AEROSPACE POWER IN THE INDIAN CONTEXT OF NATION BUILDING

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The aim of this paper is to undertake a brief overview of the prevailing and future applications of aerospace power in providing solutions to national security objectives in the larger process of nation building. In the contemporary dynamic environment, it is essential to have a clear understanding of the attributes, limitations and potential of air power so as to enable its optimum exploitation in furthering national objectives.

ROLE OF AEROSPACE POWER IN INDIA'S NATIONAL DEVELOPMENT

AEROSPACE POWER AND NATION BUILDING

India's general environment is a complex amalgam of its history, geography, culture, politics, etc and, consequently, its security environment is equally complex. The security challenges facing India are varied, complex and dynamic. At the same time, the country no longer views national security in isolation, but as an essential adjunct of overall national growth and development. The new millennium has been witness to sweeping changes, with India emerging as a fast growing economy having major stakes and influence on the global arena. As the nation marches ahead on the path of socio-economic growth and seeks to fulfill the legitimate aspirations of its

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citizens, it can ill afford to be complacent about the existing and future security challenges. Seeking optimal solutions to these challenges would be imperative to our uninterrupted growth and development.

As we move ahead, it would be essential to bear in mind the fact that India ranks amongst the top five countries in the "number of conflict years experienced"; it is second in the list of countries involved in "most wars of all types"; and tops the list of countries that "have experienced the greatest number of intra-state wars"[1]. Evidently, India's security challenges are unique in more ways than one—they are prolonged, diverse and span the entire spectrum of conflict. Consequently, there are a myriad issues that have the potential to profoundly affect the economic, social, and political institutions of our nation. The ability to prevail despite the challenges and continue on the path of development is a paramount need.

At the same time, the requirement to maintain a restrained, measured and balanced response to these challenges has always been a primary one. The response to security challenges needs to be mulled upon as a subset of the overall scheme of uninterrupted growth and national development, and not in isolation. This is so for a variety of reasons apart from the main fact that India's national security objectives have evolved against a backdrop of its core values, namely, democracy, secularism, peaceful coexistence and the national goal of social and economic development.[2] As a nation with no extra-territorial ambitions, it would be essential to possess a potent instrument of national power capable of deterring conflict, maintaining

1. Ref Human Security Report 2009/10, "The Causes of Peace and The Shrinking Costs of War", Part-III at http://www.hsrgroup.org/human-security-reports/20092010/overview.aspx
2. Core values, as stated by Ministry of Defence. Refer site of India's Ministry of Defence for details on India's national security objectives at http://mod.nic.in/aforces/body.htm. Accessed on February 28, 2011.

peace and performing the wide variety of complex tasks that a growing power demands.

This is especially so in view of our growth trajectory that is on the ascent and would continue to be so for quite some time in the future. Economic growth is one of the foremost indices of development and numerous international reports ranging from McKinsey to Global Policy predict a shift of the world's economic centre of gravity to Asia, particularly India and China, by around 2025.[3]

They would also greatly impact the national economy, the diplomatic apparatus, administrative apparatus and, most importantly, the common man.

As the economic matrix shifts, the dynamics of geo-politics and aerospace power would also shift since all three factors are intrinsically linked and impact each other in many ways. For instance, a vibrant economy in the global context automatically implies an increased geo-political role for India in the comity of nations. An increased role implies an increased area of influence that demands support by instruments of national power that are equally far-reaching, rapidly responsive and flexible. These characteristics are intrinsic to the nature of aerospace power. Elements in air and space are sought precisely for these capabilities. As India rises, its sphere of influence across the globe would rise and the dynamics of geo-politics would demand a variety of tasks ranging from humanitarian ones like disaster relief, casualty evacuation to military power projection across the world. Our national instruments of power, both military and otherwise, would need to be supported by aerospace capabilities that are equally far-reaching, responsive and flexible. These capabilities would seminally impact all three military Services and the other security forces. They would also greatly impact the national economy, the diplomatic apparatus, administrative apparatus and, most importantly, the common man. Aerospace capabilities need to be viewed in the wider context of overall national development and growth; they are the perfect glue enabling jointness not only amongst

3. See Mckinsey Global Institute, "The Bird of Gold: The Rise of India's Consumer Market" *McKinsey Report,* May 2007; and Charles A Kupchan, "Getting Ready for a World Transformed", Council on Foreign Relations, November 2012 available at http://www.cfr.org/politics-and-strategy/getting-ready-world-transformed/p29392. Accessed on February 7, 2015.

the Services but across the nation. As in the case of national air power that includes both civil and military aviation, aerospace power today is a matrix of total national capability and when viewed through the national prism, it represents an extraordinarily potent force that impacts across the geo-politics, geo-economic and security spectrum. Consequently, aerospace power needs to be employed in pursuance of national objectives with great wisdom, acumen and clarity of purpose. The endeavour is complex and it would be essential to comprehend the complexities, challenges and options in our particular context for national advancement.

