National Maritime Foundation

www.maritimeindia.org

FROM THE TRADITIONAL TO THE CONTEMPORARY – HOW INDIA MUST PREPARE FOR WAR

Captain KS Vikramaditya, Indian Navy

The nature of war is a constant – war is inherently violent and is (or at least it should be) conducted in pursuance of political aims.[1] This is what distinguishes a war from crime. The character of war, however, is continuously changing. Shaped by rapid technological advancements, evolving geopolitical dynamics, and the blurring of conventional and unconventional battlefronts, warfare has undergone a profound transformation in the 21st century. Traditional military engagements have given way to hybrid conflicts, where cyber warfare, information manipulation, space-based capabilities, and autonomous weaponry alongside conventional arms play decisive roles.

Contemporary conflict has demonstrated that many established notions of superiority—such as the belief that expensive, high-end manned platforms provide a guaranteed advantage—are being challenged by inexpensive yet effective autonomous systems. The ongoing Russia-Ukraine war, for example, has underscored how distributed operations, containerised missile systems, and drone proliferation can dramatically influence the battlefield. This environment compels India to ask: *How should she pursue a force restructuring model that is in keeping with futuristic trends of warfare and is both adaptive and robust?*

For India, a nation with diverse security challenges ranging from nuclear-armed adversarial (and collusive) neighbours to ever evolving asymmetric threats, the need for a holistic and future-ready defence equipping strategy is imperative. The country unlike many others has no option but to balance conventional military modernisation and strategic deterrence alongside investments in asymmetric and hybrid capabilities. In this context, there is no change or for that matter trend that in the recent past has been more influential in affecting the way wars are fought than *unmanned systems*.

AN ASSESSMENT OF THE ENVIRONMENT

History stands testament to the fact that at the most fundamental level, a country's capability to prevail in war, especially a long drawn out one, depends primarily on three factors – ***economic robustness, technological prowess, and industrial base/ capacity***. Access to resources too is important and may be clubbed with the above three. Since the intent of this article is to suggest a way forward for equipping India's defence forces (and not the conduct of war itself), economic robustness may be looked at in terms of *budgetary allocations for defence*.

[1] Carl Von Clausewitz, *On War*, translated by JJ Graham(N Trubner & Co, London, 1873), 1-2

China remains India's primary threat and adversary. It would thus be prudent to compare India and China in respect of the three metrics mentioned above. It however needs to be borne in mind that the aim of this article is not to dwell upon the asymmetries between the defence related capabilities of the two countries, but to provide a bird's-eye perspective that facilitates further discussion on the equipping strategy that could be followed. The ensuing discussion is also predicated on the assumption that solutions with regard to China would enable India to also thwart Pakistan.

Budgetary Allocations for Defence

A comparison of the defence budgets of India and China over a period of 10 years (2014 – 2023) is quite revealing. The figures below have been taken from data published by the World Bank and may vary from officially published ones by the two countries.

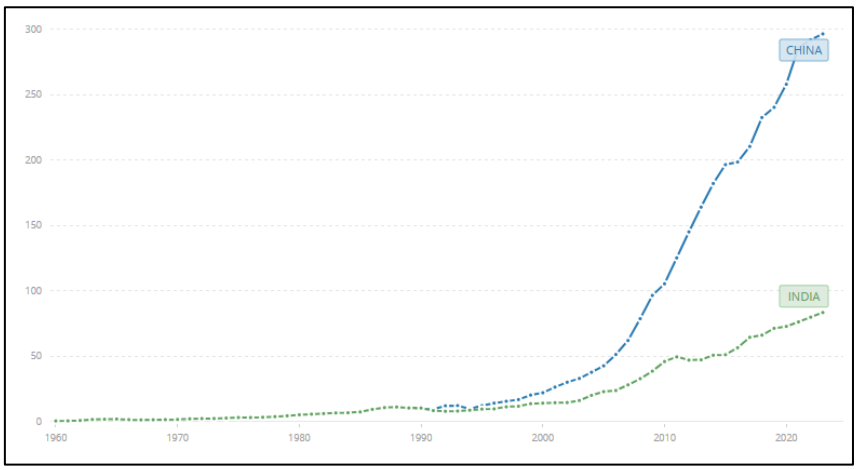

Figure 1: Military Expenditure – China, India[2]

Year	China ($ Billion)	India ($ Billion)	Difference ($ Billion)
2023	296.44	83.57	212.87
2022	291.96	81.3	210.66
2021	285.93	76.35	209.58
2020	257.97	72.94	185.03
2019	240.33	71.47	168.86
2018	232.53	66.26	166.27
2017	210.44	64.56	145.88
2016	198.54	56.64	141.90
2015	196.54	51.30	145.24

[2] World Bank Group, Military Expenditure (current UDSD) – China, India. https://data.worldbank.org/indicator/MS.MIL.XPND.CD?locations=CN-IN

2014	182.11	50.91	131.20
		675.30	**1717.49**

Table 1: Comparison of Chinese and Indian Defence Budget over 10 years[3]

China spent $1.717 trillion more on defence than did India, over the ten-year period from 2014 to 2023. This is close to ***Rs 146 trillion (1 trillion = 100 thousand crore)*** at the conversion rate of $1 = Rs 85.00. This amount is almost three times the total expenditure (Rs 50.65 lakh Crore)[4] estimate in India's budget for 2025. *The differential in defence related capacity (and even capability) that this translates into cannot be bridged in any meaningful timeframe.*

Technology

Technology has always played a fundamental role in warfare. Technology is possibly the primary tool that could (to an extent) bridge the chasm in funding described above. However, here too, some facts on ground merit mention. Unlike the early and middle decades of the 20th century, where the defence establishment was the primary incubator of technology that thereafter permeated into the civilian world (the internet being a case in point), today, it is the civilian technology ecosystem that leads innovation and disruption, which thereafter is infused into the military domain. The Australian Strategic Policy Institute's (ASPI) Critical Technology Tracker is a comprehensive, data-driven project that monitors 64 critical technologies across various sectors, including defence, space, energy, the environment, artificial intelligence, biotechnology, robotics, cybersecurity, computing, advanced materials, and key quantum technology areas. It serves as a key indicator of a country's research performance, strategic direction, and potential future capabilities in science and technology. Key findings of the ASPI Technology Tracker (2024) that are considered relevant to this article are as follows [5]: -

(a) China leads global research in 57 of 64 critical technologies.

(b) China poses a monopoly risk in research in advanced composite materials, advanced protection, coatings, smart materials, novel metamaterials, and nanoscale materials and manufacturing. This is also the case in several key communication fields, notably advanced optical and radiofrequency communication, and undersea wireless communication.

(c) Scientific breakthroughs and research innovations in key defence technologies are increasingly likely to occur in China. Radar, satellite positioning and navigation, advanced aircraft engines, drones, swarming and collaborative robots, hypersonic detection and tracking, and electronic warfare are areas of particular concern.

(d) China's research lead in advanced materials and manufacturing technologies continues to grow. Additionally, China is making substantial advances in advanced magnets and superconductors.

---

[3] World Bank Group, Military Expenditure (current UDSD) – China, India. https://data.worldbank.org/indicator/MS.MIL.XPND.CD?locations=CN-IN

[4] Ministry of Finance, GoI, "Highlights of Union Budget 2025-26", PIB Delhi, 01 Feb 2025. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2098353

[5] Jennifer Wong Leung, Stephan Robin, Danielle Cave, "ASPI's two-decade Critical Technology Tracker: The rewards of long-term research investment", ASPI, Aug 2024. https://www.aspi.org.au/report/aspis-two-decade-critical-technology-tracker

In addition to the above, the recent unveiling of the AI Large Language Model (LLM), "DeepSeek" by China on 10 January 2025, despite stringent restrictions on availability of advanced semiconductor chips[6] and lithography machinery (from ASML Holland)[7], has served to set the *cat amongst the pigeons* in the *Tech World*. The impact has been so profound that it led to a meltdown in the market capitalisation of *Big Tech* in the US stock market. Nvidia, which makes the most advanced GPUs in the world in particular, suffered colossal losses.[8] On the other hand, China's equity markets rallied spectacularly from the lows of September 2024, spurred in large measure by DeepSeek's impact on Western investors.[9] Economics provides the most accurate estimate of sentiment, in this case, China's tech prowess.

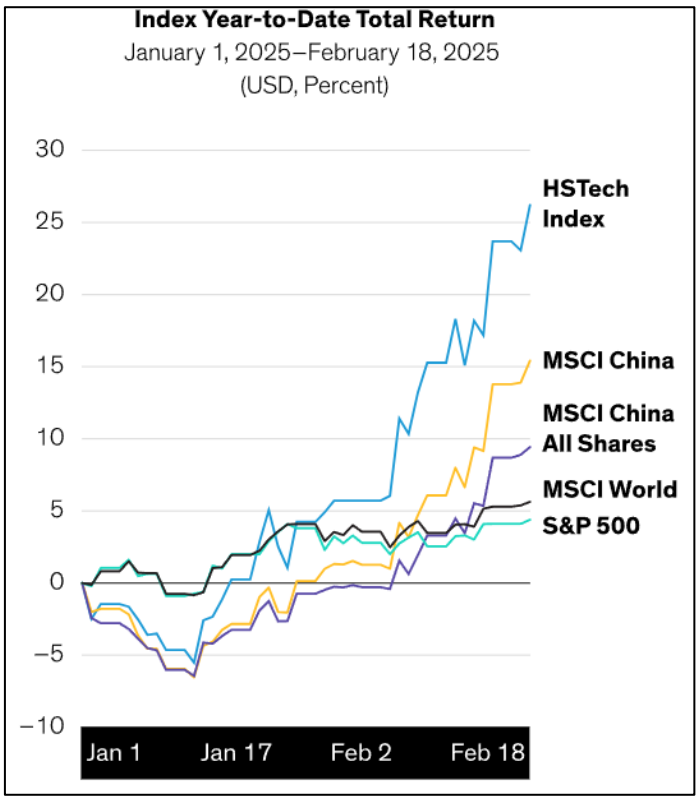

Figure 2: Chinese Stock Market Indices 01 Jan – 18 Feb 2025[10]

Considering China's concerted focus on civil-military fusion it is only natural to expect that China's tech prowess has permeated deep into the domain of defence. However, rather than further elaboration of this aspect, it may be more prudent to examine the question - ***Where does India stand in the Defence Equipment and Defence Tech Race via-a-vis China***? Here, a

---

[6] Karen Freifeld, "US tightens its grip on AI chip flows across the globe", Reuters, 13 January 2025. https://www.reuters.com/technology/artificial-intelligence/us-tightens-its-grip-ai-chip-flows-across-globe-2025-01-13/#:~:text=

[7] Arjun Kharpal, "ASML blocked from shipping some of its critical chipmaking tools to China", CNBC, 02 January 2024. https://www.cnbc.com/2024/01/02/asml-blocked-from-exporting-some-critical-chipmaking-tools-to-china.html

[8] TOI tech Desk, "How China's DeepSeek sent shockwaves in American stock market, wiping out billions from market cap of tech superstar", TOI, 28 January 2025. https://timesofindia.indiatimes.com/technology/tech-news/how-chinas-deepseek-sent-shockwaves-in-american-stock-market-wiping-out-billions-from-market-cap-of-tech-superstar/articleshow/117609742.cms

[9] John Lin, "The AI breakthrough spotlights some of China's distinctive features that deserve closer attention from investors", AllianceBernstein, 28 February 2025. https://www.alliancebernstein.com/corporate/en/insights/investment-insights/what-does-the-deepseek-halo-teach-us-about-chinese-stocks.html#:~:text=

[10] John Lin, "The AI breakthrough".

comparison of the fighter aircraft development programmes of the two countries provides a somewhat nuanced perspective.

5th Generation Fighter Aircraft

China is inducting fifth generation aircraft at the rate of about 120 units per year. China aims to have 1000 J-20 fighters by 2035.[11] When it comes to such advanced systems, it may be presumed that China has been able to overcome problems associated with sub-optimal jet engine technology, even though these may not be as advanced as US and other Western origin engines. China has also unveiled its second fifth generation fighter, the J-35A, in November 2024.[12]

India's struggle in the areas of fighter aircraft and jet engines needs no great elaboration. Even so, the *Tejas* programme (Light Combat Aircraft) bears examination. The first *Tejas* was delivered in 2016. However, the IAF currently operates just two squadrons, i.e., 36 aircraft.[13] The rate of production of the *Tejas* has been as abysmally low as six to nine aircraft per year. Even with a push to somehow increase this to 24, and then possibly 28,[14] it would require at least another 12 years (2037) to deliver the 324 aircraft (for 18 squadrons)[15] that are envisaged to be inducted by the IAF. Associated with this is the issue of jet engine technology that in a sense exemplifies the problems with the *Tejas* programme. The indigenous Kaveri engine earmarked for the *Tejas* has been under development since 1986 but has suffered from recurring delays and underperformance. The *Tejas* Mk1 (initial version) is thus equipped with the GE-404 engine. Ongoing plans centre around what is being called the Kaveri Engine Derivative (KDE) that is being developed based on consultancy received from M/s Safran, France (between 2014 and 2018), targeting a wet thrust (with after-burner) of 73-74 kN. The KDE is slated for demonstration in late 2025. However, the thrust of the KDE is much lower than the 84 kN wet thrust of the GE-404. The KDE, thus, cannot be used for either the *Tejas* Mk1 or the more advanced Mk1A that is slated to come out shortly. The KDE will be a stepping stone for the Kaveri 2.0 with a wet thrust of 90 kN and is envisaged to rival the GE-414 engine (98 kN) slated for the Tejas Mk II. The development of Kaveri 2.0 will take at least another six to seven years provided the KDE meets all its envisaged targets. 2031-32 is the earliest timeframe when this engine could (not "will") be available.[16] Till such time the Kaveri 2.0 matures, India will be dependent on a foreign sourced engine, which thus becomes a critical vulnerability.

