground forces, a long-range air force (VVS DA) itself divided between a small intercontinental nuclear strike contingent and a larger medium-range combat support element, an air defence force responsible for interception (PVO), Naval Aviation, the Ministry of Interior's Internal Forces Aviation focused on countering secessionism, and Army Aviation (Monks 1978, Baev 1997, Lefebvre 2002). An overall clarity of purpose and intent was neither possible nor required. Subordination to the aims of the Soviet ground forces and to the power of its controlling ministries ensured that air power's potential effects were limited. In light of the demands of the Soviet armed forces throughout its history – civil war, national defence and interventions in peripheral states – air power was not required to do any more than this.

The rich history of Russian air power theory from the 1920s and 30s, which advocated independent, strategic effect through the framework of the Deep Operation was largely discounted except for where it could offer defensive potential. For example, the 'air operation' was a feature of warfighting plans from the early-1970s which utilised Soviet air power to attack NATO airfields in order to establish air superiority and thwart its tactical nuclear delivery methods (United States, Central Intelligence Agency 1988, 4). However, the Deep Operation was revived in Marshal N.V. Ogarkov's work from the early-1970s until the mid-1980s which revisited and revised it in light of modern technological developments. As detailed by FitzGerald's analysis of Ogarkov's original, contemporary writing, through the 'modern theatre operation' Ogarkov theorised that conventional precision weapons could have operational and strategic effects, well beyond the impact of tactical weapons and with a greater utility than nuclear weapons (FitzGerald 1986). This broke with Soviet orthodoxy on the decisive nature of nuclear weapons, their unique ability to have strategic effect and suggested that weapons other than ballistic missiles could be used to strike at depth. It extended the broader Soviet shift towards conventional warfighting and numerical parity with the United States which had begun in 1964 (Kainikara 2011) but it did so by proposing a far more radical and wide-ranging use of conventional force. Long-range conventional precision weapons would be able to strike simultaneously throughout the depth of an entire country, create nuclear-type effects with less collateral damage, and be used to achieve the state's main objectives (FitzGerald 1986, 15-

16). Thus, from the perspective of Soviet air power development, Ogarkov and other proponents of conventional precision strike created a gap between frontal aviation and long-range nuclear strike where air power could be utilised strategically. Reconnaissance-strike complexes were the key element to fill this gap, through which ground and airborne ISR, C2 and precision weapons – kinetic and electronic – would be combined and rapidly applied for strategic effect (FitzGerald 1986, Admiral 1993, Kainikara 2005). These would provide the Soviet Union with the ability to strike a whole country rather than just the borders or a specific battlefield and the need to occupy territory would no longer be required – the destruction of the adversary's military capability and infrastructure from the air could potentially achieve Soviet political-military objectives on its own (Admiral 1993, Kainikara 2005).

Several factors prevented Ogarkov's ideas from being realised during the 1980s. These included the removal of Ogarkov as Chief of Staff and from the politburo in 1984 for unspecified reasons, but which were considered in contemporary reports to have included disagreements over the shape and direction of military expenditure and defence reform and the clash between his views and the entrenched political thinking on defence and the economy (Kaiser 1984, Davenport 1991). Moreover, the theorist-driven, technologically-focused solutions that Ogarkov was advocating the collaborative nature of Russian strategic culture embodied in the General Staff and warfighting's emphasis on manpower and strategic patience (Adamsky 2010). Specifically, reform would have required the re-ordering of defence priorities by reducing the importance of nuclear weapons and promoting the VVS in doctrine, investing in military-focused new technologies at the expense of mass production and jobs, and in so-doing challenge established political structures and the allocation of domestic resources (Davenport 1991). Thus, Ogarkov's suggested reforms and use of air power would not be implemented by the Soviet Union. The broader shift in Soviet defence thinking under Mikhail Gorbachev which emphasised a defensive stance and the concept of 'reasonable sufficiency' in military forces in light of a weak economy further emphasised the distance between the direction of Ogarkov's proposed reforms and political reality (Kainikara 2005, 229, Adamsky 2010). This left Soviet air power in the late-1980s numerically strong but relatively narrowly-focused, doctrinally limited, and organisationally fragmented. The subsequent formal collapse of the Soviet state in 1991, and with it the end of the Cold War, removed the political-military rationale for the structure of its air power and, at the time, its focus. For the reformed VVS, a long-term opportunity existed to recast itself as an independent force and to enact the reforms, reorganisation and recapitalisation of Russian air power that would be increasingly necessary.

Comparing the United States and the Soviet Union, the core rationale for strategic air power's role and focus in both states during the Cold War was deterrence. Both states focused on using long-range bombers for nuclear deterrence and strike, with tactical combat aircraft assigned to air defence and CAS roles in theatre. By the 1980s, reflecting on earlier conflicts and technological change, military officers in both states explored the innovative potential for conventional air power to be used for strategic effect and the advantage in warfighting that this might offer. Notably, this innovation was largely driven from within the military – by USAF officers and the Ogarkov-led group of officers from the General Staff. Crucially for the development of modern strategic air power, only the United States was in a position to ultimately act upon this opportunity. It did so through the organisational transformation of the USAF's TAC, leveraging new technology, reconceptualised operations, and theory in light of new battlefield threats to create a viable means of utilising air power to create strategic effects and realise political objectives. This innovation was supported and enabled by civilian leaders in the USAF as a means of giving purpose and direction to the organisation in a period of significant environmental change, and embodied in the 'Global Reach – Global Power' White Paper. Restricted by its political system, unsupportive civilian leaders, military culture, the negative implications of widespread investment and reform, and then the collapse of the state, the Soviet Union did not and then could not pursue its own parallel capability. Thus, US air power entered the post-Cold War period with the ability to influence events, achieve political objectives, project power and become a central tool in national security. Russian air power, already structurally weak, was further weakened by a lack of fundamental reforms, reorganisation and investment. There were strong theoretical roots and a strong rationale for the development of a conventional strategic capability, but this would not be fully possible for another two decades.

Deterrence & Stability: Britain & France

In the context of Cold War deterrence, the approach to air power taken by Britain and France was markedly different to that of the United States and the Soviet Union / Russia. For different reasons, Britain and France had respectively reached a point in the early-1970s that set the organisation, thinking and doctrine of their air power capabilities for much of the following two decades. The British experience and rationale will be considered first. Britain adopted NATO's tactical air power doctrine in the early-1970s, ending over four decades of independent air power thinking. Responsibility for this lay in the gradual erosion of the Royal Air Force's (RAF's) core missions over the previous two decades. In the aftermath of the Second World War, British air power could provide a full spectrum of capabilities, including air defence at home and in Britain's colonies, logistical and combat support to ground and maritime forces,

and strategic bombing. A series of shifts in British policy, technology and the geopolitical environment changed this. The first shift was the move away from conventional strategic bombing to nuclear deterrence and strike during the 1950s with the advent of the British atomic bomb and the growing threat from the Soviet Union. This shift rewrote post-war air power doctrine to focus on the nuclear mission, bolstered the RAF's global, strategic role, and led to the creation of the V-force of bomber and tanker aircraft to deliver nuclear weapons to their targets (Great Britain 1957, Jones 2017). The second development was the end of the British Empire, the Suez Crisis, and the accompanying withdrawal of military forces from the Far East and Middle East during the 1950s and 1960s. For Britain's air power, this reduced the scope of its role in global power projection, albeit offset by the nuclear mission, but was a clear sign that conventional air power would primarily be focused on Britain and Europe in the future. The third shift was the loss of the strategic nuclear mission during the 1960s. A combination of factors led to this: the shortcomings of the operational *Blue Steel* nuclear cruise missile, the cancellation of the Anglo-American *Skybolt* nuclear cruise missile programme in 1962, and the subsequent British agreement to adopt the US *Polaris* submarine-launched ballistic missile system (Jones 2018, Fedorchak 2019). As a consequence, the RAF and the Royal Navy's Fleet Air Arm (FAA) were stripped of their strategic nuclear roles. The RAF was particularly hard-hit. Having already absorbed a reduction in the scope of its conventional role, its nuclear-focused doctrine was also invalidated, its large force of bomber aircraft was made obsolete, and it was left with only a relatively narrow and tactical focus countering the Soviet Union and Warsaw Pact in Europe. Consequently, NATO's Allied Tactical Publication was adopted as doctrine from the early-1970s (Finn 2009). This better-suited operational reality, and, as Fedorchak (2019) notes, was an admission that there was no longer an independent or strategic vision for British air power.

Through the 1970s and into the 1980s, British air power served the four main roles required by British defence policy of the time: providing theatre nuclear strike to NATO, defending British airspace, supporting land forces in the European theatre, and supporting maritime forces in the Eastern Atlantic and the Channel (Mason 1984). Air defence, reconnaissance, low-level bombing for CAS, interdiction and anti-airfield missions, and enabling capabilities were the focus. These utilised new, dedicated aircraft including variants of the Phantom, Buccaneer, Tornado, Harrier and Nimrod, as well as the repurposed V-force for a combination of conventional strike and aerial refuelling. The most notable challenge to Britain's focus on NATO and the European theatre was the invasion of the Falkland Islands by Argentina in 1982. The subsequent response utilised many aspects of British air power. This included the use of Vulcans for long-range conventional bombing, re-purposed Victors for aerial refuelling,

and the FAA's Harriers and rotary aircraft for air defence, control of the air, interdiction and maritime strike missions from Royal Navy carriers. The effect of the Vulcan missions denied the use of Port Stanley's airfield to the adversary and also signalled that the Argentine mainland could be held at risk by Britain despite the distance involved. As noted by Air Vice Marshal Mason (1984), this had a significant strategic effect, forcing Argentina to redeploy air power away from the Falkland Islands for national air defence. Despite the logistical, tactical and strategic successes, the Falklands campaign did not change the overall focus of British defence from NATO and the European theatre, or the essentially tactical nature of British air power. Considering the existential threat posed by a Soviet attack on Europe this was justifiable, and this threat underpinned the organisation of British air power and drove its strong performance in related NATO exercises (Peach 2003). Nonetheless, the lack of national doctrine development and critical thinking on air power was recognised within the RAF as problematic. In an attempt to fill the intellectual vacuum that emerged in the early-1970s, the position of Director of Defence Studies was established within the RAF in 1977 (Finn 2009). This position aimed to re-examine the role of air power and the future of the RAF, bringing together military and academia thinkers, from Britain and from allied nations, particularly the United States. This would lay the groundwork for the return of independent British air power doctrine in 1990.

France reached much the same position as Britain did in its air power thinking by the early-1970s. It reached this position for quite different reasons though and the long-term consequences for the development of its air power were more significant. In 1972, France published the White Paper on Defence which stated the four core missions of the armed forces and established the role that air power would play. The core missions were nuclear deterrence, territorial defence, manoeuvre in Europe, and action outside of Europe (France 1972, 7-14). Accordingly, the combat elements of the *Armée de l'Air* [French Air Force] were organised into three distinct branches. The Strategic Air Force (CFAS) provided nuclear deterrence and strike, the Tactical Air Force (FATAC) supported the army in theatre and assisted with territorial defence, and the Air Defence Forces (CAFDA) protected French airspace (France 1972). The capabilities of the *Force Maritime de L'Aéronautique Navale* [French Naval Aviation] (*l'Aero*) complemented these core missions. French air power in 1972 was the product of a historic focus on national defence and support to the army, and the more recent establishment of a French nuclear capability. Prior to the Second World War the dominance of the *Armée de terre* focused air power on control of national airspace and support to ground forces (Young 1974, De Lespinos 2008). Post-war, the concept of air power was broadened to include not just the *Armée de l'Air* but also the supporting and linked elements of industry,

civil aviation, the broader armed forces and defence doctrine under the idea of *puissance aérienne globale* [total air power] (De Lespinos 2008). In addition to air defence, the necessity of providing CAS and mobility to the army was re-emphasised through colonial wars in Indochina and Algeria, which also quietened calls for a more independently capable *Armée de l'Air* (Le Saint 2007a). Air power's role as a symbol and guarantor of French security, freedom of action, and independence also grew. France's development of the nuclear *Force de Frappe* (later *Force de Dissuasion*) in the 1950s created a new role for its air power by 1964, with the introduction of Mirage IVA strike aircraft carrying a single freefall nuclear bomb (Freedman 2003, Gunston 1985). This role solidified air power as a guarantor of national defence – and independence – but also solidified the concept of air power in military thinking. The *Armée de l'Air's* nuclear mission came to define 'strategic' and this precluded any discussion or debate for other strategic uses of air power as such discussion would undermine the effectiveness of French nuclear strategy (de Durand 2014).

Thus, by the early 1970s the structure and purpose of French air power was clear: territorial defence, support to the army in limited wars, and nuclear deterrence. CFAS was equipped with the dedicated Mirage IVA bomber, which served into the mid-1990s, and retained the *Armée de l'Air's* only aerial refuelling capability, the C-135F. FATAC was equipped with Mirage III, Mirage 5 and Jaguar strike aircraft, the CAFDA with Mirage F1Cs, and *l'Aero* with F-8E Crusaders for air defence, Etendard IVMs for conventional strike and, from 1978, Super Etendards which were upgraded in the early 1980s to carry the AN-52 freefall nuclear bomb and the ASMP nuclear cruise missile (Gunston 1985). French air power was consequently well-equipped and logically structured for the missions set by the 1972 White Paper on Defence. This structure and focus remained constant throughout the remainder of the Cold War and into the 1990s.

The broadly similar positions that British and French air power reached in the early-1970s repressed the further development of air power and thinking on the potential strategic role that it could play. At the centre of this were structural, political and economic constraints on innovation. Structurally, a resistance to thinking about air power in strategic terms can be seen in Britain as a consequence of repeated failures of doctrine to protect the RAF from political change, the association between strategic and a global role that disappeared with empire, and the further association between 'strategic' and the nuclear mission that was lost in the 1960s. In France, resistance was primarily linked to nuclear strategy and specifically the credibility of its independent nuclear deterrent towards the Soviet Union which could not be undermined by debate on air power's role in conventional strike beyond the battlefield. Politically, Britain and

France had both determined that their respective nuclear programmes provided the strategic options appropriate to Cold War deterrence. Britain curtailed its air power accordingly to focus on the Royal Navy's strategic nuclear role, retaining air power's tactical nuclear strike only, and France clearly defined its core missions and air power's role in delivering them in the 1972 White Paper. Economically, two mid-sized powers in a Cold War between superpowers had to make determinations about where limited funding, research and efforts should be focused. This created a further constraint on just how innovative either state could afford to be.

The resultant positions reached in the early-1970s – acceptance of NATO's tactical air power doctrine by Britain, and a nationally-focused and organised role for air power by France – were similarly accepting of the constraints and realities of the environment but quite different in their rationales. This would have consequences for the development of their respective air power thinking in the early-1990s and their receptiveness to the concept of strategic air power. Having adopted NATO's air power doctrine when that doctrine was both highly relevant to the threat environment and essential to providing guidance to the RAF when it needed it, Britain was free to promote, accept and benefit from innovative thinking on air power when the Cold War ended and the focus and rationale of the alliance changed. This was aided by the intellectual groundwork laid from the late-1970s by military officers and an independent British air power doctrine was thus created when it was required in 1990. In short, change was (relatively) simple. The French approach to its air power had been arrived at for the opposite reason, largely independent of NATO air power thinking and organisation, and arranged around national political and defence needs within the context of the Cold War. Air power provided France with an important element of its national defence, nuclear deterrence and an independent contribution to NATO in support of a potential ground war. The end of the Cold War removed the immediate context for its thinking on air power but the national security roots, freedom of action, and logic of its independent nuclear deterrent were unchanged. Consequently, in the absence of a recognition of fundamental change and uncertainty, post-1990 air power reform, doctrine change and the development of a modern strategic air power capability was protracted, contested and difficult.

National Defence: Israel & Australia

For Israel and Australia, the Cold War was not the primary driver for their respective approaches to organising air power, its focus or its doctrine. Being relatively distant geographically from the primary theatres of potential conflict and facing unique challenges of their own, the development of air power up to the early-1990s had instead been driven by the necessity of territorial defence and deterring potential conventionally-armed aggressors. The

Cold War did shape some elements of defence thinking though. Israel had to consider and, particularly in the 1973 War, adapt to and tackle its Soviet-backed and -equipped neighbours; for Australia, the fluctuating debate on whether to focus on national defence or extended defence in Asia and beyond was shaped by Cold War politics and the expectations of its US ally. To mitigate and address their respective security challenges both focused on maintaining a qualitative military and technological edge over their regional adversaries, which in turn shaped their approach to air power. The development of Israeli air power will be considered first.

Israel's overarching national security strategy, the Ben-Gurion Doctrine, was captured in a 1961 document 'The Defence Problems of the State of Israel' having been articulated in a series of speeches during the 1950s by Prime Minister David Ben-Gurion. It directly shaped Israeli defence policy, including the role of air power, into the early-1990s. It was based upon three principles: deterrence of adversaries, detection of potential threats and attacks, and the use of decisive force against them (Israel 1961, paras 27-29). The role of air power was to achieve and maintain air superiority against the adversary creating the time and space required for ground forces to conduct offensive operations and for reserves to be mobilised (Israel 1961, paras 27-30, 40, Nagel & Schanzer 2019). Air power also played a significant role in the detection of potential threats through intelligence gathering, and in the application of decisive force. Under the Ben-Gurion Doctrine, air power was limited to indirect strategic effects contextualised by what it could do to enable and support decisive ground operations and the occasional long-range pre-emptive strike against distant targets – specifically Operation *Babylon* in 1981 against the Osirak nuclear reactor in Iraq. This application of air power had a deterrent effect in its own right: the adversary would know that Israel had the means and intent to strike at depth, gain air superiority and expose his ground forces to attack. The logic of the Ben-Gurion Doctrine and the role of air power for Israel was driven by geopolitical necessity. Relative to its neighbours (and adversaries) the state is small in area but has long borders that must be defended. It lacks any strategic depth from which to absorb an attacking force or from which to launch attacks with relative security (Israel 1961, para 23, Rodman 2001). Thus, Israel must avoid wars of attrition and avoid heavy fighting on its own territory and thus aim to fight short wars on the territory of its adversaries through an operational doctrine of offensive manoeuvre warfare (Israel 1961, paras 22 & 27, Rodman 2001). A parallel concept of defence, the 'iron wall', formulated by Jabotinsky in 1923 also results from Israel's geography and has consistently informed defence thinking (Israel & Paikowsky 2017, Nagel & Schanzer 2019). Accepting that Israel is at a quantitative disadvantage to its adversaries, the state's focus must be on gaining and maintaining a

qualitative edge – on building a metaphorical 'iron wall' – that both signals, and credibly ensures, that Israel cannot be defeated militarily despite its relative size (Israel & Paikowsky 2017).

The Ben-Gurion Doctrine and the Iron Wall concept have been central to the development of Israeli air power. They led to the prioritisation of air superiority for the Israeli Air Force (IAF) from the late-1950s, which in turn directed platform and weapons procurements and their subsequent use (Brun 2011). Central to this was IAF chief Dan Tolkovski who responded to the geographic, political and economic constraints on the air force by procuring advanced multirole aircraft and developing high quality pilot training to create a qualitative edge over adversary air forces in both aerial and ground operations (Rubinstein & Goldman 1979). The use of air power against Egypt in 1956 and again in 1967 emphasised Israel's strategy of establishing air superiority to permit offensive ground operations. The IAF launched strikes on airfields and unprotected aircraft, as well as successfully engaging in air-to-air combat, and effectively destroyed the Egyptian Air Force. Israel's adversaries adapted to the IAF's power and strategy with the construction of numerous geographically-dispersed airfields, hardened structures, and with significantly more capable Soviet-supplied layered air defence systems (Wragg 2003, Finkel 2011). In the subsequent 1973 War between Israel and a coalition of Arab states led by Egypt and Syria, Israeli air power's ability to establish air superiority was blunted through a combination of offensive surprise and Egyptian and Syrian air defences. The underlying failure of Israeli intelligence to warn of an attack, the initial vulnerability of its ground forces due to a lack of air cover, and the use of sophisticated counter-armour weapons also contributed to changing the environmental assumptions that Israel's defence rested upon (Brun 2011, Finkel 2011).

The consequences for Israeli air power were both immediate and long-term. During the war itself, the IAF was required to conduct a new range of operations, including counter-air defence strikes, and to strike infrastructure and political targets, particularly in Syria (Rubenstein & Goldman 1979). These operations had mixed success but ultimately gave Israel air superiority. The 1973 War led to reform of the IAF under Benyamin Peled, focused on intelligence integration, counter-SAM tactics, increased exercises, and both quantitative and qualitative improvements (Brun 2011). These reforms intended to make Israel's air power more credible but did not fundamentally alter its purpose. The foundation of Israeli defence, the Ben-Gurion Doctrine's deter-detect-decisive force approach, and the adversaries to whom it was directed had not changed. The necessity for Israeli air power to maintain a qualitative edge continued to reflect both the enduring geographic reality and the prevailing security challenges of the

time. The IAF's operational capabilities through the 1970s and 1980s reflected this, with air defence and strike aircraft sourced from France and the United States. Platforms included the *Nesher* and *Kfir* (Israeli variants of the Mirage 5), A-4N *Skyhawks*, F-4E *Phantoms*, and F-16C/Ds which provided a range of strike options for the IAF and ensured a qualitative advantage over its neighbours' air forces. These were supported by intelligence collectors including EC-707s, and IAI *Scout* unmanned aircraft, and enablers including E-2 *Hawkeye* for AEW and 707 *Oryx* and KC-130 tankers. Thus, Israeli air power was modernised post-1973 in line with its role supporting the Ben-Gurion Doctrine. This was driven by a combination of failure-driven adaptation in conflict and post-war civilian- and military-driven reforms. Despite this, there was no rationale for modifying Israel's core defence doctrine – and thus the role that air power played within it – until the threat changed in the 1990s.

The development of Australian air power is rooted in its ability to both exploit and mitigate the state's geographic environment and associated geopolitical challenges. This in turn has set the direction of Australia's defence relationships, its air power procurement choices, and has guided the perennial debate on where defence efforts are best focused. The challenge of geography can be found at the core of national defence thinking. As stated in the 1987 White Paper and detailed in subsequent white papers, three elements embody the geographic challenge: distance, the air-sea gap, and the depth-advantage paradox (Australia 1987). The challenge of distance includes monitoring, detecting and responding to threats to the Australian homeland and its overseas territories (Australia 1994a). This has driven an enduring focus on early warning systems and forces able to operate in the maritime domain, specifically naval and air capabilities (Australia 2000). The long-standing assumption in Australian defence planning is that any major threat – such as an invasion – will come from the north due to the relatively close proximity of other states (Australia 1987). Thus, the maintenance of the 'air-sea gap' between the north of Australia and Asia is vital to national security. To maintain this gap, during the 1970s and 1980s Australia created a layered defence consisting of ISR capabilities to identify and track threats early, combat aircraft and naval vessels to intercept and destroy these threats at distance, and planned for the rapid deployment of forces to the north of Australia to deny an adversary a foothold (Australia 1987, Ball 1991). However, the advantage of depth was also recognised as a paradox in which Australia's vast space and isolated economic infrastructure could be exploited by an enemy through dispersed, unpredictable attacks (Australia 1987). Consequently, the layered defence approach was supplemented with and enhanced by a focus on defence technology, including advanced combat aircraft and weapons, supplied by allies in line with Australia's core defence policy of self-reliance through partnerships. Australia's most important partnership is its

alliance with the United States, formalised through the 1951 ANZUS treaty and a range of subsequent agreements (United States 2020). This provides Australia with intelligence, technology and training, permitting it to know more, to develop more and to do more than it could on its own. Consequently, there is a long-standing alignment of geostrategic views between Australia and the United States which has driven the need for military interoperability and a gradual transition from British to US combat aircraft in the post-war period.

The Royal Australian Air Force (RAAF) took part in operations during the Vietnam War, from 1964 to 1971. Its roles included airlift and, from 1967, strike using Canberra jet bombers (Australia 2007b, 106-114). This use of air power reflected the geographically-distant Cold War's impact on Australian defence policy which considered the potential of conflict with a regional power and was focused on 'forward defence'. In the post-Vietnam period, the broad question of how best to defend Australia – at distance ('forward defence') or through national defence ('defence of Australia') – was debated. This was not a new debate and alternation between these two directions of strategic policy has been a feature since Australia's independence (Stephens 2014). In this context, the 1987 White Paper – entitled 'The Defence of Australia' – was clear on the direction of national defence into the 1990s and on the implications for Australian air power. It set out the objectives of conducting offensive strike operations against enemy naval forces and against landed forces on Australian territory, prioritising defence in depth using the scale of Australia to its own advantage, and maintaining the air-sea gap (Australia 1987, 23-33). To do this, air power offered a broad set of solutions, able to quickly overcome significant distances, to identify threats and to attack them. This was made possible through the procurement of advanced combat aircraft, centred around the F/A-18A/B fleet. These were introduced from 1984 to replace Mirage IIIs and to complement the long-range F-111Cs used for strike and reconnaissance. These two advanced combat aircraft types modernised the RAAF's strike capabilities and aligned it closely with the United States. In parallel, formalised independent RAAF thinking on air power doctrine began in 1989 with the creation of the Air Power Studies Centre (later the Air Power Development Centre) to serve as the RAAF's 'think tank' (Waters 1993, Australia 2007b). From here the RAAF created Australia's first independent air power doctrine in 1990, the Air Power Manual, replacing the British AP 1300 doctrine. For Australia, the 1990 doctrine marked the point of divergence from a theory of air power contextualised by British imperial policy and the provision of air support to land forces towards the adoption of a more offensive, independent air power influenced by the United States and better-aligned to the 1987 White Paper. The doctrine's offensive focus is notable in a state that alternates its overarching national security policy between two different defensive strategies. This suggests that Posen's (1986) proposition that

organisation's favour offensive doctrines and Rosen's argument that the 'need to develop strategies for managing uncertainty' is at the core of technological innovation (1994, 52) – embodied by the RAAF's increasingly advanced combat aircraft and weapons – were both factors for Australia at this time.

Comparing Israel and Australia during the period before 1989 it is clear that they faced quite different security environments. Israel was challenged by imminent, local and potentially existential threats. It had little choice in its defence strategy. Australia foresaw the potential threat from rising powers in Asia but was not immediately or seriously threatened by them. It had the luxury of being able to choose homeland defence over extended deterrence. Despite these differences, a similar solution and approach to air power was pursued which maximised the advantages of two technologically and economically advanced US allies and minimised their respective geographic and demographic disadvantages. The benefits accrued from creating and maintaining a qualitative military and technological edge was central to this approach, with air power its primary manifestation. With advanced air power, both states could pursue offensive doctrines that had the potential to deter adversaries through a rapid, direct response against enemy forces and the establishment of air superiority. Should this fail, air power offered a credible means of defence, creating space, distance and time for Israel to mobilise, and conversely quickly filling the space and reducing the time in which Australia's adversaries could operate. A qualitative edge in air power created the means of multiplying force, through multirole combat aircraft and enabling capabilities. This increased the potential impact of air power in national defence and increased its efficiency, both vital attributes for states at a quantitative disadvantage to their adversaries. Maintenance of the qualitative edge required frequent incremental improvements to stay ahead of rivals, based on perceptions of threat, combat experience and the provision of platforms and weapons from their common ally. The conclusion of the Cold War changed little for Israel and Australia as their respective perceptions of threat, necessity of maintaining a qualitative edge to address this, and the place of air power within it remained valid.

Conclusions

At the end of the Cold War there was no common view across the six case study states as to what 'strategic' air power was. Each state organised its core air power capabilities around either nuclear deterrence or national defence; the former did not exclude the latter but in the context of 'strategic' forces, the nuclear role was the focus. Within these two broad approaches, the states were divided by doctrines which either emphasised a 'strategic' air force with varying levels of responsibility in the case of nuclear war, or doctrine that largely

excluded ‘strategic’ air power in any sense. In the cases of the United States, Soviet Union / Russia and France, strategic air power was a nuclear deterrence and strike force, defined by distance, payload and the broader direction of nuclear strategy. In the cases of Britain, Australia and Israel, the concept of strategic air power did not formally exist in their respective doctrines, with strategic effect a result of one-off actions – as demonstrated in the Falklands War and Operation *Babylon* – and with other associations such as strategic bombing and nuclear strike not relevant to their contemporary concept of air power. The notable outlier of the six states at this time was the United States. In this period, the consequences of the reforms and theorising following the Vietnam War had begun to re-baseline the concept for the USAF. This was primarily driven by the intended and unintended consequences of TAC and Army doctrine, the application and outsized advantages of new technologies, and the shift to operational-level thinking and planning. This re-baselining of the concept to draw from TAC’s innovative approach rather than the nuclear-focused SAC had far-reaching consequences for US strategic air power. It also introduced the first two underlying development factors that account for the direction of modern strategic air power.

The first factor is the transformation of air power’s role through the combination of a reconceived battlefield and the enablement of new technologies. Transformation was rooted in the lessons of air power in Vietnam coupled with the growing potential of new technologies to gather intelligence, leverage computing power and greatly enhance the precision of air-launched weapons. These were then applied in the context of the USAF’s TAC role on a changing, reconceived battlefield in which air power acted at depth to affect the frontline. This development path enabled a greater utility for conventional air power against the contemporary Soviet threat and, by extension, in the coming post-Cold War period against a range of conventionally-armed adversaries. The second factor was the United States’ ability to take its transformed air power capability and reframe it from a tool of deterrence and tactical support to a tool for conventional strategic effect. This reframing was reflected in Warden’s theory, Rice’s white paper, and assumptions about warfighting in the post-Cold War environment. It would be applied in 1991 as a core component of Operation *Desert Storm*.

Thinking on strategic air power had not reached the same level of conceptual maturity in the other case study states at this time. The Soviet Union had come closest through the work of Ogarkov and his contemporaries, appreciating the transformative potential of modern air power, new technologies, and a role for conventional strategic weapons, but the myriad historic, military, political, economic and technological reasons discussed collectively scuppered air power reforms, radical or otherwise. Thus, the role of air power for the Soviet

Union remained relatively unchanged in the late-Cold War period, a new baseline could not yet be established, innovation and adaptation to the reconceived battlefield and new technologies was not translated into action, and the reframing of air power within Soviet national security could not take place. In Britain, the adoption of NATO's tactical air power doctrine had suited the threat environment in which British air power was required to operate and offered direction in a challenging period. The end of the Cold War removed the underlying rationale for this approach, and, through the combination of sustained military-academic thinking on air power and the relative ease with which external doctrine could be replaced, favourable conditions for reform emerged. Over the next few years these would lead to a new, independent doctrine which better reflected the challenges of the post-Cold War environment, create a new baseline for what strategic air power was, and place this at the heart of national defence. France's clear linkage between its national security objectives, the context of Cold War deterrence, and the role of its air power created a clearly defined and delineated air force. The end of the Cold War provided some rationale for changing this structure but, with structural rationales rooted in broadly unchanging national security objectives, the need to do so was not pressing and was resisted. This made innovation and adaptation controversial and difficult, and changing the role of air power in relation to national security largely unnecessary. The structure and role of air power for Israel and Australia was not directly shaped by Cold War deterrence or hypothetical warfighting but by national defence requirements. In 1991 Israel was still focused on the basic tenets of the Ben-Gurion Doctrine and its guidance for air power, whilst Australia was looking at how to best defend itself from threats to its north by utilising a combined air-naval approach to maintaining the air-sea gap and providing long-range defence. Maintaining a qualitative technological and military edge to achieve these goals was an important and underlying rationale for their respective approaches to air power into the 1990s.

CHAPTER 2 Interpreting *Desert Storm*: The Air Campaign and its Implications for Strategic Air Power (1991-1995)

Operation *Desert Storm's* air campaign was the defining element of the 1990-91 Gulf War. The conflict and its aftermath was also the second distinct stage of development for modern strategic air power. The theoretical underpinnings, operational successes, and analyses of the air campaign disrupted thinking on what post-Cold War warfighting might look like and the role of air power within it. Through its air campaign-centric and effects-based approach to planning and targeting, *Desert Storm* translated late-Cold War air power theory into practice and showed the necessity of reform to the case study states, provided direction, and shaped the subsequent development of their air power. The air campaign was not seen uniformly across the case study states or as an unambiguous triumph of strategic air power as a means of warfighting or as a theory. Instead, a number of broad interpretations can be discerned, and it is from these that the structure of this chapter is derived, arranged from 'most positive / confirmatory' to 'least positive / disrupting'. For the United States, *Desert Storm* was a confirmation of its approach to warfighting, a validation of theory, reform and investment, and proof of US primacy in the post-Cold War environment. It strongly influenced the development and direction of the USAF's doctrine, capabilities, procurements, and operational thinking well into the next decade. For the United States' close allies, Britain and Australia, the air campaign provided direction for their respective air power capabilities and their subsequent reforms and investments. With relatively limited resources but ambitions to be influential in the post-Cold War world, the *Desert Storm* air campaign was a demonstration of an efficient, credible and attainable military capability. For Russia, *Desert Storm* invalidated a wide range of assumptions, structures, and the defence and air power doctrines that it had inherited from the Soviet Union. However, it also offered a validation of Ogarkov's theories on air power, precision effects and future warfare, and provided guidance for reform and the development of new doctrine. For France and Israel it was disruptive to their respective thinking about defence and the role of air power. Although *Desert Storm* offered some direction on the future of warfare and strategic air power's potential, this was not as instructive as for other US allies, clashing as it did with deeply held assumptions about national defence.

This chapter details each states' respective interpretations of the *Desert Storm* air campaign. It reflects on how national context influenced these interpretations and their implications for the direction of national air power development in the following years through defence reform and new air power doctrine. The *Desert Storm* air campaign was a seminal event for strategic air power, bringing together theory, capability and a new operational framework to deliver a rapid, overwhelming victory for the Allies. In doing so, it shaped the perception of post-Cold

War air power by confirming the importance and potential of precision weapons to future warfighting, highlighting the centrality of conventional air power to future operations, and driving investment in long-range strike and the creation of new national defence strategies. Collectively, these challenged the prevailing understanding of the concept in the case study states beyond the United States, prompting a period of evaluation and reform, and had significant implications for the direction and development of modern strategic air power.

United States: A Confirmation of Air Power

The *Desert Storm* air campaign was interpreted as confirming the direction of US air power over the preceding decade. It was a demonstration, in practice, of the reformed USAF and the capability investments and conceptual changes that had accompanied it, as well as a validation of the direction set by the 1990 'Global Reach, Global Power' white paper. Further, the Gulf War saw the confluence of a relatively recent theory on warfighting – Warden's enemy as a system and the associated concept of parallel warfare – with the opportunity to incorporate it operationally and apply it in practice. Consequently, there is no shortage of analysis on the *Desert Storm* air campaign, with the interpretations and assessments of the USAF, the post-conflict Gulf War Air Power Survey, and of air power academics of particular note. *Desert Storm's* influence on contemporary US air power included the prominence of strategic attack in the new USAF doctrine in 1992, the role that precision weapons and effects-based planning and targeting would play in future warfighting, and structural changes intended to better reflect a new operational reality.

The Air Campaign & Strategic Effect

The *Desert Storm* air campaign's objectives were captured in the Gulf War Air Power Survey ('the Survey'), an official analysis of the *Desert Storm* air campaign sponsored by the Air Force but which drew upon the whole US defence community. It was published in 1993 and its production was directed by Eliot Cohen. The campaign's objectives were aligned to the primary centres of gravity identified by pre-war planners and aimed to '(1) destroy Iraq's military capability to wage war…; (2) gain and maintain air supremacy; (3) cut Iraq('s) supply lines…; (4) destroy Iraq's chemical, biological, and nuclear capability; (5) destroy Republican Guard forces; and (6) liberate Kuwait City with Arab forces' (Cohen 1993, Vol I, 2-4; *numbers in brackets as published*). The air campaign consisted of four phases 'aimed at the destruction of Iraq's centers [sic] of gravity: leadership and C2; chemical, biological and nuclear capability; ballistic missiles; and Republic Guard' (United States 1991c, 10). The first phase included 'extensive air attacks… to destroy Iraq's ability to command and control, eliminate Iraq's chemical, biological and nuclear capability, and neutralize [sic] other strategic targets that

would contribute to Iraq's overall ability to wage war' (United States 1991c, 10). Coalition air power was directed against eight strategic target sets in Iraq, with the intent to destroy fixed targets and to disrupt the Republican Guard's operations and broader government communications (Cohen 1993, Vol I, 11). The second phase overlapped the first and shifted focus from Iraq to Kuwait, with the aim of 'establishing air supremacy… and isolate(ing) the battlefield by cutting supply lines and blocking escape routes' (United States 1991c, 10). The air campaign's third phase focused on battlefield preparation through 'air and artillery attacks focused on reducing the effectiveness of Iraqi defenses [sic]' in Kuwait and, once sufficiently achieved, the fourth phase 'initiated a multi-axis ground, naval and air attack' to liberate Kuwait (United States 1991c, 10). The genesis of the four-phase air campaign included elements of pre-war scenario planning 'OPLAN 1002-90', the Central Command Air Force's Rapid Reaction Plan 1307-88, and significant influence and input from the Air Staff's Checkmate team's 'Instant Thunder' plan (Cohen 1993, Vol I, 26-41, 105-6, 108-126). The latter was developed under the leadership of John Warden and 'the foundation for Instant Thunder's target selection scheme was Colonel Warden's five rings theory' and his 1988 work 'The Air Campaign' (Cohen 1993, Vol I, 115, Keaney & Cohen 1993, 36-44). The Instant Thunder plan was broadened and deepened through inputs from the Air Force, Navy, Joint Chiefs and political leaders to become the *Desert Storm* OPLAN, but Warden's team was influential in its methodology, including then-Colonel David Deptula's Master Attack Plan to determine the timing and sequencing of attacks to maximise impact and effect (Cohen 1993, Vol I, 123-126).

Assessments of the air campaign generally, and the first two 'strategic' phases specifically, from within the air power community and the Survey were broadly positive. In the months after the conclusion of the air campaign analysis by Central Command stated that 'the success of the air campaign validated the effectiveness of tactics used by coalition air crews. Large strike package management, high-altitude bombing, employment of "killer scouts", use of precision guided munitions against armor [sic], bridges and hardened aircraft shelters, and the ability to retarget aircraft on short notice were all effectively demonstrated in Desert Storm' (United States 1991c, 15). A USAF white paper capturing initial impressions of the air campaign highlighted the rapidity of air power's deployment, its overwhelming air-to-air combat success and its high-tempo of sorties (United States 1991b, 2). It also highlighted the essential roles of the broad range of intelligence, strike and enabling capabilities assembled for use against Iraq, the role of new platforms including the F-117A *Nighthawk*, F-15E *Strike Eagle*, and the E-8 JSTARS, and the broad success of coalition interoperability and cooperation (United States 1991b, 4-12). In its conclusion, the white paper stated that 'the Air Force today has the "global reach"' and the "global power" to support national security objectives', a clear reference

to the white paper of the same name which had captured the emergent institutional thinking for air power's role (United States 1991b, 15). The *Desert Storm* air campaign validated the thesis of 'Global Reach, Global Power', demonstrating its promise in practice, and providing the basis for the USAF's forthcoming new doctrine. In its assessment of the first phase of the air campaign, the Survey noted its achievements including the successful degradation of Iraq's IADS to the point that it no longer offered an effective defence against coalition air power, the successful establishment of air supremacy over Iraq, that attacks on C2, air defences and the electrical grid 'had succeeded beyond the most optimistic assumptions', and that there had been 'an almost flawless flow of operations' (Cohen 1993, Vol II, 156). The result was that 'on the Iraqi side, the intensity of the offensive as well as the level of damage that the attackers inflicted undoubtedly came as a surprise. Coalition attacks on communications, electricity, and air defences had sowed confusion within a tightly controlled system… the effect of these raids magnified the confusion, uncertainty, and frictions attendant on waging of war' (Cohen 1993, Vol II, 158). The Survey highlighted five technologies and capabilities that worked particularly well during the Gulf War – stealth/low observability, laser-guided bombs, aerial refuelling, high-speed anti-radiation missiles, and secure communications – noting that many of these were developed and deployed in limited form during the Vietnam War (Keaney & Cohen 1993, 223). This highlighted the long-term evolution of the technological enablers of strategic air power, enhanced through investment and research during the 1980s, and combined and focused through the air campaign. The far-reaching question this raised, as noted in the Survey, is whether this arrangement and application of air power constituted a revolution in warfare. Its summary conclusion suggested that 'revolutions in war may take decades and require not merely new technologies but new forms of organization [sic] and behavior [sic] to mature' and thus 'it is probably too soon to conclude without reservation that we have entered a new era of warfare' (Keaney & Cohen 1993, 251).

The Survey was also at the forefront of a more critical analysis of the air campaign and the debate over strategic effect that emerged in its aftermath. It highlighted various issues and frictions that had emerged during the first two phases, including the unexpected complexity of managing operations such as assembling the Master Attack Plan of targets which suffered from delays in intelligence gathering and the quality of bomb damage assessment, the impact of weather conditions on missions, and the consequences of redirecting air power towards hunting down mobile Scud missile launchers (Cohen 1993, Vol II, 160, 164, 179-191). The Survey also raised the key question of the effectiveness of air power against the strategic target sets that defined the first phase of the air campaign. In its analysis, the Survey determined that strikes against the 'core' strategic targets – leadership and C3, electricity and

oil, and weapons of mass destruction and Scud missiles – had varying effects, meeting objectives against the electricity grid, failing to markedly impact Scud missile launches, and mixed, indeterminate effects on leadership and C3 (Keaney & Cohen 1993, 64-90). This highlighted the challenges faced in locating and striking hidden and fleeting targets versus striking visible and fixed targets, as well as the growing issue of measuring effects from distance and over time. This latter issue was also noted in the USAF's preliminary view of air power's performance, relating to bomb damage assessment and tactical intelligence (United States 1991b, 14). The question raised by the Survey opened an academic debate on the effectiveness, implications, and decisiveness of modern strategic air power, with work by Frostic (1994), Pape (1996), Press (2001) and Hooker Jr. (2016) amongst others explicitly critiquing the strategic phases of the *Desert Storm* air campaign. This criticism centred on the link between strategic attacks on Iraq and their affect – or not – on Iraq's fielded forces in Kuwait, in contrast to direct attacks on these forces by air and on the ground, as well as Pape's assertion that the strategic air campaign focused unnecessarily on political leadership and communications, neither of which could affect independent Iraqi operations in Kuwait. Both lines of criticism were refuted by Warden (1997), who highlighted the successes of the air campaign's parallel warfare method in targeting the means by which Iraq's leadership maintained control of the country and of its forces in Kuwait, and the consequences of attacks on communications, electricity, bridges and railway lines in maintaining supplies to deployed forces and their effective functioning.

The Rise of Strategic Attack Doctrine

The year after the conclusion of Operation *Desert Storm*, the USAF published its first new doctrine since 1984. The 1992 Air Force Manual 1-1 consisted of two volumes, the first a concise focus on the core roles of the USAF in the post-Cold War era and the second a series of underpinning essays. The influence of *Desert Storm* is evident, particularly in volume 2, as is the broader revolution in TAC's capabilities since the mid-1980s. Air Force Manual 1-1 outlined the four basic roles around which US air power would be organised: aerospace control; force application including strategic attack, interdiction and CAS; force enhancement including aerial refuelling and airlift; and force support (United States 1992a, 6). In the doctrine, control of the air is the first goal of any commander in order to achieve air supremacy, which in turn, permits attacks against the full spectrum of enemy capability (United States 1992a, 10-11). Precision weapons are used to increase operational tempo, decrease risk and decrease collateral damage and can be used for strategic attack in order to produce effects 'well beyond the proportion of effort expended in their execution' (United States 1992a, 11). These attacks must be persistent and coordinated with the aim of decreasing enemy capability

and potentially decreasing the will to fight, targeted at centres of gravity, and aim to 'affect the entire war effort' (United States 1992a, 11). In line with the development of TAC's interdiction role, the doctrine also states that deep interdiction can also be used to produce strategic effects but with a delayed effect on the frontline (United States 1992a, 12). The doctrine stated that the USAF should be equipped to focus on power projection capabilities, using platforms with sufficient 'range, endurance, payload, precision, and survivability', to maximise efficiency and ensure rapid worldwide deployability in order 'to attack any segment of the enemy's war-making capability' (United States 1992a, 19). Notably absent from the 1992 doctrine is any significant reference to the contemporary effects-based targeting and planning methodology that was introduced by Deptula during the planning for *Desert Storm*. Although effects are covered broadly, particularly in relation to strategic attack and its role in the strategic level of warfare, specific discussion was absent until the USAF's successor doctrine in 1997.

The 1992 Air Force Manual was supported by a volume of essays which provided the practical, operational and theoretical underpinnings for the new doctrine. These essays were influenced by and drew from the success of the *Desert Storm* air campaign. This included broad lessons such as the 'vivid demonstrat(ion) (of) the ability of aerospace forces to independently… attack strategic, operational, and tactical objectives, simultaneously or separately', the increase in air power efficiency, and air power's potential 'as a strategic deterrent' resulting from 'the focused devastation wrought by coalition air forces' (United States 1992b, 83, 120, 178-179). Specific lessons were also captured, including that the operation's success 'was hinged on the ability of aerospace forces to blind enemy air defense [sic] and surveillance systems, while capitalizing [sic] on the resulting opportunity to attack other vital military and infrastructure targets with a minimum of interference', that 'the increased flexibility of all forces gained by attaining control of the air opens up an array of campaign options… ha(d) strategic consequences' for how *Desert Storm* was fought, and the vital role of aerial refuelling to successful power projection from the United States to the Middle East (United States 1992b, 192, 223, 256). Shortly after the publication of Air Force Manual 1-1, the USAF enacted a substantial organisational change to better reflect the post-Cold War warfighting environment, embodied in *Desert Storm* and reflected in its new doctrine. In June 1992 five of the USAF's commands were deactivated, including the long-established TAC and SAC, and replaced with three new commands, including Air Combat Command (ACC) which assumed the roles, capabilities and personnel previously assigned to TAC and SAC (Haulman 2017). This organisational structure reflected the operational reality that the *Desert Storm* air campaign had demonstrated, the obsolescence of delineating air power as either tactical or strategic,

and, in the absence of the Cold War context and threat from the Soviet Union, a structure that would better address the post-Cold War warfighting environment.

Britain & Australia: A New Direction for Air Power

Positive Disruption

For Britain, the *Desert Storm* air campaign was an inflection point in its thinking on air power. It occurred in parallel with geopolitical changes in Europe which challenged its organisational and doctrinal underpinnings. *Desert Storm* highlighted the limits of British air power, its future potential, and the immediate necessity for emphasis to shift away from the narrowly-focused, tactical approach to NATO warfighting in the European theatre to expeditionary operations, greater political utility and greater independence. This shift disrupted both the underlying rationale of British air power *and* the emerging direction of British defence policy from 1990. In doing so the influencing factors identified as instrumental to the development of modern strategic air power by the United States in the 1980s – the necessity to innovate in light of a reconceived battlefield and the reframing of air power in relation to national security – were realised and acted upon by Britain in the aftermath of *Desert Storm*. This was reflected in subsequent air power doctrine, capabilities, focus and practice, and in the RAF's evolution into a strategic force.

The Gulf War saw the most significant use of British air power since the Falklands War and, like that conflict, served as a test of the RAF's capabilities in an expeditionary environment under circumstances far removed from its prevailing doctrine. The conflict also placed British air power into a coalition warfighting environment and operationally exposed it for the first time to the USAF's strategic air power capabilities and campaign planning. The air campaign saw a variety of British capabilities deployed and utilised, including strike and air defence combat aircraft – Tornado GR1s and Jaguars, and Tornado F3s, respectively – supported by Nimrod R1s and MR2s for reconnaissance and VC-10 tankers. As a consequence of its doctrinal focus the RAF did not have any precision or stand-off weapons in its arsenal or the capability to bomb from high-altitude (Ritchie 2014). In line with NATO doctrine, the RAF's offensive strike capabilities were instead focused on battlefield interdiction and counter-airfield attack through low-altitude bombing. As Air Vice-Marshal Mason noted, the Tornado GR1 fleet's specialised role to attack Warsaw Pact runways was utilised against Iraqi airfields as a unique British contribution to the air campaign (Mason 1991). However, the recently-released official narratives on Tornado and Jaguar operations in the Gulf War from the RAF Air Historical Branch highlighted the issues these platforms encountered. These included the low-altitude delivery of the GR1s' anti-runway bombs which exposed aircraft to Iraqi SAMs. This resulted

in a relatively high loss rate and mitigating this risk through medium-altitude bombing reduced the effectiveness of the strikes (Ritchie 2021a). The Jaguar fleet's unguided rockets also lacked accuracy and thus effectiveness, and the Tornado F3 fleet's air defence capabilities were not sufficient to permit offensive counter-air missions (Ritchie 2021a, 2021b). These shortcomings, resulting from two decades of focus on tactical operations in the European theatre, showed the limits of British air power in a new operating environment, fighting different adversaries, and working alongside an ally that had reconceived, recapitalised and refocused its air power to deliver strategic effect. The broad success of high-altitude bombing with precision weapons by the USAF, its swift seizure of air superiority over Iraq, and the clear operational framework the air campaign followed further disrupted British thinking on how air power should be directed. Although aligning British capabilities and thinking with the United States would require far-reaching changes to RAF doctrine, training and tactics, *Desert Storm* highlighted the operational and political advantages of doing so. US strategic air power provided a path for British air power to follow, including the necessary investment and focus for future defence reforms and doctrine. This in turn would provide politicians with the ability to credibly project power through conventional means, protect British interests overseas, and assert influence in the post-Cold War environment for as long as Britain could maintain broad parity in capability and thinking with its US ally.

For Australia, the *Desert Storm* air campaign was similarly disruptive to air power thinking as it was for Britain and also essentially positive by providing a direction for future development, doctrine and capability. A marked difference with Britain's direct experience of *Desert Storm* was that Australian air power did not play an active role in the campaign, although RAAF personnel did serve in the Combined Air Operations Centre in Saudi Arabia (Australian War Memorial 2021). In the absence of operational experience from which to draw conclusions, the US-led air campaign was interpreted in the context of air power's contribution to the defence of Australia outlined in the 1987 White Paper, in the RAAF's first independent air power doctrine in 1990, and through the broader security relationship between Australia and the United States. This in turn informed, and was reflected in, updates to Australia's defence policy and air power doctrine in 1994. The 1987 White Paper's central focus on the defence of Australia had provided the catalyst for the creation of the RAAF's initial Air Power Manual. This reflected the core tasks assigned to air power by the White Paper, acknowledged the necessity for an independently Australian doctrine aligned to specific national and regional challenges, and sought to assert the RAAF's independent identity as a provider of national defence (Waters 1990, Espeland 1991). Group Captain Gary Waters, RAAF, summarised the missions of the air force in the 1990 doctrine as being control of the air, strategic targeting and

defeat of surface forces, and its primary aim as guiding the use of air power against an invading force to 'control the initial attack' by 'disrupting and destroying the enemy to compel him to adopt a defensive posture so that friendly forces could deploy' (Waters 1993, 46-47). Thus, in 1990 the RAAF was focused on the best means to achieve this national defence mission. It found these means through the Gulf War. The RAAF viewed the war as a demonstration of the technology-driven revolution in US air power, centred upon precision, range, C3, and stealth, and its ability to multiply force and to produce independent effects (Chipman 1993, Harvey 1995). In light of its national defence missions, the challenge of geography, and the necessity to operate efficiently with limited resources, this demonstration was inherently attractive and instructive to the RAAF. A sufficiently advanced air power capability, equipped for and directed towards strategic effect, could sustain and further Australia's qualitative military edge over its potential rivals and in doing so, enhance national defence. More broadly, the 1987 White Paper's determination that air power would be at the core of Australian national defence, and its reliance upon the defence partnership with the United States for technology, equipment and training, created a receptive and essential linkage between Australian air power and that of its closest ally. The collective benefits to Australian air power and national security offered by the demonstrable success of US strategic air power in the Gulf were subsequently reflected in the next defence white paper and the second edition of the Air Power Manual, both published in 1994.