THE COMPLEXITIES IN WIELDING AEROSPACE POWER

Aerospace power is extraordinarily potent and, as in the case of most potent instruments, is correspondingly complex. It is capable of being put to multifarious uses, it can adapt to various roles, hence, demands employment with consummate skill and acumen. The varied roles fulfilled by aerospace power have been demonstratively apparent in the recent past. Using the aerospace medium, nations vastly removed in distance and time have exercised their power and influence across continents with astonishing rapidity. On the other hand, as evident during 9/11, non-state actors have also exploited gaps in air defence to ram civilian passenger aircraft onto buildings.

The opportunities and challenges in aerospace are manifold. Only a clear understanding of the aerospace doctrine will allow nations to leverage and exploit its tremendous potential. Air power doctrine in the past, and now, aerospace doctrine, is primarily a derivative of the fundamental principles that guide the application of air and space power and innovative ideas on optimum exploitation of the medium. Its fundamental principles draw on operational experiences and are time-honoured as the optimum way to succeed. They comprise guidelines that have worked in the past. Conversely, innovative ideas look to the future and are limited only by one's imagination and technology. The overall interaction of these two constituents, therefore, makes air power doctrine a particularly dynamic doctrine bounded by the limits of experience, imagination and technology.

Unless the unique attributes and limitations of air power are understood, the perils of sub-optimal utilisation would continue to prevail. History is replete with such instances primarily because of the fact that air power is the youngest form of military power to have evolved. Its relevance and application are yet to completely sink into the minds of military strategists and practitioners of operational art.

This is particularly so in our unique context since we are witness to the historical fact that civilisations waxed and waned depending on the might of their armies. For instance, the survival of the various empires of the Mauryas, the Guptas, and later, the Mughals, etc through thousands of years, was entirely dependent on their armies until the British introduced the concept of maritime power by the 18th century. Armies have been, visible manifestations of sovereign might for thousands of years. The British displayed to the world the impact of maritime power in the recent centuries. Thus, a generic comprehension of the utility of armies and, to a certain extent, maritime power is inherent in the national psyche.

Air power, by contrast, arrived in the past few decades and, hence, its relevance, potential, and applicability are yet to sink in fully into our nation's consciousness. The use of air power as a powerful flexible tool for 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 the Indian Air Force (IAF) during conventional wars like the 1965 and 1971 India-Pakistan Wars, its non-utilisation during the 1962 Indo-China War and restricted use during the 1999 Kargil conflict serve to illustrate the point.

EXAMINING THE ROLE OF AEROSPACE POWER IN THE INDIAN CONTEXT

Air power, in its classic sense, is understood as the total ability of a nation to assert its will through the medium of air.[4] It includes both civil and military aviation, existing and potential. The traditional interpretation

4. This classic definition is attributed to the Russian air power theorist Alexander Procofieff Seversky.

evolved further as technology evolved to allow a variety of platforms to operate at a variety of heights in the atmosphere and beyond. For instance, Common Aerospace Vehicles (CAVs) are today a reality with platforms like the X-37 B launching into space to perform space operations and then gliding back to earth. Other nations have likewise begun their programmes to both harness the opportunities presented by the opening up of space, and to prepare against the challenges of defending against threats from air and space.[5] Apart from platforms, space capabilities are used in conjunction with air capabilities to fulfill a variety of tasks ranging from observation to communication, navigation, etc. No longer is high-level aerial imagery used in isolation—it is used in combination with space-based observation. Similarly, for navigation, a combination of inertial navigation and satellite navigation is in vogue. Quite clearly, in the modern sense, air power has evolved to aerospace power that is a product of aerospace capability and aerospace doctrine. Within this broad premise, national air forces are unique in the sense that they are the only national military institution exclusively devoted to military operations in the aerospace continuum. Little wonder then, that across the world, the transformation of air power to aerospace power is spearheaded by national air forces.

