Ministry of Defence

Joint Doctrine Publication 0-30

UK Air Power

Third Edition

Joint Doctrine Publication 0-30

UK Air Power

Joint Doctrine Publication 0-30 (JDP 0-30) (3rd Edition), dated September 2022, is promulgated as directed by the Chiefs of Staff

Head Doctrine

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Foreword

The last decade has seen dramatic technological change set against a backdrop of significant geopolitical challenge in a world in which information and data have transformed the way we interact. Traditional distinctions between peace and war have become dangerously blurred and the competitive nature of international relations in this information age requires us to evaluate rapidly and respond decisively to events. Air power, with its ability to influence audiences through both hard and soft power, supports that requirement unequivocally and offers flexible, timely, scalable, and responsive options to the UK government in support of national security objectives.

It is critical that those charged with employing and directing the use of air power do so from a position of knowledge and common understanding. Doctrine provides us with an agreed upon and operationally relevant body of best practices, principles and beliefs that articulates how we fight today. It is our collective wisdom drawn at considerable cost from operations, training, and experimentation. It must not be allowed to become dogma.

The UK maintains highly credible air power but cannot provide the full breadth of air power capabilities and enablers to generate, coordinate and sustain the mass required to conduct high-intensity operations alone. For that reason, we must always be innovative in our development and application of air power, and the way we integrate it across all operational domains and with our international allies and partners.

While the enduring principles of air power remain constant, maintaining relevance in a fast-changing world remains key. Our air power doctrine has to evolve continually to meet the challenges of the current geopolitical context and the increasingly complex joint and combined operating environment. This latest edition of JDP 0-30, *UK Air Power*, should be considered essential reading for a wide audience across Defence, and desirable reading for our partners across government – I commend it to you.

Air Chief Marshal Sir Mike Wigston KCB CBE ADC
Chief of the Air Staff

Preface

Purpose

1. Joint Doctrine Publication (JDP) 0-30, *UK Air Power* is the UK's keystone air domain doctrine publication. Whilst JDP 0-01, *UK Defence Doctrine* provides the broad principles and philosophy underpinning the use of UK Armed Forces, and the North Atlantic Treaty Organization's (NATO's) Allied Joint Publication (AJP)-3.3, *Allied Joint Doctrine for Air and Space Operations* focuses on the application of NATO air power, JDP 0-30 is focused specifically on UK air power. It brings together higher-level doctrine, government policy and enduring air power knowledge and experience to provide a basis for understanding the utility of the air domain. JDP 0-30 highlights the strengths and discusses the limitations of air power and considers those factors which, in broad terms, enable the effective employment of air power. It also explores its relationship with the other operational domains and its interdependence with the other elements of national and military power, as well as with multinational and private sector partners.

Context

2. This third edition of JDP 0-30 continues the joint theme that runs through the previous editions, whilst reflecting the UK's adoption of an integrated approach to operations. Previous versions of JDP 0-30 have encompassed both air power and space power. For this version, due to the increasing maturity of the space domain enterprise across UK Defence, it has been decided to split air power and space power into separate doctrine publications.[1]

Audience

3. This third edition of JDP 0-30 is a simple and concise explanation of air power, which seeks to inform a wide audience. It is designed to highlight the strategic utility of air power and its contribution to national power. JDP 0-30 should be of value to all departments of the Ministry of Defence (MOD), joint commanders and staffs at all levels, the single Services, the broader defence community and other government departments, as well as partners and allies of the UK.

1 For more information on space power, see JDP 0-40, *UK Space Power*.

Structure

4. JDP 0-30 is divided into four chapters with a supporting lexicon. An outline of what is covered in these chapters is detailed below.

a. **Chapter 1 – An introduction to air power.** This chapter provides an overview of the basics of air power and introduces air capabilities. It discusses influence and power from the air and places air power into a strategic context.

b. **Chapter 2 – The roles of air power.** This chapter discusses in detail the enduring and fundamental roles of air power. It also introduces the key and critical enablers of electromagnetic warfare and command and control.

c. **Chapter 3 – Command and control.** This chapter provides more detail on the command and control of air power. This includes discussing the principles of command and control, UK capabilities and the planning and tasking of air power.

d. **Chapter 4 – The employment of air power.** This chapter considers the application of UK air power in the context of joint operations, cross-government integration and integrated action. It provides an overview of air power enablers and outlines air power's utility.

Linkages

5. JDP 0-30, *UK Air Power* is the keystone air domain doctrine publication within the joint doctrine architecture, sitting below JDP 0-01, *UK Defence Doctrine* and alongside other joint domain-centric doctrine: JDP 0-10, *UK Maritime Power*; JDP 0-20, *UK Land Power*; JDP 0-40, *UK Space Power*; and JDP 0-50, *UK Defence Cyber and Electromagnetic Doctrine*. It reflects current UK government and MOD policy, in particular the 2021 *Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy*. JDP 0-30 is coherent with AJP-3.3, *Allied Joint Doctrine for Air and Space Operations*. Whilst reflecting the joint context, it is also coherent with the Royal Air Force's capstone doctrine, Air Publication (AP) 3002, *Air and Space Warfare*, which provides more detail of air and space power.

Contents

Chapter 1

This chapter provides an overview of UK air power, outlining its enduring utility in an era of persistent and complex competition. It introduces the attributes and roles, and provides a definition of UK air power. The chapter further provides a brief introduction to air capabilities, discusses influence and power from the air, and concludes by placing air power into context.

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> The fundamental purpose of military air power is achieving mastery of the air.

Air Publication 3002, *Air and Space Warfare*

Chapter 1

An introduction to air power

Section 1 – The basics of air power

1.1. The UK government uses four instruments of power in pursuit of national policy goals; these are the diplomatic, information, military and economic instruments.[1] The military instrument of national power spans the operational domains[2] of maritime, land, air, space, and cyber and electromagnetic. Since its inception, air power has made a vital contribution to the UK military instrument, helping to maintain the freedom of the nation and to project national influence when called upon.

1.2. In the UK, the Royal Air Force (RAF) has the conceptual lead for warfare across the air domain, thus the structure of the UK Armed Forces predominantly focuses the generation and employment of air power around the RAF. However, the Fleet Air Arm of the Royal Navy and the Army Air Corps and other aviation elements of the British Army also contribute significantly to the delivery of UK air power.

Air power is defined as:

The ability to use air capabilities in and from the air, to influence the behaviour of actors and the course of events.[3]

1.3. By the end of World War 1, the impact of air power was beginning to be felt across all forms of warfare. The enduring characteristics of height, speed and reach had been established and the fundamental roles of air power codified. By World War 2, no military activity could overlook the significance of air power; when properly targeted and coordinated, it proved influential – often decisive – in all theatres of the war. During and after World

1 See Joint Doctrine Publication (JDP) 0-01, *UK Defence Doctrine* for a full explanation of national power, national security, the national interest and national strategy.
2 An operational domain is defined as: a specified sphere of capabilities and activities that can be applied within an engagement space. NATOTerm.
3 JDP 0-01.1, *UK Terminology Supplement to NATOTerm*.

War 2, the technological development of air power accelerated dramatically, with investment in airframe, engine, sensor and weapon technologies, which enabled operational and tactical developments across all operational domains. Air power is now recognised as an extremely responsive and scalable element of the military instrument of national power.

The characteristics of air power

1.4. At the heart of air power are its characteristics. The hard-earned experience of over a century of military air power has confirmed these to be: height, speed and reach.

a. **Height** enables the observation, and delivery, of activities in the land and maritime environments. Three-dimensional manoeuvre, facilitated by height, is also an important survivability factor.

b. **Speed** enables the rapid and responsive projection of power, which permits missions to be completed quickly, generating tempo and offering the potential to exploit time. At the tactical level, high speed flight reduces exposure to hostile fire and increases survivability, whilst the ability to fly at low speed allows extended loiter time.

c. **Reach** enables audiences, actors, adversaries and enemies to be influenced, regardless of their location. Whilst 70% of the world's surface is covered by water, 100% of it is covered by air. This provides air power with unrivalled reach, usually unimpeded by terrain, enabling distant or isolated targets to be prosecuted and potential restrictions to be circumvented.

1.5. While height, speed and reach represent fundamental air power characteristics in their own right, they also act together synergistically to produce additional characteristics. These additional characteristics are: agility, ubiquity[4] and concentration.

a. **Agility.** Agility is a blend of responsiveness, adaptability, flexibility and resilience. Air power is inherently agile, a characteristic amplified by the multi-role capability of many platforms. Agility permits aircraft to move quickly and decisively between the strategic, operational and tactical levels of operations, and to move across and between

4 Ubiquity is defined as: present, appearing, or found everywhere. *Concise Oxford English Dictionary* (COED).

operational theatres, sometimes during the same mission, and to act as a manoeuvre force in its own right.

b. **Ubiquity.** Height, speed and reach, combined with the agility of air capabilities, provide air power with ubiquity. This is because threats can be posed or countered across a wide area, with significantly fewer constraints than exist in the land and maritime environments.

c. **Concentration.** Speed, reach and agility allow air power to concentrate military force in time and space, when and where it is required. Precision weaponry means that effects can be concentrated without the requirement for combat mass. The psychological and physical shock imposed by the concentration of effects is often crucial in achieving successful operational outcomes.

1.6. In combination, air power's characteristics enable the delivery of significant combat power. Speed, reach and height, coupled with modern sensor technology, precision weaponry and, for a number of aircraft, the ability to remain aloft for extended periods, provide the capability to shape and influence the operational environment. Moreover, the agility and ubiquity of air power mean that it can be used to revisit points of interest within short response times or cover multiple joint operations areas in one sortie, thereby delivering an additional degree of persistence. Equally, air power can be used fleetingly and with a very small footprint to offer covertness, discretion and deniability, should these be required.

Atlas C-1 (A400M) takes off from RAF Akrotiri

1.7. These characteristics mean that air power is ideally suited to create effects across the entire spectrum of operations. It can, for example:

- enable freedom of movement;
- deliver humanitarian aid;
- deliver deliberate interventions through attack operations;
- reassure allies; and
- deny and/or deter adversary activity.

The air environment

1.8. The air environment is an unforgiving one and, thus, aircraft are designed to meet the challenges of operating at a variety of altitudes, temperature extremes and speed ranges. The physics and aerodynamic principles associated with the air environment also complicate the design process for aircraft.

1.9. Most crewed aircraft are able to withstand or avoid the extreme weather that can occur in the air, but as the majority of uncrewed aircraft tend, currently, to be lighter, slower and less robust than their crewed counterparts they can be more susceptible to such conditions. The laws of physics dictate that the performance of some aircraft, sensors and weapon systems are also adversely affected by extremes of poor weather. However, the versatility offered by an array of sensors across the electromagnetic and acoustic spectra provides an acceptable level of resilience and enables agility.

Voyager KC Mk2, in VIP livery, refuelling F-35B Lightnings and a Typhoon FGR4

Limitations of air power

1.10. Air power does have its limitations. But, like its strengths, these are relative rather than absolute and need to be understood in that context. Some of the limitations are explored below.

a. **Impermanence.** Aircraft cannot yet stay airborne indefinitely, although some uncrewed platforms are now capable of long loiter/mission times. Although the use of air-to-air refuelling can extend the range and endurance of aircraft, no means have yet been found to rearm 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 activities may have to be repeated to sustain the desired degree of influence or effect. Whilst multiple aircraft cycling through the same task can provide a degree of permanence, in certain circumstances impermanence may be an advantage; for example, it may avert the potential military and political liabilities that result from an extended land-based presence in a foreign country.

b. **Limited payload.** The payloads that can be carried by aircraft may be limited in comparison with ships or land vehicles. However, air power trades off load-carrying capability against speed and reach, as well as the ability to access areas that surface forces cannot physically access. A small payload delivered quickly may be of far more value in influencing a critical situation than a larger one deployed much later. Air power often provides the only means of creating effects at a point of crisis rapidly enough to meet policy objectives.[5]

c. **Fragility.** Structurally, aircraft are highly stressed and built to be as light as practicable, carrying little or no armour protection; thus, relatively low levels of battle damage may have a catastrophic effect. However, structural fragility must not be confused with vulnerability in the air, where survivability is achieved by the exploitation of speed, height and manoeuvrability.

d. **Cost.** Many military aircraft use cutting-edge technology, which, inevitably, comes at significant financial cost. This cost must be balanced against the multiple and adaptive capabilities delivered; indeed, low-cost uncrewed aircraft may offer an expendable capability.

5 These effects could be delivering personnel, equipment or humanitarian aid, or dropping munitions.

Moreover, air power can, in certain situations, offer alternative policy options to the large-scale commitment of land forces, with the heavy financial and human consequences that this frequently entails.

e. **Basing and overflight.** All forms of military power depend on basing, support and protection; aircraft are no exception. Air power's requirements for access, basing and overflight rights are often cited as a weakness; however, the UK uses its diplomatic influence to mitigate this weakness. Consequently, gaining the support of allies, partners and friendly nations has rarely proved to be a significant problem. The use of carrier-enabled power projection also mitigates the reliance on land basing of some air assets.

f. **Weather.** Historically, air power was constrained by night and poor weather. Poor weather may still create some difficulties, but modern technology means that the majority of military aircraft can now operate in all light conditions, day and night, regardless of weather conditions. Indeed, advanced navigation equipment, sensors, targeting systems and weaponry mean that night and poor weather may give UK air power distinct advantages when facing an adversary lacking these capabilities.[6]

Section 2 – Air capabilities

1.11. Air capabilities naturally centre on aircraft, which the North Atlantic Treaty Organization (NATO) defines as: any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.[7] This definition therefore includes fixed-wing, rotary wing and tilt-rotor aircraft, both crewed and uncrewed. Whilst the overall number of UK military aircraft has decreased over the past two decades, the capabilities of individual aircraft types have developed significantly, notably in regard to enhanced precision attack capabilities, intelligence, surveillance and reconnaissance (ISR) sensors, low-observable technology and data link connectivity. Consequently, more aircraft types are now capable of conducting multiple air power roles during a sortie, often simultaneously. This enhances the inherent flexibility of air power and offers the operational commander a tailored response to evolving circumstances and an array of capabilities that can rapidly transition between tasks.

6 This paragraph refers to terrestrial weather, for the impact of space weather on air operations see JDP 0-40, *UK Space Power*.
7 NATOTerm.

Puma HC2 formation as part of celebrations marking 50 years of Puma service with the RAF

Crewed aircraft

1.12. Crewed aircraft continue to provide the bulk of UK air power capabilities. Whilst uncrewed aircraft technology continues to develop at a rapid pace, the presence of an on board crew currently remains essential to successfully execute the majority of core air missions; this is especially the case within a contested environment where command and control will be limited, high energy combat manoeuvring may be necessary or close tactical coordination between a large number of aircraft may be required to achieve the necessary combat mass. Below the threshold of armed conflict, the use of crewed aircraft in the air mobility role ensures regulatory requirements concerning passenger safety are met whilst larger ISR aircraft such as the UK's RC-135 Joint Rivet carry a multidiscipline crew able to exploit the information gathered in real time. Whilst crewed aircraft carry with them an inherent risk to the crew that cannot be eliminated, particularly within high-threat environments, currently they represent the most flexible method of delivering decentralised execution of air tasks across the broadest set of probable scenarios.

1.13. Crewed combat aircraft are generally categorised according to their 'generation', which broadly reflects their capabilities. A generational shift in combat aircraft occurs when a technological innovation cannot be incorporated into an existing aircraft through upgrades and retrofits. There are

currently five broadly accepted generations, although most NATO air forces are now equipped with fourth and fifth generation aircraft.

a. **Fourth generation.** Fourth generation aircraft are those designed to bridge the gap between the developments of the 1960s and 1970s and those entering service after 2000. Key characteristics include: high manoeuvrability and supersonic dash performance; fly-by-wire controls; mechanically scanned radar; and a look-down, shoot-down air-to-air capability. There are over 46 individual types of fourth generation aircraft in the world, including the RAF's Typhoon aircraft.[8]

b. **Fifth generation.** Fifth generation aircraft combine new developments such as thrust vectoring, composite materials, supercruise (the ability to cruise at supersonic speeds efficiently), low-observable technology, advanced electronically scanned radars and sensors, and integrated avionics to greatly improve crew situational awareness. There are only five operational fifth generation aircraft types in the world, including the UK's F-35B Lightning II.

Uncrewed aircraft

1.14. There is, after over a century of crewed flight, a broad understanding of the variety, operation and regulation of crewed aircraft; however, the past couple of decades have seen an almost exponential increase in the development, capability and use of uncrewed aircraft. Whilst this publication seeks to reflect the normalisation of the operation of uncrewed aircraft, there are some areas in which uncrewed aircraft differ from crewed that merit inclusion. These areas are classification, terminology and legal aspects, which are discussed below.

1.15. Due to the lack of a requirement to accommodate a human being, uncrewed aircraft can be significantly smaller than crewed aircraft, thus the range of sizes can be greater than that of crewed aircraft. This led to a requirement to categorise uncrewed aircraft to provide a reference tool for the procurement, regulation and operation of them. The UK uses both NATO[9] and UK Military Aviation Authority[10] classifications of uncrewed aircraft.[11]

8 Although designed as a fourth generation aircraft, the Typhoon has been enhanced over recent years with upgrades to avionics and weapons and is now referred to as a 4.5 generation aircraft.
9 AJP-3.3, *Allied Joint Doctrine for Air and Space Operations*, Edition B, Version 1, Figure 4.2.
10 Military Aviation Authority Regulatory Article 1600.
11 NATO uses the terms 'unmanned aircraft' and 'unmanned aircraft system'.

