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## CHALLENGES FOR AIR POWER TO FULFIL INDIAN NATIONAL SECURITY IMPERATIVES FOR THE NEXT TWO DECADES

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For centuries, many scholars have enunciated principles and strategies for the practice of military operations. From these have evolved military doctrines and strategies and tactics. The Chinese military general, and strategist, General Sun Tzu,<sup>1</sup> and India's Kautilya (Chanakya) in his *Arthashastra*,<sup>2</sup> were the first to document principles and guidelines for the preparation and conduct of war. Among the modern thinkers, Carl von Clausewitz<sup>3</sup> must be credited for consolidating the works of earlier scholar-strategists into the modern principles of war. The *Arthashastra*, the ancient Indian treatise covered statecraft, political science, economic policy and military strategy. It looked at numerous scenarios and causes for war. Nearly 3,000 years ago, Chanakya had envisaged what he called open war, covert war and silent

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<sup>1.</sup> Joshua J. Mark, *Sun-Tzu*, *World History Encyclopaedia*, July 9, 2020, https://www.worldhistory. org/Sun-Tzu/. Accessed on July 29, 2022.

<sup>2.</sup> Joshua J. Mark, *Arthashastra*, *World History Encyclopaedia*, June 23, 2020, https://www.worldhistory.org/Arthashastra/. Accessed on July 29, 2022.

Francis Miyata, THE GRAND STRATEGY OF CARL VON CLAUSEWITZ, War Room—U.S. Army War College, March 26, 2021, https://warroom.armywarcollege.edu/articles/grandstrategy-clausewitz/. Accessed on July 29, 2022.

Air power is the combined employment of all air and space assets to exercise control over aerospace environments to achieve national security objectives. Air power exploits its unique operational characteristics in the multidimensional environment to offer a very broad range of strategic and tactical military options. war. He believed that the ruler (the king) must exercise the choice and method of pursuing war or peace. He mentions the need to fortify the nation, prepare the armed forces and give them resources to defend the nation. Capability means deterrence and ensuring peace without engagement in war, he wrote. He also gave high importance to leadership qualities, intelligence gathering, and information warfare as weapons of war to achieve military objectives.

Air power is the combined employment of all air and space assets to exercise control

over aerospace environments to achieve national security objectives. Air power exploits its unique operational characteristics in the multi-dimensional environment to offer a very broad range of strategic and tactical military options. The inherent characteristics of speed, range, precision, lethality, responsiveness, versatility, and flexibility make it the first choice for strategic effects and options. Air power is crucial for preparing the initial state and for continuously shaping the surface battles. Air power continues to be in the lead for imbibing technologies, and its force multiplier operational capabilities make it one of the most potent elements of national power. Air and space provide unhindered movement and unlimited exploitable vertical depth for freedom of manoeuvre, and help exploit both vantage point and speed. Clearly, the one who controls the air and space controls planet earth and much beyond. Yet air power's greatest limitation is the lack of full understanding of its potential by some non-practitioners of air power.

### PRINCIPLES OF AIR POWER

Air power is defined as the ability to project military power through control and exploitation in, from, and through, the air. The principles of air power<sup>4</sup> evolved over years of employment in operations and training. The initial generic principles of air power included the need and criticality of a degree of air control. This was the fundamental principle of air power. It could be air supremacy or a degree of air superiority. Centralised control-decentralised execution, essentially means that the air power assets be centrally controlled and employed by an air commander. This will result in employment of

Decentralised execution allows the field air commander the latitude to employ air power based on the localised situation. This flexibility improves the response in real-time.

air power in the correct perspective, and responsiveness, meaning flexibility and versatility. Most importantly, the scarce and expensive effort will not get divided. Air power must exploit its massive, precise firepower with concentration and singularity of purpose. Decentralised execution allows the field air commander the latitude to employ air power based on the localised situation. This flexibility improves the response in real-time. Prioritisation of the air effort and its employment synergistically in a balanced manner are important requirements.

Employment of air power has changed in the recent times on many counts. The US Air Force (USAF) doctrine published in 2021,<sup>5</sup> mentions the need for an air force that can fly, fight, and win as part of a joint team. Victory will go to the side that can rapidly integrate new ideas, and innovate and incorporate concepts and technologies. It highlights air power employment for "Global Vigilance"—essentially the need to maintain awareness, understand intent, and be warned and prepared. "Global Reach" is the ability to respond and project military power. "Global Power" is the ability to strike any target anywhere with decisive effects, hitting the adversary's centres of gravity. The need is to integrate capabilities across multiple domains for joint

Lieutenant Colonel Johnny R. Jones, "Air Power", Air University USAF, https://www. airuniversity.af.edu/Portals/10/ASPJ/journals/Chronicles/jjones.pdf. Accessed on July 23, 2022.

