AIR POWER: FUTURE CHALLENGES AND EMERGING ROLES

DHIRAJ KUKREJA

INTRODUCTION

From the end of the last century, it has been seen that the nature of war and armed conflict has been changing significantly, primarily due to two reasons, namely, the constantly evolving geo-political equations; and the unparalleled developments in technology, which were once considered to be a figment of the imagination. The world order today is changing at a rate that may be termed as illusory. The pace of the change may be comparable to the times that followed the defeat of Napoleon in 1815 and the defeat of Germany and Japan at the end of World War II in 1945. These changes, coupled with the advancements in technology, have significant implications on the nature of war, and, hence, national strategy, military strategy and force structure.

Ever since the first use of air power as an instrument of war, it has been constantly evolving. Being a technology reliant and technology intensive force projection capability, air power has always capitalised on developments that have taken place within scientific research. The combination of innovative concepts for its employment and active technological support has made air power one of the primary tools to be employed by governments across the world in pursuit of their national interests. The position that it occupies in the

Air Marshal **Dhiraj Kukreja** is a Distinguished Fellow at the Centre for Air Power Studies, New Delhi.

The last decade of the 20th century and the first decade of the 21st century have given us more than an inkling of the possible ways in which air power could develop. It has also indicated the pitfalls that always accompany rapid progress.

forefront of military capability demands that future developments in this vital capability be studied in earnest.

The last decade of the 20th century and the first decade of the 21st century have given us more than an inkling of the possible ways in which air power could develop. It has also indicated the pitfalls that always accompany rapid progress. Without doubt, air power seems to have come of age by a display of its capabilities. The cynics who thought that air power could not ever, by itself, fight and win wars have been proved wrong. While this assertion is debatable, there is now a reluctant acceptance of the independent status of air power. Military thinkers have come a long way from the times when the other two older (senior) Services were bent upon suppressing the concept of independent air power and reducing it to a mere support status.

Since air power has proven to be extremely effective in the past two decades of intermittent and limited warfare, it is necessary to study its current state and then understand the ongoing transformation. The key to this transformation, as also the changes that are likely in the future, is the close interaction of the advancements in technology and the characteristics of air power. As mentioned, no other power projection capability has been born of technology, constantly been nurtured by technology, and remains constantly underpinned by technology for its very existence.

Even a cursory look at its development through history reveals that air power has always been a constantly and rapidly evolving entity. As we continue our march into the 21st century, there is, therefore, a need to examine the possible ways in which the traditional roles of air power are likely to evolve, which this paper shall endeavour to. The paper shall also take a broad view of the development of air power and the challenges that it is likely to encounter in the face of emerging threat trends that the air power strategists would have to grapple with in the employment of this

versatile force projection capability. The future is uncharted territory; it is, therefore, essential to begin with a credible reference as a starting point with some suppositions in reference to the future, in general, and the way wars will be fought, in particular.

ASSUMPTIONS

Crystal ball gazing is a risky proposition, especially when one wishes to predict the future, as it is fraught with the danger of being completely off-track. If, however, the predictions are based on assumptions which are well argued or thought of, the uncertainties could be limited, thereby improving the accuracy of predictions and making the process of planning for the future comparatively simpler. The assumptions are as under.

Whether a nation commits itself to join a conflict or not depends on its foreign policy. The commitments so made also have a ramification on the threats that the nation may have to face, and, hence, on the force structure it would have to maintain.

- **Indistinctness:** The clear demarcation of boundaries in the social, economic, political and geo-strategic spheres has become blurred—examples of which can be seen on a daily basis—thereby making the world an uncertain place in the foreseeable future. Since each of the spheres mentioned impinges on the other to some extent, the future in all spheres is near impossible to predict. There may be some clarity in individual spheres, making events more predictable, but the overall greater uncertainty overshadows it. The inherent indistinctness is a universal phenomenon and has to be accepted as such.
- **Political Involvement:** Whether a nation commits itself to join a conflict or not depends on its foreign policy. The commitments so made also have a ramification on the threats that the nation may have to face, and, hence, on the force structure it would have to maintain. The force structure would obviously include air power. Considering the ubiquitous nature of air power, there has always been political interest in its deployment. With the passage of time, it has been seen that the impact of air power has increased tremendously and, hence, it can be

assumed that the political involvement, that has been the norm so far, will only increase in the future. What effect such involvement will have on the efficiency of air power is difficult to predict.

