Counter-Unmanned Aerial Systems in the Era of Precise Mass

Operational Lessons from Recent Conflicts and Implications for India

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Recent conflicts constitute the most consequential empirical test of counter-unmanned aerial systems (C-UAS) and layered air defence architectures since the inception of modern drone warfare. This article synthesises verified open-source evidence from the 2026 Iran War, the Russia–Ukraine conflict and India's Operation Sindoor to identify three paradigm-altering developments: the industrialisation of drone–missile saturation as an operational norm; the emergence of low-cost interceptor drones as the decisive corrective to unfavourable cost-exchange ratios; and the migration of command-and-control architectures to satellite-mediated networks that render conventional electronic warfare increasingly inadequate. The analysis demonstrates that interceptor magazine depth—rather than detection capability or single-shot accuracy—has become the binding strategic constraint in sustained high-intensity C-UAS operations. Recommendations for India's C-UAS posture are derived inferentially from these findings, with particular emphasis on indigenous low-cost interceptor development, directed-energy weapon recalibration and sovereign satellite communication backbones for C-UAS command and control.

Keywords: *Counter-Unmanned Aerial Systems; C-UAS; Air Defence; Drones; Unmanned Aerial Vehicles; UAVs*

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Introduction

The unmanned aerial systems (UAS) have transformed from niche military adjuncts into the central weapon platform of contemporary conflict. The trajectory of this transformation—from the normalisation of military unmanned aerial vehicles (UAVs) in the 1990s, through the weaponisation by non-state actors in the mid-2010s, to the codification of drone-centric warfare in high-intensity peer conflicts from 2022 onwards—has been extensively documented in doctrinal literature.[1] What the existing literature did not adequately anticipate, however, is the velocity at which the cost-exchange calculus would invert, rendering traditional interceptor-based air defence economically unsustainable against industrialised drone saturation.

The 2026 Iran War has provided the definitive empirical confirmation of this inversion. Within three weeks of the commencement of Operation Epic Fury on 28 February 2026, Iran launched approximately 500 ballistic and naval missiles, alongside 2,000 plus UAVs, against Israel and all six Gulf Cooperation Council (GCC) states simultaneously[2]—the first occasion a state actor directed sustained drone–missile saturation raids against every member of a regional security bloc. The United Arab Emirates (UAE) alone had absorbed 314 ballistic missiles, 1,672 drone attacks and 15 cruise missiles by 17 March.[3] Drones constituted approximately 71 per cent of all recorded strikes on Gulf states in the first week of the campaign.[4]

The evolution of UAS threats has unfolded across three overlapping waves. The first, spanning the 1990s to early 2010s, saw state-controlled platforms, such as the MQ-1 Predator and MQ-9 Reaper, normalise persistent Intelligence, Surveillance and Reconnaissance (ISR) and precision strike without aircrew exposure. The second, from the mid-2010s, witnessed violent non-state actors—most notably, the Islamic State—rapidly adapting commercial quadcopters for improvised explosive device (IED) delivery and propaganda, exposing critical blind spots in legacy air defence systems designed for high-altitude, high-speed manned threats. The third wave, from 2022 onwards, codified small UAS as the central weapon platform in high-intensity peer warfare, driven primarily by the Russia–Ukraine conflict, Operation Sindoor and now, the 2026 Iran War.

Operation Epic Fury has decisively extended this third wave beyond bilateral or theatre-confined engagements into what the Council on Foreign Relations (CFR) terms the era of 'precise mass'. The conflict also witnessed the combat debut of the United States (US) Low-Cost Unmanned Combat Attack System (LUCAS), reverse engineered from Iran's Shahed-136, a

development of profound doctrinal significance, signalling that even the world's most advanced military now prioritises mass-produced attritable platforms alongside exquisite systems. The US Department of Defense's own strategy for countering unmanned systems, published in December 2024, frames the challenge as an enterprise-wide problem requiring unified approaches, common architectures and urgent fielding pathways,[5] a characterisation that the 2026 conflict has validated with incontrovertible empirical force.

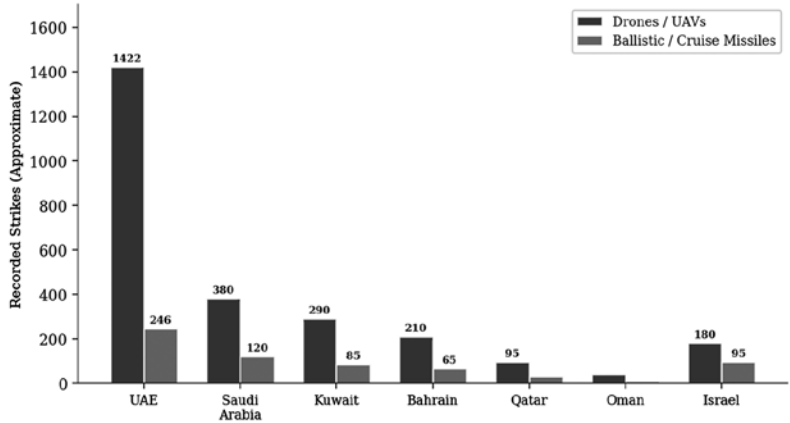


Figure 1 Distribution of Iranian Strikes by Target State (first week, March 2026)
Source: UAE MoD, CSIS (Bondar 2026), ACLED Middle East Special Issue.

UAE Ministry of Defence, Official reporting on Iranian strikes, compiled via multiple outlets, as of 17 March 2026; K. Bondar, 'Unpacking Iran's Drone Campaign in the Gulf: Early Lessons for Future Drone Warfare', Commentary, Center for Strategic and International Studies (CSIS), 10 March 2026, available at https://www.csis.org/analysis/unpacking-irans-drone-campaign-gulf-early-lessons-future-drone-warfare; L. Nevola, M. Al Abdullah, N. Khdour and T. Lay, 'Middle East Special Issue: March 2026', Armed Conflict Location & Event Data Project (ACLED), 5 March 2026.

