



CENTRE FOR AEROSPACE POWER AND STRATEGIC STUDIES (CAPSS)

Forum for National Security Studies (FNSS)

AEROSPACE NEWSLETTER



IAF Organises First Ever Full-Scale Air Show in Guwahati to Mark 93rd Anniversary around the theme "Infallible, Impervious and Precise"

Source: <https://www.newsonair.gov.in/iaf-to-hold-first-ever-full-scale-air-show-in-guwahati-to-mark-93rd-anniversary/>

VOL V NO 12

05 December 2025

 Centre for Aerospace Power and Strategic Studies |  @CAPSS_India

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Opinions and Analysis

President's Rafale Sortie: Symbolism in the Skies Move With Caution

Group Captain VP Naik VM | 30 October
2025

[Source: CAPSS India | https://capssindia.org/presidents-rafale-sortie-symbolism-in-the-skies/](https://capssindia.org/presidents-rafale-sortie-symbolism-in-the-skies/)



The "Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return."

Leonardo Da Vinci

Introduction

Rafale sortie by President Droupadi Murmu, the Supreme Commander of the Indian Armed Forces on 29 October, 2025 at Ambala AF Station was not just a ceremonial event but a highly symbolic event showcasing the pride, prestige and power of the Indian Air Force. It was another significant milestone in President Droupadi Murmu's journey, showcasing her indomitable courage and confidence in IAF's prowess. It was a testimony to the decisive role played by the Indian Air Force

(IAF) in Operation Sindoor and a befitting occasion to declare the commencement of Ex Trishul, India's tri-services training military exercise, on the Gujrat border.

The flight was symbolic because it represented India's coming of age in its defence capabilities, displays faith in India's quest for strategic autonomy and, more importantly, reflected the confidence that the Supreme Commander had placed in the nation's armed forces in general and the IAF in particular. Incidentally, she is the only President to have flown in a fighter aircraft on two occasions, including a Su-30 MKI in 2023.

Ceremony and Substance

While such flights by Heads of State are not unprecedented, for India, it was a full-fledged ceremonial event, keeping with the finest traditions of the armed forces. The Supreme Commander would have experienced what very few heads of state in the world ever do: the immense exhilaration, agility and awe of modern aerial combat—the tip of the spear and the pure joy of fighter flying. There is also a tremendous amount of substance associated with this flight. The flight reflects civilian leadership deeply engaged with the military's operational arm, bridging the gap between symbolism and substance.

Wide-spread anarchy in the world, narcissistic leadership, sycophancy across Governments and a rapidly changing world order are largely a reflection of the instability

prevailing in the world order today. Casting aside all concerns of a Volatile, Uncertain, Complex and Ambiguous (VUCA) world, the President got a unique opportunity to strap up in a fighter and take to the skies to experience the pure and exhilarating joys of flying. The event was not only about optics, it was also a statement highlighting the intricate integration of air power in India's strategic milieu, reaffirming the nation's faith in the IAF personnel, who operate these complex machines and ensure the safety of the Indian airspace. It was also a firm and thumping acknowledgement of the IAF's 'First Responder' role in India's Neighbourhood during both natural and man-made disasters and other contingencies. It was also a reaffirmation of the confidence in IAF's readiness posture across the entire battle space, transcending all domains.

Symbolism from the Cockpit

For a President to take control of a fighter aircraft, albeit even for a brief period, is a symbolic reaffirmation of civil-military fusion and mutual respect. In a democratic set-up like India, the armed forces operate under civilian control. Yet, such authority gains its moral legitimacy from understanding and empathising with the lives and missions of the men and women in uniform. Dr APJ Abdul Kalam, Mrs Pratibha Devisingh Patil and President Murmu have all flown in a Su-30 MKI earlier, and this sortie marks a first for the Rafale fleet. Dr Zakir Husain (HT-2 basic trainer) and Dr APJ Abdul Kalam (HJT-16 Kiran) have flown in trainer aircraft earlier. This sortie is different because the Rafale

represents something more contemporary, reflecting India's rise as a confident regional power capable of holding its own amongst the comity of nations. It shows the world that India's leadership is not distant from those responsible for its defence and it also reassures Indians that India's safety and sovereignty is in safe hands.

Operational Readiness and Strategic Messaging

Presently, India faces an ever-increasing complex security environment; from its contested borders, on-going tariff issues and turbulence in the Indo-Pacific region to a volatile and highly polarised world. The President flying in a fighter aircraft drives home a message of reassurance for all Indians and emphasizes India's credible deterrence capability to the entire world. India needs to be prepared for all contingencies, spanning from short and swift wars to long drawn-out wars. These high-profile ceremonial and symbolic events serve as a huge source of inspiration, not only for all the armed forces personnel but the nation's ordinary citizens as well. These events also help in reposing faith in the national leadership. The President would have experienced first-hand the professionalism, the extraordinary skills and the courage of the IAF personnel. She would have also witnessed the highly efficient and impeccably maintained Indian Air Force machinery at work, highlighting the professionalism and determination of the IAF personnel.

Air Power and National Prestige

The armed forces of a nation are symbolic of its military prowess and prestige. In recent times, the IAF has been chosen as the preferred 'instrument for application of force' during various contingencies on account of its speed, responsiveness, reach, precision and lethality. The President's sortie is symbolic of IAF's technological prowess and power projection. IAF has the capabilities and the capacities to deliver a strong and unambiguous statement of India's resolve for maintaining its territorial integrity and sovereignty. The sortie also highlighted the sterling role played by IAF in nation-building and serving as the first responder in various global crises, over the years. From Humanitarian Assistance and Disaster Relief (HADR) missions and peace keeping operations with the United Nations to providing timely aid and succour for victims of natural disasters across the world, IAF has always delivered, on time and on target.

Indian leadership has regularly been flying fighter aircraft, sailing on aircraft carriers and visiting forward areas in the highest battlefields of the world. The same is however not true with India's adversaries. One has never seen Pakistani leadership taking to the skies, probably due to a lack of confidence and trust in their own armed forces. President Murmu has done it not once but twice!

The Indian armed forces are a symbol of modernity, sovereignty and autonomy, reflecting India's ability to absorb as well

as indigenise advanced technologies. The sortie would also give an impetus to India's 'Make in India' programme, wherein the acquisition of foreign technologies serves as a conduit for future indigenous design, development and manufacturing, not just a mere substitute for it.

The sortie comes at a time when the political rhetoric has been heating up. Encouraged by America's new found friendship with them, Pakistan has unfortunately once again started nuclear sabre-rattling with renewed vigour. Pakistan has also reportedly started upping the ante in the Sir Creek area, probably emboldened by Chinese support. During such tense and volatile situations, the conduct of military training exercises not only convey the determination but the intent of a nation as well. Ex Trishul-2025, a tri services exercise is aimed at enhancing the operational readiness of the three services through joint planning and integrated application of combat power. The Exercise was scheduled to commence along the International Border, in the Gujrat area from October 30, 2025. It is not just a military training exercise, it is also a statement of India's resolve, innovation and force-integration.

Conclusion

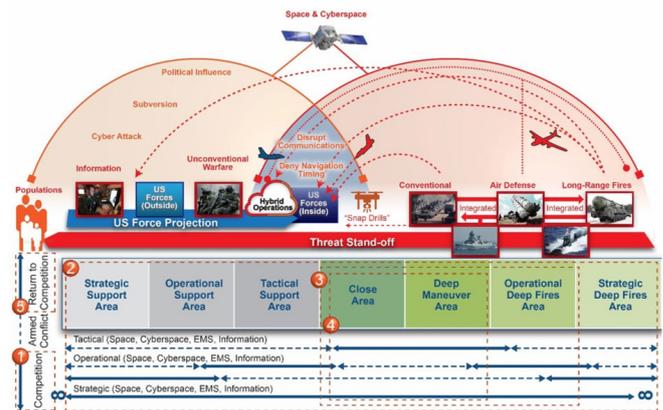
The Supreme Commander's sortie in the Rafale aircraft was a reassertion of the President's confidence in the professionalism and the might of the IAF. The event would be forever enshrined in IAF's glorious history. The Rafale aircraft

is symbolic not just for its technological advancement and fire power, but it is also a metaphor in India’s long and arduous journey for strategic autonomy. The President’s sortie in Ambala also sends the unambiguous message that Indian airspace and sovereignty are inviolable and secure. The IAF air warriors are always ready and willing to take on the adversary.

America’s Multi- Domain Operations at 250: A Strategy, Concept or Mirage?

Ms Khyati Singh | 26 November 2025

Source: CAPSS India | <https://capssindia.org/americas-multi-domain-operations-at-250-a-strategy-concept-or-mirage/>



Introduction

The United States (US) Army marks its 250th year in 2025, and places Multi-Domain Operations (MDO) as the vision for warfighting in the future. Despite this, MDO remains more of a concept than a concrete strategy, filled with aspirations but enmeshed with institutional constraints and the abstraction of doctrines. Hence, unless the Military grounds MDO in strategic clarity, joint operational design, and realistic resources, it risks repeating the mistakes of earlier doctrinal overreaches that weighed form over function.

General Mark Milley heralded the US Army’s conceptual pivot toward the MDO with his remarks that the future conflict will be “fundamentally different” because of the convergence of informational, cognitive, and physical domains. The doctrine of

MDO was officially codified in the US Army Training and Doctrine Command's documents in 2018, and aims to address the loopholes in the existing legacy concepts like Air-Land Battle and the counterinsurgency-centric doctrine. With the Army celebrating its 250th anniversary, MDO reflects a mix of strategic anxiety and institutional ambition, namely the hope of remaining relevant in an era of great power competition, hybrid threats, and technological upheaval. However, despite its elaborate, conceptual promise, it falls short of structural and operational merit, raising speculations about its viability.

The Strategic Assurance of MDO

The central idea of MDO is to enable US forces to converge effects across all domains – land, sea, space, air, cyber, and electromagnetic spectrum, in order to create overmatch and unleash multiple attacks and dilemmas on the adversary. As per the US Army Concept for Manoeuvre in Multi-Domain Operations, 2028-2040 concept, the US must prepare to penetrate and break down the sophisticated anti-access/anti-denial (A2/AD) systems developed and deployed by enemy states like China and Russia. MDO envisions the Army in the role of an integrator within the larger ambit of joint operations, providing long-range fires, expeditionary logistics and tactical manoeuvres in critical and contested environments.

Changes in the international system largely shape MDO's current strategic

relevance. While the United States is losing its military dominance, MDO enables it to adapt to the speed and complexity of multiple domains. Michael Mazarr and Frank Hoffman emphasise the importance of grey-zone competition and hybrid warfare- areas where MDO, in theory, provides an integrated solution.

MDO still lacks the articulation of a political theory of victory, even though it is theoretically appealing. In terms of political outcomes, the Army claims that convergence has created operational advantages; however, it is still unclear how these advantages form a political outcome. Unless the Army defines strategic success as measurable goals in terms of deterrence, control escalation, or the termination of a conflict, MDO runs the high risk of becoming a solution still searching for a problem.

Administrative Restraints and Institutional Inertia

There is a misalignment between theory and practice. The MDO is still doctrinally underdeveloped and operationally untested. The Army's organisational culture is predominantly driven by decades of platform-centric procurement and service-based planning. The integrative approach of MDO encounters a bureaucratic quagmire. Outdated conventional systems like Patriot missile batteries and Abrams tanks, still dominate budgets, leaving little room for investment in cyberspace, electronic warfare, and autonomous systems.

