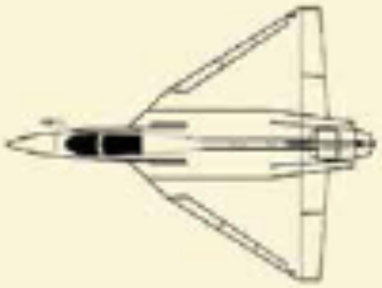

Rapporteur Report
CAPSS and MP-IDSA Conference
Strategic Renaissance of Air Power

24 and 25 March 2026

CENTRE FOR AEROSPACE POWER AND STRATEGIC STUDIES

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The Centre for Aerospace Power and Strategic Studies (CAPSS) and Manohar Parrikar Institute of Defence Studies and Analyses (MP-IDSA) organised a first of its kind conference on the Strategic Renaissance of Air Power at the Conference Hall of MP-IDSA on 24 and 25 March 2026. The conference was aimed at providing a platform for critically examining the changing character, challenges and opportunities of aerospace power in both current and future operational environments. The seminar brought together a distinguished panel of experts drawn from India's friendly foreign countries, armed forces, academia and the strategic community to generate fresh insights and practical recommendations.

Inaugural Session

Opening Address: The session commenced with. Ambassador Sujan R Chinoy, DG, MP-IDSA delivering the Opening Address. He set the tone for the conference by talking about how contemporary

warfare had become a seamless spectrum integrating aircraft, missiles, drones and space-based assets. He also spoke of how aerospace power had begun to offer far greater operational flexibility across both the vertical as well as horizontal dimension making it central not only to offensive operations but also to intelligence, surveillance and reconnaissance (ISR) functions that underpin all domains of warfare. He underscored the importance of ongoing collaborations such as the proposed Indo-French engine development initiative, but stressed that genuine self-reliance would require sustained domestic capability building across design, development and manufacturing. The DG argued that future conflicts, likely characterised by attrition and high consumption of precision systems, would depend not only on platforms but on resilient supply chains and production capacity. He further added that, India would need to prioritise indigenous development in areas such as drones, counter-drone systems and dual-use aerospace manufacturing. He concluded his address by emphasising that the future of warfare would be shaped as much by the strength of supporting industrial ecosystems as by frontline capabilities, and called for urgent and coordinated efforts to build both.

Welcome Address. Air Vice Marshal Anil Golani (Retd), DG CAPSS, welcomed all the guests and panellists and called air power as the harbinger of change. He spoke of how from the early visions of Douhet, Trenchard and Billy Mitchell to the precision led paradigms of John Warden and David Deptula, thew evolution of air power had constantly redefined the grammar of warfare. Citing

ongoing conflicts, the DG mentioned that the world was at a cusp of something very profound, which was not just an evolution but a strategic renaissance. He also mentioned that air power was no longer confined just to the skies but had begun to extend into space, cyber and the electromagnetic spectrum and called the renaissance a convergence of technology, geopolitics and doctrine. The DG introduced all the sessions bringing out key aspects of control of air, geopolitical shifts and contests in air, future trajectory of aerospace design, some emerging trends in air warfare, challenges of space enabled operations and finally air power strategy and the need for doctrinal transformation. AVM Golani also spoke on the enduring insight of John Boyd who emphasised the importance of operating inside an adversary's Observe-Orient-Decide-Act (OODA) cycle. He further mentioned that in modern warfare, the OODA loop was no longer confined to the cockpit or the command centres but spanned across domains and cognitive spaces. Therefore, he added that the strategic renaissance of air power was not just about new capabilities, it was about speed, integration, adaptability and achieving strategic effects in an increasingly complex and contested environment. In the end, the DG urged all the participants to use this platform to share insights as well as challenge assumptions, explore new ideas and contribute to a deeper understanding of where air power was headed.

Keynote Address: Former Chief of the Air Staff, Air Chief Marshal RKS Bhadauria delivered the keynote address wherein he began by speaking of the growing centrality of air power in contemporary and future conflicts, arguing that air power not

only shaped the opening phases of war but also set the tempo of operations, controlled the escalation ladder and impacted outcomes. The Chief highlighted the role of low-cost, high-impact technologies like Shahed-136 drones in the ongoing conflicts and how they had exposed vulnerabilities in advanced air defence (AD) architecture challenging the efficacy of such systems. He also added that the advent of such technology necessitated a comprehensive reassessment of traditional force structures and operational paradigms. ACM Bhadauria brought out the fact that there were significant gaps in India's capabilities in niche technology like Artificial Intelligence (AI) especially in terms of indigenous data, algorithms and intellectual property, which required urgent attention. He also spoke on the salience of achieving and maintaining control of air and how it was increasingly becoming difficult in peer or near-peer conflict scenarios. The former Chief called for greater integration not only between the armed forces but also between all elements of Comprehensive National Power (CNP) to enable the conduct of multi-domain operations (MDO). He ended his address by stressing on the need for aligning technological development with operational realities rather than past requirements which may not necessarily deliver meaningful combat advantage.

SESSION-I

Control of the Air

Chair: Air Chief Marshal VR Chaudhari PVSM AVSM VM (Retd.), Former Chief of the Air Staff

Panellists: Dr Alexander Ludi Epifanijanto (Indonesia Centre for Air Power Studies), Maj Gen SERA Tatsuhiro (Director JASI), Air Mshl D Choudhary PVSM AVSM VM VSM (Retd), former Commandant NDC.

Air Chief Marshal Chaudhari set the tone with his insightful opening remarks for the session. He mentioned that the concept of control of air had undergone significant transformation across successive conflicts and traced its evolution from the Battle of Britain, the Arab-Israeli wars, the Indo-Pak war of 1971 and the two Gulf Wars highlighting the fact that achieving and maintaining control of air was key to further progress of the land and sea campaigns. Moving on to the ongoing conflict in Ukraine, he brought out that neither Russia nor Ukraine was able to achieve the requisite degree of control of air resulting in a highly contested battle space. He further added that 'air parity' was increasingly becoming the norm, especially in near-peer conflicts, driven by dense and layered AD networks, technological diffusion and comparable force structures. In such situations, the Chief added, the challenge was not just achieving control of air but continuously contesting, degrading and selectively dominating both in time as well as space.

Speaking on *Gaining Control of Air-Feasibility and Relevance in Future Conflicts*, **Dr Alexander Ludi Epifanijanto** spoke of the increasing difficulty of achieving sustained dominance in contested environments. He highlighted that advances in integrated air defence systems, precision strike capabilities and multi-domain operations were eroding the feasibility of traditional air superiority and added

that as a result of the advances, control of air in future wars was likely to be episodic and mission based, achieved for limited durations with specific operational objectives.

Maj Gen SERA Tatsuhiro spoke on the *Control of Air Over Maritime Spaces,* bringing out the importance of control of air in an era of persistent contestation in the air domain. He argued that the air domain today was rarely permissive, with sustained air superiority becoming increasingly difficult due to the proliferation of networked AD systems and precision strike capabilities. As a result, the focus had moved beyond binary notions of air superiority towards more fluid conditions of contested or mutually denied airspace, where access was constrained by time, mission objectives and operational risk. Focusing on the Indo-Pacific, he highlighted that control of the air was critical for freedom of manoeuvre and enabling joint and combined operations across a vast maritime geography. However, this environment presented distinct challenges, including expansive operational distances, the presence of sophisticated anti-access/ area denial (A2/AD) systems, and the vulnerability of forward-deployed infrastructure. These factors further complicated the ability to generate and sustain air power in the region. He highlighted the need for distributed and resilient force structures, greater reliance on unmanned systems and deeper integration across all domains. Importantly, he suggested that in the Indo-Pacific context, control of air was not just a national objective but increasingly a collective endeavour, enabled through international cooperation. Such an approach, he suggested, was essential for maintaining a free and

open Indo-Pacific. He also called for distributed, mobile and resilient systems to achieve the requisite degree of control of air when and where required.

