

BRITISH AIR AND SPACE POWER DOCTRINE

AP 3000 FOURTH EDITION



AP 3000

BRITISH AIR AND SPACE POWER DOCTRINE

FOURTH EDITION

AIR STAFF

MINISTRY OF DEFENCE

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FOREWORD

CHIEF OF THE AIR STAFF
AIR CHIEF MARSHAL SIR STEPHEN DALTON
KCB ADC BSc FRAeS FCGI RAF

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

The Royal Air Force Vision



The dynamic, complex and often uncertain nature of the contemporary operating environment means that establishing a sound conceptual basis for air and space operations is arguably more important than it ever has been before. Our continuing success in combat will increasingly depend both on the depth of our understanding of air and space power itself, and on our ability to recognise - and advocate to others - how its potential can best be unlocked so that it can make a decisive contribution to the Joint Campaign.

Consequently, this new, fourth, edition of AP3000 provides the authoritative direction necessary to underpin the conceptual component of the Royal Air Force's fighting power in the twenty-first century by setting out the broad principles and philosophy for the application of air and space power in a clear and digestible format. It aims to demystify air and space power by distilling its essence into just four, fundamental roles, and then explains how these capabilities may be used to influence behaviours and change the course events within a Comprehensive, inter-agency Approach to operations. While the RAF is the prime custodian of the United Kingdom's air and space power capability and takes the conceptual lead in its delivery, AP3000's title - British Air and Space Doctrine - reflects the inherently joint nature of air and space operations and the contribution of the other components.

Since its inception ninety-one years ago, the RAF has provided a decisive air power capability to the Joint Force, while retaining a unique and independent ability to project national influence whenever and wherever it is required. The principles that underpin today's RAF were equally evident in 1918, when Lord Trenchard's vision of an independent air force was rooted in the experience of expeditionary warfare and a tradition of joint operations, a willingness to embrace emerging technologies and, in particular, a deep-



Our Core Values: Respect, Integrity, Service and Excellence

seated belief that the Service's success depended on the training, education and development of its people. In this respect, little has changed: well-motivated and highly quality personnel with the agility to adapt to a constantly changing operational environment remain at the core of the RAF's effectiveness; the core values of respect, integrity, service and excellence provide the cornerstones of our capability.

In this context, AP3000 has a vital role to play in providing the intellectual basis for our activities and helping to foster that peculiarly innovative and adaptable mindset that marks us all out as airmen and airwomen. I commend it to you.

Stephen Dalton

PREFACE

Purpose

The purpose of *AP3000* is defined in *British Defence Doctrine*, which refers to the discrete doctrine publications of the maritime, land and air environments ‘that guide the single Services and provide the necessary familiarity and broad basis of understanding for joint and component commanders, formations and units to operate effectively across environmental boundaries’.¹

The fourth edition of *AP3000* therefore has two aims: to provide authoritative direction on the employment of air and space power to airmen; and to explain as clearly as possible its utility to sailors, soldiers and all of the other actors who, as part of the Comprehensive Approach to ordering crises, influence, or are influenced by, the use of air and space power. Just as *British Defence Doctrine* ‘provides the broad philosophy and principles underpinning the employment of the British armed forces’,² so *AP3000* serves the same purpose for the Air Component by describing *what* air and space power does; the detail of how it is delivered is provided elsewhere, notably in *AP3001: Air Power Essentials* and *AP3002: Air Operations*.

Air and space power is:

‘The ability to project power from the air and space to influence the behaviour of people or the course of events’.

Understanding air and space power is critical for three reasons:

- Because air and space power has shaped the contemporary operating environment, providing the basis for Western conventional warfighting dominance and forcing our adversaries to fight asymmetrically, as irregulars.
- Because the air environment pervades both the land and maritime environments, air power is absolutely essential in enabling genuinely joint, rather than separate land, air or sea campaigns to be conducted, particularly by guaranteeing freedom of manoeuvre through control of the air.
- Because British air and space power underpins the United Kingdom’s capability to conduct deep operations, influencing events and behaviours anywhere, and at any time.

¹ JDP 0-01: British Defence Doctrine Edition 3, p. 4-4.

² *Ibid.*, p. v.

Context

AP3000 Edition 3 was published in 1999. It articulated the utility of air power in the light of the Strategic Defence Review (SDR) of 1998, which emphasised flexible, mobile, expeditionary operations and anticipated the development of joint doctrine and structures. While the philosophy and principles guiding the employment of air and space power are enduring, in the decade since *AP3000 Edition 3* was published the military and strategic context has changed significantly enough to warrant a reappraisal in this revised, fourth edition.

For the United Kingdom, the contemporary operating environment is dominated by the commitment of forces to enduring operations, rather than the shorter duration interventions envisaged by the SDR. It should be noted, however, that in the last decade British air and space power has been employed in conflicts as disparate as Kosovo in 1999, Sierra Leone in 2000, the air policing and containment of Iraq from 1991-2003, and the conventional warfighting phase of the Iraq War in 2003, spanning the entire spectrum of conflict.

Doctrinally, a new edition of *AP3000* is required to set air and space power in the context of the Comprehensive Approach, which aims to achieve militarily and politically favourable outcomes in complex crises by using all available levers of power in a cross-governmental and inter-agency approach. The military contribution is expressed through the campaigning process, where the achievement of desired outcomes results from synchronised activities delivering required effects.

Other developments meriting consideration since the publication of *AP3000 Edition 3* include the renewed emphasis on air-land integration, the consequences of the fruition of joint theory and practice anticipated by the SDR, and the impact of Networked Enabled Capability (NEC) on air command and control processes.

AP3000 Edition 4 therefore explains how British air and space power can be applied in an uncertain world, where expeditionary warfare is as likely to be enduring as interventionist, but where success in contemporary counter-insurgency operations, conducted within a framework of joint action, must be balanced against the retention of a contingent, full spectrum capability, able to deliver national security objectives whatever the nature of the crisis. This may involve protecting the security of the United Kingdom and its dependent territories, meeting treaty obligations to the North Atlantic Treaty Organisation (NATO) and European Union (EU) under the modified Brussels Treaty, and the promotion and defence of British interests worldwide.

Structure

The previous edition of *AP3000* pre-dated the contemporary hierarchy of joint doctrine and, consequently, included material that was generic to defence rather than being specific to the air and space domains. Concepts such as the components of fighting power are now detailed in *British Defence Doctrine*, so *AP3000 Edition 4* has been précised to distil the essence of air and space power into a concise and digestible format, with the aim of complementing joint doctrine rather than replicating it. *AP3000* is designed to be read in a logical progression from chapter to chapter, but individual chapters are also intended to stand by themselves.

Chapter One, *The Nature of Air and Space Power*, defines air and space power and relates them to each other, describes the environments and their unique characteristics, analyses the complementary strengths and weaknesses of air and space power, and details the key enabling functions required to deliver it. Chapters Two and Three, *Air Power in the Contemporary Operating Environment* and *The Four Fundamental Air and Space Roles* represent the doctrinal heart of *AP3000*; they detail how air and space power provides the basis of conventional warfighting dominance, its key role in irregular warfare, and the way it can be applied in the modern environment to create joint action in a Comprehensive Approach, using a language and lexicon that aims to be intelligible to both airmen as practitioners, and the other users of air power in the joint campaign. Finally, Chapter Four, *Air and Space Command and Control*, considers the particular facets of command and leadership that are required to deliver air and space power most effectively.

Linkages

AP3000 is complementary to the extant hierarchy of joint doctrine publications. In particular, it should be read in conjunction with *British Defence Doctrine Edition 3*, which sets out the generic concepts of warfighting valid across all environments. *Joint Doctrine Publication 01: Campaigning and Joint Doctrine Note 1/07: Joint Action* amplify the campaign design process and detail the joint action framework, while the core doctrinal tenets of *AP3000* inform *Joint Doctrine Note 2/08: Air/Land Integration*. Additionally, *Allied Joint Publication-3.3: Air and Space* provides the context for NATO air operations.

AP3000 is the capstone document that guides and informs lower level, single Service doctrine. It may be regarded as strategic doctrine, explaining the *what* and *why* of air and space power, while tactical doctrine is provided in the form of *AP3002: Air Operations*, which explains the how of air power application. In addition, *AP3001: Air Power Essentials*, is designed as a summary of Air Power themes, targeted at a wider and less specialised audience. A historical context to the evolution of British air and space power is provided by *AP3003: A Brief History of the Royal Air Force*.

Feedback from readers and users is welcome and should be addressed to:

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CHAPTER 1

THE NATURE OF AIR AND SPACE POWER

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

Sir Winston Churchill

Introduction

The aim of this chapter is to explain the key characteristics of air and space power. The chapter presents a definition of air and space power, discusses the particular factors – and strengths and weaknesses – that affect it, examines its dependence on two key enabling functions, force protection and air logistics, and reinforces the requirement for air and space power to be delivered by air-minded practitioners employing an airman's perspective. As a concluding summary, an analysis of the principles of war as applied to air and space power is included.

AIR AND SPACE POWER

Air power's fundamental attributes make precise definitions problematic. It can be difficult to specify exactly what a unit of air power is, or even what it can do, and this has sometimes led to misconceptions about its utility. In the future, advances in technology and the restructuring of organisations and processes are likely to blur the boundaries between the air and space environments, so that the concept of *aerospace power* will better express a pervasive and seamless military use of the third dimension. Until that point is reached, space power is best regarded as being separate, but complementary to air power, sharing many of its attributes, but in a distinct way, and at a very different scale.



A Typhoon F3 is prepared for flight at RAF Coningsby

The key to understanding air and space power is recognising its ability to create influence, through direct kinetic action to indirect cognitive consequences. It is the ways in which the unique characteristics of air power can be applied to create influence that differentiate it from other forms of power. Accordingly, influence lies at the heart of the United Kingdom's definition of air and space power as:

The ability to project power from the air and space to influence the behaviour of people or the course of events.

British air power is rooted in the ability of the RAF, the world's longest-established independent air force, to deliver a capability that is, size for size, second to none. The RAF exists to organise, train and equip airmen to provide:

- Permanently committed forces dedicated to the protection and security of the United Kingdom and her dependent territories.
- National contingency forces providing the core capability to meet a challenge to national interests – including, if required, military aid to the civil authorities – and operations in support of international peace and stability.

PERMANENT COMMITMENTS

The RAF is structured and configured to carry out a broad range of activities across the full spectrum of operations; this means that many force elements are permanently tasked, notwithstanding expeditionary commitments. For example, in 2007, ninety-eight alerts were called and home-based RAF fighters scrambled forty-three times to intercept unidentified or unresponsive aircraft, or to escort aircraft out of the United Kingdom's airspace. Additionally, 1,220 people (and another forty-one in the Falkland Islands) were assisted by RAF Search and Rescue Helicopters.

British air and space power is not, however, delivered by the RAF alone. It is a product of many factors including: the organic aviation assets of the other Services; the resources drawn from a history of alliances and partnerships formed over nearly a century of air operations; the legacy of air-mindedness bequeathed by Britain's role as an aviation pioneer; the innovative technologies provided by a strong aerospace industry; and the critical mass created by world-leading airlines.

British air and space power is, therefore:



Global reach: A C-17A Globemaster III dispenses flares

- Inherently joint, combined and multinational.
- Drawn from all three Services.
- Concerned with the effective exploitation of all air and space power assets.
- Supported by national civilian and commercial resources.
- Influenced by, and influences, the land and maritime environments.

The Air and Space Environment

Operating in the air and space environment requires a whole range of disciplines to be mastered simply in order to survive. The unique characteristics of their environments provide air and space power with very different strengths and weaknesses from land and sea power. Many of the characteristics of the different domains are complementary, which is why joint operations, properly executed, can be so effective. However, before a joint approach can be implemented, the fundamentals of what makes the air and space environments different must be understood – and this begins with a definition of their characteristics.

THE CHARACTERISTICS OF AIR AND SPACE POWER

The air environment is contiguous around the globe; air overlays both the land and maritime environments, and air, land and sea all are surmounted by space. Air and space power is therefore uniquely pervasive, potentially unconstrained by national boundaries and terrain, and offers the prospect of free access to any point on or above the Earth, with the opportunity to observe and decisively influence operations in the other environments.

Military use of the air and space provides a perspective over the whole battlespace and the opportunity to apply power directly against all elements of an adversary's resources, regardless of their location.

Air Power Strengths and Weaknesses

Air power exploits the third dimension. Because air has little resistance and aircraft can route directly, air vehicles are invariably faster and generally have greater reach than naval vessels or land vehicles, while elevation is inherent to air operations. The core characteristics of air power are therefore speed, reach and height. These attributes are shared with the space environment, but in different ways, and at an entirely different scale; consequently, the unique features of space power are considered separately.

