Multi-Domain Operations
Air Force as the Central Node

Ankit Abbott*

Introduction

The modern battlespace is heavily influenced by technology and it has forced modern militaries to reflect on the question, 'What comes after Joint.'[1] There is growing recognition that in the contemporary operational environment, focus on 'joint' is no longer sufficient. The character of warfare has undergone a profound transformation; the modern battlespace has become an intricate, multifaceted environment where success is contingent upon the harmonious orchestration of capabilities spanning diverse operational domains.[2] While the term 'joint' usually signifies integration at the operational level, 'multi-domain' aims to achieve integration across all levels—from strategic to tactical.[3] Multi-Domain Operations (MDOs) have evolved as a method to integrate and synchronise activities across land, sea, air, space, cyber and information domains to achieve strategic objectives. The ability to seamlessly operate across these domains is crucial for military success in any contemporary and future conflict. This commentary argues that air forces are best suited to play the predominant role in these operations due to their advanced technological

* Wg Cdr Ankit Abbott is a flying branch officer of the Indian Air Force, and is currently posted at the Directorate of Ops (Strategy) at Air HQ.

ISSN 0976-1004 (print); 2583-7567 (online)

Journal of Defence Studies, Vol. 19, No. 2, April–June 2025, pp. 130–146

capabilities, strategic flexibility, robust command and control structures, and a culture of innovation. The commentary will dwell on these attributes and their implications for MDOs, drawing on historical evidences and will also carry out a comparative analysis with other military branches—namely the army and navy—highlighting the distinct advantages of air force in conduct of MDOs.

Scope

The scope of this commentary is focused solely on examining the role of air forces in conducting multi-domain operations during combat scenarios wherein direct application of firepower is undertaken, sometimes referred to as kinetic warfare. The analysis is limited to situations of formal conflict, where air forces operate as the central component in achieving military objectives. The commentary does not assess the use of air forces in conditions of 'No War No Peace' or 'Grey Zone', where non-combat actions and irregular tactics may be more prevalent.

Understanding Multi-Domain Operations

Multi-domain concepts involve the convergence of capabilities within and from multiple domains; the greatest value can be achieved by drawing in as many capabilities as possible to find the most potent combinations to exploit the vulnerabilities of the adversary and meet the objectives of the activities in question.[4] Different countries and militaries define MDOs in slightly different terms, reflecting differences in doctrine, operational concepts and organisational structures. While the universally accepted specific definition and implementation of MDOs may have variations across countries and military organisations, several common elements and characteristics are fundamental to its understanding and execution. These have been elaborated in succeeding paragraphs.

Elements of Multi-Domain Operations

Integration

MDOs mandate integration of activities across multiple domains, including land, sea, air, space, cyber and information. The integration has to commence from the conceptualisation phase and carry on till the execution phase is concluded. Such an integration[5] that emanates from the conceptualisation

phase enables the forces to operate cohesively and exploit the synergies between different capabilities.

Synchronisation
Effective synchronisation of the activities is essential towards execution of coordinated and complementary operations across different domains. A plan which is conceptualised in an integrated manner exploiting capabilities of different domains, remains synchronised during the execution phase, and thereby empowers the forces to achieve desired effects[6] and maintain tempo while exploiting the weaknesses of the adversary.

Interoperability
Interoperability between different armed services and other modern domains of warfare is critical for the success of MDOs. Interoperability permits seamless exchange of information, resources and capabilities, and thus, enhances the overall operational effectiveness.

Flexibility
The successful execution of MDOs requires flexibility to rapidly adapt to evolving circumstances and situations, and simultaneously exploit emerging opportunities. Flexibility arms the forces with the capability to modulate tactics, techniques and procedures in real-time to achieve desired objectives while rendering appropriate responses to dynamic threats.

Command and Control
To achieve requisite levels of integration and synchronisation, and to exercise adequate flexibility, robust command and control structures are mandatory to coordinate MDOs. Robust and effective command and control enables centralised planning, de-centralised execution, and swifter adaptation to evolving situations.

Information Superiority
Information superiority[7] is a cornerstone of MDOs. It allows the forces to obtain and maintain comprehensive understanding of the battlespace—more easily understood as battlefield transparency. The process involves collection, processing, analysis and dissemination of accurate information in a timely manner. The information, thus supplied, supports decision-making and operations.