Laying Foundations: Reforms, Investment & Doctrine

The impact of *Desert Storm* on British air power can be seen in both its effect on the direction of defence reforms of the early-1990s and the RAF's first and second post-Cold War air power doctrines. Prior to the Gulf War, the first phase of British post-Cold War defence reforms had already been outlined. Led by 'Options for Change' in July 1990, initial reforms reflected on the withdrawal of Soviet forces from Eastern Europe and aimed to create 'smaller forces, better equipped… flexible and mobile and able to contribute both in NATO and, if necessary, elsewhere' and, in doing so, make significant cost savings (Great Britain, House of Commons 1990, 468). Options for Change retained the RAF's core focus on tactical nuclear weapons, territorial air defence, combat aircraft forward deployed in Germany, and the FAA's carrier-based strike force. However, there were reductions in equipment and personnel across all roles predicated on the idea that in the 1990s Britain's armed forces would be required to *do* less *with* less. The Gulf War in 1991 challenged this assumption. Shortly after Options for Change, the RAF published its first doctrine in two decades, AP 3000. The new doctrine reflected on the necessity for an independent air power focused on CAS, strategic effect and anti-surface warfare but did not directly reflect on the contemporary events in the Gulf, instead

focusing on re-establishing the RAF's independent role (Great Britain 1991, Fedorchak 2019). AP 3000 notably marked conventional air power's formal return to a strategic role for the first time since 1957. *Desert Storm* would directly influence the next edition of AP 3000. Air Chief Marshal Sir Brendan Jackson reflected that air power during the Gulf War had 'demonstrated the destructive power of air-launched 'smart' weapons, and the clinical precision with which command and control systems, air defence facilities, and other key installations can be destroyed' as well as air power's essential support to ground forces (Jackson 1992, 27). In short, 'the Gulf War showed how a well-conceived air campaign can destroy an enemy's will to fight' (Jackson 1992, 27). Air Chief Marshal Sir Michael Graydon concurred, noting that the Gulf War had showed that 'air power has come of age' and that 'technology has finally caught up with the theory' with precision weapons used to inflict the 'necessary degree of damage' and the use of rapid engagement to deter Iraqi aggression (Graydon 1992, 32). These views provide the context and direction of thinking leading to the second edition of AP 3000 in 1993. This doctrine, reflecting on air power lessons from the Gulf War, adopted US ideas and conceptions of strategic air power, paralysis, centres of gravity, and precision, as well as the importance of joint air-land operations and the centrality of intelligence, surveillance, target acquisition and reconnaissance (ISTAR) in modern operations (Great Britain 1993). Doctrine and thinking also now reflected post-Cold War challenges including out-of-area operations for NATO, expeditionary, coalition and joint warfare. This culminated in a re-conception of the RAF – and by extension, British air power – as an essential, conventional and strategic force.

The second edition of AP 3000 was influential in the next major review of defence which followed in 1994. This review was forced to balance the necessity of further cost savings with the demands of the post-Cold War environment exemplified by the Gulf War. The government determined that 'front line first' would be the guiding principle, with savings found through reform of defence's supporting infrastructure (Great Britain, House of Commons 1994). Consequently, the 'front line first' reforms were broadly positive for air power, directing new procurement, upgrade and research towards strategic capabilities in line with the second edition of AP 3000. These included the mid-life upgrade of the Tornado GR1 fleet, commitment to the Eurofighter 2000 (Typhoon) programme, procurement of laser-guided precision weapons, and research on a long-range stand-off weapon (Great Britain, House of Commons 1994). Thus, by the mid-1990s, British air power was being transformed as a result of post-Cold War defence reforms, the guidance and focus provided by new RAF doctrine, and the influence of the *Desert Storm* air campaign and US strategic air power. Despite some capacity reductions this period was essentially positive for British air power and particularly for the development of a future strategic air power capability. There was a clear understanding that

for air power to be effective, even if reduced in capacity, investment would be needed in new capabilities, and precision strike was placed at the centre of investment in British air power.

In Australia, the 1994 Defence White Paper remained focused on national territorial defence as its 1987 forerunner had. It outlined an expanded range of strategic strike missions for Australian air power over the previous white paper, with targets comprising enemy ships, land forces, and infrastructure, using F-111s and F/A-18s armed with precision weapons (Australia 1994a). In detailing how such operations would be achieved the new RAAF doctrine introduced the focus and terminology of US strategic air power theory, including centres of gravity, disruptive effects, and the necessity of high-quality intelligence and targeting practices (Australia 1994b). It stated that strategic strike is concerned with 'punishing and discriminatory strikes against an enemy's centres of gravity' (Australia 1994b, 44) which are intended to surprise and shock, be part of a sustained campaign or a single political strike, and linked to clear and unchanging strategic goals (Australia 1994b). The abundant influence of US strategic air power thinking on doctrine by 1994 contrasts with calls for and expectations of a uniquely Australian doctrine from the late-1980s, such as that expressed by RAAF officers Peter Criss and David Schubert (1990), the latter of whom co-wrote the first Air Power Manual. Instead, the 1994 doctrine is the point at which Australia most comprehensively adopts US strategic air power theory in the research period, despite its narrow applicability to planned-for national defence operations. Indeed, the focus on national territorial defence by Australia after 1987 does not immediately appear to lend itself to the adoption of an air power concept based on offensive operations. However, the ability to attack an adversary away from the main battle offered Australia an independent means of winning a potential conflict, creating a deterrent effect in its own right towards potential adversaries (Australia 1994b). Thus, developing and deploying a strategic strike capability was an efficient, cost-effective means of providing national defence and regional deterrence. It reinforced the vital partnership and security relationship with the United States, and for the RAAF it underlined its independent identity and role within the armed forces in national defence. The concept of strategic air power and its demonstration in the Gulf War provided Australia with a theoretical and operational framework for the use of its air power and set the subsequent course of its development.

Russia: Invalidation / Validation

From the perspective of Soviet air power, the Gulf War's air campaign was interpreted to have invalidated much of its doctrine, force structure and concept of warfighting. Conversely, it was also interpreted as validating the ideas and direction of air power advocated by Ogarkov, which provided a broad direction for the future doctrine and fundamental reforms of Russian air

power. Soviet interpretations of the Gulf War were framed by the context of its overarching military doctrine and thinking, from which air power's context, role and application was derived. There was a diversity of views amongst senior officers and academics as to the implications of *Desert Storm* for air power but common themes emerged around the necessity of building a modern offensive air power capability based on precision weapons, high-technology, enabling capabilities, professionalisation and a reformed air force. These themes directly and indirectly influenced the 1993 Military Doctrine and the future direction of the VVS. However, the extraordinary circumstances and repercussions of the collapse of the Soviet Union, the subsequent political and economic turmoil of the early- and mid-1990s, and the need to employ its unreformed, fragmented air forces in the war in Chechnya from 1994, severely constrained the development of Russian air power and its transformation into a strategic force during this period.

Competing Interpretations

From the outset of the Gulf War the conflict was monitored, analysed and extensively commented upon by senior military officers and academics in the Soviet Union. This was in the belief that the methods and weapons used by the US-led coalition would go on to shape the structure of NATO and the future of war, with obvious implications for the Soviet Union (Felker 1994). Analysis of the war revealed a range of views, ideas and expectations for the development of the Soviet armed forces and particularly for its air power. These analyses were published in Soviet journals and in turn analysed and interpreted by Western academics including FitzGerald (1991), Villahermosa & Glantz (1991), Lambeth (1992), Admiral (1993), Kaufman (1993) and Felker (1994). From these analyses, three schools of thought – reformist, moderate and conservative – were identified (Kaufman 1993). The view of the reformists and, broadly, the moderates was that the US-led air campaign marked a change in the nature of warfare by showing that under specific circumstances a first strike air attack could have a decisive outcome on a conflict (FitzGerald 1991, Admiral 1993). Such a change correlated with a view of future warfare held by some within the Soviet General Staff, such as General-Major V. I. Slipchenko, in which new technologies would make 'aerospace war' viable (FitzGerald 1991). The United States had achieved this through a military-technology revolution which had brought stealth, precision weapons, enabling ISR and communications, and space-based systems together to create the reconnaissance-strike complexes previously theorised by Marshal Ogarkov (Admiral 1993). The *Desert Storm* air campaign was perceived to have achieved nuclear-type effects – first strike decisiveness and simultaneous broad nationwide targeting – with conventional weapons. This validated Ogarkov's ideas from the early-1980s, and in turn invalidated the Soviet Union's 1987 Military Doctrine which

emphasised defence and the idea of quantitative parity in conventional weapons (FitzGerald 1991, Felker 1994). For the reformist school, far-reaching reforms to the armed forces would need to be enacted to qualitatively match the conventional capabilities of the United States, with particular emphasis on the role of technology, training, and offensive force, as well as a re-conceptualisation of *how* to fight future wars (FitzGerald 1991). The view of the moderates was that in light of the Soviet Union's significant economic challenges, the collapse of the basic elements of its military system, and its technological shortcomings, that only essential reforms could be entertained in the early-1990s.

The view of the conservatives was that, broadly, the Gulf War was an abrogation of traditional warfare in which the effects of air power, precision and intelligence were overemphasised, the failure of Iraq to pre-emptively strike the coalition and to maintain and coordinate its armed forces contributed to its defeat, and that there was no parallel between Iraqi forces and those of the Soviet Union (Kaufman 1993). Specific criticism was directed at the air campaign. This included suggestions that attacks on Iraqi infrastructure were unnecessary and a dispersion of effort away from counterforce strikes, that strategic strikes did not reflect the situation on the ground, that Iraqi forces were able to deceive airborne ISR through camouflage and mobility, and that the air campaign was both much longer and less decisive than expected (Lambeth 1992, Admiral 1993, Felker 1994). This criticism emanated from all branches of the armed forces through analysis conducted by the General Staff, who looked at the failings of the campaign, emphasised the traditional roles of each military branch, and considered the means required for defeating the modern strategic air power capabilities employed by the United States (Lambeth 1992, Admiral 1993). All three schools of thought agreed that more emphasis on conventional offensive warfare would be necessary in future, even if defensive warfare remained central to Soviet thinking out of economic necessity, but disagreed over what this emphasis should look like. A degree of compromise was reached in the 1993 Military Doctrine but it was not until 2000 that the moderate-reformist views were reflected in military thinking and later still when the necessary reforms and recapitalisation could be implemented. Two other areas of agreement emerged from the Soviet analysis of *Desert Storm*: first, that the Gulf War was perceived to be the initial example of NATO conducting operations beyond its remit and borders, with the implication that this was enforcing a new, unipolar order in which Russian interests and views were side-lined; and second, that it was now a necessity for long-range conventional firepower to be used strategically, and potentially for it to be employed pre-emptively (Villahermosa & Glantz 1991, Kaufman 1993). Both views had implications for the subsequent development of Russian air power into a strategic force. They emphasised the necessity to build a comparable advanced conventional capability to match that of NATO, and

that conventional forces – led by air power – could be used as a deep strike capability that would provide a credible offensive warfighting option short of nuclear weapons.

Post-Soviet Reforms, Air Power in Chechnya & the Necessity of Change

The first post-Soviet military doctrine was drafted in 1992 and published in 1993, and began to reflect on the Gulf War and the conclusions that had been reached. The 1993 Military Doctrine clarified the role of nuclear weapons in Russian defence, shifting them from tools of warfighting to tools of deterrence against nuclear threats and conventional strategic attack (Russia 1993, 3). This change increased the role of the conventional armed forces, creating the necessary organisational and conceptual space for an offensive air power capability to be developed. Proposed reforms of the newly-founded *Russian* Air Force, in parallel with the new doctrine, emphasised quality over quantity in order to create a new offensive force, in which legacy Soviet fighters would be retired, production of most aircraft types would cease, and emphasis would be placed upon ground-attack and multirole combat aircraft based on the Su-27 (Admiral 1993). Prior to the implementation of the reforms required to realise the 1993 doctrine, Russian air power was used in Chechnya from 1994. This conflict, and the significant shortcomings and issues it exposed, was as important for the future development of Russian air power as the *Desert Storm* air campaign. Whereas *Desert Storm* had highlighted to Russia the potential of technologically-driven offensive air power in practice, the First Chechen War highlighted the parlous state of its own capabilities and the absolute necessity of reform and recapitalisation.

The performance of Russian air power in Chechnya suffered from a combination of poor timing, operational failures, and the complex and confused force structures inherited from the Soviet Union. The opening air strikes against Chechen airfields in 1994 that marked the start of military operations were the first use of fixed wing combat air power by Russia since the mid-1980s in Afghanistan (Westermann 1999). The planned joint air-land campaign to remove the president from power and to demonstrate Russian force, based on air superiority and a quick capture of the Chechen capital by armoured units, failed due to significant rebel opposition (Baev 1997). The use of air power was expanded from pre-emptive strikes against the Chechen Air Force to sustained CAS to enable the armoured force to reach Grozny, which escalated into the bombardment and widespread destruction of the city (Baev 1997, Thomas 1997). Bombing accuracy was low due to the combination of a congested battlefield, poor weather, poor communications between forces, and high-altitude bombing (Lambeth 1996, Baev 1997). Further air attacks were later launched against villages believed to be supporting rebel forces in a campaign of ‘selective terror’ (Baev 1997). Air power enabled Russian forces

to capture Grozny in early-1995 but it was recaptured by the Chechens in August 1996, leading to a ceasefire and the end of Russian operations (Baev 1997).

The First Chechen War exposed the limitations and consequences of the complex arrangement of contemporary Russian air power. Fixed-wing operations in Chechnya were conducted by three different forces – VVS Frontal Aviation, Army Aviation and Internal Forces Aviation – and the Ministry of Interior also operated rotary-wing forces (Thomas 1997). Control of operations resided with both the Ministry of Defence and the Ministry of Interior, and each force conducted its own missions in its own air corridors without central coordination or cooperation (Baev 1997, Thomas 1997). Further, Russia pursued the Chechen military along 'Napoleonic' lines with air power used to strike increasingly dispersed military assets rather than enemy infrastructure and C2 (Baev 1997, 12). The consequences for Russian air power were twofold. First, the argument made be conservative military officers during the Gulf War that Russia's armed forces were qualitatively superior to those of Iraq and thus not susceptible to a similar air campaign was essentially invalidated. Both the air forces and the ground forces had performed relatively poorly against a small, weak adversary, making wholesale reform essential. Second, the arguments concerning the Gulf War and whether the air campaign heralded the future of warfare was a somewhat theoretical-doctrinal issue with indirect, long-term consequences, whereas Chechnya had exposed a direct, immediate national security threat by showing that Russia's conventional military power was inadequate. This would need to be addressed quickly and decisively. Consequently, the first of two phases of major reform of Russian air power would begin in the aftermath of the conflict in 1996.

France & Israel: Disruption

Negative Disruption

The Gulf War was a defining and disruptive moment for French air power. The *Desert Storm* air campaign demonstrated two fundamental changes in the post-Cold War defence environment: first, the US-led operating philosophy of *ad hoc* coalitions, shared objectives, and interoperability; and second, that fighting limited wars in distant places would replace existential and national defence. In France, there was political disagreement about the rationale for conflict beyond the situation in Kuwait, with France viewing Iraq as essentially stable, secular and pro-Western, and about the way in which the US-led coalition was planning to fight. French political leaders perceived the Gulf War as 'too Anglo-Saxon' (Souvignet & Virem 2006, 93) which reinforced long-held views that France should not be subordinate to the United States, with senior politicians divided over whether to join the coalition at all. Once it was decided that France would participate, its air power focused almost exclusively on

defensive operations outside of the formal coalition structure and specifically did not take part in joint missions with the United States (Souvignet & Virem 2006). These constraints were rooted in an active attempt to continue to separate French military thinking from that of the United States and Britain, and the more passive constraint of France's national defence focus which was inherently defensive. In their assessment of France's role in the Gulf War Commandant José Souvignet and Lieutenant-colonel Stéphane Virem (2006) suggested that as a result of its traditional national defence focus, *Desert Storm* was too big, too technical, and too modern for the *Armée de l'Air* as an organisation to understand and to deal with. The *Armée de l'Air* was well-equipped to fulfil the four core missions of the 1972 White Paper but not to contribute effectively to coalition operations. It lacked the deployable organisation to manage an expeditionary force, C2 and ISR platforms, the will to utilise the equipment it did have, and failed to understand the necessity of the US-led air campaign's high operational tempo (Souvignet & Virem 2006). In the aftermath of the conflict, specific lessons for air power were identified including weaknesses in intelligence collection and dissemination, campaign planning, interoperability, deployed logistics and C2, power projection, precision weapons and force structure (Souvignet & Virem 2006, Le Saint 2007, de Durand 2014). General Jean Fleury, *Armée de l'Air* Chief of Staff during the Gulf War summarised the broader lessons France took from the conflict as being that effective air power must utilise the massive projection of force from the air, not single aircraft on single missions, and that adaptation due to politics and the enemy itself is necessary (Fleury 2012b, 50-51).

Like France, Israel initially interpreted the *Desert Storm* air campaign with scepticism and in a broadly negative manner. Although it did not express the same reservations about the approach to warfighting that the US-led coalition was taking, its interpretations of the outcomes were strongly influenced by its own immediate national security concerns. The air campaign was viewed in Israel as a failure that exposed the limits of strategic air power and fell short of the promise of a revolution in military affairs. Israeli criticism was directed along two specific national security lines. First, that the air campaign had failed to locate and destroy Iraq's Scud missile launchers and their supporting C2 systems (Thomas 1991). Scud missiles continued to be fired into Israel throughout the conflict, undermining perceptions of Israeli deterrence and creating disruption to civilian life (Inbar & Sandler 1993, Kober 1994). Second, Israel saw the coalition's failure to destroy the Iraqi army – and remove the threat it posed to Israel – as a further failure of the air campaign (Thomas 1991). In the context of its national defence, Israel drew three lessons from *Desert Storm*. First, that technology would not necessarily be a deciding factor in post-Cold War conflicts because the Iraqi military largely survived the superior air power and weapons of the US-led coalition (Inbar & Sandler 1993); second, that

the success of the ground offensive following the air campaign emphasised the continued need for combined operations (Kober 1994); and third, that precision weapons were operationally useful and offered Israel a firepower-led warfighting option but that they should not be central to Israeli defensive or offensive manoeuvre operations in future (Inbar & Sandler 1993, Kober 1994). More broadly, the Gulf War highlighted to Israel its vulnerability to ballistic missile attack and the limits of the deterrence element in the Ben-Gurion Doctrine. This in turn prompted a reassessment of how it would need to define victory in future – in the negative, by stopping the adversary from attacking and preventing them from achieving their goals, rather than the positive, decisive victories of the past (Kober 1994, 2006). This change in thinking would be central to how Israel perceived its adversaries and utilised its air power over the next decade. It also shaped a broader interpretation of the *Desert Storm* air campaign based on the juxtaposition of the United States' focus on decisive victory over Iraq in Kuwait and the increasing impracticability of such an approach for Israel. The traditional focus on conventional state warfare which had guided the IDF since 1948 had started to change during the 1980s. As a result of its battlefield success, the peace accords with Egypt, and a shift in tactics by Palestinian non-state actors, the IDF had begun to focus on maintaining order and security within Israel as its primary duty. The previous proactive and pre-emptive approach to operations became reactive to attacks taking place; decisive force was not possible, and protracted, low-level violence became normal. Air power was increasingly used for tactical missions aimed at stopping attacks and punishing enemy leadership in a way that was rapid, precise, visual, and relatively low-risk – but never decisive.

Reform, National Defence & Long-Term Implications

In response to the lessons learned from *Desert Storm*, France undertook two significant reforms to its air power. The first was the establishment of the first phase of the System for Command and Control of the Air (SCCOA) which brought together all elements of France's air operations under a single organisation in 1993 (Aubout *et al.* 2013). This included command of nuclear deterrence and national defence, readiness, theatre deployments, enablers and, in subsequent phases, would provide France the ability to lead coalition C2 if required. The second reform merged the *Armée de l'Air's* FATAC and the CAFDA forces under the Air Defence and Air Operations Command (CDAOC) in 1994, with the intention of ensuring that national defence could be efficiently coordinated and extended beyond France, and guarantee freedom of action through control (Aubout *et al.* 2013). The specific operational lessons, the broader lessons on the use of air power, and the realisation that thinking on defence rooted in Cold War territorial defence and nuclear deterrence was insufficient in the post-Cold War environment, began to be reflected in the biannual military programming law

from 1992. This included ‘the development of… projection capabilities and joint operations in Europe and around the world’ and ‘provid(ing)… forces with a precise long-range strike capability’ (France 1992, I, Annex VI part 3). Addressing environmental challenges and realising power projection goals formed the basis for wide-ranging reform of the armed forces, including the *Armée de l'Air*, through the 1994 White Paper.

The 1994 White Paper on Defence was the first for 22 years and its publication marked the first of two post-Cold War shifts that broadened and deepened France’s conception of its defence environment. The White Paper acknowledged the changes brought about by the end of the Cold War to the geostrategic and geopolitical environments in which France’s national interests would be pursued. It reaffirmed the previous white paper’s core national interests and geographic focus but expanded these to include the Middle East, international shipping routes and a reconceived post-Soviet European security (France 1994a). It also recognised some broad lessons from the Gulf War – that conflicts not linked to vital national interests would now require intervention to ensure global stability, that high-end conventional forces could be used without the risk of nuclear escalation, and operations would often be at distance from French territory (France 1994a). This promoted a new role for conventional forces, filling the emerging gap between protecting French territory and nuclear deterrence and also marked the decoupling of conventional and nuclear forces from their singular focus of the Cold War. Political direction was given to create an air force capable of addressing the new environment which would require the development of platforms and systems designed for long-range operations, able to control large areas – including AWACS and ISR collectors – aerial refuelling and precision weapons to allow for ‘massive bombardment’ and CAS (France 1994a, 92-93). In doing so, the White Paper addressed the issues arising from the *Desert Storm* air campaign, driving new acquisitions and structural reforms for the *Armée de l'Air* and *l’Aero*, and new national intelligence capabilities (France 1994a, 85-103). This was reflected in the military programme set out later in 1994 which formally committed France to reforming its C2, intelligence, mobility and crisis management to ensure future strategic autonomy, and the modernisation of air power through the Mirage 2000D, the new Rafale, carrier strike, and a family of new precision weapons (France 1994b, II parts 2-3a).

Despite the 1994 White Paper’s direction and subsequent reforms, the broadening of France’s conventional air power and its more independent role were still anchored to the core missions of providing territorial defence and nuclear deterrence to ensure an independent means of survival and to guarantee freedom of action. Thus, new thinking and attempts to create new doctrine reflecting how conventional air power might be used differently – and strategically –

was inherently constrained. Resistance to change was widespread. This included officers within the *Armée de l'Air* that saw formal doctrine as abstract, dogmatic and not linked to operational reality, views within the armed forces that considered NATO to be a suitable source of guidance for any operation beyond the core national missions of defence and deterrence, and industry which had a stake in the continuation of long-term weapons programmes which could be threatened or disrupted by shifting air power's emphasis (Le Saint 2007a). Consequently, this resistance to the disruptive effects of the 1994 White Paper, itself influenced by the conduct and implications of the Gulf War, would constrain elements of France's development of its own strategic air power capability and new air power doctrine into the 2000s.

Although the *Desert Storm* air campaign offered Israel relatively few immediate and directly applicable lessons for its own use of air power, the campaign did have longer-term influence over the direction and development of the IAF. This can be seen in three areas: air power's potential to reduce operational risk; the use of firepower to create space for manoeuvre; and the use of long-range conventional strike for deterrence. In the early-1990s, the IDF was engaged in low-intensity counterterrorism operations as a result of shifts in tactics by its adversaries. These operations presented lower risks, lower casualties and lower collateral damage than the wars of the recent past and were conducted under greater media and public scrutiny (Brun 2011). The result was a public change in expectations of warfighting, a closer identification of IDF personnel as individuals rather than as a force, and the embrace of 'post-heroic' warfighting practices (Shamir 2018). Post-heroic warfare, as termed by Luttwak (1995), envisages warfare exploiting the technical potential of modern weapons and utilising them for strategic effect to achieve goals with minimal bloodshed (Luttwak 1995, 114, 120-122). The *Desert Storm* air campaign was the exemplar of such warfighting and in the 1990s had growing appeal and relevance to Israel. Thus, the IAF increasingly employed the use of air-launched precision weapons to replicate and replace attacks that had previously required ground forces to conduct.

The second influence of *Desert Storm* was the potential for air power to offer a solution to the challenge of the increasingly complex, 'saturated' battlefield of non-state actors and threats, willing and able to strike at Israel from within (Rodman 2001). In this environment offensive manoeuvre warfare was becoming increasingly difficult. The US approach to warfighting which emphasised long-range strike enabled by stand-off weapons and highly capable air platforms and intelligence could create space for ground forces to operate (Rodman 2001). It also reduced risks to personnel, emphasised Israel's qualitative advantage in air power platforms,

weapons and intelligence gathering, and could be achieved with the smaller, more capable force that the IDF was becoming in the absence of conventional state threats.

The third influence on Israeli air power was the demonstrated utility of long-range strike by the United States which was of particular interest in the context of maintaining its regional qualitative military edge and in deterring and potentially pre-emptively striking Iran. Having previously relied upon such pre-emption against its near-neighbours, the USAF's F-15E *Strike Eagle* offered Israel a solution to conducting operations at greater distance. Consequently, Israel ordered the platform in 1994 marking the first step in its development of a long-range conventional strike capability (UPI Archives 1994, Mizokami 2019). Despite the initial criticism of the *Desert Storm* air campaign and the divergence between Israeli and US operating environments and focus in the early-1990s, the longer-term influence on Israeli air power even by the mid-1990s was clear. The shift to a post-heroic approach to operations, the increased reliance on air-launched firepower, and the pursuit of a conventional deterrence capability laid the groundwork for the development of new theory and a greater embrace of US strategic air power ideas by the late-1990s.

Conclusions

The first major conflict of the post-Cold War era was of seminal importance to air power generally and to the development of strategic air power specifically. Operation *Desert Storm's* strategic air campaign was a rare opportunity to test a recent warfighting theory and its associated operational framework, combined with newly-developed capabilities, and apply them against a model adversary. During the first two phases of the air campaign, strategic attacks against Iraq's C2, IADS and key enabling infrastructure were broadly successful, disrupting the Iraqi leadership's means of power and control, enabling air supremacy over Iraq and Kuwait, and hastening the end of the invasion. Other aspects of the air campaign did not achieve all they sought, particularly the pursuit of dispersed mobile Scud launchers, and the effects of striking some targets were difficult to measure and discern. In the United States, the air campaign was largely interpreted as positive, confirmatory, and ensured the direction of its air power set during the late-1980s would continue into the post-Cold War era. For the other case study states the *Desert Storm* air campaign was not interpreted uniformly. Two primary reasons can be discerned as to why: each state's relationship with the United States and underlying structural factors.

For Britain and Australia, a certain receptiveness to their US ally's ideas was clear, as *Desert Storm* demonstrated a new direction for their air power. Both were also structurally

predisposed to accepting leadership from the United States. Britain had recently returned to producing independent air power doctrine, its defence reforms were focused on maintaining influence with fewer resources, and alignment with its US ally was essential to retaining its role in the world. Australia was looking for the means to maintain its qualitative military edge, increase its deterrence options, and bolster its position and influence in an Asia-Pacific region it saw as increasingly more threatening to its interests. In both cases air power offered a cost-effective means of achieving national security goals and the United States offered the direction for that air power to be maximised. In contrast, the politically-shaped view of warfighting and the consequent role of air power within it held by the Soviet Union created a natural barrier to accepting US theory or the meaning of its effectiveness in practice. However, *Desert Storm* created deep debate within the Soviet military and its Russian successor, not least because of the prior work of Ogarkov and his ideas on the role of technology, precision and air power in future war. The Chechen War, more-so than *Desert Storm*, highlighted the inadequacies of Russian air power and the pressing need for reform but the significant, disruptive structural changes to the state prevented any real progress until after the mid-1990s. For France, the logic, framework and means by which *Desert Storm* was conducted clashed with its own ways of employing air power. Its basic tenets, rooted in France's view of its defence environment, were challenged. The broad range of lessons that were drawn included the nature of the future operating environment, the role of air power within it, and how France could maintain its independence and freedom of action. Unlike its allies Britain and Australia, a direct acceptance of US strategic air power theory and its implications was not appropriate or possible for France. Finally, Israel was receptive to adopting some of the capabilities demonstrated by its US ally during the air campaign but the broader concept and framework for operations in which they were employed did not readily appeal. Aside from some scepticism over the air campaign's effectiveness, there was no fundamental rationale for Israel to accept US theory at this time. The IAF's role within the Ben-Gurion Doctrine was clear, tested, and contemporary changes to its role were influenced by the nature of the threat the state faced rather than by the United States.

Despite the range of views, a number of areas of broad agreement about the implications of the *Desert Storm* air campaign are apparent. These were: the importance and potential of precision weapons in future warfighting; the associated centrality of air power to future operations; the broader shift towards a conventional, strategically-capable air force; the potential for that air force to contribute to deterrence through long-range conventional strike; and the consequential necessity for new national defence strategies to capture these changes. From amongst the broadly agreed implications of *Desert Storm*, the role of precision weapons

in future warfighting was acknowledged by all of the case study states as having long-term consequences for their development and use of air power. For the United States, the use of precision weapons to achieve specific operational goals in practice was seen as a validation of investment, air power theory, and the operational framework that directed their use. For Britain and Australia, their use and effects confirmed the necessity of incorporating precision weapons into their own air power and undertaking the reforms required to employ them in future conflicts. For France, Israel and Russia, *Desert Storm* highlighted the potential of precision weapons, prompting an examination of how such weapons could be developed and incorporated into their own defence thinking. Consequently, the recognition of the unique role of precision weapons in enabling strategic attack, strategic effects and conventional deterrence, and the consequential reforms to national air power, can be determined to be the third influencing factor in modern strategic air power's development. In the four years after *Desert Storm*, all six case study states embarked upon reforms that emphasised the role of precision weapons in their respective air power capabilities, through a combination of national defence reform, budgetary, development and procurement decisions, and updates to air power doctrine.

The Development Process

This period in the concept's development is also notable for the state-level development process that begins at this time and repeats throughout the research period. The development process links the case study states' respective contemporary understandings of strategic air power, expressed through theory, doctrine and capability, to direct or indirect practice. The process is illustrated at Figure 1.

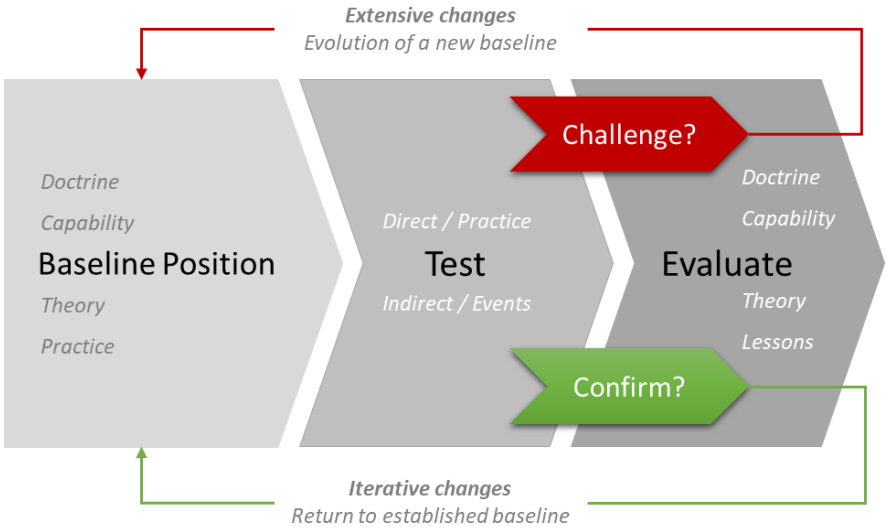

Figure 1. The Strategic Air Power Development Process

The development process consists of three parts:

First, a state's baseline position is established. In the early-1990s, this was a product of prior theorising, existing doctrine, extant capability, and the experience from practice. It is from this position that the state understands and approaches strategic air power conceptually. The baseline position shapes the state's operational options and its perception of events and conflicts involving air power.

Second, the baseline position is periodically tested. This may be a direct test through practice or an indirect test through its perception and reaction to events and conflicts. Consequently the state's understanding of strategic air power is either confirmed or challenged. In the case of *Desert Storm*, the US baseline of conventional strategic effect established by the late-1980s was confirmed through broadly successful operational outcome that achieved the objectives set. The baseline positions of strategic air power in the other case study states, rooted in either nuclear strategy or one-off actions outside of doctrine, were challenged.

Third, a period of evaluation then follows that provides feedback to the baseline position. The evaluation period consists of a series of assessments, lessons, and directions from military, political, and academic sources, often over several years. Evaluation is driven by a combination of different, related reasons, including the consequences of failure, the implications of technological or strategic change for the state or air forces, and interpretations of the future environment in which air power will operate.

The evaluation period's feedback drives organisational reforms, capability investments, updated or new air power doctrine, and theoretical debate on strategic effect. The extent and scope of these is determined by whether the test confirmed or challenged the baseline and the consequent feedback from evaluation. In the cases of confirmation, changes are iterative, and the original baseline remains valid. This was the case for the United States in 1991. In the cases of challenge these changes are more extensive and result in an evolution of the state's understanding of strategic air power to produce a new baseline position. This was the case for Britain, Australia, the Soviet Union / Russia, France and Israel, who all entered a period of significant reforms from 1991 into the mid-1990s.

CHAPTER 3 Strategic Air Power in the Era of Intervention (1995-2003)

The nine years from 1995 to 2003 was a period in which the case study states used air power as a means of affecting strategic change. This 'era of intervention' saw air power used during five conflicts – in Bosnia, Chechnya, Kosovo, Afghanistan and Iraq – with the intention of achieving strategic effects including cost/benefit manipulation and the destruction of the adversary. The era of intervention was the third distinct stage in the concept's development and emerged from a geopolitical environment in which the combination of a dominant United States, a relatively weak and inwardly-focused Russia, and an expansion of NATO's collective security focus, permitted preventative and offensive interventions against states and armed groups disrupting or threatening the post-Cold War order or a state's national security. Air power was at the centre of this era and the primary means for intervention. The success of air power-led operations in the early-1990s, the incorporation of lessons learned into doctrine, reforms and investment, and the continued impact of new technologies on precision weapons, computing and communications, produced air power capabilities which, at their best, offered a precise, relatively low-risk and low-cost, rapid and visible tool for political effect.

This chapter considers the era of intervention in three parts: first, the use of strategic air power in Bosnia and the direction and impact of the second phase of post-Cold War defence reforms; second, analysis of the conduct, outcomes and comparative approaches taken by the United States, France and Britain in Kosovo and Russia in Chechnya in 1999; and third, the development of a new model of strategic air power applied in the conflicts with Afghanistan and Iraq in the early-2000s and the implications of this for Russian and Israeli air power. The era of intervention was a period in which the promise and potential of *Desert Storm* and its resulting reforms and capability investments became central to how conflict was fought. The result of the era's frequent air campaigns, combined with technological progress and underpinned by reform, was a compressed air power development cycle in which new capabilities were rapidly introduced, analysed and evaluated. This, and the related advances in sensor-to-shooter timescales that opened up new strategic options, would go on to fundamentally change the direction of modern strategic air power in the first decade of the 21st century.

Deliberate Force and the Second Phase of Post-Cold War Reforms

In late-August 1995 NATO launched a limited air campaign, Operation *Deliberate Force*, against the Bosnian Serb Army. Its intent was to change the Bosnian Serb leadership's cost-benefit calculations towards continuing its military offensive, to withdraw its forces and to accept a negotiated peace to the regional conflict (NATO 1995a, 1995b). The United States,

Britain and France were the principal contributors to the air campaign, accounting for over 83 percent of sorties flown, and deploying a broad array of capabilities including *Armée de l'Air* Mirage F1s, Mirage 2000s, and Jaguars, RAF Harrier GR7s, USAF F-15Es, F-16s, F-4s, EF-111s and A-10s, Marine Corps. F/A-18s and US Navy EA-6Bs, as well as supporting KC-10s, E-3 Sentry AWACS and EC-130s (Tirpak 1997, Conversino 2000). As noted by USAF Colonel Christopher Campbell who analysed the air campaign using access to classified NATO and USAF materials, the air campaign grew out of NATO's ongoing *Deny Flight* operation and consisted of attacks against Bosnian IADS and ammunition production, and against the Bosnian Serb Army both directly and indirectly (Campbell 2000). The Bosnian Serb centre of gravity was identified as its 'historic fear of domination' which could be exploited by attacking their heavy weapons, their commanders and the supporting C2 infrastructure in Bosnia which, once lost, would shift the balance of power away from the Bosnian Serb Army and thereby force an end to the conflict (Campbell 2000, 107). The *Deliberate Force* air campaign included direct strikes on Bosnian Serb C2, military logistics areas and ammunition depots and strikes on supporting infrastructure including specific bridges and tunnels to force the Bosnian Serb Army to use particular routes when retreating (Tirpak 1997, Haulman 2000, Conversino 2000). Precision weapons were used extensively, both as a means of ensuring specific target points were hit to maximise effect, and to minimise collateral damage which was a major political consideration in light of the potential for mistakes to be exploited by the Bosnian Serbs or their Russian allies (Tirpak 1997, Haulman 2000, Conversino 2000). Across both operations, 69 percent of strikes were conducted with precision weapons, primarily laser-guided and electro-optically guided bombs, as well as small numbers of stand-off weapons and naval-launched cruise missiles (Tirpak 1997).

The initial strikes of *Deliberate Force* enjoyed some success, partially disabling the IADS and 'severely degraded' ammunition production, storage and distribution (Conversino 2000, 145, Campbell 2000). A series of further attacks on the IADS were required, with mixed success in destroying it due to weather conditions, availability of assets, and political limitations; the wider *Deliberate Force* campaign also suffered the same issues but was broadly able to strike targets across Bosnia, as well as provide CAS and interdiction, in order to maintain pressure on the Bosnian Serb Army and its leadership (Conversino 2000). The air campaign, in conjunction with diplomatic efforts and the Croat Army's offensive on the ground, was, over two weeks, able to change the cost-benefit calculation of the Serbian leadership and led to the achievement of NATO's objectives including a negotiated settlement at Dayton later in 1995 (NATO 1995c). The broad success of the air campaign was made possible due to the outsized role of US air power, limited campaign objectives, and the fruition of reforms enacted

post-*Desert Storm* by Britain and France which enabled them to make a greater relative contribution than in 1991 through combat management and their ability to use laser-guided bombs operationally for the first time (Great Britain, House of Commons 1995, Sargent 2000, James 2002). Operation *Deliberate Force* can be considered an evolutionary rather than revolutionary step for the development of modern strategic air power. It confirmed the air campaign framework employed in *Desert Storm*, the means required to execute such a campaign, the link between precision weapons, battlefield effect and control, and the utility of the concept in a limited conflict in Europe under the auspices of NATO. This would go on to influence NATO's response to the crisis in Kosovo in 1999 as well as Russia's perception of European security and the direction of its own air power. Operation *Deliberate Force* also presaged a second phase of post-Cold War reforms that further developed strategic air power capabilities across the case study states.

Air Power Reforms

A new phase of defence reforms took place between 1996 and 1999. This marked the second phase of reforms to air power since the end of the Cold War, following the structurally-driven, *Desert Storm*-influenced first phase. Russia was the exception to this. Due to the political-economic context of the early 1990s and the subsequent war in Chechnya, Russia was still embarking on the first phase of substantive and essential reforms to its air power, based on the 1993 Military Doctrine. The timing of this 'second' phase of reforms was driven by the combination of the implementation of the first phase, lessons learned from that process, technological developments which influenced new procurement, budgetary considerations, and the broader geopolitical environment in which the United States and NATO were increasingly willing and able to intervene in Eastern European crises. The second phase of air power reforms can be grouped into three. First, the United States, whose strategic air power capabilities and thinking remained well-ahead of the other case study states. The USAF focused on incorporating the link between precision and effect into doctrine through the formal adoption of EBO. Second, developments in British, French, Israeli and Australian air power that focused on trading capacity for capability and began to explore, and to an extent incorporate, ideas on EBO. Third, the fundamental reorganisation of air power by Russia, long-overdue and focused on capacity reductions, structural simplification, and providing a basis for future development.

Aligning Effects-Based Operations and Doctrine: United States

In 1997 the USAF Basic Doctrine, Air Force Doctrine Document 1 (AFDD 1), was released, updating the 1992 Air Force Manual. The intervening years had seen not only the release of

the Gulf War Air Power Survey and the accompanying debate on the effectiveness of strategic air power in the Gulf, but also influential work on the role of air power by USAF Colonels Philip Meilinger and David Deptula, both in 1995, and the publication of multiple revisions to US National Security Strategy, a new DoD Joint Doctrine, and two new USAF white papers. Collectively, these formed the context for AFDD 1 and the direction of US air power in the mid-1990s. Meilinger's 1995 work '10 Propositions Regarding Air Power' summarised the core attributes of modern air power, drawing on historic and contemporary understanding, theory and operations. These attributes included *inter alia* that air power is inherently strategic, primarily offensive, that targeting, intelligence and effects are intrinsically linked, that operations can be conducted in parallel and at all levels of war, and that precision air weapons have redefined the meaning of mass (Meilinger 1995). Building on his role in the planning of the *Desert Storm* air campaign, Deptula detailed his ideas on effects-based targeting in 'Firing for Effect: Change in the Nature of Warfare', also published in 1995. Deptula outlined the potential of rapid decisive operations through parallel warfare, the importance of stealth and precision weapons, and the benefits of focusing on effects over destruction (Deptula 1995). For US air power, these ideas were contextualised by the prevailing National Security Strategies which emphasised a new era in which the uncertainty of the immediate aftermath of the Cold War would be replaced with a clearer security environment, in which challenges and opportunities for the United States could be met through a combination of soft power, regional alliances, power projection and the ability to fight two near-simultaneous regional wars if necessary (United States 1994, 1995). The 1995 Doctrine for Joint Operations underpinned how the United States would so this, including through simultaneity and depth, attaining dimensional superiority in the air and at sea, 'direct attack of enemy CoG (by) air, missile, special operations, and other deep-ranging capabilities' with the aim to be decisive or to 'cause paralysis and destroy cohesion', and all linked to broader joint operations (United States 1995b, xi, IV-5, IV-6, IV-7).

AFDD 1 reflected many of the ideas and concepts captured by Meilinger, Deptula, the Doctrine on Joint Operations, and the guidance of the National Security Strategies. The new doctrine emphasised the link between precision and effect, which the USAF also argued had redefined the meaning of mass in modern warfare, and which air power was uniquely well-positioned to exploit (United States 1997b, 30). The new doctrine linked precise effects with information superiority, which, once achieved offered both strategic advantage and new warfighting options. Through the USAF's air- and space-based ISR platforms, information dominance could be achieved, providing the ability to improve 'the speed and quality of our observe-orient-decide-act loop, but also significantly degrade and influence the adversary's cycle time… and,

ultimately, shape the adversary's perception of the situation and courses of action' (United States 1997b, 32). This combination of precision, effects, and information superiority would support the USAF's ability to conduct global attack operations, in which rapid, persistent strike could be delivered worldwide through space-based systems, the bomber force, the attack force and the tanker fleet. Collectively this created and defined US air power's strategic attack capability, which could 'affect the enemy's entire effort rather than just a single action, battle, or campaign' and which constituted 'the most efficient means of employing air and space power' (United States 1997b, 51-52). An accompanying annex on strategic attack, Air Force Doctrine Document 2-1.2, provided greater detail on the USAF's capabilities and thinking. This included the conduct of parallel warfare to overwhelm the enemy's critical centres and reduce the ability to conduct war operations, a view of the enemy as a system of systems, the use of massed force to 'paralyze [sic] opponents and make them ineffective, rather than necessarily having to destroy them', and 'disrupting critical command and control and war-sustaining capabilities (whilst) avoiding a sequential fight through layers of surface forces to reach the objective' (United States 1998, 13-16). It also stated that 'early and persistent application of strategic attack is highly desirable in most aerospace operations' (United States 1998, 18). The first opportunity for the USAF's revised and expanded doctrine to be tested in practice emerged the following year with the crisis in Kosovo, but, for political reasons, the design of the NATO air campaign would embrace few of the principles of contemporary strategic attack.

Capacity vs Capability: France, Britain, Israel & Australia

For France, Britain, Israel and Australia, the second phase of post-Cold War air power reforms were broadly arranged around the common principle that the future effectiveness, credibility and utility of their air power was contingent upon wholesale improvements to its capabilities. These improvements included new and upgraded multirole strike aircraft, precision-guided and stand-off weapons, greater numbers of enabling platforms, better intelligence gathering, fusion and dissemination, and increasing joint capabilities. Reductions in capacity would be required to make such improvements viable. The net result would be a future air power capability able to operate at range with much greater efficiency and which would be capable of delivering strategic effects.

In July 1996 France published its first five-year military budget and programme, the *loi de programmation militaire (LPM), 1997-2002*, committing significant long-term investment to its air power. This included provisioning for conventional force projection through carrier strike and committing to the Rafale multirole combat aircraft for both the air force and the navy as the future core of French air power, alongside the Mirage 2000 (France 1996, 1.3.3, 1.4.3).

These platforms would be armed with newly-developed AASM (modular air-ground armament) precision-guided missiles and the APACHE / SCALP stand-off weapon (France 1996, 2.3.3). Airborne intelligence gathering, C2 and carrier AEW would also see upgrades and recapitalisation to modernise, enhance and focus the capability of French air power (France 1996, 2.3.4). In parallel, the LPM reduced the personnel and platforms in service for the *Armée de l'Air* and *l'Aero* in line with a broader move to a fully-professional and recapitalised armed forces (France 1996, 1.4.3, 2.2.2). Despite these reforms and investments, France remained unable to revise its own doctrine to reflect the new, conventional role for its air power. The 1994 Defence White Paper had highlighted the need for joint coordination of national and coalition forces. In doing so it prompted France to start writing a concept on the use of force and for the *Armée de l'Air* to create its own doctrine (Le Saint 2007a). In 1997 the *Armée de l'Air* produced its first 'Concept' but this was not ratified or published. Resistance to new doctrine – apparent post-*Desert Storm* and the 1994 White Paper – remained and there was no impetus to change until significant environmental disruption in 2001. The absence of a formal body within the *Armée de l'Air* to develop doctrine also hamstrung development, an issue that was not addressed until the mid-2000s (Etienne-Leccia 2007).

The broad direction of French air power reflected in the LPM mirrored that of Britain earlier in the 1990s: capacity reductions balanced with capability enhancements, a focus on power projection, and an increasingly prominent role for conventional, precision strike. Britain's own second phase of defence reform was centred on the Strategic Defence Review (SDR) of 1998. The 1998 SDR marked an end to eight years of reform reacting to the end of the Cold War defence environment and transitioned to a more proactive set of reforms designed to secure British interests and goals into the next century (Great Britain 1998, Ch. 2). Building on the first phase of reforms, the strategic potential and unique attributes of long-range strike were noted, specifically that 'long-range air-attack will continue to be important both as an integral part of warfighting and as a coercive instrument to support political objectives… there will be an increasing premium on "stand-off" precision missiles which can be launched at targets from long range' (Great Britain 1998, para 87). SDR 1998 committed the future of British air power to a more focused, three-type fleet of the Tornado GR4, armed with precision weapons and the *Storm Shadow* stand-off weapon, the Eurofighter Typhoon for both air defence and to supersede the Jaguar fleet's air-to-ground strike role, and a future carrier aircraft to be deployed on the new generation of Royal Navy aircraft carriers (Great Britain 1998, paras 115, 117, 146). Expeditionary support was increased through the planned procurement of C-17 heavy-lift aircraft, and plans to recapitalise the medium-lift and tanker fleets (Great Britain 1998, para 147). The direction of reform in the 1998 SDR shifted British air power towards a

more capable, strike-focused force, and away from Cold War deterrence. This was highlighted by the earlier-than-expected withdrawal of the RAF's WE.177 sub-strategic nuclear weapons, which ended its direct nuclear role. The third edition of the RAF's air power doctrine was written in the context of the 1998 SDR and continued to be influenced by US strategic air power theory. The new AP 3000 built upon the conceptual foundations laid earlier in the decade, updating and developing the fundamental concepts and approach to strategic air power from the second edition. The 1999 doctrine emphasised the linked roles of air power in controlling the air, exploiting information, delivering strategic effect, and operating as part of the joint force (Great Britain 1999, para 1.2.15-16). It also focused on the importance of precision, targeting, and on the destruction or disruption of identified centres of gravity (Great Britain 1999, paras 2.6.1 & 2.6.9-12). The link between destruction and strategic effect was, like in the USAF's 1997 AFDD 1, expanded upon to consider disruption and paralysis by overwhelming the adversary's observe-orientate-decide-act loop (Great Britain 1999, 2.4.1). Effects-based operations were also embedded into doctrine in 1999, with the intent 'to shatter the enemy's cohesion and will, rather than simply to destroy manpower and materiel' (Great Britain 1999, 2.6.7).

Air power reforms in Israel were less substantial than in France and Britain, but the move towards a 'small and smart military' envisioned by Defence Minister Ehud Barak was underway in light of developments in precision weapons and Israel's security environment (Shamir 2018, 692). Israel increased its conventional long-range strike capability with the entry into service of the F-15I variant of the F-15E in 1998 and the subsequent procurement and development of precision weapons kits (Boeing 1998). The 1970s-vintage Kfir C-7 fleet was largely retired by the mid-1990s and an indigenous AEW and ELINT capability introduced with the Boeing 707 *Phalcon* (IISS 1995). More broadly, changes in the IAF reflected a growing theoretical influence from the United States and the acceleration of a shift from manoeuvre warfare to firepower-led operations. This was evident in two influential works which were published in the mid-1990s. Both were written by IDF officer Shimon Naveh. In 1995, Naveh wrote an article, 'The cult of the offensive preemption [sic] and future challenges for Israeli operational thought', in which he outlined Israel's reliance on offensive manoeuvre, warned of the complacency its previously successful use created prior to the 1973 War and highlighted its fragility due to the scale of intelligence it requires to be successful (Naveh 1995). This was a prelude to Naveh's own concept, Systemic Operational Design, which built upon both the 1995 article and his book 'The Pursuit of Military Excellence', published in 1997. Naveh critiqued the historic development and evolution of offensive manoeuvre warfare, arguing that the concept's strategic level application was flawed because it was essentially an extended set of tactics

and thus any associated strategic expectations could not be met (Naveh 1997). Instead, Naveh argued that the Soviet theory of the Deep Operation offered an operational and strategic solution, which, combined with the General Systems Theory of Ludwig von Bertalanffy, is able to capture the dynamic, open nature of actors in conflict who interact, adapt, and change according to circumstances and actions (Naveh 1997). The theory that emerged was Systemic Operational Design, which 'is an attempt to rationalize [sic] complexity through systemic logic… (it) is fundamentally an alternative method of problem framing to aid the design of campaigns and operations' (Sorrells *et al.* 2005, 15). Such an approach could offer Israel a new element to its qualitative military edge, providing an operational advantage through better understanding, adaptation and reaction in conflict. With air power increasingly embodying Israel's qualitative military edge, Naveh's theory and framework would become influential in the early-mid 2000s.

Finally, in Australia reforms focused on increasing joint capabilities that would enhance its air power. Following the recommendation of the 1994 Defence White Paper, Australia centralised its intelligence gathering and command structure through the establishment of Headquarters Australian Theatre in 1997 to join up national intelligence and military C2 (Australia 1994a, 37-38, Treloar 2000). This was an important step for Australian air power, increasing its ability to better coordinate national defence in which air power was a core element, and broadening the concept of air power beyond the RAAF by joining its own C2 with that of the other services. During this period, no new platforms or weapons systems were procured, leaving the RAAF with the same capabilities and fleet size as it had in the early 1990s, but now better coordinated and doctrinally guided. The increasingly joint thinking about the defence of Australia was influential in the direction taken by the third edition of the RAAF's Air Power Manual, published in 1998. The new doctrine was a refinement of the more revolutionary shift marked by the second Air Power Manual. In the new edition the underlying concepts and terminology of strategic air power adopted from the United States were reconsidered in the context of Australia's own needs. Examples included changing the term 'strategic strike' to 'precision strike' and considerably broadening the application of this to include all aspects of offensive air power from long-range strike to battlefield interdiction to close air support in order to deter, pre-empt and defend against an adversary (Australia 1998). This new, broader understanding of air power's strike role is a significant stretch from the more narrowly-defined US strategic air power theory at the heart of the previous doctrine, focused as it was on control through paralysis attained by striking the enemy's identified centres of gravity. The third edition of RAAF doctrine reflected a balance between the relatively Australian-centric first doctrine and

the US-centric second doctrine, in which Australia's understanding of how strategic air power could best serve its national defence objectives continued to be contested.

Fundamental Reform: Russia

In the mid-late 1990s, Russian air power reform was only entering its first, fundamental stage through which the major issues that had arisen in the post-Cold War environment were addressed. These issues included force structure, platforms, weapons and enabling capabilities, C2, and the associated reorganisation of the wider armed forces. The direction of the reforms which began in 1996 was derived from the 1993 Military Doctrine and driven by the military themselves out of political and economic necessity. At the highest level, the first phase of defence reforms attempted to better-focus Russia's armed forces by reducing capacity, removing duplicate commands, and by establishing new Military Districts (MDs) to control operations (Lefebvre 2002). For air power, organisational reforms were far-reaching. In 1997 the VVS's Frontal Aviation was merged with the PVO (Air Defence Forces) into a single air force covering air defence and CAS. The VVS was divided between the six MDs and Moscow and directed towards operations specific to these territories. Personnel, facilities and bases were drastically reduced, and over 600 legacy combat and training aircraft were retired (Dick 1999). The reforms did not overtly change the focus of air power from the primary tasks of air defence and ground support but did begin to broaden air power's role and lay the conceptual groundwork for more sophisticated operations in the future. This began with an emphasis on procuring multirole combat aircraft to replace retiring task-specific platforms, with the Su-27 and its variants and upgraded MiG-29s the core focus, the development and integration of precision weapons to act as force multipliers, and bolstering conventional strike by utilising VVS DA platforms (Dick 1999). Achieving and maintaining air supremacy was acknowledged to be central to permitting all other operations, and the VVS's missions were expanded to reflect the potential of using air power to weaken the adversary's military-economic potential, disorganising his C2, and engaging at depth (Lefebvre 2002).