- **Speed**
Speed allows the rapid projection of military power and permits missions to be completed quickly, generating tempo and offering the potential to exploit time, the fourth dimension. At the tactical level, high speed reduces exposure to hostile fire and increases survivability.
- **Reach**
Seventy percent of the world's surface is covered by water, but all of it is covered by air, providing air power with unrivalled reach, usually unimpeded by terrain. This enables distant or isolated targets to be attacked and potential restrictions to be circumvented.
- **Height**
The advantage of height allows airmen to observe and dominate activities on the surface of the globe and below the sea, enabling direct fire to be used against an adversary's forces across the battlespace and permitting three-dimensional manoeuvre, an important survivability factor.

While speed, reach and height represent core air power characteristics in their own right, they act together synergistically to produce additional strengths:

- **Ubiquity**
Ubiquity is a combination of reach and persistence. Air to Air Refuelling and technological

developments, such as the advent of Unmanned Aerial Vehicles (UAVs), have hugely increased the ubiquity of air power, allowing aircraft to counter or pose simultaneous threats across a far wider geographical area than is possible with surface systems.

- **Agility**
Agility is a blend of responsiveness, adaptability, flexibility, resilience and acuity. Air power is inherently agile, a characteristic amplified by the multi-role capability of many platforms: this permits air assets to move quickly and decisively between the strategic, operational and tactical levels of warfare, and to move across and between operational theatres – sometimes during the same mission.
- **Concentration**
Speed, reach and flexibility allow air power to concentrate military force in time and space, when and where it is required. Precision weaponry now means that effect can often be concentrated without the requirement for numbers. The psychological and physical shock imposed by the concentration of effect is often crucial in achieving successful operational outcomes.

In combination, air power's characteristics provide significant combat power. Speed, reach and height, coupled with modern sensor technology, precision weaponry and the ability to remain aloft for extended periods, enable responsive over-watch and provide the capability to shape and influence the operational environment. Moreover, the ubiquity and agility of air power mean that it can be used to revisit points of interest within short response times, delivering an additional degree of persistence. Equally, air power can be used fleetingly and with a very small footprint to offer discretion and deniability, should these be required. Finally, survivability may be enhanced by both technical and nontechnical measures.³

These attributes mean that air power is uniquely suited to contribute across the entire spectrum of operations: providing a wealth of information to help build situational awareness; spearheading a humanitarian response; delivering deliberate interventions through deep attack operations; putting entry forces in place; and establishing the early elements of a coercive or deterrent posture, or indeed providing the totality of that response.

Air power has its limitations too. But like its strengths, these are relative rather than absolute and need to be understood in that context:

- **Impermanence**
Aircraft cannot stay airborne indefinitely – yet. Although the use of UAVs and Air to Air Refuelling can extend the range and endurance of aircraft, no means have yet been found to re-arm or service an aircraft in flight. To that extent, air power is an impermanent form of military force; the influence it creates may be transient and to sustain the desired degree of influence operations may have to be repeated. However, in certain circumstances impermanence can be an advantage - for example, it may avert the potential military and political liabilities that result from an extended presence in a foreign country - while the successful policing of the no-fly zones over Iraq on a twenty-four hours-

³ Survivability is enabled by defensive aids and weapons, stealth technologies for signature management, and passive measures such as routing, flight profiles and speed.

a-day, seven-days-a-week basis for an eleven-year period from 1992 to 2003 demonstrates that the impermanence of air power is relative.

- **Limited Payload**

The payloads that can be carried by aircraft are limited in comparison with ships or land vehicles. However, air power trades off load-carrying capability against speed, reach and security, where surface transport is difficult or unsafe. A small payload delivered quickly may be of far more value in stabilizing a critical situation than a larger one deployed much later, and air power often provides the only means of delivering personnel or equipment to a point of crisis rapidly enough to meet policy objectives.

RAPID RESPONSE AND GLOBAL INFLUENCE

After the Pakistani earthquake in 2005, RAF Hercules transport aircraft were used to deliver immediate aid and assistance. Within ten days, Chinook helicopters had been flown into the region by C-17 heavy lift aircraft and were operating where roads had been destroyed or were otherwise impassable. As well as satisfying the humanitarian impulse to help, air power helped to spread goodwill and influence in an area of real security interest for the United Kingdom.

- **Fragility**

Structurally, aircraft are highly stressed and built to be as light as practicable, carrying little or no armour protection. Consequently, relatively low levels of battle damage may have catastrophic effects and this limits the extent to which it is sensible to risk exposure to enemy fire. However, fragility must not be confused with vulnerability. Although aircraft are less robust than land vehicles or ships, this is offset by the survivability that is achieved by the exploitation of speed, height and manoeuvrability.

- **Cost**

Military aircraft use cutting-edge technology. Inevitably, this comes at a cost, but this must be balanced against the multiple and adaptive capabilities delivered, while history demonstrates that even slight technical shortfalls in the air environment are punished very heavily and usually with devastating consequences. Moreover, air power offers alternative policy options to the large-scale commitment of land forces, with the heavy financial and human consequences that this always entails.

- **Basing**

All forms of military power depend on basing and support, and aircraft are no exception. Air power's requirements for access, basing and over-flight rights are often cited as a weakness, but in reality, the employment of British air power in the post-Cold War era has invariably been consistent with legal and moral justifications understood by the states neighbouring the zone of crisis, and gaining host nation support has rarely proved to be a significant problem.

- **Weather**

In the past, air power was constrained by night and poor weather. Bad weather may still create difficulties with take-offs and landings, navigation and target acquisition, but this is increasingly less the case as rapid advances in technology mean that many aircraft can now operate in all light conditions, day and night, regardless of weather conditions. Indeed, advanced navigation, targeting equipment and weaponry mean that night and poor weather may give British air power distinct advantages when facing an enemy lacking these capabilities, while providing the assurance of support, whatever the conditions, demanded in the joint campaign.

THE UNIQUE ASPECTS OF SPACE POWER

The potential of aircraft was not recognised immediately. Their initial use was confined to observation...until one day, the full advantage of applying force from the air was realised, and the rest was history. So too with the business of space.

*General Estes, former Commander-in-Chief,
USAF Space Command, 1996 - 1998*

The Increasing Importance of Space

Following the spectacular success of the American-led coalition in the 1991 Gulf War, China identified the West's space capability as both its battle-winning advantage and potential point of failure, and began to invest strategically in space as a result. Today, the situation is even clearer. Over ninety percent of current United Kingdom military procurement projects rely to a greater or lesser extent on space; the Position, Navigation and Timing (PNT) function provided by the Global Positioning System (GPS), for example, supports key elements of all military operations and an increasing number of commercial activities.

It would now be unimaginable for military operations to be attempted without space support. The provision of accurate location and time data, for example, enables all-weather precision attack and the synchronisation of frequency-agile secure communications; everything from weather forecasting to satellite communications and from logistics tracking to surveillance depends on space. This support must be assured in the future.

Attack Into and From Space

There is no sovereign territory in space, but each launching state is responsible for damage caused on earth, or to other space objects, by the operation of space vehicles. The United Kingdom abides by the provisions of the 1967 *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies*, better known as the Outer Space Treaty (OST). This prohibits 'objects carrying nuclear weapons or any other kinds of weapons of mass destruction' and 'the establishment of military bases, installations, or military fortifications' in space, or on the moon or other celestial bodies'.⁴

⁴ Article IV, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 1967.

Most nations interpret non-kinetic military functions, such as communications transmission, surveillance and reconnaissance, and PNT as complying with the OST. While there is widespread international acceptance that intra-space conflict is undesirable, this does not rule out the use of earth or air-based weapons against space capabilities, and China and the United States have both demonstrated the capability to intercept satellites.

Additionally, there is no proscription of kinetic and non-kinetic attacks on terrestrial space support infrastructure, including launching and storage facilities and control and communications sites, where these would otherwise constitute legitimate military objectives under international humanitarian law.

Space Power Strengths and Weaknesses

- **Global Access**

There are no geographical boundaries or terrestrial obstructions in space; it represents the ultimate high ground and a single satellite in a low-earth polar orbit will over-fly any location on the earth's surface within a given time period. Basic orbital mechanics limit the time satellites can remain over a particular geographical area, so with the exception of geosynchronous orbits, the amount of time that a terrestrial object will remain within a satellite's direct field of view varies from minutes to hours, depending on the satellite's orbit-type and the field of view of its sensors and antennas. However, a continuous line of sight can be maintained to any point on the earth's surface with a sufficient number of satellites in a properly configured constellation, and most platforms can serve multiple users simultaneously, as is the case with certain missile warning satellites.

- **Persistence**

The movement of space assets in orbit is neither tied to the earth's surface, nor significantly impeded by the low-level atmosphere. This permits assets to remain on orbit for extended periods – generally years. However, because orbits are relatively easily identified, an adversary may be able to determine dwell times and establish windows of opportunity for unobserved activity outside satellite coverage. Other sensors must therefore be used to supplement satellites if assured and continuous surveillance of a specific area is desired.

- **Cost**

The single greatest constraint on the exploitation of space has been cost. The introduction of small satellites employing nanotechnologies, able to operate in or just above near space, has driven down costs significantly, offering a potential route for the development of indigenous space capabilities as an alternative to cost-sharing, or negotiating access to the space assets of allies and partners.

- **Unique Physical Characteristics**

The space environment affects both terrestrial and space-based systems. Solar flares and other natural phenomena create space storms and atmospheric changes that can interrupt communications, cause electronic failures and reduce sensor performance.

- **Design-Life**
Maintenance cannot be performed on most satellites and repairs are usually limited to the activation of back-up systems. Additionally, the amount of fuel carried for changing or maintaining orbit and attitude – particularly low orbits, which will decay into the atmosphere without additional energy inputs – is often limited.
- **Predictable Orbits**
A satellite's motion or orbital location is predictable, allowing warning of satellite over-flight and permitting objects to be tracked in space. However, this is not entirely straightforward, as there are forces at work that will slowly change a satellite's orbit and degrade prediction accuracy over time, while satellites may also have the capability to manoeuvre or change orbit, albeit at a high cost to limited onboard fuel supplies.
- **Vulnerability**
Satellites are at risk from kinetic and non-kinetic attack. Ground-to-satellite links are susceptible to jamming, and fixed command and control and launch facilities are vulnerable to conventional attack. Some space capabilities may also be subject to exploitation by adversaries, with GPS available for navigation and commercial imagery for targeting.
- **Resource Considerations**
Space resources are limited and requirements will be prioritised, so unlimited support for military commanders cannot be assured. Competition for bandwidth, tasking priorities and the physical access of satellites to specific locations may all affect the availability of space support.
- **Legal Considerations and Space Treaties**
International laws and treaties must be considered in the planning stages of any operations that involve space support. Although some acts are prohibited, there are relatively few legal restrictions on the use of space for military purposes, other than for the deployment of weapons of mass destruction.

The unique characteristics of the space environment provide distinct and critical capabilities, permitting a continuous global presence to be established and conferring a relative immunity from political sensitivities, particularly in terms of legal over-flight constraints.

While many of the characteristics of space power are shared with air power, the scale is entirely different and space capabilities are best regarded as being separate, but complementary, to the strengths and weaknesses of air power.

THE KEY ENABLERS OF AIR AND SPACE POWER

The full exploitation of air and space power depends on two key enabling functions: force protection and air logistics.



Air-Minded Force Protection: RAF Regiment in Afghanistan

Air-Minded Force Protection

Force Protection (FP) is a critical requirement for the successful delivery of all forms of expeditionary military power, to counter threats and hazards, enable freedom of action and enhance operational effectiveness. Because air and spacecraft are scarce, expensive and fragile, and operating bases are also potentially vulnerable if they are located in a hostile, non-linear battlespace, a specialist, air-minded FP capability is required to mitigate the strategic consequences of the loss of air freedom of manoeuvre, or of a key air platform.

An early-entry FP capability is necessary at the outset of a campaign to shape the environment and facilitate the arrival of critical air assets; it will also provide the nucleus for an enduring FP organisation. This will need to integrate organic, specialist and complementary FP elements, using a command and control structure that can provide a central focus for cross-spectrum activity. The responsibility for balancing the protection of the defended location and force elements against the requirement to continue air operations must be vested in the air commander, who is in the best

position to adjudicate between these potentially competing demands.

