# Essays on
# AIR POWER

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# Foreword

The last century has seen the aeroplane move from an observation platform to becoming a lethal instrument of war at the forefront of conflict. A military force's success in conflict is very closely tied to its having a capable air force. Possession of highly sophisticated weapons platforms and support systems that operate at the cutting-edge of technology is not enough for an air force to be effective. The efficient and flexible employment of these systems is dependent on the ability of the members of the Air Force to operate them optimally. Essential to this man-machine interface is the technical and professional competency of air force personnel that is built on a clear understanding of air power developed through professional knowledge.

Professional mastery through air power education, therefore, remains a priority for all members of the Air Force. Professional mastery is a combination of a member's technical proficiency combined with a better than working knowledge of the application of air power. The dynamic environment within which our Air Force operates demands that all of us devote time to continually improving our professional knowledge.

Securing our nation's security interests, now and into the future, will depend on Australia having a capable and balanced Air Force. The Royal Australian Air Force's ability to deliver the necessary capability to the nation when required resides not in a platform-centric approach, but in a judicious combination of highly capable and professional people operating advanced weapon platforms and

systems. The measure of the Air Force's capability rests with its people.

Members of the Air Force must strive to achieve the necessary level of professional mastery by understanding the application of air power in a changing global environment. This should be an ongoing process throughout a person's career. The professional mastery of our people is the key to the future well-being of our Air Force.

This compendium of essays by Dr Sanu Kainikara provides an outstanding summary of the essentials of air power that is an excellent start to a member's professional library on air power. I trust that the essays will prompt all military members, especially Air Force personnel, to take up further study of contemporary air power matters, as an initial move into the professional mastery sphere.

I commend this collection of excellent essays to you.

**G.C. BROWN**
Air Marshal
Chief of Air Force
May 2012

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# Preface

It was Winston Churchill who said, 'Air power is the most difficult of all forms of military force to measure, or even express in precise terms'. While this sentiment was expressed at a time when air power theories were still being distilled in the aftermath of World War II, it holds true even today. However, in the ensuing years a sizeable quantity of work has been published regarding all aspects of air power; from academic discussions of its influence on the security environment, to the tactical appreciation of the effects of its application. Having established itself as a critical component of the warfighting abilities of a military force in the last century, air power is destined to play a significant role in determining a nation's military capability and intent in the 21st century. It is therefore, incumbent on all who are in the profession of arms or associated with it in some way to have a basic understanding of the fundamental facets of air power. This is not an easy task, but it is well within the capability of an average person with sufficient motivation and a penchant for learning.

New entrants to a military force are put through a dedicated training regime to ensure that they have the necessary skill sets to function as part of a team that may have to go into combat at short notice. This is a necessity. The training regime within most air forces, while attempting to achieve the same end-state, is somewhat more nuanced in its approach in comparison to the other Services. Since a majority of airmen will have to deal proficiently with technologically sophisticated equipment, the training schedule is normally much longer than those of the other Services and from a technology perspective, more intense. This is a double-edged sword. On the one edge, it creates personnel with highly developed skills and with the ability to readily absorb high levels of technological innovation rapidly. However, on the other

edge, they also tend to be resistant to furthering their learning from the pure technical mastery that they have obtained—this in spite of their ability to expand the envelope of technical mastery fairly easily when required. This tendency is further embedded in the culture of air forces because of the platform-centricity in the generation and application of air power, proficiency in which is fundamentally based on technical mastery of a very high order.

On the other hand, the transition from technical mastery to professional mastery is vitally important both for individual development and collectively for the evolution of the air force to increased efficiency and influence. This development is almost completely dependent on the education levels of the personnel. Professional military education and training is intrinsically connected; education, of any consequence, cannot commence without the individual having achieved a minimum desired level of technical mastery through training. Individual professional mastery, of the level required commensurate to an individual's position in the force, when combined optimally creates the collective professional mastery of the air force. Collective professional mastery of the highest order is fundamental to an air force evolving into a competent force with strategic influence. It is to the early developmental stages of an individual's professional mastery that this book—a collection of brief essays on air power, covering topics of primary interest—is targeted.

All members of the Air Force have a responsibility to educate themselves in the understanding of air power—its generation, application and sustainment. This knowledge must also provide a clear appreciation of the primary roles and characteristics of air power, as well as how an air force normally applies air power through an air campaign to create the effects necessary to achieve national security objectives. This can best be achieved by identifying the status of air power within the elements of national power and

distinguishing the subtleties of applying air power effectively as opposed to other forms of military power.

There is a tangible connection between the education of individuals within an air force and national security at the strategic level. An air force's primary function is to generate, apply and sustain air power to meet the national security objectives laid out by government. This can only be achieved when the force has sufficient collective professional mastery to employ air power optimally so that it can enhance its effectiveness in meeting grand strategic and military strategic objectives. Professional mastery is the linchpin in achieving this with the required level of proficiency. The ability to employ technologically sophisticated systems is only the starting point in the long journey to becoming a professional master of air power; appropriate education is the cornerstone on which such mastery is developed. This is particularly the case given the rapid and almost continuous changes taking place in the technology and application of air power, making individual professional development a critical requirement throughout an individual's air force career.

The continuum is clear; dedicated training to achieve technical mastery, followed by learning and education to attain the desired level of professional mastery, leading to collective professional mastery of the force that in turn permits it to evolve into a strategically influential element of national power. The role of the individual can never be overstressed.

This book contains 12 short essays on the fundamentals of air power, most of them dealing with enduring concepts and ideas and a few on the flexible adaptation of air power to deal with contemporary security challenges that are relevant to air forces today.

I acknowledge the invaluable insights provided by GPCAPT Phil Edwards on each of the essays and the clear suggestions and

support that came from GPCAPT Mark Hinchcliffe that have collectively made the essays more precise and readable.

It is hoped that this volume will provide a foundational knowledge of the complex and broad concept of air power for a beginner to its study and whet the appetite to engage in more detailed and involved analysis and understanding of this fascinating subject.

**SANU KAINIKARA**
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May 2012

# 1

# An Element of National Power

*Air power has become predominant, both as a deterrent to war, and—in the eventuality of war—as the devastating force to destroy an enemy's potential and fatally undermine his will to wage war.*

—General Omar Bradley[1]

The term 'air power' was first used by H.G. Wells in 1908 in his novel *The War in the Air*[2]. However, it became common usage only in the 1920s after air power had been extensively used as a military capability during World War I. At that time it was generally accepted that understanding air power theory was a complex issue and its optimum application even more so. Even now, although air power has matured into an indispensable military force within a single century, the complexity in its employment is profound. Air power has now become integral to the conduct of modern warfare and, in certain instances, the central element in conflict. Therefore, a clear understanding of its employment and the effects it can create is necessary at all levels of national security.

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[1] Quoted in Colonel Charles M. Westenhoff, USAF, Retired, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts*, Air University Press, Maxwell Air Force Base, Alabama, March 2007, p.54.

[2] H.G. Wells, *The War in the Air*, George Bell & Sons, London, 1908.

Air power encompasses all the uses of aviation and related capabilities in the pursuit of a state's, and in some cases non-state entities', security interests. Although air power is primarily considered an instrument of national military power, under certain conditions it transcends the purely military realm and affects national security directly. In these cases it becomes an element of national power. As a corollary, a number of non-military factors within the nation influence the development of air power capabilities. In this context, some of the broader considerations that have a salutary impact on a nation's air power are national technology base, sociological dimensions, economic considerations and cultural orientation of the population. All of these factors significantly affect a nation's ability to generate, employ and sustain air power.

The military and foreign policies of a nation, in combination with its intelligence and other policies, support the national security policy. These policies provide the means to achieve a desired end-state that will secure the nation. The primary concern is always to deter potential adversaries and, if that fails, to fight and win any ensuing conflict. Air power provides two fundamental inputs to this broader national security equation, over and above its principle use as a military force in conflict. First, it can support or assume a lead role in enhancing the deterrent posture of the nation. Second, air power can be very effective when employed in deterrent or coercive roles by the threat of use of force and demonstrated capability to apply lethal force.

In its simplest form, deterrence aims to prevent someone from doing something that is contrary to one's own inclinations. From a national security perspective, deterrence starts with attempts to avoid conflict through the employment of appropriate elements of national power and further steps that provide graduated responses to emerging situations. A nation that adopts a strategy of deterrence must ensure that its response capabilities, in case of attack, are extremely robust and demonstrated, and that potential adversaries

perceive them as such. This must be reinforced by the national will to employ the forces available.

In a deterrent role, air power encompasses the four cardinal principles on which a strategy of deterrence is based: intelligence, credibility, perception and applicability. Airborne Intelligence, Surveillance and Reconnaissance (ISR) capabilities provide major inputs to the enforcement of a deterrent strategy by collecting and disseminating timely and accurate intelligence on adversary manoeuvre and capability. Credibility of a strategy of deterrence is dependent on the adversary being convinced that they will be attacked if actions inimical to the state are initiated. Air power's ability to carry out lethal attacks with precision, discrimination and proportionality directly reinforces this credibility.