This article seeks to examine the operational lessons, technological implications and doctrinal consequences across five domains: (*i*) the cost-exchange crisis; (*ii*) the interceptor drone revolution; (*iii*) the satellite–electronic warfare (EW) paradigm shift; (*iv*) directed-energy weapon validation; and (*v*) the North Atlantic Treaty Organization's (NATO) first ballistic missile defence engagement against a state actor.

Industrialised Saturation and the Cost-Exchange Crisis

As stated earlier, the 2026 conflict has provided the definitive evidence that warfare has entered 'the era of precise mass', that is, high-volume deployment of low-cost, increasingly autonomous systems with high-accuracy guidance.[6] The arithmetic underpinning this paradigm is stark. A Shahed-type one-way attack drone costs approximately US$ 35,000 to produce, whereas a single Patriot PAC-3 MSE interceptor costs over US$ 3 million and an Arrow 3 anti-ballistic missile interceptor costs US$ 2–3 million.[7] This yields a cost-exchange ratio exceeding 100:1 in the attacker's favour and permits him to swarm the environment and outplay the defender's capacities by attacking in very high numbers, thus overpowering the interception capacities.

The consequences of this asymmetry were visible with devastating clarity during Operation Epic Fury. Israel reportedly entered the 2026 war with interceptor stocks already diminished from the June 2025 Twelve-Day War, during which the US alone expended an estimated 150 Terminal High Altitude Area Defense (THAAD) interceptors—approximately one-quarter of its global inventory.[8] By mid-March 2026, the US officials confirmed that Israel had communicated it was running 'critically low' on ballistic missile interceptors.[9] The Israeli government approved an emergency transfer of NIS 2.6 billion (approximately US$ 826 million) for 'urgent and essential defence procurement' mid-conflict.[10] The US Patriot interceptor expenditure in the first five days alone was estimated to be around US$ 2.4 billion;[11] and Lockheed Martin's entire 2025 production of 600 PAC-3 MSE interceptors was reported to have been consumed within approximately three days of Gulf state air defence operations.[12]

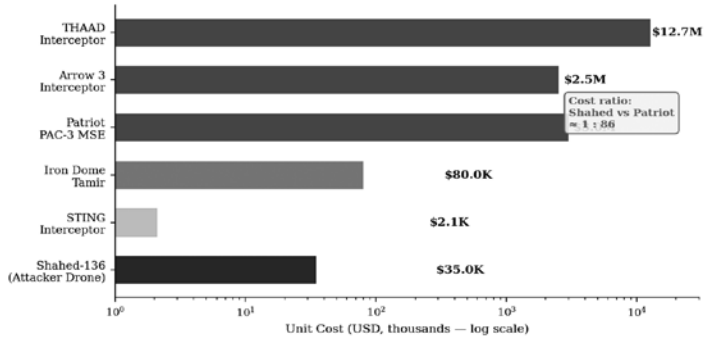


Figure 2 The Cost-Exchange Crisis: Unit Costs across the Kill Chain
Unit Cost (USD, thousands—log scale)
Source: Summarised by the author from various open source data on the internet.

Iran's campaign was not merely a quantitative surge but reflected a deliberate doctrinal framework of 'attrition through abundance', in which saturation volume, decoys and manoeuvrable payloads impose disproportionate economic and logistical strain on interceptor-based defence networks. Iran further complicated the defensive challenge by introducing cluster munitions on some ballistic missiles, forcing defenders to engage individual submunitions with short-range systems, thereby accelerating interceptor consumption. This evidence confirms that interceptor magazine depth—rather than detection capability or engagement accuracy—has emerged as the binding strategic constraint in sustained high-intensity counter-unmanned aerial systems (C-UAS) operations. A comprehensive assessment of the US C-UAS programmes, while accepting the US Army's estimated requirement for 6,000 Coyote kinetic interceptors between fiscal years 2025 and 2029, has acknowledged that even the Coyote is 'not necessarily cost-effective against cheap drones'.[13]

The Interceptor Drone Revolution: Correcting the Cost-Exchange Ratio

Perhaps the most consequential C-UAS development to emerge from the overlapping Russia–Ukraine conflict and the 2026 Iran War has been the maturation of low-cost interceptor drones as a scalable hard-kill layer that fundamentally corrects the cost-exchange ratio. Born of necessity when Western-supplied missile interceptors proved economically unsustainable against nightly Shahed waves over Ukrainian cities, Ukraine's interceptor drone ecosystem has reportedly produced a family of 3D-printed, first-person-view (FPV) guided kinetic interceptors costing between US$ 1,000 and US$ 2,500 per unit.[14]

As per available evidence, by February 2026, these systems accounted for over 70 per cent of Shahed downings over Kyiv and one-third of all Russian aerial targets destroyed nationally, according to Ukraine's Commander-in-Chief.[15] Furthermore, the Wild Hornets STING interceptor, costing approximately US$ 2,100 per unit, with speeds of up to 343 kms per hour and engagement ranges up to 25 kms, has recorded over 3,900 confirmed kills since May 2025.[16] SkyFall's P1-SUN, priced at approximately US$ 1,000 per unit with fibre-optic guidance and artificial intelligence (AI) assisted terminal homing, is believed to have downed over 1,500 Shaheds in four months, with the manufacturer claiming production capacity of up to 50,000 units per month.[17] Ukraine claims to have produced 100,000 interceptor drones

in 2025, with production capacity increasing eightfold. Indeed, by January 2026, the country was claiming capabilities to deliver 1,500 interceptors per day to frontline units.[18]

The strategic implications of these aspects became inescapable during the 2026 Iran War. Eleven countries, including the US, formally requested Ukrainian interceptor drone assistance. In March 2026, reportedly 201 Ukrainian drone warfare specialists were deployed across the Gulf states to protect the US military installations and allied infrastructure.[19] This represents a historical inversion of extraordinary significance, wherein the world's pre-eminent military power was seen requesting air defence technology from a nation still fighting for its own survival. As one analysis observed, the besieged country that spent four years seeking Patriot batteries had quietly built a new layer of air defence at a fraction of the cost.[20]