General Charles Q. Brown, Jr. General, USAF, Chief of Staff, United States Air Force, Air Force Doctrine—Publication 1. US Air Force, March 10, 2021, https://www.doctrine.af.mil/ Portals/61/documents/AFDP\_1/AFDP-1.pdf. Accessed on July 23, 2022.

operations, to prepare for operations in the information and cyber domains, to have the ability to exploit the electronic spectrum under the electronic warfare environment, and to retain command and control. The role of special operations and global mobility is significant. Control of the air remains a necessary precondition. Exploiting mass and manoeuvre simultaneously to engage various elements of the adversary power remains relevant. Effective integration of capabilities, people, weapons, bases, logistics, and supporting infrastructure is a force multiplier. Persistent synergistic effort will pay dividends. Lastly is the concentration, not so much for numbers, but for effect. Centralised command empowers the air component commander to respond to changes in the environment, and enables priority and balance.

Dr. Sanu Kainikara explains the correlation between the timeless Principles of War and Air Power.<sup>6</sup> The selection and maintenance of aim, concentration of force, combined arms coordination, offensive action, security, surprise, flexibility, economy of effort, sustainment, maintenance of morale, unity of command, and command and control are all equally important as basic principles of war and the principles specific to air power.

### **EVOLVING AIR POWER**

The 21st century continues to be the century of air and space power, and will be a combat enabler for the application of any force. Air power must be applied unhindered by geography, terrain, time, and weather. Air power now includes the air, space and cyber space domains. Air will achieve effects in hours and minutes, space power in seconds and cyber space in milliseconds. Aerospace power will continue to blur the difference between the strategic and tactical levels. Speed and surprise should compensate for mass. Offensive application will remain the essence of aerospace power. Electronic measures and stealth will be even more relevant. Air superiority may be achieved through better platforms, numbers and better employment. The role of technology and the aerospace industry will be even more

Sanu Kainikara, Principles of War and Air Power, Working Paper, ROYAL AUSTRALIAN AIR FORCE, AIR POWER DEVELOPMENT CENTRE, 2011, https://airpower.airforce.gov.au/sites/ default/files/2021-03/WP31-Principles-of-War-and-Air-Power.pdf. Accessed on July 24, 2022.

important. Intelligence will remain a strategic resource, and aerospace the best means to acquire it. Targets will be small, and require precision. More terrorists have been killed by American air power than by any other means.

Aerial engagements and targeting will be from much larger ranges, and weapon inventories will have to be built accordingly. Gaining the initial advantage will be important. Wars will not be short and swift as earlier envisaged. The ability to sustain and win an extended war will require industrial and economic backing. The advantage of information handling will have to be exploited for quicker and accurate decision-making. The profile of the space domain<sup>7</sup> is growing and the boundaries between air and space are becoming less distinct. Space has also become more accessible and affordable. Air and space must become a single domain and be part of the unified aerospace force.

Unmanned aerial platforms will increase, but the manned systems will stay. Manned-Unmanned Teaming<sup>8</sup> (MUM-T) will become a norm. Practically all missions transportation, including heavy cargo, will be possible with unmanned platforms. While asymmetry will give an early favourable situation, air forces will have to prepare to fight with peer adversaries. Numbers will be required to fight, take losses, and continue to provide relevant capabilities.<sup>9</sup> Robust networks for data flow and command and control will be crucial in the cyber threat environment.

### **CHINESE AIR POWER**

The once ground force-centric China's leaders became clear on the centrality of air and space power in modern warfare, and for becoming a significant

Director Concepts and Doctrine, Joint Doctrine Publication 0-30, UK Air and Space Power, December 2017, https://assets.publishing.service.gov.uk/government/uploads/system/ uploads/attachment\_data/file/668710/doctrine\_uk\_air\_space\_power\_jdp\_0\_30.pdf Accessed on July 24, 2022.