Terminology relating to uncrewed aircraft

The UK uses the following definitions. The UK definitions are new but aligned as closely as possible with the NATO Agreed definitions.

uncrewed aircraft
An aircraft that does not carry a human operator and is operated remotely using varying levels of automated functions.
Notes 1. Uncrewed aircraft can be expendable or recoverable.
2. Uncrewed aircraft may carry a lethal or non-lethal payload.
3. Cruise missiles are not considered uncrewed aircraft.
(Joint Doctrine Publication (JDP) 0-01.1)

uncrewed aircraft system
A system whose components include the uncrewed aircraft, the supporting network and all equipment and personnel necessary to control the uncrewed aircraft. (JDP 0-01.1)

remotely piloted aircraft
An uncrewed aircraft that is controlled from a remote pilot station by a pilot who has been trained and certified to the same standards as a pilot of a crewed aircraft. (JDP 0-01.1)

remotely piloted aircraft system
A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design. (NATOTerm)

The terms automated and autonomous are often used and discussed in relation to uncrewed aircraft, therefore it is important to understand these terms and how they relate to uncrewed aircraft systems. The NATO Agreed definitions are as follows.

automated
Pertaining to a system that, in response to inputs, follows a predetermined set of rules to provide a predictable outcome. (NATOTerm)

autonomous
Pertaining to a system that decides and acts to accomplish desired goals, within defined parameters, based on acquired knowledge and an evolving situational awareness, following an optimal but potentially unpredictable course of action. (NATOTerm)

1.16. Whilst definitions can vary, the key difference is that an automated system is capable of carrying out complicated tasks but is incapable of complex decision-making, whereas an autonomous system is capable of deciding a course of action without depending on human oversight and control. There is no doubt that automated systems are becoming more complex and sophisticated.

1.17. There is much public and academic debate around the definitions of automated and autonomous when applied to weapons systems. Lethal autonomous weapons systems are the subject of discussion at the United Nations (UN) under the Convention on Certain Conventional Weapons; however, there is no international agreement over the definitions or characteristics of these systems.

1.18. Fully autonomous weapons systems – systems with no human involvement at all – currently do not exist. Due to the inherent unpredictability of a fully automated system's decision-making, it is unlikely that rational commanders and politicians will want to employ such systems as this unpredictability could impede and limit their decision-making across the levels of operations. The growing recognition that narratives and information are of increasing importance further underlines this reluctance to hand control of lethal force to fully autonomous systems – no matter how sophisticated they may become.

1.19. All UK uncrewed aircraft and associated systems are automated to varying degrees, but none of them are fully autonomous. The UK does not possess armed autonomous aircraft systems, and has no intention of developing them. The UK government's policy is clear that the operation of UK weapons will always be under human control as an absolute guarantee of human oversight, authority and accountability. Whilst weapon systems may operate in automatic modes, there is always a person involved in setting appropriate parameters.

SkyGuardian (MQ-9B), due to enter RAF service in 2024 as the Protector RG Mk1, during a visit to its future operating base at RAF Waddington

Legal, moral and ethical aspects of uncrewed aircraft operations

1.20. Arguments against using uncrewed aircraft are centred on concerns that they will be misused or used illegally. Such concerns are not unique to uncrewed air systems. All such systems are subject to the same requirement for legal review[12] before their entry into service and any use of armed force by such systems will always be consistent with the applicable law; for example, the law of armed conflict that applies in the context of an armed conflict. All missions, including attack, are conducted under exactly the same rules of engagement and legal authority as crewed missions.

1.21. There are frequently voiced concerns about using military uncrewed aircraft for attack missions, specifically focusing on the morality and ethics of a human not being present in the platform that is creating a destructive and potentially lethal effect. These concerns are that the range and relative safety of the remote operators will in some way reduce their awareness, empathy, humanity and observance of legal and political constraints. However, it has been noted that removing the physical and mental challenges of crewed flight, particularly the high workload associated with single-seat aircraft, increases the operator's capacity to make informed decisions. Operators have access to

12 In accordance with Article 36 of Additional Protocol I to the Geneva Conventions.

legal and political advisers during armed missions to ensure that their activities comply with the law of armed conflict, published rules of engagement and with policy and political intent.

1.22. Uncrewed aircraft increase the utility of air power. This is because they expand the range of options available for action due to the reduced risk to personnel compared to the personnel survivability concerns when employing a crewed aircraft in a high threat environment.

Section 3 – Influence and power from the air

1.23. Political, military and economic credibility, together with a coherent diplomatic agenda, play a large part in the UK's ability to influence.[13] Power is the capacity to influence the behaviour of people or the course of events and it underpins the ability to influence. The UK applies power across the instruments of national power to achieve policy goals by using smart power, which is a blend of 'hard' and 'soft' power. These are described below.

a. **Hard power.** Hard power employs military capability and economic strength to achieve the desired behaviours of states, groups or individuals, or to directly change the course of events. Those using hard power seek to coerce opponents to adopt a course of action that they would not otherwise choose themselves. The military and economic instruments are important sources of hard power and deterrence, supported by the diplomatic and information instruments. The difference between deterrence and coercion is important. Both are aspects of hard power but deterrence aims to dissuade a course of action whilst coercion aims to encourage a course of action. An air power contribution to hard power activity could be the delivery of a precision-guided weapon by a combat aircraft employed in the attack role.

> The key to understanding air power is recognising its ability to influence a wide variety of audiences, through both hard and soft power.

13 JDP 04, *Understanding and Decision-making*.

b. **Soft power.** Soft power is the ability to persuade or encourage others to adopt an alternative approach primarily through cultural and ideological means or by encouraging emulation. Soft power is generally slower and more difficult to employ in a targeted way. Much soft power lies outside a democratic government's control, presenting a challenge to its generation. Therefore, applying soft power demands: investment over time; clear, consistent communication strategies and measures of effectiveness; and a developed understanding of the intended audience and their societal codes, beliefs and cultures. Diplomatic and informational capabilities underpin the effectiveness of soft power. Soft power is important to the UK. The UK's soft power, the size and depth of its global connections and the trust we enjoy, has a direct impact on our prosperity and security. The military is generally considered the quintessential instrument of hard power, but it has important soft power uses, for instance, air power can contribute to soft power activities through, among other things, delivering training to another nation as part of Defence engagement or participating in multinational exercises.

1.24. A variety of military options can be used to influence the behaviour of audiences and the course of events, and although air power can be used independently, it primarily seeks to create effects and exert an influence in other operational domains. It is therefore inherently integrated and manoeuvrist[14] across all levels of operations, and the desired effects must be synchronised across the operational domains, not just within the air domain. Similarly, operations in the maritime, land, space, and cyber and electromagnetic domains all have the ability to influence events in the air domain.

Political aspects

1.25. Air power offers policymakers an agile, timely and focused capability that can be highly effective in resolving or averting a developing crisis. It can also potentially negate the requirement to deploy a larger force over a broader timescale by land or sea. By minimising or removing the requirement for land forces, air power can make it easier to commit militarily in politically challenging circumstances. Its speed, mobility and precision combine to make it an attractive element of the military instrument of national power. Speed is a particularly attractive feature because it enables air power to rapidly accomplish political and military objectives, for example, by striking at an adversary's vulnerabilities or by delivering humanitarian aid in support of an ally.

14 The three tenets of UK military doctrine are: integrated action, the manoeuvrist approach and mission command. JDP 0-01, *UK Defence Doctrine*, 6th Edition.

Air support to humanitarian relief activity – Operation Ruman

Operation Ruman was the UK's military contribution to the international relief effort in the Caribbean Islands, which were left devastated by Hurricane Irma in 2017. RAF Voyager, C-17 and A-400M aircraft departed the UK within hours of the incident to provide immediate relief to people who had seen their homes destroyed. They carried over 300 UK military personnel, including 200 Royal Marines, engineers and specialist personnel from all three Services. Urgently needed medical supplies, emergency shelter kits, rations and clean water were also flown to the area. Puma helicopters were transported to the region to allow hub and spoke operations to be conducted from the UK joint task force base in Barbados. In addition, embarked in Royal Fleet Auxiliary Mounts Bay was a Royal Navy Wildcat helicopter, which was used to conduct reconnaissance flights of the area and more air power arrived within days, including RAF Chinooks, on board HMS Ocean. As well as satisfying the humane and moral requirement to help those in need, Operation Ruman signalled the UK's support for the region through a rapid response that was largely enabled by air power.

1.26. Air power's agility means the scale and scope of operations can be rapidly escalated or de-escalated in response to a change in political guidance or political strategic objectives, from delivering humanitarian aid at one end of the spectrum to full-scale warfighting at the other.[15] It can also be an effective means of achieving objectives by avoiding the military and political liabilities that can arise from an extended land-based presence in a foreign country. Consequently, since the end of the Cold War, air power has played a major role in state responses to conflict.

Legal aspects

1.27. Each nation state has sovereignty over the airspace above their territory.[16] Therefore, although the attributes of air power provide it with the theoretical ability to reach any point on Earth, the permission of sovereign territories is required to operate within their airspace. Exceptions to this requirement do exist, for example, if measures involving armed force are permitted by a UN Security Council resolution or when acting in self-defence in accordance with Article 51 of the UN Charter. The UK will always operate in accordance with its legal obligations, including the law of armed conflict when applicable.[17]

1.28. All UK military aircraft are operated in accordance with domestic and international law. As detailed above, uncrewed aircraft system missions will be planned and conducted in accordance with the same rules of engagement and other legal requirements as applies to crewed aircraft.

Economic aspects

1.29. Freedom of navigation in the air environment enables international trade and helps to secure international safety. As our national security depends on our economic security, the ability to influence and shape what happens in the air environment is of fundamental importance to not only our national security but also our continued prosperity. As an island nation, the UK relies on its air lines of communication for this prosperity, just as it does its sea and land lines of communication. The air environment must therefore be secured to allow the freedom of movement, which bolsters the economy and supports the prosperity of the nation.

15 The mere deployment of combat aircraft to a location in close proximity to a potential adversary can achieve influence, such as deterrence.
16 As recognised under Article 1 of the Convention on International Civil Aviation (Chicago Convention) 1944.
17 See Joint Service Publication 383, *Joint Service Manual of the Law of Armed Conflict* and the Attorney General's speech at the International Institute for Strategic Studies, 11 January 2017.

A Reaper (MQ-9A) prepares for take off

1.30. Although this publication focuses on the military elements of air power, there are aspects of broader UK air power that bolster the UK economy, and ultimately reinforce national security. These include, for example: UK international airports, airlines and freight carriers; the ability to control and support international air traffic through the existence of the Civil Aviation Authority and civilian air traffic control; and the domestic aircraft industry.

Section 4 – Air power in context

The strategic context

1.31. The strategic context within which UK air power is employed is unstable, complex and uncertain. It is characterised by a continuum of competition between an increasingly wide range of actors, both state and non-state, which has blurred the traditional distinctions between war and peace.

1.32. It is within this uncertain, changeable global socio-economic context that air power offers flexible, timely, scalable and responsive options to the UK government in support of national security objectives. It contributes to a wide variety of tasks, ranging from high-end warfighting, through to deterrence and Defence engagement. Within these tasks sit a broad range of activities, including counterterrorism, delivering humanitarian assistance and providing military aid to the civil authorities.

1.33. The increasing proliferation of commercially available technology has the potential to increase the capability and effectiveness of our adversaries. Secure communications, surveillance systems and uncrewed aircraft are now more affordable and can be easily acquired and adapted to perform a variety of functions, including kinetic attacks.

1.34. Surface-to-air missile technology has advanced rapidly and the proliferation of such systems is spreading, particularly those developed in Russia and China. Some have significant lethal engagement ranges and can travel at hypersonic speeds, and they are therefore able to threaten aircraft and bases previously viewed as being beyond the range of adversaries. Such capabilities offer potential adversaries the option to adopt anti-access and area denial strategies, which could have a significant negative impact on the ability of the UK and its allies and partners to gain control of the air. We must continue to develop counters to such threats across all operational domains to ensure control of the air and freedom of manoeuvre.

1.35. Being agile, adaptable and capable, UK air power has significant utility as it can offer a tailored response to evolving circumstances and an array of capabilities that can rapidly transition between tasks. To fulfil these tasks, UK air capabilities are held at the appropriate readiness to be applied at the right time and place, both at home and overseas.

1.36. Air power is truly global in nature because it theoretically enables access to any point on Earth, be it over land or sea. Air power thus has strategic agility as it can hold multiple regions, theatres and operations at risk from a single location because of its reach and speed. To maximise the utility of air power, the key aspects of the air domain, the surrounding context and the contemporary operating environment must all be clearly understood.

The Red Arrows fly over the Golden Gate Bridge, San Francisco, during their North American Tour 2019

Global alliances and partnerships

1.37. The globalised nature of international security encourages the UK to form alliances and partnerships, which help ensure security and protect national interests. Such relationships are increasingly important because the complex nature of potential threats often requires a multifaceted response. Interoperability between air forces also enhances alliances and coalitions by generating greater combat mass, resilience and access to an array of capabilities. For the UK, NATO is our principal alliance.

Defence engagement

1.38. The UK's dependence on multinational cooperation means it must take every opportunity to promote interoperability and engage with a broad range of potential partners, regardless of their level of technological sophistication or capability. As part of an integrated, cross-government approach to Defence engagement,[18] both the RAF and the air arms of the other single Services regularly conduct multinational training and exercises, and participate in overseas exchange and Defence attaché programmes.

18 See Joint Doctrine Note 1/15, *Defence Engagement* for more detail.

1.39. Defence engagement also contributes to the prosperity agenda through support to sales campaigns. Examples of this are the overseas tours by the RAF Aerobatic Team, the Red Arrows, which have generated significant inward investment to the UK,[19] and the creation of the joint RAF/Qatar Emiri Air Force Typhoon and Hawk squadrons.

UK Security, Defence, Development and Foreign Policy Strategic Framework

1.40. The Defence contribution to the four overarching objectives of the Strategic Framework is set out in the 2021 *Global Britain in a competitive age: Integrated Review of Security, Defence, Development and Foreign Policy*. Air power supports these objectives as follows.

a. **Strengthening security and defence at home and overseas.** The core purpose of air power activity is providing military capability in the air domain to deter and, if required, defeat threats to the UK and Overseas Territories. The most visible and persistent example of this is the RAF combat aircraft, air-to-air refuelling aircraft and control and reporting centres, which provide the permanently available airborne quick reaction alert capability.[20]

b. **Building resilience at home and overseas.** The attributes of air power make it a valuable tool for supporting resilience activities, be that rapidly delivering humanitarian aid to the Caribbean in 2017 following a hurricane, supporting activity to prevent the Whaley Bridge dam collapsing during flooding in the UK in 2019 or rapidly delivering vaccines and moving patients by air during the response to the COVID-19 pandemic in 2020–21.

c. **Shaping the open international order of the future.** UK air power acts in support of this objective by demonstrating adherence to the laws, rules and conventions that underpin the rules-based international order whilst conducting all activities, and encouraging allies and partners and other air arms with whom we operate to act in a similar fashion. Other activities such as mentoring and building the capacity of friendly or non-aligned nations also assists.

19 The Red Arrows 2017 tour of the Asia Pacific and Middle East regions generated inward investment of approximately £4.2 billion.
20 Air power activity such as the quick reaction alert can provide a highly effective means of messaging within information operations activity that forms a part of deterrence.

d. **Sustaining strategic advantage through science and technology.** Air power has always been at the cutting edge of technology and the UK's continued investment and involvement in the plethora of technological developments linked to air power continues to support this objective. The work being done by Team Tempest, linking national and commercial scientific and technological development with operational requirements, to develop the RAF's sixth generation combat aircraft is a prime example of this.

Key points

- Air power is defined as: the ability to use air capabilities in and from the air, to influence the behaviour of actors and the course of events.
- UK air power is persistently active, domestically and globally, protecting UK national interests at home and overseas.
- Although air power can be used independently of the other operational domains, it seeks to create effects and exert influence within them.
- Conversely, maritime, land, space and cyber forces all have the ability to influence events in the air environment.
- Being agile, adaptable and capable, UK air power has significant utility because it possesses an array of capabilities that can offer a tailored response to evolving circumstances.
- Air power is truly global in nature because it theoretically enables access to any point on Earth, be it over land or sea.
- Air power offers policymakers an agile, timely and focused capability that can be highly effective in resolving or averting a developing crisis.

Chapter 2

This chapter discusses the roles of air power. It also introduces air command and control as a critical enabler and electromagnetic warfare as a key enabler.

2

> For good or for ill, air mastery is today the supreme expression of military power and fleets and armies, however vital and important, must accept a subordinate rank.

Sir Winston Churchill

Chapter 2

The roles of air power

2.1. There are four fundamental roles of air power: control of the air; attack; intelligence, surveillance and reconnaissance (ISR); and air mobility. These four roles are shown in Figure 2.1. When conducted in isolation, combined or, more usually, as part of multi-domain operations within an integrated approach, these roles contribute to persistent influence and deterrence activities as well as to the direct task assigned.

