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THEMATIC CURRENT AFFAIRS

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It's important to note that simply compiling current affairs won't suffice; it's crucial to learn how to utilize and link them effectively.

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Prelims Sampoorna 2024

UPSC CSE Current Affairs

1

Missile System

1. ASTRA AIR-TO-AIR MISSILE

CONTEXT

Recently, the Light Combat Aircraft (LCA) Tejas Limited Series Production-7 (LSP-7) successfully test fired the **ASTRA indigenous Beyond Visual Range (BVR)** air-to-air missile off the **coast of Goa.**

Background

- The Astra project was officially launched in the **early 2000s** with defined parameters and proposed future variants.
- Around 2017, the development phase of the **Mk-1 version** was complete.
- Several successful tests have been conducted since 2017 from **Sukhoi-30 MKIs.**

About ASTRA indigenous Beyond Visual Range (BVR):

- The Astra Mk-1 is a **Air-to-Air Missile (AAM).**
- BVM missiles are capable of engaging beyond the range of **20 nautical miles or 37 kilometers**.
- AAMs are fired from an **airborne asset** to destroy **an airborne target.**
- **Range:** The range for Astra Mk-1 is around 110 km.
  - The Mk-2 with a range over 150 km is under development and Mk-3 version with a longer range is being envisaged.
  - One more version of Astra, with a range smaller than Mk-1 is also under development.
- **Designed and Developed by:**
  - Defence Research and Development Organisation (DRDO)

What is a missile?

- A **missile** is a guided airborne ranged weapon capable of **self-propelled flight** usually by a jet engine or rocket motor.
- The word **missile** referred to **any projectile** that is thrown, shot or propelled towards a target; this usage is still recognized today.
- Missiles are thus also called **guided missiles** or **guided rockets** (when in rocket form).
- T**ypes:** Missiles are generally classified on the basis of their **Type, Launch Mode, Range, Propulsion and Warhead.**

CLASSIFICATION OF MISSILES

1. Based on launching base

- **Surface-to-Surface Missile**: A surface-to-surface missile is a guided projectile launched from a hand-held, vehicle mounted, trailer mounted or fixed installation. It is often powered by a rocket motor or sometimes fired by an explosive charge since the launch platform is stationary.
- **Surface-to-Air Missile**: A surface-to-air missile is designed for launch from the ground to destroy aerial targets like aircrafts, helicopters and even ballistic missile. These missiles are generally called air defence systems as they defend any aerial attacks by the enemy.
- **Surface (Coast)-to-Sea Missile**: A Surface (Coast)-to-Sea Missile is designed to be launched from land to ship in the sea as targets.
- **Air-to-Air Missile**: An Air-to-Air Missile is launched from an aircraft to destroy the enemy aircraft. The missile flies at a speed of 4 Mach.
- **Air-to-Surface Missile**: An Air-to-Surface Missile is designed for launch from military aircraft and strikes ground targets on land, at sea or both. The missiles are basically guided via laser guidance infrared guidance and optical guidance or via GPS signals. The type of guidance depends on the type of target.
- **Sea-to-Sea Missile**: Sea-to-Sea Missile is designed for launch from one ship to another ship.
- **Sea-to-Surface (Coast) Missile**: A Sea-to-Surface (Coast) Missile is designed for launch from ship to land based targets.
- **Anti-Tank Missile:** An Anti-Tank Missile is a guided missile primarily designed to hit and destroy heavily-armoured tanks and other armoured fighting vehicles. Anti-tank missiles could be launched from aircraft, helicopters, tanks and also from shoulder mounted launcher.

2. Based on Speed

- **Subsonic cruise missile:** Subsonic cruise missile flies at a speed lesser than that of sound. It travels at a speed of around 0.8 Mach. Example: **American Tomahawk cruise missile**, **Harpoon of USA and Exocet of France**.
- **Supersonic cruise missile:** Supersonic cruise missile travels at a speed of around 2-3 Mach i.e.; it travels a kilometre approximately in a second.
- **Hypersonic cruise missile:** Hypersonic cruise missile travels at a speed of more than 5 Mach.

3. Based on intended target

- **Ballistic missiles**: After the boost stage, ballistic missiles follow a trajectory mainly determined by ballistics. The guidance is for relatively small deviations from that. **Ballistic missiles are largely used for land attack missions**. Although normally associated with nuclear weapons, some conventionally armed ballistic missiles are in service, such as MGM-140 ATACMS.
- **Cruise missile**: Cruise missiles are generally associated with **land-attack operations**, but also have an important role **as anti-shipping weapons**.
  - They are primarily launched from **air, sea or submarine platforms in both roles**, although land-based launchers also exist.
- **Anti-ship and Anti-submarine**: These missile are generally use the missile in order to deliver another weapon system such as a torpedo or depth charge to the location of the submarine, at which point the other weapon will conduct the underwater phase of the mission.
- **Anti-tank**: it is man-portable missile proved and may be launched from aircraft, vehicles or by ground troops in the case of smaller weapons.

2. AGNI SERIES

CONTEXT

India's **Agni-V ICBM (Intercontinental-range Ballistic missile)** has undergone nine successful trials since its maiden flight in 2012.

About Agni Series:

- Agni missiles are **long-range ballistic missiles** and form the backbone of India's nuclear deterrence.
- The series includes
  - Agni-I (700 km range)
  - Agni-II (2,000 km range)
  - Agni-III (3,000 km range)
  - Agni-IV (4,000 km range)
  - Agni-V (5,000 km range)

Series	About
Agni-I	⦿ It is a **two-stage Agni technology** demonstrator with a solid-fuel first stage. ⦿ It was first tested at the Interim Test Range in Chandipur in 1989. ⦿ It has a strike range of 700-1200 km and can carry a payload of 1,000 kg. ⦿ As compared to Agni-II, Agni-I is less costly, simple, accurate and more mobile.

Agni-II	⦿ It is a two-stage ballistic missile with a strike range of 2,000-3000 km. ⦿ It can carry a payload of 1,000 kg and was first launched in 2012.
Agni-III	⦿ It is the third in the Agni series of missiles. ⦿ It is an intermediate-range ballistic missile with a 3,500-5,000 km range. ⦿ It can carry a payload of 1,500 kg.
Agni-IV	⦿ It is an intermediate-range ballistic missile with a range of around 4,000 km ⦿ Agni-IV bridges the gap between Agni II and Agni III. Agni-IV can take a warhead of 1,000 kg. ⦿ With state-of-the-art technologies, Agni-IV is designed to increase kill efficiency and higher range performance. ⦿ It can be fired from a road-mobile launcher.
Agni-V	⦿ It is a solid-fuelled intercontinental ballistic missile (ICBM) which has a strike range of over 7,000 km.
Agni-P	⦿ Agni-P is the sixth missile in the Agni (missile) series of ballistic missiles. ⦿ It is a family of medium to intercontinental range ballistic missiles developed by India, named after one of the five elements of nature.

3. AGNI P MISSILE

CONTEXT

In a significant milestone, India's Defence Research and Development Organisation (DRDO) successfully conducted a flight test of the new generation ballistic missile called 'Agni Prime'.

What is Agni Prime?

⦿ The **Agni P missile**, developed by India's DRDO, is a **two-stage ballistic missile** that uses solid propellant and is stored in a canister.

⦿ It is equipped with a redundant navigation and guidance system.

⦿ The Agni Prime missile is an advanced version that follows the Agni-I and Agni-II missiles which are currently in operational use by the Strategic Forces Command.

⦿ Agni P incorporates significant upgrades including an improved composite motor casing, a **manoeuvrable re-entry vehicle (MaRV),** and enhanced propellants, navigation, and guidance systems.

⦿ With the inclusion of a MaRV, the Agni-P missile gains the ability to deliver warheads to two distinct targets.

4. MULTIPLE INDEPENDENTLY TARGETABLE RE-ENTRY VEHICLE (MIRV)

CONTEXT

Agni-P, the latest but miniaturized version of Agni missiles, reportedly carried MIRVs or its decoys during its first test flight in June 2021 and during pre-induction night launch conducted by the Strategic Forces Command.

What is multiple independently targetable re-entry vehicle (MIRV)?

- A **multiple independently targetable re-entry vehicle (MIRV)** is a **sophisticated missile technology** that allows a **single ballistic missile** to carry multiple warheads, each capable of being aimed at hitting a different target.
- The concept of MIRV involves launching multiple independently targetable re-entry vehicles (ICBMs and SLBMs) carrying nuclear warheads.
- This technology is significant in strategic nuclear warfare, as it enables a single missile to effectively target several locations simultaneously.

Pakistan's Ababeel

- Pakistan successfully test-fired a **medium-range ballistic missile**, designed to penetrate **India's developing air defense system.**
- The Ababeel weapon system is designed to deliver multiple warheads in a single flight.
- Ababeel is capable of carrying **independently targetable re-entry vehicles (MIRVs).**

5. PRITHVI SERIES

CONTEXT

Seeking to enhance its precision strike capabilities, India is planning to replace its 150 km-range **Prithvi ballistic missiles** with the newly developed quick reaction **Prahar missiles.**

About Prithvi Series:

- The Prithvi is India's **first indigenously developed ballistic missile**.
- It is a **Short-Range Ballistic missile (SRBM)** and evolved from the **Integrated Guided Missile Development Program.**
- The missiles come in various variants like:
  - Prithvi-I (150 km range)

- Prithvi-II (250 km range)
- Prithvi-III (350 km range)

- These missiles are known for their tactical advantages and quick deployment.

6. PRALAY MISSILE

CONTEXT

India's surface-to-surface short-range ballistic missile (SRBM) "Pralay" was successfully test-fired.

About Pralay Missile

- Pralay is a **350-500 km short-range**, **surface-to-surface missile** with a payload capacity of 500-1,000 kg.
- It is a **solid-fuel, battlefield missile** based on the **Prithvi Defence Vehicle (PDV)** from **Indian Ballistic Missile Defence Programme** and **Prahaar tactical Missile.**
- Pralay has been developed for deployment along the Line of Actual Control (LAC) and Line of Control (LoC).
- The missile can be compared with China's 'Dong Feng 12' and Russia's 'Iskander'.

Prahaar Missile

- 'Prahaar', developed by the Defence Research and Development Organisation (DRDO), is capable of filling the gap between the multi-barrel rocket system 'Pinaka' and medium-range ballistic missile 'Prithvi'.
- It can also engage multiple targets in different directions.
- **High manoeuvrability.** Primarily a battlefield support system for the Army.

7. ASTRA MISSILE

CONTEXT

The Indian Air Force (IAF) has placed two contracts with **Bharat Dynamics Limited (BDL)** for the indigenous **Astra Beyond Visual Range (BVR) Air to Air Missile** and the first batch is expected to be inducted by the end of 2023.

What is Astra?

- Astra is a **state-of-the-art BVR air-to-air missile** with a range of over 100 km designed to engage and destroy highly manoeuvrable supersonic aerial targets.

- It is designed and developed by the **Defence Research and Development Laboratory (DRDL), Research Centre Imarat (RCI)** and other DRDO laboratories.

8. NIRBHAY MISSILE

CONTEXT

Bharat Dynamics, which has been reported to make the Nirbhay class of missiles, may get a shot in the arm as all three defence forces will reportedly induct these weapons designed to hit a target more than 1,000 kilometres away.

About

- The Nirbhay class cruise missiles complement the **supersonic BrahMos cruise missiles** that travel a shorter range.
- The Nirbhay class long-range cruise missiles have been developed by the **Defence Research and Development Organisation (DRDO)** indigenously and travel at a speed lower than that of sound.
- The Nirbhay measures 6 m in length, 0.5 m in diameter and weighs 1,500-1,600 kg at launch. It has a range of 800-1,000 km while carrying a 450 kg payload.
- It equips a land-based mobile launcher and carries high-explosives or submunitions, although a small nuclear warhead with a 12 KT yield is also possible.

9. NAG ANTI-TANK GUIDED MISSILE (ATGM)

CONTEXT

India's **Defence Research and Development Organisation (DRDO)** recently confirmed that the **Nag anti-tank guided missile (ATGM)**, the development of which was started in the 1980s, has cleared all the flight and user trials required for induction into the Indian Army.

What is Nag Missile?