Furthermore, the Army's personnel system, especially its talent management model, has not fully adapted to the demands of MDO. As has been remarked by LG (Retd.) David Barno and Dr Nora Bensahel argue that the structure of the Army still remains conservative, prioritising conventional career paths over cultivating leaders that possess in-depth technical expertise in cyber, space and information operations.

Another aspect that further constrains MDO's trajectory is budgetary policies. The Army's modernisation must increasingly compete in a joint environment that is sliding in favour of naval and air power projections, especially in the case of the Indo-Pacific region. Despite the establishment of the Army Future Command to fast-track innovation, its integration with other services and allies remains largely uneven.

Inter-service rivalries are often the least addressed among the barriers hindering joint planning and progress. MDO assumes full integration with the Air Force, Navy, Marine Corps and Space Force, as well as allied militaries. However, the services continue to follow separate, uncoordinated, and parallel modernisation pathways. Without cross-institutional design tools to ensure joint synchronisations, as with the Goldwater-Nichols reforms, MDO will forever remain an Army-centred aspiration.

Scenario Disconnect: Is MDO Waging the Wrong War?

MDO appears to be tailor-made for high-end conventional conflicts against peers, particularly in the European theatres and the Indo-Pacific Region. Since, at its core, MDO is shaped by potential confrontation with and challenges posed by peer competitors like China and Russia, it requires the United States to develop a force capable of penetrating and disintegrating layered anti-access/area-denial systems, operating across contested domains, and integrating joint and allied capabilities to achieve convergence at decisive points. Such networks- comprising integrated and disparate elements of air-defence, precision-strike, electronic warfare (EW), and the Intelligence, Surveillance, and Reconnaissance (ISR) systems configuration- are predominant in the Indo-Pacific and European operational theatres. Therefore, the fundamental components of MDO- long-range precision fires, deep sensing, joint domain convergence, cyber-EW integration, and tiered decision making- are designed for major, high-tempo, high-technology, and large-scale conflict against advanced large state militaries.

In contrast, these requirements are not central to grey-zone, proxy, or irregular conflicts, where ambiguity, deniability, political signaling, and attrition- not cross-domain penetration- drive outcomes. Thus, MDO naturally aligns with peer-level, conventional scenarios and is less

inherently adaptable to the low-intensity competition that dominates real-world military usage.

However, this creates a risk of over-investing in scenarios that might never materialise. Experts like T.X. Hammes[6] have shown caution against a force structure best suited for high-end warfare while being underprepared for proxy, protracted and grey zone conflicts.

Furthermore, many of the technological tenets underpinning MDO, assuming resilient communications in denied environments, seamless cross-domain data integration, and uninterrupted sensor-to-shooter networks, seem out of place given the current realities of the battlefield. The basis of this assessment stems from the current Ukraine conflict, where one can observe Russian electronic warfare successfully disrupting Ukraine's ISR networks while jamming GPS, degrading drones, and interfering with precision-guided fires. The warfare demonstrated how quickly sophisticated digital networks can be routed in a contested electromagnetic environment. US government evaluations and GAO reports similarly highlight persistent vulnerabilities in American tactical networks, difficulties in maintaining secure communications under electronic attack, and incomplete joint data interoperability[8]. When peer adversaries like China and Russia possess mature capabilities explicitly designed to degrade or deceive these networks, any MDO concept that presumes information

dominance, continuous connectivity, or flawless real-time data fusion risks becoming strategically brittle. If these systems cannot survive or function under high-end combat conditions, the operational logic of MDO gets weakened at its core.

What remains most worrying is the MDO mismatch with the political use of military force. When rivals operate below the threshold of a declared war, the ability to create cross-domain fires to "dilemma" the enemy is tactically constructive, but strategically useless. The Army's strategic planner faces the question: how does MDO situate itself within the national policy objectives in the event of an imminent conflict?

Onto a Real Strategy

To implement the ambitious goals of MDO, there needs to be a major focus on the underlying theory of victory and design of the force structure to create strategies that are realistic and credible. Simply advocating political support for MDO is not enough. It is a concept that needs grounding. For MDO to work as envisaged, it needs to be incorporated into a real joint and coalition environment. This requires purposeful alignment with NATO's doctrine in Europe and close synchronisation with Indo-Pacific allies, particularly in the areas of intelligence sharing, domain awareness, secure communication networks, and combined operational fires. Without these political and military interoperabilities, MDO is destined to remain an Army-centric

aspiration rather than a consolidated operational construct.

There are also parallels with the technological ‘human capital’ that the Army needs to invest strategically. Without leaders who think and operate in different domains, MDO will find itself with unachieved objectives. Structural redesigns will be required for flexible educational pathways and career systems. MDO should be treated with caution. It should not be treated as a simplistic justification for spending. Instead, ‘spending’ should come from an informed consideration of what capabilities to allocate, enhance, or eliminate.

Conclusion

At the striking age of 250, the US Army stands at a conceptual crossroads. Multi-Domain Operations offer a compelling vision for fighting and winning wars in an increasingly complex war space. However, history perpetually reminds us that without strategic clarity and institutional commitments, concepts often devolve into doctrinal mirages. For the MDO to achieve success, it must be more than a catchphrase and evolve into the Army’s organising purpose. Only then can the Army remain not just operationally relevant, but also strategically decisive in its next 250 years.

Nyoma-A Tool for Strategic Communication

Wg Cdr Akash Godbole | 17 November 2025

Source: CAPSS India | <https://capssindia.org/nyoma-a-tool-for-strategic-communication/>



Introduction

On November 12, 2025, the Indian Air Force (IAF) chief, Air Chief Marshal AP Singh, arrived on board a C-130J transport aircraft, accompanied by C-in-C Western Air Command, at one of its northernmost airfields, Mudh-Nyoma. The landing was part of the inauguration ceremony that declared the airfield fully operational, making it the third of its kind in the Eastern Ladakh region, alongside Leh and Thoise. The Mudh-Nyoma airstrip was developed initially as an Advanced Landing Ground (ALG) during the 1962 conflict. In 2009, an AN-32 carried out a landing at the base, thus bringing it into focus after years of neglect. The airfield is another step in the series of infrastructure push undertaken since the Galwan clash of 2020. The article aims to identify the likely operational significance of the said airfield

and its manifestation during an operational scenario.

Build to Compete

At an elevation of 13,700 feet above mean sea level, Nyoma is India's highest and the fifth-highest airfield in the world, capable of undertaking fighter aircraft operations. It is situated just 30-35 km from the Line of Actual Control (LAC). Other airfields, such as Leh and Thoise, are significantly farther from the LAC and hence result in increased deployment and reaction times. In recent times, there has been significant progress in the development of infrastructure at high altitudes, especially in the Tibet Autonomous Region (TAR), where China supports multiple bases to support transport and fighter operations. However, what distinguishes Nyoma is the scale of terrain gradient and topographic complexity involved in its construction. Although most TAR airfields are located at an altitude of 13,000-14,000 feet, the entire TAR region has relatively flat terrain that permits convenient movement and the faster development of such airfields. It is essential to acknowledge this remarkable achievement, as it has taken just about two years from initialisation to operationalisation. This began when the Minister of Defence, Rajnath Singh, laid the foundation in September 2023. This suggests the urgency and operational requirement that the IAF felt for the airfield to be operational at such short notice. The Galwan incident triggered large-scale actions known as "Rebalancing 1.0", which involved the permanent forward positioning of approximately 50,000 troops,

the emergency procurement of surveillance and weapon systems, and the accelerated completion of border infrastructure projects. The operationalisation of this airfield provides for a limited reaction time and associated deterrence. The broader action set suggests a combination of deterrence by denial and punishment. Denial by sustaining the ability for rapid forward deployment and punishment by placing fighters at the airfield with such capabilities.

Operational Significance

While there are several operational scenarios where the airfield can support the IAF in particular and the Indian military operations in general, some have been suggested below: –

1. Proximity. Nyoma's proximity to the LAC suggests that it was felt that Western airfields, such as Leh and Thoise, were either inadequate or too far inland to pose an effective deterrent. The IAF swung into action during the Galwan crisis and was able to muster adequate combat capability to deter any Chinese misgivings. Over 68,000 troops, 90 tanks, and 330 BMP infantry combat vehicles were airlifted during these operations. Operationalising an airfield near the LAC significantly reduces reaction time. It enhances forward mobility and facilitates the evacuation of personnel and supplies during emergencies.
2. Operability. Regarding the

operational strengths of the airfield, it features a long runway (~2.7-3.0 km) that supports the movement of fighters and heavy transport. It manifests in multiple operational possibilities, including an increased presence of fighters in an operational readiness state and the availability of a forward landing base to position troops en masse. Movement of troops and equipment requires a substantial period of time, a luxury that one may not have in a time of conflict. Additionally, it would also facilitate routine movement in and out of the area expeditiously. All of this amounts to savings of time and money due to reduced costs of sustenance. This forms part of the triad of airfields at Leh and Thoise that translates into redundancy and enhanced combat capacity.

3. Intent. The infrastructure development at Nyoma is part of a broader effort to enhance border areas in Ladakh and the northeastern states. Multiple projects aimed at increasing connectivity are indicative of a shift in mindset that has alleviated the operational lethargy. Historically, India followed a “Scorched Earth Policy,” which argued that any infrastructure development in these areas would likely assist the adversary in the event of a conflict. This argument was flawed and lacked supporting evidence. The recent undertakings have communicated a clear intent

of breaking the myth of adversarial supremacy in these sectors.

4. Terrain. A comparative analysis of the airfield infrastructure on both sides of the LAC indicates that both forces face a similar dilemma when weighing the aspect of altitude of operation and its manifestations. All three airfields in India and multiple airfields in TAR are restricted in supporting aircraft operations with heavier payloads, thereby reducing the operational viability of their use. However, India has an edge in the proximity of these bases to its inland bases, which are located at much lower altitudes. Therefore, an operational scenario can enable aircraft to take off with heavier payloads from lower airfields[14] and recover at these bases, resulting in a longer combat period. The Chinese case is complicated because their lower-altitude bases are located much farther away, and they are dependent on these local airfields for support. Hence, Nyoma, in conjunction with Leh and Thoise, aims to balance the large capacity that the Chinese have built up over the years in TAR.

Conclusion

The rapid operationalisation of Nyoma suggests a fundamental transformation in the strategic thinking towards border defence. It indicates a shift from dependence on terrain barriers to creating a deterrent posture based upon infrastructure-backed

operational capability. Tactically, Nyoma translates to reduced reaction time, longer loitering periods and an operational recovery facility for aircraft with higher payloads. Operationally, it provides a troika of airfields that offer redundancy and distributed asset management. Strategically, it conveys to the adversary that we are here to compete and that India does not concede to any belligerent intentions. Achieving infrastructural parity is a long way off; however, it suggests intent and translates to deterrence, stability, and control of escalation. It does not topple the operational capability that the adversary has built up over time, but it does increase the cost of any misadventure manifold.

Air Power Musings: A Fighter Pilot's Monologue

Gp Capt VP Naik VM | 24 November 2025

[Source: CAPSS India | https://capssindia.org/air-power-musings-a-fighter-pilots-monologue/](https://capssindia.org/air-power-musings-a-fighter-pilots-monologue/)



Fighter pilot is an attitude. It is cockiness. It is aggressiveness. It is self-confidence. It is a streak of rebelliousness and it is competitiveness. But there's something else- there's a spark. There's a desire to be good. To do well, in the eyes of your peers and in your own mind.