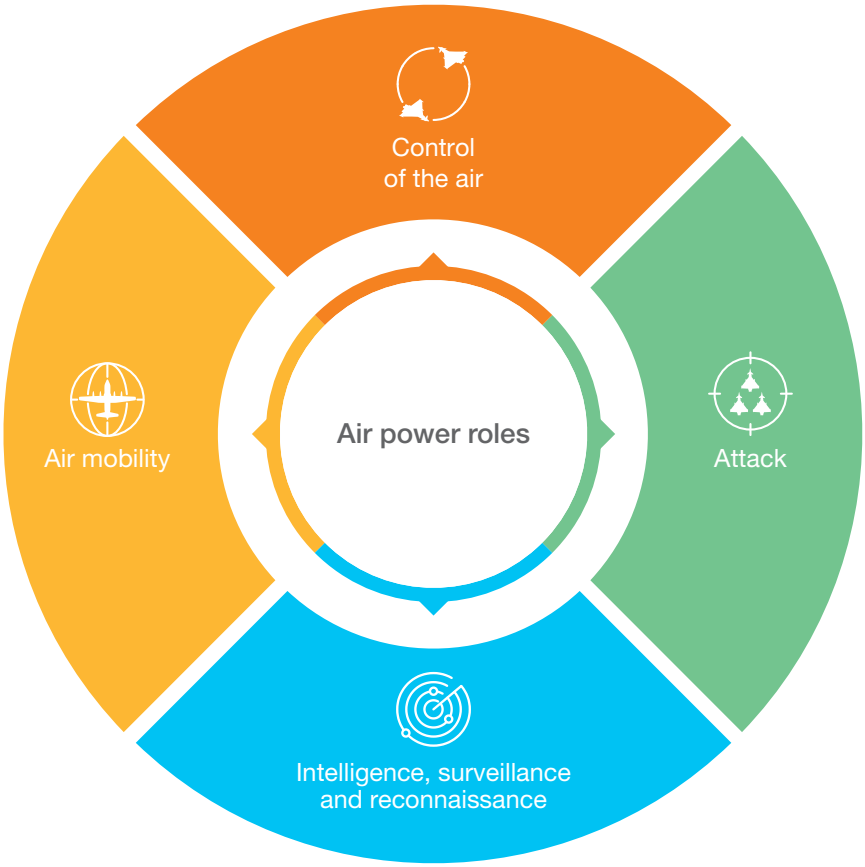

Figure 2.1 – The roles of air power

Section 1 – Control of the air

2.2. Control of the air underpins all air operations because it secures freedom of action in the air domain, while limiting or denying its use by an adversary. It is this role that protects the UK, Overseas Territories and deployed forces from attack. It also enables freedom of manoeuvre across the maritime and land domains and safeguards space and cyber fixed infrastructure, enabling forces to dominate the engagement space[21] and seize the initiative. The breakdown of control of the air is depicted in Figure 2.2.

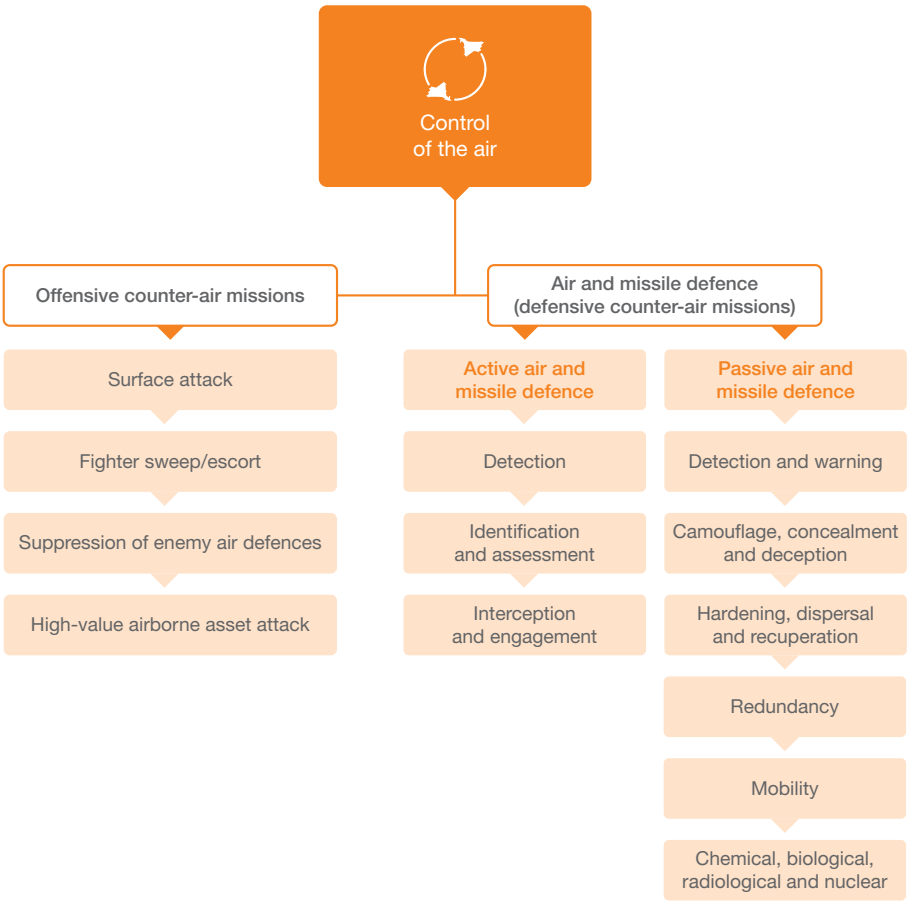

Figure 2.2 – Breakdown of the control of the air role

2.3. Control of the air is a relative condition and depends on available resources, an adversary's capability and will, and the risk that a commander

21 The North Atlantic Treaty Organization (NATO) has agreed that engagement space and battlespace are synonyms. The UK uses engagement space as it better describes the contemporary operating environment.

is prepared to accept. Maritime and land operations can be conducted without achieving control of the air in advance, but the associated risks could be significant. There are three degrees of control of the air.[22]

a. **Air parity.** Air parity exists where no force enjoys decisive control of the air in either time or space. Consequently, both friendly and adversary land, maritime and air forces may encounter significant interference by the opposing force. Parity is not a 'stand-off', nor does it mean that air operations have halted. On the contrary, parity may be typified by high-intensity air operations with maximum effort exerted between belligerents to achieve some level of favourable control. This condition is a major resource drain and losses due to an adversary's air power can be anticipated.

b. **Air superiority.** Air superiority is that degree of dominance in the air battle of one force over another, which permits the conduct of operations by the former, and its related maritime, land and air forces, at a given time and place, without prohibitive interference by the opposing force.

c. **Air supremacy.** Air supremacy is the degree of air superiority where the opposing air force is incapable of effective interference. It is important to note that even air supremacy cannot guarantee that an adversary will not inflict some damage or losses, particularly given the extensive proliferation of small arms weapons and man-portable air defence systems. This is normally the highest level of control of the air that a joint force can achieve.

2.4. Control of the air is not a permanent state and constant activity is required to achieve it. To gain and maintain the required degree of control of the air, counter-air operations are conducted to disrupt, degrade, deny or destroy an adversary's ability to challenge such control. Counter-air operations comprise two key missions: offensive counter-air (OCA) and defensive counter-air (DCA) missions.

a. **Offensive counter-air missions.** OCA missions target enemy air capabilities as close to their source as possible. They are generally proactive in nature and seek to dominate an adversary's airspace to prevent them launching threats against our forces by affecting them on the ground, along with their supporting systems. Although primarily conducted by aircraft, they can also be conducted by naval surface or sub-surface fire, land artillery or special forces direct action targeted against adversary air capabilities.[23]

22 Allied Joint Publication (AJP)-3.3.1, *Allied Joint Doctrine for Counter-Air Operations*.
23 See Air Publication (AP) 3002, *Air and Space Warfare*, Edition 4, Chapter 5 for more detail on individual OCA missions.

Somewhere off the UK, a Typhoon FGR4 intercepts and escorts a Russian Tupolev TU-95 Bear

b. **Defensive counter-air missions.** DCA missions, otherwise known as air and missile defence operations, are generally reactive in nature and seek to nullify or reduce the effectiveness of enemy air and missile threats through active or passive measures. Active measures include methods of detection, interception and engagement. These measures are usually achieved via a system of layered defence-in-depth using reactive air-to-air fighters, surface-to-air missile (SAM) systems and additional aircraft placed on ground or airborne alert.[24] Such a system is termed an integrated air and missile defence system. Passive measures for the defence and protection of friendly forces include: early warning; camouflage, concealment and deception; hardening; recuperation; redundancy; dispersal; mobility; and the use of chemical, biological, radiological and nuclear (CBRN) protective equipment and facilities.[25]

2.5. **Challenges to control of the air.** Western air power has dominated conflicts in which it has been involved over the past 40 years, ensuring a high degree of control of the air and thereby helping to lower the risk to operations in other operational domains. However, to achieve a similar degree of control of the air in future will require focused, tailored, aggressive

24 See AJP-3.3.1, *Allied Joint Doctrine for Counter-Air Operations*, for more details.
25 See AP3002, *Air and Space Warfare*, Edition 4, Chapter 5, for more detail on individual DCA missions and Allied Tactical Publication-3.3.6, *Force Protection for Air Operations* and AP3241, *RAF Force Protection for Air Operations* for the links between passive DCA and passive force protection measures.

and innovative counter-air campaigns. This is due to the threats posed by increasingly sophisticated anti-access and area denial (A2AD) capabilities, including electromagnetic warfare, cyber operations, SAM systems, and ballistic, hypersonic and counter-carrier missiles. Such capabilities are designed to prevent deployment to a theatre of operations or deny air operations in theatre. The emerging threat from hostile uncrewed aircraft also challenges control of lower airspace, threatening land and maritime forces. We must therefore continue to develop counter-A2AD and uncrewed aircraft system technologies to ensure freedom of action in a contested, degraded and operationally limited domain. The challenge to control of the air may also be increasingly contested in the home environment. It is likely that this will initially be through cyber and electromagnetic asymmetric actions, but peer adversaries do have the capability to challenge our domestic control of the air with capabilities across all operational domains.

Operation Granby versus Operation Corporate

Operation Granby was the UK's military contribution to the United States-led coalition that freed Kuwait from Iraqi occupation in 1991. The Iraqi Army was the fifth largest in the world and President Saddam Hussein intended to inflict an unacceptable level of casualties on the coalition. However, the coalition exploited their comparative advantage – air power – to avoid fighting on his terms. Control of the air was quickly achieved, enabling coalition air forces to switch the main effort to counter-land operations against Iraqi ground forces. This was so successful that the Iraqi Army's combat capability was vastly reduced by the time the coalition launched the land offensive and helped ensure a decisive victory with only a few coalition casualties.

In comparison, it was difficult to secure control of the air with the limited carrier-borne capabilities available for Operation Corporate, the UK's 1982 campaign to retake the Falkland Islands. The continuing Argentinean air threat meant that the carrier group had to remain east of the Islands after landing the task force at San Carlos. The range to the combat zone also limited the time that fighters could spend on task. With only partial air cover available, some Argentinean aircraft penetrated the defensive screen provided by the Royal Navy's frigates and destroyers, inflicting significant losses on the task force. Sufficient control of the air was attained to ensure that the campaign was successful, but the margins were fine. The Falklands conflict highlights the potential risks if a campaign is mounted without the assurance of control of the air.

Section 2 – Attack

2.6. The use of overwhelming force through an attack from the air lies at the heart of the ability of air power to influence the behaviour of actors and the course of events. Air attack can deter adversaries, disrupt their activities or ultimately defeat them by destroying their resources and capabilities. UK air power is equipped with a broad spectrum of precise weapon technologies, both lethal and non-lethal, offering the ability to decisively shape the engagement space, in any weather conditions, day or night. The attack role consists of three mission types: strategic attack; counter-land operations; and counter-maritime operations. Figure 2.3 illustrates this breakdown.

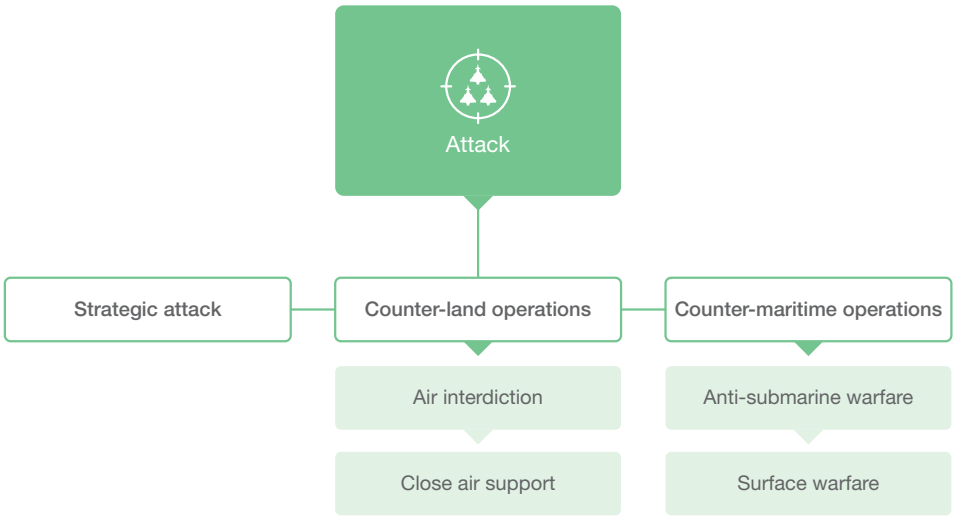

Figure 2.3 – The breakdown of the attack role

2.7. **Strategic attack.** These operations are aimed at an adversary's fundamental ability to wage war by attacking their structures or organisations. Targets may include centres of gravity, such as national leadership and command elements, war production resources or critical national infrastructure and resources. In this context, 'strategic' describes the effect, not the location or distance to the target, or type of weapon system or delivery platform. It can be at its most effective when a wide array of targets are attacked simultaneously, causing maximum shock effect and placing significant stress on an adversary's processes, thereby limiting their ability to adapt and react.

> Because of its independence of surface limitations and its superior speed the airplane is the offensive weapon par excellence.
>
> Giulio Douhet

2.8. **Counter-land operations.** These operations are conducted to defeat an adversary's fielded forces, destroy their supporting infrastructure or create psychological effects to shatter their cohesion or will to fight. Counter-land operations are also a force multiplier because they enhance the potency of friendly land forces, allowing them to achieve their objectives while minimising the risk of casualties. They consist of two broad mission types: air interdiction and close air support (CAS).

a. **Air interdiction.** Air interdiction is the activities conducted to disrupt, degrade, deny or destroy an adversary's capabilities before they can be used against friendly forces. Air interdiction targets elements such as enemy personnel, lines of communication, command and control nodes, logistics and supporting systems at ranges beyond which an adversary can engage friendly land forces. It can be conducted in support of friendly land force operations but since it is normally carried out at significant distance from their location, detailed integration is not routinely required. However, when air interdiction is conducted between the forward line of own troops (FLOT)[26] and the fire support coordination line (FSCL),[27] in airspace controlled by the land commander and thus requiring coordination between air and land forces, these missions are categorised as battlefield air interdiction (BAI).[28] There are two main employment options for air interdiction, which are pre-planned and immediate. The most efficient option is pre-planned because this allows planning to take into account the multitude of variables that will affect the probability of target destruction. Immediate air interdiction, attacking mobile or short-notice targets, may appear to offer a more flexible response, but the trade-off may be a reduction in the planning and

26 The forward line of own troops is defined as: a line which indicates the most forward positions of friendly forces in any kind of military operation at a specific time. NATOTerm.
27 The fire support coordination line is defined as: within an assigned area of operations, a line established by a land or amphibious force commander to denote coordination requirements for fires by other force elements which may affect the commander's current and planned operations. NATOTerm. (See lexicon for full definition.)
28 Increases in the range of land rocket artillery systems means that battlefield air interdiction is likely to be more prevalent in the future as the distance between the FLOT and the FSCL is expected to increase.

coordination time, which in turn can reduce the probability of success. The increasing sophistication and utility of data link communication between ground units and aircraft does mitigate the impact of reduced formal planning and coordination time. Where the exact location of the enemy is unknown, kill box interdiction (KBI), strike coordination and reconnaissance (SCAR) and armed reconnaissance may be tasked to attack targets of opportunity.[29]

b. **Close air support.** CAS is the action taken to disrupt, degrade, deny or destroy enemy activity or capabilities that are in close proximity to friendly land forces. It complements land force ground attack capabilities with significant firepower to coerce adversary forces. Consequently, intensive air-land integration and coordination is critical to accurately identify targets and minimise the risk of fratricide. CAS can be crucial to the success or survival of land forces, as has been proven during recent operations in Iraq and Afghanistan.

2.9. **Counter-maritime operations.** Air power can be used to conduct direct action in the maritime domain or to enable and enhance surface and sub-surface capabilities. Counter-maritime operations are the employment of air attack in the maritime domain and consist of two mission types: anti-submarine warfare and surface warfare.[30]

a. **Anti-submarine warfare.** These are operations which search for, locate, track and attack submarines and their support assets. Sensors can be used to detect submarines, including radar, electro-optical sensors, magnetic anomaly detection devices, and active or passive acoustic sensors.

b. **Surface warfare.** These are operations which detect and engage adversary maritime surface forces. The type of support provided by aircraft depends on operational requirements and on their capabilities, but it can include detection, location, identification, tracking and, ultimately, attack.

29 For more detail see AP3002, *Air and Space Warfare*, Edition 4, Chapter 6.
30 In maritime doctrine anti-submarine warfare and surface warfare are sub-sets of underwater warfare and above-water warfare respectively; but for the purposes of air attack doctrine they are considered in isolation. The term surface warfare is being incorporated into Royal Navy doctrine, it is also used by the United States Navy, and is increasingly being adopted across NATO; however, officially, NATO still uses anti-surface warfare.

Poseidon MRA1 maritime patrol aircraft launches a Mk 54 torpedo

2.10. **Challenges to attack.** The success of an air attack is largely dependent on the ability of aircraft or weapons to penetrate or counter adversary air defences, and these have become increasingly capable. There are also practical limits to the number of weapons that aircraft can carry. However, this challenge has been mitigated by the development of precision-guided weapons and electronic attack technology, which has led to the same or even greater effect being created with a fewer weapons. Poor weather can also hinder attack operations but the development of a wide range of weapon guidance options, such as laser, Global Positioning System (GPS) or radar guidance, have mitigated this challenge and provide significant operational and tactical flexibility. Air attacks can therefore be conducted by day or night and in adverse weather conditions, which can provide a distinct advantage if an adversary lacks such capabilities.