Deterrence is a matter of perception. Air power incorporates the ability to detect, deter and defeat adversaries and these same attributes can be tailored to emphasise the deterrent capabilities of the nation. Further, they can also be employed to alter the perceptions of the adversary through both kinetic and non-kinetic operations better than many other types of military forces and thereby uphold the strategy of deterrence. In fact, non-kinetic actions that indicate to the adversary that their centres of gravity and value systems have been identified and can be targeted at will are potent tools of deterrence. Applicability of deterrence is dependent on the quantum of influence that a state can bring to bear on an adversary. Sustained operations, with the inherent risk of high casualty levels, will detract from the effectiveness of deterrence.

While deterrence aims to avoid the use of force, coercion requires the ability to achieve a systematic and escalating level of destruction, if required, of the adversary's warfighting capabilities and other centres of gravity. In other words the necessity is to compel the adversary to accept the demands placed on them. Air power could achieve this through graduated non-kinetic action, such as show of force, although the success rate of these operations

may not be high. However, the concept of coercion through the application of force is particularly suited to the employment of air power because of its inherent ability to carry out precision strikes against high-value targets.

The application of lethal force is a last resort. Accordingly, deterrence and coercive strategies, based primarily on non-kinetic actions, have become more predominant and acceptable. These strategies have also become heavily dependent on influencing and shaping the environment rather than adopting a more belligerent posture. Air power comes into its own in these circumstances through the delivery of humanitarian aid in a responsive manner and by demonstrating the nation's innate ability to secure its interests. While these actions contribute directly to achieving national objectives and indirectly to national security, they have to be clearly underpinned by the ability to respond rapidly with force when necessary. Therefore, in order to be effective, air forces need to be flexible and retain a balanced force that can create the necessary effects across the full spectrum of conflict.

Under these circumstances, air power can be considered an element of national power. National air power therefore could be defined as the ability of a nation to assert its will through the medium of the air. This is a broad and overarching definition but provides an insight into the capacity of holistic air power to influence national security imperatives.

**Main Points**

- *National air power is the ability of a nation to assert its will through the medium of the air.*
- *Air power can enhance or be the lead agency in applying a strategy of deterrence.*
- *Air power is effective in implementing deterrent or coercive strategies if and when necessary.*

# 2

# A Balanced Force

*A modern, autonomous, and thoroughly trained Air Force in being at all times will not alone be sufficient, but without it there can be no national security.*

—General H. H 'Hap' Arnold, USAAF[1]

It is conventional wisdom that an air force of calibre will be inherently balanced, meaning that it will be the repository of air power capabilities that are necessary to conduct all key roles or air power credibly to a minimum desired degree. The term 'balanced' is now almost common usage in contemporary discussions of air power capabilities. So what exactly does a balanced air force mean?

Air forces have traditionally been platform and system-centric organisations, measuring their competence in terms of the number of aircraft that could be fielded as demonstration of their capability. However, with the increasing sophistication in the concepts of operation, facilitated by technology, this measure is not indicative anymore of the actual capability of a force. The effectiveness of a force is now measured in terms of the effects that it can create through the synergistic application of its capabilities in adequate quantity and in the appropriate mix. The efficiency of

[1] Great Aviation Quotes: Air Power http://wwwskygod.com/quotes/airpower.html. Accessed on 15 May 2012.

such application is dependent on the force being able to employ the inherent advantageous characteristics of air power in such a way as to mitigate its limitations. It is in this context that the need for balanced air power becomes critical.

A balanced air force must be able to carry out four fundamental roles. First, it must be able to obtain and maintain **control of the air**, delineated in terms of a predetermined quantum of time and space. The ability to do this is paramount to being balanced. The level of control of the air could vary vastly—from parity to supremacy. However, a balanced air force should be able to create the minimum necessary control of the air for other operations to be conducted in a relatively safe manner, even if opposed by an equally competent air force. Another aspect of control of the air is that it is the product of synergistic application of the other primary roles of airpower. This means that, in a circular manner, achieving adequate control of the air will require the air force to be balanced.

Second, a balanced air force must be able to carry out dedicated **strikes** at all levels of war. The distinction between strategic and tactical strikes has blurred in the recent past. Even then, a balanced air force must have the capability to strike with reasonable assurance of success at the centres of gravity of the adversary, exercising the inherent characteristics of reach and penetration. Further, a balanced strike capability should encompass the ability to do so with precision, discrimination and proportionality. In today's terms this would entail the possession of precision guided munitions and the associated systems necessary to wield them effectively. Strike capability is the distinguishing element between military and civil air power capabilities. Therefore, an air force without adequate strike capabilities cannot be considered balanced.

**Air mobility** is a unique capability of air power, one that is leveraged by governments as a possible solution to a range of challenging circumstances. An air force needs to have air mobility, spread sufficiently between large, medium and small airlift

capabilities to be considered balanced. Air mobility is a term that encompasses general airlift, aeromedical evacuation, and search and rescue, as well as specialist capabilities such as airborne operations and Special Forces insertion and extraction. While having the spread of capabilities is important, it is critical for a balanced air force to be able to provide the flexibility for rapid deployment of a minimum amount of forces sufficiently removed from home base. The size of the force to be deployed and the distances involved would be a function of the national security policy and the posture developed from it.

Fourth is the ability to gather, analyse and distribute information in a timely manner. In an air force this function comes under the aegis of **ISR**. The ISR capabilities of an air force must have the minimum capacity to provide adequately analysed and high-fidelity information to all who require it with minimal time delay. Airborne ISR capabilities have improved incrementally in the past few decades and now have the capacity to carry out surveillance for long periods of time without a break. To convert this capability to useful information that is readily available requires a robust command and control (C2) network and a number of integrated high-technology systems. This is a primary requirement for a balanced force. Further, in a dynamic combat situation there will be conflicting requirements of timeliness and accuracy of information—in certain cases timeliness will be the priority and in others the veracity. The ISR capabilities of a balanced air force must be able to meet this challenging demand.

These are the four primary roles that an air force must be able to carry out with reasonable adequacy to be considered balanced. In ensuring these capabilities there are a number of subsidiary enablers that also have to be integrated into the functioning of the air force. A balanced air force therefore is a complex organisation that requires a significant amount of resources to be dedicated to it. Since air power capabilities are technology-enabled, the training

required to achieve a minimum acceptable level of competence is complex and lengthy. Further, sustaining the necessary level and quantum of air power, both in relative peace and conflict, requires substantial resources. This is not always within the reach of all nations and, therefore, there are now fewer numbers of balanced air forces worldwide.

There are two facts that must be considered whenever the issue of a balanced air force is discussed. First, a balanced air force does not mean a 'large' air force. Even a small air force can be balanced and the numerical size of the force will be dependent on the threat perception and other broader security issues within the overarching geopolitical environment, i.e. the missions it must perform. The second is more involved. It is now an accepted belief that wars can generally be won only by a joint force and that independent Services cannot conclusively win campaigns or wars. Therefore, the national requirement would be to have a balanced defence force that can achieve the desired objectives. For a defence force to be balanced it will always be necessary to have a balanced air force as an integral element within it. A balanced air force is critical to national security.

**Main Points**

- *A balanced air force must be able to carry out the four fundamental roles of air power.*
- *Sustaining a balanced air force is resource intensive.*
- *National security is dependent on a balanced defence force within which a balanced air force is a critical element.*

# 3

# Professional Mastery

*Professional mastery within the Air Force is a product of the knowledge, skills and attitudes of leaders at all levels and the flexibility and robustness of the organisation.*[1]

In recent times the employment of air power, to ensure national security, has come under intense scrutiny from a number of different perspectives. It is therefore incumbent on airmen to have a clear understanding of all aspects of air operations and an appropriate level of professional mastery in order to ensure that air power is optimised to meet the three fundamental principles of the application of force—necessity, discrimination and proportionality. Air operations, tailored to create the necessary effects, must be carefully integrated into the joint campaign to achieve the desired end-state. Only an air force with an adequately skilled and professional workforce will be able to achieve the integration necessary to adapt rapidly to emerging and dynamic challenges.

The primary role of an air force is to defend the nation's interests, through the application of lethal force if necessary. This entails participating in activities across the spectrum of conflict—from providing humanitarian assistance to fighting wars of national survival. These are fundamentally human activities. Therefore, people are the primary assets of an air force and central

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[1] Commonwealth of Australia, *The Air Power Manual AAP 1000-D*, Air Power Development Centre, Canberra, 2007, p.18.

to its efficiency. This is contrary to the common perception that air forces are dependent on technology to the exclusion of the human element. The fact is that while air forces are indeed technology-dependent, their employment—in terms of strategy, concepts, tactics and the conduct of actual operations—is dependent on the skills of the people within the force.

Air force personnel need to be competent at what they do. This is an essential ingredient in making any organisation function efficiently at the basic level. Individually, the necessary competence that ensures a person's ability to carry out specific functions within the system that produces air power is called technical mastery. While technical and professional mastery are a part of the other Services also, an airman goes through a comparatively extended period of training to achieve the basic level of technical competence. From a broader air force perspective, it is essentially the combined technical mastery of all individuals at the unit level that directly produces or contributes to the development of a certain quantum of air power. Technical mastery—largely achieved through training—is the first building block, critical to the development and further growth of individuals towards professional mastery. However, converting technical mastery, achieved through a long period of dedicated training, into a broader professional mastery is a challenge for an accomplished air force.