FP depends on effective risk management, based on a detailed assessment of the threat and hazards drawn from accurate, timely, all-source intelligence, fused and analysed organically. This information is used to prioritise the allocation of resources, and risk is mitigated by the judicious application of proactive and reactive FP measures.⁵ These are designed to reduce the likelihood or significance of an attack, and thus to enable the continued prosecution or resumption of air operations with the minimum of degradation or delay. Resource limitations, constraints imposed by the nature of coalition or joint operations, and changes in the operating environment will force threats and hazards to be reviewed as part of an iterative process. Where specific FP measures are constrained by host nation sensitivities, imagination and negotiation may be required to achieve the desired outcome, but using different means.

Air Logistics

Logistics is: *'the science of planning and carrying out the movement and maintenance of forces'*.⁶ Integrating logistics with operational planning is essential to ensure success in military operations; the challenge for air logisticians is to deliver timely and assured support to enhance freedom of manoeuvre through a combination of innovative solutions, supported by established procedures and bounded and guided by

⁵ Detailed guidance for Air FP planning and execution of operations at the operational and tactical level for air operations is provided in AP3241 - Force Protection Doctrine for Air Operations.

⁶ JDP 4-00.



Deployed Air Logistics: RAF Air Movements personnel unload a C-130 Hercules transport aircraft

logistics principles and procedures laid down in UK Joint, Air and Multinational logistic publications.⁷ As an integral element of the Joint Supply Chain, Air Logistics is governed by the same generic guiding principles,⁸ but is also subject to the additional and distinct air-logistics principles of *responsiveness*, *attainability*, *sustainability* and *survivability*.

- **Responsiveness**

Responsiveness is the concept of assured support, at the right time and in the right place, to meet the dynamic requirements of air operations. To be responsive, the logistics system requires a degree of foresight, agility and flexibility and it is essential that logistics planning is integral to the air estimate process, and to subsequent planning and execution, to ensure that courses of action are logistically supportable.

- **Attainability**

Attainability includes a degree of risk mitigation in supporting air operations and establishes an absolute minimum level of acceptable support, should the desired level of logistical support not be achievable. Logisticians must understand the commander's intent and their part in the execution of his plan to fully understand the balance of economy and risk.

⁷ These are: JDP 4-00, AP 100C-72 Air Operations Logistic Doctrine and the Air Logistic Concept of Operations and AP 100C-75 RAF Logistic Support to Operations, and AJP-4 (A) Allied Joint Logistic Doctrine.

⁸ Foresight, Simplicity, Efficiency, Co-operation and Agility.

- **Sustainability**

Sustainability is ‘the ability of a force to maintain the necessary level of combat power for the duration required to achieve its objectives’.⁹ Logistics is the process by which sustainment is achieved. Sustainability focuses on the minimum essential materiel levels to sustain operations; this ensures that an air operation does not culminate before its aims have been realised. Sustainability is addressed in the logistics estimate through consideration of four factors: Destination, Distance, Demand and Duration.¹⁰

- **Survivability**

Survivability is the ability to counter threats to logistics systems and includes resilience and the security of industrial supply and support.¹¹ Logistics force elements represent high value targets and should be safeguarded by a suitably resourced defence plan that considers: the dispersal of materiel; the physical protection of personnel and equipment; deception; and management of optimised logistic footprints for each fielded capability. Vulnerabilities include computer networks used to demand, manage and track supplies; industrial and commercial infrastructure; Air, Sea or Rail Ports of Disembarkation; Force rendezvous points (RVs) and depots; and lines of communication, including shipping and pipelines.

Air Power and the Airman

Air-mindedness is much harder to convey than the perspectives of soldiers and sailors for several reasons. The viewpoint of the soldier and sailor - bounded by the apparent horizon - is part of everyday life and instinctive understanding; few have ever operated an aircraft or contemplated the problems of aerial warfare; and few popular sources of information reflect an Airman's perspective.

*General H H 'Hap' Arnold
Commanding General US Army Air Forces, 1942-46*

The Airman's Perspective

Airmen operate in a different dimension of range, altitude, and time from sailors and soldiers – and often at very high speed. This demands specific skills and expertise, and generates a different type of ethos amongst air and space practitioners. In geographic terms, airmen think on a theatre or Joint Operations Area (JOA) scale, not in terms of individually assigned, geographic Areas of Operation (AOO). In units of measurement, they think in terms of miles per minute, ranges in thousands of miles, altitudes in thousands of feet in the air or thousands of miles in space and timing in fractions of seconds. This instinctive empathy with scale and size and ease in operating across the different levels of warfare – sometimes on the same mission – provides airmen with a unique perspective.

⁹ AAP-6 NATO Terms and Definitions.

¹⁰ JDP 4-00 Chp 8.

¹¹ Includes Contractors Deployed on Operations (CONDO) and the industrial supply chain outwith the JOA or UK home base.



The Airman's Perspective: the flight deck of a C-130J Hercules on operations

The Airman's Joint Perspective

Air pervades and overlays both the land and sea environments, so air power is inherently joint; airmen intuitively understand that they must act within a framework of Joint Action. The expeditionary and influence-based approach to future operations means that increasingly, air power will be deployed as part of the Comprehensive Approach to resolving crises, working closely not just with the Land and Maritime Components, but also Other Government Departments (OGDs) and national and multinational Non-Governmental Organizations (NGOs). Air power's part in the Comprehensive Approach is considered in the next chapter.

Air-Mindedness

To successfully meet its responsibility as the United Kingdom's custodian of the air environment, the RAF must be able to establish and maintain control of the air against threats from the surface, the air and space. This depends upon developing airmen who understand and appreciate air power, and are able to articulate and advocate it – this is air-mindedness. Air-mindedness is an approach that sets the context for air operations, maximising effectiveness and minimising fratricide and accidents. It is based on a thorough understanding of how air power achieves influence, so that activities in the joint campaign can be

properly integrated at the start of the campaign design process, synergistically exploiting the full value of air operations, rather than adding them as an afterthought to a plan that has already been developed.

Air-mindedness is not confined to those who fly, but must also be exercised by all those who employ or support any aspect of air power capability. It is a fundamental requirement for not just air forces, but all users of the air, whether they operate, or have access to, manned and unmanned aircraft, helicopters, satellites and other space platforms. In particular, the delivery of effective air power must be enabled by air-minded FP and air-minded logisticians. Air-minded FP recognises that FP activity must only restrict air activity when the risk of continuing air operations exceeds the risk of the failure to deliver air power to the joint campaign.

Consequently, air-minded FP personnel must understand both the value of air power and the threats to air operations, and this demands specialist doctrine, equipment and training tailored to the specific context of air operations.¹² Similarly, air-minded logisticians must recognise that sustainability can provide, or deny, air power's capability to operate and will influence the tempo, duration and intensity of air operations. Air-minded logistics must be totally integrated in the air campaign from the outset; surges in the flying effort must be matched by a surge in logistics support. Air-mindedness includes an understanding of air tasking, command and control, operating and safety issues, and the capabilities and mindsets of airmen. It is developed through a focus on the delivery of air power in formal and continuation training, exercises, evaluation and operations, and is based on ethos, values, and a shared culture and body of experience. It provides the basis of an agile air force.

THE PRINCIPLES OF WAR APPLIED TO AIR AND SPACE POWER¹³

Selection and Maintenance of the Aim

A single, unambiguous aim is the keystone of successful military operations and selection and maintenance of the aim is regarded as the master principle of war. The Joint Force Air Component Commander (JFACC) provides unity to the overall air effort, ensuring that air power capabilities are not diluted. He will select his aim during the air estimate process in the light of the military strategic objectives and the direction of the Joint Force Commander (JFC). Although maintenance of the aim is critical, objectives must be constantly reviewed to ensure their continued validity as the campaign evolves, circumstances change and events unfold.

Maintenance of Morale

Air power is essential in underpinning the moral component of the Joint Force's fighting power, particularly because of its psychological impact. Control of the air removes the threat of enemy air attack while providing the Joint Force with freedom of manoeuvre. Air mobility permits rapid re-supply and reinforcement, and allows surface forces to advance to contact in the knowledge that rapid aeromedical evacuation is available if required, while aerial surveillance and reconnaissance enhances

¹² This exists as AP 3241 RAF Force Protection Doctrine for Air Operations, AP 3241A Force Protection for Air Operations CONOPs and AP 3241B RAF Force Protection TTPs.

¹³ The principles of war are detailed in JDP 0-01 British Defence Doctrine, Edition 3, p. 2-3.

situational awareness and reduces uncertainty and surprise. Finally, air power provides the assurance of heavy firepower support through precision aerial attack, vastly reducing the threat of casualties to friendly surface forces.

Offensive Action

The inherent characteristics of air power, particularly speed, reach, and agility, mean that it is primarily an offensive weapon and is best used decisively. However, the extent to which the initiative may be seized through offensive action will be dictated by constraints, not least those driven by Rules Of Engagement (ROE).

Security

Air and space force elements are relatively fragile and most vulnerable when on the ground or at sea, so force protection is fundamental to the delivery of air power, especially during deployed operations, where air bases may be sited in a hostile location. Conversely, control of the air provides security to the Joint Force, while denying it to the enemy – air may be used to provide force protection over large areas where friendly force ratios are low, for example supporting Special Forces operations in the Western Desert during Operation Telic in 2003.

Surprise

The speed and range at which air and space forces operate offer huge potential for surprise, with the possibility of attack from any direction with scant warning; the opening of the Desert Storm air operation against Iraq in 1991 is a classic example of the physical and psychological shock imposed by air power's potential to dominate the fourth dimension. However, the political realities of the contemporary operating environment, and the increasing role of the global media, mean that it may now be difficult to achieve strategic, or even operational surprise, so plans must be developed to maximize surprise at the tactical level.

Concentration of Force

Traditionally, fighting power must be massed at the decisive time and place to achieve decisive results. The speed, range and flexibility of air forces, complemented by the accuracy and lethality of precision weapons and advances in information technology, allow concentration of force through weight of effort, rather than overwhelming numbers: precision has allowed concentration of effect, rather than mass.

Economy of Effort

Air power acts as an enormous force multiplier in any joint campaign, providing modestly-sized surface forces with a level of mobility and firepower that would otherwise require a massive commitment on the ground. The versatility of air and space power makes it an attractive option for many tasks, so demand will often exceed supply, and priorities must be established between the Component Commanders and the JFC to guide efficient and economical apportionment and allocation.

Flexibility

Air power is innately flexible and it can be used to deliver a wide range of effects, both kinetic and non-kinetic, across all levels of warfare. For example, a flight of Harriers operating in Afghanistan in July 2007 delivered a strategic level attack against a key leadership target, then provided surveillance support to a tactical land forces operation using high resolution targeting pods, and finally flew a non-kinetic show of force to disperse a crowd threatening a friendly patrol – all within a matter of minutes. Increasing numbers of air platforms are being provided with genuinely multi-role capabilities, further underpinning flexibility and agility.

Cooperation

Air operations often require inter-component and multinational cooperation and, ideally, integration. For example, land forces may be used to find and fix enemy targets for strike from the air, and vice versa. This level of cooperation demands integrated planning, where the campaign is designed jointly from the outset, rather than air operations being added to a plan that has already been developed. This is most likely to be achieved through the insertion of high quality liaison officers into counterpart headquarters. Cooperation can be developed through collective training, but true integration requires a deeper level of understanding and empathy.

Sustainability

Air power makes a significant contribution to the sustainability of the Joint Force. Inter-theatre air transport provides the strategic air bridge, permitting the rapid movement of time-sensitive personnel and mission-critical equipment. Intra-theatre air lift, including precision air drop, is particularly important in sustaining the campaign, especially where surface transport is difficult or dangerous, while control of the air establishes the conditions under which the logistics system can operate.

CHAPTER 2

AIR POWER IN THE CONTEMPORARY
OPERATING ENVIRONMENT

Much will be said about the success of joint operations during DESERT SHIELD and DESERT STORM ... what carried the day was that we, the component commanders, shook hands and said 'we're not going to screw this up, we're going to make it work'. And it did.

*Vice Admiral Stanley R Arthur,
Commander US Navy Forces,
CENTCOM, 1990-91*

Introduction

The aim of this chapter is to describe the changing operational environment and explain how air and space power can act effectively within it, as part of the Comprehensive Approach to crisis resolution. The Chapter will describe the contemporary operating environment in terms of the shifting balance of combat power, the resultant prominence of irregular and hybrid warfare and the consequent blurring of the levels of warfare. It will then explain how the employment of air and space power can be conceptualised within the framework of Joint Action, as part of the campaigning process expressing the military contribution to the Comprehensive Approach.

Western Dominance and Asymmetric Responses

While the essence of violent conflict has remained constant, the character of warfare is changing, largely in response to the overwhelming conventional combat power developed by the West in general and the United States in particular. This has been most apparent in Western superiority in the air, including dominance of space, although this is being increasingly contested by emerging regional powers.