Section 3 – Intelligence, surveillance and reconnaissance

2.11. The use of aircraft changed how the battlespace, as it was then termed, was viewed, as they provided an alternative perspective to that offered by maritime or land platforms. The ISR role, illustrated in Figure 2.4, develops situational awareness and enhances understanding, thereby helping shape the conduct of operations.

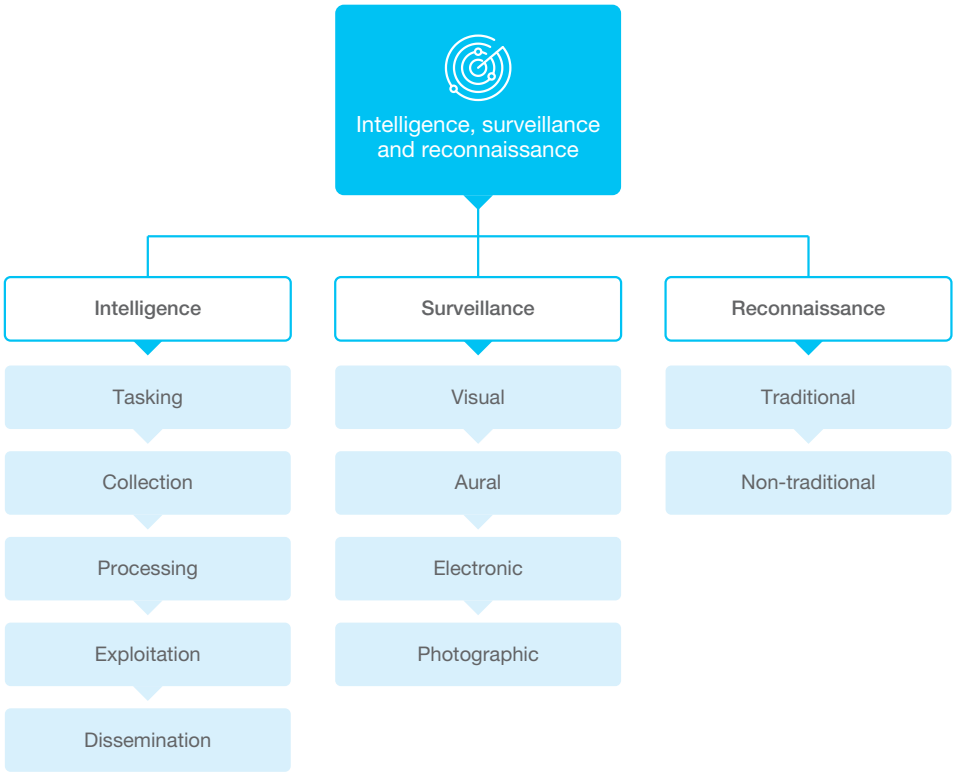

Figure 2.4 – The breakdown of the intelligence, surveillance and reconnaissance role

2.12. The synchronisation of information collected from aircraft and the subsequent processing, exploitation and dissemination (PED) identifies trends, linkages and threats. It supports decision-making by enabling the identification of an adversary's dependencies, vulnerabilities and strengths. ISR consists of three linked 'inform' functions.

a. **Intelligence.** Aircraft do not directly deliver intelligence but provide timely, accurate and relevant information that is processed and disseminated, and potentially combined with other sources of information to provide intelligence. Intelligence informs political and military decision-making processes and makes a major contribution to the assessment of when and how specific objectives might be achieved or an end state attained.

b. **Surveillance.** Surveillance is the continuing and systematic observation of a wide area of interest. The area of interest can be in any

one of the air, surface or sub-surface environments, observed by visual, aural, electronic, photographic or other means. It is not orientated towards a specific target but designed to provide warning of broad adversarial initiatives and to detect potential threats.

c. **Reconnaissance.** Reconnaissance complements surveillance by observing a specific area of interest to gain specific information about specific activities. Intelligence that is critical to the prosecution of current operations is often derived from reconnaissance operations, so it should be evaluated and transmitted with minimum delay to those elements that need the information.

> Find the enemy. Don't let the enemy find you. Reconnaissance! Reconnaissance! Reconnaissance!
>
> Tom Clancy

2.13. Speed and wide area surveillance capabilities make aircraft among the most responsive of ISR platforms and their reach gives them the ability to fly long distances and cover vast areas, collecting information from a variety of sensors. Radar, acoustic, imagery and signals intelligence sensors have varying but complementary operating characteristics, offering a spread of options. Crews are trained to recognise and respond to changing conditions by modifying missions whilst they are in progress, and share information gained from onboard systems through voice or data links.[31] Uncrewed aircraft, whilst not, currently, being as fast as crewed aircraft, do tend to have greater endurance and can provide significant persistence when compared with crewed aircraft.

2.14. The effectiveness of individual ISR capabilities can be increased by networking them into a system. For example, a surveillance sensor on a given ISR aircraft can observe a wide area before cueing higher resolution sensors with a narrower field of view to conduct reconnaissance on a specific point of interest. Secure network systems also enable multiple platforms to benefit from the ISR capabilities generated and shared by a single aircraft.

2.15. Historically, large ISR aircraft provided the majority of air-enabled ISR but this role is no longer limited to those aircraft or sensors that were

31 Short-notice modification of missions can be enhanced by near real time processing, exploitation and dissemination support.

specifically designed for this role. The increasing sophistication of airborne sensors has resulted in many aircraft being able to conduct ISR, even if it is not their primary mission. Combat aircraft and helicopters provide significant input to the ISR enterprise. However, unlike large, multi-crew ISR aircraft, non-dedicated ISR aircraft do not always have an associated analytical capability, or the means to effectively disseminate information.

2.16. **Challenges to intelligence, surveillance and reconnaissance.** The main challenges to air ISR centre on data volume, impermanence and threat. These challenges are explored below.

a. **Data volume.** There are significant PED demands associated with collecting large volumes of data by a number of multi-spectral sensors. This presents the challenge of providing decision-makers with fused intelligence that they can act on, rather than proliferating data from a multitude of systems that may swamp decision-makers with unactionable information. Some ISR sensors can also be negatively impacted by poor weather conditions and the use of camouflage and concealment techniques. However, by using a broad spectrum of sensors on a variety of aircraft, some of these challenges can be overcome.

b. **Impermanence.** The impermanence of air power has historically and justifiably been recognised as a limitation of air power and it is one that particularly affects the ISR role. However, although aircraft are not able to remain airborne indefinitely, despite the benefits of air-to-air refuelling, the increased loiter time of uncrewed aircraft has brought significant benefits as points of interest can, potentially, be persistently monitored. The Ministry of Defence is expanding airborne ISR capabilities by harnessing emerging technologies to overcome the challenge of impermanence, as demonstrated by the acquisition of high-altitude pseudo satellites, such as Zephyr, and further mitigating the impermanence of aircraft by enhancing the space-based ISR suite.[32]

c. **Threat.** Traditional airborne ISR is increasingly threatened by long-range SAMs, air-to-air missiles and targeted jamming. These threats force ISR aircraft to operate further away from their areas of interest, thus reducing their effectiveness.

32 More detail on space-based ISR is contained in Joint Doctrine Publication (JDP) 0-40, *UK Space Power*.

Section 4 – Air mobility

2.17. Air mobility provides the ability to deploy, sustain and recover personnel and equipment, often over significant distance. The speed and reach of air power offers the ability to create rapid strategic influence in support of UK national objectives or in support of allies, such as through the insertion of special forces or delivering humanitarian aid due to a natural disaster. At the operational and tactical levels, air mobility supports land operations by enabling manoeuvre when movement on land is particularly difficult due to poor terrain, poor roads or unacceptable threats to land forces. Air mobility consists of three mission types: air-to-air refuelling; airlift; and personnel recovery. These are illustrated in Figure 2.5.

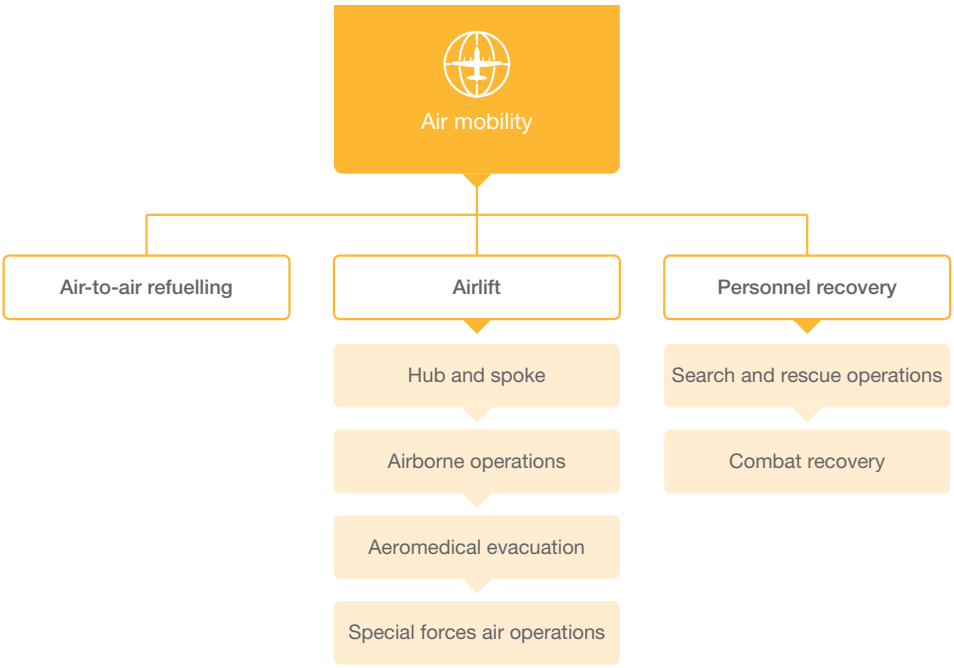

Figure 2.5 – The breakdown of the air mobility role

2.18. **Air-to-air refuelling.** Air-to-air refuelling significantly increases the reach, endurance and flexibility of air power and is therefore a crucial capability. It enhances strategic and operational mobility by helping to mitigate access issues caused by a lack of basing options, overflight limitations or A2AD threats that may otherwise constrain air operations. It also improves the

persistence, availability and responsiveness of tactical air operations by maximising the endurance of combat aircraft.[33]

2.19. **Airlift.** Airlift is the ability to transport personnel and materiel through the air; they can be either inter- or intra-theatre and are subdivided into: hub and spoke operations; airborne operations; aeromedical evacuation; and special forces air operations.

a. **Hub and spoke operations.** Hub and spoke operations consist of inter- and intra-theatre airlift and are the cornerstone of airlift operations to operational theatres, delivering personnel and/or equipment as required. Inter-theatre airlift provides the air bridge that links the UK to airfields in, or near, theatres of operations, known as hubs. It is provided by air transport aircraft operating in the strategic role, supplemented by chartered civilian airlift. The hub is the focal point for subsequent intra-theatre airlift to spoke airfields located throughout the theatre of operations. Intra-theatre airlift is normally fulfilled by fixed-wing air transport aircraft operating in the tactical role or support helicopters, both of which are capable of operating under a wide range of conditions, including small, remote field operations. It should be noted that not all airlift tasks will require the use of hub and spoke operations; routine national or global movement of cargo and passengers frequently operate directly between military air bases and civil airports with no requirement for the onward movement of payload by air.

b. **Airborne operations.** Airborne operations are the transportation of land forces and their equipment directly to, or close to, their objective and subsequently sustaining or extracting them, when required. This can be done by either air-land or air-drop operations. Air-land delivery is when an aircraft lands directly at its objective to unload, whereas air-drop is delivery from an aircraft in flight, using parachutes.

During World War 2 some dogs were trained to parachute alongside British paratroopers. 'Para Dogs' went into action on D-Day, when a dog, called 'Bing', landed in a tree where he remained until his handler could rescue him the next morning!

33 By increasing the flight time of combat aircraft, they can extend their combat air patrols in support of a control of the air mission, remain airborne to attack more targets in an air interdiction mission, provide longer support to land forces in a close air support mission, or gather time-critical reconnaissance information in the ISR role.

Pathfinder personnel practise high altitude low opening insertion from a Globemaster C-17

c. **Aeromedical evacuation.** Aeromedical evacuation is a specialist form of airlift that transports injured or seriously ill personnel under medical supervision. Forward aeromedical evacuation is moving injured personnel from the battlefield to appropriate medical treatment facilities. Tactical aeromedical evacuation is moving patients between medical facilities in, or close to, theatre. Strategic aeromedical evacuation operations involve repatriating ill or wounded personnel from in-theatre medical facilities, primarily in specially equipped and staffed aircraft.[34]

d. **Special forces air operations.** Special forces air operations are air operations conducted by specialist aircraft and personnel that enable the insertion, sustainment and extraction of special forces. Although all four air power roles could be used to support special forces operations, having the ability to rapidly move specialist personnel in support of high priority political objectives is a critical capability.

2.20. **Personnel recovery.** Personnel recovery operations frequently use air mobility capabilities to rescue captured, isolated or missing personnel during combat or peacetime operations. Personnel recovery is subdivided into

34 For more detail on aeromedical evacuation operations, see AJP-4.10, *Allied Joint Medical Doctrine for Medical Support* (with UK national elements) and AP3002, *Air and Space Warfare*, Edition 4, Chapter 8.

peacetime recovery and combat recovery.[35] Peacetime recovery operations are undertaken to recover personnel where no threat is posed by hostile interference, such as search and rescue operations or military assistance to the civil authorities. A combat recovery operation is the extraction of isolated personnel from a situation where hostile interference is expected; it is therefore amongst the most time-sensitive of air operations.

2.21. **Challenges to air mobility.** There are practical limits to the payload that aircraft can carry, but this limitation needs to be offset against the advantages offered by speed and reach. Maritime platforms can move significantly more personnel and equipment in support of military operations but at significantly slower speeds. Also, movement on the ground is relatively time consuming and can be hindered by terrain or contested by a threat. Air mobility therefore balances the challenge of a limited payload with the military advantages offered by speed of action. Air mobility aircraft can also be more vulnerable to air and ground launched threats due to their size, relatively slow speed and limited manoeuvrability. However, by understanding the threats posed before employing air mobility aircraft, and ensuring that the aircraft are equipped with appropriate platform protection capabilities, actions can be taken to mitigate the risk posed.

Section 5 – Key enablers

2.22. **Air command and control.** The four fundamental roles of air power, conceptually and doctrinally endorsed and operationally validated throughout the history of British air power, and mirrored in the doctrine of the North Atlantic Treaty Organization (NATO) and wider allies and partners, do not, in themselves, fully describe why air power can be so effective. The four fundamental roles explain what air power can deliver, but there has to be something that enables the synergy, both across the roles and to integrate air power with the other operational domains. This critical enabler, driven by information, is command and control, which provides the where, when, why, how, what and with what of air power. Without it, air activities would be incoherent and ineffective. Command and control is not a role in its own right but, as can be seen in Figure 2.6, it envelops all air activities and, in turn, is cocooned by the sphere of information, whilst air activities are delivered by the fundamental roles. The criticality of air command and control has only

35 For more detail on personnel recovery operations, see AJP-3.7, *Allied Joint Doctrine for the Recovery of Personnel in a Hostile Environment*, Allied Personnel Recovery Publication-3.3.7.5, *The NATO Survival, Escape/Evasion, Resistance and Extraction Training Standard* and AP3002, *Air and Space Warfare*, Edition 4, Chapter 8.

increased as air activities are now delivered within multi-domain operations as part of integrated action. Air command and control is discussed in more detail in Chapter 3.

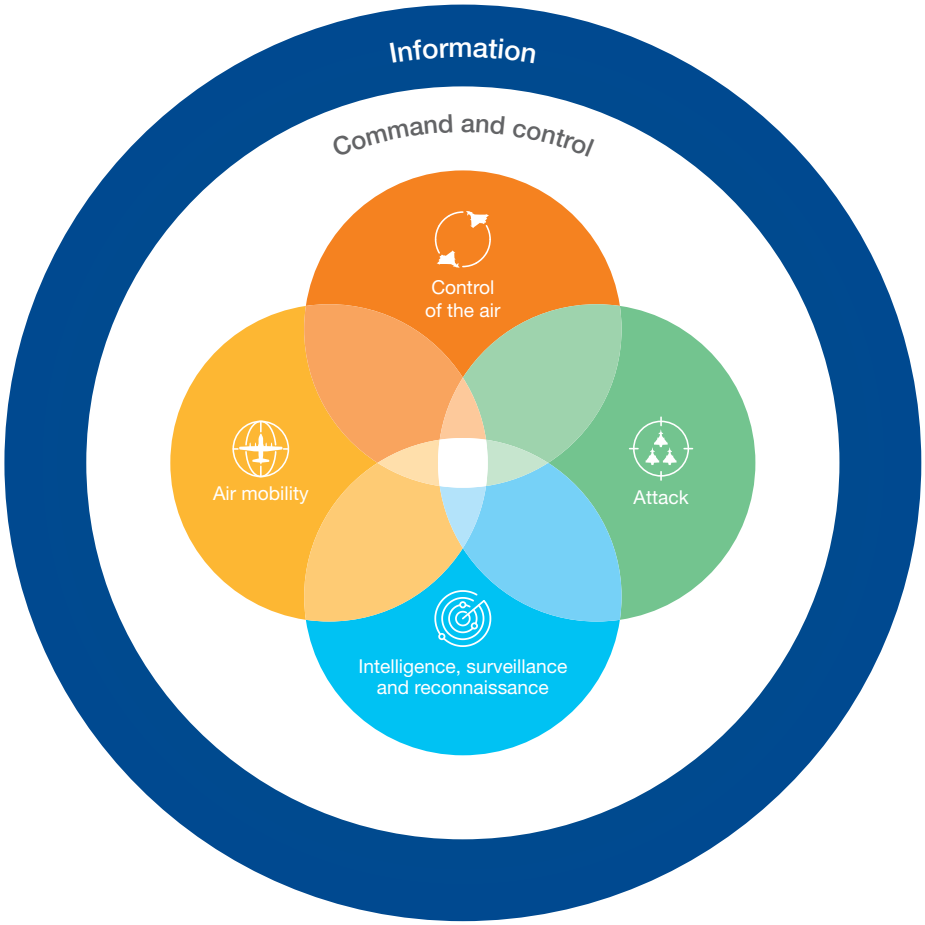

Figure 2.6 – The air power model

2.23. **Electromagnetic warfare.** Access to the electromagnetic environment (EME) is a key enabler across all the roles of air power. Electromagnetic activities aim to assure freedom of action across the electromagnetic spectrum whilst denying an adversary such freedoms. It includes: electronic defence to assure freedom of action for friendly forces; electronic surveillance to enable us to understand the threat systems, communication and navigation limitations, or exploitable opportunities throughout the EME; and electronic attack, which can increase the scope of available strike options, including that of non-kinetic action. When considered in the context of the pervasiveness of information and the political risk of collateral damage caused by kinetic weapons, electronic attack may be more politically acceptable.

