Basic Doctrine of the Indian Air Force

2012

DOCTRINE TEAM
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Foreword

Air Chief Marshal NAK BROWNE
PVSM AVSM VM ADC
Chief of the Air Staff

The IAF has had a remarkable and memorable journey since its formation on October 8, 1932. It has since been operating in an environment that is both challenging and demanding and is now a seasoned and battle tested force. Its inventory has been diverse and it has executed its tasks and roles with professionalism and élan. The IAF's quest for greater professionalism in conducting its operations is a continuous process. Recording the collective memory of core beliefs in the form of a doctrine enforces a discipline and clarity of thought that helps sustain this dynamic process. Once recorded and periodically updated, the doctrine provides a common baseline for education and the dissemination of collective thought.

The first air power doctrine of the IAF was published in October 1995. It dealt with topics such as: the theory of war, characteristics of air power and its relationship with strategy, various air campaigns, combat support operations and aspects related to prosecuting an air war. It provided an exhaustive narrative of the basics of air power employment. Taking into account, the considerable changes in technology and the evolving global security environment, the doctrine was revised in 2007. Hence, an updated version entitled *IAP 2000-07* (Part 1 & 2) was issued in 2007. In keeping with the evolutionary nature of air power and the need to stay relevant across the spectrum of conflict in an inter-connected environment, we felt the need to share our thoughts with the diverse stakeholders of national security that included not only

the armed forces and government, but also think-tanks, universities, media and all those interested in knowing more about how the IAF operates. This unclassified version of the doctrine is the result of that endeavour.

The basic doctrine of the IAF has been declassified and revised. It is reflective of the environment around us, and adopts a holistic approach towards the security paradigm that engulfs us, and is a sincere effort to reach out to a much wider audience which has an equal stake in the security and well being of India. It is a foundational document which, hopefully, will help the reader understand the nuances of application of air power and lead to better understanding and appreciation of the capabilities of air power. Since a doctrine is not a dogma, it changes and evolves. Suggestions from air warriors, strategists, academicians, research scholars and practitioners of land and naval warfare will enrich the discourse on the employability and development of air power. I sincerely hope that this document contributes to the overall development of strategic thought in our country.

Jai Hind!

NAK Browne
Air Chief Marshal
Chief of the Air Staff

17 September 2012
New Delhi

Preface

A doctrine provides a military commander with the framework to prepare and fight a war in a coordinated and controlled manner. This edition of the 'Basic Doctrine' of the IAF has been declassified to allow a wider audience to understand the IAF's vision, organisation, structure and role. Air power has come a long way in its journey of a little over hundred years. The expectations from its inherent capabilities have also increased exponentially. In our context, therefore, it is important to define the IAF's role and its responsibilities. A potent and lethal force, the IAF, provides a wide spectrum of choices to decision makers in any contingency. Principles of war have evolved over time. However, the contexts in which they need to be understood and employed have their own nuances. The characteristics of air power and its peculiarities need to be understood within the right framework for its correct application.

The structure of air power too needs to be appreciated to ensure optimal employment of air power to achieve national security objectives. Air strategy gets effectively utilised by executing the three aerial campaigns viz. Counter Air, Counter Surface Force Ops and Strategic Campaign with the omnipresent requirement of Combat Enabling Operations. Experiences of the recent past have clearly highlighted the growing proliferation of sub conventional warfare. Contrary to a widespread belief, air power possesses diverse and effective tools to make a significant contribution in these operations. Joint operations are the only way to achieve political objectives in modern conflict. Air power remains the lynchpin of any joint application of combat power in modern warfare. Space is no longer a frontier. The IAF has for long been aware of its importance in modern war fighting. It enables commanders to make decisions in the fog of war and provides the advantage of high ground. Information is the key to success in any endeavour and more

so in aerial operations. It is pervasive in nature, omnipresent and yet not always visible. It has its own dynamics that needs to be assimilated and understood. It calls for motivated and trained air warriors, who understand technology and can incorporate it into the art of warfare.

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1

Vision, Mission Statement & Core Values

VISION

To *acquire strategic reach and capabilities across the spectrum of conflict that serve the ends of military diplomacy, nation building and enable force projection within India's strategic area of influence.* In this endeavour, People First, Mission Always will be the IAF's guiding beacon.

MISSION STATEMENT

To be a modern, flexible and professional aerospace power with full-spectrum capability to protect and further national interests and objectives.

IAF CORE VALUES

The IAF leadership has identified three core values that must govern whatever it does – in peace or war. These are:

Mission, Integrity & Excellence

MISSION
EXCELLENCE
INTEGRITY
सत्यमेव जयते
भारतीय
वायु सेना
नभः स्पृशं दीप्तम्

2

Air Power in the Indian Context

Doctrine does not fight wars; people do. And although airmen may prefer to be 'doers,' only those who can think rigorously but creatively about future war are likely to be successful when crisis presents itself.

— Colonel Phillip S. Meilinger

AIR POWER IN PERSPECTIVE

The contemporary global environment is characterized by change and the future is expected to be no different. In this dynamic environment, it is essential to have a clear understanding of the attributes, limitations and the potential of air power to enable its optimum exploitation for furthering national objectives. India's security environment is an amalgam of its history, geography, culture, politics etc and thus the security challenges facing India are varied, complex and dynamic. Therefore, for India national security is an essential adjunct of overall national growth and development. The new millennium has witnessed sweeping changes with India emerging as a fast growing economy with a major stake and influence in the global arena. As the nation marches ahead on the path of socio-economic growth and seeks to fulfil the legitimate aspirations of its citizens, it can ill afford to be complacent about the existing and future security challenges. Seeking optimal solutions to these challenges would be imperative for our uninterrupted growth and development.

India's response to these challenges through the years has always been restrained, measured and moderate. This is because India's national security objectives have evolved against the backdrop of its core values of democracy, secularism, peaceful co-existence and the national goal of social and economic development. Even though as a nation India has no extra-territorial ambitions, it is still essential that it possesses a potent instrument of national power capable of deterring conflict and maintaining peace.

Air power fulfils all these needs. The varied roles played by air power have been demonstratively proven in the recent past. The aerospace medium has enabled nations vastly removed in distance and time to exercise their power and influence across continents with astonishing rapidity. On the other hand, non-state actors have also exploited gaps in air defence to fly passenger aircraft into buildings. The opportunities and challenges, therefore, are manifold. It is only a clearly articulated air power doctrine that allows nations to leverage and exploit its tremendous potential.

Air power doctrine is primarily a derivative of the fundamental principles that guide the application of air and space power and offers innovative ideas for the optimum exploitation of the medium. Fundamental principles draw on operational experiences and are time-honoured ways for achieving optimum success. They are guidelines that have worked in the past. Conversely, innovative ideas are futuristic and are limited only by imagination and technology. The interaction of these two constituents, makes an air power doctrine particularly dynamic bound only by experience, imagination and technology.

Unless the unique attributes and limitations of air power are understood, its sub-optimal utilisation would continue. History is replete with such instances primarily because air power is the youngest form of military power. Its relevance and application are yet to be completely comprehended by military strategists and practitioners of operational art. This is particularly applicable in our unique context. It is a historical fact that various empires through thousands of years

were entirely dependent on their armies and navies for survival. Armies and navies have traditionally been visible manifestations of sovereign might and capability. Thus, a generic appreciation regarding the utility of armies, and to a certain extent, maritime power, is inherent in most national psyches.

Air power, by contrast, only arrived in the last century and its optimum exploitation only began in the past few decades. Hence, its relevance, potential and applicability are yet to be fully absorbed into our nation's consciousness. Air power as a powerful and flexible tool of national security, statecraft and overall development is yet to be comprehended in full measure, leading to continued instances of its sub-optimal utilisation. The full-scale utilisation of IAF during conventional wars like the 1965 and 1971 Indo-Pak wars, its non-utilisation during the 1962 Indo-China war and restricted use during the 1999 Kargil conflict serve to illustrate the point.

Air power, in a classic sense is defined as the *total ability of a nation to assert its will through the medium of air.* It includes both civil and military aviation, existing and potential. In the modern sense, air power which has evolved into aerospace power is defined **as the product of aerospace capability and aerospace doctrine**. Air power is the strength of an air force as opposed to an attendant capability. The strength of India's air power lies in the IAF with the capabilities of air arms of the other services reinforcing that strength. Aviation related research and development as also industrial capabilities have a force multiplier effect. Space capabilities further add to the above to enhance the aerospace power of the nation.

The IAF has played a pivotal role in the country's security ever since its inception nearly 80 years ago. The IAF was established as an independent force on October 8, 1932 making it one of the oldest, continuously functioning independent air forces of the world. Over the years the IAF has evolved from being primarily a tactical auxiliary arm of the Royal Air Force in India, to an independent professional strategic force which endeavours to be at the forefront of national service.

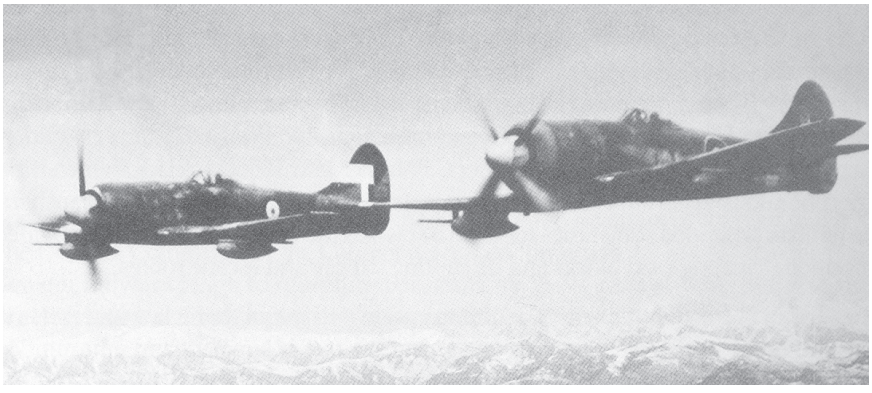
AIR POWER AND NATIONAL SECURITY

The dominant role played by air power in modern warfare, the high cost of aircraft and allied equipment, and a host of other factors demand that its capability and role in securing national interests be closely scrutinised. The case of the IAF can be no different, since the strength of our nation's air power is rooted in the IAF. It is hence essential to understand the place of the IAF in the national security matrix.

The Preamble to the Indian Constitution summarises our aims and objectives as a nation which in turn determines our national security objectives. These, in turn, dictate the military strategy, which is the process of coordinating the development, deployment and employment of military forces to achieve national security objectives. Military strategy essentially is a combination of land, maritime and air strategies. Since land, sea and air have their distinct characteristics, advantages and limitations, the strategic options enabled by land, maritime and air power are equally distinct.

Success in conventional conflict has historically hinged on the destruction of an enemy's fielded forces, followed by the capture or capitulation of the enemy's leadership. Hence, land and naval forces had few options apart from fighting their way through even if it meant having to accept significant attrition. The advent of air power changed all that. Air power could circumvent the enemy's land, naval forces and directly attack the enemy leadership, their command and control centres and other critical vulnerabilities, which would hasten the enemy's capitulation. This was illustrated in ample measure during the 1971 Indo-Pak war when following the bombing of the governor's house in Dhaka by the IAF, Pakistan agreed to a ceasefire when most of its military forces in the western sector were largely intact.

Air power can also decisively interfere with enemy land and sea operations without the reverse being true. A striking example of this is the battle of Longewala, wherein, Pakistan's armour was decimated by the IAF without reciprocal damage. The IAF dominated the skies and hence it could operate freely as it pleased.



Tempest over Kashmir Valley, 1948

The ability of the IAF to rapidly project military force and influence statecraft has become increasingly evident post-independence. The speedy aerial reinforcement of Srinagar during the 1947-48 conflict with Pakistan was the first visible exploitation of air power by India to further national strategy. Similarly, the aerial evacuation of King Tribhuvan of Nepal in 1950 and his subsequent restoration to the

Poonch: Refugees being evacuated in 12 Squadron Dakotas

throne paved the way for the Indo-Nepalese treaty of friendship. The swift air landed operation undertaken by the IAF during *Operation Cactus* in 1989 to airdrop Indian forces at Male was crucial in the foiling of a coup attempt and the subsequent restoration of the Maldives government.

In keeping with its mandate of enabling national development, the IAF also plays a significant role in aid to civil population during disasters, crisis etc. Notwithstanding the size of the country and the varied terrain, it deploys swiftly and frequently across the country for disaster mitigation and control. The IAF is frequently deployed for supply drops as also aerial evacuation during natural disasters such as earthquakes, cyclones, landslides, floods etc both within the country and even beyond. For instance, during the 2004 Tsunami, the IAF undertook airlift and relief operations in the Andaman & Nicobar Islands as also in the Maldives and Sri Lanka. Its transcontinental reach was apparent when during Hurricane Katrina the IAF rapidly responded and delivered aid and supplies to St Louis, Mississippi, USA. The IAF has conducted numerous such operations as for instance: evacuating thousands of people during snowstorms in Jammu and Kashmir in 2005; airlifting of more than 100,000 Indian citizens from Iraq and Kuwait during Gulf War I in conjunction with Air India and Indian Airlines which are the other elements of Indian air power. The IAF also serves the ends of democracy by periodically transporting paramilitary and civilian personnel for election duties.

The role of the IAF in defending the skies on a daily basis is carried out by fully armed aircraft on live Operational Readiness Platforms (ORP) or Combat Air Patrol (CAP). These are capable of launching within minutes to signal the resolve of the government of India for deterring any aerial misadventure. All the above examples demonstrate that air power enables force projection, both benign and otherwise, to support national security objectives in more ways than one.

RECENT PERSPECTIVES

Following World War II, the invention of nuclear weapons changed the concept of both warfare, and strategic deterrence. The emphasis during the Cold War was on nuclear balance and strategic bombing was linked to this balance. This led to the development of nuclear bombers and high altitude interceptors. The large payloads carried by these aircraft and the unmatched rapidity with which they could deliver them made air power the instrument of choice. Achieving air superiority quickly, proved crucial in the 1967 Arab-Israeli war for neutralising superior Arab capabilities. The Vietnam War highlighted the limitations of air power against low value low contrast target systems and the need for Suppression of Enemy Air Defences (SEAD) to reduce aircraft losses. As air defences against aircraft flying at medium and high altitudes improved, air forces around the world came to prefer the protection offered by a high-speed low-level ingress while operating in a densely hostile air defence environment.

The 1973 Arab-Israeli war clearly highlighted the potency of air defence (AD) weapons and reinforced the importance of SEAD to reduce attrition. In the 1980s, the **Air Land doctrine was enunciated by the US army**. It highlighted the significance of manoeuvre warfare and the synchronised application of air power to manipulate the battlefield for swift success in wars. In the 1982 Bekaa Valley operations, force multipliers such as RPAs, AWACS, and EW played a vital role in gaining technological asymmetry and for creating conditions which would quickly achieve air superiority. In the 1991 Gulf War, once again **medium and high attitude operations came back into favour** to prevent aircraft losses to shoulder fired missiles and highly lethal low level air defences. This was also validated during the Kargil conflict of 1999. In the 1991 Gulf war technology created a paradigm shift albeit selectively in the employment of air power. The enemy was treated as a target system and air power was used strategically to carry out parallel attacks on the enemy's vital Centres of Gravity. In Kosovo, air power was the only military instrument used to achieve coalition objectives.

Air power's ability to create strategic outcomes without transiting territories on ground made it a primary instrument of choice. However, subsequent air campaigns in Afghanistan and Iraq along with the Israeli experience against Hezbollah and other non-state actors have yielded mixed results. The clear lesson is that while air power remains an instrument of choice, its effectiveness depends to a large extent upon the adversary, the kind of target systems that can be engaged through the medium of air, and the ability of military and political leadership to use it for maximum effect.

The major post Cold War innovations included stealth, precision, extended reach, night sensors and enhanced computing power. Leadership now became a viable target. A significant shift also took place with the development of night fighting enabling technology that reduced the flexibility enjoyed earlier by surface forces to manoeuvre at night. Further, **space became closely integrated with warfare** and was utilised for Intelligence, Surveillance and Reconnaissance (ISR) functions, secure communications, integrated early warning, weather forecasting and navigation. Space based assets significantly enhanced the potency of air power. Due to increased battlefield transparency, it also became easier to discern enemy intentions. **Use of precision weapons at long range proved effective in causing a strategic paralysis**.

The media brought warfare into living rooms and therefore significantly influenced the way in which wars were conducted. It created international pressure and sensitivity regarding friendly losses and collateral damage. Whilst short duration of wars meant there was little time for the strategic effect to manifest itself, but the necessity of making a swift strategic impact, increased especially when operating under nuclear thresholds. With technological advancement, air power provided the capabilities that linked tactical actions with strategic outcomes that could prove crucial, especially in short duration wars.

With increasing globalisation, power concepts are moving away from territorial acquisitions to the extracting of political/economic

concessions. While traditional threats have reduced, threats from non-state actors have increased. From attrition oriented warfare, war waging concepts have rapidly moved towards **Effects Based Operations**, wherein functional paralysis is more desirable than the physical destruction of target systems. The **Revolution in Military Affairs** has transformed the role of technology and doctrines in fighting wars. The aim now is to isolate the enemy's command and control structures, augment psychological warfare and precision strikes on the critical vulnerabilities deep inside enemy territory. **These changes favour employment of air power more than any other form of military power**.

The importance of sequential advantage in warfare has been recognised and its relationship with force and space appreciated. As such, **air power today applies parallel force at all levels of war**. The strategic, operational and tactical levels themselves have been merged and are now more related to functionality than to location or type of targets. The networking of sensors, operators and decision makers has significantly reduced the sensor-to-shooter time period. This has also resulted in transforming linear warfare into non-linear warfare. The increased **focus today is on knowledge and effect** and to apply forces synergistically **to achieve the desired outcome in the shortest period of time, with minimum casualties and collateral damage.**

AIR POWER AND JOINTNESS

The IAF has always been cognizant of the fact that air power delivers best when used in synergy with the other components of military power. The conflicts and developments of the past three decades indicate a growing role for air forces. In fact, certain air campaigns conducted in the 1980s and 1990s led to the emergence of a school of thought that believed that wars could be won entirely by air forces. However, the IAF does not subscribe to this view since it is based on the experiences of air forces pitted against markedly inferior militaries with little or no air power capabilities.

In India's case, it is clear that air power alone cannot win a war, but at the same time, no modern war can be won without it. Our experience indicates that in almost every war fought since independence, the IAF has played a significant, and at times a pivotal role. It is also clear that air power can best be exploited not only in synergy with the other two components of the military, but also in tandem with diplomatic efforts and other national civil processes. The spectrum of modern conflict is significantly different and modern wars, whether conventional or sub-conventional (with or without a nuclear overhang) cannot be won singly by any one of the three primary components of military power. Modern conflicts can be decisively influenced only by each component of military power operating in synergy with each other and optimally exploiting the unique attributes of its medium of operation (air, land and sea) to achieve national objectives. Since the objective is common, joint operations would be the most logical response to national challenges. Integrated and joint operations are the cornerstone of modern military operations and air power must be seen as the binding factor. This is so, mainly because land and naval forces historically operated independent of each other until the advent of air power. It is air power that enables land and naval forces to undertake sustained operations beyond their physical operating mediums, leading to the increasingly accepted perception that air power is the lynchpin of joint operations.

3

Principles of War and the Nature of Air Power

The raison d'ètre, the reason for its (the air force's) very existence, is to try and neutralise the enemy's various war potentials in wartime, by every possible means and to protect one's own.

— Air Chief Marshal PC Lal

BLENDING AIR POWER WITH PRINCIPLES OF WAR

The principles of war are the most fundamental form of doctrine. They have evolved from the experience of previous wars and are designed to provide a better understanding of combat operations. However, the characteristics of wars have undergone significant changes due to the considerable technological advances. These have led to changes in the hitherto accepted principles and introduced a few new ones that reflect the changing nature of warfare.

- **Selection and Maintenance of Aim.** This would be a combined Politico-Military aim. In war, it is essential to identify an aim clearly so as to provide a focus to all elements involved in warfare. Thereafter, synchronised efforts must be made for its attainment. Since war is an extension of state policy, military aims are based on political objectives.

Further, multiple constraints including domestic pressures could play an important role in defining the desired end state, especially in asymmetric conflicts. The military aim should ensure maximum post conflict advantage while being achievable. The aim must be decided after due consideration of all politico-military factors and it should be modified if there is a change in circumstances. All components of national power should be focused towards attaining this aim.

- **Intelligence.** The key to air power is targeting and the key to targeting is intelligence relating to the potential enemy's intentions, dispositions and the likely pattern of his operations. Intelligence is vital for identifying the enemy's crucial vulnerabilities, weaknesses and strengths and his Centres of Gravity which in turn will help in devising an effective strategy. A force needs precise intelligence if it is to employ precision weapons. Intelligence also has a direct bearing on the attainment of effect and managing change.
- **Maintenance of Morale.** Morale is a state of mind, but it is very sensitive to material conditions. It remains high when it is based on a clear understanding of the assigned task, periodic practical training and discipline. It is especially responsive to good leadership and effective leadership can sustain high morale even when all other factors go against it. It is adversely affected by inferior or inefficient equipment and poor administration. History shows that success in battle is the best stimulant for morale. In the case of asymmetric warfare, morale can play a significant role due to the involvement of the civilian population. The factors important for the maintenance of morale include dynamic leadership, sound administration, discipline and the welfare of personnel.
- **Offensive Action.** In conventional wars, offensive action was the prime means of seizing the initiative and establishing moral ascendancy over the enemy. This entailed control over the purpose, scope and intensity of operations while placing premium on early action. In unconventional or sub-conventional conflict, the initiative may not be with the state and pre-emptive action without proper

intelligence may prove counterproductive. Hence, most states end up reacting to situations rather than taking a pro-active approach. However, the freedom to act at a place and time of one's choosing even while reacting to a scenario, would wrest the initiative from the enemy at any level of conflict. In these circumstances, the emphasis should be more on achieving and exploiting freedom of action across all levels and dimensions of war as well as denial of the same to the opponent. This would need accurate real time intelligence, physical and information security, a sound and focused strategy, technology savvy forces, effective deployment, synergy of effort, prompt offensive action and sound logistics. The side that loses freedom of action loses its ability to influence the conduct of war.

- **Concentration of Force.** Traditionally, success in war depended on the ability to field forces superior to those of the enemy at a particular time and place. However, modern concepts of warfare look at systemic targeting and ensuring strategic paralysis rather than the amassing of forces. It is better to concentrate decisive fire power on crucial locations and vulnerabilities to achieve the desired effect. Air power with its ability to circumvent the enemy's massed forces, coupled with superior technological capabilities that go beyond visual range engagements and standoff weapons has changed the focus from the earlier concept of concentrating mass to concentrating fire power at the decisive point. Effects and not mass lie at the heart of concentrating air power.
- **Economy of Effort.** Economy of effort is the principle of judiciously employing available resources in warfare. However with the advent of effects based operations, it may be more prudent to view this principle as attainment of the desired effect. By shifting the focus to attainment of effect rather than merely economising effort, the emphasis shifts to the goal rather than the means. Further, economy of effort automatically forms part of attainment of effect, because achieving the desired outcome by causing functional paralysis is always more economical than causing physical destruction of target systems.