In contrast, the F-15 Eagle of the USAF first flew in July 1972, with the first aircraft destined for a combat squadron being delivered in January 1976. The C and D versions of the aircraft fielded in 1979 had engines rated at approximately 105 kN.[17] It is certainly illuminating insofar as the level of technical and manufacturing prowess is concerned that *India with the technology of today, has*

---

[11] Ritu Sharma, "China Aims At 1000 J-20 Fighters By 2035 When India Gets 5th-Gen AMCA; Can IAF Narrow the Gap With PLAAF", The Eurasian Times, 11 June 2024. https://www.eurasiantimes.com/china-aims-at-1000-j-20-fighters-by-2035/

[12] Air Marshal Anil Chopra, PVSM, AVSM, VM, VSM (Retd), "Fifth Generation Aircraft, Way Ahead for India", DEFSTRAT, 25 January 2025. https://www.defstrat.com/magazine_articles/fifth-generation-aircraft-way-ahead-for-india/

[13] Shivani Kumar, "High-level panel to resolve Tejas delivery delays after air chief's rap: Sources", India Today, 24 February 2025. https://www.indiatoday.in/india/story/high-level-committee-defence-ministry-hindustan-aeronautics-limited-lca-tejas-delay-indian-air-force-2684463-2025-02-24

[14] Raunak Kunde, First Nashik-Made Tejas Mk1A jet to Roll Out by March 2025", IDRW, 22 April 2024. https://idrw.org/first-nashik-made-tejas-mk1a-jet-to-roll-out-by-march-2025/#:~:text=

[15] Bharat Karnad, "Let Private Sector also produce the Tejas LCA", Security Wise, 30 August 2024. https://bharatkarnad.com/2024/08/30/let-private-sector-also-produce-the-tejas-lca/

[16] Raunak Kunde, "IAF likely to back new Kaveri Engine to Power Tejas mk1A, Eyes Local Replacement for GE F404, 30 March 2025. https://idrw.org/iaf-likely-to-back-new-kaveri-engine-to-power-tejas-mk1a-eyes-local-replacement-for-ge-f404/#:~:text=

[17] USAF, F-15 Eagle, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104501/f-15-eagle/#:~:text=

not yet been able to develop a jet engine (all mitigating factors considered) that the US with the technology available then, developed in the 1970s.

The Advanced Medium Combat Aircraft (AMCA) programme is India's foray into the fifth-generation domain. It is expected that mass production of the AMCA will begin in 2035, which again will be in two variants. Most of the advanced capabilities will adorn the second variant, the timelines for which could extend well beyond 2035. As brought out before, ***by this timeframe China intends to induct almost 1000 J-20 aircraft***. Considering the complexities involved with deck operations, the Indian Navy (IN) has decided to go in for what is being called the Twin Engine Deck Based Fighter (TEDBF), that scales down some of the advanced features of AMCA. The TEDBF is being touted as a "fifth generation minus" aircraft.[18] What the difference between the TEDBF and a 4.5 Gen plus fighter like the Rafale-M would be is hard to quantify at this stage. However, it may be stated that the *IN would get an indigenous aircraft very much like the Rafale-M by 2038* (the envisaged induction timeframe).

China has recently revealed footage of what is believed to be its sixth-generation fighter aircraft.[19] Considering the advanced state of its fifth-generation program and now this new development, it can be safely assumed that this domain will present a *critical and ever-widening (about 15 years at present) capability gap between India and China*.

Other Disruptive Technologies

The other disruptive defence technologies in which China enjoys a substantial lead are hypersonic missiles and glide vehicles, research in quantum computing and communication, and a focus on AI and algorithmic warfare integral to its "intelligentised warfare" strategy comprising autonomous systems, advanced space and cyber warfare capabilities, AI-driven decision-support, and a marked shift towards the cognitive domain.[20] Self-splitting swarming drones are one such example that China has unveiled, which the world had not seen thus far.[21]

The Maritime Domain

China today has emerged as the largest shipbuilding nation in the world accounting for 53.3% of global capacity. Through "military-civil fusion", China has integrated commercial and military production at many of its shipyards, giving the PLA Navy access to infrastructure, investment, and intellectual property acquired from commercial contracts.[22] According to the US Congressional Research Service the PLA Navy is the largest navy in the world with a battle force of over 370 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries. This is expected to grow to 395

---

[18] Raunak Kunde, "ADA Advances TEDBF Program, Targets 2027", IDRW, 17 February 2025. https://idrw.org/ada-advances-tedbf-program-targets-2027-for/

[19] Military Watch Magazine Editorial Staff, "China's Sixth Generation Heavyweight Fighter Completes Fourth Flight: F-47 Remains Behind", Military Watch Magazine, 27 March 2025. https://militarywatchmagazine.com/article/china-sixth-generation-heavyweight-fighter-fourth-flight

[20] Aleksandra Gadzala Tirziu, "China's military expansion: A global power shift in the making", GIS, 16 December 2024. https://www.gisreportsonline.com/r/china-military-expansion/

[21] Stephen Chen, "Chinese scientists create swarming drones that can rapidly multiply mid-air to create a tactical shock", myNews, 19 March 2024. https://www.scmp.com/news/china/science/article/3255809/chinese-scientists-create-swarming-drones-can-rapidly-multiply-mid-air-create-tactical-shock

[22] Matthew P. Funaiole, Brian Hart, and Aidan Powers-Riggs, "China Dominates the Shipbuilding Industry", CSIS, 25 March 2025. https://www.csis.org/analysis/china-dominates-shipbuilding-industry#:~:text=

ships by 2025, and 435 ships by 2030.[23] India's share in the global shipbuilding industry stands at 0.06%.[24] The Indian Navy is expected to reach a force level of 155 to 160 ships by 2030.[25]

The Chief of Naval Staff of the Indian Navy, at a strategic dialogue in February 2025, had commented that China has been maintaining six to eight very capable combatants (warships) in the Indian Ocean.[26] Considering the rapidly increasing PLAN strength alongside China's growing interests in the IOR in general, and Africa in particular, it may be surmised that this figure would increase substantially in the near future. Deployment of one aircraft carrier group along with 10 to 12 escorts and an SSN is, possibly, just over the horizon. This would increase the number of PLAN ships in the Indian Ocean to about 18. This figure could go up to 26 to 28, allowing for support and other special-purpose vessels.[27] In case of a conflict-like situation, a substantial increase in these numbers, including the deployment of a second aircraft carrier group is very much within the realm of possibility. When viewed in consonance with China's focus on increasing what it calls Strategic Strong Points in the IOR, prospective bases such as Gwadar, stake in numerous ports in the region, and access to disruptive and asymmetric technologies, this presents a huge challenge to the Indian Navy.

Industrial Base/ Capacity

This metric, amongst the three being considered, requires perhaps the least substantiation. China now commands a manufacturing base roughly three times larger than that of the United States—an edge that shapes the balance of military and technological power—and it outproduces the next nine countries combined. Since Beijing entered the World Trade Organisation, its share of global manufacturing has soared five-fold to about 30% percent, while the US share has fallen to roughly 15%. U.N. projections suggest that by 2030, China could hold 45% of worldwide output, with the United States at only 11%.[28]

China already dwarfs the United States in many fundamental industries, turning out 20 times more cement, 13 times more steel, three times more automobiles, and double the electricity. It is also racing ahead in newer high-tech arenas. Spurred by sweeping initiatives such as "Made in China 2025," the country now produces nearly half of the world's chemicals and ships, over two-thirds of electric vehicles, more than three-quarters of lithium-ion batteries, 80% of consumer drones, and 90% of solar panels and refined rare-earth minerals. China accounted for half of all industrial-robot installations last year—seven times the US total—and is roughly ten

---

[23] Congressional Research Service, "China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress", CRS Report RL33153, 16 August 2024. https://sgp.fas.org/crs/row/RL33153.pdf

[24] Vasudha Mukherjee, "What does the global shipbuilding industry look like, and where is India?", Business Standard, 16 September 2024. https://www.business-standard.com/industry/news/decoded-india-s-shipbuilding-industry-global-impact-and-future-growth-124091600643_1.html

[25] Rajat Pandit, "To counter China in Indian Ocean region, India plans 175-warship Navy by 2035", Times of India, 18 September 2023. https://timesofindia.indiatimes.com/india/to-counter-china-in-indian-ocean-region-india-plans-175-warship-navy-by-2035/articleshow/103739450.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

[26] PTI, "China increasing presence in IOR but India knows who goes where: Navy Chief", Hindustan Times, 28 February 2025. https://www.hindustantimes.com/india-news/china-increasing-presence-in-ior-but-india-knows-who-goes-where-navy-chief-101740747167262.html

[27] Kamlesh Kumar Agnihotri, Leveraging High-technology Developments in the Chinese Military and Maritime Domains (New Delhi: KW Publishers,2022), 224-25

[28] Kurt M. Campbell and Rush Doshi, "Underestimating China: Why America Needs a New Strategy of Allied Scale to Offset Beijing's Enduring Advantages", Foreign Affairs May/ June 2025. 10 April 2025. https://www.foreignaffairs.com/china/underestimating-china

years ahead of its nearest rival in bringing fourth-generation nuclear reactors to the market. Not since the United States' own manufacturing heyday (from the 1870s to the 1940s) has a single power dominated global production so completely.[29]

A Reality Check

Insofar as the three factors that affect a country's ability to prevail in conflict are concerned – China has seemingly an unbridgeable advantage. *What, then, should be India's strategy to hold its own against the Chinese*?

The Himalayas to the north have, post 1962, provided India a favourable obstacle to deter and dissuade the Chinese from attempting large-scale military operations. Mountains tend to balance out technological disparity, mountains eat up men and material, and India knows how to fight on mountains. When it comes to the Indian Ocean, the tyranny of distance, narrow choke points and the strategic location of the Andaman and Nicobar Islands, provide India a definitive advantage. However, the already huge and exponentially increasing differential in technology and capacity will (if that is not already the case) enable China to soon bridge these constraints. When viewed in consonance with China's far superior industrial strength, ***the conventional way of equipping and fighting in an India-China scenario may not be sustainable for much longer***. General David Petraeus has said about the US defence forces – "our procurement system especially for major items tends to produce yesterday's technology for tomorrow's wars".[30] As the *Tejas* example highlighted earlier shows, this statement couldn't be truer than in India's case. In the same breath, General Petraeus, commenting on the agility and innovative ability shown by Ukraine in the ongoing conflict says, "this is a system that they (Ukraine) have that now produces tomorrow's technology for today's wars".[31] *Does the Ukrainian example hold lessons for India?*

LESSONS FROM CONTEMPORARY AND ONGOING CONFLICTS

It would be prudent to consider aspects and the lessons provided by a few contemporary and ongoing conflicts, namely the Nagorno-Karabakh conflict, the conflict in the Red Sea, and the Russia-Ukraine war.

Nagorno-Karabakh

The 2020 conflict between Armenia and Azerbaijan over the disputed Nagorno-Karabakh region offers several key lessons across the military, political, and strategic dimensions. Some of the key ones are: -

(a) Azerbaijan's use of drones (Unmanned Aerial Systems) was decisive. These drones, supplied by Turkey and Israel, enabled precision strikes on Armenian forces, disrupting their defences and morale.[32]

---

[29] Kurt M. Campbell and Rush Doshi, "Underestimating China".
[30] "General David Petraeus: Dispatches from Munich", The Cipher Brief, YouTube video, 11:39, 16 February 2025. https://www.youtube.com/watch?v=YHZT4uk9Cjk&t=16s.
[31] "General David Petraeus: Dispatches from Munich".
[32] Phillip Andrews, "Lessons from the Nagorno-Karabakh 2020 Conflict", Centre for Army Lessons Learned Catalog 21-655, August 2021. https://api.army.mil/e2/c/downloads/2023/01/31/693ac148/21-655-nagorno-karabakh-2020-conflict-catalog-aug-21-public.pdf

(b) The conflict highlighted the vulnerability of traditional ground forces to airpower, especially in the absence of robust air defence systems.[33]

(c) Azerbaijan's technological superiority overcame the geographical challenge presented by Nagorno-Karabakh's mountainous terrain that favours the defender.[34] This underscores the diminishing role of terrain in modern warfare when countered by advanced technology.

(d) The conflict demonstrated the importance of full-spectrum and integrated air defence systems to counter drones, missiles, and rocket artillery effectively.[35]

(e) The synchronisation of new weapons makes the modern battlefield more lethal. Azerbaijan's combination of drones and artillery, and drones and missiles effectively targeted Armenia's high-value military assets.[36]

What, however, needs to be borne in mind, is that the drones being discussed in the context of this conflict are what could be called conventional drones – reconnaissance drones such as the Hermes 450 and 900, the Heron, Aerostar and the Searcher; and the Turkish Bayraktar TB2 (Combat UAV). Additionally, loitering ammunition such as the Israeli Harop was also used.[37] This distinction wherein the term conventional drones is used, is relevant to what will be discussed further on in this article. In this context, it would be pertinent to highlight that the export cost of a Bayraktar TB2 is approximately $5 million[38], while that of a Hermes 900 is almost $30 million[39]. An Israeli Harpy loitering ammunition costs about $70,000 per piece,[40] with the larger Harop known to be far more expensive. However, there is a wide variation in reported costs of the Harpy/ Harop, with some websites quoting as much as $700,000 for the latter.

The Red Sea Conflict

Since November 2023, the Houthis have been striking commercial vessels in the Red Sea—as well as warships taking part in the US-led Op PROSPERITY GUARDIAN—using Iranian-designed drones and missiles. Their arsenal includes inexpensive one-way attack drones that can cost as little as $2,000 each, more advanced Shahed-series drones priced around $20,000, and anti-ship cruise and ballistic missiles estimated at $80,000–$100,000 apiece. By contrast, the

---

[33] Shaan Shaikh and Wes Rumbaugh, "The Air and Missile War in Nagorno-Karabakh: Lessons for the Future of Strike and Defense", CSIS, 08 December 2020. https://www.csis.org/analysis/air-and-missile-war-nagorno-karabakh-lessons-future-strike-and-defense

[34] Gustav Gressel, "Military lessons from Nagorno-Karabakh: Reason for Europe to worry", ECFR, 24 November 2020. https://ecfr.eu/article/military-lessons-from-nagorno-karabakh-reason-for-europe-to-worry/#:~:text=

[35] Shaan Shaikh and Wes Rumbaugh, "The Air and Missile War in Nagorno-Karabakh.

[36] Shaan Shaikh and Wes Rumbaugh, "The Air and Missile War in Nagorno-Karabakh.

