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FOREWORD

In this volume of the *Journal of Aerospace & Security Studies*, readers will encounter more than scholarly discourse; they will witness the intellectual rigour that propels Research Scholars beyond the commonplace. This second volume is not merely a collection of articles but a convergence of diverse perspectives, a crucible where ideas are forged, refined, and presented with the precision demanded by the field of Aerospace and Security Studies. Each manuscript within this edition has withstood meticulous desk review and an exhaustive evaluation by subject-matter experts. This process ensures not only the delivery of well-researched and analytical content but also present a rich array of original ideas and pragmatic policy prescriptions.

Shaza Arif's exploration of India's acquisition of the S-400 from Russia delves into the geostrategic implications, challenging prevailing narratives influenced by Indian media and policymakers. Sameer Ali Khan categorises kinetic and non-kinetic ASAT weapons, examining their applicability within the framework of treaty and customary international law. Abdullah Rehman Butt conceptualises modern counter-drone systems, highlighting their impact on regional stability, while Moiz Khan analyses India's ABM capabilities and their implications on strategic stability. Beyond these technological themes, the journal's Board has selected 'International Relations' and 'Political Economy' as secondary foci. Hadeed Ashfaque's paper critically explores the persistent phenomenon of political bias in media, emphasising its far-reaching effects on societal progress and governance within the context of Pakistan's political climate.

In addition to technological insights, the Journal presents book reviews of works by influential authors like Walter

Isaacson, Tao Wang, and Josh Simons, providing a valuable reading list for anyone interested in Aerospace and Security issues.

As we navigate the complexities of global security and growing aerospace challenges, my vision for this CASS flagship publication is that it should serve as a compass, guiding us toward human-centric solutions, a deeper understanding of our world and contribute to the advancement of technologies, foster critical dialogue, and shape the trajectory of our shared global security.

I commend the Editorial Board and Scholars for their exceptional efforts, making the publication of this second volume possible. I anticipate that JASS will garner significant readership and research contributions, both domestically and internationally, in the years ahead.

Air Marshal Farhat Hussain Khan, SI(M), SBt (Retd)

President CASS, Islamabad

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India's Acquisition of S-400 Air Defence System and Pakistan's Response Options

Shaza Arif

Abstract

India's acquisition of the S-400 from Russia has stirred significant discussion in geostrategic circles globally. Touted as a groundbreaking defence asset, the S-400 is expected to amplify India's military stature, particularly as a deterrent against Pakistan. However, the prevailing Indian narrative, influenced by its media and policymakers, appears to overstate the system's actual impact in the South Asian context. Integrating and achieving optimal performance from the Air Defence System (ADS) presents India with tangible challenges. In response, Pakistan is poised to consider robust countermeasures. This paper delves into the implications of the S-400's deployment, outlines the anticipated operational hurdles for India, and explores Pakistan's potential counterstrategies.

Keywords: Defence Technology, Military Capabilities, Air Defence System, Defence Acquisition, Deterrence Strategy.

Introduction

The Russian S-400 Air Defence System (ADS) has elicited considerable attention. The ADS is claimed as one of the best in the world and is seen as superior to its Western counterparts, such as American Patriot Advanced Capability (PAC) and Terminal High Altitude Area Defence (THAAD) systems. It is engineered to intercept advanced aircraft, Unmanned Aerial Vehicles (UAVs), ballistic missiles, and cruise missiles.[1]Its recognition as a formidable defence asset is attributed to its sophisticated features, encompassing extended operational range, augmented manoeuvrability, increased velocity, and enhanced radar systems.[2] Additionally, the system offers a distinctive layered defence strategy, utilising four distinct missile types, each designed for specific operational ranges: 40km, 120km, 250km, and 400km, respectively.

The S-400 ADS gained relevance in South Asia following India's USD5.5 billion deal with Kremlin in 2018.[3] Driven by realist ambitions and hegemonic designs, India is bent on augmenting its military power in the region. The deal was seen with apprehension in Washington, and India was repeatedly asked to abandon it.[4]

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1 Peter Suciu, "Why Everyone Wants to Buy Russia's S-400 Missile System," *National Interest*, December 25, 2021, https://nationalinterest.org/blog/reboot/why-everyone-wants-buy-russias-s-400-missile-system-198329.

2 "S-400 Triumph Air Defence Missile System," *Army Technology*, February 3,2020, https://www.army-technology.com/projects/s-400-triumph-air-defence-missile-system/.

3 Franz-Stephan Gady, "India, Russia Sign $5.5 Billion S-400 Deal during Modi-Putin Summit," *Diplomat*, October 5, 2018, https://thediplomat.com/2018/10/india-russia-sign-5-5-billion-s-400-deal-during-modi-putin-summit/.

4 Vikas Pandey, "S-400: India Missile Defence Purchase in US-Russia Crosshairs,"*BBC News*, October 5, 2018, https://www.bbc.com/news/world-asia-india-45757556.

However, New Delhi went ahead with the acquisition. Subsequently, in 2021, training of Indian military personnel and technicians was conducted in Russia.[5] This was shortly followed by deliveries of the systems in November 2021,[6] brushing aside US concerns and ending all ambiguities regarding their arrival.

India's purchase of the S-400 system raised questions concerning potential sanctions under the Countering American Adversaries Through Sanctions Act (CAATSA).[7] Notably, both China[8] and Türkiye[9] faced stringent sanctions subsequent to their acquisition of the same system. While the US made it clear that a blanket waiver for India was not on the table,[10] the implementation of

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5 Snehesh Alex Philip, "Despite Covid, 100+ IAF Personnel are in Russia on S-400 Missile Training as Delivery Nears," *Print*, May 17, 2021, https://theprint.in/defence/despite-covid-100-iaf-personnel-are-in-russia-on-s-400-missile-training-as-delivery-nears/658533/.

6 Editorial, "Russia starts Missile Supplies to India despite U.S. Sanctions Risk," *Reuters*, November 14, 2021, https://www.reuters.com/world/india/russia-starts-missile-supplies-india-despite-us-sanctions-risk-2021-11-14/.

7 Manveena Suri and Steve George, "India risks US Sanctions following $5 Billion Russia Defense Deal," *CNN*, October 5, 2018, https://edition.cnn.com/2018/10/05/asia/india-s400-deal-intl/index.html.

8 Franz-Stefan Gady, "US Sanctions China over Purchase of S-400 Air Defense Systems, Su-35 Fighter Jets from Russia," *Diplomat*, September 21, 2018, https://thediplomat.com/2018/09/us-sanctions-china-over-purchase-of-s-400-air-defense-system-su-35-fighter-jets-from-russia/.

9 Jonathan Marcus, "US removes Turkey from F-35 Fighter Jet Programme," *BBC News*, July 17, 2019, https://www.bbc.com/news/world-us-canada-49023115.

10 Franz-Stefan Gady, "Senior US Official: No Blanket Waiver for India on S-400 Buy," *Diplomat*, January 10, 2020, https://thediplomat.com/2020/01/senior-us-official-no-blanket-waiver-for-india-on-s-400-buy/.

sanctions hinged on the arrival of the systems in India.[11] Ironically, these systems were delivered to India and no sanctions were levied. In fact, on the contrary, in July 2022, the US House of Representatives approved a legislative amendment granting India a waiver from punitive sanctions related to the S-400 acquisition, thereby resolving any remaining uncertainties.[12]

From a strategic standpoint, India's acquisition of the S-400 system and the subsequent diplomatic maneuvering to avoid US sanctions underscore its growing geopolitical influence and assertiveness in defence procurement. Given that China and Türkiye faced repercussions for similar acquisitions, the US decision to exempt India highlights the country's unique standing in international politics. This move will not only amplify her defensive capabilities but is also likely to shift the power dynamics in the South Asian region.

These developments significantly alter regional dynamics. Pakistan, being a primary strategic competitor of India in the region, will inevitably feel pressured to recalibrate its defence and foreign policies in light of this new acquisition to devise response strategies to mitigate the enhanced threat profile and restore balance in regional strategic stability. Consequently, prompt and innovative measures become imperative for other regional actors as well to ensure that the balance of power and strategic deterrence remain intact amidst evolving defence postures.

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[11] Snehesh Alex Philip, "US raises Russian S-400 Issue, India says it has Diversified Portfolio," *Print,* March 20, 2021, https://theprint.in/diplomacy/us-raises-russian-s-400-issue-india-says-it-has-diversified-portfolio/625459/.

[12] "US House Approves CAATSA Waiver for India's Purchase of Russian S-400 Missile Defence System," *Wire,* July 15, 2022, https://thewire.in/external-affairs/us-house-approves-caatsa-waiver-for-indias-purchase-of-russian-s-400-missile-defence-system.

The paper will briefly discuss India's potential deployment options for the S-400 ADS. It will focus on various challenges related to its effectiveness and integration. The analysis will culminate by exploring options available to Pakistan. A realist framework informs this study. The research methodology incorporated both primary and secondary sources. Open-ended interviews were conducted, and data was also sourced from journal articles, reports, newspaper articles, and online platforms. A notable limitation of this research is scarce academic content on the subject, especially in books and journals. Additionally, given the sensitive nature of their high-security roles, it was imperative to maintain the anonymity of several interviewees in the study.

Indian Deployment Options

Since the 2018 agreement with Russia, the S-400 system has garnered significant attention in the Indian media. As the country has now received the system, an examination of its deployment becomes imperative. The precise positioning of the newly procured ADS remains to be seen. As stipulated by the agreement with the Kremlin, India will acquire five S-400 systems.[13] The designated deployment locations for these systems have not been publicly disclosed; however, specific indicators may provide insights into potential deployment strategies.

Threat perception will be an important factor that will guide the deployment of the systems. The South Asian geostrategic environment is increasingly conflict-prone, where India-China and India-Pakistan rivalries shape regional dynamics. Apart from Pakistan and China, India does not regard any of its other neighbours as a major threat. Hence, in such an environment, it is

[13] Mark Episkopos, "Russia's Sale of the S-400 to India: Part of a Bigger Defense Partnership," *National Interest*, November 11, 2018, https://nationalinterest.org/blog/buzz/russias-sale-s-400-india-part-bigger-defense-partnership-35732.

likely that all five systems will be deployed against Pakistan and China. Furthermore, while India may project the notion that its strategic capabilities are driven by a two-front approach, historical analysis suggests that Pakistan has consistently been the more dominant concern in Indian strategic calculations. Consequently, one could anticipate a deployment configuration that is skewed towards Pakistan — perhaps three systems oriented towards Pakistan and two towards China. Regardless of the specific deployment plans concerning China, it is evident that the primary emphasis of these deployments is directed at Pakistan.

As reported by *India Today*, one system is already deployed against Pakistan in the Punjab sector on the western front.[14] Another system is likely to be deployed in the southern region bordering Pakistan ensuring coverage of that sector. The third system is projected to be positioned equidistantly between the first two, bridging any gaps and maximising the coverage area. Regarding China, it can be inferred that out of the two systems; one may be deployed in the Arunachal Pradesh region bordering the latter.[15]The strategic significance of Arunachal Pradesh, given the territorial disputes between India and China, further underscores the rationale for the system's deployment there. The second system is likely to be located on the north-western frontier, proximate to the Ladakh region. Notably, due to the region's geographic contiguity, a deployment near the north-western border might also serve, to some extent, as a countermeasure against Pakistan.

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[14] Manjeet Negi, "India deploys First S-400 Air Defence System in Punjab Sector," *India Today*, December 21, 2021, https://www.indiatoday.in/india/story/india-russia-s-400-air-defence-missile-system-punjab-sector-1890141-2021-12-21.

[15] Jeff Smith, "China-India Border Crisis," *Journal of Indo-Pacific Affairs* 3, no. 4 (2021): 29-33, https://www.airuniversity.af.edu/Portals/10/JIPA/IndoPacificPerspectives/June%202021/07%20Smith.pdf.

Effectiveness of the S-400 against Various Targets

After inferring its probable deployment, it is pertinent to discuss effectiveness of the system and its possible challenges. Effectiveness depends on a number of factors. One, how far the systems are deployed from the Indian border. The system is of great strategic importance, and this outweighs its operational relevance. India will certainly place the system at a distance where it is well-protected. Nonetheless, the proximity to the border at which the S-400 system is deployed hinges significantly on the specific missile variant in use. The S-400 ADS incorporates four distinct missile types, each with its respective range: the 9M96E (40km), 9M96E2 (120km), 48N6 (250km), and the 40N6E (400km). Together, these missiles provide a stratified defensive shield.[16] Within the Indian strategic discourse, considerable emphasis has been placed on the 400km range offered by the ADS, particularly the 40N6E missile. It remains to be seen whether India receives the 40N6E missile or not.

Should the S-400 ADS incorporate the 40N6E missile variant with its 400km range, it would permit the deployment of all five systems further within Indian territory. Conversely, if the 48N6 missile variant with a 250km range is procured, the strategic dynamics will shift markedly. Strategically, positioning the ADS in close proximity to the border may not align with India's interests. Such a deployment might expose the system to potential engagement by Pakistani aircraft and Unmanned Aerial Vehicles (UAVs), rendering it susceptible to direct neutralisation efforts. Moreover, the S-400 uses single engagement radar to illuminate the targets for each

[16] Stephen Bryen, "Why Russia's S-400 Anti-Air System is Deadlier Than You Think," *National Interest*, November 9, 2019, https://nationalinterest.org/blog/buzz/why-russias-s-400-anti-air-system-deadlier-you-think-94541.

battery deployed.[17] This radar, detectable during its transmission phase, is susceptible to long-range precision strikes using anti-radiation missiles or TV/LASER guided weapons. Without this crucial radar component, the functionality of the entire battery would be compromised.[18] Conversely, deployment deep within Indian territory could compromise the system's operational efficacy. These opposing considerations present a complex dilemma for Indian strategists, with implications for the systems' overall effectiveness.

Secondly, it is essential to distinguish between the advertised maximum ranges of the ADS missiles and their effective operational ranges. The nominal, or advertised, ranges may not consistently align with real-world engagement distances. Various factors, such as the Earth's curvature, reliance on ground-based radar systems, and the topographical features of the deployment area, can influence the actual effective ranges of the ADS missiles in potential scenarios.[19] The challenges of engaging a moving target are often underestimated. Effective range of S-400 missiles against manoeuvrable targets at low altitudes may be as low as 20 to 35 km.[20] In a hypothetical situation where India seeks to operationalise the 400km range capability, an aircraft would need to maintain an altitude of 70,000 feet to be detected and

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17 Robert Dalsjö, Christofer Berglund and Michael Jonsson, *Bursting the Bubble Russian A2/AD in the Baltic Sea Region: Capabilities, Countermeasures, and Implications*, report (Stockholm: FOI-Swedish Defence Research Agency, 2019), 53, https://www.foi.se/rest-api/report/FOI-R--4651--SE.

18 Ibid.

19 Usman Ansari, "Can Pakistan Counter India's New S-400 Air Defense System?" *Defence News*, January 17, 2022, https://www.defensenews.com/global/asia-pacific/2022/01/16/can-pakistan-counter-indias-new-s-400-air-defense-system/.

20 Michael Jonsson and Robert Dalsjö, *Beyond Bursting Bubbles*, report (Stockholm: FOI-Swedish Defence Research Agency 2020), 97, https://www.foi.se/rest-api/report/FOI-R--4991--SE.

intercepted by the system.[21] For aircraft operating at lower altitudes, detection ranges diminish substantially, potentially to as little as 60-70km.Consequently, an aircraft might penetrate deep into Indian airspace before detection. Such a limitation could significantly constrain the operational utility of the S-400 system.

Of paramount importance in the discourse on missile technology is the operational limitation of the ADS in the South Asian context.[22] Given the close geographical proximity between India and Pakistan, missile delivery times are markedly reduced, often amounting to mere seconds. This abbreviated delivery interval consequently diminishes the response window, thereby impeding the optimal performance of the ADS. Nonetheless, the S-400 system stands out as a significant countermeasure against aircraft operating at higher altitudes. Conversely, its efficacy diminishes substantially when confronted with low-altitude aircraft or missile threats, given its relatively constrained range in such scenarios.

Lastly, despite judicious strategic placement of the S-400 systems, inherent coverage gaps are likely to persist, particularly given the extensive span of the border. Regions outside the purview of the ADS will remain susceptible to potential assaults. Moreover, even with the deployment of all five units, vast tracts of India's southern and central territories would continue to be exposed, thus undermining the comprehensive defensive efficacy of the ADS. Consequently, any assessment of the ADS' effectiveness ought to be approached with caution, considering the myriad of influencing variables.

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21 Asim Sulaiman, interview by Arshad Sharif, *Power Play,* February 16, 2021, https://www.youtube.com/watch?v=CKIZOaWwreI&t=1671s.

22 Adil Sultan, interview by Faisal Rahman, *Views on News*, December 22, 2021, https://www.youtube.com/watch?v=aRRJYxmsNLU.

Challenges vis-à-vis Employment

Indian thinking on how it wishes to employ the system is also critical to evaluate its impact. The employment of the ADS can be offensive, defensive or a combination of both. As previously mentioned in the paper, the ADS appears to be a powerful asset and deserves due consideration. It is undoubtedly a force multiplier that will add strength to any military possessing it. However, its impact is highly exaggerated by the Indian side. Whether it is employed for offensive or defensive purposes, several challenges will be encountered vis-à-vis S-400 by the military leadership in terms of its integration and operationalisation.

The utility and function of the S-400 system ought to be understood within the broader context of an expansive defence network. Its efficacy is maximised when it operates as a component within a larger Integrated Air Defence System (IADS). Optimal performance of the ADS is intrinsically linked to its centrality in such an overarching network, necessitating a robust centralised command and control structure. Drawing from a definition provided by a USAF intelligence expert, an IADS can be characterised as the 'structure, equipment, personnel, procedures, and weapons used to counter an adversary's airborne penetration of one's own claimed territory.'[23] This intricate system seeks to synchronise disparate elements of air defence mechanisms, facilitating concurrent air surveillance, battle management, and weapons control.

Regarding the S-400, its strategic utility is predicated upon its seamless integration with other defence assets present within India, thereby amplifying the overall strength of the air defence and

[23] Peter W. Mattes, "What is a Modern Integrated Air Defense System," *Air Force Magazine,* October 1, 2019, https://www.airforcemag.com/article/what-is-a-modern-integrated-air-defense-system/#:~:text=An%20IADS%20is%20the%20%E2%80%9Cstructure,one%20Air%20Force%20intelligence%20expert.

concurrently addressing potential vulnerabilities. While India's aspirations for the S-400 hinge upon its successful incorporation into an IADS, the realisation of this objective, although feasible, represents a multifaceted and exacting challenge.

The IADS must be tailored to meet the operational demands and augment the efficacy of the tri-service components of the Indian armed forces. These three distinct services possess divergent perspectives, doctrines, and conceptualisations of warfare. Accordingly, each service employs its unique command and control apparatus, reflecting its specific operational and strategic nuances.[24] Notwithstanding the joint exercises undertaken by the tri-service components, there appears to be a marked deficit in emphasis on achieving uniformity across various domains, namely networks, operations, communication, logistics, maintenance, transport, and training.[25] Furthermore, the integration of radars, sensors, and electronic communication systems, especially in the context of the S-400, presents intricate challenges.[26] Differing beliefs and convictions pertaining to these systems can further complicate matters, potentially hindering the seamless integration of the system.

India's air defence matrix is also characterised by a multiplicity of weapon systems, underscoring its diverse origins. Beyond indigenous capabilities, the Indian inventory encompasses armaments from the United States (US), Israel, France, Europe, and Russia. The task of integrating such a heterogeneous array of systems is inherently complex, necessitating significant time, expertise, and meticulous processes. The fusion of foreign

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[24] Ashwani Kumar Sachdev, "Challenges of Integrated Air Defence," *Indian Defence Review* 36, no 2, (2021), http://www.indiandefencereview.com/news/challenges-of-integrated-air-defence/.

[25] Ibid.

[26] Ibid.

weaponry is further contingent upon the acquiescence of the respective donor nations. For instance, the US is likely to harbour reservations regarding the amalgamation of its armaments with the Russian ADS. As a result, India faces an extended timeline in surmounting these integration challenges, which, in turn, could influence the operational effectiveness of the S-400 ADS.

In a potential aerial confrontation, the battlefield becomes intricately multifaceted.[27] Dense air activity typifies such scenarios, with both allied and adversarial aircraft operating in close quarters. The airspace becomes a complex matrix, influenced not only by vertical and horizontal dimensions but also by the dynamic interplay of time and space. This intricate environment encompasses fast jets, slower helicopters, missiles, and ground-based air defence systems like the S-400. The imperative for timely information sharing across these systems cannot be overstated, as lapses in this regard can exacerbate the risk of fratricide. One pertinent case study is the unfortunate event of 27 February 2019 when an IAF missile inadvertently targeted its own Budgam Mi-17 helicopter.[28] The mishap, which resulted in the tragic loss of six Indian personnel, was attributed to an electronic recognition failure.

Within such complex operational contexts, especially when systems from different services are in close coordination, the fog of war can significantly amplify the potential for fratricide. The introduction of the S-400, with its expansive range and high-altitude capabilities, might further complicate this matrix. The likelihood of

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[27] "Challenges of Integrated Air Defence," *Air Power Asia*, April 4, 2020, https://airpowerasia.com/2020/04/24/challenges-of-integrated-air-defence/.

[28] Abhishek Bhalla, "Budgam Mi-17 Crash: IAF Chief admits Big Mistake, says our Own Missile Hit Chopper," *India Today*, October 4, 2019, https://www.indiatoday.in/india/story/budgam-mi-17-crash-iaf-chief-admits-big-mistake-1606217-2019-10-04.

such inadvertent engagements increases, especially if systems are deployed offensively, given the intricate dynamics of the battlefield.

Similarly, there are tangible risks associated with inadvertently targeting commercial airlines operating in proximate airspaces. A salient example of such a tragedy occurred in 2020 when Iran unintentionally downed a commercial aircraft belonging to Ukraine International Airlines, mistakenly identifying it as a hostile entity.

The discourse on operational failures gains further relevance in light of a revelation by the Indian Defence Ministry on 11 March 2022. They confirmed that an Indian missile was unintentionally launched into Pakistani territory due to a technical malfunction on 9 March 2022.[29] Such an incident, prima facie, underscores potential shortcomings in the operational rigor of the Indian Armed Forces. Moreover, it inevitably precipitates concerns surrounding the integration and management of more intricate weapon systems like the S-400

India's acquisition of the S-400 has been met with significant optimism, often lauded as a strategic coup with transformative implications. It is being championed as an instrumental force-multiplier, purportedly bolstering India's air defence capabilities and rendering its territory less susceptible to external aerial threats. Furthermore, the Indian government had made claims to suggest that this acquisition might grant India leverage over Pakistani airspace. However, the practical implications of deploying the system do not align perfectly with such optimistic projections. As elucidated in the preceding discussions, the deployment and operationalisation of the ADS involve intricate complexities and necessitate judicious decision-making.

[29] Ministry of Defence, "Statement of Accidental Firing of a Missile," press release, Government of India, March 11, 2022, https://pib.gov.in/PressReleasePage.aspx?PRID=1805148.

Options for Pakistan

Given its geographical proximity and long-standing geopolitical dynamics with India, Pakistan finds itself compelled to formulate countermeasures against this emergent technology, even if the ADS might be perceived as somewhat inflated in its strategic significance. Historically, in the Indo-Pak paradigm, Pakistan has consistently responded with calibrated measures to address any perceived shifts in strategic balance. The country has assiduously ensured that no unilateral action by India disturbs the regional equilibrium to its detriment. This strategic doctrine is likely to persist in the face of new challenges.

For Pakistan, the focal point of concern is not solely India's procurement of the air defence system. Rather, it is the potential for this acquisition to instil an undue sense of security among Indian policymakers. Over the past three years, following a pronounced setback against the Pakistan Air Force (PAF) on 27 February 2019,[30] India has refrained from embarking on military ventures in the region. Yet, the sustainability of this restraint remains ambiguous. Given India's historical predilection for strategic miscalculations, an augmented military capability in the forthcoming years might embolden its leadership to revert to assertive actions. In response, Pakistan must evaluate a spectrum of strategic options to recalibrate the evolving balance of power.

Pakistan has the capacity to employ both non-kinetic and kinetic strategies against the system. Electronic Countermeasures (ECMs) stand out as particularly viable tools to mitigate threats posed by the ADS. These ECMs can deploy both active and passive techniques to jam or disrupt the system's radars. This prowess was evinced by the PAF on 27 February 2019, where it adeptly utilised electronic countermeasures against Wing Commander Abhinandan

[30] Shaza Arif, "Revisiting February 27, 2019: PAF's Befitting Reply to Indian Aggression," *Regional Times*, February 24, 2020.

Varthaman's aircraft.[31] It is, however, noteworthy that the ADS may be fortified with Electronic Counter-Countermeasure (ECCM) capabilities. Yet, in the ever-evolving technological landscape, each advancement is invariably met with an equivalent or superior countermeasure. Given this dynamic, it would be prudent for the PAF to intensify its investments in cultivating more sophisticated ECMs to pre-emptively address such threats.

From a kinetic standpoint, it would be prudent for Pakistan to leverage cutting-edge technologies and innovative techniques. These might encompass saturation strategies, Unmanned Aerial Vehicles (UAVs), Multiple Integrated Reentry Targetable Vehicles (MIRVs), and hypersonic systems. Saturation, which involves inundating an ADS with more targets than it can successfully intercept, emerges as a potent counterstrategy against systems like the S-400. When faced with an overwhelming number of targets, the efficacy of any ADS is inherently compromised. Pakistan already possesses a strong arsenal of ballistic and cruise missiles which can take part in the strike package for saturation along with decoys. It should leverage its industrial capability of cruise and ballistic missile production against this threat. In 2017, Russia did not use its S-400 present in Syria to protect Shayrat air base against the American Tomahawk cruise missile strikes.[32] It is likely that the S-400 was intentionally not used given that its inability to take down some of the cruise missiles would have raised questions about its efficiency.