- The Nag ATGM was developed by **Bharat Dynamics Limited (BDL)** and the **DRDO's Defence Research and Development Laboratory (DRDL)** to meet an Indian Army requirement for a vehicle- and air-launched ATGM with a maximum range of 4 km.
- The Nag is a **tripod-mounted ATGM** that can also be mounted on helicopters and the **Nag Missile Carrier (NAMICA) armoured vehicle**, a variant of the **Russian BMP-2 Sarath** developed by the DRDO.
- For targeting, the Nag missile employs a **passive mercury cadmium telluride (MCT) focal plane-array imaging infrared (IIR)/longwave IR (LWIR) seeker**.
- The missile uses a **lock-on before launch (LOBL) mode**; however, it is designed with stretch potential for **lock-on after launch (LOAL) capability.**

- Following launch, the roll, pitch, and yaw of the missile are controlled by rotating the rear fins with an all-electric actuation mechanism powered by thermal batteries.
- The combined thrust of the booster and sustainer propulsion systems ejects the Nag from its launch tube, following which the fins unfold. It uses a high-energy nitramine-based, extruded double-band, smokeless sustainer propellant.
- The missile uses an **8 kg tandem high-explosive anti-tank (HEAT) warhead**.
- The warhead is capable of penetrating 800 mm of **rolled homogeneous armour equivalent (RHAe)** behind **explosive reactive armour (ERA).**
- The Nag has a length, diameter, and weight of 1.83 m, 0.15 m, and 42 kg respectively.

10. B-05LV MISSILE

CONTEXT

A **Short-range B-05LV missile** was successfully test-fired by **DRDO.**

About

- Also Known as **"Sagrika",** the **Short-range B-05LV missile** has a range of more than 700 kilometres and it is currently in service with **India's SSBN Fleet.**
- BS-05 is the code name for **K-15 Submarine launched Ballistic Missile (SSBN).**
- The K-15 is a two-stage submarine-launched ballistic missile which uses a gas booster to eject out of its launch platform and rise up to the surface of water. A solid rocket motor is fired after the missile reaches a fixed altitude.
- The missile has a modest range of around 750 kilometres. The missile has a maximum speed of Mach 7.5.
- The missile uses Inertial navigation system with GPS/NavIC satellite guidance for mid-course and Terrain contour matching for terminal stage. The missile has demonstrated single digit impact-accuracy in the previous trials.
- The Shaurya missile is a canister-launched **Hypersonic surface-to-surface tactical missile** is speculated to be the land version of the under-water **Sagarika K-15 missile.**
- The K-15 missile has been integrated with **India's SSBN INS Arihant** and was fully operationalised in August 2018. INS Arihant can be equipped with **12 × K-15 Sagarika SLBMs.**

11. DRDO, INDIAN NAVY CONDUCTS SUCCESSFUL TRIAL OF INTERCEPTOR MISSILE

CONTEXT

Defence Research and Development Organisation (DRDO) and Indian Navy successfully conducted a maiden flight trial of a sea-based endo-atmospheric interceptor missile off the coast of Odisha in the Bay of Bengal.

Key-highlights

- The purpose of the trial was to engage and neutralize a hostile ballistic missile threat thereby elevating India into the elite club of Nations having Naval Ballistic missile defence (BMD) capability.
  - **AWACS (airborne warning and control systems)** and other hostile aircraft, as well as approaching long-range nuclear missiles, can be intercepted by BMDs.
- Prior to this, DRDO successfully demonstrated land-based BMD system with the capability to neutralize ballistic missile threats, emerging from adversaries.

Endo-atmospheric missiles

- **Endo-atmospheric interception** means the missile fired by Indian testing agencies had destroyed the incoming enemy ballistic missile within the Earth's atmosphere.
  - The endo-atmospheric missiles are those that function within the earth's atmosphere and have a range of less than 100 kilometres.
- **Exo-atmospheric interception**, on the other hand, is for destroying incoming enemy ballistic missiles outside of the Earth's atmosphere at a higher altitude.
  - The exo-atmospheric missiles are capable of completing missions in the uppermost part of the earth's atmosphere.
- **India's phase-II ballistic missile defence interceptor AD-1,** which can engage a wide variety of targets, successfully completed its first flight test in November.
- **Long-range ballistic missiles** and planes can be intercepted by the **AD-1 long-range interceptor missile** in both "low exo-atmospheric" and "endo-atmospheric" settings.

12. IAF TEST-FIRES EXTENDED-RANGE BRAHMOS

CONTEXT

For the second time this year, the **Indian Air Force (IAF)** fired the "extended-range" version of the **BrahMos air-launched missile from a Sukhoi-30 MKI fighter aircraft.**

About

- The BrahMos supersonic cruise missile has a two-stage solid propellant booster engine as its first stage which takes it to supersonic speed.
- The second stage is the liquid ramjet engine which takes it closer to Mach 3 (3 times the speed of sound) speed in the cruise phase.
- The BrahMos missile is universal for multiple platforms and can be launched from air, land, and sea platforms.
- The missile works on the 'Fire and Forget principle', meaning it doesn't require further guidance after launch, and it maintains a high supersonic throughout the flight.
- The missile is said to have a low radar signature.

"Extended-Range" version:

- The "extended-range" version means the missile can travel more than 300 km.
- Before India joined the **MTCR,** the Russian technology of the BrahMos was restricted as the MTCR limits the export of missile technology which can travel beyond 300 km.
- The missile cap of 300 km range on India was lifted after it was inducted into the Missile Technology Control Regime (MTCR) six years ago.

13. MISSILE DESTROYER INS MORMUGAO COMMISSIONED INTO THE INDIAN NAVY

CONTEXT

INS Mormugao, an indigenously developed missile destroyer has been commissioned into the Indian Navy.

Details:

- **INS Mormugao (Pennant D67)** is the second of the **Project 15B**stealth-guided missile destroyers.
- **It is** built by Mazagon Dock Shipbuilders Limited (MDSL).
- The ship, named after a **key port in Goa**, was commissioned a day before the Goa Liberation Day celebrations.

What is Project 15B?

- The contract for four ships of Project 15B was signed in 2011.
- This Project is follow-on of the **Kolkata class (Project 15A) destroyers** commissioned in the last decade.
- A total of four ships are being developed under this project.

- **Visakhapatnam:** The lead ship of the Project - INS Visakhapatnam has already been commissioned into the Indian Navy on 21 Nov 21.
- **Mormugao**
- **Imphal**
- **Surat**

- The purpose of the Indian Navy's Project 15B is to develop stealth destroyers having maximized indigenous inputs.
- They are all designed by the Indian Navy's in-house organized, **Warship Design Bureau**.
- They are built by Mazagon Dock Shipbuilders Ltd in Mumbai.

Weaponry

- Barak-8 surface-to-air missiles
- BrahMos surface-to-surface cruise missiles
- 127 mm main gun
- four AK-630 30 mm guns
- 533 mm torpedo launchers
- RBU-6000 anti-submarine rocket launchers.

14. DRDO CONDUCTS MAIDEN FLIGHT-TEST OF PHASE-II BALLISTIC MISSILE DEFENSE INTERCEPTOR

CONTEXT

India has successfully conducted the maiden flight test of the **Phase-II Ballistic Missile Defence (BMD) interceptor AD-1 missile.**

About AD (Air Defense)-1:

- The AD-1 is a **long-range interceptor missile**.
- AD-1 is a unique type of interceptor with advanced technologies available with only a very few nations in the world.
- It is designed for both **low exo-atmospheric and endo-atmospheric interception** of long-range ballistic missiles as well as aircraft.
- It is propelled by a two-stage solid motor and equipped with an indigenously-developed advanced control system, navigation, and guidance algorithm to precisely guide the vehicle to the target.

Apprehensions:

- **BMD is ineffective against Cruise missiles**. Both China and Pakistan have cruise missile capable of delivering the nuclear payload.
- **No BMD can have a 100% success rate** in the interception of the projectile (ballistic missile).
- **BMD is a very costly affair**.
- Even after interception there remain **chances of damage**, especially if the interception is done in the terminal phase of the ballistic missile.

What's Ballistic Missile Defence (BMD) System?

- A Ballistic Missile Defence system (BMD) is a missile defense system that acts as a shield against ballistic missile attacks.
- You may not that the purpose is defense (by intercepting a ballistic missile) and not attack/offense.
- A ballistic missile can be intercepted in three phases:
- **Terminal phase**: During the atmospheric descent phase.
- **Mid-course interception (in-flight interception):** Most preferred interception.
- **Lift-off phase:** Targeting at the launch point- requires advanced radars.

Indian Ballistic Missile Defence Programme:

- The Indian Ballistic Missile Defence Program is an initiative to develop and deploy a multi-layered ballistic missile defense system to protect India from ballistic missile attacks.
- **It was launched in 2000 after Kargil War** by the Atal Bihari Vajpayee government.
- India has an active ABM development effort using indigenously developed and integrated radars, and indigenous missiles.
- In November 2006, India successfully conducted the PADE (Prithvi Air Defence Exercise) in which an anti-ballistic missile, called the Prithvi Air Defence (PAD), an exo-atmospheric (outside the atmosphere) interceptor system, intercepted a Prithvi-II ballistic missile.

Two- tiers of India's BMD

Prithvi Air Defence (PAD)	Advanced Air Defense (AAD)
Also referred as Pradyumna Ballistic Missile Interceptor.	It is also called Ashwin Ballistic Missile Interceptor.
It's designed for High altitude interception (exo-atmospheric interception).	It's an endo-atmospheric interception system (for low-altitude interception).
Intercept missiles at altitudes between 50 – 80 km.	Altitude of interception is range up to 30 km.
The interceptor is Prithvi Defense Vehicle (PDV) which has two-stage, both with solid propellants.	It has a single-stage solid-fueled missile.

15. IAF TO INCREASE SUKHOIS ARMED WITH BRAHMOS SUPERSONIC CRUISE MISSILE

CONTEXT

The **Indian Air Force (IAF)** is set to increase the number of **Sukhoi 30 (SU-30) MKI fighters** integrated with BrahMos supersonic missile, which now has a range of over 500 kilometres.

About BrahMos Missile

- The BrahMos is **a ramjet supersonic cruise missile** of a short-range developed by the **Defence Research and Development Organisation (DRDO) and the Russian Federation's NPO Mashinostroyeniya (NPOM)**.
- It is named after **two major rivers** of India and Russia: **Brahmaputra and Moskva.**
- The use of BrahMos missiles for**land as well as anti-ship attacks.**
- They can be launched from **land, air and sea**, and all three variants are in service in the Indian armed forces.
- It is a two-stage (solid propellant engine in the first stage and liquid ramjet in second) missile.
- It operates on the "**Fire and Forgets**" principle i.e. it does not require further guidance after launch.
- BrahMos missiles are manufactured in India under a joint venture that was formed in 1998 between **India's Defence Research and Development Organisation** and **Russia's NPO Mashinostroyeniya.**

The Sukhoi 30 (SU-30) MKI fighter Jets

- The **Sukhoi Su-30MKI** is a twinjet multirole air **superiority fighter**developed by Russia's Sukhoi and built under licence by India's Hindustan Aeronautics Limited (HAL) for the Indian Air Force (IAF).
- A variant of the Sukhoi Su-30, it is a heavy, all-weather, long-range fighter.
- The first Russian-made Su-30MKI variant was accepted into the Indian Air Force in 2002, while the **first Su-30MKI** assembled in India entered service with the **IAF in 2004.**
- The IAF has nearly **260 Su-30MKIs** in inventory as of January 2020.
- The Su-30MKI is expected to form the backbone of the Indian Air Force's fighter fleet to 2020 and beyond.

The IAF currently has **40 SU-30 MKI** with BrahMos, the only supersonic cruise missile in the world.

16. HYPERSONIC PLATFORMS

CONTEXT

Recently, Russia used a hypersonic missile for the first time in the ongoing **conflict with Ukraine**.

What is a Hypersonic Missile?

- A hypersonic missile is a weapon system **that flies at least at Mach 5 i.e. five times the speed of sound** and is maneuverable.
- The maneuverability of the hypersonic missile is **what sets it apart from a ballistic missile as the latter follows a set course** or a ballistic trajectory.
- Thus, unlike ballistic missiles, **hypersonic missiles do not follow a ballistic trajectory** and can be maneuvered to the intended target.
- The two types of hypersonic weapons systems are **Hypersonic Glide Vehicles (HGV) and Hypersonic Cruise Missiles**.

The HGV is launched from a rocket before gliding to the intended target while the hypersonic cruise missile is powered by air-breathing high-speed engines or **'scramjets'** after acquiring their target.

17. THIRD STEALTH FRIGATE OF PROJECT 17A TARAGIRI LAUNCHED

CONTEXT

Mazagon Dock Shipbuilders Ltd (MDL) recently launched the **third Stealth Frigate** of Project 17A "Taragiri".

About Taragiri:

- Taragiri is the **indigenously-designed Nilgiri-class stealth guided-missile frigate** constructed by **Mazgaon Dock Shipbuilders Limited (MDL).**
- Taragiri is the **third stealth frigate** built as part of **Project 17A**under which a series of such guided-missile frigates are being constructed for the Navy.
- The 149-metre-long and 17.8-metre-wide ship is propelled by a combination of two gas turbines and two main diesel engines which are designed to achieve a speed of more than 28 knots at a displacement of as much as 6,670 tonnes
- The steel used in the hull construction of P17A frigates is indigenously developed DMR 249A, which is a low carbon micro-alloy grade steel manufactured by the Steel Authority of India Limited.
- **Construction methodology:** This ship has been built using integrated construction methodology.
- In this method, several modules of the vessel are pre-constructed and later fitted on the ship.