The first phase of reforms faced a number of constraints which limited their scope and success. These included resistance from some commanders, deficiencies in equipment and training, and limits on investment in capabilities due to national economic difficulties in the late-1990s (Dick 1999, Felgenhauer 2000). The 1997 National Security Blueprint acknowledged Russia's declining influence and its challenging economic, scientific and demographic circumstances (Russia 1997, 2, 4). These limited the options available to respond to threats to the state which ranged from internal issues, including the economy and a 'burdensome' military organisation, to external trends which included attempts to undermine

Russia's international influence, crises in peripheral states, European security consolidation and NATO expansion (Russia 1997, 2, 6-9). In response, the Blueprint focused on non-military solutions, including economic reforms and multilateralism, as well as the necessity to reform, reorganise and modernise its military forces to support a minimum level of deterrence and defence (Russia 1997, 11-17). Russian air power developments mirrored this minimum aim: the VVS underwent a significant but necessarily limited series of reforms to its organisation, personnel and equipment in order to downsize, professionalise and focus it. Changes to its aims, an expansion of its remit and greater independence were not possible nor required in this period.

Reforms Applied: Comparing Air Power in Kosovo & Chechnya

In 1999 NATO and Russia respectively conducted near-parallel air campaigns against the Federal Republic of Yugoslavia's[1] forces in the then-Yugoslav province of Kosovo and against Chechen secessionists in the Russian region of Chechnya. In both cases air power was the primary method employed to alter the situation on the ground. These two instances of air power being used for strategic effect can be analysed in several different and complementary ways: as standalone air campaigns, in which strategic air power's contribution to the achievement of political objectives and its application in the context of doctrinal expectations is evaluated; in comparison with a previous, relevant air campaign – Kosovo with Bosnia and the Second Chechen War with the First – to reveal similarities and differences in the use of air power; and to one another as a means of assessing the relative positions, capabilities and approaches to strategic air power of the United States, France, Britain and Russia in 1999.

Operation Allied Force

Operation *Allied Force* had limited but broad objectives. These were to first, demonstrate NATO's seriousness to the Yugoslav government; second, to deter further bloodshed in Kosovo; and third, 'if necessary, to seriously damage the Serbian military's capacity to harm the people of Kosovo; to limit Milosevic's ability to make war in Kosovo' (United States, Congressional Research Service (CRS) 1999a, 5). The air campaign was planned over five phases to manipulate the Yugoslav leadership's cost/benefit calculations of continuing with their actions in Kosovo and to compel them to change their behaviour in line with NATO's core demands. After initial deployment of air assets to the region, the air campaign was designed

[1] The Federal Republic of Yugoslavia consisted of Serbia and Montenegro from 1992-2003. For simplicity the state will be referred to as Yugoslavia unless a direct quotation uses a different term or when referring to the geographic area of Serbia

to ‘establish air superiority over Kosovo… and degrade command and control and the integrated air-defense [sic] system’ throughout Serbia, to ‘attack military targets in Kosovo and… forces south of Belgrade’, and to ‘expand air operations against a wide range of high-value military and security force targets throughout the Federal Republic of Yugoslavia’ (United States 2000, 7-8). A final phase of redeployments as necessary was also planned. For the principal NATO contributors – the United States, France and Britain – *Allied Force* was an opportunity to demonstrate in practice the culmination of nearly a decade of post-Cold War reforms, investment, doctrinal change and thinking on conventional strategic air power. The air power capabilities committed to the operation, the significant and effective use of precision weapons, and, for both France and Britain, the leap in sophistication of their contributions compared to *Desert Storm* suggested tangible, measurable progress in using air power for strategic effect. However, the *Allied Force* air campaign did not follow the approach or philosophy of strategic attack contained in US and British air power doctrine of the late-1990s. It was markedly different from *Desert Storm* in its design, execution and context due to the direction given by national leaders, the political considerations of NATO as an alliance, and the environmental and technological limits on Allied air power that emerged.

The US, French and British air power contributions to *Allied Force* demonstrated the breadth of conventional capabilities available by 1999 and the significant progress since the beginning of the decade. The United States was the predominant contributor of air power, deploying a broad array of assets from its bases and aircraft carriers in Europe, and launching long-range bombing missions directly from the United States. In several areas, such as EW and aerial refuelling, the United States’ role was critical to the ability of NATO to operate and for the air campaign’s viability (United States, CRS 1999b). A wide range of USAF and US Navy intelligence, strike and enabling platforms were utilised. Of particular note were the first combat deployment of the JDAM-equipped B-2 stealth bomber, the Navy’s EA-6B electronic attack platform which was the sole aircraft type capable of and used for standoff and escort jamming, and the F-117A *Nighthawk* and the E-8 JSTARS (United States 2000, United States Air Force 2000, Peters *et al.* 2001). France was the second largest contributor to *Allied Force*, eight years after being reluctant and largely unable to participate in *Desert Storm* and five years after beginning substantive reforms. A combination of *Armée de l’Air* and *l’Aero* assets were deployed and used to conduct a broad range of missions. These included Mirage 2000Ds, Jaguars, Mirage F1CTs and IVPs, and *l’Aero* Super Etendards for strike operations, a C-160G and Mirage F1CRs for EW, KC-135s for aerial refuelling, and E-3Fs for AEW and ISR, alongside the Mirage IVPs and unmanned platforms (France, National Assembly 1999, Sec. IV, B. 1. a), Peters *et al.* 2001). Along with Britain, France was the only European state

with the ability to use precision weapons, which included Paveway II and III laser-guided bomb kits and the indigenous AS30L air-to-ground missile. Like France, Britain also committed a significant proportion of its air power to *Allied Force* and participated in a wide range of missions. Strike capabilities were provided by RAF Tornado GR1s, Harrier GR7s and the FAA's Sea Harriers deployed from the Royal Navy carrier *Invincible* (Parliament. House of Commons 1999). As with France, British aircraft could drop Paveway II and III laser-guided bombs and also used ALARM anti-radiation missiles against Serbian SAM sites (Peters *et al.* 2001). Strike missions were supported by intelligence-collecting Nimrod R1s and a PR-9 Canberra, E-3Ds for AEW, and most of the RAF's aerial refuelling fleet. In the context of the second phase of post-Cold War defence reforms, the capabilities committed to *Allied Force* reflected the direction of air power towards precision strike, limited engagement, coalition interoperability and expeditionary operations reflected in doctrine, thinking and defence programmes. Conversely, the application of these capabilities did not reflect doctrinal guidance on strategic attack, effects-based targeting and information dominance.

The considerable air power capabilities of the United States, France and Britain were initially directed against the Yugoslav C2 and IADS networks, alongside attacks by naval-launched cruise missiles (United States Air Force 2000). This afforded NATO air superiority and targeted the most valuable element of Yugoslavia's control over its fielded forces (NATO 2000). However, it was limited in its success due to the mobility of Yugoslav SAMs and the relative autonomy of the fielded forces in Kosovo (United States 2000, 80, NATO 2000). The first phase of the air campaign was not directly connected to the political objectives sought and was unable to affect events on the ground. The second phase focused on air strikes against fielded military forces in Kosovo and southern Serbia. This was a more direct and active attempt to affect the ability of Yugoslav forces to operate but was essentially tactical in its approach and aims. Targeting fielded forces was inherently difficult due to the mobility of the targets, active adaptation and deception by the adversary, and sensor-to-shooter timescales being too long (Great Britain, Ministry of Defence 2000 paras 7.6-7.7). The addition of political restrictions on what could be targeted made the second phase of operations more difficult still (United States, CRS 1999b, Lambeth 2001). The third – and final – phase of the air campaign was the first in which air power was used strategically. In this phase, targets across Serbia were attacked, including war-supporting infrastructure such as oil refineries and ammunition storage, the electricity grid, railways and bridges, as well as targets associated with the Yugoslav leadership's ability to govern and communicate (United States 2000). The sortie rate was increased, made continuous and launched from multiple directions. This final phase of the air campaign lasted around five weeks until the government of Yugoslavia signed an

agreement with NATO, ending the air campaign on June 10th, 1999 (United States, CRS 1999a, Nardulli *et al.* 2002).

Operation *Allied Force's* overarching objective was to manipulate the cost/benefit calculations of the Yugoslav government in continuing its course of action and accepting NATO's demands. This objective was ultimately achieved. Air power was not the only factor in why the Yugoslav leadership capitulated, and was not necessarily the decisive factor either. As was noted in post-conflict analysis and discussion in the United States, France and Britain, reasons included *inter alia* NATO plans for a ground invasion, parallel European and Russian diplomatic efforts, Milosovic's indictment by the International Criminal Tribunal, and the Yugoslav leadership's failure to divide NATO and halt the air campaign (United States, CRS 1999b, France, National Assembly 1999, Britain, House of Commons 2000). Yugoslavia's withdrawal of its forces from Kosovo and its accession to NATO's demands also coincided with the third, strategic phase of the air campaign, in which 'NATO targeted factories, television stations and other assets of Milosevic's key supporters' (United States, CRS 1999b, 7). Yugoslavia's centre of gravity – its leadership and their own power structures – were held at risk for the first time, in combination with the personal threat of indictment and a loss of Russian support, which shifted the cost/benefit calculation of the Yugoslav leadership against continuing its actions in Kosovo. Air power, and particularly strategic air power, had made a significant contribution to achieving this outcome. In doing so it had highlighted several areas of progress and success since the conflict in Bosnia and the subsequent second phase of post-Cold War defence reforms.

The first area was ISR collection, fusion and dissemination, aided by both space-based assets and the growing use of unmanned aircraft. The United States noted the success of its ISR assets, particularly the U-2, RC-135 *Rivet Joint* and JSTARS platforms, its 'reach back' sensor-processing analysis process, and the use of 'UAVs operat(ing) as remote-controlled ISR platforms... these systems were used at unprecedented levels during Operation *Allied Force* and played an important role in our overall success' (United States 2000, 55-56). General Jean-Patrick Gaviard, Commander of the *Armée de l'Air* during Operation *Allied Force* noted that French intelligence gathering and dissemination had benefitted from the investment in a broad, capable system of assets created in the mid-1990s including the *Helios* IMINT satellite programme and unmanned ISR collectors. These provided France and other coalition members without such assets an independent and reliable means of assessing targets, strikes and collecting ISR (Gaviard 2012). Britain noted the particular impact and success of its *Phoenix* UAVs for ISR collection both during the air campaign and in assessing Russia's

presence in Kosovo in its aftermath (Parliament. House of Commons 2000, 162-164). The second area was the success in reducing sensor-to-shooter times, which was highlighted in post-conflict analysis by the United States and France, although noted as an area in need of improvement by Britain (Great Britain, Ministry of Defence 2000, para 7.46). The DoD After-Action Report on Kosovo notes that 'the capabilities available at the CAOC enabled C2ISR assets to successfully tighten timelines that had been problematic in the past. Real-time threat information provided by airborne signals-intelligence sensors were relayed to appropriate theatre command-and-control assets, and, in some cases, even directly to strike aircraft' (United States 2000, 58). France also achieved success in this area, showing that it was now capable of prosecuting time-sensitive targets through a combination of its ISR and strike capabilities, directed by a 'force level execution cell' to fuse together intelligence and to direct attacks (Gaviard 2012, 54).

Despite its successes, the planning, execution and outcome of Operational *Allied Force* raised a number of issues. These can be divided into three areas. First, the role of planning constraints on the use of strategic air power in practice. *Allied Force* was governed by a set of negative objectives, which as Clodfelter (1989) noted in relation to Operation *Rolling Thunder*, are the limits that are imposed on the use of force beyond national law and the laws of war. *Allied Force* was defined by what it would *not* achieve, which included 'taking Kosovo away from Serbia by force, providing defense [sic] for the Kosovo Liberation Army, or removing Milosevic from power' (United States, CRS 1999b, 2). NATO's political leaders further constrained operations by determining limits on which strategic targets could be attacked and when, which created an operational plan based on phases of gradual escalation. This was driven by the alliance's first objective – to signal its resolve to the Yugoslav leadership – and the hope and expectation that the first phase of *Allied Force* might be enough to achieve the second objective of deterring further Yugoslav action and end the conflict. The gradual escalation of the air campaign did not have the desired political effect and instead 'ceded time and initiative to Milosevic… (and) permitted physical and psychological accommodations and adjustments to be made' (United States, CRS 1999b, 5). A gradual application of air power is the antithesis of strategic air power and *Allied Force's* air campaign diverged from the contemporary air power doctrines of both the United States and Britain concerning strategic attack and effects-based targeting until its third and final phase (United States 1997b, Great Britain 1999). The rationale for this was to ensure the essential collective political agreement across NATO through the minimal application of force (Great Britain, Ministry of Defence 2000, para 7.4).

The second area of interest is the limits and shortfalls of air power exposed by the second phase of operations against Yugoslav forces in Kosovo and southern Serbia. Through a combination of poor weather, the associated limitations of using laser-guided weapons, a risk-reducing determination to conduct strikes from high-altitude, political constraints on targeting barracks, Yugoslav camouflage and deception activities, and the inherent mobility of fielded forces, operations against fielded forces were relatively ineffective and did not realise the political objectives set (Parliament. House of Commons 2000, paras 112-118 , United States 2000, 84-85, Lambeth 2001). As with the planning of the air campaign, the second phase of operations diverged from modern strategic air power theory by focusing on the fifth and least consequential ring of Warden's five rings, and diverging from USAF doctrine on strategic attack against fielded forces which should be 'conducted against identified COGs such as major reserves or politically significant military formations' rather than individual units and vehicles (United States 1997b, 51).

The third area of interest concerns the shortfalls in French and British air power capabilities exposed by *Allied Force*, divided between those already identified and accounted for through ongoing reforms, and those revealed through operational experience. France identified issues with a lack of laser-designation pods on which the use of laser-guided bombs depended, with only the Mirage 2000D fleet carrying such pods. This limited the use of laser-guided bombs, which were also not usable unless weather conditions were excellent (France, National Assembly 1999, Sec. IV, B. 1. b)-d)). Further, such bombs and all other weapons used in *Allied Force* had to be dropped from high-altitude which was contrary to French tactics upon which 'the emphasis for the past ten years has been placed on low-altitude attack aircraft missions', and which necessitated in-combat modifications to weapons and aircraft (France, National Assembly 1999, Sec. IV, B. 3). French air power lacked 'soft weapons' such as graphite bombs to disrupt rather than destroy infrastructure and to create precision effects, as well as anti-radiation missiles for SEAD missions (France, National Assembly 1999, Sec. IV, B. 1. c)). Platform limitations were also identified, particularly the *Armée de l'Air's* Jaguars and *l'Aero's* Super Etendards, which were inefficient to operation as they had to fly in pairs, required additional aircraft to deploy ahead of them to verify the objective and authorise the strike, and were limited to day flying (France, National Assembly 1999, Sec. IV, B. 1. b)-d)). Finally, a national shortfall in aerial refuelling capabilities was noted, which limited *l'Aero* operations even with cooperation from USAF tankers. Britain noted a number of shortcomings in its own air power including a reliance on the United States for SEAD as well as its lack of electronic attack capability and shortfalls in intelligence dissemination and communications between platforms (Parliament. House of Commons 2000, paras 102-111). The most serious issue

though was stated by the Select Committee on Defence to be 'the lack of a precision-guided weapons capable of being used in all weathers against static and mobile targets', and the Committee also noted that delayed upgrades to the Tornado strike fleet impacted its effectiveness and that the continued and significant use of unguided bombs was unacceptable (Paraliament. House of Commons 2000, paras 140-146).

Operation *Allied Force* was conducted four years after the *Deliberate Force* air campaign in Bosnia. The two campaigns shared many parallels – both took place in the same region, both were led by NATO member states and featured significant US air power, both had limited objectives to force compliance with demands, and both featured indirect assistance to an allied ground force. From the perspective of strategic air power though, there was divergence between the two campaigns in several key areas. First, *Deliberate Force* was focused on the Bosnian Serb centre of gravity from the start whereas *Allied Force* was not until the third phase of the operation when strategic targets associated with Yugoslavian government communications, means of influence, and its supporters were attacked. Second, air power in Bosnia enabled and strengthened the position of local ground forces which were directly linked to threatening the Bosnian Serb centre of gravity. This was not the case in Kosovo. The second phase of operations targeted Yugoslav forces in Kosovo but, through the combination of limitations discussed including issues with weather, target identification, and deception, were not particularly effective nor were they directly coordinated with the Kosovo Liberation Army (KLA) or designed to assist the KLA's campaign. Instead they were aimed at preventing action against Kosovo's population, which, whilst understandable from NATO's perspective, did not strike at the Yugoslav's centre of gravity. Third, and related, was the framing of operational objectives positively in the case of *Deliberate Force* and negatively in the case of *Allied Force*. These respective approaches defined how air power would be used, the strategic targets available for attack, the relationship between those targets and the objectives being sought, and the relative success of strategic effects in achieving the overall operational goals.

The Second Chechen War

In August 1999 Russia launched a large-scale, pre-planned operation against separatist forces in Chechnya, with air power playing a central and often independent role in achieving the state's objectives. The initial phase of operations had three objectives: to destroy rebel forces and create a security zone in north Chechnya, to isolate the Chechen economy, and to minimise losses to advancing Russian ground forces (Evans 2001). The overarching operational objective was to destroy the adversary's means of controlling Chechnya and fighting the invading Russian force, and thus end the separatist movement. This would be

achieved through a multi-phase air and land operation in which an opening air campaign would be followed by further long-range attacks by air and artillery units prior to the commitment of significant ground forces to recapture Chechen territory. Contrasting with the First Chechen War, military commanders were permitted a high degree of independence, with near-unlimited authority over operations and with little political interference, and an emphasis placed on using the VVS and artillery to prepare the ground in order to reduce Russian military casualties (Evans 2001, De Haas 2003). The 1997 merger of the VVS with the had created a single Air Force though which Russia had a more focused and independent air power capability than at any time in its history (Lefebvre 2002). The new-look VVS committed a broad range of capabilities to the first three phases of operations in Chechnya. These included modern Su-27 and Su-30 *Flanker* fighters to establish air superiority, Su-25 *Frogfoot* and Su-24M *Fencer* fighter-bombers for strategic attack, interdiction and CAS, Su-24s, MiG-25 *Foxbats*, AN-30B *Clanks* and Il-20 *Coots* for ISR, and A-50 *Mainstays* for AEW and C2 (De Haas 2003, 12). For the first time these capabilities operated under unified command and in cooperation rather than independently. The first phase of post-Cold War reforms had emphasised operational groupings and the application of joint force by the Russian armed forces and it was through this context that air power was operated in Chechnya (Felgenhauer 2000).

The air campaign was organised through the North Caucasus Military District's 4th Air Army at a dedicated headquarters under the command of Lieutenant General Valeriy Gorbenko (Evans 2001). Gorbenko controlled all air operations and utilised Forward Air Controller-type units to help coordinate strikes designed to produce operational effects in the war's first three phases. The first phase used air power independently to isolate Chechen forces and prepare for ground invasion through the destruction of military bases, supplies and weapons, bridges, some roads, fuel production and storage, power supplies, and weapons factories (Evans 2001, De Haas 2003). The second and third phases of the air campaign shifted to operations similar to the First Chechen War – the provision of CAS for advancing ground forces, interdiction of fielded Chechen forces, large-scale attacks against the city of Grozny, and air strikes against villages seen to be supportive of the rebels (Evans 2001). Air power was used in both a broadly strategic manner in these phases of the conflict in order to ensure ground forces avoided the types of engagement that had proved costly in 1995, and in a narrowly strategic manner in the first phase to prevent Chechen forces from being able to operate effectively or oppose Russian ground forces. This was achieved by a greater reliance on aerial firepower and a mix of unguided and precision weapons (Felgenhauer 2000, Evans 2001). This use of air power was broadly successful when measured against the campaign's initial objectives, which were achieved.

Despite the relative success of air operations and marked improvements since 1996, a post-conflict review by the VVS highlighted the need for increased training, new aircraft, weapons and avionics in order to have a greater effect (De Haas 2003). In comparison to the operational failings of air power in the First Chechen War, largely resulting from the complex post-Soviet structure of Russian air power and its overlapping commands, tasks and general lack of coordination, the Second Chechen War was still a major step forwards. Air power benefitted from the ongoing reform of the armed forces, clear objectives, and much clearer leadership. It also served as demonstration of Russia's more assertive employment of its armed forces. However, this demonstration had occurred within the borders of Russia and strategic air power had been employed in the least sophisticated and efficient way, aimed at the establishment of control over territory through the wholesale destruction of the adversary. Initial air strikes were designed to cripple the ability of Chechen forces to manoeuvre and be supplied before the then-immobile fielded forces and the cities and villages they held were destroyed. This offered Russia the twin benefit of eliminating the adversary and reducing the risk to advancing ground forces but at the cost of large-scale, long-term collateral damage. During the latter phases of the operation, which focused on countering the remaining separatist forces in the southern mountains of Chechnya, air power was broadly unsuccessful in locating and targeting enemy bases and forces (De Haas 2003). This showed the limits of contemporary Russian air power. The first three phases of the air campaign had used a blunt but effective approach to destroy the adversary, but in the absence of clear counter-force or counter-value targets, the VVS was unable to create strategic effects. More broadly, the Second Chechen War showed that Russian air power still lacked substantial capabilities for complex, expeditionary operations and the theoretical and doctrinal basis on which to operate independently and strategically.

Comparative Analysis: Allied Force & the Second Chechen War

In comparing *Allied Force* and the Second Chechen War there are a number of clear but essentially superficial parallels between the air campaigns. Both operations took place in the same year, six months apart, and were both limited in their geographic focus. Air power was central to both operations and aimed at changing conditions on the ground in favour of the offensive force through multiple phases of attack. The differences between the air campaigns are equally clear but more pronounced. *Allied Force* employed a strategy through which the level of force applied was initially minimal and gradually increased, driven by a combination of political necessity and expectation that the application of significant, strategic force would not be necessary. Russian air power focused on concentrated attack, initially operating a high tempo of sorties to attack infrastructure, fielded forces and cities, before reducing missions to

necessary CAS and eventually limited strikes against dispersed rebel forces. The two operations had quite different overarching objectives. NATO attempted to manipulate the cost/benefit calculations of the Yugoslav government to compel them to accept its political demands; Russia was attempting no such compellence of the Chechen rebel forces but their destruction, to be achieved through attacks on their infrastructure, territory and fielded forces. These contrasting objectives dictated the focus of air power, its intended strategic effect, and the weapons available.

A further consequence of these objectives and the context of coalition versus single state control was the level of political influence and military commanders' independence in the conduct of operations. Simply, NATO's overriding political unity and resolve dictated a high level of political influence, and with it, operational limitations on how air power could be used and a minimal amount of resulting independence for military commanders. The converse was true for Russia. The political imperative to decisively end the separatist threat in Chechnya trumped the necessity for political control; military commanders were afforded independence to pursue the destruction of the Chechen rebels' sources of strength through combined air-land operations. The ground forces element was also a further key difference in the two air campaigns. As NATO had ruled out a ground invasion from the beginning, the expectations on air power to deliver the overarching objective of the alliance and its specific military objectives was high. Although parallel diplomatic and legal efforts were also exerting pressure on the Yugoslav government to comply with NATO's demands, only air power was available to directly affect the situation on the ground. In Chechnya, the destructive power of the VVS's attacks on infrastructure independently effected the ability of Chechen forces to manoeuvre, but its full destructive impact was achieved against Chechen cities in combination with artillery – and then exploited by 100,000 troops on the ground. The expectations of Russian air power were still significant, but the overall success of the conflict was rooted in the reoccupation of the territory and elimination of the separatist threat, not on compellence and demands.

In these parallel but contrasting operations, four notable areas of importance for strategic air power emerge. First, the relationship between the respective air campaigns and centres of gravity. Although central to the achievement of strategic effect, the NATO air campaign did not immediately focus on the Yugoslav government's centres of gravity, which disconnected the strategic objective from operational practice. In contrast, Russia focused on the Chechen separatists' centres of gravity, specifically the destruction of the means by which they controlled the territory they claimed as well as the territory itself. That this was a simpler strategic objective for Russian air power to achieve in comparison to NATO's is evident, but

the initial phases of air operations in Chechnya were clearly connected to the achievement of the strategic objective. Second, the demonstration of contemporary strategic air power capability in practice. This was paradoxical for NATO, and particularly the United States, in that *Allied Force* confirmed the breadth and depth of capability available to the USAF and US Navy, as well as the progress made by Britain and France in reforming and refocusing their air power towards precision attack and strategic effect, but directed this capability in a way than was inherently constraining and less effective than its use in *Desert Storm* and *Deliberate Force*. The Second Chechen War was a test of Russian air power that confirmed progress from the mid-1990s, the impact of organisational reforms, a basic strategic capability able to destroy a relatively weak adversary's ability to fight, and highlighted the still-significant changes required for the VVS to be a credible strategic force in more challenging scenarios. Third, both air campaigns were essentially new applications of strategic air power. The strategy employed by *Allied Force* was designed to apply the minimum necessary level of force to persuade the adversary to concede. This contrasted with other post-Cold War operations in which strategic air power was directed to apply concentrated pressure from the outset. Russia's use of air power was also new, marking the first use of the unified VVS and the first time that it had used air power as a central, strategic element in its warfighting. These three areas of importance inform the fourth: the long-term implications of *Allied Force* and the Second Chechen War for the direction of strategic air power in the United States, France and Britain, and Russia, respectively.

Operation *Allied Force* marked the first point of tension, and of overt divergence, between modern strategic air power theory and operational practice in the post-Cold War period. Prior to the intervention in Kosovo, *Desert Storm* had been the exemplar of modern theory, adhering to a broadly 'pure' translation of Wardenian theory into operational reality when coupled with a reformed and reorganised US air power capability. Air commanders were able to execute an air campaign devised by air planners within the guiding limits of objectives set by political leaders. *Desert Storm* showcased the potential of this 'pure' modern strategic air power with its emphasis on the application of concentrated force, effects-based targeting, and strikes against the adversary's centres of gravity. These attributes were also applied in Bosnia, albeit for a more limited set of objectives and in quite different circumstances. *Allied Force* diverged from the 'pure' translation of theory into practice. The combination of the operating environment, political objectives, and political expediency in ensuring a united coalition, created a new 'political' variant of strategic air power in which deep and overriding political consideration would dictate that the minimal level of force would be used to meet objectives, gradual application of force would be used to signal intent and direction, and targeting would

be determined by political not military necessity. The resulting split between the 'pure' strategic air power approach of the early-mid 1990s and the 'political' direction of 1999 created long-term consequences for air power generally, with different future air campaigns taking different approaches depending on the prevailing political and environmental circumstances. A further long-term implication from *Allied Force* was the growing expectation that fleeting and mobile targets could be attacked using air power both efficiently and for strategic effect. Such expectations arose from *Allied Force's* emphasis on direct attacks on fielded forces to prevent them from operating and the resulting difficulties in doing so. As noted, this was reflected in the lessons learned by the Allied states in their emphasis on improving all aspects of the sensor-to-shooter timescales. The long-term implications of this emphasis would be reflected in the long counter-insurgency campaigns that air power would fight during the 2000s and contribute to the blurring of tactical and strategic effects. The final long-term implication from 1999 was the effect of the Second Chechen War on how Russia would develop and utilise its air power. As the first major operation for the unified VVS, the first opportunity to apply air power independently as well as jointly, and its contribution to the relative success of the operation, the Second Chechen War served as a baseline for Russian air power's future application. Notwithstanding the significant reforms and recapitalisation still required, and broadly understood to be necessary, the Second Chechen War demonstrated the effectiveness and utility of using air power for strategic destruction. This would shape the development of Russian air power in the 2000s and as a strategy be used again in Syria in the 2010s.

System Collapse: Strategic Air Power in Afghanistan & Iraq

The final two operations in the era of intervention followed the terrorist attacks against the United States by Al Qaeda in 2001. The strategic intent of both operations was regime change, first in Afghanistan then in Iraq, and air power was central to achieving this. The respective air campaigns of Operations *Enduring Freedom* (OEF)[2] and *Iraqi Freedom* (OIF) relied upon a new model in using air power, combining strategic attack, time-sensitive targeting and special operations forces to achieve objectives with a minimal footprint on the ground. The air campaigns confirmed the significant progress in capability and application made through the era of intervention, as well as areas of limitation and future investment, particularly for the air power of the United States' allies. Both OEF and OIF were important to the direction of the air power across the case study states, through the direct experiences of the United States,

[2] Operation Enduring Freedom refers to the US-led operation in Afghanistan; it does not include the broader use of the OEF name for operations elsewhere as part of the Global War on Terror

Britain, Australia and, in a limited capacity, France, and indirectly through the perspectives of Russia and Israel as to what the Allied air campaigns signified for their own air power capabilities, doctrines and reforms.

Strategic Air Power and Regime Change: A New Model & National Developments

Operation *Enduring Freedom* was the first post-Cold War use of armed force in which Western states aimed to remove another state's leaders from power. As such, the direction, emphasis and operational employment of strategic air power was quite different to the preceding uses of offensive air power during the 1990s. To realise regime change, a new model for the achievement of strategic effect was created. This brought together air power with special operations forces (SOFs) and local allies on the ground to identify, direct, assess and capitalise on precision strikes to achieve strategic objectives. This model, according to then-Secretary of Defense Rumsfeld, permitted a 'modest' coalition footprint, low civilian casualties and would allow the United States and its allies 'to leave as soon as possible' (Rumsfeld 2003). The objectives of OEF were to remove the Taliban from power, to destroy Al Qaeda's base of operations, to hunt Al Qaeda's leaders and to eliminate members of the terrorist organisation (United States, Senate 2002, 5, Lambeth 2005). The air campaign utilised large numbers of naval strike aircraft and enablers, a major USAF and RAF aerial refuelling effort, USAF bombers deployed from Diego Garcia and from the United States itself, and a wide range of space-based and air platform ISR collectors for targeting and situational awareness. Additionally, the CIA would use air power in the form of its armed MQ-1 Predator unmanned aircraft to locate and target enemy leadership. Afghan infrastructure not directly related to the Taliban was not targeted in order to avoid civilian casualties, manage perceptions of the war effort, and to avoid post-conflict reconstruction (Lambeth 2005).

The air campaign was executed in two phases. The first phase focused on a range of pre-planned targets including air defences, airfields, C2 and leadership facilities. These were attacked by a combination of Navy ships and strike aircraft, USAF bombers and US and British submarine-launched cruise missiles over the first weeks of OEF (Parliament. House of Commons 2001, Bereiter 2016). These initial strikes aimed to provide the United States with air superiority through the total destruction of the Afghan Air Force and its air defences and to eliminate obvious targets rather than to significantly disrupt, paralyse or destroy the Taliban, which, along with Al Qaeda had already largely dispersed from targeted locations (Lambeth 2005, Haulman 2015). The second phase of the air campaign shifted focus from fixed targets to time-sensitive targets. This was enabled by the air superiority already achieved and key to meeting the objective of removing the Taliban from power through its destruction. This

destruction was achieved through a combination of persistent air power in place over engagement zones across the country and directed by the growing numbers of deployed SOFs, and by enabling local opposition forces to advance and hold captured territory. The success of this strategy enabled the air campaign to focus on supporting the hunt for and elimination of Al Qaeda's presence and remaining Taliban forces in Afghanistan, ending with ISR and combat support to the large scale ground forces engagement, Operation *Anaconda*, in March 2002 (Grant 2005).

The air campaign element of Operation *Iraqi Freedom* shared a number of similarities with the new model employed for OEF. As with OEF, OIF's air campaign was situated within a broader joint operation – OPLAN 1003V – and tasked with a combination of strategic attack and support to ground forces through interdiction and CAS, and aimed for the 'elimination of the Iraqi Regime by pressuring Iraqi centers [sic] of gravity in order to create crises to which the regime cannot respond' (United States, CENTCOM 2003, 17, United States Air Force 2003). To achieve this, OPLAN 1003V focused on creating 'overwhelming effects by attacking simultaneously along several lines of operation' with the intent that the resultant 'series of dilemmas will quickly overwhelm the regime and force its collapse through higher operational tempo' (United States, CENTCOM 2003, 17). The air campaign aimed to apply pressure to all levels of the Iraqi state simultaneously and nationwide through multiple, complementary campaigns. The CENTCOM OPLAN identified Iraq's 'strategic center [sic] of gravity' as 'the regime; Baghdad; and the Security Forces / Intelligence Services structure', which collectively accounted for Iraq's means of power and control (United States, CENTCOM 2003, 6). Denial of Iraq's Scud capabilities in the west of the country was determined to be a 'strategic decisive point' and the lack of loyalty of the regular Iraqi Army as a 'critical vulnerability' that would force Hussein to concentrate orders through 'trusted agents within his security forces' (United States, CENTCOM 2003, 7).

Consequently the air campaign was directed towards 'strik(ing) key leadership targets focusing the weight of effort on internal security and regime support apparatus while maintaining the capability to strike the Iraqi leadership directly', attacking WMD targets, supporting SOF in the north of Iraq, countering the Scud missile threat in the west, and supporting the concurrent ground force invasion in the south through CAS (United States, CENTCOM 2003, 17-20, Grant 2004, Pirnie *et al.* 2015). It was executed over the first three phases of OIF, focusing first on suppressing Iraq's IADS to achieve air superiority, 'intrusive ISR' to enhance pre-invasion intelligence and planning, and countering fielded WMD systems, then on a second phase of attacks against strategic targets, leadership, regime security, and

interdiction of Republican Guard C2 and logistics to disrupt their manoeuvre, and a third phase 'countering Iraqi WMD capability... the destruction of regime security forces, and (the) defeat (of) opposing military forces' (United States, CENTCOM 2003, 22-30). Major infrastructure including the electricity grid and oil facilities were not targets of the strategic air campaign due to their post-conflict importance and the overall objective of swiftly occupying Iraq. This required paralysis of the regime and its means of control, not paralysis of the country as a whole. The strategic targets attacked during OIF were intended to have maximum impact on the ability of the Iraqi leadership to retain control and to resist the ground invasion. It was not designed to achieve victory in its own right. Instead, it curtailed the options available to the Iraqi leadership, removing its Scuds as an option for leverage, its air force to resist Allied air superiority and attacks, disrupted its C2, and degraded and demoralised the Republican Guard through persistent attack and interdiction (Grant 2004). Collectively, this significantly reduced the ability for Iraq's armed forces to mount an organised or substantial resistance to the ground offensive, resulting in the capture of Baghdad after three weeks of combat operations.

Analysis of the two strategic air campaigns of the early-2000s suggests several areas of particular interest for the direction of the concept of strategic air power. First, strategic air power was used as a means of removing the leadership of another state and affecting significant political change. This was well beyond the objectives sought through by the Western states in the Gulf War, Bosnia and Kosovo and was arguably closer in alignment to the fundamental tenets of modern strategic air power articulated by Warden. The means by which the Taliban controlled Afghanistan and Saddam Hussein controlled Iraq were identified and swiftly and simultaneously damaged or destroyed, in concert with ground forces, to affect a collapse of the system of control and create rapid political and military change. The full spectrum of air power capabilities was employed to achieve this, with particular emphasis on space-based and airborne intelligence collection and dissemination, C3, precision weapons, and force projection and persistence enablers, particularly aerial refuelling. The second area of interest is the creation of a new model of strategic attack. The OEF and OIF air campaigns both broadly followed the USAF's 1997 doctrinal guidance on strategic attack, conducting parallel operations, targeting and disrupting the Taliban's critical centres, producing wide-ranging effects and targeting politically significant fielded forces. The critical adaptation was to combine this with SOFs and the ground offensive, and extend the use of air power to provide a persistent and flexible interdiction in support of ground forces (Grant 2004, Lambeth 2005). The resulting new model expanded the potential for air power to have strategic effect by leveraging the impact of limited ground forces and permitting the occupation and retention of

territory. The United States played a critical and central role in both air campaigns. Indeed, USAF and US Navy capabilities were by design the near-exclusive providers of air power for OEF, primarily due to the United States' unique ability to generate air power at significant geographic distance for use in Afghanistan and in order to avoid the constraints that had been so apparent in the coalition environment of *Allied Force* (Lambeth 2005).

Two particular elements of the new model's use of air power are notable from across the two campaigns. First, the potential of conventional global strike, initially demonstrated in limited form during *Allied Force*, was realised and utilised widely to create strategic effect. The USAF's bomber force, operating from Diego Garcia and from the United States itself, successfully conducted long-range precision strikes against multiple pre-planned fixed targets and were also re-tasked to attack new targets of opportunity once in theatre (Grant 2004, Perry & Kassing 2015). This not only directly contributed to the strategic air campaign's goals but also created a strategic effect in its own right, demonstrating the credibility of the United States' conventional strike capabilities to other states as a tool of deterrence. The second notable area was the expansion of, reliance on, and possibilities offered by space- and air-based ISR capabilities. The United States employed capabilities including the Defense Support Programme reconnaissance satellites, SATCOM, GPS, JSTARS, *Rivet Joint*, U-2, P-3 *Orions*, Global Hawks and a wide range of other UAVs, and E-3 AWACS in significant numbers, particularly during OIF, in order to inform, direct and assess the air campaigns and to support ground operations (United States Air Force 2003, Grant 2003, 2004, Perry *et al.* 2015). The scale and depth of the intelligence and situational awareness created by these capabilities directly contributed to how the new model worked, permitting time-sensitive targets to be identified, tracked and attacked as never before.

Beyond the United States, the Allied contribution to OEF was deliberately limited in scope and, notwithstanding the contribution of SOFs, mainly focused on providing airborne enabling capabilities to support US operations. Britain and Australia both participated in OEF's air campaign. The British contribution, Operation *Veritas*, involved the deployment of enabling platforms – E-3 Sentry AWACS and aerial refuelling aircraft – intelligence-collecting Nimrod R1s / MR2s and Canberra PR9s, and a range of mobility and lift platforms (Great Britain, Ministry of Defence 2001). These platforms made a significant supporting contribution to the US air campaign, particularly in aerial refuelling (Great Britain, Ministry of Defence 2002). The RAF and FAA did not take part in or deploy offensive strike capabilities during Operation *Veritas*. Australia deployed four F/A-18s to Diego Garcia under Operation *Slipper*. The F/A-18s did not see combat operations in Afghanistan and briefly performed CAP duties before

being withdrawn (Australia 2007b). *Slipper* also featured a deployment of tanker aircraft to Kyrgyzstan to support coalition operations (Australia 2007b, Cameron 2009). This built upon Operation *Warden* in 1999 which saw the airborne insertion of Australian forces and the deployment of F-111 strike aircraft for reconnaissance missions in Timor-Leste, the first combat operations for the RAAF since the Vietnam War. The collective contributions to the OEF air campaign offered few direct lessons for the development of national strategic air power in Britain and Australia, beyond the operational experience provided for their enabling and expeditionary capabilities. Indirectly, operating alongside US air power engaged in a new model for warfighting in which the strategic air campaign, flexible and reactive targeting, direction by SOFs on the ground, and cooperation with local ground forces would be both required and need to be executed near-simultaneously, signalled a new direction for their own use of air power. For Britain and Australia the ability for their air power to operate within this new model would be immediately tested in Iraq.

Britain's contribution to OIF, Operation *Telic*, saw a much more comprehensive use of its air power than in OEF, particularly during the initial invasion in March and April 2003. The air component contained all types of RAF strike aircraft – Tornado GR4s, Jaguar GR3s, and Harrier GR7s – air defence aircraft, Nimrods, Canberras, and AWACS and tanker support (Great Britain, Ministry of Defence 2003b, United States Air Force 2003). The MoD published an initial lessons learned report on Operation *Telic* in December 2003 which outlined Britain's contribution to the strategic air campaign. The report noted that 'the UK assisted in the development of a list of over 900 potential coalition targets to overwhelm the Saddam Hussein regime and its security forces and to degrade the command and control capacity of the Iraqi Armed Forces' and that 'these targets included key military installations, weapon sites, command and control centres, notable regime targets and communications networks' (Great Britain, Ministry of Defence 2003a, 6.3). Targets were selected and attacked with an 'increased emphasis… placed on creating particular effects – possibly not destruction – and a significant proportion of targets were also mobile' (Great Britain, Ministry of Defence 2003a, 6.5). In contrast to the use of British air power during the 1990s, 'the extensive use of precision weapons was vital in delivering an overwhelming, high tempo and effects-based air campaign. Around 85% of RAF munitions used were precision guided… this demonstrates a huge leap forward in capability since the 1991 Gulf conflict, when the proportion of precision guided munitions was around 18%, improving to 25% for the Kosovo campaign in 1999' (Great Britain, Ministry of Defence 2003a, 6.6). All British air assets were pooled with those of the United States and placed under US command, with British officers part of the Air Component Commander's team (Parliament. House of Commons 2004, para 92). The Defence Select

Committee's report on the Lessons of Iraq noted the success of the air component's targeting practices, the high degree of influence British officers had with their US counterparts, and the speed and tempo of decision making as part of the broader air campaign to overwhelm Iraqi C2 (Parliament. House of Commons 2004, paras 94-97). It also noted the broad success of CAS which was able to provide the necessary support to coalition ground forces with high levels of precision, but that there were shortcomings in communications and the capability of British targeting pods relative to some of the tasks required (Parliament. House of Commons 2004, paras 99-104). The operational use of British air power during the 2000s reflected the results of the previous decade's defence reforms, aircraft upgrades and weapons procurements, and solutions found to the lessons of the Kosovo conflict. It was notably more integrated, more precise and more effects-driven than before. This affirmed the direction of British air power and its growing capabilities, with some elements – particularly those that supported the strategic campaign – performing particularly well, and others – notably aspects of CAS, intelligence gathering and communications – still lagging those of the United States.

Operation *Falconer*, Australia's contribution to OIF, included the deployment of RAAF F/A-18s to initially provide defensive counter-air (DCA) support to coalition tanker aircraft. Later this shifted to a swing-role of DCA and strikes against pre-planned targets and targets of opportunity (Australia 2003a, 26-27, Australia 2007b, 159-161). These strikes marked the first by the RAAF in 32 years and included its 'first deliberately planned strike mission' against targets at an Iraqi Republican Guard facility, alongside US and British aircraft, followed by three further missions 'against a variety of military targets including Iraqi Intelligence Service facilities' (Australia 2003a, 28). The use of Australian air power during Operation *Falconer* provided operational experience of limited strikes in line with the scope of the 2000 Defence White Paper's role for strategic attack. The White Paper stated, 'we do not intend to seek a strike capability large enough to conduct sustained attacks on an adversary's wider civil infrastructure; our capability would be focused on an ability to attack those militarily significant targets that might be used to mount or support an attack on Australia' (Australia 2000, 92). This was echoed in the fourth edition of the Air Power Manual released in 2002, which continued with the task of balancing strategic air power theory with its practical applicability to Australia's defence environment. Specifically, it acknowledged the potential for strike to have strategic effect and that 'strategic strike operations' can be used for the progressive destruction and disintegration of enemy capabilities (Australia 2002, 174). However, given the RAAF's offensive scale this was not an explicitly stated role and emphasis was placed upon striking 'enemy-occupied staging bases' on Australian territory and strikes against maritime targets which are not in contact with Australian or allied forces 'but posing an indirect or longer-

term threat' (Australia 2002, 176). The use of air power in Iraq gave credence to Australia's doctrinal tasks for its strategic air power as means of deterring an adversary from attacking and disrupting any invasion prior to or in the early stages of landing in Australia. It also enforced the credibility of the qualitative edge offered by offensive air power that underpinned its national defence. The British and Australian contributions and experiences of OIF provided a degree of confirmation about their respective capabilities, interoperability with their US ally and its contemporary approach to warfighting, and further direction for the future of their own national air power.

Perspectives: France, Russia & Israel

The French perspective on the post-9/11 defence environment and its implications for the direction of its air power was captured in the 2003 programming law that set out military spending and defence reforms for the following five years. The next White Paper on Defence would not be published until 2008 so the contemporary LPM offers the best view of French thinking at this time alongside assessments of the OIF air campaigns. Analysis of the OIF air campaign by Faury & Brenot (2006) concluded that the key elements to success were the responsiveness of air support to ground forces, the coordination of intelligence and firepower, and the management of air operations by specialised cells from across the armed forces. They further concluded that OIF demonstrated the innovation of the United States' AirLand Battle doctrine and its validation through operational success (Faury & Brenot 2006, 19). In the programming law, France reflected on the United States' increasing willingness and ability to act independently of NATO to address failed states and terrorist threats (France 2003, Part 1, Sec. 1.3). The implication of this was that the relevance of France and the rest of NATO to US security would diminish, and, through the United States' increased defence spending, the existing gap in relative capability would grow (France 2003).

This assessment had three direct implications for French air power. First, France would need to invest in highly mobile forces in order to project its own power and to have options in response to future threats. The rapid deployment of French air power beyond Europe in support of OEF confirmed that this was possible but limited. Operation *Pamir* deployed Mirage IVP reconnaissance aircraft from the UAE, supported by C-135FR tankers, and the subsequent naval mission *Héraclès* from November 2001 utilised carrier-based Super Etendards. In future, a larger force of 25 out of a planned 100 combat-ready aircraft would need to be deployed up to 5,000kms at three days' notice (France 2003, Part 1, Sec. 2.3.1.c)). Second, additional investment in a more capable range of airborne C3 platforms and systems was determined to be necessary as a result of identified shortfalls in capability from operations

in the Balkans and Afghanistan. This would include new Syracuse communications satellites, *Helios* IMINT satellites, aerial sensors, unmanned aircraft, upgraded DC-8 *Sarigue*s and new and upgraded AEW platforms (France 2003, Part 2, Sec. 2.1.2, 2.1.7). Improved ISR and situational awareness would both improve French capabilities, contributing to its core principle of freedom of action, and close the gap to the United States. Third, it confirmed the direction of French offensive air power in light of planned acquisitions of strike aircraft and precision weapons. Modernisation of the strike fleet was beginning through the introduction of the Rafale for first *l'Aero* and then the *Armée de l'Air*, which, alongside upgraded sensors and Mirage 2000s, permitted the concurrent retirement of the Jaguar, the Mirage F1 and the Mirage IVP fleets. In parallel, major development and acquisitions of precision weapons were also underway, including the SCALP EG and the AASM which would provide France with an all-weather precision strike capability and greatly expand France's conventional air power options against new, diverse adversaries (France, Sénate 2002, Section III E. 1, France 2003, Part 2, Sec. 2.1.4).

The Russian perspective of this period concerned the growing threat from the conventional forces and power projection of NATO. In 2003 the Ministry of Defence released a report, *'Aktualnyye Zadachi Razvitiya Vooruzhennykh Sil RF'* [Actual Development Tasks of the Armed Forces of the Russian Federation] which reflected on the first phase of post-Cold War defence reforms, Russia's defence environment and threats, and incorporated lessons identified from the initial phases of OEF and OIF (Russia 2003). This report built upon the environmental assessment articulated in the 2000 National Security Concept and the accompanying Military Doctrine, in which NATO and its increasing global role and interventions are identified as a major external threat to Russia's interests and in which nuclear weapons provide deterrence against large-scale conventional attacks (Russia 2000a, 5, Russia 2000b, 7). In addition, the necessity of continued and expanded reforms to the conventional armed forces is noted, with air power a significant focus. Contemporary conflicts demonstrated to the Russian Ministry of Defence the primacy of air power, the importance of the initial phase of conflict in which air power can maximise its effect and be decisive, and the necessity of targeting – in the broadest sense – the adversary's C2 and population rather than just military forces, including through information warfare and electronic attack (Russia 2003, De Haas 2011). Specifically, the 2003 report stated that Russia must be able to counter the conventional capabilities of its adversaries through 'the capability to strike military assets of the enemy (with) long-range high-precision weapons (and a) long-range Air Force outside the immediate area of conflict. To achieve this, (we) need both our own long-range high-precision strike capability and other assets that enable (us) to transfer hostilities directly to enemy

territory' (Russia 2003, 32). This emphasis on conventional capabilities reflected not only the high-end threat from NATO's own conventional forces but also the lessons from the Second Chechen War, which emphasised the potential of air power to significantly contribute to joint air-ground operations, and the related, broader threat from irregular adversaries and terrorist groups (De Haas 2011). Countering both high- and low-end threats would require significant additional reform of the Russian armed forces and investment in modern precision weapons, platforms, systems and associated training over the next decade.

For Israel, the 1990s had not featured any significant operations that required the use of its air power. The consequence of this was the erosion of the IDF's warfighting capabilities generally and a drift away from the traditional emphasis on operations to inform defence thinking and development (Shamir 2018). This in turn created a gap in which theory could be explored as a means of directing Israeli warfighting, including its air power. Theory development in the early-2000s was based on the work of Naveh at the Operational Theory Research Institute and his Deep Operation-influenced Systemic Operational Design as a means of planning and directing operations, combined with the growing influence of US warfighting's emphasis on technology to dominate and control the battlefield. Israel's thinking on air power, as with warfighting more generally, was converging with that of the United States, reflected in a growing number of similar challenges including terrorism and non-state actors and on solutions leveraging technology, intelligence and firepower. A new generation of IDF officers, lacking in direct operational experience, worked jointly with their US counterparts on exploring the revolution in military affairs and were attracted to the solutions it offered (Gracier 2017, Shamir 2018). The application of strategic air power to rapidly defeat the Taliban in 2001 and Iraq in 2003 further convinced the theoreticians in the IDF of the need to emulate US theory and Naveh applied his work on SOD to IDF doctrine from 2000 to 2005 (Shamir 2018).

Concurrently, in 2003 the IDF launched a five-year development plan with its core aim to balance the traditional manoeuvre warfare approach with firepower provided by precision weapons and intelligence (Catignani 2004). This reflected the non-state threats faced by Israel in which rapid sensor-to-shooter reactions would be required, reductions in the personnel and equipment capacity of the IDF, and a shift to technology-driven multirole capabilities (Catignani 2004). Due to the continued focus on armour and the ground forces in IDF strategy, reform was primarily directed towards the IAF whose professional structure, capabilities and tasks were predisposed to a more technologically-driven precision-approach to warfighting. Concurrently with theory development and defence reform, Israeli air power was used operationally in the West Bank and Gaza during the Second Intifada, 2000-05. There was an

increased use of air power relative to earlier interventions against Palestinian groups, with the IAF tasked with operations against missile sites that would historically have been assigned to the ground forces (Brun 2011). Air power was used for significant numbers of targeted killings, continuing a long-standing security policy, but again extending the means of doing so from ground forces and intelligence officers to the IAF (Kober 2006, Bergman 2019). Limited air strikes on Palestinian infrastructure were also carried out to weaken the Palestinian Authority and force them to reign in militant groups (Brun 2011).

Conclusions

The era of intervention was a period of significant and far-reaching change in the development of modern strategic air power. In nine years, five different strategic air campaigns were conducted, directly featuring five of the six case study states. Strategic effects from cost/benefit manipulation to system paralysis to system destruction were attempted in practice. The breadth and depth of states' air power capabilities grew, often in parallel with reductions in overall capacity, and programmes of reform made changes ranging from the basic reorganisation and reconstruction of Russian air power to the development of expeditionary-capable, precision strike-focused air power in Britain, France and Australia. Having established a new baseline understanding of the concept in the aftermath of *Desert Storm*, the case study states tested this in practice during this period. The era of intervention largely confirmed the approaches taken, with air power able to make substantive contributions to the achievement of national strategic objectives. Consequently, this period was marked by incremental changes to the baseline understanding of strategic air power in most cases. This included iterative updates to doctrine in the United States, Britain and Australia, and capability improvements and investments in all cases. In Russia though, a more substantive set of reforms established its first post-Soviet baseline position for air power and strategic effect that was then tested in Chechnya. Beyond the case study states, the operational experiences of this period had long-term significance and implications for the concept's development in three areas.