From an air force perspective, professional mastery is the discipline of striving continually to achieve the most appropriate, effective and efficient way to generate and employ air power. This requires a comprehensive understanding of the vast body of knowledge that pertains to the air force complemented by the recognised ability to apply that knowledge unerringly to achieve the desired objective. Professional mastery is fundamentally personal and its adequacy is determined by the ability of the individual to apply it confidently through the lens of personal experience and intellect. In order to achieve the appropriate level of professional

mastery, it is critical to have a correct mix and balance between knowledge and experience. The balance will be complex because it must contain a mix of both individual and institutional elements of knowledge and experience.

When the professional mastery of individual members of an air force is combined in a collective manner it has the potential to create a substantial, and extremely valuable body of professional mastery within the force. It is the level of this collective professional mastery that distinguishes an air force as one of calibre, whether in operations or as a strategic instrument of national power. Collective professional mastery is the binding force that transforms disparate groups and units into a cohesive air force capable of projecting force and providing the government with viable options to ensure national security. It is the professional mastery of each individual that makes up the overall proficiency of the force; in other words, the personal understanding of air power is the starting point from which the discipline of professional mastery—individual and collective—is built.

The development and status of an air force can be gauged by measuring the collective professional mastery that the force is able to deliver within the ambit of the broader military and national security campaigns. At the personal level, professional mastery begins at the acme of technical mastery in core functions, which could be flying, engineering, logistics etc., oriented towards contributing effectively to the generation of air power. An operational unit must be able to bring together individual technical mastery in a complementary manner and be able to contribute positively to the generation of air power, forming an air force by combining efficiently with other units. This binding together of units that have reached an acceptable level of cohesion requires an air force to transcend technical mastery and function at the lower levels of professional mastery. This requires individual members to have achieved a minimum level of professional mastery and the

ability of the force to function as a viable whole. This level makes the force one that has attained collective professional mastery of the single Service domain.

Professional mastery at the joint level is a major step forward and is achieved by fulfilling three basic requirements—the force should have consistently demonstrated its ability to excel in the single Service domain; there must be a critical minimum number of personnel who have achieved individual professional mastery of a high order; and the force must have competent leadership at all levels of command. Leadership competence itself is a product of extremely well-developed individual professional mastery. Professional mastery at the joint level entails an air force being able to positively influence the joint campaign and the achievement of the desired military end-state. The next step in the progression of an air force is the function of the collective professional mastery of individuals within the force and influences the overall military strategy of the nation. For an individual this is a definitive step forward because, firstly, it involves functioning at the conceptual level and, second, it transitions the individual from experience and competence in specific jobs to the realm of education, knowledge and self-development. Similarly, this transition is also a defining point for the evolution of an air force. An air force that can function at the highest levels of military strategy will be able to influence all aspects of military operations.

The next level of collective professional mastery is when an air force becomes one that is able to influence the national security calculus. This is a very difficult step forward because the military force of a nation is only one element of national power and therefore its influence will be constrained and the collective professional mastery required of an air force increases exponentially as it progresses through the various levels and is the highest at this stage of its development. This is accentuated by the increased level of professional mastery required of the senior leadership for the force

to reach and perform consistently at this level. The ultimate position of excellence is for an air force to achieve professional mastery at the grand strategic level of national security. This requires the concerted effort of the entire force and is ensured only by its being able to consistently perform at this level of effectiveness.

Air forces can only be effective entities when they have achieved a level of professional mastery that permits them to operate as a cohesive whole. This is only the starting point for an air force to commence its journey to becoming an indelible part of national security and an element of national power. Professional mastery of each individual is a foundational requirement for the force to adapt and transform in its continual search for excellence.

**Main Points**

- *Technical mastery is the ability to excel in a particular task, achieved mainly through training.*
- *Professional mastery is the ability to contribute effectively to the generation of air power as part of a cohesive unit.*
- *An air force has to develop and evolve through a number of stages of collective professional mastery before it can be an effective element of national power.*

# 4

# Generating and Sustaining Air Power

*A nation may have every other element of air power and still lag behind if its government has no real urge to insure its future development. The attitude and actions of government will fully determine the size of our military air establishment, and greatly affect the efficiency of our civil air establishment, our aeronautical industry and facilities—hence our air power in being.*

—John C. Cooper[1]

Each element of national power must have a source from which it is derived and generated to a desired level. This is true of national military power, and within it air power. The sources from which air power is generated can be divided into two categories—one, the national infrastructure necessary to develop air power and two, the elements resident in an air force, which are critical to generating high quality air power. Intimately connected to the capacity to generate air power is the capability to sustain it at a desired level and for the duration required. Generation and sustainment are two sides of the same coin and one without the

[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* pp.29-30.

other will not serve the purpose for which air forces are created—underpinning national security.

There are two primary factors within the national infrastructure needed to generate air power. The first factor is the availability of appropriate technology and the ability and will of a nation to use it optimally. Air power is founded on technology and it continues to be a technology-based and enabled capability. Therefore, it is necessary for any nation aspiring to generate air power—through maintaining a standing air force of sufficient calibre—to have a critical minimum technology base. The robustness of this technology base is dependent on four major factors: the national educational system and its bias, the state of development and relative sophistication of the overall national industrial base, the competence of the aviation industry component within that base, and an intangible factor of the national mindset regarding technology and aviation. Even minor shortfalls in any of these factors will have significant impact on the nation's capacity to generate air power.

The second national factor is the challenge of adequate resource allocation. Aviation is inherently a resource-intensive capability, within which military air power—the ability to project force at will through the medium of air—is at the higher end of the resource requirement spectrum. Resources expended in generating air power may not provide a clear return that is visible to the general population, unlike resources used to build hospitals or schools. The dividends of air power are conceived in terms of continued stability and security of a nation and the region and the freedom from interruptions to trade and commerce and, *in extremis,* freedom from direct attack. This situation may produce a tension in the resource allocation between domestic priorities and defence requirements. To ensure adequate protection of a nation, the government must be willing to allocate the necessary resources to generating air power, even during long periods of comparative

peace. This is crucial because the lead time required to acquire and generate air power is considerably long.

The generation of air power and creation of a demonstrable air power projection capability are the key functions of the air force. In an overarching manner, even civil aviation capabilities feed into the national air power calculus, but air power, as envisaged in a military context, is primarily resident in a nation's air force. Generating military air power is the fundamental task of air forces and the process is complex and involved. There are two distinct aspects to generating air power—a vigorous capability development process which will decide the acquisition of necessary equipment and an adequate training infrastructure to create sufficient numbers of qualified personnel. The capability development process ideally takes into account a nation's security stance, grand strategy, national policy on security as well as the military strategy and is the link between national security objectives and the air force. Based on the identified capabilities necessary to ensure that national security objectives are achieved, equipment that can generate the capabilities of the necessary quality is acquired. This is only one part of the equation. The methods of acquiring equipment are many and could vary from indigenous manufacture to outright purchase from foreign sources. There is also an indirect, but critical, connection between the acquisition process and the issues discussed within the national infrastructure that will influence the entire process.

The second part of the equation is the training capability of an air force. Irrespective of the technological sophistication of its equipment, at the base level it is the people who employ them that distinguish an air force as one of excellence and competence. Adequacy of training is dependent on the ability of the air force to attract people with the requisite education and aptitude, the competence of the training process itself, the capability to train the required numbers, and the capacity of the force to retain well-trained personnel for sufficiently long periods to make the

training investment cost-effective. The right people employing the right equipment to implement the right concepts of operations that support a strategy that is fully aligned with national security objectives is the highest level of professionalism in the generation of air power.

Sustaining the desired level and quality of air power is the other prime responsibility of the air force. This capability however comes at a high cost both in resources and in personnel requirements. The framework necessary to sustain air power is both elaborate and expensive and consists of air bases, the infrastructure within the bases to generate air power, technical services that maintain sophisticated equipment, qualified personnel and ongoing training capability. Since maintaining this framework is resource intensive, air forces, especially smaller forces, normally plan for eventualities in terms of the minimum time that they would be required to sustain the application of air power. This period is calculated as a function of the national security planning and based on the strategic guidance provided by the government from time to time. An intangible factor in sustaining air power, however, is the national will and commitment to allocate the resources necessary to do so.

For smaller air forces sustaining the focused application of air power will always be a challenge. This challenge is exacerbated when there is a requirement to employ air power in different theatres simultaneously. This challenge of concurrency could become unsustainable for forces with limited numerical capacity and those facing resource constraints for any reason. The corollary is that sustaining air operations for the duration necessary is vital to the success of any campaign and therefore terminating or reducing air operations to a more manageable level during the campaign is not a desirable option. Therefore, sustaining air power application is a vexed issue for air forces and merits careful consideration at the highest levels of national security planning.

