

ADAPTABILITY, DEFENSIBILITY, AND SUSTAINABILITY IN SPACE TO MAINTAIN OPERATIONAL SUPERIORITY IN MULTI- DOMAIN OPERATIONS

**BISWAJIT BARICK, GOPAL BHUSHAN AND
PAWAN ANAND**

INTRODUCTION

On August 27, 2025, as part of the event, "*Ran Samwad*", a first-of-its-kind tri-Service seminar on war, warfare, and warfighting, at the Army War College in Dr Ambedkar Nagar, Madhya Pradesh, Hon'ble Raksha Mantri Shri Rajnath Singh, released the Joint Doctrine for Multi-Domain Operations (MDOs).¹ The doctrine charts

Lieutenant Colonel **Biswajit Barick** is a PhD Scholar at Amity Institute of Defence & Strategic Studies, Amity University.

Dr. **Gopal Bhushan** is Deputy Director General, Amity Directorate of Science & Innovation, Amity University.

Major General (Dr) **Pawan Anand**, AVSM (Retd) is a Professor at the National Defence College.

1. Press Information Bureau, Ministry of Defence, Government of India, "Mastering Existing Tech & Staying Ready for New Innovations & Unforeseen Challenges is Key to Effectively Tackle Complexities of Modern-day Warfare: Raksha Mantri at RAN SAMWAD," 2025, <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2161131>. Accessed on September 4, 2025.

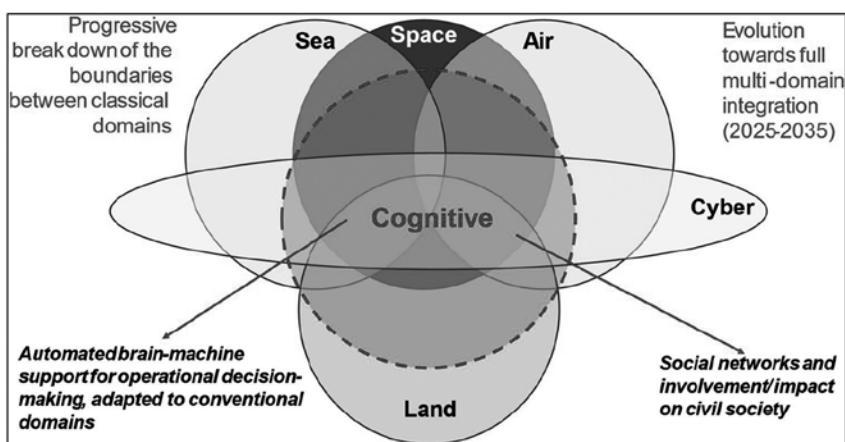
the way forward for integrated and synergised employment of the armed forces across the land, sea, air, space, cyber and cognitive domains, for strengthening jointness and future readiness.² The six domains are depicted in Fig 1. MDOs represent a central and evolving concept in modern military doctrine, developed primarily by the US Army to counter and defeat adversaries in all domains of competition and armed conflict.³ This framework evolved from the Multi-Domain Battle (MDB) concept, which was introduced in 2017 following extensive wargames and exercises with joint and multinational partners.⁴ The core objective of MDOs is to orchestrate the “convergence of effects” by rapidly and continuously integrating capabilities across the air, land, sea, cyber, and space domains, including non-military activities, to present the adversary with multiple, simultaneous dilemmas, and gain the desired outcomes at the right place and time. The shift from a “joint” to a “multi-domain” approach is not merely a semantic change; it is a fundamental mindset transformation. “Joint operations” promote coordination with all military domains, while in a “multi-domain” mindset, the operations go beyond military and include non-military assets, which is the key differentiating factor. The North Atlantic Treaty Organisation (NATO), in formalising its own approach, defines MDOs as “the orchestration of military activities across all domains and environments, synchronised with non-military activities, to enable the Alliance to deliver converging effects at the speed of relevance.”⁵

2. Ibid.

3. US Department of Defence, Government of the United States, “The US Army Concept for Maneuver in Multi-Domain Operations, 2028–2040,” n.d., <https://apps.dtic.mil/sti/pdfs/AD1118627.pdf>. Accessed on September 2, 2025.

4. Tomasz WÓJTOWICZ and Dariusz KRÓL, “Multi-Domain Battle. New Doctrine of the United States Armed Forces,” *Zeszyty Naukowe Akademii Sztuki Wojennej*, 112, no. 3, 2019, 64–78, <https://doi.org/10.5604/01.3001.0013.0879>. Accessed on September 2, 2025.

5. Victor A Mercado, “Cyber Warfare and the Future of Conflict,” 2025, <https://bearworks.missouristate.edu/theses/4078>. Accessed on September 1, 2025.

Fig 1: Classification of Domains in Multi-Domain Operations⁶

This definition acknowledges the augmented complexity of the modern operating landscape and the need to integrate non-military instruments of power, such as diplomacy, informational, and economic influence, at all stages of a conflict.

