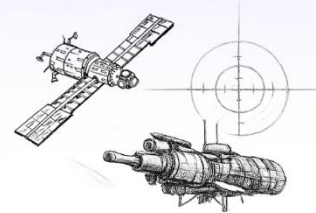
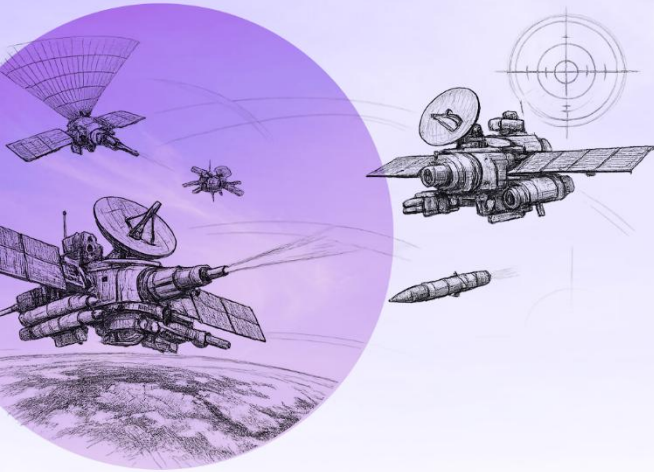




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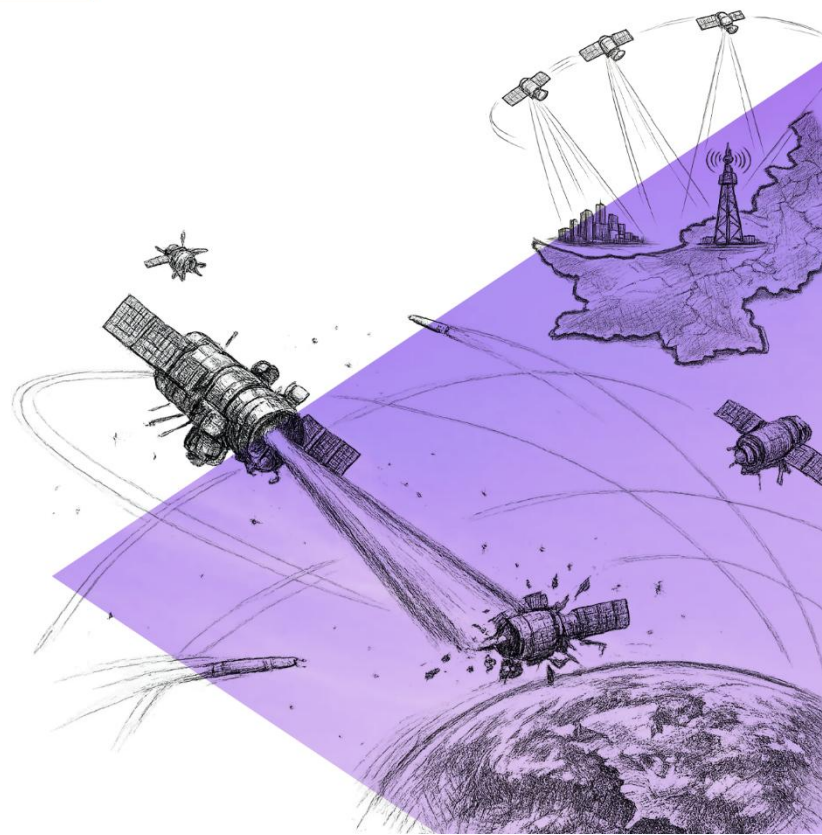


# Space-Enabled Warfare in the 21st Century: Pathways for Developing States

Shafaq Zernab

*Research Assistant*

**Working Paper**



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CENTRE for AEROSPACE & SECURITY STUDIES

# **Space-Enabled Warfare in the 21<sup>st</sup> Century: Pathways for Developing States**

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**Shafaq Zernab**

Research Assistant



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## Abstract

*This working paper explores space-enabled warfare as a force multiplier in the 21<sup>st</sup> century air operations and considers practical ways in which developing nations can be involved in this arena despite all the deep asymmetries associated with it. Even as key actors assume control of orbital infrastructure and counterspace capabilities, a space-related netocracy characterised by distributed networks, public-private partnerships (PPPs), fast commercial innovation, and transnational resilience has reduced barriers for entry and provided opportunities to resource-constrained states to improve the performance of their operations without necessarily seeking full-spectrum dominance. Based on a qualitative thematic analysis of secondary sources, the paper suggests that there are two complementary ways in which developing countries can leverage space: indigenisation to construct sovereign nodes to achieve autonomy, and strategic alliances to become part of larger netocratic ecosystems. The pathways enable asymmetric advantages in military action, especially in air warfare, including Intelligence, Surveillance, and Reconnaissance (ISR)-fueled precision attacks, strong command and control, and hybrid electronic-cyber effects, as demonstrated in the paper through the examples from India, Pakistan, the United Arab Emirates (UAE), Brazil, Nigeria, and the commercial integration of space in Ukraine. The analysis has recognised major obstacles, including technical, economic, geopolitical entrapment, normative, and operational risks to jamming or cyber interruption, but notes that these risks can be reduced through diversified and selective approaches. The paper has concluded that netocratic democratisation makes space-enabled warfare a place of opportunity for the developing states, particularly the Global South, where small self-reliance and networked involvement can redefine the air-centric conflict politics in the future.*

**Keywords:** Space, warfare, ISR, Pakistan, India, Cyber, Alliances, Militarisation, Counter-space, Satellites, Starlink.



## Introduction

Space has emerged as a distinct domain of warfare alongside land, sea, air, and cyber. Developed countries like the United States, Russia, and China possess offensive and support capabilities in space. In the shadowed expanse of Low Earth Orbit (LEO), where satellites operate like silent custodians, the 2022 Russian invasion of Ukraine transformed the nature of modern conflict. As Russian troops marched forward, the commercial satellites like Maxar and Planet, which are operated by Western firms, captured high-resolution imagery of Russian troops, providing real-time intelligence to Ukrainian commanders, unlike ever before. Such an unprecedented 'view from above' not only exposed Moscow's intentions but also strengthened Ukraine's asymmetric defence.<sup>1</sup> However, the most pivotal shift was the democratisation of space-enabled warfare, which changed the nature of orbital assets from being exclusive instruments of superpowers into accessible force multipliers for resource-constrained states.