Important Features

- **Base-design:** It has been built with Niligir-like features.
- **Stealth and modular profile**: The two key features of the Taragiri ship are expected to be stealth and modular profile.
- **Undetectable:** The vessel has been constructed using composite materials which can decrease its infrared signal and maintain a low radar cross-section, making it almost undetectable.
- **Missile system:** It will be fitted with supersonic surface-to-surface missile system.
- **Air defence capability:** The ship's air defence capability, designed to counter the threat of enemy aircraft and anti-ship cruise missiles will revolve around the vertical launch and long range surface to air missile system.
- **Gunfire support:** Two 30 mm rapid-fire guns will provide the ship with close-in-defence capability while an SRGM Gun will enable her to provide effective naval gunfire support.
- **Torpedo and rocket launcher**: Indigenously developed triple tube light weight torpedo launchers and rocket launchers will add punch to the ship's anti-submarine capability.

What is Project 17A of the Indian Navy?

- **Project 17 Alpha frigates (P-17A)** were launched by the Indian Navy in 2019.
- **Objective:** To construct a series of stealth guided-missile frigates, which are currently being constructed by two companies - Mazagon Dock Shipbuilders (MDL) and Garden Reach Shipbuilders & Engineers (GRSE).
- **Nilgiri:** The first stealth ship launched under Project 17A was launched in 2019 and is expected to be commissioned in the Indian Navy by the end of this year.
- **Udaygiri:** The second ship was launched in May 2022, and likely to be commissioned in 2024.

18. AGM-88 HARM, THE NEW ANTI-RADAR MISSILE

CONTEXT

US has supplied some "anti-radiation missiles" to Ukraine, which could be fired from some Ukrainian Air Force aircraft.

AGM-88 HARM missile:

- The acronym 'HARM' in the AGM-88 HARM air-to-surface missile stands for High-Speed Anti-Radiation Missile.
- It is a tactical weapon fired from fighter aircraft, and has the capability to detect and home into radiation emitted by hostile radar stations that have surface-to-air detection capabilities.
- The missile was originally developed by the Dallas-headquartered Texas Instruments, but is now produced by the major American defence contractor Raytheon Corporation.

- An advanced version of the weapon is manufactured by Dulles, Virginia-based Northrop Grumman.
- The AGM-88 HARM is 14 metres in length, but only 10 inches in diameter.
- It weighs around 360 kg and carries a fragmentation type warhead that is optimised for radar targets.
- It also has an anti-radar homing seeker broadband RF antenna and receiver, and a solid state digital processor.
- The missile has a range of more than 100 km.
- The AGM-88 can detect, attack and destroy a target with minimum aircrew input.
- The proportional guidance system that hones in on enemy radar emissions has a fixed antenna and seeker head in the missile nose.
- A smokeless, solid-propellant, dual-thrust rocket motor propels the missile.

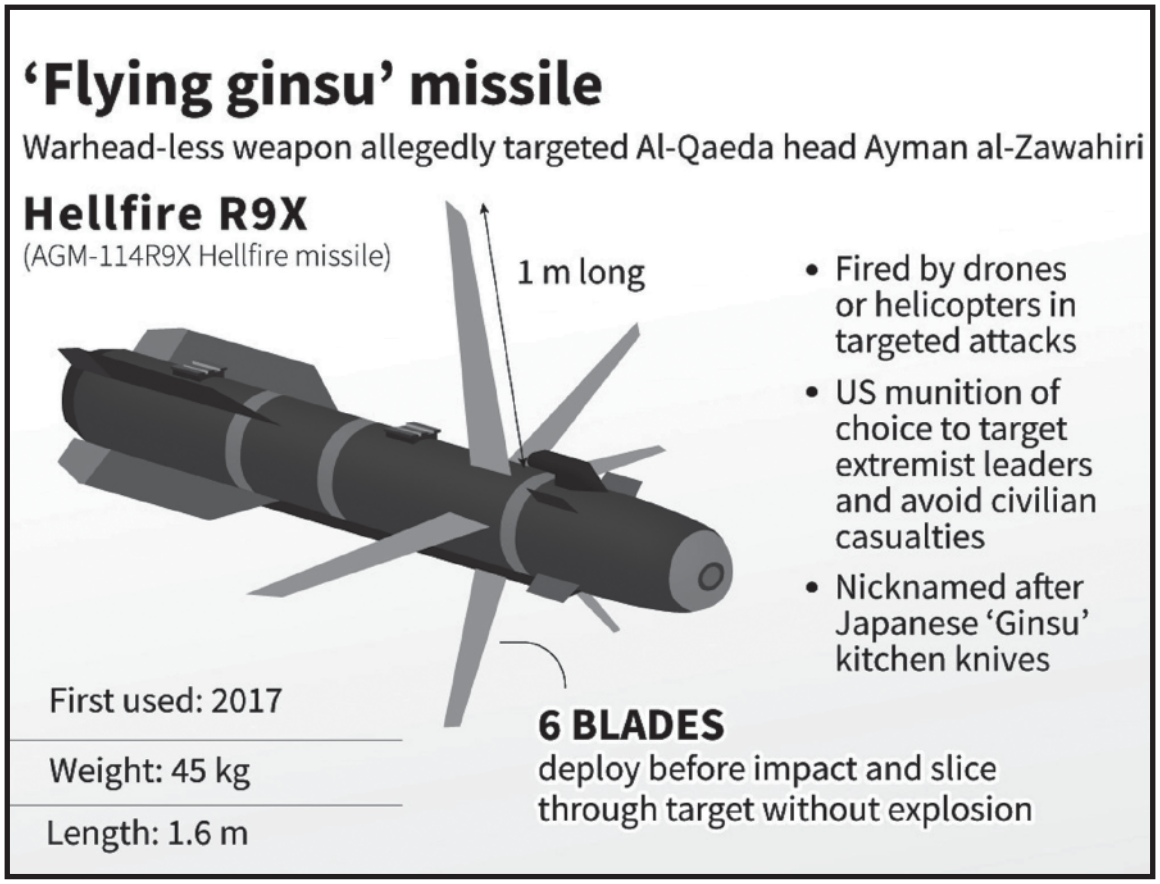
19. HELLFIRE R9X MISSILE

CONTEXT

Ayman al-Zawahiri was killed in a US strike recently. The US military used its 'secret weapon', the Hellfire R9X missile, to kill him.

Hellfire R9X Missile:

- The Hellfire R9X (or AGM-114 R9X) is a US-origin missile known to cause minimum collateral damage while engaging individual targets.
- It is also known as the 'Ninja Missile'.
- This weapon does not carry a warhead and instead deploys razor-sharp blades at the terminal stage of its attack trajectory.
  - This helps it to break through even thick steel sheets and cut down the target using the kinetic energy of its propulsion without causing any damage to the persons in the general vicinity or to the structure of the building.
- The blades pop out of the missile and cut down the intended target without causing the massive damage to the surroundings which would be the case with a missile carrying an explosive warhead.
- The Hellfire 9RX missile is known to have been in active service since 2017.
  - However, its existence became public knowledge two years later in 2019.
- It is a variant of the original Hellfire missile family which is used in conventional form with warheads and is traditionally used from helicopters, ground-based vehicles, and sometimes small ships and fast moving vessels.
- Hellfire is actually an acronym for Heliborne, Laser, Fire and Forget Missile and it was developed in the US initially to target tanks from the Apache AH-64 attack helicopters.
  - Later, the usage of these missiles spread to several other variants of helicopters and also ground and sea-based systems and drones.
- The Hellfire missile has other variants such as 'Longbow' and 'Romeo' apart from the 'Ninja'



20. NUCLEAR TRIAD CLUB

CONTEXT

India is also part of the elite Nuclear Triad club.

What is a nuclear triad?

⊙ A nuclear triad is a three-pronged military force structure comprising land-launched nuclear missiles, nuclear-missile-armed submarines, and strategic aircraft carrying nuclear bombs and missiles.

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2

Drones

1. MQ-9B PREDATOR DRONES

CONTEXT

India is planning to deploy 16 **MQ-9B Predator drones** on the land border, out of the total 31 drones being bought from the United States.

What are the Predator drones?

- The Predator drone or the MQ-9 Reaper is an **unmanned aerial vehicle (UAV)**.
- **Developed by:** General Atomics Aeronautical Systems
- It is primarily used for **long-endurance, high-altitude surveillance and strike missions.**
- The Reaper is the successor to the **MQ-1 Predator drone**. The development of the Predator began in the 1990s.
- Its ISR capabilities, endurance, and armament make it an effective tool for tracking and targeting insurgent and terrorist networks, disrupting their activities, and supporting ground operations.

Role and capabilities

- The primary role of the Predator drone is **intelligence, surveillance, and reconnaissance (ISR).**
- **Precision airstrikes:** It is capable to conduct precision airstrikes. It can carry and employ a range of munitions, including the **AGM-114 Hellfire missiles** and **GBU-12 Paveway II laser-guided bombs.**
- **Close Air Support:** The Reaper can provide close air support (CAS) to ground forces engaged in combat operations.
- **Real-time support:** It can loiter over an area for extended periods, allowing it to provide real-time support, reconnaissance, and strike capabilities to troops on the ground.
- **Image gathering and transmission:** It is equipped with a range of sensors and cameras that enable it to gather real-time imagery and transmit it to ground stations for analysis.
- Its capabilities make it a **valuable asset** for military operations, border surveillance, and counterterrorism efforts.

2. ISKANDER-M MISSILE SYSTEM

CONTEXT

Russia threatened to send nuclear capable short-range missile systems to its ally Belarus.

Iskander-M system:

- The Iskander-M is a mobile guided missile system code-named **"SS-26 Stone"** by NATO, which replaced the **Soviet "Scud**."
- Russia defines Iskander-M System as both the **transporter-erector launch system and the short-range ballistic missile (SRBM) it fires.**
- The system can **also fire ground-launched cruise missiles (GLCMs)** – the SSC-7 and the SSC-8.
- The **Iskander-M system has been exclusively used by the Russian military**, whereas **Iskander-E is the one meant for export.**
- US-based think tank, the Center for Strategic and International Studies (CSIS), says that the Iskander missiles are designed to confuse missile defences by flying on a low trajectory and manoeuvring in flight to strike targets within 2 to 5 metres accuracy.

Missile's capability and range:

- **Range:** The Iskander-M missile has a **range of 500 km** and it can carry a payload of up to **700 kg.**
- **Weapon:** It is capable of **carrying both conventional and nuclear warheads**.
- The conventional warheads can be equipped with include cluster bombs, electromagnetic pulse (EMP) warheads and bunker-buster munitions.
- The export variant, Iskander-E, has a range of 280 km with a reduced 480 kg payload.

3. MEDIUM RANGE SURFACE-TO-AIR MISSILE (MRSAM)

CONTEXT

The DRDO conducted two successful flight tests of the Army version of Medium Range Surface to Air Missile (MRSAM).

About MRSAM:

- The MRSAM is a **surface-to-air missile** jointly developed by **DRDO and Israel Aerospace Industries (IAI)** for use by the Indian Army.

- The missile will **replace the ageing Air Defence systems** of the Army.
- The MRSAM weapon system comprises **multi-function radar, mobile launcher system and other vehicles.**
- It has Army, Navy and Air Force variants.
- The mobile **launcher can transport, place and launch eight canisterised missiles**.
- These can be fired either in single mode or in ripple firing mode in a vertical firing position.
- The missile's management system uses the radar to track and correctly identify the target, calculates the distance from it and gives all the information to the Commander for a decision to be made on interception.
- The missile itself is **5 metres in length with a weight of around 275 kg.**
- It is equipped with fins and canards to stabilise its flight and provide it manoeuvrability.
- The missile is powered by a solid propulsion system coupled with a thrust vector control system.
- The missile can move at a maximum speed of Mach 2 (twice the speed of sound).
- It can engage multiple targets upto a range of 70 km.

List of the surface to air missiles in India:

- Akash
- Akash-1S
- Akash Mk2
- Akash-NG
- QRSAM
- Barak 8
- MR-SAM
- LR-SAM
- XR-SAM

About DRDO

- DRDO is the R&D wing of Ministry of Defence, Government of India.
- DRDO was formed in 1958 from the amalgamation of the then already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO).
- DRDO's pursuit of self-reliance and successful indigenous development and production of strategic systems and platforms have given quantum jump to India's military might, generating effective deterrence and providing crucial leverage, such as:
  - **Agni and Prithvi** series of missiles
  - light combat aircraft, **Tejas**
  - multi-barrel rocket launcher, **Pinaka**
  - air defence system, **Akash**
  - a wide range of radars and electronic warfare systems; etc.,

4. AKASH MISSILE SYSTEM

CONTEXT

India demonstrated the capability of the Akash missile system to engage four aerial targets simultaneously at a range of 25 kilometres.