The interceptor drone model also resolves a doctrinal tension in the original C-UAS literature between soft-kill primacy (EW, Global Navigation Satellite System [GNSS] denial) and hard-kill necessity (kinetic destruction) by offering hard-kill certainty at soft-kill economics. They are not intended to replace missile systems; they preserve them, absorbing the volume layer of attacks so that scarce, expensive interceptors can be reserved for the ballistic missile and cruise missile threats which they were designed to counter. This layered allocation of effectors by threat type and cost represents a mature doctrinal response to the saturation problem. Furthermore, the rapid development cycle—from prototype to mass production in months rather than years—demonstrates a model of defence innovation fundamentally different from traditional acquisition. Ukraine's Brave1 innovation hub, established in 2023, has incubated over 20 interceptor drone companies, creating a competitive ecosystem that iterates faster than any single prime contractor. India's Innovations for Defence Excellence (iDEX) and Defence India Start-up Challenge (DISC) programmes could serve an analogous catalytic function if explicitly tasked with interceptor drone development and provided with access to instrumented test ranges.

System	Origin	Unit Cost	Max Speed	Range	Confirmed Kills
STING	Ukraine (Wild Hornets)	~$2,100	343 km/h	25 km	3,900+
P1-SUN	Ukraine (SkyFall)	~$1,000	300+ km/h	20 km	1,500+
Bullet	Ukraine (General Cherry)	~$2,500	280 km/h	15 km	Hundreds
Iron Dome Tamir	Israel (Rafael)	~$80,000	Mach 2.2	70 km	Thousands
Patriot PAC-3 MSE	USA (Lockheed)	~$3,000,000	Mach 5	35 km	Classified

Figure 3 Interceptor Systems Comparison: Cost-Exchange at a Glance

Source: Summarised by the author from various open source data on the internet.

The Satellite–EW Paradigm Shift

The 2026 conflict has exposed a paradigm-altering challenge to the EW foundations of C-UAS doctrine. The integration of commercial Low Earth Orbit (LEO) satellite constellations—principally SpaceX's Starlink and its military-grade derivative, Starshield—into drone command-and-control architectures has created a class of unmanned systems that are, for practical purposes, immune to conventional ground-based radiofrequency (RF) jamming. The US-manufactured LUCAS, supposedly reverse-engineered from Iran's Shahed-136 and manufactured by Spektre Works, was paired with Starlink/Starshield satellite communications during its Pentagon development, enabling un-jammable beyond-line-of-sight operations and cooperative swarming tactics.[21] Russian military analysts publicly assessed that Starshield's narrow-beam, interference-resistant profile renders LUCAS 'nearly impossible to jam with conventional electronic warfare'.[22] Admiral Brad Cooper, Commander of the US Central Command (CENTCOM), also confirmed the system's operational significance, stating that LUCAS retains the low cost of its predecessor while integrating commercial satellite networks for un-jammable operations.[23]

Concurrently, however, Iran demonstrated in January 2026 that nation state-level EW can degrade even Starlink's ostensibly resilient architecture. During the suppression of domestic protests, Iranian forces reportedly reduced satellite connectivity by over 80 per cent using what analysts assess may be a Russian-origin Kalinka jamming prototype.[24] The electromagnetic contest has thus shifted from ground-to-drone frequency denial to a satellite-mediated struggle, in which both attackers and defenders increasingly route their command and control through space-based infrastructure.

This development carries profound implications for any nation, including India, whose C-UAS doctrine relies on RF jamming and GNSS denial as primary soft-kill mechanisms. The 2026 evidence suggests that future adversary drones operating on satellite-enabled command and control will be substantively immune to conventional ground-based EW. The shift is not merely technological but doctrinal, wherein the entire conceptual framework of soft-kill C-UAS—which assumes that severing the RF control link between operator and drone will force an abort, forced landing or return-to-home behaviour—becomes invalid against platforms that navigate via satellite and execute terminal guidance through onboard AI. This does not render EW obsolete; rather, it demands that EW evolve to address the space domain,

including counter-satellite jamming, uplink interference and the exploitation of satellite communication protocol vulnerabilities.

For India, this necessitates urgent investment in indigenous satellite communication backbones (geosynchronous satellite [GSAT]/independent regional satellite navigation system [IRNSS]) for C-UAS command and control, lest Indian forces find themselves dependent on foreign constellations that may be denied, geofenced or commercially restricted during crisis. The SpaceX whitelist enforcement episode of February 2026—in which the company disabled unauthorised Starlink terminals across the Russian frontline in Ukraine, collapsing battlefield communications in multiple sectors—demonstrated that commercial satellite operators now wield battlefield-level power over military operations. India's SAKSHAM C-UAS Grid must be architected on sovereign satellite infrastructure from inception, with no single-point-of-failure dependency on any commercial or foreign government constellation. Simultaneously, India's EW research community should prioritise the development of counter-satellite command-and-control disruption capabilities and the integration of cyber-EW into the standard C-UAS operational repertoire. This was aptly demonstrated by the US Cyber Command when it disabled the Iranian military telecommunications in the opening hours of the conflict.

