



Strategic Defence Technologies in India

For Prelims: [BrahMos](#), [S-400 Triumph](#), [Supersonic Cruise Missile](#), [Indian Ocean Region](#), [unmanned aerial system \(UAS\)](#), [US-India COMPACT Initiative](#), [MFN](#), [Scorpene Submarines](#).

For Mains: Strategic defence technologies in India and their role in India's defence preparedness.

[Source: IE](#)

Why in News?

India's Defence Minister Rajnath Singh inaugurated the [BrahMos Integration and Testing Centre in Lucknow](#), underscoring the significance of the **BrahMos supersonic cruise missile**.

- In a separate development, India's growing defence ties and the effectiveness of the [S-400 Triumph](#) system were highlighted as it successfully intercepted missile and **Asisguard Songar drone attacks launched by Pakistan**, showcasing a swift and decisive **kinetic response**.

What are Key Facts About BrahMos and S400 Triumph?

BrahMos

- **Name Origin:** "BrahMos" is derived from **Brahmaputra (India)** and **Moskva (Russia)** rivers.
- **Developed By:** **BrahMos Aerospace** a **joint venture** between **India's Defence Research and Development Organisation (DRDO) (50.5%)** and **Russia's NPO Mashinostroyenia (NPOM) (49.5%)**.
- **First Test:** BrahMos was successfully tested in **2001**, from Chandipur, Odisha.
- **Type:** BrahMos is a **two-stage supersonic cruise missile** designed for **high precision and speed**. It features a solid-propellant booster in the first stage, followed by a **liquid-fuelled ramjet** in the second stage that sustains a cruise speed of **Mach 3** (three times the speed of sound), making it one of the fastest cruise missiles in the world.
 - It is a [supersonic cruise missile](#) with '**fire and forget**' **capability** (requiring no further input after being launched).
 - BrahMos is a **stand-off range weapon** designed to be launched from a safe distance beyond enemy defense range. It can cruise at **altitudes up to 15 km and strike targets as low as 10 meters for precision**.
- **Range:** BrahMos' range has evolved from 290 km to 350 km, with future versions aiming for up to 800 km and hypersonic speeds (Mach 5+).
 - BrahMos is **three times faster, 2.5 times longer in range, and has a higher seeker range than subsonic missiles**, resulting in greater accuracy and nine times more [kinetic energy](#).
- **Variants of BrahMos:**
 - **Ship-Based Variant:** Deployed on the Indian Navy's frontline warships since 2005, it can launch a single missile or salvo (up to 8) missiles, effectively executing both **sea-to-sea**

and sea-to-land strikes.

- It was first deployed on the INS Rajput, enhancing the Indian Navy's strike capability.
- **Land-Based Variant:** It has 4-6 mobile launchers, each carrying 3 missiles that can be fired simultaneously at different targets in various configurations.
 - It was operationalized by the **Indian Army** in **2007**, cruises at **2.8 Mach** and, after upgrades, can strike targets with precision up to **400 kilometres**.
- **Air-launched Variant:** The **BrahMos Air-Launched Cruise Missile (ALCM)** is the **heaviest weapon integrated with India's Sukhoi-30 MKI fighter jets**.
 - With a 1,500 km range, BrahMos-armed Sukhois serve as a key deterrent along borders and in the [Indian Ocean Region](#).
- **Submarine-launched Variant:** It can operate from 50 meters underwater using separate settings for underwater and aerial flight.
- **Futuristic BrahMos-NG:** BrahMos-NG (Next Generation), a **lighter, stealthier next-gen missile** under development, is designed for **air, naval, and underwater platforms** and **torpedo tube** launch capability



S400 Triumf

- **About:** The S-400 Triumf, developed by Russia, it is one of the world's most advanced [long-range surface-to-air missile \(SAM\) systems](#).
 - It is dubbed **SA-21 Growler** by **North Atlantic Treaty Organization (NATO)**, it was inducted into service in 2007.
 - It is designed for multi-layered air defence, it can intercept a wide range of aerial threats including aircraft, ballistic missiles, cruise missiles, drones, and stealth targets.
- **Range:** Engages targets up to **400 km** away and at altitudes up to **30 km**.
- **Speed:** Can intercept targets flying at speeds of up to **Mach 14** (~17,000 km/h).
- **Radar Reach:** Detects targets up to **600 km** using advanced radar systems.
- **Target Handling:** Tracks up to **300 targets** and engages up to **36 simultaneously**.
- **Missile Types:**
 - **40N6:** Long-range (up to 400 km)
 - **48N6:** Medium-range (up to 250 km)
 - **9M96E / 9M96E2:** Short to medium-range (40-120 km)
- **India's Role with the S-400:** In 2018, India signed a USD 5.4 billion deal with Russia for **five S-400 air defence squadrons**.
 - Three are currently operational, with two more due by 2026. **Known as Sudarshan Chakra in India**, the S-400 was used by the IAF to counter a Pakistani aerial attack, highlighting its strategic significance.