Lieutenant Colonel Livio Rossetti, "Manned-Unmanned Teaming", Joint Air Power Competence Centre, January 2020, in Journal Edition 29, https://www.japcc.org/articles/manned-unmanned-teaming/. Accessed on July 29, 2022.
David Alman and Heather Venable, "Bending the Principle of Mass: Why That Approach No

David Alman and Heather Venable, "Bending the Principle of Mass: Why That Approach No Longer Works for Airpower", War on the Rocks, September 15, 2020, https://warontherocks. com/2020/09/bending-the-principle-of-mass-why-that-approach-no-longer-works-forairpower/. Accessed on July 24, 2022.

power.<sup>10</sup> All their industrial and military asset building investments have been focussed towards that. China is not only pushing ahead with two fifth-generation stealth fighters, but also working on a stealth bomber, large transports, dedicated electronic warfare aircraft, and a plethora of Unmanned Aerial Vehicles (UAVs). The under construction aircraft carriers will give China's air power greater reach. China could potentially exceed 60 space launches in 2022.<sup>11</sup> Its hypersonic missile and glide vehicle programmes are well on track and under final testing. Clearly, China is the only country that has made the greatest strides in developing its air power capability. The People's Liberation Army Air Force (PLAAF) has transformed itself from a large, poorly-trained force, into a leaner and meaner world class, high-technology air force that is capable of prevailing against sophisticated adversaries in regional conflicts. The PLAAF now trains like a modern air force and with technology focus and better professionalism. It is getting set to be able to neutralise any threat to its dominance in the Western Pacific. The People's Liberation Army Strategic Support Force (PLASSF)<sup>12</sup> has put together space, cyber, and electronic warfare capabilities. China's "informatised" warfare capabilities are all integrating and networking through air and space-based systems. China has a significant land-based air defence network. The People's Liberation Army Rocket Force (PLARF)<sup>13</sup> is estimated to have nearly 2,000 land-based short/medium range conventional ballistic missiles. These can threaten important Indian installations and

Richard P. Hallion, Roger Cliff, and Phillip C. Saun, eds., "The Chinese Air Force Evolving Concepts, Roles, and Capabilities", Centre for the Study of Chinese Military Affairs, INSTITUTE FOR NATIONAL STRATEGIC STUDIES, National Defense University, 2012, https://ndupress. ndu.edu/Portals/68/Documents/Books/chinese-air-force.pdf. Accessed on July 24, 2022.

Andrew Jones, "China Plans More than 50 Space Launches in 2022", Space News, February 9, 2022, https://spacenews.com/china-plans-more-than-50-space-launches-in-2022/. Accessed on July 24, 2022.

John Costello and Joe McReynolds, "China's Strategic Support Force: A Force for a New Era", Centre for the Study of Chinese Military Affairs, Institute for National Strategic Studies, China Strategic Perspectives, No. 13, October 2018, https://ndupress.ndu.edu/Portals/68/ Documents/stratperspective/china/china-perspectives\_13.pdf. Accessed on July 29, 2022.

Major Christopher J. Mihal, PMP, "Understanding the People's Liberation Army Rocket Force", U.S. Army Military Review Journal, July-August 2021, https://www.armyupress.army. mil/Portals/7/military-review/Archives/English/JA-21/Mihal-PLA-Rocket-Force-v1.pdf. Accessed on July 29, 2022.

assets. China also possesses a large inventory of ground and air launched cruise missiles. In November 2020, China's Central Military Commission (CMC) issued a draft of its "PLA Joint Operation Outlines" to reinforce the need for greater jointness,<sup>14</sup> and all-domain coordinated operations. China's comprehensive air power capability should be factored in by India for asset and combat potential building. India must keep watching the aerospace developments in China very closely, to understand how it may employ air power in the future.

### AIR POWER IN UKRAINE

The war in Ukraine is still going on. The narrative of each side is to contest the success of the opponent. The West is fighting the information war on behalf of Ukraine. It is in their interest to show the Russian air power capabilities and employment in a poor light. The Russians have their own side of the story. Because of the large asymmetry in force levels, Russia was expected to run a massive initial air campaign to destroy all Ukrainian air assets on the ground and to put down all airfields. It was also expected to run a massive Suppression of Enemy Air Defences (SEAD) campaign, but that did not happen. Ukraine was able to shoot down many Russian aircraft, mostly using ground-based air defence weapons. Ukraine also sank the Russian flagship guided missile cruiser *Moskva* using sea-skimming anti-shipping missiles.<sup>15</sup> Ukraine concentrated on air space denial. It used mobility and dispersion to conserve its air defence assets and yet kept them operationally effective. It used "shoot and scoot" tactics.<sup>16</sup> It camouflaged its Air Defence

Tanmay Kadam, "China's 'Pressing Military' Reform—Top PLA Commanders To Be Trained For Joint Ops As Xi Jinping Called It 'Top Priority'", *EurAsian Times*, March 31, 2022, https:// eurasiantimes.com/pla-commanders-to-be-trained-for-joint-ops-as-xi-jinping/. Accessed on July 24, 2022.

