AEROSPACE POWER IN THE TWENTY-FIRST CENTURY AND CHALLENGES FOR THE INDIAN AIR FORCE

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Introduction

No vision of twenty-first century Indian national security can be complete without factoring the significance of the elements of air, space and cyberspace. Surrounding the earth in its entirety, only air and space afford fullest and most rapid mobility with truly global range, capable of operating above any part of the earth's surface – land or sea – unconstrained by the barriers of geography.[1]

Aerospace power, defined as the ability to project power from the air and space to influence the behaviour of people or the course of events,[2] is expected to dominate the security environment in the 21st century. However, in order to achieve this pre-eminence, aerospace power would need to adapt and develop to tackle a broad spectrum of threats extending from the high to the low end, from conventional wars against nation states to irregular warfare to counter non-state actors. Flowing from this threat analysis, strategic and perspective planning issues such as force structure and modernisation priorities across the spectrum of contingencies need to be considered. Aerospace power would also invariably need to operate in an increasingly joint environment and this would demand greater networking not only within the air force but also with the other armed services. The Indian Air Force (IAF), is the fourth largest air force in the world, is in a transition phase and undergoing a major modernisation program. Hence, it is important to examine the growth path that needs to be adopted by the IAF taking into account factors likely to define aerospace power in the 21st century while ensuring that national interests are kept in the forefront and dynamics of the region suitably factored.

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[1]*The Institute for Foreign Policy Analysis, 'Air, Space and Cyberspace Power in the Twenty First Century', 38th IFPA-Fletcher Conference on National Security Strategy and Policy, 2010, p vii.*
[2]*British Air and Space Power Doctrine (AP 3000), Fourth Edition, 2009, available at www.raf.mod.uk/rafcms, (accessed on 12 Dec 2013).*

Technology and its Diffusion

The advances in technology have meant that the effects of aerospace power have increased manifold since the invention of the aircraft. The battlefield of the future is likely to be more lethal as combatants take advantage of commercially based navigation aids for precision guidance and advanced weapons systems. In addition, global and theatre boundaries will tend to blur with longer range missile systems becoming more common in enemy arsenals.[3]

While these technologies will enhance the capabilities of air power, their proliferation among non state actors will put the countries at greater risk. Non-state entities such as Hezbollah have in the past used advanced missile systems to target state adversaries.[4]   Hence, the possibility of insurgents in J&K or the elements of Left Wing Extremism (LWE) procuring such weapons would need to be countered and this could possibly require in the foreseeable future the intervention of the IAF.

Spectrum of Threats

While the conventional threat posed by nation states will remain, the challenge posed by asymmetric warfare waged by non-state actors is likely to become more prominent in the present century. There is a strong possibility of the emergence of failed or failing states in India's neighbourhood unable to control their territory. Therefore, the security environment in which the armed forces, including aerospace power, would operate will become increasingly complex with a wide array of actors. With an increase in the asymmetric threat intensity, there would be a requirement to use airpower to counter the same. Examples already exist in the form of the British intervention in Ireland, the Soviets in Afghanistan and Chechnya, and Indian Peace Keeping Force (IPKF) operations in Sri Lanka.[5] However, employment of airpower in such scenarios today will pose a number of challenges and would entail operations in difficult terrains including urban areas where the requirement would be to minimize collateral damage. Use of aerospace power for the spectrum spanning conventional operations to

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[3]*The Institute for Foreign Policy Analysis, 'Air, Space and Cyberspace Power in the Twenty First Century', 38th IFPA-Fletcher Conference on National Security Strategy and Policy, 2010, p 7.*
[4]*Ibid, p 7.*
[5]*Lt Col R Ghose, 'Air Power in Sub-Conventional Warfare in the South Asian Region: Past Lessons and Future Trends', Journal of Air Power and Space Studies, Vol 5 No.1, 2010, p 3.*

asymmetric warfare against non-state actors would thus require a re-orientation in terms of the capabilities to be acquired.

Joint Operations

Across the world there has been a perceptible shift in the understanding of the concept of 'jointness' at the strategic level of military thinking. The reasons for this move away from parochial and often sub-optimal single-service thinking are many, the least of which being the clear 'writing on the wall' that no individual service capability can prevail and win over even a minimal enemy except under certain conditions.[6] There is a need for military forces to be able to project a joint capability in order to maximise the efficiency of the whole. While it is patently clear that the ground forces are crucial to victory in war, there is a need to remember that air (and space) power, operating as it does in the third dimension, is capable of achieving strategic effect independent of other forms of military power.[7] Hence, there is a need to build capabilities that allow for seamless integration of joint operations among the three services.