First, the scale and tempo of air power's use in conflicts increased during this period, generating large amounts of empirical data and feedback on strategic air power as a concept, its collective capabilities, and associated doctrine and theory. This was analysed during and after operations, influencing the direction, emphasis and frequency of reforms, developments, procurements and updates to national doctrine. Consequently, progress in areas including intelligence collection, precision firepower, interoperability and targeting accelerated. Second, significant progress was made on improving sensor-to-shooter timescales. This was enabled by broad technological progress in intelligence collection, fusion and dissemination, joint C2,

the increased persistence of manned and unmanned air platforms, the proliferation of precision weapons, and increased air-land cooperation particularly with SOFs. It was underpinned by investments made during the second phase of defence reforms and the necessity of making improvements in light of the demands (and noted failures) of tracking Scuds during *Desert Storm* and the fielded Yugoslav Army during *Allied Force*. Improvements in sensor-to-shooter times varied, with the United States enjoying the most sophisticated and comprehensive capabilities, but in all six states improvements were made, and, crucially, the consequences of progress were the same. Specifically, time-sensitive targeting became far more viable by the early-2000s and a central feature in both OEF and OIF as well as for Israel during the Second Intifada. Third, there was an increased emphasis on precision weapons by all six case study states, and with it, a common experience of the strategic and battlefield effects made possible through their employment, as well as their limitations. The extensive operational use of precision weapons during this period validated their unique role in enabling strategic attack, strategic effects and conventional deterrence, and confirmed them as a driving factor in modern strategic air power's development. However, operational practice also contained multiple warnings and limitations. These concerned environmental conditions, enemy adaptation, legacy platforms, the measurement of effects, the growing complexity of their use, and the risks of politicised targeting and control.

From these three areas, two new factors in modern strategic air power's development emerged during the era of intervention. The first factor was the compression of the air power development cycle in response to operational experience, and the consequent emergence of new and improved capabilities. The relative frequency of operations, the substantive air power reforms made in all six states, and further technological developments in areas including precision, computing and communications, combined to create a virtuous circle of rapid capability and conceptual development. Strategic attack doctrine and capabilities were applied in practice, albeit to varying degrees, the data generated and lessons identified analysed, changes made, and new doctrine, reforms and capabilities applied during subsequent air campaigns. The United States was the primary beneficiary and driver of this factor in light of its substantive contributions to the air campaigns in which it was involved but all of the case study states benefited to some degree, both directly and indirectly.

The second new factor was the revolutionary improvement in sensor-to-shooter timescales to create new options for targeting and control. As discussed, this was enabled by technological progress, advances in intelligence gathering and processing, underlying air power reforms and operational necessity. Aside from making air support and interdiction more reactive to

changing conditions on the ground, time-sensitive targeting could be applied directly to enemy leadership and other high-value personnel. This in turn created new options for strategic attack, offering the potential of system paralysis through decapitation strikes, a concentrated focus on the first of Warden's five rings, and a shift in strategic air power's emphasis. Alongside the compressed air power development cycle, this would become central to the direction of warfighting in the coming decade.

CHAPTER 4 The Limits of Strategic Air Power (2003-2011)

The application of modern strategic air power theory in practice from 1990 until the early-2000s had broadly followed Warden's theoretical framework, albeit with national variations and circumstantial, political modifications. It had been applied in well-planned air campaigns against broadly well-understood state actors (with the exception of Russia's wars in Chechnya). By 2003 this had begun to change. The operational focus shifted to a combination of counterterrorism and counterinsurgency, featuring disparate, flexible and adaptive actors, sometimes state-backed, often able to blend into civilian populations, and intent on disrupting or destroying the fledgling or established orders in Afghanistan, Iraq and Israel. Air power continued to be at the centre of political-military efforts to counter these actors. Consequently, the operational experience of the preceding decade's strategic air campaigns was applied in radically different circumstances and guided by the combined doctrines of air power, counterterrorism, and counterinsurgency. Although air power could ostensibly make major contributions to both in Afghanistan and Iraq – not least through the revolutionary advances in precision weapons, intelligence fusion, and time-sensitive targeting – achieving strategic effect became problematic. Operations exposed the tensions between modern strategic air power theory, counterterrorism and counterinsurgency, specifically in their objectives and the methods employed to achieve them. They also highlighted a divergence between the expected strategic effects and outcomes against terrorist and insurgent groups and a reality in which these groups adapted, survived and exploited air power's failures. This period also presented new challenges for Israeli air power against a hybrid adversary during the Second Lebanon War of 2006, and for Russian air power in the 2008 war with Georgia, a qualitatively well-armed, well-trained neighbouring state.

Collectively, operations during the 2000s revealed a number of challenges and limitations to modern strategic air power. Parallel discussions by academics and military officers attempted to offer new solutions, approaches and methods, drawing upon earlier strategic air campaigns as well as contemporary operations. These discussions offered original ideas, deep analysis, and guidance for future doctrine, but also added to the growing complexity and broadening of theory. A third phase of reforms to national air power followed in the late-2000s, including numerous updates to doctrine to reflect both the operational experiences of Afghanistan, Iraq, Lebanon and Georgia, and some of the ideas originating from discussions on theory. From the complexity, challenges and limits of this period the post-Cold War consensus on the broad direction, approach and tenets of strategic air power gave way to divergence, and from this divergence those states that had been able to quickly learn lessons from short air campaigns began to adapt. Both Russia and Israel enacted reforms that put into practice a more limited,

focused application of strategic air power that provided alternative models for operations to the prevailing counterinsurgency direction.

Strategic Air Power & Non-State Actors: Counterterrorism & Counterinsurgency

In the immediate aftermath of the strategic air campaigns against Afghanistan and Iraq, and the collapse of the Taliban and Hussein governments respectively, a distinctly different period of operations began. The United States, Britain, France and Australia directed their air power against non-state actors who were intent on threatening and disrupting the post-war order. Operations were focused on countering the terrorist threat from the Al Qaeda network in Afghanistan and its offshoots in Iraq, and on countering the growing insurgencies led by the Taliban in Afghanistan from their bases in Pakistan and from a variety of sectarian, Baathist and externally-backed groups in Iraq. The impact of addressing a radically different set of adversaries and the conflation of counterterrorism and counterinsurgency tactics to do so had a significant and wide-reaching impact on the direction of strategic air power during the 2000s. In order to have strategic effect, air power was focused on two linked but distinct tasks: disrupting and destroying the leadership and other high value targets within Al Qaeda, its affiliates, and the Taliban's leadership; and on providing security to the fledgling administrations in Afghanistan and Iraq through direct strikes, deterrence and support to ground operations against the fielded forces of insurgent groups. To prosecute these two tasks, and led primarily by the United States, air power drew upon a broad range of defence and security doctrine, thinking and theory. This included counterterrorism strategy, late-Cold War nuclear strategy, counterinsurgency and irregular warfare doctrines, Warden's ring theory, and an 'enhanced' tactical focus for air power that had emerged from capability developments and operational experiences in the late-1990s and early-2000s. The result was a complex, somewhat disconnected use of air power, in which competing objectives in combination with a diverse, dynamic range of adversaries exposed several limits and issues for the modern concept of strategic air power.

The use of air power against Al Qaeda, its affiliates, and the Taliban leadership was directed by contemporary counterterrorism strategy. This emphasised the necessity of decapitating the organisation's senior leaders in order to reduce its capability to organise, to disrupt operations, force resources to be shifted towards leadership protection, and to deter action, with the potential for organisational collapse to result (Price 2012). Decapitation aims to reduce the effectiveness of a terrorist group rather than destroy it outright, exploiting the closely-connected nature of the group's organisation, and the leaders' outsized role in strategy, planning and recruitment as well as their personal symbolism (Johnstone 2012, Price 2012). It should be noted that there is a debate within the field about the effectiveness of decapitation

as a strategy, with analyses of large data sets, diverse groups, and long time periods producing a variety of results that both support and undermine the case for decapitation; these include work by Byman (2006), Johnstone (2012), Price (2012), Jordan (2014) and Yaoren (2019). Until the early-2000s, decapitation and conventional air power were not closely associated. Timely intelligence on a leader's whereabouts, sufficiently precise means of attack, and proximity to the target had constrained such operations. The United States' (failed) strike against Libyan leader Colonel Gaddafi's residential compound at Bab al-Aziziyah barracks, Tripoli, as part of Operation *El Dorado Canyon* in April 1986, provides one of the few historic examples (Endicott 2000). Instead, operations were either conducted by intelligence agents or special forces on the ground – for example Israel's Operation *Wrath of God* and the assassination of leaders in various Palestinian militant groups – or constituted an element of nuclear strategy, as in the case of the United States' focus on the Soviet leadership in late-Cold War nuclear targeting (Bergman 2019, Ball & Toth 1990). The combination of capability developments and operational experience in the late-1990s and early-2000s changed this. The advances made in precision weapons, in intelligence gathering and fusion, and in persistence through the development of unmanned aircraft, combined with the application and refinement of time-sensitive targeting, made air power a viable method of conducting decapitation strikes by the early-2000s. In addition, the broader counterterrorism tactic of High Value Targeting (HVT) in which both kinetic and non-kinetic effects are applied to key personnel, assets and capabilities of a terrorist organisation with the intent of disrupting operations, were also increasingly possible from the air (Lushenko 2015). There is a clear theoretical overlap between modern strategic air power's focus on the exploitation of systems to disrupt and paralyse, and indeed on Warden's primary focus on leadership and its command and control of the system in his rings model, and counterterrorism's focus on decapitating the leadership to maximise disruption within the terrorist group's system. This overlap became the central element in the United States' use of air power against Al Qaeda, its affiliates, and the Taliban leadership in Afghanistan and Pakistan in the 2000s.

In parallel to air power's role in counterterrorism, strategic effect was also sought through air power's contribution to counterinsurgency operations. In contrast to counterterrorism operations which are broadly seeking negative objectives – disruption and collapse of the group through direct attacks – counterinsurgency operations are broadly seeking to achieve positive objectives related to ensuring the security of the population and the stability and legitimacy of the government. Achieving this distinction and these goals are difficult. As Vick *et al.* (2006) note, insurgency and counterinsurgency are competitions for the legitimacy of governance, through which both sides seek to weaken or destroy the power and legitimacy of

the other whilst simultaneously increasing their own, and in which the population is the central feature. Air power's contribution to counterinsurgency during the 2000s included providing a broad, persistent ISR capability through both manned and unmanned platforms in order to monitor, understand and predict insurgent behaviour, CAS to ground forces engaging insurgents, counter-IED operations, direct targeting of fielded forces, and contributing to HVT against insurgent groups' organisations (Schwartz 2011). This contribution was guided by both the US Army-Marine Corps. Counterinsurgency doctrine, FM 3-24, published in December 2006 and by the USAF's Irregular Warfare doctrine, AFDD 2-3, published in August 2007. FM 3-24 states that 'airpower [sic] can contribute significant support to land forces conducting counterinsurgency operations… provid(ing) considerable asymmetric advantages to counterinsurgents' (United States 2006a, E-1, E-2). Air power's roles include strike, intelligence collection, air and space operations including EW and influence, and airlift, using a combination of high- and low-technology assets (United States 2006a). Army counterinsurgency doctrine urges a high degree of caution when employing air power for strike missions, noting that 'bombing, even with the most precise weapons, can cause unintended civilian casualties... an air strike can cause collateral damage that turns people against the host-nation government and provides insurgents with a major propaganda victory' (United States 2006a, E-5).

Crucially, FM 3-24 framed air power's role as limited, supportive and essentially tactical, and in doing so failed to leverage the inherent advantages and potential for strategic effect offered by contemporary air power. The Army's counterinsurgency doctrine was criticised accordingly by senior USAF officers including Major General Charles Dunlap, and spurred the creation of the USAF's own irregular warfare doctrine (Dunlap 2007, Berg 2007, United States 2007c). AFDD 2-3 covered both counterinsurgency and counterterrorism, acknowledging that the former will be complex, population-focused, largely made up of non-kinetic actions, intelligence-intensive, and may feature the latter to counter elements of the insurgents' own strategy (United States 2007c, 8-13). Strategic elements of the USAF's contribution to irregular warfare are noted as the rapid engagement of 'time-sensitive and high-value targets… (to which) applying lethal and non-lethal options at certain times may dramatically influence the outcome of operations on the ground', particularly when targeted against 'insurgent leaders and active supporters', as well as providing security to the national government, and limiting the enemy's options (United States 2007c, 16, 20-24).

Central to the means by which air power was used for counterterrorism and counterinsurgency operations during this period was the development of 'enhanced' tactical capabilities in the

late-1990s and early-2000s. As discussed, one of the long-term implications of Operation *Allied Force* was the expectation that time-sensitive targets, often mobile and fleetingly available to engage, could be identified and precisely attacked from the air with the expectation of creating strategic effect. The Allies reflected this in their lessons learned from *Allied Force* and invested in improvements to their sensor-to-shooter capabilities to improve target identification, the distribution of data to enable collaboration between platforms and systems, and to greatly reduce the timescales involved before a strike. Thus, the spectrum of capabilities that had been developed as the core of modern strategic air power were progressively improved to enhance their short-term, reactive, *tactical* application on the battlefield. This had a significant consequence for the direction of modern strategic air power, offering the potential to deliver effects at the strategic level – and to contribute to the achievement of national objectives – without the necessity of a large-scale, complex strategic air campaign, and its associated capability and logistical footprint. Potentially, with 'enhanced' tactical means, air power could utilise relatively small numbers of platforms, including unmanned aircraft previously used solely for ISR, appropriately armed and sufficiently directed by timely intelligence, to reactively strike at the centres of gravity within an adversary's system when opportunities were presented. The advantages provided by modern strategic air power of simultaneity of attack, parallel warfare against all levels of the adversary's system, and the resulting nuclear-type effects of system paralysis or destruction – and with them control – would not be possible, but the expectation was that limited counter-personnel and counter-force targeting would create sufficient strategic effects in the context of the operating environment. This was well-suited to the aims of counterterrorism and counterinsurgency operations in this period. Notably, it was not the USAF or an Allied air force that most enthusiastically adopted or exploited this new capability, but the Central Intelligence Agency (CIA).

The CIA's interest in utilising unmanned aircraft for counterterrorism strikes was founded on the gap between real-time ISR collection to identify targets during Operation *Allied Force* and the ability to strike such targets using weapons fired by secondary airborne or naval platforms (Williams 2010). Consequently, the unmanned MQ-1 *Predator's* ISR capabilities were augmented with a pair of laser-guided AGM-114 *Hellfire* missiles for the CIA's use, first against Al Qaeda and pro-Taliban warlords in cooperation with USAF strikes in the early stages of OEF, and then to successfully track and assassinate senior Al Qaeda operative Abu Ali al-Harithi in Yemen in November 2002 (Risen & Miller 2002, Williams 2010). These successes showed the potential for CIA operations against Al Qaeda, the Taliban and affiliated groups in north-western Pakistan in support of the broader conflict in Afghanistan. Strike operations

began in 2004 and slowly increased in frequency until 2008 before significantly increasing to peak at an estimated 117 strikes in 2010 (Long War Journal 2021). The quantity and quality of the CIA's strike capability grew with the introduction of the MQ-9 *Reaper* in 2007 which was able to carry eight *Hellfire* missiles or be armed with a variety of larger precision guided bombs. Analysis suggests that the majority of the CIA's strikes were counter-personnel, with some counter-value strikes as well, launched in cooperation with CIA units on the ground working with local tribes for direction, intelligence and targeting (Williams 2010). The strategic impact of the CIA's unmanned strike operations was to deny safe havens to the enemy beyond the Afghan theatre, to disrupt planning and operations, to apply psychological pressure on the enemy leadership, and to remove key figures from Al Qaeda, the Taliban and affiliated, supporting groups such as the Haqqani network (Jordán 2014).

That the CIA was able to develop, deploy and utilise unmanned aircraft, precision weapons and benefit from an extensive network of airborne intelligence and enabling capabilities, largely rested upon capability developments in the 1990s and early-2000s associated with strategic air power. Precision strike, decreased sensor-to-shooter timescales and networked platforms developed to improve strategic effect also created the means by which 'enhanced' tactical missions, narrowly-focused and applied, could be executed. This is what the CIA was able to leverage for its own counterterrorism ends, including the strategic disruption and potential paralysis of Al Qaeda and the Taliban in Pakistan. However, the limited range of targets – which were predominantly personnel – and the small number of strikes – only 389 between 2004 and 2015 – limited the potential for strategic effects to the denial of large-scale attacks at distance but not the defeat or severe curtailment of Al Qaeda as an organisation or the Taliban's insurgency in Afghanistan (Long War Journal 2021). Nonetheless, the impact of the CIA's unmanned strike operations on the direction of strategic air power during this period cannot be ignored. It demonstrated the potential for unmanned strike to combine persistence with precision, particularly against time-sensitive, fleeting targets, the ability for air power to be used outside of the defined battlefield when airspace isn't contested, and the low-risk, low-cost benefits versus manned platforms. The USAF mirrored the CIA's adoption of armed unmanned aircraft, introducing the MQ-1 *Predator* in 2002 and the MQ-9 *Reaper* in 2007 (United States Air Force 2015a, 2015b). The conceptual impact was equally significant: the 'hunter-killer' function of strike platforms, reactive counter-personnel targeting, and the absence of a broader air campaign combined to redefine how strategic effect should be delivered against non-state actors. This would be influential in how air power would be applied to countering the Islamic State in the 2010s.

The use of air power to support counterinsurgency operations in Afghanistan and Iraq exposed several limits and issues with modern strategic air power theory. The first limit was the challenge of creating strategic effect against dynamic, dispersed systems, as embodied by Al Qaeda, the Taliban, and the myriad insurgent groups in Iraq. The predominant focus of modern theory on affecting state systems, complex in nature but reasonably well-understood, with identifiable centres of gravity against which broadly measurable effects could be targeted, was not directly replicable against non-state actors. Their structures, methods of operation, dispersed nature and ideological underpinnings presented significant challenges to conducting a modern strategic air campaign against them, and to achieving sufficient disruption, paralysis or destruction to achieve strategic objectives. This shortfall in theory – and in the doctrine of the Allied air forces – created a gap in which new actors directed air power in the context of counterterrorism and counterinsurgency doctrine in an attempt to produce strategic effects.

In this application of air power lies the second limit: the attempt to 'shortcut' how strategic effect was achieved by only focusing air power on attacking enemy leaders and providing reactive strikes against fielded forces, rather than identifying and attacking the adversaries' broader systems of power and support. The rationale for a narrower focus was rooted in the CIA's counterterrorism strategy, predicated on decapitation as a legitimate and effective means of creating strategic disruption, and the US Army-Marine Corps counterinsurgency strategy which guided coalition operations and in which air power's effectiveness was primarily considered to be in non-kinetic support and limited, on-call force protection tasks. That such limited approaches to targeting were considered sufficient to achieve the desired strategic objectives in Afghanistan and Iraq in the mid-late 2000s pointed towards a third, underlying issue within the concept: the 'paradox of precision', in which greater targeting accuracy does not lead to clearer, better or necessarily strategic outcomes. This paradox resulted from the creation of 'enhanced' tactical capabilities which could reactively target individual actors or engaged fielded forces with the consequent expectations of strategic-level effects. In practice, effects were short-lived, limited in scope, and essentially tactical, constrained by a combination of a narrow focus, related rules of engagement and doctrinal guidance, and a failure to understand and target the vulnerabilities of adversaries beyond their leaders and active forces.

The result of these limits and issues was to change the direction of modern strategic air power during this period. Despite the continuing evolution of the concept in Allied air power doctrine in which offensive actions, strategic-level effects, and EBO remained central, the practical application of air power for strategic effect through the narrow lenses of counterterrorism and

counterinsurgency reframed strategic air power as indistinct from tactical air power. The consequences of this were reflected in theory, doctrine and operations into the 2010s.

New Challenges: A Hybrid Adversary & A Capable Opponent

During the mid-late 2000s both Israel and Russia used their air power capabilities to address two new challenges. In 2006 Israel engaged in a second war in Lebanon and in 2008 Russia launched a combined-arms offensive against Georgia. Israel's war with the state-backed, militant group Hezbollah in Lebanon was operationally influenced by the Second Intifada and guided by doctrine theoretically influenced by Naveh's SOD. Neither provided the necessary experience or guidance to successfully fight Hezbollah. The successes of Israeli air power in the Second Lebanon War were outweighed by its failures, highlighted through Hezbollah's continued adaptation, survival and exploitation of the limits of Israeli air power and the political constraints placed upon it. In contrast, Russia fought its brief war with Georgia after nearly a decade without a major operation, with a quantitatively significant combined force, and against a capable opponent armed with relatively modern weapons. The 2008 Russo-Georgian War highlighted both the failure to invest in the VVS and associated intelligence and enabling capabilities in the broader armed forces since the Second Chechen War, and the significant limits the VVS still faced in providing Russia with a credible strategic air power capability. Through these two campaigns, three broader limits and issues within modern strategic air power were highlighted, concerning strategic effect, the paradox of precision, and the adversary's ability to influence and reduce operational options.

The early-mid 2000s saw Israeli air power used against non-state actors in two conflicts: the Second Intifada and the Second Lebanon War. With the rise of non-state actors, willing and able to strike at Israel from within, Israel's preferred strategy of offensive manoeuvre became increasingly difficult and unsuited to striking decisively against adversaries that refused to accept defeat and which used insurgent tactics. In parallel, the approach to warfighting demonstrated by the United States which emphasised long-range strike enabled by stand-off weapons and highly capable delivery platforms and intelligence, was increasingly noted in Israel in the context of Naveh's SOD theory of warfighting and incorporated into IDF doctrine (Shamir 2018). This approach emphasised Israel's qualitative advantage in air power platforms, weapons and intelligence gathering, could create the space for ground forces to fight the adversary when necessary, reduce risks to IDF personnel, and have battlefield effects in its own right. Elements of this air power-centric, precision weapons-led approach were emphasised during the Second Intifada in Gaza and the West Bank in the early-2000s through long-range missile strikes by the IAF against fleeting targets and enemy leaders. The relative

and perceived success of this strategy influenced the approach Israel took to the subsequent conflict with Hezbollah in southern Lebanon (Kober 2006, Brun 2011). Thus, air power was at the forefront of a revolution in Israeli warfighting, guided by a new SOD-influenced doctrine that planned for systemic disintegration through precision firepower in order to achieve rapid and decisive control over its adversaries. Initial operations in 2006 were solely conducted by the IAF and the first phase of strikes against Hezbollah long-range missiles, infrastructure, and command buildings in Dahiya, Beirut, were highly successful (Israel, Ministry of Foreign Affairs 2006a, 2006b, 2006c, Kober 2008, Brun 2011, Gabrielsen 2013). With the initial strategic targets destroyed as planned, the IAF was tasked with a second phase of actions. to meet broad, ambitious political objectives. These were to locate and destroy over 12,000 short-range missiles and their launchers, and to defeat Hezbollah in southern Lebanon, and operations shifted to focus on launch sites, their supporting infrastructure, and military vehicles (Israel, Ministry of Foreign Affairs 2006d, 2006e, 2006f). Despite the number of targets hit, the objectives were not feasible given the operational challenges of locating so many potential and relatively mobile targets and without a parallel, supporting ground offensive. Consequently, the failure of the IAF to prevent Hezbollah firing missiles, and the large-scale but severely time-constrained ground invasion at the end of the war, shortly before a ceasefire came into force, framed all aspects of the conflict as a failure for Israel (Matthews 2008, Gabrielsen 2013).

Israel conducted a civilian-led post-conflict inquiry into the Second Lebanon War. The Winograd Commission concluded that there had been a dislocation between the political aims and the military means used, coupled with a lack of preparedness by the IDF, particularly the army, and an over-reliance on technology (Winograd Commission 2007, 2008). Contextual influences on these failures were drawn out in several post-conflict critiques, in particular: the IDF's adherence to post-heroic warfare, with the objective of avoiding casualties dictating operations; the impact of conducting policing actions for the past 20 years against weak adversaries rather than combat against a sophisticated and well-armed enemy; the reliance on air power-delivered firepower over traditional ground-centric offensive manoeuvre and the unquestioned adoption of untested technological solutions, all linked to SOD theory and EBO; and the consequences of control warfare in which territory was not occupied but controlled at distance, but which was perceived as an Israeli military failure and exploited by Hezbollah (Kober 2008, Matthews 2008, Vego 2009, Brun 2011, Gabrielsen 2013, Shamir 2018). Thus, for Israeli air power and its concept of strategic air power, the Second Lebanon War was highly negative despite some significant successes in the opening phase of the conflict, and despite large parts of the post-conflict analysis exposing broader political and military failings. The

erosion of deterrence and the lack of a decisive outcome to a conflict in which air power played the central role, built upon an expectation that precision firepower could deliver such an outcome, prompted a shift back towards a more balanced IDF in which air power and ground forces would act in concert.

Two years after the Second Lebanon War, Russian air power faced the challenge of operating against Georgia, which although a small state, had built itself a qualitatively competitive military force. This conflict occurred nearly a decade after the Second Chechen War and its inferred objectives were 'to end Georgia's sovereignty over Abkhazia and South Ossetia permanently, to cripple the Georgian armed forces, and to end Georgia's drive to join NATO' (Cohen & Hamilton 2011, 13). This was to be achieved through a large-scale, pre-planned combined-arms assault featuring a ground and naval invasion supported by cyber, information, and air operations. The air campaign combined elements of strategic attack, interdiction and CAS. Unlike the Second Chechen War which was fought against relatively weak separatists, the war with Georgia pitted Russia against a state armed with a combination of Russian- and Israeli-built air defences, a legacy Soviet-equipped air force upgraded by Israel, and Western-trained and -armed ground forces. Although strategically outmatched and quantitatively inferior, Georgia's qualitatively comparable forces challenged the operational capabilities of the VVS. Russia committed some 300 combat aircraft to the air campaign, including Su-24 *Lancer* and Su-25 *Frogfoot* ground attack aircraft, Su-27 *Flankers* for air superiority, and Tu-22M *Backfire* long-range bombers (Kojori 2008). The VVS was given a wide range of tasks. These were: to achieve air superiority against Georgia's small air force of Su-25 strike aircraft and L-39 jet trainers; attack strategic targets including air and naval bases, military infrastructure, and aircraft production; interdict Georgian forces; provide CAS to the ground assault; and to transport personnel and materiel to the region (Cohen & Hamilton 2011). The strategic attacks had the twin goals of disrupting Georgian resistance to the combined ground and naval invasion and supporting Russia's broader strategic goal of preventing Georgia's future entry into the NATO alliance (Kojori 2008). Strategic effect was also demonstrated through the continuation of tactics used during the Second Chechen War, with Russia combining the rapid manoeuvre and concentration of its ground forces with 'massive air and artillery attacks against Georgian forces' to produce a 'significant shock effect' (Cohen & Hamilton 2011, 34).

Despite the achievement of Russia's strategic goals in Georgia and the contribution of the VVS to gaining air superiority, conducting relatively successful interdictions, and playing a crucial mobility role, much criticism was levelled against it from within Russia and by Western

commentators. Areas highlighted in post-conflict analysis by the Russian armed forces focused on the severe limitations of the precision weapons available and used, the quality and use of intelligence for targeting, and interoperability and communications shortfalls between the VVS and the other branches of the armed forces (Cohen & Hamilton 2011). The consequences of these limits and shortfalls translated into battlefield failures. These included: the loss of at least seven combat aircraft to Georgian air defences; the loss of a Tu-22M whilst conducting battlefield ISR in the absence of dedicated assets; strikes against civilian infrastructure due to poor intelligence and a reliance on unguided weapons; the lack of precision weapons and the failure of those available due to poor weather and limited satellite coverage; and outdated intelligence leading to attacks on unoccupied airfields and few attacks on those operationally active (Kojori 2008, Pallinn & Westerlund 2010, Cohen & Hamilton 2011). The 2008 Russo-Georgian War highlighted Russia's failure to invest in its air power post-Chechnya, as well as broader issues and failures within the post-Soviet armed forces that were still in need of resolution. Consequently this triggered a period of significant, far-reaching reform and investment starting the following year.

As with the Allied use of air power to conduct counterterrorism and counterinsurgency operations in Afghanistan and Iraq, Israeli and Russian operations also revealed limits and issues for modern strategic air power. Israeli air power faced the twin issues of sufficiently effecting a dynamic, dispersed system of power and the disconnection between precision and effect. As discussed, the former issue was a general limitation of modern strategic air power theory in this period, which was then combined with the myriad rules of engagement that Israel placed upon the IAF during the Second Lebanon War. The latter issue also echoed the Allied experience, with Israeli air power sufficiently capable of striking Hezbollah's long-range missiles and other strategic targets but unable to materially affect the adversary's ability to fight when it was refocused against fielded forces. In the Israeli case, the expectation of strategic effect was rooted in the SOD theory that influenced operational planning and the military-political confidence that firepower alone, delivered from distance, could defeat Hezbollah. However, the number of targets to be identified and rapidly struck before they dispersed overwhelmed the IAF. In switching to an essentially tactical hunt for individual missile launchers, significant time and resources were expended with little hope of strategic effect for Israel but which provided the adversary with a means to claim victory.

In the case of Russia's brief war with Georgia, and to a lesser extent the IAF experience in the Second Lebanon War, a further limit on the application of modern strategic air power was revealed: the adversary's ability to limit or dictate operational options. Although the adversaries faced during the 1990s and early-2000s had been able to influence operational

options to varying degrees, operations against a well-resourced hybrid adversary and a capable opponent emphasised the myriad ways in which this influence could be used and, in both cases, shaped the extent to which air power could produce strategic effect. In short, the challenges faced provided some insights into the future battlefield. In Georgia, these challenges included operating in contested air space in which modern air defences, combat air platforms, weapons and systems procured from the attacking state itself operated, the resultant curtailing of freedom to manoeuvre and limits imposed on the attacker in locating and hitting some key targets. The limiting of operational options for the IAF in Lebanon was less influenced by modern military systems than by the adaptation of Hezbollah, its dispersed method of operating, and use of information operations to exploit the political limits imposed on the IAF and to promote a narrative of survival, resistance and victory.

Theoretical Debates: Complexity, Effects & Criticism

The apparent limits of modern strategic air power theory were the subject of discussion, debate and criticism within the air power community during the early-mid 2000s. These limits reflected both the varied operational experiences of the previous era of intervention and the use of air power by the United States and its allies in fighting counterinsurgencies and conducting counterterrorism missions, as well as Israel's experience against Hezbollah. This was not the first or last period of critical engagement with the concept by academics and military officers but the concentration of debate at this time is notable. Discussion drew from observations of the role of strategic air power in practice, its effectiveness on different battlefields and against different adversaries, and the growing sophistication of air power capabilities employed by states other than the United States. Thus, this period offered more perspectives on the concept than had been possible during the 1990s, reflected a period of challenge and change for air power, and was enabled by new air power journals for officers in Britain and France in which discussions and ideas could be published. These discussions and ideas focused on three elements of modern strategic air power theory: critiquing the Wardenian approach to centres of gravity and arguing for a broader, deeper view; exploring how to better understand and exploit the complexity of systems; and the expansion and application of EBO to national thinking in parallel to growing criticism of the concept in the United States. The theoretical developments of this period emphasised the depth of thinking about how best to achieve strategic effect, the significant difficulty in translating more complex theory into practical application, and the growing divergence between contemporary operations and theory.

Criticism, debate and exploration of how strategic air power was directed against the centres of gravity in Warden's five rings model was debated across the case study states in the early-2000s. This criticism built upon earlier works including Strange's 1996 'Centers [sic] of Gravity & Critical Vulnerabilities', which argued that Warden's concept emphasised the enemy's strengths rather than weaknesses and that the concept should be broadened to comprise the enemy's capabilities, requirements and vulnerabilities in order to better direct targeting for strategic effect (Strange 1996). This work was the basis of criticism of British air power doctrine offered by Richard Lock-Pullan of the Defence Studies Department at the Joint Services Command and Staff College in 2002. Lock-Pullan (2002) argued that British definitions of strategic effect and centres of gravity were vague, that the RAF was trapped by its historic focus on bombing missions, and that the RAF's understanding of strategic effect and centres of gravity were determined by the capabilities of its aircraft and seen through a political lens that was shaped by the state's end-goals. Further, Lock-Pullan suggested that the Wardenian concept of centres of gravity adopted in British air power doctrine fell into the trap Strange had identified, narrowly focusing on the adversary's strengths rather than broader, deeper vulnerabilities.

A contemporary French critique was also offered by Lieutenant-colonel Philippe Cexus writing in the journal *Penser les Ailes Française* in 2004. Cexus's critique of US strategic air power theory – *le modoèle del'adversaire et son milieu* [the model of the adversary and his environment] – was based on the identification of weaknesses in Warden's model and advocated a broadening of theory to incorporate environmental factors and the complexity of linkages and interactions between parts of the adversary's system (Cexus 2004). Cexus argued that each adversary's unique environment affected his behaviour and the options available to him, that both the physical domain of territory and the vital functions of the system – infrastructure and its redundancy – add to system complexity, and that these must be understood and accounted for if air power is to have strategic effect against the adversary's system. The necessity of broadening the understanding of what the adversary's centres of gravity comprises in order to better exploit its vulnerabilities was echoed in several articles on 'axiological targeting' that appeared in air power journals in the United States, Great Britain and Australia in the mid-2000s. Axiological targeting 'engages the minds and needs of leaders at all levels, knowing that they, and not their warfighting stuff, are the real source of the conflict and its prolongation and the essential ingredient to its resolution' and 'sees nonmilitary centers [sic] of gravity as more strategic and counter-value targets as more important than counterforce targets' (Kan 2004, 25-26). The proposed mitigations to the identified weaknesses in Warden's centres of gravity all aimed to improve the utility of strategic air power

by focusing it where it could have the greatest effect on the adversary. In doing so, the requirement for deep, detailed and timely intelligence and planning, beyond the significant burden already required for a strategic air campaign, would further increase – and with it the complexity of achieving strategic effect.

The second area of theoretical debate concerned complexity itself, and specifically how to exploit the complexity of an adversary's system of power and control. This area of focus was in part a reaction to operational experience, including the growing disconnection between planned effects and those observed on the increasingly complex battlefield, and in part a critique of Warden's rings model and its underlying assumption of a static adversary. The common approach to incorporating complexity into strategic air power's core assumptions was to explore how the adversaries' systems function, adapt, and could be targeted to exploit vulnerabilities. Freniere, Dickmann and Cares (2003) work in the United States critiqued modern targeting for its focus on the physical properties of the systems it was being used against and its necessarily limited application to avoid total destruction but which allowed the time and space for the adversary's system to adapt to attack. The proposed solution was 'complexity-based targeting' through which system-wide disruption can be achieved through kinetic, non-kinetic and information operations. These are applied simultaneously and exploit a deep, broad understanding of the adversary's system based on individual components' contributions, methods of interaction, failure thresholds, and the system's critical flows and rules (Freniere, Dickmann & Cares 2003). The aim is to sufficiently disrupt the adversary's system to prevent its successful adaptation to attack, thus imposing a degree of control over the adversary and the achievement of strategic objectives.

A similar approach to conceptualising and exploiting systems was also explored in the *Penser les Ailes Française* journal, particularly by Colonel Régis Chamagne in 2004. In his article *bombardement aérien: de l'attrition au délitement* [aerial bombardment: from attrition to disintegration] Chamagne focused on the idea of the emergent properties and intelligence of a system. He argued that these occur out of the function of separate entities within the system each doing their jobs but which creates an organic set of 'higher elements' that are not designed but which are vital to a system's operations (Chamagne 2004). If these higher elements are identified and targeted the system will disintegrate and collapse under the weight of its own complexity, with some systems which lack redundancy at all levels particularly vulnerable to attack. As with Warden's ideas of paralysis being achieved suddenly once a system reaches a point where it can no longer function, Chamagne suggests that an inflection point emerges once disintegration of the system begins – at which point the adversary will be

unable to oppose the attack. Similarly, Cexus also argued in his 2004 work that the complexity of a system can be better understood by viewing it as a combination of things that it 'has', which take physical form like territory and natural resources, and things that allow it to 'be', and which are non-physical, social constructions, like the political and legal systems. Between these are links which require effort to maintain and contribute to the functioning of the system – by gaining an understanding of these links and combining that with an understanding of the adversary's unique environment, a set of tailored, precise effects could be directed against the adversary (Cexus 2004). A final, novel approach to strategic effect was offered by RAF Squadron Leader A H Killey in 2005. Killey's work was built around the question of where air power should be focused to achieve specific effects and proposed the Human Systems Model (HSM) as a framework for predicting the cascade of direct and indirect physical and psychological effects that would follow a successful strike (Killey 2005). The HSM identifies activity components within each of the enemy's systems which deliver its outputs – manifest as power – and the cognitive components that are required to support these outputs – manifest as decisions. Once identified, the interdependencies, linkages and relative importance of each of these outputs and supporting functions can be discovered, highlighting the enemy's centres of gravity and thus its vulnerabilities to be targeted (Killey 2005).

The final area of debate during the mid-2000s centred on EBO. Although not exclusive to air power, EBO was closely associated with strategic air power as a methodology for planning and attaining the desired strategic effects in an air campaign. During this period, EBO was increasingly central to how air power was used in practice, reflected in national air power doctrine, but also criticised for its perceived failures as a methodology. The concept had been incorporated into USAF doctrine in 1997, and the 2003 update to AFDD 1 described EBO as 'a vital part of the new approach to warfare… (which) explicitly and logically links the effects of individual tactical actions directly to desired military and political outcomes… Effects-based actions or operations are those designed to produce distinct, desired effects while avoiding unintended or undesired effects' (United States 2003b, 18). The accompanying annex on Strategic Attack, AFDD 2-1.2, emphasised for the first time the link between strategic attack and EBO (United States 2003c, 1, 7-8), and the 'Operations & Organization' [sic] doctrine released in 2007 placed an 'effects-based approach to military operations' at the centre of USAF thinking (United States 2007b, 13-20). Israel had similarly embraced EBO within IDF doctrine, through the theoretical framework of SOD which includes the pursuit of operational effects once the adversary's system, its command and its logistics have been thoroughly understood (Sorrels *et al.* 2005).

In contrast, both Australian and British air power doctrine during this period adopted a broader understanding of EBO, acknowledging its place within operations but placing it within the context of national strategy. Australia's view, expressed in the fifth edition of the RAAF's doctrine in 2007, states that 'the Air Force contributes to the National Effects-Based Approach (NEBA) to Australia's national security' as part of 'an effects-based approach to strategic and operational planning as a means of translating a broad range of military actions into a sequence of intended effects that lead to desired outcomes' (Australia 2007a, 54, 57-59). The RAAF's strategic attack capability 'can make a decisive contribution in a NEBA' by 'target(ing) an adversary's leadership, command structure, essential facilities, infrastructure, research and production facilities, and military capabilities' (Australia 2007a, 145). Britain's fourth edition of the RAF's AP 3000 doctrine echoed Australia's approach to EBO, framing the concept as part of 'the Comprehensive Approach, employing all available levers of power' in which 'elements of the joint force… achieve specific supporting effects, which may be physical or psychological in nature' as part of 'a nuanced philosophy that links activities, effects, and outcomes' rather than 'a mechanistic implementation of an effects-based approach to operations' (Great Britain 2009a, 33-34).

Indeed, the avoidance of a 'mechanistic implementation' of EBO noted in British doctrine reflected part of the criticism of the concept that had built up in the United States and Israel since 2006 and culminated in the US Joint Forces Command 'Commander's Guidance for Effects-based Operations' issued by General James Mattis in 2008. The catalyst for the sustained criticism of EBO during this period was the performance of the IAF in the Second Lebanon War and the close association between the perceived failures of operations against Hezbollah and the SOD planning methodology used by Israel. As discussed, SOD contained elements of EBO and their conflation in post-conflict analysis in the United States, such as by Vego (2006) and Matthews (2008), emphasised the concept's theoretical detachment from operational practice and its contribution to complexity and failure. In addition, the proliferation of concepts based on and associated with EBO, the myriad interpretations of different elements of EBO, and the resultant confusion across the US armed forces created further institutional opposition to the concept. This was captured in Mattis' 2008 guidance that USJFCOM would 'no longer use, sponsor, or export the terms and concepts related to EBO… in our training (and) doctrine development' (Mattis 2008, 23). The basis for this guidance was Matthews' 2008 study on the Second Lebanon War, Israel's post-conflict Winograd Commission, a 2004 Australian Army critique of the concept, and the belief that the US Army-Marine Corps' FM 3-24 Counterinsurgency doctrine could achieve contemporary operational

objectives (Mattis 2008). Consequently, contemporary US-led operations in Afghanistan and Iraq were guided by this doctrine, with air power providing a supporting role.

The debates concerning modern strategic air power's direction during this period can be seen as a response to the new challenges presented in the operating environment and to the growing complexity of both operations and the technology being utilised. As discussed, the necessity to fight insurgents, terrorists and hybrid actors during this period created a clash between state-centric modern strategic air power theory and the counter-approaches chosen and in which air power was required to deliver strategic effects. The three debates – on the Wardenian approach to centres of gravity, the understanding and targeting of systems, and on effects-based approaches to the utilisation of national air power – reveal two distinct and divergent directions for theory. The first direction was advocated from within the air power community and sought to tackle the increasing complexity of contemporary operations with a parallel increase in the sophistication of strategic air power's focus and application in practice. This direction acknowledged the limitations of theory as applied in the post-Cold War period, the necessity of its evolution to address contemporary threats, and proposed the broader, deeper consideration of centres of gravity, a much more sophisticated approach to the exploitation of systems, and the commensurate increase in intelligence collection and fusion to achieve this. The second direction was the opposite of this: to simplify the use of air power in contemporary conflicts, reducing the complexity that had emerged in planning and execution, and to return to more traditional, established methodologies. This direction resulted from the broadly negative interpretation of how EBO had been understood, incorporated into planning, and applied in conflict during this period. It primarily came from outside of the air power communities in Israel and the United States in particular, and equated effects-based approaches with the (over)use of and (over)reliance on air power which had failed to deliver strategic objectives on the ground.

Both directions were problematic for the practical delivery of strategic effect using air power and neither direction offered a solution to how best to adapt the concept to the contemporary operating environment. The first direction added time and complexity throughout the planning, targeting and post-strike assessment processes, threatening the overall effectiveness of air power's practical use for strategic effect and disconnecting the concept from the prevailing operational demands for time-sensitive and reactive strikes. The second direction emphasised air power's role as being that of support to ground operations and confined it to a narrow range of targets – leadership and active fielded forces – as prescribed by counterterrorism and counterinsurgency strategies. The potential for air power to provide strategic effect was

sacrificed for simplicity and tactical gain. The tension between the two directions that emerged in modern strategic air power theory during this period were reflected in the parallel and subsequent third phase of air power reforms that attempted to balance contemporary practice with an uncertain future operating environment.

Strategic Air Power Refocused: Capability Reforms, New Doctrines & The 'Israeli Model'

During the late-2000s a third phase of post-Cold War air power reforms took place across the case study states. The drivers of these reforms were three-fold: responses to the changing battlefield in which technology, non-state actors, asymmetry and information warfare were prominent features; operational experiences and the lessons identified from them; and the necessity of restructuring air power capabilities for the future. How these drivers were interpreted in each state determined the direction and shape of the reforms subsequently undertaken. The most significant and wide-ranging reforms during this period were seen in Britain and Russia, with reforms in the other case study states falling between the capability reductions seen in the case of Britain and the transformative shift in emphasis and investment in Russian air power. These reforms were reflected in updates to doctrine across several of the case study states, which also echoed operational experiences and the expected continuation of irregular warfare into the future. Despite the significant challenge presented towards EBO in the United States and Israel, effects-based approaches to operations remained in national air power doctrines and in several cases increased in scope, suggesting the wider criticisms of the concept were not wholly accepted or influential in the air power community. In parallel with this period of reform and doctrinal change, Israel engaged in two air power-centric operations that refocused strategic air power on achieving limited but far-reaching objectives. In so-doing, it created a new operating model and an alternative approach to the use of air power in contemporary conflicts.

Air Power Reform: Phase Three

Britain's third phase of defence reform was centred on the Strategic Defence and Security Review (SDSR) of 2010. The SDSR was notably different to the 1998 SDR. It was broadened in scope to include and integrate security challenges with defence, overseen by the recently-formed National Security Council, and focused on cost-savings in light of the global financial crisis and extended military deployments overseas. Like the 1998 SDR it pursued the rationalisation of the RAF's strike capabilities, which were to be focused on a two-type 'fast jet fleet of Typhoon and Joint Strike Fighter aircraft with around one third at high readiness… able to operate in the future high-threat airspace while providing air defence, precision ground attack and combat ISTAR capabilities' (Great Britain 2010, 25). Consequently, the Tornado

strike aircraft fleet was reduced in scale but retained for ongoing operations in Afghanistan, and the Harrier fleet was retired the following year. More substantive changes were proposed to carrier strike, with a decision made to retire the contemporary carrier force and its Harrier strike aircraft, build only one new carrier, and to reduce the number of F-35s to be procured (Great Britain 2010, 22-23). Enabling capabilities were severely impacted by the SDSR: the long-delayed Nimrod MRA4 intelligence and maritime patrol aircraft programme was cancelled, the aerial refuelling fleet would be replaced with a smaller force of new tankers, and the Sentinel R1 intelligence collector was proposed for retirement (Great Britain 2010, 27). Capability gaps – in carrier strike, maritime patrol and intelligence gathering – were accepted as necessary, with allied support filling some elements. SDSR 2010 continued Britain's long-standing air power capacity for capability trade-off but it went much further than previous reforms in reducing this capacity, cutting into operational capabilities. This reflected both the pressure on the defence budget in light of the significant national budget deficit and the counterinsurgency-focused operational environment of the 2000s against which the relatively broad air power capabilities previously operated and planned for could no longer be justified. SDSR 2010 narrowed the scope of British air power for future operations and made it far more reliant on the United States and France to be strategically effective.

In contrast, reforms to Russian air power, the broader armed forces and national security following the 2008 Russo-Georgian War were both transformative and future-focused. These reforms included the 'New Look' defence reforms, a new National Security Strategy in 2009 and a new Military Doctrine in 2010. The potential – and limitations – of the 1996-2000 defence reforms was apparent in the relative improvement of the armed forces' performance in both the Second Chechen War and in the Russo-Georgian War. However, weaknesses in the armed forces were still numerous and critically the earlier reforms had failed to address the underlying Soviet-era structure of the armed forces. A new phase of military reform was outlined in late-2008, four months after the end of fighting in Georgia, by the Chief of the General Staff, General Nikolai Makarov and implemented the following year by Defense Minister Serdyukov (Lannon 2011, Barabanov, Makienko & Pukhov 2012). The New Look reforms were ambitious and significant in scale and depth. Broadly they aimed to replace the prevailing Soviet structure and emphasis on mass mobilisation with a professional, contemporary structure drawing upon Western ideas, permanent readiness and improved C2, ISR and weapons capabilities (Lannon 2011, Barabanov 2014, Defense Intelligence Agency 2017). The resulting armed forces would be more responsive to threats and more agile, with investment focused on a smaller, more capable force (Bartles 2011, Lannon 2011). The New Look reforms attempted to transform Russian air power. Significant investment was made in

modernising the VVS and Naval Aviation with upgraded and new variants of advanced combat aircraft, the introduction of new sensors, avionics and weapons. Capabilities including communications and ISR were also improved relative to what had been operated before, although not yet to Western standards, allowing the Soviet-theorised reconnaissance-strike complexes to come come closer to reality for Russian air power later in the decade (Adamsky 2018, Shields 2018).

In parallel with New Look, the 2009 National Security Strategy outlined the security environment in which its reformed armed forces would operate. The 2009 Strategy continued and expanded the security concerns of the 2000 Concept, with emphasis on areas including the 'one-sided use of force in international relations', control of energy resources in the Russian periphery, and the destabilising impact of US missile defences (Russia 2009, 2-4). Specific military threats were identified as being the 'develop(ment of) high-precision, informational and other high-technology means of conducting armed warfare (and) strategic non-nuclear arms', and the linked withdrawal of the US and Europe from arms limitation agreements (Russia 2009, 5). In response, Russia redefined strategic deterrence from a relatively narrow nuclear focus to cover the 'development and systemic realisation of a range of interconnected political, diplomatic, military, economic, informational and other measures' (Russia 2009, 5). Military reform, reorganisation, modernisation and investment in the defence industry were all stated as vital components in realising Russian strategic deterrence and defence (Russia 2009, 6). For air power, the 2009 Strategy affirmed at the highest level of the state the core elements of the New Look defence reforms and the necessity of transforming the military from a legacy Soviet force into a modern force aligned to Russia's defence priorities and concept of warfighting.

Between the two poles of the third phase of reforms lay those of the other four case study states. For France and Australia, their respective reform agendas can be characterised as continued modernisation and consolidation of their air power capabilities, directed towards enhancing precision, intelligence fusion, and power projection. For France, the invasion of Afghanistan, the global war on terror, and the consequences of a destabilised Middle East following the US-led invasion of Iraq had further complicated its defence environment. This necessitated an expansion of focus to include new and distant geographic areas, new and complex actors, and new and 'dematerialised' domains such as cyber and information (Boutherin & Pajon 2013). To address these challenges, France published a new White Paper on Defence and National Security in 2008. It emphasised the need for increased knowledge and anticipation to be delivered through a greater focus on intelligence, space systems and

leveraging French overseas territorial advantages for global coverage (France 2008a). Air power would be directed to traditional areas – nuclear deterrence, air defence – on priority areas including intelligence gathering, and on force projection utilising an air component of the *Armée de l'Air* and *l'Aero* aircraft pre-positioned overseas (France 2008a). The five-year defence programme from 2009 supported these changes and included enhancements to the air power element of the nuclear deterrent through upgrades to the Mirage 2000N fleet, the introduction of nuclear-capable Rafales from 2010, and the entry into service of new aerial refuelling capabilities (France 2008c, 2.2.2.2). The reforms also prioritised air-land battlefield integration, the final rationalisation of the combat air fleet around the Mirage 2000D and Rafale, new targeting pods, and day-night and dual-guidance upgrades to precision weapons to enhance strike (France 2008c, 2.5.1.1, 2.5.1.4, 2.1.5.7). The reform law also provided clear direction for the future of French conventional air power, stating that 'the penetration and strike capacities in support of the land forces will be privileged' and that 'precision strike capabilities will be favoured, either for actions in depth, or for supporting forces in contact' (France 2008c, 2.5.1.4, 2.5.1.7). Australia also undertook a similar level of modernisation and rationalisation of its air power during the late-2000s, with significant funding allocated to the upgrade of the F/A-18 *Hornet* fleet, the acquisition of new F/A-18F *Super Hornets*, KC-30 aerial refuelling tankers, project *Wedgetail* AEW&C aircraft, electronic warfare capabilities, and a new generation of communications satellites (Australia 2008, 37-44). In 2009, approval was given for the acquisition of the F-35A as the long-term replacement for the *Hornet* fleet, which would also provide Australia with the option to conduct strategic attack operations in contested airspace, as envisaged by the 2007 Future Air and Space Operating Concept (Australia 2009b, 339, Australia 2007c, 40). Subsequently, the F-111 fleet was retired from service in 2010 with the arrival of the *Super Hornets*, leaving the RAAF with an all-F/A-18 fleet for the rest of the research period, supported by new aerial refuelling and AEW&C platforms, and armed with a combination of unguided, precision and stand-off weapons.

The United States laid out a significant programme for the transformation of its air power at the beginning of this period through the USAF's 2003 'Transformation Flight Plan'. This document acknowledged the necessity of changing from a force of the industrial age force to one for the information age, focused on leveraging intelligence and communications technologies, combined with precision weapons, to destroy or affect the enemy's centres of gravity (United States 2003a, i). It also acknowledged that the USAF would need to conduct a broader range of operations as a 'post-Cold War force', able to address the threats of terrorism, attacks in space, weapons of mass destruction, and to contribute to homeland security and irregular warfare (United States 2003a, i). In order to achieve this transformation

in practice, the USAF published its 'Air Force Roadmap 2006-2025' in 2006, laying out its core roles and the platforms and weapons that would be deployed in the future. The aim of the roadmap was to outline the planned modernisation and recapitalisation of the USAF, resulting in 'a powerful force structure that will dominate adversaries in air, space, and cyberspace across the spectrum of conflict, now through 2025' (United States 2006b). The global attack role would continue to be performed by the existing bomber fleets through 2025, with the proposed addition of a new bomber by 2018, as well as by the F-15E, F-16C/D, F-22A and new F-35A combat aircraft fleets, and the A-10 and MQ-9 for CAS and interdiction. The plan foresaw the long-term rationalisation of the bomber fleet to a single type and the broader combat fleet to only two types, the F-22A and F-35A. A broad range of precision weapons would continue in service, and new ones including the Small Diameter Bomb, an extended range Joint Air-to-Surface Standoff Missile, and the High-Speed Hypersonic Standoff Weapon introduced. C4ISR was broadly unchanged from 2006, with the RC-135 series, E-3 AWACS, E-8 JSTARS, MQ-1 and RQ-4 remaining in service and the U-2 proposed for retirement in the 2010s. Aerial refuelling would continue to be provided by KC-10s and KC-135s through 2025, with the parallel addition of the first phase of their recapitalisation through the KC-X programme. In addition, a wide-ranging array of aircraft, weapons and systems for special operations would also continue to be utilised and developed, with crossover in platforms and weapons in some areas. The roadmap confirmed the USAF's focus on providing both global, peer-focused strategic air power and support-orientated tactical capabilities for irregular warfare.