Generating and sustaining air power is the primary function of an air force. However, its capacity to do so is critically dependent on a number of factors over which the air force has limited control. It is necessary for the government to ensure the availability of necessary resources for an air force to deliver its commitments within the national security imperatives.

**Main Points**

- *Generating air power is a function of the national government and air force in equal measure.*
- *A robust national technology and industrial base is a prerequisite to generate indigenous air power of calibre.*
- *Sustaining the application of air power must be carefully factored in the planning stage of a campaign itself.*

# 5

# Air Power Characteristics and Roles

*Air power is indivisible. If you split it up into compartments, you merely pull it to pieces and destroy its greatest asset—its flexibility.*

—Field Marshal B. L. Montgomery[1]

The air domain is fundamentally different to the land, maritime and space domains and has unique physical aspects. These physical aspects create distinctive attributes and qualities inherent in the air domain that in turn gives air power its distinguishing characteristics. These characteristics are neither advantages nor disadvantages but are simply factors that impact and influence the conduct of air operations—with the maximum impact being felt when two or more are combined, rather than when considered individually—and define the fundamental roles of air power. Further, they can also be combined to ensure that one mitigates the negative influence of another, thereby ensuring that any weaknesses of air power are effectively neutralised. Understanding this nuance in the application of air power is a fundamental aspect of professional mastery of air power and is a critical function of planning and conducting air campaigns.

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[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* p.13.

The main characteristics of air power are perspective, speed, reach, penetration, responsiveness, flexibility, dependency, payload and impermanence as reflected in Air Force's current doctrinal thinking and statement.

**Perspective** is the way that a force physically views the battlespace and is generally limited to the visual and sensor horizons. The operating height of air power sensors greatly enhances their horizon and field of view, becoming a vital enabler for increased ISR capabilities. In the air domain platforms can operate at distinctly greater **speed** than those on land or sea. The greater relative speed of air power assets can be exploited at the tactical, operational and strategic levels of conflict. The physical speed of air assets can be translated to increased speed in the dissemination of information that in turn leads to improved decision-making capacity within the joint force. **Reach** is the ability to project air power over great distances unconstrained by barriers, globally if necessary. Reach is enhanced by forward basing and air-to-air refuelling, and when combined with speed can swiftly create effects across the spectrum of theatre operations.

**Penetration** is the combination of speed, reach and perspective—permitting air power to operate deep inside the adversary's battlespace. Air power's inherent speed and reach combine to make it the most **responsive** of military capabilities. Often air power provides the initial response to humanitarian assistance requirements as well as to emerging security challenges. Air power is inherently **flexible** in that its assets can carry out multiple roles in the same mission, at times even concurrently.

Air power also has few inherent operational **dependencies.** Essentially it requires an air base from which it can be generated and sustained, and air bases by themselves are complex entities that coordinate the functioning of a number of systems. This dependency makes air bases a vital and vulnerable centre of gravity that requires careful mitigation through adequate protection.

Limitations of **payload**—the sum of passengers, cargo, sensors and weapons that can be carried on an airborne platform—is another constraint of air power. These restrictions can be overcome by undertaking simultaneous multiple missions and also by accurate and responsive delivery of the weapon to create the desired effect. As a form of military power, air power has relative **impermanence;** however, technology is improving the loiter time of airborne assets considerably.

The primary role of an air force is to generate and apply air power in the defence of the nation and in support of its national interests. This is achieved through the conduct of an air campaign that applies air power roles—the fundamental and enduring functions of air power—through successfully accomplishing subordinate missions. There are four fundamental and enduring air power roles; control of the air, strike, air mobility and ISR.

The primary role of an air force is to create the necessary degree of **control of the air** required for the safe conduct of friendly air and surface operations—essentially a prerequisite for success. This is achieved through operations aimed at destroying, degrading and/or disrupting the adversary's offensive air power capabilities. Since the end of the Cold War, Western forces have not encountered enemy air strikes because of the dominance of Western air power and there is a possibility of complacency in taking adequate control of the air for granted. Achieving control of the air requires the conduct of missions within two primary combat air operations: offensive counter air and defensive counter air operations.

**Strike** is the application of lethal force in the conduct of offensive air operations to destroy, damage or disrupt the adversary's centres of gravity at all levels of the conflict. Strikes can be either deliberate or dynamic. Deliberate strikes are pre-planned and conducted to shape the adversary and the battlespace; and create strategic outcomes within the overall joint campaign objectives. Dynamic strikes are ones that are conducted in coordination with surface

forces—land and maritime—to influence the outcome of an immediate and ongoing tactical action. Strike is characterised by missions such as strategic strike, maritime strike, air interdiction and close air support.

**Air mobility** is the ability to rapidly move personnel, materiel and forces by air to and from or within a theatre of operations. This capability provides commanders with a responsive option to deploy, manoeuvre, sustain and extract forces into and out of areas that could otherwise be inaccessible, mainly because of difficult terrain. A critical advantage of air mobility is that it provides the force multiplication capability for a numerically constrained force to dominate a large area. Air mobility also provides national airlift capabilities for the government to respond to humanitarian crises rapidly and at great distances. The range of air mobility missions includes airlifts, airborne operations, air-to-air refuelling and aeromedical evacuation.

Airborne **ISR** has grown in importance in recent years and is now considered a primary role of air forces. The fundamental objective of ISR is getting the right information and intelligence to the right people, at the right time. This continuum achieved through ISR enables the adequacy of information across the command spectrum and is a critical contributory element in decision-making. While a primary role of air forces, ISR essentially remains a critical enabler for the force to conduct operations to create the desired effects—both kinetic and non-kinetic. By itself, ISR can only produce information and intelligence for operational use by other elements of the force.

The efficient conduct of these primary roles of an air force requires sophisticated equipment as well as technology-enhanced and networked systems that function synergistically to generate and apply air power. The primary roles are enabled through robust command and control capabilities, an overarching and robust training and education regime leading to professional mastery, air

base and infrastructure support and adequate logistics. A balanced air force will have the ability to carry out all the primary roles at the desired level adequately supported by enabling capabilities.

**Main Points**

- *Air power characteristics are influenced by the physical properties of the air domain.*
- *Air power is dependent on technology for its evolution towards becoming an even more efficient power projection capability.*
- *There are four primary air power roles: control of the air, strike, air mobility and ISR.*

# 6

# The Air Campaign

*Air power will play the leading role in our response to the security challenges of the unchartered future. It will in some circumstances be the only engaging form of military power and in others the form upon which successful surface operations depend.*

—Lieutenant General Charles G. Boyd[1]

The term air campaign describes the contribution air power makes in joint, coalition and multi-agency campaigns to support the achievement of national security objectives. The prime elements in this contribution are: the ability to apply lethal force with precision, discrimination and proportionality. It is the controlled conduct of a series of interrelated air operations to achieve specified objectives at all levels of conflict and covers all theatres of operations. There are two overarching advantages to an air force applying air power through the planning and conduct of an air campaign. First, because air power is a resource-intensive capability with its assets—at the cutting edge of sophisticated technology—being extremely expensive to acquire and operate, most air forces do not possess sufficient quantities of assets to meet

[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* p.37.

all the demands placed on them. Therefore, centralised control of these scarce assets is of paramount importance to ensure optimum employment and to avoid the pitfall of penny packeting them. This is achieved through a centralised air campaign plan that permits strategic oversight and yet retains the flexibility to execute the campaign in a decentralised manner. Second, contemporary conflict is extremely complex and the demands are such that no single Service can resolve them through acting alone. Therefore, most military forces have a joint focus with campaigns being designed and directed skilfully to achieve strategic goals through the employment of all available forces.

Centrally planned and balanced, the conduct of an air campaign is the optimum way an air force can ensure that its mission, operations, and campaign objectives are fully aligned with those of the joint or coalition campaign objectives. The tenet of 'centralised control and decentralised execution' is embodied in an air campaign. Centralised control ensures that air campaigns remain focused on joint strategic outcomes and air power assets are allocated based on priorities that best meet joint and coalition objectives across the theatre of operations. On the other hand, decentralised execution ensures that subordinate commanders fully exploit the strengths of air power—versatility, responsiveness, penetration and precision—in a flexible manner to meet the air campaign objectives through coordinated air operations and tactical actions. Essentially this process ensures that the employment of air power at every level of command is in alignment with the objectives of the theatre air campaign.

An air campaign is built on flexibility that provides a strategically focused force with the freedom to determine the best employment of air power in different circumstances. The actual process of planning and executing an air campaign is termed air campaigning. For an air force to realise the full potential of air power and deliver it to the nation, it requires four major ingredients: modern air power

systems, competent training, embedded air campaigning skills and professional mastery.

An air force offers the means to act responsively to create the effects needed to achieve decisive outcomes across geographically dispersed areas. It provides the strategic depth needed to deal with emergent threats through the entire spectrum of conflict, ranging from high-end conventional warfighting across large theatres to localised humanitarian operations. The air campaign is the means to coordinate the employment of air assets to ensure that they contribute effectively to the achievement of the overall joint objectives. The breadth of coverage and the scale of operations of an air campaign often makes it the most pervasive in a theatre of operations. Air power's speed of manoeuvre, perspective, reach and precision attack capabilities, brought together through an air campaign, enables it to create multiple effects concurrently or in rapid succession in and around one or more theatres simultaneously.