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 the air arms of the other Services reinforcing that strength. Other aviation related research and development as also industrial capabilities provide a force multiplier effect. The strength of air power includes the ability to harness the opportunities in the operating medium and also to secure the nation against threats from the operating medium. With the altitude now having been pushed beyond the atmosphere into space, it is imperative that space capabilities are integrated to provide aerospace power to the nation. With the largest constellation of civilian

5. For a more exhaustive treatment of the evolution, see Wg Cdr KK Nair, "The X-37B Space Plane: Space Militarisation, Weaponisation or Plain Experimentation", *Infocus Journal*, October 17, 2014, available at capsindia.org/files/documents/CAPS_Infocus_KKN-1.pdf

remote sensing and communication satellites, India's space capabilities are formidable. With cryogenic technology being mastered, our launch capabilities are amongst the cheapest and best in the world. However, the fact that the Indian military boasts of nothing more than one dedicated military satellite clearly indicates a large gap in the integration of space capabilities. Apart from the opportunities, the threats also need to be taken cognisance of. As of now, the ability for situational awareness over our sovereign territory is confined to the lower reaches of the atmosphere where most aircraft fly. The upper atmosphere, used by high altitude drones, observation balloons, missiles, common aerospace vehicles and spacecraft, remains unobserved. An attendant and available strength in the form of space capabilities is neither harnessed nor secured against. The dictates of modern warfare demand pitting strength against an attendant vulnerability. Our adversaries can be expected to do likewise, hence, it would be essential to harness our civilian strengths in space so as to pit strength against strength and prevail when the challenges of modern warfare present themselves. Our strength as a nation now lies in our cumulative aerospace capabilities and it is essential to adapt and evolve accordingly.

The Preamble of the Indian Constitution summarises our aims and objectives as a nation. From our national aims and values enshrined in the Constitution flow our national interests, which, in turn, determine our national security objectives.

THE ROLE OF THE IAF IN THE NATIONAL SECURITY MATRIX

The IAF has played a pivotal role in the country's security ever since its inception over 75 years ago. Contrary to conventional wisdom, 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. The past years have witnessed the IAF grow from a fledgling companion of the Royal Air Force (RAF) in India to an independent professional fighting force that has always endeavoured to be in the forefront of national service.

Hence, land and naval forces had little option apart from fighting their way in to decisively influence the outcome, even if it meant having to accept significant attrition. The arrival of air power changed all that.

They are also witness to its gradual evolution to a credible aerospace power.

The dominant role of air power in modern warfare, the high costs of aircraft and allied equipment, and a host of other factors demand closer attention to their potential and role in securing national interests. The case of the IAF can be no different, since the strength of our nation's air power is rooted in it. It would, hence, be essential to understand the place of the IAF in the national security matrix.

The Preamble of the Indian Constitution summarises our aims and objectives as a nation. From our national aims and values enshrined in the Constitution flow our national interests, which, in turn, determine our national security objectives. This, in turn, dictates 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 capture or termination of the enemy's leadership. Hence, land and naval forces had little option apart from fighting their way in to decisively influence the outcome, even if it meant having to accept significant attrition. The arrival of air power changed all that. Air power could circumvent the enemy's land, naval forces and directly attack the enemy's leadership, its command and control centres and other areas of critical vulnerabilities which would lead to early capitulation of the enemy. This was illustrated in ample measure during the 1971 Indo-Pak War when, following a bombing of the Governor's House in Dacca by the IAF, Pakistan agreed to a ceasefire with most of its military forces in the western sector relatively intact.

Apart from the ability to circumvent is the ability of air power to decisively interfere in the enemy's land and sea operations without the reverse being true. Take, for instance, the battle for Longewala, wherein Pakistani armour was decimated by the IAF with no reciprocal damage. The IAF dominated the skies and, hence, it could interfere as it pleased.

The ability of the IAF to rapidly project military force and influence statecraft have become increasing evident post-independence. The speedy aerial reinforcement of Srinagar during the 1947-48 conflict with Pakistan demonstrated the first visible exploitation of air power by India to further national strategy. Similarly, the aerial evacuation of King Tribhuvan of Nepal in 1950 during a crisis and his subsequent reinstation to the throne paved the way for the Indo-Nepalese Treaty of Friendship. Air power's coercive capability (without any offensive action) was demonstrated in 1987 when the IAF conducted a humanitarian air-drop to provide succour to the Tamil civil population in Jaffna. This finally led to the Indo-Sri Lanka Accord of 1987. The role of the IAF in launching a swift air-landed operation during Operation Cactus in 1989 to drop Indian forces at Male was crucial in the rescue of the besieged Republic of Maldives and subsequent restoration of the Maldives government.