This was affirmed in the subsequent white paper 'The Nation's Guardians', published in 2007, and which emphasised the necessity of cross-domain dominance in air, space and cyber, to achieve global vigilance, reach and power (United States 2007a). A final area of reform during this period was the re-prioritisation of nuclear weapons for the USAF. In 2009 Global Strike Command (GSC) was inducted, unifying the USAF's airborne nuclear forces for the first time since 1992 (United States 2017). The rationale for this reform was to bring the ICBM and nuclear bomber forces under a single command, emphasising the nuclear weapons role of the USAF, and responding to various high-profile errors in nuclear weapons stewardship which were attributed to structural failures (United States 2009, Wilson 2009). The geopolitical context of the mid-late 2000s of Russian and Chinese nuclear force modernisation, as well as North Korea's frequent nuclear tests, also contributed to the GSC reform (United States 2013b). The USAF's 8th Air Force, home to the B-1B, B-2 and B-52 fleets which had been used extensively for long-range strategic strike missions throughout the 1990s and 2000s, became part of GSC in 2010 having formerly been part of ACC (United States Air Force 2010).

This period of reform in US air power was characterised by modernisation, a degree of rationalisation, balancing the necessity of 'low' capabilities for the prevailing counterinsurgency role with the 'high' capabilities of future state conflict and conventional deterrence, and the re-emphasis of the USAF's role in nuclear operations. Collectively, these reforms can be interpreted as a means of perpetuating the traditional and unique roles of US air power beyond the long wars in Afghanistan and Iraq.

Reform of air power in Israel in the late-2000s was influenced by the shock that resulted from the failure of Israeli air power to achieve a decisive victory over Hezbollah in 2006. In the aftermath of the Second Lebanon War, the IDF reflected on what was operationally possible and necessary against adversaries that were state-backed and not as weak as those that it had previously policed (Kober 2008). In 2007 the IDF began a wide-ranging reform process which sought to better integrate its forces through 'joint training and combat operation of the different branches, the strengthening of the IDF land maneuver [sic] capability' and to address doctrinal confusion through a 'clarifying of fighting values' (Israel 2008). In parallel, the Israeli government began to accept that low-level political violence would continue and that it could not decisively defeat its non-state adversaries (Rid 2012). In accepting this, the IAF would be responsible for enforcing political red lines should Israel's adversaries cross them, enabling air power to be focused on where it could have strategic effect by upholding the core national security principle of deterrence through the application of decisive force. More broadly, during this period of reform Israel's concern over Iran's regional ambitions and its alleged nuclear weapons programme reinforced the necessity for the IAF to field a next-generation combat aircraft and associated sensors and precision weapons. To this end, Israel ordered its first squadron of F-35I's from the United States in October 2010 (Lockheed Martin 2010).

Doctrinal Developments

In parallel to the capability reforms of the late-2000s a series of updates were made to national air power doctrine to capture the previous decade's operational experiences, theoretical debates, and the future direction of air power. For both the United States and Britain, doctrinal developments reflected a broadening of air power's contemporary functions which reduced the relative importance of strategic attack, the growing incorporation of an effects-based approach to operations, and the influence of irregular warfare on air power. Australian air power doctrine during this period focused more narrowly on refinements that reflected its own operational needs and on considering air power's strategic effect in a broader context. France produced its first air power concept document in 2008, providing a high-level view of French thinking on strategic air power, but reflecting little of the detailed debate and understanding

found in the journals of the *Armée de l'Air*. No public updates to air power doctrine came from Israel or Russia, with the latter publishing a new national-level Military Doctrine that outlined Moscow's view of the threats the state faced, its defence policy, and the necessity of the modernisation outlined in the New Look reforms.

The USAF published a suite of doctrinal updates in 2006/07, reflecting on changes to the operational environment since the last major revision of doctrine in 2003. From the perspective of strategic air power, these changes primarily situated strategic attack in the context of irregular warfare and the EBO methodology at the heart of USAF planning. Notably the Basic Doctrine, AFDD 1, was not updated at this time and remained in place for another four years. Expanding on AFDD 1 a companion document on operations and organisation, AFDD 2, was released in mid-2006 and revised in early-2007. AFDD 2 focused on how the USAF 'organizes [sic] and employs air and space power at the operational level across the range of military operations' with an 'effects-based approach to military operations' at its core (United States 2007b, i, 13). AFDD 2 provided a detailed explanation of EBO, its logic, its relationship with operations and national objectives, and its place in a range of different environments from homeland defence to irregular warfare and major conventional conflict (United States 2007b). For the USAF, EBO combined traditional approaches to conflict with the benefits of advanced technologies allowing for rapidity, precision, mobility and predictive battlespace awareness (United States 2007b, 15-16). This approach incorporates kinetic and non-kinetic elements, including information warfare and psychological operations, which do not aim to destroy the adversary but to compel him to act in a particular way in accordance with US strategic objectives (United States 2007b, 19). AFDD 2 acknowledged that this requires both a comprehensive knowledge and systems-based view of an adversary, which presents a considerable intelligence and analysis burden, and the difficulty of tracing and predicting cause and effect, especially indirect effects, despite their vital roles in achieving the desired strategic effects of operations (United States 2007b, 19, 85-97).

As discussed, the USAF also produced its first Irregular Warfare doctrine, AFDD 2-3, in 2007 which provided both a counter to the US Army-Marine Corps. FM 3-24 Counterinsurgency doctrine and emphasised the unique contributions and effects of air power in contemporary operations (United States 2007c). An update to the USAF's Strategic Attack doctrine was also published in 2007, with AFDD 3-70 updating the 2003 doctrine to introduce the link between strategic attack and cyber operations and the use of strategic attack in irregular warfare. AFDD 3-70 outlined how strategic attack can be used to target enemy personnel, resources and infrastructure directly and indirectly in order to benefit friendly forces and convince populations

of US intent, to launch cyber-attacks against financial resources, and to pre-emptively strike key facilities that would otherwise be seized and used by insurgents (United States 2007d, 12). The final major doctrinal development for the USAF during this period was the revision of Basic Doctrine in 2011. The new AFDD 1 updated the 2003 doctrine and incorporated AFDD 2 into a single, broader document. The major change for strategic air power was the shift in focus for strategic attack from the first function of the USAF in 2003 to its inclusion in 'global precision attack' in 2011 (United States 2011, 48-49). The arrangement of the USAF's core functions in AFDD 1 was reorganised to reflect and balance contemporary emphasis, importance and role, starting with nuclear deterrence, then air, space and cyber superiority, C2 and ISR, then attack functions, and finally support (United States 2011, 43). Consequently, strategic attack's placement was organisationally logical, reflected the diversification of US air power through the incorporation of EBO outlined in the 2007 AFDD 2 doctrine, and was an acknowledgement that in the context of a broad set of missions that strategic attack had become one of many capabilities rather than the central capability.

The RAF published its fourth – and final – edition of AP 3000 in 2009. The doctrine updated the third edition of 1999 and reflected a broadening of the role of air power in national thinking. It stated that air power was now about the 'creation of influence' through direct kinetic action and indirect cognitive consequences, which had become necessary due to the enemy's adaptation to Western warfighting methods and the emergence of hybrid threats over the past decade (Great Britain 2009a, 13-14). Contextually, air power was situated within the government's Comprehensive Approach and closely linked to joint doctrine, with its effects aimed at achieving the respective goals of both. This reflected the influence of Britain's National Security Strategy (NSS) which was formally published for the first time in 2008. The NSS began to broaden the concept of national security from the traditional defence, foreign and security policy focus to embrace a broad range of potential non-military threats, acknowledging the close link between domestic and foreign policy, and on an integrated approach to national security across government (Great Britain 2008, 3-8). An updated NSS was published in 2010. It continued to broaden the concept of national security, with British 'influence in world affairs' – defined as Britain's ability to 'project power and to use our unique network of alliances and relationships' – now considered paramount (Great Britain 2010, 4-5). Within this context, the fourth edition of AP 3000 simplified the roles of air power. These were captured in four broad areas: control of the air and space, air mobility, ISR and situational awareness, and attack. The latter incorporated all levels of warfare, from tactical CAS to 'deep attack' that would disrupt or destroy the adversary's centres of gravity (Great Britain 2009a, 51-54). The enduring, evolving operations in Afghanistan and Iraq during the 2000s, featuring

an initial strategic air campaign followed by a much longer and variable support role to counterinsurgency operations, created the context for a future in which a nominally independent air power would become part of a broader, joint approach. The role of strategic effect deepened and broadened, taking on greater detail in its planning, execution and measurement, whilst bringing the strategic air offensive into the broader concept of attack in which it was more closely linked to influencing the adversary and the joint campaign (Great Britain 2009a, 2009b). This paved the way for the RAF's air power doctrine to evolve from a service-specific publication to a joint doctrine in the 2010s.

The RAAF published the fifth edition of the Air Power Manual in 2007. It contained two key theoretical developments for Australian strategic air power: first, the formal introduction of EBO, in line with the USAF's own incorporation of the concept into doctrine; and second, a national variant of strategic attack called 'integrated air operations'. Previous references to strategic effects can be seen in Australian thinking from the early 1990s but it was not until the 2007 doctrine that a broader framework for strategic attack through the concept of a National Effects-Based Approach was introduced (Australia 2007a). As previously discussed, this directly linked the RAAF's role in providing strategic attack to the pursuit of national political objectives (Australia 2007a, 145). The second key development was the introduction of integrated air operations. This operation saw the combined use of air power with land or naval forces to attack an enemy 'in order to deprive the enemy of military power needed to exploit, manoeuvre in, or occupy land or sea-space' (Australia 2007a, 147). Integrated air operations were positioned in Australian thinking between strategic-level attack against the adversary's centres of gravity and offensive air support at the tactical-level. The intention was to create primary effects at the operational level with the potential for these to have strategic effect within the broader campaign, depending on the effects desired (Australia 2007a). Integrated air operations can be characterised as an acknowledgement that Australia would have limited opportunity to employ strategic attack against the centres of gravity of a distant enemy using its relatively small air force whilst still attempting to create strategic effect at a more local level. This is consistent with Australian air power doctrine throughout the research period, simultaneously adopting US theory and concepts whilst attempting to shape and adapt them to be relevant to its own resources, operating environment and threats.

For France this period saw the first post-Cold War publication of an air power concept document. In 2008 the *Concept de L'Armée de L'Air* was released, marking the first step in over a decade of attempts to formalise air power thinking. Resistance to the formalisation of operating concepts and doctrine, stemming from the disruptive proposals of the 1994 White

Paper and from within the *Armée de l'Air,* was overcome through bureaucratic changes in the mid-2000s. These changes centred on the establishment of the *Centre Interarmées de Concepts, de Doctrines et d'Expérimentations* (CICDE) in 2005 and the founding of the concept division of *Le Centre d'Enseignement Supérieur Aérien* (CESA) in 2006 (Etienne-Leccia 2007). The Concept took direction from the 2008 White Paper and captured the *Armée de l'Air's* view that air power 'can strike or act in depth and participate in the operational paralysis of the adversary. The goal is not to conduct a campaign of systematic attrition, but to make a significant dent in certain functions which contribute to the functioning of the enemy's military apparatus' (France 2008b, 17). It is important to note that the 2008 Concept was not *Armée de l'Air* doctrine per se, as in the organisation of French military documentation by CICDE the prevailing political direction is placed at the highest level, followed by concepts, then doctrine, and finally publications, with each level increasingly specific and detailed. Consequently, only the high-level thinking on strategic air power's relevance to the *Armée de l'Air* is formally reflected in the 2008 Concept, with the doctrinal detail of this captured by the *Doctrine Interarmées 3.3 'Opérations aériennes'* remaining classified.

Limited Operations: The 'Israeli Model'

Israel's reaction to the limits of its air power revealed during the Second Lebanon War was unique amongst the case study states as it led to the creation of a new operating model for the IAF. This new model was characterised by three elements: first, an emphasis on Israeli air power's qualitative military edge which would now be applied in limited operations and under specific circumstances; second, the leveraging of air power's ability to strike rapidly, simultaneously and at depth; and third, the linkage of the IAF's capacity to produce strategic effects and the pursuit of Israel's national deterrence objectives. This reflected the post-Lebanon acceptance that within Israel's immediate environment – Gaza, the West Bank and south Lebanon – low-level political violence could not be prevented, only managed, and that more significant threats further afield in Syria and Iran needed to be addressed pre-emptively. Thus, Israel began fighting 'the war between the wars' through a combination of air power and special operations that aimed to uphold deterrence through the use of limited decisive force in order to prevent full-scale wars (Lappin 2017). Air power was uniquely well-placed to implement this new strategy in which deterrence is not static but accumulated over time and continually reinforced (Rid 2012, Inbar & Shamir 2014). The new 'Israeli Model' was demonstrated in the late-2000s through two operations: *Outside the Box* in 2007 and *Cast Lead* in 2008-9.

Operation *Outside the Box* utilised the IAF to destroy the al-Kibar nuclear facility in Deir al-Zour province, Syria. The operation used the IAF's G550 *Shavit* for sophisticated electronic attacks that triggered the failure of the Syrian air defence radar network and disrupted local air defence sites. These attacks permitted F-15I and F-16I combat aircraft to subsequently launch precision weapons that destroyed two air defence radars, multiple SAM sites, and the nuclear reactor itself (Gasparre 2008, Israel 2018). Operation *Outside the Box* was one of the earliest and most high profile elements in Israel's new strategy of using its air power to pre-emptively strike emerging regional threats. This subsequently focused on the threat from Hezbollah and Iranian militias in Syria and Lebanon through attacks on weapons depots and transfers of long-range missiles, and has become a major part of Israel's broader strategy of disrupting and destroying strategic threats through targeted killings, sabotage, and cyberattacks.

Operation *Cast Lead* in 2008-9 saw Israeli air power conduct its first large-scale operation since the Second Lebanon War. *Cast Lead* served as an opportunity to re-establish the advantages, capabilities and deterrent effect of Israeli air power and to contribute to mitigating Israel's unique security challenges. Against a limited set of political goals aimed at deterring future attacks and establishing a long-term ceasefire, and underpinned by strong intelligence gathering, the IAF launched an opening strike against 100 targets in four minutes using 88 aircraft, creating shock and paralysis within Hamas (Catignani 2009, Inbar & Shamir 2014). Additional strikes targeted Hamas's network of tunnels, used to smuggle missiles, and a wide range of Hamas leaders with the intent to deter and disrupt future operations, which were then followed by limited ground assaults against Hamas targets (Catignani 2009). *Cast Lead* was broadly successful, although it was concluded prior to all objectives being reached under international political pressure, and served to create a period of relative peace with Hamas and to re-establish the reputation of the IDF and Israeli deterrence, damaged as it was post-Lebanon (Lambeth 2011). For Israeli air power, *Cast Lead* reconfirmed its capabilities through operations essentially the same as those in the first phase of the Second Lebanon War but with far greater political and public appreciation of what was attainable and in clear concert with ground forces. The operation also employed the concept of 'diffused operations' in which multi-source intelligence is rapidly collected, fused and disseminated to the asset best-placed to execute a task. This enabled fast sensor-to-shooter timescales, quickly targeting and striking Hamas, which was unable to respond and abandoned fighting directly with Israeli forces (Catignani 2009). A final lesson from *Cast Lead* was that air power remained, and remains, a core element in Israel's ability to reinforce deterrence and to control adversaries' behaviours, despite the limits of control warfare exposed in 2006. Indeed, as Inbar & Shamir

(2014) argue, deterrence and control through limited operations in order to create periods of enemy inaction has become the accepted strategy for Israel to address intractable threats and persistent, unchangeable adversaries. Thus, in this limited manner, air power provided, and continues to provide, Israel with some degree of control over its most immediate threats.

Conclusions

Following the strategic air campaigns of the era of intervention, the period from 2003-2011 disrupted modern strategic air power, from the case study states' baseline understanding to the concept itself, and exposed limits in its theory and practice. New actors emerged as drivers of how air power would be used for strategic effect and as its intended targets, and radically different objectives to the previous era were pursued in new operating environments. Collectively these tested and challenged the case study states' established baseline positions from the 1990s, albeit due to markedly different conflicts, objectives, and underlying factors. For the Allies, operations demanded a rapid re-evaluation of their understanding and approach to strategic effect to focus on counterterrorism and counterinsurgency strategies. The means to achieve this were derived from the 'enhanced' tactical capabilities that had emerged from practice and subsequent investment in the late-1990s, and applied through a patchwork of different strategies and approaches, many originating from outside of the air power community. The new baseline position that these established was quickly tested in practice and itself challenged through its mixed results and the variety of issues and limitations it exposed. These included how theory was applied in practice to effect dynamic, dispersed systems, the disconnection between technological progress, operational expectations and battlefield success, the (negative) impact of operations on key elements of strategic air power theory including EBO, and the ability for adversaries to limit air power's effectiveness and options in practice. Israel's own baseline position, newly-established in light of challenges from US practice and new indigenous theory, was also tested against a capable, adaptive adversary in Lebanon and challenged in light of its perceived failure.

To mitigate the limits of contemporary strategic air power the Allies' re-evaluated their understanding of the concept in the late-2000s. Through reform and adaptation they attempted to balance the demands of producing strategic effect in contemporary operations with future warfighting, albeit constrained by the necessity to continue both counterterrorism and counterinsurgency. Israel's post-Lebanon re-evaluation was deeper and more decisive, creating a new model through which strategic air power would uphold national deterrence by regularly striking at distance and be applied in a limited but significant manner locally to paralyse an attacking adversary and restore the status quo. In contrast, this period saw Russia

draw on lessons from the era of intervention to establish a new baseline understanding of how it could utilise strategic air power to potentially match and deter NATO. This baseline emerged from the period of evaluation that started with the assessment of the threat from NATO embodied by *Allied Force* and ended with recommendations to bolster Russia's conventional air and missile forces following OIF. The new baseline position was tested in the Russo-Georgia War and challenged by the numerous shortfalls and failures of the VVS to create the strategic effects desired due to a combination of intelligence, capability, communication, and targeting issues. The credibility of Russia's strategic air power was undermined, and the failure to sufficiently reform and invest in the VVS to create the desired capabilities was exposed. To mitigate this failure, a new period of evaluation began, staring with the New Look reforms, which would ultimately create a new baseline understanding for Russian strategic air power.

Two broad consequences from this period can be discerned. The first is that it marked the end of two decades of air power's general convergence and the beginning of a period of divergence. Starting with the revolution in tactical air power in the United States during the 1980s, the reframing of national strategic air power to focus on conventional strike and strategic-level effects, investment in the spectrum of capabilities to produce such effects, and through the evolving, complex yet successful strategic air campaigns of the mid-1990s into the early-2000s, amongst the case study states air power as a whole became 'more strategic' in its focus and direction. The diverse operational demands of the subsequent period, the limitations and issues with modern strategic air power that they revealed, and the ascendency of 'enhanced' tactical capabilities ended the relatively clear understanding of what the concept was, where it could be applied, and its future direction. The result was the start of a period of conceptual fragmentation in which strategic air power was divided between a core approach that featured the application of 'enhanced' tactical capabilities and a more niche strategic attack function, associated with power projection, deterrence, and future conflicts between states. The balance between these two approaches varied by state and was reflected in the reforms in the late-2000s which emphasised this distinction to different degrees. Thus, a new factor in modern strategic air power's development can be seen: the divergence of agreement in the concept's future direction in light of its tactically-focused adaptation, narrow application, and limited achievements against diverse (predominantly non-state) adversaries.

The second consequence of this period and the second new development factor was the extent to which the expectations placed upon each states' strategic air power capability was reflected upon, and its consequent repositioning in national defence, in light of perceived failure and/or shortfalls in practice. In this area, Israel and Russia led the Allies. During this

period both fought limited conflicts in which their respective air power capabilities and assumptions about its use in practice failed or fell short of expectations. Due to the limited timescales of these conflicts – 34 days for the Second Lebanon War and only a week for the Russo-Georgian War – these failures and shortfalls occurred quickly and within clearly bound geographic and adversarial limits. Consequently, through a period of post-conflict evaluation both Israel and Russia were able to identify the roots of air power's failures and pursue appropriate reforms. Israel re-baselined its understanding of strategic air power by reconceiving it as a core component of active deterrence, reflecting on the limits to what the IAF could be used to effect in practice, and applied air power towards the political objectives it could best achieve. Russia embarked upon major reforms to its armed forces, including substantial investment, modernisation and restructuring of the VVS and, like Israel, created a new baseline position in which air power could be used for maximum effect in a broader political context. In contrast, during this period the Allies were fighting long wars in which there was no operational end and in which the adversary and the political objectives guiding air power's use evolved. Although refinements and new capabilities were introduced, the extent to which substantive change could be made through evaluation was limited by ongoing practice.

CHAPTER 5 The Fragmentation of Strategic Air Power (2011-2015)

The divergent approaches to modern strategic air power taken by the case study states in the latter part of the 2000s were reflected in the concept's direction and application in the 2010s. The result was that the relatively clear direction of development through the 1990s and into the 2000s was now far less clear and the concept was increasingly fragmented along national and allied lines. Due to the sustained focus of Allied air power on counterterrorism and counterinsurgency operations – characterised by 'enhanced' tactical capabilities, reactive engagements outside of a formal campaign framework, and the dynamic targeting of enemy leaders and fielded forces – the Allied states continued with this approach in Libya, Mali and against Islamic State in Iraq. During these operations, national and coalition politics created significant operating constraints and shaped narrow, often negative strategic objectives for air power to achieve. Combined with the paradox of precision, each operation saw a notable disconnection between the effects sought and what was actually accomplished, leading to relatively slow campaigns of attrition. Conversely, the Allied states were also increasingly concerned in white papers and doctrine with how air power could affect a peer competitor in a future operating environment marked by contested or denied air space and simultaneous attacks across multiple domains. This resulted in a response comprising recapitalisation, investment in next-generation programmes, and the repositioning of new capabilities resulting from investments made in the previous decade. For Israel and Russia, who had been able to reconceive their air power in light of operational failings in the mid-late-2000s, this period was marked by contrasting fortunes. The successful development and application of the Israeli Model had provided Israel with a means of utilising its air power for strategic effect against non-state actors, applying limited but decisive force and actively building deterrence whilst simultaneously reducing the capabilities of its adversaries. The Model was challenged in the 2010s by Hamas who successfully adapted to the IAF's strategy and innovated to blunt it to a large extent. In contrast, this period saw Russian strategic air power reach a post-Cold War peak, through its capabilities, organisation, and practice in Syria, applied in the context of New Type Warfare. Thus, by 2015 the direction of modern strategic air power was far from clear, lacking in unity of purpose or broad agreement in approach, shaped by the legacy of enduring operations, national politics and coalitions, and innovative and adaptable adversaries.

Operations in North Africa: Libya, Mali and the Question of Control

In the early-2010s French, British and US air power was used in two operations in North Africa. In Libya, the US-led Operation *Odyssey Dawn* and the following NATO-led Operation *Unified Protector* were conducted in 2011, and in Mali the French-led Operation *Serval* took place in

2013-14[3]. These operations shared a number of features. They were multinational operations, featured a reduced role for the United States relative to all other Allied air campaigns since 1990, and involved significant air operations in concert with surface forces. Both operations leveraged local ground forces – anti-government rebels indirectly in Libya and government forces directly in Mali – to achieve the overarching objective of changing the governing status quo in Libya and preserving it in Mali. Finally, both operations paralleled the ongoing commitment by the United States, Britain and France to operations in Afghanistan and broadly leveraged the model and methods of air power being employed there at the time. Contemporary reporting and post-conflict assessment focused on the rationale for these operations, the timelines for action, coalition dynamics, shortfalls and deficiencies in Allied air power and broader interoperability issues, and the long-term failure in both cases to aid the creation of stable states. Work by Barrie (2012), Davidson (2013), Greenleaf (2013), Gros (2014), Howorth (2014), Muller (2014), Boeke & Schuurman (2015), Wing (2016) and Pashakhanlou (2017) *inter alia* discusses these elements in detail. In the context of modern strategic air power's development and practice, two further elements can be considered: the extent to which these operations utilised the framework of modern strategic air power to create effects and control of adversaries, and thereby achieve political objectives; and what these operations meant for the contemporary direction of the concept.

Operations Odyssey Dawn & Unified Protector

Operations *Odyssey Dawn* and *Unified Protector* were launched to enforce UN Security Council Resolution 1973 on Libya in 2011. The Resolution authorised member states 'to take all necessary measures… to protect civilians and civilian populated areas under threat of attack… while excluding a foreign occupation force of any form on any part of Libyan territory', to establish and enforce a no-fly zone over Libya, and to enforce an arms embargo against the Libyan government (United Nations 2011, 3-4). France unilaterally launched its first air strikes under Operation *Harmattan* against Libyan targets on the afternoon of 19th March, performing 'air defence missions to enforce the no-fly zone in the Benghazi area and prevent Colonel Gaddafi's aircraft from flying (and) strikes on the ground (against) identified military targets which are a threat for the civilian population' (France 2011b). These strikes utilised the *Armée de l'Air's* Rafale and Mirage 2000D combat aircraft, supported by C-135FR tankers and an E-3F AWACS and destroyed four armoured vehicles (France 2011b, 2011c). As noted in Britain's post-conflict analysis, these strikes were conducted outside of the agreed US-British-

[3] The names of French and British operations in Libya, *Harmattan* and *Ellamy* respectively, are also used where appropriate

French approach, launched before *Odyssey Dawn's* planned initial strikes, and removed any element of surprise these initial strikes might have had (Great Britain, House of Commons 2012, 36-37). The planned initial strike of *Odyssey Dawn* targeted the Libyan air defence network of SA-5s, SA-3s and SA-2s around Tripoli and along the coast using a combination of cruise missiles launched from ships and submarines in the Mediterranean, precision strikes by USAF B-2's, RAF Tornado GR4s and US Navy AV-8Bs, and electronic attacks by EA-18G's (US AFRICOM Public Affairs 2011a, Garamone 2011a, 2011b, Ritchie 2018). The aim of the initial strikes was to establish air superiority, allowing for the enforcement of the no-fly zone, and to mitigate the risk of attacking fielded Libyan forces where necessary. To this end, further strikes were launched against Libyan airfields by B-2s which destroyed Libyan aircraft in their shelters, combined US, British and French air strikes to halt Libyan ground forces threatening the city of Benghazi, and US and British naval attacks on Libyan C2 targets (US AFRICOM Public Affairs 2011b, 2011c, Garamone 2011b). The initial strikes of *Odyssey Dawn* were assessed as meeting their objectives, with Commander, US Africa Command, General Ham noting 'since the initial strikes, we have detected no emissions from regime long-range air defense radars. Air attacks have succeeded in stopping regime ground forces from advancing to Benghazi' (US AFRICOM Public Affairs 2011c). Four days after the start of *Odyssey Dawn*, the air campaign was refocused against fielded Libyan forces, with the Joint Task Force's Rear Admiral Hueber stating that 'our targeting priorities are mechanized forces, artillery… those mobile surface-to-air missile sites, interdicting their lines of communications (and) their command and control' (US AFRICOM Public Affairs 2011d). Command of operations in Libya was transferred from the United States to NATO on March 31st, concluding *Odyssey Dawn* after eleven days, and transitioning to Operation *Unified Protector*.

The second phase of operations saw a politically-determined reduction in the participation of US strike platforms and a corresponding increase in French, British and broader Allied contributions (Gros 2014, Ritchie 2018). During its first month *Unified Protector* primarily focused on the fielded forces of the Libyan government, and by the end of April 'coalition aircraft had destroyed 176 main battle tanks, 108 other armoured vehicles, 50 artillery pieces and much else besides' (Ritchie 2018, 91). Relative to other air campaigns in the research period, the small number of sorties conducted during *Unified Protector* is notable. A typical week for lead-contributor France totalled only 120 combat sorties and targets attacked comprised 'a tank west of Misratah (April 01); five armored [sic] vehicles in the Sirte region (April 02); two tank carriers in the region of Ras Lanouf (April 03); a military vehicle southwest of Brega (05 April); and two anti-aircraft missile sites… (April 06)' (France 2011d; *dates in brackets as published*). As noted by Gros (2014), Goulter (2015) and Ritchie (2018), much of

Unified Protector was tactically-focused, reactive to events on the ground, and concerned with the immediate protection of civilians from Libyan government forces in line with the UNSC mandate. A broader strategy to deny the Libyan armed forces the means to operate, disrupt national C2 and to isolate the Libyan leadership from its sources of strength only emerged in late-May following a broadening of NATO's interpretation of how it would protect the civilian population (NATO 2011a, Goulter 2015, Ritchie 2018). This strategy culminated in NATO's parallel approach from July 2011 in which air power supported rebel offensives against towns en route to Tripoli whilst simultaneously targeting the capital itself, alongside information operations (NATO 2011b, Ritchie 2018). The RAF was at the forefront of strikes against Tripoli, and 'targets include(ed) C2 nodes, defensive positions, fielded forces, ordnance depots and fuel storage sites. In terms of both accuracy and effect, coalition air strikes in this period were particularly successful… but the impact proved extremely difficult to measure' (Ritchie 2018, 96). Rebel gains aided by continued NATO air strikes against Libyan fielded forces, the fall of Tripoli in late-August, and the dispersal and eventual isolation and destruction of government forces in central Libya by October created the conditions for Operation *Unified Protector* to conclude at the end of that month.

Following the operation, military officers from France and Britain praised the effectiveness and applicability of their respective precision strike capabilities. General Desclaux, Commander of the *Armée de l'Air's* CDAOC, noted that the Rafale was highly effective and allowed for a choice of weapons, effects and reconnaissance capabilities that enabled it to precisely hit targets from the first day of Operation *Harmattan* (Desclaux 2012). British Air Chief Marshal Dalton praised Typhoon's combat debut, its successful air-to-air and air-to-ground missions, and its precise employment of laser-guided bombs (Great Britain, House of Commons 2012, Ev 46-47). France also deployed its *Harfang* unmanned platform for the first time, adding additional reconnaissance capabilities alongside Rafale (France 2011f). Despite the successes, capability gaps, shortfalls and the general reliance of the Allies on the United States for key enabling and ISR capabilities was noted in the aftermath of *Unified Protector* (Gros 2014, Goulter 2015). For Britain this was particularly acute in the shadow of the 2010 SDSR which had determined a further reduction in ISR capabilities including the Sentinel R1 and Nimrod R1 platforms which were to be retired post-Afghanistan and post-Libya respectively (Great Britain, House of Commons 2012).

The use of air power during Operations *Odyssey Dawn* and *Unified Protector* was unlike the previous Allied operations against the governments of Afghanistan and Iraq in the early-2000s. Neither *Odyssey Dawn* nor *Unified Protector* featured a large-scale strategic air campaign

against Libyan infrastructure or Colonel Gaddafi's centres of gravity, and *Unified Protector* did not initially seek to disrupt, paralyse or destroy his system of power. Instead, both operations were formulated in accordance with an overarching UNSC mandate and within the confines of a diverse coalition. In this sense, and in its execution, the use of air power against Libya in 2011 shares many of the same features as Operation *Allied Force* against Serbia in 1999. Both followed a broad three-phase approach, targeting the adversaries' IADS in the first phase to enable air superiority, identifying, tracking and striking fielded forces that threatened civilian populations during the second phase, and only moving somewhat reluctantly to a recognisably strategic campaign in the third phase of operations. These phases were also sequential in both cases, with phases two and three in Libya blurring to some extent. A strategic air campaign against Gaddafi's sources of power and control was not an initial focus for *United Protector* and became necessary as the limits of indirectly supporting anti-government rebel forces through strikes against the Libyan armed forces was acknowledged and NATO accepted the logic of striking the regime directly to protect the civilian population. This echoed NATO's general reluctance to strike the Milosovic regime's means of control in Serbia itself during *Allied Force* until it was clear that operations in the field were not having the desired effect. At the core of *Unified Protector's* use of air power was the continued leveraging of the 'enhanced' tactical application of air power that had emerged from *Allied Force* and had been applied by the United States in particular in the aftermath of the strategic air campaigns in Afghanistan and Iraq. The rapid sensor-to-shooter timescales enabled by the contemporary capabilities of French and British air power, supported by US ISR assets and networks, made the reactive, dynamic targeting of Libyan fielded forces a viable strategy and one that was in line with the mandated objectives of the operation. The limits of this strategy were seen in the fluctuating successes of the anti-government rebel forces, with whom air strikes were not coordinated, and in the lack of any change in the behaviour of Colonel Gaddafi and his armed forces. Essentially, for much of Operation *Unified Protector* there was a disconnection between the effects NATO sought and the strategy it employed to achieve them. Consequently, control over Colonel Gaddafi and his armed forces was only achieved when parallel attacks were launched against both his means of control in Tripoli and his fielded forces, and the resultant weakening of both control and power were exploited by rebel forces.

Operation Serval

Operation *Serval* was launched by France in January 2013 at the request of the Malian government. This request resulted from events following the self-declared secession of the north of Mali by the Tuareg National Movement for the Liberation of Azawad (MNLA) in March 2012 and the subsequent takeover of MNLA-controlled cities by an alliance of jihadist terrorist

groups which, by January 2013, had begun to move south (France, National Assembly 2013a, Part I, A, 2, b-c). Air power was central to France's immediate response to Mali's request and to the operation that followed. The objectives of *Serval* were to 'help the Malian Armed Forces… to stop the advance of terrorist groups and push them back while ensuring the safety of civilian populations, (to) help Mali to recover its territorial integrity and sovereignty', and to create the conditions for the deployment of complementary international support and training missions to the country (France 2013c). To achieve these objectives, four *Armée de l'Air* Mirage 2000Ds, forward deployed to N'Djamena in Chad, conducted air strikes against jihadist forces in northern Mali within hours of the request for intervention. Initial strikes focused on stopping the jihadist forces moving south and targeted 'significant number of pick-ups equipped with heavy machine guns and high-performance military equipment, such as rocket launchers, coming largely from Libya' (France, National Assembly 2013a, Part I, B, 3. a). From the third day of operations Rafale combat aircraft flew from their base at Saint-Dizier in France to conduct offensive strikes, supplementing the core '*Épevier* Force' of ten Mirage 2000Ds, a pair of Mirage F1CRs, C-135FR tankers and airlift capabilities, as well as special forces, based in Chad (France 2013d, France, National Assembly 2013a, Part I, B, 3. a). Over the following month the *Armée de l'Air* struck a wide-range of targets in central Mali, including weapons systems, command centres, and training and logistics bases in order to stop the jihadist advance and to support the second phase of operations to recapture the northern cities involving French, Malian and Chadian troops (French Air Staff 2013, France, National Assembly 2013a, Part I, B, 3. b-c). With the successful recapture of Mali's cities, from May 2013 Operation *Serval* transitioned from an intervention into a support mission to aid Malian and regional forces to counter the remaining terrorist threat. *Serval* itself concluded 15 months later, to be superseded by the broader, ongoing, Operation *Barkhane*.

The two core phases of Operation *Serval* – halting the jihadist advance and supporting ground forces to recapture Mali's northern cities – confirmed several important elements of French strategy and air power's role in delivering it. They also highlighted some limits and areas for improvement. First, through Serval, '*la France a démontré sa capacité à entrer en premier sur un théâtre, clef de son autonomie stratégique*' [France demonstrated its capacity to enter a theatre first, the key to its strategic autonomy], confirming both a central tenet of French defence policy and the 2008 White Paper's guidance to pre-position a quick-reaction force in the Sahel region (France, National Assembly 2013a, Part I, B, 1.). Second, forward deployed air power through the *Épevier* Force was vital to achieving the rapid halt of jihadist forces in the first phase of operations (France, National Assembly 2013a, Part I, B, 4. b). Third, the air power capabilities demonstrated in Afghanistan and Libya were confirmed, with the Rafales

and Mirage 2000Ds utilising an assortment of precision weapons, conducting long-range strikes, and contributing to different aspects of the operation including CAS and time-sensitive targeting in a single sortie (France, National Assembly 2013a, Part I, B, 4. b. ii). The limits of French air power highlighted by Operation *Serval* concerned logistics – which required significant Allied support to be effective and enable timely operations – and ISR, to which the United States and Britain contributed E-8 JSTAR, MQ-1 *Predator* and Sentinel R1 platforms to assist French efforts (France, National Assembly 2013a, Part I, B, 5., Part II, A, 1.). The specific limits of national airborne ISR were noted to include the Mirage 2000D fleet's lack of reconnaissance capability and the *Harfang* unmanned ISR platform's endurance and limited numbers (France, National Assembly 2013a, Part II, A, 1. b). From the perspective of French strategic air power as understood in the 2008 Concept, the use of the *Armée de l'Air* during Operation *Serval* followed and demonstrated the Concept's expectation of air power striking and acting in depth, and broadly interpreted, participating 'in the operational paralysis of the adversary' through their destruction (France 2008b, 17). However, strikes by the *Armée de l'Air* were primarily reactive and counter-force rather than targeted against the 'functioning of the enemy's military apparatus' (France 2008b, 17). Given the reactive nature of the operation itself though, the fast-moving situation on the ground, and the immediate and strategic objectives France was trying to achieve, the balance of air power's focus during the initial phase of *Serval* is understandable. Air power offered both a rapid response and a means of mitigating the significant distances between areas of operation, and bought the time required to deploy regionally-based French troops, the Malian armed forces and neighbouring ground forces to recapture lost territory.

Perspectives & Consequences

The employment of French, British and US air power in North Africa in 2011 and 2013 can be considered both from the perspective of the operations themselves – their unique characteristics, what they were trying to achieve, and what they were not – and the consequences of national experiences for national concepts of modern strategic air power. Operations in both Libya and Mali were, as Byford (2013) characterised the latter, quick reaction interventions in which the relatively light-footprint of air power provided an agile, responsive and cost-effective means of intervening in a situation within accepted political and public limits. The limits imposed by these types of interventions is that the pre-planning associated with a strategic air campaign, reliant upon deep and broad intelligence collection, the identification of centres of gravity, their weaknesses, dependencies and the critical connections to be targeted, is not possible. Deliberate, pre-planned targeting is either limited to known, critical elements of the enemy system such as the IADS and air force that must be

destroyed to guarantee air superiority – as in *Odyssey Dawn* – or absent due to the reactive nature of the operation, the mobility of the enemy, and a lack of prior intelligence on fixed assets – as in *Serval*. Consequently, targeting is necessarily dynamic, time-sensitive and highly reactive to events on the ground. Producing strategic effects with air power under such operational conditions is arguably not possible, and control of the adversary through disruption, paralysis or destruction of his system is not explicitly sought. However, strategic effect is still expected. Dynamic, time-sensitive targeting seeks to produce immediate effects against fielded forces in the expectation that these will alter the adversary's cost/benefit calculations, and thereby produce the desired strategic effect. If this doesn't occur, as in the case of Libya, then mission creep results. Indeed, as Boeke & Schuurman (2015) suggest, the relative successes of air power in North Africa during this period must be balanced between what they initially prevented and what they ultimately achieved. Central to both *Unified Protector* and *Serval* was prevention. The use of Allied air power was broadly successful at stopping and reversing enemy gains, preventing immediate civilian casualties, and by so doing, create the conditions for ground forces to capture territory. However, this did not ultimately achieve the strategic objectives sought – Libya's civilian population was still threatened in the civil war that followed the Gaddafi regime's fall, and Mali's successive, fragile governments have been unable to fully control their own territory or defeat the jihadist threat in the north.

Of the three case study states involved in operations in North Africa, France played the largest role. As the primary actor in both operations it drew largely positive lessons for how it deployed and utilised its air power. Both *Harmattan* and *Serval* demonstrated the state's ability to project power, to deploy rapidly and before other states using its forward deployed forces, to act relatively independently in a strategically important region, and to change the course of events on the ground in its favour. Collectively these were seen as confirming the direction given by the 2008 White Paper, the long-term capability investments made in air power, and the experience of and approach to operations in Afghanistan (Desclaux 2012, France, National Assembly 2013a, Laborie 2013, de Durand 2014, Spet 2015). In short, *Harmattan* and *Serval* signposted the near-future of French air power operations: limited interventions in strategically important regions featuring immediate, reactive, counter-force strikes and support to ground forces, reinforcing French defence independence and freedom of action.

For Britain, the high-level post-conflict lessons of Operation *Ellamy* echoed that of the French. These included Britain's demonstration of the armed forces' expeditionary capabilities, the flexibility, adaptability and rapid deployability of its forces, and the broad success of the

mission overall (Great Britain, House of Commons 2012, Chapter 5). Specific lessons for air power highlighted the flexibility and accuracy of air operations, the aforementioned ISR shortfalls in light of the 2010 SDSR, missile stockpiles, and the general operational reliance on the United States (Great Britain, House of Commons 2012, 45-48, 50-55). The nature and direction of British air power during *Ellamy* does not appear to have been considered by the Defence Committee in 2012 beyond the context of the UNSC mandate, NATO's rules of engagement and in meeting operational expectations. Britain's contribution to Operation *Serval* was limited compared to France, focused on the provision of airlift and ISR assets, and provided in support of the French mission; consequently, there are no lessons for Britain's concept of strategic air power to be drawn.

For the United States, operations in North Africa provided an insight into the political limitations that could be imposed on the use of air power when vital national interests were not considered to be at stake. The aims of Operation *Odyssey Dawn* were the closest the United States came to using air power for strategic effect in Libya, enabling the broader NATO mission that followed to protect civilians through the destruction of the elements of the Libyan armed forces that could have credibly threatened Allied air power. The full spectrum of US air power was utilised to achieve this, including B-2 and B-1B bombers, a variety of precision guided weapons, electronic attack, and a broad range of ISR collectors and other enablers. Once achieved, the United States' primary contribution to *Unified Protector* was in the provision of ISR and aerial refuelling to enable Allied operations to continue. In support of Operation *Serval*, the same capabilities were deployed again to enable French combat operations, as well as air lift platforms to bolster French logistics. More broadly, the relative success of Allied air power in its prevention missions in North Africa highlighted both the reliance of the United States' allies on its enabling capabilities and the general effectiveness of even limited air power absent a significant US contribution to create changes on the ground. The creation of immediate results from limited means, which coincided with parallel light-footprint, reactive 'hunter-killer' strikes in Afghanistan, would be at the core of US air power a few years later against Islamic State in Iraq and Syria. In parallel to operations in Libya and Mali though, a quite different model for the use of air power for strategic effect was being utilised and tested to its limits by Israel.

Deterrence Through Action? The Diminishing Returns of the Israeli Model

In the final part of the research period, Israeli air power was based on the utilisation of a model for creating strategic effect that followed two parallel tracks developed in the aftermath of the Second Lebanon War. As discussed, these two tracks consisted of using the IAF against

militant groups – particularly Hamas – in local, limited actions to restore the status quo and to deter future disruptions, and an active process of accumulating deterrence against Iran and its proxies in Lebanon, Syria and beyond, through long-range strikes and a broader intelligence-led campaign of sabotage. The two tracks were united by the common Israeli perspective that by the 2010s deterrence had become 'a series of acts of force to create and maintain general norms of behaviour for many political actors over an extended period of time' (Rid 2012, 125). The broadly successful use of the first track in Operation *Cast Lead* and the apparent first use of air power on the second track in Sudan in 2009 suggested that that limited, focused air power could contribute to Israel's objective of deterring its adversaries and maintaining a level of normal life for its citizens. In the 2010s two operations in Gaza against Hamas, *Pillar of Defense* in 2012 and *Protective Edge* in 2014, tested the Israeli Model, as did a significant increase in air strikes against targets in Syria from 2013 onwards. The initial results were broadly positive, with the combination of excellent Israeli intelligence, precision firepower, and rapid sensor-to-shooter timescales delivering strategic effects as expected. However, in a relatively short period of time a combination of enemy adaptation, deficits in intelligence gathering, and the limits of using air power against targets in a complex urban environment led to diminishing returns on the promise of the Israeli Model.

In November 2012 Israel launched Operation *Pillar of Defense* against Hamas targets in Gaza. This was the first major operation since *Cast Lead* four years earlier and a response to increasing rocket and mortar fire from the territory (Israel 2012c). The operation had four objectives: to 'strengthen… deterrence', to 'inflict serious damage on the rocket launching network', to 'deliver a painful blow for Hamas and the other terrorist organizations [sic]' and to 'minimize [sic] damage to our home front' (Israel 2012a). *Pillar of Defense* was led by the IAF in conjunction with the security services and military intelligence, and opened with 'the elimination of Hamas' military leader Ahmed Jabari' and strikes against 'most of the long range Fajr missiles and additional Hamas infrastructure' (Israel 2012a). The air campaign sought to 'remove a strategic threat to Israeli citizens' by 'reducing the capabilities of Hamas' long and short range rocket forces… (and) to impair Hamas' command and control system' (Israel 2012b). After eight days of strikes, a ceasefire agreement was reached with the mediation of Egypt, by which point the IAF had 'targeted over 1,500 terror sites including 19 senior command centers [sic], operational control centers [sic] and Hamas' senior-rank headquarters, 30 senior operatives, damage(ed) Hamas' command and control (and) hundreds of underground rocket launchers' (Israel 2012d).

Three elements of the operation are of note. First, *Pillar of Defense* provided confirmation of the model of operations that had been employed since *Cast Lead.* The operation demonstrated that 'through the application of limited military force, Israel's aims in the operation – to act against the terrorist infrastructures in Gaza and stop the rocket fire, thereby improving the security reality and allowing a normal life for Israelis – were reached' (Israel 2012e). In turn 'Israel believes that it has re-established its deterrence and that Hamas and the other terrorist organizations [sic] will hesitate before attacking Israeli civilians in the future' (Israel 2012e). The direct link between the IAF's performance and the outcome achieved was subsequently questioned, with the role of Egypt as a mediator particularly noted as being instrumental in ending the conflict (Tzabag 2015, Cohen *et al.* 2017). Nonetheless, the perception of the success of the air-centric approach to operations allowed 'the argument that airpower [sic] could achieve Israel's objectives without ground forces (to) gain… prominence' (Cohen *et al.* 2013, 64).

The second element of note is the role played by missile defence during *Pillar of Defense*. Israel's Iron Dome short-range missile defence system was deployed and extensively used to intercept missiles fired from Gaza. According to Israel, 'the Iron Dome defense system has accomplished a high rate of successful interceptions (84%) and Hamas' accuracy with regards to hitting populated areas within Israel remained below 7%' (Israel 2012e, *brackets as quoted*). The operational effect of Iron Dome, in conjunction with air power, suggested by Cohen *et al*, 'may have lessened the effects of Hamas attacks during the eight-day war and potentially allowed Israel to control escalation and reduce the need to respond with a ground incursion' (2017, 62). Iron Dome 'provided the political echelons with strategic leeway', allowing the IAF to continue its strikes against Hamas targets despite ongoing missile launches (Tzabag 2015, 90). This ensured the relative safety of Israeli territory and marked an evolution in Israeli strategy from the traditional use of air power to provide cover for the use of ground forces to a new approach where effective missile defences were used to provide cover for the use of air power.

The third notable element is the consequences of this combination of Israeli air power and missile defences for the direction of the IDF and the strategy of Hamas. For the IDF operation *Pillar of Defense* reinforced the necessity of investing in missile defence outlined by the 2013 five-year defence plan and tipped the balance between investment in the ground forces and investment in air and cyber in the latter's favour at a time of overall budgetary contraction (Cohen *et a*l. 2017). This in turn would shape the direction of Israeli air power and the options available in conflicts later in the decade. For Hamas, the overriding lesson from the attacks on

its leadership and C2 during *Pillar of Defense* was 'that survival would depend on moving underground, where ISR and air interdiction would be much less effective' (Cohen *et al.* 2017, 66). Israeli air power's future ability to strike, control and reinforce deterrence against Hamas would consequently be threatened by the adaptation of its adversary.

This period also saw an increasingly active role for the IAF in the broader application of the Israeli Model to strike decisively, pre-emptively and at depth to uphold deterrence and to mitigate future threats. Operation *Outside the Box* in 2007 and an alleged Israeli air strike in eastern Sudan in early-2009, which destroyed a convoy of trucks carrying Iranian weapons bound for Hamas in Gaza, had already demonstrated Israel's contemporary willingness and ability to strike at distance for strategic effect (Gordon & Gettleman 2009). From 2012, the number of long-range strikes appeared to increase in response to greater arms transfers from Iran, primarily through Syria. In October 2012 the Sudanese government accused Israel of carrying out an air strike on a weapons factory in Khartoum allegedly associated with Iranian weapons transfers to Palestinian militant groups (Kershner 2012). In 2013, a number of air strikes were launched against targets in Syria associated with long-range missiles, arms convoys and weapons research. The Syrian government frequently accused Israel of responsibility and in some cases US officials confirmed Israeli involvement to the US press. Strikes included a January 2013 attack on anti-aircraft missiles being transferred to Hezbollah and against a Syrian weapons research centre, two strikes in May 2013 against surface-to-surface missiles also destined for Hezbollah, and a number of Syrian military facilities, and a July 2013 strike against a transfer of anti-ship missiles in Latakia (Keshner & Gordon 2013, Sanger, Schmitt & Rudoren 2013, Barnard, Gordon & Rudoren 2013, Barnard 2013, Gordon 2013). Beyond the accruing operational benefits of pre-emptively striking its adversaries' most powerful weapons, the strategic benefit sought was to deter Iranian proxy aggression and to signal Israel's potential to strike Iran itself. The use of air power was, and continues to be, part of a broader strategy of deterrence involving intelligence operatives, sabotage and extensive cyber operations (Williams 2011, Sanger 2011, Lappin 2013, Siman-Tov & Schweitzer 2015, Anderson & Sadjadpour 2018).

Despite the qualified success of *Pillar of Defense* in 2012 and the numerous deterrent-building strikes over the following year, Hamas was ultimately neither deterred nor prevented from launching further missile attacks against Israel. In response to a combination of missile fire and the growing network of tunnels constructed by Hamas to infiltrate Israel, Operation *Protective Edge* was launched in July 2014 (Israel 2014a, 2014c). The operation's objectives were 'to restore stability and quiet to the residents of Israel, to damage Hamas's capabilities

and to destroy the terror infrastructures directed against Israel and its citizens' (Israel 2014c). During the first phase of *Protective Edge* the IAF conducted 'more than 1,700 strikes' against a list of pre-planned targets that had been compiled post-*Pillar of Defense*, prior to the launch of a broader campaign utilising IDF ground forces (Cohen *et al.* 2017, 91). Targets included 'tunnels, weapon(s) manufacturing and storage facilities, and command and control centers [sic]… weapon caches and Hamas… training facilities' (Israel 2014b). Crucially, *Protective Edge* was unable to deliver the same shock to Hamas' leadership and infrastructure that had been possible only two years before. As Cohen *et al.* note, Hamas had successfully adapted and 'applied the lessons it learned in *Pillar of Defense* to diminish the effectiveness of the IAF's ISR and precision attack capabilities' (2017, 92). The construction of the Hamas tunnel network presented a significant challenge to Israeli air power and the Israeli Model for addressing persistent non-state threats – it was hidden from immediate view, harder to physically disrupt or destroy, and located beneath civilian areas, limiting targeting options (Tira 2014).

The operational and strategic consequences were numerous: the pre-planned target list was based on outdated intelligence; expected effects against Hamas C2 and missile capabilities from attacking pre-planned targets were not realised; the tunnel network afforded Hamas mobility and protection and forced Israel to rapidly locate, identify and strike fleeting targets in cluttered, civilian environments whilst adhering to its own rules of engagement and to international law; and the nature of the tunnel network forced Israel to use ground forces, with the associated risks to personnel (Israel 2014c, Cohen *et al.* 2017). Operation *Protective Edge* ended after 29 days in which time 32 Hamas tunnels had been destroyed and nearly 5,000 targets hit by the IAF (Israel 2014b), but, in contrast to *Pillar of Defense*, Israeli air power was unable to achieve comparable, significant or independent strategic effects. Thus, the end of Operation *Protective Edge* can be seen as the end of an arc of strategic air power development and use by Israel that began in the aftermath of the Second Lebanon War in 2006, peaked between 2008 and 2012 with operations *Cast Lead* and *Pillar of Defense*, and rapidly diminished by 2014. Israel's initially successful adaptation of its air power to the strategic environment in which it needed to have effect was eventually checked and undermined by the adaptation of its adversaries, particularly Hamas. Israeli air power's advantages in ISR, precision strike and risk mitigation relative to the use of ground forces were blunted, making decisive force and the disruption of the adversary's leadership, C2 and mobility highly challenging. Consequently, the growing necessity to reassess Israeli air power's strategic potential in local, limited conflicts was evident by 2015 and for the first time, a publicly available defence doctrine, the IDF Strategy, was released to highlight *inter alia* the principles for the

use of force, deterrence, the campaign between the wars, and the role of air power (Israel 2015).