It highlights that space, once a domain of peaceful exploration and passive support for communication, navigation, and Earth observation, has evolved into a contested area integral to modern military conflicts and control of space decides the outcome long before the real battle begins. In the 21<sup>st</sup> century, space-enabled warfare represents a transition from a supporting function to an active enabler across multiple domains. Space-based assets perform the following functions that reduce the fog of war. They provide ISR for real-time situational awareness on the battlefield, secure satellite communication (SATCOM) for command and control (C2), ultra-precise positioning, navigation and timing (PNT) for electromagnetic spectrum dominance through jamming evasion and guided munitions, as well as to achieve cyber-space hybrid effects that disrupt adversary networks through spoofing.<sup>2</sup>

In this paper, space-enabled warfare is conceptualised as the integration of orbital assets to support, enhance and amplify the efficiency of terrestrial military operations, particularly in air warfare. It is different from space warfare, which is the direct kinetic or non-kinetic action in space itself.<sup>3</sup> Major powers like the US, Russia and China possess advanced counterspace capabilities such as anti-satellite (ASAT) weapons, directed-energy weapons (DEWs), orbital manoeuvres and electromagnetic jamming to degrade or deny enemy space access.<sup>4</sup> This space dominance creates asymmetries for developing states in contested environments. Without space as an enabler, they

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<sup>1</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts* (2025), [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html).

<sup>2</sup> Ron Gurantz, 'Satellites in the Russia-Ukraine War', *Books, Monographs & Collaborative Studies*, 21 August 2024, <https://press.armywarcollege.edu/monographs/971/>.

<sup>3</sup> Sitki Egeli, 'Space-to-Space Warfare and Proximity Operations: The Impact on Nuclear Command, Control, and Communications and Strategic Stability', *Journal for Peace and Nuclear Disarmament* 4, no. 1 (January 2021): 116–40, <https://doi.org/10.1080/25751654.2021.1942681>.

<sup>4</sup> 'Extending the Battlespace to Space', accessed 29 December 2025, <https://www.csis.org/analysis/chapter-8-extending-battlespace-space>.



are exposed to threats such as jamming, which could potentially sabotage precision air strikes, while SATCOM denial could cripple targeting and logistics. Moreover, the predominant literature focuses on great power rivalry and counter-space capabilities. Comparatively, scant attention is given to how resource-constrained states, especially in the Global South, can realistically utilise or defend against space-enabled warfare despite emerging prospects of commercialisation and partnerships. The present literature overlooks pathways for collaboration and diversification of alliances to fill this technological gap.

To address this gap, the central claim of this paper is that developing nations can use space as an enabler in warfare particularly in air operations through ISR, communication, navigation and hybrid effects without resorting to direct orbital warfare by prioritising investment in indigenous research and development (R&D) for strategic autonomy, while forging alliances to integrate space capabilities, thereby improving operational outcomes by reducing military asymmetries. The proliferation of commercial constellations, CubeSats, and rideshare launchers has accelerated this shift, allowing even resource-constrained countries to deploy and utilise these networks for tactical advantage.<sup>5</sup>

This transformation is best conceived in terms of James Clay Moltz's concept of space-related netocracy.<sup>6</sup> Its fundamental assertion is that, in the 21<sup>st</sup> century, sovereignty is networked, deviating from the 20<sup>th</sup> century 'technocracy' (state-led programmes). It is defined by a new form of organisation based on PPPs, distributed and resilient networks and rapid innovation rather than state-controlled monopolies. This new approach is characterised by a flexible and collaborative netocracy where commercial actors have a decisive role to play in the formation of transnational alliances, allowing for faster adaptations and greater resiliency in a contested environment, especially in support of air and multi-domain operations (MDOs).<sup>7</sup> Developing states can leverage this netocratic environment by developing indigenous capabilities such as sovereign network nodes and form strategic alliances, thus integrating into broader coalitions to facilitate asymmetric disruption as a viable strategy for resource-scarce states.<sup>8</sup>

The paper follows a qualitative thematic analysis, drawing on secondary sources. Data is gathered from books, peer-reviewed journal articles, think-tank reports, defence doctrines, and expert commentaries from policy outlets. The paper is divided into the following sections: first, it conceptualises space's enabling role in modern warfare,

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<sup>5</sup> *Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion*, (Washington, D.C.: Defense Intelligence Agency, 2022).

<sup>6</sup> James Moltz, 'The Changing Dynamics of Twenty-First-Century Space Power', *Journal of Strategic Security* 12, no. 1 (April 2019): 15–43, <https://doi.org/10.5038/1944-0472.12.1.1729>.

<sup>7</sup> 'Japcc.Org/Wp-Content/Uploads/JAPCC\_J29\_screen.Pdf', n.d., accessed 25 January 2026, [https://www.japcc.org/wp-content/uploads/JAPCC\\_J29\\_screen.pdf](https://www.japcc.org/wp-content/uploads/JAPCC_J29_screen.pdf).

<sup>8</sup> John J. Klein, "Space Strategy Considerations for Medium Space Powers," *Astropolitics* 10, No. 2 (2012): 110 – 125. <https://www.tandfonline.com/doi/full/10.1080/14777622.2012.698929>



particularly air operations, through a netocracy lens; second, it identifies pathways for developing states, like indigenisation and forging alliances, substantiated by illustrative examples; third, it highlights potential challenges while proposing recommendations for policymakers.

## Methodology

The study employs qualitative research methods. Data was collected from secondary sources, including books, journal articles, reports, dissertations, and archival records. Moreover, think tank reports, newspaper analyses, and media commentaries were also incorporated to examine space-enabled warfare and the strategic pathways available to developing countries. Thematic analysis was used to systematically identify and interpret recurring patterns, such as shifts to netocratic networks, commercial democratisation, and asymmetric enabling strategies. To maintain the credibility of the research, key themes were extracted and interpreted to uncover underlying trends in space-enabled warfare for developing states.