In keeping with its mandate of enabling national development, the IAF also plays a significant role in aid of civil population during disasters, crises, etc. Notwithstanding the size of the country and the varied terrain, it deploys swiftly and frequently across the country for disaster mitigation, control, etc. The IAF frequently deploys for supply drops as also aerial evacuation during natural disasters like earthquakes, cyclones, landslides, floods, etc both within the country and even beyond. For instance, during the 2004 tsunami, the IAF conducted airlift and relief operations in the Andaman and Nicobar Islands as also in Maldives and Sri Lanka. Its transcontinental reach was apparent when, during Hurricane Katrina, the IAF rapidly responded and delivered aid and supplies in Arkansas, USA. Numerous such operations have been conducted and the statistics are mind-boggling. For instance, the IAF evacuated 40,000 people during snowstorms in Jammu and Kashmir in 2005. It evacuated over 1,13,700 Indians during the 1990

Iraqi invasion of Kuwait, making it the biggest airlift ever, at almost double the figures of the famous Berlin airlift.

It also serves the ends of democracy by periodically transporting paramilitary and civilian personnel for election duties in violence prone areas.

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 (ORPs) or Combat Air Patrols (CAPs). These are capable of responding within minutes to signal the resolve of the Government of India in deterring any aerial misadventure. All the above examples are demonstrative of the fact that air power enables force projection, both benign and otherwise, in support of national security objectives in a myriad ways.

AIR POWER AND JOINTNESS

At the same time, there always has to be cognisance 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 by the Western air forces, particularly the US and its allied forces, have led to a school of thought that believes wars can be won entirely by air forces. The thought is extremely enticing. However, one needs to be cautious in subscribing to these views since these perceptions draw on the experiences of air forces pitted against markedly inferior militaries, with little or no air power capabilities. The context is entirely different, and the conclusions and inferences of these operations have to be applied with caution in our Indian context.

In our case, the experiences of the past indicate that air power cannot win a war by itself, and, at the same time, no modern war can be won without it. Our records indicate that in almost every war fought since independence, the IAF has played a significant, and, at times, pivotal role. It also indicates that air power can be exploited best not only when it is in synergy with the other two components of the military, but also with the diplomatic efforts and other national civil processes. The spectrum of modern conflicts

is significantly different, and modern wars, whether conventional, sub-conventional or unconventional (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, joining forces and operating jointly would be the most logical recourse of arriving at solutions to national challenges. Integrated and joint operations comprise the cornerstone of modern military operations, and aerospace power must be seen as the binding factor. This is primarily so since land and naval forces historically operated independent of each other until the advent of air power. Air power enables land and naval forces to undertake sustained operations beyond their physical operating mediums of land and sea, leading to the increasingly accepted perspective of air power being the lynchpin of joint operations.

EXPANDING JOINTNESS BEYOND THE SERVICES

AIR POWER AND NATIONAL DEVELOPMENT IN THE WIDER CONTEXT OF ECONOMIC GROWTH

Apart from national air forces which enable military power projection, it also needs to be borne in mind that national civil aviation and the industry and infrastructure supporting aviation comprise one of the most powerful drivers of national economies. Growth in national aviation is a catalyst to economic growth and vice-versa. The above is particularly relevant in view of the fact that our national economy grew at a rate of 9.1 percent during the first half of 2006-07, Gross Domestic Product (GDP) growth rate spiked to 9.7 in 2008, and spiked again to 9.4 in 2011. The GDP rates have fallen since, but the fall is not expected to last[6] in view of

6. See "Economy, Market on High Octane", *The Times of India*, January 13, 2007, and World Bank GDP growth rate data at http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG and India GDP Annual Growth rate at http://www.tradingeconomics.com/india/gdp-growth-annual.