Robin Olds

Introduction

If you are hearing about this now, probably you have all gathered to remember me, not as your friend, colleague or acquaintance, not as a name on an old squadron photograph, but as an individual who once lived, laughed, cried, made mistakes, learnt, and flew. That is why I choose to speak to you frankly, honestly and with humility and dignity that a lifetime in uniform has taught me.

Let me take you back in time and tell you something interesting. I was not born a fighter pilot. Like everyone else, I was born into a loving family, with my feet

firmly planted on the ground and my eyes looking upwards, vaguely aware of the distant sky. I had the exact same childhood as all of you had, and I had my share of successes and failures as I grew from a child to an adult. It was during this journey that the distant skies beckoned; perhaps it was the sound of aircraft flying overhead or movies like *Top Gun* that inspired me. Perhaps inspiring stories from World War II or tales from the Kargil War got me hooked, or perhaps it was just a simple book like *Jonathan Livingston Seagull*, by Richard Bach, that channelised my dreams. Something changed in me, and the sky became less of a medium and more of a destination. I wanted to fly!

Like all of you, I had bright sparks in my eyes as I went after my dream. There was no arrogance or overconfidence; there was just pure passion, desire, and determination. The journey was long, arduous and dangerous, because let's face it, humans aren't naturally designed to fly and do not possess any aerodynamic characteristics. There were days when I almost gave up. Academic rigour and the physical strain both challenged my mind and body, yet I bashed on regardless. I learned to endure pain and think on my feet under duress because these attributes were essential to being a pilot. I learned to have faith in my mentors and instructors because they were not only teaching me how to fly, they were teaching me how to survive. Through it all, I persevered, because somewhere down the line, I realised I was meant to fly!

My first tryst with fighter flying was a humbling experience. Strapping into a single cockpit, the assuring hum of the engines and the sheer power of propulsion were very terrifying yet mystically mesmerising. It also drove home an important lesson of life as a fighter pilot, where life-altering decisions need to be made in microseconds, where mistakes can make craters and where the line between triumphant return and silent obscurity is razor thin. Flying is not just about getting airborne and landing back safely. It is the thrill and challenge that accompany every moment that I am in the sky. It is the metaphorical freedom that brings a smile on one's face, and it is a swan song that rides on one's lips if things don't quite go down well. Up in the sky, it is in these moments when an eerie silence prevails, allowing deep thought, making us realise that the sky is infinite. It is something sacred and safe. It is also something challenging and unforgiving. I understood my shortcomings and limitations as well as the unforgiving nature of flying.

Flying fighters is not just about the thrill; it is about self-discipline, self-confidence and above all, a mastery born out of repetition and practice. It is this mastery that is both supreme yet very humbling. You develop a respect for the machine, and the machine becomes a partner. The machine will take you where you want to go and do what you want it to do, provided you learn to respect both your own limitations and the machine's. The skies become your second home, and

the aircraft your life partner in that home. However, the skies have no favourites and do not necessarily care about reputation and past performance. Each day is new and each sortie is novel. The skies only care for discipline, precision, preparation, and mutual respect.

Over the years, the machines changed, and so did I. I became better not only at reacting to situations but also at anticipating them. My perceptions of life also changed, and I no longer took life for granted. The arrogance and overconfidence of youth matured into humility and assured self-confidence. I lost many friends and colleagues to the hazards of flying, and that made me appreciate the fragility of life. More importantly, their passing made me a better pilot. I learnt from their mistakes and mine. I learnt that an aircraft was, after all, a machine, a mechanical invention, which, like all mechanical inventions, could fail. One leaking valve, one misjudged angle, and one moment of indecision could end everything. This knowledge made me better, sharper and also, if I may add, a kind of perfectionist.

Through it all, I matured, I learnt to live life by laughing loudly, crying intensely, loving passionately and forgiving easily. I developed empathy not just for my juniors but also towards mankind in general. I cherished the small joys of life and began to value relationships. As the popular saying goes, there are either old pilots or bold pilots, but no old and bold pilots. Courage is not the absence of fear, and fear is

omnipresent. It is this fear that manifests as mutual respect between the man and the machine, the pilot and his aircraft, the ship and its crew. That sense of respect stayed with me every time I walked towards my aircraft; it made me do my checks more diligently and strapped up with me in the cockpit. The fear transformed into quiet confidence when the engines roared to life and whispered to me whenever something went wrong. It is that fear that kept me alive all these years, and I always said a quiet 'Thank You' after every sortie.

Military flying is not just about the enemy. It is about professionalism, patriotism, pragmatism, and most importantly, passion. We fight because we fight for our country and our people. We fight for strangers who will never know us but who rely on us to save them. We fight for the larger cause. It is this cause and calling that makes me get up every day and take to the skies with the same intensity and professionalism day in and day out. This is what makes me a responsible citizen, a better colleague, a good mentor and a good fighter pilot.

My entire life revolved around aircraft and the squadron. The squadrons are not just a workplace; they are family. Forged by a shared sense of purpose, common ethos and work culture and a tightly knit environment, the squadron has always been my 'go-to' place. From grueling briefings to trying debriefs, from parties to picnics, and from birthdays and anniversaries to funeral parades, the squadron stands with you through thick and thin. The camaraderie

tends to numb that ever prevalent, silent fear and assures you with that feel-good R/T call, "your tail is clear."

That, in a nutshell, has been my life. A life full of action, adrenaline and professionalism. A dream turned into reality, and a man who became a fighter pilot. Over the years, I flew many aircraft and achieved many milestones. I became a valued member of the fighter pilot clan and was very fortunate to have been chosen to fly the first indigenous fighter aircraft developed by my country. The aircraft was the pride of the nation, a technological marvel and a pilot's dream. The aircraft was a testimony to the nation's quest for self-reliance, and I was proud to have been selected to fly it. I soon qualified in all roles of the aircraft and was also chosen to demonstrate the capability of the aircraft to the whole world in air shows across the globe. The aircraft was the cynosure of all eyes whenever it took to the skies. With an enviable safety record, way better than most other aircraft in the world, the aircraft was a joy to fly and jaw-dropping to watch. As a harbinger of indigenisation, the aircraft represented technological achievement as well as confidence in my nation's manufacturing capacity. I could not have asked for a better machine to take to the skies.

On that fateful day, when I flew my last sortie, nothing was different. I prepared like I always did, I ate what I always ate, I attended the morning briefing like I always did, I wore the same flying clothing that I

wore yesterday, and I strapped in with the same confidence, respect and calmness that I have always done for the many years that I have been a fighter pilot. I did everything the way it was meant to be done, and yet something happened. There are some things beyond one's control. Murphy's law states that anything that can go wrong will go wrong. I have lived by it my entire life and been well prepared, but that, ladies and gentlemen, is life. My journey ended suddenly, violently and with many unanswered questions, but I did not for one moment fear this ending because all fighter pilots make peace with this fact of life long before their name shows up as part of statistics.

What is hard to understand is the frenzy created by social media platforms, news channels and various online forums to arrive at conclusions before the official court of inquiry has even started investigating into the accident. My message to all the self-proclaimed aviation experts is that You do not know what went wrong. You weren't there when it happened. Then why are you judging what happened and how?

Remember me not for what went wrong. Remember me for what I did right. Remember me with pride and not with sorrow. Remember me for my spirit and enthusiasm, and remember me not just as a peaked cap atop a coffin but as a human who dared to dream big and 'Touch the Sky with Glory'. I am truly where I always belonged.

Burden of Proof: Latest Dynamic in Air Power Employment Calculus

Wg Cdr Akash Godbole | 26 November 2025

[Source: CAPSS India | https://capssindia.org/burden-of-proof-latest-dynamic-in-air-power-employment-calculus/](https://capssindia.org/burden-of-proof-latest-dynamic-in-air-power-employment-calculus/)



Introduction

It is said in Judiciary circles that Justice must not only be done, but also seem to be done. This article aims to draw a similar analogy to the employment of Air Power, especially in the backdrop of Operation Sindoor. The highest echelons of the Indian Air Force (IAF) repeatedly acknowledged that during the 2019 Balakot air strike, there was insufficient visual proof to demonstrate its success. In stark contrast, an ample number of videos/photographs have been provided to the electronic/digital media to validate the likely extent of damage caused by the successful strikes by the Indian Armed Forces during Operation Sindoor. This suggests fundamental implications for

doctrines prescribing the employment of Air Power moving forward.

Analysis

Traditionally, the analysis of strike damage formed part of the broader sequence of battle damage assessment (BDA) that feeds into subsequent mission planning. It has been a vital mission-planning tool for decision-makers, especially in the military, revealing the extent of damage to the target and the need for additional waves of attack to neutralise its operational capabilities. However, it had never attained the stature of a prerequisite for proving the success of an operation. The times have changed drastically from when acknowledging damage was considered part of the military ethos.

This phenomenon has become even more acute, given the lengths to which nations and civilisations go to control the strategic narrative. While the latest technologies have brought greater visibility through satellite and intelligence, surveillance, and reconnaissance (ISR) inputs, they have also enabled digital media to spread like wildfire. The case of “Doosra banda” reeks of motivated social media campaigns to engineer a narrative directed at a domestic media and fallible international audience that is keener on what comes first than on what is correct. In this environment, how is the employment

of Air Power affected? It gets affected in a multitude of ways: –

(a) Operational Choices: It is beginning to fundamentally influence target selection. The Vice Chief of Air Staff (VCAS), Air Marshal Narmdeshwar Tiwari, reflected on how the armed forces narrowed down to selecting nine targets out of many identified during strike preparation. This suggests that some evidential priorities were factored into target selection, leading to the selection of targets on whom damage could be unambiguously documented. Traditionally, targets have been chosen solely on operational considerations, such as the concentration of terrorist training infrastructure and their headquarters. Parallel arrangements were made to plan BDA missions to obtain the requisite assessment. Increasingly, these missions are likely to provide documentary evidence of the damage to the international and national media. As far as Operation Sindoor is concerned, the targets specifically for IAF were the terror headquarters at Muridke and Bahawalpur, a good 30 km and 100 km inside Pakistan territory, respectively. Targeting these sites offered the dual advantage of military strategic value and demonstrable visual proof of damage against legitimate targets, satisfying military requirements for both strategic value and proof generation.

The contrast with Balakot is instructive for all to see.

Choice of Weapon has evolved beyond the traditional criteria of lethality, precision and cost-effectiveness. The VCAS, while displaying live strike footage, demonstrated how the use of weapons with integrated sensor packages enabled real-time documentation. Another manifestation of this aspect is the inclusion of unmanned systems specifically for strike documentation, beyond those mandated by BDA considerations. Moving forward, this is likely to affect the entire procurement process, force structuring, mission planning, and execution.

(b) Phase and Timing of Campaign: The proof-driven employment structure must be considered in the context of the campaign's phase. Since it had to be a surprise strike with a limited window for targeting, every weapon had to deliver what it meant to. More than that, every weapon hit should be comprehensively proved to have made an impact. The same cannot be said of campaigns elsewhere, such as in Ukraine and Gaza. However, for such short and swift conflicts with limited objectives on the part of at least one of the belligerents, the need to factor in provability, especially in Air Power employment, needs to be considered.