## Historical Background of Space-enabled Warfare

The role of space as an enabler in terrestrial military operations dates back to the Cold War era. It has transitioned from being an area of strategic prestige to being an indispensable force multiplier serving as the backbone of modern military operations.<sup>9</sup> The dawn of the space race started in 1957 with the launch of Sputnik 1. The main impetus of the first space age (1957-1991) was the imperatives of the Cold War and national prestige.<sup>10</sup> During that period, space-based capabilities played a critical role in preventing surprise nuclear attack and verifying arms control treaties, leading to the militarisation of space.<sup>11</sup>

### Operation Desert Storm and the First Space War

The Gulf War was an important turning point and is sometimes used as the reference for the first space war in which the US integrated space-based assets to achieve tactical and operational results.<sup>12</sup> However, it was limited to the use of Global Positioning System (GPS) for positioning and navigation of troop movements, delivering precision munitions, and tracking forces. SATCOM proved vital for managing large Joint Task Forces across vast desert terrain.<sup>13</sup> Over the next decade, during coalition operations in the Balkans, Southwest Asia, and Afghanistan, space

<sup>9</sup> 'The 21<sup>st</sup>-Century Space Race', U.S. Naval Institute, 29 December 2015, <https://www.usni.org/magazines/proceedings/2015/december/21st-century-space-race>.

<sup>10</sup> Charles D Lutes, *Spacepower in the 21<sup>st</sup> Century*, n.d., 66.

<sup>11</sup> Julie Michelle Klinger, 'Outer Space Infrastructures', in *The Rise of the Infrastructure State*, ed. Seth Schindler and Jessica DiCarlo (Bristol University Press, 2022), 13, <https://doi.org/10.51952/9781529220803.ch020>.

<sup>12</sup> Lutes, *Spacepower in the 21<sup>st</sup> Century*, 66.

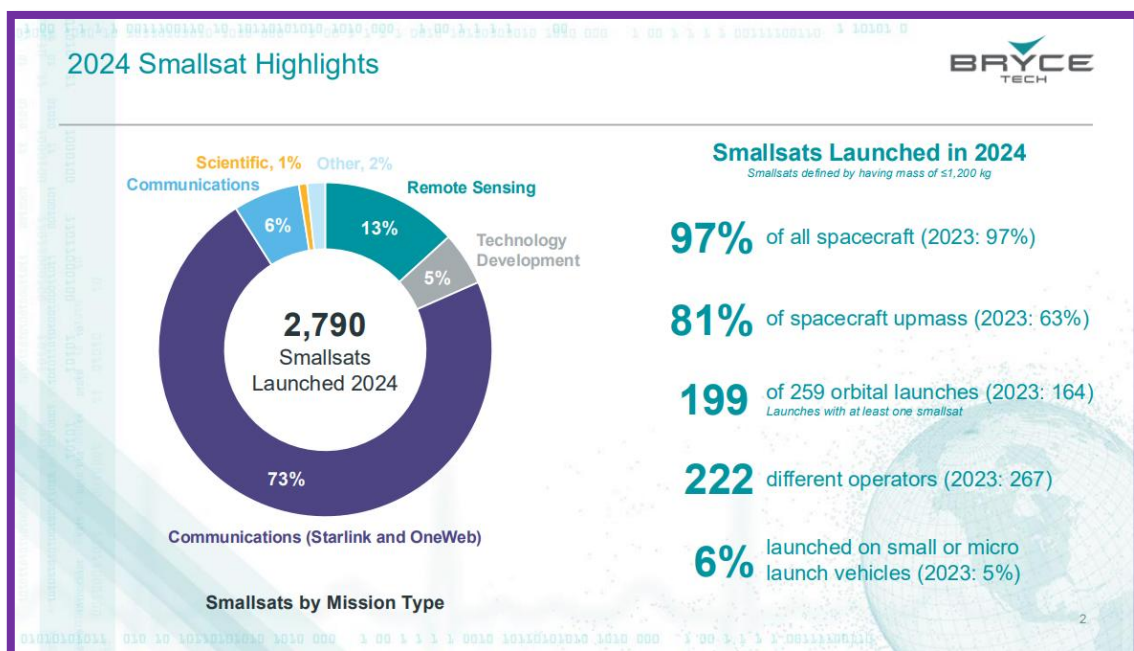
<sup>13</sup> Karl Ginter, *Space Technology and Network Centric Warfare: A Strategic Paradox*, n.d., 12.



capabilities were normalised to support US domination of the battlespace.<sup>14</sup> Hence, space-enabled information services (SEIS) became the core force capabilities that allowed militaries to strike with seamless precision, accuracy and clarity.

### Expansion of Commercial Satellites Assisting Military Operations

Space emerged as a foundational pillar of integrated military operations, where commercial satellites have drastically reduced launch costs. The Union of Concerned Scientists' Satellite Database shows that there are 11,539 operational satellites in Earth's orbit, which is a significant increase from 3,371 in 2020.<sup>15</sup> Out of these, approximately 100-200 offer sub-meter resolution (<1 m) for detailed target identification. Commercial Satellites like Maxar Worldview (30cm), Airbus Pleiades Neo (30cm), Black Sky (50cm), and ICEYE Synthetic Aperture Radar (SAR) (25-50cm), alongside dual-use military satellites like US National Reconnaissance Office (NRO) Keyhole, China GAofen-11, dominate the spectrum. They fall in different ranges, varying from 1-3m precision. A report from Bryce Tech suggests that the commercial sector alone contributed nearly 2,800 small satellite launches in 2024, accounting for 81 per cent of total upmass and 97 per cent of all spacecraft, as shown in the figure, making space a key enabler of military operations.<sup>16</sup>



<sup>14</sup> 'Space Force Doctrine Document 1 FINAL\_4Apr25.Pdf', n.d., 33, accessed 29 December 2025, [https://www.starcom.spaceforce.mil/Portals/2/Space%20Force%20Doctrine%20Document%201%20FINAL\\_4Apr25.pdf](https://www.starcom.spaceforce.mil/Portals/2/Space%20Force%20Doctrine%20Document%201%20FINAL_4Apr25.pdf).