Characteristics of Multi-Domain Operations

Cross-Domain Synergy
Execution of MDOs mandates coordinated and complementary application of synergistic force across various domains to achieve desired effects.[8] By leveraging synergies and complementary capabilities, MDOs enable commanders to create multiple dilemmas for adversaries and provides opportunities to exploit their vulnerabilities.

Decentralised Execution
Decentralised execution of missions is the hallmark of MDOs, where subordinate units are empowered to make decisions and initiate suitable actions based on 'Commander's Intent'[9] and overarching objectives. Decentralised execution provides the forces the capability to adapt to situations rapidly as they unfold and exploit local opportunities.

Dynamic Planning and Execution
In order for the forces to be able to respond rapidly to emerging threats and opportunities, MDOs require dynamic[10] planning and execution processes. These processes involve continuous assessment, adaptation and refinement of plans and operations based on real-time information and feedback (provided by information superiority).

Joint and Combined Operations
In MDOs, emphasis is on joint and combined operations, wherein forces from different military arms work together to achieve common objectives. It is different for the earlier perspective of an operation being conducted by an individual service where another service provides some support. Joint and combined operations enhance overall operational effectiveness and enable the forces to leverage complementary capabilities and resources; they are, thus, economical too.

Resilience and Redundancy
MDOs prioritise resilience and redundancy in capabilities and systems to ensure continuity of operations in the face of disruptions and adversary action. These two qualities enable the forces to maintain operational tempo and effectiveness despite challenges and setbacks.

Why are the Air Forces Uniquely Suited to Execute the Principal Role in MDOs

The Air Forces, traditionally, have been exercising and executing 'Cross-Domain Deterrence (CDD)' and 'Cross-Domain Coercion (CDC)'. This aspect, however, has been understood, classically, as a support role. Notwithstanding the orthodox viewpoint, the air forces today are uniquely positioned to take-on the cardinal role in MDOs. Air Forces are inherently equipped, organised and trained to operate in a multi-domain construct. Air Forces have personnel with skills and expertise within the organisation who can leverage the specialised capabilities required to move from the joint operations construct into MDOs.

Technological developments have accentuated the effects of CDD and CDC. The associated interdependencies and subsequent vulnerabilities within critical infrastructure, especially in space and cyberspace, are only becoming more prominent during this interconnected age, and these complex linkages create new domains in which deterrence and coercion might be practiced.[11] The following text highlights the capabilities and characteristics of air forces which underscores their position as the principal player in MDOs.

Leveraging High-End Technology

Though it is the most nascent armed force, Air Forces are equipped with cutting-edge technology that augments its operational capabilities to conduct operations across multiple domains. Air forces gain their technological edge through integration of advanced aircraft and weapon platforms, unmanned aerial systems (UAS), long-range stand-off precision-guided munitions (LRSOPGM), which is augmented by sophisticated electronic warfare tools. Development and exploitation of fifth generation aircraft in the battlespace has offered unparalleled stealth, sensor-fusion and network connectivity capabilities to the air forces. These capabilities are crucial to gain and maintain superiority in contested environments. These technologies enable air forces to conduct a wide spectrum of missions—from air dominance to coordinated operations (across land and maritime domain) to intelligence, surveillance and reconnaissance (ISR) to electronic warfare. These missions are conducted across the three physical spheres of land, sea and air, thereby, establishing air force in the dominant role.

Innovative Mindset of Air Force Personnel

Air Forces, aided by their culture of innovation, foster a proactive approach to problem-solving and operational planning. This innovative mindset is a prerequisite to adapt to rapidly changing dynamics of modern warfare. To counter emerging threats, Air Force personnel are encouraged to think creatively and develop new Tactics, Techniques and Procedures (TTP). For example, US Air Force's 'AFWERX'[12] initiative encourages airmen to propose innovative solutions to operational challenges and provides resources to develop and implement these ideas. On the similar lines, Indian Air Force has introduced Mehar Baba Competition.[13] To support the 'Innovations for Defence Excellence (iDEX)'[14] programme of the Government of India, Indian Air Force has an AirIdea programme internally where an initial screening of the ideas put forward by its airmen is carried out before being put up on the iDEX portal.

Strategic Flexibility and Reach

The ability to project power swiftly and effectively in contested environments is a critical precept of MDOs.[15] Air Forces possess unmatched strategic flexibility and extended reach, enabling rapid deployment and rendering effective response to threats worldwide in a compressed frame of time. Air mobility aircraft, like the C-17 Globemaster-III and KC-135 Stratotanker, are capable of deploying forces and sustaining operations across long distances. Air Forces accrue their capabilities from these assets to respond rapidly to emerging threats and conduct, as well as support, operations across multiple domains, even in remote and austere locations.