[37] Davit Khachatryan, "Beyond the Drone Hype: Unpacking Nagorno-Karabakh's Real Lessons", EVN, 27 March 2024. https://evnreport.com/opinion/beyond-the-drone-hype-unpacking-nagorno-karabakhs-real-lessons/

[38] Aaron Stein, "The TB2: The value of a cheap and "good enough" drone", Atlantic Council, 30 August 2022. https://www.atlanticcouncil.org/content-series/airpower-after-ukraine/the-tb2-the-value-of-a-cheap-and-good-enough-drone/

[39] Military Watch Magazine Editorial Staff, "Israel loses two high end Hermes Drones to Hezbollah's Air Defences", Military Watch Magazine, 07 April 2024. https://militarywatchmagazine.com/article/israel-drones-hezbollah-defences-loss

[40] David Axe, "Take a Look at Russia's New Suicide Drones", The National Interest, 09 November 2021. https://nationalinterest.org/blog/reboot/take-look-russias-new-suicide-drones-195929

interceptors deployed by Western navies are far more expensive - US forces rely on the SM-2 missile ($2.1 million), the Evolved Sea Sparrow Missile ($1.7 million), the Rolling Airframe Missile ($905,000), and 5-inch air-burst shells ($2500). The British Type 45 destroyers employ the Sea Viper firing Aster 15 and Aster 30 missiles each costing in excess of $1.2 million. In one engagement detailed by the US Central Command, two US Arleigh Burke-class destroyers and a British Type 45 destroyer shot down 18 drones, two anti-ship cruise missiles, and one anti-ship ballistic missile. The American share of the bill for that single skirmish was roughly $17 million.[41] As per Erik Prince, the founder of 'Black Water", the US has already spent more than a billion dollars in shooting down Houthi missiles and drones. However, catering to the fact that this is the inventory cost from the 1990s, the replacement cost is likely to be at least five times as much.[42] ***For a country like India, this is clearly not sustainable***.

The fact that the Houthis have been able to target Israel, Saudi Arabia, units engaged in PROSPERITY GUARDIAN, and merchant shipping, sometimes at very considerable distances from their shores highlights the democratisation of technology and the impact of drones and unmanned platforms on the conduct of warfare. Fringe actors can now take on established powers, inflict considerable damage, disrupt the rules-based order – and all these over prolonged periods. The change vis-à-vis the Nagorno-Karabakh conflict is clearly discernible in that the drones used by the Houthis are much simpler and hence cheaper, which is also one of the primary reasons for them being able to not only prolong the ongoing conflict but also to extract a heavy financial toll from their adversaries in terms of relative costs incurred by the warring parties. ***Is there a lesson here for India when it comes to tackling China?***

Russia – Ukraine Conflict

Against a widely held belief that the Russia–Ukraine conflict would last about two weeks, the war is now in its fourth year. While material support from the "West" is undeniably one of the prominent aspects of this war, the agility and innovativeness of the Ukrainians, especially in the use of unmanned platforms is perhaps its most defining characteristic.

The use of drones by Ukraine in 2022 commenced with the Turkish Bayraktar TB2, which in the initial days of the war had some spectacular successes. However, Russian air defence soon adapted to these drones with the Russians claiming to have shot down more than 100 of these by early April 2023.[43] This practically ended the Bayraktar's utilisation as a combat drone, with some reports stating that these were being used for reconnaissance missions of durations as limited as 30 minutes as against their OEM articulated endurance of 27 hours.[44] It became clear that ***conventional combat UAVs were not successful in the face of effective air defence!***

This, however, was only a precursor of what was to follow. According to Gen David Petraeus, Ukraine is throwing thousands of suicide drones at the Russians on the frontlines daily, inflicting extraordinary casualties. These drones are also targeting energy installations, refineries, and other

---

[41] Captain KS Vikramaditya, "The Red Sea Conundrum", NMF, 17 January 2024. https://maritimeindia.org/the-red-sea-conundrum/

[42] "The Future of Dynamic Warfare | Erik Prince", YouTube video, 36:36, 19 February 2025. https://www.youtube.com/watch?v=WPMgzm_9K50&t=2718s

[43] Sakshi Tiwari, "Russia 'Shot Down' Over 100 Bayraktar TB2 Drones in The Ukraine War & Kicked Them Out of Action – Moscow", The Eurasian Times, 11 April 2023. https://www.eurasiantimes.com/russia-shot-down-over-100-bayraktar-tb2-drones-in-the-ukraine/"

[44] Elisabeth Gosselin-Malo, "Are the once-vaunted Bayraktar drones losing their shine in Ukraine?", DefenseNews, 31 October 2023. https://www.defensenews.com/global/europe/2023/10/31/are-the-once-vaunted-bayraktar-drones-losing-their-shine-in-ukraine/

strategic installations such as airfields. Ukraine produced more than 1.5 million drones in the first nine months of 2024.[45] The Ukrainians have been innovating and improving the effectiveness of their drones *on the fly*, so to say. To avoid jamming, both Ukraine and Russia have introduced fibre-optic cable tethered drones. These, however, have range limitations. This is being overcome by Ukrainian companies by improving terminal guidance, including using AI, wherein operators designate targets outside EW jamming bubbles, with the drone thereafter engaging the target autonomously. Ukraine now updates some of its algorithms and drone communications software daily.[46] ***Ukraine is set to acquire 4.5 million FPV attack drones in 2025***. The integration of advanced edge AI models for FPV terminal guidance, combined with this surge in production, could through enhanced targeting efficiency and operational scale, boost Ukraine's lethality per mile of front by up to 900%.[47]

Figure 3: Ukrainian FPV Drones[48]

For Ukraine, one way attack (OWA) drones are the sole means to strike deep into Russian territory. Ukraine's largest reported attack deep inside Russia occurred on the night of 13/ 14 January 2025, targeting locations 200 to 1,100 km away. A July 2024 strike on a bomber base in Olenya, Murmansk, involved a drone flight of about 1,700 km, near its 1,800 km maximum range. Production of these long-range drones is being scaled up significantly, with plans to manufacture up to 30,000 units in 2025.[49] On commencement of the conflict, Russia began by importing the Iranian *Shahed* OWA drones. Russia thereafter started manufacturing an indigenous version that it called the *Geran*. The *Geran-2* is Russia's version of the *Shahed 136*. Russia, in fact, is using these in consonance with decoys, the *Gerbera* and the *Parodiya* (cheap structures made of wood) to overwhelm Ukrainian air defences and create a pathway for the *Gerans*. The Russians have introduced jam-resistant antennae, different types of warheads, and

[45] "General David Petraeus: Dispatches from Munich", The Cipher Brief, YouTube video, 15:50, 16 February 2025. https://www.youtube.com/watch?v=YHZT4uk9Cjk&t=16s
[46] Mick Ryan, "Why No One Is Winning in Ukraine", Foreign Affairs, 21 February 2025. https://www.foreignaffairs.com/russia/why-no-one-winning-ukraine-ryan
[47] Sean Harper, "Factory-to-Frontline Pipeline - How Ukraine's 2025 Drone Surge is Reshaping the Battlefield", War Quants, 17 March 2025. https://www.warquants.com/p/factory-to-frontline-pipeline
[48] Sean Harper, "Factory-to-Frontline".
[49] Doug Richardson, "Dawn of the Drone Wars", ESD, 19 February 2025. https://euro-sd.com/2025/02/articles/42681/dawn-of-the-drone-wars/

even datalinks that can use Ukraine's mobile telephone network. On the other hand, Ukraine has developed innovative countermeasures in the form of improved jamming and spoofing, low-cost acoustic detection networks, and even interceptor drones.[50] The intent here is bring out the ***pace and agility of fielding innovations on the edge***.

In the maritime domain, the remarkable success achieved by the Ukrainians in the Black Sea, wherein a large component of the Russian Black Sea Fleet has effectively been neutralised,[51] provides a copybook example of the effective use of technology, innovation, and asymmetric tactics in combating a larger and more powerful adversary.[52] Analysts believe that the use of sea drones has helped Ukraine to keep the Russian Black Sea Fleet out of key areas, and has facilitated the defence of Odessa and Snake Island from the sea. This is borne out by Russia's increased focus on its naval base in the separatist Georgian region of Abkhazia. However, most of Ukraine's high-profile successes such as the sinking of the *Moskova* have been caused by missiles. ***Sea drones or USVs are inherently limited in their capability to conduct a successful attack***. Real time intelligence on the target, effective navigation, sensors that can operate in the maritime environment, limitations of speed, the inherent robustness of ships (requiring an attack by multiple USVs), and many such complications make attacks by USVs difficult to conduct and orchestrate as compared to those by UAVs. In most such attacks, the target has been damaged but not sunk. However, on 26 Dec 2023 and on 31 Jan 2024, a *Ropucha* class landing ship and a *Tarantul* class corvette respectively were sunk by USVs. Another *Ropucha* class ship was sunk by a pack of USVs on 14 Feb 2024. While all these were limited tactical success, the greater gain was in terms of reopening of the grain corridor for Ukraine, and the significant redeployment of Russian ships from Sevastopol to Novorossiysk and Abkhazia. [53] ***Sea drones/ USVs have thus been effective instruments for sea denial***.

---

[50] Mathew Bint & Fabian Hinz, "Russia doubles down on the *Shahed",* IISS, 14 April 2025. https://www.iiss.org/online-analysis/military-balance/2025/04/russia-doubles-down-on-the-shahed/

[51] Peter Dickinson, "Russia's Black Sea defeats get flushed down Vladimir Putin's memory hole", Atlantic Council, 06 August 2024. https://www.atlanticcouncil.org/blogs/ukrainealert/russias-black-sea-defeats-get-flushed-down-vladimir-putins-memory-hole/

[52] Brian Glyn Williams, "How the Ukrainians – With No Navy – Defeated Russia's Black Sea Fleet", *The Conversation*, 15 April 2022. https://theconversation.com/how-the-ukrainians-with-no-navy-defeated-russias-black-sea-fleet-234259

[53] Giangiuseppe Pili, "Sea drones at war: Tactical, operational and strategic analysis of maritime uncrewed systems", ESD, 05 September 2024. https://euro-sd.com/2024/09/articles/40191/sea-drones-at-war-tactical-operational-and-strategic-analysis-of-maritime-uncrewed-systems/#_ftnref41

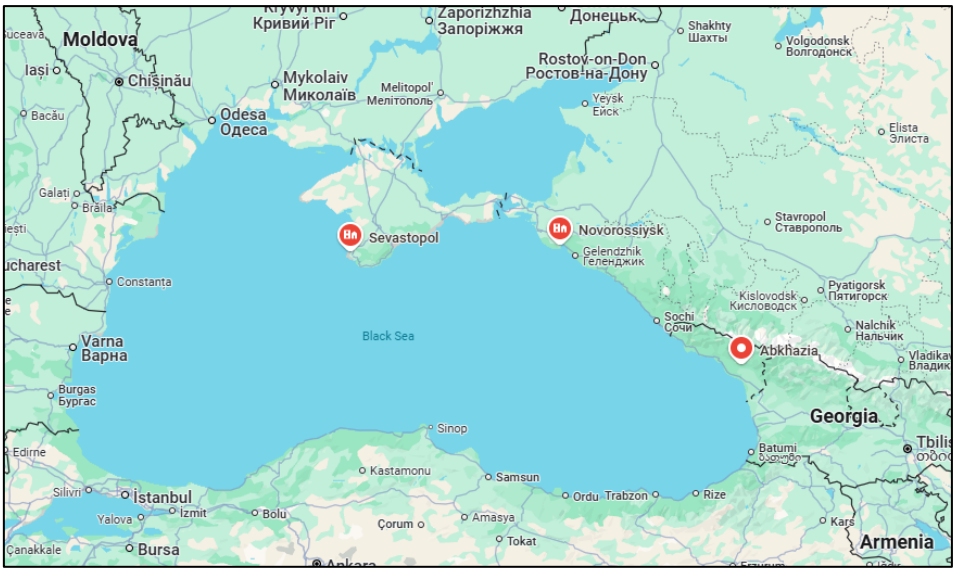

Figure 4: Map of the Black Sea[54]

A *Magura V5* sea drone shot down a Russian Mi-8 helicopter in Dec 2024, launching Air-to-Air missiles modified for the Surface to Air configuration. Ukrainian USVs on 05 Jan 2025 deployed kamikaze drones from the Black Sea to target Russian Pantsir-S1 air defence systems ($15 to 20 million per unit) in Kherson. Aerial drones deployed from USVs also inflicted heavy damage to Russian gas platforms in the Black Sea.[55]

Figure 5: A Magura V5 carrying Surface to Air Missiles[56]

Another innovation that has come to the fore in the Russia-Ukraine conflict is Drone Motherships. The Dovbush T10 reconnaissance drone fielded by Ukraine in 2022, has been adapted to carry up to six FPV drones. The mothership on releasing its payload, starts functioning as a communication

[54] Google Maps, https://www.google.com/maps/search/Sevastopol+to+Novorossiysk+and+Abkhazia/@43.5041946,32.4806371,6z?entry=ttu&g_ep=EgoyMDI1MDQxNC4xIKXMDSoASAFQAw%3D%3D.
[55] David Kirichenko, "Ukraine's Marauding Sea Drones Bewilder Russia", CEPA, 30 January 2025. https://cepa.org/article/ukraines-marauding-sea-drones-bewilder-russia/
[56] Doug Richardson, "Dawn of the Drone Wars".

relay.[57] Completely autonomous drone strikes (in a heavy EW environment) without human intervention is already a reality. The Ukrainian company manufacturing the *Saker Scout* claims that the drone was able to recognise 64 different types of targets. What is perhaps more interesting is an experiment conducted by a Norwegian tech entrepreneur who modified an inexpensive commercial drone into a precision weapon by uploading a facial image, which the drone could recognise and home onto even in the cluttered environment (pillars, furniture, obstructions, people) of a rented room.[58] Drone swarms offer an entirely different magnitude of possibilities. Self-splitting drones that separate into smaller drones, each capable of performing different roles, have already been mentioned earlier. ***The possibilities for innovation are almost limitless***.

Figure 6: Dovbush T10 Drone Carrier[59]

The primary lesson that can be drawn from the Russia – Ukraine conflict is that it is not the sophisticated and consequently expensive drones that have helped Ukraine last out and hold its own, but the simpler and cheaper ones that have been used at massive scale.

