Aerospace & Defence

Analyzing next 15 years of defence demand

India

Overweight *(no change)*

Highlighted Companies

Hindustan Aeronautics

ADD, TP Rs6325, Rs4840 close

The company's order book is up at ~Rs2.4tr; Rs1tr order pipeline supports revenue visibility; diversified backlog assures growth. The Rs150bn capex over a period of five years boosts capacity; EPS estimated at 16% YoY in FY26F and 18% YoY in FY27F; fleet upgrades (Jaguar/Mirage out, AMCA/Su-57 in) to aid the company's OEM & MRO divisions.

Bharat Electronics

ADD, TP Rs459, Rs403 close

TPCR 2025 electronics push and a multimillion-dollar project pipeline ensures revenue visibility. Operation Sindoor's success + Atmanirbharta (DAC 2020) makes the company a key government-trusted indigenization & defence electronics partner.

Summary Valuation Metrics

P/E (x)	Mar26-F	Mar27-F	Mar28-F
Hindustan Aeronautics	36.2	30.7	26.7
Bharat Electronics	47.3	38.8	33.6
P/BV (x)	**Mar26-F**	**Mar27-F**	**Mar28-F**
Hindustan Aeronautics	7.9	6.7	5.8
Bharat Electronics	12.2	10.0	8.3
Dividend Yield	**Mar26-F**	**Mar27-F**	**Mar28-F**
Hindustan Aeronautics	0.9%	1.1%	1.2%
Bharat Electronics	0.7%	0.8%	0.9%

Research Analyst(s)

Shubham DALIA

T (91) 02241611544

E shubham.dalia@incredresearch.com

- TPCR-2025 lists 457 items (vs. 221 in TPCR 2018), shifts >50% to electronics, EW & space; prioritizes sub-systems vs. platforms and boosts indigenization.
- Sudarshan Chakra project, to be completed by 2035, needs **an investment of at least 4tr** across air defence systems, radars, HAPS, DEW and space.
- HAL(ADD),BEL(ADD),BDL(NR), Astra Microwave(NR) & Data Patterns(NR) to be main beneficiaries of TPCR electronics push & Sudarshan Chakra project.

The future of Indian defence is digital, networked, and electronic

TPCR-2025 maps 457 programs and makes clear its priority, 224 (49%) are in cyber systems/electronics/electronic warfare, nearly half of all entries, signaling a decisive shift to networked, software-defined and electronic capabilities. TPCR quantifies the pivot, more than 60,000 software-defined radios, 7,000–8,000 S-band satellite terminals, dedicated integrated EW suites and AI as a service set-up for ~4,000 users, alongside specialized projects (smart adaptive jamming, electronic-denial bubbles, time-spoofers). TPCR shows India is buying hardware, software and networks. Survivability, command-and-control and lethality will be won in the electronics and cyber domains, and indigenization of these digital-electronic building blocks is imperative for defence industry investment.

There is a deliberate focus on industrial deepening

TPCR-2025 skews decisively to subsystems, 86.9% of the 457 programs (~397) target subsystem-level work, versus 13.1% (~60) for large platforms. Design democratizes opportunity, opening roles for specialized component manufacturers, micro, small and medium enterprises and technology start-ups and creates a tiered, competitive supplier base instead of concentrating value in a few large integrators. The result is a classic industrial policy move to deepen and derisk the domestic supply chain and compel prime contractors to act as system architects who manage a complex domestic ecosystem rather than merely assembling imported kits.

India needs heavy investments in air and space defence systems

India urgently needs prioritized investment in air and space defence systems to close operational seams, as a few long-range batteries cannot substitute for a geographically distributed architecture across a two-front geometry, and we expect overlapping area-defence, AWACS plus HAPS/long-endurance Unmanned Aerial Vehicles (UAVs) to be the near-term fix for radar-horizon blind spots. We expect a rapid rollout of AESA upgrades on mission-critical radars, coupled with hardened, distributed sensor-fusion and C2 nodes, and so automation drives prioritization under saturation or EW. Critically, we recommend an accelerated plan to field the SBS 3 radars to improve satellite detection. We also analyzed that cheap swarms (dozens–hundreds of small UAS/loitering munitions) demand directed-energy weapons and integration now to change the kill-economics, and that surge production plus realistic intercepts-per-day consumption models and pre-positioned stocks are essential to avoid rapid depletion in a sustained combat.

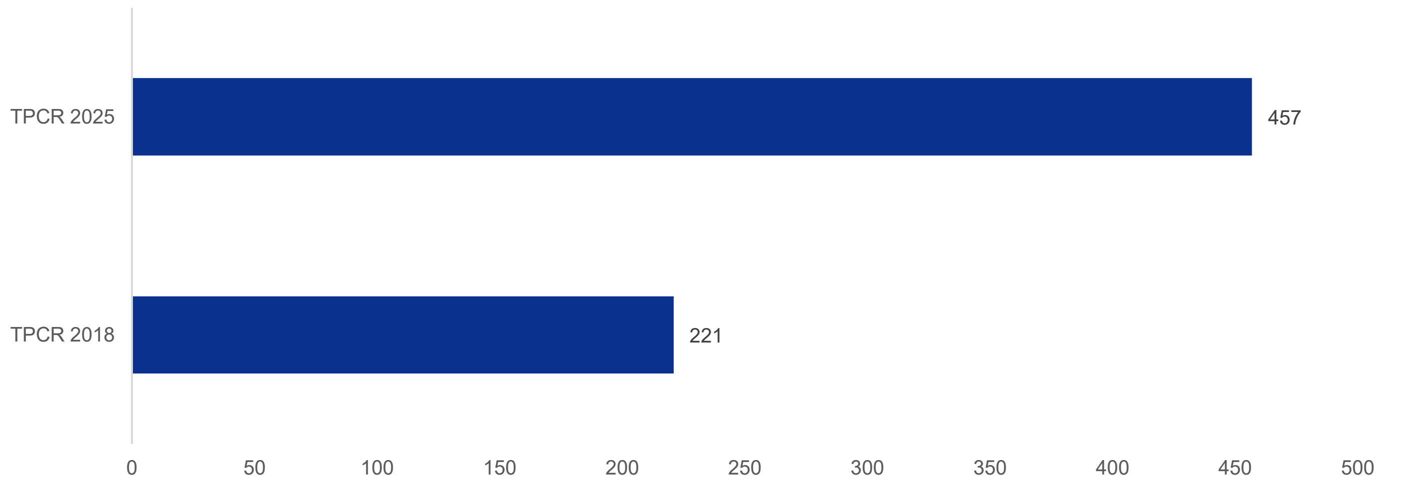
Sudarshan Chakra is an ambitious project costing Rs4tr

We analyzed that Sudarshan Chakra is an ambitious, Rs4tr integrated air and space defence program. It allocates roughly Rs1.8tr to layered area-defence (QRSAM, KUSHA, Akash Prime) for geographically distributed interception; Rs1.4tr to ground and over-the-horizon sensing (Voronezh OTH, Surya VHF, Super Swordfish) to eliminate maritime and low-altitude blind spots; space sensors and HAPS (hosted IR payloads + high-altitude pseudo-satellites) to regain boost-phase warning; directed-energy (DEW) R&D and trials to defeat dozens–hundreds swarms cost-effectively; AESA upgrades, and hardened distributed sensor-fusion/C2. Delivered at this scale and pace, Sudarshan Chakra would provide overlapping sensors (airborne, maritime, space), resilient automated C2 and economical swarm defeat.

TPCR-2025 improves on TPCR-2018 with increased focus on indigenization

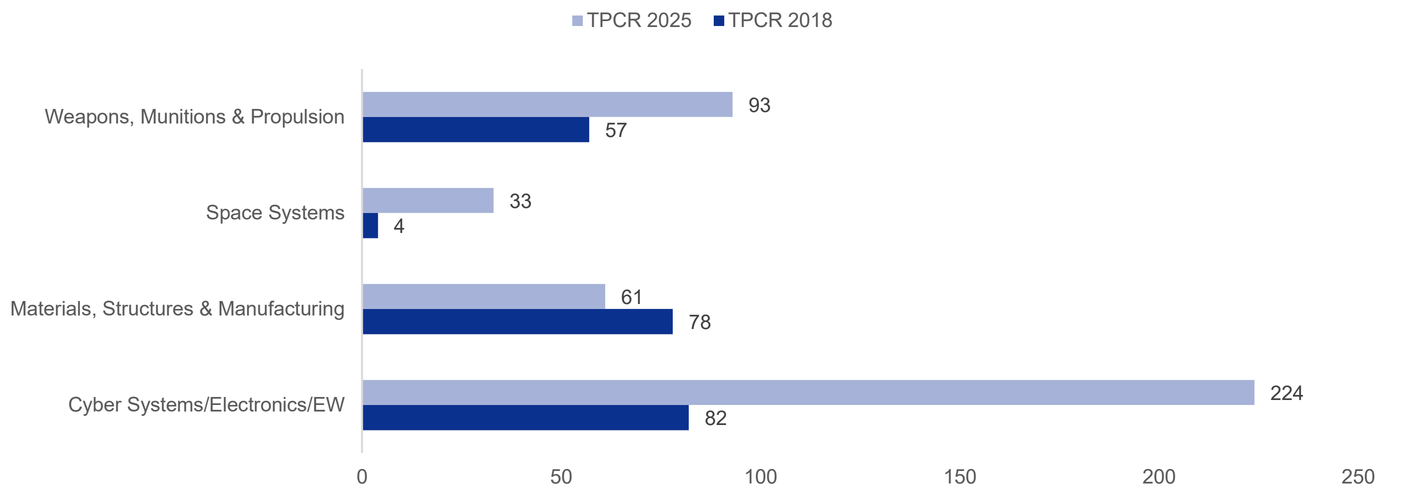
TPCR-2025 offers a clear map of the size, nature, and direction of the impending capital expenditure cycle, revealing a multi-decade opportunity for private players/DPSUs/MSMEs. It is important to note that the document is a sub-set of the overall requirement of defence services as it **details the technologies and capabilities that could be made public for use by industry.**

Figure 1: 100% increase in total TPCR programs



SOURCE: INCRED RESEARCH

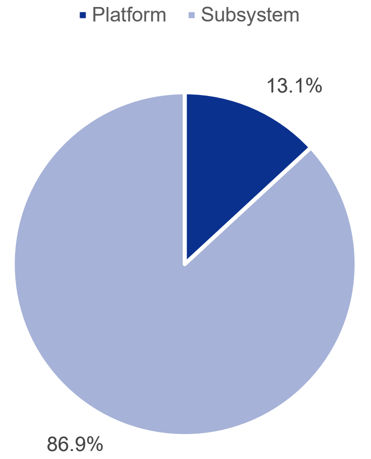
Figure 2: Electronic systems are in focus



SOURCE: INCRED RESEARCH

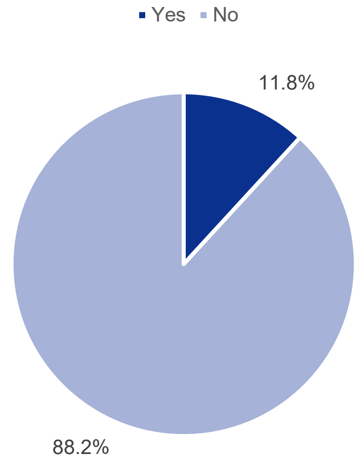
There is a deliberate focus on industrial deepening. **86.9% of the projects are at the subsystem level, compared to just 13.1% for large platforms.** This structure democratizes the opportunity, moving it beyond a handful of large-scale platform integrators. It opens the field to a tiered ecosystem of specialized component manufacturers, MSMEs, and technology start-ups, fostering a broad, competitive base of suppliers. This is a classic industrial policy strategy to build a resilient and deep supply chain, forcing large integrators to act as true system architects who must manage a complex domestic network rather than simply assembling imported kits.

Figure 3: Subsystems are taking a major chunk



SOURCE: INCRED RESEARCH

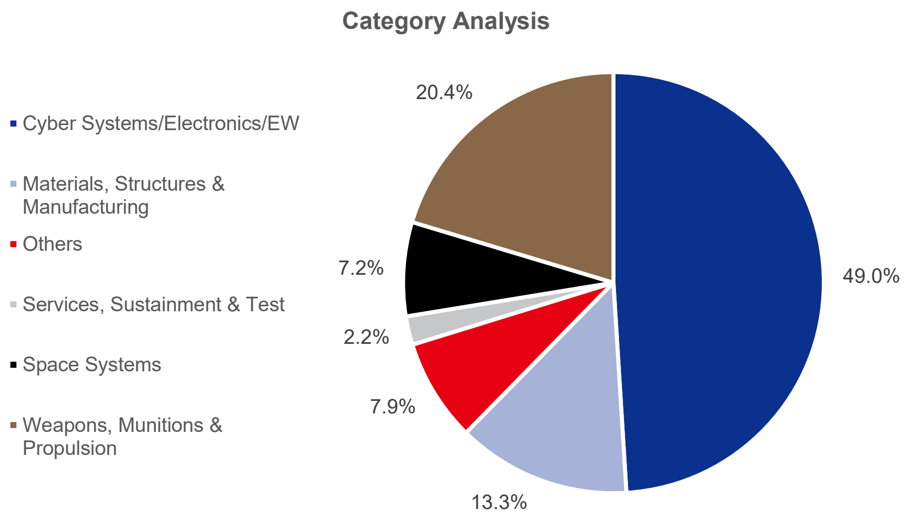
Figure 4: ~12% of items are being developed/ready for ToT



SOURCE: INCRED RESEARCH

Cyber systems/electronics/EW constitute a staggering 49.0% of all projects, followed by weapons, munitions & propulsion at 20.4%. The future of Indian defence is digital, networked, and electronic. The strategic value is shifting away from traditional heavy engineering towards high-Intellectual Property (IP), high-margin electronics, software, and systems integration.

Figure 5: Space-based systems are emerging as a technology where India is planning to invest



SOURCE: INCRED RESEARCH

The digital battlefield of electronics, EW, and cyber systems (49.0% of projects)

The digital battlefield is no longer a futuristic concept - it is the central organizing principle of India's military modernization, commanding nearly half of all planned projects. The demand is driven by the imperative of network-centric warfare, as explicitly detailed in the requirements for flagship platforms. The **Future Ready Combat Vehicle (FRCV)** and the **Light Tank**, for instance, are mandated to be fully cyber-hardened systems with integrated Battlefield Management Systems (BMS), secure data links, and the capability to operate in an intense Electronic Warfare (EW) environment.

The scale of this digital transformation is immense. The Indian Army alone requires over **60,000 Software-Defined Radios (SDRs)**, between **7,000 and 8,000 S-Band Satellite Terminals**, and between **55,000 and 60,000 Thermal Imaging Sights**. The Indian Air Force (IAF) is planning a new **IAF Strategic Communication Network**, which requires **Next-Generation Radar Warning Receivers (RWRs)** for over 300 transport and fighter aircraft, and it is procuring a host of advanced jammers and sensors. This represents a multi-year procurement cycle for a vast array of electronic systems.

The roadmap also emphasizes a significant leap in technological sophistication. There is a clear push towards next-generation systems such as **Active Electronically Scanned Array (AESA) radars**, which require advanced Gallium Nitride (GaN) based Trans-Receiver modules, **Cognitive Radio**, **Quantum Communication systems**, **AI-based Emitter Identification**, and **Zero Trust Network Architecture**. This is a strategic intent to move up the technology value chain, from licensed production to indigenous design and development of cutting-edge systems. This massive demand for advanced electronics, particularly semiconductors like GaN modules, exposes one of India's key strategic vulnerabilities but also creates a powerful catalyst. The non-negotiable requirements of the TPCR will, we believe, act as a foundational driver for the government's domestic semiconductor manufacturing and packaging (ATMP) initiatives, providing the long-term offtake assurance needed to attract private investment into a domestic fab.