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31 Editorial, "Abhinandan's Jet downed because Pakistan had Jammed Communication: Indian Media," *Pakistan Today*, August 19, 2021, https://archive.pakistantoday.com.pk/2019/08/14/abhinandans-jet-downed-because-pakistan-had-jammed-communication-indian-media/.

32 Justin Bronk, "Russia's Air Defence Challenge in Syria," *Royal United Services Institute*, June 29, 2017, https://www.rusi.org/explore-our-research/publications/rusi-defence-systems/russias-air-defence-challenge-syria.

UAVs also stand out as a compelling kinetic counterstrategy. The advent of UAVs has ushered in transformative paradigms in modern warfare. While initially anchored in traditional Intelligence, Surveillance, and Reconnaissance (ISR) roles, their operational scopes have expanded considerably, encompassing a diverse array of tactical and strategic functions. Notably, their efficacy against ADS has been empirically validated in recent conflicts. In theatres such as Armenia, Libya, and Syria, UAVs demonstrated their capability to neutralise the Russian ADS effectively.[33] Turkish Bayraktar TB2 drones in particular have emerged as pivotal assets in the modern theatre of conflict. In several confrontations, most notably those aforementioned,[34] these drones have fundamentally altered the tactical landscape by effectively neutralising enemy ADS in economically efficient manners. Given this backdrop, it is imperative for Pakistan to amplify its investments in UAV technology. This can be achieved by bolstering indigenous programmes and forging strategic collaborations with allies such as China and Türkiye. Beyond their direct kinetic capabilities, UAVs offer a dual utility; they can be employed as platforms to deploy Electronic Countermeasures, thereby evading detection. Furthermore, their potential to play a central role - especially causing saturation through drone swarming techniques - accentuates their strategic significance.

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[33] Shaza Arif, "India's Acquisition of the S-400 Air Defense System: Implications and Options for Pakistan," *Journal of Indo-Pacific Affairs* 4, no.5 (2021): 40-54, https://www.airuniversity.af.edu/JIPA/Display/Article/2743750/indias-acquisition-of-the-s-400-air-defense-system-implications-and-options-for/.

[34] Shaan Sheikh and Wes Rumbaugh, "The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense," *Centre for Strategic and International Studies*, December 8, 2020, https://www.csis.org/analysis/air-and-missile-war-nagorno-karabakh-lessons-future-strike-and-defense.

The Multiple Integrated Reentry Vehicle (MIRV) technology may also be a potent counter to systems like the S-400. With the successful test of the Ababeel missile in 2017, Pakistan affirmed its capability in this domain.[35] While the S-400 boasts a high kill-ratio, this advantage can be potentially neutralised by inundating the system with numerous warheads. The inherent design of MIRVs, which features multiple warheads, can challenge the ADS' ability to effectively engage all incoming threats, thereby breaching its defences. It is crucial that Pakistan continues to reinforce this technology as a credible countermeasure against the S-400.

Additionally, hypersonic technology warrants greater research and investment. As highlighted earlier, the S-400 exhibits potential vulnerabilities, especially concerning its engagement radar. In this context, hypersonic systems can serve as pivotal tools to penetrate the protective envelope of the Indian ADS.

Historical analysis underscores that the PAF has traditionally operated with fewer numbers relative to the Indian Air Force (IAF). Yet, this numerical disparity has not impeded the PAF's exemplary performance in past engagements. In aerial conflicts, sheer numerical strength does not invariably translate to victory. Rather, the determinative factors lie in the strategic planning, the finesse of skills demonstrated, the quality of training imparted, and the tactics deployed. In this vein, it is essential for the PAF to conceptualise and implement innovative training programmes to further enhance its operational effectiveness.

Hence, contrary to prevailing Indian assertions, the ADS is not impervious to counteractions. In addressing this threat, Pakistan

[35] Debalina Ghoshal, "Pakistan's MIRV Test: Positive Development for Strategic Stability?" *South Asian Voices*, May 8, 2017, https://southasianvoices.org/pakistan-mirvs-positive-development-strategic-stability/.

ought to employ a judicious blend of emergent technologies and innovative strategies.

Conclusion

The emergence of the S-400 ADS within South Asia signals a potential paradigm shift in the security landscape. Heralded by India as a revolutionary addition to its arsenal, there is no denying the significant expectations surrounding its deployment, particularly in the context of its strategic position against Pakistan. Notably, while its deployment design by India strongly indicates a Pakistan-centric bias, the real crux of the matter is not just operational. The system, for all its purported capabilities, also casts a profound psychological shadow. However, the system's true efficacy will be measured not just by its hardware, but by intricate factors like missile choices, vulnerabilities inherent in its engagement radar, effective operational ranges, and the broader backdrop of missile technology dynamics in South Asia.

The acquisition of the S-400 system by India is emblematic of its aspirations to bolster its air defence capabilities and project greater strategic dominance in the region. However, as with any advanced system, its integration and operation come with a spectrum of challenges. Beyond the technical intricacies of melding the S-400 into an already diverse array of weaponry, India faces the equally daunting task of ensuring seamless interoperability among services with disparate doctrines and command structures. The past incidents, including unintended missile launches and unfortunate fratricides, underscore the magnitude of the challenges ahead, with potential pitfalls not just in equipment integration but also in operational doctrine and training.

Moreover, the political ramifications of integrating Russian systems with weaponry from Western nations, notably the US, add another layer of complexity to the S-400's deployment. The system's portrayal by certain Indian quarters as an unparalleled

game-changer may well risk engendering a false sense of invincibility, potentially leading to strategic miscalculations. Ultimately, while the S-400 is undeniably a formidable addition to India's defence portfolio, its efficacy will be determined as much by the strategic, technical, and diplomatic challenges it presents as by its inherent capabilities. In navigating these challenges, India will require a nuanced, multidimensional approach rather than resorting to false bravado and rhetoric, ensuring that the system's potential and its pitfalls are recognised in equal measure.

India's acquisition of the S-400 system undeniably shifts the strategic dynamics in the South Asian airspace. Yet, as history has shown, strategic imbalances are rarely, if ever, permanent. Pakistan's defence landscape is replete with examples of successful adaptations in the face of evolving challenges. In response to the S-400 deployment, a multidimensional approach that encompasses both non-kinetic and kinetic measures emerges as the most pragmatic course. By leveraging emerging technologies - ranging from advanced electronic countermeasures to hypersonic systems - and reinforcing innovative training paradigms within the PAF, Pakistan can not only counteract the perceived advantages of the S-400 but also reaffirm its commitment to maintaining regional equilibrium. Collaboration with friendly states, investment in indigenous capabilities, and an unwavering focus on strategic preparedness will remain essential as Pakistan navigates this latest defence challenge. The dynamics of the Indo-Pak rivalry once again underscore the age-old adage: It is not the weapon but the strategy and intent behind its use that ultimately determines its efficacy.

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Testing ASATs: A Critical Appraisal

Sameer Ali Khan

Abstract

Human dependence on outer space for civilian and military purposes has increased remarkably. With advancements in developments related to outer space, the threats to space operations have also increased. States are investing in offensive and defensive counter-space capabilities to establish space superiority or to prevent their adversaries from establishing the same. One of the most notable threats is the possession of anti-satellite (ASAT) weapons by the United States (US), Russia, China and India. These weapons rely on kinetic and non-kinetic means to neutralise a satellite's functions. This paper reviews existing literature to categorise kinetic and non-kinetic ASAT weapons and demonstrations of ASAT capabilities to establish possessors and non-possessors of ASAT weapons. Following that, the paper reviews varying degrees of applicability of treaty law and customary international law on the testing and employment of kinetic and non-kinetic ASAT weapons. The paper then reviews the recent developments pertaining to the ban on direct-ascent ASATs and assesses how that could potentially shift the focus from further development and testing of kinetic ASATs toward non-kinetic means.

Subsequently, it argues that as the states ban destructive ASATs and address safety considerations by reducing the potential for debris generation, they should not lose sight of the broader issue of space security for all nations which are inextricably linked with both the kinetic and non-kinetic counter-space capabilities.

Keywords: ASAT Ban, Counter-Space Capabilities, Destructive ASATs, Kinetic ASATs, Non-Kinetic ASATs, LOAC, Space Debris.

Introduction

Since the launch of Sputnik-I, the first satellite, outer space has assumed immense importance. The initial space race essentially involved only the two Cold War antagonists – the US and the former Union of Soviet Socialist Republics (USSR). Even their formative goals were to gain critical information on the other side's nuclear forces and the ability to detect and monitor the launch of nuclear-capable missiles and denied territories. Over the next few decades, space programmes evolved to incorporate earth imagery through satellites for Intelligence Surveillance, Reconnaissance (ISR), early warning, communication, navigation, and even nuclear command and control. With time, commercial and civilian uses of outer space were also explored. However, realising the advantages that space-based assets could afford on either side, the then-leading space-faring nations (the US and the former USSR) started looking at offensive and defensive counter-space options right from the beginning. Just a year after launching its first satellite in 1958, the US demonstrated its ability to destroy a satellite in 1959.[1]

While the civilian utilities of outer space are inevitably linked with commercialisation and cooperation, the military dimensions are aimed at securing an advantageous position and denying the same to the adversary.[2] Until the end of the Cold War, the US space industry was distinctly spread over military, intelligence, civilian and commercial space.[3] However, today, most countries, e.g. the US, Russia, India, China and Japan etc., have commingled space programmes, with military operations increasingly dependent on civilian or dual-use satellites. A clear contemporary global trend is

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1 Aerospace Security "Counterspace Timeline, 1959 - 2021," March 31, 2021, https://aerospace.csis.org/counterspace-timeline/.

2 United States Space Force, *Space Capstone Publication Spacepower: Doctrine for Space Forces* (Michigan: Nimble Books LLC, 2020).

3 Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 28.

that of unprecedented integration of civilian and military space programmes and assets.[4] But countries' potential employment of counter-space options creates unique challenges depending upon what counter-space means are employed.

This paper seeks to study the more generic term, 'ASATs' (for Anti Satellite Weapons) and its various types to examine their respective impact on the safety and sustainability of space operations. It then segregates the two into kinetic and non-kinetic categories. After briefly touching upon the states that have demonstrated ASAT weapons, it explores the potential for the employment of non-kinetic means to achieve military objectives. Building upon this debate, the paper examines the international law applicable to the testing and employment of such weapon systems. Based on these findings, the paper proposes a way forward for states that do not possess counter-space capabilities and are wary of how such capabilities could affect their peaceful endeavours of exploiting the space before concluding.

Counter-Space Capabilities

With an ever-increasing reliance on space-based assets for national security, states are developing their counter-space capabilities to deny adversaries an advantage. Counter-space capabilities are also known as space control capabilities which essentially allow a state to gain space superiority - the ability to use space for one`s advantage while denying the same to an adversary.[5] These capabilities have both offensive and defensive elements where the former seeks to deny the adversary an advantage in space and the latter seeks to protect one's space-based assets against such

[4] Johnson-Freese, *Space as a Strategic Asset*, 28.

[5] Małgorzata Polkowska, "Global Space Security and Counter-Space Capabilities: The Legal and Political Challenges," *Adam Mickiewicz University Law Review* 9 (2019): 101–20, https://pressto.amu.edu.pl/index.php/ppuam/article/view/21652/20786.

attempts by the adversary. A detailed CSIS study covers the various aspects of defensive counter-space capabilities.[6] However, this paper is restricted in its scope to study only offensive counter-space capabilities.

ASAT weapons are categorised under offensive counter-space capabilities. CSIS' Space Threat Assessment 2023 categorises such capabilities under four distinct categories, i.e., 1) Kinetic Physical, 2) Non-kinetic Physical, 3) Electronic, and 4) Cyber. There is merit in such a classification, and it enables studying each category concerning the potential for collateral damage, attribution, reversibility, barriers to entry, etc.[7] However, for this paper, these capabilities are divided into two broad yet distinct categories of kinetic and non-kinetic capabilities. This categorisation allows for studying these two types based on their potential for generating orbital debris[8] which can affect the civilian and military operations of states which are non-party to the conflict that eventually leads to the employment of these capabilities.

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6 Todd Harrison, Kaitlyn Johnson and Makena Young, *Defense Against the Dark Arts in Space*, report (Washington, D.C.: Center for Strategic and International Studies, February, 2021), https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/210225_Harrison_Defense_Space.pdf?VersionId=wAqLQjDIzXK84wzzWPNbU1WRYs5dnFfU.

7 Todd Harrison, Kaitlyn Johnson, Makena Young, Nicholas Wood and Alyssa Goessler, *Space Threat Assessment 2022*, report (Washington, D.C.: CSIS Aerospace Security Project, April, 2022), https://aerospace.csis.org/wp-content/uploads/2022/05/Harrison_SpaceThreatAssessment2022_WEB_v3-compressed.pdf.

8 National Aeronautics and Space Administration, "Space Debris and Human Spacecraft," May 26, 2021, https://www.nasa.gov/mission_pages/station/news/orbital_debris.html.

Kinetic ASATs

Among all the counter-space capabilities, kinetic ASATs are the oldest with the first one being tested in 1959 by the US.[9] These kinetic weapons are further divided into three sub-categories which include direct-ascent ASAT weapons, co-orbital space weapons, and ground station attacks.[10]

The direct-ascent ASAT weapons are missiles that either directly strike the target satellite or use a proximity explosion. Unlike direct-ascent ASATs, co-orbital space weapons are first placed into an orbit and later maneuvered to strike their target – these maneuverers are also known as Rendezvous and Proximity Operations (RPOs). With their potential for removal of defunct satellites and debris, and against non-friendly satellites RPOs are gaining greater significance. Ground station attacks, on the other hand, are military attacks on the earth-based infrastructure responsible for command, control, and communication with satellites.

While ground station attacks are difficult to anticipate in times of peace and do not ostensibly present the possibility of debris creation, generally such a facility is responsible for multiple satellites, and with a lack of control from the ground, the satellites could themselves become debris and pose a risk of collision with other satellites. The prospects of debris generation in the case of direct-ascent ASATs are most pronounced. States having a Ballistic Missile Defence (BMD) programme can use this capability to target satellites as has been demonstrated by the US in 2008.[11] Likewise,

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9 Aerospace Security "Counterspace Timeline, 1959 - 2021," March 31, 2021, https://aerospace.csis.org/counterspace-timeline/.

10 Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.

11 Laura Grego, *The Anti- Satellite Capability of the Phased Adaptive Approach Missile Defense System*, report (Washington, D.C.:

Indian ASAT test of 2019 involved use of India's BMD interceptor.[12] Apart from their debris-creation potential, it is relatively easier to assess possession of this capability by various states and to attribute such actions to a particular state. Moreover, the consequences or damage caused by kinetic ASATs is irreversible. Additionally, use of such kinetic means can potentially endanger employing country's own space-based assets, which should be a restraining factor. But in case of testing and employment of co-orbital space weapons, generation of debris will depend upon the techniques used.

As of 22 December 2022, European Space Agency estimated that a total of 36500 space debris objects greater than 10 cm, 10,00,000 from greater than 1 cm to 10 cm, and 130 million from greater than 1 mm to 1 cm.[13] Under the worst-case scenario, known as Kessler's Syndrome,[14] space debris could eventually make safe space operations impossible. While experts disagree over the likelihood of such an eventuality, it remains a possibility given the proliferation of counter-space capabilities and the increase in the number of actors engaging in outer space activities.

Federation of American Scientists, 2011), https://pubs.fas.org/pir/2011winter/2011Winter-Anti-Satellite.pdf.

12 Shaan Shaikh, "India Conducts Successful ASAT Test," Missile Threat, Center for Strategic and International Studies, March 28, 2019, last modified May 28, 2019, https://missilethreat.csis.org/india-conducts-successful-asat-test/.

13 European Space Agency, "Space Debris by the Numbers," December 22, 2022, https://www.esa.int/Space_Safety/Space_Debris/Space_debris_by_the_numbers.

14 Kessler Syndrome refers to a situation where debris created from one collision can set off a chain of events creating more debris while outpacing the natural course of debris decay.

Non-Kinetic ASATs

Non-kinetic ASATs include non-kinetic physical, electronic, and cyber counter-space capabilities. Non-kinetic physical counter-space capabilities could include the use of lasers, High-Powered Microwave (HPM), and detonation of nuclear weapons in space to generate an Electromagnetic Pulse (EMP) in the space to damage the on-board circuitry of the satellites.[15]

Both, the lasers and HPM, can be deployed on land, air, sea, and space. Lasers are intense beams of light that are concentrated on a target to achieve desired results of either permanent damage or rendering the target temporarily non-functional. While high-powered lasers can irreversibly damage a satellite, low-powered beams can be used to temporarily blind the onboard sensors.[16] HPM-based counter-space capabilities, on the other hand, rely on microwaves to damage a satellite's electronics, and data stored on-board, or cause the processors to restart. An HPM weapon can cause irreversible damage to satellites. In the case of lasers, the point of origin can be ascertained with a degree of reliability and attribution can be made but the HPM weapons can be employed from different angles and even nearby satellites, thereby making the issue of attribution problematic.[17] Because of the irreversible nature of damage, lasers and HPMs are otherwise categorised as physical non-kinetic counter-space capabilities and consequences of their use can closely resemble those of kinetic ASATs. Several states, including the US, Russia, India, China, Israel and France etc,

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15 Harrison, Johnson, Young, Wood and Goessler*, Space Threat Assessment 2022*.

16 Federation of American Scientists Space Policy Project, *Threats to United States Space Capabilities,* prepared for the Commission to Assess United States National Security Space Management and Organization, (Tom Wilson Space Commission Staff Member, 2001), https://spp.fas.org/eprint/article05.html#ft74.s.

17 Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.

are pursuing DEWs for different military purposes including missile defence. As these technologies mature, there is higher likelihood of these systems assuming a greater counter-space role. However, their likelihood of use will ostensibly be lesser than other non-kinetic means owing to higher costs in terms of physical damage, attribution and potential for debris generation.

The generation of EMP in outer space through nuclear detonation is the crudest counter-space capability available to all the nuclear weapon possessor states. However, this is also the riskiest approach since all the satellites in the particular region will be affected without discrimination – creating unprecedented risks of collisions and debris generation. Besides discrimination, it will also defy the other two principles of proportionality and military necessity under the Law of Armed Conflict (LOAC). Also, testing of nuclear weapons in outer space is banned under the 1963 Partial Test Ban Treaty (PTBT) to which all the nuclear weapon possessor states – except China and North Korea – are a party.[18] Given this situation, the likelihood of such an employment remains low even if it cannot be ruled out completely. Such a use is also unlikely to bode well with the broader nuclear non-proliferation regime where none of the nuclear weapon states – except North Korea – has tested their weapons since 1998 – establishing a taboo against nuclear testing.[19]

Unlike the above-mentioned non-kinetic counter-space capabilities, electronic ASAT weapons target the satellite's communication system by generating 'noise' in the same Radio Frequency (RF)

[18] United Nations, "Treaty Banning Nuclear Weapon Tests in the Atmosphere, In Outer Space and Under Water," August 5, 1963, https://treaties.un.org/doc/Publication/UNTS/Volume%20480/volume-480-I-6964-English.pdf.

[19] Daryl G. Kimball, "Preserving the Nuclear Testing Taboo," *Arms Control Association*, September 2021, https://www.armscontrol.org/act/2021-09/focus/preserving-nuclear-testing-taboo.

band. Such a weapon that interferes with the communication signals sent to the satellite are called uplink jammers while those targeting the data sent from the satellite to the ground are called downlink jammers.[20] These RFs could also be used to transmit false signals to either the satellite or the ground station. Such attacks are reversible and do not directly pose the threat of debris creation unless it results in loss of control. Moreover, the electronic counter-space means are difficult to attribute yet easier to acquire for state and non-state actors alike.

While other non-kinetic counter-space capabilities either rely on blinding/damaging the sensors or disrupting communications, cyber-attacks target the data itself and the various associated systems that use, transmit and control the flow of data.[21] Such attacks can be used to not only monitor and intercept data traffic but also to insert false data. They also find the widest range of targets including the satellite, ground stations, and end-user equipment. In some cases, the damage can be permanent if the attacker can seize control of the satellite. It is believed that this capability presents a lower barrier to entry given low resource requirements but requires a greater understanding of the functioning of the satellite and its operator.[22]

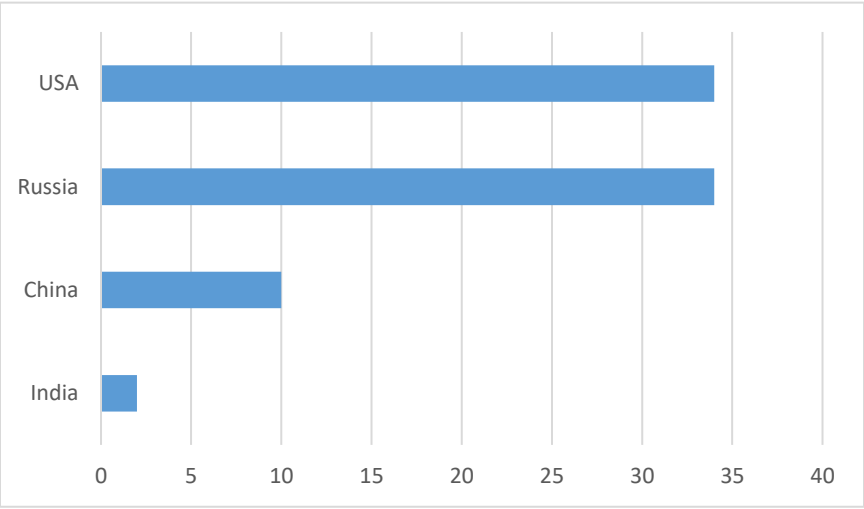
Overview of Entities with Counter-Space Capabilities

Four states – US, Russia, China, and India – have demonstrated ASAT capabilities against their satellites in the orbits. Secure World Foundation's database tracking the history of anti-satellite tests in space has recorded a total of 80 ASAT tests, including direct ascent ASATs and co-orbital, to have been conducted by these four

[20] Harrison, Johnson, Young, Wood and Goessler, *Space Threat Assessment 2022*.
[21] Ibid.
[22] Ibid.

states.[23] Both the US and Russia have tested these weapons 34 times each, while China and India have conducted ten and two such tests, respectively (see Figure 1).

Figure 1: ASAT Tests by Country



Source: Weeden, "History of ASAT Tests in Space."

The Secure World Foundation has separately catalogued the history of Robotic RPOs which are not necessarily military tests but could be seen as demonstrative of such a capability.[24] Under the category of military/intelligence RPOs, the list notes 30 such demonstrations

[23] Brian Weeden, "History of ASAT Tests in Space," *Space-Track.org*, February 8, 2022, https://docs.google.com/spreadsheets/d/1e5GtZEzdo6xk41i2_ei3c8jRZDjvP4Xwz3BVsUHwi48/edit#gid=1252618705.

[24] Kaila Pfrang, "History of Robotic Rendezvous and Proximity Operations in Space," *Space-Track.org*, May 14, 2022, https://docs.google.com/spreadsheets/d/1pHzvC-zGjF34Jrd6TdmM4odTL_MinBBoS_ld9X3jsW4/edit#gid=1782604784.

by Russia (10), the US (14), and China (6).[25] With the availability of Space Situational Awareness (SSA), such demonstrations can be monitored and attributed. In 2017, France accused Russian satellite, Luch, of espionage on a French-Italian military satellite. Previously, the same Russian satellite had performed RPOs on Intelsat's satellites, a US commercial communication company.[26] However, Russia is not alone in conducting RPOs and instances of such manoeuvres by the US and China have also been reported.[27]

While testing of laser and HPM counter-space capabilities could still be detected, albeit with difficulty, the use and testing of electronic and cyber counter-space capabilities are extremely difficult to ascertain. And hence, there are no such existing databases. However, it can still be argued that all advanced militaries could work in this direction and there will be little visibility. Electronic jamming means are widely accessible to all militaries and the cyber domain presents fairly low barriers to entry. Especially electronic jamming devices are commercially available even though these devices violate the International Telecommunication Union (ITU) convention.[28] Such devices can disrupt the onboard communication receivers of aircraft, cause degradation or total loss of communication for passenger, cargo, and humanitarian flights etc. In some cases, they can even cause

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25 Pfrang, "History of Robotic Rendezvous and Proximity Operations."

26 Kaitlyn Johnson, *Key Governance Issues in Space: Rendezvous and Proximity Operations*, report (Washington, D.C.: Center for Strategic and International Studies, 2020), https://www.jstor.org/stable/resrep26047.7.

27 Colin Clark, "US, China, Russia Test New Space War Tactics: Sats Buzzing, Spoofing, Spying," *Breaking Defense*, October 28, 2021, https://breakingdefense.com/2021/10/us-china-russia-test-new-space-war-tactics-sats-buzzing-spoofing-spying/.

28 Brian Weeden, *Radio Frequency Spectrum, Interference and Satellites Fact Sheet*, report (Washington, D.C.: Secure World Foundation, June 25, 2013), https://swfound.org/media/108538/swf_rfi_fact_sheet_2013.pdf.

radio navigation satellite services receivers to provide incorrect information to pilots and present a major safety risk.

Recently, there have been instances of Russia jamming satellite signals in the ongoing Ukraine war. After similar electronic warfare operations in its 2014 invasion of Crimea, Russia started employing similar means in 2019.[29] Russia intensified these operations through the next years[30] and in the run-up to Russia's 2022 invasion of Ukraine, the Organization for Security and Cooperation in Europe (OSCE) reported a sharp increase in jamming in 2021. OSCE's Uncrewed Aerial Vehicles (UAVs) experienced signal interference on 16 percent of flights in February, 28 percent in March, and 58 percent in April of 2021.[31] Russian employment of electronic warfare in the Ukraine war has so far resulted in a loss of ninety percent of Ukrainian drones.[32] This could be the reason behind ITU issuing a warning against use of such jamming devices, noting a sharp increase in their use.[33]

In the aftermath of Russia denying internet services in Ukraine, Starlink – a commercial internet service provider using a

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29 Michael Sheldon, "Russian GPS-Jamming Systems Return to Ukraine," *Digital Forensic Research Lab*, May 23, 2019, https://medium.com/dfrlab/russian-gps-jamming-systems-return-to-ukraine-8c4ff7d8dcb8.

