

NEXT IAS

India's Defence & Satellite Advancements

Context:

- **India will launch the first of the proposed 52-satellite based surveillance constellation by April 2026, with efforts underway to speed up the entire deployment timeline.**



1. What is the SBS-III programme?

- In October 2024, the **Prime Minister Narendra Modi-led Cabinet Committee approved \$3.2 billion** for the phase III of its **Space Based Surveillance (SBS) mission for better land and maritime domain awareness for civilian and military applications.**
- Under the programme, **ISRO will manufacture and launch the first 21 satellites**, while **private companies will handle the remaining 31.**
- The project is being handled by the **National Security Council Secretariat** along with the **Defence Space Agency** under the integrated headquarters in the **Defence Ministry.**
- During **Operation Sindoor**, **satellite-based surveillance helped Indian defence forces to act swiftly** by offering accurate intelligence, including the **trajectory and movement of drones and missiles.**
- After the **successful implementation of SBS-III, India will become more self-reliant** and **reduce its dependence on other countries.**
- It will help focus **more clearly and accurately on the Pakistan and China border** and the **Indian Ocean Region.**

2. Mention applications of military satellites in India's defence?

- In the military domain satellites have helped in providing a better **C4ISR (Command, Control, Communication, Computers, Intelligence, Surveillance and Reconnaissance) systems.**

PROVIDES INDIA WITH ASSURED NAVIGATION SERVICE FOR VITAL CIVILIAN & MILITARY APPLICATIONS WITHOUT HAVING TO DEPEND ON ANOTHER COUNTRY; FIRST SATELLITE TO BE LAUNCHED ON JULY 1; REMAINING 6 BY 2015

IRNSS: INDIAN REGIONAL NAVIGATION SATELLITE SYSTEM

7 SATELLITES

3 GEOSTATIONARY

4 GEOSYNCHRONOUS

ORBIT ALTITUDE **36,000** KM

COST **₹ 1,420** CRORES

Covers India and up to **1,500** km beyond its borders

3 extremely accurate rubidium atomic clocks in each satellite

GPS receivers will not work; need special receivers (yet to be developed)

IRNSS provides Standard Positioning Service

Open to all users

Accuracy better than 20 metres

4 satellites in geosynchronous orbit – in pairs, move in two inclined orbits – appear from ground to travel in figure '8' – assist in accurate position determination

3 satellites in geostationary orbit – appear from ground to be at fixed positions in the sky

Applications	Description
Communication	<ul style="list-style-type: none"> • Satellite communication has helped Indian defence forces in overcoming several geographical barriers which separate its far flung formations both during peace and war. • Established in 1983 INSAT series satellites are being extensively used for communication. • GSAT-17 joined the constellation of INSAT System consisting 15 operational satellites, namely – INSAT-3A, 3C, 4A, 4B, 4CR and GSAT-6, 7, 8, 9, 10, 12, 14, 15, 16 and 18.
Navigation	<ul style="list-style-type: none"> • Navigation is a major requirement of the personnel and several weapon platforms of the defence forces. .

	<ul style="list-style-type: none"> • India has designed and developed its own navigation systems <ul style="list-style-type: none"> ▪ GPS Aided GEO Augmented Navigation (GAGAN) for civil aviation. ▪ Indian Regional Navigation Satellite System (IRNSS): NavIC for others including defence forces. • ISRO has built a total of nine satellites in the IRNSS series. • Three of these satellites are in geostationary orbit (GEO) while the remaining four in geosynchronous orbits (GSO) that maintain an inclination of 29° to the equatorial plane.
<p>Earth Observation</p>	<ul style="list-style-type: none"> • Starting with IRS-1A in 1988, ISRO has launched many operational remote sensing satellites. • Today, India has one of the largest constellations of remote sensing satellites in operation. • Currently, thirteen operational satellites are in Sun-synchronous orbit – RESOURCESAT-1, 2, 2A CARTOSAT-1, 2, 2A, 2B, RISAT-1 and 2, OCEANSAT-2, Megha-Tropiques, SARAL and SCATSAT-1, and four in Geostationary orbit-INSAT-3D, Kalpana & INSAT 3A, INSAT - 3DR.
	<ul style="list-style-type: none"> • The Cartosat satellite has the ability to provide defense forces with specific scene-spot imagery and images according to the military's area of interest and help track developments along India's land borders with China and Pakistan.

<p>Exclusive Military Satellites</p>	<ul style="list-style-type: none"> Space now includes and will include for many years to come the military functions such as surveillance, reconnaissance, early warning, survivable C4I, detection, targeting, weapon control, weapon delivery and target damage assessment. <div data-bbox="540 527 1390 1455" data-label="Image"> </div> <ul style="list-style-type: none"> India's exclusive military satellites include GSAT-7 (Rukmini) for the Navy and GSAT-7A for the Air Force, enhancing their network-centric warfare capabilities.
<p>Weather Forecast</p>	<ul style="list-style-type: none"> Most military operations during peace and war are affected by weather conditions in more than one ways.

	<ul style="list-style-type: none"> • Commencement, progress and outcomes of many battles have been decided by the prevailing weather. • Weather satellites provide an accurate forecast to the defence forces in the respective theatre .
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3. Mention about ISRO's role in national security?



- **ISRO Chairman V Narayanan** had highlighted the agency's role in the ongoing national defence efforts.
- He highlighted the **importance of satellite technology in monitoring the coastline areas** and northern borders, especially given the tensions with neighbouring countries.
- While addressing the **5th convocation ceremony** of the **Central Agricultural University (CAU)** in Imphal ISRO Chairman said that **at least 10 satellites are continuously working round-the-clock** for the strategic purpose to ensure the safety and security of the citizens of the country.

4. Mention various defence institutions of India?

Institutions	Description
<p>DRDO</p>	<div data-bbox="451 373 1409 953" data-label="Image"> </div> <ul style="list-style-type: none"> • The Defence Research and Development Organisation (DRDO) is the R&D arm of the Ministry of Defence, Government of India, dedicated to achieving self-reliance in critical defence technologies and equipping the armed forces with advanced systems. • Established in 1958 through the merger of several defence R&D bodies, DRDO has expanded from 10 labs to a network of 41 laboratories and 5 Young Scientist Labs (DYSLs). • Guided by the motto "<i>Balasya Mulam Vigyanam</i>" (science is the source of strength), DRDO has successfully developed key indigenous systems such as Agni and Prithvi missiles, Tejas fighter aircraft, Pinaka rocket launcher, Akash air defence system, radars, and electronic warfare systems. • These innovations have significantly enhanced India's defence capabilities and strategic deterrence.

	<ul style="list-style-type: none">• Its research spans diverse areas including aeronautics, missiles, electronics, combat vehicles, naval systems, and life sciences, playing a vital role in strengthening national security through science and technology.
<p>HAL</p>	<div data-bbox="620 449 1203 674" data-label="Image"></div> <p data-bbox="620 695 1240 743">— A Maharatna CPSE —</p> <p data-bbox="610 764 1252 831">हिन्दुस्तान एरोनॉटिक्स लिमिटेड</p> <p data-bbox="586 840 1273 877">HINDUSTAN AERONAUTICS LIMITED</p> <ul style="list-style-type: none">• Hindustan Aeronautics Limited (HAL) is a premier aerospace and defence public sector undertaking under the Ministry of Defence, Government of India.• Established in 1940, HAL has been at the forefront of India's aviation sector, playing a vital role in the design, development, manufacture, and maintenance of aircraft, helicopters, engines, avionics, and related systems.• It has significantly contributed to India's self-reliance in aerospace and defence production.• HAL's key achievements include the production of indigenous aircraft like the Light Combat Aircraft (LCA) Tejas, Advanced Light Helicopter (ALH) Dhruv, and Light Utility Helicopter (LUH), as well as overhaul and upgrade of fighter jets like the Su-30MKI, Mirage-2000, and Jaguar.• It also supports the Indian Armed Forces by ensuring timely supply, servicing, and upgrading of aerial platforms and systems.


	<ul style="list-style-type: none"> • With a strong R&D base and collaboration with DRDO, ISRO, and global OEMs, HAL is central to India's goal of achieving Atma Nirbharta (self-reliance) in aerospace and defence manufacturing.
<p>BEL</p>	<div data-bbox="542 436 1317 806" data-label="Image"> </div> <ul style="list-style-type: none"> • Bharat Electronics Limited (BEL) is a leading Navratna Public Sector Undertaking under the Ministry of Defence, Government of India, specializing in the design, development, and manufacture of advanced electronic products for defence and civilian applications. • Established in 1954, BEL plays a crucial role in strengthening India's defence capabilities through indigenous production of cutting-edge technologies. • BEL's core areas include radars, electronic warfare systems, communication equipment, naval systems, electro-optics, and weapon systems. • It has been instrumental in supplying key systems such as the Akash Missile System radar units, coastal surveillance systems, battlefield communication solutions, and command and control centers for the Indian Armed Forces. • In addition to defence, BEL also contributes to civilian sectors like e-governance, solar power, and smart city solutions.