<sup>15</sup> Satellite Industry Association, 'Historic Number of Launches Powers Commercial Satellite Industry Growth – Satellite Industry Association Releases the 28th Annual State of the Satellite Industry Report', *Satellite Industry Association*, 13 May 2025, <https://sia.org/historic-number-of-launches-powers-commercial-satellite-industry-growth-satellite-industry-association-releases-the-28th-annual-state-of-the-satellite-industry-report/>.

<sup>16</sup> 'BryceTech Smallsats by the Numbers 2025', n.d., 2.



Due to constellations like the Yaogan series of China or the Tranche 0 of the Space Development Agency of the US, orbital systems provide approximately 95 per cent of the total bandwidth of military communications worldwide and also allow real-time ISR of expansive areas of the Earth's surface.<sup>17</sup> Thematic analysis of sources shows a similar convergence that space is most valuable in improving terrestrial effectiveness, which is demonstrated by US Department of Defence evaluations that space capabilities have the potential to cut short targeting cycle times by 40 per cent during multi-domain operations (MDO).<sup>18</sup>

## Conceptualisation of Space-enabled Warfare

Space-enabled warfare differs from space warfare or counterspace operations, which fundamentally involve the denial or destruction of orbital assets. Examples include Russia's 2021 direct-ascent ASAT test against Kosmos 1408, which generated more than 1,500 trackable space debris, or China's destruction of the FY-1C satellite, adding over 3,000 pieces of debris to the orbital environment.<sup>19</sup>

As reported by the Defence Intelligence Agency, space-enabled warfare concentrates on leveraging satellites for amplifying operations on Earth, like ISR for the battlefield, as observed in Maxar's resolution imagery supporting 70 per cent of the US strike planning.<sup>20</sup> It also provides SATCOM for resilient C2 structures, e.g. handling data rates up to 10 gigabits per second (Gbps) in contested environments.<sup>21</sup> Moreover, it provides PNT for GPS-guided precision munitions strikes, achieving 1 meter accuracy in 95 per cent, electromagnetic superiority which utilises frequency-hopping algorithms to evade 80 per cent of jamming attempts and cyber hybrids where satellite-linked malwares disrupt adversary's networks. This assessment demonstrates that although counterspace capabilities have proliferated, approximately 85 of global military space spending is directed toward support functions rather than counterspace weapons.<sup>22</sup>

<sup>17</sup> Clayton Swope et al., *THREAT ASSESSMENT 2025*, 2025, 7.

<sup>18</sup> U.S. Department of Defense, Defense Science Board, *Commercial Space: Final Report* (Washington, DC: Office of the Under Secretary of Defense for Research and Engineering, July 2024), [https://dsb.cto.mil/wp-content/uploads/2024/07/DSB\\_Commercial-Space-Final-Report\\_ForPublicRelease.pdf](https://dsb.cto.mil/wp-content/uploads/2024/07/DSB_Commercial-Space-Final-Report_ForPublicRelease.pdf).

<sup>19</sup> 'SWF\_Global\_Counterspace\_Capabilities\_2025', n.d., 184.

<sup>20</sup> *Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion*, [Second edition] (Washington, D.C.: Defense Intelligence Agency, 2022), 12–34.

<sup>21</sup> *Challenges to Security in Space*, (Washington, D.C.: Defense Intelligence Agency, 2022), 28–30.

<sup>22</sup> *Challenges to Security in Space*, (Washington, D.C.: Defence Intelligence Agency, 2022), 32.



## Conceptual Framework: Netocracy

This enabling paradigm is best captured by James Clay Moltz's adaptation of the term 'netocracy.' In the changing landscape of 21<sup>st</sup> century military power, it provides a conceptual framework explaining space-enabled warfare as a distributed, resilient, and collaborative phenomenon rather than a centralised and state-dominated domain, as was the case during the Cold War.<sup>23</sup> The term 'netocracy' was originally coined in 2,000 by Alexander Bard and Jan Soderqvist to describe a post-capitalist elite replacing the capitalist elite, who gained power by mastering digital networks and flows of information and attention.<sup>24</sup> Moltz repurposes this term specifically for the space sector in his 2019 article, 'The Changing Dynamics of Twenty-First-Century Space Power.'<sup>25</sup>

He describes it as a transformation of the 20<sup>th</sup> century technocratic, hierarchical, and government-led programs that are typified by large-scale, extensive projects to a networked model which derives power from traditional coalitions, PPPs, commercialisation, decentralised grids and interconnection.<sup>26</sup> In essence, netocracy is not about owning satellites; it is about creating resilient, adaptive networks, which realise operational effects across domains, especially air warfare.

The core logic of netocracy lies in its distributive framework. Contrary to the traditional forms of technocratic systems, which are susceptible to single-point failures (e.g., destruction or jamming of a few high-value satellites), netocratic systems are based on proliferated, redundant, and commercially-enhanced constellations capable of withstanding attrition. According to Moltz, such a model is strategically advantageous for developing states; it is faster than the state bureaucracies and offers the ability to share resources across borders. At the same time, small satellites reduce the entry cost and increase the survivability.<sup>27</sup> In military terms, netocracy converts space from a scarce, high-value asset into a ubiquitous enabler of persistent ISR, resilient SATCOM, precise PNT, and spectrum dominance in a contested arena.

In the case of developing nations, netocracy offers a viable path to agency in space-enabled warfare that does not require enormous capital investments or technological sophistication of great powers. Resource-constrained states can ensure persistent pressure for targeting, ISR, or battle damage assessment by acquiring the capability through commercial services (e.g., rideshare launches, third-party imagery, broadband constellations) and strategic alliances (e.g., Artemis Accords, Belt and Road

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<sup>23</sup> James Clay Moltz, "The Changing Dynamics of Twenty-First-Century Space Power," *Strategic Studies Quarterly* 13, no. 1 (Spring 2019): 78,  
[https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13\\_Issue-1/Moltz.pdf](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13_Issue-1/Moltz.pdf)

<sup>24</sup> Alexander Bard and Jan Söderqvist, *Netocracy: The New Power Elite and Life After Capitalism* (London: Reuters, 2002); Moltz, "The Changing Dynamics," 78.