Furkan Akar, "Analysis of The Sunken Russian Cruiser Moskva, Its Implications for Russia and Lessons for the World Navies", *Beyond the Horizon*, April 28, 2022, https://behorizon. org/analysis-of-the-sunken-russian-cruiser-moskva-and-its-implications-for-russia-and-theworld-navies/. Accessed on July 29, 2022.

Maximilian K. Bremer And Kelly A. Grieco, "In Denial About Denial: Why Ukraine's Air Success Should Worry the West", *War on the Rocks*, June 15, 2022, https://warontherocks. com/2022/06/in-denial-about-denial-why-ukraines-air-success-should-worry-the-west/. Accessed on July 26, 2022.

Unlike Iraq and Afghanistan, the first lesson from Ukraine is that now no side can take air superiority for granted. At best, there will be limited control of the air space, or temporary and localised air superiority. (AD) assets and would switch off the radar immediately after firing, making it difficult for Russia to target using anti-radiation missiles. Ukraine also very effectively used "Stinger" class Man-Portable Air Defence (MANPAD) missiles. Russia preferred to use stand-off weapons to avoid overflying Ukraine's AD assets.

The Russian long-range bombers have been launching cruise missiles, hitting both civilian and military targets. Russia has

established air dominance over the Donbas region in the east, where of the most ground battles are being fought. Russia was traditionally known for extensive use of cyber attacks and electronic warfare. The actual usage or the results of such actions have not been visible. In fact, some Russian helicopters were seen to have been shot down by heat seeking missiles, and the helicopters did not release Infra-Red (IR) flares on time.

The North Atlantic Treaty Organisation's (NATO's) satellite imagery, and Airborne Warning and Control System (AWACS) surveillance support have been of great help to Ukraine. As per some Western reports, Russia has lost close to 100 aircraft, including a few Sukhoi Su-34 and one Su-35. Russia reportedly could destroy only 24 of Ukraine's 250 S-300 launchers. These figures may be part the West's propaganda machine. But Russia failed to establish air superiority in the real sense. Unlike Iraq and Afghanistan, the first lesson from Ukraine is that now no side can take air superiority for granted. At best, there will be limited control of the air space, or temporary and localised air superiority.

Penetrating the contested air space will be a challenge. The Turkish TB-2 armed UAVs were effectively used for both surveillance and knocking down tanks with loitering munitions. Later, they themselves were being downed in large numbers. That missile armed combat drones are an important part of any air force's inventory had become clear earlier in the Nagorno-Karabakh conflict. These are much cheaper and yet very effective. Having a larger inventory of Precision Guided Munitions (PGM) and cruise missiles will be highly desirable. It is time to build larger inventories of small, cheaper, unmanned and autonomous drones, and employ swarms.

# TECHNOLOGY DRIVEN SYSTEMS AND OPERATIONS

Technology and air power are integrally and synergistically related. Fast growing new

Technology and air power are integrally and synergistically related. Fast growing new technologies are impacting every aspect of military aviation, from combat capability increase to safety of operations.

technologies are impacting every aspect of military aviation, from combat capability increase to safety of operations. Long range sensors and weapons have changed the approach to, and concepts of, air combat. Prompt, precise, global strike capability will be required. Stealth, integrated sensors, secure data-linked communications, and electronic warfare suites are a must-have. Satellite-based Intelligence, Surveillance, and Reconnaissance (ISR), early warning and control, and air and space-based kinetic and Directed Energy Weapons (DEWs) are required for all offensive and defensive actions. The need is for networks of integrated systems spread across multiple platforms. Hypersonic platforms and weapons, cyber warfare capabilities, and Artificial Intelligence (AI) are required to outdo adversaries. Intelligent usable data will have to be generated for supporting quick decision-making. The technologies must support global 360 degree situational awareness, and operational reach and survivability are crucial. Large multi-role stealth platforms could act as bombers or tankers. A greater role will get assigned to unmanned or optionally manned platforms. By the mid-2040s, it is envisaged that every aerial mission may be flown unmanned. Drone swarms and their counters are already a reality.