- **Security.** The physical protection of assets and information denial is essential for all military operations since it enables friendly forces to achieve their objectives despite enemy interference. Security of key force multipliers such as Aerostats/AAR/AWACS would be crucial for success in war. Adequate measures must be taken to ensure their physical security on ground even against asymmetric attacks. There is a need, therefore, to not only physically guard these vital assets but also have electronic surveillance devices in place to supplement physical surveillance both during peace and in war.
- **Deception and Surprise.** Speed, reach and elevation endow air power with a high degree of inherent surprise. Surprise plays the greatest role in war, and its effect on morale is great. In some operations, particularly when other factors are unfavourable, surprise may prove essential to success. Surprise can be achieved through a manoeuvre, or by exploiting a new doctrine and technology. Its elements are secrecy, concealment, deception, originality, audacity, timing and speed. Deception can be combined with initiative and innovation to increase the element of surprise.
- **Flexibility and Managing Change.** Armed forces should be able to adapt themselves to change. This could be termed as "Managing Change" and goes beyond flexibility and can also be achieved by flexibility in employing combat power. The change could occur in the various dimensions of war – land, sea and air – and also at the various levels of warfare – tactical, operational or strategic. The purpose should be to derive maximum advantage from the altered circumstances. It would require initiative, mobility and flexibility to be encompassed into one philosophy. Air power best exemplifies these attributes because it can be switched from one theatre or area of operations to the other, from one target to the other or from one role to the other.
- **Synergy, Synchronisation and Cooperation.** Modern wars demand the joint and synchronised application of force by all

elements of national power for achievement of national objectives. This is even more valid in limited wars/asymmetric conflicts where limitations of time, space or method demand synergy of effort. In the future, there is a likelihood of large and varied forces including non-military elements being employed; hence unity of command may not be feasible at all times. It is here that coordination and cooperation between different agencies becomes the guiding principle. Joint planning, training, a clear perspective about the functioning of the other services and the establishment of supportive organisations will be essential to ensure synergy. This would also enhance survivability.

- **Generation & Sustenance of Favourable Asymmetry.** The increase in battle space transparency may reduce the impact of surprise at all levels of wars. Therefore, the emphasis now has to be, not only on, catching the enemy off guard but also on keeping him off balance. This would require generating asymmetry at the desired time and place, for wresting significant combat advantage. The methods employed include generating surprise in terms of time, space and force, a favourable differential in technology and weapon systems at the decisive point, exploiting sound operational art, formulating effective and synergistic strategy and maintaining information superiority.
- **Administration.** A sound administration and responsive logistics are a pre-requisite for success in military operations. A disregard of sound logistics has led to failure in wars on numerous occasions in the past. Sustainability is the ability of a force to maintain the necessary fighting power during the time needed to achieve military objectives. The physical and moral sustenance of personnel, the maintenance and repair of equipment and aircraft, the provision of combat supplies and expendable commodities and the treatment, evacuation and replacement of casualties are all aspects of sustainability.

CHARACTERISTICS OF AIR POWER

Air power exploits the vertical dimension and its nature is a function of the physical attributes of this dimension. The vertical dimension is exploited not only as a medium of transit, but also for manoeuvre, concealment, surprise and a host of other factors. An understanding of the distinct characteristics and limitations of the vertical dimension is essential to enable optimal exploitation of air power. These distinct physical attributes make for the distinct characteristics of air power. The core characteristics of air power are speed, flexibility, reach and elevation. These attributes are shared with the space environment, but in a different way, and on an entirely different scale; consequently, the unique features of space power are dealt with separately. These core characteristics make up the larger sub-set of characteristics which are as follows:

- **Flexibility & Versatility.** The first set of characteristics of air power can be placed under the heading of flexibility and versatility. Flexibility consists of the ability to use combat power in ways suited to the situation while versatility implies that the same weapons platform can be used for a variety of missions. For example, a modern multi-role combat aircraft like the SU-30 MKI can be used for almost all roles that are assigned to modern fighter aircraft. Similarly, most modern transport aircraft like the C-130 J Hercules and helicopters like the Mi-17 V5 are designed as multi-role platforms. Flexibility and versatility have a special relevance for the IAF as aircraft and equipment costs are rising exponentially, and there is need to extract the maximum value for taxpayers' money. In short, the IAF cannot afford to operate aircraft, which can only be employed at one level of conflict or for one type of role.
- **Mobility.** The unique ability of aircraft to manoeuvre freely and swiftly in three dimensions gives them the speed and the range to apply military power where needed over a very large area. Mobility has particular relevance in joint operations where forces need to be moved and re-supplied at short notice within and between theatres.

In many circumstances aircraft will be the only means of reacting in the time available.

- **Responsiveness.** Associated with flexibility and mobility is the characteristic of responsiveness. In a crisis, the use of air power will normally be the option most readily available and usable by the government. Air power can be used to demonstrate national resolve quickly by deployment, or heightened states of readiness, and it is the most readily available means for demonstrating combat power. Air forces can also be used to establish and maintain a military presence as an extension of diplomacy.
- **Shock Effect.** It is an effect that goes beyond mere surprise; it is an effect which can induce confusion and psychological disorientation. It is created by the aircraft's ability to concentrate fire power and deliver it with little or no warning. The shock effect of air power has been enhanced greatly with the development of air launched Precision Guided Munitions (PGMs) and other specialist weapons.
- **Concentration.** The flexibility and responsiveness of air power allows a commander to concentrate force. This is of vital importance especially in a fluid tactical situation. The shock effect inherent in air power is the product of its capacity to be concentrated in time and space. However, the capacity to concentrate force can be dissipated by inefficient command and control arrangements, inappropriate division of responsibilities or dilution of core competencies. It takes intelligence and sound judgment to determine where to strike and the quantum of force to be used. If leveraged properly, air power offers national leaders and military commanders the capability to concentrate power in very effective ways. Historically, concentration refers most obviously to offensive power, but it is not limited to that. Apart from concentrating the offensive power of strike aircraft, air power can be used, for example, to deliver land forces in a concentrated form to the point on the battlefield where they can have the maximum effect. The ability to move swiftly, to concentrate and to descend from out of the blue gives the advantage

of shock to air-landed or airborne troops. Concentration is also applicable to large volumes of relief that can be delivered in disaster and humanitarian relief contingencies. This ability to concentrate quickly is the characteristic which must be exploited fully if air power is to be used to its maximum potential, both as a tool for force projection and nation building.

- **Offensive Action.** Only air forces have the ability to carry offensive action deep into enemy territory while operating from secure bases. Defensive action may prevent defeat, but wars can be won only by offensive action. This principle of war, which is also the central characteristic of air power, is often neglected or overlooked by policy-makers unversed in the application of military power. Offensive capability provides the best defence. It changes one's stance from reactive to active and allows one to seize and hold the initiative in operations. The potential to apply air power offensively is a positive contribution to deterrence. It forces a potential aggressor to look at his own vulnerabilities and divert resources to their defence. The effectiveness of deterrence depends on the perception of the potential enemy regarding the likelihood of success in relation to the costs and penalties he will incur. Air power, with its inherently offensive characteristic can raise the costs, and impose penalties that would be unacceptable to the potential aggressor. Combined together, the core characteristics of air power coupled with modern space enabled communication systems, sensors; precision positioning and navigation capabilities offer tremendous capabilities that can decisively influence both the strategic and operational environment.
- **Reach.** The medium of air and the continuum of space does not hinder the employment of air power. Isolated and distant targets in difficult terrain do not prevent engagement of such targets from the third dimension. Modern technology has matured to such an extent that air power has unparalleled reach, and if exploited correctly, will provide a tremendous advantage to the side exploiting it.

LIMITATIONS OF AIR POWER

Like its strengths, air power has its limitations too. These limitations are relative rather than absolute and need to be understood as such. Some of these limitations are highlighted below and will enable a holistic understanding of air power.

- **Sustainability.** The sustainability of air forces is frequently limited by logistics, particularly in the case of technology intensive platforms. This could prove critical in a long drawn-out war. Air forces consume large amounts of resources; infrastructure demands are extensive and expensive, and the training takes considerable time. Sustainability becomes critical when air operations are prosecuted well beyond national boundaries in expeditionary operations, the likes of which have been undertaken by the US and its coalition partners in Iraq and Afghanistan.
- **Base Dependency.** Air power operates most effectively from permanent bases, although rotary wing aircraft can operate away from fixed facilities. This dependence on a large supporting infrastructure is a negative feature of air power. It results in air power assets becoming concentrated at readily identifiable points where they are vulnerable to attack. This dependence can also limit the effectiveness of air power in a particular area if suitable airfields are not available. The ability of aircraft to operate from short and unprepared landing strips derives its strength from this limitation.
- **Sensitivity to Technology.** Air power is a product of technology and because of this it tends to be more sensitive to technological changes than the other two services. Even minor technological innovations can have a major impact on air power effectiveness.
- **Vulnerability.** Air power assets are necessarily concentrated at bases owing to their infrastructural requirements. Besides being vulnerable in the air, they are high value targets when on the ground. Protective measures such as Hardened Aircraft Shelters (HAS), can reduce their vulnerability. However, by their very nature aircraft are fragile and even comparatively low grade battle damage can

have catastrophic effects. This limits the extent to which they can be exposed to the risk of enemy fire.

- **Impermanency.** This limitation relates to air power's inability to hold ground. As such, air power is an impermanent form of military force. The effects it creates are transient, and to sustain those effects, operations have to be repeated or complemented by other arms of military power.
- **Political Constraints.** The limitations of air power's relevance, especially in sub-conventional contingencies, lie not in its capabilities, but in the political will to use these capabilities. Political constraints on the use of air power can only curtail its effectiveness and make it counterproductive. Managing perceptions regarding the effectiveness of air power in diverse situations is key for shaping political opinion on the employment of air power, particularly in the sub-conventional domain.
- **Weather.** Notwithstanding the technical advances that facilitate 24x7 operations, air power continues to be more affected by weather compared to land and maritime power.

SOURCES OF AIR POWER

Air power is a derivative as also an indicator of national power. The ability of a nation to utilise all air power resources at its disposal determines its air power capabilities. Air power, hence, is the sum total of a nation's aviation and related capabilities. It comprises national aviation assets usually described as air forces, air arms and civil aviation, along with their associated organisations, infrastructure, logistics and personnel. The use of space, either independently or in support of air power, is on the rise and consequently the term 'aerospace power' is coming increasingly into vogue. The different sources of air power are as follows:

- **Air Force.** This is the traditional term for the independent military force that delivers air power. The capabilities of air forces reflect national perspectives, priorities and strategic needs. It is only the air

forces, that are capable of employing air power to prosecute all the air campaigns, and this is reflected in their structure, technology, organisation, training and infrastructure. **It is this that sets an air force apart from an air arm.**

- **Air Arm.** In exceptional cases, an air arm is an organic component of armies, navies and para military forces, and provides a capability that is not inherent in other elements of that surface force. However, this arm would be in support of the tactical objectives of the surface force unlike the objectives of the air force that are strategic in nature. Air arms also tend to be much smaller than air forces. As a result, they are not capable of prosecuting all the air campaigns. An exception to this is the US which maintains large air arms integral to its naval and land forces.
- **Civil Air Resources.** Civil aircraft and infrastructure also contribute to a nation's air power. They augment airlift capabilities and if suitably modified, could also be used for combat support operations.
- **Space.** The acquisition, exchange and exploitation of information in the modern world have been revolutionised by the onset of the space age. An important aspect of modern air power is that it is really an 'air and space power'. The demarcation between 'air' and 'space' is becoming increasingly irrelevant, and a modern air force must be prepared to operate seamlessly in both elements. An air force that can tap into space based assets can dramatically improve its ability to prosecute a war quickly and with minimal risk.

4

Air Power Doctrine and the IAF

A doctrine of war consists in a common way of objectively approaching the subject; second, in a common way of handling it.

— Ferdinand Foch: Precepts. 1919

'Doctrine' is derived from the Latin '*doctrina*' and signifies a code of beliefs or a body of teachings. In military terms, doctrine refers to the central beliefs that enable an organisation to optimally fulfil its national obligations. Air power doctrine refers to the central beliefs and principles of the IAF that guide the employment of air power in the furtherance of national objectives. These beliefs have been acquired from the study and analysis of experiences in conflicts and crises, as well as field exercises, equipment tests etc in peace time. Where experience is lacking, the IAF in its collective wisdom analyses the theory and postulates action. Thus a doctrine is a guide to the "best way to conduct Air Force affairs"

IMPORTANCE OF DOCTRINE

The national strategy is determined by the Union Cabinet and is based on the National Security Policy. Its purpose is to combine all components of national power, political, diplomatic, economic, military, technological, informational, social and cultural, to

safeguard national interests and achieve national security objectives. The national strategy entails the coordinated employment of all elements of national power. The doctrine offers precepts for the development and employment of national power. For example, India's nuclear doctrine as operationalised by the CCS note of January 4, 2003, guides the national strategy. The joint military strategy decides the development and employment of military power, along with the respective land, maritime and air strategies. Military doctrine provides the conceptual framework for the role, scope and application of military power and underpins the formulation of military strategy.

LEVELS OF DOCTRINE

Apex doctrines relating to national security and military power, offer precepts for the development and employment of power at the strategic, operational and tactical levels. Accordingly, doctrines have distinct levels that broadly correspond with the levels of war fighting, viz. strategic, operational and tactical.

Strategic Level: This doctrine enunciates the fundamental and enduring principles which guide the use of air forces during war and crises. It establishes the framework for the effective use of air power. For example, the tenet that: 'control of air becomes a pre-requisite for effectiveness of all military activities' is an enduring principle.

Operational Level: This translates the principles of the basic doctrine into military action by prescribing the proper use of the air forces on the basis of: distinct objectives, force capabilities, broad mission areas and operational environments. An example of an operational doctrine in consonance with strategic doctrine could be: 'AOC-in-C employing his air force in counter air operations by orchestrating a variety of roles to achieve control of the air'.

Tactical Level: This converts basic and operational doctrine by delineating the proper use of specific weapon systems to accomplish

detailed objectives. Tactical doctrine prescribes how roles and tasks are to be carried out and is usually published in manuals such as those brought out by the Tactics and Air Combat Development Establishment (TACDE). For example if Mirage-2000 aircraft are flying escort to an airfield attack package, then tactical doctrine would indicate how the Mirage 2000s would be integrated and co-ordinated within the force package.

THE DOCTRINAL LOOP

A doctrine is formulated on the basis of inputs. The output would then provide the framework within which viable military capability can be developed. These capabilities would require validation through peace-time exercises or war experiences so that the feedback could be employed to refine the doctrine further. The doctrinal loop is pictorially depicted below.

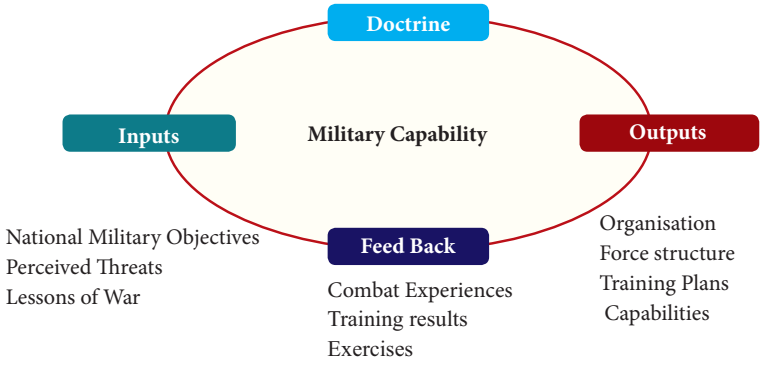


Fig. 1: The Doctrine Loop

DOCTRINE AND TECHNOLOGY

Doctrine is derived from the past and developed in the present for application in the future. Its true benefit is not what it tells us about the past, but what it suggests about the future. The doctrinal process therefore should analyse and influence the course of new and developing

technologies. In the Indian context, it may not always be possible for doctrine to drive technology due to resource and technological constraints. Instead, doctrine may be limited to playing an interactive role with technology. As such, our doctrine must be receptive to the potential advantages that new technologies have to offer. India has taken many strides in exploiting the new technologies for defence applications. An example of technology driving doctrine is the evolution of net centric warfare. Doctrine evolves post the absorption of such technological developments.

DOCTRINE AND FORCE STRUCTURE DEVELOPMENT

Doctrine is an important element in the development of future force structures and capability requirements. Although force structures keep changing they also exhibit enormous inertia and must be given the right direction and impetus. The guiding influence of doctrine in relation to force structure and capabilities can best be illustrated by an example. A decision on whether or not to acquire Remotely Piloted Aircraft (RPA) will depend on a host of factors that include cost, maintainability, operational characteristics and doctrine. The impact of doctrine on this decision is not to select a particular type of RPA or the numbers to be acquired, but to determine the applicability of this technology or capability to the employment of air power. The doctrinal argument in favour of its acquisition may proceed along the following lines:

In isolation, the RPA is neither an offensive weapon system like an aircraft, nor a defensive weapon system like a SAM. The key to its usefulness, however, is in the opportunities that the RPA offers to other offensive weapon systems with its ability to provide real time reconnaissance and intelligence that is so vital for targeting and making the battlefield transparent. In addition, the use of RPAs for Battle Damage Assessment would make air power more responsive and make it unnecessary to risk manned aircraft for the same purpose.

The doctrinal argument thus supports the procurement of RPA technology.

SUMMARY

This chapter highlights the following:

- Military doctrine could be defined as "a set of fundamental principles by which military forces direct their actions in the quest of national objectives".
- Air power doctrine enunciates the "fundamental principles that guide the employment of air power elements to achieve national objectives". It is a statement of officially sanctioned beliefs, war fighting principles and terminology that determines and directs the correct use of air forces in military operations.
- An air force doctrine determines the manner in which air forces organise, train, equip, fight and sustain their forces.
- Doctrine is authoritative but its application requires judgment.

5

Structure of Air Power

Air Forces are defeated or weakened at least as much by their internal illusions as by the enemy. The minute that, readiness data ceases to be realistic; training is cut back or separated from realistic combat conditions; effectiveness is exaggerated; equipment performance and lethality are overstated; gaps in training and doctrine are ignored; and an Air Force becomes a bureaucracy rather than a ruthlessly self –critical fighting machine; an Air Force places itself in the position when it must try to carry out in war the preparation it should have carried out in peacetime.

— Anthony Cordesman

AIR STRATEGY

Air strategy could be termed *as the process of coordinating the development, deployment and employment of air power assets to achieve national security objectives.* Air power with its intrinsic characteristics of speed, elevation and reach provides tremendous strategic options. These strategies are then prosecuted by air campaigns which comprise of a variety of air operations.

As aerial warfare evolved and the importance of command of the air grew, a distinctive strategic area for application for air power emerged. This involved operations to deter, contain or defeat the enemy's air power, a strategy which came to be termed as "counter air". Air forces can also be employed both independently of, and in

co-ordination with the surface forces to attack vital target systems. Historically, the purpose of an independent strategy was to weaken the enemy's ability to wage war and degrade his will to resist by attacking his sources of power. In contrast, the purpose of the co-ordinated strategy was to help friendly surface forces contain or defeat the enemy's land and naval forces. The operations mounted to prosecute the independent strategy came to be known as the "strategic bombing campaign", while those mounted to prosecute the auxiliary strategy were termed "tactical air support", or more recently as a "counter surface force campaign". Counter air, strategic air and counter surface force operations are the three elements of air strategy. Historically, the choice between these three strategies has tended to be one of emphasis rather than on their employment in isolation. In most recent conflicts, air forces have undertaken to prosecute all the three air strategies simultaneously, although the resources devoted to each have varied considerably. Therefore, air strategy would encompass all these options.

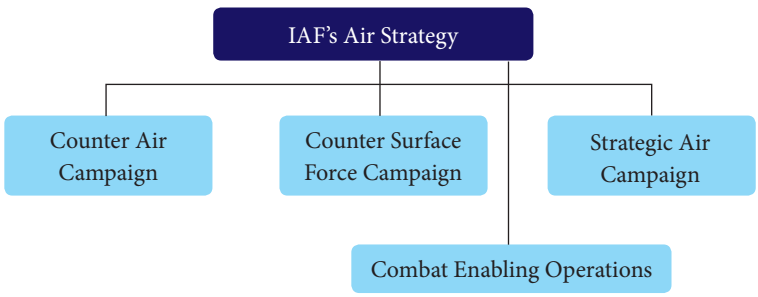


Fig. 1: Air Strategy

AIR CAMPAIGNS

Since each of these strategies is meant to achieve a specific aim, and does so by using distinct methods, its prosecution requires a dedicated "campaign". Hence, an air commander may have to wage three distinct but interdependent air campaigns in pursuit of his chosen air strategy. The sheer flexibility and versatility of modern aerial platforms and

weapons allow a commander to conduct parallel operations by prosecuting all campaigns simultaneously.

A definite order for the employment of air power can be discerned in each air campaign. For example, the counter air campaign comprises two basic air operations; **Offensive Counter Air** (OCA) and **Defensive Counter Air** (DCA) better known in the IAF as **Air Defence** (AD). Similarly, the strategic air campaign consists of **conventional** and **nuclear** operations, and the counter surface force campaign consists of **air land** and **maritime air operations**. An additional example would be air mobility operations that would form part of the combat enabling operations.

Normally, control of the air should be the first priority for air forces. This permits own air and surface forces to operate more effectively and denies the same to the enemy. The required degree of control is achieved through counter air operations. Thereafter, the air commander can deliver combat power when and where needed, to attain military objectives at any level of war. This he does by conducting strategic air and counter surface force campaigns. All the air campaigns can be conducted independently, parallel with, or in support of surface operations. A description of the various air campaigns, as well as of the combat support operations is given below:

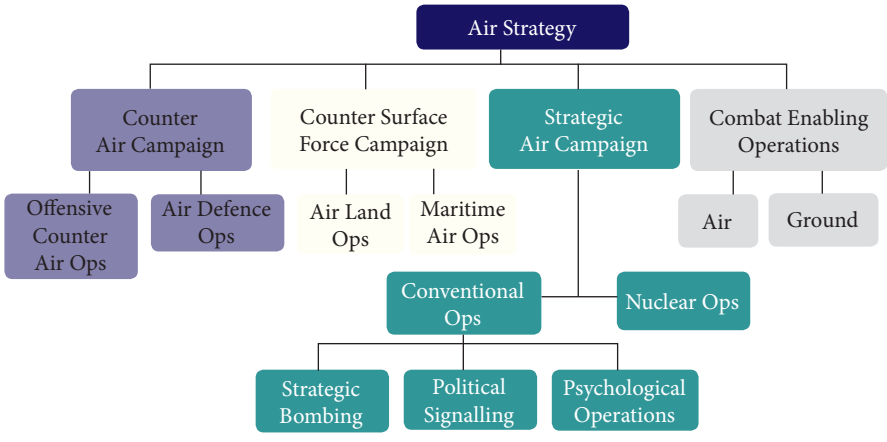


Fig. 2: Air Campaigns and Support Operations

OPERATIONAL ART

Operational strategy employs the forces earmarked for the military/air campaigns. It can be defined as the art and science of planning, orchestrating and directing military/air campaigns within a theatre to achieve national security objectives. A campaign consists of a series of related major operations, each of which may involve a number of battles, which together seek to achieve a particular objective. Within a campaign the capabilities of various forces must be combined to achieve synergy and on a broader scale, separate campaigns must be combined harmoniously to achieve war objectives. Whilst the air strategy is developed at the Air HQ, the operational art for employing air power is evolved at IAF Command HQs. For successful execution of operational art a commander must have:

- An awareness of the national security environment and the political aims
- A clear grasp of the military aim and the strategy
- Technological awareness
- An understanding of civil military affairs and media management.