- **Legal Implications:** Throughout history, war between two nations has been natural, and at times even thought of as essential; there have, however, been certain norms specified in the conduct of war to safeguard the non-combatant citizens and to ensure a degree of safety to the wounded and captured combatants. With the progress of civilisation, increasing constraints have been placed on the application of force by nation-states, whether in war or otherwise. The more mature democracies are now bound by formal codes of conduct, which put under scrutiny all applications of force. Air power, because of its spectacular and more visible nature, comes in for more than its fair share of criticism, even when genuine mistakes are made. The civilian political leaders are more than aware of the negative impact that collateral damage can play in a world shrunk by information technology. It would, therefore, be safe to assume that the application of air power by nation-states in the future would be under rigorous legal constraints; as a corollary, the non-state actors, though they may not have air power at their disposal, would be able to apply force at will, thereby increasing their asymmetric advantage.
- **Resources:** Air power is a technology-intensive force projection capability and, hence, has always needed more funding in comparison to other military capabilities. It is not only the initial research and development of a platform, but the subsequent acquisition and sustenance of the equipment and the professionals who man the force that require the high funding. Under such demand of funding, it can be assumed that resources will remain a constraint for the development and optimum utilisation of air power.
- **Technology and Air Warfare:** Technology has brought about a paradigm shift in the employment of air power and is crucial for its effectiveness, but the nature of air power is such that expectations will forever lead the capacity; notwithstanding the lag between technology and air power,

surprises that will translate into major revolutions in military capability, will continue to be sprung by technological evolutions. Air power, though, having gained predominance, both as a deterrent to war, and in the eventuality of war, as a devastating capability, may not be able to match the asymmetric advantage of increasing instances of terrorist related activities.

- **The Mindset:** An overarching aspect that needs to be considered in the context of future developments is the challenge of adapting the human mind and perceptions to optimise the utilisation of air power capabilities. While technology may be able to fulfill the necessary demands, even though it may be with a lag, human perceptions can be hard to overcome. The inertia of the mindset can be detrimental to the progression of concepts, especially when the changes are being brought about by cutting-edge technology. Continuous training after a sound basic education and an exposure to innovative thinking can improve the situation to a certain extent, but the natural mistrust in the human mind of any unproven or untested technology will have to factored in for it to be realistic.

The assumptions listed above are not necessarily the end-all of the assumptions, but they do encompass almost the entire gamut of extraneous influences. The explanations given above are considered sufficient for the purposes of this paper to set the scene, though each factor can be further discussed and debated at great length.

TRANSFORMING AIR POWER

Air power is a dynamic concept, but the characteristics have remained near constant from the first military use of air power; it is only the effectiveness and operational exploitation of air power that has altered with technological progress. The characteristics of air power must be understood as factors governing its effective employment, and not as positive and negative traits. They do not exist discreetly, and the application of air power is shaped and enhanced by the synergies and interactions between multiple characteristics.

Changes in air power capabilities and concepts for its employment have generally been brought about after careful thought, gradually, and after rehearsals, towards a known end-state, to be immediately followed by another cycle of change. It is for this reason that the present theories that steer air power need to be analysed before we try to comprehend the future options as a continuation of the present.

- **Awareness:** Future predictions can never be absolute, even though the accuracy of tools available to carry out future projections is far greater in the present times than ever in the past. Notwithstanding the lack of assurance in predicting the future environments, this availability does help to ensure that the thinking is more accurate. A question that may be asked is: why is improved predictive accuracy of importance? The answer to the question is that it is conducive to making doctrines more attuned to being dynamic and adaptive, which obviously is the foundation of successful application of air power in any contingency. An acceptance will ensure that air power is able to control the overall character of operations, from the strategic to the lowest tactical levels.
- **Availability of Real-Time Intelligence:** To any fighting force, the biggest challenge is to identify the targets that have to be neutralised. New technology has once again come to the rescue to facilitate the collation and dissemination of intelligence data, almost in real-time. Additionally, this facilitates the planning of further operations to engage newer targets. This has reduced the 'sensor-to-shooter' timeframe, a cornerstone of the ongoing transformation and a significant contributor to the primacy of air power in both combat and non-combat situations.
- **Reach and Precision:** Technology has also come to the aid by increasing the offensive capabilities of air power with discrimination in its lethality; the political constraint of collateral damage is near-removed through the utilisation of precision weapons. In addition to air-to-air refuelling, advances in propulsion technology have given air power unprecedented reach; this precludes the necessity of a forward base within or close to the theatre of operations.

- **Jointness:** Slowly but surely, a shift at the strategic level of military thinking towards 'jointness' is being noticed. There are many reasons for this shift from parochial, single-Service thinking and it bodes well for the capabilities of military forces. If adroitly manipulated, this shift can lead to an acceptable level of seamlessness in the future.