It bears mention that in view of the profound impact of unmanned and autonomous systems, and their influence on the dynamically evolving character of war, Ukraine has been the first country to establish a dedicated military arm/ force for operating unmanned systems. The ***Unmanned Systems Forces (USF)*** was created in June 2024 with approximately 3000 personnel (with active recruitment underway) and includes dedicated combat units for air, land, and sea systems. The intent was that the USF will plan operations involving unmanned systems (deep strikes), undertake

[57] Doug Richardson, "Dawn of the Drone Wars".
[58] Doug Richardson, "Dawn of the Drone Wars".
[59] The Odessa Journal, "A UAV has been developed in Ukraine that can carry six kamikaze drones", 22 November 2024. https://odessa-journal.com/a-uav-has-been-developed-in-ukraine-that-can-carry-six-kamikaze-drones

training, interface with intelligence and other arms, possibly rationalise drone procurement by prioritising successful designs, and establish a unified tactical doctrine.[60]

Another notable feature of the Russia-Ukraine conflict that is relevant to the Sino-Indian context has been the high level of effectiveness of air defences, mainly mobile ground-based, when compared with the relative ineffectiveness of manned aircraft. It may be concluded from Ukraine's success in this domain that other than for the most advanced 5th generation platforms such as the F-22 and the F-35, ground-based air defences will out match most other aircraft. Ukraine's use of mobile ground-based AD systems along with manoeuvre and dispersion has been key to nullifying Russia's considerable air advantage.[61] The requirement of air superiority for success in battle is established in military doctrine. However, the value of *air denial* is not really touched upon. Further, *air denial* is seldom thought of as a component of *sea denial*, which it very much is. *Air denial* using ground or sea-based AD is especially important from the point of view of denying an adversary air superiority, without the use of own fighter aircraft that are valuable and scarce. This is also relevant to freeing own aircraft to achieve air superiority in one sector, while denying an enemy the same in another.[62]

ERA OF PRECISE MASS

Michael Horowitz's article titled "Battles of Precise Mass" published in the Nov/ Dec 2024 volume of Foreign Affairs is possibly one of the most influential of writings on emerging military trends in recent times and one that is extremely relevant to the current discussion. Michael Horowitz argues that the concept of *mass* – more numbers in men and materiel – has always been considered to be the critical factor for victory in battle.[63] Having the largest navy enabled the British to rule the seas, and it was *mass* that won World War II for the allies. This trend however underwent a change wherein *mass* was consciously traded for *precision*. The US especially, saw great merit in pursuing precision over quantity and started investing in sophisticated weapons and systems that could accurately strike targets anywhere in the world. Countries, particularly those in the West, focused on technological superiority and scaled down their defence forces. However, ongoing conflicts show that uncrewed systems, missiles, and access to satellites and high-end commercial technology has blurred the distinction between *precision* and *mass*, wherein massed attacks can take place with high precision. Michael Horowitz calls this the **age of *precise mass***.[64] The US and the West no longer enjoy the overwhelming superiority in precision-strike capabilities that they once enjoyed. The democratisation of technology and cost efficiencies, so to say, have made reasonable precision strike outcomes at scale and at relatively low costs accessible to even non-state actors, who can now "aggregate large swarms of inexpensive munitions to create threshold precision effects". [65]

---

[60] John Hardie, "Ukraine's new Unmanned Systems Forces takes shape", FDD's Long war Journal, 21 June 2024. https://www.longwarjournal.org/archives/2024/06/ukraines-new-unmanned-systems-forces-takes-shape.php

[61] Lieutenant Colonel Herbert Bowsher, U.S. Marine Corps Reserve, "Air Denial Lessons from Ukraine", USNI Proceedings, Vol. 149/9/1,447, September 2023. https://www.usni.org/magazines/proceedings/2023/september/air-denial-lessons-ukraine#:~:text=

[62] Lieutenant Colonel Herbert Bowsher, U.S. Marine Corps Reserve, "Air Denial Lessons from Ukraine".

[63] Michael C. Horowitz, "Battles of Precise Mass", Foreign Affairs, November/ December 2024, Volume 103, Number 6, 22 Oct 2024

[64] Michael C. Horowitz, "Battles of Precise Mass".

[65] Aaron Barlow, Patrick Reilly, Sean Harper, & Colton Byer, "Supporting Evidence of the Precision Mass Thesis on the Changing Character of War", War Quants, 20 January 2025. https://www.warquants.com/p/supporting-evidence-of-the-precision

The impact of *mass* alone merits further examination. As mentioned earlier, Russia employed the *Shaheds* in relatively small numbers in the first two years of the conflict. During this period, the Ukrainians achieved a shoot-down rate of almost 85%. However, as the production of the locally manufactured *Geran-2* variant accelerated and the Russians were able to aggregate larger swarms, the shoot down rate came down to about 58%.[66] This clearly demonstrates that ***inexpensive munitions that are ineffective in small numbers can be aggregated to overwhelm air defences***. Adding *precision* to *mass* would enable results that are otherwise not possible.[67]

WHAT ARE OTHER COUNTRIES DOING?

Iran

Sanctions over the past many decades have limited Iran in its capability to maintain and modernise its defence forces. This is especially true for the Iranian Air Force that is largely equipped with U.S. aircraft that were procured prior to the Iranian revolution. To offset this limitation, Iran has actively pursued and focused on developing a credible drone and missile capability. This commenced with Iran importing missiles from China and thereafter developing its own versions through reverse engineering and joint development programmes.[68] Iran, today, can be considered to be a missile and drone power, with some like the *Shahed 136* having achieved an almost legendary reputation. Iran has equipped its proxies, i.e., Hamas, Hezbollah, and the Houthis, with both missiles and drones. The Houthis, in March 2022, targeted and heavily damaged Saudi oil facilities near Jeddah, over 1000 km away, using drones. This brought to the fore Iranian drone capability. In Jan 2020, Iran launched a missile attack on US facilities in Iraq in response to the assassination of General Soleimani,[69] demonstrating a credible capability to engage distant targets. In response to an Israeli strike on the Iranian embassy in Damascus, Iran, in April 2024, launched an attack on Israel with more than 170 drones, 30 cruise missiles, and 120 ballistic missiles (Khoramshar-4 ballistic missile, 2000 km range, 1500 kg warhead).[70] The attack also included the use of advanced models such as *Emad*, *Kheibar* and the hypersonic *Fattah-1*. This attack once again reiterated Iran's drone and missile capability. As part of its larger deterrence messaging amid threats from US President Donald Trump, Iran in Mar 2025, released a video of a drive-through within a long weapons-and-missiles-packed tunnel, which seemed to be immune to aerial attacks.[71] Iran has recently unveiled a modified container vessel with a 180m flight deck that is capable of launching and retrieving helicopters and drones, including large ones such as the *Qaher*, which is a smaller version of a local fighter jet.[72]

---

[66] Aaron Barlow, Sean Harper, & Patrick Reilly, "New Forms of Mass and Attrition - A Case Study of Russian Employment of Shahed Drones in Ukraine", War Quants, 29 November 2024. https://www.warquants.com/p/new-forms-of-mass-and-attrition

[67] Aaron Barlow, Patrick Reilly, Sean Harper, & Colton Byer, "Supporting Evidence of the Precision Mass Thesis.

[68] Shahram Akbarzadeh, "Iran's Missile and Drone Program: Disrupting U.S. Aerial Hegemony", Middle East Council on Global Affairs, Issue brief, July 2024, 28 July 2024. https://mecouncil.org/publication/irans-missile-and-drone-program-disrupting-u-s-aerial-hegemony/

[69] Al Jazeera News Agencies, "Iran launches missile attacks on US facilities in Iraq", Al Jazeera, 08 January 2020. https://www.aljazeera.com/news/2020/1/8/iran-launches-missile-attacks-on-us-facilities-in-iraq

[70] Shahram Akbarzadeh, "Iran's Missile and Drone Program".

[71] Howard Altman, "Iran Shows Off Underground Missile City", TWZ Newsletter, 25 March 2025. https://www.twz.com/news-features/iran-shows-off-underground-missile-city

[72] Reuters Desk, "Iran's first drone carrier joins the Revolutionary Guards' fleet", Reuters, 06 February 2025. https://www.reuters.com/world/middle-east/irans-first-drone-carrier-joins-revolutionary-guards-fleet-2025-02-06/

China's OWA Drone Threat

In an article in War Quants, Sean Harper brings out that there are reports that China has ordered a million one-way drones from a Chinese company called Poly Technologies.[73] He contextualises this with Xi Jinping's resolve for the unification of Taiwan, which in turn could because of the stakes involved, lead to a conflict along the entire first island chain. China has long postulated joint firepower strikes as the doctrinal underpinning for large-scale operations. This is how China would undertake Anti-Access Area Denial (A2AD) to prevent intervention by the US and its allies. The author presents a factory-to-target model, wherein he brings out how One Way Attack (OWA) drones would add an entirely different dimension to this strategy. While China has a potent missile strike capability in the form of the PLA Rocket Force (PLARF), the cost difference between OWA drones and other PLARF missiles is so great that the use of OWA drones at a previously unthought of scale is highly likely. Massed OWA drone attacks would saturate air defences, place considerable stress on defender missile inventories, and divert extensive resources (both kinetic and non-kinetic) from offensive action. Furthermore, since OWA drones are a relatively recent phenomenon, cheap countermeasures still haven't proliferated. Legacy AD systems that are far more expensive would have to fill this gap. In his model, the author assumes that each OWA drone would cost $100,000,[74] which is five times (double the cost as per the author) the cost of an Iranian *Shahed* mentioned earlier in this article. The overall cost of a million OWA drones would be $100 billion. If China targets the manufacturing of these numbers in a period of three years, it will require the production of 912 units per day. For context, Tesla produced more than 1.8 million cars in 2023 alone.[75]

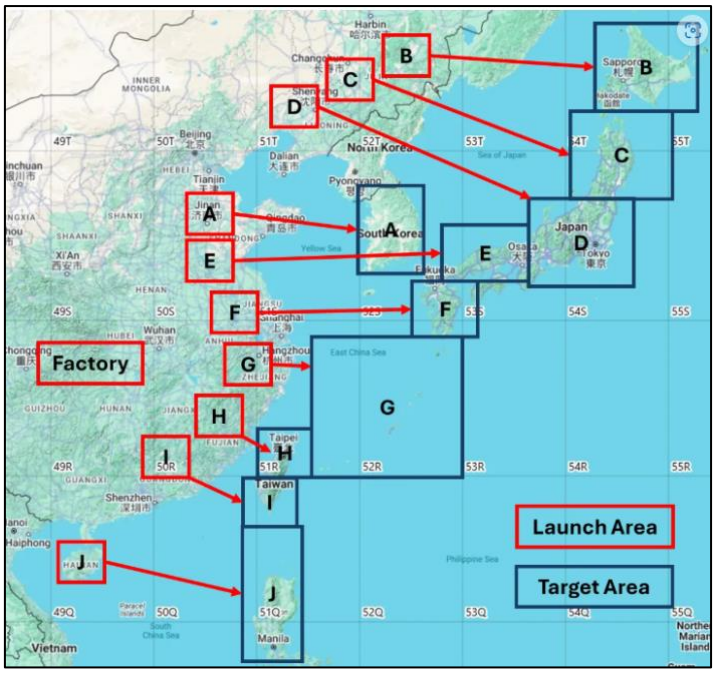

Figure 7: Notional OWA Drone Strike Map across the First Island Chain[76]

[73] Sean Harper, "One Million Suicide Drones with Chinese Characteristics - Chinese Joint Firepower Strikes and the Future of Precision Mass", War Quants, 11 January 2025. https://www.warquants.com/p/one-million-suicide-drones-with-chinese

[74] Sean Harper, "One Million Suicide Drones with Chinese Characteristics".

[75] Sean Harper, "One Million Suicide Drones with Chinese Characteristics".

[76] Sean Harper, "One Million Suicide Drones with Chinese Characteristics

Considering the notional OWA strike map above, China would be able to achieve 71 days of suppression with a million OWA drones. To get mission effects into focus, 200,000 OWA drones could be targeted at South Korea alone. Even if 25% of these were to strike their assigned targets, the overall impact would be catastrophic. As per this model, China would require 2.5 million OWA drones for 180 days of suppression.[77]

Achieving the effect described above would require a brigade of personnel, 1400 trucks daily, and $33.3 billion annually for a period of three years.[78] This, for China, is certainly achievable. The intent here is to show that cost for such a capability would not be a deterrent for China.

It may be stated, that because of its devastating prospective impact, ***Precision Mass provides conventional deterrence***.[79] This holds many important lessons for India, both in terms of offensive options, as also for investments in air defence. $33.3 billion annually may in the first instance, seem a high price for India. However, if through evolving technology, innovation, and judicious framing of requirements (QRs) the cost of these drones is brought down from $100,000 to say about $20,000, then this would mean an expenditure of about $6.66 billion per year, and in three years, India could potentially possess a million OWA drones.

(Note: It would be pertinent to reiterate that this section pertains to OWA drones and not the smaller/ simpler/ cheaper FPV drones)

Pakistan's Evolving Capability

While there may be a thought that it is only China that is of concern, this may not be entirely true. Pakistan is believed to be investing heavily in drones. Pakistan has inducted platforms such as the now renowned Turkish origin *Bayraktar TB2* and *Akinci*, as also the *Wing Loong II* and *CH-4* from China. In addition, Pakistan has an evolved indigenous inventory in the form of the *Burraq* (UCAV, 1000 km range) and the *Shahpar* (30 hr endurance, 2500 km range data link). All these provide Pakistan with a well-rounded mission capability comprising precision strikes, electronic warfare, and surveillance and reconnaissance.[80] Drone operations comprised an important component of a Pakistani Air Force air-defence exercise in mid-2024. Use of drones in consonance with manned aircraft, loitering ammunition, and next generation missiles such as the *Fatah-2* could severely undermine Indian air-defence capability, creating pathways for precision strikes.[81]

While India's industrial capacity is much greater than that of Pakistan, it must be borne in mind that in a conflict with India, Pakistan will likely receive unquestioned support from China and Turkey. In fact, it may be assumed that other than the most modern and cutting-edge systems, Pakistan would have access to whatever China has in its inventory. A continuing and essentially endless supply of drones of all kinds to Pakistan, especially FPV and OWA drones, may be considered to be a given. While Indian AD may be well equipped to counter conventional ISR and combat UAVs, the same may not hold true for massed attacks by OWA drones.

---

[77] Sean Harper, "One Million Suicide Drones with Chinese Characteristics.
[78] Sean Harper, "One Million Suicide Drones with Chinese Characteristics".
[79] Sean Harper, "One Million Suicide Drones with Chinese Characteristics".
[80] Zohaib Altaf & Nimrah Javed, "India and Pakistan's Development of Drones: Implications for Strategic Stability", Stimson Centre, 03 October 2024. https://www.stimson.org/2024/india-and-pakistans-development-of-drones-implications-for-strategic-stability/
[81] Zohaib Altaf & Nimrah Javed, "India and Pakistan's Development of Drones".