About

- The Akash, with a range of up to 25 km, is a short-range surface to air missile primarily used for protecting vulnerable areas and points from air attacks.
- The missile system is among the key platforms that India is exporting to friendly foreign countries.
- Akash has built-in **electronic counter-counter measures (ECCM) features**, which can help the missile punch through enemy jamming and other methods of evasion.
- The entire Akash weapon system has been configured on mobile platforms. This makes it agile and nimble as it can be transported fast anywhere.
- The missile is 5,870 mm long, has a diameter of 350 mm, and weighs 710 kg.
- It can be made fully automatic with a quick response time from target detection to kill. Its open-system architecture ensures adaptability to existing and futuristic air defence environments.

5. INDIA DEVELOPING LRSAM SYSTEM

CONTEXT

India is developing a **three-layered long-range surface-to-air missile (LRSAM) defence system** that will be capable of hitting enemy aircraft and missiles up to 400km away.

About LRSAM

- The LRSAM system will be designed and developed by the DRDO.
- It is envisaged to detect and neutralise aerial threats such as stealth fighters, aircraft, ballistic and cruise missiles, precision-guided munitions, and unmanned aerial vehicles (UAVs) to ranges of nearly 350 km.
- The programme is valued at over USD2.5 billion, and it seeks to build a three-tiered air-defence system with interceptor missiles capable of hitting at 150, 250, and 350 km.
- The IAF aims to operationally deploy the system by 2028–29.

6. HWASONG-17

CONTEXT

North Korea has dramatically ramped up missile tests this year and tested an intercontinental ballistic missile (ICBM).

What are ICBMs?

- An intercontinental ballistic missile (ICBM) is a missile with a minimum range of 5,500 kilometers primarily designed for nuclear weapons delivery.

- Conventional, chemical, and biological weapons can also be delivered with varying effectiveness, but have never been deployed on ICBMs.
- ICBMs are differentiated by having greater range and speed than other ballistic missiles.
- Short and medium-range ballistic missiles are known collectively as theatre ballistic missiles.
- **The International Code of Conduct against Ballistic Missile Proliferation (ICOC),** now known as the Hague Code of Conduct against Ballistic Missile Proliferation (HCOC), is a political initiative aimed at globally curbing ballistic missile proliferation.
- **India is a signatory to this convention.**
- Established in April 1987, the voluntary **Missile Technology Control Regime (MTCR)** aims to limit the spread of ballistic missiles and other unmanned delivery systems that could be used for chemical, biological, and nuclear attacks.
- **India has joined the MTCR in 2016.**

Countries that have ICBMs:

- India, Russia, the United States, North Korea, China, Israel, the United Kingdom, and France.
- North Korea conducted the first successful test of its Hwasong-14 **ICBM** in July 2017.

7. ASTRA MK-1

CONTEXT

Recently, the Ministry of Defence has signed a contract with the Hyderabad-based public-sector Bharat Dynamics Ltd (BDL) for supply of the Astra Mark-1.

- Contract was signed at a cost of Rs 2,971 crore, for deployment on fighter jets of the Indian Air Force and Indian Navy.

What are the Astra Missile and its Variants?

- The Astra project was officially launched in the early 2000s with defined parameters and proposed future variants.
- Around 2017, the development phase of the Mk-1 version was complete.
- Several successful tests have been conducted since 2017 from Sukhoi-30 MKIs.

What are the Key Highlights of the Astra Mk-1 Missile?

- The Astra Mk-1 is a Beyond Visual Range (BVR), Air-to-Air Missile (AAM).
- BVM missiles are capable of engaging beyond the range of 20 nautical miles or 37 kilometres.
- AAMs are fired from an airborne asset to destroy an airborne target.
- **Range:**

- ➤ The range for Astra Mk-1 is around 110 km.
- ➤ The Mk-2 with a range over 150 km is under development and Mk-3 version with a longer range is being envisaged.
- ➤ One more version of Astra, with a range smaller than Mk-1 is also under development.

⊙ **Designed and Developed by:** Defence Research and Development Organisation (DRDO)

8. ANTI-RADIATION MISSILE

CONTEXT

US has supplied some "anti-radiation missiles" to Ukraine, which could be fired from some Ukrainian Air Force aircraft.

AGM-88 HARM missile:

⊙ The acronym 'HARM' in the AGM-88 HARM air-to-surface missile stands for High-Speed Anti-Radiation Missile.

⊙ It is a tactical weapon fired from fighter aircraft, and has the capability to detect and home into radiation emitted by hostile radar stations that have surface-to-air detection capabilities.

⊙ The missile was originally developed by the Dallas-headquartered Texas Instruments, but is now produced by the major American defence contractor Raytheon Corporation.

⊙ An advanced version of the weapon is manufactured by Dulles, Virginia-based Northrop Grumman.

⊙ The AGM-88 HARM is 14 metres in length, but only 10 inches in diameter.

⊙ It weighs around 360 kg and carries a fragmentation type warhead that is optimised for radar targets.

⊙ It also has an anti-radar homing seeker broadband RF antenna and receiver, and a solid state digital processor.

⊙ The missile has a range of more than 100 km.

⊙ The AGM-88 can detect, attack and destroy a target with minimum aircrew input.

⊙ The proportional guidance system that hones in on enemy radar emissions has a fixed antenna and seeker head in the missile nose.

⊙ A smokeless, solid-propellant, dual-thrust rocket motor propels the missile.

9. HIMARS MISSILE SYSTEM

CONTEXT

Poland received the first batch of US-made HIMARS rocket launchers.

What is the HIMARS missile system?

- The US-made High Mobility Artillery Rocket Systems is known as HIMARS.
- It is a multiple launch rocket system, or MLRS - a mobile unit that can simultaneously launch multiple precision-guided missiles.
- HIMARS has superior range and precision.
- The M142 HIMARS system (High Mobility Artillery Rocket System) is a modernized, lighter and more agile wheel-mounted version of the track-mounted M270 MLRS developed in the 1970s for US and allied forces.
- HIMARS carry one preloaded pod of six 227 mm guided missiles (the M270 carries two pods), or one large pod loaded with an ATACMS tactical missile.

10. 'DESI' S-400: PROJECT KUSHA

CONTEXT

At the heart of 'Project Kusha' is the development of India's very own Long-Range Surface-to-Air Missiles (LR-SAM) that, according to reports, is comparable to **Russia's S-400 Triumf air defence system.**

Key-features of Project Kusha:

- This is part of the development Project Kusha, recently cleared by the **Cabinet Committee on Security.**
- The mobile LR-SAM, with its long-range surveillance and fire control radars would have different types of interceptor missiles designed to hit hostile targets at **150 km, 250 km, and 350 km ranges.**
- The LRSAM is **three-layered long-range surface-to-air missile defence system** that is capable of striking down enemy aircraft and missiles from surface.
- The range of this system is **400 km.**
- India already has air defence systems. They are sure to complement LRSAM.
- **Medium Range Surface-to-Air Missile (MRSAM)** is one such missile system that is used by all three defence services of India. The addition of **S-400** will boost India's defence capabilities.

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3

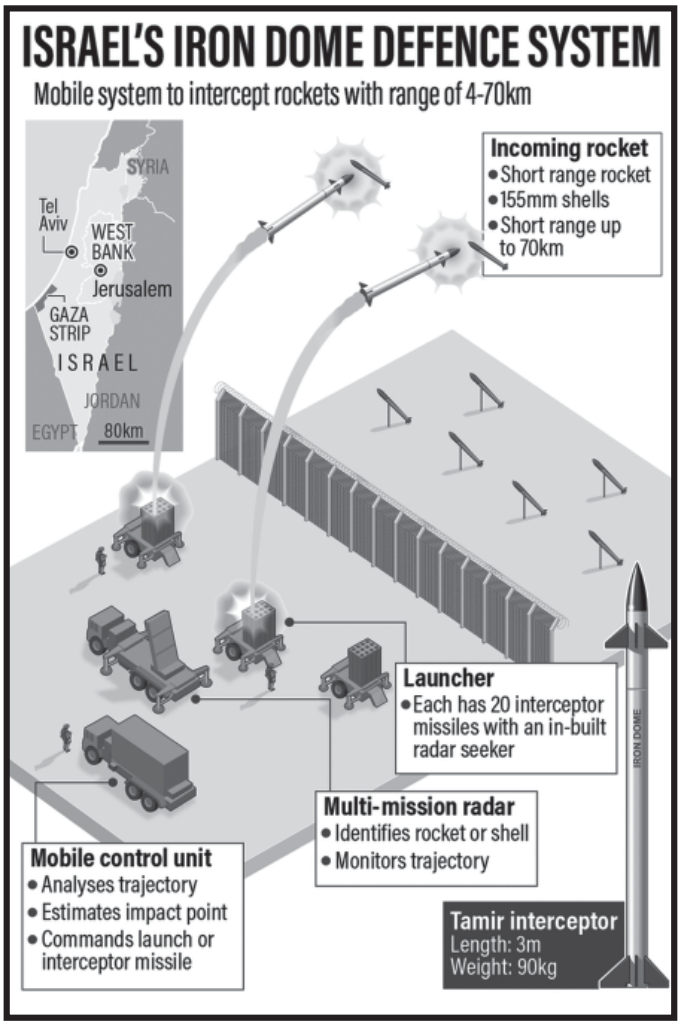
Fighter Jet System

1. ISRAEL'S IRON DOME

CONTEXT

As, the Hamas has launched a major attack in Israel, killing 250 natives, Israel's Iron Dome model has spotted light again.

What is the Iron Dome?



- The Iron Dome is a short-range, **ground-to-air**, air defence system.
- It is used for countering **rockets, artillery & mortars (C-RAM)** as well as aircraft, helicopters and unmanned aerial vehicles.
- **Components:** The Iron Dome has three main systems that work together to provide a shield over the area where it is deployed which are:
  - **Radar:** It has detection and tracking radar to spot any incoming threats.
  - **Weapon Control**: It has a battle management and weapon control system (BMC),
  - **Missile Fire**: It also has a missile firing unit. The BMC basically liaises between the radar and the interceptor missile.

How does it work?

- The Iron Dome has three main systems that work together to provide a shield over the area where it is **deployed, handling multiple threats.**

- It has detection and tracking radar to spot any incoming threats, a battle management and weapon control system (BMC), and a missile firing unit.
- The BMC basically liaises between the **radar and the interceptor missile**.
- It is capable of being used in **all weather conditions**, including during the day and night.

2. INDIA-US DEFENCE DEAL

CONTEXT

India and the US have planned for a **mega defence deal** for jointly manufacturing indigenous jet engines of '**GE F414 fighter aircraft'**.

GE F414 aircraft:

- GE F414 will power all future fighter jets including the **Tejas Mk II**, Advanced Medium Combat Aircraft (AMCA) as well as the **indigenous Twin Engine Deck Based Fighter (TEDBF**) for the Indian Navy.
- The F414 is an afterburning turbofan engine in the **22,000 pound (98 KN)** thrust class of engines.
- The Boeing Super Hornets and the Gripen fighter jets are among those aircraft that run on this engine.

3. TEJAS COMPLETES 7 YEARS OF SERVICE

CONTEXT

Indigenous Light Combat Aircraft (LCA) Tejas completed seven years of service in the Indian Air Force (IAF) on July 1 2023.

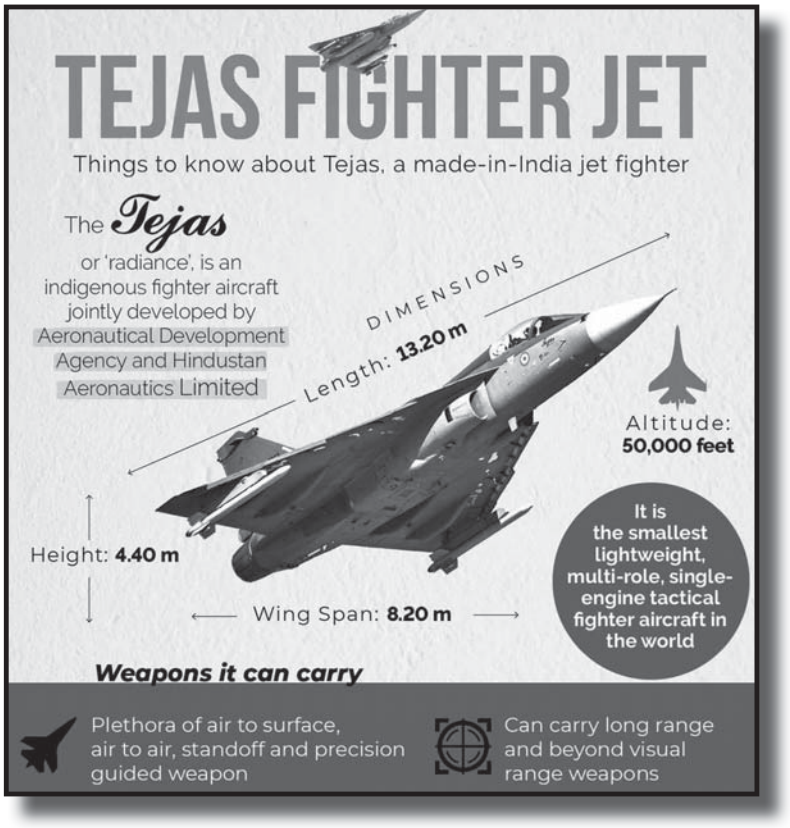
Background

- The **Light Combat Aircraft (LCA) program** was started in the early 1980s, with the Government of India (GoI) establishing the project in 1983 to replace **Mig-21 fighters**.
- The first prototype took its first flight in January 2001 and the fighter was named
- **Induction:**
- After more than a decade of trials, the first jet was finally inducted by the IAF in 2016 in the No. 45 squadron **'Flying Daggers'.**
- In 2020, the No.18 squadron **'Flying Bullets'** became the second squadron to start operating the jet.