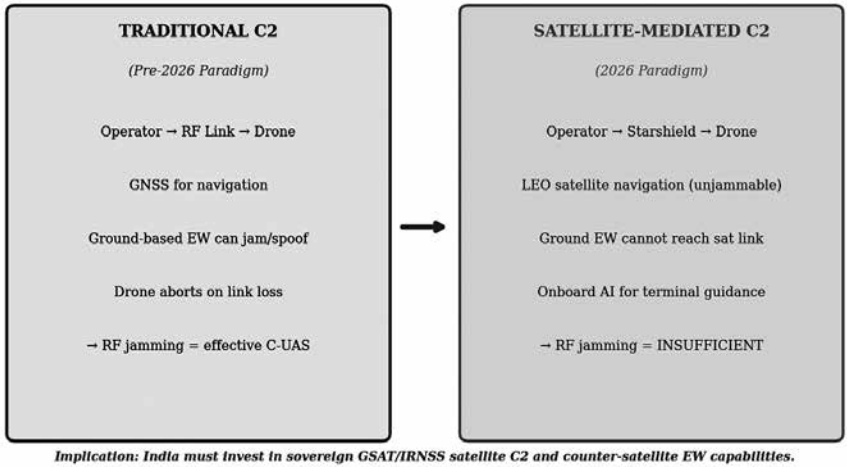


Figure 4 The EW Paradigm Shift: Traditional RF Command and Control (C2) vs Satellite-mediated C2

Source: Summarised by the author from various open source data on the internet.

Directed-Energy Weapons: First Operational Validation and Its Limits

The 2026 conflict has furnished the first near-confirmed operational validation of high-energy laser (HEL) air defence, whilst simultaneously exposing the substantial gap between prototype promise and sustained operational utility. Israel's Iron Beam system, a 100-kilowatt ground-based HEL delivered to the Israel Defense Forces (IDF) in December 2025, appears to have been employed against Hezbollah rockets and UAVs from early March 2026 onwards.[25]

The system's cost per engagement, which is approximately US$ 3–5 in electricity when compared with US$ 50,000–80,000 for an Iron Dome Tamir interceptor, effectively vindicates the economic rationale for directed-energy integration.[26] However, operational experience has tempered the expectations: Iron Beam was effective only against slow, lightweight targets at ranges of 7–10 kms; it could not engage ballistic missiles; only a small number of units were available; and dozens of UAVs continued to penetrate Israeli airspace through conventional means.[27] It has also been reported that this technology may be shared with India. Played up by several media reports as one of the biggest takeaways from Prime Minister Modi's recent Israel visit, nothing concrete has been achieved till date. The technology, if transferred, has to be absorbed and suitably produced, which will take some time.

During Operation Epic Fury, the US Navy deployed low-power Optical Dazzling Interdictor, Navy or ODIN laser dazzlers on multiple Arleigh Burke-class destroyers. The initial media reports mentioned deployment of the higher-power, 60-kilowatt HELIOS hard-kill system. However, specialist analysis corrected these media reports by stating that the visible system in CENTCOM footage was the lower-power ODIN dazzler and not the HELIOS.[28]

Most significantly for the future of high-power microwave (HPM) weapons, no such system was confirmed to be deployed in the 2026 theatre, despite the Epirus Leonidas demonstrating 100 per cent effectiveness against a 49-drone swarm during controlled testing at Camp Atterbury, Indiana, in August 2025.[29] This absence, during the most intense drone swarm campaign in history, suggests that HPM remains an experimental capability and is not yet ready for operational deployment under sustained combat conditions. For India's Defence Research and Development Organisation (DRDO) HPM programme, the 2026 evidence supports continued development, but counsels against treating HPM as a near-term operational solution; its

availability in a medium-term fielding horizon of 3–5 years appears more realistic.

System	Type	Eff. Range	Cost/Shot	Combat Status (March 2026)
Iron Beam (Israel)	100 kW HEL	7-10 km	~$3-5	**Near-confirmed combat use**
Lite Beam (Israel)	10 kW HEL	2 km	<$5	**Confirmed (40 UAVs, 2024)**
ODIN (US Navy)	Soft-kill dazzler	Classified	Minimal	**Deployed on 8 destroyers**
HELIOS (US Navy)	60 kW HEL	~8 km	Minimal	**Status disputed**
Leonidas HPM (US)	High-Power Microwave	<2 km	Minimal	**NOT deployed in 2026 theatre**

Figure 5 Directed-Energy Weapons: Operational Status as of March 2026
Source: Summarised by the author from various open source data on the internet.

The NATO's First Ballistic Missile Defence Engagement Against a State Actor

The 2026 Iran War produced an extraordinary development for alliance-level air and missile defence, wherein three Iranian ballistic missiles entering Turkish airspace were intercepted by the NATO Integrated Air and Missile Defence (IAMD) assets on 4, 9 and 13 March 2026.[30] Technical analysis indicated that at least one engagement was conducted by an SM-3 interceptor launched from a US Aegis-equipped destroyer in the Eastern Mediterranean.[31] The NATO, subsequently, reinforced its ballistic missile defence posture with additional Patriot deployments to south-eastern Turkiye; and Turkiye established new Directorates of Emergency Situations and Defence Planning across all cabinet ministries.[32] This represented the first operational employment of the NATO's IAMD architecture against state-directed ballistic missiles. The NATO Secretary General Mark Rutte stated that the alliance was not part of the conflict but would defend itself, whilst explicitly declining to invoke Article 5.[33]

For India's C-UAS benchmarking, this development validates the operational utility of networked, multinational IAMD architectures under actual combat conditions. It also demonstrates that drone–missile conflicts originating in one theatre can rapidly spill into allied territory, necessitating pre-established engagement authorities and airspace deconfliction protocols, even for nations not directly party to the conflict. The Turkish experience further illustrates the critical importance of rapid institutional adaptation, wherein Ankara's immediate establishment of emergency defence planning

directorates across all cabinet ministries, the summoning of the Iranian ambassador and the deployment of additional Patriot batteries occurred within days of the first interception. This indicates that effective crisis response requires pre-positioned legal and institutional frameworks rather than ad hoc improvisation.

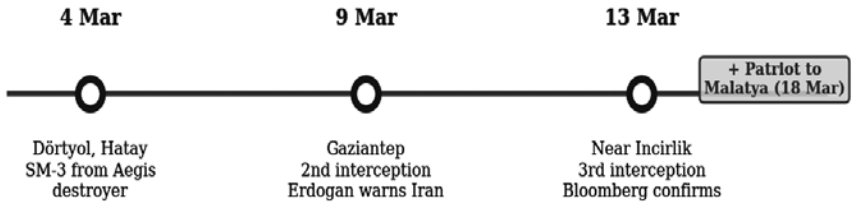


Figure 6 NATO Ballistic Missile Interceptions Over Turkey, March 2026
Source: Summarised by the author from various open source data on the internet.