	<ul style="list-style-type: none"> • With a strong R&D focus and strategic collaborations, BEL continues to drive self-reliance in defence electronics, supporting India’s vision of Atmanirbhar Bharat.
<p>BDL</p>	<div style="text-align: center;">  <p>भारत डायनामिक्स लिमिटेड BHARAT DYNAMICS LIMITED</p> </div> <ul style="list-style-type: none"> • Bharat Dynamics Limited (BDL) is a key defence public sector undertaking under the Ministry of Defence, Government of India, specializing in the production of strategic weapon systems. • Established in 1970, BDL was set up to be a manufacturing base for guided missile systems and has since grown into a vital part of India's defence manufacturing ecosystem, contributing significantly to the nation’s self-reliance in missile technology. • BDL is the primary manufacturer of several indigenously developed missiles and weapon systems, including the Akash Surface-to-Air Missile, Konkurs-M anti-tank guided missile, and the air-to-air Astra missile. • It also partners with DRDO and other defence agencies for the production of advanced systems like the Nag, Helina, and Amogha series of missiles. • With facilities across multiple locations in India, BDL supports the Indian Armed Forces by ensuring the timely supply, integration, refurbishment, and lifecycle support of weapon systems.

	<ul style="list-style-type: none"> • As a critical part of India's missile production ecosystem, BDL plays a crucial role in strengthening the country's defence preparedness and technological self-reliance.
<p>Institute for Defence Studies and Analyses (IDSA)</p>	<div data-bbox="527 472 1323 1155" data-label="Image"> </div> <ul style="list-style-type: none"> • The Institute for Defence Studies and Analyses (IDSA), now renamed as the Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA), is a premier think tank under the Ministry of Defence, Government of India. • Established in 1965, it is dedicated to advanced research in defence, security, and international relations, providing policy-relevant insights to strengthen national security and strategic decision-making. • MP-IDSA conducts in-depth studies on a wide range of issues including defence strategy, foreign policy, regional and global security trends, terrorism, and nuclear policy.

	<ul style="list-style-type: none"> • It publishes research papers, journals, and policy briefs, and hosts national and international conferences to foster dialogue on strategic affairs. • The institute also provides training and orientation to civil servants, armed forces personnel, and scholars in the field of strategic and security studies. • By promoting informed discourse and independent analysis, MP-IDS plays a critical role in shaping India’s defence and foreign policy perspectives.
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5. Mention about the missile technology of India?

Types	Description
<p>Ballistic Missiles</p>	 <p>HOW INDIA'S MISSILE DEFENCE WILL WORK But as of now despite DRDO's claims, it is only a technology demonstrator programme with many critical elements yet to be proved. An expert has termed DRDO's claims as linguistic kite-flying</p> <ol style="list-style-type: none"> 1. Enemy missile launches 2. IAF's AWACS (airborne warning and control systems) alerts control centre 3. Long-range tracking radar (Israeli Green Pine) traces velocity and direction of missile 4. As missile comes closer, second radar (French-made multifunction fire control radar) locks on to it 5. Interceptor missile launches 6. Interceptor missile flies towards enemy missile, guided by onboard thermal radars (Russian built) <p>CONTROL CENTRE Houses highly automated battle management system</p> <p>HOSTILE MISSILE DESTROYED</p>
	<ul style="list-style-type: none"> • A ballistic missile is a type of missile that uses projectile motion to deliver warheads on a target. • These weapons are powered only during relatively brief periods most of the flight is unpowered. • Short-range ballistic missiles (SRBM) typically stay within the Earth's atmosphere, while most larger missiles travel outside the atmosphere.

	<ul style="list-style-type: none"> • The type of ballistic missile with the greatest range is an intercontinental ballistic missile (ICBM). • The largest ICBMs are capable of full orbital flight. • India's ballistic missile program is anchored by the Agni and Prithvi series. • The Agni series includes medium to intercontinental range missiles (Agni-I to Agni-V), capable of carrying nuclear warheads and covering ranges up to 5,000 km and beyond. • The Prithvi series, including Prithvi-I, II, and III, are short-range missiles primarily for tactical use.
<p>Cruise Missiles</p>	<ul style="list-style-type: none"> • A cruise missile is an unmanned self-propelled guided missile that sustains flight through aerodynamic lift for most of its flight path. • Cruise missiles are designed to deliver a large payload over long distances with high precision. • Modern cruise missiles are capable of traveling at high subsonic, supersonic, or hypersonic speeds, are self-navigating, and are able to fly on a non-ballistic, extremely low-altitude trajectory. • India has developed both subsonic and supersonic cruise missiles. • The BrahMos, developed jointly with Russia, is a supersonic cruise missile with a speed of Mach 2.8 and precision strike capability.



- The **Nirbhay** is an indigenous subsonic cruise missile, capable of **long-range, low-altitude flight** for stealthy operations.



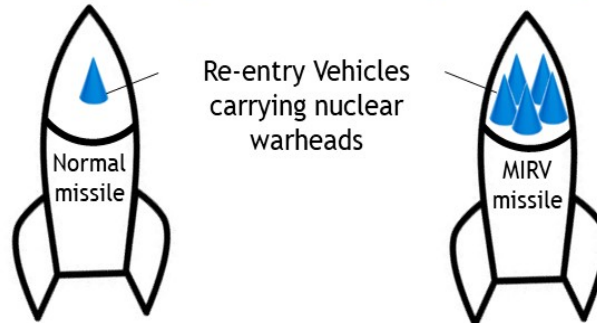
Anti-Ballistic Missile Defence

- An anti-ballistic missile (ABM) is a **surface-to-air missile** designed to destroy in-flight ballistic missiles.
- They achieve this **explosively** (chemical or nuclear), or **via hit-to-kill kinetic vehicles**, which may also have self-maneuvering.

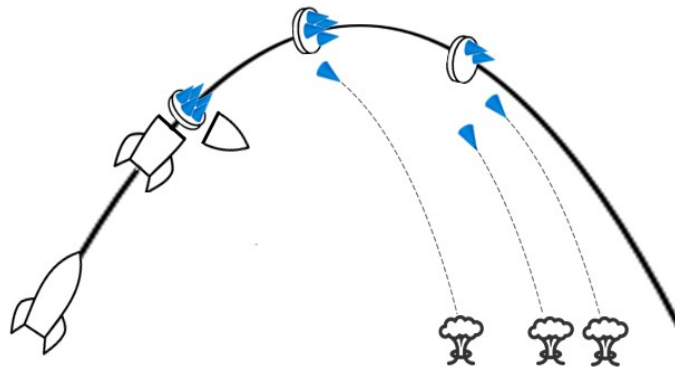
- Tactical systems are widely deployed to counter short and **intermediate-range** ballistic missiles that carry **conventional warheads**.
- Strategic systems, deployed by the **United States, Russia, and Israel**, are capable of intercepting **intercontinental ballistic missiles**, typically used to carry **strategic nuclear warheads**.
- During the **Cold War**, the **1972 ABM Treaty** limited the **nuclear arms race**, excessive ICBM production would have been favoured to overwhelm ABM systems.
- Of the modern strategic ABM systems, only Russia's are themselves armed with nuclear warheads.
- **India** is developing a **two-tiered Ballistic Missile Defence (BMD)** system to intercept incoming threats.
- The **Prithvi Air Defence (PAD)** for high-altitude interception.
- The **Advanced Air Defence (AAD)** for lower-altitude interception.
- This **layered shield** aims to **protect major cities** from **ballistic missile attacks**.

MIRV

Multiple Independently-targetable Reentry Vehicles (MIRVs)



Each re-entry vehicle can be independently targeted - launched from one missile, but hitting different targets




- **MIRV (Multiple Independently Targetable Reentry Vehicle)** is a missile technology that allows a **single missile to carry and launch multiple warheads, each aimed at a different target.**
- **First deployed by the U.S. in 1970** with the **Minuteman III**, MIRVs were developed to overcome missile defence systems by overwhelming them with multiple warheads from one missile.
- This shifted the strategic balance, making offence cheaper than defence and reinforcing the doctrine of mutual assured destruction (MAD).

	<ul style="list-style-type: none"> • While the U.S. reduced MIRV use under the 2014 New START treaty, Russia continues to develop MIRV-equipped ICBMs. • India is advancing towards integrating MIRV technology with its Agni missiles, particularly Agni-V, which would allow a single missile to carry multiple nuclear warheads, each aimed at different targets. • This significantly enhances deterrence by increasing strike capability and survivability. • India’s missile program is a symbol of its scientific prowess and strategic autonomy, placing it among the few nations with advanced missile technology capabilities.
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6. Mention a few state of the art missiles of India?