Our adversaries have come to understand the extent of Western warfighting dominance and have developed irregular strategies to counter it, including insurgency, disorder, criminal activity and terrorism.

Consequently, tactical engagements are now often fought amongst non-combatant populations and increasingly in urban areas, where situational *awareness* is no longer enough to conduct effective military operations; instead, commanders need to develop situational *understanding*. Understanding the enemy's perceptions, fears and motivations is now as important as building an awareness of his force dispositions and intentions.

The Shifting Balance of Combat Power

The historic role of maritime forces has been to exercise sea control, while land forces close and engage the enemy to take and hold ground. Air forces have traditionally supported the other components, or acted independently for strategic effect. While the relationship between the Maritime and Air Components has remained largely unchanged, the linkages between the Air and Land Components have evolved rapidly since the end of the Cold War, particularly as the capabilities of air forces have increased markedly in recent years, as demonstrated most convincingly in the 2003 Gulf War.

In conventional military operations, all-weather, precision air attack can now decisively shape the operational battlespace; the differences in speed of manoeuvre between land and air forces continue to remain orders of magnitude apart. In addition, aerial firepower support can now be routinely achieved with assurance, while space capabilities are integral to every aspect of military operations.

In parallel, non-linear battlespace has become more prevalent. The traditional, well-defined land area of operations, with its strictly delineated boundaries between formations and supported and supporting relationships, is no longer flexible enough to allow the full exploitation of air power in a fluid and fast-moving campaign. Combat identification and friendly-force tracking techniques will have to reach full maturity before the full potential of air power can be realised in this type of battlespace. Although air power's effects are being increasingly employed in support of the Land Component at the tactical level and have more to offer in a truly integrated operational plan – despite improvements in intelligence, surveillance and reconnaissance – close combat is likely to remain primarily the domain of the soldier.

The Challenge of Hybrid and Irregular Warfare

The concept of *Hybrid Warfare* has been used to describe conflicts where high-technology, conventional capabilities are mixed with irregular tactics, although examples such as the Lebanon conflict of 2006 are only the most recent applications of a type of warfare with a very long provenance. Nevertheless, the Israeli Air Force's experience in fighting *Hezbollah* demonstrated that while air power is decisive in the prosecution of conventional operations, it must be applied with great care in irregular warfare if its capabilities are to be used to best effect, not least because targets are likely to be fleeting and distributed amongst the wider population. In this type of warfare, non-kinetic air power roles may be as important as kinetic effects and a truly integrated, joint campaign is likely to be the best guarantor of success.

As irregular and hybrid warfare have blurred the boundaries between the strategic, operational and tactical levels, so traditional air power roles have become less sharply delineated. Many operations that would once have been described as tactical now have impact at the strategic level. For instance, air attacks in Afghanistan in 2008 were confined to limited target sets within a well-controlled battlespace, yet their effects resonated strongly within the local population, who were sensitive to the asymmetric application of force and represented a centre of gravity at the operational or strategic levels.

Conversely, nominally strategic assets such as United States Air Force *B-1B Lancer* bombers were, through close integration with the Land Component, used to support purely tactical actions in a close air support role. Air power has always offered the unique capability to provide strategic influence, often entirely

independently of the other components and without a commensurate commitment of surface forces - this will always remain a very attractive option politically.

STRATEGIC INFLUENCE: OPERATION EL DORADO CANYON

In 1986, The United States Navy and Air Force launched an operation against Libya, intended to deter future state-sponsorship of terrorism following attacks on US citizens. Targets included¹⁴: barracks and terrorist headquarters in Tripoli and Benghazi; a naval commando school in Tripoli, where terrorists had trained; terrorist support facilities at Tripoli's main airport; and an airfield near Benghazi, which was a direct military threat to the operation. Attacks were simultaneous and used a large air package, including aircraft based in the UK. The attack lasted less than twelve minutes and the aircraft dropped sixty tons of weapons, narrowly missing the Libyan leader. Although the attack may have precipitated the subsequent terrorist bombing of Pan Am Flight 103 over Lockerbie, the credible threat of follow-on attacks underpinned the subsequent international diplomatic strategy that positively influenced Libya's behaviour in the long-term.

In the past, the strategic use of air power was strongly associated only with kinetic attack – bombing – and usually with particular aircraft types. Current air operations conducted for strategic effect are not necessarily *strategic* in terms of range, but rather because of the effect generated – and this may be equally a result of non-kinetic as opposed to kinetic activities; for example, the humanitarian air bridge that ran to Sarajevo between 1992 and 1996, and delivered more freight than the Berlin Airlift, undoubtedly had a strategic effect.

NON-KINETIC STRATEGIC AIR POWER

In August 1990, immediately following the Iraqi invasion of Kuwait, high readiness air assets, including RAF Jaguars, Nimrod MR2s and Tornados, were deployed to the Gulf in a matter of days. This had a significant strategic effect because it bounded the crisis by providing both a deterrent to further Iraqi aggression, and reassurance to nascent Coalition partners in the region.

Deep attack, however, remains an essential capability and the precision and discrimination available to air power makes it uniquely suited to continue to play this key role in future warfare, although *deep* does not necessarily refer to the geographic position of the target within the battlespace, but may also imply that close coordination is not required with the other components to ensure deconfliction or reduce the risk of fratricide. The context is important; in irregular warfare, deep attack in the guise of stand-off strikes may be perceived as demonstrating a lack of resolve or commitment, whereas precision strikes conducted against enemy leadership targets may bring pressure to bear directly on an otherwise insulated adversary and

¹⁴ The UN Security Council moved to condemn the attack, but two countries vetoed the resolution.

strengthen consent amongst the local populace. In sum, determining whether air operations are tactical, operational or strategic depends on the context of employment and the desired outcome, not on the capability or type of platform used, or the range to target.

DEEP ATTACK: OPERATION BABYLON

In 1981, eight Israeli F-16 attack aircraft and two F-15 fighters took off from an Israeli-occupied base in the Sinai Desert. Their target was the Osirak nuclear reactor in Iraq. The mission was unchallenged as the aircraft flew at low level through Jordanian, Saudi and Iraqi airspace. At twenty kilometres from the target, the F-16 pilots climbed to height for the attack and released pairs of 1,000 kilogramme bombs at the target. The reactor was destroyed before it received its first load of nuclear fuel and never entered operational service. By dusk, all ten aircraft had returned unscathed. In 2007, Israel launched a similar attack against an alleged nuclear facility under construction in Syria.

Complementary Strengths and Weaknesses

The different components of military power have complementary strengths and weaknesses. Although precise, organic fire support is now available to the Land Component through capabilities such as the GPS-Guided Multiple Launch Rocket System, their mobility and reach are comparatively limited. Consequently, even in relatively static counter-insurgency operations, air capabilities continue to have real utility. Organic fire support, while highly responsive, is fixed and relatively inflexible.

Where the theatre of operations is large, and the density of friendly forces low, the supreme flexibility of fixed-wing air power, which can be quickly switched across an entire theatre of operations or even between theatres, will complement and enhance organic support.

The integration of air, land and maritime power is ripe for further exploitation, not so much through technical and tactical interoperability, where there has been considerable recent investment in equipment and training, but through the development of a better understanding of the ways in which air power can be used to provide influence, particularly in irregular and hybrid warfare.

The real advantage of surface capability enhanced by air power – and vice versa – is more profound than a simplistic supported or supporting relationship; for example, in conventional warfare, land forces can manoeuvre – enabled by control of the air – to find and fix the enemy for subsequent destruction by air attack, while in irregular warfare, air power can provide critical capabilities including persistent over-watch, and security and force protection for land forces over large areas, where friendly or indigenous force ratios are low.



Non-Kinetic Attack: A Harrier GR9 Conducts a 'Show of Force'

JOINT ACTION

A Comprehensive Approach

The course and outcomes of current crises are determined by many inter-dependent factors. Consequently, the Comprehensive Approach, employing all available levers of power, has been adopted by the United Kingdom as the best way to achieve favourable and enduring end-states. The military contribution to this cross-government and inter-agency approach is captured by the campaigning process.

A campaign plan articulates the ways in which a JFC, with the forces or *means* at his disposal, intends to reach his *ends*, the campaign end-state described as a series of campaign objectives. These *ways* are translated into actionable tasks that can be delegated to subordinates within the context of the JFC's overall intent. Activities are tasks conducted by elements of the joint force to achieve specific *supporting effects*, which may be physical or psychological in nature, and may also involve the activities of non-military agencies. Campaign design is based on the functions of analysis, planning, execution and assessment; where possible, all of these should be conducted collaboratively. Indeed, the scale and tempo of military crisis planning may need to be tempered to enable the full participation of multinational and multi-agency partners. The relative contribution of each lever of power, or actor, will vary according to the circumstances; the military may be supported or supporting on different lines of operation, or in creating different supporting effects.

It is impossible to model scientifically the complexity of contemporary warfare, particularly the human dimension. Therefore, a mechanistic implementation of an effects-based approach to operations is unlikely to achieve success. However, a nuanced philosophy that links activities, effects, and outcomes is a valid way of underpinning the campaign design process. This puts the emphasis on understanding the cognitive effect that activities impose on participants, demanding thinking that is focused on outcomes, but is also shaped by an understanding of the will of an opponent, as well as an assessment of his capability and capacity. The balance and linkages between physical and cognitive effects are achieved by working within the Joint Action framework.¹⁵ This helps to determine how the deliberate use and orchestration of the full range of available capabilities and activities will realise the intended effects, and also how possible unintended, undesirable effects and enemy counter actions may be anticipated and mitigated. However, it is important to note that effects are the entire set of consequences – desired or undesired, expected or unexpected, direct or indirect – that are precipitated by a particular action.

The Relationship between Joint Action and Air and Space Power

Air power has tremendous destructive potential and its utility across the spectrum of conflict has been hugely increased by the advent of precise, low collateral weaponry. However, air power has the ability to exert influence through non-kinetic as well as kinetic effects, and the Comprehensive Approach permits the full range of air and space power activities to be considered; for instance, the time that a satellite is due to pass may in itself constrain an opponent's freedom of action or influence his activity, and the very presence – or absence – of air support may influence a tactical engagement.

AIR POWER AND INFLUENCE

'Air power was of great value. One night we were grabbing a suspect and the streets cleared as we were driving out, which meant something was about to happen. I had two fast jets fly low right down the street which created a tremendous noise, and we had no problems'.¹⁶

Influence and Coercion

Air and space power has the potential to change behaviours through the parallel mechanisms of influence and coercion. All military strategies, except those of wars of annihilation, seek to influence behaviour in some way, so influence is invariably an ultimate goal at the strategic level of warfare. The hard edge of influence is coercion, which is central to the threat or use of all military force and therefore crucial in developing effective air power strategies. This is reflected in the current definition of air and space power, which encapsulates the relationship between military force and influence:

¹⁵ JDN 1/07 Joint Action: The Higher Level Operational Conceptual Commentary, paras 109 – 125.

¹⁶ Major St. John Coughlan in interview, 26 March 2006.

*The ability to project power from the air and space
to influence the behaviour of people or the course of events.*

Influence and coercion are central to operational art, which is most often expressed as the balancing of ends, ways and means.

Air and Space Power Ends, Ways and Means

Ends are the desired effects of an operation, limited only by a commander's imagination and linked to the ultimate, strategic level goal of exerting influence; they will be common to the other environments within a Joint Campaign. Air and space *means* are air and spacecraft, their weapons and enabling systems and the air-minded personnel who support and operate them. The *ways* of conducting air and space operations are described in terms of four fundamental roles or capabilities. These are: control of the air and space, air mobility, intelligence and situational awareness, and attack. They are key to a clear understanding of air and space power, and are described in detail in the next chapter.

CHAPTER 3

THE FOUR FUNDAMENTAL AIR AND SPACE POWER ROLES

Introduction

The aim of this chapter is to explain air and space power's capabilities in terms of its four fundamental roles, from which all other activities and tasks flow. These are: control of the air and space, air mobility, intelligence and situational awareness, and attack.

ROLE 1: CONTROL OF THE AIR AND SPACE

If we lose the war in the air, we lose the war, and we lose it very quickly.

Field Marshal Bernard Law Montgomery



Control of the Air: the Typhoon

Freedom of Air and Surface Manoeuvre

Control of the air is the *primus inter pares* of the four air power roles. It has doctrinal primacy because it enables freedom of manoeuvre in all of the Service environments: air, land and maritime. Control of the air provides commanders with the ability to retain the initiative while denying it to the enemy, and although military operations may be attempted without it, success may be fatally compromised beneath contested airspace. Control of the air above Iraq in 2003, for example, paved the way for major combat operations at a much reduced risk of casualties to Coalition surface forces, which enjoyed almost complete freedom of manoeuvre while facing Iraqi ground threats that had been fixed and severely degraded by air attack. Few activities can be conducted without air and space control; successful deployment to an operational theatre, for instance, depends on a benign environment created by control of the air to allow vulnerable transport vehicles, vessels and aircraft to operate safely, while space control provides the bearers that support, *inter alia*, asset tracking for materiel and accurate navigation.