The blend of availability of real-time intelligence and the improved combination of effective precision with enhanced reach, leads to a compression of the decision-making and engagement cycle. The robustness of a decision-making system at a pace faster than that of the adversary is a primary input for victory at any level of operations. Specific air power capabilities are heading towards this direction and in the future will enable commanders at all levels to achieve domination of the 'sensor-decision-shooter' cycle.

NATURE OF FUTURE WARFARE

Warfare has entered a new era with national security having gone beyond the traditional concept of safeguarding one's own frontiers from incursions. The fallout of globalisation of the economy has been that the security imperatives of all nations have grown beyond geographical boundaries. New paradigms have imposed themselves on the concept of ensuring security, with an emerging environment defined by multiplicity of threats, far more complex, diverse and non-linear. With the passage of time, the challenges that a nation faces are only going to increase in complexity and intensity; conflicts over resources, including oil and water, and deeply rooted differences based on ethnicity, religion, nationalism, and ideology can flare up with state and non-state actors using conventional and asymmetric means. The emerging security challenges can be broadly grouped as under.

- **Traditional Threats:** Traditional threats are those posed by the conventional defence forces of an adversary. An attack by the conventional forces is tantamount to declaration of war, even if instances of legal declarations are reducing in recent times. Within the international community of nations that share diplomatic and other relationships,

The proliferation of high technology weapon systems and their affordability, while assisting the military forces of all nations to improve their efficiency, is also facilitating their availability to the adversaries. A cyber attack is no longer a piece of science fiction but a reality.

the chances of such a situation developing are low, perhaps, even remote. From a military perspective, the traditional threat by the conventional forces of an adversary is dominant in capability development and force structuring; the likelihood, however, is reducing day by day. Conventional air, land or sea attacks are not likely to be conducted against a developed nation and even if such an attack were carried out, the effect would be minimal, leading an adversary to opt for asymmetry.

- **Asymmetric Threats:** The conventional military capabilities possessed by the developed nations are such that a weaker opponent would be foolish to use its conventional forces for an attack; this has led to the beginning of asymmetric warfare. The disparity between the 'haves and have-nots' has grown with the advances of technology, and security challenges can, therefore, be expected to emanate from non-state actors, including terrorist and guerrilla groups. The aim of such adversaries would be to use the terrain, including urban centres, to their advantage and attack the clear demarcation of battle-lines, targets or even combatants. Such asymmetric conflicts are only likely to increase in the future and conventional forces would be more vulnerable when under such an attack.
- **Disruptive Weapons:** The proliferation of high technology weapon-systems and their affordability, while assisting the military forces of all nations to improve their efficiency, is also facilitating their availability to the adversaries. A cyber attack is no longer a piece of science fiction but a reality; it is not difficult to imagine such an attack on the network of conventional forces to neutralise them for a given period; communication jamming is perhaps even simpler and more affordable. A viewing of the Hollywood thriller, "*Die Hard 4.0*" clearly shows the damage

that can be inflicted through a cyber attack. Emerging technologies include breakthroughs in sensors, biotechnology, miniaturisation, information technology, nano-technology, directed energy and non-lethal weapons. Currently, these technologies may present the least likely threat, but the easy availability to rogue elements must be included and catered for, in all future planning.

During the Cold War, a nuclear holocaust was considered the most dangerous, but least likely, as only the two superpowers possessed such capabilities; the current challenge, on the other end of the field, is the high likelihood of rogue elements obtaining rudimentary, yet functional WMD.

- **Weapons of Mass Destruction (WMD):** These weapons can also be termed as devastating weapon systems. During the Cold War, a nuclear holocaust was considered the most dangerous, but least likely, as only the two superpowers possessed such capabilities; the current challenge, on the other end of the field, is the high likelihood of rogue elements obtaining rudimentary, yet functional WMD. A response to such a challenge may not always be possible through military action, since there would be no assurance of their destruction. Under these conditions, only diplomatic and deterrent pressures can work, which only a few of the more powerful nations can achieve. The international community has to work together to curb such proliferation and keep this serious challenge under check.
- **Natural Disasters:** Natural disasters do not fall under the traditional definition of security challenges, yet military forces have to possess the capability to be able to respond to such situations, as has been demonstrated from time to time. These can pose security challenges by the sheer devastation caused and the further repercussions of delayed or inadequate relief to the affected population. Military forces, notwithstanding the availability of dedicated rescue and relief organisations, are arguably the best suited to face such emergencies, because of their training and equipment and ability to work as a cohesive team.