Aircraft will fly longer with aerial refuelling. It will mean multiple missions in each sortie. Crew support systems will have to cater for long flights, and may mean trans-dermal nutrient delivery, and monitoring the pilot's physical and mental state. Next-generation displays and helmets are under testing. Newer lighter, corrosion resistant materials with higher strength-to-weight ratio, elasticity and tensile strength are evolving. Torsional wing surface would obviate the need of control surfaces and high-lift devices. Significant advances are taking place in airborne radars and optical and IR sensor technologies. Technology is also playing a great role in cutting down platform development timelines. Aircraft diagnostics and repair are supported by real-time transmission of sub-system health, and AI supported fault diagnostics systems. Robots and micro drones are helping inspection. Additive 3D manufacture is reducing production time and cost, and allows spares on demand. Hybrid smart engines are already being tested. Virtual Retinal Displays (VRD) are also evolving, and may replace and reduce helmet size and weight.

### IAF: CRITICAL ASSET REQUIREMENTS

The Indian Air Force (IAF) is the primary repository of India's air power assets. India's airlines and private aircraft operators have large fleets of civil passenger and cargo aircraft. The Indian Army, Indian Navy, Indian Coast Guard and various other government agencies have their own air assets. All these contribute to the air power assets of the nation.

The IAF's force structure development and deployment are based on threat assessment. This assessment flows from the Raksha Mantri's (defence minister's) operational directive<sup>17</sup> that is issued from time to time. It must also be based on the yet to be released national security strategy. The IAF has to integrate its assets and operational efforts with the other instruments of national power, especially the army and navy. The IAF has inducted many path-breaking air power assets after the Kargil conflict. These include a large fleet of Su-30 MKI, Airborne Early Warning and Control (AEW&C) platforms, Flight Refuelling Aircraft (FRA), and UAVs. In the last over a decade, it has expanded its global reach by inducting the C-17 Globemaster

Understanding Military Doctrine: A Primer, Directorate of Doctrine, Training and Doctrine Division, HQ Integrated Defence Staff, New Delhi, September 2018, https://www.ids. nic.in/IDSAdmin/upload\_images/doctrine/Primer%20on%20Military%20Doctrine-%20 September%202018.pdf. Accessed on July 29, 2022.

III and C-130 for special operations. Similarly, it has acquired the Chinook heavy-lift and Apache attack helicopters. More recently, it has inducted the Rafale and Light Combat Aircraft (LCA). It has greatly increased its network-centric warfare ability by operationalising the secure Air Force Network (AF-Net) and the Integrated Air Command and Control System (IACCS). Indigenous air defence radars and missiles, including the Akash, Astra, and BrahMos, have been added in significant numbers. Yet a lot more needs to be done.

First and foremost is the need to get back the number of fighter squadrons from the low of around 30 to the government authorised 42. The logic proffered by some that the operational capability and weapon carriage of newer aircraft is multiple times that of those they are replacing, and therefore, the IAF should downsize the force requirement, is highly flawed. The IAF has two major air forces as adversaries. Both are modernising rapidly and still retaining numbers. The government has told the Services to be prepared for a two-front contingency, and that they will be playing a greater role in the Indo-Pacific. Therefore, if at all, the numbers required may be even more. This can be achieved by hastening the production and development of the LCA variants and the Advanced Medium Combat Aircraft (AMCA). Also the planned procurement of the 114 new fighters<sup>18</sup> must go through quickly.

The IAF's transport and helicopter numbers are quite adequate and with induction of the CASA C295 later, the capability will increase further. For a continental sized country, the current holdings of AEW&C, three each IL-76 based Phalcon, and three Embraer ERJ145 based 'Netra', and just six FRA are highly inadequate. Even the Pakistan Air Force (PAF) has larger numbers of AEW&C aircraft. My assessment is that the IAF should have, to begin with, around 10 large and 10 smaller AEW&C aircraft, and must hasten the acquisitions. Similarly, there is a need for at least 15 FRA.

ANI, "Aatmanirbhar Bharat Scheme: IAF Plans to Build 96 Fighter Jets in India", Business Standard, June 12, 2022, https://www.business-standard.com/article/economy-policy/ aatmanirbhar-bharat-scheme-iaf-plans-to-build-96-fighter-jets-in-india-122061200308\_1.html. Accessed on July 29, 2022.

The space domain is already impacting and supporting all military operations, and emerging as an area for great power conflict and also a possible area of asymmetry. The country has to start evolving and understanding doctrinal and organisational positions and building capabilities to exploit the "ultimate high ground." be remembered that air operations across the Himalayas will require both these assets in large numbers.