Back to the Future: Degrading Islamic State & Planning for Tomorrow's Air Power

The final Allied air campaign of the research period was Operation *Inherent Resolve*, directed against the terrorist group Islamic State (IS)[4], first in Iraq and later in Syria. It was conducted over three phases with the strategic goal of defeating IS. The first phase of the operation featured all four Allied case study states. Their respective air power was used in intelligence gathering, strike, and enabling roles, aiming to degrade IS forces and support local allies on the ground. Air power was applied gradually and, for a variety of political and military reasons, utilised the counterinsurgency approach from Afghanistan that had become the standard for Allied air power since the mid-2000s. Parallels with the NATO approach to *Allied Force*, the nature of France's Operation *Serval*, and the difficulties encountered by Israel in the Second Lebanon War in assessing, targeting and effecting a hybrid adversary can also be seen. In contrast, with the increasingly assertive behaviour of both Russia and China at this time there was also a growing necessity for the Allied states to look ahead to the future of warfare and the role of air power within it. Contemporary white papers and doctrine highlighted the threat posed by state peer competitors and how air power could be used for strategic effect in a contested, multi-domain threat environment and as a component of the joint force. This view of the future operating environment prompted investment in the recapitalisation of enabling capabilities, the start of next-generation platform, weapon and systems programmes, and sought to leverage newly acquired and expanded capabilities from the earlier third phase of post-Cold War air power reforms. Thus, by the end of the research period the Allied states faced a balance between the challenges of a contemporary hybrid adversary, the politics of coalition and the resulting application of air power, and the necessity to consider a radically different and far more challenging operating environment in the future.

Degrading Islamic State: Phase I of Operation Inherent Resolve

Operation *Inherent Resolve* (OIR) began in August 2014 and continued beyond the end of the research period. It was focused on countering the terrorist activities and territorial expansion of IS, with initial operations focused on Iraq and a later expansion to include Syria. OIR was a broad coalition effort, led by the United States under the 'Combined Joint Task Force' (CJTF) and featuring Britain, France, Australia, a variety of NATO members and Gulf states in combat

[4] For simplicity, the Islamic State group is referred to as IS throughout, unless a direct quotation uses an alternative name for the group e.g. ISIS

roles. The OIR coalition was focused on ‘supporting military operations, capacity building, and training; stopping the flow of foreign terrorist fighters; cutting off IS access to financing and funding; addressing associated humanitarian relief and crises; and exposing IS’ true nature’ (United States, Congressional Research Service 2016, 1). Air power was the primary means of conducting offensive military operations against IS and also contributed to aspects of cutting off financing and funding to the group. In the five years from the initial action against IS to the loss of its territory, air operations moved through three phases: degrade, counterattack, and defeat. The first phase was focused on Iraq and consisted of initial, reactive support to local allies under threat from IS, followed by efforts to degrade IS more broadly.

The case study states committed significant air power to achieve this. The United States deployed a near-complete complement of USAF and US Navy platforms to the first phase of operations, ranging from F-15Es, F/A-18s, F-22s and B-1Bs for strike, as well as unmanned *Predators* and *Reapers* for ISR-strike missions, RC-135 *Rivet Joints* and EC-130s for electronic attack, KC-135 and KC-10 tankers, and a host of C2 and ISR platforms including E-3s, E-8s, RQ-4 *Global Hawks* and U-2s (Wasser *et al.* 2021, 372-381). The British air component largely reflected the one assembled for 2011’s Operation *Ellamy*. It comprised strike aircraft – first Tornado GR4s, then Typhoons and MQ-9A *Reaper*s – supported by the new RC-135W *Rivet Joint*, intelligence collecting Sentinel R1s, and E-3 *Sentry* and *Voyager* enabling platforms for AEW&C and aerial refuelling respectively (Parliament. House of Commons 2015, para 70, Great Britain 2020). The French deployment in September 2014 was initially modest, with three *Armée de la Air* Rafales from France, supported by a KC-135 tanker, an E-3F AWACS and an Atlantique-2 (France 2020, 14). The Rafales were replaced with Jordan-based Mirage 2000Ds later in 2014, and further Rafales and *l’Aero* Rafales, Super Etendards and E-2D *Hawkeye* AEW platforms deployed from the carrier *Charles De Gaulle* from early-2015 (Wasser *et al.* 2021, 362-364). By late-2015, the most advanced of France’s precision weapons, SCALP cruise missiles, were being launched from both Rafales and Mirage 2000s in combat for the first time, alongside precision-guided bombs (France 2020, 15). Australian air power contributed to the first phase of OIR with ‘eight Royal Australian Air Force F/A-18 combat aircraft, an E-7A *Wedgetail*… and a KC-30A’ (Australia 2014c).

This quantitatively and qualitatively impressive array of Allied air power was applied gradually and reactively during the first phase of operations. Strikes were initiated at the request of the government of Iraq and focused on supporting Iraqi forces in their ground operations against IS and protecting other local partners as circumstances dictated (CJTF 2020). The operation broadened through late-2014 and into 2015 into a series of missions to degrade IS capabilities

in Iraq (CJTF 2020). Analysis by Wasser *et al.* (2021, 62-63) of coalition air strikes during this period showed the majority of strikes were counter-force, targeting IS personnel and vehicles. Infrastructure, supply lines, C2 and leadership were also struck but not to any significant extent. This began to change during the second phase of OIR from October 2015 when operations expanded into Syria. The first operation of the second phase was *Tidal Wave II*. This operation 'systematically attack(ed) oil extraction, production, and distribution targets' at al-Omar in Syria which 'aimed to cripple ISIS's oil operations for months if not years in a far more destructive and expansive wave of strikes' (CJTF 2015, Wasser *et al.* 2021, 71). The initial strike hit 26 targets simultaneously, with strike aircraft from the United States, Britain, France, Australia and a number of NATO states participating. A parallel operation, *Point Blank*, began shortly after the research period in early-2016 and focused on IS's cash storage and transport network.

The first phase of OIR was subject to a large number of constraints and negative objectives which had consequences for the effects that the extensive and highly-capably array of air power assembled could achieve. These included the politically-imposed limits of a strategy that was necessarily focused on Iraq first, in the absence of a cooperative partner government in Syria; an expansive and diverse rules of engagement across the broad coalition of states, as well as contrary goals being sought with local actors such as the Kurds in Northern Iraq; the necessity of minimising collateral damage and IS's ability to exploit any that resulted; and the limits of intelligence and target identification derived from the air and focused on an adaptive, concealed enemy dispersed across a wide area and different environments. The first phase of OIR also shared some similarities with the difficulties faced by Israel during the Second Lebanon War, in which the hybrid nature of the enemy presented challenges for planners in identifying centres of gravity and for air power in targeting them, and doing so in a way that met overarching objectives and constraints on action. IS benefitted from many of these constraints, through its initial ability to continue to operate from and expand its territory in Syria, largely safe from coalition air strikes, and to learn from early errors by becoming more mobile, maximising the cost of fighting for local forces, and exploiting its territorial gains to spread influence and recruit new fighters (Wasser *et al.* 2021).

Consequently, the conduct and focus of OIR received criticism from the US air power community, including Lieutenant General David Deptula who in 2018 highlighted the lack of jointness in US operations generally, emphasised by the OIR air campaign being directed by a series of Army generals, the conduct of OIR as a continuation of the counterinsurgency campaigns fought in recent years, and the slow progress made by applying air power narrowly

and reactively which gave IS time to react, spread and survive (Deptula 2018, 11-12). The second and third phases of OIR, beyond the research period, did include a greater focus on IS's sources of strength, but the overarching political and coalition constraints on air power continued to dictate how and where it would be applied. In parallel with the contemporary challenges of defeating IS, the Allied air power communities were also focused on preparing for a future operating environment in which state threats would need to be deterred and potentially addressed.

Planning for Tomorrow: New Directions & Capability Developments

Between 2013 and 2015 a series of defence white papers and updates to air power doctrine were published in the United States, Great Britain, France and Australia. These documents provide insights into contemporary thinking about the role of strategic air power in the defence environment of the mid-2010s and plans for air power to operate against the threats of the 2020s and beyond. Across the four states several trends pertinent to the direction of strategic air power emerged. The first was a focus on the resurgence of state threats and how air power will need to be developed to mitigate them. This trend was evident in the USAF's suite of new white papers released in 2013 and 2014 that set out the future direction of US air power, and the subsequent 2015 National Military Strategy, Britain's 2015 National Security Strategy that highlighted the threat from Russia, and, to a lesser extent, in the French and Australian white papers of 2013 which also highlight regional state threats, competition and military modernisation (United States 2013a, 6, 8, United States 2014, 7, 16, United States, Department of Defense 2015a, 16, Great Britain 2015, 18, 20, 24, France 2013a, 35-26, Australia 2013, 14-15).

The second trend was the continuation and expansion of air power's definition and role to encapsulate the air, space and cyber domains in the expectation of greater, unified effects. This was apparent from the National Military Strategy's focus on 'decision advantage' to be achieved through the United States' ability to leverage its technological edge in air, space and cyber technology and to operate these as one (United States, Department of Defense 2015a, 16). The UK Air & Space Power Doctrine, 2013, highlighted both air-cyber and air-space integration, including the offensive and defensive applications of air-cyber power, and the creation of 'desired joint warfighting effects in a given area of operations' by air-space power (Great Britain 2013, paras 414-418). In the context of future interventions, France also saw continued 'operational superiority' as requiring 'coercive engagements… (to) be coordinated in all five environments – earth, air, sea, outer space and cyberspace' and enabled by 'technological superiority in the fields of intelligence, range, power, precision and coordination

of the resources' of its armed forces (France 2013a, 79-81). Australia continued to draw together strike, space and cyber capabilities as part of its joint and enabling forces, building on the direction set by the 2009 White Paper for the armed forces of 2030 (Australia 2013, 77-81).

The third and final trend that emerged from the documents of the Allied states was a degree of divergence between the United States and the other Allied states in how they contextualised strategic attack. The United States largely maintained its traditional view of strategic attack as a core function of its air power in the USAF's 2015 Basic Doctrine and continued to leave it outside of contemporary Joint Doctrine. Australia attempted to balance a broader view of strategic attack with the constraints of its national air power, and Britain and France increasingly defined strategic attack both more broadly and in the context of joint operations by the joint force. The USAF's doctrinal view continued to emphasise air power's unique capability to 'simultaneously strike directly at the adversary's centers [sic] of gravity, vital centers [sic], critical vulnerabilities, and strategy', and in doing so have 'a significant impact to an enemy's will in addition to the physical blow' and 'to achieve effects well beyond the tactical effects of individual actions, at a tempo that disrupts the adversary's decision cycle' (United States 2015, Ch.2). These effects were designed to 'impair the adversary's ability to carry out war or hostilities in general' and 'should neutralize [sic] the adversary's centers [sic] of gravity' (United States 2015, Ch.3).

In contrast, Australian, British and French strategic air power was being defined more broadly. A new defence white paper was published by Australia in 2013. Its core national security goal remained to independently deter and defend Australia against attack through a policy of self-reliance and its long-standing alliance with the United States. Central to this was 'controlling the sea and air approaches to our continent (a)s the key to defending Australia' which required 'a credible force with effective capabilities for sea and air control and denial, strike and power projection' (Australia 2013, 3.42, 3.47). The RAAF's method for doing this was articulated through the sixth edition of the Air Power Manual in 2014. The new doctrine continued to emphasise air power's position within Australia's National Effects-Based Approach to defence planning and operations, but at the same time, revised the concept of 'strike' to be broader – including operations against sea and land targets, interdiction and offensive air support – and to be more independent (Australia 2014a). The 2014 doctrine once again reflected the recurring tensions in organising and positioning its air power between its own national defence environment, its primarily defensive posture and its force of limited mass, with the thinking and position of its closest ally. In Britain, the 2013 Doctrine noted the expansive role that air power

would play in joint operations, ‘using air capabilities to influence the behaviour of actors and the course of events’ (Great Britain 2013, para 102). Strategic effect was key to achieving this, consisting of kinetic and non-kinetic effects across a broad range of operations including deployment, signalling, protection, intelligence and strike, and in which the outcome is not instantaneous (Great Britain 2013, paras 119-121). The joint doctrine linked attack with coercion – compelling or deterring the behaviour of the adversary – through a combination of firepower and information. In this context, strategic attack is focused on denying an adversary’s ability to wage war by disrupting or destroying his centres of gravity, and part of a broader range of effects coordinated across multiple domains and simultaneous operations (Great Britain 2013, paras 316-319). France’s conception of strategic attack also broadened to include the joint force, with the 2014 Doctrine for the Employment of the Armed Forces detailing how a range of effects could be produced by the armed forces, including intimidation, containment, neutralisation and security (France 2014, Ch.4). Neutralisation aims to ‘paralyze [sic] a threat or eliminate neutralizing [sic] actors through destruction or capture’ and uses the full range of capabilities available, ‘physical, electronic, information technology, (and) psychological’ (France 2014, para 405 c.). It also requires consideration of ‘the tempo given to the action, simultaneity of effort, surprise, the exploitation of initiative and the ability to dictate the course of events to the adversary’ with the focus ‘of force on identified vulnerabilities in order to weaken centres of gravity’ (France 2014, paras 434-435).

In parallel with thinking on the direction of future air power, the third phase of air power reforms and investment of the mid-late 2000s began to be reflected in US, British, French and Australian capability developments from 2013 onwards. These developments sought to enhance the spectrum of capabilities required for strategic air power to remain credible, reflecting the Allies increasing focus on how to maintain and develop credible means to deter and, if necessary, fight major state powers in the coming decades. There were multiple elements to air power developments in this period: the recapitalisation of outdated platforms; enhancements to combat aircraft and additional platform procurement; the introduction of new, potentially transformative aircraft and weapons; and the launch of multiple efforts to define and develop the next-generation of strike platforms.

The recapitalisation element was primarily focused on enabling capabilities. Britain, France and Australia all began to realise the complete replacement of their aerial refuelling platforms, initiated in the mid-2000s, with national variants of the A330 Multirole Tanker/Transport (MRTT). For Britain the A330 MRTT replaced the TriStar and the last remnant of the V-Force, the VC-10, both of which were retired by 2014, with the first of fourteen A330 *Voyager* aircraft

entering service in 2012 (Pocock 2014, Vallis 2014). The much-needed recapitalisation of France's aerial refuelling fleet, vital for nuclear deterrence, protection, and conventional intervention missions, and largely reliant upon 50-year old C-135FRs, began in 2014 with the authorisation to procure fourteen A330 MRTTs (France, National Assembly 2013b, 2.1.2). The first of these entered service in 2018. Australia had retired its Boeing 707 aerial refuelling fleet in 2008 and was forced to accept a gap in capabilities until 2013 and the establishment of the initial operating capability for the KC-30A, the RAAF's designation for the A330 MRTT (Australian Aviation 2019). Closing this gap was essential for the RAAF to meet the doctrinally mandated tasks of striking at distance against land, naval or infrastructure targets, conducting extended range anti-surface warfare, and maintaining long-range airborne surveillance, from mainland Australia and by extension, its strategic air power credibility. The United States also made steps towards recapitalising its KC-135 and KC-10 fleets with the eventual and protracted selection of Boeing's KC-46A as the winner of the KC-X competition in 2011 (Tirpak 2011). Entry into USAF service began in 2019. Britain also recapitalised its long-range ELINT capability during this period, with the RC-135W *Rivet Joint* joining the RAF from 2013 to replace the Nimrod R-1 which had retired following Operation *Ellamy* (Great Britain, Ministry of Defence 2013, Allison 2018). The primary drivers of aerial refuelling fleet recapitalisation in this period were airframe age and the considerable airframe usage in support of the enduring operations in Afghanistan and Iraq, as well as more recent operations and ongoing national commitments. Additional factors included technological progress, operating costs, upgrade costs and, in Britain's case with the *Rivet Joint* procurement, a trend to align ISR collectors with those of its US ally.

The second element was the enhancement of combat aircraft capabilities and the procurement of new platforms, which began in the mid-2010s. For British and French combat aircraft these enhancements went beyond standard modernisation and upgrade to platforms, and aimed to increase the range of weapons, tasks and missions the aircraft could undertake in order to retire other combat aircraft types and increase multirole functions for the future. Britain focused on transitioning capabilities from the Tornado GR4 fleet to Typhoon before the former's planned retirement from service in 2019. Under Project Centurion, the RAF's Typhoon FGR4s were upgraded from 2015 and by late-2018 were capable of deploying with Storm Shadow stand-off weapons, the Brimstone ground attack missile, and the Meteor beyond-visual-range air-to-air missile (Royal Air Force 2019). Britain also signalled its intention at the 2015 SDSR to add to its fleet of MQ-9A *Reapers* with a new 'B' variant, known as *Protector* and able to carry British missiles, sensors, and fly in unsegregated airspace (Great Britain 2015, 32). France continued the process of developing its future strike capabilities around Rafale, with

the intention of making it the sole combat aircraft type for the *Armée de l'Air* and *l'Aero* by 2025 (France 2013a, 91). The 2013 five-year defence plan added capabilities including new missiles and laser-designation pods for precision weapons, as well as upgrading the Mirage 2000D fleet's ground attack capabilities to keep it operationally relevant into the 2020s (France, National Assembly 2013b, 2.8.2). The enhancement of the Rafale and Mirage 2000D fleets would later allow for the retirement of the Mirage F1CRs of the *Armée de l'Air* and the Super Etendards of *l'Aero* by 2016 (France, National Assembly 2013b, 2.7.1). France also added to its existing airborne ISR capabilities at this time, ordering additional MQ-9A *Reapers* and new *MUSIS* IMINT satellites in the five-year defence plan (France, National Assembly 2013b, 2.2). Australia expanded its F/A-18 fleet through the introduction of F/A-18Fs to bridge the gap to its purchase of F-35A following the retirement of the F-111 fighter/bomber fleet in 2009. It also ordered twelve EA-18G *Growler* electronic attack aircraft from the United States to significantly increase its capabilities in EW (Australia 2013, 8.16-8.18). The enhancements and additions made during this period were in part driven by the necessity to remain relevant in the future operating environment and interoperable with the United States, and in part to fill gaps in capability that had been highlighted in French and British air power in Libya and Mali.

The final elements in Allied air power development in this period were the introduction of potentially transformative platforms into service and plans made to invest in a host of next-generation air capabilities. The United States introduced its first F-35s in 2015, with the short take-off and vertical landing 'B' variant joining the Marine Corps, shortly before the first conventional 'A' variant entered USAF service the following year (United States Marine Corps. 2015, United States Air Force 2016). Despite well-documented delays in development and acquisition, the F-35 potentially offers a major leap in combat air power through a new concept of operations in which stealth, air-to-air and air-to-ground attack, ISR collection, and onboard data fusion and dissemination capabilities are combined to deliver battlefield advantage over the adversary (United States Air Force 2014, Deptula 2018, 7, United States, Congressional Research Service 2020). The F-35's acquisition by major US allies including Britain, Australia, Israel, Japan and South Korea, as well as several NATO air forces, places it and its concept of operations, at the centre of Allied air power well into the 2040s. The United States also enhanced its airborne ISR capabilities with the apparent fielding of the 'RQ-180', a partially-revealed long-range, high-altitude, low-observable and unmanned platform. Its existence was suggested in 2013, with entry into service predicted to have been in 2010 or earlier, but no official confirmation of the platform was made then or since (Butler & Sweetman 2013). Alongside the smaller RQ-170 *Sentinel*, the 'RQ-180' provides the United States with the ability to collect real-time ISR in closed or contested airspace in which operating the U-2, MQ-

4 *Global Hawk* or the F-35 would be inappropriate or too risky (Trevithick 2021, D'Urso 2021). A range of future-focused, next-generation strike capabilities also came to prominence during the early-2010s. These included the commencement of studies in the United States into the generation of combat aircraft beyond F-35 through the USAF's Next Generation Air Dominance programme and the US Navy's F/A-XX programme, the USAF's 2014 request for proposals to meet its Long-Range Strike Bomber (LRS-B) requirement to replace the B-1B and B-2 fleets, although classified work likely began years earlier, and Anglo-French efforts to cooperated on a next-generation combat aircraft beyond Typhoon and Rafale (Air Force Magazine 2014, Great Britain 2015, United States, Department of Defense 2015b, United States, CRS 2020). The United States' new capabilities, and the broader Allied focus on stealth, ISR and next-generation systems, reflected long-term planning for a future threat environment in which adversaries could credibly threaten the Allies' dominant post-Cold War capability to control the air and to operate with relative freedom. The necessity to fully integrate air, space and cyber capabilities, and strike and ISR, was being realised, invested in and became the long-term focus for Allied air power.

New Type Warfare: Russian Strategic Air Power in Syria

In September 2015, Russia deployed its armed forces to Syria to support the increasingly-vulnerable government of its ally Bashar al-Assad. This deployment was led by elements of the newly-formed Russian Aerospace Forces (VKS) and represented the culmination of the post-Georgia reforms and investments that had re-baselined what Russian strategic air power was and how it would be used in practice. The means of intervening in Syria rested upon a significant equipment modernisation programme, structural reform of air power, the unification of Russian C2, and a new defence strategy. Collectively these were applied in a campaign of strategic destruction against both the Islamic State group and anti-government forces and the areas under their control. This campaign revealed the progress made since the Russo-Georgia War in 2008, the strategic utility of limited expeditionary air operations for Moscow's regional goals, as well as Russian air power's continued underlying limitations.

The New Look defence reforms provided the necessary investment and direction to modernise the VVS's capabilities and ultimately allow Russia to conduct air operations in Syria. Two new platform-types were acquired in the 2010s: the Su-34 *Fullback*, a dedicated ground attack variant of the Su-27, which began entering service in 2010 and was used extensively in Syria; and the multirole Su-35 *Flanker-E* from 2012 (IISS 2010, TASS 2015). In parallel, Naval Aviation began receiving the MiG-29 'K' variant from 2010 and the Su-30 *Flanker-C* from 2014 (IISS 2010, 2015). Development of these platforms preceded the New Look reforms, but the

investment and impetus required to introduce them in number became possible from late-2008. Weapons development and acquisition also accelerated in the 2010s, providing a greater range of options for use in Syria. According to Colonel-General Viktor Bondarev, Commander of the Air Force, 'the main emphasis (was) on long-range cruise missiles and air-to-surface precision-guided munitions' including the KAB-500S satellite-guided bomb (Bondarev 2018, quoted in Barrie 2018). Prior to the intervention in Syria, two influential structural changes were also made. First, Russian C2 was reorganised and centralised at the new National Defense Management Center [sic] (NTsUO) in Moscow in late-2014. The NTsUO brought together a wide range of C2 and intelligence functions, agencies, ministries, and the branches of the armed forces in a single place to collect, process, analyse and disseminate data and intelligence, manage military operations, and provide an overview of international and national developments (McDermott 2014). Second, in August 2015 the VVS was merged with the Russian Aerospace Defence Forces, which comprised national air defences, missile defence and military satellites. This created the unitary Russian Aerospace Forces (*Vozdushno-kosmicheskiye sily* (VKS)) which has control of all non-nuclear air and space assets, with the exception of Naval Aviation, divided between three branches: the Air Force, the Air and Missile Defence Force, and the Space Force.

As the New Look defence reforms modernised the VVS's force structure and capabilities, and the NTsUO centralised how air power and the broader armed forces would be commanded and coordinated, a parallel shift occurred in Russian defence strategy. The concept of New Type Warfare emerged in the early-2010s as a means for Russia to take a variety of actions across the whole of government to counter the threat articulated in successive National Security Strategies in 2009 and 2015 of US unipolarity and its own political-military activities. These documents were explicit in asserting that the United States and Europe are the originators of many of the threats to Russia, through actions including 'countering integration processes and creating seats of tension in the Eurasian region (which) is exerting a negative influence on the realization [sic] of Russian national interests' (Russia 2015, 4). In light of the 2009 Strategy and its related defence reforms, by 2015 Russia emphasised the readiness of its armed forces, its ability to identify threat situations, and its ability to mobilise, all within the framework of strategic deterrence (Russia 2015, 7-8). New Type Warfare is associated with both Valery Gerasimov, Chief of the Russian General Staff, and Yevgeny Primakov, Prime Minister and Foreign Minister (Rumer 2019). Actions within New Type Warfare combine 'both low-end, hidden state involvement with high-end, direct, even braggadocio superpower involvement' in areas of national interest (Karber & Thibeault 2016). The concept 'represents the Russian view of how non-military instruments can affect a country's information

environment, internal political stability or economy, but are coordinated with conventional military capabilities that inflict strategic damage, such as long-range precision guided weapons and massed aerospace attack' (Kofman 2020). As Kofman (2020) argues, despite the attention focused on the non-military instruments at Russia's disposal, it is the state's military power that lies at the heart of the concept. It is here that the investments of the New Look reforms can be seen, modernising and expanding the capabilities of Russian air power, and making expeditionary operations more viable.

Only the first few months of Russia's intervention in Syria fall within the research period, but from both the deployment of the VKS and Naval Aviation and the initial phase of operations, a number of important steps forward for Russian air power were evident. First, the combination of a modernised, restructured VKS, centralised C2, and the guiding framework of New Type Warfare provided the means for Russia to proactively respond to a threat to its national interests beyond its near-abroad for the first time since the 1980s. Second, the Russian air campaign mirrored, in part, the model of operations employed by the United States in Afghanistan, combining its relatively superior air power with an array of friendly ground forces. These included the Syrian Army, Iranian-backed militias, and Russian private military contractors (Pukhov 2017). The aim of this was to deny anti-government forces the means to fight the Syrian Army by striking at the systems that held them together, including C2, supply chains and economic centres of gravity (Adamsky 2018, Kainikara 2018). Third, Russia committed its most capable air power platforms and weapons to operations from the start. These included up to eight Su-34s, armed with a range of precision weapons, recently upgraded Su-24M2s which dropped unguided bombs, and Tu-22M3 and Tu-160 long-range bombers which launched Kh-555 and Kh-101 cruise missiles, with the latter deploying from bases in Russia and the former as part of a rotating 30-50 combat aircraft deployment to Syria (Pukhov 2017, Polovinkin 2016 quoted in Barrie & Gethin 2018, Lavrov 2018). Fourth, operations attempted to utilise the long-theorised and increasingly viable reconnaissance-strike complex, enabled by the investment in and deployment of ISR, C2 and strike platforms. These included the extensive deployment of UAVs, GLONASS satellites, coordination between Moscow and theatre commanders through the NTsUO, and the previously noted strike platforms and weapons (Adamsky 2018, Shield 2018). Notably, the coordinated use of complex air power, embodied by the reconnaissance-strike concept, was not widely employed. As Shield (2018) found, air power was mostly directed towards tactical, counter-force engagements, saturation bombing and support to allied ground forces rather than for the systematic disruption of enemy infrastructure. In light of Russia's focus on ensuring its goals

were met through a campaign of strategic destruction, highly accurate strikes or coordinated effects were not required.

Despite the important steps for Russian air power development taken during the Syrian intervention, its ability to deliver complex strategic effects were still curtailed by several underlying weaknesses. The VKS's employment of reconnaissance-strike complexes was limited not only by the strategy of destruction being pursued but also by shortfalls in C2, ISR and precision strike options. Although much-improved since the 2008 Russo-Georgian War, C2 and ISR capabilities lacked the scale and sophistication of the Allies', resulting in gaps in battlefield intelligence and missed opportunities to strike time-sensitive targets (Shield 2018). Initially, only the deployed Su-34s carrying satellite-guided weapons and combat aircraft were employed on solo or paired missions (Lavrov 2018). This limited the precision strike options available, with simultaneous, high-tempo and widespread strikes not possible, and dictated a reactive, attritional campaign against IS and anti-government forces. Underpinning the shortfalls in C2, ISR and strike capabilities were the limitations of the domestic defence industry, which was constrained in what it could supply the VKS. Investment from the New Look reforms was directed towards the modernisation of existing platforms and increasing the procurement of Soviet-designed combat aircraft, particularly derivatives of the Su-27 (Gressel 2017, Connolly & Boulègue 2018). Due to a combination of the legacy of atrophy and underinvestment in industry in the 1990s, long-standing shortages of machine-tools and microelectronic components, decreasing numbers of new engineers and scientists, and the impact of sanctions from 2014 on imported components, Russia's defence industrial base has struggled to produce next-generation aircraft and systems, and modernisation has focused as much on platform life extension as on capability upgrades (Frolov 2017, Connolly & Boulègue 2018). The consequences of this imposed structural limitations on what the VKS could realistically achieve, including the strategic effects it could produce, even in the permissive, uncontested warfighting environment of Syria.

Conclusions

The final five years of the research period saw all six case study states attempt to utilise their respective air power for strategic effect. All of these uses of air power drew on the political, doctrinal and technological legacies of the conflicts in which each state had respectively used its air power in the previous decade. From these legacies a clear continuity in national approaches can be discerned. The Allied states broadly continued to adhere to their baseline position in which strategic air power was utilised in the context of counterterrorism and counterinsurgency strategies during this period. Air power was targeted against enemy

leaders, fielded forces and in support of friendly governments. It leveraged the 'enhanced' tactical capabilities on which Allied air power had increasingly been focused to enable light-footprint, rapid interventions in which dynamic targeting was expected to create strategic effects, control the adversary, and deliver national objectives. Israel continued with the new baseline and model it had created in the aftermath of the Second Lebanon War and applied so successfully in Operations *Outside the Box* and *Cast Lead*, in which air power could offer decisive results through limited operations that reinforced deterrence and actively limited future threats. Russia continued through a period of evaluation that resulted from the VVS's poor performance in the Russo-Georgian War, making the necessary investments and organisational changes to create air power that was more credible, capable and could be utilised in the context of New Type Warfare.

In practice, the distinct approaches taken by the Allies, Israel and Russia were linked to the objectives being sought through the employment of air power and the strategy chosen to achieve them. Despite the different approaches, a common factor can be discerned through practice during this period: the emergence of structural limits on the possible strategic effects that could be delivered in practice, driven by the normalisation of certain methods and the context in which they were being applied. The initial approach taken by the Allies in Libya, Mali and in the first phase of operations against IS did not attempt to disrupt, paralyse or destroy the systems of power and control. Instead, they focused on changing cost-benefit calculations concerning the continuation of violence and territorial expansion. This strategy was the consequence of circumstances – the need to reactively intervene to prevent a situation worsening or broadening – and of the direction of Allied air power development and of national and coalition politics, with each influencing the other. Operations in Afghanistan had normalised persistent, reactive counter-personnel and counter-force strike as a primary means of employing air power, leveraging the capabilities of strategic air power for essentially tactical means. The consequences of this were threefold: these 'enhanced' tactical capabilities could be mobilised at short notice and were thus well-suited to the interventions of the 2010s; it provided granular political control over how and where air power was applied, essential to satisfy complex rules of engagement and for the avoidance of exploitable collateral damage; and, in the context of the coalitions assembled to fight hybrid, cross-border actors, it provided a solution to the resulting constraints and limits imposed on air power by differing national politics, goals and laws, by limiting what air power could be called on to do. The end result of this was to impose a structural constraint on what Allied strategic air power could achieve. Specifically, the changing of the adversaries' respective cost/benefit calculations became the focus because air power had become politically limited to only being applied gradually and

reactively against a limited range of targets of opportunity. Deliberately planned, large scale, simultaneous strikes against identified centres of gravity and critical vulnerabilities were simply not initially possible given the overarching political direction and the threats to be addressed. This resulting strategy offered no prospect of creating the strategic effects necessary to sufficiently disrupt, paralyse or destroy the adversaries' systems of power and control or to achieving national objectives without a significant change in approach. It was only later in the operations against Libya and IS that a more expansive air campaign of disruption and destruction was developed and executed to achieve the objectives sought.

The Israeli Model continued to be employed in this period to deliver a combination of deterrence and decisive, limited action. The Model was predicated on the logic that the certainty of Israeli air power's ability to locate, identify and strike its adversaries would create a deterrent effect, that should an attack be launched by its adversaries that air power could manipulate cost-benefit calculations to force a return to the status quo, and that in doing so deterrence would be re-established and reinforced. The underlying acceptance by the Israeli government of a level of continued violence, and concern for what might replace Hamas in Gaza should it be destroyed, dictated a strategy in which control through destruction or paralysis was not an option, and a combination of system disruption (as a best case, as in *Cast Lead*) and cost-benefit manipulation was the strategic goal for air power to achieve. In the context of Israeli rules of engagement and social expectations of low casualties, the pervasive and persistent war for control of the narrative, the time constraints indirectly imposed by the international community on operations, and the distinct capability advantage enjoyed by Israel, limited operations in which a level of decisive action could be achieved were a necessity. Critically though, the adaptation of Hamas and its innovative use of urban areas and underground networks exploited the limits of the Israeli Model as first conceived and forced its re-evaluation and subsequent adaptation to include more ground forces and methods to counter Hamas' adaptations. Thus, both the Allies and Israel saw strategic effect during this period through a narrow lens, dictated by circumstance, environment and structure, and as a means through which only a limited range of outcomes could be realistically expected. The potential for this to change though was contained in their respective plans for the future operating environment, in which next-generation platforms, weapons, sensors and systems will be required if strategic effect against a hostile state with comparable armed forces is to be viable. From the perspective of the Allies, Russia was potentially that state, whose own approach to employing its air power in this period demonstrated its increasing capabilities and credibility as a strategic force.

Russia's use of air power in Syria tested and largely confirmed its new baseline understanding of strategic air power. Through a campaign of strategic destruction, with the goal of securing its Syrian ally's position against anti-government forces, the culmination of the previous seven years of defence reforms through New Look, investment in air platform modernisation and procurement, structural changes that created the VKS and the NTsUO, and the new operating framework of New Type Warfare, was demonstrated. For the first time in the research period Russian air power was independently and successfully directed towards achieving Moscow's strategic goals. The VKS performed a wide range of roles in Syria, including creating strategic effects on the ground through the destruction of opposition strongholds which enabled a degree of control over its adversary that was exploited by Iranian proxies and the Syrian Army. In doing so, Russian air power demonstrably contributed to achieving the national goals of maintaining the status quo in Syria, safeguarding and expanding Russia's political, military and economic presence in the Middle East, and reaffirming its great power status, not least to a domestic audience. It also demonstrated that Russian air power could credibly be used for destructive strategic effect and that it was less constrained by politics, prior operations, and environmental circumstances than Israel or the Allied states. However, the Syrian intervention also demonstrated that underlying weaknesses in Russian air power remained, including in C2, ISR and strike, the supporting defence industrial base, and that strategic destruction was the only credible strategic effect its air power could create.

CONCLUSIONS The Direction of Modern Strategic Air Power

Over the course of the research period the United States, Britain, France, Australia, Israel and Russia developed, reformed, and applied their air power to create strategic effects in nearly twenty operations. In doing so they took the theories of modern strategic air power that had emerged during the 1980s in the United States, and to an extent in the Soviet Union, and considered, shaped and refined them in the context of their own national defence needs. Over the next two-and-a-half decades technological advances in platforms, weapons, sensors and system capabilities, political direction through reforms and investments, national and military contexts, developments and debates in air power theory and doctrine, and the successes, failures and gaps resulting from operational practice contributed to the direction of the concept's development. In this conclusion the research question is answered. The research question asked, 'how did the concept of strategic air power develop and evolve in the post-Cold War period and what factors accounted for its direction?'. To understand the development, evolution, and direction of strategic air power three perspectives are required.

First, strategic air power's evolution is accounted for through the experiences of the case study states. From across the research period operational practice, the relationship between the concept and national air power doctrine, and the role of organisational dynamics – military officers, rivalries, and convergence – are of significance. These features are highlighted and considered in the context of the prevailing debates in air power theory and military innovation. Second, strategic air power's development is accounted for by a repeating process through which the case study states understood, tested, and evaluated the concept. The development process's emergence, influence and impact are discussed and traced over the research period. Third, the direction of strategic air power is accounted for by taking the factors identified as common to the experience of all case study states and creating a concept-level model. This model shows why strategic air power developed in the direction that it did after the Cold War and serves as the basis for a proposed final theory of historic cyclical development. The conclusions end with a brief discussion of the research's contribution to the field.

Accounting for Change: The Features of Strategic Air Power's Evolution

The first part of the answer considers the key features of strategic air power's evolution from the perspective of the case study states. Between the end of the Cold War and the mid-2010s, strategic air power changed significantly. It transformed from a fledgling capability, unique to the United States, with the potential to deliver a wide range of conventional strategic effects against state actors to a concept understood more widely, used in practice more frequently, but subject to narrower, politically-directed applications against non-state adversaries able to

blunt its effects. The research finds that this evolution of modern strategic air power was influenced by operational practice, doctrinal change, politicisation, the role of military officers, organisational rivalry, and organisational convergence. Based on the collective experiences of the case study states, this section highlights the central roles that these factors played in strategic air power's evolution, and where they confirm or challenge the central debates in both air power theory and military innovation.

Practice, Doctrine & Politicisation

Operational practice had a major influence over strategic air power's development. This was a function of the frequency of air power's use in combat which provided direct experiences on which to evaluate conceptual understanding, capabilities, and doctrine. Examples can be drawn from across the research period. The RAF's experience of Operation *Desert Storm* both reinvigorated and changed the direction of British air power. The technological advances made during Operation *Allied Force* enabled US strategic air power's adaptation in response to the challenges of terrorism and insurgency in Afghanistan and Iraq. Russian air power's broad failures in the First Chechen War and the Russo-Georgian War drove the first and second phases of post-Soviet air power reforms respectively and substantial organisational changes within the VVS. Additionally, the case study states looked to one-another's experiences as well to understand the role of their own air power. France's interpretation of US air power-led operations post-9/11 prompted French air power to become more expeditionary-focused. Australia's indirect experience of *Desert Storm* provided it with direction for its own limited air power to be used to enhance its qualitative military edge in East Asia. The influence of operational practice manifested itself in a range of ways – in military reforms, capability investments, theoretical debate, and doctrinal change – and was directed through both civilian and military channels.

In several case study states the role of civilian leaders in incorporating the experiences, lessons, and implications of operational practice into the future direction of national strategic air power was predominant. This was the case for France and Russia. A significant proportion of French strategic air power's development resulted from legislative and government decisions, budgets, and the 1994 and 2008 White Papers, responding to changes in the defence environment and the need to uphold the core tenets of independence and freedom of action. In Russia, the government reforms to national defence post-Chechnya and the New Look defence reforms post-Georgia were both pivotal for the organisation, capabilities, and strategic direction of Russian air power, responding to the implications of operational failures and shortfalls for national security. In other states – the United States, Britain and Australia –

both civilian authorities and the military, particularly their respective Air Forces, were both involved in translating the lessons of operational practice into progress. This included civilian-led post-conflict analyses, Britain's periodic and influential Strategic Defence Reviews, and Australia's guiding White Papers that determined the strategic role of the RAAF. The influence of the USAF's own White Papers on setting institutional direction, and the influence over both theory and doctrine of USAF, RAF, and RAAF officers, often in response to lessons from operational practice were also of importance. Finally, Israel's interpretation of operational practice was arguably the most-rooted in the military, a result of the history, culture, and relative independence of the IDF as well as the existential nature of defence for Israel. The IDF's reaction to US operational practice, including the work and influence of Naveh, as well as its own operations, was central to its development and understanding of strategic air power. However, civilian influence over air power's direction became notably more prominent in the aftermath of failure, specifically through the Winograd Commission post-Lebanon War. Reflecting on a debate in the military innovation literature on the relative roles of civilian and military leaders in enabling innovation, in the relationship between operational practice and strategic air power two conclusions can be drawn. The first is that civilian mechanisms – legislatures, committees, commissions, and politicians – and military mechanisms – officers, white papers, exchanges – are both evidently important in driving change, although the balance varies between states based on the relative independence of the military to affect change. The second conclusion is that failures and shortfalls in operational practice are a catalyst for increased civilian intervention, which is consistent with the arguments of Posen (1986) and Zisk (2001).

The relationship between air power doctrine and the evolution of strategic air power since the end of the Cold War can be broadly divided into three general phases. In the first phase, the theory, concept, and capabilities that enabled air forces to develop and deliver strategic effect were not reflected in doctrine. There was a discernible lag between what air power could do in practice and what was captured by doctrine. This was the case throughout the 1980s for the United States, and well into the 1990s for all of the case study states once they began developing their conventional strategic air power capabilities. In the second phase, doctrine largely caught up with the concept, and the gap closed between what national air power was able – and expected – to do in practice, and what was institutionally codified. Doctrinal-conceptual alignment coincided with the US-led strategic air campaigns against Afghanistan and Iraq, but was also challenged by the politicised use of air power for Operation *Allied Force* that attempted to achieve strategic effects under significant constraints and outside of doctrine. In the third phase, the divergence between doctrine and practice became more pronounced.

A combination of new operating environments, adversaries, broader objectives, and increased political intervention led to strategic air power's use in practice frequently differing from the campaign-led, effects-based doctrines that prevailed. Attempts were made to realign doctrine and practice – through the USAF's Irregular Warfare doctrine in 2005 for example – but in most cases, new air power doctrine failed to reflect operational practice and instead focused on national priorities, future state threats, and a broader, often joint approach to effects.

From the perspective of doctrine, two conclusions can be drawn about its role in strategic air power's evolution. First, the role that air power doctrine played in determining the strategy by which air power was employed was relatively limited. Instead, it was frequently written in retrospect, catching up to air power's use in practice and lagging both theory and national capabilities. It was primarily a repository of ideas, a belated reflection of theory, and a place in which experiences and lessons of combat were captured. Second, because doctrine was retrospective and often lagged the strategic capabilities of national Air Forces, this left ample room for air power's politicisation. This was driven by dynamics including the political necessity of coalition operations, the need to affect change in unexpected operating environments against adaptive, non-state adversaries, and the increasingly granular control that was possible over the direction of air power by the 2010s. Van Creveld (2011) argued that air power is ill-suited to conflict with non-state actors because of their nature, tactics, and ability to adapt, but a further consideration arises in the late research period: that the political control over air operations against such actors, the options made available by rapid sensor-to-shooter timescales, and the accompanying rules of engagement, further increases the challenge of using air power against non-state actors effectively. Indeed, in the 2010s strategic effects were gradually narrowed, structurally constrained, and unable to deliver the objectives expected of air power. This was evident in the Allied strategy against Islamic State and the ultimate failure of the Israeli Model of strategic air power.

Organisational Dynamics

Several organisational aspects were important to the evolution of strategic air power. The first is the role of individual military officers. This was particularly evident in the United States and Israel, and was seen to varying degrees in Britain, Australia, France, and Russia. Military officers, and particularly Air Force officers, contributed greatly to the development of strategic air power theory, as well as to developing the suite of capabilities required for strategic effect, and to updating air power doctrines. The contributions to theory by USAF officers were built upon the seminal work of Warden on the operational use of air power for strategic effect, the influence of Boyd's work on competition, warfighting, strategy and systems, and Deptula's

work on EBO. Collectively they laid the foundations of US strategic air power theory, strongly influenced its direction in *Desert Storm* and beyond, and contributed to major updates to the USAF's Basic Doctrine in 1992 and 1997. The work of Naveh and his team at the Operational Theory Research Institute in Israel had a significant, if ultimately brief, impact on the direction of Israeli air power and its use for strategic effect in the early-2000s. In the mid-2000s, British and French officers wrote frequently on the challenges of delivering strategic effects against non-state adversaries and critiqued and adapted Warden's ideas in light of national considerations. In addition, the interactions between military officers amongst allies are also notable, with the meetings between Israeli and US military officers in the early-2000s that explored the implications of the revolution in military affairs influencing the work of Naveh, and the meetings between RAF and USAF officers in the 1980s bridging the gap between independent British air power doctrines in the 1970s and 1990s. Consequently, the clearly influential role of military officers in the development of strategic air power – conceptually and doctrinally – concurs with Rosen's (1994) argument on the role that the military itself plays in the creation of doctrine. Indeed, the core innovations of strategic air power – Warden's operational framework, Deptula's EBO, Naveh's SOD theory – that markedly changed the way that the USAF, IAF, and their allies organised and operated, originated within the military. As discussed, other broader considerations must be acknowledged as having a significant impact on strategic air power's evolution, and not all ideas and recommendations of military officers were necessarily adopted or reflected in doctrine, but from the perspective of the underlying theory of strategic air power, military officers played the key role.

Two further and related organisational aspects of strategic air power's evolution are of note. The first is the impact of inter-organisational rivalries, particularly in the United States and Israel, on the development of theory and its incorporation into doctrine and practice. The second is the apparent general trend towards the convergence of Allied organisations, thinking, and application of strategic air power, particularly in the 2010s. Effects-Based Operations were at the centre of inter-organisational rivalry in the United States, in light of its central role in USAF doctrine by 2003 and increasingly broad adoption by the DoD. The concept was opposed by Mattis at US Joint Forces Command based on criticism from within the US Army, Australian Army, and a belief that the US Army-Marine Corps' FM 3-24 Counterinsurgency doctrine was better suited to contemporary operations. The conflation of EBO with SOD theory, and the latter's apparent operational failure for the IAF in the 2006 Lebanon War, brought additional criticism from the IDF and through the Winograd Commission. Despite inter-organisational opposition to an important element of modern strategic air power – and the associated critiques found in the air power theory literature – the

research found that EBO remained a central feature in several air power doctrines over the remained of the research period. This was the case in the United States, Britain and Australia, where it was incorporated into a broader national effects-based approach to warfighting, as well as there being some linkage with Russia's New Type Warfare concept on which its own strategic effects were based.

The second organisational aspect concerns convergence amongst the Allies over the research period. Considering the broad adoption of US strategic air power thinking, language, and capabilities by Britain, Australia, and to a lesser extent, France, a degree of organisational convergence might be expected. As Farrell (2022) notes, this may be driven by either natural selection – finding efficiency between allies through organisational similarity – or through norms established over time – and the presence of the dominant USAF organisational model that could reduce uncertainty and increase legitimacy. Both routes are credible, but they are not the only reasons for Allied convergence. The frequency of joint operations over the research period, and the mutual challenges faced in operating environments, adversaries, and increased political control, also drove a convergence of thinking about strategic air power as well as its application in practice. Indeed, a distinct 'Allied' approach to creating strategic effect using air power was apparent by the early-2010s, but this was ultimately not beneficial. As discussed, Allied strategic air power became structurally constrained and politically limited to only being applied gradually and reactively against a limited range of targets of opportunity – a result of granular political control, complex rules of engagement, and the limits imposed on air power by Allied coalitions.

The Development Process: A Repeating & Common Approach to Change

The second part of the answer discusses the importance of the state-level development process. This process explains how the case study states formed, tested, evaluated, and – as necessary – reformed their respective approaches to strategic air power over the research period. The development process incorporates all of the features previously noted as important to strategic air power's evolution – practice, doctrine, organisational dynamics – and through it the states followed a common, repeating methodology to develop their understanding of the concept in response to change. The development process outlined in Chapter 2 is provided again at Figure 1.1 for reference. A brief discussion of the process 'in action' across the research period then follows.

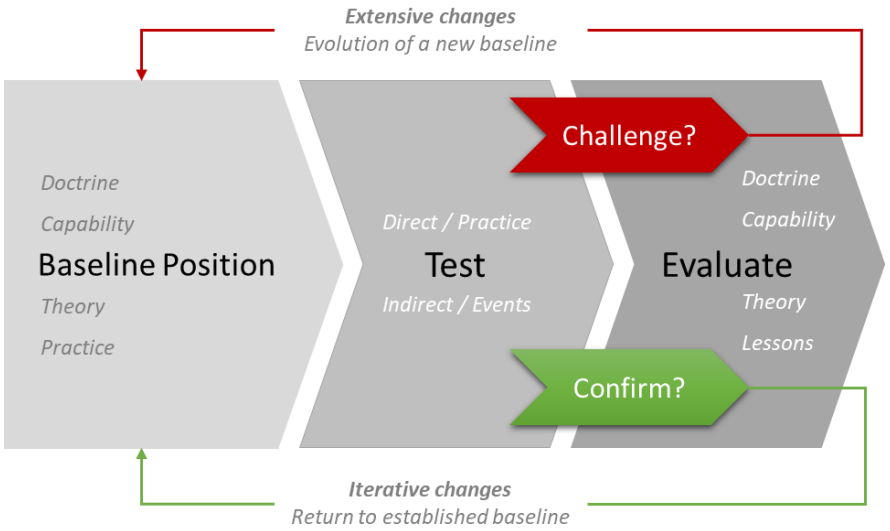

Figure 1.1 The Strategic Air Power Development Process

The Process in Action: 1989-2015

The development process can be traced across each of the five phases of strategic air power's post-Cold War development. In the first phase, the foundations of the process were laid. These were based upon how each state organised its air power in the late-Cold War period, the role that strategic air power played, and the degree to which the use of conventional air power for strategic effect was theorised. Together they determined the baseline position for each state and in turn set the direction of the concept for the 1990s and for the various interpretations of *Desert Storm*. In the second phase of development, the process itself was established. It began after *Desert Storm* because the US air campaign challenged the basic assumptions held about strategic air power by the other case study states. This prompted periods of evaluation by military, civilian, and academic communities, which fed back into – and changed – their baseline positions through substantial organisational reforms to air power, investments in the suite of capabilities required for conventional strategic effect, and – in several states – doctrinal changes.

The third development phase was marked by strategic air power's use in practice in five conflicts, between 1995 and 2003, in which it became a core means of creating strategic effect and changing the course of events on the ground. In this period, the direct tests of the baseline positions of the United States, Britain, and France were largely confirmatory of the prevailing understanding of what strategic air power was and what it could do in practice. This was driven by the focus of Allied air operations on state actors and the ultimate success of the period's strategic air campaigns, despite the politicisation and coalition limitations of *Allied Force* in particular. Consequently, air power doctrine was able to catch up with theory and align in the

early-2000s. Australian and Israeli experiences were similar, despite fewer direct tests of their baseline understandings, and feedback from their evaluation of Allied operations confirmed their positions and affirmed iterative changes to doctrine and capabilities. The development of Russian strategic air power was far more active during this period, with two clear tests of its baseline position. The first test was direct. The Second Chechen War tested the efficacy of the fundamental reforms undertaken from 1996 onwards, and the relative success of the VVS broadly confirmed Russia's new baseline understanding of its air power's strategic role. The second test was indirect and rooted in the implied threat to Russia posed by the use of force – and particularly by strategic air power – from the United States and its allies against Serbia, Afghanistan, and Iraq. This challenged Russia's baseline understanding and, through the military's evaluation, led to an aspirational new baseline position for Russian strategic air power by 2004 that would leverage long-range conventional strike to counter NATO.

In the fourth phase of development, operations in Afghanistan and Iraq saw Allied understanding of strategic air power undergo two cycles of re-evaluation in eight years. The first cycle was driven by the shift from strategic air campaigns against other states into supporting counterterrorism and counterinsurgency strategies. This challenge forced a rapid re-evaluation of how air power could be used for strategic effect, and created a new baseline position that combined conventional strategic capabilities with unmanned platforms, HVT, dynamic targeting, often in support of ground forces. The second cycle began soon after this, driven by the new concept's decidedly mixed results on the ground, as well as a growing political and military focus on future state threats. The evaluation of the shortfalls of Allied air power drove the creation of a more balanced concept that could be applied effectively to both the prevailing operational challenges of non-state actors and against future state threats. The United States did this by shifting the USAF towards a more future-focused, inter-state warfare-orientated plan for its future fleet and approach to strategic effect and (re)established Global Strike Command in 2009. For Britain, France, and Australia, financial constraints and the shortfalls of air power in practice had a corrosive effect on both capacity and capabilities, making the acknowledged complex and demanding task of delivering strategic effect across a broad spectrum much harder.

In this period, Israeli strategic air power was also tested twice, first through its use in Lebanon against Hezbollah in 2006, and then against Hamas in 2008. Between the two tests, a substantial re-evaluation of Israeli air power took place. Incorporating the technology-centric firepower-led US approach to strategic air power with Naveh's systems-focused SOD theory, Israeli strategic air power was reconceived by 2005 as a means of achieving the disintegration

of its enemy as a credible fighting force. This new baseline was tested immediately against Hezbollah in 2006 but fell well short of expectations. The post-conflict evaluation, based on the findings of the Winograd Commission, underpinned accompanying reforms to the IDF. This created the Israeli Model of strategic air power in which strategic effect would be sought in a more limited set of circumstances. This new baseline was tested and confirmed through the broad success of Operation *Cast Lead*. Finally, the Russo-Georgian War in 2008 was a major test for Russian air power, and it exposed the gulf between the VVS's conceptual understanding – and aspirations – and the realities of its capabilities in practice. The conflict revealed myriad issues from weapons to intelligence to communications. Consequently, a major evaluation took place over the following five years, led by the New Look defence reforms which sought to close the gap between concept and capability. In conjunction with updates to the National Security Strategy and to military doctrine, the foundations were laid for a new baseline position for Russian strategic air power on which Moscow's Syria campaign would later rest.