(c) **Strategic Communication Architecture:** Despite the efforts of the Indian armed forces, this aspect still requires further institutional refinement. As observed during engagements spanning the last two decades, the Indian follow-up to a military action has been nuanced, relying on accurate data collection and formal public communication through media briefings. This reflects how a civilised nation behaves; however, what has changed recently is the promulgation and consumption of social media outlets. The IAF, on its part, has made considerable efforts to release strike videos, pre- and post-satellite images, and detailed damage assessments for public consumption. This is not to say that the Indian system is ineffective, but there is room for improvement, especially regarding institutionalised mechanisms for narrative management. Cognitive warfare demands systemic integration of communication into operational design. The enemy, meanwhile, is openly demonstrating how it managed the narrative in its favour during the conflict.

To manage a coordinated, effective, and timely follow-up, it is imperative to institutionalise communication procedures and systems. Training and simulations can only thrive in a system mandated and designed to support them. It would require a flow of aural,

visual, and digital information to vantage points that can further decide and regulate its flow to the requisite avenues. This would improve the efficiency and viability of communication; otherwise, it is likely to grow stale and appear to be a manufactured response to enemy propaganda.

(d) **Operational Viability:** The most significant factor affecting a military planner is the operational viability of undertaking such an operation. While it does affect the employment of Air Power in ways it never has till now, provability must not come at the cost of operational effectiveness. The damage caused by long-range surface-to-air weapons has been unprecedented. As noted earlier, this would require subtle changes and inclusions at the procurement stage, while balancing economic considerations. Training would need to align with these weapons and their respective procedures. The most crucial aspect planners need to understand clearly is that this is another factor to be managed and must in no way offset operational effectiveness. Especially as AI-enabled and autonomous weapons rise, it is prudent to maintain positive visual feedback to address legal and ethical concerns. A calculated percentage of weapons with such capabilities would need to be factored in, especially given the likelihood of short, swift conflicts in the neighbourhood.

This remains true for India, considering the nuclear dimension unlikely to yield a protracted contest.

Conclusion

The burden of proof has now transcended the realm of BDA and is now an essential consideration for Air Power employment. Operation Sindoor thus highlights a larger paradigm shift in military doctrine, suggesting provability as a crucial operational parameter in the modern information environment. Thomas Schelling describes communication as an essential aspect of deterrence along with capability and intent. The same is true of military actions today, as communications come out into full public glare. For this to remain relevant, it would need timely, authentic visual proof to support the narrative.

In this regard, Operation Sindoor demonstrated the systematic integration of proof generation into operational structures, including target prioritisation, weapon choices, campaign phasing, visible escalation control, optimal communication mechanisms, and limited social media engineering. Moving forward, it would require a revisit to institutionalise this aspect into military planning, which would demand modifications to procurement procedures, training curricula, and operational procedures. Procurement would require a deeper analysis to arrive at the optimal percentage of such weapons

and equipment. Communication systems for a ready flow of information with inbuilt regulatory provisions need to be conceived and operationalised at the earliest. A broader introspection would be required to integrate communication mechanisms into operational structures. Training and Simulation would need to follow up.

It has been repeatedly stated that Sindoor has laid to rest the ghost of Balakot, but what remains a concern is perception management, especially in the age of social media. The enduring lesson remains that in contemporary conflict, perception shapes reality and damage as an operational objective must not only be done but also seem to be done.

AIR POWER

Utilisation of Drones in the Russia-Ukraine War: Shift from Manned Aircraft to Drones

Mr Kalpesh Bhagoji Khandekar | 13 November 2025

[Source: CAPSS India | https://capssindia.org/utilisation-of-drones-in-the-russia-ukraine-war-shift-from-manned-aircraft-to-drones/](https://capssindia.org/utilisation-of-drones-in-the-russia-ukraine-war-shift-from-manned-aircraft-to-drones/)



Introduction: War in the Drone Age

When Russia invaded Ukraine in February 2022, the world anticipated that tanks, fighter planes, and guns would come to characterise the battlefield. Instead, 'Drone', a new actor, moved into the limelight. Within months, the skies of Eastern Europe became a battlefield not for bold pilots, but for quiet, unmanned devices that could observe, attack, and go where manned aircraft could not.

From Ukraine's Bayraktar TB2s obliterating Russian air defences and even sinking the Moskva warship, to Russia launching waves of Shahed-136 "kamikaze" drones to cripple Ukrainian infrastructure,

the Unmanned Aerial Vehicles (UAVs) have become much more than support tools; they are now game-changing weapons. They attack deep within enemy lines without putting their pilots at risk, target artillery with precision, and reveal enemy movements in real-time.

This war has demonstrated a profound change; air superiority no longer requires expensive fighter planes or gallant pilots. Rather, cheap, small, and stubborn drones are rewriting the very definition of air power. What was science fiction not so long ago is now a matter-of-fact aspect of war, and the Russia-Ukraine conflict is the most unambiguous indication yet that the era of the drone has officially started.

Ukraine's Bayraktar TB2 and Russia's Shahed-136 and Lancet Drones: A Game-Changer

One of the most recognised drones of the conflict is the Bayraktar TB2, manufactured in Türkiye and used by Ukraine. The Medium Altitude Long Endurance (MALE) drone can fly for up to 27 hours, has a ceiling of approximately 25,000 feet, and can carry laser-guided missile weapons. At the outset of the war, the TB2s were instrumental in the destruction of Russian air defence systems and Russian convoys. They even sank the Russian Black Sea Fleet flagship, the Moskva. The TB2 also provided real-time targeting data for artillery strikes. As the conflict continued and as Russia improved its air defences, the TB2 shifted from conducting attacks to fulfilling the role of Intelligence,

Surveillance, and Reconnaissance (ISR).

Russia has employed Iranian-manufactured Shahed-136 drones, which they refer to as Geran-2, a type of “kamikaze drone” designed to fly into a target and explode. The Shahed-136 is relatively cheap and can be launched in swarms. Russia is using them for strikes on everything from power stations to military facilities to cities. Often, Russian forces send them at night to overwhelm air defences. In this way, the Shahed-136 has taken the place of long-range bomber missions by aircraft, which would be much more expensive to use and riskier to send on distant missions.

The Lancet drone by Russians is a precision-guided loitering munition which is utilised to destroy tanks, artillery pieces, and radar stations. Lancet was used in the wake of a Shahed attack to hit targets that survived the first wave. The Lancet has undertaken missions that would have been carried out by Su-25 ground-attack aircraft or an attack helicopter. Although these assets are now often forced to operate from greater distances because of the threat of portable air-defence systems.

Commercial UAVs on the Frontline

Both Russia and Ukraine heavily utilise First-Person View (FPV) drones, which are often adapted from commercial drones. These are small, fast, and manually piloted using a live camera feed, allowing operators to guide them with extreme

precision. FPV drones are perfect for trench warfare and urban fighting. They are inexpensive, hard to shoot down, and ideal for missions.

Commercial drones, such as the DJI Mavic series and Matrice series, have also become a standard tool on the battlefield. On the front line, drones are used for artillery spotting, reconnaissance and even light bombing by attaching small explosives. In some cases, these drones have replaced scout helicopters and observation planes. They are inexpensive, readily available, and simple for soldiers to use and operate. A front-line unit can unpack, launch, and fly a drone in just minutes, providing them with instantaneous situational awareness.

Shift from Manned Aircraft to Drones

Why this shift from manned aircraft to drones? Safety is the most obvious factor. If one is shot down, the loss is a machine, not a human life. Price is yet another significant factor. Although a new fighter plane will cost an enormous amount of money, a drone can be constructed and piloted for a fraction of that price. Another benefit is endurance; most drones can remain aloft much longer than manned planes, as pilots get tired and run out of fuel are the only limitations for them. The mere ability of drones to provide real-time video and images means that they can deliver precision strikes or guide artillery fire to the precise location. And since they have no human aboard, they can be launched into deep-defended territory

where a manned aircraft would stand little chance of survival.

Vulnerabilities of using Drones

However, drones have certain disadvantages. Even after using fewer munitions, their speed is invariably slower. Many of them are also susceptible to adverse weather conditions. Electronic warfare also poses a significant threat. Signals can be jammed or hacked, or they can crash. There will be obstacles in coordinating airspace for simultaneous use by drones and manned aircraft, as avoiding collisions beyond visual line-of-sight will rely on sensing and control systems with advanced capabilities. And finally, there are ethical questions. Drones can often be deployed with ease and inexpensive redundancy, which leads to questions of whether this would cause the military and others to lower the threshold to use lethal force. Civilian casualties created by the use of drone strikes are still a hotly contested public debate, as is the potential for autonomous targeting against humans without human intervention. The availability of drones in the open market creates a risk to national security if technologically advanced UAVs are obtained by non-state actors and used in coordinated attacks.

Key Lessons for India from the Drone Era

India must respond to the drone era with strategic and intelligent adaptation

rather than mindlessly copying others. Accelerated investment in domestic counter-drone technologies is the first step. For example, the D4 system, developed by the Defence Research and Development Organisation (DRDO) and Bharat Electronics Limited (BEL), neutralises small UAVs by combining hard-kill options, such as lasers or kinetic interceptors, with soft-kill techniques, like jamming. In addition to government initiatives, private companies are also developing innovative projects. For example, Bhargavastra, a micro-missile solution for swarm drones, demonstrates that India can lead the world in specialised counter-UAS technology.

Second, India must implement a layered air defence system, combining drones, electronic warfare, radars, and missile systems at various ranges.[20] Experience from the Ukrainian employment of drones for artillery ranging and precision targeting emphasises the need for training in networked, joint operations where drones are not only used for reconnaissance but also for fire control, intelligence gathering, and logistics support.

Third, the Russian-Ukrainian conflict revealed fundamental supply-chain risks. To prevent similar threats, India needs to minimise import dependence by creating local ecosystems for vital components, such as sensors, chips, payloads, and Artificial Intelligence (AI) software.

Lastly, India should ready itself against

the emerging threat of low-cost commercial drones being used atrociously by non-state actors, especially in the border regions, and safeguard civilian infrastructure as well.

Essentially, the most critical takeaway for India is to shift from a reactive to an anticipatory posture: build indigenous counter-UAS capabilities, integrate them into multi-layered defences, reinforce domestic supply chains, and actively confront asymmetric drone threats across all domains.

Way Forward: The New Face of Air Power

Although there are challenges, the war in Ukraine has shown that drones are not merely backup systems anymore; they are now part of military strategy and capable of taking over missions formerly attended by belligerents with helicopters and fixed-wing aircraft. In Ukraine, drones have been used to identify targets for artillery fire, adjust artillery rounds to targets, engage direct strikes against targets, and induce psychological effects on enemy forces by always ensuring they know they are being monitored. For Russia, drones allow long-range attacks deep into Ukrainian territory without risking pilots or expensive aircraft. This represents a profound shift in how drones are applied in modern warfare.

In the future, the experiences of this war are likely to influence military planning globally. Military forces will allocate more

resources to drone manufacturing, pilot training, and anti-drone systems. The ratio between human-crewed and unmanned systems will continue to evolve, with unmanned planes increasingly handling perilous and routine assignments. Though manned aircraft will not become extinct, they do retain an edge in speed, payload, and specific mission types. Their domain will diminish in wars where the airspace is contested, and the threats are real. The ethics, strategy, and technology surrounding this transformation will haunt us for decades to come, but one thing is sure: the age of the drone has arrived.