Integrated Command and Control Structure

Sophisticated command and control (C2) infrastructure have been developed by air forces the world over, which have been utilised for C2 of operations by the air forces. Such C2 centres are now essential for conducting MDOs. These systems integrated with multi-domain ISR, provide real-time situational awareness and efficient decision-making. The Air Operations Centre[16] (AOC) of the USAF serves as the nerve centre for air force operations. It provides a centralised hub for planning, directing and assessment of air and space operations. Inputs from multiple sensors, platforms and agencies are integrated at the AOC to produce a unified comprehensive operational picture of the adversary and own forces. This enables commanders to make informed decisions and allocate resources intelligently as per the situation at hand. Indian Air Force (IAF) also has

a similar C2 structure, named the Integrated Air Command and Control System[17] (IACCS) which has a proven combat record and would continue to serve as a war winning combat enabler.

ISR Capabilities as a Cornerstone

To meet the demands of observing and orienting in MDOs, it is necessary to identify cross-domain opportunities and vulnerabilities[18] by leveraging increasingly vast amounts of data to provide clarity in complexity. This would provide broader awareness to a more diverse set of actors. Air Forces excel in conducting ISR operations through the use of advanced platforms such as ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) aircraft, Unmanned Aerial Systems (UAS) such as MQ-9 and Heron, and other tactical reconnaissance pods onboard fighter aircraft. These systems provide ISR updates across the land, sea and air domains. Thus, the Air Forces emerge as the most important cog in conducting ISR.

Utilisation of Space as a Warfighting Domain

The importance of considering air and space as a continuum has been acknowledged the world over. Major countries of the world are already transforming their air force into 'Air and Space Force/Aerospace Force'.[19] Air Forces are leveraging the current capabilities offered by space-based systems that include communications, satellite-based positioning and navigation systems, and ISR systems. The advent of hypersonic platforms will further erode the difference between an air and a space platform, since such platforms will transit and travel through the continuum of air and space. Weaponisation of space is the next logical step that will occur. Air Forces thus become the natural choice to be transformed to Air and Space Force.

Integration of Cyber Capabilities

Cyber capabilities are critical enablers of MDOs. Air Forces have adapted to this reality and are conducting offensive and defensive cyber operations to protect their networks while simultaneously disrupting enemy networks and communication systems. Cyber surveillance is augmenting ISR capabilities by enhancing situational awareness. The integration of cyber operations with traditional air force missions allows for a comprehensive approach to MDOs and enhances their overall effectiveness.

The facts and attributes stated above have highlighted the ability of air forces to conduct operations across multiple domains in parallel. This capability provides air forces with a comprehensive toolkit to address complex

and dynamic threats, which ensures that air forces can maintain a strategic advantage in modern military operations.

Historical Case Studies

Historical case studies provide valuable insights into the effectiveness of air forces during MDOs. Utility of air force during the Gulf War, Operation Enduring Freedom, Russian Special Military Operations against Ukraine, Israel–Hamas conflict, India–Pakistan War of 1971 and the Operation Sankalp 2024 would be evaluated to determine practical application of air force capabilities in MDOs in real-world scenarios, and reaffirm the rationale for air forces to be in the central role in MDOs.

Gulf War

During the Gulf War, the combined air forces of the coalition played a central role in the MDO strategy. Operation Desert Storm[20] commenced with an air campaign. This first phase was characterised by massive aerial bombardment, which saw the targeting of Iraq's command and control infrastructure, air defence systems and strategic assets. The use of advanced technologies, such as stealth aircraft and precision-guided munitions, enabled the coalition air forces to achieve air superiority quickly and degrade/destroy Iraq's military capabilities. The air campaign was characterised by integration of air, space and cyber capabilities for a multitude of tasks. The use of space-based assets[21]—Global Positioning System (GPS) satellites for accurate navigation by aircraft and precision munitions, and satellites for communication—augmented the inherent capabilities of air power. ISR from aircraft-based sensors was augmented by satellite-based sensors thus aiding in faster updates of enemy dispositions. Cyber network capabilities enabled secure and robust communication leading to effective command and control of the coalition of airborne forces. The devastating effect of the just over 1000 hours (43 days) coalition air campaign was such that the ground campaign lasted only 100 hours. The Gulf War demonstrated the effectiveness of air forces in playing the pivotal role in MDOs and achieving strategic objectives.