30 Dana Goward, "Russia Ramps up GPS Jamming along with Troops at Ukraine Border," *GPS World*, April 21, 2021, https://www.gpsworld.com/russia-ramps-up-gps-jamming-along-with-troops-at-ukraine-border/.

31 David Axe, "Russia's Electronic-Warfare Troops Knocked Out 90 Percent of Ukraine's Drones," *Forbes*, December 24, 2022, https://www.forbes.com/sites/davidaxe/2022/12/24/russia-electronic-warfare-troops-knocked-out-90-percent-of-ukraines-drones/.

32 Ibid.

33 ITU News, "ITU Issues Warning on Interference with Radio Navigation Satellite Service," *UN Specialized Agency for ICTs,* August 23, 2022, https://www.itu.int/hub/2022/08/warning-harmful-interference-rnss/.

constellation of satellites in the LEO – filled in the void by shipping its receivers into the conflict zones. While Starlink's provision of services was seen as an altruistic measure, the US government and other European states were paying for most of the financial costs and the company warned of its inability to provide services in case the US government did not increase its financial contribution.[34] The deployment of Starlink receivers was supposedly meant for use by Ukrainian people, hospitals and schools. However, its greater adoption by the Ukrainian military force to aid their offensive drone operations soon caused the company to restrict its services. The company had to clarify that its services were 'never never meant to be weaponised.'[35] Such involvement of commercial entities in conflict zones risks making them a party to the conflict once their services are utilised for offensive military operations rather than in aid of humanitarian purposes.

Another dimension of commercial space entities operations was witnessed in case of protests in Iran. Once the Iranian government imposed internet restrictions to curb the protests – in response to the death of a girl in Iranian custody – Starlink got involved on the pretext of protecting the right to protest and freedom of expression. However, in this case it suffered serious limitations. Even as the Starlink receivers were smuggled into Iran, there were no ground stations in Iran and the communications had to rely on nearby

[34] Alex Marquardt, "Exclusive: Musk's SpaceX says It Can No Longer Pay for Critical Satellite Services in Ukraine, asks Pentagon to Pick Up the Tab," *CNN*, October 14, 2022, https://edition.cnn.com/2022/10/13/politics/elon-musk-spacex-starlink-ukraine/index.html.

[35] Joey Roulette, "SpaceX Curbed Ukraine's Use of Starlink Internet for Drones - Company President," *Reuters*, February 9, 2023, https://www.reuters.com/business/aerospace-defense/spacex-curbed-ukraines-use-starlink-internet-drones-company-president-2023-02-09/.

ground stations in Turkey, Iraq or Azerbaijan.[36] While the outcomes of Starlink's provisions of services in the desired direction remained limited, the development was used by hackers to spread malware on Iranian devices.[37] Such activism by commercial entities also raises an important issue of selective approach. While the company has been active in areas of Western concerns, similar approach seems to have been absent in other conflict areas like Indian Illegally Occupied Jammu and Kashmir (IIOJ&K) where the residents were subject to Indian government's unprecedented internet blackout for 552 days[38] but neither the commercial nor the government entities took such drastic measures to aid restoration of communication services in the disputed region.

While the Russian employment of electronic counter-space capabilities has gained prominence because of employment in the Ukraine war, the US, China, and India are also known to possess similar capabilities. The Secure World Foundation's report on 'Global Counter-space Capabilities' has identified Australia, France, Iran, Japan, North Korea, South Korea, and the United Kingdom (UK) as seven new actors with emerging counter-space capabilities or

[36] Emma Woollacott, "Starlink Terminals Smuggled Into Iran - But How Effective Can They Be?," *Forbes*, October 25, 2022, https://www.forbes.com/sites/emmawoollacott/2022/10/25/starlink-terminals-smuggled-into-iranbut-how-effective-can-they-be/?sh=329d355d1027.

[37] Maziar Motamedi, "Why Elon Musk's Starlink will not Affect Protests in Iran," *Al Jazeera*, September 26, 2022, https://www.aljazeera.com/news/2022/9/26/why-elon-musks-starlink-wont-impact-protests-in-iran.

[38] Surf Shark, "4.2 billion People Experienced Internet Censorship in 2022," *Surf Shark*, January 17, 2023, https://surfshark.com/blog/internet-censorship-2022.

programmes.[39] Of these, only Iran and North Korea are seen as hostile actors by the US and its allies.

Unlike kinetic counter-space capabilities, the use of non-kinetic counter-space capabilities is not only difficult to attribute but their possession by other states can also not be ascertained. Electronic and cyber counter-space capabilities are especially noteworthy in this regard owing to their wider availability, lower barriers to entry, and difficulty in detection and attribution. Space operations' increasing dependence on digital technologies and the use of computer networks introduces new vulnerabilities and cybersecurity threats. Orbital hacking, compromising the security of a space system through cyber means, is an exacerbating concern for space actors. In case of non-kinetic counter-space capabilities, attribution becomes a particularly worrisome issue. In the absence of clear evidence, attribution of a cyber or electronic attack to a particular actor can be complex. This highlights the need for enhanced cooperation and information-sharing between space actors to improve situational awareness and mitigation of risks posed by these capabilities.

However, the focus on banning the testing of ASATs remains restricted to kinetic counter-space capabilities. This is essentially because such a capability is easier to demonstrate and is closely linked with the issue of debris generation in outer space which is gaining wider attention – due to the growing commercial and economic relevance of outer space. Moreover, the issue of kinetic ASAT testing is also linked with the wider applicability of the LOAC and the various environmental protection laws which are now gaining prominence.

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[39] Brian Weeden and Victoria Samson, *Global Counterspace Capabilities: An Open Source Assessment,* report (Washington, D.C.: Secure World Foundation, 2022), https://swfound.org/media/207350/swf_global_counterspace_capabilities_2022_rev2.pdf.

Legality of ASATs in International Law

Most recent destructive ASAT tests by India and Russia have resulted in greater attention to the issue. India demonstrated its DA-ASAT capability in 2019 when it used a variant of its BMD interceptor, Prithvi Defence Vehicle (PDV), to destroy one of its own satellites in the LEO. Russia also tested a DA-ASAT in 2021 which resulted in significant debris creation and received wider condemnation. The driving force behind this attention appears to be the destructive and debris-creating nature of these tests. Primarily, the argument revolves around the understanding that such testing would negatively affect the sustainability of the outer space environment for peaceful purposes by making accidents in space more likely and raising the costs for space operations. In the absence of any international law explicitly banning the testing and employment of ASATs, a new treaty is considered to be the way forward.[40]

The existing space treaties do not cover the aspect of ASAT weapons and the early negotiations between the US and former USSR hit roadblocks when it came to defining ASATs, inclusion or exclusion of US space shuttles, verification of compliance and membership for such a treaty. In the absence of treaty law on the issue, it is important to consider how such actions are governed under Customary International Law (CIL) – which consists of rules that come from a general practice accepted as law and exist independent of treaty law.[41] More importantly, CIL applies to all states, unlike the treaty law that only applies to member states – the only exemption from CIL is available to states that persistently

[40] Bruce McClintock, "U.S. Decision on ASAT Testing a Positive Step Towards Space Sustainability," *RAND Corporation*, April 21, 2022, https://www.rand.org/blog/2022/04/united-states-decision-on-asat-testing-a-positive-step.html.

[41] International Committee of the Red Cross, "Customary International Humanitarian Law," October 29, 2010, https://www.icrc.org/en/war-and-law/treaties-customary-law/customary-law.

object to the newly arising norm. Professor David A. Koplow has an interesting take on the subject. In his seminal work, Koplow asserts that existing LOAC applies in the case of employment of destructive ASATs.[42] This is primarily because of three underlying reasons:

1. **Discrimination**. Under the LOAC, any use of military force has to be able to discriminate between legitimate military targets and non-combatants. While kinetic ASATs are highly capable of discriminating but their indirect or second-order effects do not retain this characteristic and resultant debris could affect civilian satellites. Moreover, satellites are becoming increasingly dual-use and cannot always be neatly distinguished.
2. **Proportionality**. Under the principle of proportionality, the attacker must consider short, medium, and long-term effects on neutral states and even nature. While the perceived value of an ASAT operation could be extremely high, it ought to be seen in relation to the potential for collateral damage – which in the case of kinetic ASATs could be extremely high.
3. **Necessity**. The principle of necessity dictates that an ASAT operation has to be indispensable in securing the prompt submission of the enemy. While a certain state's reliance on space-based assets could be very high, it remains uncertain if the destruction of its space-based assets would prompt it to submit.

These LOAC principles of discrimination, proportionality, and necessity are only applicable to the employment of kinetic ASAT weapons in times of armed conflict and hence do not govern the testing of ASAT weapons. On the issue of testing these weapons,

[42] David A Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons," *Michigan Journal of International Law* 30:1187 Summer (2009), https://scholarship.law.georgetown.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1452&context=facpub.

Koplow asserts that environmental agreements, like the 1972 Stockholm Declaration and 1992 Rio Declaration on Environment and Development, require states to ensure that 'activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond the limits of national jurisdiction.'[43] This essentially means that states could condemn such destructive tests as illegal and against the spirit of these declarations as they harm the outer space environment and affect humankind's ability to benefit from it. The recent Indian and Russian ASAT tests can be seen as a missed opportunity in this regard as the condemnations fell short of terming these actions illegal under the existing environmental laws.

It is ostensibly this scare around debris creation and sustainability of outer space that drives attention towards banning destructive ASATs rather than addressing the broader issue of space weaponisation.[44] Another associated factor could be the advanced offensive and defensive ballistic missile programmes that various countries around the world have developed. For instance, the US used its SM-3 interceptor missiles deployed on Aegis destroyers for its 2008 ASAT operation. The operation only required 'modification of the system software and could have been done from any of the 5 cruisers or 16 destroyers equipped with the Aegis system.'[45] Notably, the same missile defence capability is operated by Japan, South Korea, Poland and Romania. The US is not the only state to

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43 Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons."

44 Victoria Samson, "Breaking the Impasse Over Security in Space," *Arms Control Association*, September 2022, accessed January 27, 2023, https://www.armscontrol.org/act/2022-09/features/breaking-impasse-over-security-space#endnote01.

45 Laura Grego, *The Anti- Satellite Capability of the Phased Adaptive Approach Missile Defense System*, report (Washington, D.C.: Federation of American Scientists, 2011), https://pubs.fas.org/pir/2011winter/2011Winter-Anti-Satellite.pdf.

have such a capability, even the Indian DA-ASAT test of 2019 was an offshoot of its BMD programme.

The use of non-kinetic ASATs primarily evades the popular discourse because the capabilities are not known for causing collateral damage except in circumstances where the target satellite also escapes ground control and acts as debris itself. Moreover, non-kinetic capabilities are currently known to be only possessed by developed states (with the possible exception of Iran and North Korea). Even as these countries test, it would be difficult for others to detect and attribute in most cases. Any efforts to bring non-kinetic counter-space capabilities are also going to face the herculean task of ensuring adequate verification mechanisms. Since such capabilities are less likely to cause any collateral damage, are discriminate, and will pass the principles of proportionality and military necessity; their employment is unlikely to be seen as a violation of the LOAC.[46] Similarly, their unlikely impact on the space environment will keep them outside the ambit of international environmental laws. However, these observations will not be valid in case of non-kinetic counter-space capabilities which cause irreversible damage.

[46] Koplow, "ASAT-Isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons."

Table 1: LOAC and Use of Kinetic/ Non-Kinetic ASATs

Principles of LOAC	Discrimination	Proportionality	Necessity
Kinetic	Yes, but indirect or second-order effects.	Likely collateral damage for neutral states and their space-based assets defies proportionality.	Does not guarantee the enemy's submission.
Non-Kinetic	Yes – as long as doesn't result in debris.	As long as there's no collateral damage.	Even if it doesn't result in the enemy's submission, the absence of collateral damage can be used to build a case.

Source: Author's own.

Way Forward

Towards the end of 2020, UK pushed a resolution, 'Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours,' at the United Nations General Assembly (UNGA). The resolution recognised the challenges associated with effective verification of the space objects vis-a-vis their civilian or military utility and invited member states to inform the relevant bodies about their national space security policies, strategies or doctrines on a voluntary basis.[47] It further encouraged the member states to 'share their ideas on the further development and implementation

[47] United Nations General Assembly, "Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviours," December 16, 2020, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/354/39/PDF/N2035439.pdf?OpenElement.

of norms, rules and principles of responsible behaviours and on the reduction of the risks of misunderstanding and miscalculations with respect to outer space.'[48] The resolution was adopted by 164 votes in favour, 12 against (Bolivia, Burundi, China, Comoros, Cuba, DPRK, Iran, Nicaragua, Russia, Syria, Venezuela, and Zimbabwe), and 6 abstentions (Armenia, Belarus, India, Israel, Madagascar, Palau).[49]

The UK-sponsored UNGA resolution on responsible behaviour also stressed that, 'that the creation of long-lived orbital debris arising from the deliberate destruction of space systems increases the risk of in-orbit collisions and the potential for misunderstanding and miscalculations that could lead to conflict.'[50] However, the Russian destructive ASAT test, in November 2021, may have provided the necessary impetus for the US unilateral moratorium on destructive ASAT testing and the subsequent UNGA resolution. The US Department of Defense condemned the Russian test while calling for an end to debris-creating tests.[51] Only a few months later in April 2022, the US announced a unilateral moratorium on testing destructive ASATs.[52] Other countries, including Australia, Canada, France, Germany, Japan, New Zealand, South Korea, Switzerland,

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48 United Nations General Assembly, "Reducing Space Threats."

49 United Nations General Assembly, "75th Session, 37th Plenary Meeting," December 7, 2022, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/343/94/PDF/N2034394.pdf?OpenElement.

50 Opcit.

51 Marcia Smith, "Space Council Condemns Russian ASAT Test, DOD Calls for End to Debris-Creating Tests," *SpacePolicyonline.Com*, December 1, 2021, https://spacepolicyonline.com/news/russian-asat-test-draws-more-condemnation-from-national-space-council-dod-wants-to-end-debris-creating-tests/.

52 Daryl G. Kimball, "U.S. Commits to ASAT Ban," *Arms Control Association*, May 2022, https://www.armscontrol.org/act/2022-05/news/us-commits-asat-ban.

and the UK have also made similar commitments following the US moratorium.[53]

This approach of banning destructive ASATs is gaining global momentum reflected in the UN General Assembly's adoption of the resolution on 'Destructive Direct-Ascent Anti-Satellite Missile Testing' that received the support of 154 countries while eight countries opposed the resolution and 10 abstained.[54] Pakistan was amongst the countries that abstained from voting and questioned if the initiative added any relevance and value and to what extent it contributed 'meaningfully to the universally shared goal of preventing an arms race and placement of weapons in outer space.'[55] While the resolution is non-binding, it demonstrates the majority's preference for addressing safety-related concerns before moving to the more problematic and polarising issue of security in outer space.

The direction, that international discourse is taking, seems to be in line with RAND Corporation's assessment that safety in outer space is a more immediate concern and should be tackled as such.[56] It is appreciable that the redressal of safety concerns in outer space is

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53 Rajeswari Pillai Rajagopalan, "Why an ASAT Test Ban is Important," *Observer Research Foundation,* December 20, 2022, https://www.orfonline.org/research/why-an-asat-test-ban-is-important/.

54 United Nations General Assembly, "Approving 21 Drafts, First Committee Asks General Assembly to Halt Destructive Direct-Ascent Anti-Satellite Missile Tests in Outer Space," Seventy-Seventh Session, 27th & 28th Meetings, November 1, 2022, https://press.un.org/en/2022/gadis3703.doc.htm.

55 Ibid.

56 Bruce McClintock, Katie Feistel, Douglas C. Ligor and Kathryn O'Connor, *Responsible Space Behavior for the New Space Era: Preserving the Province of Humanity*, report (California: RAND Corporation, 2021), https://www.rand.org/content/dam/rand/pubs/perspectives/PEA800/PEA887-2/RAND_PEA887-2.pdf.

gaining momentum and could eventually evolve into legally binding instruments of international law to forbid testing of destructive ASATs that degrade the outer space environment and risk sustainability. However, this could also be the first step towards consolidating the 'haves' and 'have-nots' when it comes to the demonstration of a counter-space capability that could consolidate space superiority for the 'haves' at the cost of space (in)security for 'have-nots'. This particular approach is reflected in Indian abstention from voting but also from the analysis suggesting that India should conduct more such tests to develop a triad of ASATs (land, air, and sea-based destructive ASATs) to serve its military objectives in outer space.[57]

It remains unclear if Russia, China, and India would respect this emerging norm even if their national security considerations dictate otherwise. However, it will be difficult for a new entrant to demonstrate such a capability in the future without risking the label of 'illegal actions.' The only other option for such states (that feel threatened by their adversary's perceived space superiority) would be to move in the direction of non-kinetic counter-space capabilities. This could well be the case with states like Australia, France, Germany, Japan, South Korea, and UK joining the US-led moratorium on destructive ASATs even though they are otherwise known to be pursuing non-kinetic counter-space capabilities.[58]

There is a common factor driving these three DA-ASAT capability possessors' opposition or abstention (in case of India) and that is a preference for a legally binding treaty. Russia maintains that its proposal for PPWT and NFPWOS is a more comprehensive approach to dealing with the issue of arms race in outer space and that this particular resolution fails to achieve that. The Russian

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[57] Kartik Bommakanti, "An A-SAT Test Ban can Wait: India needs to Widen Kinetic A-SAT Capabilities," *Observer Research Foundation*, January 25, 2023, https://www.orfonline.org/expert-speak/an-a-sat-test-ban-can-wait/.

[58] Weeden and Samson, *Global Counterspace Capabilities*.

representative further highlighted that the US had already carried out the necessary ASAT tests and the resolution did not address the issue of production and development of DA-ASATs.[59] An added criticism was based on the fact that this resolution neither prevents states from employment of ASATs, destruction of existing ASAT capabilities and testing of non-kinetic ones.

China also supported the Russian position and emphasised the need for considering a legally binding arrangement to address space security issue in a comprehensive manner.[60] In an editorial, carried by China Military Online, Yang Min argues that the ban is an attempt to prevent other countries from developing similar capabilities and protecting the US satellites against the threat of space debris.[61] Unlike Russia and China, India abstained from voting on the resolution. While it shared its concern over the potential dangers arising from space debris, it highlighted Indian preference for a legally binding instrument to prevent arms race in outer space which it believed was not addressed in the resolution.[62] While Indian officials acknowledge the potential dangers of space debris, certain Indian academics believe that modernisation of the country's counter-space capabilities is essential for ensuring its space security.[63]

Russia rightly identified the critical gap that leaves non-kinetic capabilities unaddressed. But, as has been highlighted earlier, non-kinetic capabilities are difficult to demonstrate and will be ill-suited for states that want to deter their potential adversaries from the use

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59 United Nations General Assembly, "Approving 21 Drafts, First Committee Asks General Assembly to Halt Destructive Direct-Ascent Anti-Satellite Missile Tests in Outer Space."

60 Ibid.

61 Yang Min, "Why US Bans Direct Ascent Anti-Satellite Missile Test?," *China Military Online*, December 22, 2022, http://eng.chinamil.com.cn/view/2022-12/21/content_10207040.htm

62 Opcit.

63 Bommakanti, "An A-SAT Test Ban can Wait."

of counter-space capabilities. States wary of their adversary's counter-space capabilities are more likely to move in the direction of developing and employing non-kinetic capabilities which are neither seen as violating the LOAC nor as threatening the sustainability of outer space. Under these factors and limited abilities of detection and attribution, such capabilities are more likely to be employed in times of peace and war – thereby increasing the likelihood of warfighting in outer space.

While banning destructive ASATs could be a useful first step, it should not be the last. It should incrementally lead to greater communication, engagement, and transparency to build trust and confidence among the various stakeholders. An environment of trust should then enable progress toward security agreements as safety issues are addressed.

Conclusion

The distinction between kinetic and non-kinetic counter-space capabilities is instructive in the sense that the former, also referred to here as DA-ASATs, is older, easily identifiable and an attributable capability. Because of its pronounced potential for debris generation and risking the sustainability of outer space for peaceful purposes, DA-ASAT capabilities have gained greater public attention. This focus is reflected in the UNGA resolution banning DA-ASAT testing. With the UNGA resolution, albeit non-binding, it appears that the era of destructive ASAT weapons testing may be coming to an end with a greater focus on the risks that they pose to the sustainability of outer space. The instruments of international law are catching up to declare such testing as illegal. Of the four possessors of destructive ASAT capabilities, only the US has committed to banning these. Even though the US commitment is shared by nine more like-minded states (Australia, Canada, France, Germany, Japan, New Zealand, South Korea, Switzerland, and the UK), the three other possessors (Russia, China, and India) have not indicated such intentions. Nonetheless, if these holdouts

do not resume testing of destructive ASATs, the norm of non-testing is likely to consolidate. Eventually, there could be a treaty law with verification and implementing mechanisms to outlaw the testing of destructive ASATS.

However, as DA-ASATs are banned, the next issues to be addressed are those of space security and weaponisation since DA-ASATs are not the only threat to sustainable space operations. Banning DA-ASAT weapons only addresses a singular aspect of space security. As has been discussed, even in case of employment of non-kinetic counter-space capabilities like lasers and HPMs, there are risks of debris creation in case of irreversible damage or permanent loss of control over a satellite. Failing to comprehensively address the issue of space security would only exacerbate security dilemmas for various states.

The motivations to gain space superiority, or deny an adversary the same, would push states in the direction of non-kinetic counter-space options as demonstration of DA-ASAT capability becomes difficult in the wake of emerging opposition to such tests. While, in most cases, such options reduce the potential for collateral damage and debris creation, they carry an inherent lack of transparency. Moreover, limitations with detection and attribution make such weapons more likely to be used. Unlike destructive ASATs, their employment in conflicts is also unlikely to be hindered by the LOAC.

As the world moves to ban certain categories of weapons (destructive ASATs in this case), it should not increase motivations for states to develop other categories of weapons (non-kinetic ASATs). Unless the issues of space security and weaponisation are addressed satisfactorily, the situation could result in the perpetual establishment of ASAT haves and have-nots. Such an approach has failed in case of the nuclear non-proliferation regime where states have developed their own nuclear weapons capabilities to serve their national security interests irrespective of the established non-

proliferation norms. If history is any guide, replication of such an approach in the domain of outer space is unlikely to serve collective security concerns when it comes to outer space.

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Conceptualising Counter-Drone Systems: A New Arms Race in South Asia

Abdullah Rehman Butt

Abstract

In contemporary times, drones have evolved into an essential tool of modern warfare and a rapidly growing element of airpower. Drones of varying sizes, speed, types, and capabilities are being used by modern militaries for a variety of roles. The manifestation of novel concepts like 'Loyal Wingman' and 'Swarming' has further added to their lethality. Hence, defending against such credible threats has become a complex as well as daunting task for the militaries of this era. This raises the need for appropriate air defence systems to detect and, if required, bring down unauthorised drones. Their massive proliferation in both civil and security domains, as well as existing gaps in aerial defence systems, are the fundamental drivers of the tremendous development of the market for counter-drone systems. This paper aims at conceptualising modern counter-drone systems, as well as their threat mitigation process and capabilities. It also intends to provide insight about how Indian acquisitions in this domain are triggering an arms race in South Asia which would have serious consequences for regional stability.

Keywords: C-UAS, Counter-Drone Systems, Arms Race, Strategic Stability, India-Pakistan.

Introduction

In contemporary times, drones—also called Unmanned Aerial Vehicles (UAVs), Unmanned Aerial Systems (UAS), or Remotely Piloted Vehicles (RPVs) — have evolved into an essential tool of modern warfare and a rapidly growing element of airpower. The idea of UAVs was first adopted by the Austrian military when they employed unmanned balloons packed with explosives to strike enemy positions in Venice in 1849.[1] Since then, they have been used for different roles in various military campaigns around the world including both World Wars, Vietnam War, Gulf War, Iraq War, Operation Enduring Freedom, Nagorno-Karabakh War, and more recently in the Russia-Ukraine War.[2] During the late Twentieth Century, development of UAVs witnessed unprecedented growth as improvement in technology matched with the idea of uninhabited aircraft and rendered massive horizontal and vertical proliferation of these systems.

For instance, between 2002 and 2010, the United States (US) military's fleet of UAVs grew forty-fold,[3] driven by the wars in Afghanistan and Iraq, where they were used for surveillance, reconnaissance, and later, for targeted strikes. Since the 1990s, UAVs have become an integral part of US military operations, with various types being employed, such as the MQ-1C Gray Eagle, MQ-9 Reaper, MQ-25 Stingray, RQ-4 Global Hawk, MQ-4C Triton, and RQ-170 Sentinel. These developments indicate a steady increase in the use and complexity of UAVs in military operations. While exact numbers have varied over the years, there has been a clear

1 Kashyap Vyas, "A Brief History of Drones: The Remote Controlled Unmanned Aerial Vehicles (UAVs)," *Interesting Engineering*, June 29, 2020, https://interestingengineering.com/a-brief-history-of-drones-the-remote-controlled-unmanned-aerial-vehicles-uavs.

2 Jonathan Marcus, "Combat Drones: We Are in a New Era of Warfare - Here's Why," *BBC News*, February 4, 2022, sec. World, https://www.bbc.com/news/world-60047328.

3 John Hill and Ann Rogers, *Unmanned: Drone Warfare and Global Security* (London: Pluto Press, 2014).

trend of increasing quantities. For instance, the MQ-1 Predator, which was one of the first widely used UAVs by the US military, saw its numbers grow significantly in the first decade of the 2000s before being phased out for more advanced models. The number of other countries possessing UAVs (with diverse capabilities) has hiked up to more than 95.[4] The Indian Armed Forces have operated over 200 Medium Altitude Long Endurance (MALE) Searcher and Heron UAVs of Israeli origin, along with a few HAROP UAVs recently inducted by the Indian Air Force (IAF). These UAVs have been essential for surveillance along India's borders and coastal areas, and they have seen service in various regions, including Indian Occupied Jammu and Kashmir and the Sino-Indian border. The Indian Armed Forces plan to induct 5,000 UAVs in the next ten years, marking a substantial increase and demonstrating the growing role of UAVs in modern military strategy. This expansion reflects the increasing importance of UAVs as force multipliers.