Speaking on *Control of Air in Modern Conflict – An Indian Appreciation*, **Air Mshl D Choudhury** began by cautioning against drawing simplistic conclusions about air power based solely on individual conflicts. He emphasised that while air power could deliver decisive effects, its success ultimately depended on its integration with the broader national strategy. The Air Mshl brought out certain key facets from India's wars from 1948 onwards stressing on the fact that control of air existed in various degrees rather than being an absolute condition. The extent of interference determined the level of control achieved, which in turn shaped the depth and scale of operations that could be conducted. In high-intensity scenarios involving capable adversaries, there was, therefore, a need for continuously contesting the control of air and that it should never be assumed at any stage of the conflict. From an operational standpoint, he stressed that securing one's own airspace was the first priority followed by the ability to project power into the adversary's territory. To accomplish this, the Air Mshl highlighted the need for robust AD systems, integrated command and control structures and a network-centric architecture that ensured effective sensor-to-shooter linkages. The ability to generate and sustain such an integrated system would be critical for achieving and maintaining operational advantage. He further spoke of the unique challenge posed to India alluding to the collusive threat from Pakistan and China. He added that given the collusive

threat, the enormity of India's airspace and demands of extended operational theatres, achieving and maintaining control of air was becoming more complex. Looking ahead, the Air Mshl suggested a shift towards a broader aerospace framework, integrating air and space domains to enhance situational awareness and operational capabilities. He emphasised that control of the air should not be seen as an end in itself, but as an enabler of wider military objectives. This would necessitate a multi-domain, multi-service and multi-agency approach, particularly in the context of India's expanding interests in the Indian Ocean Region and the Indo-Pacific.

SESSION-II

Geopolitical Shifts and Contests in Air

Chair: Mr Sandeep Unnithan, Editor in Chief, Chakra News

Panellists: Wg Cdr Survesh Dhir, HQ_WAC, Dr Pooja Bhatt, OP Jindal University, Colonel Pilot Staff Ahmed Mohamed Rageh Fathalla Mohamed Zohdy, Egyptian Air Force, Colonel Ali Mohamed Ali Dowaid Alzeyoudi, Joint Command and Staff College UAE.

Mr Sandeep Unnithan opened the session by bringing out the relevance of theoretical air power discussions in the context of contemporary global conflicts. He noted that the current international landscape was witnessing one of the most intense air campaigns of the 21st century, characterised by a defining moment for air policy. This comparison suggested that the world was at a critical juncture where the nature of warfare and geopolitical

influence was being fundamentally reshaped by developments in the aerial domain. The Chair critiqued the historical perception of air power's effectiveness in achieving strategic political outcomes. He specifically challenged the notion held by some commentators that air power had never independently facilitated regime change or caused significant geopolitical shifts, and cited the 1945 strategic bombing campaign against Japan, the 1999 Kosovo intervention, and the 2011 operations in Libya as clear instances where aerial superiority dictated terms on the ground. He suggested that the current global situation may represent a fourth major era where air power would serve as the primary driver of geopolitical change. Mr Unnithan gave the example of Op-*Sindoor* to bring out how air power turned the tide of the conflict within a period of 88 hours without the necessity of a conventional ground invasion. He also spoke of how events unfolded after the 1995 Purulia arms drop and how it served as a catalyst for developing an indigenous AD 'system of systems', called the Integrated Air Command and Control System (IACCS).

Wg Cdr Survesh Dhir gave a presentation on *Air Domain Awareness – Collaboration in South Asia* where he emphasised on the need for establishing credible air domain awareness (ADA) framework within South Asia and the IOR. The Wg Cdr defined ADA as the integrated collection, analysis and timely sharing of intelligence among all stakeholders and argued that traditional maritime surveillance was no longer sufficient to protect national interests in a multi-domain threat landscape. He further alluded to the Russia-Ukraine war which he called a laboratory for unmanned

aerial vehicles (UAVs), cruise missiles and stand-off weapons. He also spoke of how Houthi operations in the Red Sea had heralded the democratisation of military technology allowing non-state actors to disrupt global shipping. He called the 37 hours, non-stop, missions flown by US B-2 bombers as a demonstration of global reach. Speaking on the escalating risks in IOR, the Wg Cdr brought to the fore the massive surge in both civil aviation as well as maritime trade adding that there was a 15 percent increase in domestic air traffic, while the IOR was host to 70 percent of the world's oil transportation and 50 percent of the global container traffic. He further added that incidents affecting maritime security had grown by 79 percent between 2017 and 2024 and that amongst those incidents, the contribution of aerial, missile and drone threats rose dramatically from 3.6 percent to 31 percent adding to the threat spectrum which maritime domain awareness (MDA) alone could not address. During the presentation, he identified that air space control over international waters would require a collaborative, multi-domain approach that was capable of integrating space based assets, terrestrial sensors, high altitude pseudo satellites (HAPS) and sub-surface sensors to secure the entire spectrum of threats. He proposed the creation of a dedicated ADA Centre within the region and recommended permanent presence of liaison officers from all stake holders from friendly foreign countries and establishing joint working groups to standardise operating procedures. On the national level, the speaker urged IAF to maintain an outward looking focus by extending early warning capabilities far beyond the Andaman

and Nicobar Islands and the Lakshadweep and Minicoy Islands by leveraging modern technology and ensuring comprehensive multi-domain coverage in India's area of interest.

Dr Pooja Bhatt focussed on providing a conceptual and theoretical framework for air power emphasising that there was a need for scholars to analyse the 'why' dimension of air power while practitioners looked at the 'how' part of it. Her presentation explored the evolution of air power from 1903, the differing schools of thought like strategic bombing and military denial and also examined the same in the back drop of China's current activities in the South China Sea. The speaker delineated a significant academic debate between "Strategic Bombing" and "Denial Strategy." While early theorists like Giulio Douhet and John Warden prioritised offensive bombing to achieve independent victory by targeting an adversary's leadership and systems, scholars like Robert Pape argued that air power was most effective when used to prevent an enemy from achieving its goals. In the Indian context, the speaker highlighted the contributions of the late Air Commodore Jasjit Singh, who adapted these global theories to emphasise joint operations. She added that Singh's work identified precision, reach, lethality, and rapid mobility as the core competencies that allowed air power to influence strategic centres of gravity with minimal ground involvement. A major portion of the presentation was dedicated to China's "Strategic Expansion" within the South China Sea, where Beijing claimed approximately 80 percent of the territory via the "Nine-Dash Line." The speaker identified three core goals of

China's air power development, viz., *reinforcing maritime territorial claims, establishing permanent military infrastructure to ensure rapid response, and projecting power to deter regional rivals* like Vietnam and the Philippines. She also brought out how China was transforming formerly insignificant topographical features into sophisticated outposts that hosted long-range sensors, surface to air missile systems and advanced fighter detachments. The speaker provided updated evidence of China's reclamation efforts, specifically highlighting the rapid development of Antelope Reef in the Paracel Islands. She ended her presentation by showing satellite imagery from March 2026 wherein, Antelope Reef had been expanded to nearly 1,490 acres, rivalling Mischief Reef as one of the largest features in the region. This site was further being developed with runways, hardened shelters and sensor arrays capable of hosting J-10 and J-11 fighters as well as H-6K bombers. These "dual-use" facilities allowed for persistent patrolling and provided China with the ability to impose air superiority over critical trade routes, effectively challenging the freedom of navigation in the region.