The conflict in Ukraine has indicated that wars are not likely to be short and intense. Similar lessons can be drawn from many past wars as in Korea, Vietnam, Iraq and Afghanistan. It will be a test of endurance and resilience. In the absence of sufficient indigenous production capability, the weapon inventories of cruise missile and precision munitions would have to go up. Similar assessments would have to be done of other forms of reserves. Hypersonic and DEW weapons will enter the armed forces

in significant numbers in the next two decades. These will have to fit into the operational plans and employment. Electronic warfare assets and cyber warfare capability would require major investments.

### AIR AND SPACE INTO SINGLE DOMAIN

The space domain is already impacting and supporting all military operations, and emerging as an area for great power conflict and also a possible area of asymmetry. The country has to start evolving and understanding doctrinal and organisational positions and building capabilities to exploit the "ultimate high ground." Also, prepare for the militarisation of space and emergence as a strategic playground.

The US Space Force became the 6th independent US military Service branch through an Act signed on December 20, 2019.<sup>19</sup> It comes under the Department of the Air Force in the same way the Marine Corps comes under the Department of the Navy. The new US combatant command is led by an

<sup>19.</sup> United States Space Force, Military.com, https://www.military.com/spaceforce#:~:text=The%20U.S.%20Space%20Force%20is,2020%20National%20Defense%20 Authorization%20Act. Accessed on July 27 2022.

air force general. The US Space Force's direct antecedent, the Air Force Space Command, was an air force major command. Ever since 1954, the space assets have been under the air force. Even today, the US Space Force derives most of its support personnel from the US Air Force. The US Space Force and Air Force also share the same Service secretary and military department, along with common commissioning sources and training programmes. The Air Force Research Laboratory and Air Force Office of Scientific Research (AFOSR) also conduct research to benefit the space force. The National Aeronautics and Space Administration (NASA) India's tri-Service Defence Space Agency (DSA) already operates the space warfare and satellite intelligence assets. It is headed by an air force officer. The agency should one day become a full-sized military command and protect Indian interests in space.

is an independent agency. NASA and the US Space Force work closely on space launches, space domain awareness and planetary defence operations.

India's tri-Service Defence Space Agency (DSA) already operates the space warfare and satellite intelligence assets. It is headed by an air force officer. The agency should one day become a full-sized military command and protect Indian interests in space and prepare for any potential space conflict. It would also develop the country's space warfare strategy and project technology requirements, including anti-satellite weapon systems.

The thin line between the atmosphere and space is fast disappearing with more craft transiting more frequently between the two mediums. There will, thus, be a need to consider setting up an aerospace structure under a single force. The American model is one way to approach it. Another approach could be like that of the China's People's Liberation Army Strategic Support Force (PLASSF) that combines space, cyber, and electronic warfare.

### JOINT OPERATIONS

Air power will play a significant role in surface and sub-surface battles. The armies and navies are themselves acquiring air assets, but will require much

larger direct and indirect support from the air forces. Also, the tactical battle areas will be highly congested and require direct and procedural control to manage de-confliction, yet give adequate freedom of operations for all elements. Air power will first try and achieve air superiority to defend the nation from enemy air attacks, and also allow greater freedom to surface forces. Air interdiction of enemy forces and supplies would have a great impact on the land or sea battle. Direct air support in the contact battle will also be crucial. Air will also support quick inter-intra-theatre mobility. Network-centricity will support understanding the aerial situational awareness, air movement clearance, and reduced risk of fratricide. There is a greater need for joint planning and exercises in the electronic and cyber threat environments. The complexity of command and control, and the capabilities and limitations of air power would need to be understood and factored in.

### **GEOGRAPHY AND INFRASTRUCTURE**

India is a large country and has a variety of terrains. These include a large coastline and island territories, the world's highest mountains, jungles, deserts and irrigated plains. Asset positioning and infrastructure also depend on the threat assessment and air strategy and tactics. The entire Line of Actual Control (LAC) with China is across very high mountains. It can be divided into the Ladakh, Central, and Eastern sectors. The Ladakh sector is also served by airfields in Jammu and Kashmir (J&K) and the plains of Punjab. The airfield at Thoise is now fit for fighter operations. There are many smaller runways fit for transport operations, including at Daulat Beg Oldie (DBO). The Central sector has Nepal between the two countries. There are adequate airfields here. In the Eastern sector, many civil airfields have been made fit for dual use. However, the hardened shelters at some airfields are still work in-progress. The air assets have been suitably positioned. India has nearly 25 airfields that may be used for a China contingency. Except those in the Ladakh region, and the few in Kashmir, all other airfields are at altitudes below 2,500 ft. China has nearly 12 airfields in the Tibet and

Xinjiang regions that face India. Most of these are at altitudes close to 10,000 ft. Clearly, the IAF has an advantage. Neutralising of a few Chinese airfields would have a much greater operational impact on People's Liberation Army Air Force (PLAAF) operations, compared to the same if a few IAF air bases were neutralised. The radar cover in the mountains will be an issue. More AEW&C aircraft will be required. There will be a need for greater training for operations and attacks on high altitude targets.