Name	Description
Nirbhay	<ul style="list-style-type: none"> • Nirbhay is India’s first indigenously developed subsonic cruise missile, designed for precision long-range strikes. • It resembles the U.S. Tomahawk and Russian Club SS-N-27, featuring a cylindrical fuselage. • Its development began with a first test in 2013, followed by several trials, some successful, others marred by guidance system failures (notably in 2013, 2015, and 2016). • The missile is 6 meters long, weighs around 1,500–1,600 kg, and can carry a 450 kg payload over a range of 800–1,000 km. • It is launched from a land-based mobile launcher and powered by a solid booster and a turbojet engine, cruising at Mach 0.65.

	<ul style="list-style-type: none"> • It uses INS/GPS guidance with an active radar seeker and may be enhanced by India's own navigation satellite system. • Nirbhay can carry high-explosive, submunitions, or a nuclear warhead (up to 12 kT), and future versions may be submarine-launched. 
<p>BrahMos</p>	<ul style="list-style-type: none"> • BrahMos is a supersonic cruise missile jointly developed by India's DRDO and Russia's Mashinostroyeniye, named after the Brahmaputra and Moscow rivers. • Based on Russia's SS-N-26 (Oniks) missile, it was developed under the BrahMos Aerospace joint venture formed in 1998. • The BrahMos PJ-10 missile travels at Mach 2.0–2.8, making it hard to intercept and capable of delivering powerful strikes. • It uses stealth features, INS/GPS navigation, and active/passive radar for terminal guidance. • Depending on the variant, it has a range of 300–500 km, and can carry a 200–300 kg warhead. • It is launched from land, sea, air, and even submerged

	<p>platforms, with different configurations for each platform.</p> <ul style="list-style-type: none"> • The missile uses a solid booster and liquid-fueled ramjet for propulsion. • An advanced version, BrahMos-II, is being developed with hypersonic speed (Mach 5), powered by a scramjet engine and special fuel. • In 2016, after India joined the Missile Technology Control Regime (MTCR), it began exporting BrahMos, starting with Vietnam, though export versions are limited to 290 km range to comply with MTCR rules.
<p>Sagarika/ Shaurya</p>	<ul style="list-style-type: none"> • Sagarika (K-15) is India's first submarine-launched ballistic missile (SLBM), developed since the 1990s. With a range of 700 km, it is powered by a two-stage solid propellant motor and can carry a 500–800 kg payload, possibly nuclear or high-explosive. Due to its short range, it has limited strategic utility against distant targets like China or Pakistan and is believed to serve primarily as an R&D platform for longer-range SLBMs. • It underwent multiple tests between 2004 and 2010, with its first fully integrated test in 2010. • Shaurya is considered the land-based version of the Sagarika, though later tests showed enhanced capabilities. • First tested in 2008 and 2011, it demonstrated a range of up to 3,500 km during undersea barge launches in 2014, possibly indicating future submarine compatibility. • Though official details are scarce, Shaurya is estimated to be 12 meters long, weigh ~17 tons, and carry up to a 2-ton payload, likely including nuclear warheads.

	<ul style="list-style-type: none"> • It is intended to strengthen India’s nuclear triad and may also support conventional missions
Agni-V	<ul style="list-style-type: none"> • Agni-V is India’s most advanced intercontinental ballistic missile (ICBM) with a range exceeding 5,000 km, capable of carrying nuclear or conventional payloads. • Developed by DRDO, it evolved from the Agni-III and features an added third-stage motor for extended range. The missile is 17.5 meters long, weighs 50,000 kg, and can carry a 1,100 kg payload, with a maximum throw weight of 1,650 kg. • First tested in 2012, Agni-V has since undergone multiple successful launches, including canister-based tests from road-mobile launchers, significantly reducing launch preparation time. • It uses solid fuel, a ring laser gyro-based inertial guidance system, and flexseal thrust vector control for in-flight adjustments. • Its “cold-launch” canisterized system increases survivability, reduces wear, and enables quicker, concealed deployment. • Agni-V was officially inducted into India’s Strategic Forces Command in 2019, marking a key step in strengthening India’s nuclear deterrence and strategic reach.
Prahaar	<ul style="list-style-type: none"> • Prahaar is a short-range, road-mobile ballistic missile developed by India for tactical strikes against close-range targets. • It was designed to replace the Prithvi-I missile and offers quick-reaction capability. • Following India’s entry into the Missile Technology Control Regime (MTCR), an export variant called Pragati was showcased in South Korea in 2014.

	<ul style="list-style-type: none"> • The missile is 7.3 meters long, weighs 1,280 kg, and has a range of up to 150 km. • It carries a 200 kg payload, which can be nuclear, high-explosive, or submunitions. • Powered by a single-stage solid propellant, Prahara is launched from a TATRA Transporter-Erector-Launcher vehicle that can carry six missiles. It supports vertical launches, salvo firing, and possibly ripple firing, enabling rapid and flexible battlefield use.
<p>Akash-NG</p>	<ul style="list-style-type: none"> • Akash-NG is an advanced surface-to-air missile (SAM) developed by DRDO as an upgraded version of the original Akash missile system. • Designed to neutralize high-speed aerial threats, it offers quicker reaction time, improved accuracy, and reduced crew involvement. • The missile is equipped with a dual-pulse solid rocket motor, giving it extended range and better control during terminal phases. • It has a range of up to 70–80 km and uses an active electronically scanned array (AESA) radar seeker for improved target tracking. • Akash-NG is road-mobile and can be deployed rapidly, making it ideal for air defence of sensitive installations.
<p>Astra Mk-II</p>	<ul style="list-style-type: none"> • Astra Mk-II is an indigenously developed beyond-visual-range air-to-air missile (BVRAAM), following the Astra Mk-I. • It is designed to engage and destroy highly maneuverable enemy aircraft at longer ranges and higher altitudes.

	<ul style="list-style-type: none"> • Astra Mk-II features a dual-pulse solid rocket motor that extends its range to about 160 km, compared to 110 km for Astra Mk-I. • It uses an inertial navigation system (INS) with mid-course updates and an active radar seeker for terminal guidance. • The missile enhances the Indian Air Force’s capability to carry out long-range aerial engagements, reducing dependency on imported weapons.
<p>Pralay</p>	<ul style="list-style-type: none"> • Pralay is a short-range, quasi-ballistic tactical missile, developed by DRDO for quick-strike battlefield use. • It was designed as a conventional counterpart to the Prithvi series, offering better precision and survivability. • The missile is powered by a solid-fuel rocket motor, travels on a depressed trajectory, and is capable of evading missile defence systems. • It has a range of 150 to 500 km and can carry a payload of 350–700 kg, including high-explosive or fragmentation warheads. • Road-mobile and canisterized, Pralay enables rapid launch and is intended for use against enemy radar sites, command posts, and logistics hubs in high-intensity conflict scenarios.
<p>Prithvi-II</p>	<ul style="list-style-type: none"> • Prithvi-II is a short-range ballistic missile (SRBM) developed by DRDO and in service with the Indian Air Force since 2003. • It is an upgraded variant of the Prithvi-I and shares its design with the Dhanush and Prithvi Air Defence interceptor systems.

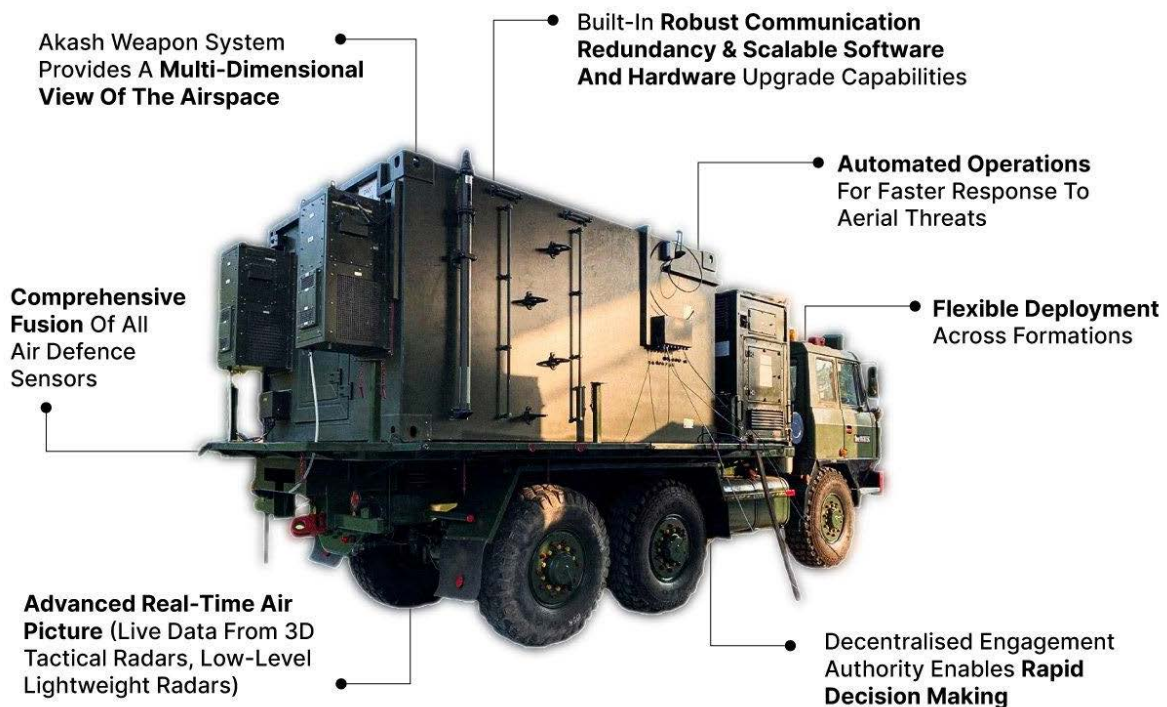
- Designed as a **nuclear-capable delivery system**, it is part of India's **Strategic Forces Command**.
- The missile is **9.5 meters long**, has a **1-meter diameter**, and weighs over **4,600 kg** at launch.
- It uses a **single-stage liquid-fuel engine** generating **6 tons of thrust**, achieving a range of **250–350 km**, depending on payload.
- Guidance is provided by a **hybrid GPS-inertial navigation system**, offering **accuracy up to 50 meters CEP**.
- Prithvi-II can carry **conventional or nuclear warheads**, including unitary and submunition types.
- Around **30 units** are believed to carry **nuclear warheads**. India regularly conducts user trials, with **at least 18 test launches since 2009**, and has also begun **upgrading Prithvi-I missiles** to the Prithvi-II configuration.