What is Tejas Mk-1?

- The Tejas Mk-1 is light **supersonic multirole jet**, capable of doing multiple missions including

- ➤ air-defence (air-to-air)
- ➤ intelligence, surveillance and reconnaissance (ISR)
- ➤ air-interdiction (striking enemy targets deep into enemy territory)
- ➤ maritime strike and reconnaissance missions



- ⦿ The jet carries, an **Israeli laser designating pod**, multi-mode radar, helmet mounted display system and self-protection suite.
- ⦿ **Tejas Mk-1A**: Its other variant — **Tejas Mk-1A** — 83 of which the IAF ordered from Hindustan Aeronautics Limited (HAL) in a deal worth Rs 48,000 crore in 2021, will be even more advanced.
  - ➤ **Tejas Mk-1A** will have 40 major improvements compared to the Tejas Mk-1.
  - ➤ It will have an active electronically-scanned array radar for detecting enemy aircraft at greater ranges and resistance to jamming, a new advanced self-protection jamming suite (ASPJ), digital flying control computer (DFCC), as well as, faster turnaround times for each aircraft after every sortie.

Current status of fighter jets

- ⦿ The IAF presently has 32 squadrons (16-18 planes each) of fighter jets against the 42 needed to tackle a collusive two-front threat against Pakistan and China.
- ⦿ Over the next two-three years, all four squadrons (each one has 16-18 planes) of the Soviet-era MiG-21 fighter jets will retire.
- ⦿ The IAF's Jaguar, MiG-29 and Mirage 2000 jet fleets — all inducted in phases during the 1980s — are slated to retire in batches beyond 2029-30.
- ⦿ These four types of jets are about 250 in number and are operating on an extended lifecycle.

4. MULTILATERAL EXERCISE DESERT FLAG VIII

CONTEXT

Five indigenous **Light Combat Aircraft (LCA)** along with a contingent of **110 Indian Air Force (IAF)** personnel arrived at **Al Dahfra airbase of United Arab Emirates (UAE)** for participating in the **multilateral Exercise Desert Flag VIII.**

Background:

- In 2021, the defence ministry awarded Rs 48,000-crore contract to **Hindustan Aeronautics Limited** for 83 LCA Mk-1A jets for the IAF.
- The **first Mk-1A** aircraft will be delivered in February 2024, with the rest slated to join the combat fleet by 2029.
- The government gave its nod for developing **the LCA Mk-2**, a platform that will form an important element of future air combat.

About the exercise:

- Exercise **Desert Flag** is a multilateral air exercise in which Air Forces from **UAE, France, Kuwait, Australia, UK, Bahrain, Morocco, Spain, Republic of Korea, and USA** would also be participating.
- The exercise is scheduled from **February 27 to March 17.**
- **Aim:** To participate in **diverse fighter engagements** and learn from the best practices of various Air Forces.

This is the first occasion for **the LCA Tejas** to participate in an international flying exercise outside India

Light Combat Aircraft:

- The **Light Combat Aircraft (LCA)** programme was started by the **Government of India in 1984** when they established the **Aeronautical Development Agency (ADA)** to manage the LCA programme.
- It replaced the ageing **Mig 21 fighter planes**.
- **Designed by:** Aeronautical Development Agency under the Department of Defence Research and Development.
- **Manufactured by:** State-owned Hindustan Aeronautics Limited (HAL).
- **Features:**
  - The lightest, smallest and tailless multi-role supersonic fighter aircraft in its class.
  - Designed to carry a range of air-to-air, air-to-surface, precision-guided, weapons.

- Air to air refuelling capability.
- Maximum payload capacity of 4000 kg.
- It can attend the maximum speed of Mach 1.8.
- The range of the aircraft is 3,000km

Variants of Tejas:

- **Tejas Trainer**: 2-seater operational conversion trainer for training air force pilots.
- **LCA Navy**: Twin- and single-seat carrier-capable for the Indian Navy.
- **LCA Tejas Navy MK2**: This is phase 2 of the LCA Navy variant.
- **LCA Tejas Mk-1A:** This is an improvement over the **LCA Tejas Mk1** with a higher thrust engine.

5. U.S. AIR FORCE'S B-1B LANCER LANDS AT AERO INDIA 2023

CONTEXT

The **United States Air Force (USAF)** has once again sent their **B-1B Lancers** and an array of other defence machinery to participate in the **Aero Show 2023** held at Bengaluru.

What is B-1B Lancer?

- B-1B Lancer, also known as 'Bone' (for B-one), carries the largest conventional payload of both guided and unguided weapons in the USAF.
  - It is considered the backbone of America's long-range bomber force.
  - This is the second time that the long-range, supersonic, heavy bomber is participating in Aero India.
  - The aircraft performed a fly-by on the inaugural day of Aero India 2021, escorted by an **Indian Air Force Tejas fighter.**
- The long-range, supersonic heavy-bomber which is dubbed Bone (for "B-one") carries the largest conventional payload of both guided and unguided weapons in the USAF.
  - Apart from the B-1s, the US line-up at the biennial air show includes the USAF's newest fifth-generation fighters – the stealthy, supersonic, multirole F-35A Lightning II and F-35A Joint Strike Fighter.
- An F-16 Fighting Falcon duo has been conducting daily aerial demonstrations, while the US Navy F/A-18E and F/A-18F Super Hornet multirole fighters are on static display.

6. REPLACING CHEETAH, CHETAK CHOPPERS WITH LUH

CONTEXT

The Indian Army has started replacing its old **Chetak and Cheetah helicopters** with the indigenously-made **Light Utility Helicopters (LUH).**

Key-highlights

- The entire fleet of old Chetak and Cheetah helicopters will be replaced in the next 10 to 12 years as the armed forces is looking forward to modernise its capabilities with new helicopters and UAVs.
- The army is also looking to ramp up the fleet of **Unmanned Aerial Vehicle (UAV)** fleet in the next five years with a range of new UAVs including:
  - Israeli Heron Mk 2
  - Hermes Starliner

The **Army Aviation Corps** is currently operating around 190 **Chetak, Cheetah and Cheetal helicopters.**

What is LUH?

- The LUH is a **three-ton class new generation single engine** indigenously designed helicopter and can operate at 20,000 feet above sea level.
- Though it has been designed and developed indigenously, the single-engine LUH is powered by the **Ardiden 1U engine** from Safran, the French aerospace major.
- Hindustan Aeronautics **Limited (HAL) Helicopter Factory** in Tumakuru, Karnataka, India's largest helicopter manufacturing unit, will initially produce Light Utility Helicopters (LUHs).

Important Features:

- The LUH can transport six passengers at a time and can fulfil multiple roles including transportation, troop movement, and civil operations.
- It can achieve a maximum speed of up to 240 km per hour and the maximum take of weight for the helicopter is 3,150 kg.
- However, it can only carry around 75 kg at the peak of its operational ceiling, while the Cheetah and Chetak can carry only 30 kg to 40 kg respectively.

The Chetak, a licensed version of the French Alouette III helicopter produced by HAL in India, was majorly utilized for transportation, reconnaissance, and search and rescue operations.

7. SOUTH KOREAN LIGHT ARMED HELICOPTER (LAH) IS CHALLENGING INDIA'S LCH 'PRACHAND'

CONTEXT

India and South Korea are manufacturing similar lines of products, which has positioned them as competitors in the global export market.

Details:

- India's Tejas and South Korea's FA-50 Light Combat Aircraft (LAC) can be seen competing for the Malaysian Light Attack Fighter contract.
- The South Korean aircraft appears to be having a slight advantage over the Indian LCA.
- South Korea has now also decided to accelerate the production of its Light Armed Helicopter.
- It authorized a 5.75 trillion won (US$4.3 billion) plan to begin mass production of a home-grown light-armed helicopter (LAH) in the coming months.

India's Light Combat Helicopter (LCH):

- The LCH is the **only attack helicopter in the world** which can land and take off at an altitude of 5,000 meters with a considerable load of weapons and fuel.
- The **helicopter uses radar-absorbing material to lower radar signature** and has a significantly crash-proof structure and landing gear.
- A pressurized cabin offers protection from Nuclear, Biological and Chemical (NBC) contingencies.
- The **helicopter is equipped with a countermeasure dispensing system** that protects it from enemy radars or infrared seekers of enemy missiles.
- LCH is powered by **two French-origin Shakti engines** manufactured by the HAL.

KAI Light Armed Helicopter (LAH) of South Korea.

- **Project Type:** Light-armed helicopter
- **Manufacturer:** Korean Aerospace Industries (KAI)

- **Engine:** The helicopter is powered by two Arriel 2L2 turboshaft engines.
- **First Flight:** July 2019
- **Cruise Distance:** 411 kilometres
- **Operation time:** Two hours and 35 minutes
- **Armament:** The rotorcraft is armed with a chin-mounted 20mm Gatling-type gun.

Comparison:

KAI Light Armed Helicopter (LAH)	Light Combat Helicopter (Prachand)
Weight: 4.9-ton	Weight: 5.8-ton
Maximum speed: 275 kmph	Maximum speed: 243 kmph
Maximum Range: 857 km	Maximum Range: 500 km
Utility: Destroying Tanks; light attacks; close-air support, escort, and troop transport.	**Utility**: Air-to-air operations; escort operations, support of combat search and rescue operations, and anti-tank and anti-infantry operations.
Equipment: four-axis automatic flight control system (AFCS), a helmet-mounted display, a fire control system (FCS), and an anti-jamming global positioning system (GPS).	**Equipment:** Electro-Optical Pod consisting of a CCD camera, FLIR, Laser Range Finder (LRF), and Laser Designator (LD)
High Altitude Operations: NO	**High Altitude Operations:** Yes. It is based on India's unique security considerations, which are different from that of Seoul.

India's recent developments in the Defence Sector:

- **INS Vikrant:** Aircraft Carrier
- **Dhanush:** Long-range artillery gun
- **Arihant:** Nuclear Submarine

8. ARMY ACCELERATES PROCUREMENT OF LIGHT TANK 'ZORAWAR' FOR LAC

CONTEXT

With the "increased threat" from China along India's northern borders "likely to remain in the foreseeable future", the Army is launching **Project Zorawar** — the induction of indigenous light tanks for quicker deployment and movement in high altitude areas.

Project Zorawar:

- The **Indigenous Indian Light Tank** aptly named **'Zorawar'** is designed to operate in varying terrain from **High Altitude Areas**, the marginal terrain to the Island territories will be highly transportable for rapid deployment to meet any operational situation.
- The **Army is looking at a light tank with a maximum weight of 25 tons**— with a margin of 10 per cent — with the same firepower as its regular tanks.
- The tank should be armed with Artificial Intelligence (AI), integration of tactical surveillance drones to provide a high degree of situational awareness and loitering munition, along with an **active protection system**.

The name game:

The project has been **named 'Zorawar'** after **Zorawar Singh Kahluria**, a military general who served under Jammu's Raja Gulab Singh, known as the 'conquerer of Ladakh'.

Swarm Drone Systems

- In another development Indian Army has also given go-ahead for the induction of indigenous **"swarm drone systems":**
- Indian Army has inducted **indigenously produced Swarm Drones Systems** aiming to employ them in **both offensive and defensive operations.**
- A swarm drone system **consists of a number of small drones which are AI-enabled and capable of communicating with the control station** as well as among them and provide asymmetric capabilities for taking out frontline assets of the adversary.
- Swarm drones consist of a number of drones controlled from the same station which can be programmed using an algorithm to carry out various tasks, including surveillance.