Intelligence Fusion

The biggest challenge that faces the application of air power is to identify targets that have to be eliminated or neutralised in order of priority. This becomes a greater imperative when applying airpower to counter an asymmetric threat in an urban environment. Technology has once again helped to shorten the sensor to shooter cycle and the ability to rapidly fuse information from varying sources enables the conduct of time-sensitive targeting.[8] This aspect is a cornerstone of the ongoing transformation and contributes directly to the increasing primacy of aerospace power in both combat and non-combat situations.

Space Dominance and Cyber Warfare

Space is increasingly becoming a contested domain with a growing number of actors and the potential for kinetic and non-kinetic attacks, Anti-

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[6]*Sanu Kainikara, 'Air Power in the 21st Century: A Snapshot of Emerging Roles and Future Challenges', Air Power Development Centre of the Royal Australian Air Force, 2005, p 4.*
[7]*Air Cmde (Retd) Jasjit Singh, 'Winning the Next War-Jointly', Journal of Air Power and Space Studies, Vol 2 No. 4, 2007, p 15.*
[8]*Sanu Kainikara, op. cit., p 5.*

Satellite (ASAT) weapons, Electro Magnetic Pulse (EMP) and jamming.[9] In addition, space-based assets are crucial for networking, improved communications, intelligence, surveillance and reconnaissance.[10] These attributes become increasingly important for network centric operations and developing of battle space dominance. Real-time intelligence and surveillance will also be critical for countering the actions of non-state actors in a dense urban environment. There will be a requirement to protect vital space-based platforms and networks by reducing their vulnerability to attack or disruption and increasing the country's resilience should an attack occur.

Cyber warfare has become a major security challenge. National and defence networks are susceptible to exploitation and attack with potentially serious national security consequences. Time and distance become essentially irrelevant because cyber war can be conducted across global distances in milliseconds. Such attacks can also spread quickly among networks, making it extremely difficult to trace source and perpetrator and also take retaliatory action and, therefore, to develop a deterrence strategy. It may become necessary to reconfigure command and control networks to ensure an unbroken, flat chain of command that is more resilient and dependable in an increasingly degraded environment resulting from cyber attacks. In addition, there will be a requirement to dominate cyber space in order to dominate air, land and sea domains.[11]

CHALLENGES FOR THE IAF AND WAY AHEAD

The IAF will have to take into account the dynamism of the challenges to national security and remain flexible in adapting to emerging situations within the context and available time-frame. The primary thrust should be for the IAF to be able to provide consistent battle-space dominance. In order to provide such dominance, the weapon platforms required would necessarily have to be stealthy with a judicious mix of manned and unmanned platforms.

Capability Building vis-à-vis Threat Perception

The IAF has formulated its Long Term Perspective Plan (LTPP) and plans

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[9]*The Institute for Foreign Policy Analysis, 'Air, Space and Cyberspace Power in the Twenty First Century', 38th IFPA-Fletcher Conference on National Security Strategy and Policy, 2010, p xiv.*
[10]*Air Mshl Vinod Patney (Retd), 'Roles and Missions of the Indian Air Force-2032 AD', Journal of Air Power and Space Studies, Vol.2 No.4, 2007, p 49.*
[11]*Air Mshl Vinod Patney (Retd), 'Roles and Missions of the Indian Air Force-2032 AD', Journal of Air Power and Space Studies, Vol.2 No.4, 2007, p 53.*

to induct a number of assets across the entire spectrum in order to fill existing gaps in force structure as well as to become a more potent aerospace power. IAF's modernisation plan aims to sustain and enhance its operational potential and consolidate the specified force levels through judicious and cost-effective replacements and upgradation of existing resources.[12] The IAF needs to induct capabilities vis-à-vis future threat perceptions within the spectrum of employability of aerospace power. Therefore, conventional capabilities would need to be built up in order to achieve deterrence against China which would automatically cater to the threat posed by Pakistan. The IAF would require development/induction of suitable technologies for effective air-to-ground attack in the mountains, given that India's disputed territories for the most part lie in the Himalayas.[13] In order for troops to operate for prolonged periods in austere environments, greater force protection, logistics and both intra-theatre as well as inter-theatre lift are needed.

The other areas in which the IAF would need to concentrate include increased networking and secure communications for single service operations as well as for greater integration with the Army and Navy. Efforts need to be made to acquire/develop stealth technologies in the face of increasingly sophisticated enemy integrated air defence environments and these could fructify with the induction of the fifth-generation fighter aircraft. At the same time, cutting-edge electronic warfare will be a key enabling capability across the conflict spectrum.