the fact that India has been the 9th fastest growing economy since 1980 and is expected to sustain this growth till at least 2020. The sustained growth is expected to lead to an unprecedented rise in the demands on civil aviation. Aircraft orders to meet the growing demand are expected to continue rising till 2020. Secondly, India's burgeoning middle class, which drives the booming economy, is increasingly choosing air over rail travel. The above has led to an increased demand for civil aviation. For example, during the Paris Air Show in 2005, India's order for 400 aircraft was the largest in the world. The boom in demand may not be consistent, but it certainly would increase in the future. To put matters in perspective, passenger traffic is expected to increase by more than 50 percent. The forecast of growth of passenger traffic at 7.7 percent in India is well above the global average of 4.8 percent and even above China's 7.2 percent[7]. India is currently the 9th largest aviation market handling 121 million domestic and 41 million international passengers.[8] Overall, air transport (including air freight) in India attracted Foreign Direct Investment (FDI) worth US$ 456.84 million from April 2000 to July 2013, as per the data released by the Department of Industrial Policy and Promotion (DIPP)[9]. All of the above is considering that the domestic regional aviation market is yet to open up. The potential, at present, is only unfolding and as time progresses and the economy stabilises, the demands on civil aviation can only be expected to increase.

It is, hence, not surprising that while most of the globe post September11 experienced a drawdown in civil aviation, India registered a reverse trend. At the same time, the present global recession complicates future projections. The future is always fraught with uncertainty. The Indian economy would not be immune to the global meltdown and the impact would certainly be felt. However, since the aviation market and industry are characteristically capital-intensive and cyclical, with long lags between investment decisions

7. As revealed by Airbus's global market forecast in Press Trust of India Report, "India to Face $105 Bn Demand for Aircraft", *The Financial Times*, December 7, 2006.
8. See Indian Brand Equity Foundation Report, dated September 13, 2013, at http://www.ibef.org/industry/indian-aviation.aspx
9. Ibid.

and project completions, the impact of a short-term recession would be cushioned.

With regards to the military component of national air power, India's military aviation sector is also amongst the fastest growing in the world. Around 500 aircraft and acquisitions worth billions are expected within the next few years[10]. The IAF, as part of its modernisation drive, is expected to procure air assets worth over $ 38 billion by 2020.[11]

The point being made is that the scale of economies herein is massive. The economic clout presently being wielded by Indian air power is the most powerful in the world. Its ripple effect on the economies of other nations would be tremendous. The factors driving our decisions, hence, would need to take into account both the narrow operational and tactical requirements as also the larger national strategic issues. The standard dictum of concentration of force and effort makes enormous sense in this case. We would need to leverage our advantages as a singular cohesive entity to obtain maximum returns keeping the breadth and depth of our national goals in mind. The depth demands we look beyond the conventional to the advantages now accruing beyond the atmosphere also. We need to look upwards onto space, not for divine intervention, but to harness the earthly advantages accruing due to the Indian revolution in outer space.

HARNESSING THE INDIAN SPACE REVOLUTION

With regards to space, its impact on revolutionising national development and commerce is apparent to the entire nation. India ranks among the top six space-faring nations of the world in terms of budgets and technological capabilities. In 2009, the Indian Space Research Organisation's (ISRO's) budgetary allocation was Rs.41.67 billion (US$ 0.91 billion), in 2010-11 it rose to Rs.57.78 billion (US$ 1.26 billion), accounting for about 0.14 percent of the GDP, and continues rising[12]. The commercial aerospace industry plays a progressively larger role in the space missions and taps

10. Refer Rajat Pandit, "Aviation Majors Eye Indian Defence Market", *The Times of India*, December 21, 2006.
11. Refer FICCI Report, "Indian Aviation: Spreading its Wings," February 2013.
12. Refer Deloitte Report, "Overview of Indian Space Sector-2010," August 2010.

The total acquisition of civil and military aircraft up to the year 2025 is expected to number over 1,600 and monetarily worth hundreds of billions of dollars. On the other hand, our space assets presently earn for the nation revenues of around $ 90 million.

the outsourcing work offered by ISRO. From the successful launch of the GSLV D-5 in January 2013, it is demonstrably evident that India's cryogenic technologies have matured. This augurs well for all the three prime components of national power. It serves the needs of knowledge and information, the economy, as also the military. Apart from launches, India's national space programme is focussed primarily on space-based telecommunications and observation which form the backbone of modern information systems. The Indian Navy has obtained its dedicated military satellite for communications[13]. With the successful launch of the GSLV D-5, the other Services would soon receive their much sought communication capabilities. A complement of observation satellites serves for certain military and civil purposes, navigation satellites are on the anvil, and overall the major components enabling air and space-based '*informationalisation*' are in place. Purposeful and efficient utilisation would demand integration of these components.