US Initiatives

The US Department of Defence, in line with the evolving character of warfare, has been demonstrating substantial interest in *precise mass*. The US Air Force amongst many uncrewed initiatives, is working with the private sector to produce cruise missiles that would cost about $150,000, as against current ones that cost between $1 million to $3 million. Similarly, the US navy has created a new squadron for uncrewed surface vessels.[82] However, perhaps the most impactful US investment in *precise mass* is the "Replicator Initiative" that aims to accelerate the adoption of innovations that the US military needs today, and not in the distant future as is the conventional way of running defence programmes.[83]

The aim of the first iteration of Replicator termed Replicator 1 (announced in Aug 2023) was to induct thousands of all-domain attritable autonomous systems across multiple domains of warfighting by August 2025.[84] The second iteration of Replicator, Replicator 2 was announced in Sep 2024 and is focussed on countering small uncrewed aerial systems (C-sUAS). The programme seeks to leverage and synergise the efforts and innovativeness of both traditional and non-traditional defence industry players towards delivering record volumes of attritable systems.[85] Through this programme, the US Department of Defence has been able to develop capability that would normally take many years, in less than a year.[86]
Alongside the Replicator, the US military is undertaking the required organisational steps (training, equipment, deployment) to enable adaption of these new technologies. The Defence Innovation Unit, an organisation tasked with accelerating the development and deployment of commercial technology, has been placed directly under the Secretary of Defence and has been assigned a substantial budget increase. Also, the Rapid Defence Experimentation Reserve (RDER), a key program to accelerate new capability development,[87] has been used to advance induction of key technologies. As part of one of its initiatives, improvements to the Marine Corps ability to undertake strike operations in the Indo-Pacific has been accelerated by five years.[88]

SOME HARD QUESTIONS

India clearly lags behind China in the three metrics critical to warfighting – resources, technology, and industrial capacity. The gap in all three is such that it cannot be bridged in any timeframe that could be considered relevant to the current discussion. ***What is it that India could do to bridge this capacity deficit***?

The Ukraine, Gaza and Red Sea conflicts have shown that as against the myth of "short wars", prolonged conflicts might well be the norm. In the Indian context, considering the asymmetry in capacity (not considering intangibles such as morale) a prolonged conflict would work in China's favour. Leave aside China, there are some difficult questions that are staring India in the face. Can India sustain a prolonged conflict even with a far less capable but innovative adversary (Israel – Hamas)? Can India sustain a campaign such as the PROSPERITY GUARDIAN in the

[82] Michael C. Horowitz, "Battles of Precise Mass".
[83] Michael C. Horowitz, "Battles of Precise Mass".
[84] Defense Innovation Unit, "Replicator", https://www.diu.mil/replicator
[85] Defense Innovation Unit, "Replicator", https://www.diu.mil/replicator
[86] Michael C. Horowitz, "Battles of Precise Mass".
[87] U.S. DoD, "Rapid Defense Experimentation Reserve", https://ac.cto.mil/pe/rder/.
[88] Michael C. Horowitz, "Battles of Precise Mass".

Red Sea? Does the Indian Navy have the wherewithal to continue shooting down missiles and drones over extended periods? ***What then must India do improve staying power in such conflicts?***

One of the primary lessons of recent and ongoing conflicts is that if something is visible, it is detectable. And what is detectable, is targetable. Locations of critical defence establishments are not difficult to ascertain. What needs to be taken cognisance of is that the *detectable is targetable* adage holds true not only for fixed infrastructure and establishments but also for mobile assets in all three domains. ***What then must India do to improve survivability of critical installations and assets?***

The Ukraine-Russia conflict has shown that the efficacy of any new warfighting system tends to degrade over time since it prods the development of countermeasures, both material and tactical. The ability to continually innovate, even during the course of a conflict, is thus key. Innovation is also important from the point of view of constantly endeavouring to reduce the detection-to-destruction gap – a vital parameter for victory. ***What must then India do to become more agile in terms of technological innovation and adaptation?***

As brought out earlier, India currently holds the advantage in the maritime domain (mainly in the IOR), which at present can be used for deterrence. However, the sheer scale of the PLAN and its inherently increasing ability to surge into the IOR in significant numbers would soon adversely impact the Indian Navy's ability to provide the kind of options that it can bring to bear at the present juncture. ***What must then India to do prevent or counter a PLAN surge into the IOR?***

India would be hard-pressed in countering or defending against a massed OWA drone campaign over even a short period of time. An extended campaign as brought out in the example before could be catastrophic. This is a threat that India faces not only from China but considering its fast-evolving capabilities and Chinese support, also from Pakistan. Furthermore, Pakistan enjoys a close (defence) relationship with Türkiye, which can be considered a technological and a drone powerhouse in its own right. ***What must then India do to counter the possibility, and if required, defend against a massed OWA drone attack?***

A credible and visible capability to deter, and if for some reason deterrence fails, to respond immediately and deliver a punitive blow is extremely relevant in India's context. Nothing exemplifies this more than the recent carnage in which 26 (mainly) civilians were shot dead on 22 April 2025 by Pakistan backed terrorists and proxies at Pahalgam in the Indian territory of Jammu and Kashmir.[89] However, considering that Pakistan is a nuclear armed country, and one that could be considered a near peer adversary, ***what is it that India could do to deter it and other adversaries from indulging in such non-conventional forms of warfare and if required, mete out punishment while retaining escalation dominance?***

Possible answers to some of the questions raised above would be attempted in the next section. However, it needs reiteration that the issues highlighted in this section are merely illustrative, and there are many more that could be raised and would need serious deliberation.

---

[89] Arvind Ojha, "Firing at exit gate, tourists ran toward entry and then…: Pahalgam terror plot", India Today, 29 April 2025. https://www.indiatoday.in/india/story/pahalgam-terror-attack-plot-baisaran-valley-kashmir-firing-exit-gate-tourists-2716756-2025-04-29

HOW SHOULD INDIA RESPOND TO CONTEMPORARY REALITIES?

The discussion thus far would indicate that the intent of the author is to simply bring to the fore the overriding importance and impact of drones in modern warfare, and to suggest that the Indian defence forces must go this way. While this is one of the primary aims of this article and one that addresses most of the questions that have been raised, the perhaps unduly detailed discussion (that need not have been so elaborate) in the previous sections is ***aimed at helping the reader, especially policy makers, in internalising this facet***. The higher defence structure of most countries, including India, will otherwise find it difficult to choose drones over high value items such as advanced fighter jets and aircraft carriers that visibly demonstrate strength, prestige, and status.[90]

Before delving into what India needs to do, indigenous forays in the drone development domain merit mention. To cut a long story short, every DRDO drone endeavour thus far has been a failure. DRDO has been hard-pressed to provide even relatively simple unmanned aerial targets that meet the requirements of the defence forces, forcing the Indian Navy to eventually go in for a UK sourced option. The fact that Iran, a country under heavy financial and technological sanctions for the past many decades, could become a drone power, and India could not, defies reason. This just points to either a lack of focus or the inability to leverage the latent capacity available within this country. The reasons for these failures are, however, not the subject of this article. In the same vein, it merits mention that there has been heartening progress in this domain through startups and the private sector, which must now be harnessed at scale. When it comes to China, in view of the ever-increasing gap in capacity, technology, and resources the solutions would need to be asymmetric. **Asymmetric warfare** is often misunderstood as only being a weaker side's strategy against a stronger force. However, the principle of asymmetry applies more widely. For India, asymmetric solutions allow the achievement of security objectives without necessarily seeking parity with every adversary system. India may not have the capacity and resources of China, but it does have substantial capacity and resources of its own.

Induction of drones is what could be colloquially called a "*no brainer*". The Indian Army, Navy, and Air Force can each benefit from expanded drone fleets—ranging from reconnaissance quadcopters and vertical take-off and landing (VTOL) UAVs to large ocean-going unmanned surface vessels (USVs), UUVs including extra-large UUVs (XLUUV), and advanced unmanned combat aerial vehicles (UCAVs). These kinds of drones however are complicated systems and are very expensive ($30 million for the Hermes 900, the cost of 31 MQ-9B Reaper for India is approximately $3.5 billion).[91] Their high cost itself prohibits the induction of such platforms at scale. Furthermore, while a platform like the MQ-9B may be the best in its class, it would be difficult to employ it in a combat role in a contested environment, other than from substantial stand-off ranges. The real utility of such platforms lies in their use during peace time or in situations of no-war-no-peace. Conventional military thought over the past 30 years has got conditioned, perhaps overly so, by US operations in *the war against terror*, where the employment of drones was overwhelmingly more (and successful) than that of other aircraft. However, what is often lost sight of is that the opposition then had virtually no air defence capability. The

---

[90] Shyam Tekwani, "From Factory to Frontline - Why U.S.–India Drone Collaboration Could Shape the Next Era of Deterrence", DKI APCSS Security Nexus, 24 April 2025. https://dkiapcss.edu/nexus_articles/from-factory-to-frontline-why-u-s-india-drone-collaboration-could-shape-the-next-era-of-deterrence/

[91] NDTV News Desk, "India Signs Mega Deal For 31 Predator Drones From US", NDTV World, 15 October 2024. https://www.ndtv.com/world-news/india-signs-deal-for-31-predator-drones-from-us-6792986

vulnerability of such platforms has been amply highlighted in previous sections (Russia-Ukraine conflict).

If India is to ***induct drones at scale***, then these would need to be simple, cheap, and easy to manufacture and induct. This brings into focus FPV and OWA drones, and USVs and UUVs (maritime) that are primarily kamikaze in nature. This however would require a ***shift in mindset*** across all branches of the defence forces. While the use of drones for ISR, electronic warfare, logistics, and in combat roles must be aspired for, the key is to leverage scale for the following: -

(a) **Strike/ Offensive Operations**. Effects-based operations by employing the principle of *precise mass*.

(b) **As Force Multipliers**. Employing swarming tactics to overwhelm or distract an adversary's defences, enabling other assets to strike more effectively.

(c) **As a Personal Weapon**. Drones need to be looked-at as the "personal weapon" of a soldier. Only then will there be proliferation to the levels required.

The first Gulf War saw an aircraft guiding a bomb from 25000 feet through a window of a building. Erik Prince brings out that today, each soldier can carry six small commercial drones that could do the same thing from 15 km away[92] and even target armoured vehicles like tanks. The Ukrainians did this with a simple shaped charge on a drone with an attached 3D printed copper cone that produced a copper slug travelling at 8000 feet per second that completely destroyed Russian tanks. Prince also brings out that this *democratised precision* comes much cheaper than conventional weapons. A *Javelin* anti-tank missile costs approximately $ 200,000 and requires a launcher that costs about $ 150,000. As against this, a modified commercial drone with a shaped charge that could target a tank from a distance of 15 km would cost just about $ 500 to $ 800.[93]

The Indian Army must take inspiration from the above analogy and aspire for such scale that various configurations of FPV drones are available if not at the level of every soldier, then at least at that of a Section (10 to 12 soldiers). These drones must be cheap, modular, and easy to carry and to assemble. Such drones must also proliferate in the *Internal Security* domain. Most casualties that are seen in anti-terrorist and Naxalite operations could be avoided by the use of AI enabled FPV drones. Such proliferation would yield the added benefit of the internal security structure being able to support the defence forces in case of a conflict or a contingency.

As has been brought out earlier, USVs are now a potent threat at sea. This is especially the case in constricted waters, and in the vicinity of choke points. Countering a fast moving, low observable USV is a difficult task, which any Navy would find extremely challenging. Onboard weapons and systems are not optimised for such targets. In addition to existing weapons, the use of FPV drones supplemented with a shaped charge, including small swarms, could be very effective for this purpose and must be explored. Alongside personnel manning conventional weapons, the LIMO (Low Intensity Maritime Operations) organisation of a warship must have dedicated sailors for the operation of FPV drones (that would also supplement the reconnaissance effort). In fact, drones must form a part of the surveillance bubble of ships at anchorage, and in harbour. Their employment could be coordinated when ships are in company.

---

[92] War, AI, and the West's Dangerous Weakness | Erik Prince and Melissa Chen, YouTube video, 0:56, 28 February 2025. https://www.youtube.com/watch?v=beagINudzVY&t=147s

[93] The Future of War with Former Navy SEAL | Erik Prince, YouTube video, 03:33, 15 March 2025. https://www.youtube.com/watch?v=WsKtfLRSo2c

As mentioned earlier, precise mass provides and substantiates conventional deterrence. Would the capacity to immediately launch a long-range precise strike at multiple targets with say 10000 OWA drones, with the promise of multiple such waves held in reserve, have given India the option to respond immediately to the Pahalgam terrorist attack? Would it have deterred Pakistan from indulging in this form of statecraft in the first instance? For reference, the location of the primary Pakistani Air Force bases along with a notional OWA strike map is shown in the figure below. The answer to both these questions if not an emphatic one, would at least be an insistent *yes*. In such situations unmanned and attritable systems give far more flexibility than conventional weapons. Their use can be recalibrated constantly, managing escalation. Further, the loss of drones doesn't invoke the kind of outrage that a manned platform would. The sinking of a warship could lead to all-out war, as against the loss of a drone[94] that possibly produces more exasperation, consternation, and analyses than anything else, as is exemplified by the shooting down of thus far, seven US *Reaper* drones by the Houthis.[95]

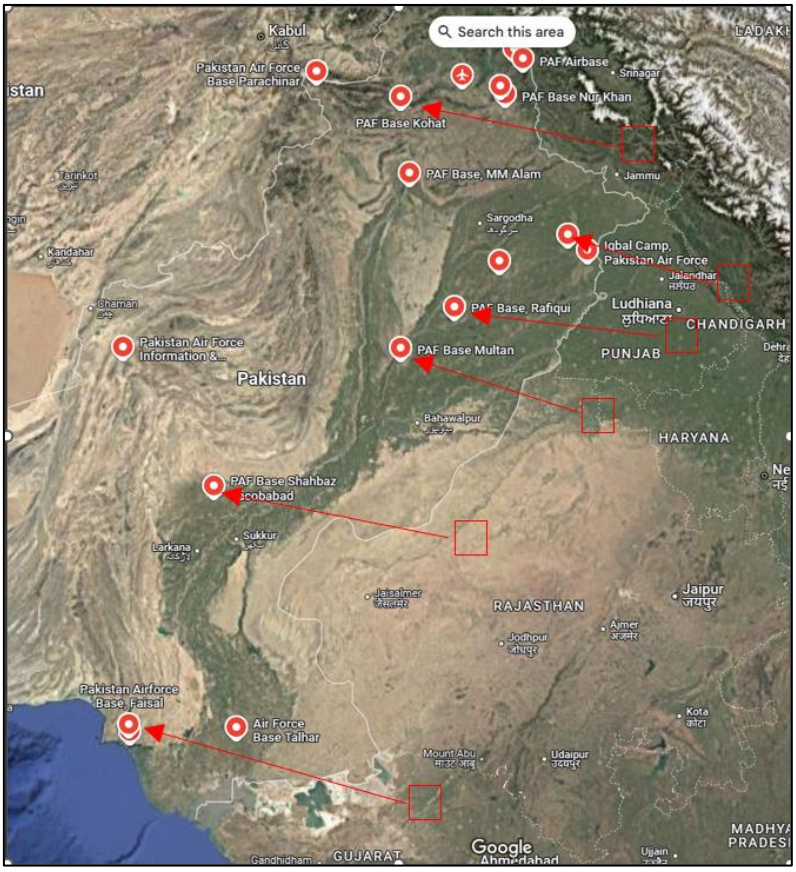

Figure 8: Notional OWA Drone Strike Plan on PAF Air Bases[96]

[94] Shyam Tekwani, "From Factory to Frontline".
[95] Global Desk, "U.S. military stunned as Houthi rebels down 7 high-tech Reaper drones in weeks, costing over $300 million and raising eyebrows", The Economic Times, 26 April 2025. https://economictimes.indiatimes.com/news/international/us/u-s-military-stunned-as-houthi-rebels-down-7-high-tech-reaper-drones-in-weeks-costing-over-300-million-and-raising-eyebrows/articleshow/120647451.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
[96] Google Maps, "Pakistani Air Force Bases", https://www.google.com/maps/search/Pakistani+air+force+bases/@29.4247533,73.0465646,1422014m/data=!3m1!1e3?entry=ttu&g_ep=EgoyMDI1MDQyOC4wIKXMDSoASAFQAw%3D%3D.