Colonel Pilot Staff Ahmed Mohamed Rageh Fathalla Mohamed Zohdy spoke on the *Challenges from Non-state Actors in Air* and the increasing complexity of the same. He brought out that modern technology had democratised aerial capabilities, allowing small groups and individuals to create strategic effects , something which only well established nation-states did in the past. Col Zohdy mentioned that a Shahed-136 drone costed around USD 30,000 to produce and at the same time, the interceptor missiles used to

intercept the drones costed around USD 1-4 Million. This "cost ratio imbalance" allowed non-state actors to conduct attrition warfare to economically exhaust a state's AD resources. Further, the speaker noted that the proliferation of commercial satellite imagery and GPS jamming tools had granted the non-state actors access to high end ISR capabilities at a fraction of the cost. To address these issues, the Colonel proposed an adaptive, AI-assisted defence model consisting of five distinct layers designed to use the "minimum force necessary" to achieve the maximum defensive effect:

- **Layer 1, Soft-Kill (Electronic/Cyber):** This was proposed to be the primary layer for low-cost UAVs utilising GPS jamming, cyber hacking and network disruption to neutralise threats without physical destruction, minimising collateral damage.
- **Layer 2, Directed Energy (Hard-Kill):** This layer would employ high-energy lasers and high-power microwaves to achieve precise, low-cost engagements against close-range threats.
- **Layer 3, Kinetic Hard-Kill (Conventional):** Utilising aircraft, surface-to-air missiles, or defensive UAVs to target high-speed threats that could not be stopped by electronic means.
- **Layer 4, High-End Interceptors:** Systems like the S-400 or Patriot. The speaker advised that this layer could be avoided for low-end drones due to high costs, reserved only for high-value strategic threats.
- **Layer 5, Passive Defence:** This layer would be "always active" and included hardening of infrastructure, camouflage and tactical dispersion to ensure resilience even if an aerial breach occurred.

The Colonel concluded his remarks by stressing on the need for the right layer to be used at the right time. He emphasised on the requirement to integrate AI into the C2 architecture in order to evaluate developing threats in real time and select the most cost effective as well as suitable response in order to neutralise the threat.

Offering provocative insights into the events unfolding in West Asia, **Colonel Ali Mohamed Ali Dowaid Alzeyoudi**, called the war a 'live laboratory' for strategic testing of weapons and tactics. Focussing on regional resilience and technological independence, the Colonel examined why major powers and regional states had shown hesitation in commiting conventional air assets, despite being in possession of advanced platforms. He added that rather than seeking full-scale combat, these operations were designed to test the detection thresholds of both Western response systems and Gulf state defences. By launching waves of low-cost drones, the adversary was successfully able to map the integrated defence networks. Forcing the defenders into a reactive posture. As a result, by intercepting cheap drones using high-cost weapons, often at night and at low altitudes, significant depletion of conventional defence resources took place and that too at a very high cost. He also highlighted the apparent gap between theoretical capabilities and demonstrated performance in contested operational environments. He further added that this created a significant 'integration gap' and hesitation among regional states to align fully with extra-regional powers like the USA. The speaker also argued that reliance on external security guarantees often came with pressure points and misaligned objectives, prompting nations

to reconsider the sustainability of such military alliances. Citing UAE as a case study, the Colonel spoke of the rapid acceleration in indigenous defence research and development for creation of autonomy becoming a strategic imperative. He mentioned that the gola was tos hield the nation from external poressures by reducing reliance on foreign-produced systems which may not be available or optimised for local conditions.

The session concluded with the Chair recommending accelerated development of niche technology, leap frogging to reduce timelines, building a unified regional network connecting detection and execution across allies and partners, establishing economic and security partnerships to create shared resilience and how there was a need to master and integrate all five domains to be credible.

SESSION-III

Future Trajectory of Aerospace Design

Chair: Air Chief Marshal RKS Bhaduria, PVSM AVSM VM, Former Chief of the Air Staff.

Panellists: Air Cmde Girish Dantale VM, Air HQ (VB), Brig Gen Houston R. Cantwell (Retd.), Senior Resident Fellow for Air Power Studies, Mitchell Institute for Aerospace Studies, USA (online), Dr Noh Ikyu, KIDA.

Air Chief Marshal Bhadauria opened the session by speaking on an urgent need to create a system capable of being able to detect and target drones and UAVs, seamlessly integrating with the existing system to create robust full spectrum defence capabilities.

He also spoke of how Manned-Unmanned Teaming (MUM-T) and hypersonic weapons would change the way future wars would be fought and that there was a need for the armed forces to adopt emerging technology and use niche technology like AI at the earliest, failure to do so would put India far behind the West.

Acknowledging that while MUM-T technology had existed for quite some time, **Air Cmde Dantale** explained how automation and automatic systems had been misconstrued as MUM-T. The speaker also brought out how unmanned systems were yet to be able to look at situations from an ethical and legal standpoint and how limitations in AI capability made it impossible to replace humans with unmanned autonomous systems in the application of combat force. He further added that unmanned systems were also required for high-risk, high-reward missions without risking lives. Considering these issues, the Air Cmde said that MUM-T provided the much-needed balance between manned and unmanned systems. The Air Cmde also spoke of the entire spectrum of war ranging from full war, limited war, hybrid war and peace to conduct of counter insurgency/counter terrorism (CI/CT) operations. He brought out a very important operational philosophy where Humans on the Loop (HOTL) and Humans in the Loop (HITL) were required at two extremes of the spectrum. HOTL at the full war level, gradually increasing human role to HITL during conduct of peace time operations like CI/CT. The Air Cmde ended with saying that India needed to make a capability road map for miniaturisation of hardware, focus on semiconductors and protection of IP for individual developers.

Speaking online, **Brig Gen Houston R. Cantwell** put the 2025 National Security Strategy (NSS) of the USA into perspective and said that precision strikes and high tempo air campaigns had become the 'go to' tool for the USA. He began with how the NSS broadly outlined the USA's priorities for national defence with an increased focus on homeland defence. He also brought out the need for USA to secure overseas interests and project military power whenever interests were threatened. He added that in order for the US to be able to do that, US would require requisite degree of control of the air as demonstrated in Iraq, Kosovo, Op Midnight Hammer and Op Epic Fury. The speaker also alluded to the risk averseness of the American population and therefore the need for them to make precision air power the preferred way to fight. He added that even when land forces were used, air power was heavily relied on to shape the battlespace and achieve air superiority. Citing the war in Ukraine, he mentioned that both sides were not able to achieve air superiority and as a result the ground forces were denied freedom of manoeuvre. He also mentioned that there was a constant upgradation in drone technology and that stockpiling them was not recommended. He alluded to the robust US military technology ecosystem comprising of colleges and universities, Think-tanks, industry and the various research labs involved in developing the next generation of niche technologies and working in unison to bridge the gap between theory and application. Speaking of a military engagement with China, the speaker said that it would be a big challenge for the USA to project power across the Pacific and control the skies especially in

the event of an armed takeover bid of Taiwan by China. He based his comments on the 2025 Mitchell Institute War Game—Denying Sanctuary, where a possible engagement with China was war gamed. He said that achieving and maintaining air superiority in certain areas would become a key operational imperative for the Americans and they would also need to conduct a dedicated campaign to address mainland China in order to degrade Chinese warfighting capability. A possible force structure that the war game came up with consisted of 200 B-21s and 300 F-47s. The Brigadier General also spoke on the need for USA to maintain its technological edge over the world by staying ahead of the curve. Replacing 4th and 5th generation aircraft, developing 6th generation aircraft and MUM-T technology along with low observable technology would go a long way in retaining the edge. The speaker ended with the need for administrative, legislative and congressional assistance in realizing USA's developmental roadmap.