Critical Infrastructure Targeting at Industrial Scale

Iranian retaliatory strikes targeted Dubai International Airport, the Ruwais Industrial Complex refinery (producing 922,000 barrels per day for the Abu Dhabi National Oil Company), the Jebel Ali Port, Amazon Web Services (AWS) cloud computing data centres and the BAZAN Group refinery complex in Haifa (Figure 7).[34] The Strait of Hormuz, through which approximately 20 per cent of global energy supplies transit, was effectively interdicted through persistent drone, mine and unmanned surface vessel (USV) attacks. On 1 March 2026, an Iranian USV struck the Marshall Islands-flagged oil tanker *MKD VYOM* in the Gulf of Oman—the first confirmed state-directed deployment of an explosive drone boat against commercial shipping.[35]

Target	Location	Attack Vector	Impact
Dubai Int'l Airport	UAE	Aerial drone	Flights disrupted, evacuations
ADNOC Ruwais Refinery	UAE	Aerial drone	922,000 bbl/day shutdown
AWS Data Centre	UAE	Unknown objects	Fire, power outage
Jebel Ali Port	UAE	Intercept debris	Fire at port complex
BAZAN Refinery	Israel (Haifa)	Missile attack	Fire and damage
Strait of Hormuz	Maritime	Drone/USV/mine	20% global energy interdicted
MKD VYOM tanker	Gulf of Oman	USV (state-directed)	First confirmed USV attack

Figure 7 Critical Infrastructure Targets, 2026 Iran War
Source: Summarised by the author from various open source data on the internet.

These developments have extended the threat taxonomy far beyond the energy grid attacks documented in Ukraine's 2024–2025 campaigns, demonstrating that drone-enabled infrastructure warfare can impose systemic economic disruption at a global scale. The World Trade Organization (WTO) has estimated that sustained high energy prices resulting from Hormuz interdiction could reduce 2026 global gross domestic product (GDP) growth by 0.3 per cent, with Europe facing at least 1 per cent less growth than previously expected.[36] In addition, the targeting of cloud computing infrastructure (AWS data centres) represents a novel vector previously not addressed in C-UAS doctrine, with implications for the resilience of digital infrastructure upon which modern military and civilian systems depend.

The maritime dimension warrants particular attention. The effective closure of the Strait of Hormuz through persistent drone, mine and USV operations has demonstrated that a relatively modest investment in unmanned systems can interdict a chokepoint through which 20 per cent of global energy supplies transit. Iran's strategy, characterised by defence analysts as 'stand-in' attrition leveraging the strait's narrow 21-nautical mile navigable channel, has imposed huge costs on defenders, disproportionate to the investment required. The broader implication is that any nation dependent on maritime energy imports or trade routes through constrained waterways faces analogous vulnerability. For India, with its extensive coastline and dependence on Gulf energy imports, the 2026 Hormuz precedent should inform a dedicated maritime C-UAS capability development programme.

A further operational pattern deserving analysis is the demonstrated effectiveness of offensive counter-force against UAS production and launch infrastructure. Iranian drone attack rates declined by 86 per cent and missile launches by 90 per cent within 10 days of the commencement of US–Israeli strikes, indicating that suppression of launch infrastructure remains a decisive complement to defensive C-UAS. However, Iran continued daily launches at reduced rates through mid-March, despite Pentagon claims that its ballistic missile capacity had been 'functionally destroyed', suggesting that dispersed, low-cost drone production is inherently more resilient to interdiction than centralised missile manufacturing. This asymmetry between missile vulnerability and drone resilience further strengthens the case for defender investment in volume-capable, low-cost effectors rather than high-end interceptors alone.

Implications for India's C-UAS Posture

India confronts a multifaceted UAS threat continuum spanning state-sponsored military vectors from both Pakistan and China, persistent cross-border smuggling operations and domestic terrorist exploitation of commercial drone platforms. Operation Sindoor in May 2025 demonstrated that the Indian air defence systems, orchestrated through the Integrated Air Command and Control System (IACCS), were able to successfully counter coordinated mixed drone–missile saturation raids through disciplined weapons-tight protocols, safeguarding high-value defence assets, including S-400 systems, against Pakistani attempts to unmask their positions through Chinese-origin electromagnetic warfare payloads and Global Positioning System (GPS) jamming devices.

However, the 2026 Iran War evidence suggests that the scale of saturation India may face in a future high-intensity conflict could exceed the parameters encountered during Operation Sindoor by an order of magnitude. Pakistan's employment of low-cost Chinese and Turkish drones during that operation and China's demonstrated proficiency in orchestrating over 200 AI-enabled UAVs from a single operator station foreshadow threats that will test Indian C-UAS architectures at scales for which current force structures may be insufficiently dimensioned.

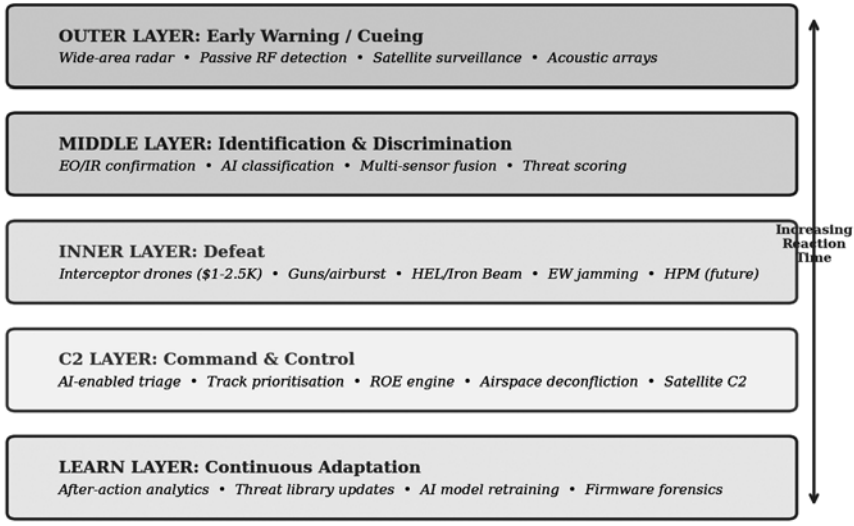


Figure 8 Layered C-UAS Defence Architecture: Detect–Track–ID–Decide–Defeat

Source: Summarised by the author from various open source data on the internet.