Because Western air power has been so dominant in post-Cold War conflicts, this fundamental requirement is easily forgotten and control of the air is taken for granted. Similarly, while space power provides capabilities that are so embedded in all aspects of military operations that access to it is a *sine qua non* requirement, space control is often assumed, rather than proactively planned for and implemented. These are very dangerous assumptions, because even where conventional air threats are largely absent, either as a result of successful control of the air operations or because they were absent at the outset, adversaries recognise the importance of control of the air and space and will contest it with all the means at their disposal. Although fast jet aircraft may enjoy freedom from most threats after successful counter-air operations, opponents will fight for the lower airspace with man-portable missiles, rockets and small arms. Rotary aircraft and slow, fixed-wing transport aircraft may be vulnerable to these threats, particularly when taking off and landing, so FP must dominate the ground around airfields to be effective. Even in the absence of an opposing air force, control of the air may therefore not be total, and is likely to be contested.

Defining Control of the Air

Consequently, traditional conceptions of air superiority have limited utility in contemporary operations. Instead, control of the air may be considered in terms of freedom and denial, so that control of the air is defined as:

The freedom, bound by time, to use a volume of airspace for one's own purposes while, if necessary, denying its use to an opponent.

Against this relative standard of freedom of action, the required degree of control is achieved when a commander assesses that a planned surface or air operation will not be compromised by enemy action and that the risk to his own forces posed by enemy air is acceptable.

ACHIEVING CONTROL OF THE AIR: COUNTER-AIR OPERATIONS

Counter-air operations achieve control of the air through the destruction, degradation or disruption of an enemy's air capability. Counter-air operations may include the actions of any component and involve the use of land or ship-based assets to counter threats including manned or unmanned aircraft, surface-to-air systems, ballistic and cruise missiles and maritime or land forces. Counter-air operations are subdivided into offensive and defensive counter-air missions:

- **Offensive Counter-Air (OCA) Missions.**
OCA missions are offensive operations aiming to destroy, disrupt or degrade enemy air and missile threats, either by destroying them on the ground, or as close to their source as possible. Such operations may be pre-planned or immediate, and are conducted across enemy territory at the initiative of friendly forces. Pre-planned operations depend on continuous and accurate intelligence, while immediate operations are conducted against unexpected mobile and time-sensitive targets, where there may be only a small window available for attack. OCA includes surface attack operations, air-to-air missions the Suppression of Enemy Air Defences (SEAD) and Electronic Warfare (EW).
- **Defensive Counter-Air (DCA) Operations.**
DCA operations are synonymous with Air Defence (AD). They consist of active and passive operations to detect, identify, intercept and destroy or negate enemy air and missile forces attempting to penetrate friendly battlespace, or the reduction of the effectiveness of such attacks, should they escape destruction.
- **Active Air Defence.**
Active AD involves any direct defensive action taken to destroy, nullify or reduce the effectiveness of enemy air and missile attack. It is achieved through integrated detection, identification, assessment, interception and engagement. It is frequently characterised by layered defence-in-depth, permitting multiple engagements to be made with reactive air-to-air fighters, Surface-to-Air Missiles (SAMs) and other assets.
- **Passive Air Defence.**
Passive AD is part of the overall FP posture and consists of the measures taken to minimise the effectiveness of hostile attack through the individual or collective protection of friendly forces and critical assets. Elements of passive AD include early warning, camouflage, concealment and deception, hardening, dispersion, reconstitution, and low-observable or stealth technologies.

Control of Space

For the United Kingdom, sufficient control of space is becoming increasingly important for the success of all military operations. Continuing assurance of access to space capabilities will include cooperation with allies

– the United States’ freedom of action in orbit is particularly important in this respect – and the exploitation of specialist knowledge, in addition to the development of indigenous capabilities. In this context, space control may be defined as:

The conditions, bound by time, that enable effective space support of military operations.

Space Operations

Space operations potentially include offensive or defensive operations to attain and maintain a desired degree of freedom of action in space, allowing friendly forces to exploit space capabilities, while negating the enemy’s ability to do the same. These may include operations against a third-party nation with space capabilities supporting an adversary’s interests. However, the results of the Chinese anti-satellite attack test in January 2007, which produced tens of thousands of pieces of space debris, creating unintended difficulties for all users including China herself, demonstrate the risks inherent in kinetic counter-space operations. Space launch facilities and command and control centres are more attractive targets; they are vulnerable to conventional kinetic attack because they are large, fixed and not subject to the same legal restraints as operations in space. The command and control links are even more vulnerable, as they can be jammed or spoofed; by employing Computer Network Operations (CNO), it is possible that an adversary might attempt to wrest control of a space platform for his own purposes, and while military satellites use encryption to minimise this risk, commercial and dual-use platforms often do not have the same degree of protection.

ACHIEVING CONTROL OF SPACE: COUNTER-SPACE OPERATIONS

Counter-space operations may be offensive or defensive and are dependent on robust space situation awareness (SpSA). Counter-space operations are conducted by the entire joint force, across all three levels of warfare.

- **Space Situation Awareness.**
SpSA is knowledge of space-related conditions, constraints, capabilities, and activities. It provides the foundation for all space activities and includes space surveillance, detailed reconnaissance of specific space assets, collection and processing of intelligence data on space systems, and the monitoring of the space environment. It also involves the use of traditional intelligence sources to provide an insight into an adversary’s space and counter-space operations.
- **Defensive Counter-Space (DCS) Operations.**
DCS operations preserve the ability to exploit space by using active and passive means to protect space assets from attack or interference. DCS operations include measures to protect, preserve,

recover and reconstitute space means before, during, and after attack by an adversary, and may also target an adversary's counter-space capability.

- **Offensive Counter-Space (OCS) Operations.** OCS operations prevent adversaries from exploiting space by attacking their capabilities through deception, disruption, denial, degradation and destruction. As adversaries become more dependent on space, OCS operations will become increasingly important in affecting their ability to organise and orchestrate military campaigns.

ROLE 2: AIR MOBILITY

*Give me fifty DC-3s and the
Japanese can have the Burma Road.*

*Chiang Kai-Shek,
Nationalist Chinese Leader 1924 - 1974*

Deployment, Sustainability and Manoeuvre

Air mobility and lift (including precision air delivery) enable the global, regional and local deployment of military and civilian personnel and materiel. Although air lift is limited in payload in comparison with surface lift, in many crisis situations it represents the only way of providing immediate influence by rapidly deploying and sustaining forces. Like air and space control, air mobility acts as a fundamental enabler for surface manoeuvre; it is particularly useful for moving light and Special Forces where the threat to surface movement is high.

Air assault has tremendous utility in irregular warfare and dispersed operations, acting as a force multiplier by enabling combat power to be massed at high tempo. Air to Air Refuelling is also a crucial enabler, significantly enhancing strategic and operational level mobility, while greatly improving the persistence of surveillance and combat aircraft, and consequently improving tactical responsiveness.

Air mobility is vital for swift casualty evacuations from austere locations, underpinning the moral component of fighting power; it is often the only way to get wounded personnel to specialist medical care quickly enough to preserve life.

Air lift can also be used to support policy objectives and deliver strategic effect through disaster relief or other humanitarian operations, or by achieving influence within local populations by supporting local projects and evacuating civilian casualties to medical facilities.

AEROMEDICAL EVACUATION

In June 2007, the crew of a Merlin HC3 extracted a seriously wounded soldier from Basra at night under sustained small arms fire. It was assessed that the soldier would have died within fifteen minutes without the rapid insertion of the Immediate Response Team.



Fixed-Wing air lift: a C-130K Hercules begins a mission in the Gulf

Fixed-Wing Aircraft

Large, fixed-wing aircraft such as the *C-17A Globemaster* and *C-130 Hercules* are capable of both inter and intra-theatre lift. A *C-17A* can deploy from the United Kingdom to typical theatres of operation in hours, while a *C-130* can transit from forward operating bases to typical areas of operation in minutes.

While operations in and out of main operating bases permit maximum effectiveness in handling large numbers of personnel and high volumes of materiel, even the largest fixed-wing transport aircraft can operate independently of main operating bases where the need is urgent and the ground threat can be managed. Where threats to surface movement are high, for example through Improvised Explosive Devices (IEDs),

tactical fixed-wing aircraft can re-supply ground forces using precision air drop at a lower risk than running ground convoys.

All air transport aircraft are potentially vulnerable to ground fire, including small arms, particularly when at low speeds and operating close to or on the ground, but threats can be minimised through the use of intelligence, sensible basing strategies, effective defensive aids and adaptive tactics, including the avoidance of high-risk threat areas and pattern-setting.

PRECISION AIR DROP

Between May and December 2007, RAF C-130J Hercules in Afghanistan conducted low altitude night missions to re-supply forward operating bases using an air-dropped container delivery system. Nearly 1,000 containers were dropped, containing 800 tons of food, water, ammunition, fuel, generators and even power-plants for CVR (T) fighting vehicles.



Precision air drop: a C-130J Hercules air-drop in Afghanistan

Rotary-Wing Aircraft

Support helicopters are the lynch pins of tactical mobility. Typically operating at lower heights and speeds than fixed-wing aircraft, they enable rapid tactical movement of personnel and materiel over difficult terrain. They are the fundamental enablers of ground manoeuvre, adding speed and surprise and allowing forces to leapfrog difficult terrain and bypass ground threats. Support helicopters are invariably in great demand and short supply.

ROTARY-WING AIRCRAFT - THE LYNCH PINS OF TACTICAL MOBILITY

Rotary-wing aircraft are significant force multipliers, allowing ground forces to mass capability in time and space and sustain high tempo operations. In early 2008, Joint Helicopter Force (Afghanistan) aircraft flew 293,000 kg of cargo and over 6,000 troops within its Area of Operations in a single month. Helicopters supported Immediate Response Teams and High Readiness Forces twenty-four hours a day, and were held on standby for casualty evacuation and to transport the Quick Reaction Force to support Troops in Contact engagements.

THE PROVISION OF AIR MOBILITY

Air mobility enables forces to be moved and sustained worldwide, across the entire spectrum of operations. It provides rapid and flexible options to military planners and national and international government agencies, allowing rapid responses to crisis situations globally. It consists of the following six sub-sets:

- **Air Lift**
Air lift provides the capability to enable rapid global deployment and redeployment of military personnel and associated equipment. In times of crisis and when speed of response is essential, air lift provides an ability to extract non-combatants. Integral to the defence Logistics Support Chain, it provides a highly agile and responsive means to sustain deployed forces worldwide. Inter-theatre air lift is the air bridge that links theatres to home bases and to other theatres, whilst intra-theatre air lift provides air lift within a specific theatre or JOA. Whilst it cannot match the capacity of sea lift, air lift allows rapid and focused responses anywhere in the world.
- **Air to Air Refuelling**
Air to Air Refuelling is a significant force multiplier. It increases the range, endurance, payload and flexibility of all receiver-capable aircraft and is especially important when forward basing is limited or unavailable, or where access, basing and over-flight limitations would otherwise impose constraints on air operations.
- **Airborne Operations**
At one end of the scale, airborne operations project combat power through the air delivery of

land forces onto an objective. They may be operational or strategic in nature; however, they are invariably high-risk, high-gain undertakings. At the other end of the scale, the discrete insertion of small patrols has much utility in low-density battlespace, such as recent operations in Afghanistan.

- **Special Air Operations**

Special Forces (SF) are usually small units of carefully selected personnel employing modified equipment and unconventional tactics against strategic and operational objectives. They are heavily dependent on air support, and special air operations elements are an integral part of SF.

- **Aerial Delivery**

Aerial delivery enables the rapid precision delivery of logistics stores to remote or isolated locations that are not served by either a secure landing strip or a secure surface line of communication.

- **Aeromedical Evacuation (AE)**

AE is a specialised form of air lift for transporting ill or injured personnel under medical supervision to appropriate medical treatment facilities.



The Lynch pins of Tactical Mobility: a Chinook HC2 arrives at a Tactical Landing Zone during Operation HERRICK in Afghanistan

ROLE 3: INTELLIGENCE AND SITUATIONAL AWARENESS

Once command of the air is obtained, the war must become a conflict between a seeing host and one that is blind.