Cybersecurity has also been elevated to a strategic imperative. The inclusion of numerous projects for indigenous tools, from **web-based vulnerability assessment** and **indigenous code analysis** to **deep fake detection** and the creation of **cyber ranges** for training, marks the recognition of the cyber domain as a critical warfighting front.

Lethality and propulsion (20.4% of projects)

The second-largest category of expenditure is dedicated to the modernization of India's kinetic capabilities, with a clear shift towards precision, extended range, and smarter munitions.

The primary focus is on defeating modern armoured threats, evidenced by the large-scale requirement **for 20,000 to 50,000 units of 4th/5th Generation Anti-Tank Guided Missiles (ATGMs) for the Indian Army**, alongside advanced 125mm tank ammunition. In the artillery domain, the demand for **600,000 Enhanced Range Artillery Projectiles and thousands of Course Correctible Fuzes (CCF)** for existing 155mm guns signifies a major leap in capability. This initiative aims to transform a vast inventory of conventional shells into precision-guided weapons, a cost-effective force multiplier. Similarly, the Indian Navy's requirement of advanced **Lightweight Torpedoes, Extended Range Anti-Submarine Warfare (ASW) Rockets**, and various types of **Guided Ammunition** for its naval guns reflect the imperative to counter both surface and sub-surface threats in the maritime domain.

Beyond munitions, the roadmap outlines ambitious, long-term projects in critical propulsion technologies, aiming for technological parity with global powers. These include the development of **Scramjet Propulsion for Hypersonic Missiles, Nuclear Propulsion** for future aircraft carriers and surface combatants, and **Air Independent Propulsion (AIP)** systems for conventional submarines.

Platforms and integration (7.9% of projects)

While platforms represent a smaller portion of the total project count, they are the high-value, high-visibility anchors of the defence ecosystem. These large-scale programmes are critical not only for their direct contract value but also for their role in driving development and business across the entire domestic supply chain.

On land, the key programmes are the **Future Ready Combat Vehicle (FRCV), with a projected requirement of 1,700-1,800 units to replace the T-72 fleet, and the Light Tank project, with a requirement of 300-400 units** for versatile deployment. It is crucial to note that these are not mere manufacturing contracts; they are complex design and development challenges with a heavy emphasis on modern electronic architecture, network-centric capabilities, and the integration of unmanned systems.

In the naval domain, the flagship programmes include the next indigenous **Aircraft Carrier, Next Generation Destroyers (NGD), Next Generation Corvettes (NGC), and specialized vessels like Mine Counter Measure Vessels (MCMV).** These platforms are characterized by increasing complexity, advanced stealth features, and a significant and growing proportion of their value being derived from their onboard electronic suites and weapon systems.

The role of the platform manufacturers themselves is evolving. They are increasingly required to act as prime integrators and system architects, responsible for managing a vast and complex network of Tier-1 and Tier-2 domestic suppliers to deliver a fully functional, indigenized system. A complex platform like an NGD or FRCV consists of thousands of subsystems, and the indigenization mandate forces the prime contractor to cultivate a domestic supply chain. This creates a powerful pull effect on the entire MSME ecosystem, where a single high-value contract for a prime integrator generates a cascading wave of business for hundreds of smaller firms.

The new frontiers of unmanned, space, and directed energy weapons

TPCR-2025 dedicates significant attention to forward-looking, high-growth segments that will define the future of warfare. These areas, while nascent in terms of current revenue, represent immense long-term growth potential for companies that can establish an early technology lead.

The roadmap for **Unmanned Systems** is comprehensive, spanning every domain of warfare. It includes requirements for strategic assets like **Medium and High-Altitude Long Endurance (MALE/HALE) RPAS, High-Altitude Pseudo-Satellites (HAPS)** for persistent surveillance, and ultimately, **Stealth Unmanned Combat Aerial Vehicles (UCAVs)** capable of supersonic speeds and Manned-Unmanned Teaming (MUM-T). The emphasis is clearly on autonomy, stealth, and SATCOM-based, beyond-line-of-sight operational capabilities.

Space-based assets emerge as a major new focus area, reflecting the domain's growing importance for military operations. The TPCR details requirements for a wide range of satellites, including **Multiband RF Sensors** for electronic intelligence, **High Throughput Communication Satellites in Low Earth Orbit (LEO)** to provide low-latency connectivity, and **L/P band Synthetic Aperture Radar (SAR) satellites** for all-weather surveillance. The vision extends to ambitious concepts like **On-Orbit Servicing, Maintenance, and Refuelling (OOMR)** and the use of on-board AI for real-time data processing, signifying a desire to build a resilient and technologically advanced space architecture.

The push into **Directed Energy Weapons (DEW),** while in its early stages, is strategically significant. **Tactical High Energy Lasers** and **High-Power Electromagnetic Weapon Systems are** designed to counter the threats ranging from drones to electronic systems. We view this as a long-term R&D focus with the potential for disruptive impact on the battlefield. The government appears to be using these "new frontier" domains, particularly drones and space, to deliberately seed a new ecosystem of defence start-ups, bypassing the legacy structures of Defence Public Sector Undertakings (DPSUs). Domains like Unmanned Combat Aerial Vehicle (UCAVs) and small satellites are software-intensive and rely on rapid, agile innovation cycles, characteristics better suited to start-ups than to large, hierarchical PSUs.

Introduction to air defence analysis

Abstract

We examine the technical architecture, operational coverage, and industrial implications of India's present and planned air-defence posture, including integrated surface-to-air/ballistic-missile layers, space-domain sensors and interceptors, and the ground-based long-range radar backbone that supports persistent domain awareness.

Our scope covers (a) technical capability mapping (systems, ranges, sensor fusion and coverage gaps), & (b) ongoing and expected procurements and R&D programs.

Critical strategic assumption

*India needs ~**Rs4tr** of additional investment for its ambitious Sudarshan Chakra project.*

Our analysis explicitly assumes that India faces a sustained two-front threat from the People's Republic of China on the northern and eastern approaches and from Pakistan on the western front. Preparing for a credible two-front defence posture materially changes force-structure requirements and unit-cost aggregation. As a guiding aphorism we emphasize that **"the best way to avoid a war is to prepare for it."**

We therefore include comparative technical assessments of China's and Pakistan's relevant aerospace and missile capabilities, sensors, fighters, ballistic and cruise missile inventories, and integrated air-defence systems to ensure our gap analysis and procurement projections are stress-tested against realistic threat envelopes.

Also, our primary focus in this analysis is defensive and not offensive investments/upgrades in the armed forces' capabilities.

Key findings

Consolidating ongoing contracts, announced programmes and our capability-gap analysis under the two-front assumption, we estimate India will need at least **Rs4tr** of additional investment for air and space domain modernization through **2035**.

India needs system procurement, new ground-radar deployment, space-sensor assets and associated sustainment. **This estimate is explicitly linked to the strategic ambition described by Prime Minister Narendra Modi in his 15th Aug 2025 Independence Day address under the 'Sudarshan Chakra' umbrella**, which we treat as a guiding political commitment and parametric driver for procurement timelines.

Figure 6: Key expected investments

System	Expected Investment (tr)
Air Defense	1.82
Space Defense	0.2
Ground Radars	1.4
Others	0.5
Total Investment	3.9

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Understanding the threats

Pakistani air threats

We assess that Pakistan's air threat to India stems from its mix of 3rd/4th-generation fighters, modern drones, and a growing missile arsenal. The Pakistan Air Force (PAF) fields roughly 418 combat jets, chiefly F-16s, indigenously co-developed JF-17s, and newly acquired Chinese J-10C fighters. Most older types (Mirages and F-7s) are being retired in favour of these.

Pakistan received the first batch of J-10CE fighters in 2022. These Mach-1.8, AESA-radar jets carry long-range PL-15 air-to-air missiles and precision air-to-surface munitions. The JF-17 Thunder (Mach-1.6), built jointly by Pakistan and China, is the PAF's workhorse (Block-3 standard, AESA radar) and carries Chinese AAMs (PL-10, PL-12/15) and air-launched cruise missiles. Legacy F-16s (Mach ~2.0) remain in service with Pakistan (~70–80 active, after retirements).

In past skirmishes (e.g. Feb 2019's aerial clash), Pakistani JF-17s were deployed against India. Conversely, Pakistan has **publicly denied** any current deal for Chinese 5th-generation stealth fighters. However, Turkish UCAVs and 5th-gen projects remain wildcards, given Islamabad's Turkey ties.

Figure 7: Pakistan's fighter jet details (pre-Operation Sindoor)

Platform	Active	Ordered	Origin / Producer	Top speed (typ.)	Stealth / RCS	Representative range / radius	Typical armament examples
F-7 (J-7 family)	72		China (Shenyang / Chengdu derivative of MiG-21)	Mach 2.0	Non-stealth (classic small fighter RCS)	Combat radius ~300–600 km (variant dependent)	Short-range AAMs (PL-5/Python equivalents), unguided bombs
F-16A/C	44		USA (Lockheed Martin)	Mach 2.0	Non-stealth (low observable in later blocks only via RCS reduction kits)	Ferry ~4,200 km; combat radius ~550 km	AIM-120 AMRAAM, AIM-9/Python, LGBs, A2G stores
J-10C	20	5	China (Chengdu)	Mach 1.8	Reduced RCS (not full stealth); AESA-radar on later examples	Combat radius ~900–1,200 km (est.)	PL-10, PL-12 / PL-15 AAMs; ALCMs (KD-88 / equivalents)
JF-17 (Block-3)	123	35	Pakistan/China co-production (PAC/CAC)	Mach 1.6	Small RCS on Block-3 (reduced signature; not true stealth)	Combat radius ~800–900 km (variant dependent)	PL-10, PL-12/15 AAMs, Ra'ad ALCM, ASMs, guided bombs
Mirage III / IIIEP / OF / RP	69		France (Dassault; licence builds / upgrades)	Mach 2.2	Non-stealth	Combat radius ~500–800 km (variant dependent)	R-550 / Matra AAMs, dumb/laser-guided bombs
Mirage 5 / 5EF / F / PA	90		France (Dassault)	Mach 2.0–2.1	Non-stealth	Similar to Mirage III variants	Air-to-surface ordnance, AAMs (older types)

SOURCE: INCRED RESEARCH, FLIGHT GLOBAL

Pakistan's missile threat likewise spans subsonic cruise missiles and ballistic missiles. For example, the CSIS Missile Threat database lists Pakistan's Babur cruise missile (Hatf-7) as a subsonic weapon (Mach ~0.6) with a 350–700km range , and its air-launched Ra'ad (Hatf-8) as a terrain-following cruise with ~600 km range. Short-range missiles like the Hatf-9 "NASR" (70km, tactical nuke) and Hatf-2 "Abdali" (180km) provide battlefield deterrence. Longer-range ballistic missiles include the Shaheen-1 SRBM (750–900km) and Shaheen-2 MRBM (1,500–2,000km), both Mach~5 re-entry systems capable of carrying nuclear or conventional warheads. The Shaheen-3 (range ~2,750km) and Ababeel (MIRV-capable, 2,200km) are under development.

Figure 8: Pakistan's missile details

Missile Name	Class	Range (km)	Typical speed (typ.)	Warhead / Payload	Guidance
Abdali (Hatf-2)	SRBM	180–200 km	Ballistic, terminal: hypersonic (>Mach 5)	~500 kg (conventional/nuclear)	Inertial; road-mobile TEL
Babur (Hatf-7)	Cruise missile	350–700 km	Subsonic cruise ~ Mach 0.6–0.85	~300–450 kg (conventional or nuclear)	INS + TERCOM/DSMAC; satellite updates on later variants
Exocet	Anti-ship cruise missile (ASCM)	40–180 km	Subsonic ~ Mach 0.7–0.9 (variant dependent)	~150–300 kg (HE/penetrating)	INS/active radar terminal seeker (ship-targeting)
Hatf-5 "Ghauri"	MRBM	1,250–1,500 km	Ballistic, terminal: hypersonic (>Mach 5)	~700–1,000 kg (conventional/nuclear)	Inertial (liquid-fuel design; older)
Ghaznavi (Hatf-3)	SRBM	290 km	Ballistic, terminal: hypersonic (>Mach 5)	~500–700 kg	Inertial; reported post-separation corrections
Hatf-1	SRBM	70–100 km	Ballistic, terminal: hypersonic (>Mach 5)	Small conventional/nuclear payloads (legacy)	Inertial
Nasr (Hatf-9)	SRBM / Tactical ballistic	70 km	Ballistic, terminal: hypersonic (>Mach 5)	Low-yield tactical nuclear (sub-kt)	Inertial; mobile TEL
Shaheen-1 (Hatf-4)	SRBM / short-MRBM (solid)	750–900 km	Ballistic, terminal: hypersonic (>Mach 5)	Up to ~1,000 kg (nuclear/conventional)	INS + post-separation attitude correction
Shaheen-2 (Hatf-6)	MRBM	1,500–2,000 km	Ballistic, terminal: hypersonic (>Mach 5)	~1,000 kg (nuclear/conventional)	Solid-fuel; inertial with reported guidance upgrades

SOURCE: INCRED RESEARCH, CSIS

Potential future Pakistani threats

Looking ahead to 2035, Pakistan's threat profile may expand via Chinese and Turkish partnerships. In aircraft, Pakistan is reportedly **not** finalizing any Chinese 5th-gen deal, but we see a **high probability** of the country acquiring some stealth platforms via China/Turkey by 2035 (e.g. a two-seat FC-31/J-35 or Turkey's TF-X). Pakistani officials have begun F-16 Block 70 modernization talks with the US, which could add more capable F-16s. Meanwhile, Turkey's new supersonic UCAV *Kızılelma* (Mach ~0.9, low RCS) may be exported; mass production of *Kızılelma* began in 2024. On the missile side, we anticipate **Pakistani jets fielding supersonic missiles like China's CM-400AKG** (a Mach ~4 AShM, range ~200 km).

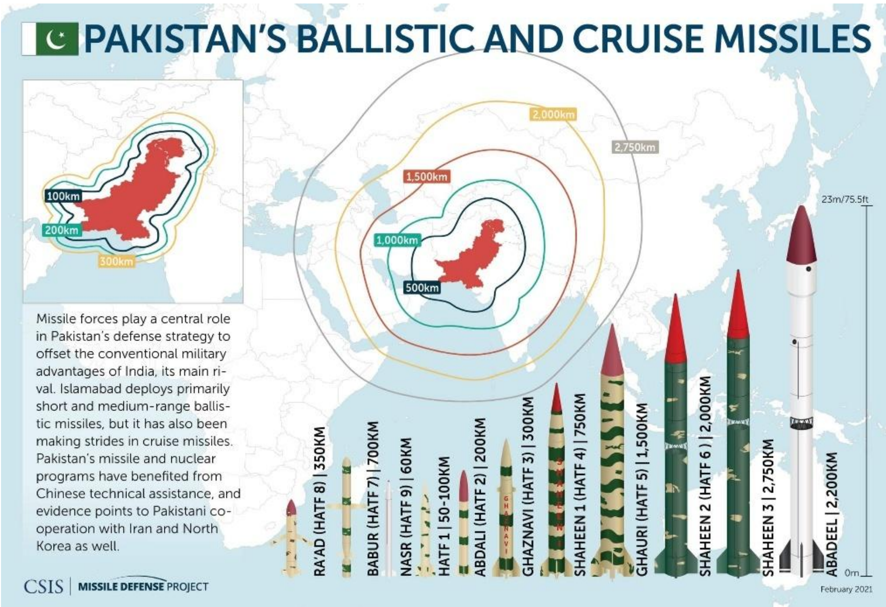
Pakistan has also tested Fatah-II guided rockets (~400km range) and continues to develop longer-range MRBMs (Shaheen-3, Ababeel MIRV).