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Exercise Garuda: From Tactical Interoperability to Strategic Convergence

Group Captain (Dr) Dinesh Kumar Pandey (Retd) | 24 November 2025

Source: CAPSS India | <https://capssindia.org/exercise-garuda-from-tactical-interoperability-to-strategic-convergence/>



Introduction

A bilateral Exercise Garuda-VIII (2025) is ongoing from November 16 to 27, pitting the Indian Air Force (IAF) against France's Air and Space Force (FASF) in a simulated combat. This exercise features the IAF's Su-30MKI aircraft manoeuvring alongside French multirole fighters in complex air combat situations. The primary focus will be on air-to-air combat, air defence, and joint strike operations. In addition, 'Garuda-VIII' provides a platform for the two forces to interact professionally, exchange knowledge, and share best practices, reinforcing the strong Indo-French strategic partnership.

The exercise is a building block on previous versions, as it lays stress on interoperability and sharing of tactics,

which will strengthen India-France defence relations in the context of joint ventures such as Rafale procurement and co-development of military hardware. It will provide a platform for IAF Rafale pilots to enhance their general employability and the exploitation of aircraft in peculiar conditions.

Exercise Garuda is a tactical bilateral air exercise aimed at enhancing interoperability, sharing of best practices and strengthening defence cooperation between the IAF and the FASF. The exercise is usually complex, incorporating complex air defence and ground attack missions with often sophisticated fighter aircraft, aerial refuelling and joint tactical operations. The locations have slipped back and forth between India and France, with the memorable First edition held at Gwalior Air Force Station (India) and Mont-de-Marsan Air Base (France).

Brief History (from 2003-2024): The 'Garuda' Legacy of 22 years

The exercise "Garuda" has a 22-year history and offers forward-looking strategic and doctrinal advantages to the IAF. The Garuda exercise series, which was inaugurated in 2003, has been carried out in phases. It was initially focused on the basics of interoperability (2003-2010); later moved on to critically pre-inducting the Dassault Rafale and its operational systems (Garuda VI, 2019); and finally became a top-notch platform for demonstrating the validity of India's indigenous combat systems, like the

LCA Tejas and LCH Prachand (Garuda VII, 2022).

The genesis of Exercise Garuda is explicitly linked to the Indo-French strategic partnership, which started on January 26, 1998. This partnership made defence and security principal pillars of the bilateral relationship. To make this cooperation dynamic, the two countries introduced a set of regular triennial training exercises for the collaborating Armed forces of both countries. These exercises are:

- (a) Ex Varuna, for both Navies,
- (b) Ex Shakti, for both Armies, and
- (c) Ex Garuda, for both Air Forces.

The first five editions focused on creating basic-level interoperability. During the exercise, the IAF and the FAF flew various air combat missions both by day and by night. These missions included 1 vs 1 and 2 vs 1 visual air combats. Large Force Engagement (LFE) in a near-realistic environment were the attraction of air combat training missions. Both Air forces exchanged best practices to enhance their operational capabilities. The objective of the exercise was to enhance professional engagements and interoperability between IAF and FAF through the exchange of operational knowledge and experience, besides the solidification of bilateral relations between the two air forces. The focus areas of previous versions of exercises were:

- (a) The first edition, Garuda I (February 2003), was held at Air Force Station Gwalior, India, and was attended by the Chief of Staff of the FASF.
- (b) Garuda II (June 2005) was held at Istres Air Base, France. It was the Indian Air Force's first exercise in Europe.
- (c) IAF hosted the FASF for the Garuda III (February 2007) at Air Force Station Kalaikunda,
- (d) Garuda IV (June 2010) was organised at Istres Air Base, France and saw the participation of Singapore Air Force with its F-16s and some of the impressive paratrooper jumps of Indian Garud and French Special Forces from Indian IL-76s. It was an opportunity for IAF IL-78 MKI tankers and FASF KC-135 Stratotankers to practise and validate cross-refuelling procedures.
- (e) The IAF hosted exercise, Garuda-V (June 2014), at its air base in Jodhpur. It was to solve the complicated "East-West" doctrinal and technical equation. Historically, a major user of Russian-origin platforms, the IAF used the exercises to operate the Su-30MKI heavy fighter alongside FASF's Mirage 2000 and Rafale fighters. This integration involved the standardisation of communication procedures, air combat tactics, and the acquisition of complex technical procedures such as air-to-air refuelling (AAR). The IAF contingent had four Su-30 MKIs, one

IL-78 AAR, and two C-17 Globemaster transport aircraft. The C-17, the strategic lift aircraft, flew with 134 air warriors, ground equipment and the logistic support for the IAF contingent during its induction and later de-induction after the exercise. The FAF had deployed Mirage 2000, Rafale, and Alpha Jet fighter aircraft, E-3F Sentry AWACS, C-135 flight refuelling aircraft, and C-130 and CN-235 transport aircraft, with 94 personnel.

(f) Garuda-VI (July 2019) was held at Mont-de-Marsan Airbase 118. The IAF contingent, of seven Indian aircraft – 4 Sukhoi Su-30, 2 C17s and 1 Ilyushin 78, landed at the southwest of France at Mont-de-Marsan Airbase 118 on June 28. This exercise saw the deployment of a great number of French Air Force aircraft: Rafale, Alpha Jet, Mirage 2000, C135, E3F, C130, and Casa.

(g) Ex Garuda VII (November 2022): The LCA Tejas and the LCH Prachand were part of any kind of international exercise for the first time. The exercise incorporated four FASF Rafale fighters and one A-330 Multi Role Tanker Transport (MRTT) aircraft. The IAF contingent was besides the LCA and LCH, Su-30 MKI, Rafale, and Jaguar fighter aircraft and Mi-17 helicopters. Combat Enabling Assets that constituted a part of the IAF contingent were Flight Refuelling Aircraft, AWACS, AEW&C, and Garud Special Forces. The Exercise witnessed the combined flying of Air

Chief Marshal VR Chaudhari, the Chief of the Air Staff (CAS) of IAF, in an IAF Rafale fighter, and the Chief of the Air Staff of FASF, General Stephane Mille, in an IAF Su-30MKI fighter.

Garuda 2025: Doctrine Refinement

The eighth edition, Garuda-VIII (16-27 November 2025), marks a new doctrinal phase. The IAF contingent, which arrived in France on November 10, 2025, consists of six Sukhoi-30MKI fighter jets, supported by an IL-78 mid-air refueller and a C-17 Globemaster-III transport aircraft, for the exercise.[8] FASF is employing 10 Rafales, six Mirage 2000s; and on an ad hoc basis, one H225M Caracal, one A330 MRTT Phénix and one A400M Atlas. The focus of this exercise is the optimum level of operational synergy between the IAF's mature and heavyweight Su-30MKI force and the FASF's Rafale-centric force. This objective is accomplished through stress testing of IAF tactics in complex, high-intensity simulated scenarios, including joint strike operations, in an unfamiliar "away game" environment at Mont-de-Marne, France.

IAF's Tri-Level Benefit

The strategic benefits granted by the IAF are threefold. From the doctrinal point of view, the exercise was of invaluable value as it resulted in IAF pilots gaining exposure to Western combat methodologies and subsequently incorporating the same into the training and operational syllabus of the

IAF. Tactically, it perfects the integrated “potent combination” of its Su-30MKI and Rafale fleets. Strategically, it wants to validate IAF’s transcontinental power-projection capability by rigorously testing its IL-78 tanker and C-17 Globemaster III transport assets.

Strategic Cornerstone for Multilateralism

The deep, high-level trust and technical interoperability between the two sides achieved through the bilateral Garuda series has become the foundation for India’s larger multilateral air power ambitions. This is proven by the fact that France was part of India’s first multinational exercise -Tarang Shakti exercise in 2024 as an anchor participant, a multilateral event with a stated intention of being “broadened from Garuda”. Consequently, Garuda has helped IAF transform from a participant in foreign exercises to a global convenor of air power.

Significance of Ex Garuda

These exercises have gone through a prolonged process starting from MiG-21 to Mirage-2000 and more advanced ones such as Su-30 MKI, Rafale, and the indigenous Tejas aircraft, which reflects the upgrade in technology for both air forces. Early editions included basic air defence, while recent ones included SEAD, electronic warfare, night ops and multi-domain integration. Aerial refuelling, AWACS coordination and joint planning have become the norm, increasing operational synergy. Exercises

have coincided with India-France defence deals (e.g. the Rafale purchase) and with security issues in the region (e.g. Indo-Pacific security, China).

Conclusion

The IAF participates in ‘Garuda-VIII’ at Mont-de-Marsan, France, with the FASF until November 27, to ensure better exploitation of tactics and interoperability. This exercise is characterised by complex combat situations, with an emphasis on air-to-air BVR combat, air defence, and joint strike operations, thereby strengthening a long-standing strategic partnership.

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IAF's New Self-Protection Jammer to Sharpen Su-30MKI's Electronic Warfare Edge

Adhidev Jasrotia | 28 October 2025

[Source: SSB Crack | https://www.ssbcrack.com/2025/10/iafs-new-self-protection-jammer-to-sharpen-su-30mkis-electronic-warfare-edge.html](https://www.ssbcrack.com/2025/10/iafs-new-self-protection-jammer-to-sharpen-su-30mkis-electronic-warfare-edge.html)



The Indian Air Force (IAF) has issued a Request for Information (RFI) for the procurement of 100 Advanced Self-Protection Jammer (ASPJ) pods for its frontline Su-30MKI fighter jets, marking a major push to boost survivability and electronic warfare (EW) capabilities under the Super Sukhoi modernisation programme.

The ASPJ pods will utilise Digital Radio Frequency Memory (DRFM) technology to receive, analyse, and retransmit modified radar signals — effectively deceiving enemy sensors and missiles. Unlike traditional noise-based jammers, these advanced systems can create false radar targets and execute range and velocity gate pull-off manoeuvres, significantly enhancing aircraft survivability in high-threat environments. Officials indicate that the system will deliver

360-degree protection, countering radar-guided missile threats from any direction. The jammers will feature Gallium Nitride (GaN)-based Active Electronically Scanned Array (AESA) transmitters — offering superior power efficiency, compact size, and faster electronic beam steering. The high Effective Radiated Power (ERP) will ensure robust countermeasures against enemy surveillance and fire-control radars.

Integration with Super Sukhoi Upgrade
The ASPJ acquisition forms a key component of the Super Sukhoi upgrade, which aims to transform the Su-30MKI fleet into a 4.5-generation air superiority platform. The program includes replacing the aircraft's N011M Bars PESA radar with DRDO's GaN-based AESA radar 'Virupaksha', offering longer detection ranges, enhanced tracking, and greater resistance to jamming.

A new all-digital glass cockpit, improved Radar Warning Receivers, and integration of indigenous Beyond Visual Range (BVR) missiles and precision-guided munitions are also part of the comprehensive upgrade plan.

The ASPJ pods will work in tandem with a new Defensive Aids System (DAS) to form a unified electronic warfare suite, drastically improving mission effectiveness and survivability in contested airspaces.

Indigenous Collaboration and Aatmanirbhar Focus

Under the Make in India framework, the IAF is prioritising domestic production and technology transfer for the project. The RFI suggests collaboration between DRDO's Defence Avionics Research Establishment (DARE) and Bharat Electronics Limited (BEL) to design and manufacture the ASPJ systems indigenously.

This partnership is expected to bolster India's self-reliance in critical EW technologies, ensure cost-effective sustainment, and pave the way for integration of similar systems into future platforms such as the Tejas Mk-1A, Tejas Mk-2, and the Advanced Medium Combat Aircraft (AMCA).

Extending Combat Relevance

The Super Sukhoi upgrade, coupled with the ASPJ integration, is projected to extend the operational life of the Su-30MKI fleet by nearly two decades. The introduction of DRFM and GaN-based systems will not only modernise the aircraft but also bring India's air combat capabilities closer to global standards.