Each of these categories can have a bearing on the other, the degree of influence depending on the circumstances and environment of the emerging trial. The spectrum is vastly spread with the possibility of a traditional challenge with irregular and disruptive capabilities playing a small role on the one end, to an emerging challenge that has just the opposite—a predominance of irregular and disruptive content and a near absence of traditional challenge. The future may, thus, demand capabilities that focus on how an adversary may fight rather than specifically on who the adversary is or where a fight may occur.

An attempt to neutralise the preponderant military capabilities of the developed world is more likely to be through asymmetry. Cyber attacks, not just on military networks, but on all aspects of national infrastructure vital to the economy, can be expected to increase; the possibility of rogue elements attempting to neutralise space assets cannot be ruled out and have to be catered for, for such attacks, if well coordinated, can be disastrous to any military operation. Hence, such security challenges demand a very balanced and flexible response from national military forces, compounded by traditional forces having to resort to irregular or disruptive strategies.

The only military response possible to foil such asymmetry is through long-range coercive strikes, coordinated among the land, air and maritime forces; the omnipresent characteristics of air power to be able to respond swiftly, with lethality at long ranges, make it a dominant and decisive factor. Hence, air power application would have to be factored in a strategic manner to achieve quick and dynamic results. The primacy of air power will continue even while undertaking operations at the lower end of the spectrum; only air power, or land forces aided by air power and space-based assets can effectively deny success to the adversary.

Future conflicts will have some common characteristics, which will be further emphasised with the passage of time. They will erupt abruptly, but the intensity and tempo associated with conventional warfare will only last for a short duration. The conflict is, thereafter, likely to degrade into a long-drawn campaign of attrition and testing of the will of the more conventional protagonists. The asymmetrical opponent is likely to gain

the initiative through the element of surprise by choosing the time and place of a confrontation. It is only air power, or ground forces aided by a combination of air power and space power, that can effectively deny time-space expansion, so vital to the survival of such an adversary.

UNIQUENESS OF AIR POWER

Air power characteristics have remained near constant since its first employment in operations; it is only the effectiveness and operational exploitation of air power that has altered with technological progress. It, therefore, would be apt to discuss the uniqueness of air power that makes it a primary choice in any kind of warfare.

Air power has the capability to cater for the rapid changes occurring in the challenges to national security through its flexibility to adapt to the emerging situations, within the context and given timeframe. The primary thrust for air power has been, and should continue, to be able to provide uninterrupted battle space dominance, defined in terms of time and space. In order to provide such dominance with persistence, the weapon platforms would necessarily have to be a healthy mix of manned and unmanned vehicles. The contribution of the Unmanned Aerial Vehicle (UAV), both in the armed and unarmed roles, in achieving and maintaining dominance in the battle space, is cost-effective as opposed to the manned vehicles and hence, has made it a part of a well-conceived force mix.

In combination with the platforms, the weapons themselves have to undergo positive changes to be effective. The use of precision weapons has come to be expected, notwithstanding the high cost, as collateral damage has to be kept at a minimum. With precision, the dependence on mass or numbers is reduced, while the option of the use of non-precision weapons or weapons in numbers to destroy a target, continues to be available. There are other non-kinetic weapons being tested and non-lethal solutions are also on the drawing board. Although the use of such weapons is likely to be shrouded in debate due to the legal issues on their use and possible objections by human rights activists, a pragmatic view has to be taken to include them in the arsenal, with their availability and affordability being the only restrictions.

Apart from the principal contribution of air power to provide persistent battle space dominance through rapid and effective response, two other enabling capabilities also need to be well honed, namely, network centricity and utilisation of space. It has been aptly demonstrated in the conflicts of the last two decades or so that the efficiency of a force is, almost completely, controlled by shared situational awareness provided by secure data-transfer techniques and procedures. In order to reduce response time as a counter to surprise, data-transfer redundancy and a high rate of transfer, to achieve near real-time capabilities, are essential. The network, connected to space-based assets, has already become the 'eyes and ears' of deployed military forces all over the world with increasing dependence; the importance of the network as the backbone of the communications system cannot be overemphasised to be provided the highest security.

There is a subtle shift in the way air power is now viewed, as compared to about two decades ago. In the 1990s, the emphasis was on the aircraft, its inherent capabilities and the technology that enabled it. In the last decade, the accent shifted to weapons, with the delivery platform being considered secondary. The current trend indicates that the attention from weapons is shifting to demanding a desired effect rather than the wherewithal for it to do so. From attrition-oriented warfare, the concept is changing, with physical destruction of targets being replaced with the dual concept of strategic control and functional paralysis. The aim behind this shift is to isolate the Command and Control (C2) structures, augment psychological warfare and strike deep into the adversary's territory to paralyse his centres of gravity. Air power, in essence, has become a form of war with the advantage of high mobility, adequately supported by technology, to get the better of the adversary without spilling too much blood.