Dr Noh Ikyu spoke on the *Korean approach to future design – Aeroengines and Combat aircraft*. He began his talk by bringing out the four main challenges facing ROKAF starting with the heightened threat posed by North Korea's nuclear programme and aggressive development of ballistic missiles. He explained that Pyongyang's ever-expanding nuclear arsenal with hard-to-find, quick-launch solid-fuel Intercontinental ballistic missiles (ICBMs), and the building of Nuclear Submarines equipped with Submarine-launched Ballistic missiles (SLBMs) to enhance North Korea's second-strike capabilities, were constant concerns for South

Korea. He also emphasised that enhanced cooperation between the Democratic People's Republic of Korea (DPRK) and Russia could be a game-changer in the region and was a cause for concern in Seoul. He then spoke of the second challenge for ROKAF which was the ongoing competitive global arms race, particularly in East Asia. Talking of the US-China rivalry, which has constantly intensified since the 2010s, upending the global security order with huge implications for East Asia, he added that China had emerged as a source for fuelling arms race and maritime disputes across East Asia, and China's own military modernisation was also a source for the upset in the regional/global balance and contributed to deepening threat perceptions. He cited that by 2023, China's high tech (4.5th and 5thgeneration) aircraft numbers would be more than South Korea and Japan's numbers combined and that raised serious questions with regards to East Aisa's air power balance. Speaking of the third challenge, Dr Noh mentioned that the new policies of President Trump regarding the need for increased spending by NATO and allies towards defence (pledging 5 percent of GDP) created additional financial stress on the country. He further stated that the USA's constant demands, ever-rising threats and the looming abandonment risk have made South Korea rethink its relationship with them. The fourth challenge Dr Noh spoke of was the rapid progress in defence technologies, such as robots, drones, AI, autonomous systems and hypersonic weapons, among others, was changing modern battlefields and South Korea was not fully prepared for such a battle. He also acknowledged that drones and

unmanned systems were changing and reshaping modern warfare and there was a need for South Korea to learn and adapt. As part of the 'ROKAF Vision 2050', he added that the programme, Air Force Quantum, was directed towards development of greater ISR capability, transforming ROKAF into a technologically advanced fighting force, reflecting their strong desire to become an *aerospace force* capable of undertaking multi domain operations (MDO). Dr Noh also spoke of the vision of their new President, Lee Jae-myung who had laid down the concept of 'Air Guardian' which included AI-based MUM-T, greater long-distance strike capabilities, and better force integration. The concept also called for development of a 6th-generation fighter by 2040. The speaker also spoke of the success of the indigenously designed and developed KF-21 Boramae and said that the aircraft would also serve as a platform for developing the next generation fighters in ROKAF. Speaking of space, Dr Noh ended his talk by highlighting the need for transforming ROKAF into an air and space force gradually expanding its domain into space in an integrated manner.

The Chair gave the closing remarks by complimenting all the speakers for their valuable comments and interventions. He called for the need to address the immediate challenge of small, yet lethal, drones as seen in the ongoing conflicts. He said that while a soft kill option has been developed, the need of the hour was developing suitable hard kill options. He urged all stake holders to come together and develop viable and scalable technology to address the immediate challenges. He ended with the thought that the future of aerospace

design was standoff engagements with precise weapons, autonomous platforms, hypersonics and advanced sensor technologies and urged Indian Industry to concentrate in these areas. He also said that AI and its associated technology would significantly change the design landscape by reducing a 10-15 year developmental cycle to just 1-2 years and that there was a need to curate and purify our data and information to enable AI do its job.

SESSION-IV

Future Trajectory of Aerospace Design

Chair: Vice Admiral Shekhar Sinha PVSM AVSM NM** (Retd) former FOC-in-C WNC.

Panellists: Dr Javed Alam, Research Associate, CAPSS, Gp Capt YAN Petkar, 200 Sqn, Dr Manpreet Sethi, Distinguished Fellow, CAPSS.

Vice Admiral Shekhar Sinha set the tone for the session by introducing the panellists and also added that modern air power had the capability to influence the battle space both over land and sea and that it must be given its due cognizance.

Dr Javed Alam spoke on the *Impact of Hypersonic Weapons on Modern Warfare*. The speaker began by shedding light on the history and evolution of hypersonic weapons, beginning from the end of World War II, when significant investment in missile technology had just started, to the twenty-first century, where missiles were more commonly being used as conventional war-fighting tools. From tools of coercion and deterrence, the ballistic missiles had

now become regular use weapons as is being seen in the ongoing wars across the world. Dr Javed spoke of the changing dynamics of missiles by highlighting key differences from the Cold War era to the post-Cold War era where precision, guidance and speed had now become central to their development. Dr Alam then proceeded to describe the key characteristics of hypersonic weapons like high-speed compressing response time, their unpredictable trajectories, high-precision potential and dual use capabilities. He further explained the difference between ballistic and hypersonic missiles including their limitations alluding to the fact that both ballistic as well as hypersonic missiles travelled beyond Mach 5 in their terminal phase making them difficult to target. What separated hypersonic missiles from ballistic missiles was their mid-course and terminal phase manoeuvreability. The speaker then discussed the key features of hypersonic missiles like high speed, high manoeuvreability, low altitude flight and difficulty in detecting and intercepting them. Speaking of operational hypersonic missiles, the speaker said that DF-17, DF-21D and the under-development DF-26 were the three main weapons being operationalised by China. The speaker also brought out the huge impact of hypersonic weapons on deterrence capability because these weapons challenged traditional deterrence, created ambiguity and increased crisis instability especially during heightened tensions between two nuclear powers. On the issue of impact on global stability, the speaker said that hypersonic weapons had destabilised the global balance, blurred conventional and nuclear red lines and encouraged an global arms race to develop such

weapons. Bringing out military advantages of the technology, Dr Javed highlighted their ability to rapidly strike high value targets and penetrate even the best defences. Speaking of limitations, he said that the technology was extremely expensive, there were myriad technical challenges and had limited payload capacity. Dr Javed clarified that in the Russia-Ukraine War, Kinzhal and Zircon systems were used and also intercepted. He highlighted that Kinzhal was not a classical hypersonic weapon and was categorised so only because of its speed. He further added that because of the missile not being able to manouvre, Kinzhal was an aero-ballistic missile and thus successfully intercepted by Ukrainian AD. The speaker concluded by stating that hypersonic weapons would reshape warfare in the future, increase risks and uncertainties and therefore there was a need for arms control mechanism and policy response.