Now, UAVs of varying sizes, speed, types, and capabilities are being used by modern militaries for a variety of roles including ISR (for real-time data collection, target identification, greater battlefield awareness), attack (air-to-air and air-to-ground precision strikes, SEAD and DEAD missions[5]), and combat support

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4 Dan Gettinger, *The Drone DataBook* (New York: Center for the Study of the Drones, Bard College, 2019), https://dronecenter.bard.edu/files/2019/10/CSD-Drone-Databook-Web.pdf.

5 SEAD (Suppression of Enemy Air Defences) missions involve the use of specialised aircraft and weapons to suppress or destroy enemy air defence systems such as radar and surface-to-air missile sites. These missions are typically conducted at the beginning of a larger air campaign to ensure that friendly aircraft can operate safely and effectively in the airspace. DEAD (Destruction of Enemy Air Defences) missions are similar to SEAD missions but involve a more aggressive approach, often involving larger-scale attacks on enemy air defence systems with the goal of completely destroying them. These missions

(electronic warfare, early warning, communication relay, search and rescue missions, logistics, training).[6] Relentless advances in this domain and related technologies, low production and in-service costs, easy and effective deployability, precision in both navigation and attack capabilities, and integration with Artificial Intelligence (AI) have transformed them into a significant conventional war-fighting asset for states. For example, in their defence budget for fiscal 2025, the US government is planning to allocate USD 1 billion to create a hedge portfolio for drones with AI capabilities under a newly introduced 'Replicator' programme. For fiscal 2024, the US Department of Defense (DoD) has sought USD 1.8 billion specifically for AI projects. As of 2021, it was supervising over 685 AI-related initiatives.[7]

The manifestation of novel concepts like 'Loyal Wingman'[8] and 'Swarming'[9] has further added to their lethality and given a boost to investments in this technology around the globe. 'Loyal Wingman' drones are being developed by the US to fly alongside expensive new jets like the F-35 with plans for 1,000 of these

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may be conducted as part of a larger offensive campaign, or in response to a specific threat or incident.

6 National Research Council, *Autonomous Vehicles in Support of Naval Operations* (Washington, D.C: The National Academies Press, 2005), https://doi.org/10.17226/11379.

7 Noah Robertson, "Pentagon Unveils 'Replicator' Drone Program to Compete with China," *Defense News*, August 28, 2023, https://www.defensenews.com/pentagon/2023/08/28/pentagon-unveils-replicator-drone-program-to-compete-with-china/.

8 Garrett Reim, "US Air Force 'Commits' to Fielding Loyal Wingman UAVs," *Flight Global*, December 11, 2021, https://www.flightglobal.com/military-uavs/us-air-force-commits-to-fielding-loyal-wingman-uavs/146802.article.

9 David Hambling, "What Are Drone Swarms and Why Does Every Military Suddenly Want One?," *Forbes*, March 1, 2021, https://www.forbes.com/sites/davidhambling/2021/03/01/what-are-drone-swarms-and-why-does-everyone-suddenly-want-one/.

'collaborative combat aircraft' in 2024.[10] 'Loitering munitions' — drones that can circle the battlefield and divebomb targets on their own — are being developed by numerous countries, and have already seen combat in Libya, Armenia and Ukraine.[11] Hence, defending against such credible threats has become a complex as well as daunting task for militaries of this era. Resultantly, technologies to counter them will become a vital and omnipresent weapon for states in future conflicts.[12]

Apart from rapid adoption in the military domain, the commercial sector has also witnessed an exponential growth of small UAVs and their applications during the last few years. Resultantly, they are getting more sophisticated, cheaper, and easily available for everyone in the civil sector. While this unlocks more options for beneficial usage, it also gives space to malevolent actors to employ these capabilities for illicit activities. Likewise, non-state actors, as well as terrorist groups, are increasingly using commercially available small drones as a weapon of choice for their desired purposes, with varying degrees of success.

The ever-increasing traffic of civil drones is also posing some serious challenges for Air-Traffic Management Systems around

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10 Stephen Losey, "US Air Force eyes Fleet of 1,000 Drone Wingmen as Planning Accelerates," *Defense News*, March 8, 2023, https://www.defensenews.com/air/2023/03/08/us-air-force-eyes-fleet-of-1000-drone-wingmen-as-planning-accelerates/.

11 Eva Dou and Gerrit De Vynck, "Pentagon Plans a Drone Army to Counter China's Market Dominance," *Washington Post*, December 1, 223, https://www.washingtonpost.com/technology/2023/12/01/pentagon-drones-replicator-ukraine/.

12 Arthur Holland Michel, *Counter Drone Systems*, report (New York: Center for the Study of the Drone, Bard College, December 2019), https://dronecenter.bard.edu/files/2019/12/CSD-CUAS-2nd-Edition-Web.pdf.

the world.[13] As a result, the proliferation of small Commercial Off-The-Shelf (COTS) UAVs poses a substantial threat to both the safety and security of civilians as well as military installations.[14] For instance, in 2019, a drone sighted near Gatwick Airport in the United Kingdom (UK) affected the schedule of 1000 national and international flights.[15] A similar incident happened in Germany in May 2019 and March 2020, when several flights were cancelled and diverted after small drones appeared near Frankfurt Airport.[16] In 2019, a drone strike on a Saudi oilfield disrupted the production of 5.7 million barrels of crude oil, causing major disruptions in global fuel supplies.[17]

All these asymmetric threats and aforementioned factors raise the need for appropriate Air Defence Systems (ADS) to detect and, if required, bring down unauthorised drones. Conventional air defence systems employed to defend against traditional aerial threats have limitations against small, slow-moving, low-flying UAVs.[18] For instance, a simple drone entered Israel from Syria and

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13 Zsolt Sándor, "Challenges caused by the Unmanned Aerial Vehicle in Air Traffic Management," *Periodica Polytechnica Transportation Engineering* 47, no. 2 (2019): 96–105, https://doi.org/10.3311/PPtr.11204.

14 Thomas G. Pledger, *The Role of Drones in Future Terrorist Attacks*, report (Association of the United States Army, February 2021), https://www.ausa.org/sites/default/files/publications/LWP-137-The-Role-of-Drones-in-Future-Terrorist-Attacks_0.pdf.

15 Justin Rowlatt, "Gatwick Drone Attack Possible Inside Job, Say Police," *BBC News*, April 14, 2019, sec. UK, https://www.bbc.com/news/uk-47919680.

16 "Frankfurt Flights Suspended Twice for Drone Sightings," *Reuters*, March 2, 2020, sec. Industrials, https://www.reuters.com/article/us-germany-airport-drone-idUSKBN20P1O8.

17 Associated Press, "Drone Attack on World's Largest Oil Processing Site Sparks Huge Fire," *NBC News*, accessed March 26, 2022, https://www.nbcnews.com/news/world/drone-attacks-world-s-largest-oil-processing-site-oil-field-n1054511.

18 Michel, *Counter Drone Systems*.

survived one air-to-air attack as well as two patriot missiles fired at it.[19] Traditional military radars, likewise, only detect larger aircraft as compared to the smaller drone. Besides, because drones are cheaper, it is not viable to take them down with exorbitantly expensive conventional anti-aircraft capabilities.[20]

Contemplating all these issues, states have started adopting dedicated systems to counter the threats posed by drones in both civil and military domains, which are based upon a combination of modern detection and mitigating capabilities.

Multiple state and non-state entities started to research and develop these systems right at the start of the Twenty-first Century. For instance, NATO and RAND Corporation launched two separate studies, in 2003 and 2008 respectively, to find possible solutions to defend against drone threats.[21] Today, hundreds of counter-drone systems by government-owned and private companies are available in the global market. The massive proliferation of drones in both the civil and security sector, as well as existing gaps in aerial defence systems, are the fundamental drivers of the tremendous development of this market. A report by Market Research Future indicates that this market is estimated to reach USD 4,754.2 million from USD 826.4 million with a Composite Annual Growth Rate (CAGR) of 24.7%.[22] There used to

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19 Ilan Ben Zion, "IDF Fails 3 Times to Bring down Drone over Golan," *Times of Israel*, July 17, 2016, http://www.timesofisrael.com/idf-we-tried-and-failed-3-times-to-bring-down-drone-over-golan/.

20 Andrew Liptak, "A US Ally Shot down a $200 Drone with a $3 Million Patriot Missile," *Verge*, March 16, 2017, https://www.theverge.com/2017/3/16/14944256/patriot-missile-shot-down-consumer-drone-us-military.

21 "Counter Drone Systems: Military Sector," DABIN Systems, accessed March 27, 2022, http://www.dabinsystems.com.

22 "Counter-UAS Market by Size, Share, Segments, Trends and Forecast 2027," Market Research Future, February 2021, https://www.marketresearchfuture.com/reports/counter-uas-market-7430.

be only 12 dedicated counter-drone systems available around the globe till 2015.[23] However, since then, data indicates that there are now more than 537 systems available in the market developed by 277 companies around the world in partnership with 38 state entities.[24]

Although, these defence systems are more effective and efficient than the traditional ones, however, they are much more expensive as well.[25] Still many modern militaries are acquiring as well as deploying them and have triggered an arms race in this area at both global and regional levels. This arms race has also hit the South Asian region where India is investing heavily in both offensive and defensive capabilities for drone warfare. This has some serious destabilising effects on regional stability and the strategic environment that is shaped by the conflicting interests of two nuclear neighbours, India and Pakistan. This paper aims at conceptualising modern counter-drone systems, as well as their threat mitigation process and capabilities. It also intends to provide insight about how Indian acquisitions in this sphere are likely to trigger an arms race in South Asia which would have serious consequences for regional stability.

Conceptualising Counter-Drone Systems

Counter-drone systems are a state-of-the-art development in the domain of advanced military technology in the Twenty-first Century. These systems, also known as C-UAV, or C-UAS, are a

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23 Gabriel Carisle Birch, John Clark Griffin and Matthew Kelly Erdman, *UAS Detection Classification and Neutralization: Market Survey 2015*, report (Albuquerque: Sandia National Lab, July 2015), https://doi.org/10.2172/1222445.

24 Michel, *Counter Drone Systems*, 6.

25 Jen Judson, "Pentagon Wants a Cheap, Ground-Launched and Hand-Held Counter-Drone Capability," *Defense News*, May 10, 2021, https://www.defensenews.com/pentagon/2021/05/10/pentagon-wants-cheap-ground-launched-and-handheld-counter-drone-capability/.

combination of sophisticated methods and technologies that enable the effective detection and/or disabling of hostile unmanned aircraft.[26] In an era when drones are becoming a weapon of choice for both states and non-state actors, counter-drone systems can be employed against various threats. During a military conflict, C-UAS can be utilised to defend naval assets, air force bases, ground troops, and military convoys. While during peace times, these can be used to protect sensitive installations, critical infrastructure, large public gatherings, and also for border monitoring purposes.[27] For a better understanding of the working of C-UAS, it is necessary to take the types of hostile drones and the categories of threats posed by them, into consideration.

Types of Drones

There exists no globally recognised definition of drones, and their various types are difficult to discern because of their overlapping roles and characteristics.[28] However, the US DoD has divided drones into various groups based on their size, speed, weight, operating altitude, and speed. These details are given in Table 1:

[26] Michel, *Counter Drone Systems*.
[27] "Tech Area of Interest: Installation Counter Unmanned Aerial Systems (CUAS)," *DefTech*, March 11, 2019, https://deftech.nc.gov/blog/2019/03/11/tech-area-interest-installation-counter-unmanned-aerial-systems-cuas.
[28] M.J. Armitage, *Unmanned Aircraft* (London: Brasseys, 1988).

Table 1: Classification of Drones

UAV Group	Size	Weight Range (lbs)	Speed (knots)	Operating Altitude
Group 1	Small	0-20	100	<1200 Above Ground Level (AGL)
Group 2	Medium	21-55	<250	<3500 AGL
Group 3	Large	<1320	<250	<Flight Level (FL) 180
Group 4	Larger	>1320	Any	<Flight Level (FL) 180
Group 5	Largest	>1320	Any	>FL 180

Source: Paul G. Fahlstrom and Thomas J Gleason, "Classes and Missions of UAVs," in *Introduction to UAV Systems*, 4th ed. (New York: Wiley, 2012), 312, https://www.wiley.com/en-us/Introduction+to+UAV+Systems%2C+4th+Edition-p-9781119978664.

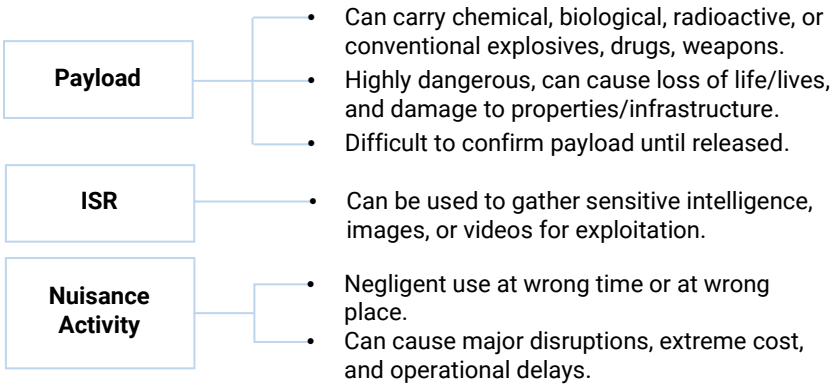
Counter-drone systems face significant challenges in dealing with Group 1 and 2 UAVs listed in Table 1, primarily due to their small size/speed, which makes them difficult to detect and neutralise. Moreover, they are also cheaper and easily available to criminals and non-state entities. These drones can be further categorised into two classes based on their design: Multi-Copter and Fixed-Wing. With low speed and vertical take-off ability, multi-copters are easy to operate and have better manoeuvrability. While fixed-wing drones have more range and fly at higher speed with low manoeuvrability.[29]

[29] Armitage, *Unmanned Aircraft*.

Categories of Threats posed by Drones

The threats posed by drones can be classified into three broader categories: Payload Delivery, ISR, and Nuisance Activity.

Figure 1: Categories of Threats



Source: "C-UAS Factbook, AI-enabled Multi-Mission Solutions," *DroneShield*, accessed March 27, 2022, https://www.droneshield.com/cuas-factbook.

Counter-drone systems must cater to all these threats posed by an individual drone or drone swarms. Drone swarms can be defined as '6 or more drones exhibiting cooperative and/or autonomous behaviour.'[30]Swarming effects are being achieved by integrating AI and Machine Learning (ML) algorithms with the UAS to enhance their efficiency and reach for automated and decentralised missions.[31] Multiple drones coming from various

[30] "Tech Area of Interest: Installation Counter Unmanned Aerial Systems (CUAS)."

[31] Choon Seng Tan, Douglas L. Van Bossuyt and Britta Hale, "System Analysis of Counter-Unmanned Aerial Systems Kill Chain in an Operational Environment," *Systems 9*, no. 4 (December 2021): 79, https://doi.org/10.3390/systems9040079.

directions can pose serious challenges for counter-drone systems to detect and defeat the whole swarm simultaneously.

Counter-Drone System Processing Chain

Countering an unauthorised drone is a multi-stage process that involves real-time coordination between various systems and their operator. The US Department of Homeland Security describes a counter-drone system processing chain as 'a framework for approaching the potential threat posed by the UAS.'[32] This processing chain resembles the US Air Force's general targeting dynamic kill chain, i.e., 'Find, Fix, Track, Target, Engage, and Assess' (F2T2EA),[33] but is less complicated. The steps involved in this processing chain are shown in Figure 2:

Figure 2: Counter-Drone System Processing Chain

Source: Patel and Rizer, "Counter-Unmanned Aircraft Systems Technology Guide," 13.

Detection

First of all, an unauthorised drone needs to be detected by the sensors of a counter-drone system. Following distinct sensors (or their combination) can be used for detection purposes:

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[32] Bhargav Patel and Dmitri Rizer, "Counter-Unmanned Aircraft Systems Technology Guide," (paper, National Urban Security Technology Laboratory, U.S. Department of Homeland Security Science and Technology Directorate, New York, September 2019), https://www.dhs.gov/sites/default/files/publications/c-uas-tech-guide_final_28feb2020.pdf.

[33] "Air Force Doctrine Publication 3-60: Targeting," (U.S. Air Force, November 12, 2021), https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-60/3-60-AFDP-TARGETING.pdf.

Video Detection: Drone attacks can be detected by using high-resolution cameras and securing a visual record of relevant developments. These cameras are largely standard daylight cameras with optical sensors of thermal or infrared imaging. They help provide visualisation of a flying drone and its potential payload. The images gathered can also be used as forensic evidence in prosecution matters.[34] One of its drawbacks is that it cannot be independently used for detection and has high false-alarm rates. Plus, these cameras become highly unreliable in the dark, fog, and other extreme weather conditions.[35]

Audio Detection: Audio detection is also an important method through which unmanned aircraft are detected by C-UAS. A drone produces a specific sound whose frequency can range from 400 hertz (Hz) to 8 kilohertz (kHz). This technique employs numerous microphones which enable identification of the distinct acoustic signature of micro unmanned aircraft. The signal detected is later compared with the information already stored in a database. If more sets of microphones are used, triangulation can take place. This technology can detect every single drone within a near field including those flying without emitting RF emissions. It is also efficient in detecting drones in the ground clutter, which remains undetectable by using other technologies. It is mobile, deployable, as well as passive and can fill gaps in those areas which are usually not detected by other sensors. One of its drawbacks is

[34] Argyrios Georgiou, Peter Masters, Stephen Johnson and Luke Feetham, "UAV-Assisted Real-Time Evidence Detection in Outdoor Crime Scene Investigations," *Journal of Forensic Sciences* 67, no. 3 (2022): 1221-1232, doi:10.1111/1556-4029.15009.

[35] Robin Radar Systems, "10 Counter-Drone Technologies to Detect and Stop Drones Today," accessed March 28, 2022, https://www.robinradar.com/press/blog/10-counter-drone-technologies-to-detect-and-stop-drones-today.

that it cannot work in a noisy environment and has a short range of 300 to 500 metres.[36]

Radio Frequency Detection (RFD): A C-UAS employs a sensor system that locates, identifies, and detects the presence of a nearby unmanned aircraft by matching the frequencies with which that drone operates. The altitude of a drone, the GPS coordinates of both the drone and the pilot handling it, and another unique identifier are identified through RF detection. During the process, one or more antennae are employed to receive radio waves and a processor is used to examine the RF spectrum. The information gathered is used to draw up the conversation between the drone and its handler. Through RF detection the Media Access Control (MAC) addresses can also be detected. As a result of which, drones operated through telecommunication devices or Wi-Fi can also be detected. In addition to acting as an anti-drone system, RFD is also used in prosecution matters, by producing a link between a drone and its controller. By using multiple radio units, some advanced systems can triangulate the drone along with its pilot and detect its possible manoeuvring. It is cost-effective and can identify various drones and their controllers simultaneously. However, some of its drawbacks include at times failure to locate and track drones. As it often fails to detect autonomous drones, it is also not very effective in crowded RF areas and is confined to a short-range.[37]

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[36] Sara Al-Emadi, Abdulla Al-Ali and Abdulaziz Al-Ali, "Audio-Based Drone Detection and Identification Using Deep Learning Techniques with Dataset Enhancement through Generative Adversarial Networks," *Sensors* 21, no. 15 (July 21, 2021): 4953, https://doi.org/10.3390/s21154953.

[37] Huan Lv, Fang Liu and NaiChang Yuan, "Drone Presence Detection by the Drone's RF Communication," *Journal of Physics: Conference Series* 1738, no. 1 (January 1, 2021): 012044, https://doi.org/10.1088/1742-6596/1738/1/012044.

Infrared Detection: Infrared detectors detect the heat signature of a drone produced by its fuel combustion or by its electric circuits. This detection method is suitable for detecting small drones, especially at night-time.[38]

Radar-based Detection: As drones are small, low-flying aircraft, a radar system usually fails to detect them, so if the radar is specifically designed with a high resolution and 3D tracking function, it can successfully detect small-scale drones. It is through radio signatures of small, unmanned aircraft that a C-UAS detects their presence. These radio signatures are produced when the unmanned aircraft comes across the radio frequency waves emitted by the detection device. A C-UAS uses algorithms to detect drones and this professional function enables it to spare other low-flying objects, like birds. This method uses radio energy to detect an object by giving out a signal and then receiving its reflection. By this, the drone detection radar measures the direction, position, and distance of the drone. A radar system does not pick up small objects and its radio signals are mostly designed for larger and faster objects, like aircraft. One of its strengths is its long-range, constant tracking ability, power to detect multiple targets simultaneously. Unlike video detection, it works independently of visual conditions and bad weather. One of its drawbacks is that it is the drone size and speed on which its detection range depends, and at times, it fails to distinguish a drone from a bird which can result in serious accidents.[39]

The majority of counter-drone systems available in the market use multiple detection methods simultaneously — also called Layered

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[38] Petar Andraši, Tomislav Radišić, Mario Muštra and Jurica Ivošević, "Night-Time Detection of UAVs Using Thermal Infrared Camera," *Transportation Research Procedia* 28 (January 1, 2017): 183–90, https://doi.org/10.1016/j.trpro.2017.12.184.

[39] 911 Security, "Radar Drone Detection: Can Drones Be Detected Using a Radar?," accessed March 28, 2022, https://www.911security.com/en-us/knowledge-hub/drone-detection/radar.

Detection Mechanism — for effective detection of threats. The layered approach provides credible detection solutions against an attack launched by drones of different types and specifications. However, it significantly increases the cost of the systems.

Tracking

Multiple detection methods and sensors are used to detect a threat and also provide auxiliary data of the detected drone as well as track its continuously changing location. A track can be defined as 'a compilation of location reports over a period of time.'[40] Tracks can be in the form of quadrant alerts or a heat map display.

Identification

The identification stage includes the classification and assessment of the intent of the detected drone. The system analyses the data and the track provided by the detectors and decides, whether it is a threat or not, with the assistance of the C-UAS operator. However, the integration of AI, big data, and ML with modern counter-drone systems has made them independent of human assistance.[41] After the identification of a threat, the system disseminates the signal to available response options to counter it.

Target Engagement

There are two types of target engagement measures available in counter-drone systems — Kinetic and Non-Kinetic.

[40] Patel and Rizer, "Counter-Unmanned Aircraft Systems Technology Guide."

[41] Tan, Van Bossuyt and Hale, "System Analysis of Counter-Unmanned Aerial Systems Kill Chain in an Operational Environment."

Kinetic Measures: Kinetic measures also called 'hard-kill' options employed to counter hostile drones generally involve some sort of direct physical acts designed to eliminate or lower the incoming threat. These include High Power Microwave (HPM) Devices, High-Energy Lasers, Drone Catchers, and Conventional Ammunition.

HPM devices generate an Electromagnetic Pulse (EMP) that can ultimately lead to the disruption of electronic devices carried by the drone. The electronic circuitry in drones is disrupted and destroyed when the EMP interferes with radio links.[42] There are, however, many risks involved in the use of HPM devices. For instance, their cost is exorbitantly high, and they always run a risk of disrupting other electronic devices in the area where they operate. In some cases, they switch off the drone instantly and make it fall to the ground in an uncontrolled manner, risking lives and damage to properties. However, HMPs are considered to be one of the best options to counter swarm attacks among all other options available in the market.[43]

Another important kinetic counter-measure is the use of High-Energy Lasers. These lasers are high-powered optical devices that generate a focused beam of light carrying high energy, also called laser beams. The laser beam is used to attack the drone for damaging either its structure and/or its electronics, thus rendering it inoperable. One of its benefits is that it can physically stop the drone, but the dangers associated with it outweigh its benefits. On

[42] Shaza Arif, "Chinese EMP Test to Counter Unmanned Aerial Systems – Analysis," *Eurasia Review*, September 25, 2021, https://www.eurasiareview.com/25092021-chinese-emp-test-to-counter-unmanned-aerial-systems-analysis/.

[43] "EMPs Could Combat Vast Drone Swarms Better than Weapons," *Mind Matters*, August 23, 2021, https://mindmatters.ai/2021/08/emps-could-combat-vast-drone-swarms-better-than-weapons/.

the one hand, it is highly expensive and on other hand, the risk of collateral damage may be more.[44]

Drone catchers are popular kinetic measures among civil Law Enforcement Agencies (LEAs) to target and capture an attacking drone. In this system, a hanging net is deployed with a drone, and net cannon fired either from the ground and/or a drone itself is used to entrap the targeting drone. As it physically captures the drone, there is always a low risk of collateral damage associated with it. As these nets are launched from the ground, they are semi-automatic with high precision and accuracy. The range of these catchers can be increased by launching them from another drone. The captured drone can be used to gather information for forensics and prosecution.[45]

Conventional ammunition is also being used to destroy drones in many countries. This includes sniper guns and shotguns to shoot down UAVs, suicidal drones, and artillery shells that burst into the air to destroy and disrupt swarm attacks.[46] These are cheaper options as compared to other sophisticated counter-measures. However, these options are less accurate and need a high degree of skill.

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[44] Philip Butterworth-Hayes, "High Energy Lasers: Almost Ready for Effective Drone Defence on the Battlefield," *Unmanned Airspace*, September 1, 2021, https://www.unmannedairspace.info/counter-uas-systems-and-policies/high-energy-lasers-almost-but-not-quite-ready-for-drone-defence-on-the-battlefield/.

[45] "Pneumatic Powered Drone Catcher Gun: Net Thrower," *Nevon Projects*, November 13, 2020, https://nevonprojects.com/pneumatic-powered-drone-catcher-gun-net-thrower/.