TACTICS

Tactics are the art and science of employing forces at the battlefield. The difference between tactics and higher levels of strategy is that tactics are employed on the battlefield while operational strategy brings the forces to the battlefield. Modern wars necessitate that tactics must keep pace with advancements in technology and weapons. Failure to do so could prove to be devastating, especially for the air forces. Tactics should be designed to exploit the capabilities of equipment and weapon systems to enhance effectiveness and reduce vulnerabilities. However, in some circumstances, equipment may need to be adapted to fulfil tactical requirements. Innovative and unpredictable tactics will always produce positive results.

INTER-RELATIONSHIPS WITHIN AIR CAMPAIGNS

Each air campaign includes conduct of **specific air operations**, which encompass various tactical level air power functions or "**roles**". These not only include combat roles but also combat enabling roles. For example, the combat roles needed to prosecute **OCA** include suppression of enemy air defences (**SEAD**), **airfield attacks**, **fighter sweeps** and **escorts**. To be fully effective these missions need to be enabled by electronic warfare assets, surveillance and reconnaissance information, airborne warning and control systems (AWACS), air-to-air refuelling (AAR) and at times air transport support. Also necessary, are a sound command, control, communications and intelligence system, ground defences, maintenance, logistics and administrative support.

Combat roles tend to be specific to a particular air operation, combat enabling air roles can apply to many, if not, to all air operations, while ground support activities apply to all air operations.

The air power roles are accomplished through a series of tasks, which involve a number of missions and each mission may involve one or more sorties. For example as part of air strategy, we would execute a counter air campaign, involving OCA operations by aircraft in SEAD role which could be tasked to target high power radar inside the enemy territory. To accomplish this task, a mission of strike aircraft (with appropriate force packaging) undertaking a number of sorties would be planned. The structure of air power is as follows:

THE STRUCTURE OF AIR POWER AND ITS INTER-RELATIONSHIPS

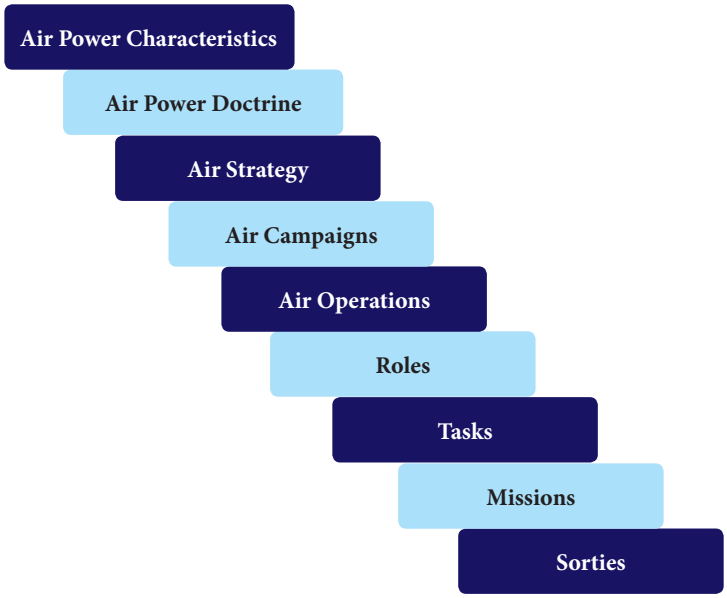


Fig. 3: The Structure of Air Power

AIR CAMPAIGNS AND ENABLING FUNCTIONS

The relevance of the various air campaigns and enabling functions can be better understood by viewing air power employment in its four basic functions. These are:

- **Control of the Air.** This is achieved by a dedicated counter air campaign through offensive counter air and defensive counter air or air defence operations. Their objective is to gain and maintain the required degree of control of air so as to permit effective employment of all facets of air and surface power.
- **Application of Combat Power.** This is achieved through strategic air and counter surface force campaigns. Here, combat power is applied against surface targets and does not include the targets that are specific to the counter air campaign. Typical roles for air land

operations are air interdiction, battlefield air interdiction, battlefield air strike, tactical recce, search and strikes while anti shipping and maritime air strikes are undertaken by the maritime air arm.

- **Enhancing Combat Power.** The air power roles contributing to enhancement of combat power increase the mobility, lethality, accuracy, survivability or flexibility of air and surface forces. This is achieved by combat enabling air operations and air mobility operations. Combat enabling air operations include airborne assault, special air operations, special heliborne operations, air-to-air refuelling, electronic warfare, surveillance and reconnaissance, airborne early warning and search and rescue. Combat enabling air operations also involve testing and evaluation and research and development.
- **Sustaining Combat Power.** If air operations are to be successful they need to be sustained and supported by combat enabling ground operations. Runway rehabilitation, CBRN defence, ground defence, passive air defence (including camouflage and concealment), training, administration and HRD are some examples of these.

ROLES

The exact role that an air force will play would depend on the nature of the threat, resources available and the unique nature of the campaign. Usually, roles envisaged for the air force are as follows:

- Defence of national and island territories, against attacks from air and space both during peace and war.
- Deterring an aggressor from carrying out hostile acts and if deterrence fails to mount an effective response.
- During operations, achieve control of the air to the required degree to provide full freedom of action to the air and surface forces.
- Applying direct pressure on the enemy's power of resistance by attacking his crucial centres of gravity.
- Synergising the combat potential of air power with that of the surface forces to achieve joint military aims and objectives.

- Deploying and employing forces to protect and project the national interests in any out of country contingency operation.
- Assisting the government in disaster management or humanitarian relief tasks.
- Executing counter terrorism and counter insurgency operations.
- Fulfilling international commitments requiring air power assets, consistent with our national policies and interests.
- Providing viable second-strike capability in case of a nuclear attack.

6

The Air Campaigns

THE COUNTER AIR CAMPAIGN
THE COUNTER SURFACE FORCE CAMPAIGN
THE STRATEGIC AIR CAMPAIGN

SECTION I

THE COUNTER AIR CAMPAIGN

Any one who has to fight, even with the most modern weapons against an enemy who has complete control of air, fights like a savage, under the same handicaps and with the same chances of success.

— Field Marshal Rommel

INTRODUCTION

With the increase in the effectiveness of air power, the need to contain the enemy's air power also increased significantly. As early as in World War I, air power was used in airfield attacks, air to air combat and offensive sweeps to seek and destroy enemy aircraft in the air as well as on the ground, so as to achieve control of air. During World War II, the need for a dedicated counter air campaign was realised not only for the success of air operations, but virtually for all types of surface and sub-surface operations. Various campaigns e.g. the Arab-Israeli war in

1967 and the India-Pakistan conflict of 1971 highlighted the successes achieved due to control of the air.

AIM OF THE COUNTER AIR CAMPAIGN

The aim of the counter air campaign is to **achieve and maintain the necessary degree of control of air**. These operations are directed against the enemy's air power either in air or on ground with the objective of preventing the enemy from using his air power effectively against friendly forces, yet permitting own use of air power against him.

DEGREES OF CONTROL OF THE AIR

The three classical degrees of control of air are:

- **Air Supremacy.** Air supremacy exists, if the enemy air power has been incapacitated to the extent that it is incapable of any air interference. This is characterised as: firstly, not being limited by time and space and secondly, being representative of the highest degree of 'control of air.'
- **Air Superiority.** Air superiority can be defined as a high degree of dominance in air, which permits the conduct of land, sea and air operations at a given time and place without prohibitive interference from the enemy air force. This condition is said to exist when, firstly, aircraft of all types can operate in all types of roles at a given time and place without serious interference from the enemy and secondly, it can limit the enemy's air operations. Further, this provides the additional advantage of information superiority due to own ability to execute desired reconnaissance missions, while preventing the enemy from doing so.
- **Favourable Air Situation (FAS).** FAS is limited by time and space to a much greater extent and it assures a lower degree of control of the air. Therefore, a higher degree of enemy air interference can be expected. The level of control of air is such that it enables the exercise of specific capabilities or conduct specific operations. An example of FAS is when one acquires just the required degree of

control of air in a localised area by executing SEAD, airfield attacks and offensive sweeps to permit a friendly break out of armour at the desired time.

ACHIEVING CONDITIONS FOR CONTROL OF AIR

The degrees of control over air are intangible. While air supremacy, can be easily discerned, it is not so in the case of air superiority and favourable air situation. In the case of the latter, the achievement of the said condition is known only after it is achieved and exploited. These realities imply that in the campaigns carried out to achieve the conditions for control of air, effort must be made to achieve it with a higher degree of assurance.

A pair of MiG-29s on an air defence mission

PRIMACY OF THE COUNTER AIR CAMPAIGN

The above three air campaigns historically have been pursued simultaneously but in case the enemy has a powerful air force, priority must be given to the achievement of control of the air so that the enemy air force's ability to interfere with own surface force action is blunted. However, this does not mean that no other campaign is to be undertaken till air superiority is achieved. Instead, it means that no other operations be commenced, if they are going to jeopardise the attainment of air superiority, or are going to use up the resources required to attain or maintain air superiority. At the same time, temporary emergencies may arise when such resources have to be diverted to other tasks as was the case in the opening moments of 1965 war when the IAF thwarted the Pak armour thrust in Chamb area on September 1, 1965 by launching fighter aircraft within one hour of getting the clearance to seek and destroy Pak armour, anti-aircraft guns and vehicles.

COUNTER AIR CAMPAIGN

The counter air campaign comprises of two distinct but complementary operations; offensive counter air and air defence (or defensive counter air). The components of the counter air campaign are as shown below:

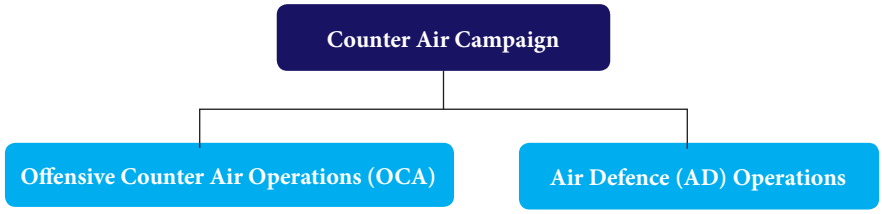


Fig. 1: Counter Air Campaign

OFFENSIVE COUNTER AIR OPERATIONS

Offensive counter air operations or OCA are aimed at destroying, disrupting or limiting the enemy air power as close to its source as possible. Air superiority is hindered by aircraft and ground based weapon systems which are supported by radars, other sensors,

communications and intelligence. Not directly related to combat, but nevertheless essential, is the infrastructure that supports these combat systems – ammunition, fuel, airfields and aircraft servicing areas. Attacks on some or most of these target systems may be necessary to achieve air superiority.

INTELLIGENCE

Intelligence is a vital input for planning and executing OCA operations. During peacetime, targets need to be prioritised depending on how vulnerable the enemy would be to their individual and/or collective destruction. Prior to commencement of hostilities intelligence agencies should be clearly aware of the intelligence required by the operational air commander and his intent, so that information gathering systems are put in place. An additional requirement during war would relate to Bomb Damage Assessment (BDA).

ROLES OF OCA

Successful OCA operations require:

- Suppression/Destruction of Enemy Air Defences (SEAD/DEAD).
- Airfield attacks.
- Fighter sweeps.
- Escorts.
- Helicopter and Transport aircraft.

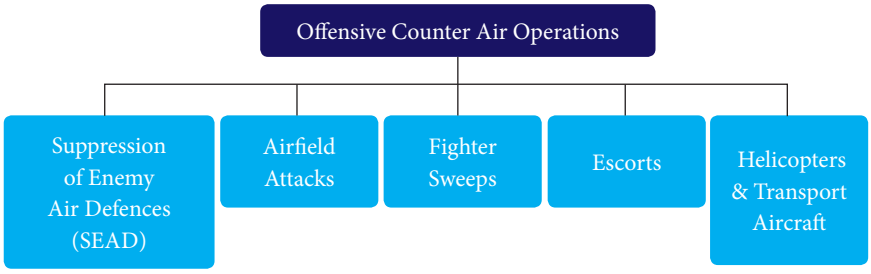


Fig. 2: OCA Operations

Suppression/Destruction of Enemy Air Defences (SEAD / DEAD). The early seventies proved to be a critical watershed in the history of air warfare. During the opening stages of the 1973 Arab-Israeli War, Syria and Egypt so dominated the skies over the Golan heights and Sinai respectively with an integrated network of surface-to-air missiles (SAMs) and anti-aircraft-artillery (AAA) that they succeeded in imposing – at least temporarily – "air denial" on the Israel Air Force. In the first three days of war, the Israelis experienced attrition of over 4 per cent. So grave were the losses that Israel had to temporarily suspend operations over the Golan Heights till the SAMs and AAA had been neutralised by ECM and/ or physical attacks. The importance of electronic warfare and the need for specialist aircraft and munitions to suppress, degrade or destroy enemy ground-based air defences was brought into sharp focus during this war.

SEAD/DEAD can be defined as activity which neutralises, destroys or temporarily degrades enemy air defence systems in a specific area by physical attack (hard kill) and/or electronic warfare (soft kill). SEAD can significantly reduce attrition and help sustain offensive air action against an enemy who has a strong air defence network. Specialised weapons, tactics and training play a particularly important part in SEAD. Targets to be attacked would include radars and other types of sensors, SAMs and AAA sites, and communication systems/ nodes. The inherent weaknesses of each component of the AD system would have to be identified and targeted to produce results, which is where Electronic Intelligence (ELINT), Communications Intelligence (COMINT) and other means of intelligence gathering would play a vital role. The major role in SEAD will invariably be played by the air forces, but the contribution of surface forces should not be overlooked. Special forces, artillery and naval support have been employed successfully in past conflicts to help suppress enemy air defences.

Airfield Attacks. Airbases have traditionally been crucial targets for offensive counter air attacks. Though the importance of airfields as

targets is on the decline, on account of rapid runway rehabilitation systems and the shift of focus on effects based operations, but even so airfields being static concentration centres would continue to contain densely packed high-value targets. Aircraft on the ground at airfields are more concentrated and vulnerable than they are in flight. Experience of the 1991 Gulf War has shown that even when aircraft on ground are protected by Hardened Aircraft Shelters (Blast Pens as the IAF terms it), they are not sufficiently protected; because of the precision attack and penetrative capability of PGMs. Apart from aircraft, the damage or destruction of critical base facilities can also prove to be decisive. When airfields are unable to provide landing, take-off or critical support facilities (maintenance, fuel, ammunition), air forces are effectively grounded. Reducing the number of enemy operable bases leads to the overcrowding and overtaxing of the available bases, making them even more worthwhile targets. Airfield attacks were used to devastating effect by the Israelis in 1967 war wherein, the Arab air forces were decimated on ground itself.

Operating Surfaces. Damage to runways and taxi tracks can only temporarily close airfields. Modern runway repair equipment makes it possible to make an airfield operational within a few hours. While this may be a worthwhile objective, to either assist friendly ground forces to launch an offensive, or to deny enemy ground forces air support to prosecute their offensive, it must be kept in mind, that the attrition suffered in repeated airfield attacks against runways and taxi tracks could also subsequently render the attacker too weak to counter the opposing air force. Another factor to be kept in mind is the effort required to attack a well-defended airfield. During the 1991Gulf War, a package of 38 aircraft needed 30 support aircraft to ensure that eight aircraft could hit a target with a reasonable chance of survival, i.e. a ratio of support aircraft to strike aircraft of 4 to 1.

Other Airfield Targets. Besides targeting operating surfaces, airfield attacks must also target aircraft, personnel and the support infrastructure. However, detailed intelligence would be required

regarding the location of such facilities, their hardening and redundancy. Key facilities are likely to be hardened and concealed and target acquisition would be difficult. At the same time, the collateral impact on the morale of the local commander and his administration because of intense pressure of bomb disposal, casualty evacuation and treatment, fire fighting and base recuperation, cannot be over looked.

Fighter Sweeps. These are operations mounted to seek and destroy enemy aircraft in the air in an allocated area of operations. Mission success depends on two factors. Firstly, the availability of friendly radar cover in the area of the sweep (supplemented by onboard hi-tech AI radars), and secondly, the willingness of the enemy air forces to oppose the sweep. Fighter sweeps are best conducted by modern air superiority fighters, which have higher loiter times, excellent AI radars, IFF integration and long range BVR capability. Their potency is significantly enhanced by AWACS/Aerostats support. The offensive sweeps also help generate dynamic air control in the enemy air space. In case, enemy air power refuses to engage, then the aircraft could carry air to ground armaments and attack high value targets in a role termed as 'Intimidation'. This combines the offensive sweep role with the attack function.

SU-30 MKI firing an air to air missile

Escorts. This role involves the assigning of fighter aircraft to protect friendly strike aircraft during a mission. Their purpose is to act as counter threat to the enemy air defence fighters, and by doing so, enable friendly missions to proceed unhindered to their targets and back. Fighter escorts are usually provided to strike aircraft, ECM aircraft and photo recce aircraft. They could also be provided to transport aircraft involved in combat enabling or support missions.

Helicopter and Transport Aircraft. In a counter air campaign, the forward tier of enemy radars could be neutralised by armed and attack helicopters, which can play a significant role in realising campaign objectives. Utility helicopters escorted by armed helicopters can also insert special forces in the vicinity of forward tier enemy radars with an aim of neutralising the radars by direct action. Transport aircraft like C-130 could also be utilised for inserting special forces and capturing enemy airfields.

FORCE PACKAGING

OCA missions are likely to include a package of attack aircraft supported by other combat support elements such as AAR and EW, SEAD and AD aircraft. The coordination of such packages is demanding and requires training and practice in peacetime. Operational effectiveness should be achieved by saturating defences through spatial and temporal compression of the attacks carried out.

AIR DEFENCE OPERATIONS

Air defence (AD) involves the employment of a combination of passive and active measures to nullify or reduce the effectiveness of an enemy aerial attack or a hostile ballistic/cruise missile attack. Air defence, by itself, cannot achieve a lasting favourable air situation, since it is reactive. A military strategy which is based solely on AD operations concedes the timing, scope and tempo of air operations to the enemy and entails considerable military risk. AD operations have little scope

of exploiting surprise, initiative and offensive action. AD operations should always be complemented by OCA operations to retain the initiative and authority in air.

Effective AD depends upon the integration of sensors, weapon systems, secure communications and the real-time transfer of data. A centralised command and control infrastructure must be overlaid to provide both direction and co-ordination for the many elements of an air defence system including those from other armed forces, especially in an integrated battlefield scenario. The effectiveness of an AD system is heavily dependent on its surveillance and early warning systems to provide time in which to react. This response usually entails committing a range of weapon systems against the threat via the medium of the control system. In practice, both surveillance operations and control systems utilise a common system known as Control and Reporting (C&R) system.

The success of AD operations depends largely upon factors such as the quality and timeliness of intelligence, the assurance of detection, response times of weapon systems and the ability of AD elements to remain operational while absorbing battle damage. The degree of reliability and redundancy in the air defence command and control system is a critical factor.

The overall structure of AD operations is as shown below.

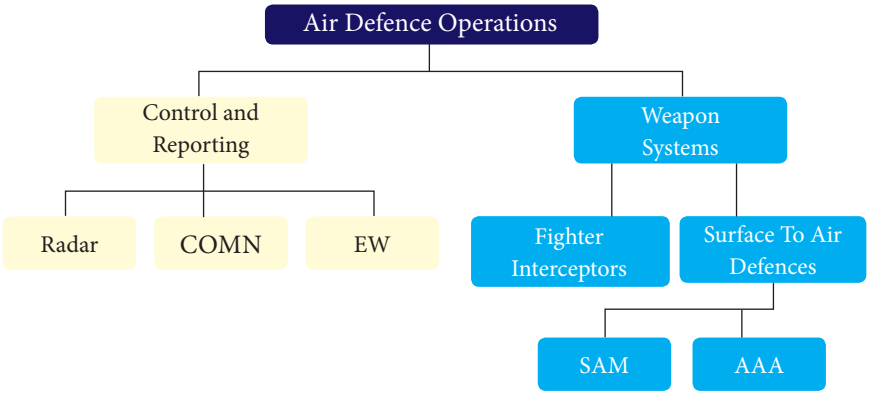


Fig. 3: AD Operations

The IAF air defence system is structured to allow:

- Wide-area surveillance coverage and control capability.
- High degree of control of national airspace and the tactical battle area.
- An ability to inflict high attrition on the enemy.
- Sufficient system redundancy to ensure that battle damage will not significantly hamper sensor, data exchange or command and control functions.

PRIORITIES IN AIR DEFENCE

The aim of AD is to suitably defend relevant airspace and assets, and in this process, also inflict maximum attrition on the enemy. Should this be achieved, the adversary's capability to concentrate effort in subsequent raids would be reduced and he would be dissuaded from carrying out future attacks. Consequently, the damage sustained by friendly forces and facilities would also be reduced. This then should guide the force structuring and related operational art. The emphasis should be on causing maximum attrition by means of an active air defence network.

Principles of AD. The four employment principles applicable when planning for active AD are: mass, mix, mobility and integration. The control and reporting (C&R) structure must be able to effectively handle a number of AD units, i.e. "mass", and also a "mix" of airborne and ground-based weapon systems. The C&R system should be at the same time responsive to the changing tactical situation, which involves "mobility" and "flexibility". Finally, all the elements need to be integrated to provide a layered and in depth coverage.

Airspace Control. Airspace control is a combination of airspace organisation and planning procedures to achieve effective control and coordination minimise risks and permit efficient and flexible use of airspace by all the elements involved in joint air, land and sea operations. While airspace control promotes greater flexibility of operations, the authority to approve, disapprove or deny combat operations is vested

in only one operational commander. This would significantly reduce chances of fratricide.

Methods of Airspace Control. There are two basic methods of exercising airspace control:

- **Positive Control.** Positive airspace control employs electronic elements for the positive identification, tracking and directing of aircraft within given airspace. Radar is the primary means of exercising such control, though other sensors such as IFF can also be employed. These sensors need to be integrated with control centres through real time reliable, secure and jam-resistant communications. Data link will further strengthen the capability. Only such integration can achieve the positive identification of platforms and avoidance of fratricide.
- **Procedural Control.** Procedural airspace control is a system of airspace control, which relies on a combination of previously, agreed and promulgated orders and procedures. Procedural airspace control includes techniques such as segmenting the airspace by volume and time and/or the use of weapon control orders. This method is more restrictive than positive air-space control, but is less vulnerable to interference by electronic means and physical attack. It however does ensure continuity of operations under adverse environmental conditions, and must always be available as an immediate fall-back system should the positive control be degraded, or when positive control is not considered appropriate for the operation at hand.