EMERGING TRENDS IN MODERN CONFLICTS

The global landscape is undergoing a rapid transformation, and the same is experienced by the defence sector, which is shaping the modern-day strategy and operations worldwide. From the autonomous and unmanned systems to the integrated command frameworks, all are setting the stage for the next era of battle. Historically, the military worldwide has centred around manned, high-value platforms, but that is changing quickly. Militaries are now prioritising autonomous systems capable of operating across diverse conditions, with minimal human intervention to ensure adaptability in contested and denied environments.

In the Indian context also, during a recent address at the tri-Services conference, the Chief of Defence Staff (CDS), General Anil Chauhan, PVSM, UYSM, AVSM, SM, VSM, mentioned the four

6. Indian Armed Forces, *Joint Doctrine for Multi Domain Operations*, English, JP 2.06, Vol. JP 2.06, Headquarters Integrated Defence Staff, New Delhi-110021, 2025, <https://ids.nic.in/WriteReadData/Document/2/13/MDO%20Doctrine.pdf>. Accessed on September 2, 2025.

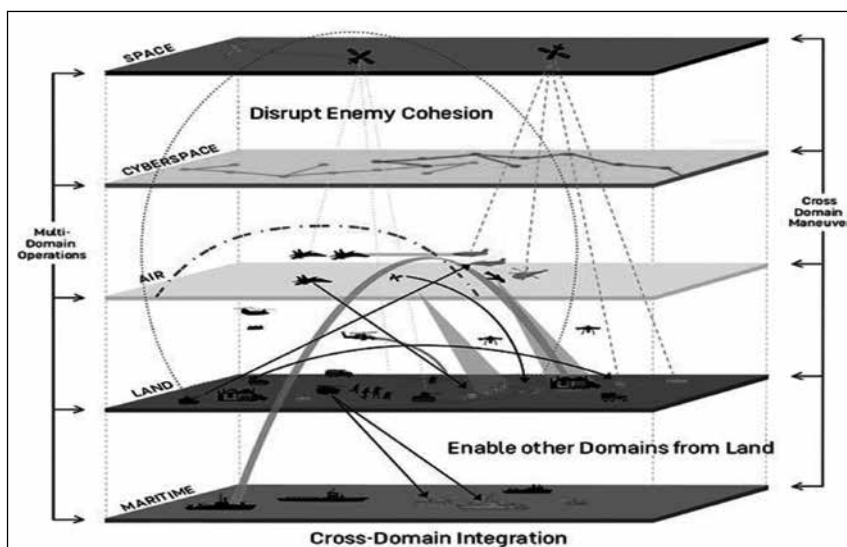
identified emerging trends defining modern conflicts. First is the blurring of war and peace, wherein the conflicts span a continuum from competition to combat rather than being discrete wars. The second trend is the increased readiness to use force, in which nations are viewing short-duration conflicts as a means for achieving political objectives. The third trend identified is the importance of people, in which human and moral dimensions now play a larger role in warfare. The fourth trend is redefining victory, wherein success in battle today hinges on speed, precision, and narrative dominance, and not just enemy casualties.⁷ Rightly so, it is aptly clear that all these four aspects need to be applied simultaneously and coherently to achieve a decisive victory in any MDO. The emphasis on joint operations across conventional and emerging domains—particularly space and cyber—reflects a strategic shift essential for future resilience.

During the same address, General Anil Chauhan introduced the **Sudarshan Chakra** project,⁸ which is India's indigenous equivalent of the Iron Dome. Designed to act as both shield and sword, this tri-Services Air-Defence (AD) system emphasises multi-domain Intelligence, Surveillance, Reconnaissance (ISR) integration across the ground, air, maritime, undersea, and space. It relies on Artificial Intelligence (AI), advanced computation, data analytics, and quantum technologies.⁹ Therefore, the space domain forms the central part of the MDO due to its persistent ISR, assured communications, resilient Positioning, Navigation, and Timing (PNT), global missile warning,

-
7. "We Are a Peace-Loving Nation, but Cannot Be Pacifists: CDS Anil Chauhan's Strong Message Highlights Future War Trends," *The Times of India*, August 26, 2025, <https://timesofindia.indiatimes.com/india/we-are-a-peace-loving-nation-but-cannot-be-pacifists-cds-anil-chauhan-strong-message-highlights-future-war-trends/articleshow/123516753.cms>. Accessed on September 3, 2025.
 8. "Sudarshan Chakra Project Will Need Huge Tri-Services Efforts: CDS General Anil Chauhan," *The Economic Times*, August 27, 2025, <https://economictimes.indiatimes.com/news/defence/sudarshan-chakra-project-will-need-huge-tri-services-efforts-cds-general-anil-chauhan/articleshow/123519125.cms?from=mdr>. Accessed on September 3, 2025.
 9. "Mission Sudarshan Chakra to Develop Indigenous Aerial Defence System by 2035, Says PM Modi," *The Hindu*, August 15, 2025, <https://www.thehindu.com/news/national/pm-modi-announces-sudarshan-chakra-project-to-boost-defence-shield/article69936196.ece>. Accessed on September 7, 2025.

and the data transport that fuses sensors with shooters. The MDO without space is largely blind, mute, and disjointed.