A CHANGE IN AIR POWER ROLES

Traditionally, the primary role of air power has been to gain and maintain air superiority. Having achieved this, it is normally pushed into a support role, providing firepower and other support functions to maritime and land forces. If air power is to genuinely create effects, as is being asked from

it, the current roles will also have to be given a boost to conform to this paradigm. Until some years ago, air power did not have the capability of precision with an acceptable assurance in surface attack missions; it was not able to stay over target areas for too long, nor was it able to provide the rapidity that has today become a necessity. Adept use of cutting-edge technology has almost eliminated these lacunae to an extent that air power today has become the primary instrument of choice in waging any type of war. Under these circumstances, the evolving roles of air power could be listed as follows:

- Control of the air;
- Strike;
- Airlift;
- Enabling operations; and
- Environmental air control.

Control of the Air: Control of the air, quantified in time and space, as well as in varying degrees of dominance, is an absolute essential for the successful culmination of any military activity. This has been the *raison d'être* for air forces for almost a full century. There is an undeniable interdependence of the strike role and the quest for control of the air. Though most strike operations will be dependent on an acceptable air superiority situation for their success, operations aimed at gaining control of the air can be listed as a major priority in any campaign. In some cases, independent strikes with limited control of the air can be executed with a combination of stealth, state-of-the-art self-protection technology with the backing of sufficient situational awareness, provided by adequate real-time information; such a combine can provide a fair degree of safety assurance for the strike platform. Notwithstanding the technology available, one cannot be carried out without the other and therein lies the question of prioritisation. It, therefore, would be correct to state that both have an equal and determinate role to play in the efficient employment of air power towards the achievement of national objectives.

Lack of precision that necessitated the use of a large number of air-delivered weapons on a target to get a high degree of assurance of damage or destruction, can today be addressed by accuracy that was probably unthinkable even at the turn of the century.

Two factors are underlined for the achievement of success in an air superiority campaign. First, in an air force with limited assets, control of the air will always have to be calculated and measured in terms of time and space. Asset allocation would also have to be balanced to meet the three requirements of the initial days of the war, namely, air superiority leading to control of the air, Suppression of Enemy Air Defences (SEAD), and strike; these form sub-sets within the primary roles of control of the air and strike. To achieve eventual success in the operations, where juggling of resource allocation has to be resorted to due to the limited resource availability, one cannot advocate the application of any 'thumb-rule' and it would be up to the authorities to exercise caution, judgement and discretion.

The second factor important to achieving success in air superiority operations is the security of own assets and availability of air bases. While availability of air bases away from one's area, that is to say, having an air base in another allied nation, is more a matter of politics, the security of these bases and own bases is a matter of concern. Both availability and security, therefore, are to be ensured prior to launching an air campaign.

Strike: This role, as mentioned above, is interdependent with the quest for control of the air. Three modern traits have given the strike role predominance in air power, namely, reach, payload and precision. A negative aspect in the past that affected strike capabilities was that of limited range, which, in turn, had an effect on the load carried and the requirement of adequate basing facilities in the near vicinity of the theatre of operations, thus, degrading the assurance levels for success. Technology, in the form of long-endurance platforms and Air-to-Air Refuelling (AAR), has mitigated the adverse effects of the shortcoming. Today, sufficient AAR capabilities are an indicator of assurance of the reach of air power to any distance, while operating from the safety of own bases.

Technological improvements have also increased the effects of a certain weight of attack; this too has resolved the issue of restricted payload carrying capacity that had harassed the planners of strike forces in the past. A target that would have needed multiple strikes for it to be neutralised, can, today, be attacked with a single weapon. The era of 'carpet bombing' is also over due to technology providing the necessary precision to the weapons as well as the platforms. Lack of precision that necessitated the use of a large number of air-delivered weapons on a target to get a high degree of assurance of damage or destruction, can today be addressed by accuracy that was probably unthinkable even at the turn of the century.

It is extremely important to possess the capability for an immediate airlift to respond in times of natural calamities, or terrorist attacks; such a quick response may achieve strategic effects of its own.

With these three drawbacks resolved to a very large extent, air power is now capable of covering the entire spectrum, from the strategic to the tactical, thus, giving it versatility and providing the decision-makers a force for first consideration that can deliver with inherent flexibility and lethality. In the days to come, air power is likely to possess another capability, through cutting-edge technology, that of using the Electro-Magnetic (EM) spectrum as a part of the larger strike role. Invasive intrusion in the EM spectrum is emerging as a powerful and effective weapon to achieve the necessary results to gain enough prominence for it to be included as a sub-set of the strike role.