Gp Capt YAN Petkar spoke on *Drones and Missiles - An Effective Comparison in Long Range Strikes*, and began his talk with examining the warhead-to-target matching process across different munitions and comparatively analysed the dynamics between Shahed-131, Shahed-136 and Rafael's Ice Breaker subsonic cruise missile concluding that while Shahed and its variants were largely saturation weapons, the Ice Breaker was a precision weapon. He spoke of the blast effect of weapons vis-à-vis the explosive weight of charge bringing out the fact that as distance from the blast site increased, the effectiveness of the blast reduced. The speaker also brought out the effects of impact velocity of various munitions, including the Shahed Geran-1 and 2 variants, UMPB, Tomahawk,

Storm Shadow, ATACMS, Brahmos, Iskander-M and Kinzhal, before turning to their cost-effectiveness. Carrying out a target reachability comparison, the speaker brought out that ballistic missiles had the lowest interception rate as compared to Shahed drones and its variants in the Russia-Ukraine war. However, he also brought out that the interception rate for all kinds of munitions in the West Asia conflict was around 90-93 percent primarily because of better AD weapons being used. He also stated that better interception rates for Shahed and other cruise missiles was significantly higher because of high launch ranges and slow speed. *Comparing and analysing all attributes, the speaker said that the effective lethal hit probability of weapons being used in Russia-Ukraine conflict and the conflict in West Asia was the lowest for Shahed class of weapons and highest for high-speed weapons like Kinzhal.* The speaker also brought out some miscellaneous factors like geography and terrain; and launch platforms (whether air launched or surface launched) and recommended high calibre, high speed, low cost and good accuracy weapons as weapons of choice for future wars. He concluded the talk by stressing on the fact that while weapons had become lethal and effective, an effective strategy for both offence and defence would determine who would win the war.

Dr Manpreet Sethi spoke on *Aerial Attack on Nuclear Installations – Impact and Future Prospects* and commenced her talk with the fact that the title of her talk was very prescient given the events unfolding in West Asia where nuclear installations were being targeted from the air. She also added that the talk would focus

primarily on civilian nuclear installations, direct aerial attacks on reactors, spent fuel storage, enrichment facilities and reprocessing plants and not on weapon storage areas and silos. She identified the main aerial threats as aircraft, missiles and drones and also stated that an emerging significant threat was cyber-attack on C2 to cause operational disruption and malfunctions in the system. Dr Sethi also explained that the purpose of attacks on nuclear facilities could be for counter-proliferation, crippling electricity supply or to impact a nation's war-making potential. The speaker carried out an analysis of target vulnerability and likely impact concluding that cooling towers and transformers/grids were the most vulnerable as they were the most exposed as compared to spent fuel pools and reactor core. Bringing out legal prohibitions on attacks on nuclear facilities, the speaker spoke of the Additional Protocols I and II of 1977 to the 1949 Geneva Conventions which prohibited targeting of nuclear and associated facilities including UNGA and IAEA General Conference Resolutions. She added that the Nuclear Weapon Free Zone Treaties also provided a framework for not striking nuclear facilities. However, she added that since 1980 attack on Iraq's Osirak reactor, there have been numerous instances of targeting nuclear facilities primarily by US and Israel which only bring out the fact that while provisions and resolutions existed, applicability and enforceability was severely lacking. Bringing out recent attacks on Russian and Ukrainian nuclear facilities, she highlighted that weaponization of nuclear facilities had started, not seen in the past. She highlighted that the only instance of respecting the laid down treaties and resolutions was between India

and Pakistan, signed in 1988 and it could serve as a model for other bilateral/regional/multilateral agreements. The speaker concluded by listing the future challenges and mitigation means in the nuclear domain. She spoke of the greater acceptability of use of force in inter-state equations, emerging risks of new technologies and weapons, and the psychological impact of attack even with limited damage. She stressed on the fact that the only way to mitigate the challenges was by protecting through realisation, strengthening norms, codes of conduct and regulating military behaviour.

The Chair thanked the panellists for their valuable insights and concluded the session by stressing that development in technology has enabled easier targeting of nuclear facilities and the major change has been in the increased use of space based ISR and long-range precision targeting capability.

SESSION-V

Challenges of Space Enabled Operations in Modern Conflicts

Chair: Air Marshal S.P. Dharkar PVSM UYSM AVSM (Retd), Former Vice Chief of the Air Staff.

Panellists: Brig Anshuman Narang (Retd), Founder Atmanirbhar Soch, Gp Capt Parijat Agashe, AWSC, Air HQ (VB), Gp Capt T. H. Anand Rao (Retd.), Director, ISpA.

Air Mshl SP Dharkar set the tone for the session by saying that the international rules-based order had taken a hit, given the unfolding situations across the globe. He added that the term

international law had become an oxymoron and the conventional domains of warfare, viz., land, sea and air were facing significant challenges, however, space presented a distinct and uniquely complex set of issues and challenges. He highlighted five key concerns of prime relevance in the domain as orbital congestion, competition over the electromagnetic spectrum, rapidly increasing number of players (including private, government and military), the nature, complexity and evolution of space technology and the high costs associated with space operations. The regulatory and governance frameworks have not evolved at the same pace as the rate of proliferation of space activities. As more nations and commercial entities sought to deploy satellites and establish presence in space, the necessity of a robust rules-based system had become increasingly evident to ensure the safe, sustainable and equitable use of outer space.

Brig Anshuman Narang spoke on the *Dual Use Infrastructure in Space: Trends and Prospects* and began his talk by bringing out the the growing convergence of civilian and military space infrastructure in reshaping the character of modern conflict, making space a critical strategic domain. The Brigadier said that recent trends indicated that space assets, particularly commercial satellites, were increasingly being integrated into military operations for ISR, navigation and communication. The speaker analysed the dual use scope of space from a Chinese lens and spoke of the effectiveness of the Chinese space architecture. He added that conflicts between Iran and Israel as well as India and Pakistan had demonstrated how commercially available satellite imagery, algorithmic targeting and real-time

data fusion were enhancing battlefield awareness and precision strike capabilities. China, in particular, had been leveraging a dense network of civil and commercial satellites to collect high-frequency imagery and feed it into artificial intelligence systems, enabling rapid improvement in targeting algorithms and decision-support systems. He cited examples from Maxar providing civilian satellite images to Pakistan before Pahalgam happened, China using civilian satellites to map Doklam before moving troops forward, bringing out the fact that space had become a very important domain for the conduct of modern warfare. He also highlighted the importance of purified data to enable AI to mature and enable edge computing, adding that space was a very big domain providing purified data. He further added that space was the new commanding height and data the new oil. He also quoted a Chinese satellite imaging venture between 12-24 Jun 2025 where Chinese commercial satellites took 350 images of Iran per day, which amounted to 35 images per day light hour which was more than one image every two minutes. They had information of every THAAD interceptor's deployment and the same could have also been provided to Iran. The main area of focus was that the Chinese were purifying their data at a very rapid pace. An interesting fact that the speaker brought out was that while the world was imaging China around 500 times per day, China was imaging India alone around 500 times a day which gives an idea of the colossal effort on space-based systems and ISR by China. The speaker also spoke of the next big trend in space was to transit from *sensing and analysing in space* to *decide*