Operation Enduring Freedom

Op Enduring Freedom (OEF) in Afghanistan is another example of Air Forces playing the central and decisive role in MDOs. Following the infamous 9/11 attacks, the US and its allies launched a campaign to dismantle Al-Qaeda and overthrow Taliban rule. The Air Force conducted multitude of operations

across various domains—from ISR providing real-time intelligence on enemy movements, to strikes using precision-guided munitions through use of space-based guidance. The flexibility and reach of air forces, along with the capability to operate in most austere terrain in the world was aptly demonstrated during OEF. The air forces conducted combat and combat support missions with high tempo over an extended period.[22] The centrality of the air forces in conducting any future military operation was once again established during the OEF.

Russia–Ukraine Conflict

The Russian Armed Forces rely heavily on ground force capabilities;[23] this heightened emphasis on the land component means that missions that are necessarily 'multi-domain' and joint as per Western doctrines might be conducted solely by one Service (and in one domain) in the Russian context. In the ongoing Russia–Ukraine conflict, the use of Russian Air Force has been notably less.[24] This is assessed to be one of the primary causes contributing to the slow achievement of Russia's strategic objectives. Thus, once again, the requirement of air operations as the central node in the overall game-plan of MDO is established.

Israel–Hamas Conflict

In the Israel–Hamas conflict, the Israeli Air Force[25] (IsAF) has played a pre-eminent role in conducting multi-domain operations; the ground offensive was launched well after the air campaign.[26] The IsAF's advanced ISR capabilities (augmented by Artificial Intelligence[27]) have provided real-time intelligence on Hamas activities, thereby allowing precise targeting of key personnel and other infrastructure. Collateral damage has been minimal while key Hamas capabilities have been degraded effectively. This has been coupled with effective cyber and information warfare, which has augmented the accrued effects. This coordinated approach has demonstrated the capabilities of the air force in leading multi-domain operations.

India–Pakistan War, 1971

During the 1971 India–Pakistan War, the IAF was instrumental in executing multi-domain operations that integrated air, land and sea military capabilities. This integration significantly contributed to India's decisive victory and the subsequent creation of Bangladesh. The IAF swiftly established air dominance over East Pakistan by targeting and neutralising key Pakistani airbases. This rendered the Pakistani Air Force totally grounded allowing the Indian

forces to rapidly advance into the adversary's territory. Subsequently, IAF conducted interdiction missions, targeting enemy supply lines, ammunition dumps and troop concentrations. These operations disrupted Pakistani logistics and command structures, hastening their retreat and surrender. On 4 December 1971, IAF initiated air strikes on key installations at Karachi. These strikes destroyed oil depots at Karachi, setting them ablaze and thereby paving the way for the Navy's missile attacks the following day.[28] The IAF executed significant airborne operations to out-manoeuvre Pakistani defences. Notably, the Tangail airdrop on 11 December 1971 involved 46 aircraft deploying nearly 1,000 paratroopers to secure the Poongli bridge, cutting off the retreating Pakistani forces.[29] Additionally, Operation Catus-Lily saw IAF helicopters airlift troops across the Meghna River,[30] bypassing destroyed bridges and enabling a swift advance towards Dhaka. The IAF also played a role in psychological operations.[31] On 17 December 1971, the IAF targeted the Governor's House in Dhaka during a high-level meeting. This led to the resignation of the East Pakistani Governor. To summarise, the IAF's comprehensive approach during the 1971 war—encompassing air dominance, coordinated operations with the Army and Navy, strategic airlifts and psychological operations—was foundational to successful execution of multi-domain operations, leading to swift and decisive victory.

Operation Sankalp 2024

In March 2024, the IAF played a pivotal role in a high-stakes and time-sensitive rescue operation to free the hijacked merchant ship *MV Ruen* in the Arabian Sea. The merchant ship was located approximately 2,600 km from the Indian coast. The IAF deployed a C-17 Globemaster III aircraft, which undertook a non-stop 10-hour flight to the target area. The C-17 delivered two Combat Rubberised Raiding Craft (CRRC) along with a team of Indian Navy MARCOS (Marine Commandos) into the Arabian Sea through precision airdrop. This strategic drop[32] enabled the commandos to board and retake control of the vessel, leading to the rescue of 17 crew members and the capture of 35 pirates. This operation, again, highlights the central role of air force in execution of multi-domain operations.