China aiming to acquire a million OWA drones is entirely plausible, especially when viewed in the context of the Taiwan issue. However, what needs to be borne in mind is that China could dedicate or divert such a force towards India too. While from the point of view of availability of suitable targets, geography possibly favours the Chinese, the ability to launch such drones from the Tibetan plateau needs looking into. A similar capability, maybe not to the same scale would provide India considerable deterrence, especially with regards to prospective targets in south-east China, and against military infrastructure in Tibet.

Equipping warships with OWA drones could add a different dimension to their inherent strike capability in terms of extended reach and attack from an unexpected direction. AI enabled OWA drones could effectively target other ships, including warships. While these may not be able to sink warships, they could cause considerable damage, especially when used in small swarms (would require AI) and possibly in consonance with other anti-ship missiles (saturate the air defences of the adversary) and USVs. An AI-enabled OWA drone could make a ship practically defenceless by taking out its main air defence radar. These also provide a cheap option to provide auxiliary vessels and even merchant ships with offensive capability that could be used for sea denial and even as part of a larger A2AD campaign. Merchant ships would be particularly vulnerable to AI enabled OWA drones, rendering the latter a credible option for interdiction of trade. Most versions enable launch via launch rails or other such compact arrangements that could be easily installed onboard a ship or even rolled out (from storage) to a convenient location such as its helicopter deck. Once again, these drones must be cheap, modular, and come in the form of kits that can be easily stored and quickly assembled. In this configuration, one of the two helicopter hangers on board a Delhi Class destroyer should be easily able to accommodate 50 such drones, maybe even more. Another area where the maritime domain lends itself to innovation as compared to land is the ***recovery*** of such drones (prospectively with a parachute arrangement) that are normally of a one-way configuration.

Figure 9: An Iranian Shahed-136 drone being launched during an exercise[97]

[97] AP, "The Iranian-made killer drones vying for supremacy in Ukrainian skies", The Times of Israel, 18 October 2022, https://www.timesofisrael.com/the-iranian-made-killer-drones-vying-for-supremacy-in-ukrainian-skies/.

Figure 10: A U.S. Marine Corps Hero-400 loitering munition drone is staged before flight[98]

India because of its geography and the prevailing security situation does not have the luxury of making a choice between say a 4.5+ generation aircraft, or drones – both must be inducted. However, limited finances would always call for judicious balancing and sometimes, hard choices. The induction of drones in all three domains is not a choice but a strategic compulsion. India must have its own *Replicator* programme, with drones across all genres as its primary focus. The first priority should be to induct and maintain an inventory of at least 250,000 OWA drones. At $ 20,000 per piece, the overall cost for this endeavour would be $5 billion. Alongside this, FPV drones must be inducted in such numbers that these proliferate down to the lowest echelons of the armed forces and the internal security apparatus. Taking a cue from the Ukrainian experience, the aim should be to maintain an inventory of about five million such drones. Even with a highly exaggerated cost of $1000 per piece, this would amount to a requirement of another $5 billion. Since it would take time to develop the required industrial capability for manufacturing at this scale, the overall requirement of $10 billion would be spread over at least three (229 drones/ day) to five (137 drones/ day) years, requiring an annual allocation that would range from $2 billion to $3.3 billion. This, at the higher end, would be approximately 4% of India's current defence budget (ballpark figure of $80 billion). This is eminently doable. The overall cost will go down once the initially envisaged figures are achieved. The rate of manufacturing would also increase once assembly lines stabilise. India must eventually endeavour to maintain an inventory of about 500,000 OWA drones. This will provide a measure of deterrence, and if required, a first/ counter strike capability against both China and Pakistan. The figures of 250,000 and 500,000 are not based on any statistical analysis, but on three aspects - managing finances, nascent manufacturing infrastructure, and an inventory that would last at least 50 days and 100 days respectively considering even an inordinately high expenditure of 5000 drones per day (25 high value targets, 200 drones/ target). The discussion in this section does not consider maritime drones (USVs), which will be addressed separately.

Additionally, the supply chains and the industrial plan must be such that these ensure maintenance and supplementing of the required inventory in quick time. Thousands of drones, both FPV and OWA, can be expected to be expended during a conflict. The industrial machinery must be able to at least nominally make up these numbers even as the conflict progresses. Identifying and nominating the primary drone suppliers and keeping production and

[98] Jon Harper, "DOD intensifying search for new tech to defeat kamikaze drones", DEFENSESCOOP, 12 October 2022, https://defensescoop.com/2022/10/12/dod-intensifying-search-for-new-tech-to-defeat-kamikaze-drones/.

assembly lines alive during peacetime, with a plan to scale up production at short notice, is required to always be in place.

Most innovation in this domain happens through the startup ecosystem. Startups, however, are very vulnerable to issues related to funding and cash-flow. In such a situation, ***selling of intellectual property rights*** (IPR) to foreign entities which are always on the lookout for such opportunities is a big threat. A methodology for safeguarding intellectual capital must be put in place – one that ***concentrates on technology and not solely on a finished product***.

Adaptation/ Innovation on the Go

Among the pivotal takeaways from the conflict in Ukraine is the requirement of both **tactical** (detection to destruction gap) and **strategic** adaptation. Ukraine has been at the forefront in terms of frontline improvisations—using civilian drones, reconfiguring commercial vehicles, and deploying advanced counterintelligence methods at the lowest levels of combat. On the other hand, **Russia** has shown a capacity for **strategic adaptation**, translating battlefield lessons into new operational concepts and quickly scaling them up through its defence-industrial base. For India, the challenge is to combine both forms of adaptation: -

(a) **Tactical Adaptation**. The ability of junior leaders to innovate in the field to exploit vulnerabilities and incorporate new equipment and tactics at short notice.

(b) **Strategic Adaptation**. The capacity of the government and armed forces hierarchy to implement doctrinal, organisational, and industrial changes in a systematic yet rapid manner that allows synchronisation with not only future requirements but also with the ongoing battle rhythm.

A key step here is to reduce the lag between operational feedback and large-scale doctrinal, procurement, and industrial decisions. This will require establishing **dedicated "lessons learned" cells** embedded in operational formations and commands, mandated to share results across the armed forces, and more importantly, with the defence industrial sector, a dynamic relationship with which will help the Indian military pivot more quickly than legacy structures. As in the case of the Ukrainians, the structure envisaged must enable ploughing back of field inputs into equipment and systems within a timeframe that could be counted in days and not weeks, months, or years. For example, the structure needs to be so agile that it facilitates an OEM representative undertaking immediate software updates on the drone inventory held in a particular location, based on the requirements that have been projected. These could simultaneously be assessed at higher echelons for force wide implementation.

The Role of Resilience in Modern Warfare

Ongoing events demonstrate that success in conflict is often premised on a robust and resilient defence. **Resilience**—the capacity to withstand, recover, and adapt from attacks—must become a cornerstone of India's force structuring. This is not new and is obviously factored into operational planning. The intent here is to reiterate a few aspects that need focus.

India has the advantage of space. In the first instance, dispersal and spread of assets and munitions across maximum possible locations, preferably in depth, must be established in doctrinal terms. The Indian Navy is particularly vulnerable here. Primary Naval airbases and

critical establishments such as Naval Dockyards will definitely be targeted in a conflict. Even the Indian Air Force despite its nation-wide spread is not immune to this aspect. Conventional Blast Pens used for parking aircraft (mainly fighters) are meant primarily to provide protection against conventional bombs. Their suitability against missiles, especially ballistic missiles needs specific examination.

Ammunition depots/ dumps/ magazines, because of their very nature are high value targets the destruction of which could greatly debilitate the war waging potential of not only specific formations, but entire theatres. All future magazines, especially those in major ammunition depots must be built below ground and to standards that make them resilient to massed attacks by at least short-range ballistic missiles. Insofar as anti-drone measures are concerned, even basic physical countermeasures such as wire-caging could be very effective for fixed assets. Resilience must also be catered to for the manufacturing and storage infrastructure for drones that has been proposed earlier.

Deterrence in the Indian Ocean

One of the problems stated in the previous sections pertains to countering a surge of the PLA Navy into the Indian Ocean. This falls primarily in the domain of the Indian Navy and would obviously be a subject of frequent deliberation and operational planning. The Indian Navy has always pursued an aircraft carrier based concept of operations with the ability to exercise *sea control* in an area of its choosing. However, given the prospective Chinese threat (two Carrier Battle Groups, numerous escorts, 02 to 03 SSNs, research and intelligence gathering ships, UAVs and USVs, and support from deep water fishing fleet) this needs to be supplemented with effective A2AD capability. This is particularly relevant in the eastern segment of the Indian Ocean, where geography, mainly because of the Andaman and Nicobar Islands and the presence of various maritime choke points, is favourable to India in terms of thwarting the PLAN right from the time it commences its ingress into the Indian Ocean.

In addition to conventional assets such as warships, maritime patrol aircraft, shore-based strike aircraft (Air Force), submarines, and mobile batteries of anti-ship missiles, every unconventional and asymmetric system that could target or assist in targeting PLAN assets should be brought to bear. Containerised missile systems on non-weapon platforms introduce another method for increasing fire power and aggregating mass. When used in consonance with such systems installed onboard merchant ships, these offer another avenue for cost-effective **dispersed lethality** that forces potential adversaries to allocate more resources for intelligence, surveillance, and reconnaissance (ISR) and limits their offensive options. These systems need to be modular, cheap and simple, and ones that require very basic inputs in terms of target coordinates that can be shared by means of ordinary radio telephony (RT) or very basic data-link fly away kits. As in the case of the US (mentioned earlier) the aim should be to keep the cost down to about $150,000 per missile. The platforms (including types of commercial vessels) on which these would be installed would need to be identified in peacetime, with regular drills and trained manpower ready for deployment at short notice. In the first instance, all naval (without anti-ship missiles) and coast guard ships, both blue and brown water, that have the space for the installation of such systems should be considered, with crew training being undertaken at regular intervals at shore-based facilities that could be established in each of the three Indian Navy Commands. Equipping warships and other craft-of-opportunity, with OWA drones as suggested earlier, adds another dimension of (dispersed) lethality.

In the context of A2AD the statement of Commander US INDOPACOM, Admiral Samuel J Paparo, wherein in response to a question regarding the possible invasion of Taiwan by China,

he stated that "I want to turn the Taiwan Strait into an unmanned hellscape using a number of classified capabilities",[99] is very telling. It is obvious that he is referring to the deployment of drones in all three domains (UAV/ USV/ UUW) in the Taiwan Strait. While inspiration may be taken from this statement, it must also be borne in mind that the options that the US has because of the weight of its technology and financial heft, are not available to India. The classified capabilities mentioned here are likely to be cutting edge and extremely expensive. While such technologies should, in time, be a part of India's repertoire, the intent of this article is to stress on the necessity of ***low cost, modularity, lethality, and scale***. Hence higher-end technologies and functionality therein have not been elaborated upon here. These, however, must remain part of ongoing induction plans.

As brought out earlier, the effectiveness of USVs in sinking ships may be limited in open seas. However, swarms of such vessels in constricted waters can be effective. The use of USVs as mother ships that carry multiple UAVs is another use-case that is worth pursuing especially in the context of the straits of Malacca, Sunda, Lombok, and Ombei and Wetar.