S-400 SURFACE-TO-AIR MISSILE SYSTEM



S-400 TRIUMF (SA-21 Growler)

Maximum detection range	600km
Maximum altitude	30km
Maximum target speed	4.8km/sec
Targets engaged simultaneously	Up to 36

Missile ranges

9M96: 120km

48N6: 250km

40N6: 400km



Mobile command post



Fire control radar



Launcher: Equipped with four missile canisters. Up to eight launchers in S-400 battery

Each canister holds four short-range missiles or one longer range missile

- Can shoot down up to 80 target simultaneously
- Cannot yet accurately target low-flying aircraft and missiles (altitude below 30,000 ft) at great distances

Note: Asisguard Songar drones are Turkey's first indigenous armed [unmanned aerial system \(UAS\)](#), equipped with assault rifles, grenade launchers, mortars, or tear gas, all featuring safety mechanisms.

Designed for stealth and coordination, they enable reconnaissance and precision strikes.

What is Kinetic and Non-kinetic Warfare?

- **Kinetic Warfare:** Kinetic warfare involves the use of **direct physical force, such as airstrikes, artillery, and ground assaults**, to defeat an adversary.
 - Examples include [Operation Sindoor \(2025\)](#) and the [Balakot Airstrike \(2019\)](#), where the IAF targeted **Jaish-e-Mohammed camps after the Pulwama terror attack**.
- **Non-kinetic Warfare:** It involves strategies that **do not rely on direct physical attacks** but instead target an **enemy's political, economic, informational, or psychological stability**.
 - It includes **cyber warfare** (e.g., Israel's cyber attack on Iran's nuclear facilities), **information warfare** (e.g., fake Rafale downing claims during Operation Sindoor), **electronic warfare** (e.g., India's Samyukta and Divya Drishti systems), **psychological warfare** (e.g., threats, troop videos), and **economic warfare** (e.g., India revoking Pakistan's [Most-Favored-Nation \(MFN\)](#) status post-Pulwama).

What are Defence Agreements of India in the Recent Past?

- **India-Russia:** India has acquired [S-400 systems](#), **MiG-29 fighters**, and **Kamov helicopters** from **Russia**, alongside agreements for **licensed production** of **T-90 tanks**, **Su-30MKI fighters**, **AK-203 rifles**, and **BrahMos missiles**.
- **India-US:** India and the US launched the [US-India COMPACT initiative](#), aimed at fostering military and technological cooperation.
 - A **Security of Supply Arrangement (SOSA)** and **Memorandum of Agreement** on Liaison Officers were signed, ensuring **reciprocal support for defence needs**.
 - India has integrated several **US-origin defence items**, including **C-130J Super Hercules**, **C-17 Globemaster III**, and **AH-64E Apache helicopters**, and is also in talks to acquire **F-35 Lightning-II** combat aircraft.
- **India-UK:** Finalised [Free Trade Agreement](#) to deepen defence trade and cooperation. **Thales UK** and **Bharat Dynamics Limited (BDL)** for the supply of **laser beam riding MANPADs** (Man-Portable Air Defense Systems) and **STARStreak missiles (short range surface-to-air missile)**.
 - Both are collaborating on a first-of-its-kind **air-to-air missile assembly and testing facility** in Hyderabad.
- **India-France:** India and France signed an Inter-Governmental Agreement (IGA) for **26 Rafale-M aircraft** for the **Indian Navy** and a **Defence Industrial Roadmap**, covering [Scorpene submarines](#), Rafale jets, and indigenous production.