[46] Jen Judson, "Industry Pitches Munitions Designed to Defeat Drones," *Defense News*, September 13, 2017, https://www.defensenews.com/digital-show-dailies/dsei/2017/09/13/how-to-shoot-down-a-drone-industry-pitches-munitions-designed-to-take-them-out/.

Non-Kinetic Measures: The techniques used to interfere with the communication system between a drone and its operator or with its navigation system, in order to make it ineffective, are non-kinetic countermeasures.[47] These measures include jamming, spoofing, and hacking.

'Jamming' is an efficient non-kinetic measure through which electromagnetic noise is blasted at the same radio frequency which is used by the detected drone to operate and send forth information. The drone signal jammer, in addition to recording the private conversation between a drone and its pilot, blocks communications between a drone and the entire command and control system. The goal is usually attained through using an RF jammer which is a handheld device. The device sends a large amount of RF energy toward a suspected drone and blocks the control signal that it receives from its operator. The result of the operation can be one of four possible scenarios: A drone might either fall uncontrolled to the ground or can make a controlled landing in its exact position; it can also fly to a random uncontrolled location and can also return to a user-set home location.[48] Another kind of jamming technique that disrupts a drone's communication link by RF interference that connects it with a navigation satellite, is called 'navigation jamming.' When a drone's satellite link, associated with navigation like GPS and GLONASS,[49] is disrupted, the detected drone gets blind and disabled.[50]

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47 Patel and Rizer, "Counter-Unmanned Aircraft Systems Technology Guide," 23.

48 Shawn Manaher, "Will A Drone Jammer Take Out My Drone? Is It Legal?," *Hobby Nation*, accessed March 28, 2022, https://hobbynation.net/will-a-drone-jammer-take-out-my-drone/.

49 GLONASS means GLObalnayaNAvigatsionnayaSputnikovaya Sistema in Russian. The function of Russia's GLONASS satellite navigation system is analogous to that of several other global satellite positioning systems: the GPS (Global Positioning System) of the

A relatively new non-kinetic measure used to counter drones is 'spoofing.' This measure enables feeding a counterfeit navigation link or communication command to take full control or redirect the targeted drone. A spoofing transmitter radiates a new signal to the drone, which captures it by replacing the earlier communication with the GPS, which it would otherwise use for navigation.[51]

'Hacking' is yet another important method among the non-kinetic measures of counter-drone systems. Different software is used to hijack drones using weak authentication and encryption methods in their communication links. This method enables a hacker to send commands to a targeted drone. Thus, a persistent backdoor established by induced malware allows a hacker to fully control the functions of a drone—be it related to bringing it down to the ground or hijacking it to conduct independent surveillance.[52]

The most important element of any counter-drone system is its command and control setup which keeps its processing chain — from detection to interception — intact. Such a setup involves various hardware as well as software components, and multipurpose screens on which the operations of a counter-drone system can be monitored by an operator. Although AI has revolutionised defence systems, the process of making decisions for countering drone threats has primarily remained in human hands till now.

United States, Europe's Galileo satellite positioning system, and China's BeiDou satellite navigation system.

50 "GPS Spoofing and Jamming: A Viable Defence against Drones?," accessed March 28, 2022, https://www.linkedin.com/pulse/gps-spoofing-jamming-viable-defence-against-drones-guy-buesnel.

51 Ibid.

52 Systems, "10 Counter-Drone Technologies to Detect and Stop Drones Today."

A New Arms Race in South Asia

As technology is getting more sophisticated over time, warfare is becoming even more expensive.[53] Nevertheless, states around the globe are still investing heavily in emerging military technologies to safeguard their national interest. Drone technology is one of the most significant technologies shaping modern warfare. With the advancements discussed earlier, the roles of UAVs will also continue to evolve. According to Jonathan Marcus, a professor at the Strategy and Security Institute at Exeter University, 'The combat drone was once the preserve of military superpowers but no longer. Its use by insurgents and smaller nations is already changing the nature of battle.'[54] Therefore, to secure themselves against drone attacks and to retain their technological edge in this domain, developed states are significantly spending on Research and Development of integrated counter-drone systems rendering a new arms race at both global and regional levels.

Beyond the involvement of nation-states, numerous commercial enterprises and leading technology companies have entered the counter-drone industry, unveiling solutions tailored for both military and civilian applications. Consequently, the competitive dynamics in this field are multifaceted. The first aspect of this competition involves states striving to assert dominance in this sector. The second aspect encompasses a rivalry within the commercial sphere, where drone manufacturers and counter-drone solution providers continually endeavour to outpace each other, aiming to maintain a competitive edge.[55]

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53 Tejvan Pettinger, "Why War Is Becoming More Costly," *Economics Help*, March 11, 2022, https://www.economicshelp.org/blog/167994/economics/why-war-is-becoming-more-costly/.

54 Marcus, "Combat Drones."

55 Steven Melendez, "The Anti-Drone Arms Race Is Taking Off," *Fast Company*, September 21, 2016,

In South Asia, the Indian military's extensive acquisition of counter-drone systems, including both locally developed and imported technologies, has notably intensified the competitive dynamics in the region's defence sector. India's Defence Research and Development Organisation (DRDO), in collaboration with the Bharat Electronics Limited (BEL) and two other private companies, has indigenously developed a counter-drone system D-4 that costs around INR 25 crore apiece.[56] The specifications of D-4 systems are given in Table 2:

Table 2: DRDO's Counter-Drone System

Specifications of D-4 Counter-Drone System	
Country of Origin	India
Capabilities	Detection and Disruption
Detection Range	4 km
Disruption Range	1 – 2.5 km
Coverage	360 Degrees
Detection	EO Radar/ RF /GNSS
Disruption	Jamming and Laser Kill

Source: Javaid, "Explained: What Is an Anti-Drone System Developed by DRDO?"

In response to an alleged drone attack at the Indian Air Force Base Jammu on 27 June 2021, India's Defence Acquisition Council (DAC) approved the procurement of D-4 counter-drone systems for all three services. On 31 August 2021, all three Indian military services signed deals with the DRDO to purchase their D-4

https://www.fastcompany.com/3063250/the-anti-drone-arms-race-is-taking-off.

56 Arfa Javaid, "Explained: What Is an Anti-Drone System Developed by DRDO?," *Jagranjosh.com*, July 29, 2021, https://www.jagranjosh.com/general-knowledge/anti-drone-system-deveoped-by-drdo-to-counter-enemy-drones-1627561929-1.

counter-drone systems.[57] Indian officials told the media, 'All three services Army, Navy, and Air Force have signed a contract with Navratna Defence PSU Bharat Electronics Limited (BEL) for the supply of the first indigenous comprehensive Anti-Drone System with both hard-kill and soft-kill capabilities in New Delhi on 31 August 2021.'[58] After the contract was signed with the DRDO, Indian Armed Forces (IAF) immediately placed orders worth more than INR 300 crore for indigenous counter-drone systems, along with other private companies. For instance, a private Hyderabad-based tech company, Zen Technologies, revealed on 3 September 2021 that the Indian Air Force (IAF) had placed an INR 155 crore contract for counter-drone systems.[59] As per Indian media reports, some of these placed orders were delivered in December 2021.[60]

Apart from procuring the DRDO's counter-drone systems, the Indian Army has also been working with an Israeli firm, *Smart Shooter*, for acquiring their SMASH-2000 systems.[61] The Indian

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57 "After Navy, Indian Army, Air Force Sign Deal with DRDO for Anti-Drone System," *Hindustan Times*, September 4, 2021, https://www.hindustantimes.com/videos/news/after-navy-indian-army-air-force-sign-deal-with-drdo-for-anti-drone-system-101630695004009.html.

58 Manjeet Negi, "Indian Army, Navy, Air Force Sign Deal for Inducting DRDO-Developed Anti-Drone System," *India Today*, September 4, 2021, https://www.indiatoday.in/india/story/indian-army-navy-air-force-sign-deal-inducting-drdo-developed-anti-drone-system-1849097-2021-09-04.

59 "Zen Technologies Bags Rs 155 Cr Anti-Drone System Contract from IAF," *Business Today*, accessed March 29, 2022, https://www.businesstoday.in/latest/corporate/story/zen-technologies-bags-rs-155-cr-anti-drone-system-contract-from-iaf-305817-2021-09-03.

60 Rahul Singh, "Armed Forces Get New Anti-Airfield Weapon, Counter-Drone Systems," *Hindustan Times*, December 14, 2021, https://www.hindustantimes.com/india-news/armed-forces-get-new-anti-airfield-weapon-counter-drone-systems-101639492104798.html.

61 Haider Abbas, "SMASH-2000: Israel's Another Game-Changing Weapon for Indian Troops to Check-Mate Chinese, Turkish Drones?,"

Navy has already placed an order for an unspecified quantity of SMASH-2000 rifle-mounted systems from the same company.[62] The cost of one unit of SMASH-2000 Fire Control System (FAC) for a single assault rifle is around INR 1 million.[63] The Indian Navy has also signed a contract with Bharat Electronics Limited (BEL) for the development of the 'Naval Anti-Drone System (NADS)'.[64]

Along with the acquisition of these counter-drone systems, India's military is also spending an enormous budget to purchase offensive drone capabilities. India will purchase 30 advanced Predator drones from the US that can fire missiles at any target in sea, air, or ground with pinpoint accuracy. In 2022, Indian media reported that 'The discussions on the sale of 30 Predator armed

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Eurasian Times, December 12, 2020, https://eurasiantimes.com/israel-equips-indian-army-with-another-game-changing-weapon-amid-flaring-tensions-with-pakistan-china/; Anupama Ghosh, "India Could Fast-Track Israeli SMASH 2000 Plus Anti-Drone Systems to Thwart Jammu-Like Attacks?" *Eurasian Times,* June 29, 2021, https://www.eurasiantimes.com/india-could-fast-track-israeli-smash-2000-plus-anti-drone-systems-to-thwart-jammu-like-attacks/.

62 "Navy Orders Israeli SMASH 2000 Plus Systems to Tackle Drones, More Contracts in Offing," *Print*, December 8, 2020, https://theprint.in/defence/navy-orders-israeli-smash-2000-plus-systems-to-tackle-drones-more-contracts-in-offing/562955/.

63 "Indian Navy Orders Israeli Smash 2000 Plus Systems to Counter Threat from Small Drones," *Latestly*, December 9, 2020, https://www.latestly.com/india/news/indian-navy-orders-israeli-smash-2000-plus-systems-to-counter-threat-from-small-drones-2188965.html.

64 "Navy Signs Contract with BEL to Procure India's First Indigenous Naval Anti-Drone System," *Print*, August 31, 2021, https://theprint.in/defence/navy-signs-contract-with-bel-to-procure-indias-first-indigenous-naval-anti-drone-system/725726/.

drones by the US to India, the first to a non-NATO ally, at an estimated cost of USD3 billion, is at an advanced stage.'[65]

Furthermore, the Indian Army has placed an order to buy 100 swarming drone systems that can attack and hit military targets with 5-6 kg explosive devices.[66] Likewise, it has also acquired 'Smart Anti-Airfield Weapons (SAAWs) that can target enemy airfield assets such as radars, bunkers, taxiways, and runways.'[67]

As India is always trying to find space for limited armed conflict with Pakistan, the combination of offensive and defensive drone capabilities along with supersonic/hypersonic missiles in her arsenal would provide the Indian military with another choice of weapons (especially drone swarms) in case of any future conflict. In this scenario, the extensive acquisitions by India have a destabilizing effect, carrying significant implications for escalating conflicts and undermining crisis stability. The advancement of India's military capabilities has compelled Pakistan into a continuous cycle of defence enhancement, leaving it with little choice but to acquire similar capabilities in order to maintain its conventional deterrence.

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65 Shishir Gupta, "Plan to Buy Predator Drones Put on Hold," *Hindustan Times*, February 23, 2022, https://www.hindustantimes.com/india-news/plan-to-buy-predator-drones-put-on-hold-101645565612604.html. *Editor's Note:* During the finalisation of this paper, it was reported in April 2023, that the Indian Armed Forces cut down their requirement for the acquisition of US MQ-9B Predator high altitude long endurance (HALE) armed drones from 30 to 18 platforms - six each of the Indian Army, Navy, and the Air Force.

66 "Army Orders 100 Swarm Drones Under Emergency Procurement," *NDTV.com*, accessed March 29, 2022, https://www.ndtv.com/india-news/indian-army-orders-100-swarm-drones-under-emergency-procurement-2529085.

67 Rahul Singh, "Armed Forces Get New Anti-Airfield Weapon, Counter-Drone Systems," *Hindustan Times*, December 14, 2021, https://www.hindustantimes.com/india-news/armed-forces-get-new-anti-airfield-weapon-counter-drone-systems-101639492104798.html.

Conclusion

Technological evolution is profoundly reshaping both the tools and strategies of warfare. This evolution is particularly evident in the continual advancement of drones and counter-drone systems, which are set to significantly influence, if not dominate, future battlefields. The Nagorno-Karabakh conflict between Azerbaijan and Armenia, as well as the ongoing war between Russia and Ukraine, exemplify the critical role of drones in various facets of warfare, underscoring their growing importance across all levels of military engagement.

However, the strategic landscape of South Asia is markedly different and more precarious compared to other global regions. Even minor errors in judgment or misconceptions regarding an adversary's capabilities could plunge the entire region into conflict. The acquisition of advanced weaponry by India, a state which previously 'mistakenly' launched a supersonic missile into Pakistani territory, poses a significant threat not only to the stability of arms development but also to the broader crisis and strategic stability of South Asia. Furthermore, US support and provision of cutting-edge weapons and intelligence to India, as part of various strategic agreements aimed at countering China's regional influence, exacerbates the situation. Consequently, South Asia continues to be adversely affected by the lack of an effective arms control framework and the broader context of global power rivalry.

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India's Missile Defence Systems: Impact on Regional Strategic Stability

Moiz Khan

Abstract

India's ongoing development and procurement of Ballistic Missile Defence (BMD) systems are part of its broader strategy to modernise its nuclear and conventional military capabilities. In response, the country is enhancing its nuclear arsenal and delivery mechanisms, both in scale and sophistication. This effort is not merely a reaction to India's ABM advancements but also a proactive measure to maintain the credibility and effectiveness of its nuclear deterrent. Pakistan's approach involves upgrading its ballistic and cruise missile inventories and investing in a range of cost-effective and technologically advanced countermeasures. These measures are designed not only to counterbalance the emerging ABM threat but also to mitigate the risks of escalation, contributing to long-term peace and stability in South Asia. By focusing on strategic adaptability and technological innovation, Pakistan plays a crucial role in maintaining a balanced power dynamic and promoting a stable security environment in the region.

Keywords: Ballistic Missile Defence, India-Pakistan Nuclear Deterrence, Arms Race, Military Technology, Nuclear Risk.

Introduction

India has been developing and modernising its Ballistic Missile Defence (BMD) system, alternatively called the Anti-Ballistic Missile (ABM) system, since the 1990s with an aim to assemble a defence shield against inbound adversary missiles.[1] To date, India has made significant advancements in its BMD architecture, marked by a series of successful tests and developments. In 2018, the country test-launched an interceptor missile against decoy targets for the first time, demonstrating its growing capabilities in missile defence technology.[2] Further bolstering its defence portfolio, the 2019 anti-satellite (ASAT) test showcased her proficiency in space-based defence, successfully targeting a satellite orbiting at an altitude of 285 kilometres.[3] These developments were followed by two critical tests. On 3 November 2022, India conducted a successful flight test of the BMD interceptor missile from the APJ Abdul Kalam Island off the Odisha coast. This interceptor missile is designed to neutralise long-range missiles and aircraft.[4] Additionally, in a joint effort by the Defence Research and Development Organisation (DRDO) and the Indian Navy, a maiden flight trial of a sea-based endo-atmospheric interceptor missile was successfully conducted off the coast of

1 Frank O' Donnell and Yogesh Joshi, "India's Missile Defence: Is the Game Worth the Candle?" *Diplomat,* August 2, 2013, https://thediplomat.com/2013/08/indias-missile-defense-is-the-game-worth-the-candle/.

2 Franz-Stefan Gady, "India's Advanced Air Defence Interceptor Shoots Down Ballistic Missile Target in Test," *Diplomat,* August 3, 2018, https://thediplomat.com/2018/08/indias-advanced-air-defense-interceptor-shoots-down-ballistic-missile-target-in-test/.

3 Marco Langbroek, "Why India's ASAT Test Was Reckless," *Diplomat*, April 30, 2019, https://thediplomat.com/2019/05/why-indias-asat-test-was-reckless/.

4 Sushant Kulkarni, "India Successfully Tests Ballistic Missile Defence Interceptor Capable of Neutralising Long-Range Adversary Missiles," *Indian Express*, https://indianexpress.com/article/india/ballistic-missile-test-8245478/.

Odisha in the Bay of Bengal on 21 April 2023.[5] While enhancing the capabilities of its two-layered ABM system,[6] India is also in negotiations with the United States (US), Israel, and Russia to procure other such systems to expand its ABM architecture.[7]

This study provides a comprehensive analysis of India's ABM capabilities and their impact on regional strategic stability. The focus is on understanding the integration of ABM systems within India's evolving military strategy, as well as examining Pakistan's current countermeasures in response to its advancing ABM infrastructure. Additionally, the paper explores potential avenues for Pakistan to enhance and strengthen its missile penetration capabilities. By assessing the feasibility and strategic implications of developing new options, this study aims to provide insights into the ongoing arms dynamic between India and Pakistan and the broader implications for regional security.

This study adopts an analytical and explanatory approach, utilising a qualitative research methodology and draws upon a blend of primary and secondary data sources. These sources encompass a diverse range of materials, including scholarly books, research papers, and official documents such as statements and speeches. The study's scope is intentionally narrowed to provide a more in-depth and concentrated examination of the India-Pakistan dynamic in relation to ABM technologies and strategies. It deliberately

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5 "India Carries Out Maiden Flight-Test of Sea-Based Ballistic Missile Defence Interceptor," *Economic Times*, April 22, 2023, https://economictimes.indiatimes.com/news/defence/india-conducts-successful-trial-of-bmd-interceptor-missile/articleshow/99694589.cms?from=mdr.

6 Balraj Nagal, "India and Ballistic Missile Defence: Furthering a Defensive Deterrent," Carnegie Endowment for International Peace, June 30, 2016, https://carnegieendowment.org/2016/06/30/india-and-ballistic-missile-defense-furthering-defensive-deterrent-pub-63966.

7 Ibid.

excludes considerations of Chinese nuclear forces and the influence of Indian ABM systems on China.

Introduction to Missile Defence Systems

An ABM system is described as an integrated system designed to intercept inbound aerial threats, including missiles, bombers, aircraft and drones during their flight towards their targets.[8] However, ABM systems are predominantly deployed against ballistic and cruise missiles of various ranges.[9] These systems comprise radars, satellites, sensors, fire control centres and interceptors. Radars and satellites are used for early warning and detection of inbound threats.[10] Sensors help in differentiating between warheads and decoys,[11] and assist in estimating the speed of aerial threats.[12] Fire control systems help in predicting the target location and guiding the interceptor missile to the intercept point.[13]

ABM systems are categorised as per their capabilities of interception: broadly, these categories are known as 'point' or 'theatre ABM systems' and 'area' or 'strategic ABM systems.' The point or theatre ABM systems are designed to defend a relatively small area, such as vital industrial complexes, strategic forces and offices, and missile silos. On the other hand, the area or strategic ABM systems are deployed to defend major cities or an entire

8 "Fact Sheet: An Introduction to Ballistic Missile Defence," Centre for Arms Control and Non-proliferation, April 27, 2017, https://armscontrolcenter.org/fact-sheet-introduction-ballistic-missile-defense/.

9 "Fact Sheet: An Introduction to Ballistic Missile Defence."

10 Ibid.

11 Decoys act as dummy warheads comprising iron bolts and shafts designed to deceive the interceptor missiles. See, Union of Concerned Scientists, "How Does Missile Defence Work?" Explainer, June 22, 2016, https://ucsusa.org/resources/how-does-missile-defense-work

12 Ibid.

13 Ibid.

country.[14] While missile defence systems could be dispersed across all domains including land, sea or in air or space, the interception of inbound missiles takes place at various stages of the flight path: terminal, mid-course, and boost phases.[15]

During the boost phase, the missile begins ascending until its propellant burns out following the launch and ejects the warhead over the atmosphere.[16] Interception of the missile, during this phase, remains advantageous as interception takes effect before the warhead is released. However, constraints of shorter timespan are an associated challenge with respect to boost-phase interception. Interception during the mid-course phase refers to the elimination of the inbound missile after it acquires parabolic trajectory as a result of Earth's gravity.[17] In this phase, the missile launch-path provides greater time for interception. However, release of decoys with a warhead represents a major challenge for the interceptor missile. During the terminal phase of the missile flightpath, the payload enters the Earth's atmosphere. Interception remains easy during the terminal phase as decoys slow down, providing an advantage to the ABM systems to distinguish between dummy objects and warheads.[18] Thus far, no country has deployed

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14 "Missile Defence Systems at a Glance", Arms Control Association, August 2019, https://www.armscontrol.org/factsheets/missiledefenseataglance; Charles D. Ferguson and Bruce W. MacDonald, *Nuclear Dynamics in a Multipolar Strategic Ballistic Missile Defence World,* report (Washington, D.C.: Federation of American Scientists, July 2017), 1-20, https://fas.org/issues/project-on-nuclear-dynamics-in-a-multipolar-strategic-bmd-world/.

15 "Missile Defence Systems at a Glance."; Ferguson and MacDonald, "Nuclear Dynamics in a Multipolar Strategic Ballistic Missile Defence World."

16 *Missile Defence, The Space Relationship and the 21st Century*, report (Institute for Foreign Policy Analysis, 2009), x, http://www.space-library.com/0902IFPA_IWG2009.pdf.

17 Ibid., xii.

18 Ibid., xii.

any ABM system capable of boost-phase interception. All the ABM systems currently deployed across the world are either capable of mid-course interception or terminal-phase interception.[19]

Missile Defence Policies

Keeping in view improvements in missile interception technologies, ABM systems have been gaining greater significance in the security policies of states, specifically after the unravelling, in 2002, of the 1972 'Anti-Ballistic Missile Treaty', signed between the US and former Union of Soviet Socialist Republics (USSR).[20] Later, the ABM Treaty was expanded and included Russia, Ukraine, Belarus, and Kazakhstan.[21]

Article IV of the Treaty restricted both the US and USSR to deploy a limited number of ground-based ABM systems and prohibits the two countries from developing and deploying missile systems in different domains, including air, land, and mobile transport launcher.[22] Under the Treaty, the two countries could initially only deploy two fixed, ground-based ABM systems using 100 missile interceptors. However, in a protocol signed on 3 July 1974, both countries halved the number of permitted defences, limiting each side to only one ABM site.[23] The Treaty played a significant role in restraining various missile defence programmes that the US and the USSR had been pursuing during the 1950s and 1960s.

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19 "Defence Systems," Missile Threat, CSIS Missile Defence Project, Center for Strategic & International Studies, https://missilethreat.csis.org/defsys/.

20 "Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty)," Bureau of Arms Control, Verification, and Compliance, US State Department Archived Content, https://2009-2017.state.gov/t/avc/trty/101888.htm.

21 Ibid.

22 "Fact Sheet: An Introduction to Ballistic Missile Defence."

23 Ibid.

While the ABM Treaty effectively helped in controlling an arms race, it recognised that offensive and defensive weapons were linked, and that continued development and deployment of the ABM systems had adverse effects on strategic stability between the US and the USSR.[24] While the Treaty remained intact, the US continued research on several ABM systems, including the National Missile Defence (NMD) system with an aim to counter missile threats from Iran and North Korea.[25] In 2000, the massive cost of development of the NMD system and the restraints of the ABM Treaty had barred the US from multiple deployments of ground-based ABM systems. However, former US President, George W. Bush, favoured deployment of the NMD at the cost of withdrawal from the ABM Treaty.[26] Consequently, the US withdrew from the ABM Treaty in June 2002, while rationalising its withdrawal on the limitations it had on the US to assemble effective defences against possible 'rogue state' ballistic missile attacks.[27]

The US, after the demise of the ABM Treaty, continued working on its NMD system. With an aim to further improve its missile defence capabilities for defending its territory, it deployed Armed Forces around the world,[28] and upgraded its NMD legislature in 2016, which was earlier enacted in 1999.[29] Former President Barack Obama's Administration's Ballistic Missile Defence Review, in 2010, adopted a posture on the ABM systems similar to that of the Bush Administration, focusing on expanding the missile defence

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24 Ibid.

25 "The Anti-Ballistic Missile (ABM) Treaty at a Glance," Arms Control Association, December 2020, https://www.armscontrol.org/factsheets/abmtreaty.

26 "US Withdraws from ABM Treaty; Global Response Muted," Arms Control Association, July/August, 2002, https://www.armscontrol.org/act/2002-07/news/us-withdraws-abm-treaty-global-response-muted.

27 Ibid.

28 Ibid.

29 Ibid.

systems against Chinese and Russian threats.[30] Former US President Donald Trump's Administration presented its own Missile Defence Review (MDR) in 2019. The 2019 US MDR directed the US to adopt its ABM systems 'for Great Power competition', raising threat perceptions against Russia, China, Iran and North Korea.[31] Meanwhile, the MDR advocated the development of space-based interceptors and capabilities to eliminate missile threats in their boost-phase.[32]

While President Bush announced the US' withdrawal from the ABM Treaty, both Russia and China warned that they would be forced to increase their offensive capabilities against modernised US ABM systems. In response, Russia remained focused on the development of its missile defence capabilities. Russia has now been developing different types of missile interception capabilities against intercontinental, intermediate, medium and short-range ballistic missiles.[33]

China, though opposed to the US' missile defence, is also working on the development of its indigenous ABM system.[34] China found

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30 Thomas Karako, "The Missile Defeat Review in Context," in *Missile Defence and Defeat: Considerations for the New Policy Review*, ed. Thomas Karako, report (Washington, D.C: Center for Strategic & International Studies, March 2017), 8, https://missilethreat.csis.org/missile-defense-and-defeat/.