<sup>25</sup> Moltz, "The Changing Dynamics," 78–79.

<sup>26</sup> *Ibid.* 80.

<sup>27</sup> *Ibid.*, 84-85.



Space Information Corridor, or Brazil, Russia, India, China, and South Africa (BRICS) data-sharing initiatives) by participating in distributed networks.<sup>28</sup> Within netocracy, the process of indigenisation paves the way for the establishment of sovereign nodes where small constellations or dual satellites guarantee sovereignty in vital areas like air defence, ISR or resilience to navigation. Alliances, meanwhile, combine these nodes into bigger networks, which allows sharing real-time data feeds, coalition C2, and hybrid effects that enhance terrestrial operations.

The strength of this framework lies in explaining the current trends. It explains the recent development of commercial space (now more than 70 per cent of annual launches are by commercial entities), the ability to survive in conflicts like Russia-Ukraine (Starlink sustained C2 during peak jamming), and the rising involvement of developing states through alliances.<sup>29</sup> Netocracy therefore redefines space-enabled warfare as not being a zero-sum game of orbital superiority but rather as a networked arena in which selective integration and small-scale self-reliance can provide disproportionate operation advantage to resource-constrained states in military operations.

To put it into perspective, initially, the space domain was dominated by technocracy like NASA's Apollo era, with a staggering investment of USD 280 billion, which later shifted toward a distributed networked mode.<sup>30</sup> Similarly, the Space and Upper Atmosphere Research Commission (SUPARCO) in Pakistan and China have initiated five remote-sensing satellites since 2018 as part of the Beijing-led netocratic ecosystem of providing PNT accuracy during regional tensions.<sup>31</sup> Such strategies, as discussed in RAND simulations, have shown that they could improve hit rates of non-major power air strikes by up to 60 per cent, without the expenditure of full constellations, which can cost up to USD 10 billion.<sup>32</sup>

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<sup>28</sup> Secure World Foundations, *2025 Global Counterspace Capabilities Report*, June 12, 2025, 112-115, <https://www.swfound.org/publications-and-reports/2025-global-counterspace-capabilities-report>.

<sup>29</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts* RAND Research Report RRA2950-1 (Santa Moica, CA: RAND Corporation, 2025), 45-48, accessed January 16, 2026, [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html)

<sup>30</sup> James Clay Moltz, "The Changing Dynamics of Twenty-First-Century Space Power," *Strategic Studies Quarterly* 13, no. 1 (Spring 2019): 78, [https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13\\_Issue-1/Moltz.pdf](https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13_Issue-1/Moltz.pdf)

<sup>31</sup> Nadir Guramani, "Pakistan Successfully Launches Remote Sensing Satellite: Foreign Ministry," *Dawn*, July 31, 2025, accessed January 16, 2026, <https://www.dawn.com/news/1927782>.

<sup>32</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts* RAND Research Report RRA2950-1 (Santa Moica, CA: RAND Corporation, 2025), 58, accessed January 16, 2026, [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html)



## Pathways for Developing States

According to the Satellite Database by the Union of Concerned Scientists (UCS), major powers control 75 per cent of satellites in operational space, which developing countries can counter by developing sovereign nodes through indigenisation and becoming part of the distributed networks by building alliances.<sup>33</sup> This paper discusses such avenues and substantiates the hypothesis that resource-constrained states can use space as a force multiplier in modern warfare, drawing selective inspiration from multi-domain concepts to improve the results of operations without comprehensive adoption. Recurring patterns are identified by thematic analysis of the secondary sources; books, journal articles, think tank reports and defence doctrines show that indigenisation leads to autonomy, alliances lead to greater access, and synergies between the two result in resilient and netocratic benefits in kinetic operations. By analysing warfare-related applications, including the ISR-guided strikes and robust C2, this paper shows how the netocratic participation can transform the orbital weaknesses into the strategic facilitators, citing cases such as the conflict in Ukraine, highlighting the asymmetric equaliser effect.

### **Indigenisation: Building Sovereign Nodes in Netocracy**

Indigenisation serves as the strategic logic for developing economies striving to create sovereign nodes in netocracy, resisting against coercion, and gaining an advantage in decision-making in disputed situations. By investing in indigenous R&D, developing states reduce reliance on foreign infrastructure that can be destroyed during war, including GPS jamming that can reduce the effectiveness of air-strikes, which in wartime simulations have been shown to be reduced by up to 50 per cent according to a RAND Corporation study on such contested scenarios.<sup>34</sup> Under netocratic structures, states focus on distributed architectures, where small, self-sufficient nodes play a role in resilient networks without large-scale investments into large-power constellations. Small satellite constellations, CubeSats, rideshare launches, and dual-use remote-sensing technologies are examples of practical implementations, which have reduced entry barriers by about 85 per cent since 2015. According to the 2025 Small sats report by BryceTech, a rideshare launch now costs less than USD 1 million, compared to a staggering USD 50 million spent on large satellites and also supports

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<sup>33</sup> Union of Concerned Scientists, Satellite Database, updated May 1, 2023, accessed January 17, 2026, <https://www.ucsusa.org/resources/satellite-database>.

<sup>34</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts*, RAND Research Report RRA2950-1 (Santa Monica, CA: RAND Corporation, 2025), 58, accessed January 16, 2026, [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html).



an ISR network which can maintain 80 per cent functionality after sustaining 30 per cent attrition.<sup>35</sup>

One such example is the Indian Space Research Organisation (ISRO) of India, which has grown to over sixty satellites by 2025, including the Cartosat-3 series offering high resolution images, which can prove effective to target air-defences.<sup>36</sup> The 2019 Mission Shakhti ASAT test, which destroyed a satellite at 300 km in orbit and generated 400 trackable debris pieces, was another indication of sovereign deterrence capability, which increased the role of ISRO in netocratic resilience by showing indigenous counter-space alternatives without full-scale escalation.<sup>37</sup> However, such programs carry potential risks of violating the Outer Space Treaty.