A brief glimpse into historical wars and conflicts has brought to the fore the crucial role that air forces have played in achievement of objectives while simultaneously creating a substantial effect in the physical domains. Integration of space and cyber domains in air force operations has already become a primary principle. Therefore, air forces are rightfully placed as the principal node in MDOs.

Comparative Analysis: Air Force vs Army and Navy

A comparative analysis of the capabilities and structures of air forces versus the army and navy reveals the unique advantages of air forces as the principal node in the MDOs. Below are a few critical characteristics of air forces *vis-à-vis* the army and navy.

Technological Innovation

Globally, the research and development is centred around the air domain and its exploitation for civil as well as military use. Air Forces are at the forefront of technological innovation[33] in military operations. It must not be understood that technology infusion is not being undertaken by the armies and navies, however, the global focus on air and space capabilities equips air forces with unique advantage in MDOs.

Strategic Flexibility

Air Forces possess unmatched flexibility and reach, enabling rapid deployment and potent responses to threats within a compressed frame of time at any location in the world. The ability to quickly and effectively project power into contested environments is a critical component of MDOs. Air Forces are extremely dynamic unlike armies and navies whose assets once committed towards an objective are extremely difficult to be shifted towards an alternative objective. Additionally, Air Forces are extremely comfortable in conducting offensive and defensive missions simultaneously and with the same platform too. These inherent capabilities provide a distinct advantage to air forces in conducting MDOs.

Command and Control

Air Forces have a well-developed sophisticated command and control[34] infrastructure essential for coordinating MDOs. These C2 systems have been integrated with real-time updates of ISR and provide high levels of situational awareness to the commanders, thereby enabling quick and efficient decision-making. The armies and navies also have robust C2 systems. However, the focus on air and space operations places air forces at the advantageous position in conducting and coordinating multi-domain operations.

Domain Integration

Air Forces excel in integrating operations across multiple domains. They have been undertaking this task traditionally, albeit in bits and pieces, in the 'Joint Ops' construct wherein the tasks were relegated to support roles. It is a truism

that only the Air Force has the ability to counter and threaten the Air Force, Army and Navy of an enemy, and that vice-versa does not hold true. The air forces have been and will continue to be the true domain integrators with operations spread across all the physical domains of land, sea and air, and new domains of space and cyber. The ability to integrate operations across all these domains is essential for MDOs and air forces are the only armed force with this capability.

The above-mentioned crucial characteristics of the air forces *vis-à-vis* the army and navy have shed light on the advantages that air forces enjoy over its counterparts. These characteristics form the essential tenets for conducting MDOs and thus legitimately place air forces in the driving seat in MDOs.

Future Trends and Evolving Challenges

The rapid pace of technological advancements and its infusion in the battlespace will lead to increased complexities[35] in the operating environments in the future wars. Use of Artificial Intelligence (AI), hypersonic weapons, weaponisation of space, and cognitive warfare present new challenges and opportunities for military operations. AI and Machine Learning[36] (ML) have the potential to revolutionise military operations. Data is already being termed as the new munition. It could, well, be called the new gunpowder. Powered by huge amounts of data, AI and ML are changing the way decisions are being taken on the battlefield. These technologies are aiding faster and accurate responses to dynamic threats. Hypersonic weapons[37] have blurred the distinction between air and space and are posing significant challenges for detection and interception, requiring new approaches to address the threat from them. Contested space environments,[38] where adversaries can degrade or deny access to space-based assets, coupled with weaponisation of space, necessitate development of new capabilities and strategies to ensure continued effectiveness of own space operations. Successful conduct of MDOs mandates that these challenges are addressed. Air Forces with their focus on technological innovation, flexibility in application of kinetic and non-kinetic power, and capability to operate across domains with impunity will continue to maintain strategic primacy in future conflicts.

Assessment of and Recommendations for the IAF

Over the years, the IAF has significantly advanced its capabilities, positioning itself as a central player in conducting MDOs. Two instances where IAF played pivotal role in conduct of MDOs have been brought out earlier. With

strategic reach and rapid mobility offered by its transport and helicopter assets, integrated ISR through AWACS, AEW&C, UAS and Fighter recce assets, and precision-strike capabilities through multi-role fighters like the Rafale, Su-30 MKI and Mirage 2000 I/TI, along with other integral capabilities of electronic warfare and cyber warfare, the IAF is adept at orchestrating operations across air, land, sea, space and cyber domains. These capabilities reinforce IAF's role as the principal player in MDOs. However, challenges do exist. One of the most significant gaps is the absence of a fully developed tri-service MDO Doctrine along with a real-time interoperable command and control architecture.