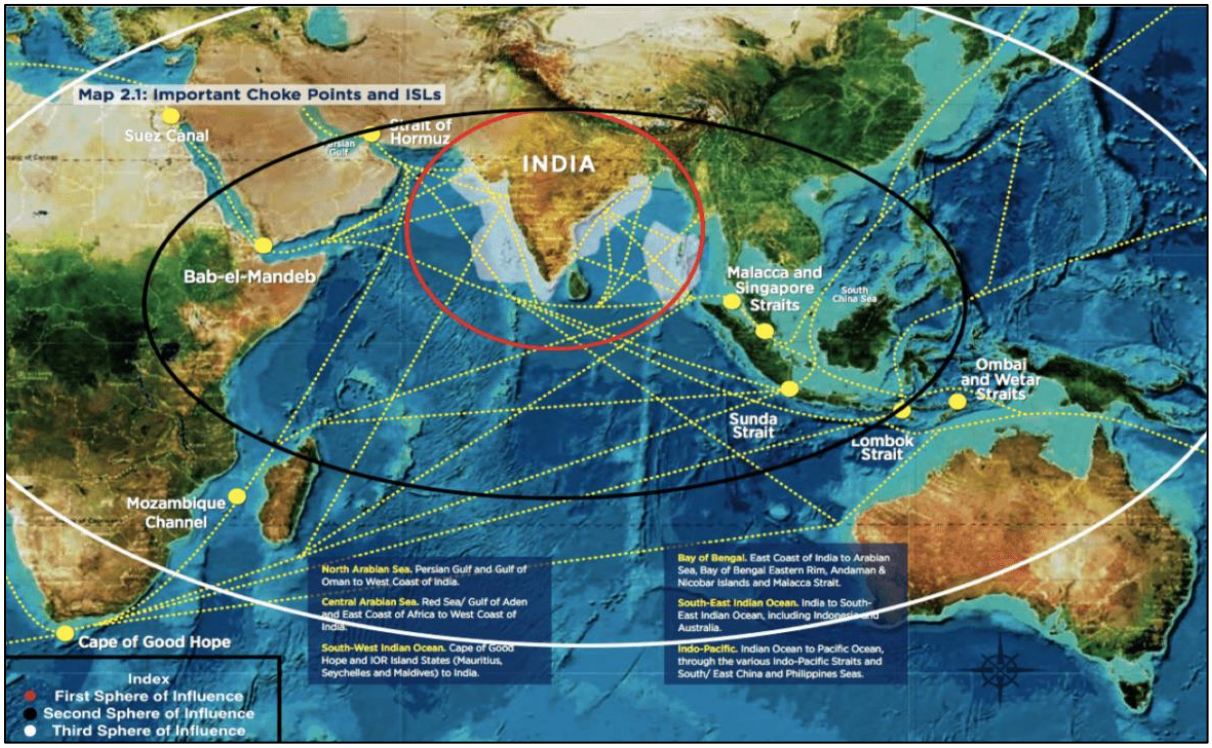

Figure 11: Important Choke Points and ISLs in the Indian Ocean[100]

While inducting USVs and UUVs, the focus must be on cost, reliability, and ***scale*** and not so much on sophistication. Further, these must be modular, have long ranges, and must be developed with the intent to cause damage. These, thus, would be *kamikaze* in nature. Modularity must support these being carried on board warships, as also aboard commercial and other vessels, including, potentially, on fishing trawlers, too. The Andaman and Nicobar Islands, the Lakshadweep Islands, and riverine areas such as Kachchh provide a conducive geography for basing/ using USVs and UUVs. However, cognisance must be taken of the fact that their effectiveness in damaging ships is contingent on many other requirements falling in place

[99] Business Insider article published by myNEWS, "US plans to turn Taiwan Strait into 'unmanned hellscape' if China invades: top admiral", myNEWS, 18 June 2024. https://www.scmp.com/news/world/united-states-canada/article/3266092/us-plans-turn-taiwan-strait-unmanned-hellscape-if-china-invades-top-admiral

[100] Kenan Agazade, "India's Political Role in the Indo-Pacific Reign", The Asia Today, 09 June 2022. https://theasiatoday.org/editorials/indias-political-role-in-the-indo-pacific-reign/

simultaneously (touched upon in previous sections). These would be far more complicated to deploy, operate, and aggregate for the required weight of attack than OWA drones in the UAV/ loitering munitions configuration. While discussing this theme, it is also understood that a UUV/ USV programme will be technologically more complicated and resource intensive as compared to one dealing with aerial drones. For reference, some of the USVs being used by Ukraine cost about $250,000.[101] The cost of UUVs is likely to be higher. How many of these would be required is hard to say at this nascent stage. However, the numbers planned for should serve the larger purpose of deterrence. Assuming that Indian industry would be able to keep costs within $150,000 per USV/ UUV, a financial outlay of about $15 million would be required for an inventory of 100. This may be an appropriate number to provide the programme the initial impetus whilst also serving as a *proof of concept*.

China, despite whatever advances it makes in terms of numbers or capacity, will always suffer from the disadvantage that it is unlikely (in timeframes considered relevant) to have access to secure bases in the Indian Ocean Region that could help sustain a PLAN Task Force over extended periods. Chinese SSNs while being extremely problematic, cannot project force. Using a combination of sea control and A2AD, India must make it clear to the Chinese that the offensive use of the PLAN in the Indian Ocean in times of conflict is not a viable option. A situation like the Galwan crisis is very different from that of a full-blown war. The former did not see too much of naval posturing (at least in the public domain) because of the prospect of undue escalation. However, in case of the latter, the message must be clear that Chinese ships and support infrastructure would be targeted relentlessly even before the PLAN enters the Indian Ocean. The Indian defence forces must be able to create their own version of ***hellscape*** in the IOR. This must be leveraged as ***India's primary deterrent*** against Chinese misadventures on the northern borders, or that of a collusive threat in consonance with Pakistan. India's A2AD strategy in terms of equipping, resilience, and effect must flow from this singular aim. ***The Indian Ocean needs to be looked at as the core guarantor of India's territorial integrity along the land (northern) borders***.

Air Denial

Air Denial as brought out earlier has been used effectively by the Ukrainians to counter the substantially superior Russian air power. The Yom Kippur war between Israel and Egypt (and allies) is also an example of the value of *air denial* using ground-based AD. The Indian defence forces, especially the navy, have looked at ***air defence essentially from the point of view of force protection***.

The Indian defence forces must look at air defence as not merely a tool for force protection but must pursue ***air denial as a specific capability*** with a robust doctrinal foundation. This is especially relevant from the point of view of the IAF and the Army that have a large area (both fronts) to cover and most of it through challenging terrain. Induction of mobile (vehicle mounted) self-contained (radar, communication, command and control, missile) short and medium range SAM systems, comprising both active and passive missiles, in ***large numbers*** is mandatory, and not an option. The configuration needs to have a small footprint so as to enable camouflage, stealth, and achievement of surprise in terms of deployment, and should preferably be mounted on a single, high-mobility vehicle. Instant cueing from the IAF's Integrated Air Command and Control System (IACCS) and other standalone systems (if required) over a basic but robust and secure datalink, and immediate acquisition thereon, needs to be in place towards

[101] Joshua Cheetham, "Sea drones: What are they and how much do they cost?", BBC, 13 September 2023. https://www.bbc.com/news/world-europe-66373052

ensuring emission control till the last moment. While there are such systems in service, their numbers and capability, especially in terms of resilience to modern electronic warfare systems, needs a fresh look. The capability has to be such that it permits complete *air denial* in areas of choice, freeing up vital resources for other tasks. The question that becomes germane therefore is - would the establishment of an ***"air denial wing"*** within the overall charge of the IAF (including Army assets on a case-to-case basis) that specifically plans, manages and coordinates *air denial* operations be worth considering? Till such time that this organisation is set in motion, would it be prudent to have a dedicated "*air denial cell*" in each of the IAF's operational commands?

Denial operations, whether these be related to the sea or air, have thus far been thought to be applicable to both sides in equal measure, i.e., even own forces cannot use the area and domain that are being denied. However, this may not be true any longer since modern communication systems and data links permit effective coordination between assets involved in denial operations, and those that intend to use that same space and domain. *Air denial* could thus be utilised to achieve a *favourable air situation*, and maybe even *air superiority*. A well-oiled organisation would be well placed to lure and entrap enemy air assets in pre-decided or opportunistic kill zones/ boxes by using tactical ruses undertaken in judicious consonance with own aircraft operations.

Insofar as the Indian Navy is concerned, its thinking has been conditioned by the type and range of AD systems in service and the very different conditions in which the Navy operates as compared to the Air Force and the Army. The platforms/ ships on which AD systems are installed are themselves very valuable in terms of the requirement of protection. The induction of the LRSAM (called MRSAM in the IAF) alongside the MFSTAR which is a very capable radar, permits *air denial*, potentially freeing up carrier-borne fighters for missions in higher priority areas. Could the Navy provide *air denial* in a manner that potentially frees up IAF aircraft for other missions, for instance over India's oil and gas offshore development areas? With the S-400 the IAF now has an AD system capable of enforcing *air denial* at considerable ranges. Could the IAF provide *air denial* in an area where naval submarines are operating/ deployed towards thwarting air borne ASW by adversaries, or for operations in waters close ashore? These are some of the concepts that need further thought.

Installation of very short-range surface to air missiles with basic EO directors/ sights on board smaller vessels that do not have integral air defence systems merits attention and must, in fact, be pursued in earnest. The AD system shown in the figure below has a turret that weighs only 480 kg and can either be integrated to the ship's combat management system or can also be used in standalone mode. Another aspect that merits further analysis is the placement of vehicle-mounted ground-based systems on board ships (vehicle parked and secured). If issues of stabilisation are addressed, this could add considerable teeth to the Navy's *air denial* capability.

Figure 12: A MISTRAL SIMBAD-RC System[102]

Defence against Massed OWA Drone Attacks

Conventional UAVs are countered by a combination of hard and soft kill measures. This requires little elaboration since such measures are being pursued in earnest and are already in place in many locations. The progress of Indian startups and industry in this domain is also very heartening. Furthermore, expending an expensive surface to air missile on a far more expensive UAV satisfies the parameters of a cost-benefit analysis. However, a massed OWA drone attack presents an entirely different challenge. Hard-kill measures are prohibitively expensive at the current juncture. India simply cannot afford to expend expensive, and more importantly, scarce surface-to-air missiles on such a threat. While considerable progress is being made in the development of soft kill measures, mainly EW systems, these are not yet as effective as they need to be. Directed energy weapons hold great promise but are still a fair distance away.

An important lesson has come to the fore during the India-Pakistan conflict that took place from 07 to 10 May 25 as a result of India launching Op SINDOOR in response to the Pakistan-supported terrorist attack at Pahalgam in Jammu and Kashmir. Legacy anti-aircraft guns and systems of the Indian Army proved to be very effective in shooting down drones. It would thus be prudent to substantially scale up the induction of such systems so as to enable unbroken air defence coverage of vital infrastructure and assets. Such systems would also provide a measure of anti-missile defence akin to the layered concept followed aboard ships on the Indian Navy. The modification of the AK 630 close-in-weapon-system (CIWS) used on board naval ships, that has a rate of fire of 4000 - 5000 rounds per minute and a range of four to five kilometres, for installation ashore, needs serious consideration. These guns could be integrated to a central radar in an establishment such as an airfield and could also have their own integral radars that could operate in standalone mode. Four AK 630 guns represented by the red emplacements in

[102] MBDA, "MISTRAL SIMBAD-RC". https://www.mbda-systems.com/products/force-protection/mistral-family/mistral-simbad-rc#:~:text=

Figure 14 below could provide all-round coverage to even a relatively large airport like the Chhatrapati Shivaji Maharaj International Airport, Mumbai. Most defence airfields would require just two guns, with four ensuring redundancy as also sufficient overlap of coverage between individual guns.

Figure 13: AK 630[103]

Figure 14:Google Earth Image of Chhatrapati Shivaji Maharaj International Airport Mumbai[104]

[103] Sumit Roy, "AK 630 Firing onboard INS Vikrant", Zee News Hindi, 05 October 2022. https://zeenews.india.com/hindi/india/photo-gallery-ak-630-ciws-gun-installed-on-ins-vikrant-know-what-is-strength-and-range/1349561/ak-630-ciws-1349563

[104] Google Earth, Chhatrapati Shivaji Maharaj International Airport Mumbai. https://earth.google.com/web/@19.08866943,72.85854586,13.95343666a,10621.25320508d,35y,0h,0t,

The Indian Army would be hard pressed to provide local AD cover to naval units. Moreover, army AD would need to be deployed from another location in case of a prospective threat. This delay, in and of itself, may be critical. It would thus be prudent to utilise this extremely effective gun system at all critical shore establishments. This could be replicated across Air Force establishments, too, where it could also be integrated within the local AD network. Since this gun has been indigenised, ramping-up production could be undertaken on a war footing.

The proliferation of soft-kill measures; dispersion, along with camouflage and use of decoys; and resilience (built in at the level of system design), are other measures that are mandatory for repelling a massed OWA drone attack. There thus needs to be a dispersal-and-resilience plan in place, one that is updated at regular intervals.

EW systems onboard ships are normally optimised for anti-missile defence. These must be supplemented with dedicated anti-drone EW systems, including handheld drone guns which in any case, must proliferate in the anti-access strategy of shore establishments of all three services. India must invest deeply in the R&D of swarm drones, especially *kamikaze* swarms. These would have the potential to thwart massed OWA drone attacks. Additionally, these may also hold potential for use in anti-missile defence.

Building ***deterrence*** with the promise of retaliation in the same vein, however with a factor that is of an order of magnitude several times of the initial attack, will perhaps be the most effective defence measure.

A distinct Drone Force?

India does not yet have the critical mass in terms of induction of drones that would create the consolidation of opinion for a separate force altogether. However, considering their impact on modern warfare, and their prospective proliferation in substantial numbers in the future, thinking on these lines must commence. While conventional drones would need to be inducted by all three defence services as per their individual requirements, OWA and FPV drones certainly merit special attention.

A separate OWA Drone Division under the Indian Air Force, which looks after all aspects of development, induction, life cycle support, functional improvement/ enhancement, innovation, and exploitation, would hasten and optimise the building up of required numbers. The Indian Navy, too, would require a similar organisation to cater to maritime requirements. The Indian Army would be the largest subscriber of FPV drones. The requirements of FPV drones could thus be managed centrally by the Indian Army. However, there must be a system in place that facilitates the permeation of requirements, ideas, and innovation across the three services.

Training of operators of conventional drones is of a specialised nature and could continue as is being undertaken under current arrangements. However, training for FPV and OWA drones would need a different structure. First, this would be far less arduous, and secondly, this training would need to be undertaken at scale, possibly for tens of thousands of personnel.

A tri-service training organisation/ school that caters to training and formulation of doctrine for the exploitation of FPV and OWA drones is recommended to be established. Considering the

---

0r/data=CgRCAggBMikKJwolCiExV2Mxekt3ZE8xc2lXaU02S3NJYXhhS3dqZXZmWlcySm0gAToDCgEwQgIIAEoICKuywuEGEAE

level of induction recommended in this article, each defence service must thereafter have a dedicated training establishment, which must be supplemented with local organisations that provide refresher training. This establishment in the navy would also need to look at USVs and UUVs. What must be kept in mind is that the intent would be to treat FPV drones almost as a personal weapon.