31 "2019 Missile Defence Review," Office of the Secretary of Defence, US Department of Defence, 4, https://media.defense.gov/2019/Jan/17/2002080666/-1/-1/1/2019-MISSILE-DEFENSE-REVIEW.PDF.

32 Ibid., xvi.

33 Keir Giles, *Russian Ballistic Missile Defence: Rhetoric and Reality,* report (Strategic Studies Institute and U.S. Army War College Press, June 2015), 15-25, https://www.jstor.org/stable/resrep11662?seq=1.

34 Lora Saalman, "China's Evolution on Ballistic Missile Defence," Carnegie Endowment for International Peace, August 23, 2012, https://carnegieendowment.org/2012/08/23/china-s-evolution-on-ballistic-missile-defense-pub-49171.

itself in a security dilemma by the early 1980s, owing to the US and Russian ballistic missile capabilities. Hence, Beijing began working on its ABM system during the early 1980s, in order to defend against the 'first strike' of an adversary country. Chinese ABM programme, dubbed as the '863 Programme', matured in March 1986.[35] The country test-launched its interceptor missile for the first time in 2010, while the second launch took place in 2013.[36] According to a few Chinese experts, China was scheduled to deploy its missile defence systems in a limited fashion, however, this plan remained unimplemented owing financial constraints. Experts argued that if China did not invest in its ABM systems, it would harm its status as a major nuclear power.[37] Apart from the US, Russia and China, several other countries including NATO states, Saudi Arabia, Iran, South Korea, and Japan possess different types of ABM systems.[38]

India's Anti-Ballistic Missile Defence Systems and Policy

India's ABM Development

According to open-source data, India started working on its ABM system development in the 1990s and gained considerable success in interception capability in the last two decades. However, there is no official record or data available noting that when

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35 Bruce W. MacDonald and Charles D. Ferguson, "Chinese Strategic Missile Defense: Will It Happen, and What Would It Mean?," Arms Control Association, November 2015, https://www.armscontrol.org/act/2015-11/features/chinese-strategic-missile-defense-happen-what-mean.

36 Ibid.

37 MacDonald, *Nuclear Dynamics in a Multipolar Strategic Ballistic Missile Defence World*.

38 Shea Cotton and Jeffrey Lewis, *The Global Missile Defence Race: Strong Test Records and Poor Operational Performance*, report (The CNS Missile and SLV Launch Databases, Nuclear Threat Initiative, September 16, 2020), https://www.nti.org/analysis/articles/global-missile-defense-race-strong-test-records-and-poor-operational-performance/.

development of its indigenous ABM system began.[39] In fact, while New Delhi claims that its two-layered ABM system is indigenously developed, including all its elements, numerous foreign suppliers have assisted its ABM programme. The DRDO considered several provisions from foreign manufacturers for key components, including command and control and sensors/radars.[40] India underwent a significant policy shift regarding the ABM Treaty to better position itself for acquiring foreign technology. During the Cold War, India was a supporter of the Treaty. However, in a strategic pivot, it aligned itself with the US, challenging the Treaty's effectiveness. In 2001, New Delhi backed Washington's missile defence initiatives, primarily to gain access to advanced missile defence technology and elevate its international standing. This policy reversal was seen by India as a strategic opportunity to forge a partnership with the US and enhance its own defensive capabilities.[41]

India's indigenous BMD is based on two-layers, comprising high altitude interceptors, including Prithvi Air Defence (PAD) and Prithvi Defence Vehicle (PDV), and low altitude interceptors, including Advanced Air Defence (AAD). The high and low altitude interceptors are capable of eliminating missiles in mid-course (exo-atmospheric) and terminal course (endo-atmospheric) levels of the missile flightpath, respectively.[42] The PDV is capable of targeting a missile at an altitude of 50-120 kilometres. The PDV is claimed to replace the PAD. The AAD is reportedly designed for eliminating missiles at an altitude of 15-40 kilometres.[43] India has also tested

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39 Yogesh Joshi, "India's Missile Defence: Is the Game Worth the Candle?", and, "India's Ballistic Missile Defence System: All You Need to Know," *Times of India,* February 12, 2017, https://timesofindia.indiatimes.com/india/indias-ballistic-missile-defence-system-all-you-need-to-know/articleshow/57105516.cms.

40 Nagal, "India and Ballistic Missile Defence."

41 Ibid.

42 "DRDO Ballistic Missile Defence System," Army Technology, January 8, 2021, http://www.army-technology.com/projects/drdp-bmd/.

43 "DRDO Ballistic Missile Defence System."

its AAD interceptor against decoys in 2018.[44] Meanwhile, in 2019, India also conducted a successful anti-satellite (ASAT) test using a modified version of the PDV anti-ballistic-missile interceptor, called PDV Mark II missile, to destroy a satellite orbiting at 285 kilometres in altitude.[45] Experts believe that the ASAT capability could be used for interception of Intercontinental Ballistic Missiles (ICBMs). This capability would effectively enhance India's BMD architecture.

According to the DRDO, India's indigenous ABM system comprises of two phases. Phase-I, consisting of the PDV and AAD interceptors, engages missiles with a strike-range of 2,000 kilometres. Hence, it provides defence against short and medium-range missiles. However, phase-II of the ABM architecture will comprise new interceptors which would intercept intermediate and intercontinental-range ballistic missiles (IRBMs and ICBMs), with strike-ranges between 3,000 and above 5,000 kilometres.[46]

In November 2022, India conducted the maiden flight-test of phase-II ballistic missile defence interceptor AD-1 capable of engaging many different types of targets. The AD-1 is a long-range interceptor missile designed for both 'low exo-atmospheric' and 'endo-atmospheric' interception of long-range ballistic missiles as well as aircraft.[47] Apart from its two-layered ABM system, India is also fielding an indigenously designed medium-range mobile surface-to-air missile defence system, known as *Akash*.[48] It also started deploying the Russian S-400 air defence systems, worth

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44 Gady, "India's Advanced Air Defence."

45 Langbroek, "Why India's ASAT Test Was Reckless."

46 "Missile Defence Shield Ready, DRDO Chief," *Hindu,* May 6, 2012, http://www.thehindu.com/news/national/missile-defence-shield-ready-drdo-chief/article3390404.ece.

47 Kulkarni, "India Successfully Tests Ballistic Missile Defence Interceptor."

48 Franz-Stefan Gady, "India Successfully Test Fires Supersonic Surface-to-Air Missile", *Diplomat,* December 6, 2017, https://thediplomat.com/2017/12/india-successfully-test-fires-supersonic-surface-to-air-missile/.

USD 5 billion, in 2018.[49] Moreover, in September 2021, the Indian Air Force (IAF) inducted a medium-range surface-to-air-missile (MRSAM) system, called *Barak-8*, capable of intercepting aircraft and cruise missiles. The *Barak-8* systems are jointly developed by India and Israel.[50] In early February 2021, India also announced the flag off of the final production batch of their Navy's Long-Range Surface-to-Air Missile (LRSAM), capable of intercepting both aircraft and cruise missiles. The LRSAM is jointly developed by India and Israel.[51]

India's ABM Policy

The primary stated objective of India's efforts to bolster its BMD shield is to defend its territory against incoming missile threats. [52] However, deeper analysis suggests that the pursuit of prestige and the desire to be recognised as a great power are also significant driving forces behind these efforts.[53] The emphasis on territorial

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[49] Krishn Kaushik, "Explained: S-400 Purchase & Implications," *Indian Express,* November 18, 2021, https://indianexpress.com/article/explained/s-400-purchase-air-defence-system-india-us-relation-7626388/.

[50] Rahul Singh, "IAF Inducts Barak 8 Air Defence System that Can Hit Multiple Targets 70km Away," *Hindustan Times,* September 9, 2021, https://www.hindustantimes.com/india-news/iaf-inducts-barak-8-air-defence-system-that-can-hit-multiple-targets-70km-away-101631198455089.html.

[51] "Indian MoD Announces Flag Off of Final LRSAM Missiles Production Batch," *Naval Technology*, February 15, 2021, https://www.naval-technology.com/news/indian-mod-lrsam-missiles/.

[52] Petr Topychkanov, "India's Prospects in the Area of Ballistic Missile Defence: A Regional Security Perspective," (Working Paper No. 3, Carnegie Moscow Centre, 2012), 9, https://carnegieendowment.org/files/WP3_2012_Topychkanov_en.pdf.

[53] Zafar Khan, "India's Ballistic Missile Defence: Implications for South Asian Deterrence Stability," *The Washington Quarterly,* 40, no. 3 (Fall 2017): 187,

defence, while crucial, is overshadowed by Delhi's broader strategic goals. The development and deployment of ABM systems are not just about neutralising potential military threats; they are also a symbol of technological prowess and military strength. This dual purpose serves both practical and symbolic needs. The country's investment in ABM technology is a clear indicator of its aspirations to be seen as a major player on the global stage. Possessing advanced missile defence capabilities is often associated with great power status, as it demonstrates not only the ability to defend against sophisticated threats but also the capability to engage in advanced technological warfare. Therefore, while the defence of territory is a key aspect, the role of ABM systems in India's military strategy extends beyond mere protective measures. It is part of a larger narrative of seeking greater international prestige and influence, positioning India as a formidable power with advanced defence capabilities.[54]

In January 2020, an Indian media report suggested that the Indian ABM programme was completed, and the IAF and the DRDO were working on proposals to seek the Indian Government's approval to begin the installation of the ABM system.[55] According to the report, the IAF and the DRDO would take three to four years to install the system.[56] While quoting Indian authorities, the report indicated that the two-layered ABM system was for New Delhi, and the Indian Government would decide which other cities would receive the system.[57] However, the DRDO has not yet issued any updated announcement regarding the timeframe of its ABM system

https://www.tandfonline.com/doi/abs/10.1080/0163660X.2017.1370339.

54 Khan, "India's Ballistic Missile Defence." See also, Topychkanov, "India's Prospects," 9.

55 Snehesh Alex Philip, "India's Ballistic Missile Defence Shield Ready, IAF and DRDO to Seek Government Nod to Protect Delhi," *Print,* January 8, 2020, https://theprint.in/defence/indias-ballistic-missile-shield-ready-iaf-drdo-to-seek-govt-nod-to-protect-delhi/345853/.

56 Ibid.

57 Ibid.

deployment. It may be due to the fact that the system has not yet been tested in an assimilated mode, with both inside and outside interceptor missiles together.

Though India has gained significant advancement in the development of its ABM system, its operationalisation and assimilation with its nuclear strategy remains open to speculation. Currently, there is no publicly available official operational or doctrinal policy from India regarding its ABM capabilities.[58] This lack of public documentation leads to the argument that Indian ABM systems may not play a significant role in its nuclear posture.[59]

However, several academics have offered their assumptions about the potential direction of Indian ABM policy. It is believed that India may opt for area ABM systems rather than a point ABM system,[60] as India deems exposing the exact locations of where its ABM systems are stored a threat to the survivability of its nuclear forces.[61] A few Indian experts and officials had indicated the possibility that the missile defence system would cover an area of 200 square kilometres.[62] Limited Indian ABM systems may be poised to protect the country's Command and Control (C2) centres, and the national capital against decapitating strikes. Academics also contend that the Indian ABM capability will be used to reinforce its so-called Nuclear No-first Use (NFU) policy.[63]

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58 Yogesh Joshi and Frank O'Donnell, *India and Nuclear Asia Forces, Doctrine, and Dangers* (Washington, D.C: Georgetown University Press, 2019), 2.

59 Ibid.

60 MacDonald, *Nuclear Dynamics in a Multipolar Strategic Ballistic Missile Defence World,* 11.

61 Ibid., 11-12.

62 "India Missile Chronology," Nuclear Threat Initiative, June 2012, https://media.nti.org/pdfs/india_missile_3.pdf.

63 Happymon Jacob, "Deterrence Debates and Defence," *Hindu*, April 21, 2014, http://www.thehindu.com/opinion/lead/deterrence-debates-

Implications of Indian ABM Systems on South Asian Strategic Stability

Wars are governed by strategy, and strategies and doctrines are significantly affected by changes in technology. For example, the nuclear revolution and long-range ballistic missiles heavily transformed the concept of total wars.[64] With missile technology advances, particularly in precision and guidance systems, both offensive and defensive weapon systems have undergone significant modernisation. This technological sophistication raises concerns that such systems might encourage armed conflicts, contrary to the deterrent role traditionally associated with nuclear weapons.[65]

BMD systems represent a significant innovation in the field of weaponry, born from advancements in missile technology. Although inherently defensive, these systems have a profound impact on strategic stability. [66] Strategic stability can be understood as a condition among states where no party is able to undermine mutual deterrence or feels compelled to initiate a nuclear strike against an adversary. This concept encompasses three key components: deterrence stability, which ensures that no state sees

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and-defence/article5931349.ece; See also, Yogesh Joshi and Alankrita Sinha, "India and Ballistic Missile Interception: From Theory to Practice," *Nuclear Notes* 2, no. 1 (June 2012): 27–28, https://www.ciaonet.org/attachments/21076/uploads.

64 J. Boone Bartholomees, Jr., "Continuity and Change in War," in *US Army War College Guide to National Security: Theory of Strategy and War*, ed. J. Boone Bartholomees, Jr., (Exeter: Strategic Studies Institute Books, 2012), 79-90.

65 Simon A. Mettler and Dan Reiter, "Ballistic Missiles and International Conflict," *The Journal of Conflict Resolution* 57, no. 5 (October 2013), 860-870, https://www.jstor.org/stable/24545573.

66 Igor Ivanov, "The Missile-Defence Mistake: Undermining Strategic Stability and the ABM Treaty," *Foreign Affairs*, September/ October 2000, https://www.foreignaffairs.com/articles/2000-09-01/missile-defense-mistake-undermining-strategic-stability-and-abm-treaty.

benefit in a first strike; arms race stability, which discourages the escalation of arms development; and crisis stability, which aims to prevent conflicts from escalating to nuclear exchanges. The development of BMD systems, by altering the balance in these areas, challenges this delicate equilibrium, potentially disrupting the established norms of nuclear deterrence and arms control.[67]

Central to deterrence stability is the principle of Mutual Assured Destruction (MAD), where the mutual vulnerability to nuclear forces of opposing states plays a crucial role in maintaining effective deterrence. This sense of mutual vulnerability, coupled with the high costs and catastrophic consequences associated with a nuclear conflict, acts as a powerful deterrent. Under the shadow of MAD, the perceived cost and damage of an attack are significantly higher than any relative benefits that might be gained from war, thus inhibiting the likelihood of conflict initiation.[68]

The introduction of ABM systems, however, has a significant impact on deterrence stability, potentially leading to inadvertent escalation. The possession of an ABM system can impart a false sense of security to a state, diminishing the perceived mutual vulnerability that underpins the MAD doctrine. In the case of India, the deployment of ABM systems could create a perception of reduced vulnerability, potentially making inadvertent escalation more likely. This perceived invulnerability might embolden India towards military assertiveness against Pakistan. Consequently, Pakistan views the Indian ABM systems with serious concern, as they pose a challenge to the existing deterrence stability between the two nations. This altered perception of risk and vulnerability

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[67] James M. Acton, "Reclaiming Strategic Stability," Carnegie Endowment for International Peace, February 5, 2013, https://carnegieendowment.org/2013/02/05/reclaiming-strategic-stability-pub-51032.

[68] Acton, "Reclaiming Strategic Stability." and, "Mutual Assured Destruction", Encyclopaedia Britannica, https://www.britannica.com/topic/mutual-assured-destruction.

could destabilise the fragile equilibrium that has historically deterred open conflict in the region.[69]

Additionally, the deployment of Indian ABM systems is undermining arms race stability by triggering an arms escalation in the region. Typically, the concept of an arms race suggests that states refrain from significantly expanding their nuclear and missile forces if they perceive no strategic incentives to do so. However, India's expanding ABM capabilities, which challenge Pakistan's missile penetration ability, disrupt this balance. In response to India's ABM advancements, Pakistan finds itself compelled to augment its nuclear capabilities and delivery systems, both qualitatively and quantitatively. This escalation is aimed at overcoming or overwhelming Indian missile defence systems, indicating a shift away from the restraint that characterises arms race stability. This dynamic reflects a growing arms competition in the region, driven by the perceived need to counterbalance advancements in defensive technologies with offensive capabilities.[70]

Furthermore, the presence of ABM systems can intensify brinkmanship in a region.[71] A state equipped with an ABM system, perceiving a lower level of vulnerability, may feel emboldened to initiate or escalate a conflict. This perceived sense of protection can destabilise crisis stability, as it might motivate the state possessing the ABM system to contemplate the first use of nuclear

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69 Zafar Nawaz Jaspal, "The Introduction of Ballistic Missile Defence in South Asia: Implications on Strategic Stability," in *Nuclear Learning in South Asia: The Next Decade,* ed. Feroz Hassan Khan, Ryan Jacobs and Emily Burke (Monterey: Naval Postgraduate School, June 2014), 127-128, https://nps.edu/documents/104111744/106151936/Nuclear+Learning+in+South+Asia_June2014.pdf.

70 Jaspal, "The Introduction of Ballistic Missile Defence in South Asia," 129-130.

71 Robert Powell, "Nuclear Deterrence Theory, Nuclear Proliferation, and National Missile Defence," *International Security* 27, no. 4 (Spring, 2003): 90, https://www.jstor.org/stable/4137605.

weapons or a pre-emptive strike against its adversary. The false sense of security provided by the ABM system can lead the possessor state to take greater risks, operating under the assumption that it could effectively absorb or neutralise a retaliatory strike. This scenario highlights the paradox where defensive systems, intended to enhance security, can paradoxically lead to more aggressive postures and increase the likelihood of conflict escalation.[72] India's ABM systems would affect crisis stability as well. In a crisis, India might be more inclined to consider a pre-emptive strike or first-use of nuclear weapons,[73] especially as its No First Use (NFU) policy has become a subject of controversy,[74] partly due to the perceived sense of security provided by the ABM shield. In response, first, Pakistan may continue to rely on its Full Spectrum Deterrence (FSD) policy to deter perceived Indian nuclear pre-emption with the help of adequate retaliation capability of disastrous consequences for India,[75] including Pakistan's assured second-strike capability.[76] However, if India's ABM systems become fully operational and effective, Pakistan may find itself compelled to revise its strategic posture. This could involve keeping its nuclear arsenal in a state of hair-trigger alert and permanently mating its nuclear warheads with delivery systems, representing a shift from a recessed deterrence posture to active deterrence.[77] Such a shift would signify an escalation in nuclear readiness,

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72 Jaspal, "The Introduction of Ballistic Missile Defence in South Asia," 127-128.

73 Ibid.

74 Ankit Panda, "From 'No First Use' to 'No, First Use?'", *Diplomat*, August 18, 2019, https://thediplomat.com/2019/08/from-no-first-use-to-no-first-use/.

75 "Rare Light Shone on Full Spectrum Deterrence Policy," *Dawn News*, December 7, 2017, https://www.dawn.com/news/1375079.

76 "Pakistan Test-Fires Nuclear-Capable Submarine-launched Cruise Missile," *Dawn News*, January 10, 2017, https://www.dawn.com/news/1307531/pakistan-test-fires-nuclear-capable-submarine-launched-cruise-missile.

77 Jaspal, "The Introduction of Ballistic Missile Defence in South Asia," 128.

reflecting the heightened tension and reduced crisis stability brought about by the advancement of ABM systems in the region. Thus, crisis instability may force Pakistan to consider first-strike against India in order to strengthen survivability of its nuclear force under India's conventional or nuclear pre-emptive strike,[78] though Pakistan has no official declaratory nuclear first-use or NFU policy, aimed at keeping its nuclear posture ambiguous.

The advancement of Indian ABM systems will also play a role in diminishing the prospects for both India and Pakistan to consider establishing a Strategic Restraint Regime (SRR). Pakistan has consistently proposed the idea of a regional SRR or an arms control mechanism to India. However, development and deployment of Indian ABM systems could be perceived as a move away from the concept of mutual restraint. This scenario implies a reduced likelihood of both nations agreeing on measures that would limit their respective military capabilities, particularly in the realm of missile defence and nuclear weapons. The presence of these advanced ABM systems thus not only complicates existing security dynamics but also poses significant challenges to the initiation and implementation of any form of arms control or restraint regime in the region, especially since India has continued to decline such proposals.[79]

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[78] Ibrahim Anjum, "Implications of Indian Ballistic Missile Defence (BMD) on Strategic Stability," *Policy Perspectives*, 13, no. 1 (2016): 110, https://www.jstor.org/stable/10.13169/polipers.13.1.0097#metadata_info_tab_contents.

[79] "Offer for Strategic Restraint Still on Table, Pakistan tells UN," *Dawn News*, October 16, 2020, https://www.dawn.com/news/1585312; Ayesha Rana, "Challenges to Strategic Stability in South Asia," *Strategic Studies* 38, no. 2 (Summer 2018): 10-20, https://www.jstor.org/stable/48539134; and, Jaspal, "The Introduction of Ballistic Missile Defence in South Asia," 129.

Options for Pakistan

MAD currently serves as the foundational principle of the nuclear postures for both India and Pakistan, with each country possessing a credible nuclear arsenal.[80] However, as discussed earlier, deployment of India's ABM systems presents a significant challenge to regional strategic stability. In light of this evolving security landscape, it becomes imperative for Pakistan to explore and consider multiple options to uphold and maintain strategic stability. This necessity stems from the need to adapt to the changing dynamics introduced by India's ABM capabilities, which potentially undermine the mutual vulnerability essential for the MAD doctrine to effectively function as a deterrent. Pakistan's strategic considerations, therefore, must evolve to address these new challenges and ensure a continued balance in the region's strategic equation.

Presently, the prospects for Pakistan to develop indigenous ABM systems appear somewhat limited. While technically, Pakistan may possess the capability to develop a point missile interception system, the effectiveness of such a system in the face of India's extensive offensive missile arsenal remains a matter of concern. The development of a point ABM system, although potentially feasible from a technical standpoint, might not provide comprehensive protection against the spectrum of threats posed by India's missile capabilities.

Furthermore, the economic implications of such a development cannot be overlooked. Investing in ABM technology represents a significant financial undertaking, and for Pakistan, directing substantial resources towards developing point ABM systems

[80] Khalid Ahmed Kidwai, "Keynote Address," (speech, CISS-IISS Workshop on *Defence, Deterrence and Stability in South Asia*, December 6, 2017), Centre for International Strategic Studies (CISS), https://ciss.org.pk/ciss-iiss-workshop-on-defence-deterrence-and-stability-in-south-asia/.

could lead to considerable economic strain. This consideration is particularly crucial in the context of Pakistan's broader economic landscape and the need to balance defence spending with other national priorities. [81]

According to Lt. Gen. Khalid Ahmed Kidwai (Retd), Adviser to the National Command Authority (NCA) of Pakistan, the country has consciously chosen not to pursue the development or procurement of BMD systems. Instead, Pakistan's strategy focuses on the development of ballistic and cruise missiles across a variety of ranges. This approach is aimed at maintaining strategic stability in relation to India. By diversifying and enhancing its missile capabilities, Pakistan seeks to preserve a balance of power and deterrence, countering the evolving security dynamics influenced by India's defense advancements. This decision reflects a strategic calculation that prioritises the development of offensive capabilities over investment in defensive BMD systems, aligning with Pakistan's broader security and defence objectives.[82]

In January 2017, Pakistan successfully test-launched both of nuclear-capable Submarine-Launched Cruise Missile (SLCM), *Babur-III*,[83] and *Ababeel*, land-based ballistic missile, capable of

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81 Ghazala Yasmin Jalil, "Indian Missile Defence Development: Implications for Deterrence Stability in South Asia," *Strategic Studies,* 35, no. 2 (Summer 2015): 39, https://www.jstor.org/stable/48527460.

82 Khalid Ahmed Kidwai, "Keynote Address" (speech, Seminar on *Strategic Stability in South Asia: Is India a Responsible Nuclear State?* June 13, 2019) Institute of Strategic Studies Islamabad (ISSI), https://issi.org.pk/remarks-by-lt-general-khalid-ahmed-kidwai-seminar-on-strategic-stability-in-south-asia-is-india-a-responsible-nuclear-state/.

83 "Pakistan Attains 'Second Strike Capability' with Test-Fire of Submarine-Launched Cruise Missile," *Dawn News,* January 9, 2017, https://www.dawn.com/news/1307384.

delivering multiple warheads using Multiple Independent Re-entry Vehicle (MIRV) technology.[84]

Opting not to pursue ABM systems, it is a more prudent for Pakistan to continue enhancing its nuclear and missile arsenal in both quantitative and qualitative terms. This approach is aimed at countering the growing missile interception capabilities of India. The development of MIRV capability is particularly crucial. It would enable Pakistan to ensure the penetration and survivability of its nuclear forces amidst the expanding missile defence systems of India. MIRVs, which allow a single missile to carry multiple warheads and target them independently, significantly increase the likelihood of penetrating missile defence shields. This technology not only complicates the interception efforts but also serves as a robust deterrent by guaranteeing a credible second-strike capability.

Additionally, the advancement of sea-based missile capabilities would further bolster Pakistan's ability to evade ABM systems. Deploying missiles from naval platforms, such as submarines, adds an element of stealth and unpredictability, enhancing the survivability of the nuclear force. This two-pronged approach, combining MIRV capabilities with sea-based assets, would provide Pakistan with a more comprehensive and effective strategy to counterbalance India's ABM systems, thereby maintaining strategic stability in the region.

Moreover, Pakistan can also consider various other technologies to strengthen its missile penetration capabilities. For example, it could consider missile skin cooling technologies which provide stealth technologies in order to conceal missiles from heat detectors.[85] It could explore development of decoys for its missile systems.

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[84] "Pakistan Conducts First Flight Test of Ababeel Surface-to-Surface Missile," *Dawn News,* January 24, 2017, https://www.dawn.com/news/1310452.

[85] Ghazala Yasmin Jalil, "Indian Missile Defence Development," 39-40.