in space and command from space. A paradigm shift in conduct of space operations. The Brigadier showed the Chinese Aerospace Force (ASF) architecture, implying the optimal exploitation of dual use infrastructure and highlighting how China was way ahead of most of the world. The speaker spoke of the need for developing indigenous space technology and asked a very pertinent question on how many Indians were using ISRO's Bhuvan satellite imaging capability and Map My India for navigation. He further added that the prolific use of Google Earth and Google Maps only added to the revenue and date base of the USA while ignoring Indian requirements. He urged all Indians to use in-house technology and applications and build indigenous ecosystems. He further added that the broader technological trajectory pointed towards miniaturisation, commercialisation and persistent low-cost space presence as demonstrated by Ukraine's effective use of commercial satellite data and drone integration. Brig Narang said that the future battlespace was increasingly defined by the fusion of data from satellites, unmanned systems and terrestrial sensors into geo-spatial artificial intelligence architectures, where algorithmic superiority would prove to be decisive. This shift underscored the importance of persistent ISR, synthetic aperture radar, resilient communication layers and reduced latency in data dissemination. Speaking on imperatives for India, he added that India needed to expand its satellite constellations, strengthen indigenous commercial space capabilities, invest in space-based data analytics and AI and build an integrated civil–military space ecosystem. Without such

measures, reliance on delayed or externally sourced imagery could create strategic vulnerabilities in crisis or conflict scenarios.

Gp Capt Parijat Agashe spoke on the *Future of Space Security: Navigating Between Deterrence and Diplomacy* and highlighted that the primary challenge in the space domain was managing the rapid proliferation of counter-space capabilities before they destabilised the operational environment. He began with a quote from Tim Marshall, "Each time humanity ventured into a new domain, it has brought war with it." The quote ominously signals the eventual weaponisation of space as the next logical development rather than just a focus of academic research. The Speaker drew on the writings of Clausewitz and highlighted the Clausewitzian trinity of Passion, Chance and Reason and juxtaposed the same to the space domain. He added that unlike traditional domains, space was borderless, technologically opaque and dominated by dual-use infrastructure, making it difficult to distinguish between cooperative and hostile actions. The presence of orbital debris and the absence of universally binding norms further increased the risk of miscalculation and threatened long-term sustainability in space. He noted that existing legal frameworks particularly the Outer Space Treaty were limited in scope as they focussed mainly on weapons of mass destruction and did not adequately address emerging threats such as electronic warfare, cyber operations and anti-satellite technologies. As a result, technological developments in space were significantly outpacing existing and emerging governance mechanisms. Discussing India's approach,

he observed that the country's space programme, traditionally civilian-led, was now gradually integrating with national security objectives. He further added that India's strategy rested on three pillars; *strengthening deterrence and resilience*, *promoting responsible behaviour and governance* and *expanding international partnerships*. Describing India's strategic position, the Group Captain described India's deterrence capability by speaking about Mission Shakti, creation of Defence Space Agency and the release of the Joint Space Doctrine. India was also developing non-kinetic counter-space capabilities, enhancing space situational awareness and moving towards more resilient and distributed satellite architectures to ensure operational continuity during crises. Diplomatically, he added, India had taken on a leadership role of the Global South for space technology development, advocated Global Space Governance and created multiple organisations to support and enhance Global Space Economy. The Group Captain emphasised on India's diplomatic initiatives such as the South Asia Satellite and capacity-building programmes like UNNATI, which reinforced regional cooperation and enhanced India's leadership among developing spacefaring nations. The speaker highlighted India's approach at the multilateral level where India continued to advocate for legally binding agreements while supporting practical and incremental measures such as debris mitigation, transparency and crisis-communication mechanisms. The speaker concluded by saying that space was increasingly becoming congested, contested and competitive where military, commercial

and civilian actors operated simultaneously. He listed three pillars for India's way ahead in space as Strength, Restraint and Leadership and speaking of India's future space security posture, he said that it depended on maintaining a careful balance between deterrence and diplomacy while strengthening domestic regulation and promoting responsible conduct.

Gp Capt T.H. Anand Rao spoke on *SSA and Space Domain Awareness: The Way Ahead* and began by emphasising on the most critical challenge in the space domain viz., *ensuring uninterrupted access to satellite services amid growing vulnerabilities*. With both military and civilian sectors increasingly reliant on satellites for communication, navigation, surveillance and early warning, a range of non-military threats such as orbital congestion, space debris and accidental collisions, as well as military threats including counter-space weapons and hostile manoeuvres had emerged. He highlighted the growing importance of Space Situational Awareness (SSA) as a core capability for detecting, tracking and predicting the behaviour of objects in orbit through networks of radars and optical sensors. Major powers such as the United States, Russia and China have maintained extensive SSA infrastructure, while multilateral and commercial organisations have also contributed to global tracking and information-sharing. Distinguishing SSA from Space Domain Awareness (SDA), he noted that while SSA focused on identifying and locating objects in space, SDA went further by analysing their intent and assessing potential threats. This distinction had become

increasingly significant with the rise of micro-satellites, proximity operations and dual-use spacecraft, which had further complicated the threat assessment. Despite progress, he pointed out several limitations in existing SSA systems, including uneven sensor coverage, the rapid growth of small satellites and the challenges of processing and sharing large volumes of data in real time. These constraints had made SSA an inherently collaborative activity, with countries forming regional partnerships to reduce reliance on any single data provider. In the Indian context, he stressed that strengthening SSA and SDA capabilities was vital for protecting national space assets and enhancing strategic autonomy which would require expanding sensor networks, integrating civilian and military data, leveraging artificial intelligence for faster analysis and deepening international data-sharing arrangements. By positioning itself as a regional hub for space tracking and traffic management, India could both safeguard its growing space dependence and strengthen its role in regional space security cooperation.

The Chair concluded the session by stating that there was a need to increase focus on space related activities and arrive at a forward-looking space policy. He added that at the same time there was also a need for concurrent focus on the other domains affecting national security highlighting a 'whole of nation approach' towards securing national interests. The ability to detect would amount to the ability to destroy and therefore, the session brought out the growing importance of SSA and SDA in the future.

SESSION-VI

Air Power Strategy and Doctrinal Transformation

Chair: Air Marshal Marshal SS Soman PVSM AVSM VM (Retd), Former AOC-in-C WAC.

Panellists: Air Marshal Rajesh Kumar PVSM AVSM VM (Retd), Gp Capt Sukhbir Kaur Minhas, Research Fellow MP-IDSA, Air Vice Marshal Anupam Agarwal VSM (Retd).

Air Mshl Soman set the tone for the session by speaking about how air power and associated technology were increasingly shaping its employment and effectiveness. He added that integration of AI into networked multi-domain operations was driving the need for paradigm shifts in the employment philosophy of air power. He also alluded to the fact that grey-zone conflicts, nuclear proliferation and the need for politically calibrated response mechanisms underscore the need for air power to be precise and adaptive requiring flexible doctrines and nuanced strategies. Speaking on doctrines and strategy, he added that while both were distinct, they were also inter-related and mutually reinforcing and that there was a need for both doctrine and strategy to adapt in an iterative manner to address challenges and complexities involved in the employment of air power. He also spoke of policy, doctrine and strategy as being mutually exclusive yet inter-woven because policy would dictate doctrine and strategy would follow in most cases, however, he mentioned that rapid and disruptive technological advancements and unseen geopolitical events may also force strategy shaping doctrinal shifts leading to operational redesign.