9. F-INSAS, NIPUN MINES, LCA — THE NEW SYSTEMS OF THE ARMY

CONTEXT

The Government handed over two new weapons – the Nipun mines, the Landing Craft Assault (LCA) and the F-INSAS system to the Army.

F-INSAS system:

- F-INSAS stands for **Future Infantry Soldier As A System**, a programme for infantry modernisation aimed at increasing the operational capability of the soldier.
- As part of the project, soldiers are being equipped with modern systems that are lightweight, all-weather-all-terrain, cost-effective and low maintenance.

- The full-gear of the F-INSAS system includes an **AK-203 assault rifle**, which is a Russian-origin gas-operated, magazine-fed, select-fire assault rifle with range of 300 metre.
- It also includes a ballistic helmet, ballistic goggles, a bulletproof jacket, elbow-pads, and knee pads.
- It is being made at **Korwa near Amethi in a Russia-India joint venture**.
- It looks to transform the soldiers deployed in the border areas into **'a self-contained fighting machine'.**
- F-INSAS also includes a **hands-free head-set** which will help enhance the operational capabilities of an infantry soldier and improve communication effectively.
- The project was conceptualised in the early 2000s by the **Defence Research and Development Organisation (DRDO)** in line with the targets of the Army's Infantry Soldier Modernisation Programme with an aim to optimise the soldier's performance across the full spectrum and duration of a military operation.

Nipun mines:

- Nipun mines are indigenously designed and developed anti-personnel mines, termed by the DRDO as '**soft target blast munition'**.
- These mines act as the **first line of defence** against the infiltrators and advancing enemy infantry.
- Anti-personnel mines are meant to be used against humans as against anti-tank mines that are aimed at heavy vehicles. They are smaller in size and can be deployed in large numbers.
- These mines are developed with the joint collaboration of the **Armament Research and Development** Establishment, a part of DRDO and an Indian firm.

Landing Craft Assault:

- The Landing Craft Assault (LCA) is a replacement for the boats with 'limited capabilities' operating **in Pangong Tso lake.**
- The LCA is much more versatile and has overcome the limitations of launch, speed and capacity.
- The LCA is touted to be the **replacement for boats for carrying personnel in battle operations.**
- These lightweight assault carriers can carry up to 35 troops.
- It has enhanced the capability to operate across the water obstacles in Eastern Ladakh.
- LCA has been indigenously **developed by M/s Aquarius Ship Yard Limited, Goa.**

10. INDIGENOUS AIRCRAFT CARRIER (IAC) VIKRANT

CONTEXT

Prime Minister Modi commissioned the **country's first indigenous aircraft carrier Indian Naval Ship (INS) Vikrant** at Cochin Shipyard Limited (CSL).

About Indigenous Aircraft Carrier 1: Vikrant

- IAC Vikrant is the **largest warship** to have ever been **built in India**.

⦿ It is also the first indigenously designed and built Aircraft Carrier for the Indian Navy.

⦿ IAC Vikrant is **262 m long and 62 m wide** and displaces approx. 43000 T when fully loaded, with a maximum designed speed of 28 Knots and an endurance of 7500 NM.

⦿ **Designed by the Indian Navy's in-house Directorate of Naval Design (DND)**and built by the CSL, a Public Sector Shipyard under the Ministry of Ports, Shipping and Waterways

⦿ It is capable of carrying more than 30 assorted aircraft including combat jets and helicopters.

⦿ The ship will be **capable of operating 30 aircraft** including **MiG-29K fighter jets, Kamov-31 Air Early Warning Helicopters, MH-60R Seahawk multi-role helicopters**, as well as the Advanced Light Helicopters (ALH) built by Bengaluru-based Hindustan Aeronautics Ltd, and the indigenously manufactured Light Combat Aircraft (LCA) (Navy).

⦿ The carrier is equipped with the **latest state-of-the-art equipment and systems**.

⦿ It boasts a **fully-fledged state-of-the-art medical complex** with the latest medical equipment facilities including major modular OT, emergency modular OT, physiotherapy clinic, ICU, laboratories, CT scanner, X-Ray machines, dental complex, isolation ward, and telemedicine facilities.

Proposed carrier:

⦿ Since 2015, the Navy has been seeking approval to build a third aircraft carrier for the country, which, if approved, will become India's second Indigenous Aircraft Carrier (IAC-2).

⦿ This proposed carrier, to be named **'INS Vishal'**, is intended to be a giant 65,000-tonne vessel, much bigger than both IAC-1 and the '**INS Vikramaditya'**

11. UNITED LAUNCH ALLIANCE'S ATLAS V ROCKET LAUNCHED WITH US SPACE FORCE SATELLITE

CONTEXT

The United Launch Alliance (ULA) has launched an Atlas V rocket with the sixth and final Space Based Infrared System Geosynchronous Earth Orbit (SBIRS GEO 6) spacecraft for the United States Space Force's Space Systems Command.

The ULA is a joint venture between Lockheed Martin and Boeing.

About SBIRS

⦿ SBIRS is an early missile warning system that will be the successor to the Defense Support Program, whose first satellite launch took place in the 1950s.

- SBIRS will consist of a constellation of three satellites in geosynchronous orbit and two other classified satellites on highly elliptical orbits around the poles.
- The first satellite of the constellation launched in 2011 and before SBIRS-6, the most recent launch was SBIRS-5 in 2021.

US Space Force

- The US Space Force is the sixth and newest department of the US military after its Army, Navy, Marine Corps, Coast Guard and Air Force.
- It was established in 2019, when the National Defense Authorization Act was signed into law.
- The creation of the Space Force came from the recognition that Space was going to be an important national security imperative in the future.

12. MIG-21 FIGHTER JETS AND INDIA

CONTEXT

The MiG-21 trainer, which had taken off from the rom the Uttarlai airbase, crashed near Bhimda village in Rajasthan. MiG-21 Fighter was developed by the Soviet Union and India being its largest user should focus on its limited uses.

Background

DesignSpecifications
- Speed: Mach 2.05 at altitude; Mach 1.05 at sea level.
- Initial Climb Rate: 58,000 ft/min.
- Range: 585 nm.
- Service Ceiling: 57,400 ft.
- Wingspan: 23.46 ft.
- Length: 40.29 ft.
- Height: 13.46 ft.

- India is the largest operator of MiG-21s. In 1961, the Indian Air Force (IAF) opted to purchase the MiG-21 over several other Western competitors.
- As part of the deal, the Soviet Union offered India full transfer of technology and rights for local assembly.
- In 1964, the MiG-21 became the first supersonic fighter jet to enter service with the IAF.
- Due to limited induction numbers and lack of pilot training, the IAF MiG-21 played a limited role in the **Indo-Pakistani War of 1965.**
- However, the IAF gained valuable experience while operating the MiG-21 for defensive sorties during the war.
- Since 1963, India has introduced more than 1**,200 MiG fighters into its air force**.
- As of 2019, 113 MiG-21s are known to be in operation in the IAF.

What is Mikoyan-Gurevich (MiG-21)?

- The **Mikoyan-Gurevich (MiG-21**) is a **supersonic jet fighter** and **interceptor aircraft**, designed by the Mikoyan-Gurevich Design Bureau in the **Soviet Union.**

- Approximately **60 countries** across four continents have flown the MiG-21, and it still serves many nations six decades after its maiden flight.
- It became the most-produced supersonic jet aircraft in aviation history, the most-produced combat aircraft since the Korean War.

13. HANSA-NG AIRCRAFT SUCCESSFULLY COMPLETED ENGINE RELIGHT TEST IN AIR

CONTEXT

'HANSA-NG' successfully completed in-flight engine relight test at the aeronautical test range (ATR) facility of Defence Research Development Organisation (DRDO) at Challakere in Karnataka's Chitradurga recently.

About HANSA-NG:

- 'HANSA-NG' is the new generation **two-seater flying trainer aircraft**.
- It is designed and **developed by Council for Scientific and Industrial Research (CSIR)-National Aerospace Laboratories (NAL).**
- 'HANSA-NG' is designed to meet the Indian flying club needs and it is an ideal aircraft for commercial pilot licensing due to its low cost and fuel consumption.
- **Features:** The unique features of Hansa-NG are:
  - Glass cockpit with cabin comfort
  - Highly efficient digitally controlled engine
  - Electrically operated flaps
  - Long endurance
  - Low acquisition and low operating cost

14. MAN, PORTABLE AIR DEFENCE SYSTEM (MANPADS)

CONTEXT

Recently, the United States approved a $200-million arms package for Ukraine, which would include US-made Stinger Missiles, which are a type of shoulder-fired **Man-Portable Air-Defence Systems (MANPADS)**.

What are MANPADS?

- Man-Portable Air-Defence Systems are **short-range, lightweight and portable surface-to-air missiles** that can be **fired by individuals or small groups** to **destroy aircraft or helicopters.**

- They help **shield troops from aerial attacks** and **are most effective in targeting low-flying aircrafts.**
  - MANPATs or Man-Portable Anti-Tank Systems work in a similar manner but are used to destroy or incapacitate military tanks.
    - MANPADS can be **shoulder-fired, launched from atop a ground-vehicle**, fired from a tripod or stand, and from a helicopter or boat.
  - **Features**
    - Weighing anywhere between 1**0 to 20 kilograms** and not being longer **than 1.8 metres.**
    - They are fairly **lightweight as compared** to o**ther elaborate weapon** systems, making them **easy to operate by individual soldiers.**
    - Operating MANPADS requires substantially less training.
    - MANPADS have a **maximum range of 8 kilometres** and **can engage targets at altitudes of 4.5 km.**
    - Most MANPADS have passive or **'fire and forget' guidance systems,** meaning the operator is not required to guide the missile to its target, enabling **them to run and relocate immediately after firing**.
    - The missile stays **locked-on to the targeted object**, not requiring active guidance from the soldier.
    - The **missiles are fitted with Infrared (IR) seekers** that identify and target the airborne vehicle through heat radiation being emitted by the latter.

15. LCH PRACHAND

CONTEXT

Recently, the **Indian Air Force** formally **inducted the indigenously developed multi-role Light Combat Helicopter (LCH), Prachanda** which is suitable for operating in high-altitude battlefields.

What is a Light Combat Helicopter?

- The LCH is the **only attack helicopter in the world** that can land and take off at an altitude of 5,000 meters with a considerable load of weapons and fuel.
- The **helicopter uses radar-absorbing material to lower radar signature** and has a significantly crash-proof structure and landing gear.
- A pressurized cabin offers protection from Nuclear, Biological and Chemical (NBC) contingencies.
- The **helicopter is equipped with a countermeasure dispensing system** that protects it from enemy radars or infrared seekers of enemy missiles.
- LCH is powered by **two French-origin Shakti engines** manufactured by the HAL.

Genesis:

- It was during the **1999 Kargil war that the need was first felt for a homegrown lightweight assault helicopter** that could hold precision strikes in all Indian battlefield scenarios.

- This meant a **craft that could operate in very hot deserts** and also in very cold high altitudes, in counter-insurgency scenarios to full-scale battle conditions.
- India has been operating sub 3 ton category French-origin legacy helicopters, **Chetak and Cheetah,** made in India by the **Hindustan Aeronautics Limited (HAL).**
- These single engine machines were, primarily, utility helicopters. Indian forces also operate the Lancer, an armed version of Cheetah.
- In addition, the Indian Air Force currently operates the Russian origin Mi-17 and its variants Mi-17 IV and Mi-17 V5, with maximum take-off weight of 13 tonnes, which are to be phased out starting 2028.
- The **government sanctioned the LCH project in October 2006** and HAL was tasked to develop it.

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4

Submarine

1. SUBMARINE IN INDIA

CONTEXT

Experts say India has lost a decade in modernizing its submarine fleet, while China has marched ahead in its larger naval and more specific submarine capabilities.

Submarines first became a major factor in naval warfare during **World War I (1914–18)**, and also played a similar role on a larger scale in **World War II (1939–45).**

Number of Submarines in India:

- Currently, India has **15 conventional diesel-electric submarines, classified as SSKs,** and **one nuclear ballistic submarine, classified as SSBN.**
- Most of India's submarines are over 25 years old, and many are getting refitted.

Classification of Submarines:

Diesel electric submarines:

- Diesel-electric submarines use electric motors charged by diesel engines to move. These engines require air and fuel to operate, which means they **need to resurface more frequently,** making them easier to detect.
- Of the SSKs, **four are Shishumar Class,** which were bought and then built in India in collaboration with the Germans starting in the 1980s.
- **Eight are Kilo Class or Sindhughosh Class** bought from Russia (including erstwhile USSR) between 1984 and 2000.

- **Three are Kalvari Class Scorpene submarines (P-75)** built at India's Mazagon Dock in partnership with France's Naval Group.