7. What is Akashteer and how is it different from Iron Dome System?

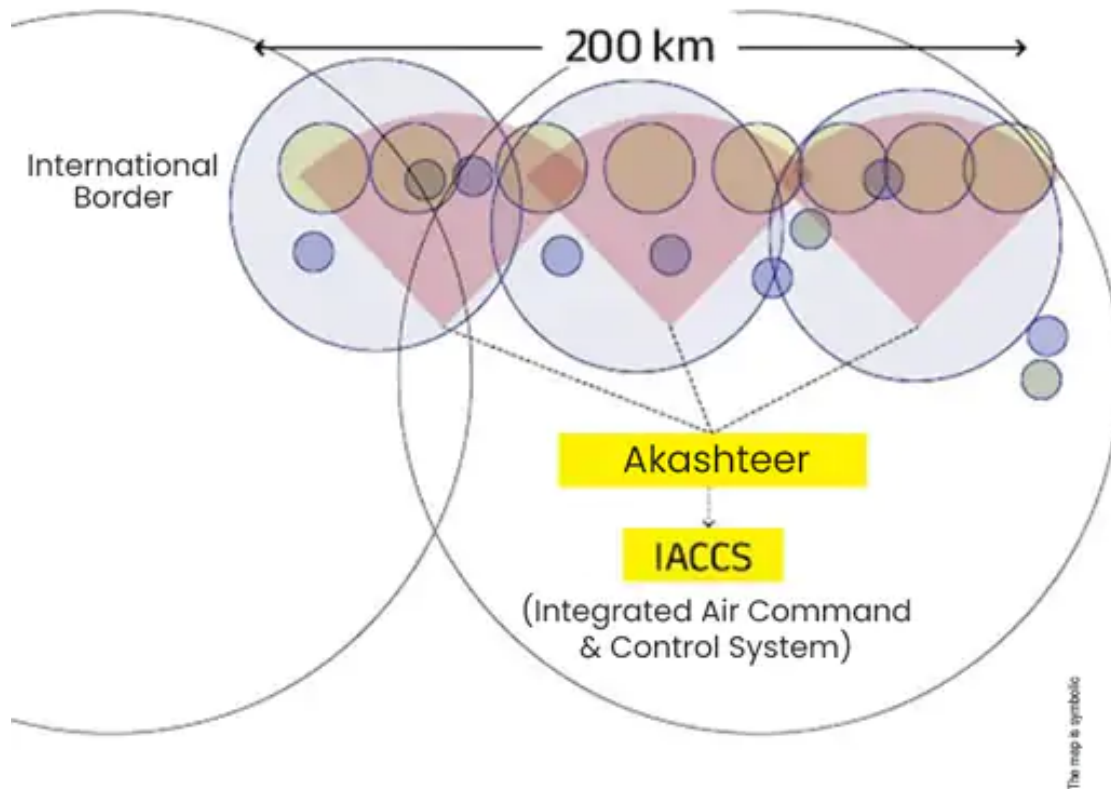
The Bolt Of Akashteer

What India's AI-Powered Air Defence System Brings To The War Room



- **Akashteer ("Sky Arrow") is an Indian mobile air defence system providing a real-time, unified air picture.**
- **It integrates radars, sensors, and communication to automate the detection, tracking, and engagement of aerial threats like aircraft and drones.**

LAYER SECURITY IN COLLABORATION WITH THE AIR FORCE



- Long-Range Surface-to-Air Missile
- Medium-Range Surface-to-Air Missile
- Short-Range Surface-to-Air Missile
- Counter Drone & MANPADS

Layer 1 – Counter Drone and MANPADS
Layer 2 – Point Air Defense, Short-Range Surface-to-Air Missile
Layer 3 – Medium-Range Surface-to-Air Missile
Layer 4 – Long-Range Surface-to-Air Missile

- It connects smoothly with **IACCS (Indian Air Force)** and **TRIGUN (Indian Navy)**, creating a clear and real-time picture of the battlefield.
- This enables the **quick and effective use of both offensive and defensive weapons.**

Hero of India/Pakistan Conflict
AKASHTER DEFENSE SYSTEM



AKASHTER SYSTEM
 (Command and Control System)



IRON DOME SYSTEM
 (Air Defense System)

20–30 km	PARAMETER	10 km
400 km	ALTITUDE	4–70 km
100% success against Pakistani missiles & drones	RANGE	90% success since 2011

AKASHTEEER SYSTEM		IRON DOME SYSTEM
Integrated radar, surveillance & weapon systems	TYPE	Interceptor and radar-based short-range ADS
Integration of Akash, S-400, Barak-8, D4 anti-drone and other air defense systems	PRIMARY ROLE	Direct targeting of short-range rockets, artillery shells, and mortars
Aircraft, drones, missiles	TARGET TYPE	Rockets, artillery, mortars
₹5-10 lakh	COST PER INSTALLATION	₹70-90 lakh
Missiles and drones	COUNTER CAPACITY	Only rockets
DRDO and BEL	DEVELOPED BY	Rafael Advanced Defense Systems
Better against high-speed aircraft and jets from China & Pakistan	STRATEGIC CONTEXT	Better against Hamas/Hezbollah rockets
Deadly for drones using powerful jammers	ELECTRONIC WARFARE	Depends on kinetic interception
Deployment in 15 minutes, missile launch in seconds	RESPONSE TIME	Detects and launches missile within seconds

8. Mention about the Indian Air Defence System?

COMPLETE LIST OF INDIA'S AIR DEFENCE SYSTEMS
CAPABILITIES, RANGE & STRATEGIC IMPORTANCE



AKASH
CAPABILITIES:
Surface-to-air missile
RANGE: 25 km



BARAK 8
CAPABILITIES
Surface-to-air missile
RANGE: 100 km




MR-SAM
CAPABILITIES:
Surface-to-air missile
RANGE: 70 km



SPYDER
CAPABILITIES
Surface-to-air missile
RANGE: 15 km

Type	About
<p>Akash Air Defense System</p>	<ul style="list-style-type: none"> ● India also used its homegrown Akash Air Defense System to ward off attacks from Pakistan. ● Manufactured by the Defence Research and Development Organisation (DRDO), the Akash is a short medium-range surface-to-air missile system (SAM). ● The system was developed under the Integrated Guided Missile Development Programme (IGMDP). ● It is 96 per cent indigenous keeping with the government's Atma Nirbhar Bharat initiative. ● The Aakash comprises launcher, a missile, a control centre, an integral mission guidance system, a multifunctional fire control radar, a system arming and explosion mechanism, a

	<p>digital autopilot, C4I (command, control communication and intelligence) centres and supporting ground equipment.</p> <ul style="list-style-type: none">• The Group Control Centre (GCC) acts as the command and control headquarters for the entire system.• Each Akash battery comes with four 3D passive electronically scanned array (PESA) radars and four self-propelled launchers with three interconnected missiles each.• It has a battery-level radar known as Rajendra and a battery control centre.• Its missiles can also self-destruct.• The Akash system can guard against aircraft, UAVs, cruise missiles and missiles launched from helicopters.• It has a range of 4.5 to 25 kilometres.• The Akash system works on mobile platforms such as battle tanks or wheeled trucks.• As per BEL, it can cover an altitude of 80 kilometres.• It can engage multiple air targets in group mode or fully autonomous mode.• It comes with inbuilt Electronic Counter-CounterMeasures (ECCM) features.• It can carry conventional and nuclear warheads weighing up to 60 kilos.• The DRDO is currently developing a new version of Akash – known as the Akash (NG).• India is exporting the Akash weapons system to Armenia.
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	<ul style="list-style-type: none"> • A number of other countries including the Philippines, Vietnam, Egypt, and Brazil have reportedly shown interest in buying the system from India.
<p>SPYDER</p>	<ul style="list-style-type: none"> • The SPYDER, which stands for Surface-to-air PYthon and DERby, is developed by Israel's Rafael Advanced Defense Systems. • The SPYDER (Surface-to-air PYthon and DERby) is a short-range, quick-reaction surface-to-air missile system. • India and Israel concluded a deal for the missiles in 2009, under the previous Indian government. • It is designed to neutralize aerial threats like aircraft, helicopters, UAVs, and precision-guided munitions. 
<p>BARAK</p>	<ul style="list-style-type: none"> • Barak-8 is an Indo-Israeli jointly developed surface to air missile (SAM) system, designed to defend against any type of airborne threat including

aircraft, helicopters, anti-ship missiles, UAVs, ballistic missiles, cruise missiles and combat jets.