Treaties Against Nuclear Weapons

Part - I

Nuclear Weapons

- The most dangerous weapons on earth; a **bomb or missile that uses nuclear energy to cause an explosion.**
- Nuclear weapons release energy either by **nuclear fission (atomic bombs) or nuclear fusion (hydrogen bombs).**
- Even a single weapon is potent of **destroying a whole city**, potentially **killing millions, jeopardising the natural environment** and lives of future generations.
- They were used for the **first and last time in WW-II** by the US in 1945 on **Hiroshima and Nagasaki.**

Treaty on the Non-Proliferation of Nuclear Weapons (NPT 1970)



- **Objective:**
 - Prevent the spread of nuclear weapons and its technology
 - Foster peaceful uses of nuclear energy
 - Further the goal of nuclear disarmament
- **Member States:**
 - 191 with **5 nuclear-weapon states (NWS)** (US, Russia, UK, France & China)
- **Nuclear-Weapon States:**
 - Those who **manufactured & exploded** a nuclear weapon or nuclear explosive device **before 1st January 1967**
- **Significance:**
 - **Only binding treaty** to the goal of disarmament by the NWS
- **India and NPT:**
 - India (along with Pakistan, Israel, North Korea, and South Sudan) is **not a member**
 - Opposes it as a **discriminative disarmament policy**
 - India's policy - **No First Use against NWS** and **no use against non-NWS**
- **NPT Review Conference:**
 - **Undertakes review** of the treaty's implementation **quinquennially**



Drishti IAS



Treaties Against Nuclear Weapons

Part II



Missile Technology Control Regime (MTCR) (1987)

- An informal and voluntary partnership
- Not legally binding
- Established in 1987 by G7 countries

Objective: To prevent the proliferation of missile and UAV (Unmanned Aerial Vehicle) technology capable of carrying >500 kg payload for range >300 km

MTCR Categories

Category I Items

- Complete rocket and UAV systems (>500 kg payload for >300 km)
- Such items are subjected to unconditional strong presumption of denial for export

Category II Items

- Less-sensitive and dual-use missile related components and other complete missile systems (range >300 km)
- Their export is subject to licensing requirements

35 Member Countries

India inducted into the MTCR in 2016 as the 35th member

China not a member

Mandate on Members

- Prohibition on supplying missiles and UAV systems controlled by the MTCR to non-members.
- In 1992, the ambit was extended to all Weapons of Mass Destruction - nuclear, chemical & biological.

Secretariat: No formal Secretariat; France serves as MTCR's Point of Contact

MTCR and UN: No formal linkage but remains committed to the UN's non-proliferation and export control efforts

Significance for India

- Can procure high-end missile technology
- Can run joint programmes for development of UAVs with other countries

Comprehensive Nuclear-Test-Ban Treaty (CTBT) (1996)

Objective: Ban all nuclear explosions - everywhere, by everyone

Negotiated At: Conference on Disarmament in Geneva 1996 (adopted by UNGA)

185 Signatories

Out of 44, 36 countries have ratified

Treaty will enter into force after all 44 States listed in Annex 2 will ratify it (States having nuclear facilities at the time the Treaty was negotiated and adopted)

8 Annex-2 Countries Not Ratified

- China, North Korea, Egypt, India, Iran, Israel, Pakistan and the US
- India, North Korea and Pakistan haven't also signed the Treaty

CTBT Organisation

- Promotes the Treaty so that it can enter into force
- Headquartered in Vienna



Conclusion

India's defence strategy combines **kinetic** (BrahMos strikes, S-400 interceptions) and **non-kinetic** (cyber, electronic warfare) capabilities to counter threats. Strengthened by agreements with **Russia (S-400, BrahMos)**, the **US (F-35 talks)**, and **France (Rafale-M)**, India is enhancing **multi-domain warfare readiness**, ensuring deterrence against adversaries like **Pakistan** and **China** while boosting indigenous defence production.

Drishti Mains Question:

With reference to India's evolving strategic environment, explain the relevance of developing indigenous air defence and missile systems.

UPSC Civil Services Examination Previous Year Question (PYQ)

Q. What is "Terminal High Altitude Area Defense (THAAD)", sometimes seen in the news? (2018)

- (a) An Israeli radar system
- (b) India's indigenous anti-missile programme

(c) An American anti-missile system

(d) A defence collaboration between Japan and South Korea.

Ans: (c)

Mains

Q. What is the significance of Indo-US defence deals over Indo-Russian defence deals? Discuss with reference to stability in the Indo-Pacific region. (2020)

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