There is also a need to focus on capabilities which would be required to counter the increasing threat posed by non-state actors such as terrorists in J&K, North-East and now Left Wing Extremism (LWE). Use of airpower in such cases would be done as a last resort and after careful deliberations. However, air power can play an important role in terms of real-time intelligence through reconnaissance and surveillance which can be critical for the force commander on the ground to interdict the elements acting inimical to the interests of the state. High-fidelity target identification and discrimination enabled by advanced radars and directed-energy systems, including the ability to find, track and target individuals in dense foliage or within a crowd, will provide battlefield commanders with improved options and new opportunities for leveraging joint

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[12]*Air Chief Mshl Fali H Major (Retd), 'Indian Air Force in the 21st Century: Challenges and Opportunities', Journal of Defence Studies, IDSA, Vol. 2 No. 1, 2008, p 24.*
[13]*Wg Cdr V Kapur, 'Challenges for Indian Air Force: 2032', Journal of Defence Studies, IDSA, Vol-7, Issue- 1, 2013, p 98.*

assets. Procurement of precision and non-kinetic weapons, low-yield directed energy weapons capable of precise targeting and controlled destruction would be required so that the same can be used when the situation so demands with minimal collateral damage.[14]

Manned Versus Unmanned

The presence of Unmanned Aerial Vehicles (UAVs), when introduced as part of a well-conceived force mix, will provide the required staying power to ensure persistence, and in the long term may also prove to be cost-effective as opposed to a fully inhabited force achieving the same effect.[15] These UAVs will have to be both armed and unarmed versions used for a number of different roles contributing centrally to the dominance of the battle space. This view is reinforced when one considers that no development work is being undertaken in either the US or Europe on a new manned combat aircraft after the Eurofighter, Rafale or Joint Strike Fighter (JSF). While this represents the global scenario, the IAF will continue to be dominated by manned platforms in the near future. Import of Unmanned Combat Aerial Vehicles (UCAVs) will not be possible due to Missile Technology Control Regime (MTCR) restrictions.[16] Therefore, while the current focus is on acquiring manned platforms with cutting-edge technology, necessary R&D needs to be undertaken to develop armed UAVs in the near future and UCAVs in the longer run.

Net Centricity and Space

Since one primary contribution of aerospace power to obtaining persistent battlespace dominance is rapid response, two enabling capabilities will need to be well-honed—network centricity and utilisation of space.[17] In order to reduce the response time required to counter surprise, it will be necessary to improve data transfer redundancy, rate of transfer and be able to achieve real-time capabilities. This network will have to be securely connected to space assets that are already the eyes and ears of deployed military forces. Evolving into an "Aerospace Force"

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[14]*Air Chief Mshl (Retd) Fali H Major, 'Employment of Aerospace Power: Regional Imperatives for Change', Journal of Air Power and Space Studies, Vol. 4 No.2, 2009, p 5.*
systems. India is not a member.
[15]*Sanu Kainikara, op. cit., p 7.*
[16]*MTCR is an informal and voluntary association of 34 countries which share the goal of non-proliferation of unmanned delivery systems capable of delivering weapons of mass destruction. These countries have imposed export licensing measures on rocket and other unmanned air vehicle delivery*
[17]*Sanu Kainikara, op. cit., p 8.*

is thus a logical progression for the IAF. The launch of GSAT 7A will allow the IAF to use the space domain for networking as well as over the horizon control of its unmanned assets. The vulnerability of these assets and, therefore, the entire network cannot be over-emphasised. Adequate steps need to be taken to protect our present day and future space-based assets especially in view of the anti-satellite technologies being developed by China. In order to have redundancy, development of cheap micro satellites needs to be promoted by using the public-private model and exploiting the research capabilities of our academic institutions.

Capability to Deal with Out of Area Contingencies (OOAC)

India as a nation has never aspired to have expeditionary capabilities and no policy document exists on such operations. However, if India's economy and power continue to grow as projected by Jim O'Neil[18] and other Goldman Sachs researchers, India's areas of interest would progressively expand well outside the Indian subcontinent. With increasing integration of the Indian economy into the world economic system, overseas interests would become an integral component of India's national interests. In such a situation, the IAF may be called upon to take military action or deploy airpower in support of India's national interests well beyond our borders.

Air Chief Marshal Fali H Major, the former Chief of the Air Staff, had stated that: "a benign presence, or assistance to friendly nations in distress, is a 'projection' of interests that IAF would be expected to execute. This requires long-range presence, persistence, 'forward-basing arrangements' etc."[19] Such requirements would span a vast spectrum—from just Humanitarian and Disaster Relief (HADR) in aid of the large Indian diaspora across the globe, through flying in ground forces to protect our assets and investments in other continents, to application of hard military force in areas far from the Indian subcontinent. This could be a situation of our forces having to 'Fight (their way) In', do their task and then 'Fight (their way) Out' (FIFO).[20] Hence, the IAF must develop and field

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[18]*Jim O'Neill, 'Building Better Global Economic BRICs', available at http://www.goldmansachs.com/our-thinking/topics/brics/brics-reports-pdfs/build-better- brics.pdf, (accessed on 29 Jan 2014).*
[19]*Air Chief Mshl Fali H Major (Retd), 'Indian Air Force in the 21st Century: Challenges and Opportunities', Journal of Defence Studies, IDSA, Vol. 2 No. 1, 2008, p 23.*
[20]*Wg Cdr V Kapur, 'Challenges for Indian Air Force: 2032', Journal of Defence Studies, IDSA, Vol-7, Issue- 1, 2013, p 97.*

credible capability to undertake OOAC operations across this entire spectrum from pure HADR to FIFO in addition to its other more conventional tasks.