All operations in the joint campaign, including the employment of air assets, are dependent on achieving and maintaining the necessary degree of control of the air in and around the theatre of operations. Control of the air, while not an end-state in a joint campaign, is an essential precondition for joint forces to conduct air, land and maritime surveillance, and influence and response operations. Counter air operations conducted to establish the necessary degree of control of the air remain the fundamental and primary consideration in air campaign planning. In some scenarios—when there is no adversary air power capability or when own and allied air power capabilities are of such calibre that it creates sufficient deterrence for the adversary not to contest control of the air—dedicated counter air operations may not be necessary. However, where control of the air is contested, offensive air operations to establish friendly control of the air to the desired degree must be conducted as the first phase of the air campaign.

Dependent on the adversary's air power capabilities, establishing friendly control of the air may warrant an independent air campaign.

Based on the needs of the joint campaign the air operations of an air campaign may be conducted independently or in coordination with surface forces. Independent air operations could be neutralising an adversary's centre of gravity that is beyond the operational range of surface forces or engaging time-sensitive targets, carrying out sensitive missions to avoid potential political and societal fallouts that restrict the use of surface forces. The priorities within an air campaign could vary significantly from the initial response through to the successful completion of the joint campaign, which could be of short or protracted duration. Air operations in an air campaign include persistent application of lethal force, meeting the demands for situational information, delivering logistic support to deploy, sustain, manoeuvre and extract friendly forces by air in and around the theatre of operations.

The process of air campaigning aligns the tactical application of air power and the planning and execution of air campaigns through a vertical interface to joint campaign objectives, the military strategy and national security policy. This vertical interface ensures that the effects created by air operations are synchronised with the diplomatic, economic and information efforts embedded in a whole-of-government approach to security. Further, the emerging security environment is such that air campaigns will almost inevitably have to be conducted both during times of hostility and in normal peacetime conditions. Since some of these will have to be conducted concurrently, it can place very stringent demands on a smaller air force's limited resources.

The aim of the air campaign is the integrated application of air power to create precise and discriminate effects that are so well harmonised with the actions and effects of the joint force that the interface appears to be seamless. The success of the joint campaign is dependent on the air campaign delivering, at a minimum, two

key outcomes—first, it must establish the necessary degree of control of the air to enable friendly force manoeuvre and, second, it must contribute to the joint force objectives by creating a wide range of decisive effects to achieve joint, coalition and multi-agency objectives in a dynamic operational environment.

**Main Points**

- *An air campaign is the controlled conduct of a series of interrelated air operations to achieve specified objectives at all levels of conflict.*
- *Operations conducted to establish the necessary degree of control of the air remain the fundamental and primary consideration in air campaign planning.*
- *The aim of the air campaign is the integrated application of air power to create precise and discriminate effects through centralised control and decentralised execution.*

# 7

# Control of the Air

*You cannot beat an air force with an army. You can't beat an air force with a navy. But you can beat either of those with an air force. It has to do with physics.*

—Major General Charles D. 'Chuck' Link[1]

The demonstrated impact of airborne intelligence, surveillance and reconnaissance on surface battles during World War I, led to control of the air becoming a fundamental requirement to ensure freedom of action. However, the theories developed during the inter-war period concentrated on the offensive strike capabilities of air power to defeat the opposing air force on the ground and thereby gain control of the air rather than having to fight for it in the air. Further, the importance of ensuring that one's own operations could be conducted without enemy interference from the air was diluted in the theories that postulated defeat of the adversary through air attacks aimed at breaking the will of the people.

The practical experience in the beginning of World War II, however, demanded a rethink regarding the importance of the freedom of manoeuvre of one's own forces—both in the air and on the surface. This realisation was further advanced by the technology

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[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* p.244.

facilitated improvements in aircraft performance and its war-making potential. While the concept of control of the air had always been understood, these improvements made it a defining role and a doctrinal tenet for air forces. So what does control of the air entail?

In a very broad manner, control of the air can be defined as the ability to conduct friendly operations in all three dimensions without effective interference from enemy air power. The corollary is that such control must also be able to ensure that one's own air forces are able to prevent the adversary from undertaking effective operations in any of the three dimensions. This corollary stems from the fact that, in general terms, only an air force can neutralise another air force while air power, under certain conditions, can defeat surface power and can even be used as a substitute.

In the context of joint operations, control of the air provides commanders with the flexibility to exploit the air environment and conduct effective surface operations at a time and place that is optimal to the achievement of campaign objectives. It must be kept in mind that gaining control of the air will not generally be the ultimate objective in a joint campaign and neither does it guarantee the success of other operations. However, it is the primary prerequisite for the success of all other operations to achieve campaign objectives. In situations where the adversary has even limited credible air power capabilities, this requirement is greatly emphasised and ignored only at the peril to one's own forces. An adversary who can pose a credible air threat that cannot be overcome by friendly air power will almost always be able to preclude the conduct of friendly air and surface activities.

The level of control of the air varies with a number of factors, the main one being the adversary's ability to contest it. In order to aid a clear understanding of the concept, five levels can be assigned to control of the air, three of which indicate positive control. First, air supremacy, which is that degree of control wherein the opposing force is incapable of any interference from the air. Second, air

superiority, which is that level of control over the air domain that permits friendly land, sea and air forces to operate without effective interference by the adversary's air power for the required period of time and necessary space. Third, a favourable air situation, which is said to exist when the effort by an enemy's air power is insufficient to prejudice the success of one's own land, sea and air operations for a specified and defined period of time and demarcated space. The two levels below this do not provide positive control of the air; they are air parity, where either side could potentially gain control of the air, and an unfavourable air situation where the adversary has better control than one's own forces. Both of these levels could result in the chances of a successful joint campaign being jeopardised.

Control of the air entails air power assets being employed to defeat an adversary's air power capabilities while simultaneously conducting other operations that contribute directly to the surface campaign. For almost 60 years—with the exception of the Falklands conflict and the 1973 Arab-Israeli conflict—Western air forces have not had to conduct a serious campaign to obtain control of the air. In fact, it has been a long time since a Western army has been attacked from the air in any significant way. The trend in contemporary conflicts, wherein the adversary is most likely to be irregular in nature with almost no air power and very limited surface-to-air capabilities, indicates that this situation is likely to continue. This state of affairs has brought about a sense of complacency—an attitude of taking it for granted—within the Western military forces regarding the need to ensure control of the air. This is a serious flaw in the broader military thinking that can distort not only concepts of operations, but also force structure development.

Air power capability development has brought about a subtle change to the way in which air operations are conducted and the manner in which control of the air can be viewed. Control of the air is the primary prerequisite for all operations—air and surface—to succeed. However, enhanced capabilities in their core and enabling

functions now permit air forces to operate mission packages that are capable of fighting their way in to attack targets and then effectively fighting their way out, while limiting attrition to acceptable limits. In other words, capable air forces can now ensure adequate control of the air as and when required to conduct air operations. The success of a joint campaign is still predicated on the ability of the air force to control the air in a sufficiently extended time and space and is therefore a critical part of the air campaign. Effective control of the ground is only possible with positive control of the air. In effect, control of the air for a prolonged duration is now perhaps comparatively more important for the success of surface operations.

A nation uses all elements of national power to achieve its national objectives. The efficacy of such employment of national power elements is directly dependent on the environment being safe and secure for them to operate without hindrance. Adequate control of the air is the fundamental requirement for this to happen efficiently. Air forces therefore, must retain the ability to achieve the necessary level of control of the air, failing which the assured achievement of national objectives may be in doubt. Contemporary conflict scenarios—wherein control of the air is not effectively contested—are not fully indicative of the future. A nation will be ill-served by an air force and a defence force that assumes this to be the case. Complacency in military thinking of control of the air being an expected right rather than a privilege that has to be fought for and won does not serve one's own national strategic interests.

**Main Points**

- *Control of the air is a prerequisite for the success of joint operations.*
- *For a long period of time Western forces have been assured of adequate control of the air in their operations.*
- *Surface forces have to be cognisant of the need to conduct a control of the air campaign within a joint campaign.*

# 8

# Strike

*70 percent of casualties and injuries to enemy troops in the Vietnam War were caused by U. S. air firepower. Half the Arab tanks damaged during the fourth Middle East War were destroyed by the Israeli Air Force. During the Falkland Islands war between Britain and Argentina, 90 percent of the 29 vessels that were lost were due to air strikes. All the above indicates that with the rapid development of air weapons, the focus of modern war is gradually shifting to the air. Air firepower is becoming the backbone of joint military operations.*

—Major General Zheng Shenxia[1]

The potential of air power to readily overcome geographic barriers, transcend borders and attack surface targets deep inside enemy territory was conceptually recognised almost from the beginning of military aviation. However, it took a great deal of time, technological innovation and procedural maturity to turn the concept into reality. Arguably, World War II saw the extensive use of air strikes as a decisive capability and its ascendance as a primary air power role. The advent of advanced bombsights,

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[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* p.54.

radar guidance and Precision Guided Munitions (PGMs) increased the accuracy, effectiveness and economy of effort of air strikes, amplifying their importance as a crucial military capability.