CONTROL AND REPORTING

Success in AD engagements depends, to a large extent, on the ability to detect an attack at the earliest possible. The defender must be aware of an impending attack in good time so as to be able to alert his own forces, to neutralise the effects of surprise and to prevent the enemy from concentrating his attack in time and space. 'Early Warning' is the generic phrase that encompasses the means for doing this and they can

be split into two distinct categories; ground-based systems and airborne early warning (AEW). AEW offers far greater flexibility, significantly larger early warning and the ability to intercept incoming threats at far greater distances, compared to ground-based systems, thus enhancing the level of attrition inflicted on the enemy. In effect, with AWACS aircraft, area defence becomes much more effective and at the same time provides greater in depth defence and a favourable force-to-space ratio.

The integration of a number of diverse sensor systems is necessary for achieving an effective level of early warning. Layered surveillance operations provide for the optimum use of sensor systems. Airborne, ship/ground based radars and mobile observation posts (MOPs) should be interconnected with links capable of rapidly transmitting electronic data, as well as voice information. Secure digital links are necessary for achieving this. Civilian radars can not only assist in correlating civil traffic but also contribute effectively towards strengthening the AD network with additional sensors and redundancy. Naval air defence radars, whether the ships are in port or at sea, and army radars in the tactical battle area, can also contribute significantly towards building a comprehensive air picture. Interoperability at the architectural level would be the key issue. Adequate systemic checks and filtering of information on a need to know basis, must be built into the architecture to avoid any overload of information at the respective levels of AD command and control.

Communications. The effectiveness of an AD system depends on an integrated and secure communications network which can meet the imperatives of the network centric warfare of the future. Without reliable communications, even the most carefully developed system will be ineffective. All links, from aircraft to ship or shore, from an operations centre to a SAM battery or from the senior to subordinate commanders, must be completely reliable and secure. Communication links consist of a combination of satellite, landline, optical, microwave and HF networks. Such communication networks must be built around

a reliable media architecture which has the capacity and capability to carry data, voice, images, video, etc., in digital mode for real time transmission and usage.

Electronic Warfare. AD operations are especially vulnerable to EW because of their reliance on the sensors to provide information in an accurate and complete form and for that information to be communicated in real-time. Air defence radars and associated equipment, therefore, must be designed for resistance to EW measures. Irrespective of the availability of ECCM, standard operating procedures (SOPs) should assume that operations will be conducted in a hostile EW environment and suitable training for the same must be an integral part of peacetime activity and training exercises.

WEAPON SYSTEMS

An air defence weapon system will normally consist of two complementary components, fighter aircraft and surface-to-air defences.

- **Fighter Aircraft.** Fighter aircraft have limited individual endurance (this now can be increased through AAR) and they cannot be re-armed, re-crewed or serviced in the air (though most modern ASFs are heavily armed for increased endurance / range and hence number of engagements). However, they are flexible and reusable and can be switched to tasks other than air defence, should the operational situation demand it. Fighter aircraft are also mobile and can be used to protect large areas or be concentrated rapidly to counter enemy saturation raids. They can be used for the following types of tasks:

    - **Interception.** An intercept mission may involve the scramble of fighters from a high state of readiness, or the redirection of aircraft from previously launched combat air patrols. Interceptions can be carried out autonomously or with the assistance of AD radars.

- **Combat Air Patrol (CAP).** Combat air patrols are mounted in an objective area over a force: that needs protection; over the critical area in a combat zone or over an air defence area, for the purpose of intercepting and destroying hostile aircraft before they reach their targets. Air effort for AD cover under such circumstances must be carried out judiciously; otherwise it can lead to a waste of air effort. The availability of AWACS / aerostats can offset the limited availability of radar cover at low altitudes inside the enemy territory. Combat air patrols traditionally are defensive in nature and sustaining them, particularly at long range and over long periods, can absorb a great deal of effort, hence they should be used with prudence. However, with air to air refuelling and AWACS cover, they have become significantly more potent and can be strategically employed well forward to enhance air dominance capability.

- **Surface-to-Air Defences**. Surface-to-air defences consist of surface to air missiles (SAMs) and anti aircraft artillery (AAA). These defences allow a state of high readiness to be maintained over long

Live firing of Pechora SAM-III Surface to Air Missile

periods, enable quick response (including firing a large number of weapons in a relatively short period of time) and in certain cases can be used to counter ballistic missiles as well. They have limited range and low mobility compared to fighter aircraft and therefore, relatively large numbers of surface to air defence systems would be required to defend anything other than point targets. However, the IAF is moving towards area defence with induction of long range surface to air weapons. The concept of multilayered point defence will shift to networked area defence with high priority targets being protected by multiple weapons providing multi tier defence.

IFF AND FRATRICIDE

Fratricide could become significant in any future war. Though reducing fratricide is desirable, eliminating it may not be entirely possible. Fratricide occurs for various reasons such as misidentification, inexperience and lack of command and control. While inexperience could be countered by training and inadequacy in command and control by better coordination among the various AD elements/ services, reliable and foolproof identification friend or foe (IFF) is still a necessity. SAMs and AAA have their own problems of IFF. With the multiplicity of SAM systems being inducted into the three services compatibility of IFF system needs to be ensured to avoid fratricide as well as to gain maximum operational benefits.

OFFENSIVE AIR DEFENCE

An overall defensive posture has been the traditional approach to air defence. The acquisition of ASF aircraft and technologies such as BVR / AAR / Aerostat / AEW / AWACS / RPAs / IACCS, necessitates a macro shift in as much that air defence tasks be taken to the enemy's air space instead of waiting for his aircraft and weapons to enter own airspace. Thus the entire philosophy of AD needs to shift from the reactive–defensive approach to offensive. The aircraft, supporting control and reporting structures of AD can be employed very effectively with an

offensive outlook to the defensive tasks. This would imply placing the AD assets literally in the enemy air space under AWACS control to tackle the enemy air power at the earliest and create conditions for achieving air dominance.

RESPONSIBILITY FOR AIR DEFENCE

The overall responsibility for the air defence of the country as per the Union War Book has been vested in the IAF, both for the combat zone as well as in other areas including the island territories and offshore installations. The defence of the airspace at sea within the limits of ADIZs except the AD of naval assets at sea also rests with the IAF. The AD of naval assets at sea, within the ADIZ or outside is a naval responsibility except when specific assistance is sought from the IAF. Air HQ is the highest authority with the ultimate responsibility for AD of the country. Because of India's large size, this responsibility has been further delegated to operational air commands, who exercise operational control over all AD forces within their respective geographical area of responsibility. Air Command HQ, either directly or through Air Defence Control Centres (ADCCs), where established, lays down broad policies, lays down operating instructions and procedures and is responsible for training and operational preparedness of all C & R and AD elements under their command and control. During war, Air Command HQ exercises operational control over all C&R and AD forces including those from other commands / services, operating within its area of responsibility. These capabilities would need to mesh with a futuristic Ballistic Missile Defence (BMD) to provide an integrated and comprehensive AD coverage of the nation.

Whilst AD operations may be executed jointly by the IAF and the army/navy, the overall responsibility for air defence would always rest with the IAF. The army and the navy look to their integral air defence weapons for the protection of vital assets and formations from aerial attack. The reality is that these weapons are self-defence weapons designed to sanitise an immediate airspace and while they need the support of

surveillance, data transfer and command and control systems, they are not focused on the AD of the entire nation. They cannot therefore exercise an all-encompassing control over the usage of airspace, which is the primary function of a balanced AD system. Naval and land forces can significantly enhance the defensive depth and the level of attrition on the attacking enemy aircraft but, they can do so only if they are fully integrated within the AD system as a whole. Failure to integrate would invite disastrous consequences in war in terms of fratricide.

DOCTRINAL PRECEPTS

The major doctrinal lessons of counter air campaign operations are listed below:

- Control of the air is vital for the success of, not only air operations but also for the success of virtually all types of surface and sub-surface operations.
- To achieve the required degree of control of the air, a dedicated air campaign is necessary to neutralise enemy air power.
- Suppression/destruction of enemy air defences is of crucial importance in the counter air campaign, especially against a modern air force.
- Even in a generally hostile air situation, it is possible to achieve a favourable air situation, temporarily, for specific operations.
- The relationship between the offensive and defensive components of the counter air campaign is dynamic and complementary and the emphasis on one or the other depends on a variety of factors.

SECTION II

COUNTER SURFACE FORCE CAMPAIGN

The Bangladesh war demonstrated that the three services working closely together were strong and decisive in their actions. Inter-services cooperation was indeed the most important lesson of that war.

— Air Chief Marshal PC Lal

INTRODUCTION

The strategic aim of the counter surface force campaign is to deprive the enemy of the military power required to occupy, control or exploit territory or sea space. Counter surface force action involves the use of air power, in cooperation with friendly surface forces to deter, contain, neutralise or defeat the enemy's army and/or navy. The ability to prosecute a counter surface force campaign effectively will depend heavily on the success of the counter air campaign and invariably these two campaigns will be closely integrated.

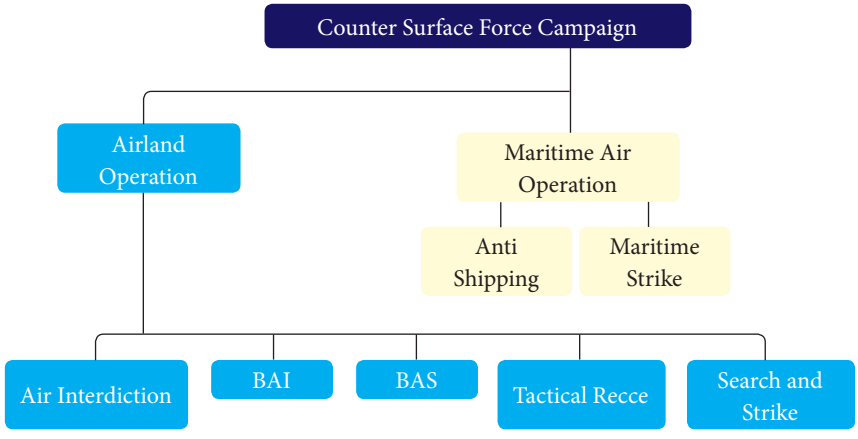


Fig. 4: Counter Surface Force Campaign

AIR LAND OPERATIONS

The inherent speed and reach of combat air power enables rapid engagement of enemy ground targets across the length and breadth of the battlefield. Air land operations include the following air power roles:

- Air Interdiction
- Battlefield Air Interdiction (BAI)
- Battlefield Air Strike (BAS)
- Tactical Reconnaissance
- Search and Strike

Air operations in an air-land battle should be so designed that they either deny the enemy the ability to concentrate forces in time and space, or facilitate the rapid momentum of own advance. The extended reach of air power and its ability to circumvent massed forces and target crucial vulnerabilities in depth provides us with the vital capability to control the force, space and time dimensions of warfare and it is in these dimensions that air power produces the desired effect.

Generally speaking, air power contributes to the land battle in one of three ways. Firstly, by attacking enemy ground forces, which are actually engaged in combat with friendly surface forces. This activity is termed Battlefield Air Strikes (BAS). Secondly, by attacking enemy forces, which are in the vicinity of the battlefield, and may be closing in to join the ground battle in the immediate future. These air attacks would take place a short distance behind the battle area and would seek to have both a direct and speedy impact on shaping the battlefield. These are known as Battlefield Air Interdiction, or BAI. Air Interdiction or AI involves the targeting of strategic reserves, reinforcements and re-supply of the entire battle space up to several hundred kilometres behind the front line. These three operations are designed to influence a limited area of operations, and though they are usually cited as examples of the tactical use of air power, they have the potential to create a 'strategic effect'. A typical example is the impact of air interdiction operations by

the Allied Forces against Rommel's Afrika Corps and its overall impact on the strategic contours of the North Africa campaign during World War II.

AIR INTERDICTION

The aim of these operations is to cut off the battlefield from strategic reserves and essential supplies as well as prevent or delay the enemy's strategic reserves/strike corps and crucial supplies from reaching their point of application, deny the enemy the options that he needs to employ his offensive elements from the countervailing position, degrade his sustenance capability and his offensive potential in the battlefield, and prevent the enemy from moving in and out of the battlefield, thereby denying him strategic space to manoeuvre. Air interdiction operations therefore are designed to destroy, neutralise or delay the enemy's strategic military potential before it is effectively brought to bear in the battlefield.

These missions are conducted at such distances from friendly forces that their detailed integration with own troops is not necessary. For men and equipment, transit routes would be along established lines of communication. Similarly, material also has to flow from its source to the front over these communication lines. Any air operations designed to slow down or inhibit this flow of men and material to the battlefield is termed as air interdiction. Interdiction targets include the enemy's strategic reserves and his supplies and the means by which his forces and provisions are moved. In other words, **air interdiction prevents the enemy from moving in or out of the battlefield**. Typical targets would include troop and vehicle concentrations, supply trains and convoys, amphibious forces, strategic ammunition dumps, communication centres, bridges, railways and waterways.

Air interdiction is the best means of exploiting the reach of air power as it can strike the enemy where he is most vulnerable and forces him to extend his air defences over a greater area. The capacity of air interdiction for disruption, diversion and, particularly, delay can produce

decisive effects. The greater the enemy land force's need for supplies and reinforcement, the more effective air interdiction is likely to be. It can have a major impact on an enemy army conducting an intensive, highly mobile battle. This will also be true for a retreating enemy too, where the synergy between air and land force offensive action is most likely to yield decisive results. However, there is inevitably a delay between an air interdiction attack and its effects being felt at the battle front. Moreover, the effects of air interdiction are cumulative, and to be fully effective, air interdiction should be undertaken for an extended period.

Joint planning by land and air forces is key to effective interdiction operations. This plan should set out the degree of neutralisation required, when desired, and the relative priority of the tasks. Based on this guidance, the air force executes the air interdiction campaign. Timely and accurate intelligence is a prerequisite to successful interdiction. Strategic analysis can identify vulnerable elements in the enemy's forces. The air commander must be aware of the extent of the enemy's communication lines, the time it takes for his forces/supplies to reach the battle area and the points where personnel and material will most likely gather for departure or arrival. These concentration points, whether supply depots/storage areas, troop staging areas, or transportation centres where re-routeing and reloading are done, will be the most lucrative targets. The same effect could also be achieved by isolating the battlefield by targeting the communication lines and preventing movement.

BATTLEFIELD AIR INTERDICTION (BAI)

Battlefield Air Interdiction is defined as air action carried out against hostile land targets, which are in a position to directly affect the friendly forces and which require joint planning and co-ordination, but do not require intimate synchronisation with the fire and movement of own forces. The basic difference between BAI and BAS lies in the proximity of targets to friendly forces and the control arrangements that are therefore needed. BAI attacks are conducted **to delay, destroy or**

neutralise enemy forces, in the battlefield, that are not yet in contact with friendly land forces. These operations may be used **to isolate the enemy forces in the battle zone from his essential reinforcements and supplies and to restrict his freedom to manoeuvre**. BAI missions are planned against targets usually beyond the limit of friendly artillery fire. Because they are conducted away from the confusion of the active battle front, they are potentially the most effective form of air support. The advantages of BAI operations over BAS are that these operations have a wider area of influence, target identification is relatively easy, targets are less likely to be defended well, chances of fratricide are lower and the targets are likely to be more vulnerable.

The objectives of BAI operations are to shape the battlefield by:

- Isolating the battle zone from critical supplies and reinforcements.
- Denying the enemy freedom of space to manoeuvre by attacking crucial lines of communication
- Degrading the enemy's offensive potential, and rendering him incapable of taking meaningful offensive action.
- Preventing the enemy from reaching decisive locations and launch pads to further their offensive.

BATTLEFIELD AIR STRIKES (BAS)

MiG-27 on a BAI mission

Battlefield Air Strikes are the air actions carried out against enemy targets in the close vicinity of own ground forces and require not only joint planning but close coordination with the fire and movement of own forces. Aircraft could be employed effectively, where the situation is becoming critical, response time requirement is less or targets are inaccessible or invulnerable to the army's organic fire power. The ground commander must play a key role in determining where BAS is to be employed. However, the air commander must be the final authority to decide on the employment of air assets keeping in mind the overall air situation.

Limited air assets imply that BAS should be employed primarily in critical operations and not frittered away in penny packets. BAS are meant to be employed quickly and decisively, and concentrated in space and time. However, BAS have their own limitations. These include problems in target acquisition and identification, difficulty in identifying the bomb line, lethal AD environment, jamming of communication between strike pilots and the FAC and high probability of fratricide.

A MiG-21 attacking grounds targets during a BAS mission

RELATIONSHIP OF BAS WITH OTHER AIR OPERATIONS

The greater the 'degree of control of the air', the greater the range of options available for undertaking BAS operations. Suppression of enemy air defences in the TBA is vital for unhindered BAS. Both air and ground commanders must contribute the necessary firepower and EW assets to achieve this. The effectiveness of interdiction operations in disrupting the enemy supply routes, limiting reinforcement of enemy ground forces and destroying/neutralising follow on echelons will influence the size and intensity of BAS requirements. The importance of tactical reconnaissance by both air force and army sensors can assist in identifying the right targets.

EMPLOYMENT CONSIDERATIONS

These are as follows:

- **High Threat Tactics.** A heavy concentration of AAA and SAMs may inhibit effective air operations over the target area, necessitating the use of sensor fused and loitering weapons that can be dropped from outside the SAM and AAA envelope.
- **Air Space Management**. The need for continuous operation of organic firepower in the battlefield area will require detailed procedures for integration with BAS missions and incorporation of effective IFF systems.
- **Communication Jamming**. Normal radio communications may be denied, requiring procedures for control/clearance for BAS strikes with little or no radio communications. Secure and jam proof communications between the pilot and the Forward Air Controller (FAC) are therefore essential for executing BAS missions.
- **Night/Adverse Weather BAS.** Providing adequate support to ground forces at night or in adverse weather is a challenging task and necessitates the availability of night vision devices and night targeting capability.
- **Requirement of Surgical Accuracy.** Taking into account the close proximity of own troops with the BAS target systems and the likely small target dimensions, it may be necessary to execute strikes with precision weapons. The designation could be carried out by the RPAs, by the delivery aircraft itself, or from ground by FACs with the help of portable laser designation systems.
- **Importance of Forward Air Controllers.** For successful conduct of BAS, it is essential to train a large number of personnel as FACs. The manpower would be provided by both the army and the IAF. Therefore, during peacetime it must be ensured that selected cadres undergo realistic training. In addition interoperability of equipment has to be ensured for effective utilisation of FACs on ground. It is pertinent to note that a well-trained and motivated FAC can make the crucial difference in any critical situation on ground.

ARMED/ATTACK ROLES OF HELICOPTERS IN BAI/BAS MISSIONS

A pair of Mi-35 attack helicopters on a BAS mission

Helicopters could be used effectively in BAI / BAS missions. Major tasks of armed/attack helicopters are:

- To provide suppressive fire options to the ground troops. This would be useful in conditions where artillery or the ground attack effort is either not available or is likely to be less effective. On account of the helicopters' variable speed and hover capabilities, engagement of surface targets in various situations would be highly effective.
- To provide flank protection to mechanised formations.
- To provide route cover and suppressive fire to heliborne assaults to create a favourable ground situation.
- To provide air defence cover against enemy armed or attack helicopters.
- To engage enemy helicopters involved in troop carriage, reconnaissance and communication duties.
- To interdict targets in the close vicinity of the TBA.

- To neutralise radar sites located close to the border.
- To neutralise bridges used by the enemy for breaking out.

FUTURE PROSPECTS OF HELICOPTER OPERATIONS

Keeping in mind the changing modern battlefield, the helicopter fleet of the IAF may be entrusted with the following roles in the future:

- Urban warfare, involving precise deployment and extrication of highly specialised troops from congested and densely populated areas.
- Covert operations within enemy territory using night vision devices, infrared systems and stealth techniques.
- Counter surface force operations in conjunction with special forces.
- High altitude operations including operations in low light conditions.
- Rapid movement of forces within the theatre.

TACTICAL RECONNAISSANCE

Collection of intelligence through the medium of airborne sensors in the tactical area is termed as tactical reconnaissance. Tactical recce information pertains to the disposition, composition, location, activities and movement of the enemy forces over land or sea. Timely response to such intelligence information is possible only if the evaluation and dissemination of tactical recce output is in near real time. Such a recce could also provide damage evaluation and is obtained through a broad spectrum of sensors employed on fighter aircraft, RPAs and satellites that range from high resolution cameras to synthetic aperture radars and infra-red (IR) detection sensors. A good C^3I network will enable real time dissemination of tactical recce intelligence.

SEARCH AND STRIKE

Air power is an option that may be exercised under conditions of air superiority, with or without FACs. These missions are meant to locate and attack enemy targets such as material, personnel and facilities. They

are also useful in attacking opportunity targets under close control in dynamic situations.

MARITIME AIR OPERATIONS

The IAF would be employed in close cooperation with Indian naval forces including naval aviation assets to undertake maritime air operations. Control of IAF aircraft would be exercised by HQ Maritime Air Operations in coordination with the Indian Navy. In the maritime realm, air power has the potential to operate deep, achieve surprise and bring to bear accurate firepower against maritime targets at considerable distances from advancing naval forces with speed. Air power could also be tasked to exert passive and often compelling psychological force on an adversary merely through the conduct of routine aerial activities like surveillance and patrolling. Air superiority fighters on CAP, fighter sweep or free escorting duties could have a profound deterrent effect on the adversary in the maritime domain.

The IAF can be called upon to carry out the following maritime air roles:

- **Anti-Shipping Strikes.** In the Indian context, detection and identification of maritime targets is the responsibility of the Indian navy. Thereafter, IAF aircraft would be integrated to carry out anti shipping strikes. These strikes would be carried out in conjunction with maritime reconnaissance (MR) aircraft of the navy, supported by other naval ships or aircraft against enemy's naval assets in the vicinity of own naval forces. Secure communications between the strike and the support aircraft are essential for a successful strike. AWACS aircraft would considerably enhance the effectiveness of maritime air operations.
- **Maritime Strike.** Unlike anti shipping strikes, where enemy naval forces are in contact, during maritime strikes, air power is applied against enemy naval targets that are not in contact with friendly forces, but pose an indirect or long term threat. These strikes could include enemy naval facilities on shore as well as naval vessels and installations in harbour and maritime patrol aircraft on ground.

Maritime air operations: Jaguar alongside INS Virat

Aerial Patrolling. The aerial patrolling of sea lines of communications is a task that is normally carried out by maritime patrol aircraft of the Indian navy. However, there is a possibility that this effort will be supplemented by multi-crew IAF aircraft like SU-30 MKI that have an extended reach and loitering capability.

Reach of Land Based Air Power. Aerial refuelling would significantly increase the reach of land-based air power, thereby adding flexibility and effectiveness for engaging maritime targets. While modernity of platforms is important, they must be regarded as only a means to operational ends and the ends are the effects produced by weapons. Modern ship AD defences are potent and constantly improving. It is therefore logical to attack naval vessels with fire-and-forget ASMs from long stand-off distances well outside the range of the ship AD systems.

DOCTRINAL PRECEPTS

The following doctrinal lessons emerge from the history of counter surface force operations.

- Some degree of control of air is necessary to execute counter surface force missions.