Chinook deploying self-protection infrared flares

Summary of the roles of air power

2.24. Although the four roles of air power are treated as being distinct, there is also overlap. Modern, multi-role aircraft afford a significant degree of simultaneity, whereby a single aircraft can perform more than one role, even during the same mission if necessary. For example, a Lightning II can conduct ISR tasks whilst engaged in a counter-maritime attack mission. As technology advances and multi-role aircraft continue to be developed, there is potential for the overlap between roles to increase further. This is a key strength of air power, as simultaneity bolsters its agility, flexibility and adaptability.

> I believe that the first and great principle of war is that you must first win your air battle before you fight your land and sea battle.
>
> Field Marshal Bernard Montgomery

Key points

- The four core roles of air power are: control of the air; attack; ISR; and air mobility.
- Control of the air underpins all air operations because it secures freedom of action in the air domain, while limiting or denying its use by an adversary.
- The use of overwhelming force through an attack from the air lies at the heart of the ability of air power to influence the behaviour of actors and the course of events.
- The speed of aircraft enables highly responsive ISR solutions; their reach gives them the ability to fly long distances and cover vast areas, collecting information from a variety of sensors.
- Air mobility provides the ability to deploy, sustain and recover personnel and equipment, often over significant distance.
- Modern, multi-role aircraft afford a significant degree of simultaneity, whereby a single aircraft can perform more than one role during the same mission.
- Command and control envelopes all four air power roles and it is critical for the effective delivery of air power.
- Access to the electromagnetic spectrum is a key enabler for all air activity; it is required for effective communication and data exchange across all force elements and is relied upon for platform navigation as well as numerous attack and defence activities.

Chapter 3

Chapter 3 outlines the principles of air command and control and provides an overview of the capabilities the UK uses to deliver air command and control across the continuum of competition. It also describes in broad terms how air power is planned and tasked at the operational level and the associated air operations tasking cycle.

> An air force commander must exploit the extreme flexibility, the high tactical mobility, and the supreme offensive quality inherent in air forces, to mystify and mislead his enemy, and so to threaten his various vital centres as to compel him to be dangerously weak at the point which is really decisive at the time.

Marshal of the RAF Sir John C. Slessor

Chapter 3

Command and control

3.1. Effective command and control underpins the successful employment of all elements of the military instrument; it is not unique to air power. However, air power, by the very nature of its work, can be extremely sensitive to any misdirection and operational experience has highlighted that air power has to be underpinned by a fast decision cycle if it is to be employed effectively. Additionally, air power's ubiquity means that it can be applied across multiple theatres, joint operations areas or even globally with competing demands placed upon limited resources. Consequently, air command and control is the key enabler without which the four fundamental air power roles cannot be delivered effectively, irrespective of the size or nature of an operation.

Section 1 – Principles

Unity of command

3.2. Unity of command ensures the concentration of effort for every objective is placed under one responsible commander. This is particularly important for air operations, irrespective of where on the continuum of competition they take place. Air assets are highly sought after because they are able to pursue strategic, operational and tactical objectives simultaneously. However, they can be limited in numbers or availability, so there is significant potential for fragmentation of the air effort. A component request for tactical air support could compete with the allocation of the same air resource for operational or strategic objectives. Consequently, centralised command of air forces under a single air commander is a fundamental tenet of air command and control.

3.3. Competing demands must be prioritised and apportioned accordingly; the enduring principle of centralised control ensures that aircraft are used as efficiently as possible to achieve military objectives. It prevents them from being inappropriately tasked by uncoordinated users against impractical objectives or being divided into small packages of air power that would inhibit flexibility and hinder any requirement for a rapid concentration of force. In addition, air operations can take place simultaneously across single or multiple theatres of operation. However, no single person is likely to have the level of situational awareness required to manage all concurrent activities. Decentralised execution delegates execution authority to subordinate or

on-scene commanders, thereby shortening the decision cycle and increasing speed of action. It is also the only feasible option for complex air campaigns, especially where communications or data links may be degraded or denied.

3.4. Aligned with the UK and North Atlantic Treaty Organization (NATO) joint doctrine philosophy of mission command, the UK's preferred method for air command and control is centralised control and decentralised execution. That said, depending on the operational context, two other options exist that can be adopted to suit a specific operation or task.

a. **Centralised control, centralised execution.** Centralised execution authority may be necessary in certain operational circumstances where the stakes are particularly high or where the highest-value assets are being employed. It might also be appropriate when there is a requirement to closely manage air activities that might have strategic effects, even though this may adversely affect tactical efficiency. A potential disadvantage of centralised execution authority is that it can result in a rigid approach that lacks tactical flexibility and is not responsive enough to local conditions. As a result, it may only be suited to specific operations for short periods of time.

b. **Decentralised control, decentralised execution.** The decentralised control and execution of air power may be allocated to subordinate commanders for specific periods of time to improve responsiveness. Nominated air units could integrate as specific task-focused and organised joint teams for certain operations.

Centralised control, centralised execution – Operation Enduring Freedom

Centralised control, centralised execution is necessary in certain circumstances, but it can also increase risk because it reduces operational tempo. Operation Enduring Freedom was the response by the United States (US) to global terrorism following the 11 September 2001 attacks in New York. The following month, the operators of a US uncrewed aircraft pinpointed the location of the supreme leader of the Taliban, Mullah Muhammad Omar, as he fled Kabul amongst a convoy of cars. As neither the uncrewed aircraft controllers nor the US Navy Fifth Fleet commander in Bahrain could authorise a strike, approval had to be sought from US Central Command in Tampa, Florida. The ensuing delay for strike approval allowed Mullah Mohammed Omar to escape.

E-7 Wedgetail, the RAF's future airborne early warning and control aircraft, which will enter service in 2024

Componency

3.5. The organisational command and control framework employed for air operations depends primarily upon the scale, size and complexity of the operating area. Complex operations are traditionally served by a deployable, or permanent, in-theatre command and control capability, especially when an operation is NATO-led, UK-led within a NATO framework, multinational coalition or US-led. However, the RAF's new command and control model based around 11 Group also allows for the command and control of air operations 'at range' from the UK using robust and secure beyond line of sight voice and data communications.

3.6. At the operational level, the UK and NATO use the concept of component organisation[36] to cohere multi-domain activity under a joint force commander (JFC), particularly for a deployed joint force. The 2* Standing Joint Force Headquarters provides this capability for the UK for small- and medium-sized operations.

3.7. A JFC may exercise command and control of joint air operations from their own headquarters, augmented by air component subject matter experts. However, it is more usual for the JFC to appoint a joint force air component commander (JFACC),[37] chosen from whichever component has the majority of

36 The components are land, maritime, air, special forces and logistics. See Allied Joint Publication (AJP)-3, *Allied Joint Doctrine for the Conduct Of Operations*.
37 NATO use the term commander joint force air component. Where an operation involves a coalition the term combined force air component commander (CFACC) may be used.

air assets and the command and control capabilities required to plan, task and execute air operations.[38]

3.8. To efficiently employ the air capabilities available, the JFACC will normally exercise operational control over their own component's forces, and tactical control over other components' forces made available for tasking by the JFC. The JFC may also establish support relationships between the JFACC and other components to facilitate operations. For example, the JFACC will usually be the supported commander for control of the air operations. Irrespective of the size of the operation, there are four key responsibilities that normally fall to the JFACC.

- Develop the overall air operations plan to support the desired outcomes of the JFC; this is normally referred to as the joint air operations plan (JAOP).
- Recommend to the JFC how best to assign the overall joint air capabilities available between the various lines of operation for a period of time; this is termed apportionment.
- Assign and task the joint air capabilities and forces made available by the Service components based on the JFC's air apportionment decision.
- Provide oversight and guidance during the execution phase and evaluate the subsequent results.

3.9. Within the complex contemporary operating environment, competing demands for access to airspace from both military and civilian users are inevitable. To integrate, coordinate or deconflict all airspace user requirements, an airspace control authority (ACA) can be appointed, who will be responsible for establishing and operating an appropriate airspace control system promulgated through an airspace control plan. For operations where an adversary has an offensive air or missile capability, an air and missile defence commander (AMDC) will usually be appointed to integrate the air and missile defence capabilities of all components. Given the interdependence of airspace control and air and missile defence, ACA and AMDC responsibilities are normally given to the JFACC.

38 Joint air operations do not include those air operations that a component conducts as an integral and organic part of its own operations.

Merlin HM Mk2 airborne surveillance and control helicopters on board HMS Queen Elizabeth

3.10. To fulfil their responsibilities, a JFACC is supported by a joint force air component headquarters (JFAC HQ), usually with an embedded air operations centre. This provides the critical interface between operational planning and tactical execution. Whilst the size, internal composition, battle rhythm and location of the JFAC HQ will vary according to the type and scope of mission, five elements are common to most. These are:

- a **strategy division**, which leads on long- and short-term air strategy and produces the JAOP;
- a **combat plans division**, which develops detailed execution plans;
- a **combat operations division**, which monitors and executes daily operations;
- an **intelligence, surveillance and reconnaissance (ISR) division**, which provides predictive and actionable intelligence, as well as a common threat and targeting picture; and
- a **combat support division**, which coordinates administrative, communications, logistics, meteorology, information management and media engagement activities.

3.11. Liaison between nations, components and non-military organisations is a key factor in the success of air operations; without it, air power cannot be employed effectively in support of multi-domain operations. This is illustrated in Figure 3.1. Whilst liaison can be conducted remotely via electronic means, all of the UK's recent military operations have highlighted the value of personal contact between senior commanders and the utility of liaison officers in facilitating that contact. For liaison to work effectively, arrangements must span the operational and tactical levels. At the highest level, senior liaison officers must possess the authority to represent their commanders on critical issues; at lower levels, subject matter experts provide planning, tasking and execution expertise regarding their component or organisation's activities.[39] Where an operation is multinational, participating nations will usually send a national contingent commander to the JFAC HQ to ensure their assigned forces operate within national rules of engagement.

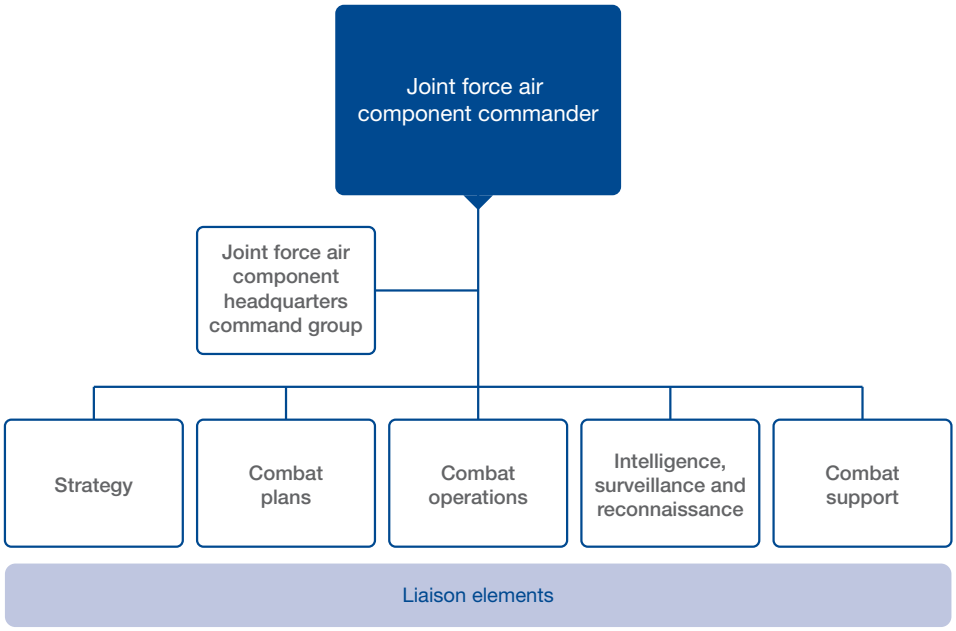

Figure 3.1 – A typical joint force air component headquarters structure

3.12. Rarely, if ever, will air power be used in isolation as a response to a crisis or to achieve a national objective; the UK's approach to employing the military instrument of national power is by design cross-government and multi-agency, including working with non-governmental organisations

39 For more detail on liaison arrangements between components see Air Publication (AP) 3002, *Air and Space Warfare*, Edition 4, Chapter 2.

where appropriate. Consequently, liaison arrangements within the JFAC HQ must take account of this. In addition, space services provide vital enabling capabilities for the air component, such as ISR, positioning, navigation and timing for aircraft and weapons, or voice and data communications. However, space assets are generally considered strategic in nature and can be national, military or privately owned and operated. Delegation of their command and control is unusual. Therefore, the presence of space subject matter experts within the JFAC HQ is key to ensuring effective air–space integration. To ensure unity of effort across the whole force, the JFC can appoint a space coordinating authority (SCA) to prioritise requirements and coordinate access. SCA responsibilities are usually delegated to the JFACC due to historical synergies between the air and space domains.

Air command and control system

3.13. Air operations are controlled through an overarching air command and control structure supported by a robust command, control, communication, computers and information system (C4IS). Without the latter, the effective employment of air power can be difficult, if not impossible, which places significant emphasis on defensive cyber support. Operational experience has shown that whilst the air command and control system used will invariably be tailored to the task at hand, five broad design considerations need to be met if air power is to be employed successfully, irrespective of the nature of the operation. These are:

- **flexibility**, capable of responding to a changing operational situation with minimum disruption or delay;
- **responsiveness**, able to provide the JFACC, or their key subordinates, with the understanding required to make effective decisions and to pass subsequent orders quickly;
- **survivability**, including protection from cyber and traditional threats as well as redundancy for critical command and control facilities and C4IS;
- **sustainability**, capable of conducting continuous operations throughout all phases of a campaign; and
- **interoperability**, with joint and coalition command and control systems to enable unity of command.

3.14. In general, the JFAC HQ's strategy, combat operations and ISR divisions form the core of the air operations centre, which acts as the senior element within the overall air command and control system.[40] Tactical control for forces executing air missions is provided by an array of units subordinate to the air operations centre; these may be surface-based or airborne assets provided by the air, land and maritime components.

3.15. Surface-based tactical command and control for air power provides a robust capability that is best suited to a permanent task such as national air policing or when a deployed presence in a theatre of operations is expected to be enduring; for example, providing air defence in the Falkland Islands. In addition, when a joint operations area is geographically large, sectorisation of the overall area between a number of ground-based command and control units can make the overall system more responsive, especially with regard to air and missile defence operations where speed of response to short-notice threats is critical. Control and reporting centres (CRCs) usually form the backbone of Western surface-based air command and control systems, a role performed by naval vessels such as the Royal Navy's Type 45 destroyer in the maritime domain.

3.16. Airborne command and control can be either fixed-wing or rotary wing. Usually tasked with air surveillance and the tactical control of air operations, they enable the command and control of air assets operating beyond the radar and communications range of surface-based command and control units. Key to their effectiveness during combat operations is the placement of their operating orbits, which must balance the aircraft's radar and communications range against the terrain and threat posed by an adversary's counter-air capabilities. Coalition operations within the Middle East over the past 20 years have relied heavily upon aircraft such as the UK's now retired E-3D Sentry to provide the deep look, low-level radar capability to support offensive and defensive air operations – most recently over Syria. Rapidly deployable from the UK, they provided Defence with the ability to respond quickly to a crisis or to conduct deterrence activity at range in support of allies. The continued relevance of this capability has seen the UK procure E-7 Wedgetail to replace the E-3D Sentry.

40 The air operations centre may be called a joint air operations centre (JAOC) or a combined air operations centre (CAOC) dependent upon whether the operation is US, NATO or UK led.

RAF air operations personnel engaged in air battlespace management

Section 2 – UK air command and control capabilities

3.17. UK air command and control capabilities are structured to support the broadest possible range of tasks, from homeland defence and persistent engagement activities such as the forward basing of air power assets, up to large-scale combat operations, as part of a NATO Article 5 response. The Royal Air Force (RAF) provides the core air command and control capability for Defence, augmented on a case-by-case basis by the other two Services to enable integration across the traditional warfighting domains. For deployed operations, these capabilities are usually under the operational command of the Chief of Joint Operations.[41] Otherwise, the operational command and control of air forces will most likely rest with the RAF's 3* Deputy Commander Operations, with delivery centred around 11 Group via either the National Air and Space Operations Centre (NASOC) or the UK JFAC HQ.