Airlift: From a purely theoretical perspective, airlift is one of the prime movers in providing the force with the capability of simultaneous ingress for concurrent operations into a theatre and subsequent sustainment. The importance of airlift as a mainstay ability has varied with time, but today, adequate capability is undoubtedly required within a force to provide an overall quick reaction. This responsiveness is perhaps more important to the land forces at the commencement of operations.

One of the most important functions of airlift in the developing tactical situation is its synergy with special operations, which cannot be successfully

completed without adept airlift capabilities that can be brought to bear upon the adversary, in a reliable and steady manner. At the tactical level, airlift provides the special forces with increased speed of response, thereby largely controlling the overall pace of the operations.

Airlift capabilities, provided by either fixed-wing or rotary-wing aircraft, tactical or strategic, are also an important component of air power in Operations Other Than War (OOTW). It is extremely important to possess the capability for an immediate airlift to respond in times of natural calamities, or terrorist attacks; such a quick response may achieve strategic effects of its own. The importance of airlift is underlined with the current trend of nations to be involved in operations away from their own mainland because of redefined security perceptions initiated by rapidly changing geo-political scenarios.

Enabling Operations: All operations that enable and support the effective employment of air power come under this generalised caption. This would include Air-to-Air Refuelling (AAR) missions, which provide the focus on reach and persistence; early warning and control activities, be they air or surface-based; information operations, including collection, collation and dissemination of relevant information; and reconnaissance.

Increasing instances of irregular threats have ensured that this role is now a part of the larger non-kinetic strike role that air power can be called to undertake. The latest technology permits identification of targets well outside the envelope of weapon release and provides intrusive information to the land forces in complex and deep urban environments. This expansion of tasking of air power in support of the ground forces is a relatively new niche capability that is becoming a sub-set of the offensive air support role to the ground forces.

For future operations, knowledge management is another necessity and the use of air assets in large numbers for the task cannot be ruled out; it is in this area that space-based assets are increasingly displaying their ascendancy. All force projection capabilities are becoming increasingly dependent on space operations, and the trend is only likely to be more evident in the decades to come. The omnipresence of space- based assets

has permeated the conduct of all operations, be they by a single Service, joint or coalition forces. The reliance on space has huge advantages, but the availability, or non-availability, of such assets needs to be factored into the planning process. For the not so technologically competent forces, space capabilities are available commercially and such availability is only likely to increase in the future; however, the issues of high costs, the reliability of information provided in times of operations and the required redundancy, may be deterring factors for nations with small economies.

Here too, resource limitations will force the prioritisation of various factors to determine the asset availability for a particular enabling operation. As a result, there is a need to balance the force projection capability with force protection and enabling experience and expertise. The balance cannot be specified since the requirements would vary as per situation, the most influential being in the context and theatre of operations.

Environmental Air Control: The Chief of Staff of the Israeli Defence Forces, Gen Dan Halutz, the author of this term, is quoted in an article, "Israeli Air Force Seeks Expanded Anti-Terror Role", in the *Defence News*, dated March 28, 2005. Environmental air control, he says, is a dynamic and evolutionary role that meets the requirement of a complex and fluid challenge posed by low intensity conflicts and insurgency. While high intensity conflicts would normally be of short duration, there could be low intensity conflicts that could test the resilience of any regular military force. Under such circumstances, air power could be a decisive factor in containing low intensity conflicts, especially in the urban environment.

The most noteworthy part that air power can play in these trying conditions is the ability to see, understand and strike more rapidly, thus, maintaining a broader perspective. Such operations, to be successful, must have flawless coordination between intelligence agencies to ensure accuracy of the threat scenario in entirety. What the commanders need to keep in mind is the dynamic nature of the threat and, hence, constantly review and refine the concept of operations to neutralise the threat.

There are three distinct advantages in employing air power to counter insurgency, terrorism or infiltration situations. First, it provides relief to the land forces from the burden that is almost fully carried by them currently. Second, it can assist in overcoming international opinion and legal implications of the presence of land forces in disputed areas. The concept of "boots on the ground", while credible in a regular war, can have a negative effect in cases where their detection itself could lead to an intensification of conflict. Finally, and conceivably the most crucial advantage is the ability of air power to interrelate strategic and tactical contexts and produce timely effects in consonance with the emerging situations. Refinements of strategy and tactics, as well as increasing awareness of the advantages that air power brings to very complex and unclear conflict situations, is important to ensure the effectiveness of such applications. In such circumstances, the decision-makers and commanders must take care while sanctioning the employment of air power against irregular warriors, who may be one's own citizens, and sections of whom may be fighting as a part of the land or air forces.