VSHORADS

- **VSHORADS is a Man Portable Air Defence system designed and developed indigenously by Research Center Imarat in collaboration with other DRDO laboratories and Development cum Production Partners.**
- **The missile system has the capability to meet the needs of all the three branches of the Armed Forces, viz. Indian Army, Navy and Air Force.**



9. Mention about the Nuclear triad of India?

- **Nuclear Triad** is a **three-sided military-force structure** consisting of **land-launched nuclear missiles, nuclear-missile-armed submarines, and strategic aircraft with nuclear bombs and missiles.**



Components of Nuclear Triad	Description
Land-based missiles	<ul style="list-style-type: none"> • India's land-based nuclear delivery systems form the backbone of its nuclear triad, managed by the Strategic Forces Command (SFC).

	<ul style="list-style-type: none"> • These primarily include nuclear-capable ballistic missiles developed by DRDO, offering a range of options from tactical to strategic strikes. • The Agni missile series is central to this force. • Agni-I (700–1,200 km) and Agni-II (2,000–3,000 km) target regional threats, while Agni-III and Agni-IV (up to 4,000–5,000 km) can reach deep into China. • The most advanced, Agni-V, is a canisterized ICBM with a range over 5,000 km, capable of carrying nuclear warheads and under development for MIRV capability. • The Prithvi-II, with a range of 250–350 km, is a short-range tactical missile, nuclear-capable and in service with the Indian Air Force. • The Shourya missile, with a range of up to 2,000 km, is a high-speed, canisterized quasi-ballistic missile designed for survivable, precision nuclear strikes. • These land-based systems provide India with a robust and flexible nuclear deterrent, supporting its No First Use (NFU) policy.
<p>Air-based component</p>	<ul style="list-style-type: none"> • India’s air-based nuclear delivery systems form the second leg of its nuclear triad, providing flexibility, mobility, and survivability. • These systems are operated by the Indian Air Force (IAF) and are based on aircraft capable of delivering nuclear gravity bombs and air-launched missiles.

	<ul style="list-style-type: none"> • The primary aircraft for nuclear missions include Mirage 2000, Jaguar IS, and the Su-30MKI fighters. These aircraft have been modified to carry nuclear gravity bombs, providing a credible aerial deterrent. Among them, the Su-30MKI, with its extended range, payload capacity, and aerial refueling capability, is the most versatile and survivable platform, capable of deep penetration and delivering strategic payloads. • To enhance stand-off capability, India has developed the Astra series and air-launched BrahMos missile. While the BrahMos-A is a supersonic cruise missile currently configured for conventional use, future variants are being considered for nuclear delivery roles due to its speed, accuracy, and range (~400 km). • India is also reportedly working on an air-launched ballistic missile (ALBM) with nuclear capability, and a possible air-launched version of the Nirbhay cruise missile may enhance long-range nuclear strike options in the future. • Overall, India's air-based nuclear deterrent adds a flexible and second-strike survivability component to its nuclear doctrine, complementing land- and sea-based systems and supporting its credible minimum deterrence and No First Use policy.
<p>Sea-based missiles</p>	<ul style="list-style-type: none"> • India's sea-based nuclear delivery systems form the second leg of its nuclear triad, offering a credible second-strike capability.

- This leg is designed to ensure nuclear retaliation even in the event of a surprise first strike, thus enhancing strategic deterrence.
- At the core of this capability is the **Arihant-class nuclear-powered ballistic missile submarines (SSBNs)**, developed under the **Advanced Technology Vessel (ATV) program**.
- These submarines are equipped with **submarine-launched ballistic missiles (SLBMs)** such as the **K-15 Sagarika** and the more advanced **K-4**.
- The **K-15 Sagarika** is India's first operational SLBM, with a range of around **700 km**, capable of carrying **nuclear warheads**.
- It is **solid-fueled** and launched from the Arihant's vertical launch tubes. While its limited range restricts strategic depth, it serves as a crucial step in undersea deterrence.
- To overcome this limitation, India has developed the **K-4 missile**, with a **range of around 3,500 km**, allowing Arihant-class submarines to strike targets deep within adversary territory from safer waters.
- It is **nuclear-capable, canisterized**, and currently in advanced stages of testing.
- With the operational deployment of **INS Arihant** and the ongoing induction of follow-on SSBNs, India is steadily building a survivable and reliable **sea-based nuclear deterrent**, completing its **nuclear triad** and reinforcing its **No First Use (NFU)** doctrine.

INDIA'S NUCLEAR TRIAD

A Land Vector

Prithvi-II (350-km), Agni-1 (700-km), Agni-2 (2,000-km), Agni-3 (3,000-km) & Agni-5 (over 5,000-km) missiles inducted by the Strategic Forces Command

B Air Vector

Sukhoi-30MKI, Mirage-2000, Jaguar & Rafale fighters can deliver nuclear gravity bombs

C Sea Vector

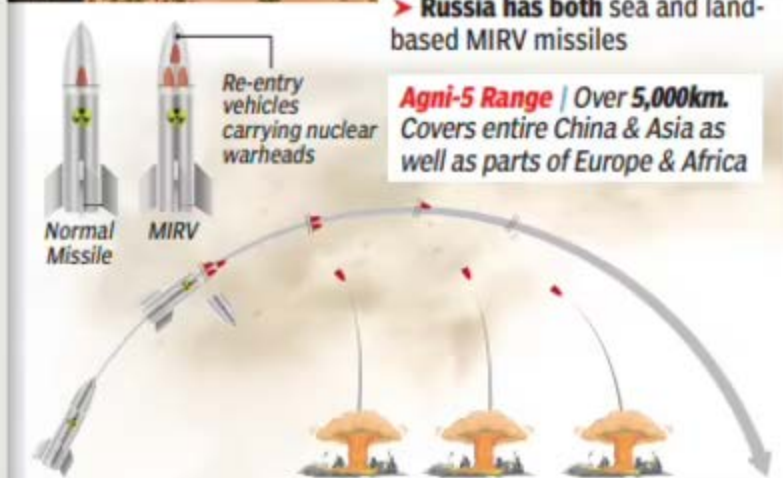
> Only 1 nuclear-powered ballistic missile submarine (SSBN), the 6,000-tonne INS Arihant, fully operational. Armed with 750-km range K-15 nuclear missiles

> 6,000-tonne INS Arighat undergoing final trials. Will be commissioned this year

> Will be followed by two 7,000-tonne SSBNs (called S-4 & S-4*) being built at Vizag. Over 13,000-tonne S-5 class SSBNs to be built later

> K-4 missiles (3,500-km range) have completed development trials

> Development of K-5 (5,000-km) and K-6 (6,000-km) SLBMs in progress



MIRV

> All Indian nuclear-capable missiles inducted so far **have single warheads**

> MIRV payload means a single missile capable of **carrying at least two to three nuclear warheads**, with each programmed to hit different targets in different directions

> The targets can be a **few hundred km apart**

> MIRV missiles can **overcome enemy defence systems** & ensure effective retaliation to a first strike

> **US, UK & France** have submarine-launched MIRV missiles

> **China** has land-based MIRV missiles

> **Russia** has both sea and land-based MIRV missiles

Agni-5 Range | Over 5,000km.
Covers entire China & Asia as well as parts of Europe & Africa

10. What is the nuclear escalation ladder?



- The **nuclear escalation ladder** is a theoretical framework developed during the Cold War, particularly by **Herman Kahn**, to analyze how **conflicts between nations could intensify, potentially leading to nuclear war.**
- It outlines a **series of steps, or rungs, representing different levels of potential conflict**, ranging from diplomatic maneuvering to all-out nuclear exchange.

- This model helps **analysts and policymakers** understand how conflicts might escalate and how to potentially manage or **de-escalate** them.



11. Mention about the indigenous aircrafts of India?



Aircrafts	Description
HT-2	<ul style="list-style-type: none"> The HT-2 was India's first indigenous aircraft, developed by Hindustan Aeronautics Limited (HAL) in the 1950s. It served as a basic trainer aircraft for the Indian Air Force and Navy, replacing British-built trainers like the Tiger Moth.