The National Air and Space Operating Centre

3.18. The NASOC is located at Headquarters Air Command and provides the UK with a permanent 24/7 air command and control capability to support enduring homeland defence commitments. The Air Officer Commanding

41 For more detail see Joint Doctrine Publication (JDP) 01, *UK Joint Operations Doctrine*.

11 Group acts as the day-to-day 2* air commander. The NASOC has two core air-related roles:

- maintaining the integrity of UK airspace; and
- providing support to NATO in the execution of its peacetime air policing mission.

3.19. To meet its national and NATO air policing responsibilities, the NASOC uses the UK Air Surveillance and Control System (ASACS), which is a network of ground-based military and civilian radars used to monitor, detect and identify all aircraft in and around UK airspace. The resulting recognised air picture is compiled by the NASOC's subordinate CRC at RAF Boulmer,[42] which also exercises tactical control of quick reaction alert fighters and supporting air-to-air refuelling aircraft. Project Guardian is upgrading the ASACS to improve information exchange and integration with allies.

The UK Joint Force Air Component Headquarters

3.20. As part of 11 Group, the UK JFAC HQ provides a full-time permanent, fixed location air command and control capability collocated with the NASOC to support global air operations conducted under the responsibility of the Air Officer Commanding 11 Group.[43] The UK JFAC HQ is structured in accordance with the model outlined within Section 1 of this chapter and comprises a command group with five subordinate divisions staffed by permanent personnel. The UK JFAC HQ also provides a high-readiness deployable air command and control capability with a permanently assigned 1* JFACC.[44]

3.21. The UK JFAC HQ can provide a full range of air command and control in support of UK air operations, including up to medium-scale, within framework nation status or augmentation of an alliance or multinational headquarters. The unit is fully scalable and would operate in a configuration dependent upon the requirements of the operation to be supported. Employment options include the following.

a. A UK-only operation at component scale where the UK would provide its own JFACC; all support and logistics functions would be carried out by UK personnel. For a small-scale national operation, air

42 The CRC also exchanges information via data links with neighbouring NATO partners, maritime units and airborne surveillance aircraft to generate the recognised air picture.
43 In their role as the standing UK Global Air Component Commander.
44 Within NATO only the UK, Germany, France, Italy, Spain, Turkey and the US have this national capability.

command and control can be provided by the JFAC HQ 'at range' from its fixed location; alternatively, a small air command and control cell could be deployed to embed within a joint force headquarters.

b. A UK-led coalition in which the UK would provide the JFACC and elements of the command hierarchy with most key functions being carried out by UK personnel. The expectation would be that the senior coalition partner would provide a deputy JFACC. This option requires the ability to fully embed coalition partners into the UK JFAC HQ infrastructure and C4IS.

c. Augmentation of a coalition-led deployment, which would ideally see the UK provide the deputy JFACC and some key elements of the JFAC HQ structure. There would also be a requirement to deploy a national coordination team to monitor UK-specific issues under a UK air contingent commander who may dual-hat as the deputy JFACC.

d. NATO reinforcement, which would see core JFAC HQ personnel deployed to support or reinforce the NATO air command and control system during times of crisis and conflict. Under current plans, personnel would either be deployed to NATO Air Command to fill specified augmentee positions within the NATO Command Structure JFAC HQ or to a deployed NATO force structure JFAC HQ (which is provided on a rotational basis by member states). The UK JFAC HQ is certified for employment as a high readiness command and control element of the NATO Response Force and as such could deploy in full.

Section 3 – Planning and tasking

3.22. Air planning is usually conducted in parallel with joint, operational-level planning.[45] Qualified and experienced air planners should engage early in the development of the joint operational plan to ensure that it is coherent and workable and that air options are fully considered and integrated from the start. A sound understanding of the wide variety of aircraft and their associated capabilities, as well as an understanding of the capabilities or operations that air power is supporting, is critical to the success of the planning phase. This section outlines the key steps in the planning and tasking process that are common to UK, NATO and the US.

45 See AJP-5, *Allied Joint Doctrine for the Planning of Operations* (with UK national elements) for more details.

Hercules C-130J refuelling from a Voyager KC3 above Ukraine in 2020

Air estimate

3.23. Operational air planning begins when the need for military action involving air activity is identified. The air estimate is intended to develop the most effective air operations plan to meet the JFC's intent and convey this information to those who will execute it. The process is not dissimilar to estimates carried out in other operational domains. The process is command-led and involves the JFAC HQ planning staff exploring the full range of probable and likely adversary and friendly courses of action before analysing and comparing friendly air capabilities against the likely threats. The air estimate is a continuous and iterative process with a number of key steps involved.[46] The final step of most air estimate methodologies, the commander's decision, is made by the JFC on which course of action to adopt as the concept of air operations. The decision is based on the recommendation of the air commander and the course of action becomes the basis for the JAOP.

46 These steps usually include background analysis, mission analysis, evaluation of factors, courses of action development, and the commander's decision. However, the actual methodology used may vary. For example, the UK JFAC HQ use the process outlined within NATO's *Comprehensive Operations Planning Directive*. See AJP-5, *Allied Joint Doctrine for the Planning of Operations* (with UK national elements) for more details.

Joint air operations plan

3.24. The JAOP is the JFACC's blueprint for integrating and coordinating air activities. It provides the necessary link to the JFC's operational plan and outlines the phasing of the overall air campaign.[47] A typical example of phasing might start with counter-air operations to gain a degree of control of the air over a specific area or at a specific time so that friendly forces can operate without unacceptable risk from adversary attack. This could be followed by a phase focusing on strategic attack, and then a phase of counter-land activity featuring concurrent air interdiction to shape the battlefield for friendly ground forces, and providing close air support. The JAOP will also usually include:

- objectives and tasks by priority, describing in which order they should be actioned, the desired effects and the weight of effort required;
- the measures or indicators of success that are to be used to determine whether air operations are meeting assigned objectives;
- detail on what air assets are required to achieve the air objectives, including force availability, deployment timing, basing availability and sustainment requirements; and
- specific procedures for allocating, tasking, exercising and transitioning the command and control of air assets.

The JAOP is implemented through the air tasking cycle, which provides an iterative and cyclical process for planning, apportioning, allocating, coordinating and tasking air assets.

> Before anything else, preparation is the key to success.
>
> Alexander Graham Bell

47 A phase will only indicate what the main effort is for the air component at a given time; however, air assets will almost certainly be conducting all roles of air power throughout a campaign or operation.

The air tasking cycle

3.25. The air tasking cycle allows for changing tactical situations or commander's guidance, as well as requests for support from other component commands at any stage in the cycle. The cycle, outlined in Figure 3.2, matches specific targets with capabilities made available to the JFACC for a given tasking period.

Figure 3.2 – The standard air tasking cycle

3.26. The air tasking cycle is built around a number of finite time phases set to plan and conduct air operations. The full cycle from JFC guidance to the completion of the execution period usually takes 72 hours. Detailed planning normally begins 48 hours in advance of the execution period to enable the integration of all component requirements. However, when appropriate, the

cycle can be compressed although this may come at the expense of achieving the most efficient use of available assets. Six phases are common and are outlined below.

a. **Phase 1** starts with the JFC's objectives and strategic direction based on current operations. The JFACC uses that consultation, and the JAOP, to produce an air operations directive (AOD)[48] to guide the subsequent planning and execution phases.

b. **Phase 2** develops targets through the guidance, apportionment and targeting (GAT) process, which matches target development to tasking. Target nominations from the components are screened and prioritised.

c. **Phase 3** sees weapon-to-target matching conducted by targeting personnel who match weapons capabilities to desired effects against prioritised targets. The final prioritised targets are given to a master air operations plan (MAOP) team who meld available air capabilities with the GAT recommendations to allocate the total number of air sorties for each objective or task.

d. **Phase 4** is where the AOD, target worksheets, MAOP, airspace control plan and the requirements of other components are translated into detailed operational and tactical direction and promulgated in the air tasking order (ATO).

e. **Phase 5** is the execution of the ATO. The JFAC HQ air operations centre and subordinate air command and control elements execute the plan, revising tasking as required, and coordinating or deconflicting any changes.

f. **Phase 6** is the evaluation of the results of air operations. The subsequent assessment of the effectiveness of air activity is fed back into the air planning cycle to inform the process.

48 The AOD is effectively a 'snapshot' of the JAOP to be enacted during the tasking period being planned.

Multinational air mission planning

The air tasking order

3.27. The ATO articulates the tasking for air operations for a specific time period, normally 24 hours. It enables all mission commanders to understand:

- what their responsibilities are for their missions;
- what tasks they are to conduct;
- where they are to conduct them;
- what support they are to expect or to provide; and
- what additional constraints or freedoms they may be operating under during the mission.

In accordance with the philosophy of mission command, the ATO only covers the 'ends' and the 'means' of the mission; the tactical 'ways' are the responsibility of the mission leaders. The ATO also allows other components to conduct their own planning and operations based on the level of air support being provided.

3.28. At any time, there will be several ATOs in various stages of development: the ATO being executed; the ATO being written; and the ATO being planned. During execution, the ATO retains flexibility to respond to changing priorities, including short-notice dynamic and time-sensitive targeting opportunities. Changes are made on the authority of the JFACC through the air operations centre.

Key points

- Command and control envelopes all four air power roles because it is essential for the effective delivery of air power.
- Centralised control and decentralised execution is the UK's preferred method for air command and control; it enables tactical flexibility whilst ensuring unity of effort at the operational level.
- Air operations are best delivered under the command of a single air commander, the JFACC.
- All air operations require a tailored air command and control system, centred around an air operations centre.
- UK air command and control capabilities are primarily delivered by the RAF via 11 Group.
- The UK JFAC HQ provides the UK with a scalable and deployable command and control capability for UK, NATO and multinational air operations.
- Air power is best integrated with the other components of the military instrument during joint operational-level planning.
- The air tasking cycle is the iterative and cyclical process for planning, apportioning, allocating, coordinating and tasking air assets.
- The UK, NATO and US use an ATO to provide mission commanders with the details required to plan and execute their missions.

Chapter 4

Chapter 4 considers the application of UK air power in the context of an integrated cross-government approach and highlights how it is integrated with other elements of military power to conduct multi-domain operations. It provides an overview of key air power enablers and outlines air power's utility.

> To commit troops to a campaign in which they cannot be provided with adequate air support is to court disaster.

Field Marshal Sir Claude Auchinleck

Chapter 4

The employment of air power

Section 1 – Cross-government integration and integrated action

4.1. Chapter 3 outlined how air power is planned, commanded and executed at the operational level within the air component. However, air power is rarely, if ever, employed on its own in response to a crisis or to achieve a national security objective. Air power works most effectively when integrated with other components of military power, benefiting from complementary capabilities and exploiting synergies between the maritime, land, air, space, and cyber and electromagnetic domains. This can be further enhanced by military forces being integrated and synchronised with other government departments, potentially alongside the use of other instruments of national power – diplomatic, information and economic – behind a common national goal.

4.2. Effective crisis management requires active cross-government and multi-agency cooperation to develop, employ and sustain a comprehensive and successful response. The UK's cross-governmental approach to national security, similar to the North Atlantic Treaty Organization's (NATO's) comprehensive approach,[49] deals with a wide variety of challenges by creating and managing strategies to address complex problems. It employs the instruments of national power to achieve desired political and strategic objectives. The coordination and synchronisation of these capabilities reduces duplication of effort, creates synergies and leads to more effective use of resources. The UK military contribution, of which air power is a key component, to pan-governmental activity is delivered through integrated action.

49 See Allied Joint Publication (AJP)-01, *Allied Joint Doctrine* for more details on NATO's comprehensive approach.

Integrated action

4.3. Integrated action can be described as the audience-centric orchestration of military activities, across all operational domains, synchronised with non-military activities to influence the attitude and behaviour of selected audiences necessary to achieve successful outcomes.

4.4. Air power contributes to integrated action through the exploitation of its attributes and roles. Using the freedom of manoeuvre provided by control of the air, air power can use the attack or air mobility roles to conduct outreach, kinetic and information activities, creating both lethal and non-lethal air effects. It can affect an actor's will, understanding or capabilities in ways informed by intelligence, surveillance and reconnaissance (ISR). In addition, air power's ubiquity and agility enable it to be used to exert influence without significant commitment; in effect, engagement without entanglement to pose or counter threats at range. Integrated action coordinates and synchronises:

- fires (military power effect through both physical and virtual means);
- information activities (including regional and key leader engagement);
- manoeuvre (the ability to remain mobile to gain advantage in time and space); and
- outreach (including stabilisation, support to governance and capacity building).

4.5. Although the effects of integrated action are primarily targeted at an adversary, it also has an impact on a wide range of other actors who need to be influenced. This can include civilian partners, such as non-governmental organisations, the UK population, allies and regional audiences. Therefore, although integrated action implies the sole use of military capabilities, it invariably requires coordination or integration with the activities of other government departments.

Joint personnel deploying on operations on board a Globemaster C-17

Section 2 – Joint operations

4.6. Operations in the modern world are rarely, if ever, conducted within a single operational domain. Historically, maritime, land and air forces have worked together to achieve agreed objectives.[50] This joint approach to operations continues to underpin the UK's ability to deliver military power across the continuum of competition. Joint operations conducted correctly are extremely effective because the various capabilities across the single Services, allied with non-military capabilities, can complement the strengths and compensate for the limitations in each, thereby creating powerful synergies. Air power enhances the scale of options for the joint force; through its flexibility and the speed with which it can reach the engagement space, it provides vital projection, sustainment and precision firepower, offering significant military advantage to the joint commander.

4.7. The emergence of the space, and cyber and electromagnetic domains as operational domains, rather than simply enablers for the maritime, land and air domains, has broadened the opportunities for the joint force to converge effects across multiple domains, thereby presenting an adversary with multiple dilemmas at a tempo that complicates or negates their response. Air power is ideally placed to support this multi-domain operations approach due to its ability to mass quickly, operate at range, target with precision and exploit an

50 This is described as a joint operation where two or more Services operate as a single military force, under a single command structure, to accomplish a specific mission.

Apache AH1-D at low level over Norway

emerging opportunity rapidly. However, to maximise the effectiveness of air assets, they need to be efficiently integrated along, and across, all of the operational domains.

4.8. Effective multi-domain operations depend on mutual trust and understanding, built on well-established cooperation between the single Services. This leads the way to genuine, pan-domain integration, where an integrated approach becomes intuitive. The following paragraphs consider the key aspects of how air currently integrates with the other operational domains on a domain-to-domain basis. However, unlike recent operations in Afghanistan where the engagement space necessitated a focus upon air-land integration, the ability to synchronise air activity and effects across multiple operational domains simultaneously is key to deterring and countering the threats posed by more capable adversaries.

Air-land integration

4.9. Air-land integration (ALI) maximises the combat power created by coordinating and synchronising complementary capabilities from the air and land domains. It encompasses all the processes that plan, coordinate, control and deconflict the activities of the air and land components within a given engagement space.[51] Air power takes advantage of the strengths of land forces, such as awareness of the land engagement space, whilst compensating for their limitations, such as providing additional firepower to help preserve freedom of action. Effective ALI requires an understanding of the land domain within which such operations are planned.[52]

51 See Air Publication (AP) 3002, *Air and Space Warfare*, Edition 4, for guidance on air-land planning considerations.
52 See Joint Doctrine Publication (JDP) 0-20, *UK Land Power* for more detail on UK land power attributes and aspects.

F-35B Lightning launching from HMS Queen Elizabeth

4.10. Whilst control of the air affords freedom of manoeuvre for land forces, effective ALI is necessary to assure timely air support in the ISR, attack and air mobility roles. Aircraft in these roles can be allocated to hold varying degrees of readiness in support of land forces, either on the ground or in the air for urgent on-call tasking. The use of attack in support of land forces, through close air support or attack aviation call for fire, requires a high degree of mutual trust and understanding, particularly in dynamic combat situations where there is no clear delineation between enemy and friendly land forces. Operations in Iraq and Afghanistan reinforced the need for suitably qualified air liaison staff at every level and, more fundamentally, suitably qualified joint terminal attack controllers (JTACs) to act as an interface between the land force elements and aircraft operators. The UK's Air Support Operations Centre[53] provides the national capability for integrating air power into land and littoral operations at the tactical level via three core functions: integration and synchronisation of air activities with joint fires and the land scheme of manoeuvre; allocation of allocated air assets; and joint battlespace management.

Air-maritime integration

4.11. Air-maritime integration (AMI) is the understanding and combination of air and maritime procedures, capabilities and limitations to increase operational effectiveness. It enhances the combat potential of each. The air and maritime domains have certain similarities, such as scale and strategic scope, and sea control, like control of the air, is an essential prerequisite for freedom of manoeuvre. AMI is required for many operations, particularly where the anti-access and area denial (A2AD) threats that are faced cannot be countered in a single operational domain.

53 As part of the broader UK Air Support Operations Squadron.

4.12. Close coordination between ISR and combat air capabilities with complementary maritime capabilities can lead to significant synergies.[54] Maritime air defence capabilities contribute to counter-air or air policing duties by integrating their anti-air warfare capabilities with land-based aircraft, which helps to establish and maintain control of the air.[55] However, the effectiveness of such integration depends on the interoperability of individual aircraft and the overall combat system. Consequently, the ability to network information across components and between platforms from separate operational domains is critical to success.