Interceptor Magazine Depth as a National Strategic Variable
India's reliance on imported or licence-produced interceptors (S-400 48N6 series, Akash, Barak-8) exposes it to the same magazine-depth vulnerability demonstrated during the 2026 conflict. India should classify interceptor magazine depth as a strategic planning variable equivalent to ammunition reserves for conventional munitions, with accelerated indigenous production, surge capacity provisions and formal war-gaming of consumption rates against 2026-scale attack profiles.

Indigenous Low-Cost Interceptor Drones as a Priority Effector Class
The Ukrainian interceptor drone model, which has been successfully validated at scale and now exported to protect the US bases in the Gulf, demands immediate attention for India's C-UAS architecture. India's defence innovation ecosystem, including the Indian Institutes of Technology (IITs), the DRDO–Bharat Electronics Limited (BEL) integrated C-UAS systems and iDEX-funded start-ups, should treat low-cost interceptor drones as a priority effector class, complementing the L-70 gun and missile-based systems currently in service. IIT Madras is in the process of realising a low-cost interceptor that can replace the current usage of L-70 and ZU-23 systems in C-UAS mode, as also provide an alternative to the use of mid-range missiles to counter drones. This low-cost interceptor drone that can down a Shahed-class attacker drone represents precisely the kind of cost-exchange correction that India's C-UAS strategy requires.

Directed-Energy Recalibration
India's DRDO HPM programme should be recalibrated in the light of the 2026 evidence. No HPM system was deployed in combat during the most intense drone war in history; hence, HPM should be treated as a medium-term capability rather than a near-term operational solution. Conversely, the HEL pathway should be accelerated. Lessons drawn from the Israeli employment of the Iron Beam's documented successes and limitations need to be analysed before incorporating the same as part of our C-UAS strategy. That notwithstanding, the proposed transfer of technology of the Iron Beam tech needs to be fast-tracked and absorbed as soon as feasible.

Sovereign Satellite Communications for C-UAS Command and Control
The satellite–EW paradigm shift demands urgent Indian investment in indigenous satellite communication backbones (GSAT/IRNSS) for C-UAS command and control. Indian forces must not find themselves dependent

on foreign constellations that may be denied, geofenced or commercially restricted during crisis. The recent crisis with the IRNSS needs to be resolved at the earliest and suitable fail-safe measures must be incorporated to ensure the same does not re-occur in the future. The SAKSHAM C-UAS Grid should be designed to operate on sovereign satellite infrastructure from its inception.

Maritime C-UAS: An Unaddressed Domain

The first confirmed state-directed USV attack on commercial shipping, the effective closure of the Strait of Hormuz and the multi-domain convergence of aerial, surface and sub-surface unmanned threats, demonstrated in 2026, demand that India develop an integrated maritime C-UAS doctrine, encompassing aerial drones, USVs and unmanned underwater vehicles. India's extensive coastline, island territories and dependence on maritime energy imports create acute vulnerability to the kind of asymmetric maritime drone warfare observed in the Gulf. The major ports, like Mumbai, Kandla, Visakhapatnam, Kochi and Chennai, should be equipped with dedicated maritime C-UAS sensor suites, optimised for the challenges of the littoral environment, including salt spray degradation, sea clutter, high winds and the wide approach vectors available to attackers from the sea. The same is applicable to other assets, like the Reliance refinery at Jamnagar, which, in any future conflict, can witness a similar threat as seen in the Gulf states. The proposed National C-UAS Test and Innovation Range should include maritime scenarios replicating the Hormuz interdiction model to stress-test the Indian Navy and the Indian Coast Guard response protocols.

Recommendations: India's C-UAS Transformation Roadmap

Figure 9 consolidates and translates an actionable priority matrix for India's C-UAS transformation. Recommendations indicated as 'CRITICAL' demand immediate action, within next three years. This includes: (*i*) the classification of interceptor magazine depth as a national strategic variable, requiring comprehensive war-gaming of consumption rates against 2026-scale saturation profiles, pre-positioned stockpiling and indigenous surge production capacity; and (*ii*) the development of an indigenous low-cost interceptor drone capability be pursued through a dual pathway of domestic innovation, by leveraging the IITs, the DRDO–BEL and iDEX-funded start-ups, and a bilateral technology partnership with nations whose

interceptor drone ecosystem has been empirically validated at scale, and also been proven successful.

Recommendation	Priority	Timeline	Key Actions
Interceptor Magazine Depth	CRITICAL	0–2 yrs	War-game, stockpile, surge capacity
Low-Cost Interceptor Drones	CRITICAL	1–3 yrs	Indigenous dev + Ukraine partnership
Sovereign Satellite C2	HIGH	2–5 yrs	GSAT/IRNSS integration into SAKSHAI
DEW Recalibration (HEL)	HIGH	3–5 yrs	HELMA-P acceleration; Iron Beam lesso
Maritime C-UAS Doctrine	HIGH	1–3 yrs	Ports, coastline, USV defence
HPM Development	MEDIUM	3–7 yrs	DRDO continuation; medium-term horiz

Figure 9 India C-UAS Recommendations: Priority Matrix
Source: Summarised by the author from various open source data on the internet.