Artificial Intelligence (AI)

AI, in the coming days, will be a defining factor for the exploitation as also for countering drones. Some areas where AI would be invaluable are – autonomous navigation, especially in a GPS-denied environment, object detection and target classification, decoy discrimination, target engagement, and the managing and coordination of swarms. In preparation for this, collection and labelling of data by means of imagery - potential targets, terrain, prominent geographical features, etc., need to be institutionalised within each service. Additionally, the endeavour must be to make every drone AI-enabled, in whatever way feasible. This is important for inculcating a culture wherein inducting and supporting AI become second nature.

Operational Stamina

The days of short and swift wars are behind us. The requirement for preparing for a short and high intensity conflict for 15/ 30/ 45 days that was often professed by the strategic community and within the think-tank circuit does not hold true any longer. Even a financially stressed country like Pakistan, with the assistance of allies (term used consciously) such as China and Turkey, could have the legs to partake in a conflict with India over a prolonged duration. While India has partners, the sustained sourcing of critical equipment and munitions over extended periods is not only likely to be a huge financial strain but may also face uncertainties due to geopolitical considerations. India, thus, has little option but to develop operational stamina through (primarily) indigenous means. A ball-park figure of six months of conflict could be considered for this purpose.

This would require continuous delving into fundamental questions such as war wastage reserves of critical equipment and munitions, especially those sourced from abroad, contingency planning for supply chains, ramping-up of indigenous production, including during the conflict, and doctrinal aspects pertaining to weapon-to-target matching. Mass induction of OWA drones and loitering munitions along with a concerted focus on resilience would improve operational stamina. The figure of 250,000 OWA drones mentioned earlier would enable expending almost 1400 of these daily over a six-month period, which should be more than sufficient to saturate and even overwhelm Pakistan's defensive capabilities. This, then, also provides a benchmark of the production rates that need to be achieved towards replenishment. As brought out in an earlier section, expending 5000 such drones daily would give an offensive capability lasting 50 days, which is quite significant.

The issue regarding Pakistan getting support from Turkey and China came to the fore during the conduct of Op SINDOOR. Pakistan, on the nights of 07/ 08 May, 08/ 09 May, and 09/ 10 May 2025 targeted military installations all across India's western border using drones (in large numbers) and missiles. During briefings by the Ministry of External Affairs, it came out that in

addition to UCAVs, Pakistan also used Turkish origin *Asisguard Songar* drones[105] to not only target Indian installations, but to also saturate air defences. A picture of this drone is placed below.

Figure 15: Asisguard Songar 2x40mm Grenade Launching Configuration[106]

As per the *Asisguard* website, this drone comes in various configurations that facilitate firing of rifle rounds, grenades, and mortar rounds. However, the website also mentions that the endurance of this drone is only 35 minutes.[107] It is thus likely that Pakistan used these drones for attacks very close to the frontlines, whereas others such as the Turkish origin Byker YEHA III kamikaze drones were being used for forays that went deeper into Indian airspace.[108] This is a drone that falls under the category of *loitering munition* that can remain airborne for several hours before conducting precision strikes.[109]

[105] India Today Science Desk, "Pakistan's strike on India likely used gun-toting Turkish drones: All about Songar", India Today, 09 May 2025. https://www.indiatoday.in/science/story/pakistans-strike-on-india-used-gun-toting-turkish-drones-all-about-songar-2722320-2025-05-09

[106] Asisguard, "Songar Grenade Launching Configuration". https://www.asisguard.com.tr/en/product/songar-2x40-mm-grenade-launcher/

[107] Asisguard, "Songar Grenade Launching Configuration".

[108] ANI, "Indian army destroys drone aimed at civilians in Punjab's Amritsar, debris recovered", The Economic Times, 10 May 2025. https://economictimes.indiatimes.com/news/defence/indian-army-destroys-drone-aimed-at-civilians-in-punjabs-amritsar-debris-recovered/articleshow/121050973.cms?from=mdr

[109] Dylan Malyasov, "Albania fields Turkish-made YIHA-III kamikaze drones", Defence Blog, 19 March 2025. https://defence-blog.com/albania-fields-turkish-made-yiha-iii-kamikaze-drones/

Figure 16: Byker YEHA III Kamikaze Drone[110]

What, however, is clear is ongoing support from Turkey, with as many as six military aircraft from that country reported to have landed in Pakistan in the days surrounding the strike.[111] A Turkish warship was also recently docked at Karachi.[112] A Songar drone's dimensions for transportation, as per Wikipedia, are 26 in × 24 in × 30 in.[113] Considering the volume of the C-130's cargo hold, a single flight would be able to transport about 340 such drones.

Leveraging Partnerships

India is in a position to undertake low-cost manufacturing at scale. This capacity can be utilised by the US in furtherance of its *Replicator* programme, to provide scale that could match the Chinese insofar as the manufacturing of drones is concerned. All existing forums such as the INDUS-X, iCET, and ASIA (Autonomous Systems Industry Alliance) must be leveraged to synergise this endeavour.

It is imperative that a suitable policy framework be formulated in terms of making the proposition attractive to the US. This could be in terms of a Special Economic Zone dedicated to the development and production of unmanned systems, offering substantial tax and regulatory concessions for extended periods. The aim should be to first place India as the destination of choice for manufacturing attritable systems for the Quad, and then as a global drone developer

---

[110] Dylan Malyasov, "Albania fields Turkish-made YIHA-III kamikaze drones".
[111] Business Today Desk, "Mystery flight? A Turkish cargo plane's presence in Pakistan raises questions after drone barrage", Business Today, 09 May 2025. https://www.businesstoday.in/india/story/mystery-flight-a-turkish-cargo-planes-presence-in-pakistan-raises-questions-after-drone-barrage-475638-2025-05-09
[112] Sushim Mukul, "What are Turkish warship, military planes doing in Pakistan amid war fears?", India Today World Desk, 06 May 2025. https://www.indiatoday.in/world/story/pahalgam-attack-india-pakistan-war-military-response-turkish-military-aircraft-warship-land-karachi-2719839-2025-05-06
[113] Wikipedia, "Asisguard Songar". https://en.wikipedia.org/wiki/Asisguard_Songar

and manufacturer. A similar strategy could also be pursued with Israel – ***Israeli technology, Indian scale***.

Towards unleashing the potential of Indian industry and uncaging its *animal spirit*, a distinct policy framework is required for the induction of attritable systems, especially FPV and OWA drones. The existing *Defence Acquisition Procedure* is not optimised for rapid induction and on-the-fly innovation and enhancement. Revolutionary reform that facilitates instant procurement in a matter of days, especially during emergencies needs to be put in place. The procurement procedure for this particular domain needs to move from ***process to outcome!***

Op SINDOOR

The writing of this article commenced before the conduct of Op SINDOOR. Op SINDOOR has been a massive and an unambiguous success for India and will lead to tectonic shifts in the prevailing narrative not only in the sub-continent but also the entire Indian Ocean Region. Even though the whole-of-government, in fact the whole-of-nation approach followed by India was on display, Op SINDOOR was essentially a swift, stunning, and overwhelming military victory. Many of the issues that have been articulated thus far in this article have been vindicated during the course of this operation. It would be prudent to consider some other lessons that could be drawn from this operation even if these go beyond the originally envisaged scope and context of this article.

The massed use of drones and the unstinted support to Pakistan from Turkey and China, and, in this context, the necessity for India to develop operational stamina through indigenous means, have already been brought out. Even though official sources have not mentioned the weapons used by India for conducting air strikes, both conventional and social media is ripe with reports of air launched Brahmos missiles having been very effective.[114] The maritime version of this missile (air, ship, and shore launched) then comes to the fore as a potent weapon for effective A2AD in the Indian Ocean against the Chinese. India must develop the materiel capacity of saturating the Indian Ocean with the Brahmos. When supplemented with OWA drones, loitering munitions, USVs and UUVs, and containerised anti-ship missiles, this would create a strong and potent deterrent.

Not only China and Pakistan, but also countries in the West will learn lessons from Op SINDOOR; the first being the need to counter the Brahmos. It is known that the missile has already been exported to the Philippines and there are many other countries that have expressed interest in procuring this missile. Partners of these countries will potentially get access to this system especially during bilateral/ multilateral exercises wherein practice missile firings could also be undertaken. In this context, India needs to be extremely circumspect in terms of prospective customers and put in place measures to ensure that confidentiality of critical technologies/ parameters/ data is maintained. The lure of increasing defence exports must not result in dilution of the existing competitive advantage. Domestic requirements alone present a large enough business opportunity.

Considering the success of Indian missile strikes, Pakistan, with Chinese assistance, will aspire to acquire a similar capability. Air defence, cutting edge electronic warfare, networking, resilience (mentioned earlier), and an effective civil defence and Home Guards organisation need

---

[114] Rajat Pandit and Sachin Parashar, "Response to Pahalgam Terror Attack marks new normal in India-Pakistan ties", The Times of India, 12 May 2025. https://timesofindia.indiatimes.com/india/response-to-pahalgam-terror-attack-marks-new-normal-in-india-pakistan-ties/articleshow/121088328.cms

continuing focus. It must be remembered that due to substantial superiority in terms of both capacity and capability, Indian resilience and tenacity have not really been put to the test during this operation. This may not be the case in the future, especially in a prospective conflict with the Chinese.

It may be stated that the IAF achieved considerable success in realising *air denial* not only within Indian territory, but, to an extent, within Pakistani airspace too. However, this was facilitated, in large measure, by effective *SEAD* (suppression of enemy air defence) operations. While it is understood that different types of operations would be synchronised towards achieving a common (favourable) end-state, there exists merit in looking at *air denial* as a distinct capability that could be enforced at a place of choosing, especially in the context of Pakistan.

CONCLUSION

The term Revolution in Military Affairs (RMA) was coined in the aftermath of the first Gulf War because of the unprecedented use of advanced technologies such as *stealth* and precision targeting by the US. The first Gulf War can rightly be seen as the harbinger of change, that moved warfare from mass to precision.

Recent conflicts have shown that warfare is once again at the cusp of a revolution. The democratisation of technology has resulted in capabilities such as precision targeting, the ability to field massed effects, and perhaps most significantly the ability to partake in a long, drawn-out conflict, earlier the domain of established powers alone, now being available to quasi-and even non-State actors. Drones and unmanned systems have been at the forefront of bringing about this change.

In a seminar on drones organised by the Centre for Air Power Studies (CAPS), New Delhi, in early May 2025, what came to the fore was that even now the Indian focus is on conventional high-end drones. The lessons from Ukraine in terms of the effects of utilisation of FPV and OWA drones at scale have, perhaps, not been given the attention that this matter merits. Surprisingly, the ***business proposition*** that the massed production of these drones presents has thus far evaded the interest of industry and startups. An ecosystem to produce such drones as would meet the requirements of the Indian defence forces, the internal security structure, and potentially that of many export customers, could galvanise the defence industrial sector. Further, it would offer the nation varied choices at not only the tactical, but also the operational and strategic levels of warfare.

This article, accordingly, is an attempt to bring into focus the changing dynamics of warfare, and the impact of democratisation of technology and the application of *precision mass* therein. The intent is not to undermine the importance of conventional systems and high-end technology, which must be inducted in accordance with the envisaged concept of operations and the desired end state. The objective is to shine a flashlight on relatively cheap and low-end unmanned systems, namely FPV and OWA drones that if inducted *en-masse* alongside conventional systems, offer increased flexibility and lethality.

The Pahalgam terrorist massacre and its aftermath offer a telling lesson. Evolving circumstances, especially with a near-peer adversary like Pakistan, lead to dilution of established deterrence. While India has set a new benchmark of deterrence with Op SINDOOR, Pahalgam-like incidents taking place again in the future is certainly not beyond the realm of possibility. Clearly, therefore, Indian authorities need to have access to multiple options that would enable

the country to respond immediately and effectively to sudden and sharp deteriorations in the security environment.

Summary of Recommendations

A number of recommendations have been provided in the previous sections. Some of these are generic in nature and would need further distilling in terms of specific activities on-ground. At their most basic, the recommendations could be summated as follows: -

(a) Continuation of the ongoing induction philosophy for conventional systems.

(b) Pursuing disruptive technologies with renewed vigour.

(c) Induction of ***low-cost attritable*** systems in the millions (five million FPV drones and 250,000 OWA drones). This could be facilitated by: -

(i) Smart, far reaching, and impactful policy interventions.

(ii) Budgetary allocation of $10 billion for OWA and FPV drones spread over three to five years. $15 million to be catered to for USVs and UUVs.

(iii) Dedicated SEZs focussed on drone production.

(iv) Focussed development of industrial capacity.

(v) Putting in place of a system that helps protect and consolidate technology and intellectual property developed by indigenous startups.

(d) Creation of a separate organisational and training structure for attritable systems.

(e) Creation of a separate OWA drone division under the IAF and a FPV drone division under the Indian Army.

(f) Increased resilience by dispersal of assets and materiel and strengthening of infrastructure.

(g) Improved strategic and tactical adaptation through a feedback loop and systems and processes that ensure ploughing back of lessons learnt in an agile and effective manner.

(h) Improved defence against massed OWA drone attacks. The following are pertinent towards this: -

(i) Amalgamation of legacy gun systems in the AD grid.

(ii) Installation of CIWS systems at all critical installations.

(iii) Use of dispersion, camouflage, decoys, and improved resilience.

(iv) Proliferation of dedicated anti-drone EW systems.

(j) Leveraging mass induction of attritable systems towards increasing operational stamina to about six months.

(k) Leveraging partnerships, especially with the U.S. and Israel towards becoming a major drone manufacturing and exporting country. This would require the putting in place of attractive commercial and geostrategic incentives.

(l) Pursuing *air denial* as a specific capability with a robust doctrinal foundation.

(i) Establishment of a joint *air denial wing* headed by the IAF.

(ii) Examination of scenarios for use of service specific capabilities for *air denial* in support of sister service operations.

(iii) Installation of modular, light-weight SAM systems onboard smaller naval vessels.

(m) Fortification of the Indian Ocean to an extent that it becomes India's primary deterrent in thwarting Chinese intent and attempts against Indian national interests.

(i) Installation of containerised anti-ship missile systems onboard all suitable naval and coast guard vessels. Prospective installation of such systems on merchant vessels to be pursued.

(ii) Deployment of OWA drones, USVs and UUVs, including from ships, merchant vessels, and other craft of opportunity.

(iii) Focus on cost-effective *dispersed lethality*.

(iv) Saturation of the Indian Ocean using the *Brahmos* missile alongside a wide range of conventional and non-conventional means.

(n) Placing of restrictions on the export of the *Brahmos* missile.