The fifth phase of strategic air power's development was characterised by the concept's fragmentation. The Allies, Israel, and Russia pursued three different approaches to strategic effect, each reflecting the new baseline positions that had emerged in response to the perceived failures in practice during the mid-late-2000s. The Allies' new 'balanced' understanding, divided between future state adversaries and countering non-state actors, was tested against Libya, Mali, and Islamic State in Iraq. Many of the same challenges re-emerged as Allied air power was largely directed to reactively strike the fielded forces of adversaries and subject to a high degree of political control over the rules of engagement and the legitimacy of targets. The expectation was that this approach would create beneficial strategic effects and control, but the real-world impact was decidedly mixed. Consequently, by the mid-2010s the Allies were beginning to examine the limits of strategic air power again, and began to evaluate how new investments in advanced capabilities might restore the strategic effects that had become increasingly difficult to achieve in practice.

In Israel, its new strategic air power Model was utilised regionally against Iranian proxies and Syrian infrastructure, and in two further operations against Hamas. After the initial success of *Cast Lead*, the Model was tested and confirmed during Operation *Pillar of Defense* but challenged during the subsequent Operation *Protective Edge*. This challenge was rooted in Hamas' innovative adaptation of its operating methods and use of the urban environment to thwart Israeli air power's advantages and approach. A degree of evaluation of the Israeli Model began in 2015 with the publication of a new IDF doctrine, but a new baseline position for Israeli

strategic air power did not emerge during the research period. Unlike Israel and the Allies, Russia entered the 2010s still evaluating its understanding of strategic air power in the aftermath of the Russo-Georgia War. Through a combination of the New Look defence reforms, further organisational consolidation of the VVS, and the broad framework of New Type Warfare, a new baseline for Russian strategic air power was established. Utilising modern platforms, weapons and systems, the VVS would project power and influence through strategic effect in support of Russia's national objectives. This new baseline was tested and confirmed in Syria, albeit in an uncontested environment.

A Model of Development: Why Strategic Air Power Developed in the Direction it Did

Having established the features of strategic air power's evolution and the process through which the case study states evaluated and changed their understanding of the concept, the third and final part of the answer explains why strategic air power developed in the direction that it did over the research period. The concept's direction was driven by eight factors. As discussed in the conclusions of each period of development, these factors emerged as a result of the common experience of practice, technological advancement, enemy adaptation, political direction, and organisational reforms across the case study states. The eight factors can be arranged into a model that shows four clear stages in strategic air power's development as a concept over time. This model is shown at Figure 2 below and provides the highest-level, conceptual view of strategic air power since the end of the Cold War. In this section, the four stages and their implications are discussed, followed by a final theory that suggests strategic air power follows a multi-decade, recurrent lifecycle.

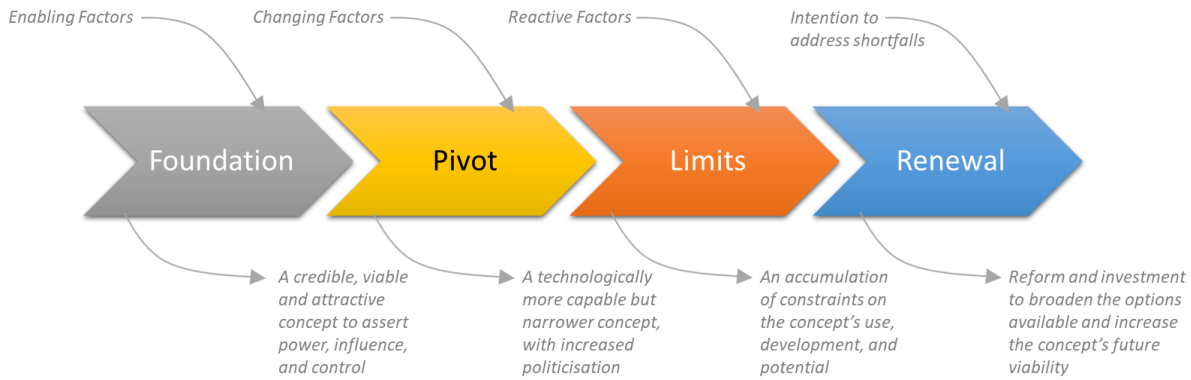

Figure 2. The model of post-Cold War strategic air power development

Stage 1: Foundation. The first stage of the model comprises the foundational or 'enabling' factors that determined the concept's initial direction, emphasis, and capabilities. For the United States this stage began a decade before the start of the research period and for the other case study states from the early-1990s. It ran until the mid-late-1990s. This stage

comprised the first three identified factors: air power's transformation through the reconceived battlefield and enabled by new technology; its consequent reframing in national defence from a nuclear and/or supporting role to a core conventional capability for strategic effect; and the recognition of the unique role of precision weapons as enablers for strategic attack and the consequences this had for air power's development through subsequent national reforms. The collective result of this foundational stage was the development of a concept of strategic air power that was credible, viable and attractive for the case study states to use as a core means of asserting power, influence, and control in pursuit of national objectives.

Stage 2: Pivot. The model's second stage comprises pivotal or 'changing' factors, those which emerged from the application of strategic air power in practice and which altered the direction of development established in the first stage. This stage began in the late-1990s and ended in the mid-2000s. Two development factors feature in this stage: the compression of the air power development cycle in response to operational experience and the consequent emergence of new and improved capabilities; and the first and foremost of these capabilities: the revolutionary improvements made to sensor-to-shooter timescales and the consequences this had for targeting, control, expectations, and the emergence of 'enhanced' tactical capabilities. The rapidity of progress during this stage created new options for air power's use in conflict, shifting emphasis away from pre-planned, large-scale strategic air campaigns against the adversary's complete system of power and towards a reactive, counter-personnel, light-footprint approach that came to dominate air power's utilisation for strategic effect. This approach offered a low-cost, low-risk means of pursuing counterterrorism and counterinsurgency strategies, rapid deployment and reaction, and granular political control over targeting and rules of engagement.

Stage 3: Limits. The third stage of the model is made up of limiting or 'reactive' factors, those which emerged as a consequence of the shortfalls and failures revealed in the concept through practice. This stage occurred from the mid-2000s into the mid-2010s. The final three development factors feature in this stage: the divergence of the concept's direction due to its increasingly tactical application, adaptation of adversaries, complexity, and the effect of shortfalls and failures; the reaction to this revealed through the repositioning of air power in national defence, driven by the duration of operations; and the emergent structural limits on which strategic effects could and would be pursued by the state, resulting from methods and context. The primary feature of this stage is the accumulation of constraints on the concept's use, development, and potential. These result from the pivotal changes made to the concept's direction in the second stage of development and their application in practice. Notably, this

stage also contains the impetus for the renewal of the concept, leading to a fourth and final stage of development.

Stage 4: Renewal. In the model's final stage an intention to address the structural limits that constrained the further development and application of strategic air power emerges. This intention is driven by three elements: addressing the shortfalls in achieving strategic effect in contemporary operations; mitigating conceptual and operational complexity and increasing utility; and an acknowledgement that the future operating environment will present a different order of challenge. The means by which these limits and challenges are addressed are through new reforms, research and capability investments, and air power theory. These include the research and development of next-generation platforms, weapons, sensors and systems, which leverage greater connectivity, speed, manoeuvrability, multiple spectrums and novel approaches, designs and uses, the development of new doctrine to guide their use, and new air power theory. Once realised, these broaden the strategic options available to the state and increase the viability of creating strategic effects against a new adversary. In the research period, this final stage of development overlapped the third stage, as the limits and shortfalls in contemporary strategic air power began to be recognised, beginning in the late-2000s and continuing through the 2010s.

The Conceptual Lifecycle of Strategic Air Power

The inferred model of strategic air power's development since the end of the Cold War explains its direction and it can be further advanced to propose a theory of concept development. This theory takes one further step from the model to suggest that the development of strategic air power is ultimately cyclical. This is based upon the contention that the outcome of the fourth and final stage of development – the intention to address emergent limitations and complexity – logically leads to a new first stage of development – the creation of a new foundation that enables the concept to be transformed. A representation of this cyclical model can be seen at Figure 3.1 below.

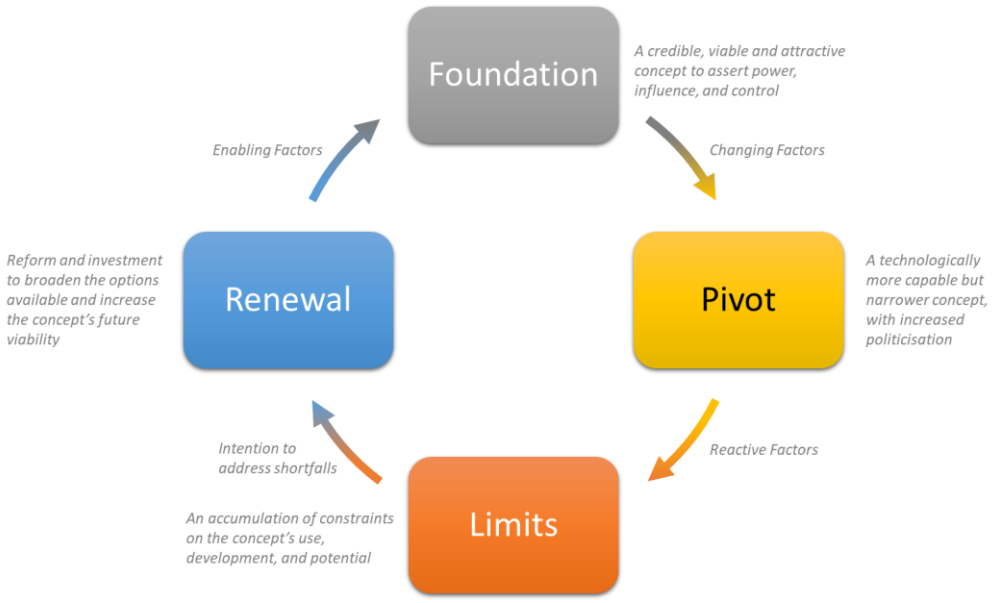

Figure 3.1 The cyclical model of strategic air power development

Applied to the research period, the cyclical model implies that the first stage of the modern concept's development was a direct result of the final stages of the previous development cycle. This previous cycle began to end in the complexity and failures of the Vietnam War and ended with the post-Vietnam reforms of US air power and the transformation that followed. It also implies that the post-Cold War development cycle has largely ended and that a new cycle has begun, evident in the advanced capability developments of the 2010s and early-2020s in areas including artificial intelligence, cloud-based combat systems, hypersonics, and low-observable unmanned platforms. If the same development model is followed in this new development cycle, these capabilities and others will create a new foundation to enable air power to deliver future strategic effect. A representation of the theory is illustrated at Figure 3.2 below.

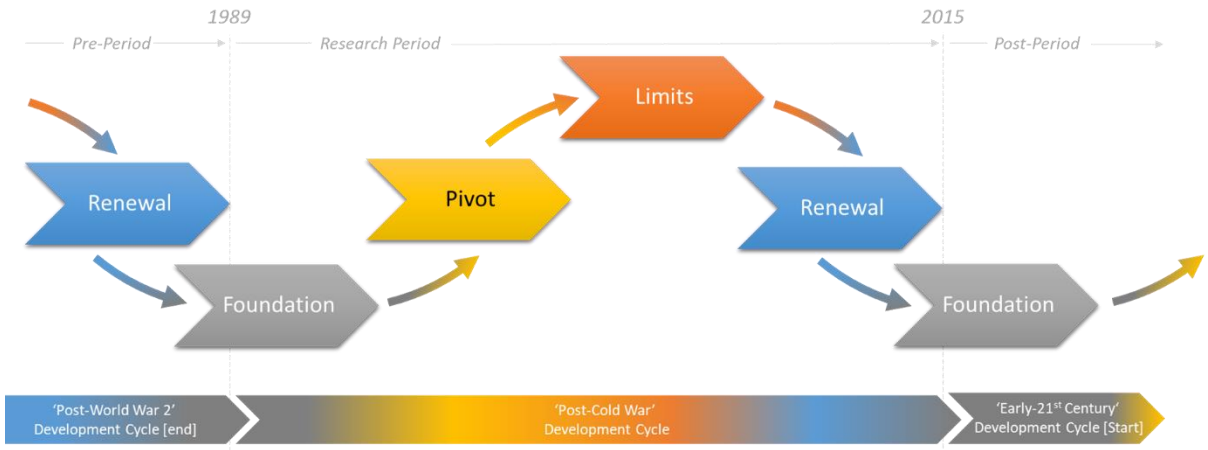

Figure 3.2 The repeating cycles of strategic air power development

Research in Context

This research has provided a detailed account of the development of strategic air power in the post-Cold War period, both as a concept and as the culmination of theory, doctrine, reform, investment, capability and practice in the six case study states. It provides a detailed account of the development of modern strategic air power in each of the case study states and it engages with contemporary debates in the literature on air power theory and military innovation. It highlights the development process that emerged after *Desert Storm* through which the states formed, tested, evaluated and refreshed their understanding of strategic air power in response to change. Over the 25-year research period, it found a number of common factors that emerged to influence the direction of the concept itself and from these factors induced a model and theory that accounts for why the concept developed in the way that it did.

This research contributes to the field of air power study in four ways. First, it presents a broad, deep view of the concept of strategic air power, adding significant detail to its development path after the Cold War and *Desert Storm*, and offers the experiences of a range of states beyond the United States with advanced air power capabilities. Second, it provides both the historic context for the emergence of the modern concept of strategic air power, again beyond the predominant analysis in the field of the US experience, and provides context for decisions and directions taken through the research period by each state, the successes they achieved and the challenges that they faced. Third, it shows that the evolution of modern strategic air power was influenced by operational practice, doctrinal change, politicisation, the role of military officers, organisational rivalry, and organisational convergence, and that there were variations in these over time and between different states. Fourth and finally, it proposes a model of development that explains why strategic air power after the Cold War proceeded in the directed that it did, and suggests a theory of cyclical development, with potential application both historically and beyond the research period.

BIBLIOGRAPHY

Primary Sources: Official State Documents *(By Country)*

Australia

Australia (1987) *The Defence of Australia* Defence White Paper 1987, Department of Defence, Canberra: Australian Government Publishing Service

Australia (1994a) *Defending Australia* Defence White Paper 1994, Department of Defence, Canberra: Australian Government Publishing Service

Australia (1994b) *The Air Power Manual*. 2nd Edition, Canberra: Royal Australian Air Force

Australia (1998) *The Air Power Manual*. 3rd Edition, Canberra: Royal Australian Air Force

Australia (2000) *Defence 2000: Our Future Defence Force*. Defence White Paper 2000, Department of Defence, Canberra: Australian Government Publishing Service

Australia (2002) *The Air Power Manual*. 4th Edition, Canberra: Royal Australian Air Force

Australia (2003a) The War in Iraq: ADF Operations in the Middle East in 2003. Canberra: Department of Defence

Australia (2007a) *The Air Power Manual*. 5th Edition, Canberra: Royal Australian Air Force

Australia (2007b) *The Australian Experience of Air Power*. 1st Edition, Canberra: Royal Australian Air Force Air Power Development Centre

Australia (2007c) *The Future Air and Space Operating Concept*. Canberra: Royal Australian Air Force Air Power Development Centre

Australia (2008) *Defence Annual Report 2008-09: Volume Two: Defence Materiel Organisation*. Department of Defence, Canberra: Australian Government Publishing Service

Australia (2009a) *Defending Australia in the Asia Pacific Century: Force 2030*. Defence White Paper 2009, Department of Defence, Canberra: Australian Government Publishing Service

Australia (2009b) *Defence Annual Report 2009-10: Volume One: Department of Defence*. Department of Defence, Canberra: Australian Government Publishing Service

Australia (2013) *2013 Defence White Paper*. Department of Defence, Canberra: Australian Government Publishing Service

Australia (2014a) *The Air Power Manual*. 6th Edition, Canberra: Royal Australian Air Force

Australia (2014b) *International Supply Mission to Iraq. Department of the Prime Minister and the Cabinet*, Canberra, *31st August 2014*. Available at: https://pmtranscripts.pmc.gov.au/release/transcript-23777 (Accessed: 9 March 2020)

Australia (2014c) *Australian Defence Force contribution to international coalition against ISIL. Department of the Prime Minister and the Cabinet, Canberra, 14th September 2014*. Available at: https://pmtranscripts.pmc.gov.au/release/transcript-23822 (Accessed: 9 March 2020)

Australia (2014d) *Joint Press Conference, Darwin. Subject: Australian Defence Force contribution to international coalition against ISIL. Department of the Prime Minister and the Cabinet, Canberra, 14th September 2014*. Available at: https://pmtranscripts.pmc.gov.au/release/transcript-23823 (Accessed: 9 March 2020)

Australia (2015a) *Minister for Defence – Statement on Iraq and Afghanistan and Operations in the Middle East. Department of Defence, Canberra. 26th February 2015*. Available at: https://www.minister.defence.gov.au/minister/kevin-andrews/statements/minister-defence-statement-iraq-and-afghanistan-and-operations (Accessed: 7 March 2020)

Australia (2015b) *Minister for Defence – Statement on Iraq and Afghanistan and Operations in the Middle East. Department of Defence, Canberra. 16th September 2015*. Available at: https://www.minister.defence.gov.au/minister/kevin-andrews/statements/minister-defence-statement-iraq-and-afghanistan-and-operations (Accessed: 7 March 2020)

Australia (2015c) *Australia to Extend Air Operations against Daesh into Syria. Department of the Prime Minister and the Cabinet, Canberra, 9th September 2015*. Available at: https://pmtranscripts.pmc.gov.au/release/transcript-24803 (Accessed: 9 March 2020)

Australia (2017) *Changes to Reporting for ADF Operations in Iraq and Syria. Department of Defence, Canberra. 2nd May 2017*. Available at: https://news.defence.gov.au/media/media-releases/changes-reporting-adf-operations-iraq-and-syria (Accessed: 15 March 2020)

Australian War Memorial (2021) *The Gulf War: Australia's Contribution 1990-91*. Available at: https://www.awm.gov.au/articles/encyclopedia/gulf (Accessed: 16 February 2021)

France

France (1972) *Livre blanc sur la défense nationale*. [National Defence White Paper]. Paris

France (1992) *Projet de loi de programmation relatif à l'équipement militaire et aux effectifs de la défense pour les années 1992-1994. (n° 2877, Assemblée nationale, déposé le 1er juillet 1992)* [Programming law relating to military equipment and defense personnel for the years

1992-1994. (n ° 2877, National Assembly, tabled on July 1, 1992)]. Digitheque MJP. Available at: https://mjp.univ-perp.fr/defense/lpm1992.htm, (Accessed: 7 March 2020)

France (1994a) *Livre blanc sur la défense nationale*. [National Defence White Paper]. Paris

France (1994b*) Loi no 94-507 du 23 juin 1994 relative à la programmation militaire pour les années 1995 à 2000* [Law no 94-507 of 23 June 1994 relating to military programming for the years 1995-2000]. Digitheque MJP. Available at: https://mjp.univ-perp.fr/defense/lpm1995.htm (Accessed: 7 March 2020)

France (1996) *Loi no 96-589 du 2 juillet 1996 relative à la programmation militaire pour les années 1997 à 2002*. [Law no 96-589 of 2 July 1996 relating to military programming for the years 1997-2002]. LegiFrance Available at: https://www.legiFrancegouv.fr/jorf/id/JORFTEXT000000560200 (Accessed: 8 March 2020)

France (2003) *Loi no 2003-73 du 27 janvier 2003 relative à la programmation militaire pour les années 2003 à 2008.* [Law no 2003-73 of 27 January 2003 relating to military programming for the years 2003-2008]. LegiFrance Available at: https://www.legiFrancegouv.fr/jorf/id/JORFTEXT000000234154/ (Accessed: 12 April 2020)

France (2008a) *The French White Paper on Defence and National Security*. Paris: Odile Jacob

France (2008b) C*oncept de L'Armée de L'Air*. [Air Force Concept] Sirpa air, Armées.

France (2008c) *Loi no 2009-928 du 29 juillet 2009 relative à la programmation militaire pour les années 2009 à 2014 et portant diverses dispositions concernant la défense.* [Law no. 2009-928 of July 29, 2009 relating to military programming for the years 2009 to 2014 and laying down various provisions concerning defence]. LegiFrance Available at: https://www.legiFrancegouv.fr/jorf/id/JORFTEXT000020915137 (Accessed: 23 April 2020)

France (2011a) *L'opération Harmattan. Ministère des Armées, 27 September 2011*. Available at: https://www.defense.gouv.fr/operations/missions-realisees/monde/operation-harmattan-2011/dossier/l-operation-harmattan (Accessed: 24 April 2020

France (2011b) *Libya: French Air Operations Begin. Ministère des Armées, 19 March 2011 (Updated 25 March)* Available at: https://www.defense.gouv.fr/english/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libya-french-air-operations-begin, (Accessed: 24 April 2020)

France (2011c) *Libya: Operations Continue. Ministère des Armées, 22 March 2011.* Available at: https://www.defense.gouv.fr/english/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libya-operations-continue, (Accessed: 24 April 2020)

France (2011d) *Libye: point de situation n°20, 12 April 2011.* Available at: https://www.defense.gouv.fr/fre/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libye-point-de-situation-n-20, (Accessed: 24 April 2020)

France (2011e) *Libye: point de situation n°30, 20 June 2011.* Available at: https://www.defense.gouv.fr/fre/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libye-point-de-situation-n-30, (Accessed: 24 April 2020)

France (2011f) *Libye: premier vol du Harfang au profit d'Harmattan, 25 August 2011.* Available at: https://www.defense.gouv.fr/fre/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libye-premier-vol-du-harfang-au-profit-d-harmattan, (Accessed: 24 April 2020)

France (2011g) *Libye: point de situation n°40, 29 August 2011.* Available at: https://www.defense.gouv.fr/fre/operations/missions-realisees/monde/operation-harmattan-2011/actualites/libye-point-de-situation-n-40. (Accessed: 24 April 2020)

France (2013a) *The French White Paper on Defence and National Security.* Paris

France (2013b) *Concept d'emploi des forces.* [Force Employment Concept]. CICDE: Paris

France (2013c) *Présentation de l'opération* [Operation Presentation], 25 October 2013. Available at: https://www.defense.gouv.fr/operations/missions-realisees/afrique/operation-serval-2013-2014/dossier/presentation-de-l-operation, (Accessed: 26 April 2020)

France (2013d) *Mali: lancement de l'opération Serval* [Mali: Launch of Operation Serval], 12 January 2013. Available at: https://www.defense.gouv.fr/operations/missions-realisees/afrique/operation-serval-2013-2014/actualite/mali-lancement-de-l-operation-serval (Accessed: 26 April 2020)

France (2014) *Doctrine for the Employment of the French Armed Forces*. CICDE: Paris

France (2020) *Dossier de presse: Opération CHAMMAL* [Press Kit: Operation Chammal], December 2020, Ministère des Armées

France, National Assembly (1999) *No. 2022 - Rapport d'Information: En conclusion des travaux d'une mission d'information sur le conflit du Kosovo*. [Concluding the work of a fact-finding mission on the conflict in Kosovo]. *Par la commission de la défense nationale et des forces armées, enregistré à la Présidence de l'Assemblée nationale le 15 décembre 1999.* Available at: https://www.assemblee-nationale.fr/rap-info/i2022.asp, (Accessed: 17 March 2020)

France, National Assembly (2013) No. 1288 - *Rapport d'Information*: *en conclusion des travaux d'une mission d'information sur l'opération Serval au Mali*. [Information Report: at the

conclusion of the work of a fact-finding mission on operation Serval in Mali]. *Et présenté par mm. Christophe Guilloteau et Philippe Nauche, Députés, enregistré à la Présidence de l'Assemblée nationale le 18 juillet 2013.* Available at: https://www2.assemblee-nationale.fr/documents/notice/14/rap-info/i1288/(index)/depots (Accessed: 17 March 2020)

France, Sénate (2002) *La programmation militaire pour les années 2003 à 2008.* [Military Programming for the Years 2003-2008]. Report 117 (2002-2003) - Committee on Foreign Affairs Available at: https://www.senat.fr/rap/l02-117/l02-117_mono.html (Accessed: 24 April 2020)

Great Britain

Great Britain (1957) *Royal Air Force Manual. Operations. AP 1300 – 4th Edition*. London: Air Ministry

Great Britain (1991) *Royal Air Force Air Power Doctrine. AP 3000 – 1st Edition.* London: HMSO

Great Britain (1993) *Royal Air Force Air Power Doctrine. AP 3000 – 2nd Edition*. London: HMSO

Great Britain (1998) *Strategic Defence Review (Cm 3999)*. London: HMSO

Great Britain (1999) *British Air Power Doctrine. AP 3000 – 3rd Edition*. London: HMSO

Great Britain (2008) *The National Security Strategy of the United Kingdom: Security in an Interdependent World (Cm 7291).* London: HMSO

Great Britain (2009a) *British Air & Space Power Doctrine. AP 3000 – 4th Edition*. London: HMSO

Great Britain (2009b) *Air Warfare Centre: Air and Space Warfare. AP 3002 – 2nd Edition*. London: HMSO

Great Britain (2010) *A Strong Britain in an Age of Uncertainty: The National Security Strategy, (Cm 7953)*. London: HMSO

Great Britain (2013) *UK Air & Space Power Doctrine. Joint Defence Publication 0-30 – 1st Edition*. London: HMSO

Great Britain (2015) *National Security Strategy and Strategic Defence and Security Review 2015: A Secure and Prosperous United Kingdom (Cm 9161)*. London: HMSO

Great Britain, House of Commons (1990) *Hansard: Defence (Options for Change),* 25 July 1990, 177, cc 468-86. Available at: https://api.parliament.uk/historic-hansard/commons/1990/jul/25/defence-options-for-change (Accessed: 19 October 2020)

Great Britain, House of Commons (1994) *Hansard: Front Line First*, 14 July 1994, 246. Available at https://hansard.parliament.uk/Commons/1994-07-14/debates/d5c8ac4f-89f3-4637-82db-68b78d76208d/FrontLineFirst (Accessed: 19 October 2020)

Great Britain, House of Commons (1995) *Hansard: Operation Deliberate Force,* 30 October 1995, 265 cc 85-6W. Available at https://api.parliament.uk/historic-hansard/written-answers/1995/oct/30/operation-deliberate-force (Accessed: 16 March 2021)

Great Britain, Ministry of Defence (2000) *Kosovo: Lessons from the Crisis*. London: HMSO

Great Britain, Ministry of Defence (2001) *Operation Veritas – British Forces*. Available at https://webarchive.nationalarchives.gov.uk/20100408092137/http://€www.operations.mod.uk/veritas/forces.htm (Accessed: 2 November 2020)

Great Britain, Ministry of Defence (2003a) *Operations in Iraq: Lessons for the Future*. London: Directorate General Corporate Communication

Great Britain, Ministry of Defence (2003b) *Operation Telic – British Forces.* Available at https://webarchive.nationalarchives.gov.uk/20100408113427/http://www.operations.mod.uk/telic/forces_archive.htm (Accessed: 2 November 2020)

Great Britain, Ministry of Defence (2013) *First Rivet Joint Aircraft Delivering to the UK.* Available at https://www.gov.uk/government/news/first-rivet-joint-aircraft-delivered-to-the-uk (Accessed: 10 June 2021)

Parliament. House of Commons (1999) *Kosovo: Operation "Allied Force"*, 29 April 1999, House of Commons Library, Research Paper 99/48. London: HMSO. Available at: https://researchbriefings.files.parliament.uk/documents/RP99-48/RP99-48.pdf (Accessed: 19 March 2019)

Parliament. House of Commons (2000) *Hansard: Defence – Fourteenth Report*, 23 October 2000, Defence Committee Publication, Session 1999-00. London: HMSO. Available at https://publications.parliament.uk/pa/cm199900/cmselect/cmdfence/347/34702.htm (Accessed: 2 November 2020)

Parliament. House of Commons (2001) *Operation Enduring Freedom and the Conflict in Afghanistan: An Update*, 31 October 2001. House of Commons Library, Research Paper 01/81. London: HMSO. Available at: https://researchbriefings.files.parliament.uk/documents/RP01-81/RP01-81.pdf (Accessed: 3 November 2020)

Parliament. House of Commons (2004) *Hansard: Lessons of Iraq,* 3 March 2004, Defence Committee Publication, Third Report of Session 2003-04, Vol 1. London: HMSO. Available at

https://publications.parliament.uk/pa/cm200304/cmselect/cmdfence/57/5702.htm (Accessed: 3 November 2020)

Parliament. House of Commons (2011) *Hansard: Operations in Afghanistan*. 06 July 2011, Defence Committee Publication, Fourth Report of Session 2010-12, Vol. 1. London: HMSO. Available at https://publications.parliament.uk/pa/cm201012/cmselect/cmdfence/554/554.pdf (Accessed: 3 November 2020)

Parliament. House of Commons (2015) *Hansard: The situation in Iraq and Syria and the response to al-Dawla al-Islamiya fi al-Iraq al-Sham (DAESH)* 27 January 2015, Defence Committee Publication, Seventh Report of Session 2014-15. London: HMSO Available at https://publications.parliament.uk/pa/cm201415/cmselect/cmdfence/690/690.pdf (Accessed: 3 November 2020)

Royal Air Force (2019) *Defence Secretary sets sights on next century of British air power as major fighter jet milestones reached, 10th January 2019*. Available at: https://www.raf.mod.uk/news/articles/defence-secretary-sets-sights-on-next-century-of-british-air-power-as-major-fighter-jet-milestones-reached/ (Accessed: 6 November 2020)

Royal Air Force (2020) *Six Years of Operation Shader, 29 August 2020.* Available at: https://www.raf.mod.uk/news/articles/six-years-of-operation-shader/ (Accessed: 5 November 2020)

Israel

Israel (1961) *The Defence Problems of the State of Israel*, Paper by David Ben-Gurion, 10 November. Available at: https://bengurionarchive.bgu.ac.il/en/search-api/bg_arc/97719 (Accessed: 12 June 2020)

Israel (2008) *IDF Response to the Winograd Commission Final Report*, Israel Ministry of Foreign Affairs Available at: https://www.jewishvirtuallibrary.org/idf-response-to-the-winograd-commission-final-report-january-2008 (Accessed: 1 July 2020)

Israel (2015) *Deterring Terror: How Israel Confronts the Next Generation of Threats*, Israel Defense Force. English Translation of the Official Strategy of the Israel Defense Forces, Belfer Center for Science and International Affairs, Harvard Kennedy School

Israel (2018) *The Secret Operation Revealed A Decade Later*, Israel Defense Force. Available at: https://www.idf.il/en/minisites/operations/the-secret-operation-revealed-a-decade-later/ (Accessed: 28 June 2020)

Israel, Ministry of Foreign Affairs (2006a) *IDF Spokesman: Hizbullah Attack on Northern Border and IDF Response*, 12 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/Hizbullah%20attack%20on%20northern%20border%20and%20IDF%20response%2012-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2006b) *Summary of IDF Operations Against Hizbullah in Lebanon*, 13 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/IDF%20operations%20against%20Hizbullah%20in%20Lebanon%2013-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2006c) *Summary of IDF Operations Against Hizbullah in Lebanon*, 14 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/IDF%20operations%20against%20Hizbullah%20in%20Lebanon%2014-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2006d) *Summary of IDF Operations Against Hizbullah in Lebanon*, 18 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/Summary%20of%20IDF%20operations%20against%20Hizbullah%20in%20Lebanon%2018-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2006e) *Summary of IDF Operations Against Hizbullah in Lebanon*, 23 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/Summary%20of%20IDF%20operations%20against%20Hizbullah%20in%20Lebanon%2023-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2006f) *Summary of IDF Operations Against Hizbullah in Lebanon*, 24 July 2006. Available at: https://www.mfa.gov.il/MFA/ForeignPolicy/Terrorism/Hizbullah/Pages/Summary%20of%20IDF%20operations%20against%20Hizbullah%20in%20Lebanon%2024-Jul-2006.aspx (Accessed: 7 July 2020)

Israel, Ministry of Foreign Affairs (2012a) *Pillar of Defense – Statement by DM Ehud Barak*, 14 November 2012. Available at: https://mfa.gov.il/MFA/PressRoom/2012/Pages/Pillar_of_Defense-Statement_DM_Barak_14-Nov-2012.aspx (Accessed: 20 July 2020)

Israel, Ministry of Foreign Affairs (2012b) *Behind the Headlines: Operation Pillar of Defense*, 14 November 2012. Available at:

https://mfa.gov.il/mfa/foreignpolicy/issues/pages/bth_operation_pillar_of_defense_14-nov-2012.aspx (Accessed: 20 July 2020)

Israel, Ministry of Foreign Affairs (2012c) *Israel Strikes Terror Targets in Gaza*, 14 November 2012. Available at: https://mfa.gov.il/MFA/ForeignPolicy/Terrorism/Pages/Israel_strikes_terror_targets_Gaza_14-Nov-2012.aspx (Accessed: 20 July 2020)

Israel, Ministry of Foreign Affairs (2012d) *Operation Pillar of Defense – IDF updates*, 22 November 2012. Available at: https://mfa.gov.il/MFA/ForeignPolicy/Terrorism/Palestinian/Pages/Operation_Pillar_of_Defense_Nov_2012-IDF_updates.aspx (Accessed: 20 July 2020)

Israel, Ministry of Foreign Affairs (2012e) *Behind the Headlines: Ceasefire ends Operation Pillar of Defense*, 25 November 2012. Available at: https://mfa.gov.il/MFA/ForeignPolicy/Issues/Pages/BTH_Ceasefire_Pillar_of_Defense_21-Nov-2012.aspx (Accessed: 20 July 2020)

Israel, Ministry of Foreign Affairs (2014a) *Operation Protective Edge – Q&A*, 14 August 2014. Available at: https://mfa.gov.il/MFA/ForeignPolicy/Issues/Pages/Operation-Protective-Edge-QA.aspx (Accessed: 23 July 2020)

Israel, Ministry of Foreign Affairs (2014b) *Operation Protective Edge: Israel Under Fire, IDF Responds*, 26 August 2014. Available at: https://mfa.gov.il/MFA/ForeignPolicy/Terrorism/Pages/Rise-in-rocket-fire-from-Gaza-3-Jul-2014.aspx (Accessed: 23 July 2020)

Israel, Ministry of Foreign Affairs (2014c) *Operation Protective Edge – The Facts*, September 2014. Available at: https://mfa.gov.il/MFA/ForeignPolicy/FAQ/Pages/Operation-Protective-Edge-The-facts.aspx#blank (Accessed: 23 July 2020)

Russia

Russia (1993) *The Basic Provisions of the Military Doctrine of the Russian Federation*, The Russian Federation Security Council. Available at: https://fas.org/nuke/guide/russia/doctrine/russia-mil-doc.html (Accessed: 8 August 2020)

Russia (1997) *Russian National Security Blueprint*, Russian Federation Presidential Edict 1300, published in Rossiiskaya Gazeta, 26 Dec 1997 pp. 4-5. Available at: https://fas.org/nuke/guide/russia/doctrine/blueprint.html (Accessed: 8 August 2020)

Russia (2000a) *2000 Russian National Security Concept*, The Russian Federation Security Council. Available at: http://www.scrf.gov.ru (Accessed: 8 August 2020)

Russia (2000b) *The Russian Federation Military Doctrine*, The Russian Federation Security Council. Available at: https://www.armscontrol.org/act/2000-05/russias-military-doctrine (Accessed: 8 August 2020)

Russia (2003) *Aktualnyye Zadachi Razvitiya Vooruzhennykh Sil RF* [Immediate Tasks of Development of the Armed Forces of the Russian Federation]. Available at: http://www.mil.ru (Accessed: 9 August 2020)

Russia (2009) *Russia's National Security Strategy to 2020, by Decree of the President of the Russian Federation, 12 May 2009, No. 537*. Available at: http://www.rustrans.wikidot.com/russia-s-national-security-strategy-to-2020 (Accessed: 9 August 2020)

Russia (2015) *Russian National Security Strategy*, *Russian Federation Presidential Edict 683*, 31 December 2015. Available at: http://www.ieee.es/Galerias/fichero/OtrasPublicaciones/Internacional/2016/Russian-National-Security-Strategy-31Dec2015.pdf (Accessed: 9 August 2020)

United States

Combined Joint Task Force – Operation Inherent Resolve (2015) *Coalition Airstrikes Target Key ISIL Revenue Source*. Available at: https://www.inherentResolvemil/Releases/News-Releases/Article/694554/coalition-airstrikes-target-key-isil-revenue-source/ (Accessed: 12 December 2020)

Combined Joint Task Force – Operation Inherent Resolve (2017a) *Fact Sheet*. Available at: https://www.inherentResolvemil/Portals/14/Documents/Mission/20170717-%20Updated%20Mission%20Statement%20Fact%20Sheet.pdf (Accessed: 9 March 2020)

Combined Joint Task Force – Operation Inherent Resolve (2020) *History of CJTF-OIR*. Available at: https://www.inherentResolvemil/Portals/14/Documents/20200903_History_of_CJTF-OIR.pdf (Accessed: 12 December 2020)

Defense Intelligence Agency. (2017) *Russian Military Power*. DIA-11-1704-161. Available at: www.dia.mil/Military-Power-Publications (Accessed: 26 September 2017)

Garamone, J. (2011a) *Coalition Launches 'Odyssey Dawn' to Implement Libya No-fly Zone*, United States Africa Command. Available at: https://www.africom.mil/article/8089/coalition-launches-odyssey-dawn-to-implement-libya (Accessed: 27 January 2021)

Garamone, J. (2011b) *Strikes Degrade Libya's Defenses, but Threats Remain*, United States Africa Command. Available at: https://www.africom.mil/article/8103/strikes-degrade-libyas-defenses-but-threats-remain (Accessed: 27 January 2021)

United States (1987) *The United States Strategic Bombing Survey: Summary Reports (European War) / (Pacific War).* Published September 1945 & July 1946. Reprinted October 1987. Maxwell Air Force Base, AL: Air University Press

United States (1990) *The Air Force and U.S. National Security: Global Reach – Global Power*. Washington, D.C.: U.S. Dept. of the Air Force.

United States (1991a) *National Security Strategy of the United States,* The White House, August 1991. Washington, D.C.: US Government Printing Office

United States (1991b) *The Air Force Performance in Desert Storm*, April 1991. Washington, D.C.: U.S. Dept. of the Air Force

United States (1991c) *Operation Desert Shield / Desert Storm*, 11 July 1991. Washington, D.C.: United States Central Command

United States (1992a) *Air Force Manual 1-1, Vol 1: Basic Doctrine of the United States Air Force*. Washington, D.C.: U.S. Dept. of the Air Force

United States (1992b) *Air Force Manual 1-1, Vol 2: Basic Doctrine of the United States Air Force*. Washington, D.C.: U.S. Dept. of the Air Force

United States (1994) *National Security Strategy of the United States,* The White House, July 1994. Washington, D.C.: US Government Printing Office

United States (1995a) *A National Security Strategy of Engagement and Enlargement*, The White House, February 1995. Washington, D.C.: US Government Printing Office

United States (1995b) *Doctrine for Joint Operations, Joint Publication 3-0*, Washington, D.C.: U.S. Joint Chiefs of Staff

United States (1997a) *A National Security Strategy for a New Century*, The White House, May 1997. Washington, D.C.: US Government Printing Office

United States (1997b) *Air Force Doctrine Document 1: Air Force Basic Doctrine.* Washington D.C.: U.S. Dept. of the Air Force

United States (1998) *Air Force Doctrine Document 2-1.2: Strategic Attack.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2000) *Kosovo/Allied Force After-Action Report,* Report to Congress, 31 January 2000. Washington, D.C.: Department of Defense

United States (2003a) *The Air Force Transformation Flight Plan*. Washington, D.C.: U.S. Dept. of the Air Force

United States (2003b) *Air Force Doctrine Document 1: Air Force Basic Doctrine.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2003c) *Air Force Doctrine Document 2-1.2: Strategic Attack.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2006a) *Counterinsurgency, FM 3-24*, December 2006. Washington D.C.: Headquarters, Department of the Army

United States (2006b) *Air Force Roadmap 2006-2025*. United States Air Force, June 2006

United States (2007a) *The Nation's Guardians: America's 21st Century Air Force*. Washington, D.C.: U.S. Dept. of the Air Force

United States (2007b) *Air Force Doctrine Document 2: Operations and Organization.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2007c) *Air Force Doctrine Document 2-3: Irregular Warfare.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2007d) *Air Force Doctrine Annex 3-70: Strategic Attack.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2009) *Global Strike Command and the Nuclear Enterprise. Secretary of the Air Force Michael B. Donley Remarks at the Air Force Global Strike Command activation ceremony, Barksdale Air Force Base, La., Aug. 7, 2009.* Available at: https://www.af.mil/About-Us/Speeches-Archive/Display/Article/143915/global-strike-command-and-the-nuclear-enterprise/ (Accessed: 6 November 2020)

United States (2011) *Air Force Doctrine Document 1: Air Force Basic Doctrine, Organization and Command.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2013a) *Global Vigilance, Global Reach, Global Power for America*. Washington, D.C.: U.S. Dept. of the Air Force

United States (2013b) *Air Force Global Strike Command Briefing. Commander, Lt Gen James M. Kowalski, 7 May 2013.* Available at: https://fas.org/programs/ssp/nukes/nuclearweapons/AFGSC-CommandBrief-May2013.pdf (Accessed: 12 December 2020)

United States (2014) *America's Air Force: A Call to the Future*. Washington, D.C.: U.S. Dept. of the Air Force

United States (2015) *Air Force Doctrine Document 1: Air Force Basic Doctrine, Organization and Command.* Washington, D.C.: U.S. Dept. of the Air Force

United States (2017) *AFGSC History. United States Air Force.* Available at: https://www.afgsc.af.mil/About/AFGSC-History/ (Accessed: 6 November 2020)

United States (2020) *U.S. Relations with Australia Bilateral Relations Fact Sheet*, Bureau of East Asian and Pacific Affairs Available at: https://www.state.gov/u-s-relations-with-australia/ (Accessed: 8 April 2020)

United States Air Force. (2000) *Operation ALLIED FORCE. Special Study: 19-02. Headquarters Air Force Materiel Command.* Available at: https://www.afmc.af.mil/Portals/13/HQ%20AFMC%20HO%20Special%20Study%2019-02_Operation%20Allied%20Force.pdf (Accessed: 3 August 2020)

United States Air Force (2003) *Operation IRAQI FREEDOM: By the Numbers. US CENTAF Assessment and Analysis Division.* Available at: https://www.globalsecurity.org/military/library/report/2003/uscentaf_oif_report_30apr2003.pdf (Accessed: 14 September 2021)

United States Air Force (2010) *8th Air Force.* Available at: https://www.8af.af.mil/About-Us/Fact-Sheets/Display/Article/333781/8th-air-force/ (Accessed: 8 November 2020)

United States Air Force (2014) *F-35A Lighting II*. Available at: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/478441/f-35a-lightning-ii/ (Accessed: 6 November 2020)

United States Air Force (2015a) *MQ-1B Predator Fact Sheet*. Available at: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104469/mq-1b-predator/ (Accessed: 6 November 2020)

United States Air Force (2015b) *MQ-9 Reaper Fact Sheet*. Available at: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/ (Accessed: 6 November 2020)

United States Air Force (2016) *AF Declares the F-35A 'Combat Ready'.* Available at: https://www.af.mil/News/Article-Display/Article/885496/af-declares-the-f-35a-combat-ready/ (Accessed: 11 June 2021)

United States, CENTCOM (2003) *CENTCOM OPLAN 1003V – Change 1,* 27 February 2003, Headquarters, US Central Command, MacDill Air Force Base, Florida. Declassified by MG Michael X. Garrett, USCENTCOM Chief of Staff. Declassified June 2015. Available at: https://ahec.armywarcollege.edu/CENTCOM-IRAQ-papers/0987.%201003V27Feb03.pdf (Accessed: 5 October 2021)

United States, Central Intelligence Agency (1988) *Soviet National Security Policy: Responses to the Changing Military and Economic Environment. An Intelligence Assessment. June 1988* [further publication details redacted]

United States, Department of Defense (2015a) *The National Military Strategy of the United States of America*. The Joint Chiefs of Staff, June 2015

United States, Department of Defense (2015b) *Annual Aviation Plan 2016-2045.* Available at: https://news.usni.org/wp-content/uploads/2015/04/Annual-Aviation-Plan-2016-2020.pdf (Accessed: 21 September 2021)

United States Marine Corps (2015) *U.S. Marine Corps Moves Forward with F-35 Transition.* Available at: https://www.marines.mil/News/News-Display/Article/613385/us-marine-corps-moves-forward-with-f-35-transition/ (Accessed: 11 June 2021)

United States, Senate (2002) *Operation Enduring Freedom,* Hearing before the Committee on Armed Services. 7 February and 31 July 2002, S. Hrg 107-801. Washington D.C.: U.S. Government Printing Service. Available at: https://www.govinfo.gov/content/pkg/CHRG-107shrg83471/pdf/CHRG-107shrg83471.pdf (Accessed: 7 November 2020)

United States, War Department (1941) A*WPD/1 – Munitions Requirements of the Army Air Forces*. Available at: https://www.scribd.com/doc/229752099/AWPD-1 (Accessed: 22 September 2019)

US AFRICOM Public Affairs (2011a) *Overview of 1st Day of U.S. Operations to Enforce UN Resolution 1973 Over Libya*, United States Africa Command, March 20 2011. Available at: https://www.africom.mil/article/8097/overview-of-1st-day-of-us-operations-to-enforce-un (Accessed: 14 January 2021)

US AFRICOM Public Affairs (2011b) *Navy and Marine Corps Aircraft Strike Libya*, United States Africa Command, March 20 2011. Available at: https://www.africom.mil/article/8093/navy-and-marine-corps-aircraft-strike-libya (Accessed: 14 January 2021)

US AFRICOM Public Affairs (2011c) *TRANSCRIPT: General Ham Briefs Pentagon Press on Operation Odyssey Dawn,* March 21 2011. Available at: https://www.africom.mil/article/8105/transcript-general-ham-briefs-pentagon-press-on-op (Accessed: 14 January 2021)

US AFRICOM Public Affairs (2011d) *TRANSCRIPT: DOD News Briefing with Rear Admiral Hueber via Telephone from USS Mount Whitney,* March 24 2011. Available at:

https://www.africom.mil/article/8114/transcript-dod-news-briefing-with-rear-admiral-hue (Accessed: 14 January 2021)

International Organisations

NATO (1995a) *Statement by the Secretary General of NATO,* Press Release (95) 73, 30 August 1995. Available at: https://www.NATOint/docu/pr/1995/p95-073.htm (Accessed: 5 July 2021)

NATO (1995b) *Statement by the Secretary General of NATO,* Press Release (95) 79, 5 September 1995. Available at: https://www.NATOint/docu/pr/1995/p95-079.htm (Accessed: 5 July 2021)

NATO (1995c) *Statement on Bosnia-Herzegovina,* Press Release M-NAC-2(95) 119, 5 December 1995. Available at: https://www.NATOint/cps/en/natohq/official_texts_24719.htm?selectedLocale=en (Accessed: 6 July 2021)

NATO (2000) *Kosovo One Year On: Achievement and Challenge,* Lord Robertson of Port Ellen, Secretary General of NATO, 21 March 2000. Available at: https://www.NATOint/kosovo/repo2000/index.htm (Accessed: 2 August 2020)

NATO (2011a) *Press Briefing on Libya,* 13th July 2011. Available at: https://www.NATOint/cps/en/natohq/opinions_76355.htm?selectedLocale=en (Accessed: 14 September 2021)

NATO (2011b) *Press Briefing on Libya,* 27th July 2011. Available at: https://www.NATOint/cps/en/natohq/opinions_76680.htm?selectedLocale=en (Accessed: 14 September 2021)

United Nations. (2011) *Resolution 1973,* 17th March 2011. Available at https://www.undocs.org/S/RES/1973%20(2011) (Accessed: 21 September 2021)

Primary Sources: Analysis, Reports, Testimony & Theory *(By Country)*

Australia

Ball, D. (1991) 'Air Power in the Regional Balance: Maintaining the Peace in South East Asia' in Stephens, A. (1991) *Smaller but Larger: Conventional Air Power in the 21st Century*. The Proceedings of a Conference held by the Royal Australian Air Force in Canberra, 25 March to 27 March 1991. Commonwealth of Australia

Criss, P. J. & Schubert D. J. (1990) *The Leading Edge: Air Power in Australia's Unique Environment*. Canberra Papers on Strategy and Defence, No. 62, Strategic and Defence Studies Centre Research School of Pacific Studies, The Australian National University

Espeland, B. J., Vallance, A. G. B. & Westenhoff, C. M. (1991) 'Current Doctrine Development' in Stephens, A. (1991) *Smaller but Larger: Conventional Air Power in the 21st Century*. The Proceedings of a Conference held by the Royal Australian Air Force in Canberra, 25 March to 27 March 1991. Commonwealth of Australia

Harvey, J. (1995) 'RAAF Air Power Doctrine Development' in Harvey, J. & Lax, M. (1995) *Regional Air Power Workshop*. The Proceedings of a Workshop held by the Royal Australian Air Force in Townsville, 4 September to 8 September 1995. Commonwealth of Australia

Stephens, A. (2002) 'The Afghanistan Experience' in Dally A. & Bourke R. (2000) *Conflict, The State and Aerospace Power*. The Proceedings of a Conference held by the Royal Australian Air Force in Canberra, 28-29 May 2002. Commonwealth of Australia

Treloar, B. (2000) 'The Australian Theatre' in Brent, K. (2000) *New Era Security: The RAAF in the Next Twenty-Five Years*. The Proceedings of a Conference held by the Royal Australian Air Force in Canberra, 8-9 May 2000. Commonwealth of Australia

Waters, G. (1990) *RAAF Air Power Doctrine: A Collection of Contemporary Essays*, Canberra, Strategic and Defence Studies Centre, Research School of Pacific Studies, Australian National University

Waters, G. (1993) 'Doctrine Development' in Waters, G. & Mordike, J. (1993) *Regional Air Power Workshop*. The Proceedings of a Workshop held by the Royal Australian Air Force in Darwin, 24 August to 26 August 1993. Commonwealth of Australia

France

Cexus, P. (2004) Le Modoèle del'adversaire et son milieu [The Model of the Adversary and his Environment] *Penser les Ailes Françaises*, No.3. pp. 56-64

Chamagne, R. (2004) Bombardement aérien: de l'attrition au délitement [Aerial Bombardment: From Attrition to Disintegration] *Penser les Ailes Françaises*, No.2. pp. 58-61

De Lespinos, J. (2008) La puissance aérienne et spatiale: vers une définition française? [Air & Space Power: Towards a French Definition] *Penser les Ailes Françaises*, No.18. pp. 32-46

Desclaux, G. (2012) Retour sur l'Afghanistan et la Libye [Back to Afghanistan and Libya] Penser les Ailes Françaises, 1991-2011: Vingt ans d'opérations aériennes Enseignements et perspectives, Automne 2012. pp. 57-61

Etienne-Leccia, G. (2007) Organisation de la fonction conceptuelle et doctrinale au sein des armées: le cas français [Organisation of Doctrinal and Conceptual Functions in the Armed Forces: the French Case] *Penser les Ailes Françaises*, No.14. pp. 106-108

Faury, E. & Brenot, J-M. (2006) L'opération Iraqi Freedom (OIF): Analyse des opérations aéroterrestres [Operation Iraqi Freedom (OIF): analysis of air-land operations] *Penser les Ailes Françaises*, No.10. pp. 10-19

French Air Staff. (2013) 'Serval: An Exemplary French Air Force Operation' in Comité d'études de défense nationale (Ed.) (2013) *L'Armée de l'air, instrument de puissance pour la France* École militaire, Paris, pp. 45-56

Fleury, J. (2012b) La guerre du Golfe et ses enseignements [The Gulf War and its Lessons] Penser les Ailes Françaises, 1991-2011: Vingt ans d'opérations aériennes Enseignements et perspectives, Automne 2012. pp. 49-51

Gautier, J. (2012) Regard sur le rôle de l'armée de l'air [A look at the role of the Air Force] Penser les Ailes Françaises, 1991-2011: Vingt ans d'opérations aériennes Enseignements et perspectives, Automne 2012. pp. 19-22

Gaviard, J-P. (2012) La guerre du Kosovo et ses enseignements [The Kosovo War and its Lessons] Penser les Ailes Françaises, 1991-2011: Vingt ans d'opérations aériennes Enseignements et perspectives, Automne 2012. pp. 52-54

Laborie, G. (2013) 'From Afghanistan to Mali: The Afghan Model 10 Years On, Still Wholly Representative' in Comité d'études de défense nationale (Ed.) (2013) *L'Armée de l'air, instrument de puissance pour la France* École Militaire: Paris. pp. 29-40

Le Saint, J-P. (2007a) Plaidoyer pour un concept national d'emploi de la puissance aérospatiale [Advocacy of a National Concept for Air Power] *Penser les Ailes Françaises*, No.14. pp. 53-59

Souvignet, J. & Virem, S. (2006) L'armée de l'air dans la tourmente [The Air Force in Turmoil] Penser les Ailes Françaises, No.9. pp. 92-96

Spet, S. (2015) Operation Serval: Analyzing the French Strategy Against Jihadists in Mali. *ASPJ: Africa and Francophonie.* 6. pp. 66-79

Great Britain

Dalton, S. (2009) The Future of British Air and Space Power: A Personal Perspective, *Air Power Review*, 12(3), Autumn 2009. pp. 1-14

Graydon, M. (1992) Roles and Changing Priorities, *The RUSI Journal*, 137(4). pp. 28-34

Jackson, B. (1992) Air Power, *The RUSI Journal*, 137(4). pp. 27-27

Kan, P. R. (2004) What Should We Bomb? Axiological Targeting and the Abiding Limits of Air Power Theory, *Air Power Review*, 7(3), Autumn 2004. pp. 31-39

Killey, A. H. (2005) Beyond Warden's Rings: A Human Systems Approach to the more Effective application of Air Power, *Air Power Review*, 8(1), Spring 2005. pp. 23-51

Lock-Pullan, R. (2002) Redefining Strategic Effect in British Air Power Doctrine, *Air Power Review*, 5(3), Autumn 2002. pp. 59-67

Peach, S. (2003) Effects-Based Operations: The Contemporary Perspective, *Air Power Review*, 6(3), Autumn 2003. pp. 27-47

Ritchie, S. (2021a) The Royal Air Force in Operation Granby, the First Gulf War, 1990-1991: Tornado F3. Air Historical Branch (RAF) Narrative. RAF Northolt, Middlesex. Released 16 March 2021. Available at: https://www.raf.mod.uk/our-organisation/units/air-historical-branch/post-coldwar-studies/tornado-f3-operations/ (Accessed: 19 July 2021)

Ritchie, S. (2021b) The Royal Air Force in Operation Granby, the First Gulf War, 1990-1991: Jaguar. Air Historical Branch (RAF) Narrative. RAF Northolt, Middlesex. Released 16 March 2021. Available at: https://www.raf.mod.uk/our-organisation/units/air-historical-branch/post-coldwar-studies/jaguar-operations/ (Accessed: 19 July 2021)

Israel

Naveh, S. (1995) The Cult of the Offensive Preemption and Future Challenges for Israeli Operational Thought, *Israel Affairs*, 2(1). pp. 168-187

Naveh, S. (1997) *In Pursuit of Military Excellence: The Evolution of Operational Theory*. London: Frank Cass

Winograd Commission. (2007) *Winograd Commission: Interim Report*, 30 April 2007. Available at: https://www.jewishvirtuallibrary.org/winograd-commission-inerim-report-april-2007 (Accessed: 3 July 2020)

Winograd Commission. (2008) *Winograd Commission: Final Report*, 30 January 2008. Available at: https://www.jewishvirtuallibrary.org/winograd-commission-final-report-january-2008 (Accessed: 3 July 2020)

Russia

Isserson, G. S. & Menning, B. W. (2013) *The Evolution of Operational Art,* US Army Combined Arms Center, Fort Leavenworth, KS: Combat Studies Institute Press

Triandafillov, V. & Kipp, J. W. (1994) *The Nature of the Operations of Modern Armies*, Ilford, Essex: F. Cass

United States

Cohen, E. A. (1993) *Gulf War Air Power Survey*, Washington D.C.: US Government Printing Office

Crowder, G. (2003) *Effects-Based Operations*, Unclassified Briefing, Headquarters Air Combat Command, United States Air Force

Deptula, D. A. (1995) *Firing for Effect: Change in the Nature of Warfare,* Arlington, VA: Aerospace Education Foundation

Deptula, D. A. (2001) *Effects-Based Operations: Change in the Nature of Warfare*, Arlington, VA: Aerospace Education Foundation

Deptula, D. A. (2018) *The St. Andrews Proclamation: A Pragmatic Assessment of 21st Century Airpower*, Arlington, VA.: Mitchell Institute for Aerospace Studies. Available at: http://docs.wixstatic.com/ugd/a2dd91_42b6b41dc8524598aaa2aef7024d5e56.pdf (Accessed: 7 November 2021)

Dunlap, C. J. (2007) Air-Minded Considerations for Joint Counterinsurgency Operations, *Air and Space Power Journal*, 21(4), Winter 2007. pp. 63-74

Keaney, T. A. & Cohen, E. A. (1993) *Gulf War Air Power Survey Summary Report*. Washington D.C.: US Government Printing Office

Mattis, J. N. (2008) USJFCOM Commander's Guidance for Effects-based Operations. *Parameters.* Autumn 2008. pp. 18-25

McConnell, J. P. (1965) The Role of Air Power in Vietnam. *Air Force Policy Letters for Commanders, Supplement*, October 1965. pp. 6–12

Meilinger, P. S. (1995) *10 Propositions Regarding Air Power*. Maxwell Air Force Base, AL: Air University Press

Mitchell, W. (2006) *Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military*. Originally published 1925, reprinted 2006. Mineola, NY: Dover Publications Inc.