Air Mshl Rajesh Kumar spoke on the *Emerging Doctrinal Shifts in the Employment of Air Power against Nuclear Powers.* He began by how the world had started rediscovering the salience of air power with every emerging conflict in modern times especially with players on either or both sides being nuclear powers. In all cases, he added that air power was being used with telling effect and the fallacy of air power usage leading to a nuclear war was increasingly been questioned. He further added that nuclear weapons were weapons of deterrence and not necessarily weapons of war fighting. He further spoke of how even during Op Sindoor, there was no talk of using nuclear weapons in spite of large-scale use of air power, albeit steering clear of the perceived red lines. He also said that Op Sindoor 2.0 would be significantly different and therefore, creating manoeuvering space under the nuclear umbrella would be an important paradigm change that India will constantly need to think about. The Air Marshal also brought out a very relevant fact that in modern times, *use of air power was not seen to be as escalatory as land incursions would be, which was a significant departure from earlier theories on the conduct of warfare*. He further added that nuclear brinkmanship would continue to deter adversaries, as seen in Indio-Pak scenario as well as Russia-Ukraine war, and alluded to how territorial loss would continue to be a significant red line. He spoke of the use of air strikes by Ukraine for crisis management as a good example where Russia did not wave the nuclear wand highlighting the fact that there was adequate space for conventional operations under the nuclear overhang. Use of Fighters, bombers, drones and missiles are regularly being used

in modern conflict with due tactical diligence like creating requite degree of control of air. He also argued that complete air superiority in contested air space was not possible and operations would have to be conducted based on time and space constraints, calling the concept '*episodic air superiority*'. The other major doctrinal shift as seen in modern conflicts was the emphasis on stand-off precision strikes to manage the contested air space. He spoke of multi-domain operations and deterrence which had emerged as a major change in doctrinal precepts especially when integrated with cyber, space, electronic warfare and information warfare. He highlighted that the key issue when prosecuting modern wars was the management of escalation and respecting red lines. The Air Mshl cautioned that tactical actions using air power could have strategic ramifications and quickly spiral the situation out of control. Development of Directed Energy Weapons (DEW) against drones would signal the next doctrinal shift and therefore India would need to formulate its own unique doctrine. Speaking on the limitations of air power, he added that air power by itself may not be able to affect regime changes as envisaged by USA in Iran and there was a need to calibrate air power keeping the limitations of air power in mind.

Group Captain Minhas spoke on *Doctrinal Shifts in Air Defence (in context of the Russia-Ukraine and Israel-Hamas conflicts.* She highlighted that air defence was no longer a static, reactive shield but an increasingly evolving, dynamic, multi-layered and integrated system. She described AD as a complex collection of perspectives spanning decades of evolution. From point defence to area defence

and lately offensive air defence, the concept had seen myriad doctrinal transformations and would continue to do so as technology and human innovativeness redefined modern warfare. Describing new age challenges, she alluded to drones and non-state actors heralding the advent of low-cost aerial warfare calling the ARAMCO attack of 2019 as a reality check. Closer to India, the Group Captain spoke of how the Balakot operations of 2019 created yet another change in the doctrinal precepts of carrying out large force engagements in contested air space. Speaking of **Israel's multi-layered defence architecture** including systems like Arrow, Iron Dome, David's Sling, Iron Beam and emerging directed-energy solutions, she highlighted the importance of layered interception capabilities. In contrast, she added, the Russia–Ukraine conflict showcased the operationalisation of "fused threat architectures," where different classes of weapons were deployed in coordinated waves to overwhelm defences. Group Captain Minhas gave a critical insight into the concept of a **"cost asymmetry crisis"** where low-cost drones and missiles could impose disproportionately high costs on advanced air defence systems, raising questions about long-term viability and sustainability. Ukraine's adaptive response, including distributed "kill web" systems, integration with NATO frameworks, and the use of mobile fire units, demonstrated how innovation and decentralisation could offset resource constraints. Speaking on the Russian Integrated Air and Missile Defence (IAMD) architecture, the speaker said that the system was seen to be largely successful in safeguarding essential infrastructure and maintained its war fighting potential.

She also noted that there was a marked improvement in fighter and ground-based air defence integration since the beginning of the war. Speaking on strategy shifts, she spoke of how from launching 300 Shahed drones per month in the beginning of the war, Russia was now launching almost 5300 drones per month. Identifying doctrinal shifts, she spoke of a tightly knit ABM architecture, selective and prioritised defence, offensive action and interoperability as drivers of a capable AD system. The session also identified key operational, technological, and organisational challenges, including detection gaps, interoperability issues, the need for doctrinal adaptation, and the growing importance of civil defence and industry partnerships. The Group Captain added that while platforms were required, doctrines were guidelines, it was strategy alone that would determine whether either of them would provide genuine security. She ended with the need for every AD architecture to be explicitly contextualized and that replicating another country's doctrine may not be as effective as developing one's own. For policy guidance there was a need for understanding what was being defended, against who, under what conditions and for how long? Answers to these questions would lead to the formulation of a sound policy leading to a responsive doctrine making strategy formulation easier.

AVM Anupam Agarwal spoke on *Human and Algorithm Synchronisation Ushering a Paradigm Shift in Warfare*. He focused on how AI and data-driven systems were reshaping military decision making, while reaffirming the central role of human judgement. The AVM started with a comparison of what algorithms were

good at and what the human brain was better at highlighting the fact that *algorithms amplified decision making and did not replace it.* A key facet that emerged was that algorithmic systems found it difficult to process, parse or understand inherently ethical and politically sensitive issues and therefore autonomous systems would always require a human moral compass. Speaking on explicit trust being imposed in AI systems, the speaker said that humans must avoid being a 'rubber stamp' and accept all solutions offered by AI. The session further highlighted how the scale of engagement had expanded from localised operations to theatre-wide, networked warfare. Advances in digital integration had compressed the "sensor-to-shooter" timeline, enabling faster and more coordinated responses. He further spoke of how today's commanders operate not just as battlefield actors but as managers of complex, data-rich operational environments. A significant focus was on the **evolution of cognitive strategy**. Traditional decision-making cycles such as the OODA loop are increasingly supplemented by predictive and AI-assisted systems that anticipate actions before they unfold. This shift marks a transition from reactive to anticipatory warfare, where speed and foresight are critical advantages. An interesting paradigm brought out by the speaker was how in modern warfare, the ubiquitous OODA loop had transformed into a *Perceive-Predict-Select-Act (PPSA) loop where algorithms would perceive and predict while humans would select and act*. This shift marked a transition from reactive to anticipatory warfare, where speed and foresight have emerged as critical advantages. The presentation also identified areas where algorithms offer operational

advantages, particularly in ISR fusion, targeting efficiency, logistics prediction, and resource allocation. Real-world applications, such as Operation Sindoor, demonstrated how integrated multi-domain data from air, land, sea, and cyber could generate a unified command view with high accuracy, enabling coordinated and precise operations. The speaker also spoke of developing human fall--back protocols in modern systems to enable survivability of systems when threatened. Cautioning against the large-scale use of AI in intelligence fusion, as observed in conflicts like Gaza, the speaker raised concerns about over-reliance, moral hazard, and the potential distancing of human accountability from the decision-making processes. In the end, the AVM said that combining speed and analytical power of machines with human ethics, judgment, and strategic control would prove to be decisive in future warfare. Human-centric integration, rather than full automation, would define an effective and responsible military power.