Equally, the UAE has also embarked on indigenisation by launching Khalifa Sat in 2018 with a dual-use remote sensing, with a 90 per cent coverage of regional hotspots.<sup>38</sup> Indigenisation continues to be useful to warfare as demonstrated by emerging programmes in Brazil and Nigeria. The CBERS-4A satellite, launched in 2019 by the National Institute of Space Research (INPE) of Brazil in partnership with China, is used to monitor the border and assist with air patrols by providing ISR data that cut incursion response time by half during 2023 exercises against illegal mining threats.<sup>39</sup>

The NigComSat-1R, launched in 2011, provides the SATCOM bandwidth to use in military C2 operations against Boko Haram, and provides drone ISR integration to enhance precision in strikes during the 2022 counter-terrorist campaigns.<sup>40</sup> These projects establish netocratic nodes to pursue autonomy: an example is by Nigeria, to launch two new sats CubeSats to provide PNT redundancy, reducing GPS vulnerabilities in air operations and providing uptime in cases of jamming.<sup>41</sup> These sovereign nodes also provide satellite-cued electronic warfare, disrupting enemy

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<sup>35</sup> BryceTech, *Smallsats by the Numbers 2025*, (March 27, 2025), 8-10, <https://brycetech.com/reports/report-documents/smallsats-2025>.

<sup>36</sup> Kartik Bommakanti, *India's Space Policy: The Emerging Contours* (Observer Research Foundation, 2023), 15-20, <https://www.orfonline.org/publications/indias-space-policy-the-emerging-contours>.

<sup>37</sup> Ankit Panda, "India's ASAT Test: An Incomplete Success," *Carnegie Endowment for International Peace*, April 15, 2019, <https://carnegieendowment.org/research/2019/04/indias-asat-test-an-incomplete-success?lang=en>.

<sup>38</sup> *UAE Space Agency, UAE Space Agency Annual Report 2024* (Abu Dhabi: UAE Space Agency, 2025), 22-25, <https://www.space.gov.ae>.

<sup>39</sup> United Nations Institute for Disarmament Research, *Space Security and Global South* (Geneva: United Nations Institute for Disarmament Research, 2024), 45-50, <https://unidir.org/publication/space-security-and-global-south>.

<sup>40</sup> Vincent Foucher, *Boko Haram: Mapping an Evolving Armed Constellation* (Geneva: United Nations Institute for Disarmament Research, 2024), [https://unidir.org/wp-content/uploads/2024/09/UNIDIR\\_Boko-Haram\\_Mapping\\_an\\_Evolving\\_Armed\\_Constellation.pdf](https://unidir.org/wp-content/uploads/2024/09/UNIDIR_Boko-Haram_Mapping_an_Evolving_Armed_Constellation.pdf)

<sup>41</sup> Othniel Canice, "Nigerian Government Set to Launch two New Satellites," *Voice of Nigeria*, September 10, 2025, <https://von.gov.ng/nigerian-government-set-to-launch-two-new-satellites/>.



radars, therefore transforming resource limitations into autonomous enablers during warfare.

### **Forging Strategic Alliances for Network Integration**

Strategic alliances provide a conceptual model for developing states to accelerate capability development, foster common resilience, and provide access that is beyond indigenous capabilities, thereby integrating them into netocratic ecosystems where collaborative networks increase the space-enabled benefits. Through these alliances, states pool resources and mitigate the costs of purchasing full constellations, estimated at USD 10 billion. As reported by the United Nations Institute for Disarmament Research (UNIDIR), space security alliances can save 70 per cent of costs through shared data feeds and interoperability.<sup>42</sup> The US-led Artemis Accords were ratified by 45 nations by 2025 and have access to NASA's Lunar Gateway for the transfer of technology. The Belt and Road Space Information Corridor in China, which includes over 30 countries in Asia and Africa and provides Beidou PNT coverage with 95 per cent accuracy, thus aiding air surveillance in case of conflicts in the region. The South-South cooperation through BRICS has enhanced ISR through joint data sharing.

For instance, Pakistan-China space cooperation, where SUPARCO has already put into orbit five remote-sensing satellites since 2018, Pakistan Remote Sensing Satellite (PRSS-1) in 2018, which is part of the Yaogan network in China to support air defence during India-Pakistan tensions. The PRSS-1 provided ISR data, which improved air force preparedness during conflict. SUPARCO has achieved a major milestone with the successful launch of Pakistan's first Hyperspectral Satellite (HS-1) from the Chinese Satellite Launch Centre. HS-1 is equipped with advanced hyperspectral imaging technology that captures data across hundreds of narrow spectral bands. This capability will enable precise monitoring and analysis of land use, vegetation health, water resources, and urban development.<sup>43</sup> The collaboration has also resulted in a 40 per cent reduction in Pakistan's dependence on US GPS, while creating hybrid cyber space impacts that disrupt opponent radars.

BRICS data-sharing projects also exemplify netocratic integration: the 2024 BRICS Space Agencies Forum has facilitated joint earth observation, with India providing RISAT-2B radar images (1-meter resolution) for disaster response that doubles military surveillance, thus would be beneficial in air border patrols by Brazil over the Amazon.<sup>44</sup> Alliances build up common resilience, such as the Artemis partners like the

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<sup>42</sup> United Nations Institute for Disarmament Research, "Outer Space Security Conference 2025," September 9-10, 2025, <https://unidir.org/event/outer-space-security-conference-2025/>.

<sup>43</sup> Ministry of Foreign Affairs, Government of Pakistan, "SUPARCO Successfully Launches Pakistan's First Hyperspectral Satellite," October 19, 2025, <https://mofa.gov.pk/press-releases/suparco-successfully-launches-pakistans-first-hyperspectral-satellite>.

<sup>44</sup> Brazilian Space Agency, *BRICS Space Agencies Forum 2024* (Brasilia: Brazilian Space Agency, 2024), 12-15, <https://www.aeb.gov.br>.