H G Wells,
Science Fiction Writer 1866 - 1946

Surveillance and Reconnaissance

Surveillance and reconnaissance are the means by which air and space power provides intelligence and situational awareness, whether for operational level commanders taking a theatre-wide perspective using space-based assets, or individual soldiers exploiting live video feeds from manned or unmanned aircraft. The high vantage point afforded by air and space allows an almost unhindered view 'over the hill' and across the electromagnetic spectrum, providing intelligence at all levels of command, although a robust capability is required to direct, collect, process and disseminate information.

Air and space systems now have sufficient sensor resolution to find and identify very small targets, down to individual people. They can also map terrain and infrastructure and even monitor patterns of change and behaviour, routinely penetrating poor weather and overcoming concealment techniques. Sensors can also intercept communications and other signals, helping to build a comprehensive and coherent intelligence picture; the 10,000 surveillance and reconnaissance sorties flown in the Middle East and South Asia during 2007 demonstrate the critical nature of air power in building a comprehensive intelligence picture.

Find, Fix, Strike and Exploit: The Changing Balance

The employment of military force has traditionally been conceived in terms of the functions *find*, *fix*, *strike* and *exploit*. In the Cold War, *strike* took precedence, as finding the enemy's large, conventional fielded forces would have been a relatively easy task. In contrast, the emphasis in contemporary operations is on the *find* function to support understanding. Signals Intelligence (SIGINT), Imagery Intelligence (IMINT), Geo Intelligence (GEOINT) and Electronic Intelligence (ELINT) all provide layers of sensing in depth that, if properly fused with other sources, provide insight into the vital human terrain as well as the physical topography of the battlefield.

At the strategic level, the broad requirement is to understand higher-level adversary intent, so the balance of effort for air and space systems is tipped towards SIGINT and certain types of IMINT. In contrast, tactical intelligence requirements in counterinsurgency operations vary enormously, even from village to village, and therefore generally favour Communications Intelligence (COMINT), Human Intelligence (HUMINT) and systems that support change detection.

The challenge is to develop *situational understanding* from the *situational awareness* created by the technological exploitation of the intelligence provided by air and space capabilities. This is possible through,

for example, the use of COMINT or the analysis of pattern of life intelligence gathered by persistent surveillance, but may also be enhanced by HUMINT, which can add the nuances and complexity of the cultural and social terrain which are otherwise difficult to detect from the air.

The most effective means for exploiting information is the ability to place information quickly in its correct context, whatever its source. This places considerable emphasis on the rapid integration and quick exploitation of information to promote situational understanding. Technology is also overcoming the lack of persistence that has been one of air power's traditional weaknesses: through space-based assets and high endurance UAVs, air and space power may now provide an unblinking eye.

In the past, this has been with a limited field of view, but the *scan-cue-focus* paradigm employed on recent operations has overcome this by using a wide-area sensor, such as the ASTOR, to cue higher resolution sensors with narrower fields of view, such as fast jet targeting pods, on to the point of interest; the analogy is floodlight to searchlight to spotlight.

FLEXIBILITY OF AIR SENSORS

Television images of Police helicopters finding and tracking vehicles and people are now familiar. Aircraft targeting pods can be adapted for similar functions in irregular warfare. In Iraq, a fast jet pilot was able to use his thermal imaging system to find an insurgent hiding in reed beds at night and direct ground forces to an arrest. In Afghanistan, close air support aircraft routinely use otherwise non-productive transit and holding time to image pre-designated areas of interest to check for Improvised Explosive Device (IED) activity. The focus on anticipated lines of ground movement and natural choke points has successfully defeated Taliban operations.

The Requirement to Integrate and Synchronise

Effective surveillance demands both broad context and detailed information. Better understanding of situations and higher responsiveness are achieved when the two are balanced: too much time spent on context can lead to a late focus on necessary detail. While air (and to a lesser extent space) capabilities may provide a measure of both, all sources must be closely integrated – and the direction, collection, processing and dissemination of products balanced – to permit situational understanding to be developed from situational awareness.

For example, almost constant surveillance can be provided by the use of full motion video, but this is not in itself a sufficient reason for conducting it. Moreover, varying the method of surveillance improves system robustness and provides redundancy.

Rather than requesting the intelligence product required, customers have historically demanded the use of a particularly favoured collection method; in contrast, an open-minded request may be satisfied in many ways, permitting a more efficient use of assets.



Surveillance and Reconnaissance: a Sentinel R1 of No V(AC) Sqn

Friendly Force Situational Awareness

Situational awareness is greatly enhanced by confidence in the position of friendly forces; this is even more important because of the range, accuracy and lethality of modern weapon systems such as *Paveway IV* and *Brimstone*. Friendly force tracker technology has allowed progress to be made in this area: in conventional warfare, rapid air attack of opportunity targets is now possible, despite some limitations in tracker technology in complex terrain. It also has increasing utility in irregular warfare, although combat identification remains difficult, because targets are now often very small, such as individual people, and the background noise can be intense, for example in urban areas.

ACHIEVING AIR INTELLIGENCE AND SITUATIONAL AWARENESS

The intelligence provided by space-based sensors and air platforms, manned and (increasingly) unmanned, significantly contributes to reducing uncertainty in the decision-making process and improving the ability to gain and maintain information superiority, which in turn increases flexibility, enhances effectiveness, increases responsiveness, aids force protection and – above all else – contributes to situational awareness.

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR)

ISTAR links several battlespace functions to allow a combat force to employ its sensors and manage the information gathered to best effect. ISTAR has four components:

- **Intelligence**
Intelligence is the product resulting from the collection, processing, integration, analysis, evaluation and interpretation of available information. Good intelligence provides accurate, relevant, timely and predictive analysis to support operations.
- **Surveillance**
Surveillance is the continuing and systematic observation of air, space, surface or subsurface areas, places, persons or things, by visual, aural, electronic, photographic or other means. Airborne (and space) surveillance assets exploit elevation to detect opponents' activities at range and behind obstacles.
- **Targeting**
Targeting consists of six steps: detection, location, identification, decision, execution and assessment. ISTAR operations play a prominent role in four of these steps: detection (ISTAR assets detect potential new targets or significant changes to existing targets), location (allows a target to be positioned accurately within a designated reference system), identification (the recognition and classification of targets in sufficient detail to allow decision-making), and assessment (allowing commanders to analyse progress against the campaign plan).
- **Reconnaissance**
Reconnaissance complements surveillance by using visual observation, or other detection methods, to obtain specific information about the activities and resources of an enemy or potential enemy. It may also secure data concerning the meteorological, hydrographical or geographic characteristics of a particular area.

ROLE 4: ATTACK

Offence is the essence of air power.

*General H H 'Hap' Arnold,
Commanding General, US Army Air Force 1941 - 1945*

Strategic, Operational and Tactical Flexibility

The concept of coercion, underpinned by air power's demonstrable capability to attack, can be used at the strategic, operational or tactical levels. However, it is no longer particularly useful to define air power roles only in association with specific levels of warfare.

Air power is inherently flexible, and the levels of warfare are now so blurred in contemporary operations that the imposition of artificial labels can confuse an understanding of the totality of air power's coercive capability.

For example, large fixed-wing bombers, originally designed for strategic attack, are quite capable of tactical close air support if properly armed and integrated with surface forces. Similarly, short-range tactical aircraft are capable of achieving strategic effect; it is how they are used and in what context that matters, not the range or reach of particular aircraft types.

Air power has enormous potential to exert influence through coercion. Because of its almost unlimited flexibility, it may be used to attack a wide range of mobile and static targets across multiple theatres of operations. Like other forms of military power, air power can also generate inadvertent strategic consequences; collateral damage may create adverse effects out of all proportion to the damage actually inflicted.

Nevertheless, the successful use of air power as a coercive instrument operating seamlessly across the strategic-operational-tactical continuum has permitted a lower ground footprint to be adopted in conflicts such as Afghanistan since 2003, reducing friendly casualties and imposing a relentless pressure on adversaries.

AIR POWER AS A FORCE MULTIPLIER

'Without air and space power, 500 to 600,000 troops would be needed in Afghanistan to achieve the same effects as the 40,000 soldiers, sailors and airmen we have there today. Air and space power provides the asymmetric advantage over the Taliban such that no matter where they choose to fight, coalition forces can bring to bear overwhelming firepower in a matter of minutes. Moreover, putting 500 to 600,000 troops into the country may achieve the same military effect, but it could have a negative impact on the population; such numbers could appear as an occupying force, rather than a security assistance force. In short, there is no substitute for effective air and space power'¹⁷.

¹⁷ Lieutenant General Karl Eikenberry, former Commander Combined Forces Command Afghanistan 2006-2007, quoted in NATO's Future Joint Air And Space Power, April 2008, p. 4.

Precision Attack and Precision Effect

Precision attacks do not always achieve precise effects. They can have unintended, or non-precise consequences and conversely, non-precision attacks can have very precise effects. Precision weapons used unwisely in an urban environment may potentially alienate an otherwise neutral population; non-precision bombing of enemy positions on a battlefield may destroy little equipment and cause few casualties, but can still create a very precise effect on enemy morale if carefully coordinated with information operations. Attacks may also be made directly against the will of an adversary, in some cases by using non-kinetic means, such as the threat of force, rather than through the physical destruction of his capability.

Coercion: The Graduated Threat or Use of Force

Air power's reach is measured in hundreds or even thousands of miles and responsive precision attack at range is one of air power's greatest strengths. It provides an ability to coerce an adversary by holding him at continuous risk.

COERCION AND STRATEGIC EFFECT

On the night of 30 April 1982, a Vulcan B2 of 101 Squadron, supported by extensive Air to Air Refuelling by the RAF's Victor force, dropped twenty-one 1,000lb bombs onto the airfield at Stanley in the Falklands Islands, cratering the runway and denying its use to Argentinean fast-jet aircraft. However, this also demonstrated Britain's capability to attack at huge ranges, potentially threatening the Argentine mainland and resulting in a number of air defence squadrons being redeployed to the north of the country, denying their potential use in the rest of the conflict.

The demonstrable capability to attack an adversary underpins a graduated range of credible threats, from diplomatic warning and military signalling, including operational and tactical level non-kinetic demonstrations of power, through to the actual use of force. Commanders can use air attack to deter opponents and, if necessary, destroy capabilities or deny courses of action. However, the ultimate goal at the strategic level of warfare is to influence an adversary to follow a desired course of behaviour. In this sense, air attack is always a means to an end, but air power's ability to escalate the use of force in easily controlled steps means that it has become an increasingly important element of coercive strategies.

Conventional Counter-Surface Force Operations

Precision air attack is now so effective against conventional fielded forces that it takes primacy in force-on-force encounters. In 2003, of nearly 20,000 targets engaged during combat operations in Iraq, over 15,000 were primarily prosecuted by air power. The percentage of air sorties flown in support of the land campaign increased from 50% percent in the 1991 Gulf War to 78% in the 2003 Gulf War. Direct air attack of



Complementary capabilities: an Army Air Corps Apache provides firepower support at night

enemy land forces represents an attractive option, not least because it minimises the risk of casualties to friendly forces in a traditional, surface force-on-force engagement.

Because attack helicopters in general, and land-based tactical missile systems in particular, have not always proved to be as flexible as fixed-wing aircraft in conducting deep operations, air component commanders should be *supported* where there are opportunities to attack lucrative conventional target sets. In these circumstances, joint commanders can use land forces to manoeuvre against and fix enemy ground forces (and provide targeting support) so that air power can attack before land forces close to contact. Land commanders could achieve better operational level agility by allowing more flexible control over the position of the fire support coordination line, but this in turn requires considerable confidence in friendly force tracking capabilities.

Air power's speed and reach should be exploited to create an emphasis on deep attack and interdiction wherever possible, attacking and disrupting enemy forces before they can engage in close combat. These are typically *denial* strategies, seeking to physically reduce the enemy's ability to continue the fight, or making the achievement of his ultimate objectives impossible. Adversaries will sometimes deliberately seek direct combat, in order to create casualties and undermine political or public will. In the event of engagement, armies can exploit air power in the close battle by using traditional counter-land procedures, including interdiction and close air support.

Counter-Sea Operations

Air attack provides a significant capability in the maritime environment. Land or ship-based assets may be used to support sea control operations as an integral part of the maritime campaign, in particular acting as a force multiplier and adding reach to surface and sub-surface attack capabilities: the different specialist counter-sea roles are detailed below. Like other forms of air power, maritime aviation has the capacity to shape outcomes at every level of warfare, from tactical air support of maritime operations to the strategic effect delivered by the imposition of a blockade.