Traditionally, strike has been divided into strategic and tactical, a division primarily based on the nature of the target being attacked and the impact of its destruction on the war or battle being fought. Strategic strikes were ones that attacked the adversary's war-making potential deep inside enemy territory and did not have an immediate effect on the conduct of the war, while tactical strikes were normally carried out on targets near or on the battlefield with their destruction having an almost immediate impact on the outcome of the battle. Within this construct, strikes were further divided into convenient groupings—strategic strikes, interdiction and close air support—which is relevant even today. Interdiction is carried out to divert, disrupt, delay or destroy the adversary's military potential before it can be employed against one's own forces, whereas close air support is conducted against an enemy who is in close proximity or in actual contact with friendly forces. Further, strikes can also be conducted against maritime targets through the conduct of strategic strike, interdiction, anti-submarine and anti-surface warfare strikes.

Typically exhibiting the complexity of air operations, strike also contributes to obtaining control of the air. Termed 'offensive counter air', it is aimed at destroying enemy air power capabilities on the ground, before they can be brought to bear against friendly forces. A classic example of such strikes being able to obtain almost complete control of the air is the pre-emptive strikes that Israel carried out in 1967, which destroyed the Arab air forces' ability to operate effectively for the duration of the war that followed and permitted uninhibited freedom of manoeuvre for Israel's forces.

In recent times, the demarcation between the different types of air strikes has become diffused and they are now considered as a single entity—strike. There are three primary reasons for

this development. One, the conduct and characteristics of armed conflict have evolved over a period of time. Today a single target could be the critical centre of gravity, the destruction of which the adversary may not be able to absorb. Two, technology now permits air strikes to be proportionate, discriminate and precise to the extent where there is only minimal possibility of error. Three, the prevailing international politico-strategic environment makes it difficult for even a stabilising military force to occupy territory, albeit for a short period of time. Therefore, the use or threat of air strikes to deter is considered a viable option. Further, in contemporary conflict, air strikes are now not only considered a necessity but, in a majority of cases, the weapon of first choice. In these conditions, the traditional division of strategic and tactical strike is no longer valid. Every single strike now has the potential to create strategic effects.

While the changes in the conduct and characteristics of war are overarching elements in making strike a crucial element of the offensive air capability, it is technology that has given it the primacy that it now enjoys. Air-to-surface weapons now have some inherent characteristics that were unheard of even a few decades ago, and which make them extremely effective. The trend is for them to become even more lethal and precise.

Strike weapons have now become truly all-weather and can retain the necessary navigation and terminal accuracy necessary for them to be used in adverse weather and at night. This effectively denies the adversary the traditional sanctuaries of weather and darkness. Their increased precision and the development of variable yield warheads minimise collateral damage, while the reduced size and weight of the weapon and the increase in load-out capability makes it possible for a single platform to carry multiple weapons. This facilitates the prosecution of multiple targets in the same mission, acting as a force multiplier and increasing the efficiency of the system.

Air-to-surface weapons now have extended range making it easier to avoid heavily defended targets, reducing the risk to the launch platform. This reduces attrition risk, which is a primary consideration in most military forces. The extended range provides the ability to reach out and strike the enemy without being threatened, which is a powerful deterrent to potential adversaries. It also permits a single platform to cover a larger area of the battlefield if the launch aircraft is adequately linked to the air battle management assets. The improved tracking ability of strike weapons gives them improved mobile target kill probability. In contemporary conflicts wherein many targets are mobile and provide only fleeting opportunities to be attacked, this ability could be the difference between operational success and failure.

Current weapons have configurable warheads and therefore have increased flexibility in their employment. It also becomes easier to match weapons to targets that in turn ensures increased lethality and the ability to achieve the desired effect while minimising collateral damage. Perhaps the most significant improvement in strike capabilities has come about because of the improvements in launch aircraft capabilities that permit enhanced connectivity between the platform, C2 nodes and ISR capabilities. This creates the capability for the weapons to be re-targeted as necessary, weapon tracking in flight and if needed the ability to abort a strike even after weapon launch. Improved communications between all mission elements reduces the kill-chain timeline, enabling real-time re-attack tasking if required. Integration of PGMs with real-time C2 and ISR provides greatly enhanced strike accuracy and effectiveness.

Air strikes now meet the universal requirement for attacks to be precise, proportionate and discriminatory while being able to threaten an adversary's strategic infrastructure simultaneously. The enhanced strike capabilities permit the conduct of air campaigns, focused on neutralising enemy 'target systems' and centres of

gravity to achieve strategic objectives from the beginning of the campaign, while simultaneously contributing effectively to the surface operations. Air strikes have now evolved into being the first, and in some cases the only, offensive action in a campaign.

**Main Points**

- *Strike is now understood more in terms of the effects it creates rather than within the traditional distinctions of range and nature of target.*
- *Technology is a critical enabler in making air strikes precise, proportionate and discriminate.*
- *Air campaigns can now be conducted to simultaneously achieve strategic as well as tactical objectives.*

# 9

# Air Mobility

*Only through speedy delivery of combat forces to favourable positions can decisive impact be exerted. Among various delivery measures, air transport is the most effective action because of its strong mobility, fast speed, and less restrictive geographic conditions.*

—Major General Zheng Shenxia[1]

Transporting personnel and materiel through the air to support military activities is one of the later innovations in the use of air power as an element of a nation's military capability. This was largely due to the fact that it was only towards the end of World War I that air power gained its undisputed place as the third component of military forces—which in itself was the watershed moment—and technological advances permitted the manufacture of large aircraft capable of carrying reasonably heavy loads. However, the concept of air transportation had been discussed and considered even earlier, evidenced by the attempts made to transport sizeable loads in airships.

The advent of aircraft capable of carrying sufficient load and travelling reasonably long distances, in short periods of time—by

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[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* p.50.

the existing standards—gave rise to greater conceptual thinking on the possible employment of this new-found capability. The conceptual development was further facilitated by the advances in air transportation made by commercial activities during the inter-war period. The advantages of transporting airfreight across the world in a matter of hours, compared to the several weeks it would take if moved by ship, were obvious.

From a purely military perspective, air mobility is the rapid movement of personnel, materiel and combat forces, by air, to and from a theatre of operations and within that theatre across the full range of operations. This capability provides a responsive means to project force and to generate and sustain expeditionary operations rapidly during a crisis. Further, the employment of air mobility can be clearly divided into two strategic components—one, when it is utilised in times of peace as an immediate response to developing humanitarian crisis and, two, when it is utilised to respond rapidly to mitigate security and military threats to the nation.

In a globalised world, devastation that befalls one nation, whether through natural disasters or through man-made calamities, can affect the stability of the entire region and could also create ripple effects internationally. In recent times the international community has reacted to such humanitarian crises quickly to avert the destabilisation from spreading beyond the immediate neighbourhood. Air mobility provides the government with a strategic mechanism that can rapidly bring the necessary personnel and supplies required to contain the crisis to the affected region. These airlifts could bring peace enforcing and/or stabilising forces in the case of volatile politico-military situations, or medical and humanitarian supplies and personnel in the case of natural calamities. In either case, these actions will be able to create the strategic effect needed to stabilise the situation sufficiently before larger loads could be brought to the affected area through maritime

transportation. The essence of success in this case—of strategic use as a stabilising humanitarian force—is the quickness of response.

The concept of national security has evolved in the last few decades to encompass the protection of a nation's strategic interests, at times far away from its geographic borders. This has produced a noticeable trend of international intervention in areas of volatility in order to avert smaller conflicts from escalating and affecting the stability of nations and regions that may not be directly linked to the area in question. As a result expeditionary operations are becoming common, especially amongst the more stable nations of the world. Mounting expeditionary operations, in a time-critical manner, can only be done with adequate captive airlift capability resident in the force. Deploying the necessary contingent is only the beginning of the generation of military power: sustaining the deployed forces adequately is a bigger task and, once again, heavily dependent on air mobility. When the thread is drawn back, the direct link between air mobility and national security is easily visible and understood.

Air mobility is a cornerstone in the concepts of operations being developed and applied in contemporary operations. Conventional military forces are heavily reliant on manoeuvre to create strategic and operational advantage over the adversary. The ability to move and concentrate forces in the desired area rapidly is by itself an asymmetric advantage. When this is combined with tactical surprise that can be achieved by the astute use of air mobility, it creates a winning concept. Modern military forces have come to rely on this capability to assume superiority, especially when confronted with irregular forces who operate in a diffused manner. Countering such adversaries requires the ability to respond as rapidly as possible—the answer lies squarely in the force's airlift capability. This capability also permits a numerically constrained force to cover a large geographic area by being able to deploy to the desired location swiftly. Further, if adequate airlift is available, such

a force will also be able to carry out simultaneous operations in dispersed locations. Airlift is a veritable force multiplier in theatre.