Exercise Garuda 25: Indian Air Force Participates In 8th Edition Of Bilateral Air Exercise With French Air And Space Force

15 November 2025

Source: [PIB | https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2190299®=3&lang=2](https://www.pib.gov.in/PressReleaseDetail.aspx?PRID=2190299®=3&lang=2)



The Indian Air Force (IAF) is participating in the 8th edition of the bilateral air exercise 'Garuda 25' with the French Air and Space Force (FASF) at Mont-de-Marsan, France, from November 16 to 27, 2025. The IAF contingent arrived in France on 10 November 2025, and will be participating with Su-30MKI fighter aircraft. The airlift support is being provided by the C-17 Globemaster III, for the induction and de-induction phases of the exercise, while the IL-78 air-to-air refuelling tankers are utilised for extending the range and endurance of the participating fighters.

During the exercise, the IAF's Su-30MKI aircraft will operate alongside the French multirole fighters in complex simulated air

combat scenarios, focusing on air-to-air combat, air defence, and joint strike operations. This exercise aims to refine tactics and procedures in a realistic operational environment, enabling mutual learning and fostering interoperability between the IAF and the FASF.

Exercise Garuda 25 also provides an opportunity for professional interaction, exchange of operational knowledge, and sharing of best practices between the two Air Forces. Participation in this exercise underscores the IAF's commitment to engage constructively with friendly foreign Air Forces through multi-lateral exercises, promoting mutual understanding and cooperation in the field of air operations..

Space

Earth on alert: Mega solar explosion shakes satellites, power grid, mid-air flights

12 November 2025

[Source: India Today | https://www.indiatoday.in/science/story/earth-on-alert-mega-solar-explosion-cme-shakes-satellites-power-grid-mid-air-flights-2817953-2025-11-12](https://www.indiatoday.in/science/story/earth-on-alert-mega-solar-explosion-cme-shakes-satellites-power-grid-mid-air-flights-2817953-2025-11-12)



The explosion originated from the region of old sunspot AR4246. (Photo: Getty)

A rare and severe solar storm has plunged satellites and power grids worldwide into heightened alert as Earth's atmosphere reels from the impact of a powerful geomagnetic disturbance.

Following the early arrival of two coronal mass ejections (CMEs) on November 11, a G4-class geomagnetic storm erupted, slamming energetic particles into the planet and producing dazzling auroras photographed as far south as Florida, Texas, and Alabama.

The solar activity reached a dramatic peak when a massive solar flare erupted from sunspot 4274. The flare expelled a surge of highly energetic protons toward

Earth, some so powerful that they are penetrating deep into the atmosphere, reaching ground level.

“This is a very significant event,” said Professor Clive Dyer of the Surrey Space Centre. “Neutron monitors around the world are detecting an unusual spike in cosmic-ray activity, evidence of what’s known as a Ground Level Event (GLE),” Dyer told spaceweather.com.

Such GLEs are extremely rare, occurring only once or twice each solar cycle.

Professor Dyer compared the current event to the last significant GLE of December 13, 2006, calling it a “20-year event.” During the 2006 episode, passengers on high-latitude flights were exposed to an increased radiation dose rate of up to 30 microSieverts per hour, an estimated 20% rise in effective radiation exposure.

Initial analysis suggests that airborne radiation levels may have spiked again, particularly over polar regions. Dyer points out that studying today’s GLE will offer valuable data for preparing against even larger outbursts, such as the infamous February 23, 1956 event that amplified radiation at high altitudes by a factor of 1,000.

The storm’s immediate effects extend beyond Earth’s lower atmosphere. In orbit, swarms of solar protons are “peppering” satellite surfaces and imaging systems, presenting significant risks to spacecraft

operations and data integrity.

Multiple CMEs in recent days have kept forecasters at the US National Oceanic and Atmospheric Administration (NOAA) on high alert. Severe geomagnetic storms threaten to disrupt radio transmissions, satellite GPS systems, and possibly even air traffic control, particularly near the poles.

While aurora hunters across much of the northern United States are enjoying unusually vibrant northern lights, experts warn that solar storms can cause much more than a beautiful sky show. Intense solar wind streams and charged plasma can overload the power grid with geomagnetically induced currents (GICs), potentially triggering blackouts.

Past storms have wrought havoc: the 1859 Carrington Event set telegraph systems ablaze, and a 1972 storm reportedly detonated U.S. sea mines off Vietnam’s coast.

Although space weather forecasting has advanced, experts emphasise that accurate long-term predictions are still elusive. Critical infrastructure and the public usually receive just a few days’ notice before a solar outburst reaches Earth.

With the current solar cycle nearing its peak, vigilant monitoring and rapid response remain the keys to minimising the impact of such celestial eruptions.

Chinese Space Agency CNES Completes First Emergency Mission To Tiangong Space Station

Simonetta Di Pippo | 21 October 2025

[Source: Indian Defense News | https://www.indiandefensenews.in/2025/11/chinese-space-agency-cnes-completes.html](https://www.indiandefensenews.in/2025/11/chinese-space-agency-cnes-completes.html)



China successfully launched the Shenzhou-22 spacecraft from the Jiuquan Satellite Launch Center on 25 November 2025, using a Long March-2F rocket to send the spacecraft into its planned orbit.

The uncrewed Shenzhou-22 is set to dock with the Tiangong Space Station within hours, providing a critical rescue vehicle for three astronauts currently aboard the station who have been without a reliable return craft due to damage sustained by a previous spacecraft.

This launch forms part of China's strategy to maintain continuous human presence in low-Earth orbit by ensuring that the crew has a safe means of returning to Earth if necessary.

The spacecraft is loaded with supplies, including food and equipment, in place of crew members, and it will serve as a lifeboat for the astronauts currently on Tiangong.

The mission aims to maintain a seamless crew rotation and safeguard the ongoing operations and scientific experiments aboard the station.

Prior to this, the Shenzhou-20 spacecraft was found damaged in orbit, preventing it from safely returning the crew, which led to the deployment of this precautionary mission. The astronauts on Tiangong conduct cutting-edge scientific research, maintenance tasks, and support construction on the multi-module station, which functions as China's permanent orbital outpost.

The Tiangong Space Station supports a crew of three and hosts over a thousand scientific experiments in a pressurised environment, including those related to microgravity combustion, material endurance, space medicine, and microbial monitoring.

The astronauts perform health monitoring activities such as cardiac and vascular ultrasounds, neuromuscular stimulation to counteract muscle loss in space, and manage critical station equipment. The robotic arms aboard the station assist in assembly tasks and spacewalk operations, with spacewalk readiness and emergency procedures part of the crew's rigorous training.

Footage of the launch showed the rocket ascending smoothly through clear desert skies, with mission control confirming each flight stage.

Shenzhou-22's successful insertion into orbit and autonomous docking demonstrate the operational maturity of China's spaceflight program and the effectiveness of their backup strategy, often referred to as a "one-for-one, rolling backup" approach, designed to handle emergencies swiftly.

This mission underscores China's expanding ambitions to operate a long-term human presence in orbit and to maintain a resilient human spaceflight infrastructure.

Shenzhou-22 is a pivotal mission within China's broader goal of sustained orbital presence and space station development. It ensures crew safety, supports continuous scientific experimentation, and exemplifies China's commitment to advancing its space capabilities in a strategic and resilient manner.

ISRO successfully tests engine that will power Gaganyaan mission

19 November 2025

Source: ISRO | <https://www.indiatoday.in/science/gaganyaan-mission/story/isro-successfully-tests-lvm-3-ce20-engine-that-will-power-gaganyaan-mission-2822523-2025-11-19>



This marks the first time Isro has achieved a boot-strap start. (Photo: ISRO)

The Indian Space Research Organisation (ISRO) has achieved a major breakthrough for its human spaceflight programme with the successful testing of a new start-up method for the CE20 cryogenic engine, which will propel the Gaganyaan mission aboard the LVM3 launch vehicle.

On November 7, 2025, engineers at Isro's Propulsion Complex in Mahendragiri carried out a landmark demonstration of the CE20 engine in boot-strap start mode under simulated high-altitude, vacuum conditions.

This marks the first time ISRO has achieved a boot-strap start for a gas-generator cycle cryogenic engine without relying on any auxiliary stored-gas system

— a feat that is likely a global first.

The CE20 engine, already flight-proven at thrust levels between 19 and 22 tonnes, typically uses stored gas to ignite and activate its turbopumps. While reliable, that method requires additional hardware and a dedicated gas bottle for every in-flight restart.

For future missions requiring multiple orbital manoeuvres or injections, including deep-space exploration and advanced commercial launches, these extra systems add weight and reduce payload capacity, limiting mission flexibility.

The new test changes that. Instead of using stored gas, ISRO deployed a multi-element igniter in both the thrust chamber and the gas generator. After the thrust chamber ignited, the gas generator kicked in using only tank-head pressure, allowing the turbopumps to spin up autonomously.

The engine then ramped up smoothly to a stable, steady operating state, proving that boot-strap starting is reliable and repeatable under real mission conditions.

This innovation significantly enhances the LVM3's capabilities. By eliminating auxiliary start-up systems, the rocket becomes lighter and more efficient, enabling more payload to be carried into orbit. It also allows Isro to execute multiple in-flight restarts with ease, essential for multi-orbit deployments, complex mission profiles, and human spaceflight requirements.

For the Gaganyaan mission, which aims to send Indian astronauts into space aboard an Indian rocket for the first time, the advancement is a timely boost.

With improved restart capability and greater operational flexibility, the CE20 engine's new boot-strap mode strengthens ISRO's position in both scientific and commercial space sectors, while pushing India closer to its historic first crewed launch.

UK and Germany have accused Russia of threatening their satellites. Here's what that means

Lauren Kent | 09 November 2025

[Source: CNN | https://edition.cnn.com/2025/11/09/europe/russian-satellite-spying-explainer-intl](https://edition.cnn.com/2025/11/09/europe/russian-satellite-spying-explainer-intl)



German Defence Minister Boris Pistorius warns of the growing threat of Russian space activities during the BDI Space Congress in Berlin on September 25. (John Macdougall/AFP/Getty Images)

London — Germany and the United Kingdom have warned of the growing threat posed by Russian and Chinese space satellites, which have been regularly spotted spying on satellites used by Western powers.

The countries have in recent weeks highlighted frequent instances of Russia stalking, jamming and interfering with their satellites in space.

“Russia’s actions, especially in space, pose a fundamental threat to us all. A threat we can no longer ignore,” German Defense Minister Boris Pistorius told a Berlin conference of space industry leaders in September.

Targeting communications satellites can impact things like satellite imagery, telecoms and broadband satellite internet access. Disrupting navigation and positioning systems can impact military operations as well as civil aviation, according to the global think tank RAND.

The warnings come in the wake of Russia’s full-scale invasion of Ukraine, now well into its third year. Ukrainian officials say Moscow has increased its level of cooperation with China, with Beijing conducting satellite reconnaissance of Ukrainian territory on its behalf.

Here is what officials and experts say about the satellite threats in space.

What has Russia been doing?

Pistorius noted that two Russian reconnaissance satellites were recently spotted tracking two IntelSat satellites, which are used by the German Armed Forces and its allies. IntelSat is a commercial satellite services provider whose fleet is used by governments and companies in the US and Europe.

“Russia and China have rapidly expanded their space warfare capabilities in recent years: They can jam, blind, manipulate, or kinetically destroy satellites,” Pistorius added, announcing a multi-billion-dollar boost in funding for German space programs.