Ballistic missile submarine:

- SSNs can stay and operate under water almost indefinitely; their endurance is limited only by food supplies for the crew. They are also equipped with a range of tactical weapons, such as torpedoes, anti-ship cruise missiles and land-attack cruise missiles.
- **India is among six nations that have SSNs,** alongside the US, the UK, Russia, France and China.
- India has **INS Chakra 2 SSN Submarine** leased from Russia until 2022.
- A **slow-moving 'bomber' and a stealthy launch platform** for nuclear weapons.
- The **Arihant and three more SSBNs** under construction are part of the **Strategic Forces Command.**

India's Modernisation Plan:

- **30 - Year Plan:** The 30-year plan (2000-30) for indigenous submarine construction, **approved by the Cabinet Committee on Security in 1999,** envisaged two production lines of six submarines each, built in India in partnership with a foreign **Original Equipment Manufacturer (OEM).**
  - The projects were called **P-75 and P-75I.**
  - It anticipated that India would get the 12 new submarines by 2012-15. Subsequently, India would make 12 of its own by 2030, taking the fleet size to 24, with the older submarines getting decommissioned.
  - But the **contract for P-75 was signed only by 2005,** with France's DCNS, now the Naval Group.
- **P-75**: Of the six being built, **P-75 has delivered three Kalvari Class Scorpene submarines so far.**
- **P-75I**: It **is yet to take off,** the Request for Proposal was issued in July 2021.
  - It will be **India's first under the Strategic Partnership Model,** which came up in 2015.

2. AUKUS DEAL

CONTEXT

The AUKUS countries (**US, UK and Australia**) have turned towards sharing nuclear technology with India.

About the AUKUS pact:

- The **AUKUS pact** was signed on September 2021.
- This defense pact is a three-way cooperation program which essentially brings the former into the nuclear sub club while extending Britain and America's reach into a **Pacific region** rapidly becoming the key global theater for the century to come.
- The **agreement** is aimed at preserving a "**free and open" Indo Pacific**.

- The core of AUKUS is a pledge by America and Britain to help Australia build at least eight nuclear-powered—but **not nuclear-armed**—attack submarines, which are known as **SSNS** (subs that carry intercontinental nuclear missiles are known as **SSBNS**, the "B" standing for "ballistic").
- **Important Pillars:**
  - **Pillar One:** The first and largest part of the agreement is the submarine contract, also known as **Pillar One.**
  - **Pillar Two:** The second AUKUS pillar will involve improving our defence capabilities with the assistance of the UK and the US in general.

What is a nuclear-powered submarine?

- A nuclear-powered submarine is **powered by a nuclear reactor**. But it is not **a nuclear weapon**.
- Every nuclear-powered submarine draws from its own miniature nuclear reactor on board, which is typically fuelled with uranium.
- For such a reactor to work, uranium has to be 'enriched' to contain 50 percent of a key isotope, **uranium-235.**
- Natural uranium consists of approximately 99.3 per cent of the **isotope uranium-238** and only 0.7 per cent of **uranium-235.**
- The process of enrichment can be carried out through gaseous diffusion, gas centrifuges or laser isotope separation.
- Only six nations own and operate these submarines currently: **China, France, India, Russia, the UK and the US.**

Types of nuclear-powered submarines:

SSNs are the oldest type of **nuclear-powered submarines** and the first of these, the American-made Nautilus, was deployed in 1954 by the US.

- Nuclear-powered submarines can be divided into **three broad categories**:
  - the nuclear-powered fast-attack submarines or SSNs
  - the nuclear-powered ballistic submarines or SSBNs
  - the nuclear-powered cruise missile submarines or SSGNs

India and the nuclear submarine industry:

- Currently, the Navy has 16 conventional submarines in service –
  - seven of the **Sindhughosh class** (Russian Kilo class)
  - four of the **Shishumar class** (modified German Type 209)
  - five of the **Kalvari class** (French Scorpene class)
- It does not have a **nuclear-powered conventional attack submarine.**

3. SUBMARINE VAGSHEER AND ITS FEATURES, CAPABILITIES

CONTEXT

Vagsheer, the sixth submarine of the P75 project of the Indian Navy was launched recently.

About Submarine 'Vagsheer':

- Vagsheer is named after the sand fish, a deep sea predator of the Indian Ocean.
- The first submarine Vagsheer, from Russia, was commissioned into the Indian Navy on December 26, 1974, and was decommissioned on April 30, 1997.
- The new Vagsheer will be officially named at the time of its commissioning.
- **Specifications:**
  - Vagsheer can take up to eight officers and 35 men.
  - It is 67.5 metres long and 12.3 metres high, with a beam measuring 6.2 metres.
  - Vagsheer can reach **top speed of 20 knots** when submerged and a top speed of 11 knots when it surfaces.
  - The **hull, fin and hydroplanes are designed for minimum underwater resistance** and all equipment inside the pressure hull is mounted on shock-absorbing cradles for enhanced stealth.
- **Features:**
  - Vagsheer is a **diesel attack submarine**, **designed to perform sea denial as well as access denial warfare against the adversary.**
  - It can do offensive operations across the spectrum of naval warfare including **anti-surface warfare, anti-submarine warfare, intelligence gathering, mine laying and area surveillance.**
  - It is **enabled with a C303 anti-torpedo counter measure system.**
  - It can carry up to 18 torpedoes or Exocet anti-ship missiles, or 30 mines in place of torpedoes.
  - Its superior stealth features include advanced acoustic absorption techniques, low radiated noise levels, hydro-dynamically optimised shape, and it has the ability to launch a crippling attack using precision guided weapons, underwater or on surface.
  - Scorpene submarines can undertake various types of missions such as anti-surface warfare, anti-submarine warfare, intelligence gathering, mine laying, area surveillance etc.

List of other submarines under Scorpene-class submarines:

- First submarine: **INS Kalvari**- commissioned on 14 December 2017.
- Second: **INS Khanderi** – September 2019
- Third**: INS Karanj** – March 2021
- Fourth: **INS Vela** – November 2021
- Fifth: **INS Vagir**- launched in November 2020 and is undergoing sea trials.

What is Project-75 (India)?

- **Project-75 (India),** also known as **P-75(I),** is a **military acquisition initiative** by the **Ministry of Defence (MoD).**
- The P-75I class will succeed the Indian Navy's P-75 Scorpene-class submarines.
- The initiative aims to procure **diesel-electric attack submarines** with **fuel cells** and **Air-Independent Propulsion System (AIP)** for the Indian Navy to build India's naval strength and develop indigenous submarine-building capabilities.
- The P75I project is part of a 30-year submarine building plan that ends in 2030.
- The project cost is about Rs. 45,000 crore.
- As part of this plan, India was to build 24 submarines — 18 conventional submarines and six nuclear-powered submarines (SSNs) — as an effective deterrent against China and Pakistan.
- This project envisages the construction of six conventional submarines with better sensors and weapons and the Air Independent Propulsion System (AIP).
- The project has been cleared under the strategic partnership model.
- Under P75, **INS Kalvari, INS Khanderi, INS Karanj and INS Vela** have been commissioned. Sea trials are on for Vagir. **Vagsheer** is the sixth; its production was delayed due to the pandemic.

Project-75 was conceived in 1997 for the construction of two indigenous SSK Submarines known as Type 1500. The project was approved by the Cabinet Committee on Security (CCS), the decision-making body of the Ministry of Defence (MoD).

4. ANTI-SUBMARINE WARFARE CRAFT 'AMINI'

CONTEXT

The **Indian Navy** has launched its most advanced and State-of-the-art anti-submarine warfare shallow watercraft, named **Amini.**

About:

- The vessel is named after a strategically important island in the Lakshadweep archipelago on India's western coast, almost **400 km** off Kochi, Kerala.
- This is the fourth in the series of **eight anti-submarine warfare** shallow watercrafts being built in India by domestic shipyards for the Indian Navy.
- Four of these ships, each with more than **80 per cent** indigenous content, have been launched this year.
- The **77-meter-long anti-submarine** warfare shallow watercraft has a displacement of **900 tonnes**, a maximum speed of **25knots** (46.3kmph) and an endurance of approximately **1800 Nautical miles (3333kms).**

- The contract for building eight anti-submarine warfare ships was signed between India's Defence Ministry and Garden Reach Shipbuilders and Engineers (GRSE), Kolkata, in April 2019.

5. KILO CLASS SUBMARINE INS SINDHUDHVAJ DECOMMISSIONED

CONTEXT

The Navy's Kilo-class submarine, **INS Sindhudhvaj**, has been decommissioned at Visakhapatnam after **35 years** in service.

About INS Sindhudhvaj

- Commissioned into the Navy in June
- It was one of the **10 Kilo-class submarines** India acquired from **Russia** between the year **1986 and 2000.**
- The submarine crest depicts a **grey colour nurse shark** and the name means **flag bearer** at sea.
- Sindhudhvaj was the flag bearer of indigenisation and Indian Navy's efforts towards achieving **Atmanir bharat** in the Russian built '**Sindhughosh'** class submarines.
- It was the only submarine to be awarded the **Chief of Naval Staff (CNS) rolling trophy** for Innovation by Prime Minister.
- **Key-features:**
  - The submarines have a displacement of **3,000**
  - It has a maximum diving depth of 300 meters, top speed of 18 knots, and they are able to operate solo **for 45 days** with a **crew of 53.**
  - It has anti-ship cruise missiles with a range of **220 km.**
  - After the decommissioning **of Sindhudhvaj, Indian** Navy now has **15 conventional submarines** in service.

What are kilo-class submarines?

- **Kilo** is a class of **diesel-electric attack submarines** originally designed in the 1970s and built in the **Soviet Union** for the **Soviet Navy.**

Operations Credited to Sindhudhvaj

- Operationalization of Indigenised sonar **USHUS**
- Indigenised Satellite Communication systems **Rukmani and MSS**
- **Inertial Navigation System**
- Indigenised **Torpedo Fire Control System**

MILITARY

Types of submarines

Submarines can either be **diesel-electric or nuclear-powered**, both types **can carry nuclear warheads**. Here's how they differ.

Diesel powered

- Require more frequent resurfacing making them easier to detect
- Tend to be smaller
- Cheaper to run and maintain

SSK Conventionally-powered attack submarine

SSB Conventionally-powered ballistic missile submarines

Nuclear powered

- Can remain completely submerged for years, limiting detection
- Tend to be larger
- Require more expensive infrastructure and maintenance

SSN Nuclear-powered attack submarine

SSBN Nuclear-powered ballistic missile submarines

Sindhughosh class Submarines in India Navy

- **Sindhughosh-class submarines** are Kilo-class **diesel-electric** submarines in active service with the Indian Navy.
- Their names are mainly in **Sanskrit.**
- The Sindhughosh submarines, were designed as part of **Project 877**, and built under a contract between **Rosvooruzhenie (Russian firm) and the Ministry of Defence (India).**

Some Submarines under Sindhughosh are:

- INS Sindhudhvaj
- INS Sindhuratna
- INS Sindhukesari

6. SHISHUMAR CLASS

- The Shishumar class vessels (Type 1500) are diesel-electric submarines which have been developed by the German yard Howaldtswerke-Deutsche Werft (HDW).
- The first two of these vessels were built by HDW at Kiel, while the remainder has been built at Mazagon Dock Limited (MDL) in Mumbai.
- The ships were commissioned between 1986 and 1994.
- The submarines have a displacement of 1660 tons when surfaced, a speed of 22 knots (41 km/h), and a complement of 40 including eight officers, and have the provision of an IKL-designed escape system.

7. ARIHANT CLASS

- The Arihant is a class of Indian nuclear-powered ballistic missile submarines being built for the Indian Navy.
- They were developed under the Rs 900 billion Advanced Technology Vessel (ATV) project to design and build nuclear-powered submarines.
- India has classified these vessels are classified as 'strategic strike nuclear submarines'.
- Launched on July 26, 2009, INS Arihant (SSBN 80), designated S2 Strategic Strike Nuclear Submarine, is the lead ship of India's Arihant class of submarines.