Fig 2: Multi-Domain Contemporary Battlespace¹⁰



Space has emerged as a warfighting domain in the contemporary battlespace, as depicted in Fig 2, where ISR, communications, navigation, and precision targeting have become indispensable. Any means to disrupt or disable these systems will cripple the operations. Therefore, the relevance and need of Anti-Satellite (ASAT) weapons and jamming/spoofing threats to space-based assets need to be debated and incorporated into the doctrines for the future. Before exploring the space domain, let us analyse the challenges in the implementation of the MDO.

CHALLENGES IN IMPLEMENTING THE MDO

The implementation of the MDO, while conceptually simple on paper, faces significant doctrinal, organisational, and technological challenges. Organisational and institutional blocks present some of the most formidable obstacles. While a doctrine may evolve to

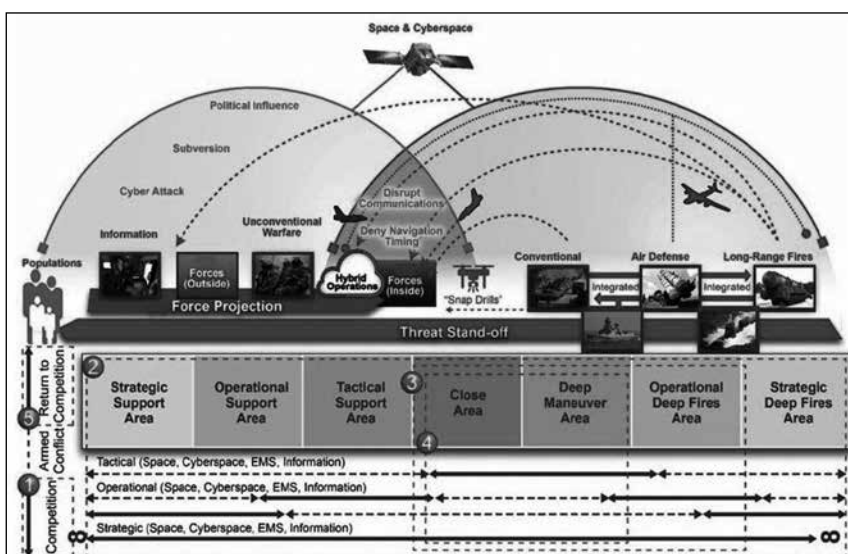
¹⁰ "Multi-Domain Operations," *Indian Military Review*, November 15, 2022, <https://imrmedia.in/multi-domain-operations/>. Accessed on September 7, 2025.

reflect the need for integration, the organisational structures and training processes often lag behind, creating a long-standing issue in coordinated and efficient acquisition and operationalisation. The primary challenges that emerged during various discussions and brainstorming at the expert levels are listed below.

Integration and Interoperability Across Domains:¹¹

Traditionally, the characteristics of military branches working in capability silos are required to be shattered for a successful MDO. The need for extensive inter-agency collaboration and information sharing across the different Services, components, and departments—a “whole of government” approach—is a significant cultural and procedural hurdle that must be overcome.¹²

Fig 3: Complex Interplay in the MDO¹³

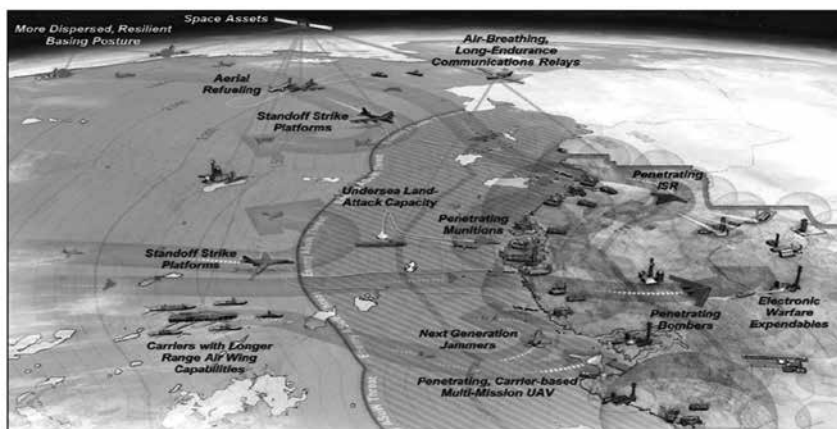


11. Robert Sroufe, “Enabling Integration,” *Integrated Management*, March, 2025, pp. 29-46, <https://doi.org/10.1108/978-1-83608-112-820252003>. Accessed on September 6, 2025.
12. N.B. Singh, “MULTI-DOMAIN OPERATIONS: CREATING CAPABILITY OVERMATCH,” *CENJOWS SYNERGY*, vol. 3, n. 2, pp. 80-82, October 19, 2024, <https://cenjows.in/wp-content/uploads/2024/10/5-Multi-Domain-Operations-Creating-Capability-Overmatch-by-Lt-Gen-Dr-NB-Singh-PVSM-AVSM-VSM-Retd.pdf>. Accessed on September 3, 2025.
13. “Connecting the Dots: Building India’s Multi-Domain Defence Fabric,” *Raksha Anirveda*, January 14, 2025, <https://raksha-anirveda.com/connecting-the-dots-building-indias-multi-domain-defence-fabric/>. Accessed on September 7, 2025.