	<ul style="list-style-type: none"> • The aircraft featured a piston engine, a low-wing monoplane design, and open cockpits for student and instructor. • It played a vital role in training generations of pilots and marked the beginning of India's self-reliance in aircraft manufacturing.
<p>Dhruv ALH</p>	<ul style="list-style-type: none"> • The Dhruv ALH, developed by HAL, is a multi-role, twin-engine helicopter designed for both military and civilian use. • It is capable of performing a variety of missions including transport, search and rescue, medical evacuation, reconnaissance, and disaster relief. Dhruv features a four-blade composite rotor, glass cockpit, and crash-worthy structures, making it highly versatile and survivable. • It is in service with the Indian Army, Navy, Air Force, and Coast Guard, and has also been exported to several countries.
<p>Tejas LCA</p>	<ul style="list-style-type: none"> • The Tejas is India's indigenous light multirole fighter aircraft, developed by HAL and Aeronautical Development Agency (ADA). • Designed for air-to-air, air-to-ground, and reconnaissance missions, Tejas is equipped with fly-by-wire controls, a glass cockpit, and advanced radar and avionics. • It is powered by a single GE F404 engine and is known for its agility and lightweight design. Inducted into the Indian Air Force and under development for the Indian Navy, Tejas reflects India's capability in developing fourth-generation fighter aircraft.

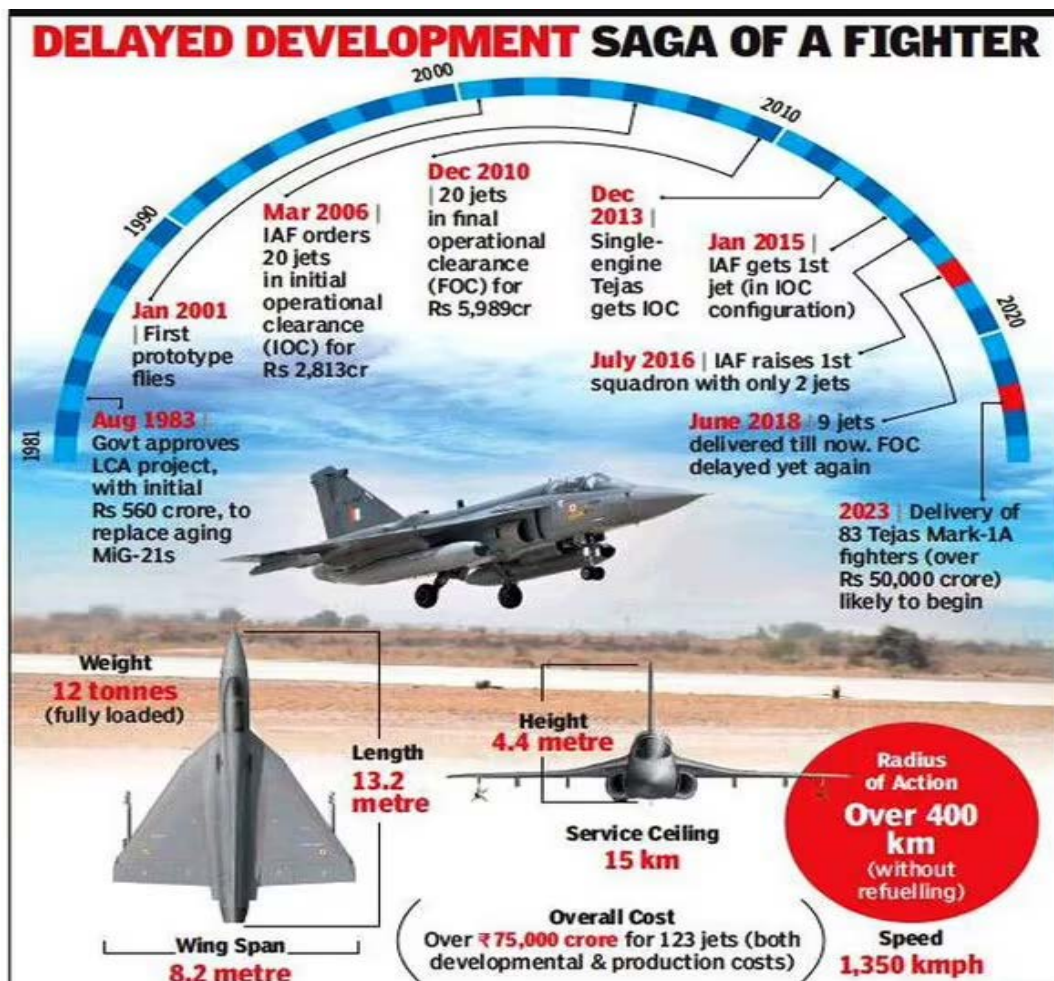
<p>Rudra</p>	<ul style="list-style-type: none"> • Rudra is the weaponized variant of the Dhruv ALH, developed by HAL for the Indian Army. • It is equipped with an array of offensive systems, including 20 mm turret guns, 70 mm rockets, anti-tank guided missiles (ATGMs), and air-to-air missiles, making it capable of conducting close air support, anti-armor, and armed reconnaissance missions. • Rudra retains the versatility of Dhruv while adding combat firepower and survivability, serving as a key component in the Army's Combat Aviation Brigade.
<p>LCH</p>	<ul style="list-style-type: none"> • The LCH, developed by HAL, is India's first dedicated attack helicopter designed for high-altitude warfare. • It is optimized for operations in the Himalayas and is capable of taking off and landing at altitudes over 5,000 meters. • The LCH features stealth features, armor protection, advanced sensors, and is armed with cannon, rockets, ATGMs, and air-to-air missiles. • It complements heavier attack platforms and is deployed with the Indian Air Force and Army for anti-tank, air defense, and counter-insurgency roles in harsh terrains.

12. Mention about various variants of Tejas?

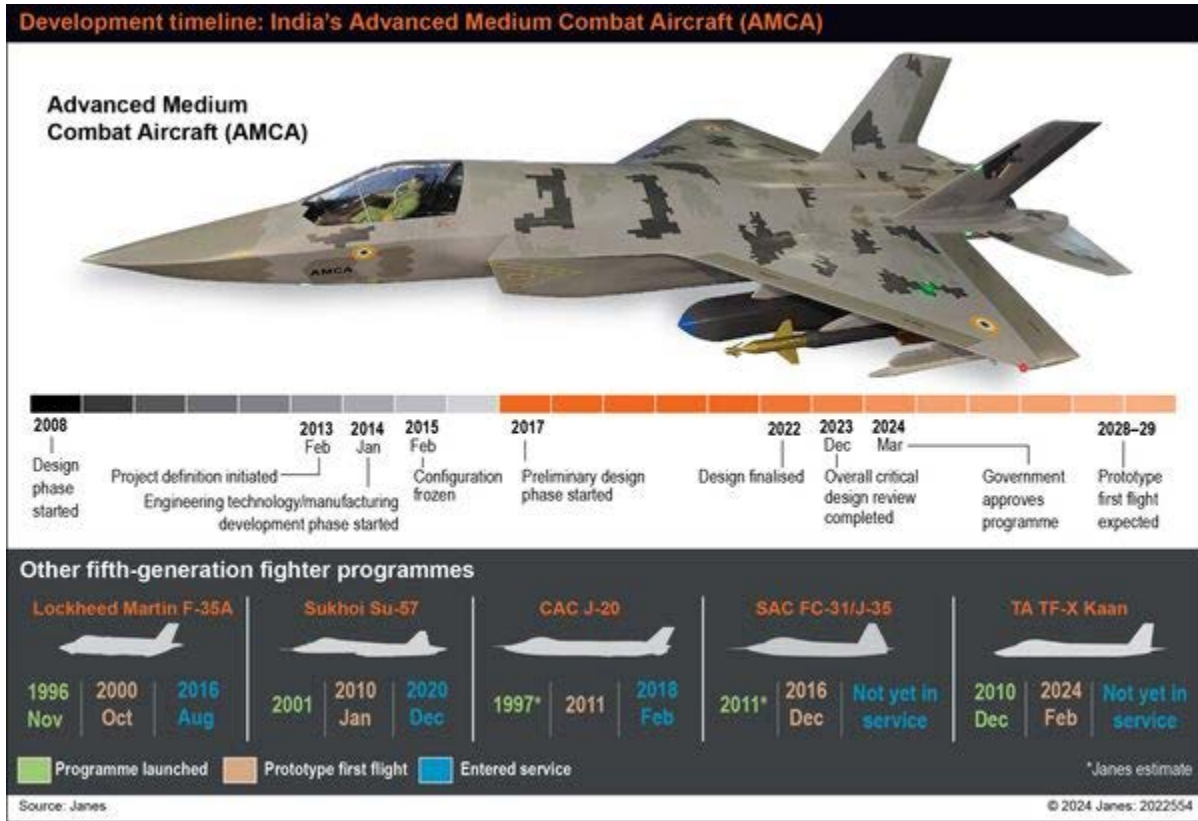


Variant	Description
Tejas Mark 1	<ul style="list-style-type: none"> The Tejas Mark 1 is the initial operational version of India's indigenous Light Combat Aircraft (LCA), designed as a single-seat, multi-role fighter capable of air-to-air and air-to-ground missions.
Tejas Mark 1A	<ul style="list-style-type: none"> The Tejas Mark 1A is an upgraded variant of Tejas Mark1 featuring advanced technologies such as an AESA radar, electronic warfare (EW) suite, mid-air refueling, and greater indigenous content, improving survivability and combat effectiveness.
Tejas Trainer	<ul style="list-style-type: none"> The Tejas Trainer is a twin-seat version developed for pilot training, while still retaining full combat capabilities. It plays a crucial role in familiarizing pilots with the aircraft's systems and handling.