The head of the UK Space Command

also sounded the alarm, saying that Russian satellites are stalking British assets in space, as well as jamming them on a “weekly” basis.

“They’ve got payloads on board that can see our satellites and are trying to collect information from them,” Major General Paul Tedman told the BBC last month. Jamming is conducted using ground-based infrastructure. Russia has spent years developing electronic warfare capabilities amid the war in Ukraine.

Separately, NATO Secretary General Mark Rutte once again warned this year of Russia’s plans to develop nuclear weapons in space to disable and destroy satellites.

Russian President Vladimir Putin has publicly said Moscow has no intention of deploying nuclear weapons in space. But Russia also vetoed a UN Security Council resolution that called for member states to not develop space-based nuclear weapons in 2024. China abstained from voting.

How does satellite ‘spying’ work and how is it detected?

In general, it’s relatively simple for space forces to detect and locate foreign satellites, but it’s difficult to determine their exact capabilities and intentions.

Authorities make assumptions about the intent of Russian satellites based on where the satellite is in space, what else it’s near and historical patterns of what

similar satellites have done, according to expert Clayton Swope, the deputy director of the Aerospace Security Project at the Center for Strategic and International Studies (CSIS) in Washington, DC.

For example, if a Russian satellite lingers for a long period of time near a European communications satellite, authorities can infer that it’s there to spy.

Experts believe the Russian satellites that got close to the two IntelSat satellites used in part by Germany were there to intercept signals.

Meanwhile, in lower orbits, Russian satellites have previously tested “things that look like weapons and fired projectiles,” Swope told CNN. Authorities can identify satellites that look similar to those equipped with projectiles to determine that they are a physical threat to other countries’ assets.

“The Russians have a history of having those types of satellites shadowing other satellites in a way that people might think it’s a sleeper cell, waiting to strike at a moment’s notice,” Swope said.

“It’s very hard to distinguish between a threat in the sense of a weapon and the threat in the sense of intelligence collection,” he added. “Sometimes you really are guessing a lot about what the capabilities of a satellite are as well as the intentions of the operator.”

The Russian space agency has previously downplayed the danger of its weapons tests in space.

How long has the threat from Russia existed?

Germany and the UK are just the latest countries to sound the alarm. The United States and France first warned more than a decade ago that Russian satellites appeared to be spying and collecting information on their assets, including on commercially run satellites.

The US Department of Defense said in 2015 that a Russian military satellite had parked itself near two Intelsat satellites, prompting the US to contact Moscow about its movements, which many at the time described as “mysterious.”

Then in 2017, after France and Italy jointly launched an intelligence satellite, Russian satellites were soon getting close to it to take a look, according to Juliana Suess, a security policy researcher at the German Institute for International and Security Affairs (SWP).

“So, these kinds of behaviors are not entirely new, but I think also need to be seen in the context of Ukraine, and to be seen in the context of the airspace violations that we see Russia conducting with regard to NATO airspace,” Suess told CNN of the recent reports of satellite spying and interference. “All of these things ought to be seen in the broader context.”

Is China also posing a threat?

China is just as much of a threat as Russia, if not more so, experts told CNN.

Although the threats from Russia are more pressing for Europe due to their proximity, “the much bigger space power is obviously China,” Suess said. Analysts have noted some sophisticated Chinese maneuvers in space aimed at getting close to other satellites, “at just incredibly high speeds and with precision that I think has really raised some eyebrows in the West.”

Some of China’s capabilities have raised international concerns, according to the SWP analyst. For example, China has tested a satellite with a robotic arm that can shift other satellites into a different orbit.

China also has “a lot more money to conduct themselves in space,” Suess said. “We’re not going to see much more space growth out of Russia at the moment. Their resources are far too stretched for that.”

Beijing’s activities in space are very active and their objectives are more opaque, according to Swope, the CSIS analyst.

“We don’t always know what they’re doing, and they’re doing a lot of different things that leave a lot of people scratching their heads,” Swope added.

Is the European response adequate?

Germany said it will budget up to €35

billion (\$40.2 billion) over the next five years for space projects.

“It is a big number, for sure. I think it also reflects that there’s a sort of political will to now catch up and, you know, really get things going,” Suess said. But she also stressed that the space race is an ongoing process, with no finish line in sight. “Europe as a whole has a lot to catch up on. Germany certainly has a lot to catch up on.”

A spokesperson for the German Ministry of Defense told CNN that its procurement measures relating to space will amount to around €1.9 billion (\$2.2 billion) in 2025, “but will grow significantly in the coming years.”

The UK government also announced a commitment to increase defense spending this year and a strategic review of British capabilities outlined that “greater attention must be given to the space and cyber and electromagnetic domains.” The UK announced in October that it is testing sensors to detect laser threats in space as part of measures to protect British satellites.

But an analysis from the London-based think tank Chatham House argued that even greater near-term investment is needed, and that the strategic review failed to recognize how urgent the threats in space truly are, putting the country at risk of falling behind.

Meanwhile, France has “been very vocal

about the need to have what they refer to as ‘bodyguard satellites,’ so, satellites whose job it is to protect other satellites,” Swope said. What those satellites will look like is an open question, he added, with development ongoing.

The US still has a historic advantage in space after investing much more in recent years, analysts said. But European allies may benefit from that through cooperation under the North Atlantic Treaty Organization (NATO) and other alliances.

NATO declared in 2019 that space is an “operational domain” for the transatlantic alliance and years later announced that Article 5 would apply in space. Article 5 is the principle that an attack on one NATO member is an attack on all members. Analysts at RAND have argued, though, that NATO needs to “throttle up” on its space enterprise or risk falling short at a critical time.

While falling behind is a real concern, particularly compared to China’s advances, there is also evidence that the Russia has not integrated its satellite systems into its military infrastructure as well as many other space powers.

Suess cited an example of a Russian fighter jet downed in Ukraine that was found with a built-in Russian navigation system but also a commercial GPS taped to the dashboard. Analysts have also seen evidence that Russia is procuring commercial satellite imagery from the

private market – an indication that its own capabilities are not up to scratch.

“We have seen from anecdotal evidence in Ukraine that Russia does not have some sort of level of confidence that one would typically expect in their own systems,” Suess added.

Explained: What is GPS spoofing and how it disrupted Delhi flights

Saurabh Sinha | 02 December 2025

[Source: Times of India | https://timesofindia.indiatimes.com/city/delhi/explained-what-is-gps-spoofing-and-how-it-disrupted-delhi-flights/articleshow/125121593.cms](https://timesofindia.indiatimes.com/city/delhi/explained-what-is-gps-spoofing-and-how-it-disrupted-delhi-flights/articleshow/125121593.cms)



NEW DELHI: The Indira Gandhi International Airport (IGIA) in Delhi has, for the first time, been witnessing GPS spoofing incidents over the past few days, severely affecting flight operations.

The disruption, which becomes worse when easterly winds blow, has forced several aircraft to land from the Dwarka

side and take off towards Vasant Kunj, causing congestion and diversions.

How GPS spoofing works

GPS spoofing happens when counterfeit satellite signals are broadcast to deceive GPS receivers, causing them to compute false position, navigation, and timing data.

Unlike GPS jamming, which blocks signals, spoofing feeds incorrect coordinates, making navigation systems misread the aircraft's real location. Such spoofing has previously been reported around conflict zones like the Black Sea and West Asia, but this marks the first known incident in Delhi.

Runway 10/28 upgrade adds to the challenge

The situation has been aggravated by the temporary withdrawal of the Instrument Landing System (ILS) on IGIA's main runway (10/28), which was closed for upgradation to Category III.

The new system, once ready, will allow landings in dense winter fog from both ends, but until then, aircraft depend on Required Navigation Performance (RNP) which itself relies on GPS signals.

With spoofing now affecting GPS from as far as 60 nautical miles from IGIA, flight movements on the main runway have been severely disrupted.

On Tuesday night alone, five IndiGo

aircraft and two Air India flights had to be diverted to Jaipur due to navigation issues.

Congestion and safety concerns

The GPS disruption comes at a time when Delhi Airport is handling up to 1,550 daily aircraft movements, leading to heavy congestion whenever spoofing incidents occur.

The airport's Automatic Terminal Information Service (ATIS) has issued repeated warnings to pilots, urging them to exercise caution while entering Delhi airspace and switch to alternative navigation systems when required.

Authorities and airlines respond

Delhi International Airport Ltd (DIAL) and aviation regulators are working to restore ILS functionality on runway 10/28 by November 27. Sources say that IndiGo has already conducted a trial flight to test the new system after the installation of a new approach lighting setup, and the findings have been submitted to the Directorate General of Civil Aviation (DGCA).

"ILS promulgation on the runway needs to be expedited as Nov 27 is a good three weeks away," said a source, stressing the urgency to bring the system back online to mitigate spoofing-related risks.

Spoofing: A global aviation threat

Experts explain that GPS jamming and

spoofing are common in war zones the former used to hide the location of military assets, and the latter to confuse navigation systems. Spoofed data can sometimes deviate by as much as 2,500 km, making it an alarming threat for civil aviation.

Airlines have begun alerting pilots in advance about possible spoofing hotspots and advising them to switch over to traditional navigation aids when affected.

What's Next for Delhi Airport

Authorities say they are aware of the problem but have declined to comment on its origins, calling it a security-sensitive issue. Their immediate focus remains on restoring ILS to ensure uninterrupted operations.

"The only thing that needs to be done is having ILS on IGIA's main runway 10/28 at the earliest," said an aviation source.

Once the ILS upgrade is complete, Delhi Airport's main runway will feature Category III capability on both ends, significantly boosting capacity and resilience during poor weather and technical disruptions.

Aerospace Industry

Iran's private sector unveils plan to build 200 satellites in three years

29 October 2025

Source: *Press TV* | <https://www.presstv.ir/Detail/2025/10/29/757788/Iran%E2%80%99s-private-sector-unveils-plan-for-200-satellite-constellation>



Iran's private sector unveils plan for 200 satellite constellation

An Iranian private aerospace company has announced an ambitious plan to launch a 200-satellite constellation in three years, with the goal of performing more than 10 launches per month for remote sensing and IoT missions.

In an interview with Tasnim News Agency published on Tuesday, Hossein Shahrabi, CEO of the private firm SpaceOmid, outlined the plan, stating that experience from previous missions, including the “Kowsar” and “Hodhod” satellites, will be used to develop a new generation of multi-purpose satellites.

The upcoming “Kowsar 1.5” satellite,

slated for launch this year, is designed to simultaneously handle both Earth imaging and IoT communications, he noted.

Elsewhere in his remarks, the CEO pointed to a fundamental migration of the space industry from the public to the private sector.

“If you want development speed, you must go to the private sector, and if you want to reduce costs, again, the private sector is the better choice,” he stated, emphasizing that private entities are nimbler and more cost-effective.

However, he noted that the ultimate goal is not merely to act as a government contractor but to become a key player in the “value chain.”

He drew a parallel to SpaceX, noting, “SpaceX did not build the Starlink constellation based on a NASA order; Starlink was designed and built based on the company’s own commercial program. This shows the real meaning of market development.”

To achieve this, the company is pursuing an international strategy, seeking partnerships within BRICS, the Shanghai Cooperation Organization, and the Eurasian Economic Union to form “a very large market.”

“A constellation cannot be designed solely for the Iranian market; such thinking is fundamentally flawed. Every constellation

must be planned for the international market,” Shahrabi underlined.