PUTTING THE ACT TOGETHER

In view of the foregoing, it is conclusively apparent that there exists an emergent need to treat the entire vertical dimension as a single entity and harness the cumulative potential of air and space systems: civil and military, existing and potential. The individual competencies of all these diverse components of aerospace power would need to be assimilated, employed and wielded as a single composite entity for commercial, military and political gains to the nation. For example, the total acquisition of civil and military aircraft up to the year 2025 is expected to number over 1,600

13. Refer PTI News Report, "India's First Defence Satellite GSAT-7 Launched Successfully", *The Times of India*, August 30, 2013; and D.S. Madhumati, "Navy's First Satellite GSAt-7 Now in Space", *The Hindu*, August 30, 2013.

and monetarily worth hundreds of billions of dollars. On the other hand, our space assets presently earn for the nation revenues of around $ 90 million, which is expected to increase. The political, economic and military clout such acquisitions and sales would accrue would be immense. Such clout wielded in concert would have a more gainful impact on the national power indices rather than the prevailing disjointed efforts.

Such mammoth transactions also arrive with a variety of attendant opportunities and chaos. Left directionless, the opportunities in air and space might go untapped, significant gains may be frittered away.

Such mammoth transactions also arrive with a variety of attendant opportunities and chaos. Left directionless, the opportunities in air and space might go untapped, significant gains may be frittered away piecemeal, and large scale chaos and rivalry would prevail. The above is in sharp contrast with global trends wherein overall national air power efforts are getting increasingly integrated. Integration of military and civil production of aircraft and allied systems is on the rise. In the case of space, military and civil programmes are deeply intertwined, and at times, almost indistinguishable, as in the case of China. The integration extends beyond the platforms and allied systems onto the support infrastructure also. In our unique case, such integration is largely absent at present. The anticipated expansion in capabilities would need to be sustained by an equally efficacious support infrastructure. For example, maintenance support would be essential for sustaining the expansion, yet, the same is in a state of serious neglect. National Maintenance, Repair and Overhaul (MRO) opportunities are aplenty, but this vital sector is presently characterised by neglect and chaos. Most heavy maintenance of civil aircraft is carried out abroad, whereas the military does the same locally and with a much more diverse set of aircraft. The IAF's large reservoir of trained aviation technicians goes untapped, in spite of the fact that hundreds superannuate annually and join the ranks of the jobless. Apart from services, manufacture is characterised by overzealousness to import technology. India's globally renowned

innovative acumen and spirit of entrepreneurship goes unnoticed. The immense potential of local industry to contribute and gain goes untapped.

On the other hand, India's civilian DoS (Department of Space) boasts of the largest constellation of remote sensing satellites in the world and provides services and products across the globe. Yet, its military is unable to tap into it, and scouts across the world, finally ending up with imagery from commercial international firms like Space Imaging, Israel's Offeq, etc. Evidently, while individual competencies are significant, the cumulative potential of air and space systems is yet to be realised or tapped.

Secondly, with regards to employability, the inherent flexibility of air and space systems enables a wide variety of common options for civil and military applications. Apart from aircraft and satellites which could be put to both military and civil uses, other platforms like Unmanned Aerial Vehicles (UAVs), etc could also be utilised for a variety of applications ranging from policing jobs to disaster mitigation, etc. Similarly, surveillance, communication, navigation as well as search and rescue assets, both military and civil, airborne and spaceborne, would need to be integrated to afford optimal utilisation of assets and coordinate efforts. A case in point is the envisaged networking of civil and military radars for a composite air picture. The same would need to be integrated and extended vertically further into space by utilising the civilian space assets. The threat to platforms is no longer limited to the atmosphere—it extends into space, and situational awareness of the realm above the atmosphere would, hence, be imperative in the present times as also in the future. The foreseen crowding of the national air space 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 the anticipated test flight of India's "multi-purpose aerospace vehicle" which would transcend the realms of both air and space[14].