<p>Naval Tejas</p>	<ul style="list-style-type: none"> The Naval Tejas is a carrier-capable version of the aircraft, available in both single- and twin-seat configurations, modified with strengthened landing gear, tailhook, and other features for operations from aircraft carriers.
<p>Tejas Mark 2</p>	<ul style="list-style-type: none"> The Tejas Mark 2 is a Medium Weight Fighter (MWF) currently under development. It will be larger, more powerful, and equipped with next-generation sensors, avionics, and weapons, aiming to fulfill roles performed by heavier aircraft like the Mirage 2000 and MiG-29 in the Indian Air Force.



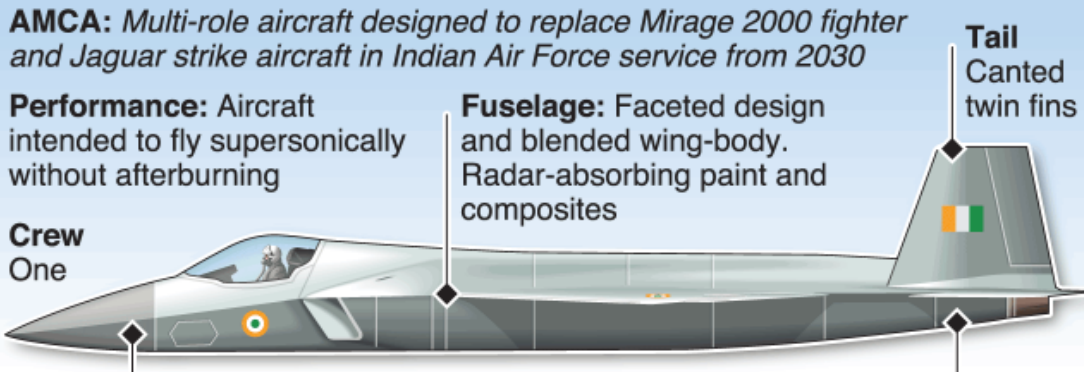
13. What is AMCA?



- The **Cabinet Committee on Security (CCS)** has approved a **Rs 15,000 crore project** for the development of **India's fifth-generation Advanced Medium Combat Aircraft (AMCA)**, marking a significant stride in indigenous defense capabilities.

India designing new stealth fighter

India is beginning preliminary design work for a new fifth generation fighter jet, named the Advanced Medium Combat Aircraft (AMCA), with the first flight scheduled for 2024



AMCA: Multi-role aircraft designed to replace Mirage 2000 fighter and Jaguar strike aircraft in Indian Air Force service from 2030

Performance: Aircraft intended to fly supersonically without afterburning

Fuselage: Faceted design and blended wing-body. Radar-absorbing paint and composites

Tail
Canted twin fins

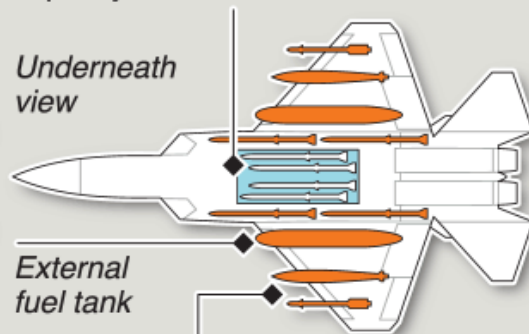
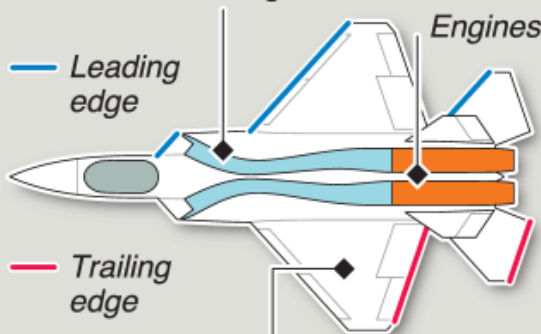
Crew
One

Avionics: Include AESA* radar, infrared search and track system and situational awareness sensors

Engines: Twin turbofans with thrust vectoring. Likely choice is upgraded General Electric F414 (115 kN class)

■ **Serpentine ducts:** Block direct line of sight to engine fan blades, hiding them from incoming radar

■ **Internal weapons bay**
Maintains stealthy configuration – capacity for four missiles or bombs



■ **Trapezoidal wing**
Aligned edges help to improve stealth characteristics by deflecting radar waves in different directions

■ **External weapons**
Non-stealth payload carried below fuselage and on three hardpoints under each wing

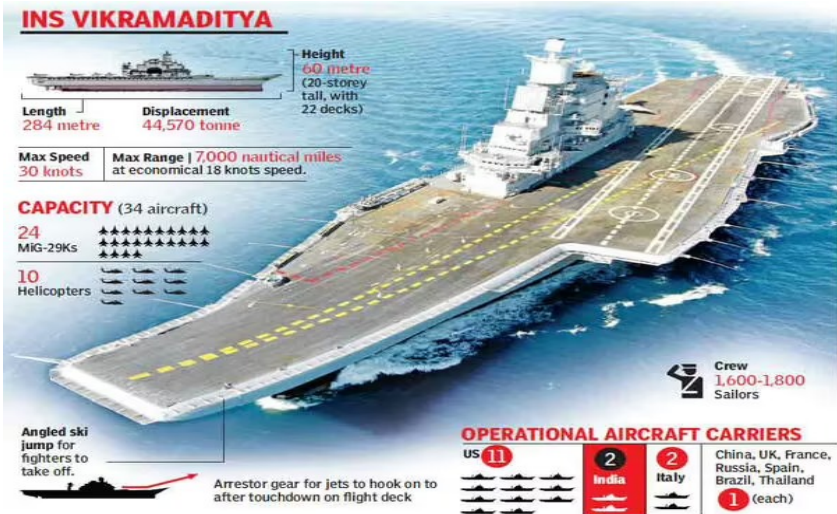
■ Shape offers efficient supersonic flight, and better handling at subsonic speeds needed for ground-attack role

■ **Specifications**
Maximum weight: **25 tonnes**
Endurance: **Two hours**

GN35184 Graphic shows features of AMCA stealth fighter.






14. Mention about the aircraft carrier used by the Indian Navy?

Name	Description
<p>INS Vikrant (R11)</p>	<ul style="list-style-type: none"> India's first aircraft carrier, commissioned in 1961. Played a decisive role in the 1971 war, enforcing a naval blockade on East Pakistan. Later upgraded for Sea Harriers. Decommissioned in 1997.
<p>INS Viraat</p>	<ul style="list-style-type: none"> Formerly UK's HMS Hermes, joined the Indian Navy in 1987. Participated in Operation Jupiter, Kargil War, and joint exercises. Operated Sea Harriers. Served for 30 years, decommissioned in 2017.
<p>INS Vikramaditya</p>	 <p>INS VIKRAMADITYA</p> <p>Length: 284 metre Displacement: 44,570 tonne Height: 60 metre (20-storey tall, with 22 decks)</p> <p>Max Speed: 30 knots Max Range: 7,000 nautical miles at economical 18 knots speed.</p> <p>CAPACITY (34 aircraft)</p> <p>24 MiG-29Ks</p> <p>10 Helicopters</p> <p>Crew: 1,600-1,800 Sailors</p> <p>OPERATIONAL AIRCRAFT CARRIERS</p> <p>US: 11 India: 2 Italy: 2 China, UK, France, Russia, Spain, Brazil, Thailand: 1 (each)</p> <p>Arrestor gear for jets to hook on to after touchdown on flight deck</p> <p>Angled ski jump for fighters to take off.</p> <ul style="list-style-type: none"> Originally Russia's Admiral Gorshkov, inducted in 2013. India's largest warship, operates MiG-29K fighters and helicopters. Acts as a mobile airbase and key naval power projection asset.

<p>INS Vikrant (IAC-1)</p>	<ul style="list-style-type: none"> • India’s first indigenously built aircraft carrier, commissioned in 2022. Operates 30 aircraft including MiG-29K, ALH, Naval LCA. A major symbol of self-reliance and indigenous defence capability.
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15. Mention about UAV technology of India?