UAE, can access the US SATCOM bandwidth and handle 10Gbps over contested bands, increasing the hybrid operations by 50 per cent as the Centre for Strategic and International Studies' (CSIS) simulations suggest.<sup>45</sup> The strategic value of alliances is seen in the fact that they enhance indigenised capabilities: the combination of Chinese Beidou with local PRSS imagery has enabled multi-domain-inspired air operations by Pakistan, where a satellite-directed electronic warfare has disrupted Indian radar systems. Similarly, Artemis' partnership with the US has included Tranche 1 PNT satellites by Space Development Agency (SDA) that have been successful in 99 per cent uptime in jamming-heavy environments and has been used to support air strikes with 80 per cent accuracy on the Houthi targets within the Red Sea, as described in a 2023 study by the Middle East Institute (MEI).<sup>46</sup> These illustrations support the hypothesis and show how network integration can alleviate asymmetries, without necessarily relying on indigenisation, and thus promote netocratic participation, which improves air warfare resilience and performance.

### Synergies for Air Warfare

Indigenisation and international alliances create netocratic benefits in air-based operations. Space-enabled capabilities improve precision, resilience, and multi-domain integration. Indigenised information-surveillance nodes provide sovereign ISR cues to airstrikes, such as the GSAT-7A satellite of India, which was launched in 2018, offering dedicated military SATCOM drone swarms.<sup>47</sup> This capability is further enhanced by alliances with integrated data feeds, as evident in Pakistan's use of the Chinese Beidou system to provide PNT, and it can be used to provide 1-metre accuracy in air-defence simulations during Indo-Pak border tensions. The recent Indo-Pak war of 2025 demonstrates Pakistan's seamless integration of space-based assets in decapitating India's air defences and C2 structures by launching coordinated electromagnetic and cyber operations.

These pathways contribute to resilient SATCOM of drone operations, as netocratic swarms have 99.9 per cent uptime in jamming that affects 80 per cent of legacy systems, according to the 2024 performance figures provided by Starlink adjusted to military requirements.<sup>48</sup> Hybrid effects also have a synergistic effect: satellite-linked cyber capabilities can reduce adversary radar, a fact that has been simulated in the

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<sup>45</sup> Clayton Swope et al., *Space Threat Assessment 2025* (Washington, DC: Centre for Strategic and International Studies, April 25, 2025), 45-50, <https://www.csis.org/analysis/space-threat-assessment-2025>.

<sup>46</sup> Michael O'Hanlon, "The UAE's Military Role in Yemen," *Brookings Institution*, 2023, <https://www.brookings.edu>.

<sup>47</sup> Kartik Bommakanti, *India's Space Policy: The Emerging Contours* (New Delhi: Observer Research Foundation, 2023), 40-45, <https://www.orfonline.org/publications/indias-space-policy-the-emerging-contours>.

<sup>48</sup> SpaceX, *Starlink Progress Report 2024* (Hawthorne, CA: SpaceX, 2024), accessed January 20, 2026, [https://starlink.com/public-files/starlinkProgressReport\\_2024.pdf](https://starlink.com/public-files/starlinkProgressReport_2024.pdf).



RAND analyses of the Ukraine war, thus allowing developing nations to selectively apply the concept of MDO to air superiority without an integrated joint architecture. The use of commercial space by Ukraine is an example of a precedent of such synergies in high-intensity warfare: although Ukraine did not have an indigenous military constellation, by 2025, it integrated more than 50,000 Starlink terminals to boost its C2 resiliency, and Ukrainian drone swarms achieved 85 per cent success rates against Russian armour.<sup>49</sup> However, the availability of such a constellation is subject to the political affiliations of the parties involved.

Commercial ISR offered by Maxar (30 cm resolution) and ICEYE (SAR imagery of 80 per cent of frontline targets) predicts 70 per cent of Ukrainian airstrikes, shortens targeting cycles by 40 per cent and aids the accuracy of precision munitions at 95 per cent in contested airspace.<sup>50</sup> This asymmetric balancing, which is based on partnering with other players, including SpaceX and the US Space Development Agency, shows how selective netocracy can be used to generate operational advantages. Comparatively, Chinese companies such as Galactic Energy, Land Space and state-led China Aerospace and Technology Corporation are developing reusable rockets and commercial satellite launch services. They play a role similar to US government space agencies, which Pakistan can leverage through satellite launches, joint space missions, and technology cooperation. Ukraine's cyber-space attacks, combined with satellite PNT, crippled Russian radar in 2023 operations in Donbas, according to CSIS 2025 reports. Such synergies imply equivalent potential for developing countries in regional conflicts. Netocratic participation is encouraged by indigenisation and alliances, eliminating asymmetries by improving the air warfare performance through inspired multi-domain effects, and 60-90 per cent greater precision and resilience in all situations.

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<sup>49</sup> Ron Gurantz, *Satellites in the Russia-Ukraine War* (Carlisle Barracks, PA: US Army War College Press, 2024), 38, accessed January 20, 2026, <https://press.armywarcollege.edu/monographs/971>.

<sup>50</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts*, RAND Research Report RRA2950-1 (Santa Monica, CA: RAND Corporation, 2025), 50, accessed January 16, 2026, [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html)



## Challenges and Risks

As much as the netocracy model can offer developing countries a viable way to engage in space-enabled warfare, pursuing indigenisation and forming alliances face serious technical, economic, geopolitical, normative, and operational issues. Unless these risks are mitigated, they could undermine strategic autonomy, increase tensions in the region or expose air-based operations to crippling disruptions. Thematic reviews of secondary literature reveal common trends of high barriers to entry, which disproportionately affect resource-constrained states. However, the stability of network-based space cooperation provides developing states with practical ways to mitigate these disadvantages, thus supporting the assumption that asymmetries are controllable.

The most immediate impediments to indigenisation include technical and economic barriers. Indigenous space development requires a large initial investment in R&D, infrastructure, and human capital. As an example, launching a small satellite constellation able to support persistent ISR may cost more than USD 100m, and talent is always in short supply. A 2023 study by the Observer Research Foundation found that India's ISRO faces a 30 per cent shortage of qualified space engineers.<sup>51</sup>

These risks are exacerbated by supply-chain dependencies. Most of the critical infrastructure, such as precision optics, hardened electronics, etc., comes from the US, China or Europe, which can be exploited during conflicts. These dependencies can potentially delay sovereign nodes' operational readiness by 5-10 years. Although strategic alliances provide access to critical capabilities, they can create dependency traps. For instance, India's reliance on GPS during the May 2025 war with Pakistan showed how dependency networks are susceptible to jamming and decapitation. There are also serious issues with escalation dynamics. Operations such as electronic jamming of European satellites by Russia in Ukraine or the orbital manoeuvring tests by China can create debris, so that even a single anti-satellite event can make the low-Earth orbit unusable for years.