Rumsfeld, D. H. (2003) *'Beyond Nation Building', Remarks as delivered by Secretary of Defense Donald H. Rumsfeld, 11th Annual Salute to Freedom, Intrepid Sea-Air-Space Museum, New York City, Friday, February 14, 2003.* Available at: http://www.defenselink.mil/speeches/2003/sp20030214-secdef0024.html (Accessed: 16 June 2021)

Sherman, W. C. (2002) *Air Warfare*. Originally published 1926, reprinted 2002. Maxwell Air Force Base, AL: Air University Press

Strange, J. (1996) *Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language.* Quantico, VA: Marine Corps. University

United States, Congressional Research Service (1999a) *Kosovo: Review and Analysis of Policy Objectives, 1998-June 1999,* CRS Report for Congress, July 21, 1999, Order Code RL30265

United States, Congressional Research Service (1999b) *Kosovo: Lessons Learned from Allied Force,* CRS Report for Congress, November 19, 1999, Order Code RL30374

United States, Congressional Research Service. (2016) *Coalition Contributions to Countering Islamic State.* Updated August 24, 2016

United States, Congressional Research Service. (2020a) *F-35 Joint Strike Fighter (JSF) Program.* Updated May 27, 2020

United States, Congressional Research Service. (2020b) *Air Force Next-Generation Air Dominance Program: An Introduction.* October 5, 2020

Warden, J. A. (1988) *The Air Campaign: Planning for Combat*. Washington D.C.: Pergamon-Brassey's

Warden, J. A. (1995) The Enemy as a System. *Airpower Journal*. 9(1), Spring 1995. pp. 40-55

Warden, J. A. (1997) Success in Modern War: A Response to Robert Pape's *Bombing to Win*. *Security Studies,* 7(2). pp. 172-190

Other

Douhet, G. & Ferrari, D. (1998) *The Command of The Air*. Washington, D.C.: Air Force History and Museums Program

Secondary Sources

Books & Book Chapters

Adamsky, D. (2010) *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the US, and Israel*. Stanford, CA: Stanford University Press

Anrig, C. F. (2015) *The Quest for Relevant Air Power: Continental European Responses to the Air Power Challenges of the Post-Cold War Era*. Maxwell Air Force Base, AL: Air University Press

Barno, D. W. & Bensahel, N. (2020) *Adaptation Under Fire: How Militaries Change in Wartime*. New York, NY: Oxford University Press

Bergman, R. (2019) *Rise and Kill First: The Secret History of Israel's Targeted Assassinations*. London: John Murray Publishers

Brun, I. (2011) 'Israeli Air Power' in Olsen, J. A. (2011) *Global Air Power*. Washington, D.C.: Potomac Books

Byman, D., Waxman, M. C., & Larson, E. (2000) *Air Power as a Coercive Instrument*. Santa Monica, CA: RAND

Clodfelter, M. (1989) *The Limits of Air Power: The American Bombing of North Vietnam*. Riverside: Free Press

Davis, R. G. (1996) *Decisive Force: Strategic Bombing in the Gulf War*. Bolling Air Force Base, Washington, D.C.: Air Force Historical Studies Office

De Durand, E. (2014) 'French Air Power: Effectiveness Through Constraints' in Olsen, J. A. (2014) *European Air Power: Challenges and Opportunities*. Lincoln, Potomac Books, pp. 3-31

Dyndal, G. L. (2007) *Trenchard and Slessor: On the Supremacy of Air Power over Sea Power*. Trondheim: Tapir Akademisk Forlag

Fadok, D. S. (1997) 'John Boyd and John Warden: Airpower's Quest for Strategic Paralysis' in Meilinger, P. S. (2010) *The Paths of Heaven: The Evolution of Airpower Theory*. Maxwell Air Force Base, AL: Air University Press, pp. 357-398

Farrell, T., Osinga, F. P. B. & Russell, J. A. (2013) *Military Adaptation in Afghanistan*. Stanford, CA: Stanford University Press

Fedorchak, V. (2019) *British Air Power: The Doctrinal Path to Jointery*. Oxford: Bloomsbury Academic

Finkel, M. (2011) On Flexibility: Recovery from Technological and Doctrinal Surprise on the Battlefield. Palo Alto, CA: Stanford University Press

Freedman, L. (2003) *The Evolution of Nuclear Strategy*. London: Palgrave Macmillan UK

Gentile, G. P. (2001) *How Effective is Strategic Bombing?: Lessons Learned from World War II and Kosovo*. New York: New York University Press

Grant, R. (2003) *Gulf War II: Air and Space Power Led the Way*. Arlington, VA: Aerospace Education Foundation. Available at: http://www.afa.org/media/reports/GulfWar.pdf (Accessed: 11 June 2018)

Grant, R. (2004) *First 600 Days of Combat: The US Air Force in the Global War on Terrorism*. Washington, D.C.: Iris Press

Gray, C. S. (2014) *Airpower for Strategic Effect*. Air Force Research Institute, Maxwell Air Force Base, AL: Air University Press

Gray, P. (2015) *Air Warfare: History, Theory and Practice*. London: Bloomsbury

Gunston, B. (1985) *Modern European Aircraft*. London: Leisure Books Ltd.

Hallion, R. (1998) *Storm over Iraq: Air Power and the Gulf War*. Washington, D.C.: Smithsonian Institution Press

International Institute for Strategic Studies (IISS) (1989) *The Military Balance, 1989-1990.* London: Brassey's

International Institute for Strategic Studies (IISS) (1995) *The Military Balance, 1995-1996.* London: Brassey's

International Institute for Strategic Studies (IISS) (2010) *The Military Balance, 2010. Vol. 110, No. 1.* London: Routledge

International Institute for Strategic Studies (IISS) (2015) *The Military Balance, 2015. Vol. 115, No. 1.* London: Routledge

Jones, M. (2017) *The Official History of the UK Strategic Nuclear Deterrent. Volume I: From the V-Bomber Era to the Arrival of Polaris, 1945-1964*. London: Routledge

Jones, M. (2018) *The Official History of the UK Strategic Nuclear Deterrent. Volume II: The Labour Government and the Polaris Programme, 1964-1970*. London: Routledge

Kainikara, S. (2011) 'Soviet/Russian Air Power' in Olsen, J. A. (2011) *Global Air Power*. Washington, D.C.: Potomac Books

Lambert, A., & Williamson, A. C. (1996) *The Dynamics of Air Power*. Bracknell: Royal Air Force Staff College

Lambeth, B. S. (2000) *The Transformation of American Air Power*. Ithaca, NY: Cornell University Press

Lambeth, B. S. (2013) *The Unseen War: Allied Air Power and the Takedown of Saddam Hussein*. Annapolis, Maryland: Naval Institute Press

Mason, R. A. (1984) *British Air Power in the 1980s: the Royal Air Force*. London: Ian Allan Ltd.

McPhedran, I. (2013) *Air Force – Inside Australia's Air Wars: Bali to Baghdad and Beyond*. Sydney: HarperCollins

Meilinger, P. S. (1997) *The Paths of Heaven: The Evolution of Airpower Theory*. Maxwell Air Force Base, AL: Air University Press

Meilinger, P. S. (2017) *Limiting Risk in America's Wars: Airpower, Asymmetrics and a New Strategic Paradigm*. Annapolis, MD: Naval Institute Press

Mey, H. H. (2014) 'German Air Power' in Olsen, J. A. (2014) *European Air Power: Challenges and Opportunities*. Lincoln: Potomac Books

Monks, A. L. (1978) 'The Soviet Strategic Air Force and Civil Defense' in Higham, R. D. S., & Kipp, J. W. (1978) *Soviet Aviation and Air Power: A Historical View*. London: Brassey's

Murray, W. (2011) *Military Adaptation in War: With Fear of Change*. New York, NY: Cambridge University Press

Olsen, J. A. (2007) *John Warden and the Renaissance of American Air Power*. Dulles, VA: Potomac Books

Olsen, J. A. (2014) *European Air Power: Challenges and Opportunities*. Lincoln: Potomac Books

Olsen, J. A. (2018) *Routledge Handbook of Air Power.* London: Routledge

Pallinn, C. V. & Westerlund, F. (2010) 'Russia's War in Georgia: Lessons and Consequences' in Rich, P. (2010) *Crisis in the Caucasus: Russia, Georgia and the West*, Abingdon: Routledge

Pape, R. A. (1996) *Bombing to Win: Air Power and Coercion in War*. Ithaca, NY: Cornell University Press

Paterson, R. H. (1997) *Britain's Strategic Nuclear Deterrent: From Before the V-Bomber to Beyond Trident*. London: Frank Cass & Co.

Peacock, L. T. & Von Rosenbach, A. (2011) *Jane's World Air Forces: 2011*. Coulsdon, Surrey: Jane's Information Group

Posen, B. (1986) *The Sources of Military Doctrine: France, Britain and Germany between the World Wars*. Ithaca NY: Cornell University Press

Putney, D. T. (2004) *Airpower Advantage: Planning the Gulf War Air Campaign, 1989-1991*. Washington, D.C.: Air Force History and Museums Program, United States Air Force

Reynolds, R. T. (1995) *Heart of the Storm: The Genesis of the Air Campaign against Iraq*. Maxwell Air Force Base, AL: Air University Press

Rosen, S. P. (1994) *Winning the Next War: Innovation and the Modern Military*. Ithaca, NY: Cornell University Press

Rubinstein, M. & Goldman, R. (1979) *The Israeli Air Force Story*. London, Book Club Associates

Sherry, M. S. (1987) *The Rise of American Air Power: The Creation of Armageddon*. New Haven, CT: Yale University Press

Stephens, A. (2011) 'The Asia Pacific Region' in Olsen, J. A. (2011) *Global Air Power: Challenges and Opportunities*. Washington, D.C.: Potomac Books

Wragg, D. W. (2003) *Jane's Air Forces of The World: The History and Composition of the World's Air Forces*. London: Collins

Zisk, K. M. (2001) *Engaging the Enemy: Organization Theory and Soviet Military Innovation 1955-1991*. Princeton, NJ: Princeton University Press

Papers, Reports & Theses

Admiral, M. A. (1993) *The Evolution of Russian Offensive Air Warfare Theory: From Deep Battle to Aerospace War*. PhD thesis. Naval Postgraduate School

Adamsky, D. (2018) *Moscow's Syria Campaign: Russian Lessons for the Art of Strategy*, No.109, French Institute of International Relations (IFRI). Available at: https://www.ifri.org/en/publications/notes-de-lifri/russieneivisions/moscows-syria-campaign-russian-lessons-art-strategy (Accessed: 12 September 2020)

Anderson, C. & Sadjadpour, K. (2018) *Iran's Cyber Threat: Espionage, Sabotage & Revenge.* Washington, D.C.: Carnegie Endowment for International Peace.

Barabanov, M., Makienko, K. & Pukhov, R. (2012) *Military Reform: Towards the New Look of the Russian Army,* Valdai Discussion Club Analytical Report, from the 'Modernization of

Russia's Armed Forces and Cooperation in International Security' conference, May 25-27, 2011

Barrie, D. & Gethin, H. (2018) *Russian Weapons in the Syrian Conflict*. Russian Studies, NATO Defense College. Available at: https://www.iiss.org/-/media/images/comment/analysis/2018/may/documents/nato-russian-weapons-in-the-syrian-conflict.pdf (Accessed: 15 September 2020)

Batschelet, A. W. (2002) *Effects-Based Operations: A New Operational Mode?,* USAWC Strategy Research Project. Carlisle, PA: U.S. Army War College

Biddle, T. D. (2019) *Air Power and Warfare: A Century of Theory and History*. Carlisle, PA: U.S. Army War College. Available at: https://press.armywarcollege.edu/monographs/378 (Accessed: 8 December 2021)

Campbell, C. M. (2000) 'The Deliberate Force Air Campaign' in Owen, R. C. (2000) *Deliberate Force A Case Study in Effective Air Campaigning*. Final Report of the Air University Balkans Air Campaign Study. January 2000, Maxwell Air Force Base, AL: Air University Press, pp. 87-130

Chipman, D. (1993) *The RAAF and Force Multipliers*. Air Power Studies Centre Paper 13, May 1993

Cohen, A. & Hamilton, R. E. (2011) *The Russian Military and the Georgia War: Lessons and Implications*. Carlisle, PA: Strategic Studies Institute, US Army War College

Cohen, R. S. (2017) *Air Force Strategic Planning: Past, Present and Future*. Santa Monica, CA: RAND

Cohen, R. S., Johnson, D. E., Thaler, D. E., Allen, B., Bartels, E. M., Cahill, J. & Efron, S. (2017) *From Cast Lead to Protective Edge: Lessons from Israel's Wars in Gaza*. Santa Monica, CA: RAND

Connolly, R. & Boulègue, M. (2018) *Russia's New State Armament Programme*, Research Paper, Chatham House. Available at: https://www.chathamhouse.org/2018/05/russias-new-state-armament-programme/5-constraining-factors-defence-industry-under-gpv-2027 (Accessed: 3 December 2021)

Conversino, M. J. (2000) 'Executing Deliberate Force, 30th August – 14th September 1995' in Owen, R. C. (2000) *Deliberate Force A Case Study in Effective Air Campaigning*. Final Report of the Air University Balkans Air Campaign Study. January 2000, Maxwell Air Force Base, AL: Air University Press, pp. 131-176

De Haas, M. (2003) *The Use of Russian Airpower in the Second Chechen War*. Camberley, Surrey, Conflict Studies Research Centre, Royal Military Academy Sandhurst, Paper B59

De Haas, M. (2011) 'Russia's Military Doctrine Development 2000-2010', in Blank, S. (2011) *Russian Military Politics and Russia's 2010 Defense Doctrine US Army War College*, Strategic Studies Institute and US Army War College Press, pp. 1-62

Dick C. J. (1999) *Military Reform and the Russian Air Force*, Camberley, Surrey, Conflict Studies Research Centre, Royal Military Academy Sandhurst, Paper B56

Endicott, J. G. (2000) 'Raid on Libya: Operation El Dorado Canyon', in Warnock, T. A. (2000) Short of War: Major USAF Contingency Operations 1947-1997. Air Force Historical Research Agency, Maxwell Air Force Base, AL: Air University Press

Evans R. D. (2001) *Russian Airpower in the Second Chechen War*. Ft. Belvoir, Defense Technical Information Center. Available at: http://www.dtic.mil/docs/citations/ADA391341 (Accessed: 26 May 2018)

Fadok, D. S. (1995) *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis*. School of Advanced Air Power Studies, February 1995. Maxwell Air Force Base, AL: Air University Press

Felker, E. J. (1994) *OZ Revisited: Russian Doctrinal Reform in Light of Their Analysis of Desert Storm*, School of Advanced Airpower Studies, Maxwell Air Force Base, AL: Air University Press

FitzGerald, M. C. (1986) *Marshal Ogarkov on the Modern Theater Operation*. Alexandria, VA: Center for Naval Analyses

Frolov, A. (2017) 'Defence Technologies and Industrial Base' in Blitzinger, R. A. & Popescu, N. (2017) *Defence Industries in Russia and China: Players and Strategies*. ISSUE Report No. 38, pp. 9-18

Frostic, F. L. (1994) *The Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations*. Santa Monica, CA: RAND

Futrell, R. F. (1989) *Ideas, Concepts, Doctrines: Basic Thinking in the United States Air Force, 1961-1984. Vol II.* Maxwell Air Force Base, AL: Air University Press

Goulter, C. (2015) 'The British Experience: Operation Ellamy' in Mueller, K. (2015) *Precision and Purpose: Airpower in the Libyan Civil War*, Santa Monica, CA, RAND, pp. 153-182

Grant, R. (2005) *Operation Anaconda: An Air Power Perspective*. Headquarters United States Air Force, Maxwell Air Force Base, AL: Air Force Historical Research Agency

Gros, P. (2014) *Libya And Mali Operations: Transatlantic Lessons Learned*, Foundation for Strategic Research & German Marshall Fund of the United States. Available at: https://www.frstrategie.org/web/documents/publications/autres/2014/2014-gros-gmf-libya-mali.pdf (Accessed: 4 April 2019)

Gressel, G. C. (2017) 'Strategy and Challenges' in Blitzinger, R. A. & Popescu, N. (2017) *Defence Industries in Russia and China: Players and Strategies*. ISSUE Report No. 38, pp. 27-38

Hamilton, R. J. (1993) *Green and Blue in the Wild Blue: An Examination of the Evolution of Army and Air Force Airpower Thinking and Doctrine Since the Vietnam War*. Maxwell Air Force Base, AL: Air University Press

Haulman, D. L. (2000) 'Resolution of Bosnian Crisis: Operation DENY FLIGHT', in Warnock, T. A. (2000) *Short of War: Major USAF Contingency Operations 1947-1997*. Air Force Historical Research Agency, Maxwell Air Force Base, AL: Air University Press

Kainikara, P. S. (2005) *Russian Concept of Air Warfare: The Impact of Ideology on the Development of Air Power*. PhD Thesis. University of Adelaide, School of History and Politics

Kainikara, S. (2018) *In the Bear's Shadow: Russian Intervention in Syria*. Canberra: Air Power Development Centre

Lambeth, B. S. (1992) *Desert Storm and its Meaning: The View from Moscow.* Santa Monica, CA: RAND

Lambeth, B. S. (2001) *NATO's Air War for Kosovo: A Strategic and Operational Assessment.* Santa Monica, CA: RAND

Lambeth, B. S. (2005) *Air Power Against Terror: America's Conduct of Operation Enduring Freedom.* Santa Monica, CA: RAND

Lambeth, B. S. (2011) *Air Operations in Israel's War Against Hezbollah: Learning from Lebanon and Getting it Right in Gaza.* Santa Monica, CA: RAND

Lambeth, B. S. (2012) *Air Power at 18,000': The Indian Air Force in the Kargil Conflict.* Washington D.C.: Carnegie Endowment for International Peace

Lappin, Y. (2013) 'Israel vs. the Iran-Hizballah Axis', *The Begin-Sadat Center for Strategic Studies*, BESA Comparative Perspectives Paper No. 221

Lappin, Y. (2017) ‘The Low Profile War Between Israel and Hezbollah’, *The Begin-Sadat Center for Strategic Studies, Bar-Ilan University*, Mideast Security and Policy Studies No. 138

Lavrov, A. (2018) *The Russian Air Campaign in Syria: A Preliminary Analysis*, CNA Occasional Papers. Available at: https://www.cna.org/CNA_files/PDF/COP-2018-U-017903-Final.pdf (Accessed: 3 March 2019)

Lefebvre, S. (2002) *The Reform of the Russian Air Force*. Camberley, Surrey: Conflict Studies Research Centre, Royal Military Academy Sandhurst, Paper B57

Matthews, M. M. (2008) *We Were Caught Unprepared: The 2006 Israeli-Hezbollah War*. Long War Occasional Paper No. 26. Fort Leavenworth, U.S. Army Combined Arms Center Combat Studies Institute Press

Mueller, K. P. (2015) *Precision and Purpose: Airpower in the Libyan Civil War*. Santa Monica, CA: RAND

Nagel, J. & Schanzer, J. (2019) ‘From Ben-Gurion to Netanyahu: The Evolution of Israel’s National Security Strategy’, *Foundation for Defense of Democracies*. Available at: https://www.fdd.org/analysis/2019/05/13/from-ben-gurion-to-netanyahu-the-evolution-of-israels-national-security-strategy/ (Accessed: 12 June 2020)

Nardulli, B. R., Perry, W. L., Pirnie, B., Gordon, J. & McGinn, J. G. (2002) *Disjointed War: Military Operations in Kosovo, 1999*. Santa Monica, CA: RAND

Perry, W. L. & Kassing, D. (2015) *Toppling the Taliban: Air-Ground Operations in Afghanistan, October 2001-June 2002*. Santa Monica, CA: RAND

Perry, W. L., O’Connell, E., Priebe, M., Hou, A. C., Schwartz, L. H. (2015) ‘Managing the War’, in Perry, W. L., Darilek, R. E., Rohn, L. L., & Sollinger, J. M. (2015) *Operation Iraqi Freedom: Decisive War, Elusive Peace*. Santa Monica, CA: RAND, pp. 245-318

Peters, J. E., Johnson, S., Bensahel, N., Liston, T. & Williams, T. (2001) *European Contributions to Operation Allied Force: Implications for Transatlantic Cooperation*. Santa Monica, CA: RAND

Pirnie, B. R., Gordon, J., Brennan Jr., R. R., Morgan, F. E., Hou, A. C., Yost, C. (2015) ‘Air Operations’, in Perry, W. L., Darilek, R. E., Rohn, L. L., & Sollinger, J. M. (2015) *Operation Iraqi Freedom: Decisive War, Elusive Peace*. Santa Monica, CA: RAND, pp. 149-182

Rumer, E. (2019) The Primakov (not Gerasimov) Doctrine in Action. *Carnegie Endowment for International Peace*, The Return of Global Russia. Available at: https://carnegieendowment.org/files/Rumer_PrimakovDoctrine_final1.pdf (Accessed: 18 August 2020)

Sargent R. L. (2000) ‘Aircraft Used in Deliberate Force’ in Owen, R. C. (2000) *Deliberate Force A Case Study in Effective Air Campaigning*. Final Report of the Air University Balkans Air Campaign Study. January 2000, Maxwell Air Force Base, AL: Air University Press, pp, 199-256

Sorrells, W. T., Downing, G. R., Blakesley, P. J., Pendall, D. W., Walk, J. K., Wallwork, R. D, (2005) *Systemic Operational Design: An Introduction.* United States Army Command and General Staff College, Fort Leavenworth: School of Advanced Military Studies

Vick, A. J., Grissom, A., Rosenau, W., Grill, B. & Mueller, K. P. (2006) *Air Power in the New Counterinsurgency Era: The Strategic Importance of USAF Advisory and Assistance Missions.* Santa Monica, CA: RAND

Villahermosa, G. & Glantz, D. M. (1991) *Desert Storm: The Soviet View*. Foreign Military Studies Office, U.S. Army

Wasser, B., Pettyjohn, S. L., Martini, J., Evans, A. T., Mueller, K. P., Edenfield, N., Tarini, G., Haberman, R. & Zeman, J. (2021) *The Air War Against the Islamic State: The Role of Airpower in Operation Inherent Resolve*, Santa Monica, CA: RAND

West, S. D. (1999) *Warden and the Air Corps Tactical School – Déjà Vu?*. Maxwell Air Force Base, AL: Air University Press

Articles

Air Force Magazine (2014) ‘USAF Issues LRS-B Request for Proposals’, *Air Force Magazine*. Available at: https://www.airforcemag.com/usaf-issues-lrs-b-request-for-proposals/ (Accessed: 10 December 2020)

Allison, G. (2018) ‘A Guide to the UK’s RC-135 Rivet Joint Surveillance Aircraft’, *UK Defence Journal*. Available at: https://ukdefencejournal.org.uk/guide-rc-135-rivet-joint/ (Accessed: 10 June 2021)

Aubout, M., Drout, Y., Marcais, M. M. & Morin, T. (2013) ‘French Command and Control of Air Defence: A Brief History’ in Comité d’études de défense nationale (Ed.) (2013) *L’Armée de l’air, instrument de puissance pour la France* École Militaire, Paris, pp. 13-19

Australian Aviation (2019) ‘From the Archives: The KC-30A’s Entry into RAAF Service’, *Australian Aviation*. Available at: https://australianaviation.com.au/2019/05/from-the-archives-the-kc-30as-entry-into-raaf-service/ (Accessed: 31 March 2020)

Baev, P. K. (1997) ‘Russia's Airpower in the Chechen War: Denial, Punishment and Defeat’, *The Journal of Slavic Military Studies*, 10(2). pp. 1-18

Ball, D. & Toth, R. C. (1990) 'Revising the SIOP: Taking War-Fighting to Dangerous Extremes', *International Security*, 14(4), Spring 1990. pp. 65-92

Barabanov, M. (2014) 'Testing a "New Look"', *Russia in Global Affairs*, No.4, October/November. Available at: https://eng.globalAffairsru/articles/testing-a-new-look/ (Accessed: 12 August 2020)

Barnard, A. (2013) 'Syria Blames Israel for Fiery Attack in Damascus', *New York Times*, 5 May. Available at: https://www.nytimes.com/2013/05/06/world/middleeast/after-strikes-in-syria-concerns-about-an-escalation-of-fighting.html (Accessed: 19 August 2021)

Barnard, A., Gordon, M. R. & Rudoren, J. (2013) 'Israel Targeted Iranian Missiles in Syria Attack', *New York Times*, 4 May. Available at: https://www.nytimes.com/2013/05/05/world/middleeast/israel-syria.html (Accessed: 19 August 2021)

Barrie, D. (2012) 'Libya's Lessons: The Air Campaign', *Survival*, 54:6, pp. 57-65

Barrie, D. (2018) 'Russian Aerospace Forces Reform and its Syrian Role: The View from Moscow', *International Institute for Strategic Studies*. Available at: https://www.iiss.org/blogs/military-balance/2018/12/russian-aerospace-reform-syria (Accessed: 12 September 2020)

Bartles, C. K. (2011) 'Defense Reforms of Russian Defense Minister Anatolii Serdyukov', *The Journal of Slavic Military Studies*, 24:1, pp. 55-80

Bereiter, G. (2016) 'The US Navy in Operation Enduring Freedom, 2001-2002', N*aval History & Heritage Command*. Available at: https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/u/us-navy-operation-enduring-freedom-2001-2002.html (Accessed: 27 July 2020)

Berg, P. D. (2007) 'Airpower and Irregular Warfare', *Air and Space Power Journal*, 21(4), Winter 2007. p. 21

Boeing (1998) 'F-15I "THUNDERS" Arrive in Israel', *Boeing Press Release*, 19 January 1998. Available at: https://boeing.mediaroom.com/1998-01-19-F-15I-THUNDERS-Arrive-in-Israel (Accessed: 14 August 2020)

Boeke, S., & Schuurman, B. (2015) 'Operation 'Serval': A Strategic Analysis of the French Intervention in Mali, 2013–2014', *Journal of Strategic Studies,* 38. pp. 801-825

Boutherin, G. & Pajon, C. (2013) 'The Battlefield and Air Power 15 Years from Now' in Comité d'études de défense nationale (2013) *L'Armée de l'air, instrument de puissance pour la France* Paris: École Militaire. pp. 87-100

Boyne, W. J. (2003) ‘The Tactical School’, *Air Force Magazine*, September 1. Available at: https://www.airforcemag.com/article/0903school/ (Accessed: 10 December 2020)

Butler, A. & Sweetman, B. (2013) ‘Secret New UAS Shows Stealth, Efficiency Advances’, *Aviation Week*, December 6. Available at: https://aviationweek.com/defense-space/secret-new-uas-shows-stealth-efficiency-advances (Accessed: 15 December 2020)

Byford, A. (2013) ‘Operation SERVAL: The Air Power Lessons of France’s Intervention in Mali’, *Air Power Review*, 16(3), Autumn 2013. pp. 72-81

Byman, D. (2006) ‘Do Targeted Killings Work?’, *Foreign Affairs*, 85(2), March/April 2006. pp. 95-111

Cameron, S. (2009) ‘INTERFET – Intervention in Timor – 1999’ in Brent, K. (2009) *Air Expeditionary Operations from World War II until Today*. The Proceedings of the 2008 RAAF History Conference held in Canberra, 1 April 2008. Commonwealth of Australia. pp. 113-126

Catignani, S. (2004) ‘Israel Defence Forces Organizational Changes in an Era of Budgetary Cutbacks’, *The RUSI Journal*, 149(5). pp. 72-76

Catignani, S. (2009) ‘Variation on a Theme: Israel's Operation Cast Lead and the Gaza Strip Missile Conundrum’, *The RUSI Journal*, 154(4). pp. 66-73

Clodfelter, M. (2015) ‘The Limits of Airpower and the Limits of Strategy: The Air Wars in Vietnam and Their Legacy’, *Joint Force Quarterly*, 78(3), July 2015. pp. 111-124

Davenport, B. A. (1991) ‘The Ogarkov Ouster: The Development of Soviet Military Doctrine and Civil/Military Relations in the 1980s’, *The Journal of Strategic Studies*, 14(2). pp. 129-147

Davidson, J. W. (2013) ‘France, Britain and the Intervention in Libya: An Integrated Analysis’, *Cambridge Review of International Affairs*, 26(2). pp. 310-329

Downs, W. B. (2005) ‘Unconventional Airpower’, *Air and Space Power Journal*, 19(1), Winter 2005. pp. 20-25

D’Urso, S. (2021) ‘Let’s Talk About The Secretive RQ-170 Sentinel Photographed In Flight Over California Desert Recently’, *The Aviationist*, December 13. Available at: https://theaviationist.com/2021/12/13/lets-talk-about-the-secretive-rq-170-sentinel-photographed-in-flight-over-california-desert-recently/ (Accessed: 18 January 2022)

Farrell, T. (2010) ‘Improving in War: Military Adaptation and the British in Helmand Province, Afghanistan, 2006–2009’, *Journal of Strategic Studies*, 33(4). pp. 567-594

Farrell, T. (2022) ‘Military Adaptation and Organisational Convergence in War: Insurgents and International Forces in Afghanistan’, *Journal of Strategic Studies*, 45(5). pp. 718-742

Felgenhauer, P. (2000) ‘Russia’s Forces Unreconstructed’, *Perspective*, 10(4). Available at: http://www.bu.edu/iscip/vol10/Felgenhauer.html (Accessed: 25 May 2018)

Finn, C. (2009) ‘British Thinking on Air Power – The Evolution of AP3000’, *Air Power Review*, 12(1), Spring 2009. pp. 56-67

FitzGerald, M. C. (1991) ‘The Soviet Military and the New Air War in the Persian Gulf’, *Airpower Journal*, 5(4), Winter 1991. pp. 64-78

Freniere, R. W., Dickmann, J. Q. & Cares, J. R. (2003) ‘Complexity-Based Targeting – New Sciences Provide Effects’, *Air Power Journal*, 17(1), Spring 2003. pp. 95-100

Gabrielsen, I. (2013) ‘Military Strategy and the Conduct of the 2006 Israel–Hezbollah War’, *Comparative Strategy*, 32(5). pp. 435-442

Gasparre, R. B. (2008) ‘The Israeli ‘E-Tack’ on Syria – Part I & Part II’, *Air Force Technology*, 9 & 10 March. Available at: https://www.airforce-technology.com/features/feature1625/ and https://www.airforce-technology.com/features/feature1669/ (Accessed: 12 June 2020)

Glantz, M. E. (1994) The origins and development of Soviet and Russian military doctrine, *The Journal of Slavic Military Studies*, 7(3). pp. 443-480

Goebel, G. (2020) ‘Dassault Combat Jets’, *AirVectors*. Available at: http://www.airvectors.net/idx_cdso.html (Accessed: 10 June 2020)

Goldman, E. O. & Andres, R. B. (1999) ‘Systemic Effects of Military Innovation and Diffusion’, *Security Studies*, 8(4). pp. 79-125

Gordon, M. R. (2013) ‘Israel Airstrike Targeted Advanced Missiles That Russia Sold to Syria, U.S. Says’, *New York Times*, 13 July. Available at: https://www.nytimes.com/2013/07/14/world/middleeast/israel-airstrike-targeted-advanced-missiles-that-russia-sold-to-syria-us-says.html (Accessed: 19 August 2021)

Gordon, M. R. & Gettleman, J. (2009) ‘U.S. Officials Say Israel Struck in Sudan’, *New York Times*, 26 March. Available at: https://www.nytimes.com/2009/03/27/world/africa/27sudan.html (Accessed: 19 August 2021)

Gracier, O. (2017) ‘Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)’, *Journal of Military and Strategic Studies*, 17(4). pp. 21-37

Greenleaf, J. R. (2013) ‘The Air War in Libya’, *Air & Space Power Journal*, 27(2). pp. 28-54

Haulman, D. S. (2017) ‘The Resurrection of Tactical Air Command and Military Airlift Command’, *Air Power History*, 64(2), Summer 2017. pp. 29-32

Hooker Jr, R. D. (2016) ‘Airpower in American Wars’, *Survival*, 58(6). pp. 121-134

Howorth, J. (2014) ‘Opération Harmattan’ in Libya: a Paradigm Shift in French, European and Transatlantic Security Arrangements?’, *Journal of Transatlantic Studies*, 12(4). pp. 405-417

Inbar, E. & Sandler, S. (1993) ‘Israel's Deterrence Strategy Revisited’, *Security Studies*, 3(2). pp. 330-358

Inbar, E. & Shamir, E. (2014) ‘‘Mowing the Grass’: Israel’s Strategy for Protracted Intractable Conflict’, *Journal of Strategic Studies*, 37(1). pp. 65-90

Israel, I. B. & Paikowsky, D. (2017) ‘The Iron Wall Logic of Israel’s Space Programme’, *Survival*, 59(4). pp. 151-166

James, W. A. W. (2002) ‘Between Operations ‘Desert Storm’ and ‘Allied Force’ Repeat ‘Lessons’ were Learned by British Air Power. What Caused this Repetition and what Lessons can be Drawn for Future Air Power Employment?’, *Defence Studies*, 2(1). pp. 83-108

Johnston, P. B. (2012) ‘Does Decapitation Work? Assessing the Effectiveness of Leadership Targeting in Counterinsurgency Campaigns’*, International Security*, 36(4), Spring 2012. pp. 47-79

Jordan, J. (2014) ‘Attacking the Leader, Missing the Mark’, *International Security,* 38(4), Spring 2014. pp. 7-38

Jordán, J. (2014) ‘The Effectiveness of the Drone Campaign against Al Qaeda Central: A Case Study’, *Journal of Strategic Studies*, 37(1). pp. 4-29

Kaiser, R. G. (1984) ‘Moscow Mystery Theories Abound on Causes of Marshal Ogarkov's Ouster’, *The Washington Post*, 8 September. Available from: https://www.washingtonpost.com/archive/politics/1984/09/08/moscow-mystery-theories-abound-on-causes-of-marshal-ogarkovs-ouster/6b910200-7635-453b-b8c1-31b60d8ac677/ (Accessed: 3 August 2020)

Karber, P. & Thibeault, J. (2016) ‘Russia’s New-Generation Warfare’, *Association of the United States Army*. Available at: https://www.ausa.org/articles/russia%E2%80%99s-new-generation-warfare (Accessed: 3 August 2020)

Kaufman, S. (1993) ‘Lessons from the 1991 Gulf War and Russian Military Doctrine’, *The Journal of Slavic Military Studies*, 6(3). pp. 375-396

Kershner, I. (2012) ‘Official Silence in Israel Over Sudan’s Accusations of Air Attack’, *New York Times*, 25 October. Available at: https://www.nytimes.com/2012/10/26/world/africa/official-silence-in-israel-over-sudans-accusations-of-air-attack.html (Accessed: 19 August 2021)

Kershner, I. & Gordon, M. R. (2013) ‘Israeli Airstrike in Syria Targets Arms Convoy, U.S. Says’, *New York Times*, 30 January. Available at: https://www.nytimes.com/2013/01/31/world/middleeast/syria-says-it-was-hit-by-strikes-from-israeli-planes.html (Accessed: 19 August 2021)

Kober, A. (1994) ‘Deterrence, Early Warning and Strategic Decision: The Israeli Security Conception in the Wake of the Gulf War’, *Contemporary Security Policy*, 15(3). pp. 228-250

Kober, A. (2006) ‘Israel's Wars of Attrition: Operational and Moral Dilemmas’, *Israel Affairs*, 12(4). pp. 801-822

Kober, A. (2008) ‘The Israel Defense Forces in the Second Lebanon War: Why the Poor Performance?’, *Journal of Strategic Studies*, 31(1). pp. 3-40

Kofman, M. (2020) ‘Russia’s Armed Forces Under Gerasimov, the Man Without a Doctrine’, *Riddle*. Available at: https://www.ridl.io/en/russia-s-armed-forces-under-gerasimov-the-man-without-a-doctrine/ (Accessed: 3 August 2020)

Kojori, S. (2008) ‘Air Power in Russia’s Georgian Campaign August 2008’, *Pathfinder,* Air Power Development Centre Bulletin, Issue 99

Kopp, C. & Cooper, B. H. (2005) ‘KC-33A: Closing the Aerial Refuelling and Strategic Air Mobility Gaps’, *Air Power Australia Analysis*, APA-2005-02. Available at: https://www.ausairpower.net/APAA/APA-2005-02.pdf (Accessed: 31 March 2020)

Kramer, M. (2005) ‘The Perils of Counterinsurgency: Russia’s War in Chechnya’, *International Security*, 29(3), Winter 2004/05. pp. 5–63

Lambeth, B. S. (1996) ‘Russia's Air War in Chechnya’, *Studies in Conflict and Terrorism*, 19. pp. 365-388

Lannon, G. P. (2011) ‘Russia's New Look Army Reforms and Russian Foreign Policy’, *The Journal of Slavic Military Studies*, 24(1). pp. 26-54

Lockheed Martin (2010) ‘Israeli Ministry of Defense Selects Lockheed Martin F-35 for its Next-Generation Fighter’, *Lockheed Martin*, 7 October. Available at: https://news.lockheedmartin.com/2010-10-07-Israeli-Ministry-of-Defense-Selects-Lockheed-Martin-F-35-for-Its-Next-Generation-Fighter (Accessed: 15 June 2020)

The Long War Journal (2021) ‘US Airstrikes in the Long War’, *The Long War Journal*. Available at: https://www.longwarjournal.org/us-airstrikes-in-the-long-war (Accessed: 19 July 2021)

Lushenko, P. (2015) ‘Reconsidering the Theory and Practice of High Value Targeting’, *Counter Terrorist Trends and Analyses*, 7(7), August 2015. pp. 23-30

Luttwak, E. N. (1995) ‘Toward Post-Heroic Warfare’, *Foreign Affairs*, 74(3), May-June 1995. pp. 109-122

Marcus, R. D. (2015) ‘Military Innovation and Tactical Adaptation in the Israel–Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF’, *Journal of Strategic Studies*, 38(4). pp. 500-552

Marcus, R. D. (2019) ‘Learning ‘Under Fire’: Israel’s improvised Military Adaptation to Hamas Tunnel Warfare’, *Journal of Strategic Studies*, 42(3-4). pp. 344-370

Mason, R. A. (1991) ‘The Air War in the Gulf’, *Survival*, 33(3). pp. 211-229

McDermott, R. (2014) ‘Russia Activates New Defense Management Center’, *Eurasia Daily Monitor*, The Jamestown Foundation, 11(196). Available at: https://jamestown.org/program/russia-activates-new-defense-management-center/ (Accessed on: 15 September 2020)

Mizokami, K. (2019) ‘Israel has its very own version of the F-15 Strike Eagle’, *National Interest*, 6 October. Available at: https://nationalinterest.org/blog/buzz/israel-has-its-very-own-version-f-15-strike-eagle-86011 (Accessed: 3 June 2020)

Mowbray, J. A. (1995) ‘Air Force Doctrine Problems: 1926-Present’, *Airpower Journal*, 9(4), Winter 1995. pp. 21-45

Osinga, F. (2013) ‘‘Getting’ A Discourse on Winning and Losing: A Primer on Boyd's ‘Theory of Intellectual Evolution’’, *Contemporary Security Policy*, 34(3). pp. 603-624

Pashakhanlou, A. H. (2017) ‘Decapitation in Libya: Winning the Conflict and Losing the Peace’, *The Washington Quarterly*, 40(4). pp. 135-149

Pendall, D. W. (2004) ‘Effects-Based Operations and the Exercise of National Power’, *Military Review*, January-February 2004. pp. 20-31

Pocock, C. (2014) ‘RAF Retires TriStar Tankers As Voyager Fleet Grows’, *AIN Online*, March 26. Available at: https://www.ainonline.com/aviation-news/defense/2014-03-26/raf-retires-tristar-tankers-voyager-fleet-grows (Accessed: 5 November 2020)

Press, D. G. (2001) ‘The Myth of Air Power in the Persian Gulf War and the Future of Warfare’, *International Security*, 26(2), Fall 2001. pp. 5-44

Price, B. C. (2012) ‘Targeting Top Terrorists: How Leadership Decapitation Contributes to Counterterrorism’, *International Security*, 36(4), Spring 2012. pp. 9-46

Pukhov, R. (2017) ‘Moscow-based think tank director: Russia’s unexpected military victory in Syria’. *Centre for Analysis of Strategies and Technologies* (CAST). Available at:

http://cast.ru/eng/news/moscow-based-think-tank-director-russia-s-unexpected-military-victory-in-syria.html (Accessed: 15 September 2020)

Renner, R. A. (2004) 'America's Asymmetric Advantage: The Utility of Airpower in the New Strategic Environment', *Defence Studies*, 4(1). pp. 87-113

Rid, T. (2012) 'Deterrence beyond the State: The Israeli Experience', *Contemporary Security Policy*, 33(1). pp. 124-147

Risen, J. & Miller, J. (2002) 'Threats and Responses: Hunt for Suspects; C.I.A. is Reported to Kill a Leader of Qaeda in Yemen', *New York Times*, 5 November. Available at: https://www.nytimes.com/2002/11/05/world/threats-responses-hunt-for-suspects-cia-reported-kill-leader-qaeda-yemen.html (Accessed: 7 July 2021)

Ritchie, S. (2014) 'The Royal Air Force and the First Gulf War, 1990-91: A Case Study in the Identification and Implementation of Air Power Lessons', *Air Power Review*, 17(1), Spring 2014. pp. 36-53

Ritchie, S. (2018) 'UK Air Power in Operation Unified Protector, Libya 2011', *Air Power Review*, 21(3), Autumn 2018. pp. 82-105

Rodman, D. (2001) 'Israel's National Security Doctrine: An Introductory Overview', *Meria Journal*, 5(3)

Sanger, D. (2011) 'America's Deadly Dynamics with Iran', *New York Times*, 5 November. Available at: https://www.nytimes.com/2011/11/06/sunday-review/the-secret-war-with-iran.html (Accessed: 22 August 2021)

Sanger, D. E., Schmitt, E. & Rudoren, J. (2013) 'Israeli Strike Into Syria Said to Damage Research Site', *New York Times*, 3 February. Available at: https://www.nytimes.com/2013/02/04/world/middleeast/syrian-weapons-center-said-to-be-damaged.html (Accessed: 19 August 2021)

Schmitt, O. (2017) 'French Military Adaptation in the Afghan War: Looking Inward or Outward?', *Journal of Strategic Studies*, 40(4). pp. 577-599

Schwartz, N. A. (2011) 'Airpower in Counterinsurgency and Stability Operations', *PRISM*, 2(2). pp. 127-134

Shamir, E. (2018) 'Israel's Post-Heroic Wars: Exploring the Influence of American Military Concepts on Israel's Adaptation of Post-Heroic Warfare', *Israel Affairs*, 24(4). pp. 686-706

Shield, R. (2018) 'Russian Airpower's Success in Syria: Assessing Evolution in Kinetic Counterinsurgency', *The Journal of Slavic Military Studies*, 31(2). pp. 214-239

Siman-Tov, D. & Schweitzer, Y. (2015) ‘Israel against Hizbollah: Between Overt and Covert Warfare, *Institute for National Security Studies*, INSS Insight No. 668

TASS (2015) ‘Russian Su-34 planes in Syria for the first time make sorties with air-to-air missiles’, *TASS*. Available at: https://tass.com/defense/840427 (Accessed: 12 September 2020)

Thomas, C. J. D. (1991) ‘How Israel saw Iraq During the Gulf War’, *The RUSI Journal*, 136(4). pp. 38-44

Thomas, T. L. (1997) ‘Air Operations in Low Intensity Conflict: The Case of Chechnya’, *Air Power Journal*, 11(4), Winter 1997. pp. 51-59

Tira, R. (2014) ‘Operation Protective Edge: Ends, Ways and Means and the Distinct Context’, *Infinity Journal*, IJ Exclusive, 10 September. Available at: https://www.infinityjournal.com/article/137/Operation_Protective_Edge_Ends_Ways_and_Means_and_the_Distinct_Context/ (Accessed: 10 June 2019)

Tirpak, J. A. (1997) ‘Deliberate Force’, *Air Force Magazine*, 1 October. Available at: https://www.airforcemag.com/article/1097deliberate/ (Accessed: 4 March 2021)

Tirpak, J. A. (2011) ‘The Tanker Answer’, *Air Force Magazine*, 11 June. Available at: https://www.airforcemag.com/PDF/MagazineArchive/Documents/2011/June%202011/0611tanker.pdf (Accessed: 10 June 2021)

Trevithick, J. (2021) ‘Declassified Docs Offer New Details About a Growing RQ-170 “Wraith” Force’, *The Drive*, 3 May. Available at: https://www.thedrive.com/the-war-zone/40427/declassified-docs-offer-new-details-about-a-growing-rq-170-wraith-force (Accessed: 18 January 2022)

Tzabag, S. (2013) ‘Operation Pillar of Defense: Lessons for Modern Warfare’, *Israel Journal of Foreign Affairs*, 7(3). pp. 79-93

UPI Archives (1994) ‘U.S. to Sell F-15s to Israel’, *UPI*, 11 April. Available at: https://www.upi.com/Archives/1994/04/11/US-to-sell-F-15s-to-Israel/8425766036800/ (Accessed: 3 June 2020)

Vallis, D. (2014) ‘Analysis of 2 Group RAF Part 1: Air Transport/Air to Air Refuelling’, *UK Defence Journal*, 17 April. Available at: https://ukdefencejournal.org.uk/air-transportair-air-refuelling-21st-century/ (Accessed: 2 November 2020)

Van Creveld, M. (2011) ‘The Rise and Fall Of Air Power’, *The RUSI Journal*, 156(3). pp. 48-54

Vego, M. N. (2009) ‘The Case Against Systemic Operational Design’, *Joint Forces Quarterly*, 53(2). pp. 69-75

Westermann, E. B. (1999) ‘The Limits of Soviet Airpower: The Failure of Military Coercion in Afghanistan, 1979-89’, *Journal of Conflict Studies*. 19(2), Fall 1999. Available at: https://journals.lib.unb.ca/index.php/jcs/article/view/4356/5011 (Accessed: 12 August 2020)

Williams, B. G. (2010) ‘The CIA's Covert Predator Drone War in Pakistan, 2004–2010: The History of an Assassination Campaign’, *Studies in Conflict & Terrorism*, 33(10). pp. 871-892

Williams, D. (2011) ‘Israel: No Iran Bomb Before 2015’, *Reuters*, 7 January. Available at: https://www.reuters.com/article/us-iran-nuclear-israel-idUSTRE70612X20110107 (Accessed: 22 August 2021)

Wilson, J. R. (2009) ‘Global Strike Command’, *Defense Media Network*. Available at: https://www.defensemedianetwork.com/stories/global-strike-command/ (Accessed: 10 November 2020)

Wing, S. D. (2016) ‘French Intervention in Mali: Strategic Alliances, Long-Term Regional Presence?’, *Small Wars & Insurgencies*, 27(1). pp. 59-80

Yaoren, K. Y. (2019) ‘Leadership Decapitation and the Impact on Terrorist Groups’, *Counter Terrorist Trends and Analyses*, 11(3), March 2019. pp. 7-12

Young, R. J. (1974) ‘The Strategic Dream: French Air Doctrine in the Inter-War Period, 1919-39’, *Journal of Contemporary History*, 9(4). pp. 57-76

Research Methods

Berenskoetter, F. (2016) *Concepts in World Politics*. London: SAGE Publications Ltd.

Bryman, A. (2016) *Social Research Methods*. Oxford: Oxford University Press

Eisenhardt, K. M. (1989) Building Theories from Case Study Research, *The Academy of Management Review*, 14(4). pp. 532-550

Hancké, B. (2013) *Intelligent Research Design: A Guide for Beginning Researchers in the Social Sciences*. Oxford, Oxford University Press

Lamont, C. K. (2015) *Research Methods in International Relations*. London, Sage

Lowndes, V., Marsh, D. & Stoker, G. (2018) *Theory and Methods in Political Science*. London: Palgrave