### AVIATION PRODUCTION ECOSYSTEM

The Indian government has already notified three positive indigenisation lists<sup>20</sup> to further push *Atmanirbhar Bharat* (Self-Reliant India). These cover 309 items which include short-range surface-to-air missiles, cruise missiles, airborne early warning systems, radars, sensors, weapons and ammunition, anti-ship missile, anti-radiation missiles, among many more. Hindustan Aeronautics Limited (HAL) and Israel Aerospace Industries (IAI) have signed a Memorandum of Understanding (MoU) to convert a civil airliner into a Multi-Mission Tanker Transport (MMTT) aircraft in India. The Defence Research and Development Organisation (DRDO) has been cleared to convert Air India's six A-319s and A-321 variants into AEW&C aircraft.

The LCA Mk1 is already flying with the IAF; 83 LCA Mk1A aircraft are on order and the first flight is expected later this year and deliveries will take place from 2024. The first flight of the Medium Weight Fighter (MWF) LCA Mk 2 is scheduled for end 2023, and the aircraft should be inducted in 2028. The AMCA critical design review should be completed in 2022,<sup>21</sup> the roll-out planned for 2024 and the first flight planned for 2025. With these fighter aircraft, the manufacturing ecosystem in the country is fully in place. Similarly, the Advanced Light Helicopter (ALH) variants are flying in

ANI, "Rajnath Singh Releases 3rd Positive List of Defence Equipment Indigenisation", *The Print*, April 7, 2022, https://theprint.in/india/rajnath-singh-releases-3rd-positive-list-ofdefence-equipment-indigenisation/906415/. Accessed on July 19, 2022.

Sakshi Tiwari, "Big Milestone' For India's AMCA Stealth Fighter Jet Program As DRDO Announces Testing Of Fifth-Gen Technology", *Eurasian Times*, March 13, 2022, https:// eurasiantimes.com/amca-stealth-fighter-jet-program-as-drdo-fifth-gen-tech/. Accessed on July 29, 2022.

India's private sector is now getting big in aviation production. It is already making aero-structures and components for global customers. There are many companies making defence electronics, and advanced technology components. large numbers across the three Services and elsewhere. The Light Combat Helicopter (LCH) and Light Utility Helicopter (LUH) are under induction. The Indian Multirole Helicopter (IMRH) is already in design. India should not have to buy helicopters from abroad. DRDO's large UAVs like the Tapas and Ghatak are still under development and they require to be pushed.

Some 40 out of the 56 EADS-CASA C-295MW transport aircraft will be built in India by a Tata-led consortium.<sup>22</sup> India had

earlier built the HS-748 and Dornier 228. Meanwhile, the Council of Scientific and Industrial Research (CSIR) and National Aerospace Laboratories (NAL) have built the 14-seat 'Saras' aircraft. The same is under testing. The Saras Mk 2, the 19-seater version, is under development. One day, India must build a regional jet. More transport aircraft production is required. DRDO's 'Netra' AEW&C is operating successfully. DRDO will soon commence developing the larger AEW&C based on the refurbished Airbus A320 platforms acquired from Air India. This could take 6-8 years. Similarly, the proposed indigenous FRA could take 6-8 years. Both need to be hastened.

India's private sector is now getting big in aviation production. It is already making aero-structures and components for global customers. There are many companies making defence electronics, and advanced technology components. Many Indian Medium, Small and Micro Enterprises (MSMEs) and start-ups are also entering defence production, especially in drones and counter-drone manufacturing. The defence production ecosystem is, thus, getting in place and is being driven at the highest level.

Dinakar Peri, "Rs 22,000 Crore Deal with Airbus for 56 C-295 Transport Planes, *The Hindu*, September 24, 2021, https://www.thehindu.com/news/national/government-seals-megadeal-with-airbus-for-purchase-of-56-c-295-military-transport-aircraft/article36644148.ece. Accessed on July 29, 2022.