Over the past two decades, conventional military forces have been combating a range of adversaries who do not have a discernible organisation and normally operate in small autonomous groups that disperse within the civilian population very quickly when confronted by superior forces and firepower. While this is an asymmetric advantage to which adversaries resort, conventional military forces have developed their own asymmetric concept of operations to counter these situations. The concept is built around airlift and the employment of Special Forces to create and leverage off the element of surprise generated through rapid mobility. Rapid insertion, sustainment and extraction of Special Forces cannot be achieved with any assurance unless adequate and effective airlift—in terms of fixed as well as rotary wing assets—is available. Further, the training required to ensure the success of such combined arms missions is very high and can also be a determinant.

Other airborne operations, such as the deployment of paratroopers, are another aspect of air mobility. Although most conventional military forces have airborne operations capabilities, the use of large airborne formations in the traditional manner is becoming somewhat redundant. However, it is obvious that airborne operations capability is a function of the adequacy of airlift. Perhaps a more important airlift capability is aeromedical evacuation. All governments have a duty of responsibility to their military personnel to ensure that they are provided adequate care in case of injury. In expeditionary operations, especially in areas that do not have adequate medical facilities, aeromedical evacuation capabilities become crucial not only to bring the injured to safety and treatment, but also to maintain the morale of deployed forces. In an indirect manner, aeromedical evacuation can also be used to win the campaign for the 'hearts and minds' of the population

in irregular wars, through making it available for the civilian population.

Airlift capacity has increased considerably with technology facilitating greater loads being delivered further than before in lesser time. Accordingly, airlift has become a critical element in the planning and execution of all operations—playing a vital part at the strategic, operational and tactical levels of combat. Unlike most other military capability, air mobility is also a capability that the government can employ to create strategic effects in a peacetime scenario as well.

**Main Points**

- *Air mobility has applicability both in times of peace as well as in conflict.*
- *Expeditionary operations are critically reliant on air mobility for the generation and sustainment of force.*
- *Aeromedical evacuation has dual use, especially in contemporary conflicts.*


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# 10

# The Criticality of Enablers

*We should base our security upon military formations which make maximum use of science and technology in order to minimize numbers of men.*

—Dwight D. Eisenhower[1]

Although the youngest of force projection capabilities, air power has carved a distinct niche for itself not only as a purely military capability but also as a critical element of national power that can be brought to bear across a broad spectrum of contingencies in support of national policy. This rise to prominence within the span of a century has been made possible by two complementary factors. First, the continuous push to enlarge the operational capability envelope of air power because of technological advancements brought about through scientific research and development and, second, the willingness of practitioners to experiment and innovatively employ emerging technology in order to refine and enhance air power capabilities. The combination of these two factors has created cascading improvements in air power capabilities, especially in the past few decades.

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[1] Colonel Charles M. Westenhoff, *Military Air Power: A Revised Digest of Air Power Opinions and Thoughts,* pp.127–128.

There is another aspect to this success story. As technology has continued to enhance air power capabilities and provide planners and warfighters with increased options for its application, the cost factor has also surged, at times disproportionately. This has resulted in a balanced force with state-of-the-art high-end air power capabilities moving beyond the reach of nations with smaller economies having to satisfy conflicting priorities for resource allocation. Capabilities ranging from the benign use of airlift in humanitarian assistance to the forceful application of precision strike have become prohibitively expensive to procure and maintain. The outcome has been the selective maintenance of niche capabilities, rather than maintaining a balanced force, in a number of air forces around the world. Maintaining a complete suite of air power capabilities, in adequate measure, is becoming increasingly expensive and governments around the world are questioning the need for such expenditure.

While the core function of air power remains force projection in support of national security, in the current fiscally constrained climate, capabilities that have been traditionally viewed as supporting the core function assume critical importance. These support capabilities are known variously as 'enablers' and/or 'force multipliers'. Irrespective of the designation, what they achieve is a tangible improvement and increase in capabilities while ensuring that the number of assets remains within the resource availability thereby achieving greater cost-effectiveness. Although these enablers are also technology reliant, the expenditure and the improvements in capability that they provide are somewhat more evenly matched. The major enablers of air power are space-based assets, early warning devices, electronic warfare assets and air-to-air refuelling capabilities.

Space-based assets cover a large swathe of capabilities. Currently a significant amount of surveillance and reconnaissance activities are done from space and these activities are intimately connected to targeting functions. Another area where space assets are

seemingly omnipresent in their usage is communications. Used sparingly even as late as a decade ago, space communications have become the centrepiece of all military communication systems. Contemporary military operations of any magnitude are heavily reliant on space-based communications for their success. From an air power perspective, these communications in conjunction with navigational systems like the Global Positioning System (GPS) are vital to the success of all missions and air campaigns. Further, the accuracy of targeting and the precision of weapon strike are both direct functions of these enablers. The exactness of the application of air power, which has become its signature and the primary reason for its preference as a force of first choice and a tool of political deterrence, is more efficiently achieved through the appropriate application of space-based enablers.

Even when air power is not being employed in an offensive or coercive manner, there is a need to deploy adequate defensive capabilities to ensure national security. The improvements in Airborne Early Warning and Control (AEW&C) capabilities now provide a measure of assurance to the viability of air defence capabilities and greatly enhance offensive applications. A minimum critical level of AEW&C capability is now considered a baseline requisite for effective air control, even when such control is delineated in time and space.

The advent of such capabilities is based on the availability of advanced technology, especially in the electronic spectrum, and therefore electronic warfare (EW) capabilities have assumed increased importance. Effective EW can create a zone of complete silence that can be exploited to great advantage by an efficient military force. The need to have sufficient EW assets and also the capability to counter enemy action in the EW sphere is a necessity in the modern battlefield. Appropriate application of EW can make even a modern large force, deficient in EW capabilities and countermeasures, blind and ineffective. The importance of EW assets will only increase in

the future with reliance on communications and other space-based assets becoming a prerequisite for effective air power application.

Historically, range and reach limitations have been considered weak links in the employment of air power. The advent of air-to-air refuelling (AAR) has mitigated this perceived disadvantage. With AAR, air power now has truly global reach. The outcome is the capability for an air force to project air power anywhere to create the necessary effect, whether it is through the air deployment of Special Forces or a direct kinetic strike on an identified centre of gravity. The rapidity with which air power can create the desired effect has greatly increased the flexibility in its employment in supporting the achievement of national security objectives.

While the major enablers discussed above have become critical to the successful employment of air power, it must also be kept in mind that all of them by themselves are expensive capabilities to obtain, maintain and operate. Their cost-effectiveness is apparent in a comparative assessment of the enhancement of air power capabilities that they bring about and the resource requirements to achieve it. The quantum of enablers needed and the types that an air force wishes to tailor for its needs will be a direct function of the role that it is expected to play in the pursuit of national security. The only hard fact is that without adequate enablers, no air force can be expected to deliver air power in a cost-effective manner for any given length of time. Quality always comes at a price.

**Main Points**

- *Technological advances have made air power capabilities prohibitively expensive to acquire and operate.*
- *Enablers or force multipliers are a cost-effective option to enhance air power capabilities to meet national security requirements.*
- *The major air power enablers are space-based assets, early warning devices, electronic warfare assets and air-to-air refuelling capabilities.*

# 11

# The Asymmetry of Air Power

*... more effective is the capacity of air power to respond, lethally if required, to emerging situations in a time critical manner. This capacity can immediately create asymmetry of an order that could overwhelm the adversary.*[1]

Military forces have historically relied on asymmetry—the ability to surprise an adversary with unpredictable and innovative actions—to win battles and wars. However, the use of the term 'asymmetry' to describe a methodology for the conduct of war is a recent development. There are two main reasons for this evolution. First, traditional warfare, codified by the Law of Armed Conflict (LOAC), has generally been considered a relatively orderly or symmetric process which translates in operations to a range of predictable options and manoeuvres on the battlefield. Second, the asymmetry associated with innovative manoeuvre and rapid action in an historical sense is not equated with the asymmetry embedded in contemporary unconventional warfare. Both these factors are underscored by the fact that until the mid-20th century, wars were mostly fought between the fielded forces of sovereign states, operating within the accepted norms of

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[1] Pathfinder No 77, *The Asymmetry of Air Power*, Air Power Development Centre, Canberra, October 2007.

the conduct of war and international law. This situation binds the use of air power to a proportionate and humanitarian response against a contemporary asymmetric threat.

The evolution of non-state or sub-state actors as primary combatants injected a new element into the equation of warfare. They gave asymmetry a new dimension by the use of non-traditional means to neutralise the advantages of a conventional force. Therefore, the contemporary use of the term asymmetry actually conveys a combined meaning of surprise and the employment of non-military assets against military forces, as well as a disdain for customary laws regarding the conduct of war.

The origin of the currently prevailing use of asymmetric means to wage war can be traced to the overwhelming conventional military superiority that democracies of the Western or developed world normally wield. Faced with this technological, economic and conceptual superiority in the conduct of warfare, adversaries of these forces sought to balance this inequality by adopting methods of combat that were beyond the conventional. Asymmetry as a concept means the redressing of lesser capability by its innovative use, thereby making the concept itself a force multiplier. Creating this asymmetry through conventional and unconventional ways is the face of '21st century operational art'.