4.13. The successful integration of potent capabilities, such as those provided by a carrier strike group (CSG), is highly dependent upon the liaison structure between the two components. A critical element within this structure for both NATO and the UK is the air operations coordination centre (maritime) (AOCC(M)), which coordinates the planning and tasking of air assets allocated in support of maritime operations and monitors their execution. For UK-led, or national-only operations involving a CSG, the AOCC(M) will usually be collocated with the maritime component commander as that is where it can provide the best support to both the air and maritime component commanders; this could be ashore or afloat.

Ministry of Defence Carbonite-2 imaging satellite

Air-space integration

4.14. Space services provide vital enabling capabilities for all of the operational domains, the importance of which has been reflected by establishing a separate UK Space Command. Air-space integration is critical to successfully employ air power. The effectiveness and potency of aircraft operations is closely linked to the effectiveness of enabling space capabilities, such as positioning, navigation and timing for aircraft and weapons, or voice and data communications. Equally, air power is

54 See Allied Tactical Publication (ATP)-3.3.3.1, *Air Maritime Coordination Procedures* for more details.
55 Such as between the Royal Navy's Type 45 Destroyer, through use of its air defence radar, in support of Royal Air Force (RAF) Typhoon quick reaction alert operations.

critical to space power, for example, by providing air defence of the ground segment infrastructure.

4.15. Effective air-space integration at the operational planning level can also provide opportunities to make use of complementary capabilities. For example, both the air and space domains offer significant ISR capabilities, which, when effectively coordinated, can ensure a more complete understanding of the engagement space and mitigate gaps in each other's coverage. For deployed operations involving a joint (or multinational) force, the nominated space coordinating authority is responsible for coordinating, planning and executing space capabilities in support of the other warfighting domains. The UK Space Operations Centre located at Royal Air Force (RAF) High Wycombe acts as the UK's focal point for space support and integration across Defence.

Air-cyber integration

4.16. Air-cyber integration is the use of air and cyber capabilities to create effects in the relevant engagement space. Air-cyber integration can involve cyber operations in support of air operations, or air operations in support of cyber operations. Air platforms and systems have become increasingly dependent on cyberspace and the people, processes, technology and data within it. Without assured access to systems such as command and control, maintenance, mission planning and communications, the ability of the air component to conduct its operations would be degraded. Commanders at all levels need to consider their reliance upon cyberspace and proactively direct measures to increase their resilience. By understanding their cyber risks, implementing cybersecurity measures and integrating with defensive cyber operations, commanders can improve their overall mission assurance on operations. Offensive cyber capabilities are generally considered to be strategic in nature with permissions for their use held either at a high level nationally, or outside the military chain of command. In addition, cyber effects can be highly classified and compartmentalised due to the sensitivity of techniques used and the nature and complexity of accesses. These factors are just some of the challenges to integration at the operational level.[56]

4.17. Offensive cyber operations in support of air operations target adversary personnel, processes, technology and data through cyberspace to increase the likelihood of successfully achieving air objectives.[57] Data links could be

56 See JDP 0-50, *UK Defence Cyber and Electromagnetic Doctrine* for more detail on UK cyber power attributes and aspects.
57 The National Cyber Force plans and conducts offensive cyber capabilities for the UK.

attacked to degrade an integrated air defence system, reducing the risk to otherwise vulnerable aircraft penetrating hostile airspace. Integrating such cyber effects can help to disrupt and overcome A2AD threats, providing the freedom to attack targets in enemy territory. However, offensive cyber capabilities are likely to require tailoring to each specific target, which might not match the timescales associated with an air power response. The potential use of a cyber capability to create an effect in support of air power therefore needs to be considered early in the planning phase with intelligence requirements set as far in advance as possible.

4.18. Air operations in support of cyber operations can include kinetic attacks on selected computer nodes to deny an adversary a critical capability or force them to use networks that can be attacked or exploited using cyber capabilities. Such activities must be coordinated through a full spectrum targeting process to ensure unintended consequences are avoided or managed. For example, a tactical operation by attack aircraft to destroy a bridge as part of an operational-level air interdiction campaign may inadvertently undermine a higher-value, strategic cyber operation if the bridge is carrying fibre optics which support the networks that are being exploited.

Multinational operations

4.19. NATO is at the heart of UK Defence and, therefore, a UK national approach will generally be framed within a broader multinational response that includes allies. Alliances and coalitions provide a range of options that most nations could not generate independently, including unique capabilities, as well as potentially providing the required mass for favourable force ratios in a contested scenario. Whilst UK air power remains capable of delivering all four air power roles independently, like most Western air forces the UK has seen a reduction in front-line aircraft numbers over the past 20 years as the cost of maintaining a technological edge over potential adversaries has increased. Interoperability with allies, especially NATO and the United States (US), enables air power to be massed at the operational level and delivered at the tactical level via mission-specific packages of aircraft drawn from different nations; this is a process that is facilitated greatly by the use of NATO air doctrine and terminology wherever possible.

Coalition operations in action – Libya

Operation Unified Protector was NATO's response to a United Nations Security Council resolution that authorised the use of 'all means necessary' to protect Libyan civilians from the forces of the country's long-time national leader Muammar Gaddafi following a widespread uprising in 2011. At the time, US air power was heavily engaged on operations in Afghanistan and Iraq and politically the US did not want to be seen to take a lead role in an intervention in another predominantly Muslim country. Consequently, a broad coalition was required to ensure both legitimacy in the eyes of the wider regional audience and provide the necessary air power capabilities – particularly in the key areas of ISR, air-to-air refuelling and suppression of enemy air defences, which NATO traditionally relied upon the US to provide. Within days, a broad coalition of 16 nations, including three Arab nations (the United Arab Emirates, Qatar and Jordan) were conducting air operations across Libya. The UK's military contribution was significant and included Typhoon aircraft rapidly modified to conduct air-to-ground attacks. Whilst the majority of air assets were provided by the US, UK and France, the contribution of smaller air forces was key to ensuring the required number of sorties were generated to meet the joint task force commander's strategy. For example, the Danish Air Force's detachment of six F-16s conducted nearly 1,300 sorties, released 923 precision-guided munitions and cancelled no sorties due to maintenance issues throughout the campaign. In just over seven months, the Western-led air campaign allowed a group of poorly equipped rebels to bring about the defeat of a well-armed military and the downfall of a dictatorship that had spanned more than 40 years.

Section 3 – Enabling air power

4.20. The ability to deliver each of the four roles of air power is dependent on four critical enablers:

- base;
- sustain;
- connect; and
- protect.

Various basing options enable rapid effect to be created across the globe: air logistics enable the sustainment of operations; command, control, computers communication and information system (C4IS) capabilities enable connectivity; and force protection capabilities enable the protection of forces at home and overseas.

Base

> A mile of highway will take you a mile. A mile of runway will take you anywhere.
>
> Anon

4.21. Air power can operate from a range of basing options, providing maximum agility for operations. Basing options include the UK mainland, Overseas Territories, allied and partner bases, sea basing and forward land basing. Each has different access constraints, in terms of staging, overflight, force protection and sustainment, and each can provide different political options when projecting power globally.

a. **UK mainland.** UK basing enables air power to protect the UK mainland and respond to crises almost immediately without the need for deployed logistic or host-nation support. However, to project air power outside the UK, permission may be required to overfly sovereign territories. Even with air-to-air refuelling, the effective operational reach of current combat air capabilities is limited to Middle Eastern and North African regions and to project air power to any of these regions, prior overflight permission from European allies will be required.

b. **Overseas Territories.** UK Overseas Territories enable air power to extend its reach to regions of strategic interest without the requirement for host-nation support. For example, the UK base in Cyprus plays a pivotal role in the ability to project power in support of national objectives and this was most recently the case when providing UK air power for coalition operations over Iraq and Syria against Islamic terrorists. However, Overseas Territories can be particularly reliant on force protection and on logistic support to sustain operations. Access to Overseas Territories can also be reliant on overflight permissions from other nations.

An RAF air traffic controller at the Royal Air Force of Oman's Thumrait Air Base during Exercise Saif Sareea

c. **Allies and partners.** Maintaining good relations with allies and partners enables the potential to operate from their sovereign territories in support of UK national or combined coalition objectives. Using such bases can significantly expand global reach but is reliant on maintaining good relations with the host nation. History has shown that allied bases can provide a politically and operationally sustainable means of enduring air operations.

d. **Sea basing.** The sea basing of aircraft enables global reach and the ability to act unilaterally with reduced dependency on staging or overflight permissions. Ships can be equipped with integrated command and control facilities, capable of directing limited air operations. Sea-based aircraft can integrate with land-based aircraft to maximise their effectiveness. Ships are also able to loiter in areas of tension, drawing on the maritime attribute of poise to deter adversaries, react to events or reassure our allies.[58]

e. **Forward land basing.** If access can be gained to, or near to, an adversary's territory and a basing option secured, it can enhance speed of response, persistence and concentration of support for land forces. Forward land basing can also be essential for force extraction. However, it is dependent on the available infrastructure to support

58 See JDP 0-10, *UK Maritime Power* for more detail on maritime power attributes.

the aircraft type, force protection and the ability to maintain control of the air in the vicinity of the base. It may also require a full suite of deployable enablers to generate and sustain the deployed force.

4.22. Since the end of the Cold War, most UK air operations have been conducted from well-found facilities, whether main operating bases in the UK or deployed operating bases such as those used in Afghanistan during Operation Herrick. Provided the threat to the airbase from an adversary can be mitigated, well-found bases remain the preferred choice for generating air power, especially for participation in large, complex, multinational air operations. However, the resurgence of state-based threats and the proliferation of A2AD capabilities places a greater emphasis on an agile basing approach. No single option can assure air power's ability to achieve global reach. Maintaining the ability to operate across a spectrum of basing options, and move seamlessly between them, provides operational flexibility in the contemporary operating environment. Selecting the most appropriate operating location will be based on an assessment of the various basing options available, taking into account the scenario and the overarching context. This includes at the tactical level where the ability to temporarily operate aircraft from austere or civilian locations on a mission-by-mission basis can significantly limit an adversary's capacity to interfere in our air operations.

Sustain

4.23. Sustainability enables air power force elements to deploy to an area of operations and remain fully mission capable for a variety of roles. It provides the flexibility to remain on task and operationally capable for as long as necessary. Sustainability is defined as: the ability of a force to maintain the necessary level of combat power for the duration required to achieve its objectives.[59] Sustainability is:

- one of the principles of war;
- the responsibility of commanders at every level of command;
- an integral part of the planning, preparing and executing of, and withdrawal and recovery from, every operation; and
- to be fully exercised in peacetime to be effective in war.

59 NATOTerm.

The RAF's Mobile Catering Squadron provides catering support to exercises and operations

4.24. Air logistics is the ability to plan and execute the movement, maintenance and sustainment of air power. Providing a variety of logistic functions is a complex, dynamic and wide-ranging series of disciplines that can often dictate the operational tempo. It is part of the standard Defence Support Network, but it has a particular dependency on reachback for the repair and replacement of high value, complex aircraft. This generates a need for an efficient supply chain and sufficient stocks for contingency operations, which links into UK and partner nation industry.

4.25. Air logistics operations are conducted in line with the nine logistics principles which were adopted from NATO. These principles are:

- authority;
- primacy of operational requirements;
- coordination and cooperation;
- assured provision;
- sufficiency;
- efficiency;
- simplicity;

- flexibility; and
- visibility.[60]

In general, responsive engineering and supply offsets aircraft fragility, high levels of equipment availability counters the cost of massing air assets, and rapid mobility and enabling can offer new basing options and the ability to rapidly enact air operations at reach. However, air logistics can also form a vulnerability due to its inherent complexity and the wide-spread supply base that is susceptible to physical, cyber, commercial and even political disruption.

Connect

4.26. Air C4IS is a key enabler for air power due to the reliance on robust lines of communication between a multitude of home locations and overseas operational theatres. Indeed, generating aircraft for air operations invariably depends upon the collaborative working, in near real time, of geographically disparate users. Moreover, effective air command and control cannot be delivered without a robust C4IS solution, irrespective of where the air commander and their staff are located. Information exchange enabled through data links at the tactical and operational levels enables force survivability, shared situational awareness and, ultimately, information advantage; all of these are critical to mission success in any complex, contested engagement space.

4.27. The successful sharing of information and data gathered on operations requires a high degree of reliable connectivity and interoperability between participating units and platforms. Some aircraft systems also require connectivity to the Internet to operate effectively. The overall C4IS solution must enable seamless integration of information whilst ensuring only those who should have access can get access (confidentiality), that the information is accessible when it is required (availability) and that the data can be assured to have not been tampered with (integrity). In addition, enabling C4IS capabilities must be capable of being held at a readiness that matches the readiness of the air assets, irrespective of the number of aircraft that are ultimately employed. This drives a requirement for a C4IS capability that is air transportable, agile[61] and scalable.[62]

60 See JDP 4-00, *Logistics for Joint Operations* for more details.
61 Agile – meaning that the information system can be reconfigured to accommodate unforeseen changes in basing strategy, command and control arrangements, coalition partners and their requirements, and differing aircraft requirements.
62 Scalable – meaning they can be expanded incrementally as the user community grows.

4.28. The criticality of C4IS to generating and delivering air power provides an opportunity for adversaries and other actors to disrupt air operations via cyberattack. As has been seen with recent cyberattacks on civilian networks,[63] such methods are difficult to attribute[64] and can be executed by malicious individuals, highly capable threat organisations or states. The rapid development of offensive cyber capabilities offers adversaries the potential of targeting our C4IS systems, which could have a significant effect on air power employment. Understanding the threat to, and vulnerability of, these systems will allow an evaluation of the associated risks. Identifying and understanding such capabilities provides the opportunity to develop means of protection through defensive cyber operations.

An RAF communications infrastructure technician working on an antenna in Cyprus

Protect

4.29. Air power projection relies on the protection of a network of operating bases, people, aircraft, C4IS networks and logistical nodes in the UK and around the world. Aircraft are scarce, expensive and fragile, and either operate from relatively large, static bases that are difficult to disguise, or from small, remote forward operating bases or forward arming and refuelling points. Force protection is required to ensure the freedom of action to operate from such bases and to help mitigate the strategic consequences that could arise from the loss of highly capable aircraft.[65]

4.30. An early-entry force protection capability at the outset of an operation secures operating bases and enables the deployment of air power. Subsequent air operations are protected through coordinated activities and measures, both on the operating base and within any assigned ground defence area, established beyond the airbase perimeter. Successful force protection relies on a detailed understanding of how the airbase operates, its resident capabilities and the local physical, human and information

63 An example of such a cyberattack was the malware attack on the company computer network of Maersk in 2017, which severely disrupted their global shipping operations for two weeks.
64 Thus, perfect for sub-threshold activities.
65 Since air power can be projected directly from the UK, force protection considerations apply equally to non-deployed capabilities.

terrain that surrounds it.[66] Air force protection measures fall into four broad categories, underpinned by force protection, command and control, and timely intelligence, which are:

- active defence, which involves measures necessary to deter, prevent, nullify or reduce the effectiveness of an adversary attack (both in the air and on the ground);
- passive defence, which involves measures to minimise the effects of adversary attack, including the hardening of key facilities; camouflage, concealment and deception; dispersion of key assets; and counter-chemical, biological, radiological and nuclear activity;
- recuperation, which covers all measures necessary for air capabilities to recover from the effects of an attack, restore essential services and enable air operations to continue; and
- security, comprising the organised systems of defensive measures instituted to ensure that key information, materiel, personnel and installations are protected against terrorism, espionage, sabotage, subversion and organised crime. Additionally, the criticality of security is reinforced by the current and future requirements for secure information access to enable fifth generation platform operations and further development.

An RAF Police dog handler with his military working dog in the Falkland Islands

4.31. Due to the likely criticality of securing an airport of embarkation as part of a non-combatant evacuation operation (NEO), and as NEOs have proved to require a short-notice rapid response, air force protection elements should be kept at an appropriately high level of readiness as part of a joint rapid reaction force.

66 See ATP-3.3.6, *NATO Force Protection Doctrine for Air Operations* for more detail on air force protection considerations and capabilities.

Force protection in action – Operation Pitting

On 15 August 2021 following a rapid offensive, Afghanistan's capital, Kabul, fell to the Taliban. In the days that followed a multinational NEO was undertaken; the UK's contribution to which, Operation Pitting, became the largest such national effort since World War 2. Centred around the international airport at Kabul and involving approximately 1,000 military personnel, predominantly from 16 Air Assault Brigade, the UK military enabled the evacuation of UK nationals, embassy staff and Afghans eligible for relocation. Within 24 hours an airbridge was established between the UK and Afghanistan with RAF Voyager, A-400M, C-17 and C-130J Hercules aircraft conducting evacuation flights. Key to these operations was the security provided by 16 Air Assault Brigade, with RAF Regiment and RAF Police personnel providing air force protection specialist capabilities who, in conjunction with US and allied forces, successfully took control of the airport. Whilst access to the airport, as well as the city at large, remained under Taliban control, the presence of a capable force protection force enabled movement staff to rapidly turnaround and load aircraft unhindered. Between the start of the operation and the final flight on 28 August 2021, in excess of 15,000 people were flown out of Kabul by the RAF; including 436 people on a single C-17 flight, triple the aircraft's designed capacity and the highest capacity flight in RAF history.