Cyber Warfare and Security

As brought out previously, the IAF will need to make rapid strides towards becoming a fully networked force able to execute networked operations. These networked operations and capabilities reside in the availability of computers and reliable infrastructure to connect them into one seamless entity. Such capabilities will, however, bring to fore new vulnerabilities. All such networks would become targets for enemy cyber attacks which could have a devastating effect on the capability of the IAF to undertake effective operations. Therefore, along with induction of cutting-edge technology, the IAF requires to devise effective means of insulating itself from the new vulnerabilities that accompany increased networking.

IAF cyberspace priorities must include developing capabilities to protect essential military cyber systems and to speed up their recovery if an attack does occur, enhancing the Air Force's capacity to provide its personnel with the necessary training and recruitment of personnel with cyber skills. The IAF should consider next generation computer network operations, firewalls and internet protocols for assured access at all times and in the face of cyber attacks launched by state or non-state actors.

Organizational Change and Joint Force Operations

A single-service approach to war fighting cannot be wished away in the near future. However, a visionary leadership, focused 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.[21]

To address growing national security challenges, increasing fiscal constraints and to become more effective, the IAF needs to adapt its organizational structure and processes to the exigencies of the information age and the security setting of the twenty-first century. This entails developing a strategy that places increased emphasis on joint operations in which IAF acts in

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[21]*Basic Doctrine of the Indian Air Force, Sep 2012, p 146.*

greater concert with the others, leverages capacities across the services without duplicating efforts and encourages interoperability. While war in the vertical dimension has to be fought and won by the Air Force by its own means, air dominance in both air-to-air and air-to-surface roles would provide enormous freedom of action for ground and naval forces.[22] Conduct of operations in OOAC will also demand greater synergy among the three services.

Academic Reorientation

An important aspect is to break free of strait-jacketed thinking to explore new ideas and connect the dots outside the box. This would require a greater academic outlook and promotion of a culture in which educational opportunities are considered essential to career advancement. There is a need to make a greater investment in post-graduate programs which would enhance the IAF's capacity to operate in a high tech environment and contribute not only to development of new technologies but most importantly support national security goals. A sincere effort needs to be made to strengthen our academic and training institutions in collaboration with other agencies from the government and private sectors.

Conclusion

The IAF must be prepared to fight wars simultaneously across the spectrum of conflict, as asymmetric warfare and major conventional operations are all likely to take place in the emerging global security environment. Hence, it is critical that acquisition of new assets be based on capability building which addresses the future security environment. The IAF needs to address issues of protection, including defence of installations, redundancy of capabilities and survivability of assets. States and other actors are increasingly empowered to wage asymmetric warfare against India encompassing potential kinetic and non-kinetic attacks such as cyber war, jamming attacks on installations and Anti-Satellite (ASAT).

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[22]*Air Cmde Jasjit Singh (Retd), 'Air Dominance and the Future of Air Power', Air Power Journal Vol 5 No.2, 2010, p 22.*

Improving joint service integration, planning and interoperability is increasingly important to combat these threats. These measures combined with an increased focus on academic pursuit will go a long way in ensuring that the IAF continues to grow and becomes a true aerospace power of the twenty first century.

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About the Author

Gp Capt Tejpal Singh, VM, was commissioned in the fighter stream of the IAF on 16 Jun 90. The officer is a Cat A2 Qualified Flying Instructor and an Experimental Test Pilot. He has over 3,400 hrs of flying on various types of aircraft including MiG 21, Su-30 MKI, Kiran, An-32 and HS-748. He has commanded a MiG 21 Bison unit at a forward air base in the Rajasthan sector. The officer is an alumnus of the National Defence Academy, French Staff College and the Naval War College. He is a recipient of the Sanjay Gandhi Memorial Trophy for being best in aerobatics at the time of commissioning and the Suranjan Das Trophy as best student test pilot during the Flight Test Course. He was awarded the Vayu Sena Medal for devotion to duty in 2011 and has been commended by the CAS in 2000 and AOC-in-C, SWAC, in 1997. The officer is currently the Chief Operations Officer of a forward air base in the Punjab sector.