Normative and legal restrictions add another layer of complexity. The Outer Space Treaty of 1967 also bans the use of weapons of mass destruction in space, but is unclear about traditional counter-space systems, leaving the developing states in a normative grey zone where they risk being condemned by other states or sanctions should they develop ASAT capabilities, as with India's experience with Mission Shakti in 2019. Dual-use technologies also pose a threat; even the spread of a small ISR to non-state actors could destabilise the region and exacerbate hybrid threats.

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<sup>51</sup> Kartik Bommakanti, *India's Space Policy: The Emerging Contours* (New Delhi: Observer Research Foundation, 2023), 28-32, <https://www.orfonline.org/publications/indias-space-policy-the-emerging-contours>.



Aerospace-specific disruptions raise concerns operational concerns. Satellite jamming or spoofing can reduce the accuracy of PNT by one metre to more than 100 metres, disabling the precision-guided munitions and autonomous drone navigation; simulations at RAND indicate that airstrikes would lose 70 to 80 per cent of their effectiveness in the face of sustained electronic warfare.<sup>52</sup>

Nonetheless, the argument that space cannot be accessible to developing countries is becoming untenable. The cost reduction of commercial CubeSats launched for less than USD 500,000 through rideshare and netocratic resilience shows that entry is feasible.

The process of mitigation has diversified: the idea of multi-partner alliances (e.g., BRICS along with Artemis), the investment in cyber-hardened small satellites, and the promotion of fair norms within the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) to preclude Kessler syndrome. Middle ground strategies, such as moderate indigenisation combined with networked alliances, can help developing states to overcome these pitfalls and achieve clear tactical advantages during conflicts.

## Conclusion and Policy Recommendations

In summation, this paper discussed how developing nations can use space as a force multiplier in warfare, particularly air operations, by focusing on local R&D to achieve desired autonomy, and building alliances to combine advanced orbital capabilities to offset military asymmetries and improve operational performance in contemporary conflicts. Based on the idea of the space-related netocracy that was developed by James Clay Moltz, the analysis has shown that the transition to distributed, resilient networks could provide the resource-constrained states with the available entry points to space-enabled warfare. Through thematic syntheses of secondary materials, the paper confirms the fact that the netocratic participation, as epitomised by the sovereign nodes and collaborative integrations, turns space into a realm of inclusion as opposed to a realm of orbital competition.

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<sup>52</sup> Andrew Radin et al., *Lessons from the War in Ukraine for Space: Challenges and Opportunities for Future Conflicts*, RAND Research Report RRA2950-1 (Santa Monica, CA: RAND Corporation, 2025), 23, accessed January 16, 2026, [https://www.rand.org/pubs/research\\_reports/RRA2950-1.html](https://www.rand.org/pubs/research_reports/RRA2950-1.html).



## Key Findings

The paper argues that the networked participation, as epitomised by collaborative integrations, is changing space into a realm of inclusion, rather than a realm of orbital competition. First, the shift from technocratic hierarchies to netocratic networks has democratised access, enabling developing states to obtain ISR, SATCOM and PNT capabilities without the prohibitive costs associated with major-power space infrastructures. It is a transformation that involves responding to systemic asymmetries by focusing on resilience rather than crude control, and which allows even small-scale capabilities to endure air operations when they are disrupted.

Second, indigenisation promotes sovereign agency through the development of autonomous nodes that guarantee decision-making in the contested environments; the concept of dual-use technologies as an indicator of deterrence and air defence without counterspace norms violation is demonstrated through examples like KhalifaSat in the UAE. Although not all developing states can be characterised under a single umbrella. Some developing states like India, which have the capital and capability to launch, can indigenise faster as compared to states like Pakistan, Nigeria or Brazil. It means that although indigenisation is the end goal, resource-constrained states can utilise partnerships.

For that, alliances enhance network integration, such as that between Pakistan and China, BRICS projects, offering mutual data feeds to have accurate targeting and hybrid effects. Analytically, these routes intersect in synergies which selectively inspire multi-domain operations as Ukraine exemplifies netocratic access, transforming vulnerabilities into equalisers to decrease targeting cycles and increase the efficacy of strikes. Nevertheless, the dependency traps and escalation risks also indicate that balanced strategies are required; otherwise, alliances might only entrench and not reduce asymmetries.

## Policy Recommendations

Netocratic space-enabled warfare can be a domain where developing countries can sustain and achieve desired objectives in air warfare through pragmatic and asymmetric approaches, which should be prioritised by governments and defence planners, as well as aerospace think tanks in developing countries.

1. **Prioritise dual-use R&D and talent acquisition:** Governments should invest in hybrid public-private models to build indigenous nodes, focusing on cost-effective and affordable technologies like CubeSats and remote sensing to assist military operations. This approach fosters autonomy by reducing foreign dependence. Moreover, governments should also build national space academies to stop brain drain and address talent shortages.



2. **Seek diversified and balanced partnerships:** Developing states should either engage with allied states or leverage already existing frameworks like Artemis Accords and BRICS. This netocratic practice can reduce geopolitical risks of entrapment by striking a careful balance.
3. **Promote fairness in multilateral forums:** The developing nations must become members of organisations such as the UN Committee on the Peaceful Uses of Outer Space (COPUOS) and the ASEAN Regional Forum (ARF) to necessitate and implement norms that regulate the proliferation of debris and the need to have common access to space, to protect netocratic networks.
4. **Enhance think tank role in capacity building:** Aerospace think tanks can engage in scenario-based briefs on netocratic integrations and air conflicts to inform national strategists.

The afore-mentioned recommendations highlight the opportunities of selective engagement to maximise benefits and avoid risks in netocratic partnerships, which puts space-enabled warfare as a space of opportunity to air-centric conflict indigenisation and alliances, providing asymmetric agency. This has the potential to radically change the dynamics of warfare, whereby the developing states would chieve their objectives to a considerable extent. Regional variations should be studied in the future to narrow such pathways down to finer detail.







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