Figure 9: Potential future threats

Platform/Missile	Category	Speed	Range (km)
Chengdu FC-31/J-35	Fighter (5th gen)	Mach ~2+	~1,500 (est.)
Turkey TF-X (Kaan)	Fighter (5th gen)	Mach ~2	~1,300 (est.)
Bayraktar Kızılelma (Turk)	UCAV	Mach 0.9	930
F-16 Block 70	Fighter	Mach 2.0	~4,300
CM-400AKG (China)	Missile (AShM)	Mach 4+	~180–250
Fatah-II (Pakistani)	Rocket/MRL	Mach ~3–4	~400
Shaheen-3 (Hatf-10)	Ballistic MRBM	Mach ~5	2,750
Ababeel (MIRV)	Ballistic MRBM	Mach ~5	2,200
DF-ZF HGV (Chinese)	Hypersonic	Mach 5–10	~~1,800 (DF-17 MRBM)
Kh-32/YJ-12A (China)	Missile	Mach ~3 (YJ-12)	~500 (YJ-12A)

SOURCE: INCRED RESEARCH

Figure 10: Pakistan's missile arsenal and range



SOURCE: INCRED RESEARCH, CSIS

Chinese air threats

Chinese Western Command bases in Tibet and Xinjiang now host advanced fighters (5th-gen J-20, J-10C, J-11, Su-30, Su-35), large-scale armed UAVs (e.g. Wing Loong series), and growing ballistic/cruise missile units (DF-21, DF-17, DF-26, CJ-10, etc.). By 2035, these will be supplemented by next-generation systems: stealthy UCAVs (GJ-11 'Sharp Sword'), hypersonic glide vehicles (DF-ZF), new long-range drones (WZ-8), and 6th-generation fighters (J-XX/J-36 prototypes).

Figure 11: China's fighter jet details

Platform	Active inventory	Origin (manufacturer)	Top speed (Mach)	Stealth / RCS (qual.)	Representative combat radius / range (km)	Typical armament examples
H-6 (bomber)	150	Xian / AVIC	0.86	Large RCS	≈1,500 (combat radius)	CJ-10/CJ-20 LACM, YJ-63 ALCM, gravity/precision bombs
J-7 (light fighter)	417	Chengdu / AVIC	2.05	High RCS (legacy)	≈800	PL-2 / PL-5 IR AAMs
J-8 (interceptor)	143	Shenyang / AVIC	2.2	Moderate RCS	≈900	PL-8, PL-12 AAMs
J-10 (multirole)	268	Chengdu / AVIC	2.2	Moderate RCS	≈800 (combat)	PL-15 BVR, PL-10 SR AAM, guided bombs
J-11 / J-16 / Su-27/30/33/35 family	365	Shenyang/Sukhoi	2	Moderate-to-large RCS	1,000+ (varies by type)	PL-15, PL-10; YJ-12 AShM; Kh-31/Kh-59 anti-rad/stand-off msl
J-20 (5th-gen stealth fighter)	19	Chengdu / AVIC	2	Low RCS (stealth)	≈1,000+	PL-15 long-range AAM; PL-10 short-range; standoff A/G munitions
JH-7 (fighter-bomber)	103	Xian / AVIC	1.75	Large RCS	700–1,000	YJ-81/83 AShM, precision glide bombs
Q-5 (ground-attack)	118	Nanchang / Hongdu	1.2	Large RCS	≈600	Unguided bombs, rockets, light precision munitions

SOURCE: INCRED RESEARCH, FLIGHT GLOBAL

China's Rocket Force fields dense short- and medium-range ballistic missile batteries near the Tibet/Xinjiang borders. Older solid-fuelled SRBMs (DF-11: ~300 km, DF-15: ~600km) provide theatre strike. Newer SRBMs (DF-16: ~800km) and MRBMs (DF-17 with hypersonic glide warhead, ~1,800–2,500km) extend this out to Pakistan and parts of India.

Even longer-range missiles are deployed, conventional DF-21C MRBMs (≳2,000km) and DF-26 IRBMs (~4,000km) are based in western China. For precision strikes, the PLAAF and Rocket Force use long-range land-attack cruise missiles. The DH-10/CJ-10 LACM (range >1,500km) and its air-launched variant CJ-20 carry ~500 kg warheads with inertial terrain guidance.

Shorter-range air-launched cruise missiles (e.g. YJ-63, ≈200km range) allow H-6 bombers to hit tactical targets with high accuracy.

Figure 12: China's missile details

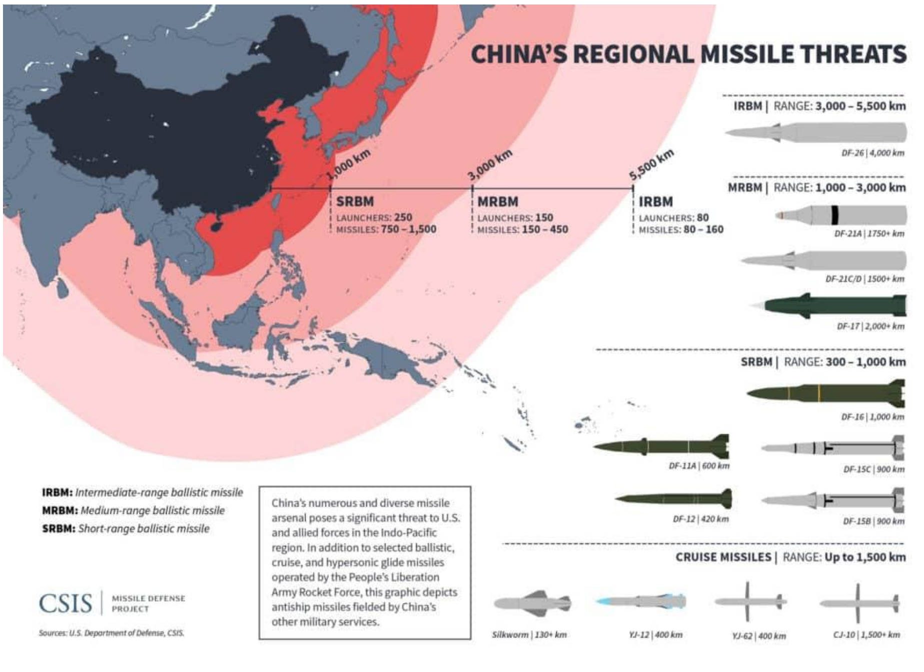
Missile Name	Class	Range (km)	Speed (typical)	Warhead / Payload	Guidance
DF-11 (CSS-7)	SRBM	280–300	Reentry ~Mach 4–6	~500 kg; HE, submunitions, or nuclear	INS; later GPS/Beidou updates (CEP ~150 m)
DF-12 / M20	SRBM	280	~Mach 4–5	480 kg; HE, cluster, penetrator	INS + GPS (30–50 m CEP)
DF-15 (CSS-6)	SRBM	600	~Mach 5	500–750 kg; HE, nuclear	INS; DF-15B adds terminal radar (CEP ~30 m)
DF-16 (CSS-11)	SRBM	800–1,000	~Mach 5	500–1,000 kg; HE, penetrator	INS + possible Beidou GPS
DF-17	Hypersonic Glide Vehicle (HGV)	1,800–2,500	Glide Mach 5–10+	300–500 kg; conventional/nuclear	Boosted by DF-16; inertial + possible terminal seeker
DF-21 (CSS-5 Mod)	MRBM	~2,150	Mach 10+ (reentry)	~600 kg; HE or nuclear (250–500 kt)	INS + GPS; some variants radar terminal
DF-26 (CSS-18)	IRBM	~4,000	Mach 10+	1,200–1,800 kg; conventional or nuclear	INS + Beidou GPS
DF-31 (CSS-10)	ICBM	7,000–11,700	Mach 20+	1,050–1,750 kg; nuclear MIRV (150–300 kt each)	INS + astro-inertial; Beidou
DF-4	IRBM / Early ICBM	4,500–5,500	Mach 15–20	~2,200 kg; single nuclear warhead (3 Mt class)	INS + astro guidance
DF-41	ICBM	12,000–15,000	Mach 20+	2,500 kg; up to 10 MIRVs (150–300 kt each)	INS + astro; possible Beidou GPS
DF-5	ICBM	~13,000	Mach 20+	~3,000 kg; single large-yield nuclear warhead (3–5 Mt)	INS + astro guidance
HN-2	Cruise Missile	1,400–1,800	Subsonic (~Mach 0.7–0.8)	~400–500 kg; HE/nuclear possible	INS + GPS + DSMAC/TERCOM
HN-3	Cruise Missile	~3,000	Subsonic (~Mach 0.75)	~500 kg; HE or nuclear	INS + GPS + terrain matching
HN-1	Cruise Missile	50–650	Subsonic (~Mach 0.7)	~400 kg; HE	INS + GPS
JL-2	SLBM (sub-launched)	8,000–9,000	Mach 15–20	1,050–2,000 kg; nuclear warheads (MIRV-capable)	INS + astro; Beidou GPS
YJ-18	Cruise Missile (land/air launched)	220–540	Subsonic cruise; terminal Mach 2.5–3 sprint	300–500 kg; HE or nuclear	INS + GPS + terminal active radar

SOURCE: INCRED RESEARCH, CSIS

Figure 13: China's missile arsenal and range - 1

SOURCE: INCRED RESEARCH, CSIS

Figure 14: China's missile arsenal and range - 2



SOURCE: INCRED RESEARCH, CSIS

China is already flight-testing next-generation systems that could pose serious threats by the early 2030s. Notably, an upgraded Shenyang J-35A (derived from the FC-31/J-31 design) was unveiled in 2024 and is entering PLA service by ~2026–27, providing a second stealth fighter type beyond the J-20. Even more advanced are the **unnamed 6th-generation fighters (J-XX, J-36)** whose prototypes flew in late 2024 - these are described as **tailless, triple-engine stealth jets capable of Mach 2+ speeds and integrated UAV swarm control.**

On the strike side, China's **DF-ZF hypersonic glide vehicle** (launched on DF-17) is nearly operational, delivering manoeuvrable Mach 5–10 glide warheads, The **WZ-8 reconnaissance drone** (Mach 3 at ~30 km) is already in limited service, and Lijian (GJ-11) UCAVs (stealthy combat drones) are slated by mid-2020s for precision strikes alongside J-20.

Figure 15: Potential future threats

Program / System	Class	Projected IOC (est.)	Key Capabilities	Expected Armament
Shenyang J-31 / J-35A (FC-31)	5th-gen stealth fighter	~2026–2030	Twin-engine low-observable design; smaller than J-20; modern sensors and avionics	PL-15 AAM; PL-10 AAM; precision A/G missiles (export variant likely)
Chengdu J-20B/C (upgraded J-20)	5th-gen stealth fighter	2025–2030 (expected)	Improved engines (supercruise); larger internal bays; two-seat version (for EW/UCAV control)	PL-10, PL-15 AAMs; anti-radiation, anti-ship missiles
J-XX / J-36 (unnamed 6th-gen fighters)	6th-gen fighter concepts	2030s (est.)	Tailless stealth design; hypersonic dash (beyond Mach 2–3); AI-enabled sensor fusion; loyal-drone wingmen	Advanced AAMs; future DEWs (lasers, railguns); standoff weapons
DF-ZF HGV (CSS-XX)	Hypersonic Glide Vehicle	~2025 (operational trials)	Mach 5–10+ reentry glide; maneuverable trajectory; high survival	~500–800 kg warhead (conventional/nuclear)
WZ-8 “Gao Feng”	Near-space reconnaissance drone	~2021–2025 (operational)	Rocket-boosted to ~30 km altitude; Mach 3 cruise; 30,000–50,000 m ceiling	No missiles (recon platform with EO/SAR sensors)
Hongdu GJ-11 “Sharp Sword” (Lijian)	Stealth UCAV	~2025 (IOC likely)	Tailless stealth UAV; networked “loyal wingman” with J-20; precision targeting	Internal payload bays for guided bombs/missiles (future ship/ground strike)
Hypersonic LACMs (DF-100/CJ-100)	Supersonic cruise missile	~2025	Subsonic/supersonic (Mach ~3) cruise missile; strike fixed bases	~300–500 kg warhead; INS/TERCOM guidance (high speed complicates defense)

SOURCE: INCRED RESEARCH

India's current air defence capabilities

Introduction

We believe that India today fields a layered, mixed analogue–digital air-defence architecture, short-range & point-defence (SPYDER, Akash variants), medium-range area defence (Barak-8, Akash Mk-II/Prime), and long-range strategic coverage (S-400 regiments plus BMD radars and interceptors). This mix provides good coverage against aircraft, subsonic cruise missiles and many tactical ballistic missiles inside defended envelopes; it is less robust against boost-phase detection/track, very short-warning hypersonic glide vehicles (HGVs), and persistent boost-phase tracking without space-based IR sensors (SBIRS-style), though planned sensor and satellite programs (Swordfish/Super-Swordfish, 52 defence satellites, Voronezh/Container negotiations) aim to reduce some of those gaps over the 2025-2035 window.

Figure 16: What India's current systems can reliably protect against

System	Threats it can credibly defeat mitigate	Limitations
S-400 (long-range SAM)	High-altitude/long-range fighter penetration, some AWACS/ISR, many cruise missiles, near-terminal ballistic targets within coverage (long-range intercepts up to a few hundred km).	Excellent stand-off denial; single S-400 regiment cannot cover all approaches, needs networked deployment for multi-front coverage.
Barak-8 (LR-SAM)	Area defence of cities/airbases against aircraft, anti-radiation missiles, and cruise missiles out to medium ranges.	Complementary to S-400 for mid-tier engagements; naval and land variants provide flexible coverage.
Akash / Akash Prime / Akash-Mk II	Point/area defence vs fighters, UCAVs, many cruise missiles in the 25–45 km band; effective at high altitude (Akash Prime has high-altitude tests).	Economical mid-layer; density necessary to protect dispersed airbases and logistics nodes.
SPYDER (SR / MR)	Rapid-reaction, point defence vs fighters, attack helicopters, UAVs and stand-in munitions at short ranges.	Mobile, low-latency layer for forward elements and high-value point targets.
PAD / AAD / AD-1 (BMD)	Intercept of short- and medium-range ballistic missiles in exo- and endo-atmospheric flight phases within tested envelopes (Phase-I/II).	Designed for traditional ballistic arcs; successful tests but coverage is geographically limited and finite interceptor inventory constrains saturation resistance.

SOURCE: INCRED RESEARCH

Operational gaps in India's air defence

The first and most visible seam is one of coverage and distribution. India has acquired high-end, long-range area-defence systems that materially improve localized denial, but these systems remain few and are geographically concentrated. A very capable long-range battery provides formidable protection where it is placed; it does not, however, substitute for a geographically distributed architecture that can cover multiple axes simultaneously. In a two-front geometry an adversary will aim to find the seams between a handful of high-value nodes, attacking along secondary axes or timing salvos to overload a single sector.

Closely related is the problem of radar horizon and low-altitude blind spots. Fixed ground radars are limited by curvature of the earth and by terrain clutter; **sea-skimming cruise missiles and terrain-hugging cruise weapons can remain undetected until minutes, or even seconds before impact.** The traditional remedy has been airborne early-warning aircraft that see below the radar horizon; AWACS increase detection ranges for low-altitude threats, but they are expensive platforms, limited in number, and are themselves vulnerable to suppression or saturation.

We therefore expect a dual approach, increasing AWACS availability in the near term while accelerating the operational deployment of high-altitude, long-endurance stratospheric systems that act as quasi-satellites. High-Altitude Pseudo-Satellites (HAPS) and long-endurance UAVs sit in a useful middle layer, flowing far longer on station than AWACS and providing a persistent look-down capability that substantially narrows the radar blind spot. For India's two-front planning, the centrepiece should be redundancy, multiple, overlapping airborne vantage points so that low-flying salvos cannot exploit a transient sensor gap.