Irregular Warfare

In irregular warfare, particularly when the adversary chooses to hide and fight in the urban environment, collateral damage and unintended effects are possible. Moreover, as emerging technology, such as small diameter bombs and limited blast radius warheads, increases precision and allows better control of direct effects, so the expectation increases that there will be no collateral damage. As with all forms of attack, even carefully targeted air operations may be perceived as delivering disproportionate force, and in some cultures, stand off combat is perceived as having no honour. Without the means to defend against or respond to air attack, adversaries will use information strategies to characterise this aspect of asymmetry as being a cruel overmatch that is somehow unfair.

Consequently, all air-land plans must include integrated information operations. In reality, air power creates only a small proportion of civilian casualties in irregular warfare.¹⁸ This is due to three factors: first, the relatively small number of air weapons used compared with surface based direct and indirect fire weapons; second, the standards of precision now possible with air weapons; and finally, the depth of training required of personnel operating combat aircraft. Aircrew are subject to intense pressure in combat, but often have sufficient useful detachment to exercise consistent discretion over weapon release.

PRECISION WEAPONS – COMPLEMENTARY CAPABILITIES

Land-based precision fires such as GPS-guided Multiple Launch Rocket System (GMLRS) provide land commanders with an organic, all-weather precision attack capability, albeit with limited range, a significant minimum range and a lack of mobility. Air power provides a greater range of effects – including non-kinetic attack – and is more useful where targeting is dynamic, but high discrimination is still required. Attack helicopters have greater reach and flexibility than land-based fires, with excellent potential for operations in complex and urban terrain, although losses have been suffered to small arms fire in Iraq and Afghanistan.

Most fixed-wing attack aircraft, such as Tornado GR4 and Typhoon FGR4 carry precision weapons and advanced sensors and are less vulnerable to ground threats, but need intensive coordination to be used in urban operations. They use optical and thermal targeting, linked to ground-based Fire Support Teams, to increase awareness and permit engagement of targets with a consistently low risk of collateral damage and fratricide.

¹⁸ Since the invasion of Iraq in 2003, between eleven and thirteen percent of civilian casualties have been attributable to air-delivered weaponry; surface weapons, from small arms to artillery, have been greater contributors. *The*

Human Cost of the War in Iraq: A Bloomberg mortality study 2002-2006, (John Hopkins University: Baltimore), 2007 and 'Mortality after the 2003 invasion of Iraq', *The Lancet*, 11 October 2006.

This is not to suggest that soldiers exercise any less discretion, but the airman's perspective, conferred by height and speed, buys thinking time and in contemporary operations, deliberate no-drop decisions taken against doubtful targets may be as significant, in terms of the overall campaign, as successful attacks against legitimate targets. Air attack, combined with intelligence and situational awareness, provide the means to pursue an enemy relentlessly.

Air weapons thus have significant utility in irregular warfare, but the potential effects on the population must be considered carefully; their trust must be maintained when targets are distributed amongst them.

Non-Lethal Attack

Air power has been used to identify and attack insurgent networks that are using IED in Iraq and Afghanistan, but it can also be used non-kinetically. For example, Coalition aircraft flew over 5,000 Electronic Warfare sorties to jam enemy communications in 2007, defeating trigger mechanisms and, in some cases, pre-detonating the IEDs themselves. However, ROE need to be scrutinised carefully, because of the potential for collateral damage from the triggering of explosives.

THE DELIVERY OF AIR ATTACK

Attack from the air can no longer be simply divided into tactical or strategic categories, as air power spans the spectrum of conflict in range, reach and effect. Additionally, attack is not solely kinetic, because air power can also provide a very effective lever against an opponent's cognitive domain. Attack from the air may be broken down into deep attack, counter-land and counter-sea operations, and information operations.

- **Deep Attack**
Deep Attack describes attacks conducted against targets often (but not always) deep in enemy territory and of significant, often strategic, importance. Deep attack is used to disrupt or destroy centres of gravity or other vital target sets such as leadership, command elements, war production resources, fielded forces or key supporting infrastructure. It seeks to disrupt an enemy's strategy, ability or will to wage war, or to carry out aggressive activity. It is the outcome required that defines deep attack, not the specific weapon system, delivery platform or type of target attacked.
- **Counter-Land Operations**
Counter-land operations aim to gain and maintain a desired degree of control of the land battlespace by targeting fielded enemy ground forces and the infrastructure directly supporting them, or by using the psychological effects of air power to attack the enemy's will. The overall campaign strategy and the specific circumstances of the conflict will determine how counter-land operations are conducted. The synergy of air forces and surface forces, operating as an integrated joint force, can often be overwhelming in cases where the activities of a single component alone

would not be decisive – this is the preferred method of employment. Counter-land operations fall into three mission types:

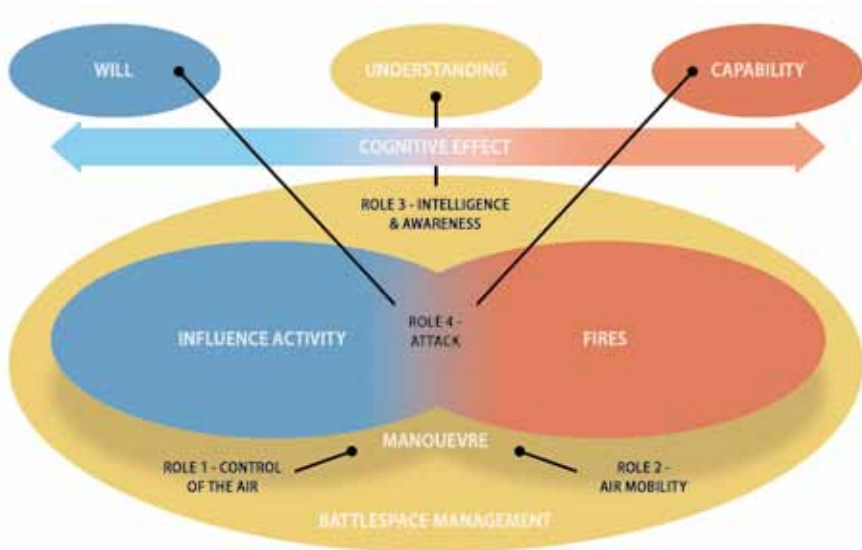
- **Air Interdiction (AI)**
AI is action to destroy, disrupt, divert or delay the enemy's surface potential before it can be used effectively against friendly forces, or otherwise achieve its objectives. It is carried out at such distance from friendly forces that detailed integration of each air mission with the fire and movement of friendly forces is not required.
- **Close Air Support (CAS)**
CAS is action by fixed and rotary wing aircraft against hostile targets requiring detailed integration with the fire and movement of friendly forces for targeting guidance and to avoid fratricide. CAS provides ground or amphibious forces with firepower in offensive and defensive operations, by day and night, to destroy, suppress, neutralise, disrupt, fix or delay enemy forces in close proximity to friendly ground forces.
- **Counter-Air Operations for Psychological Effect**
Air power is not employed solely for kinetic purposes. The psychological impact of air power, from the presence of a UAV to the noise generated by an approaching attack helicopter, has often proved to be extremely effective in exerting influence, especially when linked to information operations.
- **Counter-Sea**
Counter-sea operations extend the application of air power into the high seas or the littoral and its adjacent waters, and extend the attack range and capability of surface and sub-surface elements.
- **Anti-Surface Warfare (ASUW)**
ASUW operations are conducted to destroy or neutralise enemy naval surface forces.
- **Anti-Submarine Warfare (ASW)**
ASW operations are conducted with the intention of denying the enemy the effective use of submarines.
- **Aerial Mining**
Aerial Mining Operations are conducted to support the control of vital sea areas, by inflicting damage on an enemy's vessels or submarines to hinder operations and impede the flow of traffic through a given area.

- **Information Operations**
Information Operations are primarily non-kinetic actions taken to influence, affect or defend information, systems and decision-making. They must be integrated into air (and space) operations in the same manner as more traditional capabilities to create effects across the entire battlespace. Information Operations include:
 - **Electronic Warfare (EW)**
EW seeks control of the electromagnetic (EM) spectrum, both to enable friendly-force operations, and to deny an enemy the same degree of freedom.
 - **Influence Operations**
Influence operations affect behaviours, protect operations, communicate intent and project accurate information across the cognitive domain. The desired outcome is a change in behaviour or in an enemy's decision-making process.
 - **Computer Network Operations (CNO)**
CNO integrate the planning and employment of military capabilities to achieve desired effects across the digital battlespace. They are conducted in the information domain, consisting of hardware, software, data and human components.

THE FOUR FUNDAMENTAL AIR AND SPACE POWER ROLES AND JOINT ACTION

*The art of war is simple enough. Find out where your
enemy is. Get at him as soon as you can.
Strike him as hard as you can, and keep moving on.*

*General Ulysses S Grant,
General-in-Chief Union Army 1864 - 1868*



The Four Roles and Joint Action

This section explains how the four fundamental air and space power roles map across the Joint Action model. The core of Joint Action is the relationship between influence activity and fires; both are enabled by manoeuvre and supported by battlespace management. Taken as a whole, they can be used to undermine an opponent's will, understanding or capability by creating effects that range across the spectrum, from the cognitive to the physical.

Battlespace Management

Two air and space power functions are crucial for the success of joint operations, but as enablers rather than air and space power roles in their own right. These are PNT and air command and control; within the framework of Joint Action, they enable effective battlespace management. PNT is provided by GPS and although it is vital for many battlespace functions, including the synchronisation of secure communication networks, it is transparent to most users. Air command and control has a major bearing on the effectiveness of air power and is described in more detail in Chapter Four.

Manoeuvre

Air and space power's greatest contribution to the freedom of air and ground manoeuvre is through *Role 1: Control of the Air and Space*. Where control of the air is established, helicopters and larger fixed-wing aircraft can significantly enhance ground manoeuvre. Space control is required to guarantee international freedom of action in orbit; this is essential, as the UK depends on access to allied and commercial space platforms rather than its own resources to deliver space capability.

In the absence of offensive intra-space operations, this must be achieved through passive measures, such as reliance on the vastness of space, encryption, redundancy, hardening and diplomatic and legal means. Once a sufficient degree of control of the air has been achieved, *Role 2: Mobility and Lift*, may be employed. This makes one of the most important contributions to dispersed operations and thus to all aspects of manoeuvre.

Understanding

Role 3: Intelligence and Situational Awareness enhances a commander's understanding of an adversary, enabling the development of an effective information campaign to shape an enemy's understanding and perceptions. In this realm space power contributes importantly, supporting understanding through functions such as intelligence gathering, surveillance and reconnaissance, integrated tactical warning and attack assessments, environmental monitoring and communications transmissions.

Fires, Capability and Will

Air power delivers most of its fires through *Role 4: Attack*, but also offers non-kinetic capabilities. When properly integrated and synchronised into an operational scheme of manoeuvre, fires achieve influence through coercion, impacting principally on an adversary's capability and will. The concept of shattering an opponent's cohesion and breaking his will are rooted in the United Kingdom's manoeuvrist doctrine; this approach remains valid in irregular warfare, but the emphasis may be switched into a more discrete application of force in support of a broader campaign plan based on influence operations.

Influence and Coercion

Air and space power can create a broad spectrum of influence, from promoting international relations through managing and bounding crises to conducting direct combat operations. The evolution of planning at the strategic and operational levels of warfare (and recent experience at the tactical level) indicates a general, but not complete, shift away from an emphasis on the pure destruction of an enemy's fighting power. Where information operations once supported combat operations, influence is now dominant, requiring a more subtle application of fires and manoeuvre. The hard edge of influence is represented by coercion, which hinges upon the capability and willingness to bring offensive combat power to bear. Coercion is central to the effective employment of air power.

AIR AND SPACE POWER STRENGTHS AND WEAKNESSES IN IRREGULAR WARFARE

Strengths

Air power brings essential capabilities to bear in irregular warfare. The benefits include:

- Its capability as a force multiplier; the mobility and firepower it delivers hugely increases the capability of surface forces, permitting the ground footprint to be reduced. This may be critical if the political environment is sensitive and a major commitment of land forces is unacceptable to the local population, or to the domestic population at home.
- Its ability to bring precise and proportionate firepower to bear, maintaining the consent of the local populace.
- Its speed of response, for either kinetic or non-kinetic effect, including the delivery of humanitarian aid.
- Its ability to place manpower and material where it is required, in the most difficult terrain.
- Its unique ability to exert psychological pressure; shows of force, for example, have a significantly beneficial effect on the morale of friendly forces in addition to the cognitive impact inflicted on the enemy.
- The significant contribution it can make to building situational awareness, ranging from persistent surveillance delivered by space assets, to change detection enabled by airborne sensors, allowing pattern of life to be established in areas of interest.

¹⁹ JDP01: Campaigning.