For instance, human and procedural interoperability remains fundamental but is complicated by coalition dynamics and the rapid pace of modern warfare. This is further compounded by the obscuring of domain restrictions, where cyber, space and electronic warfare must integrate with kinetic actions in real-time.¹⁴ The complex interplay in the MDO is depicted in Fig 3.

Anti-Access/Area Denial (A2/AD) Capabilities: In today's scenarios, the adversaries' sophisticated A2/AD systems create "no-go" zones that restrict access and manoeuvrability, challenging traditional military approaches.¹⁵ Penetrating these defences requires coordinated multi-domain efforts, such as combining cyber attacks, electronic jamming, and unmanned systems with conventional strikes.¹⁶ The same is depicted in Fig 4.

Fig 4: Assets Needed to Counter A2/AD Systems in the MDO¹⁷



14. Victor A. Mercado, "Cyber Warfare and the Future of Conflict," *BearWorks*, Summer 2025, <https://bearworks.missouristate.edu/theses/4078>. Accessed on September 3, 2025.
15. US Army, "Warfare Experts Discuss Multi-Domain Operations at LANDEURO | Article | The United States Army," July 17, 2025, https://www.army.mil/article/287135/warfare_experts_discuss_multi_domain_operations_at_landeuro. Accessed on September 3, 2025.
16. "Connecting the Dots: Building India's Multi-Domain Defence Fabric", United Service Institution of India, September 12, 2025, https://usiofindia.org/pdf/file_68c3c9dd2b33e.pdf. Accessed on November 10, 2025.
17. Sameer Joshi, "Demystifying the Anti-Access/Area Denial (A2/AD) Threat," *Medium*, <https://sameerjoshi73.medium.com/demystifying-the-anti-access-area-denial-a2-ad-threat-d0ed26ae8b9e>. Accessed on September 7, 2025.

However, accelerating the targeting cycles—using AI-driven tools and live data to achieve “simultaneity of effects”—is difficult in contested environments, where delays can prove fatal. Lessons from the Ukraine conflict highlight the need for updated doctrines to counter these threats effectively.¹⁸

Technological, Institutional, and Doctrinal Coordination: From a technological and logistical perspective, MDOs demand an unprecedented level of resource availability and interoperability. The convergence of capabilities at the tactical level creates unique demands and potential resource shortages across all domains. The concept relies on a secure, cross-domain “network-of-networks” and “combat clouds” that can handle immense complexity and dynamics. Thus, there is a need to shift from centralised control and decentralised execution to a distributed control approach. The decisions should be delegated to the lowest operationally competent level. Such a shift requires new doctrinal concepts to enhance flexibility, redundancy, and decision-making speed. The organisations in today’s scenario need to reorganise and adapt to the latest technologies and evolve in MDOs in the future.

Ready Force vs. Future Force Gap: MDOs require all the available forces to operate in a particular manner for deeper integration with seamless coordination. There exists a gap between the ready force and the future force. The critical gap between current operational capabilities and future systems requires, firstly, maximising existing platform capabilities through focussed upgrades; secondly, developing autonomous systems as force multipliers rather than replacements; and, thirdly, building sustainable logistics and domestic weapons production.¹⁹

In summary, while MDOs offer advantages in contested environments, overcoming these challenges requires investment in joint doctrines, technology convergence and agile procurement to

18. “Lessons Learned, Futures Forged: Adapting Air Force Strategy for the Multi-Domain Era,” Air University, *Wild Blue Yonder*, <https://www.airuniversity.af.edu/Wild-Blue-Yonder/Article-Display/Article/4114299/lessons-learned-futures-forged-adapting-air-force-strategy-for-the-multi-domain/>. Accessed on September 2, 2025.

19. “The Critical Challenge of Achieving Cost-Effectiveness in Multi-Domain Military Operations,” *Second Line of Defense*, June, 2025, <https://sldinfo.com/2025/06/the-critical-challenge-of-achieving-cost-effectiveness-in-multi-domain-military-operations/>. Accessed on September 2, 2025.

prepare the ready force for the desired future force. Therefore, in MDOs, understanding every domain holds the key to success. Now that we have seen the challenges, let us explore the space domain, which has gained a prominent place in the layers of MDOs.

IMPERATIVE OF SPACE DOMAIN IN MDOs

Lessons from Contemporary Conflicts: The conflicts in Russia-Ukraine and Israel-Palestine have provided a crucial testbed for MDO principles, demonstrating the essential and contested nature of the space domain in modern warfare. The conflict in Ukraine is widely regarded as the first major war where both sides relied on spatial capabilities, marking a new paradigm in orbital confrontation.²⁰ A key novelty has been the unprecedented and rapid involvement of private space corporations, which have provided a significant tactical and strategic advantage to Ukraine. In the opening hours of the war, a Russian cyber attack disabled much of Ukraine's Viasat commercial internet, a critical communications link for fire missions and situational awareness. In response, Ukraine swiftly adopted SpaceX's Starlink satellite internet, which filled the void and proved so vital that some Ukrainian commanders believed the war could have been lost without it. Similarly, commercial ISR providers such as Maxar, Planet Labs, and ICEYE supplied high-resolution satellite imagery, enabling the Ukrainian forces to locate and destroy hundreds of Russian assets.²¹

While the use of these commercial assets was a decisive advantage, it also served as a poignant example of the "double-edged sword" of reliance on non-state actors. The informal agreement between Ukraine and SpaceX, struck initially over social media, demonstrated a lack of governmental oversight and contractual safeguards. This exposed a profound geopolitical vulnerability, as a company's goals and corporate interests could conflict with a nation's strategic priorities. The experience highlighted the critical need for formal

20. Marko Höyhty and Sari Uusipaavalniemi, "The Space Domain and the Russo-Ukrainian War: Actors, Tools, and Impact," Hybrid CoE, 2023, www.hybridcoe.fi. Accessed on September 1, 2025..