The IAF's network capabilities are not yet seamlessly integrated with the networks of Indian Army and Indian Navy. This leads to latency and interoperability issues. Limited indigenous space based ISR and lack of an indigenous satellite-based precision navigation system increases IAF's reliance on foreign assets; the services of which cannot be relied upon and/or guaranteed during conflict situations. Furthermore, while IAF and India are improving its cyber warfare capabilities, they may not suffice the volume and high tempo required during MDOs. Lastly, latest niche technologies changing the face of the warfare are being absorbed slowly by IAF.

To bridge these gaps and to consolidate its position as the dominant player in MDOs, the IAF must invest in several key areas. First, it should lead the crafting of an integrated MDO Doctrine in collaboration with the Indian Army, Indian Navy, Defence Space Agency and Defence Cyber Agency. Secondly, it should emphasise that the proposed restructuring must cater to command and control structure needs of future MDO wars. Third, technological modernisation must focus on accelerated indigenisation of ISR assets, resilient communications and high bandwidth secure datalinks. Fourth, the IAF must fast-track induction of autonomous systems such as loyal wingman and swarm drones.

Fifth, in collaboration with the academia and civil industry, IAF must lead development and induction of an indigenous AI-based battle management system[39] to reduce information overload as well as to reduce decision latency through decision support systems. Sixth, investments in cyber warfare[40] and cognitive warfare capabilities, both offensive and defensive, are essential to protect and exploit digital domain in future conflicts. Seventh, investments in space warfare, indigenous space based ISR,[41] and hypersonic weapons and counter hypersonics[42] must be enhanced to ensure that these technologies are developed and inducted in time. Last, modern generation aircraft and associated air delivered weapons must be indigenously developed and

inducted in the required quantities. By addressing these critical areas, the IAF will become future ready whereby it is able to retain its role as the true central node for MDOs.

Conclusion

Air Forces are best suited to be the central node in multi-domain operations due to their advanced technological capabilities, innovative mindset, strategic flexibility and integrated command and control structures. Their ability to leverage ISR, cyber and space capabilities enhances their capabilities to undertake cross-domain deterrence and cross-domain coercion. Historical case studies add weight to this argument and have proved that air forces are placed at the logical pedestal of being a dominant player in MDOs. Comparative studies of the characteristics of army, navy and air force also substantiate the fact that air force is the preferred service to play the pivotal role in MDOs. As the character of warfare continues to evolve, the role of air forces in conducting and coordinating MDOs will become increasingly important. The unique capabilities and inherent characteristics of the air forces position them as the central node in modern military multi-domain operations.

Notes

1. Jeffrey M. Reilly, 'Multidomain Operations: A Subtle but Significant Transition in Military Thought', *Air & Space Power Journal*, Spring 2016, p. 61, available at https://apps.dtic.mil/sti/tr/pdf/AD1003670.pdf.
2. Max Kimber Nettis, 'Multi-Domain Operations: Bridging the Gaps for Dominance', *Wild Blue Yonder—Online Journal*, 16 March 2020, available at https://www.airuniversity.af.edu/Wild-Blue-Yonder/Article-Display/Article/2109784/multi-domain-operations-bridging-the-gaps-for-dominance/.
3. James Black, Alice Lynch, Kristian Gustafson, David Blagden, Pauline Paille and Fiona Quimbre, 'Multi-Domain Integration in Defence: Conceptual Approaches and Lessons from Russia, China, Iran and North Korea', Report, RAND Corporation, 2022, p. 23.
4. Ibid.
5. 'Multi-Domain Operations for the Bundeswehr: A Short Introduction', Bundeswehr Office for Defence Planning, available at https://www.bundeswehr.de/resource/blob/5753432/11123cfdc6a7117559625ae08cec7b31/brochuere-engl-data.pdf, accessed on 26 August 2024.
6. Ibid.