Decoys are designed to mimic the appearance and radar signature of actual warheads, creating multiple false targets. This tactic significantly complicates the interception process, as ABM systems may struggle to distinguish real warheads from decoys, thereby increasing the probability of the genuine warhead reaching its target. In addition to decoys, Pakistan could consider investing in the enhancement of Manoeuvrable Re-entry Vehicles or Warheads (MaRVs). MaRVs are designed to alter their trajectory during re-entry, making it challenging for ABM systems to predict and intercept them accurately. This capability allows the missile to evade defensive systems by making last-minute adjustments to its flightpath, greatly reducing the likelihood of interception.[86]

Pakistan could also consider employing less expensive other offensive means including cyber operations to foil Indian ABM systems. As missile defence systems remain connected to networks and the Internet, and heavily rely on the transmission of data or digital information amongst its various including sensors, radars, fire control and C2 systems, they are quite vulnerable to cyber-attacks.[87] Reports highlighting vulnerabilities in US ABM systems,[88] particularly due to weak cybersecurity measures, point to a potential strategic avenue for Pakistan in countering the effectiveness of Indian ABM systems. Developing offensive cyber capabilities could be a critical component of Pakistan's strategy to neutralise or mitigate the threat posed by advanced Indian missile

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86 Jeffrey Lewis, "Is China Developing a MARV?" *Arms Control Wonk*, June 30, 2005, https://www.armscontrolwonk.com/archive/200655/is-china-developing-a-marv/.

87 Patricia Lewis and Beyza Unal, "The Destabilizing Danger of Cyberattacks on Missile Systems," Chatham House, July 2, 2019, https://www.chathamhouse.org/2019/07/destabilizing-danger-cyberattacks-missile-systems.

88 Geoff Ziezulewicz, "Audit Finds Cyber Vulnerabilities in US Missile Defence System," *Navy Times*, December 15, 2018, https://www.navytimes.com/news/your-navy/2018/12/14/audit-finds-cyber-vulnerabilities-in-us-missile-defense-system/.

defence systems. Focus in this area could likely involve strategies aimed at infiltrating and disrupting the technological and operational infrastructure of the Indian ABM systems. This could include targeting key components such as sensors, radars, satellites, fire control systems, and C2 networks. By employing tactics such as phishing or other forms of cyber-attacks, Pakistan could potentially gain access to these critical systems. Successful cyber operations could impair the functioning of the ABM systems in various ways. For instance, they could disrupt the launching capabilities of the system or interfere with the guidance and targeting mechanisms, preventing the system from effectively reaching and neutralising its targets. Such a disruption would significantly enhance the penetration capability of Pakistan's missiles against the Indian ABM defence architecture.

Incorporating offensive cyber operations into its military strategy would require Pakistan to invest in developing sophisticated cyber capabilities, including building a skilled workforce adept in cyber warfare techniques. This approach would add a new dimension to the regional strategic balance, underscoring the increasing importance of cyber capabilities as a tool for national defence and strategic deterrence.

Conclusion

In response to India's continued advancement in Anti-Ballistic Missile (ABM) systems, Pakistan's decision not to pursue similar systems, but rather to enhance its nuclear and missile capabilities, both quantitatively and qualitatively, stands as a prudent strategic choice. This approach directly addresses escalating missile interception capabilities of India. Central to this strategy is the development of Multiple Independently Targetable Re-entry Vehicle (MIRV) technology and advancement of sea-based missile capabilities.

To further strengthen its missile penetration capabilities, Pakistan can explore additional technological avenues, including missile

skin cooling for enhanced stealth, use of decoys, and development of Manoeuvrable Re-entry Vehicles or Warheads (MaRVs). Furthermore, recognising the strategic value of cyber capabilities, Pakistan can consider developing offensive cyber operations as a cost-effective measure to counter and potentially neutralise the threat posed by India's missile defence systems.

In navigating the evolving security landscape marked by India's development of ABM systems, Pakistan's strategic focus on enhancing its nuclear and missile capabilities serves not only as a counterbalance but also as a vital component in upholding regional stability. In scenarios of heightened crisis, India's perceived sense of invulnerability could prompt considerations of pre-emptive strikes against Pakistan. This security dilemma necessitates Pakistan to develop effective countermeasures. While these measures are part of an ongoing arms dynamic between the two South Asian nuclear states, they also represent a cautious and calculated effort by Pakistan to ensure a stable strategic equilibrium. The focus, therefore, is not merely on responding to immediate security threats but also on fostering a stable environment that can mitigate the risks of escalation and promote long-term regional peace and stability.

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Shadows and Echoes: Co-Dependence of Media and Government in the Struggle for Power

Hadeed Ashfaque

Abstract

Political bias in the media has become a persistent age-old phenomenon. The far-reaching effects of such bias are profound, influencing societal progress and governance. The absence of a truly non-partisan media allows individuals to amass disproportionate power, manipulating public opinion irrespective of ground realities. This lack of media impartiality fosters public mistrust, exacerbating political divisions based on affiliations. Social cohesion, vital for national progress, is hindered as civil discourse gives way to divisive rhetoric. This paper aims to critically analyse the role of media manipulation, state intervention in media control, and the objectives they pursue. Emphasis is placed on the micro-level manipulation of news stories and its impact on the broader sociopolitical landscape. The investigation is situated within the context of the political climate in Pakistan, examining the ongoing struggle for narrative control between the state and the media. The intertwined relationship between these entities is scrutinised, revealing how they leverage power for personal and political gains while shaping the collective understanding of crucial issues.

Keywords: Non-partisan Media, Politics, Governance, Freedom.

Introduction

The news media, ranging from present-day news broadcasters and format of the 24-hour news cycle, all the way back to the historical days of the printing press, have been the premier form of transmitting information throughout a society and state, and to disperse information and create an image and narrative of how society was or should be functioning. With the evolution of media and its accompanying technologies, industries such as digital publications and the entertainment sector also entered the fray of image building and narrative construction. Though innocuous at surface level, all forms of the media have been, and continue to be used, as tools for propaganda and misinformation, spinning webs of news stories that are barely able to be deconstructed before the next narrative takes hold of major headlines.

Noam Chomsky discusses the emergence of the first alternative press in the 19th Century in Great Britain. He explores how this press was seen as a substantial threat to the ruling elite, bringing workers together and fostering a collective confidence that could undeniably pave the way for social change.[1] At one point, an MP mentioned that the workers were comparing their current conditions with the potential rewards they could receive in the future. *'Incompatible with human nature'*, as he would go on to state, decrying the publications as inflaming passions and awakening *'selfishness'* among workers. Consequently, to clamp down on the rising resentment being harboured with the aid of these publications, laws and bills were passed that sought to slow down or outright stop the flow of information through the alternative press.

[1] Noam Chomsky and Edward S. Herman, *Manufacturing Consent: The Political Economy of the Mass Media* (New York: Pantheon Books, 1994), p.3.

Advancing into the 21st Century, an examination of the modern media landscape reveals a notable evolution. While media continues to play a role in narrative construction, its function has shifted. A critical observation shows that, unlike its historical role of critiquing state power, the media now often appears to be complicit in reinforcing state-driven narratives, suggesting a significant transformation from its earlier stance.

Building on this context of media transformation, a pertinent example is the statement made by the then-United States Secretary of Defense, Donald Rumsfeld, on 12 February 2022. His remarks serve as a contemporary illustration of how narrative manipulation manifests in the modern era: 'Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones.'[2]

Secretary Rumsfeld's statement was in response to questions posed by journalists about the pretense of the war in Iraq, where the invasion was justified by pumping the news media full of disinformation regarding the presence of Weapons of Mass Destruction (WMDs) under Saddam Hussein, a claim that was in later years disproven when it was revealed there had been little to insufficient evidence to point to their existence.[3]

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2 'DoD News Briefing - Secretary Rumsfeld and Gen. Myers', United States Department of Defense, 2002, http://archive.defense.gov/Transcripts/Transcript.aspx?TranscriptID=2636.

3 Glenn Kessler, "The Iraq War and WMDs: An Intelligence Failure or White House Spin?" *Washington Post*, March 22, 2019,

For the duration of this paper, the aim will be to contextualise and critically analyse the role of media manipulation and the state's hand in media control, its aims and objectives, and the methodologies of achieving them. The focus will remain primarily on the manipulation of news stories on a micro-level, and how they affect the bigger picture. The rest of the paper will be framed with respect to the political climate in Pakistan, and how state and media are in a fight for narrative control, while also simultaneously benefitting from the power and influence they both wield and use for their personal or political gains.

Press Practices and State Tactics: A Global Perspective

In his analysis of modern news media's role within the political sphere, Chomsky, in *'Manufacturing Consent,'* articulates how the media has evolved into a key apparatus for government control and narrative shaping. He references the 1981 scholarly study *'Media, Power, Politics'*[4] by Paletz and Entman, which categorises media into three tiers based on their 'prestige, resources, and outreach,' thereby providing a framework for understanding the hierarchical nature and influence of different media entities in shaping public discourse.[5]

The upper echelon of media groups, endowed with ample resources, prestige, and extensive outreach, alongside government entities and various local and international wire services, predominantly supply local, national, and international news content. This dissemination to comparatively lower-tier media outlets involves not just the distribution of information but also the shaping and curation of narratives on a global scale. Around 80%

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https://www.washingtonpost.com/politics/2019/03/22/iraq-war-wmds-an-intelligence-failure-or-white-house-spin/.

4 David L. Paletz and Robert M. Entman, *Media Power Politics* (New York: Free Press, 1981).

5 Chomsky and Herman, *Manufacturing Consent*.

of the global news in circulation can be traced back to four major Western wire services – Associated Press (AP), United Press International (UPI), Reuters, and Agence-France-Press (AFP). According to Paletz and Entman: 'The wire services "exist to serve markets", and their prime concern, accordingly, "is with the rich media markets of the United States, Western Europe, and Japan and increasingly with the business community…" They compete fiercely, but AP and UPI "are really U.S. enterprises that operate on an international scale… Without their domestic base, the AP and UPI could not operate as international agencies. With it, they must be American organisations, subject to American pressures and requirements.'[6]

The onset of the War on Terror (WoT) and the subsequent media frenzy marked a significant shift towards greater media influence over public opinion. This shift was characterised by the selective omission of facts in news stories and framing events through a Western-centric perspective. Such framing often emphasised the valour of American troops engaged in the Middle East, under the narrative of fighting for the freedom of the oppressed. One such highlighted news event was in 2003 when soldiers from the U.S. Army killed 54 Iraqis, stating they had 'cleared out insurgents' from the city of Samarra. Below are excerpts from three news articles (from *The New York Times*, *Fox News* and *Al-Jazeera*), each beginning with their distinct opening sentences each sentence reflecting different editorial choices and angles. These variations underscore the importance of media literacy in understanding how different outlets can present the same event in divergent ways:

The New York Times: 'American commanders vowed Monday that the killing of as many as 54 insurgents in this central Iraqi town would serve as a lesson to those fighting the United States, but

[6] Paletz and Entman, *Media Power Politics*.

Iraqis disputed the death toll and said anger against America would only rise.'[7]

Fox News: 'In the deadliest reported firefights in Iraq since the fall of Saddam Hussein's regime, U.S. forces killed at least 54 Iraqis and captured eight others while fending off simultaneous convoy ambushes Sunday in the northern city of Samarra.'[8]

Al-Jazeera: 'The US military has vowed to continue aggressive tactics after saying it killed 54 Iraqis following an ambush, but commanders admitted they had no proof to back up their claims.'[9]

Each of the aforementioned news stories is reporting on the same story and operating on the same set of facts that were available to news reporters right after the incident, though, the method of reporting the news varies between the three outlets. Out of the three, *Al-Jazeera* remained the only one that included the key fact that US forces had been unable to provide proof of their claims of neturalising active terrorists. The two outlets that were more partisan to American policies, *The New York Times* and *Fox News*, omitted this key piece of information, instead presenting the story as a victory for US forces against a targeted attack by violent insurgents. The Iraq War was still in its early days, and as can be seen with the above examples, American news outlets were actively busy in disseminating stories that would sway the public opinion

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7 Dexter Filkins and Ian Fisher, "U.S. Sees Lesson for Insurgents in an Iraq Battle," *New York Times*, December 2, 2003, https://www.nytimes.com/2003/12/02/world/us-sees-lesson-for-insurgents-in-an-iraq-battle.html.

8 Steve Centanni, "Firefights Leave Dozens of Iraqis Dead," *Fox News*, December 2, 2003, https://www.foxnews.com/story/firefights-leave-dozens-of-iraqis-dead.

9 Desk Report, "Samarra Clash Toll still a Mystery," *Al-Jazeera*, December 2, 2003, https://www.aljazeera.com/news/2003/12/2/samarra-clash-toll-still-a-mystery.

towards being pro-war. Reporting on the lack of proof available to back up Washington's claims would have potentially caused a backlash from the American public. Though the war was still fresh, American sentiment had been rapidly declining regarding the presence of US troops present in Iraq. Gallup surveys in March of 2003 polled only 23% of American citizens who saw the invasion as a mistake, but by October of the same year had reached almost 40%.[10] At a point when the public's sentiments were rapidly moving away from the narrative that the White House wanted to mainstream, reporting on civilian killings by US forces would have only reinforced the idea that the decision to send troops to Iraq was a mistake. The American government made sure that all reporting done on the war was done favourably. Reporters embedded within the U.S. forces who travelled with the troops had to send their reports through the Commanding Officers before being able to send them to their publications, with reasons of 'security' cited as the main concern.[11]

From this analysis, it is inferable that a considerable portion of news dissemination exhibits a discernible Western bias. This tendency is likely influenced by the operational and financial dependencies of these news organisations on their host countries. As a result, these media outlets often craft and distribute narratives tailored to their audiences, not only as a means of securing financial resources but also as a strategy to navigate bureaucratic complexities. The apparent influence of the White House on domestic media coverage, especially in the context of American foreign policy, was highlighted earlier, demonstrating how news narratives are shaped and framed. In a state that is regarded as one of the leading examples for media and press freedom, the amount

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10 Gallup, 'Iraq', accessed November 22, 2023, https://news.gallup.com/poll/1633/Iraq.aspx#4.

11 Elisabeth Thurlow, "War Reporting and the 2003 Invasion of Iraq," *Guardian*, February 3, 2014, https://www.theguardian.com/gnmeducationcentre/iraq-war-teaching-resource-gnm-archive.

of overreach it maintains with its own media outlets only highlights how much more control the state exerts over its media as ones goes lower down the list.[12]

The intertwining of media influence and global politics has been a topic of enduring discussion and concern within the international community for decades. This issue gained particular prominence during the New World Information and Communication Order (NWICO) debates in the 1970s, when members of the Non-Aligned Movement (NAM) – a coalition formed to avoid alignment with major global powers, Western or otherwise – voiced strong criticism against Western news agencies. These newly independent nations recognised that their political autonomy was deeply entwined with economic independence, extending to ideological realms. Western media played a crucial role in shaping perceptions, influencing investment decisions, and framing narratives about the economic landscapes and investment potential in these countries, often determining whether they became lucrative markets or remained economically subservient.[13]

Even today, amidst the proliferation of news media and the vast array of channels available for public consumption, the primary sources of information remain a select group of top-tier players. These entities have long dominated the flow and sourcing of news. The advent of social media platforms like Twitter (of late called 'X') and Facebook has further entrenched this dynamic. These platforms often serve as conduits and allies for the narratives and news stories propagated by traditional news agencies like the Associated Press (AP) and United Press International (UPI), thereby

[12] Reporters Without Borders, "Press Freedom Index," https://rsf.org/en/index.

[13] Oliver Boyd-Barrett, *Media Imperialism: Towards an International Framework for the Analysis of Media Systems* (London: Edward Arnold in association with Open University Press, 1977), pp.116-135.

perpetuating the influence of established media houses in the digital age.[14]

Pakistan's State and the Press

Shifting the perspective from the global impact of media to the specific context of Pakistan, the interplay between media and the government exhibits patterns that mirror international trends. The dynamic between these two institutions in Pakistan is characterised by a complex, often contradictory relationship. On the one hand, there is continuous tension, with each entity striving to assert its influence and control. On the other, this interaction can be seen as symbiotic, where both parties, despite conflicts, derive certain benefits that simultaneously support and undermine their respective foundational principles.

Historically, the approach towards media control in Pakistan has varied with the nature of governance. Under military rule, there have been instances of direct censorship and restriction of media freedoms as a means of controlling public discourse. In contrast, democratic regimes have often employed subtler methods to influence media narratives, oscillating between incentivisation and punitive measures. This carrot-and-stick strategy has been a prevalent tool in shaping media content to align with the interests of the ruling entities. Such tactics reflect the ongoing struggle for power and influence within the Pakistani media landscape, illustrating the intricate and evolving relationship between the state and the press.

[14] Pew Research Center, "Candidates Differ in their Use of Social Media to Connect with the Public," in *Election 2016: Campaigns as a Direct Source of News*, report (Washington, D.C., July 18, 2016), https://www.pewresearch.org/journalism/2016/07/18/candidates-differ-in-their-use-of-social-media-to-connect-with-the-public/.

For instance, the years 2001-08 in Pakistan witnessed a remarkable surge in the number of news channels on cable TV,[15] a phenomenon typically considered at odds with dictatorial regimes globally. Such regimes often resort to stringent restrictions on free speech, especially during periods leading up to political transitions. Then-President of Pakistan publicly advocated for free media, highlighting its significance in a progressive society. However, this stance was juxtaposed with a regime of strict censorship, enforced through cable watchdogs[16] appointed by the President himself in the years leading up to his downfall.[17] This period saw a clear delineation in the treatment of media groups based on their alignment with government directives. Those conforming to the government's narrative were often favoured, receiving support and privileges. Conversely, media outlets that defied the state's prescribed guidelines faced severe consequences, including being completely removed from cable television. This duality in policy underscores the complex relationship between media freedom and governmental control during that era in Pakistan.

Hence, Pakistani media has often been a participant, either actively or passively, in dynamics that ultimately limit free speech and reduce accountability for the powerful and elite. This role includes

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15 Umer Farooq, "Pakistan's Private TV News Revolution Under General Musharraf," *News Laundry*, December 26, 2018, https://www.newslaundry.com/2018/12/26/pakistans-private-tv-news-revolution-under-general-musharraf.

16 Moeed Pirzada, "Musharraf and the Media," *Guardian*, November 17, 2007, https://www.theguardian.com/commentisfree/2007/nov/19/musharrafandthemedia.

17 Hena Khursheed Bajwa, "Pakistani Media, Public Opinion, and the Downfall of Pervez Musharraf: News Attribute Agenda-Setting, and Cognitive Liberation in the Lawyers' Movement," (PhD diss., The University of Texas at Austin, May 2016), https://repositories.lib.utexas.edu/items/5c983989-845c-4f8d-9d2d-11c57f80d806.

a fluctuating relationship with various political and military entities. Journalists, as part of the media landscape, have sometimes been observed transitioning between allegiances, with their editorial histories occasionally revealing contradictory stances within relatively short periods.

For instance, shifts in political power, such as the change in government following the vote of no confidence in April 2022, led to notable changes in media narratives. Critics of the military were observed to alter their viewpoints, shifting from opposition to defence of these institutions. This pattern of oscillating perspectives[18] is not uncommon in the Pakistani media landscape, where political tides can significantly influence journalistic narratives.

Such instances illustrate the complex and sometimes malleable nature of media reporting in the face of political changes. They highlight the challenges faced in maintaining journalistic integrity and consistency in environments where political and military influences are strong. This phenomenon underscores the need for a more rigorous analysis of media practices and the factors that influence journalistic independence in the country.

In Pakistan, powerful entities/institutions have recognised the media's significant capacity to influence public opinion and, by extension, the making or breaking of governments. As a result, there is a concerted effort towards exerting comprehensive control and manipulation over the narratives disseminated across millions of screens daily. Media moguls, along with their subordinates, are acutely aware of their influential role. This awareness is often

[18] Hamid Mir (@HamidMirPAK), "I was present in a meeting at NDU…," Twitter (now X), January 9, 2023, https://twitter.com/HamidMirPAK/status/1612313458598612994. Hamid Mir (@HamidMirPAK), "Will the ambassador of Kashmir…," Twitter (now X), March 23, 2021, https://twitter.com/HamidMirPAK/status/1374428414170460166.

leveraged to consolidate power for themselves, employing tactics such as sensationalised news stories and selective reporting. Such strategies can effectively hold governments to ransom and fuel hostilities, serving the interests of these media entities while shaping public perception through careful narrative control.[19]

This paper will now further analyse how the boundaries between various stakeholders in the media landscape have become increasingly indistinct. The current turmoil enveloping digital media is projected to escalate unless decisive actions are taken. Implementing bold measures to ensure accountability and maintain a balance among all involved parties is essential for mitigating these challenges.

Reality and Consequence

> 'If men define situations as real, they are real in their consequences.'
>
> - *W.I. Thomas*

The Thomas theorem is a sociological theory that states that the interpretation of an action or situation defines and frames the reality of the situation.[20] Almost a century old, the theorem still holds true in how social interactions and framing of situations tend to result in multiple versions of a single event existing in different groups. While not directly aimed at the media, it can still be applied to contextualise how media organisations and governments maintain their relationship by indulging in a symbiotic relationship that can, at times, border on or cross ethical lines.

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[19] Nazir Hussain, "The Role of Media in Pakistan," *Journal of South Asian and Middle Easter Studies* 35, no. 4 Summer (2012), https://www.pc.gov.pk/uploads/report/TheRoleofMediainPakistan.pdf.

[20] William I. Thomas and Dorothy Swaine Thomas, *The Child in America: Behavior Problems and Programs* (New York: Knopf, 1928), pp. 571-572, https://archive.org/details/in.ernet.dli.2015.155699.

The Pakistani media landscape has historically been characterised by polarisation, a trend that traces back to periods of dictatorship and extends into the complex political terrain of the 2020s. Central to this dynamic is the role of government advertisements.

The Government of Pakistan (GoP) designates a specific budget for advertising expenditures across various media platforms. Managed by the Ministry of Information and Broadcasting (MoIB), these funds are distributed at the ministry's discretion. There is often a lack of transparency or explicit justification regarding the allocation of these funds, leading to discrepancies in how they are apportioned among media groups. This occurs even among outlets with comparable viewership figures. Such practices contribute to the ongoing debate about media independence and the influence of governmental policies on the media sector in Pakistan.

The manipulation of media by incumbent governments for their own benefit can be discerned by examining the distribution of these government advertising funds. Analysing who primarily benefits financially from these advertisements offers insight into the government's media strategy. For instance, between 2013 and 2018, the government allocated over PKR 5900 million for media advertising, with two agencies receiving a disproportionately large share of these funds. [21] In stark contrast, during the tenure of the next government, advertising revenues for these news groups experienced a significant reduction, dropping to nearly half – approximately PKR 2,800 million – until the government's tenure ended. This variance in fund allocation to media outlets under different governments indicates a strategic use of financial resources to influence media coverage and, potentially, public perception.

[21] Waqas Ahmed, "Exclusive: Data on Pakistan Govt Tv Ad Expenditure from 2013 to 2022," September 27, 2003, https://waqas.xyz/govt-ads/.

The methodology governing the allocation of government advertisements is outlined in the guidelines published by the Press Information Department, with the most recent amendments in 2021 detailing a step-by-step process. According to these guidelines, a government committee is responsible for determining the recipients of advertising funds.[22] However, a critical examination of the actual distribution of funds reveals a disproportionate allocation among channels with similar viewership ratings, suggesting potential biases within these committees.

A significant challenge in assessing the fairness of this distribution is the lack of publicly available Target Rating Points (TRP) for news channels. The competitive nature of the industry often leads to the non-disclosure of actual viewership data, complicating the task of accurately assessing the correlation between advertisement spend and viewership. When relying on surveys conducted by organisations like Gallup Pakistan, it becomes evident that government advertising revenue does not always directly align with a channel's popularity or viewership ratings. This discrepancy raises questions about the criteria and objectivity employed in the allocation of government advertising funds.

A survey conducted by Gallup in 2013 revealed significant differences in the average household reach of two competing news channels, with one channel achieving a 5.1% reach and its competitor a 1.9% reach.[23] However, in the following financial year, the channel with the lower reach received more than three times the government funding compared to the one with the higher reach. Specifically, the lower-reaching channel was allocated PKR 45 million in government funding, whereas the higher-reaching

[22] Press Information Department, "Guidelines & Procedures: Advertisement Policy 2021," Ministry of Information & Broadcasting, Government of Pakistan, http://pid.gov.pk/uploads/AdvertisementPolicy2021Updated.pdf.

[23] Amal Naeem, "Gallup TV Ratings Services", Gallup Pakistan (2013).

channel received only PKR 13 million during the same period.[24] This allocation disparity raises questions about the criteria used for distributing government advertisements and the factors influencing these decisions.

The discrepancy in government advertising spending, favouring a channel with comparatively lower reach, contradicts conventional advertising logic. Typically, advertisers prioritise channels with larger audiences to maximise their potential outreach. However, this trend of imbalanced government spending persisted, contributing to the rapid growth of Pakistan's media industry, which has been one of the fastest-growing worldwide since the early 2000s.[25] The change in government in 2018 marked a significant reduction in government advertisement expenditures across all media channels and platforms. This decrease in funding led to considerable downsizing within the media industry, as many channels experienced a substantial loss in revenue.

From mid-2018 to April 2022, there was a notable increase in media scrutiny. In contrast to previous administrations, the media focused intensively on tracking the government's manifesto and promises. This scrutiny was reflected in the creation of web portals, regular publication of op-eds, and meticulous analysis of every government action, even down to the most minute details. This period saw an enhanced level of vigilance and accountability in media reporting, marking a shift from previous practices.[26]

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[24] Ahmed, "Exclusive: Data on Pakistan Govt Tv Ad Expenditure from 2013 to 2022."

[25] Riaz Haq, "Pakistan Government Ad Spend Cuts Trigger Media Business Shakeout," *South Asia Investor*, December 2, 2018, https://www.southasiainvestor.com/2018/12/pakistan-government-ad-spend-cuts.html.