Sensor quality and fusion are the next and inseparable concern. Many existing ground radars remain older PESA designs; AESA arrays deliver higher fidelity, better multi-target tracking, improved resistance to electronic attack, and greater flexibility in beam management. Yet, the mere replacement of PESA with AESA is not sufficient if aircraft, shipborne and ground radars are upgraded piecemeal without parallel investments in robust, hardened sensor-fusion nodes. We expect a phased prioritization, AESA installs for a sub-set of mission-critical platforms and fixed radar nodes, while simultaneously building distributed fusion centres that tolerate degraded links and can operate autonomously if higher-level command is disrupted. Without fusion that combines radar returns, electro-optical/infrared cues, signals intelligence and airborne feeds into a coherent air picture, India's defenders will be forced into time-consuming human adjudication in conditions where automation and fast prioritization are decisive.

An existential gap for ballistic and emerging hypersonic threats is early launch detection**. The most advantageous window to attribute and cue against a ballistic launch is the boost phase**, but boost-phase detection requires overhead infrared sensors or other space-based capabilities that India does not yet operate at scale. Without a dedicated space-based IR early-warning constellation or a complement of hosted infrared payloads on GEO/HEO platforms, detection tends to occur in midcourse or terminal phases, which compresses decision time and complicates discrimination among decoys, multiple warheads and countermeasures. We expect that the practical near-term path will rely on mixing hosted payloads with improved ground and ship sensors, but our recommendation is an accelerated plan to field dedicated space IR nodes by 2030–2035 that materially expands reaction time and simplifies the engagement problem for missile-defence assets.

Maritime approaches and the very-long-range problem raise a separate but complementary issue**. Over-the-horizon radars (OTHR), which exploit ionospheric propagation or surface-wave techniques, detect low-flying aircraft and sea-skimming missiles at ranges beyond line-of-sight.** India's long coastline and critical sea-lanes create many vectors where littoral threats can approach undetected if OTHR coverage is thin. We expect that the right architecture combines OTHR nodes, maritime-patrol aircraft and HAPS-class persistent ISR so that sea-skimming salvos cannot exploit a single sensor domain. Practically, this requires geographically dispersed OTHR nodes fused with airborne and spaceborne feeds to create a maritime air picture that is not fragile to single-point failures.

A qualitatively new category of threat is the cheap, large-scale swarm of small UAS or loitering munitions. Swarms change the economics of engagement - an adversary can expend dozens or hundreds of low-cost elements to exhaust a defender's inventory of interceptors, especially if those interceptors are single-shot missiles with high unit costs. **Directed-energy weapons (DEW), including high-energy lasers and high-power microwave systems, change that economics.** We expect DEW prototypes and field trials to accelerate globally and to become a necessary element of base and harbour defence in the coming decade. The crucial expectation for India is that fielding an operational laser or HPM system offers the ability to defeat multiple small targets at a marginal cost far lower than kinetic interceptors; our recommendation is to expedite trials over critical bases and ports, to accelerate integration with detection and fire-control chains, and to implement doctrinal changes that put DEW into the defensive baseline for high-probability swarm-targeted nodes.

Sustained combat also exposes supply and throughput vulnerabilities. In a two-front, protracted exchange, interceptor inventories can get depleted rapidly. The defensibility of a region is therefore not only a function of peak capability but of sustainable throughput, intercepts per day that the force can sustain while resupply and production keep pace. We expect India to need realistic consumption models that map expected attack profiles to day-by-day interceptor usage, together with surge-production plans that can be activated in crisis. Near-term stockpiling and pre-positioning are necessary, but longer-term production-line scalability and supply-chain resilience must be a part of the planning baseline through 2035.

Mixed salvoes combining ballistic missiles, cruise missiles and swarms impose a cognitive and computational burden on defenders who must prioritise and allocate scarce interceptors. The C2 architecture that performs well under benign conditions may be brittle under electronic warfare or cyber-attack. Our expectation is that automated, resilient command-and-control with graceful degradation is an operational imperative, while distributed C2 nodes with the ability to exercise local autonomy, hardened datalinks and anti-spoofing measures will reduce the risk that a contested electromagnetic environment produces indecision.

Figure 17: India's air defence gaps and planned / expected / recommended development posture towards 2035

Gap	Strategic consequence in a two-front war	Threat vectors	India's planned / expected / recommended development posture toward FY2035
Concentrated long-range SAMs / limited distribution	Coverage seams and penetration risk on secondary axes; ability of an adversary to time or route salvos to exploit non-overlapping engagement arcs	Saturation strikes, flank penetrations, simultaneous two-front raids	India is investing in an indigenous long-range programme under Project Kusha (an Indian S-400 class LRSAM). We expect Delhi to pursue Project Kusha aggressively and model procurement of multiple Kusha regiments — our working planning figure for force-sizing is ~8 Kusha regiments by FY2035 (procurement + phased induction), alongside continued Russian S-400 deliveries and mobile regimental deployments.
Radar horizon / low-altitude blind spots	Late detection of terrain-hugging threats, severely compressed engagement windows for base defence and littoral assets	Sea-skimming cruise missiles, terrain-hugging cruise missiles, low-flying strike aircraft	India is expanding airborne persistent sensors — increasing AWACS capacity (Netra/Netra-MkII / "Awacs India" approvals) and accelerating HAPS/HALE acquisitions and tests. We expect a mixed AWACS + HAPS posture (more AWACS sorties in the short term, operational HAPS deployments in the mid term) to reduce radar-horizon seams.
PESA legacy & limited AESA penetration	Reduced multi-target track capacity, poorer ECCM performance and diminished ability to sustain tracking in contested EW environments	Multi-target saturation, EW contest, stealth/low-RCS probe attacks	India will lean on a mixed approach: deploy QRSAM and Akash Prime for medium-tier mobile coverage while accelerating AESA/VHF radar deployments — systems named in the roadmap include Surya (VHF) and upgraded Swordfish / Super-Swordfish long-range trackers; legacy radars will be progressively upgraded with AESA (and VHF/AESA) technologies to improve ECCM and multi-target fidelity.
Lack of space-based IR boost-phase detection	Compressed BMD reaction time, harder discrimination of warheads/decoys, reduced time to cue interceptors in a ballistic/hypersonic salvo	Ballistic missile salvos, hypersonic boost-phase launches	India is rolling out SBS-III / Space-Based Surveillance constellations for surveillance; however, SBS-III is primarily an imaging/surveillance programme — India needs and is expected to pursue a dedicated IR early-warning path (SBIRS-like / hosted IR payloads → GEO/HEO IR nodes) to provide boost-phase warning and to be operationalised by 2030–2035.
Limited OTHR coverage for maritime approaches	Late maritime warning, vulnerability to littoral salvos and low-flying maritime threats	Low-flying ISR/attack aircraft, sea-skimming missiles, small unmanned surface/air threats	India is moving to expand very-long-range coverage — procurement/negotiations for Russian Voronezh / Container-S type over-the-horizon radars have been reported, and DRDO's Super Swordfish / Swordfish upgrades will also contribute to long-range tracking and littoral surveillance; these acquisitions plus HAPS/MPA fusion are expected to form the maritime OTHR backbone by 2035.
Swarm drones and cheap saturation attacks	Attrition of expensive interceptors, crippling of logistics/hubs and port facilities if left unchecked	Loitering munitions, coordinated small-UAV swarms, expendable kamikaze drones	India has already demonstrated and is accelerating DEW development (Mk-II(A) laser tests, ongoing HPM/laser programmes). We expect trials to transition to operational DEW integration (lasers/HPM) for high-throughput base and port defence, complementing radar/EO C-UAS sensors by 2030 and expanding to wider coverage toward 2035.
Hypersonic / very high-speed threats	Extremely short reaction times, limited midcourse discrimination, need for novel intercept approaches	Hypersonic glide vehicles, rapid boost-phase ballistic missiles	India is upgrading long-range trackers (Super Swordfish / LRTR family) and investing in sensors to improve tracking of very-fast threats; these upgrades, combined with space/HAPS sensing and future fast-response interceptors, are required to address hypersonic challenges by 2035.

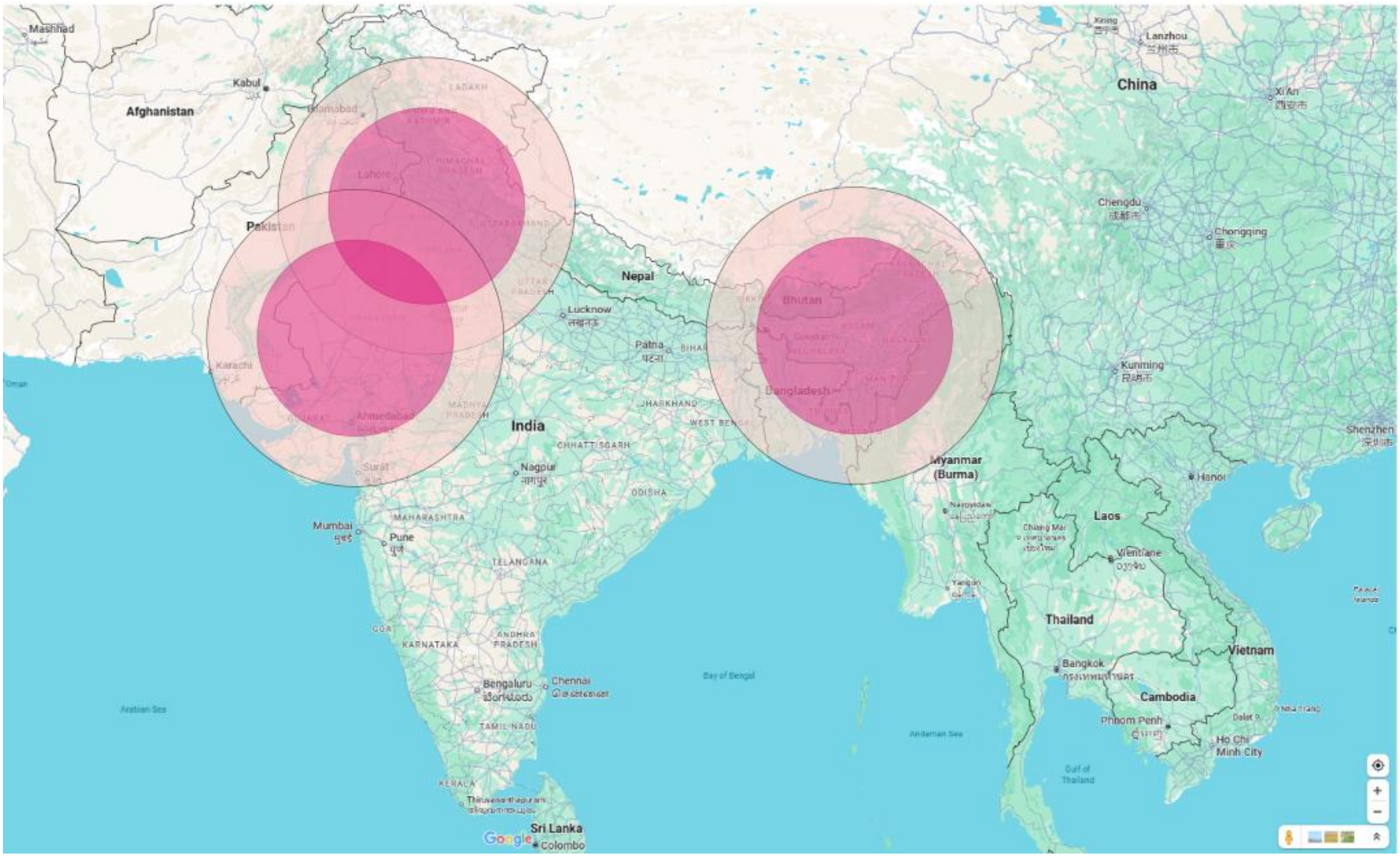
SOURCE: INCRED RESEARCH

Current systems and coverage

S-400 Triumf

The Russian-made S-400 Triumf long-range SAM system is now the backbone of India's air defence. It can track up to 300 targets and simultaneously engage 36. Under the 2018 contract (US$5.43bn), India ordered five regiments; as of 2025 three have been delivered. The first two regiments were deployed to Adampur and Halwara (Punjab) by 2021, and a third regiment to the Siliguri 'Chicken's Neck' (West Bengal) by mid-2024. These cover India's western front (Pakistan) and the northeastern flank (China). The remaining two regiments are expected by 2026F (likely to be based in Rajasthan and Arunachal/Sikkim) to guard the western desert and eastern borders.

Figure 18: Current deployment of S-400



SOURCE: INCRED RESEARCH

Figure 19: S-400 missile details

Parameter	9M96E (short)	9M96E2 (medium)	48N6 (long)	40N6 (very-long)
Maximum range	~40 km	~120 km	~200–250 km	~380–400 km
Maximum altitude	~20 km	~30 km	~27 km	~30 km
Missile / launch (weight)	~333 kg (in canister / launch weight)	~420 kg (in canister / launch weight)	~1,800–1,835 kg (launch weight)	~1,893 kg (launch weight); container ~2,600 kg
Warhead weight	~24 kg (blast/fragmentation)	~24 kg (blast/fragmentation)	~143–180 kg	~150 kg
Guidance	Inertial + active radar seeker (active homing)	Inertial + active radar seeker (active homing)	Inertial + semi-active / track-via-missile (radar guidance)	Semi-active / active radar homing
Maximum speed	~Mach 2.5–3.0	~Mach 2.9–3.5	~Mach 4–6	~Mach 4–9+

SOURCE: INCRED RESEARCH

Missile types ➤

9M96E (short-range interceptor)

The 9M96E is the S-400's short-range, high-manoeuvrability interceptor designed to fill the inner layer of the system's defensive bubble: it defends against aircraft, cruise missiles and precision guided threats at short ranges while enabling the larger missiles to focus on high-value or longer-range targets. **Around 40km range**, **intercept altitudes up to ~20km**, a launch (in-canister) mass of the order of **~330–350kg**, and a **~24kg** fragmentation warhead; it employs inertial mid-course guidance with an active radar seeker for terminal homing. These missiles are small enough to be **quad-packed** in one TEL canister (a single S-400 TEL with four containers can thus carry many 9M96 rounds), giving commanders high salvo density against saturation attacks and excellent capability against manoeuvring, low-observable threats.

9M96E2 (extended/medium-range 9M96 family)

The 9M96E2 is essentially the middle child of the 9M96 family: larger and longer reaching than the baseline 9M96E but still far smaller than the classic 48N6 family. **Around 120km range** with intercept altitudes up to **~30km**, a mass in the **~420 kg** range and the same compact **~24kg** warhead and active-seeker terminal guidance. Its purpose is to bridge the gap between short-range, high-density interceptors and the heavy long-range missiles, allowing an S-400 battery to engage a wider ladder of targets economically and to handle medium-range cruise and stand-off threats without expending the larger long-range missiles. The 9M96E2 therefore adds tactical flexibility, commanders can use it for medium-to-long escort engagements while retaining large missiles for strategic or very long-range threats.

48N6 family (long-range workhorse)

The 48N6 family (48N6E / 48N6E2 / 48N6DM etc.) are the S-400's long-range interceptors and the evolutionary heirs of the S-300 line. **Engagement ranges are typically between ~150km and ~250km**, with a launch weight of around **~1,800–1,840kg** and warheads commonly in the **~145–180kg** range; guidance is inertial with semi-active or track-via-missile radar homing in the terminal phase. The 48N6 missiles are large, single-piece rounds carried one per TEL canister (four containers per TEL), and they are optimized to engage high-value aerial targets (AWACS, tanker aircraft), stand-off weapons and even some classes of ballistic threats at their flight envelope limits. Because of their mix of reach and destructive power, the 48N6s form the S-400's principal workhorse for area denial against conventional air operations.