CHALLENGES OF THE FUTURE

In a dynamic environment and an equally dynamic capability, the future will always be cloaked in a haze of the unknown and unforeseen. Irrespective of the competence growth and greater understanding of the effectiveness and potential of air power over a wide range of activities, there would always be challenges to be faced, some intimidating and overwhelming, some minor and yet unsettling.

Considering the present geo-political setting in the world, any eruption of a crisis that warrants the use of force, will be random in its character and timing. The corollary, therefore, for air forces is that the preparatory time would be limited and inadequate. Since one of the primary characteristics of the employment of air power is rapid mobilisation, such a situation puts added pressure on existing capabilities. Under such conditions, the challenge that faces the planners and strategists alike, is the absolute need to fine-tune the process of force modernisation and development. High-end technology takes time to develop and refine; this increases the period to

field new operational capabilities with revised doctrines. This is especially applicable to air power since gestation periods are long for new acquisitions or a revamp of equipment, training and operational capability, hence, cannot be done while 'on the move'.

Technology, that promises a robust performance, has to be thoughtfully selected, despite the uncertainty surrounding its development and the flexibility required to accept and adapt to it, to produce the desired effect. Training, aimed at achieving such flexibility, can become a major issue and can consume unwarranted amounts of resources; hence, a fine balance is warranted between training with the new technology, and adhering to the existing doctrine, to mitigate the challenge to whatever degree possible.

With continuously evolving technology, the gamut of command and control is emerging as an independent entity with innumerable inputs. There is already usage of artificial intelligence to filter these inputs to the command and decision-making cycles, as the process is getting more complicated by the day. Future commanders are likely to face major complexities within the command spectrum.

- To be able to utilise the available spectrum of Intelligence, Surveillance, Reconnaissance (ISR) and communications systems in totality in a war-winning manner, commanders will need to have in-depth knowledge, not only of the human factors, but also the systems employed. The important requirement of understanding the system issues is an indication that future commanders would be trained combatants with considerable technological knowledge and training, in other words, a 'techie-combatant'.
- Another complexity that the future commander is likely to face is the matching of human and artificial, or machine intelligence, to condense the executive cycle. To achieve this effectively, in a world of high-end machines, it would be necessary to understand and establish a clear framework to merge the human in the decision-making chain; a process easier said than done.
- The prevailing Law of Armed Conflict does not refer to the use of artificial or machine intelligence inputs in decision-making, and the

The shift in focus to effects-based operations has called for a need for optimisation of the roles of the available assets while ensuring an improvement of multi-role capabilities.

results thereafter, of subsequent actions based on such inputs. Today, there is widespread condemnation of any military action that causes collateral damage, even if the military or the country claims legitimacy of such actions; the risk, with increasing use of artificial intelligence, will only amplify in the years to come. The use of such combinations has, therefore, to be understood from the legal and political angles.

The most sought-after air power application is its unsurpassed capability for rapid response with the means of delivering destructive and demoralising firepower at the forefront of force projection. Airlift is at a close second in bringing the land and other support forces to the front, at a speed better than any other mode. Then, where is the challenge? The challenge lies in balancing the rapidity of response with the weight and usefulness of the deployed force. The speed of response and enhanced reach have to be tailored to ensure adequate persistence as a built-in feature; persistence will be affected by the availability of heavy lift resources for follow-on actions, which, in turn, affect the power-projection capabilities. Depending upon the circumstances, such airlift would have to be tactical or strategic, and, hence, the accent on the need to possess heavy airlift capabilities. Resource constraints and concept of operations, some of them outdated, have made heavy lift capability a part of the wish lists, rather than actual capability, thus, making availability and adequacy a challenge.

There is an indicator of a change in strategic thinking and planning, wherein the effects are of concern rather than the weapons or the platforms employed. The shift in focus to effects-based operations has called for a need for optimisation of the roles of the available assets while ensuring an improvement of multi-role capabilities. This shift is dictated by political requirements where air power is expected to deliver a range of effects, with a proportionate use of force, while avoiding or minimising collateral damage. The challenge, therefore, will be to ensure timely delivery with

a combination of precision and accuracy. Air power, therefore, will be severely under pressure to create such capabilities with a high degree of reliability, without which, its employment may become debatable.

Technology has brought information availability to prominence, on which Situational Awareness (SA) is dependent. Superiority in information processing, in an offensive and defensive mode, is the best way to ensure that one's own SA remains superior to that of the adversary. Information warfare and 'information in warfare' have already reached revolutionary implications for military planning and operations. In recent times, however, there are many commercial assets, available off the shelf, to anyone willing to pay the cost; this makes it extremely difficult to maintain the necessary information superiority over the adversary. The requirement, hence, would be to rely increasingly on flexible and affordable space-based assets for reactive surveillance and information dissemination.