Generating air power

4.32. Organisationally, the UK delivers deployed air power primarily through the RAF's expeditionary air wing (EAW) model, aviation task forces provided by the Joint Helicopter Command (JHC) or via a Royal Navy CSG. These are discussed in more detail below.

a. **Expeditionary air wings.** EAWs provide the enabling functions for a deployed operating base, with or without the assistance of a host nation. They are scaled to meet the operational requirement, from a small deployment in support of one force element (potentially even a single aircraft) through to a large-scale deployment operating multiple types of aircraft covering all four air power roles. EAWs may be

permanent to provide air power within a long-term theatre,[67] or ad hoc in response to a specific, temporally bounded operational commitment.

b. **Aviation task forces.** The JHC provides rotary wing combat power via scalable high readiness aviation task forces (ATFs). These are task organised to meet the operational requirement with assets drawn from the most appropriate aviation organisation. To support land operations, the British Army's Aviation Brigade Combat Team can generate two ATFs; the Commando Helicopter Force can provide an ATF to support littoral operations; and the Support Helicopter Force can provide an ATF to support air assault, air mobility, humanitarian assistance and disaster relief tasks. ATFs train for worldwide, contested, multi-domain operations and act as the vanguard of JHC combat forces.

c. **Carrier strike group.** A CSG is the UK term given to describe the capability underpinned by the Queen Elizabeth Class aircraft carriers. It is an integrated and sustainable joint capability, interoperable with NATO allies and other coalition partners. It draws together the coordinated operation of the aircraft carriers, combat and support aircraft, and enabling capabilities to conduct the four roles of air power.[68] The Royal Navy's Fleet Air Arm, as well as suitably trained and marinised[69] RAF and British Army force elements can all operate from the maritime domain as part of a CSG.[70] In addition, key international and coalition partners, especially other F-35B owning nations can contribute to CSG operations.

67 Such as 905 Expeditionary Air Wing based at RAF Mount Pleasant in the Falkland Islands.

68 Within the maritime domain, the terms 'carrier strike' and 'rotary strike' are used to describe attacks against land targets using embarked fixed-wing and attack helicopters respectively. See The Fighting Instructions Book of Reference (digital) (BRd) 4487, Volume 2.1, *Strike Warfare*.

69 Marinised refers to the design, redesign or testing of products for use in a marine environment. Most commonly, it refers to use and long-term survival in harsh, highly corrosive salt water conditions. It is also taken to refer to the adaption of non-naval personnel to the requirements of operating at sea.

70 For attack operations the CSG operates F-35B Lightning, Apache and Wildcat aircraft supported by the multi-role Merlin Mk 2 for ISR support. For littoral manoeuvre and special forces operations, a mixed air group may be used comprising Chinook and Merlin for air mobility and Wildcat and Apache for attack.

A Typhoon FGR4 intercepts and escorts a Russian SU-30 over the Baltic Sea as part of the NATO Baltic Air Policing Mission

Section 4 – Employing air power

4.33. In an operating environment defined by complexity and uncertainty, our air forces are capable of exerting air power for strategic effect across a range of tasks, whether deterring adversaries, delivering aid rapidly around the globe, building partnerships through multinational exercise participation or delivering decisive actions in combat. Defence is required to operate on a campaign basis to counter persistent sub-threshold competition, whilst retaining the ability to conduct combat operations above the threshold of armed conflict.[71] Whilst not a doctrinal framework, the *Integrated Operating Concept*[72] functions of operate (protect, engage, constrain) and warfight provide a useful structure through which the employment of UK air power can be viewed.

Protect

4.34. One of the principal purposes of Defence is to contribute to the security and resilience of the home base. A secure home base acts as the first tier of

71 As outlined within *Global Britain in a competitive age: The Integrated Review of Security, Defence, Development and Foreign Policy*, March 2021.
72 For more information see the *Integrated Operating Concept*, August 2021.

A Chinook placing sandbags on Toddbrook Reservoir in 2019 in support of local authority operations to protect the town of Whaley Bridge

deterrence by denial.[73] UK air power plays a critical role in supporting the defence of the homeland and Overseas Territories by maintaining the integrity of sovereign airspace and ensuring freedom of manoeuvre. Typhoon aircraft are on permanent standby in the UK and the Falkland Islands to provide national defence and security and to assure control of the air through combat air patrol or quick reaction alert. A robust system of command and control is a critical element of this, as are our allies, who help provide the necessary early warning. The UK's ability to rapidly reinforce the home base air policing posture in the event of a specific threat or increased security risk provides operational flexibility and a clear demonstration of capability to potential adversaries.[74]

4

4.35. The ultimate guarantee to the UK's safety is provided by the nuclear continuous at sea deterrent. Although details are classified, air power provides a key enabling role to provide sustainment, protection and intelligence. Royal Navy rotary wing aircraft are employed in this capacity, as are the RAF's P-8 Poseidon maritime patrol aircraft, which conduct specialist military data gathering in support of maritime operations to deliver the nuclear deterrent.

4.36. Air power can also be employed to enhance resilience within the UK via support to civil authorities, usually in response to natural disasters, such as flooding, or to terrorist attacks. Air mobility (both rotary wing and fixed-wing) and ISR aircraft are of most utility and can be employed to provide niche capabilities that civilian agencies may lack; most recently this capability was used during the COVID-19 pandemic with specialist aeromedical airlift being used to move patients around the UK. ISR aircraft have also been used to provide imagery of disaster hit areas and help look for missing persons, both on land and in coastal waters.[75]

73 In this context, the home base, including its airspace, territorial waters or exclusive economic zone, is the UK homeland, Overseas Territories and Crown Dependencies, permanent joint operating bases, and key lines of communication.

74 For example, deploying six Typhoon aircraft to RAF Akrotiri in 2013 to protect the base from the threat of attack from Syrian aircraft. The aircraft were operational in Cyprus within 72 hours of being tasked in the UK.

75 See JDP 02, *UK Operations: the Defence Contribution to Resilience* for more detail on air power's role in support to the UK civil authorities.

The Red Arrows perform above Expo 2020 Dubai

Engage

4.37. The purpose of engage is prevent conflict, build stability and gain influence. Engage is founded on a forward deployed and persistent posture that is integrated with other government departments and is engaged internationally with our networks of allies. Air power is well placed to provide influence and understanding through a variety of means. Forward deployment of air assets, whether temporary or permanent, is not a new concept; speed and reach allows the UK to deploy air power globally, either episodically in response to a specific situation or permanently as part of a bilateral security approach with another nation. For example, permanent EAWs within the Middle East provide mutual assurance to the hosting nations as well as strategic airbases from which to project UK air power.

4.38. The reputation and professionalism earned by the RAF, Fleet Air Arm and Army Air Corps through performance on operations means that UK air power is held in high regard by both allies and potential partners. The subsequent demand for visits, collaborative training, exercise participation, both in the UK and abroad, and exchange officer programmes provides the opportunity to exert influence and gain understanding. Such engagement not only improves the capacity of host nations to handle their own internal security challenges and establishes enduring relationships with regional military and political leaders but also represents a commitment that demonstrates the UK's resolve. Air power can also be employed through engagement to fly the

flag for broader UK government activities. Display teams such as the RAF Aerobatic Team, the Red Arrows, through participation in international displays around the world support defence export programmes and provide a visible demonstration of UK air power excellence to a broad audience.

4.39. Air power's speed of response in support of disasters, such as earthquakes, flood or famine, can also generate a spirit of goodwill or alleviate previously held grievances, thereby promoting security and stability. Consequently, this task contributes to gaining and preserving access and freedom of action by building alliances and partnerships, which is vital for air power projection.

Constrain

4.40. The purpose of constrain is to compel an adversary towards a course of action or to severely restrict the scope of their ambition or activity. Activities in the constrain function form an important element of deterrence; they demonstrate resolve and capability, as well as imposing costs on an adversary. Activities with the purpose of constraining allow the UK to shape the strategic environment in our national interest. Constrain can include the application of hard power in a state of armed conflict, but also below the threshold of armed conflict, to achieve strategic objectives when the threat demands it.

4.41. Air power can be used to signal clear political intent through a range of measures, such as the overt deployment of combat aircraft to a particular region or intensified peacetime training exercises. It can contribute to stabilising a crisis situation through the airborne insertion of personnel into a region where conflict threatens to spill over into neighbouring states. It can provide implicit deterrence by deploying ISR aircraft to warn a potential aggressor that their actions are being watched and could provoke a response. Ultimately, it can also deliver strategic attack deep into an adversary's territory to deny an adversary the assurance that their homeland can be kept safe. UK air power's reach via air-to-air refuelling, airlift capacity and advanced combat air capabilities provided by the F-35B Lightning II may be employed to conduct, or facilitate, 'strategic raiding', whether as part of a joint force or as a stand-alone air operation. Where constrain activities escalate to broader combat operations, control of the air will need to be established or assured in a threat environment where near-peer adversaries and third parties could be operating air threats ranging from small uncrewed aircraft systems through to advanced fighters and surface-to-air missile systems.

Countering Russian aggression in Ukraine

On 24 February 2022, Russia invaded Ukraine in a major escalation of the Russo–Ukrainian conflict that began in 2014 with the annexation of the Crimea and the seizure of parts of south-eastern Ukraine by Russian-backed separatists. The UK and its NATO allies responded quickly to enhance Ukraine's defence capability whilst simultaneously strengthening collective defence measures in Eastern Europe. Air power was at the vanguard of the response. The rapid delivery of defensive lethal aid by air, especially shoulder-fired anti-armour weaponry, proved critical to halting Russian armoured columns attempting to encircle and seize the Ukrainian capital Kyiv, thereby denying Russia a quick strategic victory. Enhanced air policing activity to secure NATO airspace and reassure member states in Eastern Europe was enacted within 24 hours of the invasion commencing, providing a clear deterrence message to Russia. The UK's contribution centred around fully armed Typhoon aircraft operating from the UK and Cyprus which, supported by Voyager air-to-air refuelling aircraft, helped patrol the NATO airspace over Poland and Romania. In addition, the UK's intention to robustly defend NATO territory and airspace against any Russian aggression was further demonstrated through the temporary deployment of F-35B Lightning II aircraft to Estonia and providing Wildcat helicopter air support to the UK-led NATO multinational battlegroup based within the country. UK air power participation in multinational exercises within the region was also increased, such as on Exercise Swift Response, which brought together 40 aircraft, including UK Typhoons and Apaches to overtly practise close air support missions, thereby sending a clear message regarding NATO's capability to employ overwhelming force from the air if necessary.

Warfight

4.42. A transition to a warfighting campaign is an escalation from constrain and is a tool of last resort. The purpose of a warfighting campaign is the delivery of lethal violence focused in such a manner that it compels an enemy to acquiesce to the UK's or its coalition's will. The ability and willingness to commit capability to fighting wars is the foundation of our influence and deterrence. In this scenario, the key role of air power is to defeat an adversary's air forces to gain and maintain an acceptable degree of control of the air; without this, warfighting at scale against a peer, or near-peer, adversary is

unwinnable. The proliferation of advanced A2AD systems mean that the UK, and NATO, cannot take for granted the freedom to operate in the air domain as has been the case during all operations since the first Gulf War. Air power also provides the ability to mass firepower quickly in response to an adversary's attack, often while land and maritime forces marshal and deploy.

> Invincibility lies in the defence; the possibility of victory in the attack.
>
> Sun Tzu

Key points

- Although air power is capable of independently achieving desired political objectives, it works most effectively when used with the other components of military power through integrated action.
- Through air power's flexibility, and the speed with which it can reach the engagement space, it provides vital projection and sustainment, thus offering significant military advantage.
- Effective cross-domain integration depends on mutual trust and understanding, built on well-established cooperation between the single Services.
- The ability to deliver each of the four air power roles is dependent on four critical enablers: base, sustain, connect and protect.
- Air power can be employed across the functions of protect, engage, constrain and, in extremis, warfight.

Notes

Lexicon

Section 1 – Acronyms and abbreviations

A2AD	anti-access and area denial
AAR	air-to-air refuelling
ACA	airspace control authority
AJP	Allied joint publication
ALI	air-land integration
AMDC	air and missile defence commander
AMI	air-maritime integration
AOCC (M)	air operations coordination centre (maritime)
AOD	air operations directive
AP	Air Publication
ASACS	air surveillance and control system
ATF	aviation task force
ATO	air tasking order
ATP	Allied Tactical Publication
BAI	battlefield air interdiction
BRd	Book of Reference (digital)
C4IS	command, control, communication, computers and information system
CAOC	combined air operations centre
CAS	close air support
CBRN	chemical, biological, radiological and nuclear
CFACC	combined force air component commander
COED	Concise Oxford English Dictionary
CRC	control and reporting centre
CSG	carrier strike group
DCA	defensive counter-air
DCDC	Development, Concepts and Doctrine Centre
EAW	expeditionary air wing
EME	electromagnetic environment

FLOT	forward line of own troops
FSCL	fire support coordination line
GAT	guidance, apportionment and targeting
GPS	Global Positioning System
ISR	intelligence, surveillance and reconnaissance
JAOC	joint air operations centre
JAOP	joint air operations plan
JDP	joint doctrine publication
JFACC	joint force air component commander
JFAC HQ	joint force air component headquarters
JFC	joint force commander
JHC	Joint Helicopter Command
JTAC	joint terminal attack controller
KBI	kill box interdiction
MAOP	master air operations plan
MOD	Ministry of Defence
NASOC	National Air and Space Operations Centre
NATO	North Atlantic Treaty Organization
NEO	non-combatant evacuation operation
OCA	offensive counter-air
PED	processing, exploitation and dissemination
RAF	Royal Air Force
SAM	surface-to-air missile
SCA	space coordinating authority
SCAR	strike coordination and reconnaissance
UN	United Nations
US	United States

Section 2 – Terms and definitions

This section is divided into two parts. First, we list new definitions that will be added to JDP 0-01.1, *UK Terminology Supplement to NATOTerm* followed by already endorsed terms and definitions.

New definitions

remotely piloted aircraft
An uncrewed aircraft that is controlled from a remote pilot station by a pilot who has been trained and certified to the same standards as a pilot of a crewed aircraft. (JDP 0-30, 3rd Edition)

uncrewed aircraft
An aircraft that does not carry a human operator and is operated remotely using varying levels of automated functions.
Notes: 1. Uncrewed aircraft can be expendable or recoverable.
2. Uncrewed aircraft may carry a lethal or non-lethal payload.
3. Cruise missiles are not considered uncrewed aircraft.
(JDP 0-30, 3rd Edition)

uncrewed aircraft system
A system whose components include the uncrewed aircraft, the supporting network and all equipment and personnel necessary to control the uncrewed aircraft. (JDP 0-30, 3rd Edition)

Endorsed definitions

aircraft
Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface. (NATOTerm)

air mobility
A fundamental role of air power which enables movement, manoeuvre and sustainment. (AP3002, 4th Edition)

air power
The ability to use air capabilities in and from the air, to influence the behaviour of actors and the course of events. (JDP 0-01.1)

attack
A fundamental role of air power which can coerce and influence actors into changing or maintaining behaviour. (AP3002, 4th Edition)

automated
Pertaining to a system that, in response to inputs, follows a predetermined set of rules to provide a predictable outcome. (NATOTerm)

autonomous
Pertaining to a system that decides and acts to accomplish desired goals, within defined parameters, based on acquired knowledge and an evolving situational awareness, following an optimal but potentially unpredictable course of action. (NATOTerm)

command
The authority vested in an individual of the armed forces for the direction, coordination, and control of military forces. (NATOTerm)

control
The authority exercise by a commander over part of the activities of subordinate organizations, or other organizations not normally under their command, that encompasses the responsibility for implementing orders or directives. (NATOTerm)

control of the air
A fundamental role of air power which secures our freedom of action within the air environment. (AP3002, 4th Edition)

Defence engagement
The use of our people and assets to prevent conflict, build stability and gain influence. (JDP 0-01.1)

fire support coordination line
Within an assigned area of operations, a line established by a land or amphibious force commander to denote coordination requirements for fires by other force elements which may affect the commander's current and planned operations. The fire support coordination line applies to fires of air, ground or sea weapons using any type of ammunition against surface or ground targets. The establishment of the fire support coordination line must be coordinated with the appropriate commanders and supporting elements. Attacks against surface or ground targets short of the fire support coordination line must be

conducted under the positive control or procedural clearance of the associated land or amphibious force commander. Unless in exceptional circumstances, commanders of forces attacking targets beyond the fire support coordination line must coordinate with all affected commanders in order to avoid fratricide and to harmonize joint objectives.
Notes: in the context of this definition the term “surface targets” applies to those in littoral or inland waters within the designated area of operations. (NATOTerm)

forward line of own troops
Positions of friendly forces in any kind of military operation at a specific time. (NATOTerm)

intelligence
The product resulting from the directed collection and processing of information regarding the environment and the capabilities and intentions of actors, in order to identify threats and offer opportunities for exploitation by decision-makers. (NATOTerm)

intelligence, surveillance and reconnaissance
A fundamental role of air power, which informs the development of understanding across all environments. (AP3002, 4th Edition)
Note: For coherence of terminology the next edition of AP3002 will replace environments with domains.

interoperability
The ability to act together coherently, effectively and efficiently to achieve Allied tactical, operational and strategic objectives. (NATOTerm)

joint
Adjective used to describe activities, operations and organizations in which elements of at least two services participate. (NATOTerm)

joint action
The use of a combination of manoeuvre, fires, information and civil-military cooperation to create physical, virtual and cognitive effects.
Notes: Joint action is directed by command and control, informed by intelligence and supported by force protection and sustainment. (NATOTerm)

multinational
Adjective used to describe activities, operations and organisations, in which forces or agencies of more than one nation participate. (NATOTerm)

operational domain
A specified sphere of capabilities and activities that can be applied within an engagement space. (NATOTerm)

remotely piloted aircraft system
A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design. (NATOTerm)

space power
Exerting influence in, from or through space. (JDP 0-01.1)

sustainability
The ability of a force to maintain the necessary level of combat power for the duration required to achieve its objectives. (NATOTerm)

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Published by the Ministry of Defence
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