40N6 (very-long-range, strategic interceptor)

The 40N6 is the S-400's strategic, very-long-range interceptor intended to push the system's engagement bubble out into hundreds of kilometres, around **~380–400km,** and to engage high-altitude or stand-off platforms well before they reach critical assets. Launch weight figures put the 40N6 around **~1,893kg** (container mass higher), with a large fragmentation warhead in the **~150kg** neighbourhood and interception altitudes to roughly **~30km**; guidance is using mid-course updates from the system combined with an active/semi-active terminal seeker. Because of its size, loadout and mission, the 40N6 is not used for salvo-heavy inner-defence work but rather to extend the engagement envelope countering high-value adversary platforms and contributing to strategic area denial.

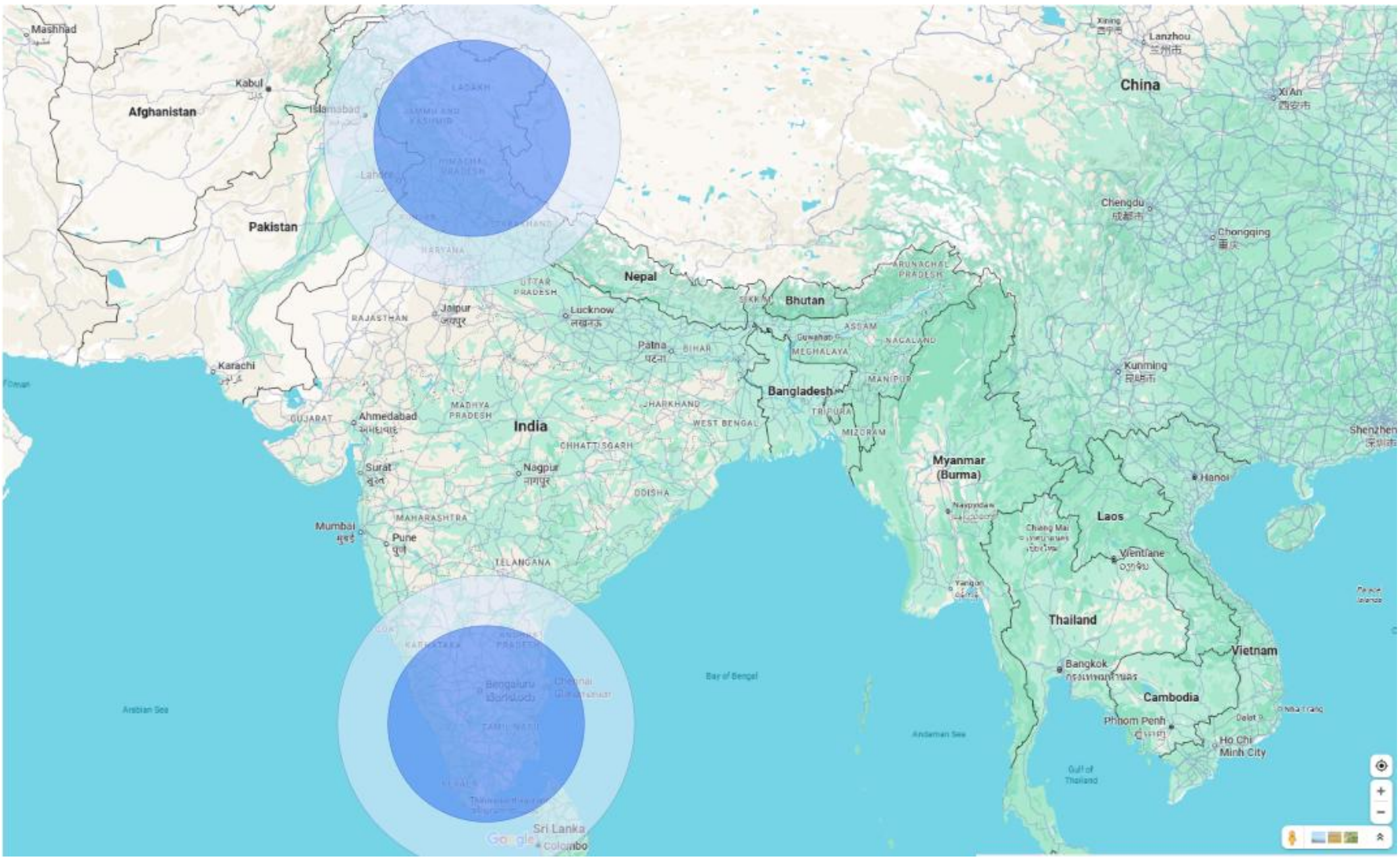
Figure 20: System-level details

System Level Details

Parameter	Value
Regiments ordered	5
Active regiments	3
Batteries per regiment	4 (2 battalions×2)
Launchers per battery	8
Canisters per launcher	4
Ready missiles per battery	32 (8×4)
Ready missiles per regiment	128
Total ready missiles (3 reg)	384
Reserve missiles (assumed 2×)	768

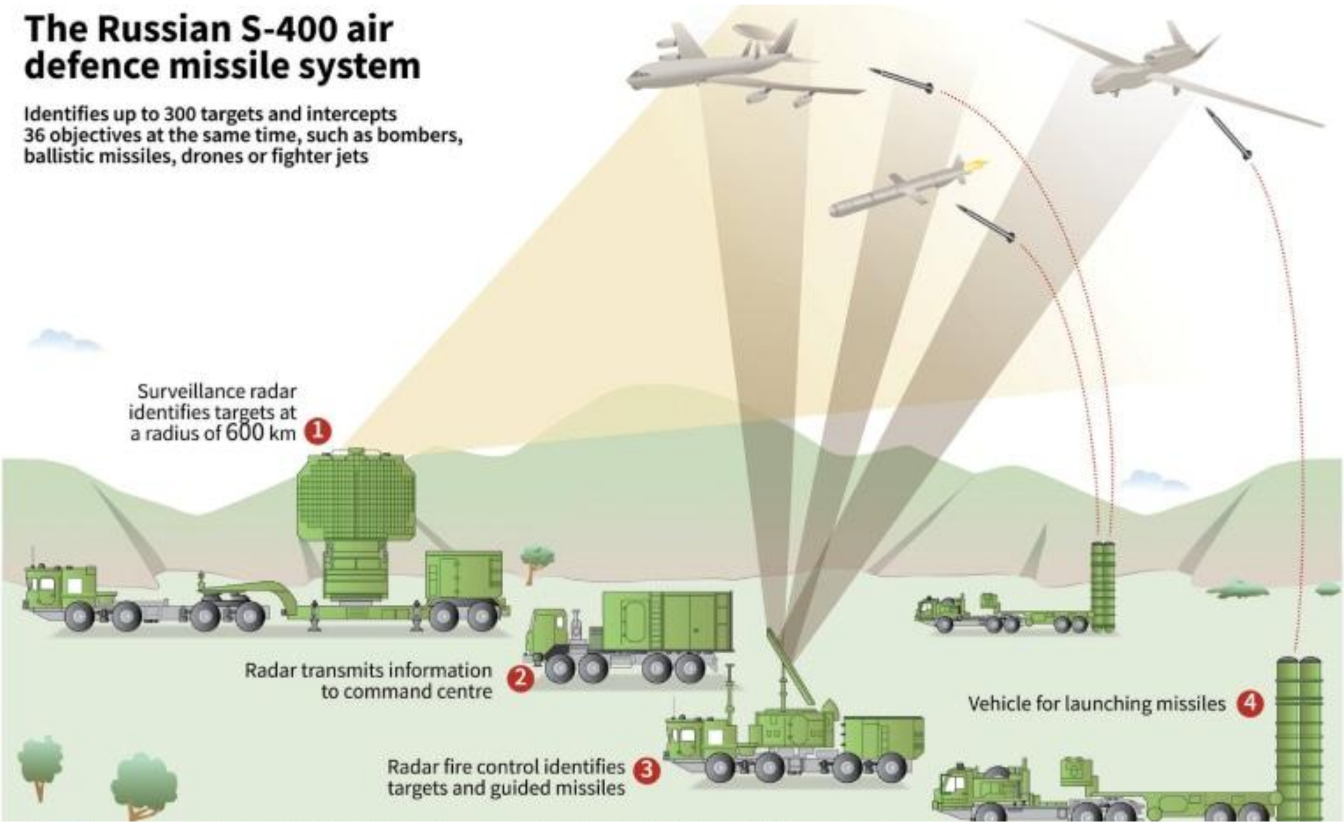
SOURCE: INCRED RESEARCH

Figure 21: Expected deployment of pending regiments, S400s



SOURCE: INCRED RESEARCH

Figure 22: S-400's working



SOURCE: INCRED RESEARCH, AFP, DAWN

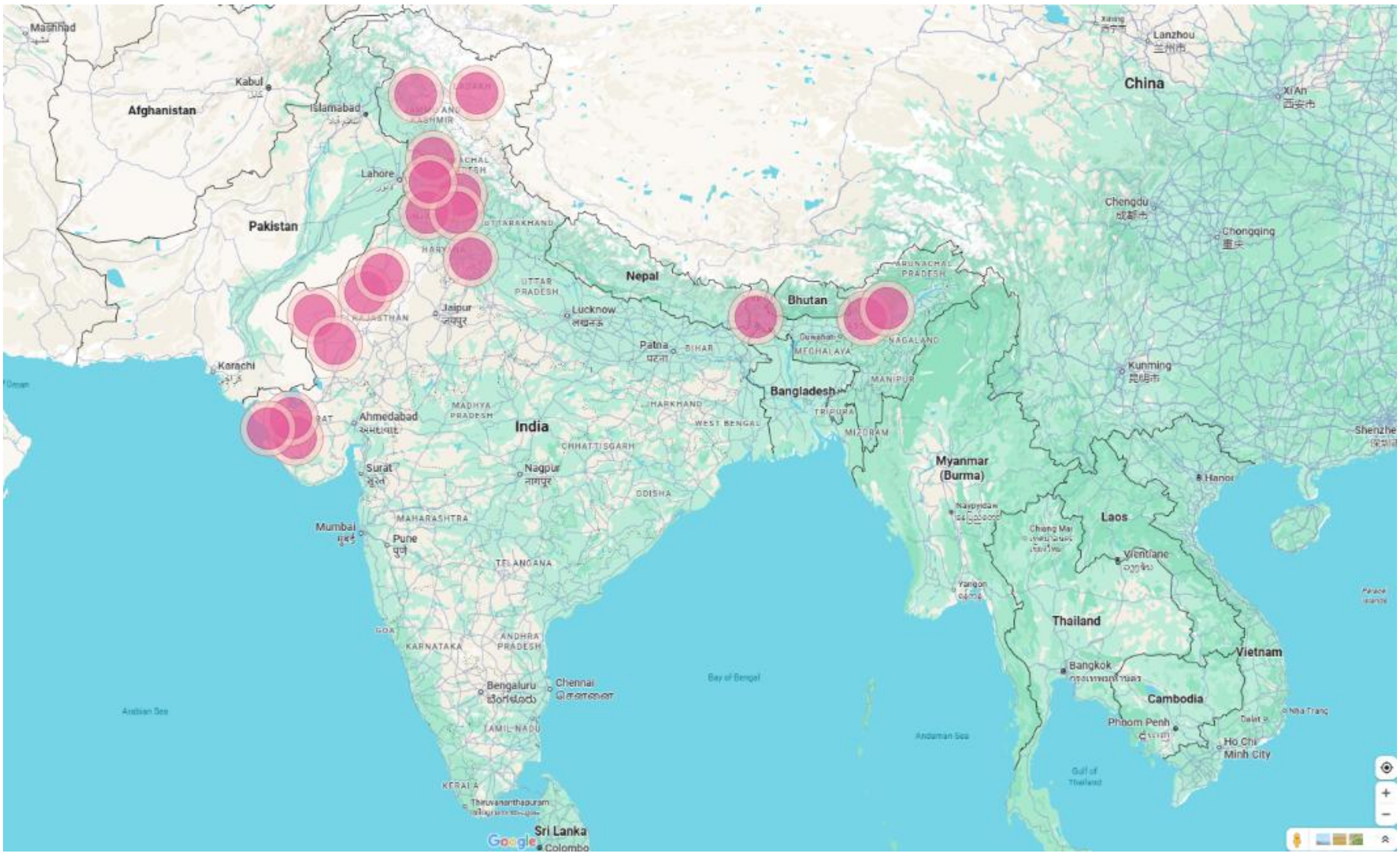
BARAK-8 MRSAM

India's BARAK-8 (MRSAM/LRSAM) is a jointly developed Indo-Israeli medium/long-range surface-to-air missile system. It provides 360° all-weather air-defence against aircraft, helicopters, unmanned aerial vehicles (UAVs), anti-ship and cruise missiles, and ballistic missile threats.

The missile was co-developed by India's Defence Research and Development Organisation (DRDO) and Israel Aerospace Industries (IAI) beginning in 2006, with production by Bharat Dynamics (BDL) in India and Rafael/IAI in Israel.

India has fielded BARAK-8 in naval (LR-SAM) and land (MR-SAM) variants: the Indian Navy's Project 15A/15B destroyers and the INS *Vikrant* carry the long-range version, while the Indian Air Force and Army have inducted the land-based MRSAM to protect key bases and border regions.

Figure 23: Current (expected) deployment of BARAK-8



SOURCE: INCRED RESEARCH

Missile types ➤

BARAK-8 (MR-SAM/LR-SAM)

The BARAK-8 is a two-stage, solid-fuelled medium/long-range SAM designed for both shipborne and land-based defence. Its development began with a 2006 Indo-Israeli agreement (about US$330m) to co-create a next-generation SAM. The naval version (also called LR-SAM) was first tested in 2015 and entered service around 2016, replacing the older BARAK-1 on Indian warships. The land variant (MR-SAM), jointly produced by DRDO and IAI with support from Indian industry, was test-fired in 2016 and inducted by the IAF/Army from 2021.

BARAK-8's operational role is to provide **point and area air defence** of critical assets. It defends airbases, cities, and naval task forces by intercepting hostile aircraft, UAVs, anti-ship and cruise missiles, and even short-range ballistic missiles. The missile's design features, including an active radar-homing seeker with thrust-vector control, a two-way datalink for mid-course guidance, and vertical launch capability for 360° coverage, give it high agility (≈30g) and quick reaction against saturated attacks. In tests, BARAK-8 interceptors have successfully engaged multiple high-speed targets in succession, demonstrating multi-target engagement under demanding scenarios.

BARAK-8ER (Extended Range)

The BARAK-8ER is an extended-range variant under development to supplement the standard BARAK-8. In this design, a larger booster stage increases the missile's engagement envelope to about **150km** (compared to 70–100km for the base missile). The ER missile is lengthened (launch length ~6m vs. 4.5m normally) and may incorporate a dual-pulse motor for added speed/endurance in mid-course. The mid- and terminal-phase guidance remains an active radar seeker with two-way datalink, as in the original variant.

BARAK-8ER's operational role will be to engage distant or high-altitude threats beyond the base missile's reach. It is intended to **knock down incoming targets well beyond the visual range**, for example, supersonic cruise missiles or longer-range aircraft approaching from afar, thus adding another layer beneath very-long-range systems like the S-400. The ER variant will automatically engage multiple beyond visual range threats, reflecting an emphasis on saturation and massed attack scenarios.

As of 2025, Barak-8ER remains in testing/development; once fielded, it should enable India to counter aerial threats up to ~150km. This extended reach would significantly enhance airspace denial, covering gaps between BARAK-8's ~100km range and the ~400km range of high-end S-400 batteries.