7. James Black et al., 'Multi-Domain Integration in Defence: Conceptual Approaches and Lessons from Russia, China, Iran and North Korea', n. 3, p. 17.
8. Maj Sean A Atkins, USAF, 'Multidomain Observing and Orienting', *Air & Space Power Journal*, Fall 2018, pp. 26–44, available at https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-32_Issue-3/F-Atkins.pdf.
9. J. Lee, Y. Hao, T. Abdelzaher, K. Marcus and R. Hobbs, 'A Command-by-Intent Architecture for Battlefield Information Acquisition Systems,' 21st International Conference on Information Fusion (FUSION), Cambridge, UK, 2018, pp. 2298–2305, DOI: 10.23919/ICIF.2018.8455376.
10. 'Multi-Domain Operations for the Bundeswehr: A Short Introduction', n. 5.
11. Sayed Ali Hadi, 'Cross-Domain Deterrence—A Critical Appraisal', Centre for Strategic and Contemporary Research, 6 March 2020, available at https://cscr.pk/explore/themes/defense-security/cross-domain-deterrence-a-critical-appraisal/.
12. 'About AFWERX', AFWERX, available at https://afwerx.com/about-us/, accessed on 26 August 2024.
13. 'Mehar Baba Competition-II', Indian Air Force, available at https://indianairforce.nic.in/mehar-baba/, accessed on 26 August 2024.
14. 'Innovations for Defence Excellence', myScheme, available at https://www.myscheme.gov.in/schemes/idex, accessed on 26 August 2024.
15. 'The U.S. Army in Multi-Domain Operations 2028', RADOC Pamphlet 525-3-1, 6 December 2018, available at https://adminpubs.tradoc.army.mil/pamphlets/TP525-3-1.pdf.
16. Colonel Frederick "Trey" Coleman, 'Air Operations Center Evolution: A Roadmap for Progress', *Wild Blue Yonder—Online Journal*, 14 March 2022, available at https://www.airuniversity.af.edu/Wild-Blue-Yonder/Articles/Article-Display/Article/2963845/air-operations-center-evolution-a-roadmap-for-progress/.
17. Air Marshal Diptendu Choudhury, 'Air Defence is Everywhere', Vivekanand International Foundation, 24 July 2020, available at https://www.vifindia.org/article/2020/july/24/air-defence-is-everywhere.
18. Maj Sean A. Atkins, USAF, 'Multidomain Observing and Orienting', *Air and Space Power Journal*, Fall 2018, pp. 26–44, available at https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Volume-32_Issue-3/F-Atkins.pdf.
19. Russia, USA, France, Spain, China and Iran are some of the countries that already have an Air and Space Force or an Aerospace Force.
20. 'Persian Gulf War', Britannica, available at https://www.britannica.com/event/Persian-Gulf-War, accessed on 31 August 2024.
21. Robert S. Dudley, 'Space Power in the Gulf', *Air & Space Forces Magazine*, 1 June 2003, available at https://www.airandspaceforces.com/article/0603edit/.
22. '2001- Operation Enduring Freedom', Air Force Historical Support Division, available at https://www.afhistory.af.mil/FAQs/Fact-Sheets/Article/458975/2001-operation-enduring-freedom/, accessed on 7 September 2024.