In communications, the lack of bandwidth is another challenge to the military forces that is likely to continue for some time to come; the availability of a dedicated bandwidth, exclusive for the use of military forces is a viable option to ensure superior SA.

Space is, perhaps, the most difficult dimension for non-state actors and smaller forces to gain access to, because of the high costs and technological advancements. The use of space, hence, will provide the necessary edge that is so essential in information management to ensure SA to own and friendly forces. Under certain conditions, the High-Altitude-Long-Endurance (HALE) unmanned aerial vehicle is proving itself as an alternative to the requirement of continuous surveillance and assured communications from space. In communications, the lack of bandwidth is another challenge to the military forces that is likely to continue for some time to come; the availability of a dedicated bandwidth, exclusive for the use of military forces is a viable option to ensure superior SA.

It is a proven fact that air superiority is an essential condition for the success of any campaign in any of the three dimensions. Control of the

third dimension can be challenged by asymmetric attacks on the support infrastructure in a manner to make air power unavailable for a speedy response; the attacks can be directed against the launch bases, supply lines, or against the air power assets themselves. The challenge, therefore, is to keep all assets secure against attacks: this need not necessarily be with conventional weapons—they can be nuclear, biological, chemical or cyber. The complexities of keeping the assets secure are further compounded by the fact that non-state adversaries and other smaller forces can easily make the employment of air power difficult through asymmetric operations. This vulnerability, hence, needs a constant vigil to give an assurance of achieving air superiority.

DO WE NEED A DOCTRINAL CHANGE?

This question can be answered by asking another question. If after the envisaged change in the roles of air power vis-à-vis the future security challenges, which are based on certain assumptions, can we continue without a doctrinal shift? Air power characteristics will continue to evolve in a comprehensive manner by combining two or more traditional roles or characteristics. Since the characteristics would then envelop a larger spectrum in the effects that they could create, their applicability would also increase. For an appraisal of the qualities that make the basic contribution of air power so significant in modern warfare, there is, therefore, a definite need to have a second look at the current doctrine, even if it is in a non-specific approach.

In any campaign, the primary contribution of air power has always been control of the air and support to the ground forces, whenever called for. A change, however, has taken place and will continue, as technology leaves an indelible impact on air power operations, especially in the refinement of precision strike capabilities. Precision contributes directly to the achievement of the desired effect with high probability. Combined with reach and speed and the capacity of air power for launching concurrent operations due to a three-dimensional perspective, the die-hard advocates of 'conventional' air power have to, therefore, also accept the need of a doctrinal shift.

With a change in the thinking about utilisation of air power, the overall war-fighting machinery would also have to undergo a doctrinal change. This would have to be at the highest level and perforce filter down to the lowest tactical level and may even have an effect on the basics of application of force. These changes would need to be carefully tracked for a meaningful interpretation and the general benefit of the entire force.

CONCLUSION

The nature of war has been changing. The transformation is likely to continue in fundamental ways, largely due to the effects of technological innovations and developments. However, the foundations and principles for the use of combat forces are not likely to change dramatically. More than normal focus on the so-called Fourth Generation Warfare, or asymmetric warfare, has tended to deemphasise the challenges and threats in traditional force-on-force warfare. Notwithstanding, effective application of all, or a combination of, air power capabilities to operations, will not only constrict the adversary's freedom of manoeuvre, but also degrade his combat potential in an exponential manner.

Air power will be the forerunner of force projection capabilities because of its inherent characteristics that have been technologically enhanced. Despite its limitations and the challenges it is likely to face, when viewed with a holistic perspective, it provides a cost- effective option in almost all situations, provided it is employed correctly, and with understanding.

In a future that is uncertain, one that will see increasing political intervention and legal constraints on the application of force, air power will be the viable and readily available option for the imposition of international will on errant, inflexible and non-compliant nations or groups. Continuing developments in technology will assist this evolution at a pace that, at times, may leave behind doctrinal and strategic thinking. Air power is essentially a technology-intensive and technology-driven capability and, hence, its sustenance will depend on the levels of technology-absorption within a nation. This, in turn, would depend upon the education and industry that a nation possesses.

The future is uncertain and will remain so, for some time to come. For a military force to be effective, it is necessary to comprehend the emerging nature of war and all the political, legal and resource constraints. The threat scenario that would have to be faced is complex, with no easy solutions. Air power has the capability of responding to such complex situations only if it is carefully balanced and adequate resources are made available. The leadership, military and political, that will deliver the desired output has to be aware to be effective and its importance cannot but be emphasised.