- Counter surface force air action can be used either to supplement or as a substitute for surface force action.
- Except in crisis situations, BAI prevails over BAS in exploiting the inherent capabilities of combat air power.
- Organic AD weapons of ground forces must be integrated into the overall IAF AD network to avoid fratricide.
- Lack of tactical recce capability adversely affects the conduct of counter surface force operations.
- Counter surface force air action works best when used in direct cooperation with friendly surface operations, and where the enemy is forced to expose and manoeuvre his forces under fire.
- Air attack against surface forces is particularly effective when an enemy is hampered by geographical restrictions, such as being forced to operate without cover (as in a desert situation), or being forced to traverse narrow defiles, causeways or roads bordering inhospitable terrain.
- Air attacks have a profound impact on ground troops, often out of proportion to the physical damage and destruction caused.
- Command of air forces must be retained at the highest practicable level and that too under an air force commander.
- Synergy between air and surface operations produces maximum effect, especially if they are planned jointly.
- The nation's and in turn the navy's out of area contingency capability, at least for the present, is limited to the regional maritime domain. If planned and employed optimally in concert with carrier borne air power of the IN, the IAF's land based air power is more than capable of meeting regional out of area requirements of the nation.

SECTION III

STRATEGIC AIR CAMPAIGN

It is not necessary for an air force, in order to defeat an enemy nation, to defeat its armed forces first. Air power can dispense with that intermediate step, can pass over the enemy navies and armies, penetrate the air defences and attack direct the centres of production, transportation and communication from which the enemy war effort is maintained.

— Viscount Trenchard

INTRODUCTION

Strategic air operations are designed to target the enemy's capability to fight or his will to resist. In the context of short-duration wars, strategic targets have to be identified and neutralised so as to weaken the adversary's capability to wage war and to put him under pressure to achieve the desired political objectives. JFC Fuller the noted historian has identified three dimensions of war: the physical, the mental and the moral. Physical implies the fighting power or the means to fight, mental relates to the thinking power, and the moral dimension indicates the staying power or the motivation of the men to fight. A strategic air campaign targets these dimensions at the strategic level to achieve the desired impact.

The strategic level deals with the overall conduct of war and includes those critical capabilities that constitute national power. The critical capabilities at the strategic level include moral strength, leadership, economic and technological muscle and the armed forces. The classification of an offensive air operation as 'strategic' is not determined by range, platform type or the weaponry used, but is determined by the objective or the purpose served by the neutralising of a particular target. It is the objective and it's effect

on the course of the war that determines whether an attack is strategic or not. Technology now enables all combat systems and elements to be deemed as strategic or tactical depending on their intended objective. The distinction is based on the target's importance for achieving the commander's objective rather than on the nature of the target itself. Thus, communication nets, fielded forces, oil refineries and transportation systems have a strategic or tactical implication depending on the desired outcome. Air power is inherently strategic in nature and its tactical application would only fritter away its prime advantage of creating strategic effects.

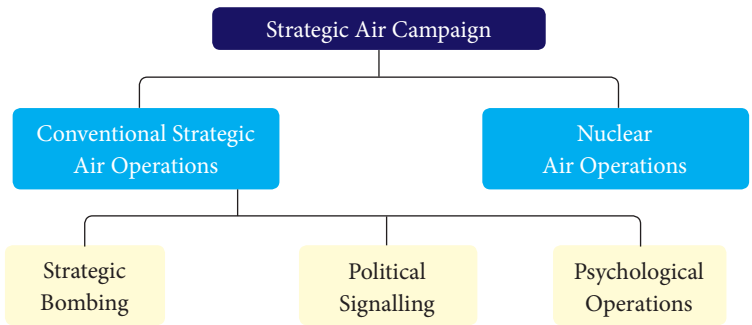


Fig. 5: Strategic Air Campaign

CONVENTIONAL STRATEGIC AIR OPERATIONS

Conventional strategic air operations could be used effectively both during crises and war situations. During the former, threat of punitive action or actual punitive strikes serves to project power, and sends the desired political signals. However, should the enemy have the capability to retaliate, own defences have to be strong enough to counter the retaliatory action. During war, conventional strategic air operations have the desired strategic influence on the operations of the army, navy and the air force, provided the targets are chosen correctly.

Jaguar dropping 1000lb bombs

Target Selection. Targets would need to be prioritized, keeping in mind their impact at the strategic level. The following target systems merit consideration:

- **Command and Control.** The enemy's command and control nodes are vital targets for paralysing leadership and consequently, erode combat effectiveness. Reliable intelligence would be a pre-requisite for locating key target systems such as communication centres and other vital structures in the command hierarchy. Successful attacks on vital command and control nodes would yield the most immediate results in war as compared to attacks on other strategic target systems. They would also serve to isolate the military from the commanders in the field, leaving them without guidance and breaking their cohesiveness.
- **Industrial Infrastructure/Vital Economic Targets.** Targets such as oil installations and power generation facilities could have a crucial impact on morale and on the enemy's capability to sustain war. Industries that have direct military connotation such as ammunition/ordnance factories and research establishments too would be strategic targets. The effect produced by these attacks

would be proportionately less in case of short duration wars, as there could be suitable reserves to overcome immediate shortages.

- **Transportation Systems.** The transportation system of any nation is extremely vital for sustaining its war effort. Destruction or disruption of the same would isolate the enemy forces in the battlefield and prevent them from launching and sustaining offensive operations. Care should be taken in target selection and alternate transportation networks must also be made inoperative.
- **Fielded Forces in Depth.** In a conventional conflict, fielded forces in depth offer significant security to commanders in terms of reserves. Vulnerable targets in such locations, if degraded, can diminish the war fighting potential and provide a strategic advantage in the overall campaign.

Selection of Weapon Systems. Conventional strategic air operations can be undertaken by manned aircraft and missile systems. The relative advantages of these weapons systems need to be considered before deciding on the target to weapon matching. The cost-effectiveness, flexibility and greater accuracy of manned aircraft in combination with PGMs favour their use. Sustained levels of readiness, a high degree of pre-launch survivability, especially with mobile launchers, difficulty of interception during flight and therefore, a high probability of reaching the target and the rapid improvements in navigation/guidance systems favour the employment of SSMs. Ideally an optimum combination of the two would have to be employed in practice.

TYPES OF CONVENTIONAL STRATEGIC AIR OPERATIONS

The following types of conventional strategic air operations are envisaged:

- **Strategic Bombing.** It seeks to attain strategic military objectives independently. Air strikes against selected targets such as industrial infrastructure, power grids and communication networks would fall in this category.

- **Political Signalling.** The mere threat of conventional air strikes or enforcement of no fly zones provides governments with a flexible and responsive instrument of crisis management. It enables them to send the desired political signals regarding their intent and determination to deter impending aggression threaten escalation or eliminate specific enemy capabilities or facilities.
- **Psychological Operations (Psy Ops).** These are designed to change the attitude and behaviour of the armed combatants and also of the civilian population. Psychological operations directly focus on the moral dimension of the war and are intended to weaken the enemy's will to fight. Offensive air action could also be employed as part of psy ops.

NUCLEAR AIR OPERATIONS

Nuclear weapons are used to convey political signals and are the ultimate national safeguard and deterrence. The authority to decide whether to exercise the nuclear option rests at the highest political level. India's no first use policy is based on minimum but credible deterrence that promises assured and massive retaliation. As part of this strategy, IAF could provide credible second strike capability.

STRATEGIC EFFECT IN SUB-CONVENTIONAL OPS

In recent times there is an increasing focus on the strategic impact of air power even in sub-conventional warfare. A classic example of air power creating a 'strategic effect' has been *Op Geronimo*: undertaken by the US to eliminate Osama Bin Laden. It was air power that facilitated stealthy and speedy execution of the mission. Not only do these operations validate the ability of air power to create a strategic effect across the spectrum of conflict, they also reinforce all its classic attributes of speed, flexibility and surprise.

DOCTRINAL PRECEPTS

The following doctrinal aspects are relevant for strategic air operations:

- Targets for strategic air attacks need to be carefully chosen and must have a direct link with the enemy's strategy or his decision making process; the neutralisation of these targets should lead to the desired strategic influence.
- The strategic air campaign can be carried out independent of other air and land campaigns; however, it tends to be much more effective when fully integrated with the overall campaign plans.
- Air superiority is desirable for conducting such operations; however, surprise and deception may also yield decisive results.
- Strategic air operations are mostly determined by political considerations unlike counter air or counter surface force operations.
- Strategic air operations straddle the spectrum of conflict.

7

Combat Enabling Air Campaigns

However, no amount of modernisation of arms, equipment, tactics, and organisations can produce results unless we have the right state of mind, manning the system.

— General K Sundarji

Definition. Combat enabling operations are those that are undertaken to sustain the combat power of air or surface combat forces. Combat power can be enhanced by the elements of mobility, surprise, lethality, accuracy, survivability, availability or flexibility of air and surface forces.

Sustaining Combat Power. If air operations are to be successful, they need to be sustained and supported by dedicated air and ground activities termed as 'combat enabling air and ground operations' which are as follows:

- **Combat Enabling Air Operations.**
  Air Transported Operations.
  Air-to-Air Refuelling (AAR).
  Surveillance and Reconnaissance.
  Remotely Piloted Aircraft (RPA).

Airborne Early Warning (AEW).
Aerostats.
Electronic Warfare (EW).
Search and Rescue (SAR).
Testing, Evaluation and Research and Development.

- **Combat Enabling Ground Operations.**

Maintenance.
Integrated Logistics.
Passive Air Defence (PAD).
Ground Defence (GD).
Special Forces (SF) Operations.
Runway Rehabilitation.
Chemical Biological Radiological and Nuclear (CBRN) Defence.
Training.
Administration.

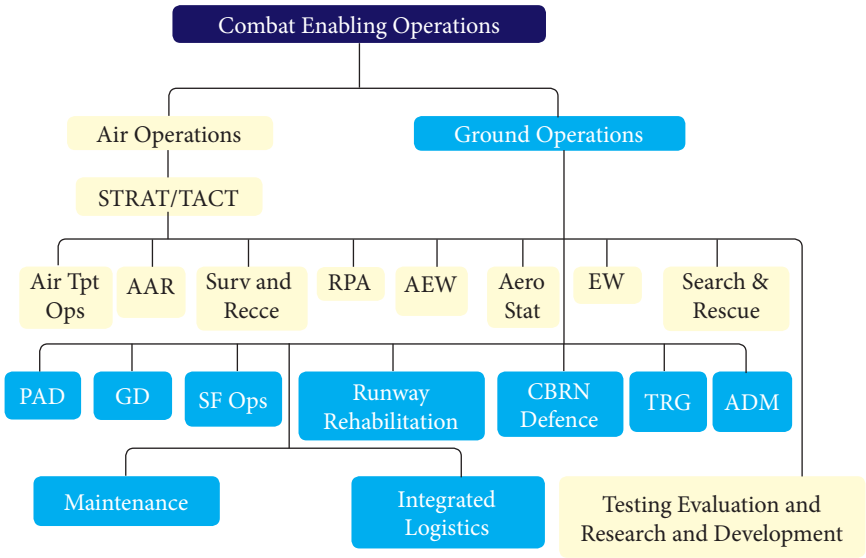


Fig. 1: Combat Enabling Operations

IL-76 on an air maintenance sortie

SECTION I

COMBAT ENABLING AIR OPERATIONS

AIR TRANSPORTED OPERATIONS

These are operations that involve the movement by air of personnel and cargo through fixed wing or rotary aircraft within and between theatres of operations.

CATEGORIES OF AIR TRANSPORTED OPERATIONS

- **Strategic Airlift. A** strategic airlift is the carriage of passengers or cargo between theatres (inter-theatre), or to any place within an area of interest. The movement of Indian troops by air from the eastern to the western theatre in 1971 and the Maldives operation in 1988 are examples of strategic airlift.
- **Tactical Airlift.** A tactical airlift is the carriage of passengers and cargo within a theatre (intra-theatre). Tactical airlift is resorted to for rapid and responsive movement within an area of operations to meet specific tactical goals.

Composition of Force. The IAF transport fleet maintains a capability for both strategic and tactical airlifts. Fixed-wing aircraft have higher transit speeds, carry heavier loads, are more reliable and are far cheaper to operate as compared to rotary wing aircraft. However, helicopters have the capability to land anywhere, and because of their greater ability to utilise terrain masking, they have greater survivability in a combat zone. Thus, both are necessary in the overall air transport force mix.

Use of Civil Resources. Civil airlines could also be pressed into service in war or crisis situations as was the case during the airlifting of the IPKF to Sri Lanka. The problems of employing civil aircraft are:

- **Cargo.** Indian carriers generally do not operate any dedicated cargo aircraft excluding those on lease. Therefore, they may need to be modified to be used for cargo purposes.

- **Infrastructure.** Modern civil aircraft need appropriate ground infrastructure as well as special ground equipment.
- **Trained Aircrew.** Civil air crews lack a military orientation which inhibits full exploitation of civil aircraft. Air force personnel too may not be able to exploit these assets as they may not be trained to operate these aircraft.

HELICOPTERS

The employment of helicopters has the following advantages:

- Fixed wing aircraft require proper strips and the use of helicopters saves engineering effort, especially in wet climates where it is difficult to make all weather landing strips.
- Troops and equipment can be delivered direct into action, thereby doing away with the need for ground lines of communication from airheads.
- Time is saved by carrying under slung loads as elaborate load lashing is not necessary.
- It is easier to conceal helicopters and helipads than airstrips.

Air transported operations for the IAF comprise of five major roles:

- Airborne Operations.
  - Airborne Assault.
  - Air Landed Operations.
  - Special Heli-Borne Operations (SHBO).
- Air Maintenance.
- Scheduled Services.
- Special Air Operations.
- Casualty Evacuation.

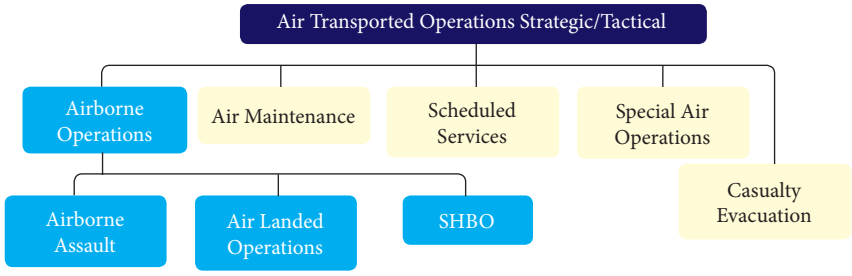


Fig. 2: Air Transported Operations

Airborne Operations. Airborne operations involve the movement of combat forces and their logistic support in an objective area from the air. Combat forces and their support may be delivered by air landing or airdrops from a fixed or rotary wing aircraft. If, on despatch from the supporting aircraft, the forces are required to immediately engage in combat, they could carry out a parachute assault or slither from a helicopter at hover. On the other hand, forces could be air landed by fixed or rotary wing aircraft, and thereafter join operations in a nearby objective area. Combat forces delivered into an objective area normally require subsequent air maintenance support until a surface link-up is effected or withdrawal is accomplished. Some other tasks of airborne operations include: gaining and maintaining favourable air situation; reconnaissance and interdiction to isolate the area of airborne operations; and to provide a high degree of immunity from enemy interference. Deception would be vital in the planning phase of any airborne operation and must be made part of the operational plan. In addition, logistic considerations in terms of fuel and loading of aircraft as well as the handling capacity of air bases must be kept in mind. Other important aspects are securing of launch bases from air and ground attacks and secrecy regarding the nature of airborne operations. Airborne forces once brought to the launch air bases, must be kept isolated and secured. They are capable of performing a variety of tasks, such as:

IL-76 taking off for a mission

- **Independent Operations.** Operations in which airborne troops have tasks independent of immediate ground operations. For example, the Entebbe rescue or the Maldives operation.
- **Strategic Tasks.** These could include capture of an airhead inside the enemy territory to serve as a base for further operations or capture of a strategically important area.
- **Special Tasks**
  - **Raids.** The aim may be the destruction of enemy installations, headquarters or individuals. Withdrawal is difficult and must be planned carefully.
  - **Guerrilla Operations.** Airborne forces can be used to carry out widespread guerrilla operations in enemy occupied territory.
  - **Tactical Tasks.** These involve close cooperation with the ground forces and are the most decisive method of using airborne troops. These operations may involve the following tasks:
    - Capture of ground which is not readily accessible to the surface troops, but is vital to the enemy.
    - Seizure of dominating ground or defiles, along the line of advance.
    - Flank protection and blocking of enemy reserves.

- Seizure of beaches or bridgeheads.
- Attacks to disrupt enemy maintenance areas, signal communications and Headquarters.

To achieve these tasks, airborne operations could be used to perform the following three broad roles:

- **Airborne Assault.** Airborne assault is a particular phase of an airborne operation and is carried out by specially trained units and formations dropped by parachute or landed by assault aircraft with their equipment. Airborne assault transports troops for immediate operations and has a considerable shock effect on the enemy. As a result, airborne forces are capable of producing results out of proportion to their numerical strength and fire power. A favourable air situation is essential for success, as is joint staff work, contingency planning and rigorous combined training. An example of this is the successful airborne assault by the Indian forces at Tangail during 1971 Indo-Pak war, which led to the collapse of Dhaka's defences and a speedy end to the war.

AN-32 landing at Daulat Beg Oldie airfield (Elevation 16,700 feet)

- **Air Landed Operations.** Air landed operations are those where the troops are landed near their objective by fixed wing aircraft, or helicopters. They organise themselves into combat units and then assault the objective either on foot or on vehicles. A favourable air situation is a must for undertaking air landed operations since the troops are particularly vulnerable immediately after landing until they get organised.
- **Special Heliborne Operations (SHBO).** Helicopters are a very, versatile component of air power. They can induct troops and

equipment direct into action. More importantly, they can extricate them on completion of the task. SHBO operations could include strikes on enemy targets where the troops either slither down on the objective, or are landed close to the objective for an assault. Helicopters can also be utilised to overcome impediments imposed by terrain as was done during the 1971 Indo-Pak war, where helicopters were used to form an air bridge over river obstacles in East Pakistan to ferry troops across in order to maintain the pace of advance.

Air Maintenance Operations. Air maintenance includes tasks, other than airborne operations, conducted to distribute and recover troops, equipment and supplies. They differ from airborne operations in that air maintenance does not usually involve the carriage of troops ready for immediate combat. Maintenance by air can be divided into the following main categories:

AN-32 carrying out para drop to sustain troops at high altitude post

- **Strategic Air Supply.** These are air operations carried out to airlift the maintenance requirements of a force in bulk from a main location to a theatre or from one theatre to another.
- **Tactical Air Supply.** These ensure the provision of aerial supplies within a theatre either by dropping or by landing. It is further classified as follows:
  - **Routine Air Supply.** Air maintenance carried out as per scheduled/routine replacing surface mode of maintenance.
  - **Emergency Supply.** This is resorted to in cases of sudden operational requirements, e.g. when forces are cut off from other means of maintenance due to weather or operational reasons. Time is of vital importance in such cases.

Scheduled Services. Scheduled air transport services are regular, programmed point-to-point air services for movement of personnel and supplies. Courier services flown by IAF aircraft in a pre-planned manner to airlift equipment and personnel are one such example.

Special Air Operations. Special air operations are conducted, at any level of conflict, to support clandestine and psychological

C-130J taking off on a training mission

operations. These operations include inserting agents or troops into the enemy occupied territory and may require specialist training such as, low level ingress and landings by using night vision devices. Some of these operations may have to be carried out regardless of the total air situation and under conditions not normally considered suitable for air operations.

Casualty Evacuation (CASEVAC). Casualty evacuation involves the movement of the injured to and between medical treatment facilities by air transportation. Casualties are evacuated from the combat zone to a forward casualty clearing area and from there moved to the rear. Casualty evacuation requires special preparation, training, equipment and personnel and can be a demanding task. Helicopters are better suited for tactical CASEVAC though modern transport aircraft like C-130 and C-17 can be fitted with equipment to support large-scale medical evacuation from battle or crisis zones.

AIR-TO-AIR REFUELLING (AAR)

DEFINITION

Air-to-Air refuelling operations involve transfer of fuel from one aircraft to another in flight. The Indian Air Force achieved AAR capability in 2003 with the induction of IL-78 tanker aircraft. These wide bodied aircraft are capable of transporting meaningful loads from one theatre to another, and can also dispense fuel to receiver aircraft in air without requiring any major change of configuration. AAR aircraft considerably reduce the lead-time and cost of operations and increase the number of options available for operations. In fact, IL-78s can be utilised for strategic lifts, para/cargo drops, air landed operations, air maintenance and CASEVAC apart from their primary role of air-to-air refuelling. There are essentially three types of air-to-air refuelling methods; probe and drogue, flying boom and buddy refuelling.

Applications. Air-to-air refuelling capability has particular relevance for India. The size of the country as well as the protection of its vital national

interests in the island territories make it imperative for the IAF to have a capability to project its air power from the mainland to these areas rapidly. Air-to-air refuelling extends the range, payload, time on task and flexibility of aircraft. It applies equally to air campaigns as well as to all types of combat enabling operations. Air-to-air refuelling can be used to enhance the capabilities of virtually all types of aircraft. In addition, where the enemy enjoys enormous depth, AAR is indispensable for reaching a greater number of targets, which otherwise would have been out of reach. It also causes potential enemies to expend disproportionate effort in defensive measures. It therefore acts as a "**force multiplier**" which not only increases the potency of the IAF in war, but also its deterrent value. Some of the advantages of AAR are:

IL-78 refuelling a pair of Mirage-2000

- **Increased Range**. The reach of IAF's strike aircraft has increased considerably with the help of AAR. Short-range aircraft can now be used for deep penetration strikes.
- **Increased Endurance**. Combat or combat support air missions can be extended in duration up to the limits of crew endurance.
- **Response Time**. AD aircraft can be kept airborne for long durations thus increasing their ability to respond to intercept requirements at short notice. Likewise strike aircraft would be able to carry out

long range strikes without the need to stage through airfields, thus improving their reaction time.

- **Increased Flexibility**. The flexibility of IAF aircraft has increased significantly with AAR. Short range combat aircraft can escort combat or combat support aircraft over longer distances. Aircraft can take off with a greater weapon load while retaining the flexibility in choice of flight profiles and tactical routing or even target selection.
- **Enemy Considerations**. Extending the strike range of IAF aircraft by AAR would have a greater impact on the enemy who would now need to expend a disproportionate amount of resources and effort for protecting area in depth.

While air-to-air refuelling offers significantly enhanced capability to a force, it nevertheless has important limitations. These are:

- **Vulnerability**. An aircraft is most vulnerable when fuel transfer is taking place in air. AAR missions must be carefully planned in safe areas avoiding hostile air environment. Escort aircraft may become essential to protect the tanker force.
- **Tanker Ground Survivability**. Large tankers are very vulnerable on ground. They cannot usually be housed in hardened aircraft shelters nor is it practical to do so. Hence, tankers would have to be dispersed to airfields in depth. However, this would complicate planning, and underscore the need for effective communications.
- **Lead Time**. AAR requires special equipment, dedicated aircraft, trained crew and well-rehearsed procedures for its efficient use during day and night. Such a capability will have to be sustained and it takes time and planning to organise and sustain the training status of participants.