Type	Description
<p>Loitering Munitions (Kamikaze Drones)</p>	<ul style="list-style-type: none"> • Loitering munitions are drones designed to hover over a target area and destroy themselves upon striking the target. • They combine surveillance and precision strike in one platform, for example, Nagastra-1, Rudrastra and Warmate. 
<p>ISR Drones (Surveillance & Reconnaissance)</p>	<ul style="list-style-type: none"> • Used for real-time intelligence and border monitoring. The Army uses Israeli Heron and Searcher Mk-II for long-endurance surveillance. • Indigenous options include SWITCH (VTOL for high altitudes), Nishant/Panchi for short-range ops, and Netra quadcopters for urban use.

<p>Target & Training Drones</p>	<ul style="list-style-type: none">• Used in exercises to simulate enemy aircraft and test weapon systems.• Lakshya is a reusable target drone, while Abhyas is an expendable one developed by DRDO.
<p>Swarm & Nano Drones</p>	 <ul style="list-style-type: none">• These include multiple small drones used in coordination.• The Army uses AI-enabled swarm drones by NewSpace Research for ISR and kamikaze roles.• The Black Hornet is a nano drone used by troops for close-range tactical surveillance.
<p>Combat UAVs & UCAVs</p>	

- These drones can perform surveillance and strikes.
- The US-made **MQ-9 Reaper** offers long-range armed capabilities.
- Indigenous systems like **HAL CATS Warrior** (loyal wingman) and **DRDO Ghatak** (stealth UCAV) are under development.

16. What is D4 Drone?

- To address the malicious threats posed by rogue Drones, a Counter Drone System has been developed by **DRDO & Productionized by BEL** which has been operationally proven.
- The **Counter Drone System (D4 System)** is capable of performing real time search, detection, tracking and neutralization (Soft/ Hard Kill) of the flying drones (Micro/Small UAVs) and will provide object details (**Optical / Thermal**) and RF spectrum display on GUI.



Components	Analysis
<p>Detection Layer</p>	<ul style="list-style-type: none"> • This is the first step, where the presence of a drone is identified. Detection involves the use of radars, electro-optical/infrared (EO/IR) sensors, RF detectors, and acoustic sensors to spot incoming drones like D-4. • For example, Indian systems like Ashlesha radar or low-level light radars are used for early drone detection even in tough terrain.
<p>Threat Analysis</p>	<ul style="list-style-type: none"> • Once a drone is detected, its type, origin, path, speed, altitude, and payload potential are analyzed. • AI-based threat recognition tools assess whether it's a harmless commercial drone or a hostile one like D-4 carrying explosives or surveillance payloads. • The goal is to prioritize response and avoid false alarms.
<p>Soft-Kill Options</p>	<ul style="list-style-type: none"> • After identifying a threat, non-destructive neutralization methods are attempted first. These soft-kill options include RF jamming (to sever its link with the operator), GPS spoofing (to mislead its navigation), or using directed-energy weapons (to interfere with sensors). • These measures aim to disable or divert drones like the D-4 without causing physical destruction or collateral damage.
<p>Hard-Kill Options</p>	<ul style="list-style-type: none"> • If soft-kill methods fail or if the drone is approaching a sensitive area rapidly, hard-kill systems are deployed.

	<ul style="list-style-type: none"> • These involve physically destroying the drone using laser weapons, missiles, anti-drone guns, or interceptor drones. • Hard-kill is the last resort but ensures the threat is completely neutralized.
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17. Mention about radars used in India’s defence?

Name	Description
INDRA Series (INDRA-I & INDRA-II)	<ul style="list-style-type: none"> • The INDRA series are 2D mobile Doppler radars. INDRA-I is designed for detecting low-level targets, featuring Track While Scan (TWS) and IFF capabilities, mounted on wheeled vehicles. • INDRA-II is used for ground-controlled interception of targets and performs well even in dense ground clutter.
Rajendra Radar (TLR)	<ul style="list-style-type: none"> • A phased array multifunction radar that acts as the fire control radar for the Akash missile system. • It can track multiple low radar cross-section targets and guide missiles in real time.
Swathi Weapon Locating Radar (WLR)	<ul style="list-style-type: none"> • This is a counter-battery radar used to detect and locate enemy artillery fire. • It can track up to seven incoming projectiles simultaneously and is crucial along the LOC for locating Pakistani gun positions.

<p>Central Acquisition Radar (3D-CAR)</p>	<ul style="list-style-type: none"> • A 3D S-Band radar used by the Army (Rohini) and Air Force (Revathi) for medium-range air surveillance. • It can detect low-flying and supersonic targets up to 180 km and is mounted on TATRA vehicles.
<p>Ashwini Radar</p>	<ul style="list-style-type: none"> • A 4D low-level transportable radar with active phased array technology, capable of tracking high-speed targets up to 200 km. • It measures distance, azimuth, elevation, and velocity, with both rotating and staring modes.
<p>AEROSTAT Radar (TARS)</p>	<ul style="list-style-type: none"> • Tethered helium-filled balloon-based radar platforms that can operate up to 15,000 ft, providing low-altitude surveillance over large areas. • Ideal for persistent coverage in border regions.
<p>Swordfish Radar (LRTR)</p>	<ul style="list-style-type: none"> • An Indian long-range tracking radar developed for the Ballistic Missile Defence (BMD) system. • It is derived from Israel's Green Pine radar and can track incoming ballistic missiles at long distances.
<p>PJT-531 Battlefield Surveillance Radar</p>	<ul style="list-style-type: none"> • A man-portable short-range 2D radar used for perimeter surveillance. • It can detect crawling men, groups, vehicles, and operates on J Band across 21 frequencies. Widely deployed at the LOC and used internationally.

18. Enlist global partners in technology collaboration in defence with India?

Partners	Description
Russia	<ul style="list-style-type: none"> India's oldest defence partner since the 1960s, Russia helped set up licensed production of MiG-21s, T-72 tanks, and later Su-30MKI, T-90s, and INS Vikramaditya. The BrahMos missile is a major joint project. Recent cooperation includes AK-203 rifles and delivery of S-400 systems.
Israel	<ul style="list-style-type: none"> Post-1998, Israel became a key tech partner in electronic warfare, UAVs, and missile systems. India and Israel co-developed the Barak-8 SAM system. Israel also supplies Heron drones, loitering munitions, and surveillance gear
United States	<ul style="list-style-type: none"> Ties deepened after 2005 under DTTI, promoting joint development in UAVs, jet engines, and ISR systems. India signed key pacts like COMCASA, BECA, and is a Major Defense Partner. India has acquired Apache, Chinook, and P-8I aircraft.
France	<ul style="list-style-type: none"> France has supported India through Rafale jets (2016 deal) and Scorpene submarines. Talks with Safran are ongoing for jet engine co-development for future fighters like AMCA.
United Kingdom	<ul style="list-style-type: none"> The UK is collaborating with India on jet engines through Rolls Royce for AMCA. The broader partnership includes maritime security, cyber defence, and military training.

Japan	<ul style="list-style-type: none">• India and Japan are working on maritime surveillance, UAVs, and cybersecurity. The US-2 amphibious aircraft is under consideration. Cooperation is growing under the Indo-Pacific strategic framework.
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19. What is the relevance of the topic for UPSC CSE?

- **For Prelims:** Operation Sindoor, Defence Acquisition Procedure (DAP)-2020, BrahMos missiles, iDEX scheme, Defense Industrial Corridors, Defense Space Agency, Positive Indigenization Lists, INS Vikrant, Aatmanirbhar Bharat, Chief of Defence Staff, SCALP Cruise Missiles, HAMMER Precision-Guided Bombs, Loitering Munitions
- **For Mains:** Key Major Developments in India's Defence Sector, Key Challenges Confronting India's Defence Sector.

Some previous years prelims questions.

Q1. Consider the following aircraft: (UPSC CSE 2024)

1. Rafael
2. MiG-29
3. Tejas MK-1

How many of the above are considered fifth generation fighter aircraft?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

Ans: (d)

Some previous years mains questions.

Q1. Foreign Direct Investment (FDI) in the defence sector is now set to be liberalized: What influence is this expected to have on Indian defence and economy in the short and long run? **(2014-12.5 Marks)**

Some questions from this year and previous years interview transcripts.

Board Sheelvardhan sir:

- Tell something about Private players in satellite making?

Board BB Swain sir:

- How far is the defence procurement policy is successful?

Board Suman Sharma mam:

- How has the Russian-Ukraine war affected defence cooperation?

Board Lt Gen Raj Shukla sir:

- What is the most radical step taken by the government for increasing defence exports?

Some questions for QUIZ.

Q1. Consider the following defence products:

1. Rudram Missile
2. INS Arihant
3. INS Tushil
4. S-400
5. Igla-S

How many of the above defence products are indigenously made in India?

- (a) Only two
- (b) Only three
- (c) Only four
- (d) All five

Ans: (c)

Some questions for POLL.

Q1. Do you think India is on the right track of defence indigenisation?

- (a) YES
- (b) NO
- (c) Can't say.

Q2. Should India procure SU 57 from Russia?

- (a) YES
- (b) NO
- (c) Can't say.