Weaknesses

While air power makes a huge contribution to the successful prosecution of irregular warfare, it must be employed with discretion and understanding. Pitfalls include:

- The misperception that its employment is disproportionate, particularly in an urban setting, because of its destructive potential.
- A mechanistic implementation of inappropriate targeting strategies; deep attack, or air interdiction, for example, may be of limited utility where the enemy has a limited material infrastructure or access to cross-border suppliers and sanctuaries.
- The temptation to take substitution of air power for ground forces beyond sensible limits. Moreover, success in irregular warfare is only likely in a joint campaign, where the military contribution is only one of the lines of operation in a Comprehensive Approach.
- Inadequate joint planning, where air operations are added as an afterthought to a two-dimensional plan that has already been conceived, rather than being integrated from the outset.

CHAPTER 4

AIR AND SPACE COMMAND AND CONTROL

*An air force is, by reason of the nature of its work,
extremely sensitive to any misdirection.*

*Air Chief Marshal Lord Tedder,
Deputy Commander SHAEF 1944 - 1945; CAS 1946 - 1950*

Introduction

The aim of this chapter is to explain how effective air command and control is essential to the delivery of air power. The chapter will cover the United Kingdom's command philosophy, describe the principles of air command, explain how the traditional emphasis between centralised control and decentralised execution may need to be rebalanced in contemporary operations, and consider how Network Enabled Capability (NEC) may be employed to facilitate mission command. The chapter concludes by detailing the principles of integrated planning.

Command Philosophy

The United Kingdom's philosophy of command is based on mission command, which promotes initiative, decentralised command, and freedom and speed of action, yet remains responsive to superior direction.¹⁹ The underlying requirement is a fundamental responsibility to act, or in certain circumstances not to act, within the overall framework of the commander's intent, consistent with the desired end-state. Mission Command is more important than ever in the contemporary operating environment, but implementing it effectively at anything other than the most tactical of levels is challenging under current models of air command and control. The advent of NEC offers the potential to enhance the agility of air command by increasing decentralisation, without detriment to the unity of purpose essential to the success of the overall air effort.

Air Command and Control

The concept of component command is central to the joint command and control of the British armed forces on operations. The JFC will designate a JFACC to exploit the full air capabilities available to the joint force; his role is to recommend how the Air Component should be employed, and he is responsible for planning, coordinating, allocating, tasking, executing and assessing air operations to accomplish assigned objectives. Because of the theatre-wide scope of air operations, the JFACC will typically maintain the same operational perspective as the JFC and, wherever possible, should collocate his headquarters with both the

JFC and the Joint Force Land Component Commander (JFLCC), a well-established principle that has nevertheless proved to be difficult to implement in recent conflicts.

THE PRINCIPLES OF COMMAND

Because air power can be used to pursue strategic, operational or tactical objectives in any combination, or all three simultaneously, unity of purpose, achieved through selection and maintenance of the aim, is particularly important:

- **Unity of Command**
Unity of air effort is most likely to be achieved when command is exercised at the highest practicable level, where the relative priorities of combined and joint demands on air and space assets can best be assessed.
- **Centralised Planning**
Centralised planning is essential to ensure that integrated operations meet the JFC's overall intent, avoid mutual interference and that high value assets can be concentrated at the critical time and place, to achieve decisive conditions.
- **Centralised Control**
Centralised control gives responsibility and authority for planning, directing and coordinating air capabilities to a single commander, maximizing operational effectiveness and avoiding duplication of effort.
- **Decentralised Execution**
Decentralised execution is the delegation of execution authority to responsible and capable subordinate commanders, providing agility and catering for the uncertainty and fluidity inevitable in all operations.

The JFACC exercises command through a Combined Air Operations Centre (CAOC), employing the processes of *centralised control*, primarily achieved through the air tasking cycle, and *decentralised execution*. Mission command is most prevalent at the level of package commanders and individual sorties. Centralised control has proved to be very effective for major combat operations under unified command; it underpins unity of purpose and accurately reflects the commander's intent, which is important where the ability to provide the situational awareness and understanding required to permit deeper delegation and further decentralisation may be limited.

²⁰ Boyd's Decision Cycle or OODA Loop comprises four steps: Observe, Orientate, Decide, and Act.

The Balance between Centralised Control and Decentralised Execution

Centralised control through the CAOC ensures that sufficient, appropriate resources are made available to meet requirements, providing allocation and apportionment of high value assets and coordinating competing demands from multiple theatres of operation. It is important that decentralisation – allocating these assets to the lowest practicable level – then follows, to permit the best possible linkages to be developed with the other components, increasing the opportunities for air power to be fully integrated into the joint campaign and to act as a key tool in shaping, up at least to the operational level. Where operational circumstances are changing rapidly, typically in irregular warfare, or where conventional warfighting operations are unfolding at pace, constant requests for tactical air support may be expected, and in these situations an emphasis on decentralised execution of missions using assets allocated by the CAOC will deliver the most agile response.

The Land Perspective of Air Command in Irregular Warfare

Irregular warfare is complex, fluid and will be invariably conducted by light forces, which will often be thinly dispersed over difficult terrain. Tribal structures may be so complex that every village can effectively represent a discrete campaign, and operational (potentially strategic) issues are routinely addressed at tactical levels of command. In this environment, land commanders require assurance that requests for support will be met quickly and, if necessary, precise attacks will be delivered with low risk of collateral damage or fratricide. In this context, a preference for organic fire support, or permanently-assigned fixed wing aircraft, while often not practicable, is understandable.

ORGANIC AIR POWER?

The United States Marine Corps (USMC) has its own organic air power, providing a very high assurance of support from airmen with a comprehensive understanding of ground combat operations. However, this did not prove to be a particularly effective model for the application of air power in the 2003 Iraq War; flexing high-value USMC assets to service higher priority tasks elsewhere in theatre was very difficult, and the perception that organic capabilities were always available to the Marines sometimes inhibited a reciprocal flow of air support when it was urgently required.

The Air Perspective

The air perspective is different. With limited numbers of capable aircraft in high demand, the need to deliver assurance and timeliness of air support to the land component must be balanced against the requirement to retain the flexibility to concentrate air power where it will be most effective, or where it is most needed, either within, or between, theatres. The challenge for airmen is to determine how the flexibility and economy of force provided by the philosophy of centralised control and decentralised execution can be successfully employed in irregular warfare, where the Land Component is primarily applying decentralised planning and execution, requiring air power to respond rapidly to situations not of

its own making. This necessitates an acknowledgement that, in some circumstances, centrally controlled air power may be allocated to specific ground operations for finite periods, to improve responsiveness and assurance; there is also clearly considerable value in nominated land and air units integrating as task-organised teams for certain operations.

However, there will be other periods when centralised control is more appropriate. The earlier that the Land Component's requirements are integrated into the air planning process, the more likely it is that the right balance – and therefore the desired levels of assurance – can be achieved between centralised and decentralised control and execution.

Tactical responsiveness can only be achieved through the coordination of competing requirements and the careful orchestration of aircraft and airspace; otherwise, consequences might include the risk of fratricide or mid-air collision. Coordination is achieved through the air tasking cycle, which may seem too rigid and bureaucratic for irregular warfare in anything other than deliberate operations.

However, the process is surprisingly flexible if it is properly understood and joint planning has been conducted from the outset, so that windows of opportunity for responsive air power have been built into the Air Tasking Order (ATO). In practice, the placing of high-calibre and qualified liaison officers in reciprocal headquarters has proved to be the key to ensuring that the right degree of flexibility is delivered.



Adaptive Air Command on operations

Adaptive Air Command

NEC has the potential to profoundly affect how air power is executed, by disseminating shared awareness and understanding, thus increasing the scope for decentralised planning and execution, but without loss of control, that is essential if scarce assets are to be used most efficiently. NEC is not a new concept; what has changed is the extent and complexity of the requirement, with the need to integrate national and multinational force elements across all environments, using disparate operating systems, information resources, communications media and software tools. It is a means to an end; what is important is the way it is used to facilitate adaptive command.

DECISION SUPERIORITY

The outcomes of battles are not solely determined by numbers, but more often by the quality of operational and tactical decision-making. In 1940, the RAF's Fighter Command benefited from an integrated air defence system, based on a networked concept dating back to 1917. This was developed into a genuinely NEC, as capabilities such as Radio Direction Finding (radar) and radio became available in the interwar period. Data from radar stations and Observer Corps posts was collected, filtered, fused, analysed and disseminated, using a network of land-lines and ground-to-air radio. This early example of NEC enabled command and battlespace management through shared situational awareness, and resulted in battle-winning decision superiority for Dowding and Park, the two principal RAF commanders.

NEC may be used simply to speed up the existing Air Tasking Cycle. There is, however, a danger that compressing the decision cycle²⁰ may in itself result in undesired consequences if *observe* and *orientate* are truncated in order to move as quickly as possible to *decide* and *act*; in this context, a focus on *time-sensitive targeting* (where speed is essential to prosecute fleeting targets), as opposed to *mission-sensitive targeting* (where the ultimate outcome is more important than the speed of prosecution) may be counterproductive.

Instead, the JFACC has the option to capitalize on the enhanced shared situational awareness provided by NEC to promote mission command, securing a much more responsive and agile delivery of air and space power. The JFACC will retain responsibility for ensuring that his subordinates are aware, and comply with, his intent and priorities. However, he may delegate either functional or regional responsibilities to responsible commanders, who in turn may empower other subordinates in the lower tiers of command, as either desired effects, or the plans of other components, demand.

This model is not dissimilar to familiar functional or tactical commands, such as RAF's Fighter Command in the Second World War, or the Allied Tactical Air Forces that were operated throughout the Cold War. The difference is that increasing degrees of NEC permit mission command to be extended, with confidence, down through the tiers of command. Desired objectives and effects need to be adequately identified, so that subordinate commanders can align their unit tasks to deliver them once the CAOC has coordinated, apportioned and allocated. The emphasis is on the JFACC to ensure that the model meets his needs, reflecting the circumstances of the conflict and the degree of shared situational awareness genuinely available.

The amount of integration and decentralization required will also vary according to the air power role: joint operations at the tactical level are likely to be very closely integrated with the other components, control of the air operations will tend to require less integration and deep operations – strategic air lift, reconnaissance or deep attack - less again. In sum, this construct allows air power to shape operations at the strategic and operational levels in irregular warfare, rather than being used as a centrally allocated, but purely tactical response, in the form of airborne surveillance and aerial artillery.

The Planning Focus

Most of the Land or Maritime Component's requirements for air support will be achieved through apportionment and timely interventions at each successive phase of the air planning process. However, air, land and maritime planning horizons are different and effective joint planning can be difficult, particularly where headquarters are remote and, for example, land operations are being conducted at brigade level or below. Assured air power can be achieved, but only if it is integrated at the outset of strategic thinking and throughout operational planning. Sufficient planning focus must be maintained at the highest level in theatre, typically through the battlefield coordination detachment embedded in the CAOC, to set the conditions for successful interventions later in the air planning process. However, detailed planning must be conducted at the lowest practical level, using an embedded air staff.

KEY PLANNING PRINCIPLES

- **Optimise Headquarters for Situational Awareness**
The campaign must be integrated at the level best suited to respond to tactical events; while the CAOC may be most appropriate for major combat operations, in irregular warfare, for example, integration of information at brigade level may be more effective.
- **Lead the Planning Process**
Where possible, commanders should communicate intent personally and be prepared to intervene to maintain the initiative; this also guards against a staff-driven plan. The personal relationship between senior joint commanders is vital; the example they set will be followed by their subordinates. For example, airmen should be ground-minded and soldiers air-minded, achieved through joint education, shared experience and mutual respect.
- **Form Small Decision-Making Teams**
Small groups promote agility and reduce the tendency to make the planning process staff or consensus-driven.
- **Collocate Component Headquarters**
History has repeatedly demonstrated the value of collocation in resolving tension, exploiting different perspectives and transcending the naturally dissimilar tempo of air, land and maritime

planning cycles. Where headquarters cannot be physically collocated, the planning effort still must be, for example by using mobile planning teams for deliberate planning.

- **Delegate Authority for Detailed Planning**

Commanders must delegate authority to the lowest practical level, exceptionally at the expense of centralised control, but without abrogating responsibility.

- **Sense Battle Dynamics**

If a commander is to make his intent understood and gain a feel for tactical dynamics, despite modern communications, he must tour the battlefield. This is naturally more difficult for air commanders, whose span of geographical control is often enormous, but NEC will facilitate contact when absent from their headquarters.

- **Embed Liaison Officers**

At coalition level, senior liaison officers can resolve tensions and achieve influence. The principle of embedding expert and qualified land and air staffs in counterpart headquarters is also important when collocated; it is vital when they are geographically separated.



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