SURVEILLANCE AND RECONNAISSANCE

Surveillance and reconnaissance operations involve the collection of information from space-based, airborne, and ground sensors regarding

the activities, forces and resources of an enemy or potential enemy. These operations can be further classified as:

- **Surveillance**. Surveillance is the systematic, repetitive gathering of information by photographic, radar, infra red, electronic, acoustic or visual means. Information gained from surveillance would normally be used for strategic decision making and building data bases.
- **Reconnaissance**. Aerial reconnaissance is the visual/photo observation of specific targets, interests and areas at a particular time to gain information about the activities, resources and intentions of an enemy.

Difference Between Reconnaissance and Surveillance. Reconnaissance is the collection of information via a specific mission, usually conducted over a limited period of time and directed against a specific target whereas, surveillance is the systematic observation of areas, or targets over a period of time by any sensor to provide accurate and timely knowledge of a potential adversary's capabilities and intentions. Surveillance and reconnaissance operations encompass the following roles:

- **Strategic Reconnaissance.** Strategic reconnaissance operations gather the information necessary for the formulation of policy, strategy and military plans at the national level. The objective of strategic reconnaissance is the collection of data which builds up a basic pattern of activity in an area of interest to track any significant departures or trends. Satellites provide an extremely important capability in this.
- **Tactical Reconnaissance.** Tactical reconnaissance operations collect information related to enemy dispositions and target systems. It also encompasses BDA following air attacks for the planning and conduct of further air operations. The objective of tactical reconnaissance is to provide information for targeting and damage assessment.

- **Target Acquisition.** Data linking strike aircraft with RPAs would provide real-time imagery of targets in the battlefield to aid target acquisition. This has specific relevance to BAS and BAI missions.

REMOTELY PILOTED AIRCRAFT (RPA)

Capabilities. New generation RPAs can carry the latest Electro-optical (EO), Infra-Red (IR) or Synthetic Aperture Radar (SAR) sensors and even PGMs. They can fly at high altitudes for extended periods of time and possess threat warning and ECM capabilities. The multiple capabilities of these RPAs allow them to undertake a host of missions that include reconnaissance, surveillance, and target acquisition (RSTA) as well as targeting and deception operations. They can also undertake maritime operations, EW and SIGINT, CBRN reconnaissance, special and psychological operations, meteorology missions, artillery direction, battle damage assessment, radio and data relay and precision attacks on high value target systems. The important employment considerations for RPAs are:

- RPAs generally require an extensive support infrastructure. This factor limits their options for deployment in operational areas. They also require data links from the control stations to the decision makers and users.
- RPAs can cover only limited areas with desired resolution in short time periods and initially require intelligence inputs and guidance from either satellites or human sources to reach a localised area of interest. Within this area, they can then search for targets.
- While the initial flight profile, small size and low speeds may conceal their entry, but once detected, the RPA is vulnerable to enemy air defences.
- The operator remains a key part of the mission, hence increased endurance of RPAs require multiple shifts of personnel for them to be successful. The organisational structure should be versatile and flexible, and the specialist personnel should be cross-trained to perform multiple tasks.

Force Mix. While imaging satellites can cover large swathes of area without violating another nation's air space they are expensive, vulnerable to deception techniques, difficult to "dynamically re-task", have extended re-visit times and do not provide direct inputs to the ultimate user. Also, since these satellites normally occupy a low earth orbit, they cannot remain stationary over a given point or area of interest. Hence their real-time tactical application becomes severely restricted. Manned aircraft offer better resolution and flexibility, but are vulnerable and have low endurance. In contrast, RPAs have role flexibility, are relatively cheap and survivable. SATCOM capabilities have greatly enhanced the area coverage of the RPAs which is limited only by the time it takes to reach the intended target area, considering the relatively low ground speeds achieved by RPAs. On the other hand, ground-based systems have limited coverage, but offer permanence. The overall force mix should, therefore, have an optimum combination of all such systems and should provide comprehensive picture of the battle space.

AIRBORNE EARLY WARNING AND AIRBORNE WARNING AND CONTROL SYSTEM (AWACS)

The induction of AWACS heralds a new chapter in the IAF's transformation to a more agile and effective combat force. Characterised by the most advanced sensor and information age technologies, AWACS, as a force multiplier gives combat forces a definite edge over the adversaries. The integration of its advanced air-battle management and C4ISR functionalities into operations also needs to be undertaken for greater efficiency. There is also a need to revamp our campaign planning and operational concepts to capitalise on the immense potential offered by AWACS.

Over the course of its history, the AWACS mission has evolved from that of primary surveillance and early warning to executing offensive air power. Often, as the first airborne asset to enter a campaign and one that is the last to leave, AWACS would be in the

theatre providing surveillance and combat support at very short notice. In today's, non-linear and extremely fluid battles where, more than one battle management task is put to the test, the biggest challenge is to maintain the flow of accurate and timely information from AWACS.

AWACS landing after a mission

Capable of detecting airborne and maritime targets as well as providing data link communication to tactical elements, the AWACS has the following inherent capabilities:

- **Enhanced Detection.** By virtue of taking the sensor to a greater height the low level detection capability of the radar can be greatly increased. This leads to a better situational awareness deep inside the enemy territory and a reduction in the desired alert status because of timely early warning.
- **Mission Flexibility/Versatility.** History has shown that AWACS can respond quickly and effectively to a crisis and can support worldwide deployment and operation at short notice. AWACS has a greater chance of surviving in warfare than fixed radar system

because of its mobility. The planned profile can be adapted as per the mission vis-à-vis emerging situations and survival requirements.

- **Deployment.** With in-flight refuelling, the system can be deployed over extended and inaccessible terrains such as seas, deserts and other inhospitable terrain.

STRATEGIC ROLES OF AWACS

Potent Instrument of Diplomacy. Given its capabilities, AWACS has been effectively utilised as a deterrent in diplomacy and as an effective instrument of force application.

Disaster Management. Post natural disasters, AWACS can play a vital role in surveillance, aircraft control and airspace management to fill the void created by the inability of ground based systems to move in quickly and operate in difficult terrain and poor infrastructure.

Humanitarian Missions. AWACS help establish localised command and control mechanisms until ground systems are able to build situational awareness.

Search and Rescue. AWACS can be effectively utilised to provide valuable search and rescue support through direct communication with non-traditional joint players such as the coast guard, local enforcement and rescue crews. Close coordination and the employment of the AWACS radar would allow crews to de-conflict the flow of airborne assets to and from the disaster area.

AWACS COMBAT ENABLING MISSIONS

Deep Penetration Attack. AWACS is capable of providing long range detection and identification of air threats, sea-surface tracks, and can detect and report the current status of an enemy's strategic SAM and EW radars through its ESM systems. The ability to quickly relay the air and real time intelligence picture can provide the beyond the line of sight picture to both the strike elements and commanders on ground, enabling real time C2 including timely corrective decisions.

Strike Control. One of the biggest advantages of the airborne radar platform is the ability to warn and control own strike missions in the adversary's territory, which hitherto was not possible owing to line of sight constraints of ground based radars.

Air Control Operations. AWACS can be used to acquire air control over an adversary's air space as well as over own air space. It can support the battle along with the army and navy to attain time critical military objectives. Initiative, surprise, concentration of firepower, shock effect and operational advantage over adversaries would remain the guiding principles for utilisation of AWACS.

Air Defence. Through its improved low level and long range radar coverage AWACS is capable of acting as an extension of AD sectors. The AWACS is an excellent option for control of air defence weapon platforms well inside the enemy territory.

Air Intelligence. As the monitoring and analysing of the enemy's air activity is an ongoing process during peace and during operations AWACS with its integral sensors can augment existing ELINT and COMINT systems.

AEROSTATS

These are aerodynamically shaped, tethered balloons that house airborne radars, a few of which are operational in the IAF. They provide electronic coverage at low, medium and high altitude deep inside the enemy territory. However, they are limited by their static location. They would, therefore, need to be protected from aerial attacks and ground threats.

ELECTRONIC WARFARE

Definition. Electronic Warfare (EW) is defined as the art and science of preserving the electromagnetic spectrum for friendly use while denying its use to the enemy. EW involves the military use of electronics to determine, exploit, reduce or prevent hostile use of the electromagnetic spectrum as well as to ensure its effective use by friendly forces. EW

includes systems using all forms of electromagnetic energy e.g., radio, radar, IR optical systems, lasers, etc. However, radiation produced by nuclear weapons is usually classified as nuclear fallout.

Applications. EW is a force multiplier. Electromagnetic capabilities are associated with all aspects of air power employment and EW considerations should form an integral part of planning and execution of all types of operations. EW operates on multiple levels in a conflict ranging from self-protection to operational attack plans. When EW actions are properly integrated with other military operations, a synergistic effect is achieved, losses minimised, and effectiveness enhanced. There is a particularly close inter-relationship between EW and the SEAD role wherein EW provides the 'soft kill' option.

SEARCH AND RESCUE OPERATIONS

Definition. Air search and rescue operations involve the use of aircraft and helicopters to locate and rescue personnel in distress and, in particular, to recover aircrew who have abandoned their aircraft. Combat Search and Rescue (CSAR) is a specific task performed to effect the recovery of distressed persons including downed aircrew and isolated personnel from a conflict zone or battle area. Space enabled SAR has also significantly enhanced the effectiveness of SAR operations.

PLANNING CONSIDERATIONS FOR SAR

Peace Time. Considering the geographical expanse of the country, the IAF has to be prepared for search and rescue operations in various terrains, which may dictate use of different types of aircraft. These aircraft must have the facility to home onto the distress transmission of the pilot rescue beacon of the downed aircrew and must also posses winching facilities. Rescue of civilians in disaster situations will be covered in a subsequent chapter.

In War. Search and rescue helicopters are unarmed and therefore, vulnerable to enemy attack. This is an important consideration when downed aircrews have to be rescued from enemy territory. This would

involve the use of an attack helicopter, or unarmed helicopter along with attack helicopters to provide covering fire, or even an armed helicopter with fighter escorts. Such operations may prove to be costly, especially if the enemy is aware of where the aircraft has crashed and deploys air and surface forces in that area. Hence, combat search and rescue operations should only be undertaken, if, the prospects of success are good and if surprise can be maintained. The depth of penetration would depend on enemy defences in that area. Further, armed helicopter escorts should take into account their own vulnerability as regards the enemy's AD systems.

Imperatives for Successful Execution of CSAR. CSAR is a specialised operation. The main factor for success in CSAR operations is quick response. Thus as soon as the aircrew ejects, his position must be quickly, and as far as possible, accurately relayed to the nearest CSAR base; the base must be located close to the border; the crew must be close to the aircraft; and the rescue beacon available with the pilot must be able to accurately indicate his location. The other contributory factors include accurate intelligence, secure communications, appropriate control over air, AD, enemy surface forces in the area and the weather.

TESTING, EVALUATION, RESEARCH AND DEVELOPMENT (R&D)

Technology and doctrine are dynamic processes and must necessarily adapt to change lest they become obsolete and lose their relevance. Self reliance in testing and flight evaluation ensures that new weapon systems acquired by the country meet the requirements of the IAF. The Aircraft and Systems Testing Establishment (ASTE) is the nodal agency for testing and evaluation activities in the IAF. Its activities support the acquisition, modification, upgradation, and maintenance of weapon systems and equipment. ASTE ensures that aircraft and equipment meet the requirement of peace and war time. It undertakes: evaluation of aircraft and equipment at the prototype stage; the evaluation and service trials of new aircraft and airborne equipment

and flight trials post any major modifications carried out on aircraft and systems.

Ideally, the doctrinal process should scrutinise and influence the direction of new and developing technologies. The IAF therefore determines the air power requirements that best fulfil its doctrinal needs for war fighting. These requirements direct the R&D effort and must be futuristic and yet practical and can be fulfilled by the further advancement of contemporary technologies. The R&D process includes concept definition and refinement, technology demonstration and system development and deployment. ASTE works as the interface between the user and the R&D agencies. ASTE steers the process of identifying user requirements based on current and future technologies on the one hand and operational requirements on the other.

SECTION II

COMBAT ENABLING GROUND OPERATIONS

MAINTENANCE

Air power must be underpinned by sound maintenance to ensure a high degree of aircraft/equipment availability at all times during operations. An effective indicator of a potent force is its ability to ensure high sortie generation rates as they would then relate to the mass – in terms of air power assets to tackle a large number of target systems in a short time span. This in turn is a function of aircraft serviceability, system reliability and spares availability.

Air power maintenance requirements are knowledge and capital intensive. The maintenance costs of air power assets are high due to repair and replacement costs, infrastructural demands and the need for skilled technical expertise. In addition, aviation activities are extensive and incorporate a wide range of modern high tech weapon systems, multiple aerial platforms, different radar systems and complex communication networks. These require diverse and highly specialised engineering support facilities. Some of the measures taken to resolve complex issues are the integration of the operational, maintenance and training philosophies right from the planning stage of the procurement cycle to ensure a seamless man-machine-materials-methods interface over the life cycle of stores and equipment.

Maintenance is also related to inspection and servicing, repairs and overhauls, storage, tracking of equipment life and extensions thereon and measures taken to prevent degradation of systems due to operations in different climatic conditions and terrains which can cause corrosion, humidity, temperature and structural fatigue.

Quality assurance of all weapons, equipment, systems and stores at every level must conform to similar specification standards at all times. Various prevention and control programmes and maintenance

workshops must be anticipated and planned periodically to promote effective maintenance philosophies. Newer methods and technologies must support the foolproof remote testing and calibration of equipment. Proper and simple documentation in all engineering, logistics and maintenance activities ensures accountability and systemisation. Standardisation of weapon systems, procedures, practices, documentation and infrastructure go a long way in guaranteeing ease of operations, maintenance, retention of expertise and interoperability. Computers and networking also simplify maintenance activities.

Maintenance: Air Warriors servicing Su-30 MKI

Ongoing midterm life upgrades resolve the problems faced by ageing fleets. Mastering upgrade technology and the indigenous application of the same in other utility platforms and equipment would further bolster performance of ageing systems. Further, modifications in airborne and ground based systems overcome deterioration in performance due to design deficiencies. In addition, systematic defect trend analyses and the incorporation of improvement schemes with inbuilt safety mechanisms facilitates better performance.

Information and communication technologies have revolutionised the conduct of warfare. True convergence of information and communication data on the same network and effective use of bandwidth and robustness of equipment have ensured the reliable networking of information for effective decision making.

Clear SOPs for care and maintenance of various sensors, platforms and conventional and un-conventional weapons must be incorporated during procurement of such systems. Requisite infrastructure of the desired standard must be put in place to ensure the guaranteed performance of such high technology assets. Maintenance organisation should be seamless to ensure smooth transition of responsibility in maintenance of systems, networks and procedures. It should be adaptable and respond effectively to changes in technological and operational requirements. Since air operations generate maintenance requirements, maintenance organisations must be knowledgeable regarding the nuances of air operations and the peculiar requirements of aerial warfare.

INTEGRATED LOGISTICS

Logistics involves planning and effecting the movement and sustenance of forces along with providing the physical means of support necessary for mounting and sustaining operations. A force is only as combat capable as the logistic support it receives. Operations require provisioning of right stores at right time, in the right quantity and at the right place. Thus logistic activities must be conducted smoothly and adequate system and equipment availability must be guaranteed. The integrated online materials management system has injected efficiency into maintenance and logistic functions by providing greater transparency and visibility to the air warriors tasked with functions of maintenance and logistics.

PASSIVE AIR DEFENCE

PAD. Passive Air Defence includes measures taken to minimize the damage caused by enemy air attacks. Some of these are:

- **Protective Measures.** These are fundamental measures taken to protect and safeguard life and assets and include PAD training, evacuation of families, dispersal of aircraft and vehicles, deploying of decoy aircraft and targets, sandbagging of important buildings, digging of trenches to provide shelter and an effective air raid warning system. It also includes the setting up of alternate facilities for sustaining air operations. Hardened Aircraft Shelters (HAS) are an important element in the PAD scheme to protect aircraft.
- **Control Measures.** These are measures taken immediately after an air attack and include processes that facilitate prompt reporting of bomb damage, casualties, fire and location of unexploded bombs. It also includes first aid and transfer of casualties to hospitals, fire fighting, clearance of debris, emergency repair of damaged power and waterlines and restoration of communications.
- **Restorative Measures.** These consist of measures taken after an air raid to restore normalcy to the extent possible. Of critical importance would be the steps undertaken to quickly restore aircraft operating surfaces and support services to permit effective re-commencement of air operations. 'Control' and 'Restorative' measures are closely interlinked and may have to be undertaken simultaneously.
- **Camouflage and Concealment.** Camouflage and concealment of targets, besides confusing the enemy, would also reduce the time available between target acquisition and weapon release, thus degrading the accuracy of attack. Simple and innovative methods go a long way in degrading the effects of enemy air attacks.

GROUND DEFENCE

Security of bases and installations is essential for effective air operations. The threat could be from airborne troops, guerrilla forces or from asymmetric fighters. The aim of ground defence should be to prevent an attack by deterrence, and if that fails, to defend the airfield and installations from hostile attacks. Ground defence forces must be available in strength for credible deterrence. Further, appropriate lighting devices and electronic

alarm systems must be installed at suitable locations. The threat of an enemy attack would be the highest for forward airfields, EW radars and the airfields where strike forces and high value assets are based.

Forces Available. All combatant personnel of the IAF and units of Defence Security Corps held on strength are classified as combatants, and are therefore available for ground defence. Moreover, units of Border Security Force, the Provincial Armed Police, and Home Guards will also be provided in emergency. These troops operate under the control of the station commander.

Counter Intelligence. With the advent of modern, compact communication systems, and their likely use by the enemy agents, D/F locating and rapid reaction may be the only means available to counter this threat. Close liaison with the local police and the population around the airfield increases the effectiveness of counter intelligence activities.

SPECIAL FORCES (SF) OPERATIONS

Characteristics. IAF Special Forces are highly trained and are equipped to carry out specific operations, in offensive and defensive roles. They operate in small numbers but the payoffs from a successful operation are generally much higher given the size of the forces involved. They generally operate independently or in close coordination with other forces at the operational level.

Role. Though the Special Forces are primarily to be used for offensive operations, the conditions for their employment are flexible. Some of these are:

- Surveillance and reconnaissance.
- Combat and peace time search and rescue missions.
- Counter Terrorism.
- Destruction and degradation of enemy air assets (DEAA).
- Special missions in the interest of IAF, sister services and the nation.
- Protection of IAF high value assets.
- Emergency response force.

Garuds: IAF special forces in action

Some of the salient aspects that need to be considered for the employment of the Special Forces are:

- Selection of objective at the strategic level and integrating with plans at the operational and tactical level.
- Joint planning from inception stage. Detailed planning for insertion, extraction and recovery. These are imperative for the successful execution of these operations.
- Success will depend on a combination of precise and accurate HUMINT, COMINT and SIGINT.
- SF have to survive in hostile environment. Thus, the elements of surprise, and the secrecy will be essential for the success of SF operations.

RUNWAY REHABILITATION

One of the limitations of conventional fixed wing aircraft is their dependence on runways and other operating surfaces. During war, the enemy may target runways and taxi tracks. Runway rehabilitation ensures operations are resumed at the earliest and this can be achieved by well trained personnel.

CHEMICAL BIOLOGICAL RADIOLOGICAL AND NUCLEAR DEFENCE

Successful chemical biological radiological and nuclear (CBRN) defence relies on deterrence that threatens equal if not higher CBRN capability. To successfully counter the CBRN threat, it is essential that plans are made in peacetime, protective clothing and equipment procured and personnel trained in their use. CBRN indoctrination capsules will go a long way towards increasing awareness regarding this vital aspect.

TRAINING

The purpose of training is to prepare air warriors of the IAF to undertake their operational functions efficiently and effectively by providing them with the necessary knowledge and skills. Since IAF operates high technology equipment, and air power assets require higher levels of skill, training assumes even greater importance. The training process should have the twin objectives of developing individual skills, as well as imparting professional military education to develop the skills required to take on higher responsibilities. This education must promote the study of war and the role of air power, so that IAF personnel are prepared to apply theory and knowledge to the task of fighting and winning the war in the air.

A review of training courses was carried out to address existing limitations, streamline the course syllabi and provide 'just in time' training. The basic learning is now being carried out through 'distance education' with a short contact programme. The highlight of this training policy is that it is now mandatory for all the officers. This also significantly promotes self-learning amongst the IAF personnel. Training should not only aim at developing individual skills, but also on developing a collective war-fighting capability. The ultimate goal should be to produce a competent and cohesive team capable of applying combat air power to meet India's national security objectives most effectively.

ADMINISTRATION

Administration includes all activities other than training and operations that are necessary to enable the IAF to operate effectively and economically. It includes security, medical services, accounts and work services. Good administration has a significant and positive influence on morale. Operations and administration go hand in hand. Therefore, for each operational plan, there must be a corresponding administrative plan. Administration provides a secure and firm base for operations. No operational plan is likely to succeed unless there is an efficient administration. Administrative arrangements must be designed to allow the commander maximum freedom of action for executing the operational plan. The administrative organisation must be structured in a way that once activated it enables maximum resilience and improvisation during war.

Medical Support. Medical support must be tailored to meet the demands of war. In peacetime, it is essential that medical officers be trained to deal with CBRN and for providing health cover to all service personnel and their dependents. The system's effectiveness would be measured by its ability to return patients to duty quickly, while minimising morbidity and mortality. In case of a likely CBRN threat, appropriate specialist measures would be necessary. Prompt and adequate medical support and facilities have an important bearing on the morale of the personnel and their families.

8

Sub-Conventional Warfare

In light of the rapidly changing nature of warfare, the reduced possibility of large scale conventional conflict and the increased proliferation of sub conventional warfare, air power is a powerful tool that the state in general and India in particular could employ to win the war against the non-state actor.

The flexibility and precision of air power makes it eminently suited for employment across the spectrum of warfare. The proliferation of terrorism and the unholy designs of non-state actors along with their capability to target the soft under belly of democratic nations have created an asymmetry of alarming proportions. In such a scenario, it is important to review the roles, missions and capabilities of air power to tackle sub conventional threats from guerrillas, insurgents, terrorists and extremists who threaten national security. Air power is a powerful tool to achieve this objective and must be employed in all its aspects to achieve national objectives.

THE ROLE OF AIR POWER IN SUB CONVENTIONAL WARFARE

Air power can play a major role in bolstering government control, while interdicting terrorist/insurgent feeders. It is

important that in such cases air power can and must be used in more than the traditional combat roles – to defend the nation's integrity. Ingenuity is a prerequisite for exploiting air power in sub conventional warfare. Aerial reconnaissance can play a key role in tracking terrorist/insurgent activities and identifying operating bases, training camps and supply nodes. Visual, photo, satellite, and RPA reconnaissance, will be of great utility in this effort. Dense vegetation and mountainous terrain hinder aerial reconnaissance. However, advances in systems and techniques have given air power the ability to overcome these problems. Electronic support measures or ESM can be used to locate terrorist/insurgent lines of communication and operating bases, as well as the hiding places of key leaders, even across international borders. Intelligence gained from adversary communications can be used to direct operations against them. The key advantages offered by air power are: flexible collection platforms with direction finding capability and long loiter times, advanced signal analysis and correlation systems, advanced signal decryption system systems, rapid communications intelligence processing capabilities, near-real time data link to other sensors, command centres and weapons platforms.