Figure 24: BARAK missile details

Parameter	Barak-8 (MR/LR-SAM)	Barak-8ER (Extended Range)
Maximum Range	100 km	150 km
Max. Altitude	16 km (operational)	30 km (estimated)
Speed	~Mach 2 (≈2,400 km/h)	~Mach 2+ (estimated)
Missile Weight	275 kg (body only, incl. 60 kg warhead)	≈300 kg (incl. booster, est.)
Warhead	60 kg high-explosive fragmentation	60 kg high-explosive fragmentation
Guidance	Inertial navigation + 2-way data link (mid-course); active radar homing (terminal)	Same guidance (INS + datalink; ARH)
Launch Platform	Vertical launch (ship VLS or mobile land launcher)	Same as Barak-8
Missiles per Launcher	8 (standard vertical launcher cell count)	8 (same launcher capacity)

SOURCE: INCRED RESEARCH

Akash missile

The **Akash** family of missiles was developed by DRDO under the Integrated Guided Missile Development Programme (IGMDP) and inducted into service in 2015. It is an indigenously designed medium-range SAM with a solid-fuel booster and ramjet sustainer.

The missile flies at about Mach 2.5, reaches altitudes near 18–20km, and carries a ~60kg high-explosive pre-fragmented warhead. Launch units can use either tracked (T-72 or BMP-2 chassis) or wheeled heavy trucks. Guidance is via radar command in mid-course and terminal active homing; the Mk-1S variant adds an indigenous seeker for higher kill probability.

An Akash battery consists of a 3D phased-array *Rajendra* radar and four launchers (3 missiles each) interlinked, giving each battery 12 ready missiles with up to four simultaneous intercepts (two missiles per target) and a single-shot kill probability around 88%.

Akash's role is area air defence of critical assets. It is a multi-target, all-weather SAM intended to neutralize fighter jets, helicopters, drones and cruise missiles. Two batteries (eight launchers) form an IAF squadron, and up to four batteries form an army regiment, coordinated by command centres. The *Rajendra* radar can automatically track dozens of threats (up to 64) and cue the launchers for quick engagement. Because the system is fully mobile (road/rail/air deployable) and uses indigenously produced components, Akash units can be rapidly redeployed to meet evolving threats. Akash batteries are deployed around key air bases, borders, and sensitive regions to provide a medium-range air-defence umbrella. With local production saving import costs, Akash bolsters India's self-reliant layered defence against aerial threats.

Figure 25: Current (expected) deployment of Akash

SOURCE: INCRED RESEARCH

Figure 26: Akash missile details

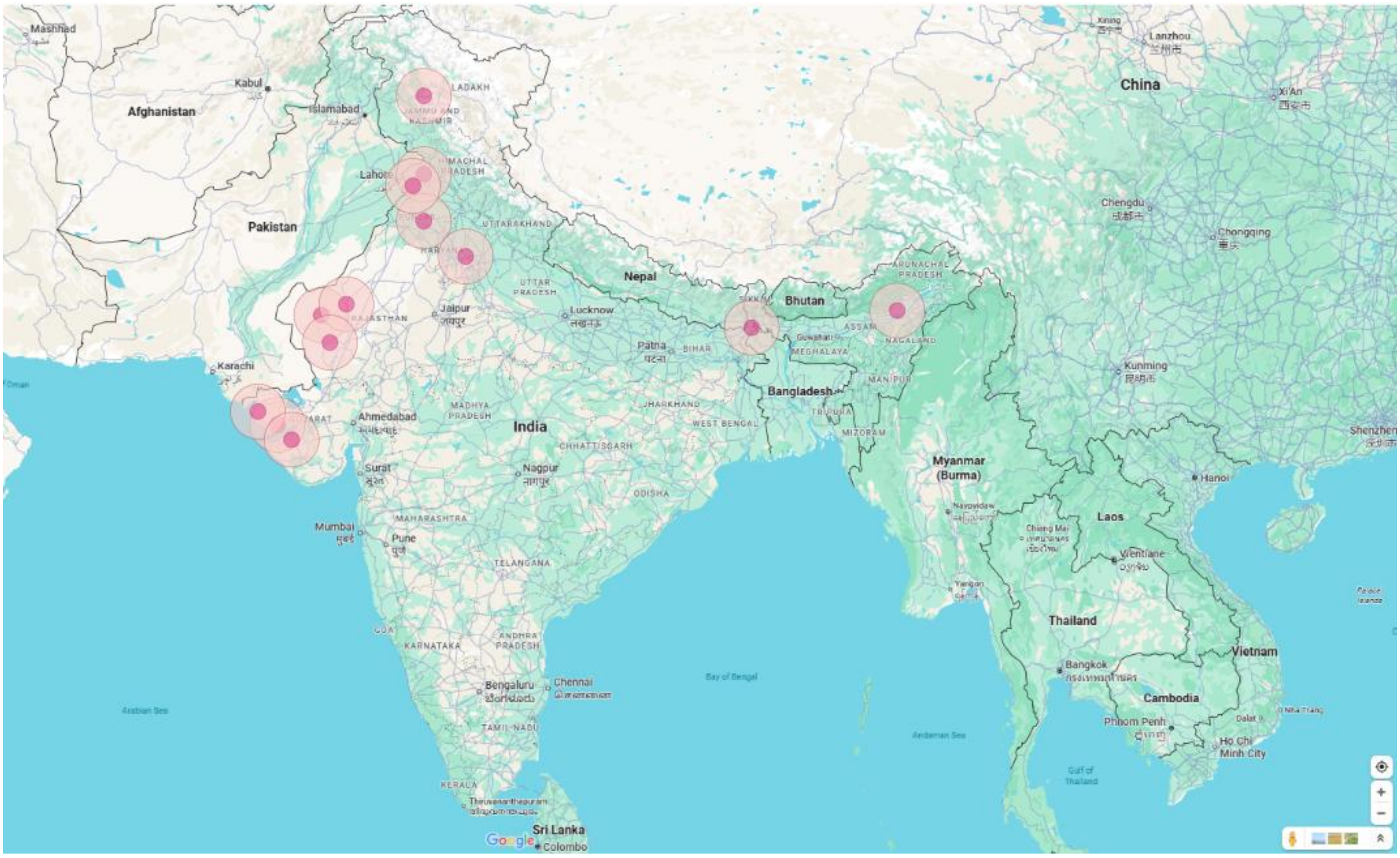
Specification	Value
Range (engagement)	30km
Max altitude	20km
Missile weight	720kg
Warhead	60kg
Guidance	Mid-course: command guidance / datalink. Terminal: indigenous active RF seeker (hybrid)
Launch platform	Tracked (T-72, BMP-2 chassis) or wheeled (Tata LPTA 8×8 truck)
Missiles per launcher	3
Simultaneous engagements	Engage ~4 targets with 8 missiles simultaneously; track up to 64 targets
Surveillance radar range	180Km
Fire-control radar range	80Km

SOURCE: INCRED RESEARCH

SPYDER (surface-to-air PYthon and Derby)

India acquired 18 SPYDER-SR batteries (six launchers each) under a 2008 contract. SPYDER units are deployed to protect key air bases and border sectors. For example, SPYDER-SR launchers have been fielded at northern airbases like Pathankot (Punjab) and Hashimara (West Bengal) as a part of a multi-tier air defence layer. In addition, SPYDER is being positioned along India's **western frontiers** facing Pakistan.

Figure 27: Current (expected) deployment of SPYDER



SOURCE: INCRED RESEARCH

SPYDER-SR

SPYDER-SR (Short Range) was jointly developed by Rafael and IAI in the early 2000s as a quick-reaction, low-altitude air defence missile system. It completed flight tests in 2005 and was aimed at countering threats like fighters, helicopters, UAVs and cruise missiles. India procured SPYDER-SR starting in 2008.

In operation, SPYDER-SR provides **point and area defence** of air bases and high-value targets. Its battery C2 and radar (EL/M-2106 ATAR) can detect low-flying threats and cue Python-5 IR missiles or Derby radar missiles to intercept. Key design features include *slant-launch* cans for 360° coverage (no vehicle turn needed), 'lock-on-after-launch' capability, and an all-weather C2. Using the same Python/Derby missiles as fighter jets maximizes commonality. India deployed SPYDER-SR to fill a gap below higher-tier systems - it can engage targets from 20m up to ~9km altitude and ~15km out, ideal for defending against low-level incursions or cruise missiles. Its mobility and quick reaction time let it cover advancing or dispersed forces.

SPYDER-MR

SPYDER-MR (Medium Range) is a longer-leg variant with booster-equipped missiles. Introduced later than SR, the MR extends SPYDER's engagement envelope – roughly **35–50km** range and up to ~20km altitude. This is achieved by adding a booster to the same Python-5 and Derby air-to-air missiles. Operationally, SPYDER-MR provides area defence coverage beyond SR's reach. Though India has so far fielded only SR units, the IAF has planned MR batteries to shield large airfields and border areas from stand-off threats. The MR's EL/M-2084 MMR radar enables wide-area surveillance and multiple target engagement, making it suitable for protecting critical assets. Like SR, SPYDER-MR is mounted on Tata truck launchers (eight-missile cells).

Figure 28: SPYDER missile details

Parameter	SPYDER-SR (short-range)	SPYDER-MR (medium-range)
Missiles Used	Python-5 (infrared-guided) and Derby (radar-guided)	Python-5 (with booster) and I-Derby ER (active-radar)
Maximum Range	~15 km	~35 km (up to ~50 km in practice)
Maximum Altitude	~9 km	~16 km (up to ~20 km)
Maximum Speed	Mach ~4 (for both Python-5 and Derby)	Mach ~4 (same missiles with boosters)
Missile Weight	Python-5: 105 kg; Derby: 118 kg	Same missiles (≈105 kg and 118 kg respectively) with booster
Warhead Weight	Python-5: 11 kg; Derby: 23 kg	Same warheads (11 kg and 23 kg)
Guidance	Python-5: dual-band IR/EO seeker; Derby: active radar	Same guidance (IR for Python-5, active radar for Derby)
Launch Platform	Tata Motors 4×4 high-mobility truck	Tata Motors 4×4 truck (same family as SR launchers)
Missiles per Launcher	4 (on a swiveling inclined launcher)	8 (on an 8-cell launcher vehicle)

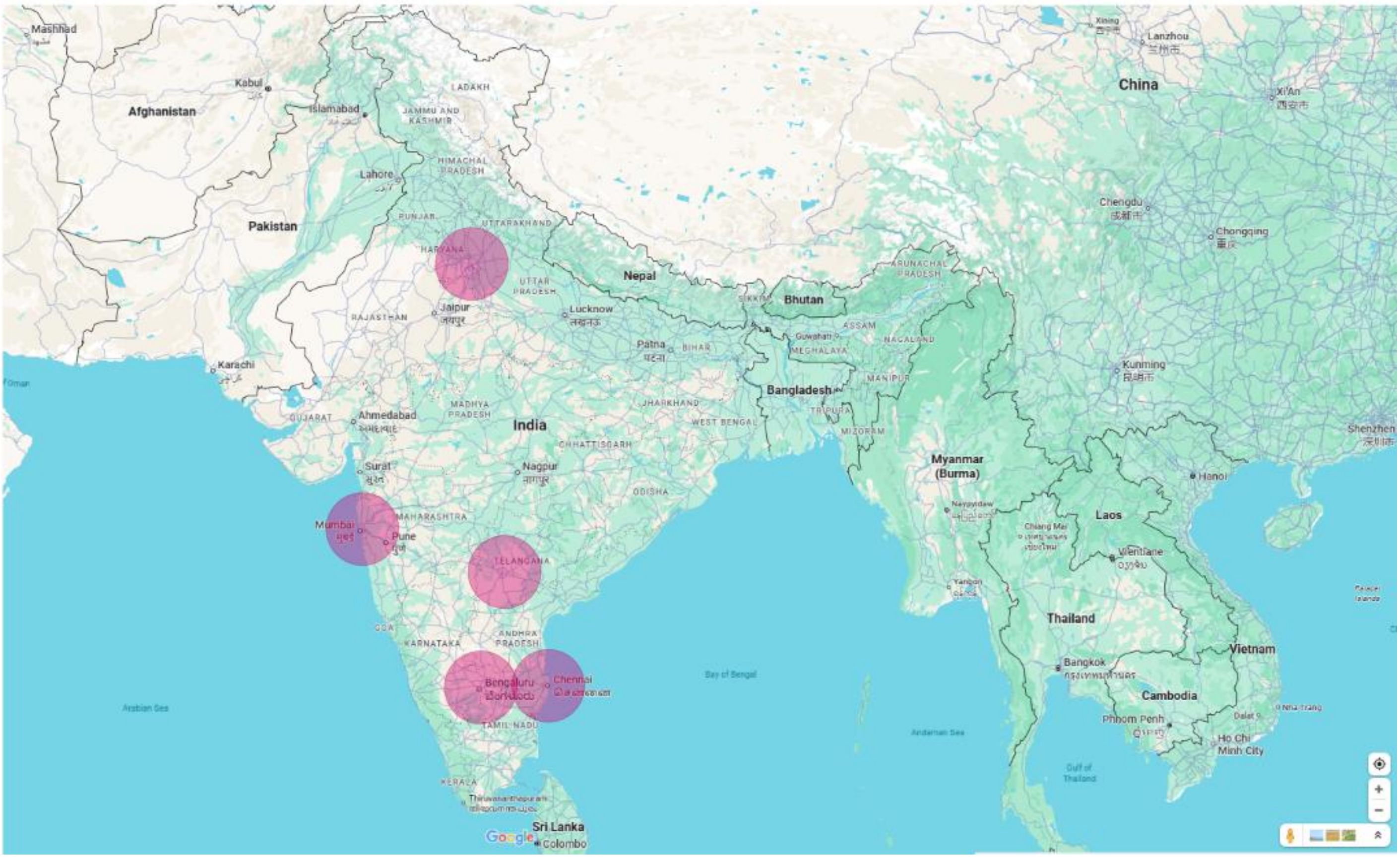
SOURCE: INCRED RESEARCH

Ballistic missile defence AAD/PAD

India's two-tier BMD Phase-I uses the **Prithvi Air Defence (PAD)** interceptor to engage incoming missiles **exo-atmospherically** (above ~50km) and the **Advanced Air Defence (AAD)** interceptor for **endo-atmospheric** (low-altitude) engagements. Targets are detected by long-range radars and satellites; the Mission Control Centre (MCC) classifies threats and assigns them to launch batteries. Launch Control Centres (LCCs) at each battery compute firing solutions and prepare the missile for launch. Multiple PAD or AAD missiles can be fired per target to improve kill probability. After launch, the interceptor receives mid-course updates via data link and then uses its onboard radar seeker for the final intercept.

Each PAD/AAD interceptor is built by Bharat Dynamics (BDL) as per DRDO design. The PAD's two-stage design gives long reach (able to engage MRBMs/IRBMs), while the AAD is a single-stage solid rocket optimized for high agility at lower altitude. Both use inertial navigation with frequent updates from ground radars (e.g. Swordfish LRTR) and carry active radar seekers for terminal homing.

Figure 29: Current (expected) deployment of AAD/PAD



SOURCE: INCRED RESEARCH

Radar and fire-control configuration

Target detection and tracking rely on dedicated BMD radars. The **Swordfish LRTR** (Long Range Tracking Radar) is an L-band AESA radar that currently detects and tracks ballistic missiles out to ~600–800km (future upgrades target ≈1,500km). It can spot very small objects at these ranges. A complementary **3D Multi-Function Control Radar (MFCR)**, developed with French support, provides fire-control for the endo-atmospheric AAD intercepts. The MFCR is an active phased array that can track multiple targets and guide AAD missiles, and it also has a role against aircraft up to ~30km altitude.