Three further recommendations are assessed as 'HIGH' priority with medium-term timelines of 1–5 years, involving: (*i*) the integration of sovereign satellite communications (GSAT/IRNSS) into the SAKSHAM C-UAS Grid to eliminate single-point-of-failure dependency on foreign constellations; (*ii*) the recalibration of India's directed-energy weapon programme to accelerate the AXISCADES–CILAS HELMA-P HEL pathway, whilst incorporating operational lessons from Israel's Iron Beam deployment; and (*iii*) the establishment of a dedicated maritime C-UAS doctrine encompassing port defence, coastline surveillance and USV countermeasures across India's five major ports and the Andaman–Nicobar Island chain.

A sixth recommendation is assessed as 'MEDIUM' priority, with a 3–7 year fielding horizon, reflecting the 2026 evidence that HPM, whilst demonstrating exceptional test-range performance, has not yet achieved the operational maturity required for sustained combat deployment. Collectively, these six lines of effort constitute a phased indigenisation roadmap that, if executed with the urgency the current evidence demands, would position India among the first nations to field a truly layered, cost-effective and sovereign C-UAS architecture calibrated to the realities of industrialised drone warfare.

Conclusion

The 2026 Iran War has confirmed what the Russia–Ukraine conflict suggested and what Operation Sindoor foreshadowed, that is, the UAS have

become the defining weapon platform of contemporary warfare; and C-UAS must be treated as a capacity-driven, system-of-systems challenge measured by track capacity, engagement throughput and decision latency, and not by any single sensor or effector.

Three developments from the recent conflicts carry structural significance for the decade ahead. First, the era of precise mass is upon us. Low-cost drones produced in the tens of thousands, guided by satellite communications and AI-assisted navigation, can now overwhelm even the most sophisticated interceptor-based air defences through sheer volume. The US itself has adopted this logic by fielding LUCAS, a drone reverse-engineered from its adversary's design.[37]

Second, the cost-exchange problem has been solved, not by directed-energy weapons or HPMs, but by low-cost, easy-to-produce interceptor drones. This is the most consequential C-UAS development of the past decade. Every nation operating air defence systems must now incorporate them as a primary effector layer, preserving expensive missile interceptors for the ballistic and cruise missile threats they were designed to counter.

Third, the migration of drone command and control to satellite-mediated networks has fundamentally challenged the assumption that RF jamming and GNSS denial constitute sufficient soft-kill mechanisms. The EW remains essential, but must now operate in a contested space domain as well as the traditional electromagnetic spectrum.

For India, these findings underscore the urgency of building layered, resilient and rapidly adaptive C-UAS capabilities, spanning peacetime border security, critical infrastructure protection and high-intensity conflict across diverse operating environments. India's long-term security and strategic autonomy require a deliberate indigenisation roadmap that pushes sovereign control over sensors, effectors, command and control and AI, while, at the same time, using selective international partnerships to access niche technologies and benchmark ecosystems. The SAKSHAM C-UAS Grid, integrated with IACCS and Akashteer, provides the architectural backbone; but the 2026 evidence demands that this grid be populated with low-cost interceptor drones, directed-energy weapon systems calibrated to realistic expectations and satellite-resilient communications, rather than relying on the interceptor-heavy paradigm that the Gulf conflict has shown to be unsustainable.

Looking ahead, the UAS threat will be defined by escalating autonomy, where AI enables fully independent navigation and collaborative mission

execution without reliance on vulnerable GNSS signals or RF control links. Swarm formations comprising heterogeneous compositions of decoys, jammers, ISR platforms and precision strikers will compress defender decision timelines beyond human cognitive capacity. The 2026 conflict, whilst devastating in its immediate human and economic toll, has also accelerated C-UAS innovation at a pace not seen since the early years of the Russia–Ukraine conflict. The nations that translate these operational lessons into doctrine, procurement and training fastest will define the air defence landscape of the 2030s. India, with its robust academic and technology base, strategic partnerships and demonstrated operational experience from Operation Sindoor, is well positioned to lead this adaptation provided it treats C-UAS not as an ancillary capability but as a core element of national defence architecture.

Notes

1. *A Comprehensive Approach to Countering Unmanned Aircraft Systems*, Joint Air Power Competence Centre (JAPCC), Kalkar, Germany, 2022.
2. L. Nevola, M. Al Abdullah, N. Khdour and T. Lay, 'Middle East Special Issue: March 2026', Armed Conflict Location & Event Data Project (ACLED), 5 March 2026.
3. UAE Ministry of Defence, Official reporting on Iranian strikes, compiled via multiple outlets, as of 17 March 2026.
4. K. Bondar, 'Unpacking Iran's Drone Campaign in the Gulf: Early Lessons for Future Drone Warfare', Commentary, Center for Strategic and International Studies (CSIS), 10 March 2026, available at https://www.csis.org/analysis/unpacking-irans-drone-campaign-gulf-early-lessons-future-drone-warfare.
5. 'DoD Announces Strategy for Countering Unmanned Systems', US Department of War, 5 December 2024, available at https://www.war.gov/News/Releases/Release/Article/3986597/dod-announces-strategy-for-countering-unmanned-systems/.
6. M.C. Horowitz and L. Kahn, 'First Ukraine, Now Iran: A New Era of Drone Warfare Takes Hold', Council on Foreign Relations (CFR), 9 March 2026, available at https://www.cfr.org/articles/the-new-era-of-drone-warfare-takes-root-in-iran.
7. F. Zakaria, 'Iran and the New Arithmetic of War', *Foreign Policy*, 20 March 2026, available at https://foreignpolicy.com/2026/03/20/iran-drone-war-lessons-fareed-zakaria/; and Arrow 3 cost estimates from *The Times of Israel*, 18 March 2026.
8. A CSIS estimate of THAAD interceptor expenditure during the June 2025 Twelve-Day War, reported via *The Times of Israel*, 18 March 2026; and *Semafor*, 14 March 2026.