In contemporary conflict, asymmetry is normally used to describe actions against the conventional military forces of sovereign nations by adversaries—normally irregular forces, non-state entities and insurgents—operating outside the confines of international law. This has given the term itself a negative connotation, which is only partially correct. If the concept is analysed objectively as a viable construct to achieve the desired effect and end-state in a conflict, its many merits will be clearly discernible. It will also become obvious that even conventional military forces can employ the concept to their advantage. Of all the conventional power projection capabilities, it is air power that

can most easily be adapted to employ the concept of asymmetry in favour of conventional military forces in any given situation.

In the contemporary global security scenario, a number of states are either failing or have already failed, thereby increasing the risk of guerrilla/insurgent/terrorist groups initiating irregular warfare in their regions. Irregular forces are by design asymmetric with no conventional trappings. On the other hand, national military forces are traditionally designed to secure the state and therefore must innovate and adapt to generate their own asymmetry when faced with such an adversary.

In contemporary conflict, the irregular force normally seizes and shapes the progress of the conflict through employing asymmetric means and operating unconventionally on their favoured ground. Under these circumstances air power has the capability to carry out surveillance and also respond lethally, if required, without having to take recourse to physical invasion with troops on the ground. This response is also classic asymmetry countering unconventional methods of operation without having to resort to large-scale military actions.

Air power contributes to three basic military roles in the pursuit of national security—the ability to find, the capability to shape and deter, and the capacity for timely response. These roles are not exclusive to air power but the advantage that air power has is that these roles can be conducted with enough flexibility and discretion to shift asymmetry in the user's favour. Such asymmetry is critical to creating the necessary effects to resolve a crisis.

ISR capabilities resident in air power are at the forefront of finding and identifying the sources of threat both at the tactical and strategic levels. This can be done by uninhabited aerial vehicles that combine extremely long endurance and precision strike capabilities, manned platforms that facilitate time-sensitive targeting and space-based assets that are discrete and have a very wide coverage.

Adequate ISR is critical to creating a decision advantage that is, in turn, a foundational requirement to create asymmetry.

Air power assets operate outside geographical constraints and directly influence the deep battlespace because of their inherent reach, speed and flexibility. By the same token, they can also operate in different theatres simultaneously, creating a deterrent effect both physical and virtual. Constant monitoring of the battlespace and timely actions to shape the environment create asymmetric effects, especially against adversaries who do not have the same level of sophistication either in capabilities or concepts of operations.

Equally important as the other two roles, and more effective in the short term, is the capacity of air power to respond, lethally if required, to emerging challenges in a time-critical manner. This capacity can immediately create asymmetry of an order that could overwhelm the adversary. Time-critical precision attacks have the capability to produce strategic effects far in excess of the actual destruction caused. This is true asymmetry, not just because the adversary cannot respond adequately, but because of the potential for the effects to be catastrophic.

By focusing on operating asymmetrically in relation to the adversary, an adaptable conventional force can retain the initiative and force the adversary to react to emerging situations rather than control them. Shaping the environment through an optimum combination of information superiority and response actions that create proportionate and discretionary effects are the asymmetric advantages that are resident in air power.

As the world is moving towards increasingly complex security scenarios, the ability of a military force to ensure the nation's security needs is becoming more constrained. To ensure that the capability envelope is kept at an acceptable level, military forces the world over are looking for force multipliers and other nuanced concepts. Asymmetry remains a flexible concept that is crucial to victory. In contemporary conflict most irregular forces

and non-state combatants employ unconventional techniques to create asymmetry on the battlefield against conventional forces. The challenge for conventional military forces is to adapt their operational art to create asymmetry while using conventional means against these adversaries. Such an approach to the application of conventional military power will deprive the adversary of a powerful tool and help conventional forces regain the initiative. Air power is at the forefront of this innovative move.

**Main Points**

- *The concept of asymmetry is not new, but its application in contemporary conflicts has been innovative.*
- *The inherent characteristics of air power make it easily adaptable to employing asymmetric concepts of operations.*
- *Air power can seize the initiative from an irregular adversary or non-state actor thereby negating their asymmetric advantage.*

# 12

# Employment in Urban Conflicts

*The principal contribution of air power to urban conflict is the greatly increased perspective that it brings to the arena. Air power is able to 'see' more with greatly clarity, analyse and understand the evolving threat faster and strike more rapidly and precisely at a far greater range than with the use of only ground forces.*[1]

The character and conduct of conflict have changed significantly over the past few decades. This has been primarily the result of an evolutionary change in the understanding of the concept of national security that in turn has altered the perception of current threats and challenges. Today, the occurrence of conventional conflicts—state-on-state, military fighting military using conventional weapons to achieve national objectives—is increasingly rare. Instead, armed conflicts that pit state forces against irregular adversaries pursuing a plethora of objectives, most of them not linked to the notion of national security, using asymmetric operational tactics and not bound by the LOAC are now common place. The RAAF understands such conflicts as irregular warfare. This shift has also resulted in most of the contemporary conflicts being initiated and conducted in urban

[1] Pathfinder No 20, *Air Power in Urban Operations*, Air Power Development Centre, Canberra, April 2005.

areas where the terrain is more advantageous to small groups of irregular forces than to modern conventional military forces.

The urban operating environment poses a number of challenges to conventional military forces such as the difficulty in distinguishing combatants and civilians and avoiding collateral damage. Inherent air power characteristics and capabilities can be selectively optimised and employed to mitigate many of these issues.

First, urban conflict normally occurs as a result of intervention requiring the deployment of external forces, the legitimacy of which will always be questioned at the global and ideological level. Prolonged presence of foreign troops in disputed areas usually leads to resentment from the local population who view them as occupying forces. The reach and penetration capabilities of air power can overcome these challenges by operating from bases that are not in contested territory. While troops on the ground may almost always be required, the numbers and duration can be minimised by using air power. Further, the use of air power will diminish the probability of mission creep since it leaves only a small and transient footprint. In the contemporary international politico-security scenario, air power may provide a more acceptable solution to this vexed problem.

Second, adversaries operating in small and diffused groups require a much larger number of troops on the ground to contain. Effective employment of airborne ISR capabilities makes the task of monitoring the activities of these dispersed groups comparatively easier. In fact the high endurance of airborne ISR assets and their relatively unobtrusive nature along with their ability to rapidly identify and fix both stationary and moving targets are key ingredients to success in urban operations. Airborne ISR is also critical to coordinating surface operations that may otherwise become disjointed because of the complex terrain encountered in urban conflicts.

Third, the necessity to minimise collateral damage sometimes negates the use of a surface force's organic firepower in the urban environment. Modern air power has unique strike capabilities that can be leveraged to meet the stringent demands of the accurate placement of weapons in urban areas. All modern conflicts demand precision, proportionality and discrimination in the application of force. This is particularly important in urban conflict where the risk of collateral damage and unintended consequences increases. Air power can carry out such precision strikes by combining its inherently broad perspective with its ability to carry out ISR using airborne platforms that have reach and persistence. A combination of long duration ISR and time-sensitive targeting is a lethal mix that can negate many of the asymmetric advantages that an irregular adversary might gain through movement and concealment in urban areas. Essentially, air power provides a 'bird's eye view' where it is possible to see, understand and strike precisely and rapidly from the air. The integration of air power's kinetic and non-kinetic capabilities permits immense flexibility in conflict and provides for very rapid transition from benign to lethal operations.

Fourth, the ability to carry out long-range but swift strikes makes air power an important strategic deterrent. A combination of advanced technology, innovative operating concepts and closely coordinated ISR activities gives air strikes a unique ability to achieve very high levels of strategic influence with relatively minimal effort. In urban conflict this could be leveraged to achieve the desired end-state even before ground forces are deployed. This takes on added importance considering that the urban battlespace poses a number of problems for surface operations.

In conflicts in urban environments, air power can be employed usefully to carry out air control. Air control is the ability to control surface operations through the employment of air power. Air power can effectively cordon off a delineated operating area to deny irregular adversaries external support, both in resources

and personnel through anti-infiltration and curfew enforcement activities. Since urban conflicts are mostly irregular in nature, non-kinetic options, such as information operations and show of force, take on added importance.

The evolutionary process of understanding the threat, both strategic and operational, and refining and adapting concepts and technology to counter it underpins operational success in urban areas. Air power can achieve a blend of persistence, precision and minimal presence at a rapid rate making it a decisive capability in low-intensity, irregular and urban conflicts in a contextual manner. Effective integration within the joint force enables air power to relieve the ground forces of some of the warfighting requirements. Close-in employment of air power in urban areas has the potential to challenge the traditional notion of the primacy of ground combat. However, this should not be viewed as air power taking on ground roles. A truly joint force will be able to seamlessly integrate the unique advantages of all of its elements to ensure that the force as a whole is successful. The innovative employment of air power provides the reinforcement to achieve this.

**Main Points**

- *The urban operating environment poses unique challenges to conventional military forces.*
- *Air power can mitigate a number of issues that may otherwise become insurmountable.*
- *In a seamless approach to conflict in urban areas, air power is a key reinforcing element.*


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