21. "The Outer-Space Dimension of the Ukraine Conflict: Toward a New Paradigm for Orbits as a War Domain?," *Columbia Journal of International Affairs*, <https://jia.sipa.columbia.edu/content/outer-space-dimension-ukraine-conflict-toward-new-paradigm-orbits-war-domain>. Accessed on September 1, 2025.

contracts and indemnification clauses to protect government interests and ensure the continuity of services during a conflict. The reliance on private industry for critical military capabilities is a new and complex dynamic that necessitates a reevaluation of government-private sector partnerships in an era of “space capitalists”.²²

While the Israel-Palestine conflict is a localised ground war, its context reinforces the status of space as a contested domain. It has been observed that the reliance of militaries on space-based capabilities for ISR, Command and Control (C2), and PNT creates a constant struggle in orbits by the warring states. The ongoing anti-space activities of jamming and spoofing satellite signals to degrade the effectiveness of Precision-Guided Munitions (PGMs) and ground communications demonstrated that space has transformed from being just a supporting theatre to an integral and active part of the MDO in every modern war.

ADAPTABILITY IN THE SPACE DOMAIN

Every terrestrial war is now simultaneously a space and cyber war, requiring identification and active monitoring of threats from space assets and threats to space assets from rival states.²³ Adaptability is a fundamental requirement for success in the MDO, and it is particularly vital for the space domain. As modern warfare becomes non-linear and unpredictable, traditional, rigid plans are becoming less effective. The new paradigm demands an ability to adapt to a constantly changing operational picture, which can only be achieved through a distributed control approach. This means that modern C2 systems must evolve away from a single, centralised commanding node, which is a vulnerable target, towards “adaptive networks of networks” that enhance redundancy and resilience.²⁴ These

22. David Roza, “What the US Can Learn From the Ukraine War’s Space Front,” *Air & Space Forces Magazine*, May 26, 2025, <https://www.airandspaceforces.com/ukraine-space-front-lessons-learned/>. Accessed on September 5, 2025.

23. Dr. Joanna Rozpedowski, “Every War Is a Space War Now,” *Geopolitical Monitor*, March 12, 2024, <https://www.geopoliticalmonitor.com/every-war-is-a-space-war-now/>. Accessed on September 5, 2025.

24. Huy T. Tran, Jean Charles Domercant, and Dimitri N. Mavris, “Evaluating the Agility of Adaptive Command and Control Networks from a Cyber Complex Adaptive Systems Perspective,” *Journal of Defense Modeling and Simulation*, Vol. 12, no. 4, 2015, pp. 405–22, <https://doi.org/10.1177/1548512915592517>. Accessed on September 5, 2025.

distributed networks are designed to allow units to work offline and later rejoin the network, ensuring the flow of data and information even when a central node is compromised.

On-Orbit Servicing (OOS): A key component of this adaptability is OOS, which is the process of repairing, refuelling, or upgrading satellites in space. OOS is a pathway to a responsive space enterprise, as it enhances the operational life and flexibility of spacecraft without the need for a costly and time-consuming new launch.²⁵ Historical projects, from the Space Shuttle missions to the Hubble Space Telescope, and modern initiatives, including the Defence Advanced Research Projects Agency's (DARPA's) Orbital Express programme and commercial successes like Northrop Grumman's Mission Extension Vehicle (MEV-1), demonstrate the growing feasibility of these capabilities.²⁶ The strategic value of OOS is amplified in the context of attrition warfare. The development of low-cost, "attritable" satellites²⁷ has enabled nations to target and destroy adversaries' space assets with minimal economic effect. The OOS capability by a nation provides an operational edge, reduces the economic burden of new launches, and enhances strategic flexibility and resilience. This makes OOS a critical component of a nation's adaptability and long-term defence posture in the space domain.

DEFENCE: COUNTERING THREATS IN A CONTESTED DOMAIN (SPACE)

The strategic shift of space from being a benign operational environment to a warfighting domain has made defence a paramount concern for spacefaring nations.²⁸ The US Space Force, for example, has evolved from a historical "deliver" mission to a "protect and

25. Hannah Duke, "On-Orbit Servicing," CSIS Aerospace Security Project, September 15, 2021, pp. 1–11, https://aerospace.csis.org/wp-content/uploads/2021/09/20210914_Duke_OSAM.pdf. Accessed on September 5, 2025.