All sensor data (from Swordfish, MFCR, coastal surveillance radars and even satellites) is fed into the MCC. The MCC (a software-intensive command node) fuses the data, classifies targets, computes engagement solutions, and assigns threats to specific launch batteries. Each launch battery's LCC then receives the target cue and computes the precise intercept timing, preparing its missiles for launch. After launch, the MCC/LCC network maintains datalinks to update the interceptor, which activates its onboard radar seeker for the final homing and impact.

Deployment and unit organization

Phase-I BMD has been **deployed around India's strategic centres**. Delhi (NCR) and Mumbai were the initial coverage areas. We expect expansion to southern hubs, notably Bengaluru (Karnataka), Chennai (Tamil Nadu) and Hyderabad (Telangana) by setting up BMD sites that can reach these cities with their long-range radars and interceptors. (We assume *five* BMD regiments are covering Delhi, Maharashtra, Karnataka, Telangana, and Tamil Nadu.)

In the field, a PAD/AAD regiment or battery comprises multiple mobile launchers and support vehicles. Each AAD launcher (AAD Mobile Launcher System) is an all-terrain 12×12 truck carrying **six canistered AAD missiles** and its own Launch Control System.

PAD launchers similarly are heavy TEL trucks (8×8 chassis) with canisterized PAD interceptors. A typical battery will include several such launchers (each with 4–6 missiles), plus a Missile Control Centre and associated generators/communications. A Swordfish radar unit and an MFCR fire-control radar are co-located or networked with the battery. All elements are joined by a secure datalink network and a central Mission Control Centre on a nearby command post.

Figure 30: PAD/AAD missile details

Parameter	PAD (Prithvi Air Defence)	AAD (Advanced Air Defence, "Ashwin")
Layer (interception)	Exo-atmospheric (50–80 km)	Endo-atmospheric (≤30–40 km)
Target class (range)	MRBMs/IRBMs (~300–2000 km range)	Shorter-range ballistic (~150–200 km range)
Max interception altitude	≈80 km	≈30–40 km
Speed	~Mach 5 (hypersonic)	~Mach 4–4.5
Propulsion	Two-stage: solid first stage + liquid second stage	Single-stage solid rocket
Guidance	INS with LRTR mid-course updates; terminal active radar homing	INS + ground updates; terminal active radar seeker
Warhead	40 kg pre-fragmentation warhead, proximity-fuzed	80 kg (kinetic "hit-to-kill" vehicle)
Launcher	Mobile TEL on 8×8 truck (BEML-Tatra)	Mobile launcher on 12×12 truck with 6 canisters
Deployed interceptors	~75 (Phase-I stockpile)	~75 (Phase-I stockpile)

SOURCE: INCRED RESEARCH

Planned/recommended air defence systems

QRSAM

QRSAM is an indigenously developed, highly mobile short-range surface-to-air missile system built by DRDO/BEL/BDL to protect moving mechanised forces and forward formations against aircraft, helicopters, UAVs and precision munitions. Recent Defence Acquisition Council/Ministry of Defence approvals have authorised a procurement package at **Rs360bn** (coverage: 3 Army regiments + 3 IAF squadrons i.e., six units total). QRSAM is a canisterized, truck-mounted launcher with six missiles per launcher, active RF seeker, two-way datalink and dual radars for 360° coverage.

Figure 31: QRSAM system specifications

Parameter	QRSAM
Role / layer	Short-range, mobile point/area air defence
Range	~25–30 km (engagement)
Altitude (engage)	Up to ≈6–10 km
Missile length / weight	≈4.36 m; ≈270 kg
Warhead	Pre-fragmented / HMX-TNT style warhead
Propulsion / stages	Single-stage solid rocket motor
Guidance	Mid-course INS + two-way datalink; terminal active radar seeker (Ku/X-band monopulse seeker). Optical/laser proximity fuze for endgame.
Launcher	Mobile TEL (8×8 truck) with 6 canisterised missiles per launcher; designed for Search-on-Move / Track-on-Move / Fire-on-Move.
Radar / sensors	Battery Surveillance Radar (360° active array) + Battery Multi-Function Radar (tracking/fire-control); fully automated C2 & datalinked architecture.
Mobility & survivability	Designed for on-the-move operation with all-terrain trucks; ECCM features to resist jamming.

SOURCE: INCRED RESEARCH

Figure 32: Phase-1 expected deployment of six regiments (Rs360bn)

	Service	City (State/UT)
1	Army	Ambala (Haryana)
2	Army	Jaisalmer (Rajasthan)
3	Army	Leh (Ladakh, UT)
4	IAF	Ambala (Haryana) — IAF Station Ambala
5	IAF	Jodhpur (Rajasthan) — IAF Station Jodhpur
6	IAF	Tezpur (Assam) — IAF Station Tezpur

SOURCE: INCRED RESEARCH

Figure 33: Phase-2 expected deployment of eight regiments (Rs480bn)

	City (State)	Primary co-located asset / corps
1	Srinagar (J&K)	Srinagar AFB / Northern valley logistics
2	Barmer (Rajasthan)	Forward desert forces (Barmer/Phalodi axis)
3	Bhuj (Kutch, Gujarat)	Kutch mechanised formations / western naval approaches
4	Jalandhar / Amritsar (Punjab)	2nd western Army concentration / Punjab corps nodes
5	Siliguri (West Bengal)	Siliguri Corridor / Bagdogra AFB
6	Guwahati / Tezpur (Assam)	NE corps staging / Tezpur & Guwahati airbases
7	Bareilly / Lucknow (Uttar Pradesh)	Central mobile reserve / lines of communication
8	Udhampur (Jammu & Kashmir)	Jammu front / forward logistics toward Ladakh

SOURCE: INCRED RESEARCH

The QRSAM missile is a single-stage solid-propellant interceptor (≈4.36 m / ≈270 kg) with a 25–30km effective range and terminal active RF seeker (Ku/X band) plus an optical proximity fuze. Each launcher is a truck-mounted TEL carrying six canisterized missiles and working with Battery Surveillance and Multi-Function radars to provide 360° detect-track-engage capability. The weapon is optimized for 'search-on-move / track-on-move / fire-on-move' operations, enabling mobile units to retain layered air defence while on the march.

Figure 34: Financial model (expected investment by 2035F)

Financial Model	
Total QRSAM regiment order	84000
Total Regiments	14
Battries per regiment	3
Launchers per battery	4
Canisters per launcher	6
Missles ready for engangement per battery	24
Missles ready for engangement per regiment	72
Total actove deploymenet missiles	1008
Reserve missles (Assumed 2x)	2016
Per missile cost (Assumed similar to Akash 25mn)	50.4bn
Lifecycle/Maintenance cost (Assumed 20% of the overall cost)	178bn
Total Project Cost	1.07tn

SOURCE: INCRED RESEARCH

KUSHA

Project KUSHA is India's indigenous, long-range, layered air defence program developed by DRDO. Approved in 2022 with an outlay of ~Rs217bn, it aims to field mobile missiles and radars capable of intercepting stealth fighters, cruise missiles, drones and even ballistic targets well beyond current systems.

KUSHA is intended to complement existing systems (Akash, BARAK-8, S-400) and bridge the gap to India's Ballistic Missile Defence (BMD) missiles.

It features three interceptor variants (M1, M2, M3) with ranges roughly 150km, 250km, and 350 – 400km, respectively (Phase II may extend the range beyond 600km).

KUSHA's development is largely indigenous, fitting India's Make-in-India defence goals. It is envisioned as a mobile, area-defence shield for vulnerable regions and strategic and tactical assets across India.

By giving India a domestic long-range SAM, KUSHA aims to reduce the reliance on imports and address both Pakistani and Chinese threats.

Radar and sensor systems

KUSHA's long range requires **advanced radars**. In addition to integrating existing sensors, DRDO is developing a new S-band long-range radar (Long Range Battle Management Radar or LRBMR) and high-frequency fire-control radars. The LRBMR will be a powerful S-band AESA radar with *500+ km* detection range. Early-warning and multi-domain surveillance will be provided by such radars (scanning ~500–600 km). Fire-control will use high-resolution X-band AESA radars (for example, shipborne LRSAM fire-control radars scaled up for land use), tracking targets in the 300–600km engagement zone

Figure 35: Financial model (expected investment by 2035F)

Financial Model	
Total Kusha regiment order	8
Total Regiments	8
Battries per regiment	2
Launchers per battery	4
Canisters per launcher	4
Missles ready for engangement per battery	16
Missles ready for engangement per regiment	32
Total actove deploymenet missiles	256
Reserve missles (Assumed 2x)	512
Per missile cost (Assumed costlier to Akash 25m/Assumed 35m)	17.9bn
Lifecycle/Maintenance cost (Assumed 20% of the overall cost)	3.58bn
Total Project Cost	661.5bn

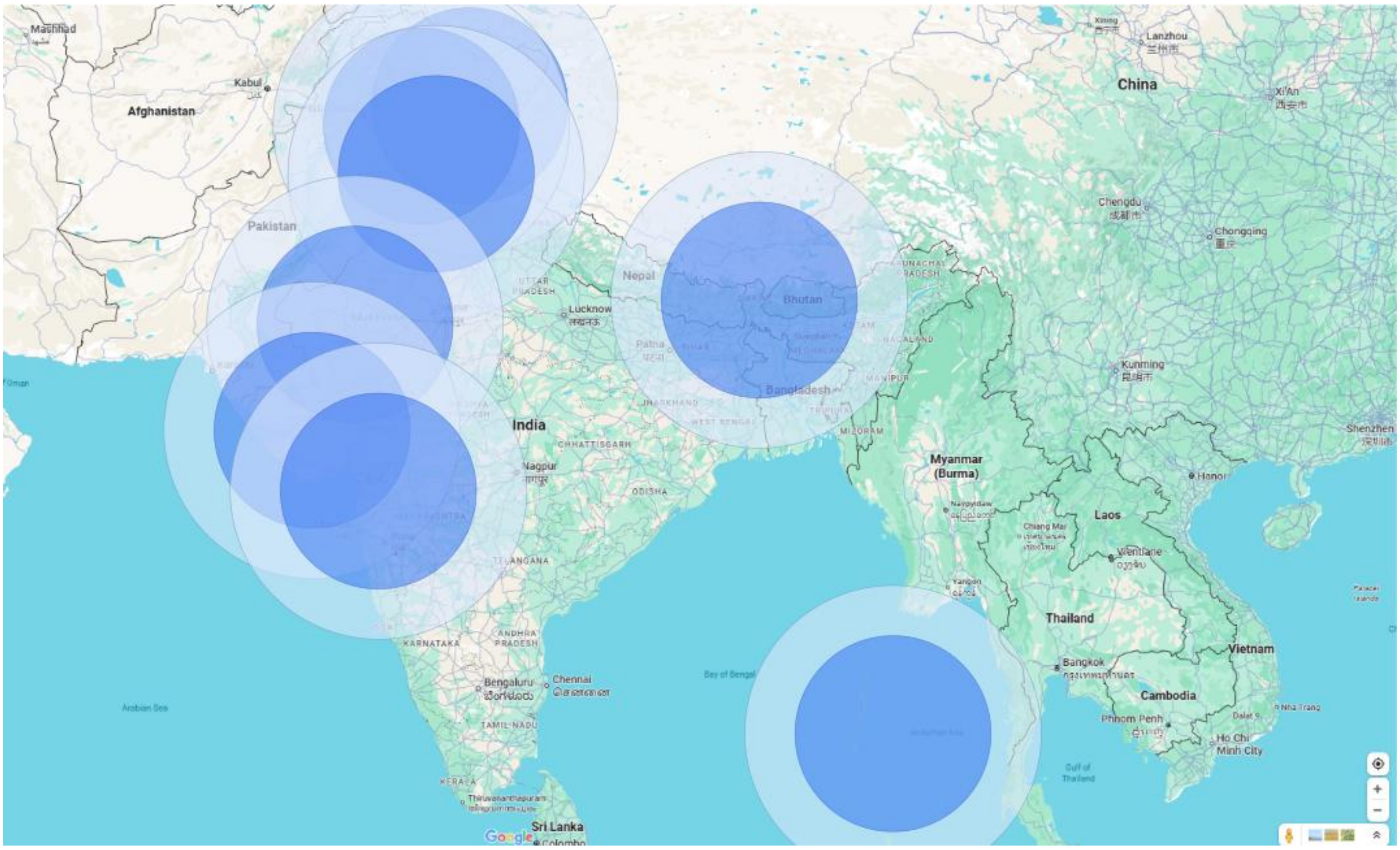
SOURCE: INCRED RESEARCH

Figure 36: Expected KUSHA regiment placement

#	State / UT	Suggested Location (base / district)
1	Ladakh (UT)	Leh sector (near Leh / DBO approach)
2	Jammu & Kashmir (UT)	Srinagar / Awantipora axis
3	Punjab / Haryana	Ambala / Jalandhar / Patiala belt
4	Rajasthan	Barmer / Jaisalmer sector
5	Gujarat	Kutch / Bhuj region
6	West Bengal	Siliguri / North Bengal (Siliguri Corridor)
7	Maharashtra	Mumbai / Pune region (Borivali or Khadakwasla area)
8	Andaman & Nicobar Islands (UT)	Port Blair / Car Nicobar

SOURCE: INCRED RESEARCH

Figure 37: Expected deployment of KUSHA



SOURCE: INCRED RESEARCH

Akash Prime

Akash Prime is an advanced, indigenously upgraded medium-range mobile SAM developed by DRDO. It builds on India's Akash missile family with enhancements for high-altitude precision. The system is designed for deployment on both tracked (Army) and wheeled (Air Force) launchers and integrates with India's radar network.

Akash Prime incorporates several upgrades over the legacy Akash Mk-I/1S systems. Importantly, it adds an indigenous active RF seeker (versus the older semi-active or Mk-IS seeker). This enables the missile to emit RF beams and home in autonomously on fast targets during the terminal phase, greatly improving kill probability under countermeasures. Other enhancements address high-altitude performance, and the Prime variant is customized for reliable operation above 4,500m in thin air and cold climates.

Despite these upgrades, the engagement envelope (range ~30km, ceiling ~20 km) and 60kg warhead remain similar to the earlier Akash Mk-I/1S. The radars (Rajendra and BSR) and launchers are essentially of the same design, and so Prime retains the multi-target engagement and networked C2 features of its predecessor. Akash Prime delivers key qualitative improvements (active seeker, altitudes, ECCM) without changing the basic performance parameters.

Figure 38: Technical Specifications of Akash Prime

Specification	Value
Range (engagement)	30km
Max altitude	20km
Missile weight	720kg
Warhead	60kg
Guidance	Mid-course: command guidance / datalink. Terminal: indigenous active RF seeker (hybrid)
Launch platform	Mobile launcher (army: tracked/T-72/BMP derivatives; air force: wheeled 8×8 trucks)
Missiles per launcher	3
Simultaneous engagements	Engage ~4 targets with 8 missiles simultaneously; track up to 64 targets
Surveillance radar range	80Km
Fire-control radar range	60Km

SOURCE: INCRED RESEARCH

Akash Prime plays a critical mid-tier role in India's multi-layered air defence network. It bridges the gap between short-range point defences (e.g. guns, MANPADS, CIWS) and long-range strategic systems (e.g. S-400 SAMP/T, fighter interceptors). Integrated into the Integrated Air Command & Control System (IACCS), Akash batteries work in concert with other sensors and shooters. For example, Rajendra radars cue the Akash missiles upon target data from long-range 3D radars, and all units link to the IACCS ground picture.

Because each Rajendra can guide eight missiles against four targets at once, an Akash battery can intercept salvoes of enemy jets or UAV swarms in real-time. This capability was demonstrated in recent trials and exercises. For instance, Akash Prime batteries scored direct hits on two fast-moving targets at 15,000 feet (4,500 m) in Ladakh. The system has also been fielded during Operation Sindoor, where it helped counter Pakistani drones and Chinese-origin aircraft under a multi-layered response. Akash Prime's networked radars and multi-engagement missiles significantly bolster India's defensive curtain over high-altitude and frontier airspace.