9. 'Israel is Running Critically Low on Interceptors, US Officials Say', *Semafor*, 14 March 2026, available at https://www.semafor.com/article/03/14/2026/israel-is-running-critically-low-on-interceptors-us-officials-say.
10. 'Government Transfers NIS 2.6b to Defense Ministry for "Urgent Defense Procurement"', *The Times of Israel*, 15 March 2026, available at https://www.timesofisrael.com/liveblog_entry/government-transfers-nis-2-6b-to-defense-ministry-for-urgent-defense-procurement/.
11. *Defence Security Asia*, March 2026; *Semafor* corroboration. Estimate based on approximate interceptor count and unit cost.
12. *DroneXL* analysis, 9 March 2026, cross-referencing Lockheed Martin production data and Gulf state Ministry of Defence interception reports.
13. D.M. Gettinger, 'Department of Defense Counter Unmanned Aircraft Systems: Background and Issues for Congress', CRS Report R48477, Congressional Research Service, 31 March 2025, available at https://www.congress.gov/crs_external_products/R/PDF/R48477/R48477.2.pdf.
14. K. Livingstone, 'Novel Interceptor Drones Bend Air-Defense Economics in Ukraine's Favor', *Defense News*, 5 March 2026, available at https://www.defensenews.com/global/europe/2026/03/05/novel-interceptor-drones-bend-air-defense-economics-in-ukraines-favor/; and *Military Times*, 11 March 2026.
15. Ukrainian Commander-in-Chief, Oleksandr Syrskyi, announced this in February 2026; see K. Livingstone, 'Novel Interceptor Drones Bend Air-Defense Economics in Ukraine's Favor', n. 14.
16. 'Sting (drone)', *Wikipedia*, accessed on 21 March 2026; Wild Hornets via *CBS News*. 3D-printed frame, 343 km/h, 25 km engagement range.
17. *Military Times*, 11 March 2026.
18. K. Livingstone, 'Novel Interceptor Drones Bend Air-Defense Economics in Ukraine's Favor', n. 14.
19. President Zelenskyy confirmed via *The New York Times* interview, *Al Jazeera*, *DroneXL*, 9–17 March 2026. About 201 Ukrainian specialists deployed across Gulf states.
20. 'Ukraine's $2,500 Drone Just became America's Most Urgent Defense Import', *DroneXL*, 9 March 2026, available at https://dronexl.co/2026/03/09/kraine-interceptor-drones-jordan-us-bases-shahed-iran/.
21. Mike Stone, David Jeans and Joey Roulette, 'US Debuts Suicide Drone in Iran after Fast-Tracked Pentagon Procurement', *Reuters*, 3 March 2026, available at https://www.reuters.com/world/middle-east/us-debuts-suicide-drone-iran-after-fast-tracked-pentagon-procurement-2026-03-03/. SpektreWorks manufacturer; Noda orchestrator software.
22. *DroneXL* analysis of Russian Telegram channels (*Obsessed with War*, *Russian Engineer*), 2 March 2026.
23. 'AI, Lasers and Satellites: Technological Innovation in the 2026 Iran War', *Jerusalum News Syndicate* (JNS), 20 March 2026, available at https://www.jns.org/analysis/ai-lasers-and-satellites-technological-innovation-in-the-2026-iran-war.

24. 'Iran Cripples Starlink Nationwide in Unprecedented Electronic Warfare Move', *Defence Security Asia*, 12 January 2026, available at https://defencesecurityasia.com/en/iran-starlink-shutdown-electronic-warfare-satellite-internet/; *National Interest* analysis.
25. *Israel Defense*, 2 March 2026; *Army Recognition*, March 2026; and *Asia Times*, 17 March 2026. Formal IDF confirmation not issued; consistent with Israeli operations security.
26. '7 Things You Need to Know about Israel's Iron Dome Defense System', American Jewish Committee, 2 March 2026; *Asia Times*, 17 March 2026.
27. A. Gilead, 'Iron Beam's Limits Exposed as Hezbollah Drones Breach Northern Israel's Skies', *The Jerusalem Post*, 12 March 2026, available at https://www.jpost.com/defense-and-tech/article-889677.
28. J. Keller, 'The Laser Weapon Quietly Watching Over the US Strikes on Iran', *Laser Wars*, 5 March 2026, available at https://www.laserwars.net/p/us-navy-laser-weapon-iran-operation-epic-fury. Sole HELIOS unit is aboard *USS Preble* (7th Fleet, Yokosuka, Japan).
29. Epirus Inc., Press release, 26 January 2026; C-UAS Hub, 8 October 2025. A 49-drone swarm was defeated with single pulse; 61/61 drones were neutralised.
30. Turkish Ministry of National Defence, official statements; NATO spokesperson; *Euronews*, 9 March 2026; *Al Jazeera*, 13 March 2026; *Bloomberg*, 13 March 2026.
31. 'NATO Air Defences Shoot Down Iranian Ballistic Missile Headed toward Turkiye', *Army Recognition*, 4 March 2026, available at https://www.armyrecognition.com/news/aerospace-news/2026/nato-air-defences-shoot-down-iranian-ballistic-missile-headed-toward-tuerkiye.
32. Turkish Presidential Decree of 7 March 2026, establishing Directorates of Emergency Situations and Defence Planning across all cabinet ministries.
33. *France24*, 9 March 2026; *Euronews*, 9 March 2026. NATO Secretary General Rutte: alliance 'not part of this war' but 'will defend itself.'
34. UAE Ministry of Defence; Dubai government statements; AWS incident report, 1 March 2026; multiple corroborating sources.
35. JNS, 20 March 2026, citing defence industry analysis.
36. 'Iran's War with Israel and the United States', in CFR, *Global Conflict Tracker*, citing WTO analysis, accessed on 21 March 2026.
37. M.C. Horowitz and L. Kahn, 'Iran's Drone Advantage: The Pentagon Copied Tehran's Technology but is Still Struggling to Keep Up', *Foreign Affairs*, 11 March 2026, available at https://www.foreignaffairs.com/iran/irans-drone-advantage.