26. Roberto Opromolla, et al., "Future In-Orbit Servicing Operations in the Space Traffic Management Context," *Acta Astronautica*, Vol. 220, May, 2024, pp. 469–477, <https://doi.org/10.1016/j.actaastro.2024.05.007>. Accessed on September 5, 2025.

27. Jason Dechiaro, "Airborne Attritable Systems and Open Systems," *Military Embedded Systems*, March 18, 2025, <https://militaryembedded.com/unmanned/payloads/airborne-attributable-systems-and-open-systems>. Accessed on September 5, 2025.

28. Anna Purkhauser, "A Time of Shift: Pivoting Space into a Warfighting Domain," *Novaspace*, June 26, 2025, <https://nova.space/in-the-loop/a-time-of-shift-pivoting-space-into-a-warfighting-domain/>. Accessed on September 5, 2025.

defend” mission in response to the expanding counter-space threats from Russia and China.²⁹ These threats exist across a spectrum, from kinetic to non-kinetic attacks.

Kinetic threats involve the physical destruction or incapacitation of satellites. ASATs, which can be launched from the ground (direct-ascent) or another satellite in orbit (co-orbital), have been successfully tested by the US, China, Russia, and India. These tests are demonstrations of capability and deterrence, but they can potentially pose grave threats to the orbital commons.

Non-kinetic threats are less visible but no less destructive. They include jamming and spoofing, which disrupt or falsify satellite signals for communications and navigation.³⁰ The Russia-Ukraine conflict showed how Russian electromagnetic attacks degraded the hit rates of advanced Global Positioning System (GPS)-guided munitions, forcing a “cat-and-mouse game” of developing counter-measures. Cyber attacks on ground-based infrastructure and C2 systems also pose a significant vulnerability, as demonstrated by the Russian cyber attack on Viasat at the start of the conflict.

A more complex and challenging dimension of modern space warfare is “grey zone” conflict.³¹ Grey zone tactics operate below the threshold of declared armed conflict, and are characterised by strategic ambiguity and actions that are difficult to attribute or define as an act of war. In space, this could involve a satellite performing “close proximity manoeuvres” to another asset, which could be an inspection or a deliberate act to render the satellite unreliable without physically destroying it.³² The dual-use capability of space assets makes them more vulnerable, wherein state actors can also wrap their military objectives behind civilian operations. This strategic

29. Bert T. Chapman, “Recent US Government and Military Space Strategy and Doctrine,” *Space Education & Strategic Applications*, Vol. 4, no. 4, 2024, <https://doi.org/10.18278/sgis.4.4.4>. Accessed on September 5, 2025.

30. n. 18.

31. Jessica West and Jordan Miller, “Clearing the Fog: The Grey Zones of Space Governance,” Centre for International Governance Innovation, no. 287, 2023, <https://www.cigionline.org/publications/clearing-the-fog-the-grey-zones-of-space-governance/>. Accessed on September 5, 2025.

32. Richard Zappulla, et al., “Real-Time Autonomous Spacecraft Proximity Maneuvers and Docking Using an Adaptive Artificial Potential Field Approach,” *IEEE Transactions on Control Systems Technology*, 27, no. 6, November 1, 2019, pp. 2598–2605, <https://doi.org/10.1109/TCST.2018.2866963>. Accessed on September 5, 2025.

ambiguity in space operations permits an adversary to carry out non-kinetic anti-space activities and make it difficult for the target nation to justify a proportional military response.³³

SUSTAINABILITY: NAVIGATING A CONGESTED AND CONTESTED ENVIRONMENT

The proliferation of counter-space capabilities and the increasing number of space actors pose a severe threat to the long-term sustainability of the space environment. A primary concern is the creation of space debris, particularly from kinetic ASAT tests, which can lead to a “cascading chain of collisions” known as the Kessler Syndrome.³⁴ This debris poses an indiscriminate threat to all space assets, from military satellites to civilian navigation systems, and could effectively limit or deny access to certain orbital altitudes for generations. Due to the increased accessibility to technology and proliferation of private players in the space domain, the amount of space debris is also on the rise. As per the European Space Environment report³⁵, released on April 1, 2025, approximately 40,000 objects have been tracked by surveillance networks. In the same report, it has also been brought out that debris objects larger than one centimetre (cm) in size are enough to cause catastrophic damage. It is estimated that there are over 1.2 million such objects, with over 50,000 objects larger than 10 cm.

The international legal framework governing space is currently insufficient to address these modern threats.³⁶ The cornerstone treaty, the 1967 Outer Space Treaty (OST), prohibits the placement of nuclear

33. Sarah Liebermann and Nicolas Peter, “The Multifarious Roles Played by State Actors in Space,” *European Review of International Studies*, Vol. 10, no. 3, 2024, pp. 261–75, <https://doi.org/10.1163/21967415-10030001>. Accessed on September 5, 2025.

34. Abhinav Singh, “Over 1,200 Objects Crashed Into Earth in 2024, Raising Kessler Syndrome Concerns: Report,” *NDTV*, April 5, 2025, <https://www.ndtv.com/science/over-1-200-objects-crashed-into-earth-in-2024-raising-kessler-syndrome-concerns-report-8090858>. Accessed on September 5, 2025.