Figure 39: Financial model of Akash Prime (Rs)

Financial Model	
Total Akash regiment order	2
Total Regiments	2
Battries per regiment	4
Launchers per battery	4
Canisters per launcher	3
Missles ready for engangement per battery	12
Missles ready for engangement per regiment	48
Total actove deploymenet missiles	96
Reserve missles (Assumed 2x)	192
Per missile cost (Assumed similar to Akash 25mn)	4.8bn
Lifecycle/Maintenance cost (Assumed 20% of the overall cost)	0.96bn
Total Project Cost	87.36bn

SOURCE: INCRED RESEARCH

SBS 3

India's SBS-3 (Space-Based Surveillance Phase-III) program will field a 52-satellite constellation by 2029 to give India round-the-clock military surveillance. In Oct 2023, the Union Cabinet cleared SBS-3 at a budget of Rs269.68bn.

Under this plan, 21 satellites will be built by ISRO (in collaboration with France) and 31 by Indian private companies. The first launch is expected by Apr 2026F, with the full constellation deployed by end-2029F.

All satellites will operate in low earth orbit (LEO) (with some in geostationary orbit for wide-area coverage) and be equipped for optical and radar imaging. They will carry advanced sensors with AI-enabled inter-satellite networking to rapidly share data. Collectively, SBS-3 will provide much higher revisit rates and image resolution than earlier spy sats, enabling persistent monitoring of border areas, adversary bases, and critical maritime zones.

Existing defence satellites

India's space-based military surveillance dates to the early 2000s. SBS Phase-I (2001–2002) launched four satellites (Cartosat-2A, Cartosat-2B, Israel's EROS-B and RISAT-2) for all-weather border monitoring. These delivered ~1 m resolution imagery that proved useful in the 2001–02 India-Pakistan standoff. SBS Phase-II (approved 2013) added six more satellites (Cartosat-2C/D, Cartosat-3A/B, Microsat-TD, RISAT-2A) to increase imaging frequency and capability. Alongside SBS sats, India also operates dedicated defence spacecraft: e.g. GSAT-7 (2013) for naval communications with a 2,000 nm Indian Ocean footprint, and GSAT-7A (2018) for air force networked communications. The navy also uses a hyperspectral observatory HySIS (launched 2018) for oceanic surveillance, and the DRDO-developed EMISAT (2019) for electronic intelligence. New military commsats like GSAT-7B (Army) and GSAT-7R (Navy) are in development (GSAT-7B's 5-tonne multi-band satellite was contracted in 2023 for Rs29.63bn). These existing systems form the backbone of India's space assets; SBS-3 will add a much larger imaging and reconnaissance layer atop this.

InCred Equities

SBS-3 constellation details

Phase-III represents a step-change in capability. The 52 satellites will include both optical and radar sensors, with some geostationary nodes for instant broadband relay. The constellation will support multiple functions, high-resolution imaging, electronic/communications intelligence, and maritime reconnaissance. For example, part of the constellation is explicitly for SATCOM links to long-range drones (e.g. MQ-9B UAVs) and naval assets. All satellites will feature modern processors and onboard AI to autonomously detect targets and route imagery/data to operators.

India will co-develop 21 satellites with French partners under a defence cooperation pact, while Indian private players will supply the remaining 31. This public–private model is unprecedented for Indian defence space, marking “nearly half” of the constellation being built by industry.

Strategic and military relevance

SBS-3 is explicitly aimed at shrinking India’s decision loop and gaining an edge in modern warfare. India must detect, identify and track potential threats when they are still in their staging areas, airfields and bases deep within an adversary’s territory.

By covering much larger areas of China, Pakistan and the Indian Ocean with superior resolution and much shorter gaps between revisits, the SBS-3 constellation will enable precisely that. It underpins a new military space doctrine that emphasizes persistent ISR (intelligence, surveillance, reconnaissance) from space. In a recent conflict ,Operation Sindoor, the armed forces relied heavily on Cartosat optical and foreign commercial satellites to guide strikes, SBS-3 will provide a dedicated Indian capability for such missions, improving the observe-orient-decide-act cycle.

AWACS Systems

Airborne Warning & Control Systems (AWACS) give the IAF a critical over-the-horizon view that ground radars lack. Flying at high altitude, AWACS radar can look down to spot low-flying aircraft, missiles or stealthy targets hidden by terrain or curvature of the Earth. They act as airborne command centres, tracking hundreds of targets and coordinating fighters and SAMs in real time.

AWACS dramatically expand detection range and situational awareness beyond what ground stations alone can cover. For example, studies note that at ~30,000 ft an AWACS can monitor low-level activity up to ~500km, whereas fixed radars can be blanked by mountains or the horizon. Likewise, modern AWACS with advanced AESA/GaN radars can detect low-RCS (stealthy) aircraft at much greater distances than legacy systems.

AWACS have proved force-multipliers: they can simultaneously track ~100 targets and cue interceptors on half of them, greatly multiplying the effectiveness of the same number of fighters.

Current IAF AWACS fleet and capabilities

As of 2025, India’s Air Force operates a very limited AWACS fleet, just six aircraft.

3 Israeli Phalcon AWACS: EL/W-2090 AESA radars mounted on Russian Ilyushin IL-76 A-50EI heavy transports. These provide 360° coverage and roughly 400km detection range. The three Phalcon jets were delivered between 2009–2011. They serve as India’s primary AWACS but have aging airframes and heavy maintenance needs (due to Russian components)

3 DRDO Netra Mk1 AEW&C: Indigenous AESA radars (two dorsal arrays) on Brazilian Embraer ERJ-145 regional jets. These give ~240° coverage (no nose array) and roughly 200–450km range (depending on target RCS). Netra Mk1 entered service around 2017–2019. These platforms (an ‘AEW&C’ system) were built by DRDO/CABS in collaboration with Hindustan Aeronautics (HAL) and provide tactical early warning. The Netra Mk1 fleet was used effectively in recent

operations (Balakot 2019 and Operation Sindoor 2025) to fuse data and cue fighters.

Planned AWACS inductions

Recognizing the shortfall, India has approved two major AEW&C programs to build up the fleet under its Aatmanirbhar push. These add 12 new AWACS by the early 2030s (plus proposals for even more):

Netra Mk1A (Embraer ERJ-145) – An upgraded AEW&C based on the existing Embraer 145. Six more Embraer 145 airframes will be procured and retrofitted with new GaN-based AESA radar and enhanced mission systems. This Rs90bn project (DAC-cleared in 2025) will nearly triple the IAF's ERJ-145 AWACS fleet. Deliveries are expected within five years, giving 240° coverage with ~450km range per aircraft.

Netra Mk2 (Airbus A321) – A larger AEW&C on six former Air India A321 airliners. Approved by CCS in 2025 for ~Rs190bn, the Mk2 will carry a dorsal AESA radar (GaN-based) plus a nose AESA for ~300°–360° coverage. This upgrade yields longer endurance, maritime domain tracking, and ballistic missile detection. First deliveries are planned around 2030–33.

(India had also proposed an AWACS-India (A330) project – 6 AESA-equipped A330 platforms for full 360° coverage – but that has stalled. Initially 2 were cleared for Rs51.13bn (2015) and six more estimated at Rs200bn, yet it remains unfunded)

Figure 40: AWACS planned and their financials

Program / System	Base Aircraft	Units	Cost (₹)	Status
Netra Mk1A (DRDO AEW&C)	Embraer ERJ-145	6	90bn	DAC-cleared 2025
Netra Mk2 (DRDO AEW&C)	Airbus A321	6	190bn	CCS-approved 2025
AWACS-India (A330 AWACS)	Airbus A330	6	200bn	2 cleared (2015), 6 planned; delayed

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Radar systems for BMD and stealth defence

India's two-front threat demands a multi-layered radar network for ballistic missile defence, from early warning to mid-course tracking and final discrimination and stealth detecting VHF radars. Key systems include indigenous and procured radars covering VHF to microwave bands.

Surya VHF radar (indigenous anti-stealth radar)

Surya is India's indigenous very-high-frequency (VHF) three-dimensional surveillance radar designed primarily to defeat low-observable targets and provide broad early surveillance. Operating at metre wavelengths, Surya exploits long-wave scattering characteristics that make it resilient against shaping and radar-absorbent materials used in modern stealth designs; this allows it to detect and track targets that would be much harder to see for higher-frequency radars. The system is built on a mobile, truck-mounted active phased-array architecture and can perform continuous 360° azimuth coverage with persistent staring modes when required. In the ballistic missile defence (BMD) context Surya's main value is spectral diversity and horizon extension: while it is optimized for detecting stealth fighters and cruise missiles, its VHF band is also capable of sensing large-signature events such as a missile boost plume or a heavy re-entry body that may be less visible at X- or Ku-band. This capability provides an additional, independent cue for launch detection during the boost and early mid-course phases and thus contributes to a layered, multi-spectral sensing strategy. Being largely indigenous, Surya also brings operational flexibility — units can be re-deployed to cover northern or western approaches in a two-front scenario — and reduces single-vendor dependencies in India's sensor mix. The program's fielding adds a complementary long-wavelength "wall" to India's radar architecture and helps close gaps that higher-frequency precision trackers can miss, especially against stealthy and low-flying threats.

Figure 41: Unit estimation

Parameter	Value
Detection radius (Surya, VHF)	360 km (reported figure for RCS ~2 m²)
Radial diameter per radar (2×R)	720 km
Terrain adjustment factor (accounts for mountains/coverage losses)	0.83 (assumption → effective linear coverage = 720 × 0.83 = ~598 km)
Planned adjacency overlap / redundancy factor	0.80 (20% overlap between adjacent radars for seam-free coverage)
Effective linear coverage per radar (used)	≈480 km (598 × 0.80 ≈ 480)
India–Pakistan linear border	3,320 km (rounded)
India–China LAC	3,488 km (rounded)
Existing Surya units (public / delivered)	6 units (contract for 6; 1st delivered)
Redundancy/depth multiplier for rear-area & maritime coverage	1.50 (to provide depth, rear coverage, redundancy & coastal approaches)

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Figure 42: Financial estimation

Front / category	Computed radars required
Pakistan front (linear spacing)	7
China front (linear spacing)	8
Linear total (both fronts)	15
With redundancy/depth (×1.5)	23
Already-delivered / contracted	6
Additional Surya radars expected to procure	17
Total Cost	7.5bn

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Voronezh over-the-horizon (OTH) radar

The Voronezh family represents a strategic, over-the-horizon early-warning capability based on long-wave sky-wave propagation through the ionosphere; India's discussions to acquire a Voronezh-class OTH radar therefore reflect a decision to acquire very long-range launch detection and strategic warning depth. By bouncing HF/VHF signals off the ionosphere, an OTH radar can detect missile launches and large aerial activity thousands of kilometres beyond the line of sight of ground radars, giving national command authorities minutes of additional warning for distant launches. For BMD this means cueing of tracking radars and interceptors well before the incoming threat reaches Indian airspace: Voronezh can detect boost-phase signatures from strategic and theatre ballistic missiles far from the coastlines or borders and provide continuous, wide-area surveillance for mid-course tracking of high-altitude objects. The system's technical trade-offs — reliance on ionospheric conditions and lower spatial resolution than line-of-sight AESA trackers — are balanced by its unrivalled range, which is precisely the capability India needs to cover distant threat corridors, especially those from deep inland launch sites. Operationally, having OTH coverage oriented toward both western and eastern theatres would materially increase the reaction time available to India's BMD layers in a two-front conflict, permitting earlier handoff to long-range trackers and space/air assets and improving interceptor cueing and allocation decisions during massed or staged launches.

Figure 43: Technical details and cost estimation

Item	Data / explanation
System name	Voronezh
Primary role	Strategic early warning: detect and track ballistic missiles, ICBMs/IRBMs, strategic aircraft, and space objects at very long ranges (boost/midcourse detection)
Range / horizon	~8,000–10,000 km (vertical up to ~8,000 km; horizon ≈6,000 km for high-altitude targets) Capable of tracking hundreds of objects concurrently.
Typical functions included	Large phased-array antenna(s), long-range search, object discrimination, space-tracking secondary function, fixed hardened site with substantial infrastructure.
Typical deployment footprint	Very large, fixed installation ("wall-like" antenna arrays); substantial land, power, infrastructure and protected compounds required.
Per unit cost	332bn
Total units estimated	2
Total estimated cost	664bn

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Super Swordfish long-range tracking radar (LRTR-II)

Super Swordfish is India's high-performance long-range tracking radar developed for mid-course surveillance and fire-control support within the BMD architecture. As an L-band active electronically scanned array (AESA), Swordfish emphasizes long-range detection, robust multitarget tracking, and the ability to support discrimination and track continuity for multiple high-velocity objects. It functions as the primary mid-course "workhorse" that transitions detection information from strategic early-warning sensors into precise, trackable state vectors that fire-control centres and interceptors can use. The radar's extended range and AESA beam agility enable it to follow objects through exo-atmospheric portions of trajectories, maintain simultaneous tracks on numerous objects and potential decoys, and provide the coarse-to-fine handoff to higher-frequency, high-resolution fire-control radars closer to engagement points. In practical terms, Super Swordfish increases the lead time available to the interceptor decision cycle, refines predicted intercept windows, and improves the probability of successful engagements in mid-course intercepts. Its resilience to jamming and ability to operate continuously against dense target sets make it especially valuable when facing advanced threats such as multiple independently targetable re-entry vehicles (MIRVs) or when simultaneous launches occur from two directions in a two-front contingency.

Very long range tracking radar (VLRTR)

The Very Long Range Tracking Radar is intended to push India's ground-based tracking envelope still farther, providing deep mid-course and near-space surveillance well beyond conventional long-range trackers. Designed around high-power, GaN-based AESA technology, VLRTR aims to sustain high signal-to-noise tracking on objects at very long ranges and to feed continuous, long-arc tracks for strategic objects, including ballistic warheads during their mid-course phases and space objects of interest. Where Super Swordfish provides theatre-level mid-course tracking, VLRTR is conceived as the strategic tracking bedrock that reduces dependence on single passes and provides longer dwell times on targets, improving discrimination between actual warheads and decoys through extended observation. Its ability to monitor objects at extreme ranges is particularly important when addressing threats from deep launch sites or when multiple engagements must be sequenced over long flight times. Integrating VLRTR data with OTH and space-based sensors strengthens the overall track file, enabling the mission control architecture to produce more reliable engagement solutions and to prioritize interceptor allocation under stress.

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InCred Research Services Private Limited
Research Analyst SEBI Registration Number: INH000011024
Registered Office: Unit No 1203, 12th Floor, B Wing, The Capital, C-70, G Block, BKC, Bandra (E), Mumbai – 400051
Phone: +91-22-6844-6100
Corporate Office: 05th floor, Laxmi Towers, Plot No. C-25, G Block, Bandra – Kurla Complex, Bandra (East), Mumbai – 400051
Phone: +91-22-4161-1500
Name of the Compliance Officer: Mr. Mayuresh Kadam
Email ID: compliance@incredresearch.com, Phone No: +91-22-41611539
For any queries or grievances, you may contact the Grievance Officer.
Name of the Grievance Officer: Mr. Rajarshi Maitra
Phone no. +91-022-41611546
Email ID: rajarshi.maitra@incredresearch.com
CIN: U74999MH2016PTC287535

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Add	The stock's total return is expected to exceed 10% over the next 12 months.
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Reduce	The stock's total return is expected to fall below 0% or more over the next 12 months.

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Neutral	A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
Underweight	An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

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Neutral	A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
Underweight	An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.