Mobility and responsiveness are perhaps the most significant contribution of air power to sub-conventional warfare. Air mobility gives the government a virtual presence capability, in which a small reaction force can effectively respond within a large geographic area. Air mobility resources enable, ground security forces to be rapidly concentrated when and where needed, in varied terrain. Military air power can also be used to transport police and other civil security elements in response to crisis. Mobility greatly enhances the speed and reach of humanitarian relief and civil support operations, all of which support government legitimacy and reduce adversary influence. Key capabilities include flexible transport platforms with sufficient range and the ability to operate from small landing strips

or zones, fully developed communications infrastructure allowing rapid coordination with the key civilian agencies, integrated civil-military command and control processes, and a systematically developed nation-wide infrastructure of landing strips/zones and maintenance facilities.

Utility and attack helicopters will be equally relevant and effective in future sub conventional conflict as they have been since their introduction. They provide a significant reconnaissance and on-call fire support capability that can be a tremendous force multiplier. Such platforms can be used to support civil security forces, quick reaction forces or larger operations. They can also be used as escort platforms for military or civil ground movements, including humanitarian relief convoys. Low speed, low altitude and smaller munitions mean attack helicopters can be employed for strike operations with reduced risk of collateral damage. Key capabilities include: enhanced self defence systems to increase survivability, improved day night capabilities, advanced target acquisition systems, smaller, more precise weapons; near-real time data link for passing and receiving target data, and flexible command and control systems and structures that incorporate civilian agencies for integrated civil-military operations.

Punitive strikes by multi-role combat aircraft are an option in the Indian context, particularly in a proxy war situation – should the political leadership so decide. Targets for punitive strike would mainly be training camps or the leadership. Fighters and attack helicopters would be best suited for this role. The importance of real time intelligence cannot be understated, as targets are not likely to be static. In order to avoid collateral damage in such attacks, precision attack capabilities would also be required.

Though casualty evacuation is a non-combatant role of air power, it is going to play an important role in sub conventional warfare. Tolerance for loss of human life in sub conventional conflict is typically lower than in the case of a full scale conventional war.

Rapid medical evacuation will greatly increase the survival rate of combat injuries. It can also be used to move doctors, both civilian and military, around the region, to provide medical care to civilians. Military aircraft could also be used to transport supplies into a remote location, provide assistance to the population and enhance popular support for the government.

TECHNOLOGY IN SUB-CONVENTIONAL WARFARE

The application of air power in sub-conventional warfare would be incomplete without taking into account the impact of emerging technology such as: intelligence, sensors, precision weapons, advanced aircraft design and electromagnetic dominance. Sub-conventional warfare is generally characterised by a difficulty in finding, identifying and isolating targets, whether in urban areas, mountains, caves or forests. Intelligence sensors can be broadly classified as wide area surveillance assets and close target reconnaissance assets. Wide area surveillance assets provide the overall picture of the target and also help in identifying the locations within the target area that require more intensive investigation. Technologies like the foliage penetration synthetic aperture radar (SAR) and moving target indicators (MTD), multispectral and hyper spectral sensors, and chemical sniffers can enhance wide area surveillance capabilities in the context of small wars and sub-conventional warfare.

STRATEGIES TO FIGHT SUB CONVENTIONAL WARFARE

Unlike conventional conflicts where there is a clear de-lineation between military action and politico-diplomatic tools for conflict resolution, strategies to combat sub-conventional warfare are far more complex and nebulous. Military action, political initiatives, diplomatic parleys and socio-economic action have to be synergised to defeat proponents of sub-conventional warfare.

MILITARY OPTIONS

Post World War II, by and large, in most sub conventional conflicts, ground forces have been deployed to combat insurgencies and guerrilla movements across the globe. Air power has been mainly used in the supporting role. It was the Israelis who realised the potential of air power as a powerful tool of the state when faced with – what was literally – a struggle for survival in the late eighties. The Israelis were also amongst the first to successfully use air power in conjunction with Special Forces to conduct an anti-terrorist operation during the famous raid on Entebbe. Since then, air power has been used offensively by Turkey against Kurdish insurgents, by Russia against the Afghan and Chechen rebels, by US and coalition forces in Kosovo, Afghanistan and Iraq, by Sri Lanka against the LTTE, and most recently, by Pakistan against the Taliban in the Swat region. The use of air power by India in Kargil does not typically fall into the category of, air power being used against non-state actors, but is an instance of the use of air power at the lower end of the spectrum of warfare – bordering on sub-conventional warfare – because the infiltrating force that occupied the icy heights of Kargil was a mix of regular troops and terrorists. Whenever offensive application of air power has been followed by clinical ground operations, the non-state actor has been pushed to the verge of defeat. However, whenever attempts have been made to defeat a non-state actor by using only air power, the campaigns have been less than successful. The non-kinetic and support roles of air power therefore continue to be extremely relevant in the war against non-state actors. A few pre-requisites for the successful employment of air power are enumerated below:

- **Political Will.** The single most important factor is the resolve of the government to use air power in sub conventional conflicts, particularly within own territory. This becomes even more critical when the use of offensive air power is contemplated.
- **Integration.** The fight against the non-state actors has to be centrally controlled and directed.

- **Surveillance Grid.** A wide and extensive surveillance grid that covers the entire area of ops is essential for integrating the terrain obstacle system, troop deployment and surveillance devices including satellites, RPAs and Human Intelligence (HUMINT).
- **Intelligence.** The integration of all intelligence sources and high grade actionable intelligence would be crucial to achieve success.
- **Targeting & Collateral Damage.** Judicious targeting minimises the risk of collateral damage. However, the government must be sensitised that limited collateral damage will be inevitable if the situation deteriorates to the extent that offensive air power has to be employed.
- **Escalation.** Offensive use of air power would raise the stakes and lead to an escalation in case the non-state actors acquire / use man portable air defence system (MANPADS). Self-protection suites and tactics should cater for such an escalation.
- **Training.** Training in selected squadrons should focus on the lower end of the spectrum of warfare. Special emphasis should be on joint training with all elements actually earmarked for such ops.
- **Night & Weather Capability.** All crew operating in such areas should be NVG qualified and exposed to the nuances of operating in such terrain.
- **Media.** The media should be engaged and public opinion built up to support military ops.

ROLE OF AIR POWER

The most acceptable use of air power has been in the non-kinetic and supporting role, subordinate to action by ground forces. However, advances in modern weaponry, longer ranges, and more destructive conventional munitions with precision and low collateral damage probabilities, offer various options to the state. Some of the more important ones are as below:

- Surveillance and reconnaissance by all available platforms (satellites, RPAs and manned aircraft) are extremely vital to find,

fix, target and engage the mobile and highly elusive non-state actor as compared to static targets that are associated with conventional conflict. Therefore, real time intelligence is critical.

- Air mobility and logistics support to ground forces that are engaged in counter insurgency, counter terrorism and proxy war operations by fixed wing aircraft and helicopters. Use of medium lift transport aircraft and utility helicopters for insertion and extraction of forces in the combat area, attack helicopters for sanitising the area and providing fire support are some other roles. Last but equally important, fighter aircraft may be required to ensure air defence cover so that the country that is providing proxy support to the non-state actor is not able to provide air support to them.
- Targeting the terrorist and the non-state leadership is a key role of offensive air power and has yielded rich dividends in various conflicts in the recent past. The systematic elimination of the Al-Qaeda leadership in Iraq and Afghanistan and the LTTE leadership in Sri Lanka, have greatly changed the course of the conflicts.
- Destruction of terrorist infrastructure, launch pads and training camps is vital in the current environment, and would be a key mission for air power in any strategy that involves 'hot pursuit'. Fixed wing platforms and attack helicopters with precision weaponry and real time targeting capability remain best suited for the two options stated above.
- Other key roles for air power in sub-conventional warfare involve casualty evacuation and search and rescue missions, humanitarian relief missions and 'show of force' and peacekeeping missions under the UN flag.

JOINT OPERATIONS AND SUB CONVENTIONAL OPERATIONS

It is extremely important to reiterate that even if air power has the ability to coerce and deter the non-state actor; surface action is imperative for final conflict resolution. Joint operations in sub-

conventional warfare demand far greater synergy and responsiveness given the unpredictable nature of the adversary. Synergy has to be developed systematically and honed first, in conventional scenarios, before being applied in contingencies arising from insurgency and terrorism. In the Indian context, it has emerged that synergies have to be built not only between the three services, but between the three services and the para-military forces and other wings of government, both at the centre and the state levels. Air power invariably is a critical facilitator in such operations and must be exploited by adhering to the basic tenets of employment.

9

Joint Operations

Separate ground, sea and air warfare is gone forever. If ever again we go should be involved in war, we will fight it in all elements, with all services, as one single, concentrated effort.

— President Dwight D. Eisenhower,
Speech to US Congress 1958

Prior to the advent of air power, armies and navies could fight battles in their respective domains, independent of each other. Air power, with its attributes of rapid mobility, reach and flexibility changed the paradigm of warfare by ensuring that troops or marine vessels could be targeted regardless of their domains. Advancing technology increasingly shapes the conduct of modern warfare, and also demands the use of military forces in concert with one another. Military forces on land, sea and air now reinforce and complement each other more than ever before. It would hence be essential to grasp the implications of these facets of modern warfare and capitalise on the synergistic value of joint operations.

THE DOCTRINE OF JOINTNESS

'Cooperation' among the three services has long been accepted as a principle of war by the Indian armed forces. Jointmanship is a progression of this principle, and enables all the three services to complement each other to achieve overall national security objectives. The essentials of jointmanship as articulated by the IAF in its first doctrine are:

Indian Army and IAF special forces on a joint operations training mission

- Cooperation rather than competition. It may well be worth remembering that the competition is in fact with the enemy.
- Operating as a partnership and respecting each other's capabilities.
- Trust and confidence, along with sincere efforts to learn about and understand the capabilities and limitations of each service.
- Finally, joint operations involve using the right tools at the right time and not necessarily a bit of everything.

These essentials of jointmanship are the building blocks of the concept of jointness. Joint operations imply an amalgamation of the strengths of each service to produce a singular synergistic effect, which is greater than the sum of the single service parts. However, true synergy only obtains if each part is strong, competent and adaptable in its own right. Each service intrinsically possesses distinct strengths which enable achievement of national security objectives. Matching these strengths to missions is the essence of joint operations. For instance, the intrinsic strength of air power to swiftly target crucial enemy vulnerabilities in depth should be optimally and creatively exploited so that surface forces can achieve quick and decisive results and then hold ground or dominate the waters to achieve strategic objectives.

Jointness seeks to achieve military efficiency and this can be attained by a well trained army, navy and air force. Specialised competencies or professional mastery of land, sea and air are fundamental to effective joint operations. Thus, when a joint force is packaged, it must be tailored around the objective, not around parochial interests. For example producing a shock effect on the battlefield is a core competence of the air force, particularly when it involves the delivery of precision weapons with surprise. This is something that the other services must understand and exploit. The objective is the most important issue-not which service makes the largest contribution, or that each service contributes equally. In the national security matrix, an integration of the strengths of the three services is an index of not just operational effectiveness, but is also a force multiplier, and above all, a means of ensuring economy and efficiency.

PLANNING OF JOINT OPERATIONS

The efficacy of joint operations rests on planning and efficiency. The planning commences with an understanding of the mission, objective, purpose, intent and the desired end-state. It is guided by the fundamentals of joint operations in conformity with the principles of war and operational requirements. The Chief of Staff Committee (COSC) initiates the planning process on being so directed by the Cabinet Committee on Security (CCS)/ Raksha Mantri (RM). Planning for conventional operations would involve the respective service HQ for exercising contingencies jointly. In case of special joint operations, the COSC would issue the operational directive to the designated HQ that would be tasked to execute the operation. The planning process in either case is the same and is as laid down in the joint doctrine of the Indian armed forces. This broad planning process lays down the norms for the planning of joint air-land operations and maritime air operations. The planning in this case also follows the same route of having a clear understanding the mission, objective, purpose, intent and the desired end-state.

CONDUCT OF JOINT OPERATIONS

The Chief of Staff Committee (COSC) issues a directive based on the aims of the war as laid down by the government. These directives would determine the actions that the land, maritime and air forces will undertake to achieve the aim. The key facets of any military operation are synchronisation and integration of various elements of combat power so that their effects complement and reinforce each other. The directions would hence enunciate the ways and means of conducting an integrated battle to achieve a quick and decisive victory with least loss of life, material and national assets.

Hence the air operations, in this case, would be tailored to attain the overall objective. This would again involve degrading the enemy's air power and following it up by reducing the enemy's capability to interfere with the operations of own surface forces; constraining the enemy's manoeuvrability and mobility; create an imbalance in his force disposition; and destroy or damage his communication and logistics.

JOINT OPERATIONS AND OUT OF AREA CONTINGENCIES

As India's economy grows and its area of influence increases, the armed forces on their part would have to prepare for tackling any contingency/ emergency that occurs beyond its geographical boundaries and has the potential to adversely impact our national interests. In such a scenario, it is a given that air power will form an integral part of most task forces. The country will look for speedy mobility, effective surveillance, precision engagement and air support for re-supply of troops and equipment. Therefore, the IAF will be required to undertake all types of air operations with the help of diverse airlift platforms, long range fighters, air to air refuellers and if possible, operate from air bases in our neighbourhood.

While the IAF is well on its way to bolster and operationalise these capabilities, there is a need to validate the concepts through realistic exercises and by refining the operating concepts. Air power will play a greater role in the domain of military diplomacy in any future OOAC that our armed forces may be called upon to address.

10

Nation Building, Aerial Diplomacy & Perception Management

What you leave behind is not what is engraved in stone monuments, but what is woven into the lives of others.

— Pericles, Greek Statesman & General

INTRODUCTION

At a time when 'soft power' is increasingly being seen as a powerful tool of statecraft, it is important to re-visit some of the missions and roles undertaken by air power to discern situations where it can be leveraged for exerting 'soft power' in furtherance of national objectives, nation building and to formalise the concept of aerial diplomacy.

In a globalised world where the utility of force is increasingly being questioned, soft power is emerging as the first option for nations to legitimately get what they want, either from other nations, or in the case of larger countries like India, from their own people. Joseph Nye, Jr. a distinguished professor at Harvard defined soft power as *"the ability to get what you want through attraction and not coercion"*. Soft power as

a doctrinal concept is not new to India. Writing in the third century Chanakya in his treatise *Arthashastra* clearly enunciated that war should always be the last resort for a king in conflict resolution. From a doctrinal standpoint it is important to examine how India can leverage the soft power capability of the IAF to further nation building and diplomacy.

NATION BUILDING

Nation building in a geographically large, ethnically varied and culturally diverse country like India primarily involves getting people together and working collectively to achieve national aims and objectives. This is a complex process that revolves around the three important pillars of governance, development and security. The armed forces have a vital role to play in, development and security, and it is in this context air power assumes significance for the years ahead. While the IAF has always been at the forefront of assisting civil administration during natural calamities and sustaining remote areas whenever asked to do so, there is a need for sensitising the country at large of the tremendous contribution of the IAF in these areas. There is a close relationship between nation building and internal unrest and that explains why this chapter follows the chapter on sub-conventional warfare. Many of the roles mentioned below have been the critical drivers for aerial campaigns in sub-conventional warfare. However, even after the sub-conventional conflict is resolved, the IAF has continued to perform these in the overall process of nation building and integration. Therefore, the overlapping of these roles into nation building is deliberate and necessary as in the case of:

- Disaster and humanitarian Relief.
- Sustenance of remote areas through the medium of air.
- Mobility for governance and election duties.
- Casualty evacuation both during disasters and internal security operations.
- Air displays to promote national integration and inspire national pride.
- Presence and employment generation in remote areas where air bases are located.

Providing succour and relief

Supporting infrastructure development in remote areas

IAF helicopter rescuing stranded tourists in Timber Trail, Parwanoo, HP

AERIAL DIPLOMACY

In recent times, diplomacy has emerged as the first option for both power projection and conflict resolution, albeit with military power to back it up with deterrence and coercive capability. Military power allows diplomacy to communicate both intent and credibility during negotiations, thereby acting as a critical enabler while remaining in the background. Different elements of military power offer different capabilities for diplomacy to leverage at different times. For example, one of the many ways in which an army can be diplomatically leveraged

is by engaging with land locked neighbours. The close cooperation between the Indian Army and the Nepal and Bhutan armies is a classic case of diplomacy being furthered by land power that leverages ethnic connects. The deployment of the Indian Navy in anti-piracy operations is a classic example of maritime diplomacy that hinges on presence and a firm intent of making a pro-active contribution to global security. Similarly, the aerial evacuation of Indian citizens from war torn Kuwait prior to the Gulf War in 1991; from Lebanon in 2006; and Libya in 2011, signals a firm commitment on the part of Indian diplomacy to leverage air power to protect national interests and human capital well beyond its shores. The decisiveness of Indian diplomacy was bolstered by air power during *Operation Cactus,* the air landed operation at Male that ensured that President Gayoom's government was not overthrown by mercenaries. The participation of IAF Jaguar fighter aircraft and IL-78 aerial tankers in *Exercise Cope Thunder* in Alaska in 2005 saw the coming of age of aerial diplomacy and the ability of the IAF to support trans-continental diplomacy. There are numerous such examples that cement the inescapable linkages between air power and diplomacy. The

Suryakiran: Aerobatic display team. Poetry in motion

main competencies that air power brings to diplomacy are speed, reach, flexibility, and as a last resort, even firepower. Some of the globally acceptable missions of aerial diplomacy are listed below and reflect the capabilities offered by air power to shape strategic events.

IAF Mi-17 in UN operations

- Humanitarian evacuation of Indian citizens from potential conflict zones.
- Speedy intervention on specific requests from friendly countries for assistance to mitigate the impact of natural disasters, human conflict and threats to sovereignty.
- Participation in UN mandated peace keeping and peace enforcement missions that further India's reputation as a responsible global player.
- Active participation in Out-of-Country contingency operations as part of a joint Indian task force.
- Air displays by aerobatic teams and friendly exercises with air forces at home and abroad.

PERCEPTION MANAGEMENT

Perception management is emerging as a key competence that government institutions must have if they want to reach out to the world and their own people. This is because of the all pervasive influence of institutions like the media and a host of non-governmental organisations that seek to understand diverse issues. It is, therefore, important for the IAF to develop skill sets that allow it to effectively engage with these organisations to ensure that a correct image of the service is transmitted to the world. Doctrinally, this would be a part of the 'soft power' capability of the IAF that translates into effective media management, public relations and image building.

With the sustained expansion of the IAF's air mobility assets in the form of both strategic and tactical transport aircraft and multi-role helicopters, the role of the IAF in nation building and aerial diplomacy is bound to increase in the coming years. It must thus be factored into the overall potential of the IAF as an important tool of governance and state policy. Air power has the potential to speedily reach hot spots well before other organs of state power and provides the state with credible and sustainable intervention capability. This is, by far, the most enduring characteristic of air power that can be exploited for effective nation building and diplomacy.

11

The Air and Space Paradigm

It was only in the crucible of the 1991 Gulf War that the synergistic potential of air and space assets began to be appreciated... In manifold ways, space demonstrated what it could bring to the new face of air warfare.

— Benjamin Lambeth

Space capabilities are becoming absolutely essential for national development, besides being crucial for conducting successful military operations. India has a robust civil space programme which is essentially geared towards scientific and development goals. Utilisation of space for economic and developmental purposes is likely to increase, and as dependence on space assets and systems increases, the concurrent vulnerability of our country to hostile action seeking to destroy, degrade or deny our space capabilities so painstakingly built over the decades would increase. It is, therefore, essential to institutionalise measures to secure, sustain and promote our peaceful utilisation of outer space.

Before dwelling on the doctrinal aspects, it is important to briefly examine the broad rationale for the military, and in particular, the IAF's involvement in space.

THE RATIONALE FOR MILITARY INVOLVEMENT IN SPACE

Recent incidents clearly indicate that threats from outer space are now a reality. Our investments in space are substantial and there is a pressing need to protect our assets in space along with the necessity of protecting our terrestrial assets on ground against threats from outer space. Space enabled capabilities are universally regarded as the backbone of military modernisation, particularly in the context of air power. Space capabilities lie at the core of the revolutionary transformation of military capability, commonly termed as Revolution in Military Affairs (RMA). The starting point for the public awareness of RMA was the US military operations, particularly *Op Desert Storm* in 1991. *Op Desert Storm* was the first war in which space systems were used by operational commanders and integrated into their daily decision-making processes. The war demonstrated the enormous utility and military transformation enabled by RMA, or Net Centric Warfare Capability (NCW) as it was later termed. Effects Based Operations (EBO) and Force Transformation Architecture (FTA) became the absolute essentials of military strategy. The bottom line was the transformation in the conduct of military affairs by the combined potential of air and space assets in terms of Intelligence Surveillance Reconnaissance (ISR), communications, navigation etc. This 'aerospace' combination provided the information dominance vital for the nuanced application of force, which in-turn enabled decisive war-winning effects.

The most important driver for the IAF's involvement in space is that it is the primary military service mandated for securing national assets and investments against threats from the skies. Threats in the new millennium range from passenger aircrafts being flown into buildings, to high speed manoeuvring missiles to anti satellites (ASAT) launched from ground and airborne platforms. The challenges have evolved beyond air into space and now encompass the entire vertical dimension of aerospace. The IAF would have to transform accordingly to cope and it would not be possible to do so without being involved in outer space.

THE DOCTRINAL DRIVERS OF MILITARY SPACE UTILISATION

The military uses of space expand with every passing conflict as emerging technologies afford greater exploitability of the environment for military activities. This expansion, however, has largely been within the doctrinal imperative of gaining the "*high ground*" for military advantage. The quest to go higher and observe the adversary from an altitude high enough not to be shot down led to the development of high-altitude aerial platforms like the U-2 and later SR-71s etc and also provided the impetus for space based observation. Space platforms were beyond the reach of terrestrial weapons and hence they enabled a more efficient and safer means of delivering military ordnance and observation.

Instead of being a frontier now, space complements air power in numerous missions as an enabler. Air and space are now regarded as complementary components of defence in that they compensate for each other's inadequacies in maintaining surveillance of the vertical dimension and in countering threats from systems like ballistic missiles that transit and manoeuvre through both air and space. Thus, in spite of technological, environmental and other differences, military space employment doctrines in the past and even today are primarily based on air power doctrines.