14. For details on the multi-purpose aerospace vehicle, see speech of President of India, Dr. APJ Abdul Kalam, "Vision for Aeronautics Missions", JRD Tata Memorial Lecture, Bangalore, August 20, 2005. Available at home site of President of India, http://presidentofindia.nic.in/scripts/sllatest1.jsp?id=579 -->

INSTITUTIONALISING THE NATIONAL AEROSPACE EFFORT WITH AN AEROSPACE BODY

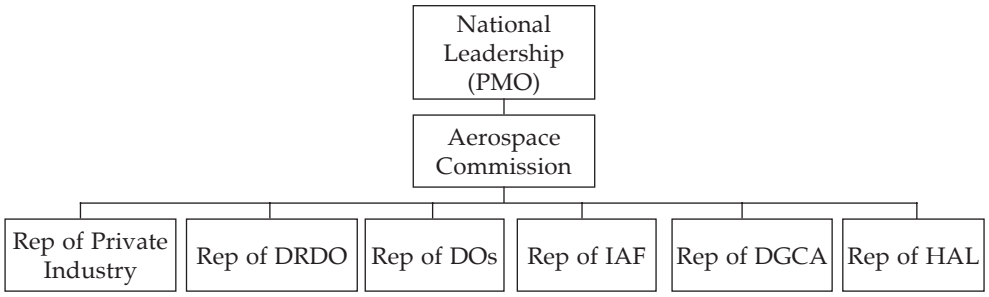
Air and space assets, nonetheless, would be scarce and costly. Hence, there would be a need for a central body to arrest duplication and coordinate national efforts for common gain as well as coherent direction during crises and contingencies. It would be imperative to streamline the acquisition, development, management and employment of these potent elements as a single entity for comprehensive national gain.

An Aerospace Commission to Synergise Air and Space Power: Paradoxically, in an era of magnificent machines, it is the man and management modes which would ultimately be decisive. Therefore, it would be essential to have a singular national body constituted with suitable men and management modes tasked with streamlining the foreseen surge in national aerospace capabilities into potent national indices of power. The body could be instituted with the task of consolidating national requirements and guiding the acquisition, management and development of national air and space capabilities and competencies. At the same time, individual competencies and tasks would be left untouched. The guiding principle would be centralised direction, decentralised control and execution. The aim would be to centralise direction while leaving organisational control and execution of committed tasks untouched. The point is not to add an additional layer of bureaucratic control, but to have a single potent body which enables cross-exchange of resources and judicious sharing of potent capabilities in tune with the larger needs of building Comprehensive National Power (CNP). Thus, the prevailing Space Commission would continue guiding the drive for national space competencies, the IAF's operational tasks would be left untouched, the Directorate General for Civil Aviation (DGCA) would continue regulating civil aviation, etc. At the same time, the means of consolidating competencies for mutual benefit (without affecting individual competencies) could be explored, scarce resources in terms of personnel, equipment and services could be traded internally, mutually damaging rivalries could be resolved, etc. In view of national interest and the greater common good of all, a roadmap and the means to

tread on it could be decided and acted upon. In sum and substance, hence, the conceptual framework of the institution dedicated to the development and exercise of national air and space power (and by extension, national power) would be of a non-intrusive yet effective paternal character. It would herd the diverse components onto the path of nation building, enable the means to tread the path with optimum efficiency, and leave the actual tread to the prescribed organisations. In keeping with the immense unpredictable pace of technology, a system to monitor and enable mid-course corrections would also need to be included. The body would need to be inherently dynamic and adaptable for harnessing newer and more potent opportunities and options.

Broadly, the following institutional structure could be envisaged as given in Fig 1 below.

Fig 1



The envisaged commission would:

- Obtain inputs from all the components and adopt a dynamic national aerospace vision as well as roadmap to guide development of national aerospace capabilities and competencies.
- Exercise its authority to enable the means of fulfilling the vision and treading the roadmap.
- Formulate a national aerospace policy for developing, sustaining and employing aerospace power in pursuit of national interest.
- Perodically review measures aimed at efficacious development and exploitation of aerospace power and recommend the options and opportunities laterally and vertically.

- Provide an authoritative interaction among the military, civil and commercial bodies as well as international bodies. Overall, it would harness and network the strengths and individual competencies of the aforestated Instruments of Power (IoP) for common gain within the aegis of national interest.

The above list is by no means exhaustive and is only illustrative of the wide variety of tasks it would be called upon to perform once it is instituted. In sum and substance, the framework of the commission would need to be dynamic and adaptable to withstand the rigours of ever-changing technology and national interests. We need to adapt and prevail in a changing world.