35. “ESA Space Environment Report 2025,” European Space Agency, 2025, https://www.esa.int/Space_Safety/Space_Debris/ESA_Space_Environment_Report_2025. Accessed on September 9, 2025.

36. Madi Gates, “Houston, We Have a Problem: International Law’s Inability to Regulate Space Exploration,” *University Journal of International Law and Politics*, January 2, 2025, <https://nyujilp.org/houston-we-have-a-problem-international-laws-inability-to-regulate-space-exploration/>. Accessed on September 5, 2025.

weapons or other weapons of mass destruction in orbit but does not explicitly ban conventional weapons. The lack of a clear legal definition of a “space weapon” and the inability of treaties to enforce their provisions against “grey zone” tactics create a permissive environment for weaponisation.³⁷ While a recent UN resolution on a moratorium on destructive direct-ascent ASAT tests has garnered wide support, such measures are often voluntary and fail to address the full spectrum of non-kinetic and “grey zone” threats.³⁸

The debate over space security reflects a core theoretical dilemma in international relations between neorealism and neoliberal institutionalism.³⁹ Neorealists argue that in an anarchic international system, militarisation and capability development are the most effective means of ensuring national security in space. Neoliberals, conversely, believe that international institutions and treaties are a more effective method. The empirical reality of the space domain to date seems to support the neorealist position: despite international efforts towards cooperation, the development and testing of military capabilities are driving the security debate, and the mere subscription to treaties has not been shown to have a positive influence on security outcomes.

GLOBAL IMPLICATIONS AND INDIA'S STRATEGIC IMPERATIVE

There is a reshaping in the global balance of space power due to the growing accessibility of space and the rapid development of counter-space capabilities by nations.⁴⁰ The space domain, which was once

37. Christian Jorgensen, “Old Law for a New Frontier : The Sufficiency of International Humanitarian Law in Outer Space,” *Case Western Reserve Journal of International Law*, vol. 57, n. 1, May 6, 2025, <https://scholarlycommons.law.case.edu/jil/vol57/iss1/11/> Accessed on September 7, 2025.

38. “Continuing the Destructive DA-ASAT Missile Test Moratorium,” Secure World Foundation, <https://www.linkedin.com/pulse/continuing-destructive-da-asat-missile-test-moratorium-swfound-vnoxc>. Accessed on September 5, 2025.

39. Aleena Joseph, “The Neo-Neo Debate in Understanding the Geopolitics of Outer Space,” *E-International Relations*, September 25, 2020, pp. 1–9, <https://www.e-ir.info/2020/09/25/neo-neo-debate-in-understanding-the-geopolitics-of-outer-space/>. Accessed on September 5, 2025.

40. Victoria Samson and Laetitia Cesari, “Global Counterspace Capabilities: An Open Source Assessment,” Secure World Foundation, 04/2025, p. 317, <https://www.swfound.org/publications-and-reports/2025-global-counterspace-capabilities-report>. Accessed on September 5, 2025.

the exclusive domain of a few nations, has become a critical arena for strategic competition. The growing potential of the space arms race and the dual-use nature of space technology further complicate this landscape. The lines between peaceful and aggressive activities⁴¹ are getting blurred in today's scenario. This strategic ambiguity contributes to a climate of distrust and rising tensions amongst the spacefaring nations.

Implications for India's Space Security: India's space programme, historically focussed on civilian development and socio-economic applications, has undergone a profound strategic awakening. The 1999 Kargil War served as a crucial catalyst, exposing the significant disadvantage of the Indian forces due to a lack of dedicated satellite imagery.⁴² This experience augmented the integration of space assets into the national security planning and marked a shift from a passive reliance on satellites as force multipliers to an active posture of space denial and resilience. India has established key institutions, including the Defence Space Agency (DSA) to operationalise counter-space capabilities and the Defence Space Research Organisation (DSRO) to strengthen military-civilian coordination and explore emerging technologies. This institutional restructuring is further reflected in India's new MDO doctrine, which charts a path for the integrated employment of the armed forces across all domains, including space and cyber. The INR 26,968 crore Phase 3 of the Space-Based Surveillance (SBS) programme, which was cleared by the prime minister-led Cabinet Committee on Security in October last year, is a positive step. The project includes the launch of 52 satellites—21 to be built and launched by the Indian Space Research Organisation (ISRO) and 31 by three private Indian companies. The DSA, which functions under the Integrated Defence

41. "The Challenges of Dual-Use Space Technologies: The Non-Peaceful Use of Satellites," Space Generation Advisory Council, April 14, 2023, <https://spacegeneration.org/the-challenges-of-dual-use-space-technologies-the-non-peaceful-use-of-satellites>. Accessed on September 5, 2025.

42. Ajay Surya, "India Overcharged for Satellite Images, Arms during Kargil," *The Times of India*, December 24, 2019, <https://timesofindia.indiatimes.com/india/during-kargil-foreign-nations-fleeced-india-sold-old-sat-pics-arms/articleshow/72570657.cms>. Accessed on September 5, 2025.