Role	Typical Air power mission	Contemporary Space mission
Control of environment	Counter Air missions	Counter Space missions
Applying combat power	Air-based force application	Space-based force application
Multiplying combat power	Airborne combat enabling	Space based terrestrial combat enabling or Force enhancement
Sustaining combat force	Enabling operations	Space enabling operations

Table 1: Doctrine on Military Use of Space

The above doctrinal premises and perceptions, articulated or otherwise, have largely been driving the militarisation and weaponisation of outer space since the dawn of the space age. Weaponisation of space

commenced with Cold War initiatives like the testing of anti-satellite (ASAT) weapons by the USSR, and the US Strategic Defence Initiative (SDI) that was popularly known as Star Wars. Space based assets like satellites were mainly meant for 'force-enhancement' missions e.g. observation, communications, navigation, meteorology etc which allowed terrestrial military forces to conduct military affairs more efficiently. Thus most military space missions were auxiliary to other more direct military activities. Most present day satellites (excluding ASATs) affording military capabilities or performing military functions are incapable of directly destroying or damaging another country's property. Apart from 'early-warning' satellites which have a clear-cut military role, most of the other military activities can also be performed by civilian satellites and vice-versa.

However, as the military and commercial reliance on satellites grows, so does the awareness that space based assets are centres of gravity, which are likely to be targeted in war. But, while during the Cold War, space systems were mainly focused on force-enhancement missions, the focus now has shifted to controlling space for one's own benefit while denying it to the adversary. The focus of the military utilisation of space is gradually shifting beyond enhancement of military force capabilities to control over the environment and actual application of military force 'in, from and through space'. This is why a number of nations are currently embarking on programmes for space control and space force projection. It is now evident that after a brief lull at the end of the Cold War, the competition for space is seeing a transition from militarisation to weaponisation.

FORCE ENHANCEMENT

Achieving full spectrum capabilities would of course be ideal. However, in view of our unique needs as also capabilities and limitations, a departure from the doctrinal prescriptions is essential. India does not currently subscribe to Counter-space or space based force applications which imply 'non-peaceful' uses of outer space. The mission of force

enhancement is ideally suited to our purposes and capabilities. It is also within the realm of our capabilities, and finances and hence, it should be our primary focus. The panoply of capabilities in the realm of space enabled force enhancement include:

- Early Warning Satellites.
- Observation/Intelligence Surveillance Reconnaissance (ISR) satellites.
- Communication Satellites.
- Navigation Satellites.
- Metreological Satellites.
- Geodetic Satellites.

A prudent option for building up our nascent capabilities would be to build on what is available and 'doable'. It needs to be borne in mind that the integration and operationalisation of these capabilities took the US the better part of four decades. Integration of space capabilities into our conventional military apparatus would be an equally time consuming affair fraught with a variety of technological and economic challenges, and we would need to maintain our focus accordingly.

INTEGRATING SPACE

The doctrinal, operational and technological challenges of integrating space into air operations and networking are demanding as well as time consuming. Going by the lessons of past conflicts and the advances in technology, information enabled assets in air and space are the key facilitators for the efficient operation of various military systems. To integrate space capabilities with air power; it would be essential to network the diverse and yet potent elements of air and space for optimal efficiency in fulfilling the obligations of national security. Only then would the true benefits of aerospace power become demonstrably evident. To this end, it would be necessary to develop systems for linking sensors as well as weapon platforms etc. The effort should be to shorten the prevailing 'sensor-to-shooter' link and deliver vital inputs and information into cockpits as also to the control and reporting centres etc.

SECURITY OF ASSETS

Air space management and security challenges have progressed to aerospace levels. The crowding of the national airspace and the challenges of air space management in the near future would also demand greater coordination of air and space assets. It would be even more imperative in view of platforms like the "Multi-Purpose Aerospace Vehicle" which operate in both air and space. All of these measures can be undertaken within the ambit of the prevailing laws governing outer space. For instance, surveillance in aerospace is well within the ambit of the 'peaceful uses of outer-space' along with hardening and manoeuvrability options. The need to weaponise outer space is not currently being envisaged; hence it is not discussed in this document.

LIMITATIONS IN USING SPACE

Space is not a substitute for all other military capabilities, or a panacea for all the information voids or military inadequacies plaguing our national security. Our doctrine on space is therefore dictated by rational security needs and not the limits of what could be technically possible. Thus, keeping the 'availability and affordability' criteria, in mind the presently available space technologies need to be leveraged to meet present national security and defence requirements. Any future requirements should be factored in with due attention to costs, the legalities and treaties in vogue, technical feasibility etc. Luxuries in the new millennium are no longer affordable, and hence the doctrinal approach is to seize the opportunities as and when they present themselves.

12

Information Warfare

Successful warfare is all about – and has always been all about – acquiring and exploiting information.

— Richard P Hallion, air power historian

The information age is transforming military operations by providing commanders with information that is unprecedented in quantity and quality. A modern military commander invariably possesses adequate information on the battle space, which gives him a powerful, if not decisive leverage over the adversary if he manages to analyse and sift that information well. It is this complex combination that comprises information warfare.

IW CATEGORIES

Information warfare can be defined as the action taken to preserve the integrity of one's own information system, while at the same time exploiting, corrupting or destroying an adversary's information system, and in the process, achieving an information advantage for the application of force. There are two mutually supportive categories of information operations (IO) – the offensive and the defensive.

- **Offensive Information Operations involve.** The integrated use of assigned and supporting capabilities and activities, to affect enemy decision-makers by attacking their information and information systems.

- **Defensive Information Operations.** Integrate and coordinate policies and procedures, operations, personnel, and technology to protect and defend friendly information and information systems.

ORGANISATION

A fully functioning IO system requires synergistic merging of the capabilities and related activities of its components. As IO will be conducted at the strategic, operational and tactical levels it will require a tiered organisational set up.

Various agencies at the national level are responsible for computer emergency response, data assurance standards, cryptography, and cyber law and training. The MoD interacts with ministry of communication and IT on issues relating to information security. HQ IDS is responsible for information security and projects in the three services.

CYBER WARFARE

Cyber warfare is an attractive low cost war-waging model because it has some notable features such as: low entry cost, blurred traditional boundaries and an expanded role for perception management. Offensive cyber warfare can be conducted across the entire range of military and nonmilitary operations to achieve national objectives. Threats in the sphere of cyber security originate from a variety of sources (known as well as unknown). These can target infrastructure, the financial sector, individuals, governments and the militaries of a country. The gravity of these attacks will vary depending on the objectives. The cyber defence environment requires deployment of technologies and capabilities for real-time protection and incident response. The existing cyber threats to the IAF can be categorised as follows:

- **Threats to IT Infrastructure.** Information networks and applications like the communication systems, air defence systems, logistics network etc span all areas of operations, administration and maintenance and this reliance will only increase in the future. Networks across the entire country will use a variety of means, ranging from optic fibre cables,

unshielded twisted pair cables, satellites, and other wireless channels and technologies, such as MPLS, VoIP, etc. These media will have their own inherent vulnerabilities, which may render the network susceptible to attack. A disruption of these networks would result in failures that would severely hamper aerospace operations and inter-service integration. Therefore, a robust and secure information security system is necessary for ensuring the security of the IT infrastructure. Notwithstanding the insulation of air force networks from the Internet, these networks would be vulnerable to IW weapons and attacks from the Internet, introduced physically by agents or subverted personnel. In future our Information networks and applications will also have to be secured from electromagnetic pulse (EMP), high energy laser (HEL) and high power microwave (HPM) devices.

- **Software/Hardware Based Threats.** User-friendly operating systems, anti-virus software, browsers, firewalls, intrusion-detection systems, encryption software, etc, are mostly of foreign origin. Similarly, most of the critical hardware components for high-end computers (mother-boards and processors) and network elements (switches, routers, modems and network cards) are also of foreign origin. These software(s)/hardware(s) may have malicious "backdoors", to perform a pre-programmed hostile activity.
- **3G and Wi Max Networks.** 3G and Wi Max networks are being established in the IAF to enhance the data and voice communication and as backup networks. The necessary security mechanisms should be in place to ensure the security, integrity and availability of data and tackle cyber related threats such as virus, worms, eavesdropping and denial of service.
- **Sophisticated Malwares.** The dynamic and vulnerable nature of IT infrastructure has forced the hacker community to continuously develop sophisticated and sustainable malwares, which could be deployed through various mechanisms and triggered when required. Agents or subverted personnel can deploy such malwares physically on the intranet.

CONCLUSION

Information warfare has gained significance, both in the military as a whole and the air force in particular. To counter the myriad threats and benefit from cyber warfare capabilities, it is necessary for the IAF to have a well defined roadmap.

Cyber warfare capability will play a crucial role in future wars, but unlike other technologies used in warfare thus far, expertise in waging a cyber war is not limited to the armed forces. Cyber warfare relies on information technology, which is used as much by the armed forces as by civilians. Ultimately, the dominance of a nation state in cyber war would critically depend on the extent to which it is able to integrate the efforts of the armed forces and other agencies.

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Human Resource Development

During an operation, decisions have usually to be made at once; there may be no time to review the situation or even to think it through. If the mind is to emerge unscathed from this relentless struggle with the unforeseen, two qualities are indispensable: First, an intellect that, even in the darkest hour, retains some glimmerings of the inner light [commander's vision] which leads to truth; and second, the courage to follow this faint light wherever it may lead.

— Karl von Clausewitz

INTRODUCTION

Human resources are one of the most important force multipliers available to the IAF. IAF personnel – officers, airmen, NCs (E) or civilians – all contribute to its ability to conduct operations across the entire spectrum. The selection, training, employing and retaining of personnel is a foundational endeavour and has a direct bearing on our ability to undertake operations and effectively employ the weapon systems that we possess or are planning to acquire. With the increasing sophistication in technology, the ability of its personnel to exploit these assets would finally determine the effectiveness of the IAF.

Hawk aircraft: learning to fly fast jets

THE DEVELOPMENT PROCESS

Air warriors with professional leadership skills are at the core of force development. The goal of force development is to prepare the air warriors to successfully lead and operate in a rapidly evolving environment, while at the same time being able to meet personal and professional expectations.

FORCE DEVELOPMENT: THE PROCESS OF MAXIMISING CAPABILITY

Human resource development (HRD) processes are designed to produce and maximise the capabilities of air warriors. HRD aims to optimise the capabilities of the individual between personal needs and organisational requirements. A focus on the elements of the force development process – induction, development and sustainment, supported by proper planning, will make for a balanced, diverse, and capable workforce. These elements combine to produce effects greater than the sum of the parts. The process is depicted as follows:

Fig. 1: Process of Force Development

FORCE DEVELOPMENT PROCESS: DEFINITION

Effective HRD is based on capability-based requirements. The success of air operations depends on the effective integration of human capabilities with the tools, tactics, techniques, and procedures that combine to produce the full spectrum of aerospace power. The first step in integrating air warriors into IAF operations is by defining the required capabilities and thereafter building the skills required to produce those capabilities.

INDUCTION

HR induction ensures that over time IAF continues to maintain the professional competence of its workforce. As human requirements and capabilities change, the processes associated with induction also

evolve. Advertising and recruiting strategies, pre-commissioning, basic military training objectives and pipeline training capabilities are crucial elements in the induction process. These will drive the IAF's ability to attract, procure and produce the right skills and competencies to meet operational requirements.

Promotion of air warriors is an indication of recognition of potential and provides a leadership cadre. Promotion also serves to motivate, to aspire to lead by providing opportunities for greater responsibility, compensation and prestige.

DEVELOPMENT

Development processes and systems hone individual capabilities through education, training and experience, thus producing skilled and competent air warriors who can apply the best tools, techniques and procedures to produce a required operational capability. Development is the process where raw aptitudes, attitudes and abilities are supplemented and transformed to craft individual competencies into the capabilities required by IAF to execute its aerospace missions. Education and training are the critical components of the development process. Education develops critical thinking skills, encourages exploration of unknown areas and creative problem solving and the ability to foresee unknown situations or new challenges. Training on the other hand focuses on providing a structured skill set and provides the individual with skill expertise.

An ongoing programme of professional, technical and academic development from the very beginning, prepares air warriors to comprehend and accomplish their assigned missions. Further, experience blended with skill, knowledge and motivation, refines the leadership qualities possessed by each air warrior. Through career planning and development, air warriors are assigned and deployed to meet mission requirements. The IAF leverages these competencies to expand the capabilities of the entire workforce and to achieve the national military objectives.

SUSTAINMENT

Sustainment processes and programmes balance organisational requirements with individual aspirations and changing operational requirements. These processes are structured to capitalise on investments in HR development. 'Quality of life' programmes clearly reflect the high value that IAF places on its people and the need to retain the right mix of people with professional / leadership skills and associated capabilities.

Physical and mental fitness along with discipline, enhance an air warrior's ability to sustain a high state of readiness. As readiness is a perishable state, the IAF continuously assesses and addresses individual and unit readiness issues.

The IAF recognises the value of family support in motivating and sustaining the capabilities of air warriors. Career decisions and associated issues of retention and force readiness take into consideration diverse family requirements. By supporting families and ensuring that they are able to enjoy a quality of life and opportunities comparable to those enjoyed by the citizens of the nation they protect, the IAF makes a tangible commitment to air warriors that recognises and values their services. These initiatives are intended to increase their commitment and their impact on morale and retention is significant.

Recognition of personnel for their achievements motivates others to aspire for excellence. Given the high risks associated with preparing for and engaging in military operations, it is only proper to honour those who have valiantly fought and voluntarily sacrificed their personal comfort to triumph over an adversary. Similarly, exceptional performance cannot be recognised only through financial remuneration, but should be formally acknowledged and reinforced. The IAF's recognition programmes are designed to highlight excellence of leadership and technical skills, as well as extraordinary dedication in performance of assigned duties or service to the nation.

CONCLUSION

Leadership is fundamental to the IAF. Creating future leaders is the responsibility of the current ones, and HRD is their means of doing so. By taking an organised approach and developing leaders from the tactical level, through the operational, to the most senior strategic levels in the air force, the service will ensure its continued pre-eminent position in the world. Leaders are inextricably linked to mission effectiveness; and developing leadership qualities through a deliberate process that guarantees that the IAF will produce the requisite leadership. **Leadership and HR development must continue to provide the IAF with its most valuable resource – its people – its motivated and superbly qualified air warriors.**

14

Technological Perspectives

Victory will smile upon those who anticipate changes in the character of war, not upon those who wait to adapt themselves after changes occur.

— Gen Giulio Douhet, in The Command of Air, 1921

INTRODUCTION

Aerospace power, since its very inception, has relied upon cutting-edge technology to maintain its supremacy over adversaries. The capabilities, effectiveness and therefore the utility of aerospace power are premised mainly on technology, with the aim of making aircraft, systems, sensors and weapons more capable and potent. Even if not related to weapon-systems, technological innovations serve to enhance fundamental organisational capabilities and efficiency, which in turn enhance their operational potential. The IAF is rapidly modernising itself by introduction of advanced and the state of the art technology across all levels. What drives the quest for technological advantage is the need to stay ahead of adversaries in terms of building significant pro-active and deterrent capabilities.

LEADERSHIP CHALLENGES

Along with its many advantages, technological advancement also enhances complexities. Unlike in the past, where requirements drove technology, today technology is driving requirements at a rapid pace. Leaders are faced with the continuing dilemma as to whether the introduction of latest technology would truly be an advantage. Training and the stabilisation of new and advanced systems before they can be made operational is a time consuming process. It must be remembered that technology is a tool, a means to an end, and not an end in itself. If the end state is known and analysed adequately, technological requirements fall into place automatically. In other words, capability building should drive technological induction and not the other way round.

MANPOWER CHALLENGES

A key concern when dealing with the rapid advancement of technology is that there is a mismatch between natural human capacities and the enormous data volumes, processing capabilities, and decision speeds that technologies either offer or demand. Although humans today are more capable of performing certain tasks than machines; machine capabilities are expected to increase to the point that humans will become the weakest component in the wide array of systems and processes. Humans and machines will need to become far more compatible, through improved human-machine interfaces and by direct augmentation of human performance. Newer ways of using science and technology to augment human performance will be essential for benefiting from the various technologies. This will further increase human efficiency, reduce the manpower needed for the same activities or provide enhanced capabilities with the given manpower.

Ensuring the adequate availability of manpower, both in terms of quality and quantity, for effective exploitation of the chosen technology, will continue to pose a challenge. There is a need to

understand and differentiate between the people operating the weapon system and those who perform the back up communication, logistics and command functions. The proverbial tooth-to-tail ratio reduces with technology and factoring this in during the transformational process and accounting for the same is another important leadership imperative.

NEED FOR TECHNOLOGY

The energy that is injected into the system due to enhanced technology is commonly referred to as 'information'. The human race has been fighting wars since time immemorial and only till a few years ago, control over high ground was considered an absolute must to win a war, mainly because it translated into better information. The concept that information is an asset and a commodity that needs to be controlled is relatively new, and is not being referred to in the classical sense as 'information warfare'. By information we mean that an enabling attribute is enhanced by the incorporation of technology. In the cockpit it may manifest itself in a higher number of tracked targets; in navigation systems in terms of higher accuracies and in terms of terminal guidance as better SSKP or CEP.

TECHNOLOGY PERSPECTIVE

It must be understood that the advancement of technology will dictate and influence how a force operates in the future. Even if unrelated to weapon-systems, technological innovations serve to sharpen fundamental organisational capabilities and efficiency, which in turn enhance operational potential. The thrust areas that have influenced the formulation of the IAF's technological needs are as follows:

- Replacement/modernisation of combat aircraft, transport aircraft, helicopters and training aircraft.
- Induction of force enhancers.
- Acquisition of modern armament and weapon systems.

- Strengthening of air defence networks/systems/weapons.
- Building up of the information and electronic warfare capability.
- Setting up of reliable and secure communication facilities.
- Space based systems and their exploitation.
- Modernisation of training facilities.
- Development of operational infrastructure.

Conclusion

Two basic criteria have to be met to ensure the defence of our nation: firstly, the government must be prepared to use its military instruments for the protection and projection of our national interests and secondly, the military instruments must be developed and readied during peacetime. We have the option of allocating our resources both strategically and tactically. We can opt for deterrence or protection or we can choose to neutralise the forces arrayed against us and degrade even their places of origin.

In a democracy like India, a defensive posture appears as being politically and economically attractive, but allows a potential opponent the freedom to concentrate all his resources on offensive strategies. To deny him this freedom of action, it is imperative that a nation's military instruments must be forged a way that they can be actively turned against an aggressor. At the cutting edge of such a capability is a nation's air power with its inherent qualities of speed, reach, lethality, precision, ability to concentrate, flexibility in the selection of weapon options, roles and target systems and shock effect.

There is no single application of air power that forms its chief strength. Be it strategic attack, counter air, battlefield air strike, interdiction or EW, it is the synergy between the multiple roles, missions, platforms and people that defines the utility of air power. Air power can go it alone, lead or follow, as the situation demands.

Military operations in the future will be increasingly networked and rely greatly on connectivity, ISR, communications and data handling capability. IAF assets that are likely to be inducted shortly, or are in the process of being inducted into service, will heighten the capability of seeking, processing and utilising information. With heavy payloads and long range weapon delivery platforms, infiltration and extraction

of own forces from an area of conflict will be possible. Intervention in a deteriorating geo political situation or providing succour in a humanitarian crisis require a robust and powerful capability. The country will demand and expect the armed forces to respond and help the needy. The speed, reach, mobility and responsiveness of air power will sustain relief and rehabilitation operations. In short, air power also offers decisive non-kinetic options to commanders.

The challenges facing joint operations in the future will mainly revolve around inter-operability and the shedding of dogmatic approaches to war fighting. Single service approaches to war fighting cannot be wished away immediately. However, a visionary leadership, focussed policy, continuous joint training and an 'objective' oriented approach will yield rich dividends when it comes to evolving a truly 'joint' philosophy of exploiting all military arms of the state in pursuit of stated national objectives.

Looking forward, the IAF is well on its way to becoming a truly transformed and lethal force. The weapon systems that have been inducted, and are being inducted will generate the necessary force multiplier effect to exploit the tenets of air power with efficiency and precision. However, it is the intangible force multipliers like leadership, morale and training that can make all the difference in war and these are often neglected in peacetime. The IAF owes it to the country to maximize operational excellence, maintain its technological edge and preserve its offensive potential.

We make war that we may live in peace.
— Aristotle

Acronyms and Abbreviations

AAA	Anti-Aircraft Artillery
AAR	Air-to-Air Refuelling
AD	Air Defence
ADCC	Air Defence Control Centre
ADIZs	Air Defence Identification Zones
AEW	Airborne Early Warning
AI	Air Interdiction
ASAT	Anti Satellites
ASMs	Anti Shipping Missiles
ASTE	Aircraft and Systems Testing Establishment
AWACS	Airborne Warning and Control System
BAI	Battlefield Air Interdiction
BAS	Battlefield Air Strike
BDA	Battle Damage Assessment
BMD	Ballistic Missile Defence
BVR	Beyond Visual Range
CAP	Combat Air Patrol
CASEVAC	Casualty Evacuation
CASR	Combat Air Search and Rescue
CBRN	Chemical Biological Radiological and Nuclear
C2	Command and Control
C3I	Command Control Communication and Intelligence
CEP	Circular Error Probability

CERT	Computer Emergency Response Team
CMP	Crisis Management Plan
COMINT	Communication Intelligence
COSC	Chiefs of Staff Committee
DCA	Defensive Counter Air
DEAA	Destruction of Enemy Air Assets
DEAD	Destruction of Enemy Air Defences
D/F	Direction Finding
DRDO	Defence Research & Development Organisation
EA	Electronic Attack
EBO	Effects Based Operations
ECCM	Electronic Counter Counter Measures
ECM	Electronic Counter Measures
EEP	Electronic Emission Policy
ELINT	Electronic Intelligence
EMP	Electromagnetic Pulse
EO	Electro-optical
EQUOLS	Equipment Accounting On-line System
ESM	Electronic Support Measures
EW	Electronic Warfare / Early Warning
FAC	Forward Air Controller
FAS	Favourable Air Situations
FLIR	Forward Looking Infra Red
FTA	Force Transformation Architecture
HAS	Hardened Aircraft Shelter
HEL	High Energy Laser
HF	High Frequency
HPM	High Power Microwave
HUMINT	Human Intelligence

IACCS	Integrated Air Command & Control System
IAF	Indian Air Force
IFF	Identification Friend or Foe
IMMOLS	Integrated Material Management On-line System
IO	Information Operations
IR	Infra-Red
ISR	Intelligence Surveillance and Reconnaissance
MPLS	Multi Protocol Label Switching
MOPs	Mobile Observation Post
MR	Maritime Reconnaissance
MTD	Moving Target Detectors
NCW	Network Centric Warfare
NVGs	Night Vision Goggles
OCA	Offensive Counter Air
OOAC	Out of Area Contingency
ORP	Operational Readiness Platform
PAD	Passive Air Defence
PGMs	Precision Guided Munitions
Psy Ops	Psychological Operations
RMA	Revolution in Military Affairs
RPA	Remotely Piloted Aircraft
RSTA	Reconnaissance Surveillance and Target Acquisition
SAMs	Surface-to-Air Missiles
SAR	Search and Rescue
SAR	Synthetic Aperture Radar
SATCOM	Satellite Communication
SEAD	Suppression of Enemy Air Defences

SF	Special Forces
SHBO	Special Heli-Borne Operations
SIGINT	Signals Intelligence
SOPs	Standard Operating Procedures
SSKP	Single Shot Kill Probability
SSMs	Surface-to-Surface Missiles
TACDE	Tactics and Combat Development Establishment
TBA	Tactical Battle Area
VoIP	Voice over Internet Protocol

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Notes