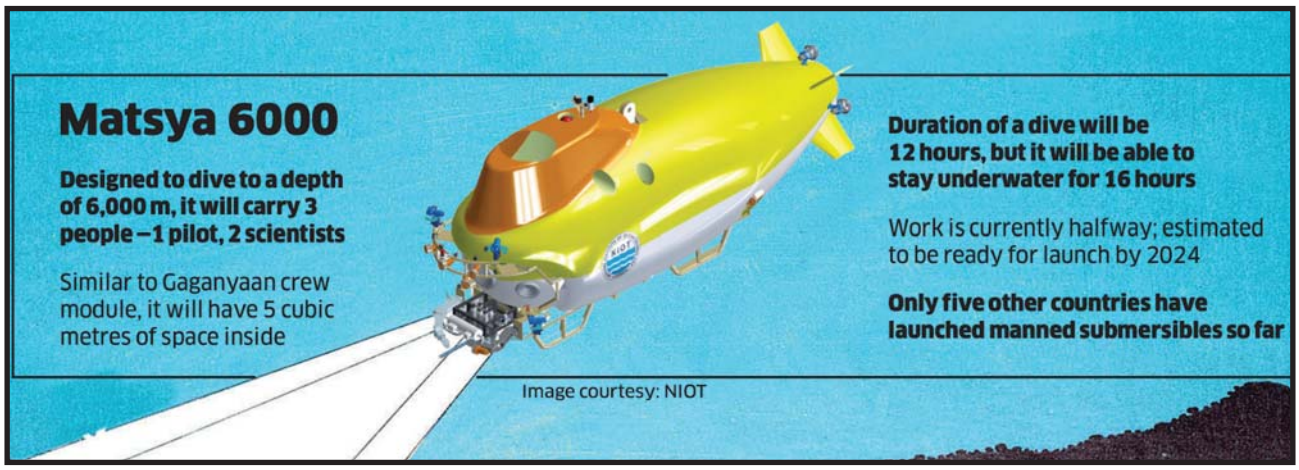
8. INDIA'S DEEP-SEA SUBMERSIBLE MATSYA 6000

CONTEXT

The government recently shared images of India's Matsya 6000 submersible on social media.

What is Matsya 6000?

- The Matsya 6000 is a **three-person submersible** that will be able to go 6,000 metres under the sea.



- Meaning 'fish' in Hindi, the vessel is being developed by Chennai's **National Institute of Ocean Technology (NIOT).**
- Made of 80mm-thick titanium alloy, it will be able to withstand a pressure 600 times greater than that at sea level.
  - All research missions globally rely on titanium
- The Matsya 6000 will be able to operate from 12 to 16 hours straight and will have an oxygen supply of 96 hours.
- It will feature the **ultra short baseline acoustic positioning system (USBL).**
  - This will allow the mothership carrying the transponder to send information and the submersible to respond.
  - This will let the mothership know where the submersible is.
- It will likely undergo trials in 2024 in the Bay of Bengal.
- It is part of **India's Samudrayaan project** to explore the deep sea. The Samudrayaan project is part of India's Rs 4,077-crore **Deep Ocean Mission**.

Only five nations – **France, the US, China, Russia and Japan** – have thus far created man submersibles.

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1. LIGO-INDIA PROJECT

CONTEXT

Prime Minister Narendra Modi laid the foundation stone **of Laser Interferometer Gravitational Wave Observatory – India (LIGO-India)**, on the occasion of the 25th anniversary of the Pokhran-II nuclear tests.

What is LIGO-India?

- LIGO-India will be an **advanced gravitational-wave observatory** to be located in India as part of a worldwide network.

Brief about LIGO

- LIGO is a **network of laboratories**, spread around the world, designed to detect gravitational waves produced by the movement of large celestial objects like stars and planets.
- These ripples were first postulated in **Albert Einstein's General Theory of Relativity** that encapsulates our current understanding of how gravitation works.
- In **2015**, LIGO made history by detecting gravitational waves for the first time.

- **Background:** LIGO-India had received the government's in-principle approval in February 2016. Since then, the project reached several milestones towards selecting and acquiring a site and building the observatory.
- **Collaboration**: It is envisaged as a collaborative project between a consortium of Indian research institutions and the **LIGO Laboratory in the USA**, along with its international partners.
  - The United States will provide key components for the lab worth USD 80 million, which amounts to Rs 560 crore.
- **Built by:** The LIGO-India project will be built by the D**epartment of Atomic Energy and the Department of Science and Technology**, with a memorandum of understanding (MoU) with the **National Science Foundation**, the US, along with several national and international research and academic institutions.
- **Location:** Hingoli district of Maharashtra, about 450 km east of Mumbai

Gravitational waves are 'ripples' in space-time caused by some of the most violent and energetic processes in the Universe.

- LIGO-India will be an **extremely sensitive interferometer** capable of sensing **gravitational waves** generated during the **merger of massive astrophysical objects** such as **black holes, and neutron stars**.
- The observatory comprises **two 4-km-long vacuum chambers**, built perpendicular to each other. **Highly reflective mirrors** are placed at the end of the vacuum chambers.
- **Fifth node:** LIGO India would be the **fifth node** of this international network of gravitational wave observatories. Currently, there are following operational gravitational wave observatories around the world–
  - **two in the United States (Hanford and Livingston)**
  - **one in Italy (Virgo)**
  - **one in Japan (Kagra)**

National Technology Day

- **May 11** marks the **25th anniversary** of the 1998 nuclear tests carried out at **Pokhran test range**, including its first test of a thermonuclear device, which has since been celebrated as the **National Technology Day** to honour scientists, engineers and technologists who made the tests possible.

2. INDIAN AIR FORCE UNVEILS ITS NEW ENSIGN AFTER 72 YEARS

CONTEXT

In a historic moment, **Indian Air Force (IAF)** unveiled the **Air Force's new ensign** at the annual Air Force Day parade at Prayagraj.

- This is the first change to the **ensign since 1951**, when the Royal Indian Air Force (RIAF) ensign was changed to make it look 'Indian'.

About the New ensign:

- The IAF ensign was created by replacing the Union Jack with the **Indian tricolour** and the RAF roundels with the **IAF tricolour roundel** in the lower right canton.
- A **new IAF ensign set to**;
  - Be unveiled tomorrow has the Air Force crest in the top right corner. The crest has the national symbol, the **Ashoka lion**, on the top with the words '**Satyameva Jayete**' in Devanagari below it.

- A Himalayan eagle, with its wings spread, has a ring in **light blue colour** encircling it with words "Indian Air Force".
- The existing motto of the IAF "Touching the sky with Glory" taken from the verse 24, Chapter 11 of the Bhagavad Gita will remain on the ensign.

The IAF motto has been taken from **verse 24, Chapter 11 of the Bhagavad Gita** and means "**Radiant Thou Touchest Heaven" or, in other words, "touching the sky with glory".**

India's Defence Sector

- India's defence imports declined by 11 per cent between 2013-17 and 2018-22.
- In 2023, India witnessed a surge in defence exports, reaching an unprecedented ₹16,000 crore in the financial year—almost ₹3,000 crore more than the preceding year.

3. CLUSTER BOMBS AND THERMOBARIC WEAPONS

CONTEXT

Human rights groups **Amnesty International and Human Rights Watch** accused Russia of using cluster bombs and vacuum bombs in the **ongoing war (on Ukraine).**

What are cluster munitions?

- A **cluster munition means a "conventional munition that is designed to disperse or release explosive submunitions** each weighing less than 20 kilograms, and includes those explosive submunitions".
- Essentially, cluster munitions are **non-precision weapons that are designed to injure or kill human beings indiscriminately over a large area,** and to destroy vehicles and infrastructure such as runways, railway or power transmission lines.
- They can be dropped **from an aircraft or launched in a projectile** that spins in flight, scattering many bomblets as it travels.
- Many of these bomblets end up not exploding, but continue to lie on the ground, often partially or fully hidden and difficult to locate and remove, posing a threat to the civilian population for long after the fighting has ceased.
- The **Convention on Cluster Munitions** specifically identifies "cluster munition remnants", which include "failed cluster munitions, abandoned cluster munitions, unexploded submunitions, and unexploded bomblets".

What is a thermobaric weapon?

- Thermobaric weapons — also known **as aerosol bombs, fuel-air explosives, or vaccum bombs** — use oxygen from the air for a large, high-temperature blast.

- A thermobaric weapon causes **significantly greater devastation than a conventional bomb** of comparable size.
- The weapons, which go off in two separate stages, can be fired as rockets from tank-mounted launchers or dropped from aircraft.
- As they hit their target, a first explosion splits open the bomb's fuel container, releasing a cloud of Fuel and metal particles that spreads over a large area.
- A second explosion then occurs, igniting the aerosol cloud into a giant ball of fire and sending out intense blast waves that can destroy even reinforced buildings or equipment and vaporize human beings.

4. UKRAINE WEAPON SYSTEM

Below is the list of major weapons used in the course of Ukraine war:

TANKS	
The US is sending Abrams tanks	The Abrams is a full-tracked, low-profile, land combat assault weapon enabling expeditionary Warfighters to dominate their adversaries through lethal firepower, unparalleled survivability, and audacious maneuver.
The UK is providing 14 Challenger 2 tanks	Challenger 2 is heavily armoured and highly mobile, designed for use in direct fire zones. It is one of the most protected tanks in the world.
Germany is providing 14 Leopard 2 tanks	The Leopard 2 is a German-manufactured main battle tank with a range of about 500km (311 miles).
The US and the UK are also providing depleted uranium tank rounds	Depleted uranium is naturally-occurring uranium which has been stripped of much - but not all - of its radioactive matter. It is a by-product from the process which prepares uranium for use in nuclear power plants and nuclear weapons.
FIGHTING VEHICLE/SYSTEM	
US has also donated Bradley infantry fighting vehicles	The Bradley infantry fighting vehicle is a tracked, medium-armoured vehicle armed with a 25mm gun.
US sent the Patriot missile system to Ukraine	The MIM-104 Patriot is the U.S. Army's primary air and missile defense system. It is a mobile system that usually includes powerful radar, a control station, a power generator, launch stations and other support vehicles.

Soviet-era S-300 surface-to-air systems	The S-300 is a long-range surface-to-air system, originally developed in the Soviet Union during the 1960s and 1970s.The S-300 is a surface-to-air missile system designed to provide long-range air defense capabilities. It is capable of engaging and neutralizing a wide range of airborne threats, including aircraft, drones, and missiles.
UK has provided Starstreak	StarStreak is a short-range, man-portable, air-defence system manufactured by Thales in the UK and is optimised to provide defence against air threats including fixed-wing Fighter Ground Attack aircraft and late unmasking Attack Helicopters.
US sent the M142 High Mobility Artillery Rocket System or Himars	Himars - the M142 High Mobility Artillery Rocket System - is a missile launcher mounted on a five-tonne truck which can fire six guided missiles in quick succession. Himars can also fire a single Army Tactical Missile System missile, which has a range of 186 miles (300 km).
Ground-Launched Small Diameter Bombs (GLSDB)	GLSDB can be fired from the High Mobility Artillery Rocket System (HIMARS). It can defeat some electronic jamming, it is usable in all weather conditions and can be used against armored vehicles.
Australia, Canada and the US sent advanced M777 howitzers	M777 is the world's first 155mm Howitzer weighing less than 10000 lbs (4218 kg). Highly portable by land, sea and air, the system features a minimal logistical footprint alongside maximum reliability.
DRONES	
Turkey sold Bayraktar TB2 armed drones to Ukraine	The Armed UAV Bayraktar TB2 is a multi-purpose platform as it can perform Target Acquisition using the onboard laser designator.

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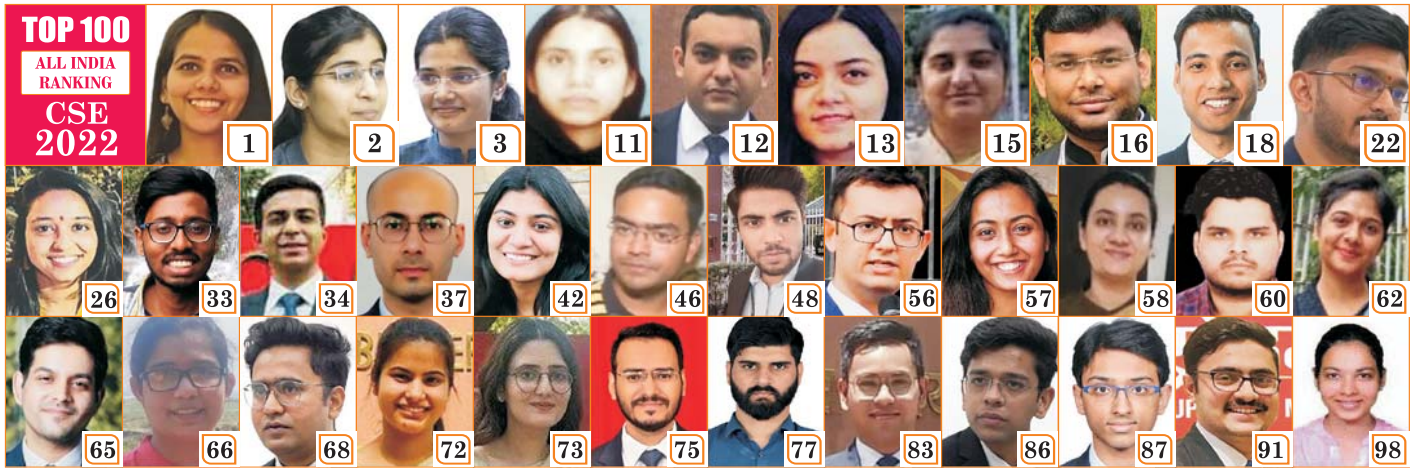

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