The Chair concluded the session by thanking the speakers for their valuable insights into doctrinal transformation and the resultant air power strategy.

Key Takeaways

Air Power Imperatives

- Control of the air will be *contested* and therefore in modern warfare, control of air would be restricted by time and space.
- '*Air parity*' is increasingly becoming the norm, especially in near-peer conflicts, driven by dense and layered AD networks,

technological diffusion and comparable force structures. In such situations, the challenge is not just achieving control of air but *continuously contesting, degrading and selectively dominating* both in time as well as space.

- Complete air superiority in contested air space will not be possible and operations would have to be conducted based on time and space constraints, an evolving concept of '*episodic air superiority*'.
- Air power by itself may not be able to affect regime changes as envisaged by USA in Iran and there is a need to calibrate air power keeping the limitations of air power in mind.
- In modern warfare, use of air power is *not as escalatory as land incursions would be*, which is a significant departure from earlier theories on the conduct of warfare.
- Tactical actions using air power could *have strategic ramifications* and quickly spiral the situation out of control.

Space Imperatives

- India needs to shift towards a broader aerospace framework, *integrating air and space domains* to enhance situational awareness and operational capabilities. Control of the air should not be seen as an end in itself, but as an enabler of wider military objectives.
- The five key concerns of prime relevance in the space domain are *orbital congestion, competition over the electromagnetic spectrum, rapidly increasing number of players (including private, government and military), the nature, complexity and evolution of space technology and the high costs* associated with space operations.

- The most critical challenge in the space domain is ensuring *uninterrupted access* to satellite services amid growing vulnerabilities.
- The next big trend in space will be the transition from sensing and analysing in space to *decide in space and command from space*.
- India needs to expand its satellite constellations, strengthen indigenous commercial space capabilities, invest in space-based data analytics and AI and build an *integrated civil–military space ecosystem*.
- India's future space security posture will depend on maintaining a careful balance between *deterrence and diplomacy* while strengthening domestic regulation and promoting responsible conduct.
- By positioning itself as a *regional hub* for *space tracking and traffic management*, India could both safeguard its growing space dependence and strengthen its role in regional space security cooperation.
- The *ability to detect* is synonymous with the *capability to destroy* and therefore, there is growing importance of Space Situational Awareness (SSA) and Space Domain Awareness (SDA) in the future because space will very soon be weaponised.

Comprehensive National Power (CNP) and Grand Strategy

- There is a need for *greater integration* not only between the armed forces but also between all elements of *Comprehensive National*

Power (CNP) to enable the conduct of multi-domain operations (MDO).

- Air Defence architecture needs to explicitly contextualised and replicating another country's doctrine may not be as effective as developing one's own. For policy guidance there is a need for understanding *what is being defended, against who, under what conditions and for how long*? Answers to these questions would lead to the formulation of a sound policy leading to a responsive doctrine making strategy formulation easier.
- Grey-zone conflicts, nuclear proliferation and the need for politically calibrated response mechanisms underscore the need for air power to be precise and adaptive requiring *flexible doctrines and nuanced strategies*.
- Op Sindoor 2.0 would be *significantly different* and therefore, *creating manoeuvering space under the nuclear umbrella* would be an important paradigm change that India will constantly need to think about.
- While *platforms are required, doctrines are guidelines*, it is *strategy* alone that would determine whether either of them would provide *genuine security*.
- *Reliance on external security guarantees* often comes with pressure points and misaligned objectives, prompting nations to *reconsider the sustainability* of such military alliances.
- On the national level, IAF needs to maintain an outward looking focus by extending early warning capabilities far beyond the Andaman and Nicobar Islands and the Lakshadweep and

Minicoy Islands by leveraging modern technology and ensuring comprehensive multi-domain coverage in India's area of interest. Towards that, national focus on Multi-Domain Awareness is a strategic imperative.

- Situational awareness over land, Maritime Domain Awareness (MDA) and air space awareness alone will not be sufficient. Enhanced and fused awareness in all domains viz., air, land, sea (including under water), space and cyber, will prove to be decisive.

Modern Warfare

- The modern Observe, Orient, Decide and Act (OODA) loop is *no longer* confined to *the cockpit or the command centres* but *spanned across domains and cognitive spaces*. Military power is the core security guarantor in today's world order and must not be compromised.
- In modern asymmetric warfare, a "*cost ratio imbalance*" has allowed non-state actors to conduct attrition warfare and economically exhaust a state's AD resources. India as a nation must strive to develop national resilience. *The armed forces alone cannot fight and a 'whole of nation' approach will be required.*
- In the next few years, *China's high tech (4.5th and 5thgeneration) aircraft numbers would be more than South Korea and Japan's numbers combined* and that raises serious questions with regards to East Asia's air power balance.

- The effective lethal *hit probability* of weapons being used in Russia-Ukraine conflict and the conflict in West Asia is the lowest for Shahed class of weapons and highest for high-speed weapons like Kinzhal. Focus *on low cost-high impact, high speed and accurate weapons* should be a technological imperative for India.
- Ukraine's adaptive response, including distributed "*kill web*" systems, integration with NATO frameworks, and the use of mobile fire units, demonstrates how *innovation and decentralisation could offset resource constraints*.
- The future battlespace will increasingly be defined by the fusion of data from satellites, unmanned systems and terrestrial sensors into geo-spatial artificial intelligence architectures, where *algorithmic superiority would prove to be decisive*.
- In modern warfare, the ubiquitous OODA loop has transformed into a *Perceive-Predict-Select-Act (PPSA) loop where algorithms would perceive and predict while humans would select and act*. This shift marks a transition from reactive to anticipatory warfare, where speed and foresight emerge as critical advantages.

Artificial Intelligence and Humans: A Developing Relationship

- There is an emergent requirement to *integrate AI into the C2 architecture* in order to evaluate developing threats in real time and select the most cost effective as well as suitable response in order to neutralise threats.

- Combining speed and analytical power of machines with human ethics, judgment, and strategic control would prove to be decisive in future warfare. *Human-centric integration, rather than full automation*, would define an effective and responsible military power.
- India must develop *'human fall-back protocols'* in modern systems to enable survivability when threatened. With large-scale use of AI in intelligence fusion, as observed in conflicts like Gaza, there are developing concerns about over-reliance, moral hazard, and the potential distancing of human accountability from the decision-making processes.
- Algorithms *amplify* decision making and *do not replace* it.

Capability Development and Atma Nirbhar Bharat

- There is a need for *aligning technological development* with *operational realities* rather than past requirements which may not necessarily deliver meaningful combat advantage.
- India needs to make a capability road map for *miniaturisation of hardware*, focus on *semiconductors and protection of IP* for individual developers.
- There is a need to address the *immediate challenge* of *small lethal drones* as seen in the ongoing conflicts. Besides soft kill options, the need of the hour is *developing suitable hard kill options* and all stake holders will need to come together and develop viable and scalable technology to address the immediate challenge.

- The future of aerospace design is *standoff engagements with precise weapons, autonomous platforms, hypersonics and advanced sensor technologies*. Indian Industry will need to focus on these areas.
- Developing *high calibre, high speed, low cost and good accuracy weapons* as weapons of choice for future wars should be the focus of Defence R&D in India.
- Development of *Directed Energy Weapons (DEW) against drones* would signal the *next doctrinal shift* and therefore India would need to formulate its own unique doctrine and capability development roadmap.