### AIR POWER IN INDIA'S FUTURE WARS

India will have to face future wars in a highly contested environment. There will be a need to acquire assets and prepare operational concepts, and doctrines for multi-domain and joint operations. The "New Wars" will require kinetic force, backed by offensive and defensive cyber and electronic means. Information warfare and grey-zone conflict will impact decision-making at all levels as well as public morale. Technologies will keep bringing disruptive change. Hypersonic and DEW are two key areas that will impact air power the While the endeavour may be to win as quickly and decisively as possible, assets would have to be built for sustaining a longer war. There will be need to balance capabilities and operations among tactical, operational, and strategic levels.

most. The space and cyber domains will have a very large impact on all operations. Defending command and control networks would be important. While the endeavour may be to win as quickly and decisively as possible, assets would have to be built for sustaining a longer war. There will be need to balance capabilities and operations among tactical, operational, and strategic levels. Assets would have to be built to exploit air power's deterrence. Global reach and long-range engagements would be crucial. Ability to maintain the spares supply chains, and stocking and positioning of munitions would be important.

New ways to train would have to evolve. Doctrines would have to be tweaked. Grooming of air commanders catering to the new environment would be important. Empowerment of field commanders and preparing them for decision-making during uncertainties will also be very important. Great importance needs to be given to realistic air training in the multidomain environment. Expeditionary force capability will be important as India's global stature increases.

China's autocratic, ambitious leadership is likely to be more aggressive. In a conflict with China, offensive and defensive counter-air and interdiction would pay greater dividends. Space-based intelligence, surveillance and reconnaissance would be important. India must build near continuous space-based coverage of certain areas along the borders. Loss of critical assets infrastructure by enemy action would need to be war-gamed and factored in.

### CONCLUSION

Some capabilities like advances in technologies and military capabilities such as lethality, precision, and stealth are common to all the armed force. Network-centricity, cyber and electronic warfare are all being exploited by all the armed forces. However, what only air power can provide is global range, mobility and power projection. The strength of air power is its ability to exploit the characteristics of speed, range, and elevation. Air and space are the best mediums for global situational awareness. Air control will remain a prerequisite and the critical principle of air power. While the surface and sub-surface forces will all benefit, no other Service has a role in the control of the air. It is the one thing that will bring decisive results for all. Air superiority must remain a fundamental strength of the air force air power. Similarly, quick global mobility is another exclusive strength of air power. It allows very long range strikes and all forms of other global operations. Air power is an inherently strategic force. Integrated employment of all air and space forces is important if the full environment has to be exploited for unmatched responsiveness. Air power allows global agility.

There will be limited wars despite the nuclear overhang. This would mean having significant conventional capability. The war may begin with a trigger event. This would mean round-the-year capability and training. Air power may be the dominant means of prosecuting future wars, but it would have to work in close coordination with the other elements of national power. Air power must remain capable of achieving national security outcomes. This is possible only through capability build-up, planning, execution, sustaining, and training. Joint doctrines must factor in the complexities of integrating air power capabilities and effects. Air assets must remain under the air component commander for more holistic and efficient employment, specifically, conceptualisation and execution of air operations. Division of limited air assets would result in sub-optimal employment and frittering away of the ability to apply force in being. This is important for air power's operational effects, and strategic outcomes to benefit national military goals. This has emerged from the lessons of the war in Iraq. The Kosovo campaign validated air power's ability to be single handedly decisive. Air power will remain a coercive instrument in a limited war as happened in Serbia. It will play a significant role in out-of-area contingencies. Air power will continue to be the first responder during political and humanitarian crises. Space will play a great role in all future wars. Exploiting air and space as a single medium will give greater dividends. Counter-space capabilities and operations would have to be planned.

Similar will be the case with the cyber space domain for asymmetrical competition. Mostly, cyber attacks will degrade and harm but may not cross the threshold to be called an act of war. The effect can be devastating even if it is for a short period. Ruggedising and redundancy will be very important. Air power as a component of grey zone operations has to be understood for both employment and defence. Young leaders would have to be trained for fog-of-war decision-making with sub-optimal inputs. Unmanned systems will proliferate. These will be cheaper and effective, and will have to be acquired in larger numbers, and exploited. It is a decisive and strategic instrument whose importance will continue to grow. Air power would have to be made cost-effective. India's national security imperatives for the next two decades have to be understood. The country must first finalise its national security strategy. Building capabilities will remain a whole of nation approach.