Staff (IDS) of the Ministry of Defence, is leading the project.⁴³ The creation of a Chief of Defence Staff (CDS) and the move towards Integrated Theatre Commands are also central to this effort, promoting the jointness and synergy necessary to conduct complex MDOs.⁴⁴

Lessons Learnt During Op Sindoor: The implications for India's space domain can be interpreted and aligned with the briefing of CDS General Anil Chauhan, during the "Ran Samvad": these are listed below:

- In modern conflicts, satellites for ISR, communication, navigation, and precision targeting are indispensable. Disabling or disrupting these systems could cripple operations. Therefore, India's MDO doctrine must anticipate ASATs, cyber intrusions on space assets, and jamming/spoofing threats and remedial measures to be outlined.
- The proposed Sudarshan Chakra air defence shield⁴⁵ relies heavily on space-based ISR and early warning systems. Integration across multiple domains needs resilient space infrastructure—both indigenous satellites and protected constellations. Therefore, India must invest not only in missile interceptors but also in Low Earth Orbit (LEO) satellite constellations, Space Situational Awareness (SSA), and counter-jamming capabilities.
- There is a need for "scholar, tech, and info warriors" to understand the space domain and work to capitalise on the same for future conflicts. *Scholar warriors* should study global trends in space militarisation, legal loopholes in the Outer Space Treaty, and space deterrence models; *tech warriors* should design AI-driven satellite networks, counter-ASAT systems, and resilient communications; and *info warriors* should shape the narratives

43. Rajat Pandit, "Post Operation Sindoor: India to Fast-Track Launch of 52 Defence Surveillance Satellites," *The Times of India*, March 17, 2025, <https://timesofindia.indiatimes.com/india/post-op-sindoor-india-to-fast-track-launch-of-52-defence-surveillance-satellites/articleshow/122149971.cms>. Accessed on September 5, 2025.

44. Press Information Bureau, Indian Army and Air Force, Government of India, "Forging One Force: The Synergy of India's Armed Forces," April 18, 2025, <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/may/doc2025518557001.pdf>. Accessed on September 5, 2025.

45. n. 8.

around India's space posture, countering disinformation about "weaponisation vs defensive preparedness."

India's strategic posture is unique in its commitment to strategic autonomy while navigating a complex security environment with adversaries like China and partners like the United States.⁴⁶ This stance is evident in its new Indian Space Policy, 2023, which formalises the role of non-government entities and a public-private partnership model.⁴⁷ This mirrors the US reliance on commercial space, signifying a global convergence on the idea that national security in space cannot be achieved by government agencies alone. Furthermore, India's indigenous approach is highlighted by the ISRO's active development of technologies for "in-orbit servicing," including a "Walking Robotic Arm" and a "Debris Capture Robotic Manipulator".⁴⁸ This demonstrates a proactive, indigenous approach that directly addresses the strategic imperatives of adaptability and sustainability, positioning India as a key player in the new space paradigm and not merely an acquirer of foreign technology.

CONCLUSION

The space domain is no longer an ancillary feature of modern warfare but a central theatre of operations, inextricably linked to the success of MDOs. The evidence from contemporary conflicts underscores the dual nature of space: it is an indispensable enabler for intelligence, command, and precision, yet its centrality makes it a primary vulnerability. The Russia-Ukraine conflict demonstrated the tactical advantage conferred by a robust commercial space ecosystem, while simultaneously exposing the geopolitical and contractual risks of reliance on non-state actors. The global security environment is increasingly defined by "grey zone" conflicts, where

46. Aparna Pande, "India's Multi-Alignment and Rising Geopolitical Profile," *GIS Reports*, July 16, 2025, <https://www.gisreportsonline.com/r/india-strategic-autonomy/>. Accessed on September 6, 2025.

47. Department of Space, Government of India, "Indian Space Policy - 2023," 2023, https://www.isro.gov.in/media_isro/pdf/IndianSpacePolicy2023.pdf. Accessed on September 5, 2025.

48. ISRO, "POEM-4 in PSLV-C60/SpaDeX Mission," https://www.isro.gov.in/POEM_4_Payloads_spadex.html. Accessed on September 6, 2025.

strategic ambiguity and dual-use technologies are leveraged to achieve military objectives without crossing the threshold of armed conflict. Addressing these realities requires nations to move beyond traditional military silos and embrace the principles of adaptability, defence, and sustainability. This includes a shift to distributed, resilient command and control networks, the development of robust counter-space capabilities across the kinetic and non-kinetic spectrum, and a proactive posture to ensure the long-term sustainability of the orbital commons. However, the analysis shows that the current international legal framework is ill-equipped to regulate this new era of competition, confirming that capability development, rather than treaty commitment, is the primary driver of national security in space.⁴⁹

For India, the path forward is clear: it must continue to leverage its strategic autonomy to build a resilient, indigenous, and integrated defence architecture. This involves fostering a dynamic public-private space ecosystem, investing in cutting-edge, dual-use technologies, and evolving its military doctrine to ensure full integration across all domains. By doing so, India can secure its position in the new multi-domain geopolitical landscape, deterring adversaries and shaping norms for a more stable orbital future.

49. Jessica West, "Norms for Outer Space," United Nations Institute for Disarmament Research, March, 2022, https://unidir.org/files/2022-04/UNIDIR-Space_Dossier_7.pdf. Accessed on September 5, 2025.