[26] "Tracking Naya Pakistan-Three Years into Power, Here's Where PTI Stands on Some of its Promises," *Dawn News*, August 18, 2021, https://www.dawn.com/news/1641014. "Khan Meter: Pakistani

While heightened scrutiny by the media is essential to prevent unchecked power and ensure accountability among leaders, it is equally important for the media to maintain consistency in its principles and values. Adhering to non-partisan reporting is crucial to uphold credibility. However, current trends suggest that the Pakistani media often appears to align with the highest bidder, compromising its impartiality. This tendency to aggressively target those who reduce or withdraw financial support undermines the media's role as an unbiased informant and guardian of public interest.

Analysing the coverage by prominent news organisations reveals a correlation between media attitudes and government patronage.[27] For instance, the period 2013-18 witnessed a tendency among certain media outlets to maintain a favourable narrative about the government, regardless of expert warnings about the country's economic state.[28] Such practices highlight the potential influence

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Entrepreneur Launches First Ever Website to Monitor Imran Khan's 100 Days," *Times of Islamabad,* July 31, 2018, https://timesofislamabad.com/31-Jul-2018/khan-meter-pakistani-entrepreneur-launches-first-ever-website-to-monitor-imran-khan-s-100-days.

27 "Pakistan Election: BBC Interview with Dawn Newspaper Boss Stirs Controversy," *BBC News*, July 19, 2018, https://www.bbc.com/news/world-asia-44872978. Ahmed, "Exclusive: Data on Pakistan Govt Tv Ad Expenditure from 2013 to 2022."

28 Ali Salman, "Five Years in Power - PML-N Largely Delivered on Promises," *Express Tribune*, June 4, 2018, https://tribune.com.pk/story/1726991/opinion-five-years-power-pml-n-largely-delivered-promises. Manoj Sharma, "Imran Khan's Worst Nightmare will be Pakistan's Crumbling Economy," *Business Today*, August 3, 2018, https://www.businesstoday.in/latest/economy-politics/story/is-the-current-state-of-pakistan-economy-imran-khan-worst-nightmare-109686-2018-08-02. "Pakistan Formally Seeks Financial Assistance from IMF," *Dawn News*, October 11, 2018, https://www.dawn.com/news/1438309. "Exports of Goods and

of governmental patronage on media reporting, calling into question the impartiality and integrity of media coverage during different political administrations. During the 2018-22 period, the incumbent government also similarly engaged in practices that could be viewed as favouring certain media outlets. This included granting selective access to journalists, prioritising specific news organisations for story publication, and offering exclusive interviews to chosen channels.[29] Such preferential treatment resulted in increased viewership and financial benefits for these favoured outlets.

While this approach did not involve direct financial incentives through advertisements, the granting of exclusive access and interviews to select media channels by high-ranking government officials, including the Prime Minister, raises ethical concerns. It deviates from the traditional role of state-run media, which is conventionally expected to be the central medium for disseminating official government messaging and information. The preferential treatment accorded to private news channels by a sitting Prime Minister not only undermines the state broadcaster's role but also challenges the principles of equal access and balanced reporting in the media landscape. Such actions contribute to a disparity in the media's portrayal of government activities and

Services (% of GDP) – Pakistan," The World Bank, https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?locations=PK.

[29] Asad Hashim, 'Silenced': Pakistan's Journalists Decry New Era of Censorship," *Al Jazeera*, August 15, 2019, https://www.aljazeera.com/features/2019/8/15/silenced-pakistans-journalists-decry-new-era-of-censorship. Umer Farooq, "How Pakistani Media has Come a Full Circle under Imran Khan," *NewsLaundry*, December 31, 2018, https://www.newslaundry.com/2018/12/31/pakistani-media-imran-khan-censorship.

priorities. The imbalance created by these actions underscores the complexities in maintaining ethical standards.

The news media frequently positions itself as a conduit for the political elite to disseminate their narratives. There are assertions that media outlets face oppressive measures from state machinery in response to critical reporting. However, the pattern wherein media proprietors secure lucrative agreements while concurrently echoing narratives favourable to the incumbent authorities raises critical questions. This juxtaposition of alleged suppression with advantageous dealings for media owners suggests a complex interplay of influence and benefit, which warrants a closer examination of the media's role and its relationship with the state.

The prevalence of inaccurate or biased reporting creates vulnerabilities that foreign entities can exploit to their advantage. For instance, the EU Disinfo Lab report, published in December 2020, sheds light on how India's government and intelligence agencies managed to manipulate narratives in Pakistani mainstream media.[30] The report uncovered a network of over 500 local media domains across 95 countries, primarily utilised to target Pakistan and influence its global narrative. Outlets like *'Times of Geneva,'* an affiliate of Asian News International (ANI), were found to frequently disseminate news sympathetic to Baloch separatist movements and other narratives aimed at destabilising Pakistan.[31]

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[30] Gary M.A. Alaphilippe, Roman Adamczyk and Antoine Grégoire, *Indian Chronicles: Deep Dive into a 15-Year Operation Targeting the EU and UN to Serve Indian Interests*, report (EU Disinfo Lab, December 2020), https://www.disinfo.eu/publications/indian-chronicles-deep-dive-into-a-15-year-operation-targeting-the-eu-and-un-to-serve-indian-interests/.

[31] Flora Carmichael and Abid Hussain, "Pro-Indian 'Fake' Websites Targeted Decision-makers in Europe," *BBC News*, December 16, 2019, https://www.bbc.com/news/world-asia-india-50749764.

Following the EU Disinfo Lab report, several websites, including 'Times of Geneva' and '4 News Agency', were taken down. However, numerous others continue to operate, spreading misinformation within an already oversaturated and unreliable media landscape in Pakistan. These are not isolated incidents but part of coordinated efforts to weaken the country.

The need for a responsible media, capable of working in conjunction with the state to counteract these efforts, is more crucial than ever. Without it, the existing cracks in the information landscape, exacerbated by the spread of misinformation, are likely to widen. The focus of the media should shift from personal career advancement and financial incentives to playing a constructive role in safeguarding the integrity of information and national stability.

Conclusion

The news media is a means of communicating political ideas within a society. Any kind of dialogue that must happen on a national level must be facilitated by the nation's news channels. The news media in Pakistan has increasingly experienced the co-opting of political narratives into mainstream reporting. This trend has facilitated the propagation of personal agendas within the public discourse. The result of this has been a huge political divide within the Pakistani public, with the space for reasonable discourse, amongst individuals of varying political opinions across the spectrum, having been reduced significantly. Accusations of political bias and incorrect reporting run rampant throughout the industry and have subsequently destroyed the public's trust in the nation's main news providers. Furthermore, the news media continues to be used by all sitting governments as a tool for policy influence, more often than not flooding the mainstream channels with information in order to sway public opinion towards a certain direction, such as with issues pertaining to inflation, or law and order.

The Pakistani media bears a significant moral obligation to uphold fairness, accuracy, and responsibility, especially as the country

stands at the precipice of a changing social order. Alterations in the operational approaches of media conglomerates have the potential to initiate a ripple effect, restoring public trust in a non-partisan and accurate media landscape. The proliferation of false information and contrived news stories has led to a growing sense of distrust among audiences towards the media. This scepticism, in turn, exacerbates the existing divides in political discourse throughout the country, underscoring the critical need for media integrity and ethical journalism in shaping a more cohesive and informed society.

Political events over the past few decades have highlighted a deteriorating relationship between the press, the public, and political figures. There is a growing recognition within the media industry that adopting a more bipartisan approach in editorial practices could attract a broader and more loyal audience, potentially leading to greater commercial success. However, without an effective system to ensure bipartisan editorial integrity, the inherent biases of journalists risk being amplified when they operate within institutions or align with parties that resonate with their personal beliefs or ideologies. This trend underscores the need for balanced journalism to maintain the credibility and effectiveness of the media in its role as a pillar of democracy.

A responsible and unbiased media landscape can re-engage the public as active participants in political discourse, moving beyond mere spectators in political conflicts. A properly regulated media system is crucial for restoring its role in checking and balancing the powers it was originally intended to oversee, thereby reinforcing the foundations of a healthy democratic process. Such a system would allow for a more cohesive, politically diverse national discourse.

Hadeed Ashfaque is a graduate in Television Studies and a freelance videographer. His academic and professional interests are deeply rooted in the study and analysis of propaganda and censorship within media landscapes.

Book Reviews

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Walter Isaacson, *Elon Musk* (Simon & Schuster, 2023).

Reviewed by Dr Usman W. Chohan
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Having been a household name around the world for several years now, Elon Musk is certainly one of the most influential, as well as polarising, figures of the modern age. As a technology entrepreneur, he has worked on launching many initiatives that have a transformative bent, along with what he argues are 'existential questions for our species.' These projects include the private aerospace initiatives SpaceX and Starlink, the electric automotive giant Tesla, the Artificial Intelligence (AI) initiative OpenAI, and technology platforms including X (Twitter) and Paypal. Given the scope of CASS's research agenda, it is clear that Elon Musk's initiatives have a striking and immediate relevance to many of those areas: emerging technologies (OpenAI and Tesla), non-traditional security (X), economics (Tesla and Paypal), and of course aerospace (Starlink and SpaceX). It is remarkable that a single individual would be key to the future of so many areas, but indeed Elon Musk is, and like him or not, his efforts are changing each of these sectors in significant ways.

It is precisely because of this consonance between Elon Musk's ambitions and these areas of research that his new biography, written by the famed Walter Isaacson, should be considered for a read. Isaacson is also famous for his biographies of Steve Jobs, Albert Einstein, Henry Kissinger, and Benjamin Franklin. He is a uniquely

erudite biographer who has straddled the worlds of think tanks (CEO, Aspen Institute), the media (CEO, CNN), and academia (Professor, Tulane). He has built fame and repute, as well as a fortune, through his previous biographies, all of which have been heavy tomes and bestsellers. His work on Elon Musk is also 688 pages long (or 19 hours as an audiobook), and this reflects the attention to detail and the time it took to write the book (roughly two years).

There are many ways to scrutinise Isaacson's work, and each of them can be touched upon briefly: core theme, style of subject portrayal, the technical vs. personal, comparisons with Isaacson's previous works, and broad lessons.

In terms of the core theme of the book, Isaacson's approach can be distilled to the following: 'Is it alright to be mean if you're smart?' This may sound as a dismissive simplification, but it really is the root of the biographer's approach. Elon is very smart, and yet he is very mean, the book proceeds to discuss at great length. Now, is one to condone or tolerate this? Aside from Elon Musk himself, many interviewees for the book were asked this basic question in one form or another, and some were more permissive in their attitudes than others (especially subordinates). But is this a particularly profound question for a biographer to even ask? Even if one revisits the Machiavellian dilemma of being either loved or feared, in this book it isn't drawn out with finesse, and is rather repeated across essentially business-school case studies of Musk's various companies. One comes about knowing by roughly the age of eight that being mean is not a good thing, even if one is really strong or really smart. In fact, it is puzzling that someone with a biographer's acumen of Walter Isaacson would choose to pursue this leitmotif at all, since it suggests that there is either a lack of profundity in Elon Musk, which many of his detractors do believe, or that it is too early to draw deeper meaning from his life. In this generous latter case, then, perhaps once he gets us to Mars or to Pluto, we will be able to appreciate his life better. For now, Isaacson's work leads us to believe that we must ponder the question of whether people can be nice or smart.

Yet in terms of the style of subject representation, Isaacson's book is extremely generous, one might even say fawning, towards his subject. In many instances where Musk's behaviour could be better characterised as frenzied (SpaceX, Twitter), Isaacson labors to rationalise it. A biographical work of quality tries to show that there are two sides to every human, with some good and some bad elements fused in constant tension. In Musk's biography, however, Isaacson instead suggests that Musk is bad *because* he is good, i.e. he is mean-spirited *because* he is brilliant, which ends up excusing much and contributing little, in the sense that popular media has already covered Musk's whimsy at great length. One therefore comes away with little in terms of nuance, and this reinforces the earlier hypothesis that perhaps it is too early to appreciate Musk's life. The excusing and fawning approach also weakens Isaacson's objectivity, and leads the reader to view the book more in light of Isaacson's other interests (think tank networking or media relations) rather than scholarly rigour.

In terms of the balance between the technical and personal, the book veers much more towards the technical than required. Much of the middle and late portions appear to be a collection of MBA case studies infused with quotes from the participants. This is unfortunate because Isaacson has previously demonstrated great prowess in balancing the technical and personal in three of his works that also dealt with scientific personalities: Benjamin Franklin, Alfred Einstein, and Steve Jobs. The personal realm might also not be sufficiently explored because it involves living persons, some of whom are antagonistically positioned towards Musk, including within his family. To scuttle any legal risks then, it is better to avoid too much intrusion, but this comes at the expense of learning for the reader, and reiterates the earlier hypothesis that it is too early for this project.

There are, nevertheless, some areas of interest that are not covered in popular media involving Musk's habits, which go against leadership stereotypes. One such habit is that Musk has always been an extreme night owl, spending time well into the early dawn working (in later life) or reading (in his childhood). Another such habit is that he honed a great many skills through incessant gaming, being a true aficionado

of strategy video games even to the present day. These two habits are not touted as stereotypical leadership habits, but they are part-and-parcel of Musk's success. A further interesting note in the book, which may slip by many readers, is the important role of Navaid Farooq, Elon's first true and lifelong friend, in maintaining a sincere camaraderie based on common interests and values. Mr Farooq is of Pakistani origin, and grew up in a household with a United Nations (UN) background. It always strikes me how cosmopolitan and well-networked our diaspora has always been. Many important personalities in the West have had close friendships with Pakistanis, and the list is, in fact, too long when one tries to put it together. This is an asset for our people that has lain dormant because we have not offered our diaspora the opportunity to channel this strength towards Pakistan. Overseas and foreign-born Pakistanis are the country's greatest asset, let us not forget.

All this said, the main lessons, for the purposes of research, are threefold. First, there are few figures in this world who span so many areas of emergent value as does Elon Musk, and therefore understanding his background, ambition, and limitations is a very prudent approach to understanding the multiple fields in which he delves. While this book may lack a depth of character, it still offers the general reader an appreciation of many projects that are worth knowing better (X, Tesla, SpaceX, etc.). Second, the breakneck pace at which changes are occurring in many fields can often overwhelm the observer, but each field builds upon existing expertise and can often sit dormant, without much progress, for long periods. This book gives an appreciation for those long periods where there was little to show for the great deal that was being quietly done. We only observe the final product, not the process behind it. Third, and as I have previously argued as well, our world is increasingly being parceled among a handful of powerful figures, who may not have our best interests at heart, and may not even be mentally stable enough to assume such responsibility. Holding the fate of the multitudes through their ownership-stake in monstrously large entities, these figures are Goliaths that can trample us on a whim. The future requires better distributions of global power that are participatory, engaging, and

empowering. Otherwise, as this book unwittingly reveals, a few egomaniacs can put us all in great jeopardy.

In sum, while the book is hardly Isaacson's best work, and seems to have been prematurely done for reasons beyond pure scholarship, the subject is one of importance, since Elon Musk's empire covers many areas simultaneously. It is therefore worth reading, but less for its exposition and more for its salience. A better book of Musk will come in due course, as his impressive and multifaceted career completes its fuller term.

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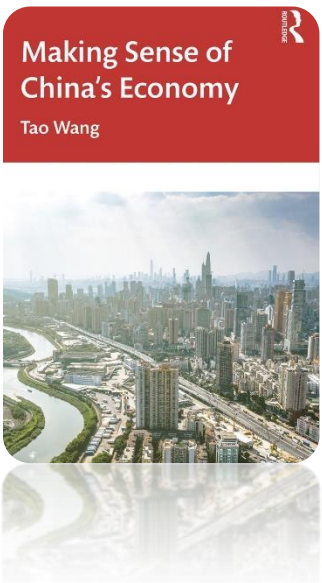

Tao Wang, *Making Sense of China's Economy* (Abingdon: Routledge, 2023).

Reviewed by Zahra Niazi, Research Assistant, Centre for Aerospace & Security Studies, Islamabad, Pakistan.

In the book *'Making Sense of China's Economy*,' Dr Tao Wang, Chief China Economist at UBS Investment Bank in Hong Kong and formerly an economist at the International Monetary Fund (IMF), untangles the complex nature of China's economic system. She discusses the evolution of China's economy, its challenges, opportunities, contradictions, its economic policymaking process, and the country's future development course.

Wang begins by highlighting the dichotomies characterising modern-day China (p. 3): It is the largest economy by some measures, yet remains underdeveloped, and despite its alarmingly high debt levels, it has not experienced a typical debt crisis. Modern Chinese cities co-exist with poor inland regions, and State-Owned Enterprises (SOEs) operate alongside vibrant private firms. However, Wang also highlights that China's progress over the past 40-some years has been tremendous, allowing it to emerge as the second-largest economy with a vibrant private sector and modern manufacturing from being one of the poorest, centrally planned, and closed economies (pp. 19-76). Today, 60-70% of the Chinese economy is in the hands of the private sector compared to the year 1978, when the entire economic activity was organised through the central planning system. China has achieved this by adopting an adaptive and pragmatic approach to development strategy and economic policy alongside introducing

numerous reforms since late 1978. The reform process was undertaken in three phases: the first having 'reforms and opening to liberate productivity,' the second comprising 'establishment of a socialist market economy,' while the third involving 'deepening, rectification, and rebalancing' of the reforms.

In terms of the policymaking process, the author discusses that while the central government in China makes the most important economic policy decisions and has more direct control over exchange rate policy, monetary policy, and fully funded fiscal policy; the process of formulating long-term policies on selected trends and issues also seeks proposals from official think tanks and other research institutes (pp. 80-102). A semblance of a bottom-up approach is more visible in the policy implementation process, where the local governments are often the most important entities, although this sometimes complicates things as the local governments' interests may not align with those of the central government or they may not have the resources required to execute the national policies. On the subject of the property market and local government finance as well, Wang highlights that local governments are directly involved in the Chinese property market (p. 130). However, this gives local governments strong incentives to boost land and property prices, pushing them beyond the usual fundamentals of housing market supply and demand.

Dr Wang also talks about the disparities in China embedded in the *hukou* system, i.e., a household registration system where the place of birth determines a person's entitlement (pp. 110-112). As a result, individuals are often excluded from many entitlements outside of their *hukou* locations. Furthermore, Wang answers one of the pressing questions many readers might have, i.e., '*Why has China not had a traditional debt crisis?*' She highlights that the reasons China's high debt levels have not translated into a traditional debt crisis are that the majority of its debt is in the form of loans possessed by state-owned banks, the government sector and the SOEs owe 60% of the country's non-financial sector debt, and the country has extremely high levels of national savings rate (pp. 172-173). Additionally, the author lauds the

evolution of the Chinese public management system, stating that '*it is a testament to its pragmatic and self-correcting mechanism of governance*' (p. 184).

From a global context, the author contends that in an environment of mistrust and tensions, it is difficult to predict a future characterised by China's further integration into an inclusive and open global economy (p. 218). Hence, in the final chapter, Wang highlights the challenges that could complicate China's sustainable transition into an advanced economy, including its rising debt levels, ageing population, ubiquitous state, inefficient SOEs, an increasing focus on party control, and high inequalities, which could be further deepened due to technological progress and greater automation (pp. 224-225). According to her, addressing key domestic challenges will majorly determine the future of China's development (p. 237).

The book's comprehensive exploration of various themes within a central topic, coupled with its accessible language and abundant factual data, makes it an informative and enriching read. The most commendable feature of the book is Dr Tao Wang's visible effort towards presenting a balanced overview and analysis of China's economic growth alongside the modern Chinese economy. She gives due credit to China's phenomenal progress over the past few decades but does not shy away from highlighting the contradictions that the country exhibits, avoids painting a rosy picture and lays the major onus of its future development path on its ability to address domestic challenges and shortcomings rather than great power competition.

However, one aspect the book does not explicitly delve into is the question of China's lack of political freedom and whether it could become a challenge for the country's sustainable transition into an advanced economy. The absence of a detailed exploration of this issue overlooks the prevailing view that the status of a country as developing or developed should also take into account the political freedom and human rights afforded to its citizens.

Nevertheless, apart from this shortcoming, even a casual reader may not be able to deny the relevance, comprehensiveness, and lucidness of the information offered in the book. It is relevant for a wide range of audiences, from students studying a beginner's course on the Chinese economy to policymakers from anywhere across the world aiming to deepen their respective country's relationship with China or seeking valuable lessons worthy of being replicated.

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Josh Simons, *Algorithms for the People: Democracy in the Age of AI* (New Jersey: Princeton University Press, 2023).

Reviewed by Shaza Arif, Research Assistant, Centre for Aerospace & Security Studies, Islamabad, Pakistan.

Artificial Intelligence's explosive integration into various facets of human life has become a subject of widespread discussion. This has led to the publication of new books and literature on the topic to debate the good, the bad and ugly societal impacts of this technology. Like other critical domains vis-à-vis AI, it is essential to see the interplay between AI and democratic values to comprehend its future implications for the general public. Authored by Josh Simons, Research Fellow in Political Theory at Harvard University, who earlier worked as a Visiting Research Scientist in AI at Facebook, the book, *'Algorithms for the People: Democracy in the Age of AI'* is a very recent take on the subject.

In his 320-page analysis, Simons scrutinises the intersection of advancing Machine Learning (ML) through AI and democratic values. The book unfolds in two distinct sections. The initial part probes into critical values like fairness, discrimination, and equity, exploring how AI shapes and is shaped by these principles. The latter half presents case studies of major digital platforms, including Facebook and Google, examining the profound impacts these entities have in the context of AI and democratic values. He concludes by stressing the

need to prioritise public interest over generating advertising revenues, ensuring diversity through the presence of more voices and values on digital platforms, and promoting shared principles through a civic information architecture. Recognising the challenges to democratic values in the age of AI, Simons calls for articulating more robust regulations for ML. He emphasises the complexity and variability in human perceptions of concepts like fairness, equity, and discrimination, compared to how machines might interpret or apply these concepts highlighting the significant difference in understanding and application between human and machine perspectives. Throughout the book, his arguments are backed up by real-life instances witnessed on various occasions in the Children, Youth and Families Office (p.14), Criminal Justice Section (p.36), Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) (p.38). The examples vividly highlight the discrepancies that exist, particularly vis-à-vis race, despite the claimed efficiency and fairness of ML.

The book's eight chapters skillfully dissect the profound influence of Facebook and Google on our collective perceptions. These chapters offer insightful analysis, illustrating how Facebook has revolutionised social interaction by creating a digital public square, where conversations and connections unfold in new, often unanticipated ways. Concurrently, Google is depicted as the modern equivalent of a public library, meticulously organising and shaping our information ecosystems. This nuanced exploration aids readers in comprehending the substantial roles these platforms play in structuring both our online interactions and access to information. Simons shows us how the algorithms embedded in these platforms do not reveal the information we require; instead, they curate and prioritise the information we should consume based on the preferences of ML. By asserting that the ongoing technical inventory powered by ML systems possesses political qualities, the writer reveals that these platforms reflect features of our social world with undertones of racial discrimination. The inherent bias in these systems is undeniable, particularly in areas like predictive policing, where the subjectivity of human data labelers often eclipses democratic principles. This bias

extends to influential platforms like Facebook's Newsfeed and Google Search, which have evolved into potent political instruments. They not only influence what we are exposed to but also significantly shape our perceptions, subtly guiding our understanding and opinions on various topics. This highlights the crucial impact of algorithmic choices in molding public discourse and opinion.

Josh Simon's most impactful insight is the revelation that ML-driven decision-making, rooted in historical data, might fail to foresee or adapt to future changes. This reliance on the past as a predictor of the future can inadvertently anchor us to the status quo, stifling innovation and the exploration of novel paths. Additionally, the book thoughtfully argues that democracy is not static but an ever-evolving process. Each generation is tasked with reimagining and reforming institutional structures to reflect democratic ideals relevant to their era's unique challenges. Thus, it is crucial to continuously reassess our interests, cultivate values, redefine concepts, and guide AI governance to align with future democratic principles. By doing so, we can ensure that governance structures remain flexible and responsive, capable of adapting to the dynamic needs of evolving societies.

'Algorithms for the People' highlights a critical challenge for policymakers, centring on the contentious debate over the principles shaping the design of ML in the public sphere. It underscores a persistent discrepancy between the technical explanations of ML processes and the institutional justifications offered by those who deploy these technologies. This discrepancy underscores the urgency for policymakers to fully comprehend the implications and adapt their strategies to the evolving landscape. The book advocates for the creation of robust oversight mechanisms, such as the proposed AI Platforms Agency (p. 185) and the AI Equality Act (AIEA) (p. 103), to effectively regulate these technologies and address their inherently political nature. Additionally, it calls for a more active engagement of civil society in the decision-making process, ensuring that societal concerns are adequately considered and addressed in the governance of ML tools. This approach aims to bridge the gap between technological advancement and its societal impact, fostering a more

balanced and equitable integration of ML into our public and institutional frameworks.

This book makes a timely and significant contribution to the discourse on AI's growing influence in our daily lives. Each chapter begins with thoughtfully selected quotations, enhancing the reader's engagement and connection to the content that follows. Simon's persuasive style effectively communicates the core arguments, though some readers may find the book's structure less captivating. In fact, some may argue that while the book is engaging, it falls short of fully aligning with its title, which suggests a comprehensive examination of AI's impact on democratic values. Instead, its primary focus is the digital landscape, particularly in the context of Facebook and Google's influence on democratic principles. A more precise title could have provided a clearer indication of this focus.

To gain a deeper understanding of the concepts discussed, readers might benefit from first exploring *'Superintelligence: Paths, Dangers, Strategies'* by Nick Bostrom. This foundational text could offer valuable context and insights.

Despite areas for improvement, the book is a worthwhile read, especially for those keen on understanding AI's impact via digital platforms. It offers valuable perspectives for policymakers, aiding them in making more informed decisions about AI governance. Furthermore, its broad applicability makes it a beneficial resource for any citizen interested in comprehending the intricacies of AI in our modern world.

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GUIDELINES FOR SUBMISSION

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Authors/research scholars/practitioners may contribute original, unpublished manuscripts based on the following:

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