23. Radin, Andrew, Lynn E. Davis, Edward Geist, Eugeniu Han, Dara Massicot, Matthew Povlock, Clint Reach, Scott Boston, Samuel Charap, William Mackenzie, Katya Migacheva, Trevor Johnston and Austin Long, 'The Future of the Russian Military: Russia's Ground Combat Capabilities and Implications for US-Russia Competition', Report RR-3099-A, RAND Corporation, available at https://www.rand.org/pubs/research_reports/RR3099.html.
24. 'Lessons of the Ukraine War: Air Aspects', United Service Institution of India, available at https://www.usiofindia.org/publication-journal/lessons-of-the-ukraine-war-air-aspects.html, accessed on 7 September 2024.
25 'Israeli Air Force Struck 31,000 Targets in Four Months of War', *Breaking Defense*, 20 February 2024, available at https://breakingdefense.com/2024/02/israeli-air-force-struck-31000-targets-in-four-months-of-war/.
26. '100 days of War: A Timeline of the Israel-Hamas Conflict', *The Week*, 15 January 2024, available at https://theweek.com/defence/timeline-israel-hamas-war.
27. 'Gaza War: Artificial Intelligence is Changing the Speed of Targeting and Scale of Civilian Harm in Unprecedented Ways', *The Conversation*, available at https://theconversation.com/gaza-war-artificial-intelligence-is-changing-the-speed-of-targeting-and-scale-of-civilian-harm-in-unprecedented-ways-228050, accessed on 2 May 2024.
28. Ujjwal Shrotriya, 'On This Day In 1971: IAF Struck Pakistan For Second Straight Day, Setting Stage For Historic Naval Raids on Karachi', *Swarajya*, 4 December 2024, available at https://swarajyamag.com/defence/on-this-day-in-1971-indian-air-force-strcuk-pakistani-installations-for-the-second-straight-day-setting-stage-for-historic-naval-raids-on-karachi.
29. Smruti Deshpande, '"Tangail Drop" & Meghna Heli-lift: IAF Ops That Gave India Edge Over Pakistan in 1971 Bangladesh War', *The Print*, 16 December 2024, available at https://theprint.in/defence/tangail-drop-meghna-heli-lift-iaf-ops-that-gave-india-edge-over-pakistan-in-1971-bangladesh-war/2404338/.
30. Ibid.
31. Divyam Sharma, '"Because of This": How Indian Air Focre's Ops Forced Pakistan to Surrender In 1971', *NDTV*, 17 December 2023, available at https://www.ndtv.com/india-news/because-of-this-how-indian-air-forces-ops-forces-pakistan-to-surrender-in-1971-vijay-diwas-4690302.
32. 'IAF's C-17 Aircraft Executes Precision Airdrop in Arabian Sea, Helps Indian Navy Seize Hijacked Vessel', *The Indian Express*, 18 March 2024, available at https://indianexpress.com/article/india/iaf-aircraft-precision-airdrop-helps-indian-navy-seize-hijacked-vessel-9219392.
33. D.E. Shahady, A.E. Thal, A. Das, A.R. Heminger and K.C. Halverson, 'Understanding the Emergence of Disruptive Innovation in Air Force Science and Technology Organizations', PICMET '08 - 2008 Portland International Conference on Management of Engineering & Technology, Cape Town, South Africa, 2008, pp. 506–518; DOI: 10.1109/PICMET.2008.4599660.

34. Colonel Frederick "Trey" Coleman, 'Air Operations Center Evolution: A Roadmap for Progress', n. 16.
35. 'The Future of the Battlefield', National Intelligence Council, USA, April 2021, available at https://www.dni.gov/files/images/globalTrends/GT2040/NIC-2021-02493--Future-of-the-Battlefield--Unsourced--14May21.pdf, accessed on 8 September 2024.
36. James Johnson, 'Artificial Intelligence & Future Warfare: Implications for International Security', *Defense & Security Analysis*, Vol. 35, 2019, pp. 1–23; DOI: 10.1080/14751798.2019.1600800.
37. 'Complex Air Defense: Countering the Hypersonic Missile Threat', Centre for Strategic and International Studies, February 2022, available at https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/220207_Karako_Complex_AirDefense.pdf, accessed on 8 September 2024.
38. 'Defence Space Strategy: Operationalising the Space Domain', Ministry of Defence, UK, February 2022, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1051456/20220120-UK_Defence_Space_Strategy_Feb_22.pdf, accessed on 8 September 2024.
39. Swaim Prakash Singh, 'Exploiting Multi-dimensional Trends for the Indian Air Force', *Journal of Defence Studies*, Vol. 17, No. 4, October–December 2023, pp. 7–24, available at https://idsa.in/wp-content/uploads/2024/04/jds-17-4 Swaim-Prakash-Singh.pdf.
40. Air Marshal Ramesh Rai, 'Focus on Fifth Domain: Cyber Space Operations Should Become an Integral Part of the IAF', *Force*, available at https://forceindia.net/guest-column/focus-fifth-domain/, accessed on 23 April 2025.
41. Huma Siddiqi, 'India Taps Private Sector to Speed Up Military Satellite Launches Amid Rising China Challenge', *Bharat Shakti*, 17 April 2025, available at https://bharatshakti.in/india-taps-private-sector-to-speed-up-military-satellite-launches-amid-rising-china-challenge/.
42. 'DRDO's Ambitious Hypersonic Program: Developing 12 Variants Including HGVs, Anti-Hypersonic Missiles, and Hypersonic Cruise Missiles', Indian Defence Research Wing, 12 March 2025, available at https://idrw.org/drdos-ambitious-hypersonic-program-developing-12-variants-including-hgvs-anti-hypersonic-missiles-and-hypersonic-cruise-missiles/.