He added that this involves collaborating with both domestic and international launch providers to facilitate the high-frequency launch schedule.

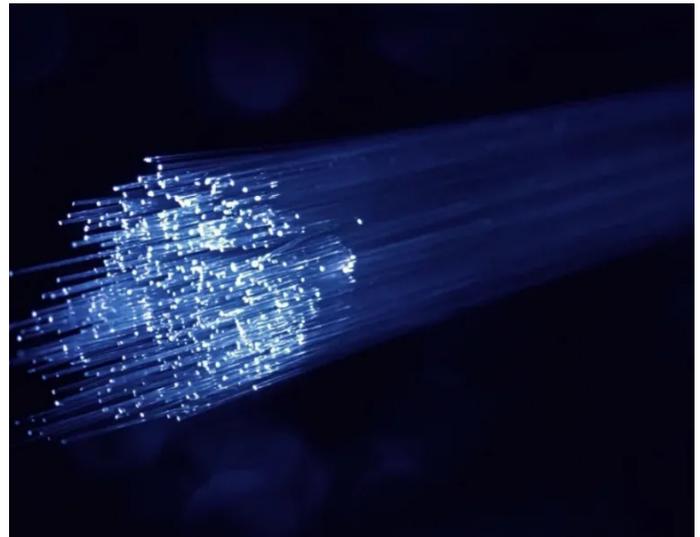
Iran’s space program stands as a testament to phenomenal scientific progress, having achieved remarkable technological breakthroughs despite decades of illegal Western-imposed sanctions.

These satellites, developed by Iranian engineers associated with various knowledge-based companies in collaboration with the Iranian Space Agency (ISA), reflect a strategic push to establish an independent satellite constellation that will support agricultural, environmental, and surveillance needs.

How Light Beam can be Weaponised: India Laser Startup Olee Space Shows the Way

N C Bipindra | 02 November 2025

Source: Defence Capital | <https://defencecapital.in/2025/11/02/how-light-beam-can-be-weaponised-india-laser-startup-olee-space-shows-the-way/>



*Photo: Laser Technology is revolutionising communication, space, and the defence sector.
Credit: Olee Space*

New Delhi: Pune-based deep-tech pioneer Olee Space has positioned itself at the cutting edge of photonics, satellite communication, and defence-grade laser technologies.

Founded in 2023 by James Solomon (IIT-Bombay alumnus) and engineer Suman Hiremath, the startup is building a multi-layer orbital network combined with secure free-space optical links and quantum-resistant encryption to serve both commercial and strategic sectors.

From its inception, Olee Space has adopted an ambitious vision: a global mesh of satellites across Low Earth

Orbit (LEO), Medium Earth Orbit (MEO), and Geostationary Orbit (GSO), all interconnected through laser beams rather than conventional radio-frequency signals.

This multi-orbital architecture enables ultra-high bandwidth, low-latency communications delivered anywhere on Earth, and even into space, James Solomon said in an interview with Defence Capital recently.

James Solomon talks of the struggles in raising money, how the company is setting high targets for itself, and how his recent fundraising will help the company. The conversation can be accessed below:

At its technological core is Free-Space Optical Communication (FSOC). The company uses infrared laser beams to transmit data across terrestrial, aerial, maritime, and orbital links, achieving speeds and security levels far beyond typical RF systems.

Their website cites “more than 10 Gbps per link,” latency below 10 ms, and optical inter-satellite links (OISLs) engineered to aerospace standards.

Security is another key pillar. Olee Space incorporates Quantum Key Distribution (QKD) capabilities into its mesh constellation, offering “un-hackable, un-traceable data journeys on light beams.” The company calls this a “quantum-safe” architecture designed for defence, government, enterprise, and critical

infrastructure.

In addition to communication infrastructure, Olee Space is active in the defence domain, developing directed-energy weapon (DEW) platforms and anti-drone/anti-satellite solutions. Its R&D spans secure links, tracking systems, laser payloads, and space-grade optical modules, according to James Solomon.

The startup’s recent milestone is a successful seed-funding round of USD 3 million led by Rockstud Capital, which will support scaling production, enhancing quantum-secure protocols, and advancing its defence roadmap.

With this backing, the company aims to become a key player in India’s push for sovereign strategic technologies and global connectivity, the company CEO said.

Olee Space thus stands out for combining home-grown innovation, deep-tech photonics, and space-communications architecture. As global demand grows for high-bandwidth, low-latency, and ultra-secure connectivity, the startup’s multi-orbit laser network and quantum-secure offering could mark a significant advance, especially from an Indian ecosystem striving for “Atmanirbhar Bharat” in strategic technologies.

With its foundation, technology stack, and recent funding, Olee Space is poised to deliver mission-critical infrastructure at the intersection of space, defence, and

telecommunications, heralding a new era of connected infrastructure built on beams of light.

IN-SPACE and SIDBI VCL Sign ₹1,000 Crore Fund Deal for India's Space Sector

24 October 2025

[Source: Timestech | https://timestech.in/in-space-and-sidbi-vc-sign-%e2%82%b91000-crore-fund-deal-for-indias-space-sectorin-space-and-sidbi-venture-capital-ltd-sign-%e2%82%b91000-crore-fund-deal-for-indias-space-sector/](https://timestech.in/in-space-and-sidbi-vc-sign-%e2%82%b91000-crore-fund-deal-for-indias-space-sectorin-space-and-sidbi-venture-capital-ltd-sign-%e2%82%b91000-crore-fund-deal-for-indias-space-sector/)



The Indian National Space Promotion and Authorisation Centre (IN-SPACE) and the Small Industries Development Bank of India Venture Capital Ltd (SIDBI Venture Capital Ltd) signed the Contribution Agreement to operationalise the ₹1,000 crore Venture Capital Ltd for the Indian space sector. This signing marks the formal beginning of the Fund's investment activities following its approval by the

Securities and Exchange Board of India (SEBI) on 31 October 2025.

The agreement was signed between Shri Lochan Sehra, IAS, Joint Secretary, IN-SPACE and Shri Arup Kumar, Managing Director and CEO, SIDBI Venture Capital Limited (SVCL, a 100% subsidiary of SIDBI). The signing was also attended by Shri Ratnesh Kumar, Deputy Director (F&A), IN-SPACE, and Shri Rajesh Kohli, Assistant Director (F&A), IN-SPACE, who represented the financial and operational leadership involved in structuring the Fund. Dr. Pawan Goenka, Chairman, IN-SPACE, addressed the ceremony virtually and conveyed his support for the activation of the Fund and its role in catalysing India's private space ecosystem.

The Union Cabinet, chaired by Hon'ble Prime Minister Shri Narendra Modi, had approved the establishment of the ₹1,000 crore Venture Capital Fund for the Indian space sector in October 2024. In March 2025, SIDBI Venture Capital was appointed as the Fund Manager, drawing from its deep experience in nurturing early-stage and technology-led enterprises across India.

The Fund is designed to provide critical early-stage and growth capital to startups working across launch technologies, satellites, payload systems, in-space services, earth observation, communication platforms and downstream applications, enabling them to scale and contribute to national space capability.

Shri Lochan Sehra, IAS, Joint Secretary, IN-SPACe, said, “This Fund is a major enabler for India’s private space sector. It will support startups with the financial runway needed to test ideas, build indigenous technologies, and scale confidently. Today’s signing strengthens our commitment to building a vibrant ecosystem where innovation flourishes and Indian enterprises become global leaders in space technology. We look forward to working closely with SIDBI as we implement this important national initiative.”

Shri Arup Kumar, Managing Director and CEO, SVCL, “SIDBI is committed to empowering India’s deep-tech and frontier technology entrepreneurs, and the space sector represents one of the most promising frontiers of national growth. This dedicated Fund will give young companies the capital and confidence to innovate boldly, commercialise breakthroughs and contribute to India’s emergence as a major space power. We are honoured to partner with IN-SPACe and the Govt of India in advancing this mission.”

IN-SPACe continues to drive India’s vision of a self-reliant and globally competitive space sector by enabling private participation, supporting startups, and catalysing technological development. The operationalisation of this fund represents a significant step toward building a strong, innovation-driven, and future-ready space industry for India.

SAFRAN Agrees For Full Technology Transfer For Fighter Jet Engine To India

26 November 2025

Source: Indian Defense News | <https://www.indiandefensenews.in/2025/11/safran-agrees-for-full-technology.html>

French aerospace major Safran has agreed to transfer 100% of its fighter jet engine technology to India, including critical hot section technology, for co-developing a new engine designed to power India’s indigenous fifth-generation Advanced Medium Combat Aircraft (AMCA), reported Economic Times.

This complete technology transfer is unique globally, with Safran collaborating closely with India’s Defence Research and Development Organisation (DRDO), particularly its Gas Turbine Research Establishment (GTRE), under Indian intellectual property rights.

The engine, expected to generate 120-140 kN thrust, will be jointly developed and manufactured in India, with several Indian private sector firms participating, including Tata Group, Larsen & Toubro, and Adani Defence.

The planned program, costing approximately \$7 billion, aims for nine engine prototypes over a 10-12 year timeline, with prototype flights by around 2028 and full-scale production expected by 2035. Safran has also agreed to the possibility of setting up an assembly line

in India for the M88 engines that power Rafale jets, pending further Indian Air Force orders.

The full transfer includes advanced technologies such as single-crystal blade technology, which is vital for handling extreme engine temperatures and stresses, enabling India to master critical engine components like compressors and turbines.

Currently, India relies heavily on foreign technology for fighter jet engines, with previous indigenous efforts like the Kaveri engine not meeting thrust requirements. This agreement addresses a critical gap, as jet engine technology is considered the pinnacle of military aerospace technology and essential for achieving true self-reliance.

Experts have called on India to create a roadmap to fully absorb the transferred technologies to upgrade its domestic aerospace ecosystem comprehensively.

Safran also recently inaugurated India's first global Maintenance, Repair and Overhaul (MRO) facility for LEAP engines in Hyderabad, supporting commercial aviation needs and aligning with Indian government efforts to develop local aerospace maintenance capacity.

The facility serves popular narrow-body aircraft engines and aims to reduce dependence on foreign services, lower costs, and create high-value jobs. Alongside engine technology transfer, Safran signed a joint venture with Bharat Electronics

Limited to produce air-to-ground weapons in India, reflecting a broadening defence collaboration.

This partnership marks a significant step towards India's goal of indigenous aircraft engine development and broader strategic autonomy in defence aerospace technology, enhancing the capabilities of Made-in-India fifth-generation fighter jets and positioning India as a key global aerospace hub.

“Strategy is adversarial; it functions in both peace and war, and it always seeks a measure of control over enemies (and often over allies and neutrals, as well).”

- Colin S. Gray



The Centre for Aerospace Power and Strategic Studies (CAPSS) is an independent, non-profit think tank that undertakes and promotes policy-related research, study and discussion on defence and military issues, trends and developments in air power and space for civil and military purposes, as also related issues of national security. The Centre is headed by Air Vice Marshal Anil Golani (Retd).

Centre for Aerospace Power and Strategic Studies

P-284 Arjan Path, Subroto Park, New Delhi - 110010

Tel.: +91 - 11 - 25699131/32 Fax: +91 - 11 - 25682533

Email: capsnetdroff@gmail.com

Website: <https://capssindia.org/>

Advisor : AVM Ashish Vohra VSM (Retd)

Editor, Concept & Content : Ms Gowri R

Composed by Mr Rohit Singh

Tel.: +91 9716511091

Email: rohit_singh.1990@hotmail.com